Before the Board of Inquiry
Waterview Connection Project

---

in the matter of: the Resource Management Act 1991

and

in the matter of: a Board of Inquiry appointed under s 149J of the Resource Management Act 1991 to decide notices of requirement and resource consent applications by the NZ Transport Agency for the Waterview Connection Project

Rebuttal evidence of **André Walter (Construction)** on behalf of the **NZ Transport Agency**

Dated: 3 February 2011

Hearing start date: 7 February 2011

REFERENCE: Suzanne Janissen (suzanne.janissen@chapmantripp.com)
Cameron Law (cameron.law@chapmantripp.com)

Chapman Tripp
T: +64 9 357 9000
F: +64 9 357 9099

23 Albert Street
PO Box 2206, Auckland 1140
New Zealand

www.chapmantripp.com
Auckland, Wellington,
Christchurch

INDEX

REBUTTAL EVIDENCE OF ANDRE WALTER ON BEHALF OF THE NZ TRANSPORT AGENCY

INTRODUCTION

1 My full name is André Walter. I refer the Board of Inquiry to the statement of my qualifications and experience set out in my evidence in chief (*EIC*) (dated 13 November 2010).

2 I repeat the confirmation given in that statement that I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court.

PURPOSE OF EVIDENCE

3 The purpose of this rebuttal evidence is to respond to certain aspects of the evidence lodged by submitters. Specifically, my evidence will respond to the evidence of:

3.1 Ms Margaret Watson, on behalf of Albert Eden Local Board (Submitter No. 252-1);[1]

3.2 Mr Andrew Tauber, on behalf of Apartments Limited (Submitter No. 75-1);

3.3 Mr Ian Clark, Ms Tania Richmond, Ms Janet Petersen, Mr Dennis Scott, Mr Andrew Beer, on behalf of Auckland Council (Submitter No. 111-1, 111-14, 111-7, 111-8, 111-9 respectively);

3.4 Mr Robert Black (Submitter No. 186-1);

3.5 Ms Belinda Chase (Submitter No. 126-1);

3.6 Mr Max Robitzsch and Ms Barbara Cuthbert, on behalf of Cycle Action Auckland (Submitter No. 79-1);

3.7 Ms Norma de Langden (Submitter No. 183-1);

3.8 Mr Graeme Easte (Submitter No. 211-1);

3.9 Mr Errol Harrhoff, on behalf of Living Communities & North Western Community Association (Submitter No. 167 and 185-1);

3.10 Ms Melean Absolum and Mr Duncan McKenzie, on behalf of Living Communities (Submitter Nos. 167-1 and 167-3);

3.11 Mr Brian Mahaffy (Submitter No. 162-1);

[1] References to Submitters' evidence as listed on the EPA website.

3.12 Sir Harold Marshall (Submitter No. 120-1);

3.13 Mr John Parlane, on behalf of Sir Marshall (Submitter No. 120-2);

3.14 Mr Bill McKay, on behalf of North Western Community Association (Submitter No. 185-1);

3.15 Mr George Richardson (Submitter No. 101-1);

3.16 Mr Richard Roberts (Submitter No. 78-1);

3.17 Mr David Shearer (Submitter No. 178-1);

3.18 Ms Louise Taylor and Mr William Aldworth (Submitter No. 200-1);

3.19 Mr Paul Conder, on behalf of Unitec Institute of Technology (Submitter No. 160-1);

3.20 Mr Brian Mitchell, Mr Robert Black, Mr Brett Skeen, on behalf of Waterview Primary School Board of Trustees & Ministry of Education (Submitter Nos. 175 and 176-1, 175 and 176-2, 175 and 176-3); and

3.21 Mr Allan Woolf (Submitter No. 234-1).

4 In addition, I will comment on relevant aspects of the section 42A Report prepared by Environmental Management Services (*EMS*) dated 7 December 2010 (*Section 42A Report*) and the Addendum Section 42A Report dated 20 December 2010 (*Addendum Report*).

VENTILATION BUILDING LOCATION REQUIREMENTS

5 In providing a ventilation system for a tunnel there are a number of principles that the designer will consider and which would be regarded as being fixed:

5.1 A key principle in designing the tunnel ventilation system is not only to ensure the air inside the tunnel does not result in adverse effects on people in the tunnel, but also on ensuring that the air discharged through the vents and portals does not cause adverse effects on the local environment.

5.2 Maximum use is made of the "piston effect".[2] Air in a tunnel is confined by the tunnel walls and hence any movement of air is restricted. In the open air, when a vehicle travels along, air is being pushed and can move in any direction

[2] Piston effect refers to the forced air flow inside a tunnel caused by a moving vehicle.

except into the ground, but within the confines of a tunnel the air cannot move through the tunnel walls and thus has to be pushed along the tunnel. Behind the moving vehicle, a negative suction pressure is created and fresh air is pulled into the tunnel and moves along the tunnel length with the vehicle. It is within this area that the pollutants are contained and must be extracted at a point prior to the tunnel portal. The situation is similar to the piston inside of an engine, hence the name 'piston effect'.

5.3 The extraction point for the in-tunnel air has to be within 100 to 150m from the portal to maximise the efficiency and benefit of the "piston effect",[3] which in turns lowers the requirement for use of the in tunnel ventilation fans during periods of normal and reduced traffic flow.

5.4 The ventilation extraction fans should be adjacent to the tunnel which is being vented and follow directly from the extraction point.

5.5 The shortest distance possible should be provided from the extraction point to the vent fans and to the vent stack to minimise friction losses from the forced ventilation system which follows extraction of the in tunnel air.

5.6 Thus ventilation buildings should be within the area of the tunnel portal.

5.7 To enable ongoing and duty maintenance of the equipment, such as transformers, communications racks, SCADA (supervisory control and data acquisition) systems and backup power, it is preferable that ventilation buildings be above ground for ease of access and replacement in the event of failure.

UNDERGROUNDING OF THE NORTHERN VENTILATION BUILDING

6 A number of submitters have requested that the northern ventilation building should be fully or partially buried underground.[4] The key concern raised by these submitters is the visual impact of the building and its location adjacent to Waterview School.

---

[3] A further consideration of the design, and taking into account the required fire and safety requirements (as described in my EIC), it was found that the distance of 80 to 100m (referred to in my EIC at paragraph 104) could be increased without any net loss of in-tunnel ventilation efficiencies.

[4] Including the statements of evidence of Ms Margot Watson (Submitter No. 252-1), paragraph 24, page 10; Mr Dennis Scott (Submitter No. 111-18), paragraph 5.44, page 18; Mr Robert Black (Submitter No. 186-1), point 4, page 16; Mr Errol Harrhoff (Submitter No. 167&185-1), paragraph 7.2, page 14; Ms Melean Absolum (Submitter No. 167-1), paragraph 3.2, page 7; Mr Duncan McKenzie (Submitter No. 167-3), paragraph 7.3, page 13.

7 The Section 42A Addendum Report has acknowledged that the redesign of the Northern Ventilation building provides significant improvements on the effects, however it goes onto note that "*we have not been persuaded by the evidence that additional facilities could not be buried* "(paragraph 3.4.10, page 10).

8 I refer the Board to the Operational Scheme Plan (Drawing No. 20.1.11-3-D-N-910-113),[5] which shows the location of the northern ventilation building (attached as **Annexure A** to my rebuttal).

9 It is important to note that the proposed design for the Northern Ventilation buildings already provides a large portion of the buildings being located underground. All the mechanical areas containing the ventilation equipment will be below ground.

10 In the rebuttal evidence of Mr David Gibbs, this is calculated as being 1,541m² out of a total buildings area 2,617m², which amounts to some 59% of the buildings.[6]

11 Options to underground the ventilation buildings were considered during the design development phase of the Project.[7] Taking into account the requirements as described above regarding the location of the building, the following additional factors were considered:

11.1 For the ventilation fan room, electrical and communication rooms, passageways and building services a total floor area of 2,617m² is required.

11.2 The available surface area directly adjacent to the cut and cover tunnel amounts to some 5,000m². The building floor area required with allowances for access roads, parking and landscaping could not reasonably be accommodated on the surface within the area constrained by; the Waterview Primary School to the west, Great North Road to the east, Herdman Street to the north and Oakley Avenue to the south.

11.3 Further, the NZTA was mindful that the housing take for the Project should be kept to an absolute minimum and that where possible, housing would be replaced following completion of the Project.

11.4 The location of the tunnel portal is fixed due to the geometric alignment of the tunnel and the connecting ramps to and from SH16.

---

[5] The Operational Scheme Plan (Drawing 20.1.11-3-D-N-910-113) has been updated post lodgement, as the operational buildings are now proposed to be located in the Southern Portal area.

[6] Gibbs rebuttal evidence at paragraphs 6 and 14.

[7] Refer to AEE Chapter 11, paragraph 11.6.7.2 for a description of the alternatives considered.

12 Given the above constraints, and the overall requirements for maintenance, placing the ventilation fan room underground provided a number of opportunities:

12.1 The ventilation fan room requires the least amount of access for maintenance. The maintenance requirements for access to the vent fans, considered to be a 3 to 6 month requirement interval, could be achieved.

12.2 Housing could be replaced following construction on the two properties between the ventilation building and Oakley Avenue.

12.3 It would allow for reasonable development of these properties with regard to landscaping and visual effects.

12.4 The building within this area is directly adjacent to the cut and cover tunnel at a depth of 8m, which provided a cost effective solution. The cost of constructing the underground chamber with secant pile walls was deemed to be less expensive than the loss of the adjacent properties.

13 To accommodate the additional parts of the buildings underground, an additional 801m² is required when the allowances for cross building passageways are removed.

14 This would require the properties between the current proposed location and Oakley Street, this is shown on Drawing No. 20.1.11-3-D-N-910-113 included in **Annexure A**.

15 Two options were considered in relation to locating as much of the building underground as possible.

Option 1 – Building wholly underground with an access ramp

16 The area required to provide this option is shown on Drawing Vent North 001 attached as **Annexure B**.

17 To achieve the access requirements for replacement of the mechanical and electrical equipment in the event of failure, a 4m wide access ramp would be required.

18 The Drawing Vent North 002 attached as **Annexure C** indicates how this access ramp would need to be constructed to enter the buildings below ground.

19 In my opinion, providing a ramp for access into the underground buildings cannot realistically be achieved from an engineering perspective for the following reasons:

19.1 To deal with the extraction requirements of the in-tunnel air, the floor of the ventilation building at this location is approximately 8m below ground level.

19.2 To enable the installation of overhead gantry cranes that would be required for the installation and removal of the ventilation fans and other equipment, and to allow the vehicular traffic underneath, the depth floor would need to be lowered by a further 6m. This would require placing the buildings some 14m below current ground level.

19.3 The undergrounding of the buildings would be undertaken by making use of a secant pile or diaphragm wall construction method. The construction of 20m deep diaphragm or secant pile walls would have an increased impact, from that already assessed, in terms of settlement and groundwater loss on the adjacent properties, as it would be undertaken wholly within the Tauranga Group Materials.

19.4 This option would require a substantial additional ventilation system for the operations building to deal with the heat generated by the electrical equipment.

19.5 To obtain access with a 10t lowbed truck which would be used for transporting the equipment, Points B and C shown on Drawing Vent North 002 must be at the same level. 150m is available between Point A and Point B, shown on Drawing Vent North 002, and within this length the road would have to decline 14m.

19.6 This results in a grade of 9.3% over this distance, which is too steep for safely dealing with heavy vehicles over the short distance and would result in a very sharp curve at the bottom of the decline.

19.7 The lowbed truck operator would be required to undertake a complex reversing manoeuvre underground within what would be a very confined environment.

19.8 The ramp would be located within the Oakley Glades Reserve with access off Great North Road. The access ramp would be a permanent requirement and this would impact on the Oakley Grades Reserve. The NZTA would require an area of 30 x 160m.

19.9 Future access ramp to cross underneath the Cut and Cover tunnel would require additional deep excavation within an area that already has significant impacts with regards to settlement and groundwater loss.

19.10 Housing could not be replaced on completion of the Project due to the risk of a transformer blow-out or other damage occurring which may require access from above.

20 Furthermore, due to the equipment within the building only low level landscape planting would be able to be accommodated on the surface.

Option 2 – Buildings underground with access hatches covered by buildings

21 Consideration was also given to placing all of the ventilation buildings underground, with access buildings located strategically above the various equipment rooms; specifically, the ventilation fan room and the transformer power rooms, including a building for the installation of a lift and stair access to be used for the daily maintenance work. These are shown on Drawing Vent North 003 included within **Annexure D**.

22 From an engineering perspective, there is no reason why this option could not be used to locate access buildings above the various equipment areas.

23 However, this option does not achieve all requirements within the design criteria because:

23.1 This option would require a substantial additional ventilation system for the operations building to deal with the heat generated by the electrical equipment.

23.2 The buildings above ground would be required to house the gantry cranes for the equipment (as shown on Drawing Vent North 003). For the ventilation fans, this would be a building 6m wide, 20m long in dimension across the bank of vent fans, with a height of 8m to house the 4t gantry crane.

23.3 It would also require a second building over the power rooms directly above the equipment, with a width of 6m, length of some 20m and a height of 6m to house the 10t gantry crane.

23.4 Within the 10t gantry building, provision would also have to be made for the installation of an access stairway and industrial lift to allow for replacement of equipment, which cannot be handled with a gantry crane such a computer racks and the SCADA equipment.

23.5 Due to the extent of the underground buildings and their function, only low level planting could be accommodated on the surface.

23.6 Housing could not be replaced on the surface and there would be a limited opportunity for development at the corner of Great North Road and Oakley Avenue.

23.7 Dealing with heavy items, such as power transformers, requires specialist and complex rigging when lifted with a gantry crane, so as to prevent damage to sensitive elements, such as the laminated cores, windings and porcelain bushings and it is generally not recommended by manufacturers.

23.8 The additional cost of these underground works is estimated to be in the order of NZ$20 million.

Conclusion – Undergrounding Northern Ventilation Buildings

24 Accordingly, I do not consider that the proposed above ground parts of the Northern ventilation buildings should be relocated underground for the following reasons:

24.1 Undergrounding the buildings will create access issues for ongoing maintenance and a safe and suitable access ramp cannot be provided;

24.2 Substantial further excavation works would be necessary with consequent settlement effects on Waterview Primary School; and

24.3 Further land take would be required; and

24.4 Regular maintenance would be difficult; and

24.5 Additional costs incurred would be significant (in excess of $20 million).

RELOCATION OF THE NORTHERN VENTILATION STACK

25 A number of submitters have requested that the Northern Ventilation stack be relocated, or at a minimum that further investigation be undertaken in relation to alternative locations.[8]

26 I refer the Board to the Operational Scheme Plan (Drawing No. 20.1.11-3-D-N-910-113) attached in **Annexure A**.[9] This shows the proposed location of the Northern Ventilation stack.

---

[8] Including the statements of evidence of Ms Margot Watson (Submitter No. 252-1), paragraph 25, page 9; Mr Robert Black (Submitter No. 186-1), point 10, page 16; Ms Norma de Langen (Submitter No. 183-1), paragraph 22, page 8; Mr Graeme Easte (Submitter No. 211-1); Mr Errol Harrhoff (Submitter No.167&185-1).

[9] The Operational Scheme Plan (Drawing 20.1.11-3-D-N-910-113) has been updated post lodgement as the operational buildings are now proposed to be located in the Southern Portal area.

27 I agree with the submitters that it is possible from an engineering and operational point of view to relocate the Northern Ventilation stack to alternative locations. The NZTA considered a number of possibilities in some detail during the design development phase of the Project.[10]

28 Following the NZTA's review of the submitters' evidence, three locations have been reconsidered as shown in Drawings Vent North 004A and 004B included in **Annexure E**), these being:[11]

28.1 Alternative 1 - East of Great North Road; and

28.2 Alternative 2 - East of Great North Road adjacent to the BP Filling Station; and

28.3 Alternative 3 - North of Herdman Street.

29 Any relocation of the ventilation stack would require an underground concrete duct of 65m² (being 10m in width with a height of 6.5m to allow for ease of maintenance and cleaning) leading from the bank of ventilation fans and attenuators to allow for the convergence of air flows into the concrete ventilation duct.

30 To relocate the ventilation stack to the locations noted above would thus require additional underground concrete ducting of:

30.1 55m for Alternative 1. This option would require an additional 14m of ducting to enable passing below the cut and cover tunnel, giving a total duct length of 69m.

30.2 78m on the diagonal for Alternative 2. This option would require an additional 7m to enable passing below the cut and cover tunnel, giving a total duct length of 85m; and

30.3 97m for Alternative 3.

31 Construction of these lengths of underground concrete ducting would require additional lengths of secant pile or diaphragm retaining walls and underground roofing slabs.

32 To reach the eastern side of Great North Road (Alternatives 1 and 2), the concrete ducting would need to be constructed underneath the cut and cover tunnel section of the Project, due to there being insufficient clearance above the tunnel and Great North Road.

32.1 These options may also result in additional disruption to traffic on Great North Road and relocation of additional

[10] Refer to AEE Chapter 11, paragraph 11.6.7.2 for a description of the alternatives considered.

[11] These three options were originally considered, paragraph 11.6.7.2 of the AEE.

services, such as the low voltage electrical cables and low pressure gas lines on the eastern side of Great North Road.

32.2 Locating the ventilation stack adjacent to the BP Filling Station (Alternative 2) would place the stack within a low lying area that is currently covered with established vegetation (as can been seen from the Drawing Vent North 004B within **Annexure E**). To construct the ventilation stack within this area would require 80m² of vegetation to be cleared to allow for the construction of the foundation and erection of the stack.

32.3 Due to the natural fall of the ground adjacent to the BP Filling station, the stack base would be some 5m lower than that proposed.

33 Relocating the ventilation stack north of Herdman Street (Alternative 3) would require the concrete ducting to be extended to the west of the cut and cover tunnel underneath Herdman Street. Undertaking this work would have the following implications:

33.1 Impacts on the Waterview Primary School boundary at the north eastern corner, where the concrete ducting would pass underground.

33.2 The stone wall on the school boundary facing Herdman Street would be directly affected.

33.3 The Pohutukawa tree in the north eastern corner of the Waterview Primary School would need to be removed.

33.4 Increased length of disruption to traffic during construction of the concrete tunnel in conjunction with the cut and cover tunnel.

33.5 Additional land purchase (for Alternatives 1 and 2).

34 While technically feasible, each of these options would require significant additional capital expenditure by the NZTA. From the cost estimate for the Project, these have been estimated to be:

34.1 Alternative 1 - $22.50 million; and

34.2 Alternative 2 - $28.72 million; and

34.3 Alternative 3 - $18.71 million.[12]

[12] In my EIC (at paragraph 72), the concrete duct was estimated to be in the order of $1 million / metre. Following further detailed design and a revision of the construction method, including a better understanding of the Tauranga Group materials, a substantial reduction in the cost of constructing the concrete duct was able to be realised.

35 The additional underground ducting/ventilation tunnel would also increase operational costs of the Project (not included above) as the ducts will need to be cleaned to regularly ensure that they remain functional and meet the design requirements.

36 The impact of these additional costs and resilience of the approved budget is discussed in the rebuttal evidence of Mr Tommy Parker.

37 In addition to the engineering, construction, design and financial implications associated with moving the northern ventilation stack, there would be a number of other environmental impacts, in particular, visual and open space effects. These effects are discussed further in the rebuttal evidence of Mr Dave Little, Mr Stephen Brown and Ms Amelia Linzey.

UNDERGROUNDING THE SOUTHERN VENTILATION BUILDINGS

38 A number of submitters have indicated that the Southern Ventilation buildings should be underground, in order to reduce the visual impacts of the building and provide more open space.[13]

39 The Section 42A Addendum Report considers "*further enquiry of the technical and cost constraints of further undergrounding is warranted*".[14]

40 I refer the Board to the Operational Scheme Plan (Drawing No. 20.1.11-3-D-N-910-117) contained in **Annexure F**. This drawing shows the proposed location of the southern ventilation building, stack and operational centre.

41 As I explained for the Northern Ventilation buildings, regular easy access is required to the building for the purposes of maintenance and repair works. It is good engineering practice that buildings are designed appropriately for maintenance, especially when heavy equipment is involved that requires special measures to install or remove, such as with large ventilation fans and heavy transformers.

42 As described above, the location of the ventilation building is determined by the location of the portal.

---

[13] Including the statement of evidence of Ms Margot Watson (Submitter No. 252-1), paragraph 10(f), 26-27; Ms Tania Richmond (Submitter No. 111-14) paragraph 5.39, 5.41; Mr Dennis Scott (Submitter No. 111-8) paragraph 5.76, page 24; Ms Belinda Chase (Submitter No. 126-1), paragraph 44, page 9; Ms Melean Absolum (Submitter No. 167-1), paragraph 4.1, 4.21; Mr Duncan McKenzie (Submitter No. 167-3), paragraph 12.1 and 13; Mr Alan Woolf (Submitter No. 234-1), paragraph 2, page 1.

[14] Paragraph 3.4.12, page 10 of the Addendum Report.

43 The NZTA considered a number of options when evaluating the tunnel methodology and tunnel geometric alignment with regards to the placement of the tunnel portal.

44 Primarily, the selection of location for the driven tunnel portal was determined by the geological profile through which the tunnel is to be constructed. The current location was chosen for the following reasons:

44.1 The dip of the seam between the Weathered East Coast Bays and the East Coast Bays formation is equal to the gradient within the tunnel.

44.2 The East Coast Bays material is at a depth suitable to commence with the tunnelling operation and provides sufficient crown rock strength to ensure the safety of the works and personnel.

44.3 The extent and depth of Basalt that would need to be excavated is minimised.

44.4 The location provides acceptable vertical and horizontal road geometry through Alan Wood Reserve to tie in with the Maioro Street Interchange.

44.5 It allowed for accommodating the proposed railtrack alignment on the north east of the road.[15]

45 The NZTA has reconsidered the options to place the buildings underground following its review of the submitters' evidence,[16] further discussions which occurred during expert caucusing, and three options have been evaluated:

45.1 Option 1 − Southern Ventilation building within a deep cut with surface access ramps;

45.2 Option 2 − Southern Ventilation building placed partially underground; and

45.3 Option 3 − Southern Ventilation building within a deep cut with surface access and gantry buildings.

46 I note that Options 2 and 3 have been developed as a result of expert landscape caucusing held on 26 January 2011, and I understand they have not yet been assessed by the NZTA's experts.

[15] Refer to the AEE Chapter 11, paragraph 11.6.9.1 and 11.6.9.2.

[16] Option 1 was originally considered in the option assessment, see paragraph 11.6.9.3 of the AEE.

Option 1 – Ventilation Building within a deep cut

47 This option is shown within Drawings Vent South 001 and a cross section shown on Drawing Vent South 001a attached as **Annexure G**. It places the building completely within the deep cut prior to the driven tunnel portal.

48 Drawing Vent South 001 (**Annexure G**) shows that:

48.1 An access ramp of 210m maximum length can be provided between points B and C. This is deemed to be the minimum length that could be accommodated without increasing the amount of land required from within the Alan Wood Reserve for the access road.

48.2 Points A and B are required to be at the same grade to facilitate the crossing of the rail.

48.3 Points C and D are required to be at the same level to facilitate the complex reversing manoeuvre to enter and exit the building.

48.4 The truck access into the building would be 8m below ground level. With the ramp having to decline over the 210m length of the ramp, this would result in a grade of 3.8%. This grade would be just acceptable for heavy vehicles over the short distance. A maximum gradient of 2.5 to 3% is preferred for heavy vehicles within a short restricted environment and where vehicles have an incline from a standing start.

48.5 With a road width of 6m, this would be acceptable for the 10t lowbed truck to negotiate the tight corners.

48.6 The operations centre would remain as a surface building.

48.7 A separate access road and parking areas as shown would have to be provided for the operations centre.

48.8 Removal and replacement of the ventilation fans and power equipment would be undertaken using a gantry crane arrangement (which is shown in Drawing Vent South 001a).

48.9 A small surface building would be required to provide stair access and an industrial lift to remove and replace that equipment which cannot be done with the gantry cranes.

48.10 The area shown for entry into the building and undertaking the reversing movement would require an additional retaining wall structure and thus be regarded as underground through the placement of a roof structure over the top.

49 It is thus my opinion that this option could work, but the following impacts should be considered:

49.1 Substantial areas of road surfacing in the park area would be required which does not provide any real benefits for increasing usable open space.

49.2 Complex operations are required for the removal and replacement of equipment within the building, with the gantry cranes and the risk associated therewith as mentioned previously when working within a constricted environment.

49.3 Placing the building wholly underground within the deep cut, prior to the driven tunnel portal would require special design considerations to deal with a building which is partially constructed within Basalt, Weathered East Coast Bays of the Waitemata Sandstones and Tauranga Group Materials.

49.4 The building would require special consideration with regard to possible seismic events; and

49.5 This option would require additional consideration to protect the building from the Basalt aquifer which currently drains towards Oakley Creek.

49.6 This option also relocates the stack a further 70m south-east into Alan Wood Reserve.

49.7 The estimated additional capital cost of $10.14 million.[17]

Option 2 – Southern Ventilation Building Placed Partially Underground

50 This option was considered to reduce the amount of open space that would be lost through road surfacing for the access ramp and roads, if the building was fully underground.

51 This option is shown within Drawings Vent South 002 and 002a providing a cross section and are included within **Annexure I**. It places the building partially within the deep cut prior to the driven tunnel portal. The building is elevated by 3m above the existing ground levels over its full extent.

52 Drawing Vent South 002 (**Annexure I**) shows that:

52.1 A ramp of 140m maximum length can be provided between points B and C, which is a reduction of 70m when compared to the fully underground ramp option. This would therefore

[17] This cost is in addition to the base cost of the ventilation building complex which is $8.6 million. A cost comparison for the Southern Ventilation building below ground option is attached as **Annexure H** to my rebuttal.

reduce the loss of open space within the Alan Wood Reserve for the access road.

52.2 Points A and B are required to be at the same grade to facilitate the crossing of the rail.

52.3 Points C and D are required to be at the same level to facilitate the complex reversing manoeuvre to exit the building.

52.4 The truck access into the building would be 3m below ground level and with the ramp having to decline over the 140m this would result in a grade of 2.1%, which would be acceptable for heavy vehicles over the short distance. This achieves the desirable maximum of 2.5 to 3% for vehicles over this distance and with a standing start prior to an incline.

52.5 With a road width of 6m, this would be acceptable for the 10t lowbed trucks to negotiate the tight corners.

52.6 The operations centre would remain as a surface building.

52.7 A separate access road and parking areas, as shown, would have to be provided for the operations centre. This road would have an incline from the rail crossing into the parking area.

52.8 Removal and replacement of the ventilation fans and power equipment would be undertaken using a gantry crane arrange (shown in Drawing Vent South 002a).

52.9 A small surface building would be required to provide stair access and an industrial lift to remove and replace that equipment which cannot be done with the gantry cranes.

52.10 The area shown for entry into the building and undertaking the reversing movement would require additional retaining wall structure. Due to the shallow depth of the building, it would not be possible to cover this section.

53 It is thus my opinion that this option would work, but the following impacts should be considered:

53.1 There remains a substantial area of road surfacing required in the park area, which does not provide any real benefits for increasing usable open space.

53.2 The complete ventilation building is elevated by 3m into the park area.

53.3 Complex operations are required for the removal and replacement of equipment within the building with the gantry cranes and the risk associated therewith as mentioned previously.

53.4 Placing the ventilation building partially underground within the deep cut, prior to the driven tunnel portal would require special design considerations to deal with a building which is partially constructed within Basalt, Weathered East Coast Bays of the Waitemata Sandstones and Tauranga Group Materials.

53.5 The building would require special consideration with regard to seismic events.

53.6 Would require additional consideration to protect the building from the Basalt aquifer which currently drains towards Oakley Creek;

53.7 This option also relocates the stack a further 70m south-east into Alan Wood Reserve; and

53.8 My estimate of the additional capital expenditure for this option is $25.2 million.[18] This option is more expensive than the previous option due to the longer length of supporting columns and increased pile foundations. (I would note that in the time available a detailed costing has not been undertaken.)

Option 3 - Ventilation Building within a Deep Cut with Surface Access and Gantry Crane Buildings

54 This option arising out of the caucusing process was considered to further reduce the amount of road surfacing that would be within the Alan Wood Reserve.

55 This option is shown within Drawings Vent South 003 and a cross section is shown on Drawing Vent South 003a attached as **Annexure J**. It places the building completely within the deep cut prior to the driven tunnel portal, with surface buildings provided to accommodate the gantry cranes for removal and replacement of the ventilation fans and power equipment.

56 Drawing Vent South 003 (**Annexure J**) shows that:

56.1 A ramp is no longer required and access to the gantry buildings can be provided off the access road to the operations centre.

[18] This cost comprises the base + Option 1 + cost of the increased structure.

56.2 With an access road width of 6m, this would be acceptable for the 10t lowbed truck to negotiate the tight corners. The road would be almost at level grade.

56.3 The operations centre would remain as a surface building.

56.4 Removal and replacement of the ventilation fans and power equipment would be undertaken using a gantry crane arrange (shown in Drawing Vent South 003a).

56.5 The gantry cranes would be housed with an L-shaped building with a floor area of 524m² and it would be 8m high. Within this building, the stair access and an industrial lift to remove and replace that equipment which cannot be done with the gantry cranes would be provided.

56.6 The area shown for entry into the building and undertaking the reversing movement would be at grade and accommodated within the parking area for the operations centre.

57 It is thus my opinion that this option could work but the following impacts should be considered:

57.1 Complex operations are required for the removal and replacement of equipment within the building with the gantry cranes and the risk associated therewith as mentioned previously.

57.2 Placing the building wholly underground within the deep cut, prior to the driven tunnel portal would require special design considerations to deal with a building which is partially constructed within Basalt, Weathered East Coast Bays of the Waitemata Sandstones and Tauranga Group Materials

57.3 The building would require special consideration with regard seismic events;

57.4 Would require additional consideration to protect the building from the Basalt aquifer which currently drains towards Oakley Creek;

57.5 This option also relocates the stack a further 70m south-east into Alan Wood Reserve; and

57.6 My estimate of the additional capital expenditure for this option is $13.5 million. I would note that in the time available, a detailed costing has not been undertaken.[19]

[19] This cost is in addition to the base cost of the ventilation building complex which is $8.6 million.

Conclusion – Undergrounding Southern Ventilation Building

58 It is thus my opinion that any of the options could be designed and constructed, however:

58.1 Each option raises particular engineering issues, such as how to deal with groundwater, ensuring structural stability of the structure within a varying geological profile.

58.2 They all involve increased costs and complexity in maintaining the equipment contained within the building.

59 In addition to the costs estimated above for the three options, there would be additional costs in relation to operational, maintenance and maintaining internal building air quality and humidity for the sensitive electrical and communications equipment estimated to be in the order of $250,000 annually. This would primarily be due to the additional power required for ventilating the building to keep equipment at optimal operating temperature.

60 Furthermore, I do not consider that the additional cost of providing the Southern Ventilation building underground with costs ranging from approximately $10.1 million to $25.2 million represents value for money.

61 The impact of additional costs and resilience of the approved Project budget has been discussed by Mr Tommy Parker within his rebuttal evidence.

Southward movement of tunnel portal

62 Mr McKenzie and Ms Absolum have sought the southward movement of the tunnel portal in order to increase available open space.[20] In Mr Stephen Brown's rebuttal evidence,[21] he addresses the visual impacts of locating the tunnel portal 80m to the south east. The three options relating to placing the Southern Ventilation building underground that I have described above would achieve this.

62.1 The actual movement of the tunnel portal as described above by placing the ventilation building within the deep cut would be 70m.

62.2 To move the full 80m, which would be possible when considering the vertical geometric alignment, would make no change to the assessment above. It would result in a slightly larger building being placed underground.

---

[20] Statement of Evidence of Duncan McKenzie, paragraphs 12.1 – 13.7; Statement of Evidence of Melean Absolum, paragraphs 4.16-4.18, 421.

[21] Refer to Stephen Brown's rebuttal evidence, paragraphs 49-51.

62.3 The 70m on which the above has been assessed is the minimum required floor area to provide for the equipment that must be housed within the ventilation building.

62.4 The maximum amount that the building can move is 80m after which the desirable vertical clearance required for the tunnel, between the motorway and the equipment within the crown can no longer be obtained. Accordingly, I would note that the request for up to 130m is not technically feasible.

PROVIDING LOCAL ROAD CONNECTION TO SH20 AT GREAT NORTH ROAD INTERCHANGE

63 In their statements of evidence, Sir Harold Marshall,[22] Mr John Parlane[23] and Mr Duncan McKenzie[24] have reiterated their views that a local road connection to SH20 should be provided at the Great North Road Interchange as part of the Project.

64 I strongly disagree that a local road connection should be provided. As I will explain, there would be a number of significant 'knock on' implications of including local road connections at Great North Road Interchange.

65 Mr Robert Mason addresses the constraints of the Great North Road Interchange area and the design issues arising from providing a local road connection to SH20 at or near the Great North Road Interchange. I fully support and concur with Mr Mason's conclusions in his rebuttal evidence.[25]

Implications on the Northern Portal Location

66 From the design work undertaken and explained in the rebuttal evidence of Mr Mason, it becomes evident that the northern tunnel portal and cut and cover section would need to be wider than currently proposed to accommodate the additional on and off ramps.[26]

67 As a consequence, the current underground section of the Northern Ventilation building would have to be moved further west to accommodate the wider cut and cover tunnel section. This would impact directly on the Waterview Primary School grounds by some 10m.

---

[22] Statement of evidence of Sir Harold Marshall, paragraph 9.

[23] Statement of evidence of Mr John Parlane, paragraph 6, page 2.

[24] Statement of evidence of Mr Duncan McKenzie, paragraph 5.4-5.5, pages 11-12.

[25] Statement of rebuttal evidence of Robert Mason, paragraphs 64 to 66.

[26] Refer to Drawing 20.1.11-D-C-109-440 within **Annexure K** to my rebuttal evidence.

68 Thus, due to insufficient free space being available adjacent to the northern portal and ventilation building between the underground ventilation fan room and the school boundary indicated as Location 1 on Drawing No. 20.1.11-D-C-109-440 within **Annexure K**, an option would be to move the portal further south.

69 As I have explained above the location of the portal and the ventilation buildings are intrinsically linked. Therefore, if the portal were moved further south, the Northern Ventilation building would need to be moved the same distance to the south.

70 Therefore, if moved, the portal would need to be located prior to the Great North Road Underpass, and adjacent to the indicative location (Location 2) shown on Drawing 20.1.11-D-C-109-440 in **Annexure K**). This is the first area that where sufficient underground space is available between the western side of the tunnel and Great North Road.

71 The vertical alignment of the Project within this section is shown in Drawing 20.1.11-3-D-C-102-403 included as **Annexure L**. At Location 2, the tunnel portal would then be approximately 21m below natural ground level.

72 As this is the portal to the tunnel, it would then require the remainder of the northbound carriageway to be a surface road, within a deep cutting passing underneath Great North Road, with Great North Road passing over SH20 on a diagonal bridge structure. Essentially this would replace the cut and cover tunnel section with an open road section.

73 The additional costs for providing the local on and off ramp connections proposed by Sir Harold have been estimated to be:

73.1 Carrington Road Southbound On Ramp – approximately $49.8 million;

73.2 SH20 Northbound Off Ramp to Great North Road - approximately $125.4 million.[27]

EXTENDING THE TUNNEL NORTH UNDER OAKLEY CREEK

74 Mr McCurdy[28]considers that the SH20 tunnels should be extended north under the tidal Oakley Creek to join SH16 within the SH16 corridor. He considers this will minimise the amount of active and passive land lost by the Project and avoid most of the vulnerable heritage sites.

---

[27] These estimates are based on the form of the on and off ramp concept designs described in the rebuttal evidence of Mr Mason (as the indicative locations contained in Sir Marshall's evidence are not feasible for the reasons explained by Mr Mason).

[28] Statement of evidence of Mr Peter McCurdy, paragraph 5.2.

75 Mr Mason's rebuttal evidence explains that to implement Mr McCurdy's proposal, the extended tunnel would need to surface within the Coastal Marine Area (*CMA*). This proposal has a number of significant implications for the design of the Project.

76 Due to the value of the tunnel asset and the financial loss incurred when tunnels are closed, it is best practice to design tunnels so that they are protected from water inundation. Locating a tunnel portal within a coastal zone does not meet this best practice requirement. It would also require substantial reclamation works within the CMA to:

76.1 Provide a landing area for the tunnel; and

76.2 Construct protection walls above the high tide level with allowance for global warming.

77 It is best practice when tunnelling underneath a coastal environment to locate the tunnel at least within stable material, which can be excavated without risk of tunnel collapse and, as a minimum, one tunnel diameter should be provided above the crown of the tunnel. Therefore, it would be required to tunnel underneath the CMA at a depth of 25m.[29]

78 Geological investigations within this area indicate that the material at this depth is likely to comprise of weathered East Coast Bays formation with Basalt overlying,[30] which does not provide the necessary geological stability for constructing a tunnel.

79 Mr Mason's rebuttal evidence explains that additional tunnel portals would need to be constructed for the ramps westbound and eastbound to SH16.

80 To accommodate the ventilation requirements of the tunnel, this would require that the current single ventilation building would be replaced with two ventilation buildings and stacks which would need to be constructed for each of the tunnel exit portals. One of which would be within the CMA area adjacent to SH16 and the other would be required to be placed adjacent to SH16 in the vicinity of the Point Chevalier shopping centre.

81 It is estimated that the additional cost of providing the SH16 ramps within tunnels would be in excess of $200 million.

---

[29] Refer to paragraph 79 of Mr Mason's rebuttal evidence.

[30] Technical Report G.24 Geotechnical Interpretive Report and Appendices.

PROVIDING OPEN SPACE MITIGATION AS EARLY WORKS

82 Several submitters have indicated in their evidence that open space mitigation should be provided as early works, given the length of the construction period.

83 In the evidence of Ms Watson, for example, she notes in relation to works in Waterview Glades that: [31]

> While the applicant proposes to reinstate this park at the end of the project, the use of this open space throughout the construction period phase is unacceptable for this period of time. It is considered too long to deprive the community of necessary and useable public open space land.

84 Mr Beer considers: [32]

> … the potential loss of active recreational opportunities currently provided by Waterview Reserve, for the five to six years when construction yard 6 is required, to be a significant effect that is not adequately addressed in NZTA's evidence .

85 Mr Beer specifically seeks, amongst other things, the expansion and development of Saxon Reserve prior to occupation of open space in Waterview by the NZTA.[33]

86 I agree that it is desirable to provide open space mitigation as early as possible to minimise impacts on the local community. In this respect, the Project has been designed in such a manner, together with the location of the construction yards, to enable open space mitigation for loss of facilities during construction to be given effect as early as possible.

87 Proposed Social condition SO.6 specifically states that the NZTA must provide, in consultation with Auckland Council and prior to the occupation of the construction areas within Waterview Reserve and Alan Wood Reserve, a number of facilities including :

87.1 A temporary playing field, basketball court and volleyball court within the relocated Waterview Reserve;

87.2 Development of Saxon Reserve as a community park, where practicable;

87.3 Improvements to the existing pathway connections at Howlett Reserve, providing wider and safer access out to either Howlett Street or Oakley Avenue, where practicable;

---

31 Statement of evidence of Ms Margot Watson, paragraph 38, page 14.

32 Statement of evidence of Mr Andrew Beer, paragraph 9.13.

33 Statement of evidence of Mr Andrew Beer (Submitter 111-9), paragraph 9.26.

87.4 Formalisation of the pathway linkage north of "Waterview Glades", connecting to Oakley Creek;

87.5 A pedestrian connection to Eric Armishaw Reserve, where practicable;

87.6 Three soccer playing fields within the Alan Wood Reserve area including associated access, ablution block and carparking; and

87.7 A temporary basketball court at Alan Wood Reserve.

88 In my opinion, this condition demonstrates the NZTA's commitment to provide equivalent open space facilities lost during the construction period.

89 It is also desirable, from the NZTA's point of view, that where possible, permanent facilities rather than temporary facilities be developed. Permanent facilities will minimise capital expenditure and reduce the impact of facilities being lost while the permanent facility is constructed.[34]

PROVISION OF CURVED BARRIERS

90 Ms Belinda Chase has suggested that if the proposed at grade surface section of the motorway through Alan Wood Reserve and Hendon Park is built, curved barriers over Sector 9 should be provided.[35]

91 Providing a curved acoustic barrier is an option which generally results in a "higher effective height" of the barrier due to the shift of the top edge of the barrier to an equivalent height.

92 In my opinion, curved barriers could be used in Sector 9 only if the design could incorporate a considerable curve and provide cover for at least half of the motorway lanes.

93 However, accepted NZTA Road Standards require any object located above the State Highway to have a clearance of at least 6m[36] above the road surface for safety and accessibility reasons. This means that a barrier curving over SH20 would need to have an upper height of at least 6m before being able to curve over the road. To achieve the objective of covering at least half of the motorway lanes

---

[34] The Section 42A Report notes that it is preferable for investment be in permanent open space facilities rather than temporary ones (paragraph 10.10.97).

[35] Statement of evidence of Belinda Chase, paragraph 26.

[36] NZTA Bridge Manual (July 2005), Appendix A.

would require a further height of 8.5m (assuming an equal radius curve for the barrier), making the total height of the barrier 13.5m.

94 As the current preferred mitigation option provided by the Project involves acoustic barrier heights of 2m to 5m (and 5m for only a limited section of the motorway), I do not consider that using a curved barrier is practical.

EARLY PROVISION OF CYCLEWAYS

95 The evidence of Ms Cuthbert on behalf of Cycle Action Auckland states:[37]

> We seek that where feasible, walk- and cycleway works are constructed early on during the project duration, to assist in mitigating the adverse effects of the construction, in addition to their inherent benefits as new or improved transport links.

96 I fully support this suggestion and agree that where it is feasible, the cycleway should be provided early and as soon as practically possible, provided that:

96.1 The safety and security of the construction works are not compromised; and

96.2 The safety and security of users of the cycleway can be ensured.

97 The early provision of cycleway and pedestrian facilities will form part of the early open space replacement and be included within the works to be done during that stage, as required by Social condition SO.6.

CONSTRUCTION DURATIONS

98 To provide further clarity to the Board and submitters regarding the indicative construction programme, an expanded version of the construction programme from that submitted within the AEE[38] and described in my EIC has been included in **Annexure M** to my rebuttal evidence.

99 It must be noted that this programme remains indicative only, and the final durations will not be known until such time that the contractors have been appointed.

---

[37] Statement of evidence of Barbara Cuthbert, paragraph 7(d).

[38] Figure 5.1 – Timing of Construction Elements, AEE, Part B, page 5.3.

COMMENTS ON SECTION 42A REPORTS

Key changes to the Project

100 Section 2 of the Addendum Section 42A Report requests that the NZTA should identify the key changes to the Project.

101 The Section 2 of Section 42A Addendum Report summarises the key changes to the project since it was lodged. I agree that the changes identified are correct.

102 For clarity, the key changes that have been made to the Project are as follows:

102.1 The emergency ventilation system at Cradock Place has been removed and NOR6 withdrawn. This is discussed further in rebuttal below in response to comments on the Section 42A Reports.

102.2 Additional design and assessment has been undertaken regarding the ventilation buildings and stacks at the northern and southern portals to the tunnel. As discussed in my EIC, this has resulted in the operational buildings originally proposed in the Northern Ventilation building to be relocated to the Southern Ventilation building. This has allowed the Northern Building footprint to be reduced in size. This is shown on the Plans showing changes to the Ventilation Building Layouts attached as **Annexure N**.

102.3 Changes to the provision of esplanade reserves beneath the Great North Road Interchange ramps to establish 20 metre corridors, the repositioning of Waterview Reserve, changes to the Alan Wood Reserve Plan, and increasing replacement esplanade reserve widths adjoining Oakley Creek in Hendon Park from 10 to 20 metres. This has resulted in an overall increase of approximately 0.6 hectares of additional reserve replacement in Waterview, and 0.9 hectares of additional reserve replacement in Alan Wood Reserve.

102.4 The trial embankments, as described in report appended as Annexure A to Mr Jeff Hsi's EIC, are part of the works that consents are being sought.

Removal of emergency exhaust

103 As discussed in paragraph 80 of my EIC, the emergency ventilation system originally proposed at 36 Cradock Street has been removed, and subsequently NOR6 was withdrawn. Accordingly, a revised Operation Scheme Plan indicating the withdrawal of NOR 6 (Drawing No. 20.1.11-3-D-N-910-115) is attached as **Annexure F** to my rebuttal.

104 Due to a revised policy by the NZTA that the SH20 tunnel would not form part of the dangerous goods route within Auckland and that other alternative routes are available, it provided an opportunity to revise the Fire Life Safety Design requirements for the tunnel. This allowed for a 50% reduction in the design fire size.

105 Due to this reduction in fire size, and combined with the installation of a deluge system, the requirement to provide for a separate smoke exhaust connected to the tunnel smoke duct was no longer necessary, as tenable conditions can be maintained over the full tunnel length in the event of a fire emergency.

106 In terms of the current tunnel design, any smoke would be extracted through the normal ventilation system and the smoke would be vented through the stacks at the portals of the bore in which the fire event has occurred.

107 Removal of the smoke duct does not result in a less safe tunnel. The design will take into account the natural layering of the smoke within the tunnel in the event of a fire and this is then dealt with through the normal ventilation system of the tunnel. This is the situation within many of the tunnels around the world.

108 Smoke from the vent stacks would only become evident in the event of a fire which is at the design fire, and this is generally accepted to be a 1:50 year event.

109 Many smaller fires that occur within a tunnel are similar to fire events on a surface road which can be dealt with directly by the driver should a fire extinguisher be within the vehicle and most of the fires can be dealt with through handheld extinguishers and the deluge system would not be activated.

110 All emergencies within the tunnel will be dealt with by the tunnel operator (NZTA). In the event of a major incident, the protocol that the NZTA has in place with the emergency services and the Police would still remain in effect. The predefined and already agreed event level triggers with the emergency services would remain in effect. These trigger levels predetermine who takes control in the event of an emergency.

111 Most of the emergencies within a tunnel are simply stationary vehicles. In the event of an accident with fatalities the predetermined trigger level defines which emergency services deals with the matter. The method by which NZTA operate their surface roads will apply to the tunnel and there is no reason why that should change.

Concrete Batching Plant Requirements

112 Paragraph 10.10.63 of the Section 42A Report (repeated in section 3.7 of the Addendum Report) seeks confirmation of the actual

design for the operation of the concrete batching plant through the Concrete Batching and Crushing Management Plan. The Report authors comment that the reference in the AEE[39] to partial enclosure of the equipment and proposed Management Plan is rather uncertain. It is suggested that a specific design of the concrete batching plant needs to be approved.

113 In order to understand the importance of the concrete batching plant, and the need for it to be located on-site, I would like to explain the sequencing of construction activities that would reasonably be expected to take place.

114 As stated with my EIC[40] there is a requirement for the tunnel construction operation to be based on a 24 hour operation to ensure maximum utilisation of resources and to provide for construction of the driven tunnels within a reasonable timeframe.

115 It is expected that the tunnel would be constructed using what is described within the industry as the Sequential Excavation Method; implying that each section of the tunnel is constructed sequentially following completion of the previous section.

116 For the purposes of the SH20 Waterview Tunnels, this has been designed and assessed as being a single heading and a bench. The first element of the section that would thus be constructed is the heading. This would be approximately the top three-quarters of the total heading (tunnel face being excavated) and then be followed by the bench.

117 The final concrete lining would follow some distance behind the excavated heading as this is not seen as a critical activity within the tunnel construction and further it would have additional complexities added into the sequence within what is already a constricted environment.

118 Following the excavation of the face, it is important that the primary support[41] be installed before the next section is excavated. This should be installed as soon as possible after the excavation is completed and no longer than 30 minutes. Should this not be done, there is a risk of the excessive roof and tunnel deformation with resultant increases in mechanical settlement beyond that considered within the settlement analysis, and in extreme cases, where failure does occur, this could lead to a loss of life.

119 It is generally accepted as best practice within SEM tunnel construction that no personnel or equipment would advance into an area not protected with primary tunnel support being in place.

---

39 At paragraph 22.15.3.2, page 22.52, AEE.

40 Paragraphs 138, 139, 141, 142 and 143 of my EIC.

41 Comprises rockbolts and shotcrete.

120 To ensure that the rockbolts and shotcrete works as a unit, quality control with regards to the shotcrete mix and method of application is extremely important. The contractor thus must have control over the quality of shotcrete mix that is delivered to the tunnel face. Due to the critical time frame for application, an error in this regard could result in a delay in application. Hence, the problems as explained above could occur.

121 As the night time shift would only be advancing a single section of the heading, it is not expected that the concrete mixer would be working all night and it would only be in operation for a short period prior to completion of the excavation and to mix the required amount for application on the section cut. This is estimated to be in the order of 20m³, which would be applied over a period of about 30 to 45 minutes and this would be required to be produced within a similar time period with allowances for transporting the mixed shotcrete underground to the tunnel face.

122 Following this preparation, setup would proceed for the next excavation cycle of the heading following sufficient time for the shotcrete to cure and dry anticipated to be around 3 to 4 hours. After this it would be deemed safe for the equipment to advance.

123 Once sufficient length of heading has been constructed, it may be possible to excavate a section of the bench to the same length as excavated on the heading within the shift, and should this be done, it would require shotcrete and rockbolts into the sidewalls. This is estimated to be some 6 to 8m³ that would require batching, to be undertaken about 2 hours after the previous mix has been made.

124 It is expected that the majority of concrete batching would be undertaken during the day during which the permanent lining would be poured and other concrete works that may be required within the tunnel such a concrete floors and chambers.

125 The provision of shotcrete during the night shift would be very intermittent and off site commercial batch plants would have difficulty in dealing with such a demand. Further, the contractor would not be able to exercise the required quality control at the point of batching, as required for the works.

126 The batch plant required for the Project would not be particularly large[42] and can be housed within a suitable enclosure to deal with aspects relating to noise and dust, as discussed by Mr Gavin Fisher and Ms Siiri Wilkening in their rebuttal evidence. I note that Ms Wilkening recommends a new condition CNV.9 requiring the plant to be fully enclosed and I support her recommendation.

[42] Expected that plant capable of producing 30m³ per hour is required.

127 In my opinion, the concrete batching plant must be able to operate 24 hours per day (Monday to Saturday afternoon), otherwise the Project as a whole is at risk.

LANDSCAPE AND VISUAL CAUCUSING

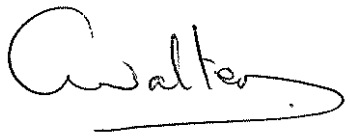
128 Finally, I would like to clarify statements that I made when I attended at the Landscape and Visual Caucusing session on 26 January 2011.

128.1 When I made reference to a period of 10 years being acceptable for the landscaping maintenance, this was specifically in relation to the SH20 tunnel portion of the Project.

128.2 This section of the Project is being procured through a Design, Construct, Maintain and Operate Alliance contract, wherein the NZTA is part of the Alliance.

128.3 The contract makes specific provision for the DCMO operator to operate and maintain the tunnels and works constructed within that contract, which extends from the Maioro Street Interchange to SH16 including the connecting ramps to SH16.

128.4 It was not intended to reflect on any of the other sections of the Project, and it is expected that within each of those contracts there will be a defined maintenance period after which the maintenance of the motorway designation will be undertaken by the NZTA.



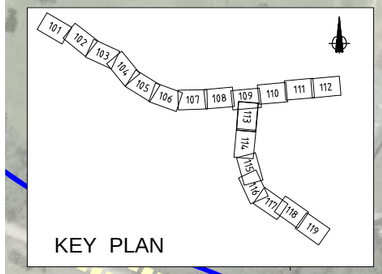
_____

André Walter
February 2011

ANNEXURE A: REVISED OPERATION SCHEME PLAN

Drawing Plotted: 03 Feb 2011 12:04

XR 08-12- -09-07- - -05-



KEY PLAN

N

GREAT NORTH ROAD

COWLEY STREET

RAMP 1

RAMP 2

HERDMAN STREET

WATERBANK CRESENT

DAVENTRY STREET

OAKLEY AVENUE

ALFORD STREET

SUBJECT TO
OUTLINE PLAN OF WORKS

JOIN LINE SHEET 109

JOIN LINE SHEET 114

A3 SCALE 1:2000
A1 SCALE 1:1000
0 10 20 30 40 60 80 100 (m)

FOR APPROVAL
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
G	REVISED FOR STATUTORY APPROVAL	ME			02.02.11
F	ISSUE FOR STATUTORY APPROVAL	BNRB			22.07.10
E	ISSUE FOR CONCEPT DESIGN REPORT	ME			12.07.10
D	ISSUE FOR EPA INFORMATION	ME			25.06.10
C	ISSUE FOR SRT/NZTA REVIEW	ME			31.05.10

Drawing Originator: Beca

Original Scale (A1) 1:1000	Designer	RM
Reduced Scale (A3) 1:2000	Reviewer	BM
	Drafting Checked	BD
	Consultant Approval	AL
	Received by Beca	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project: WATERVIEW CONNECTION PROJECT
SH16 / SH20

Title: OPERATION SCHEME PLANS
SHEET 13

Base level: MSL AUCK. VERT. DATUM 1946
Grid Reference: MT EDEN 2000
Originator No.
Project No. 20.1.11-3-D-N-910-113 Rev. G

DO NOT SCALE

IF IN DOUBT ASK.

Document No. 20.1.11-3-D-N-910-108_119.dwg

ANNEXURE B: DRAWING VENT NORTH 001

VENT - NORTH	DWG 001
LAND REQUIREMENTS	Scale 1:1000@A4

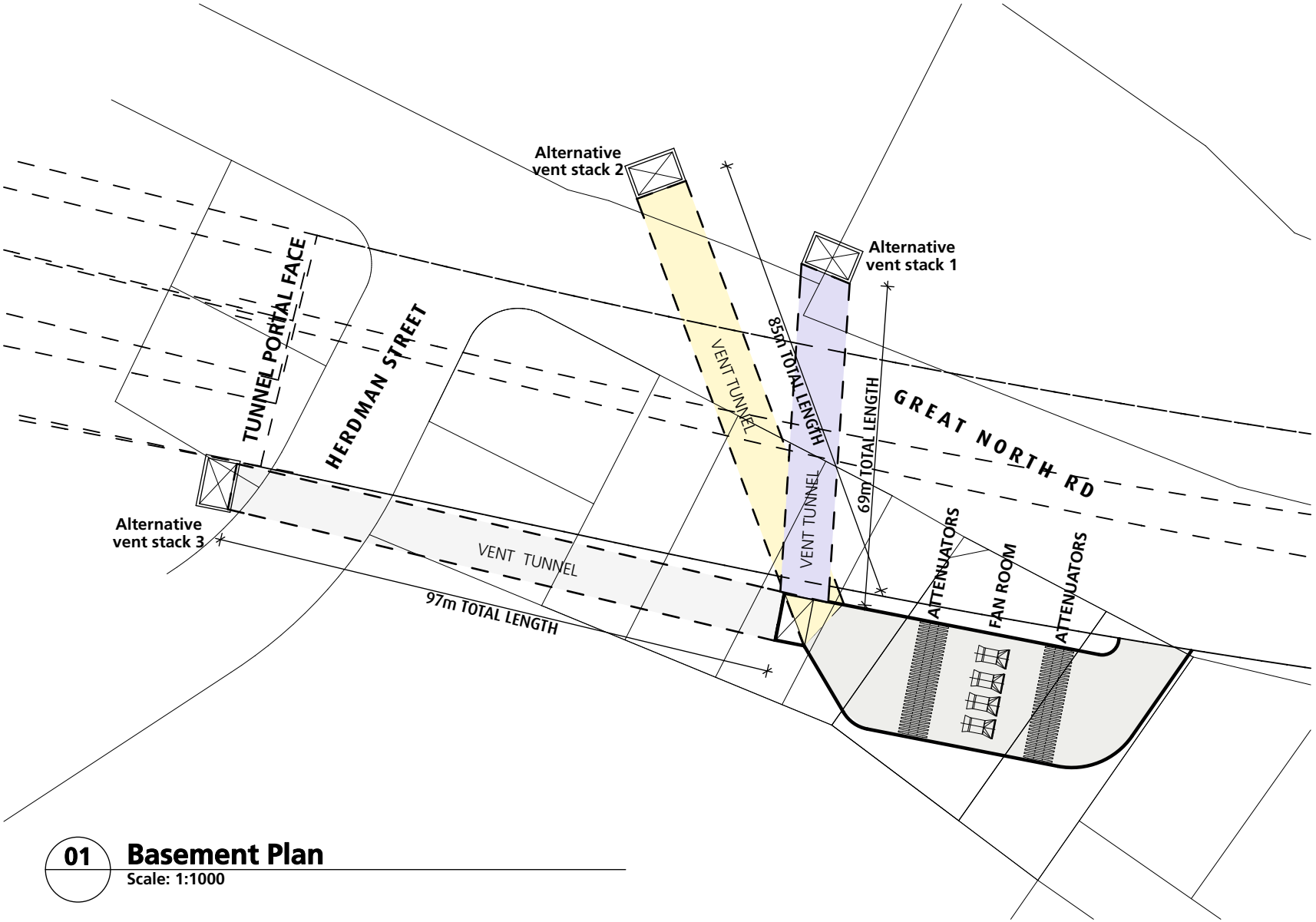
ANNEXURE C: DRAWING VENT NORTH 002

VENT - NORTH	DWG 002
RAMP OPTION- PLAN	Scale 1:1000@A4

ANNEXURE D: DRAWING VENT NORTH 003

VENT - NORTH	DWG 003
GANTRY OPTION- NO RAMP	Scale 1:1000@A4

ANNEXURE E: DRAWING VENT NORTH 004A AND 004B



01 **Basement Plan**
Scale: 1:1000

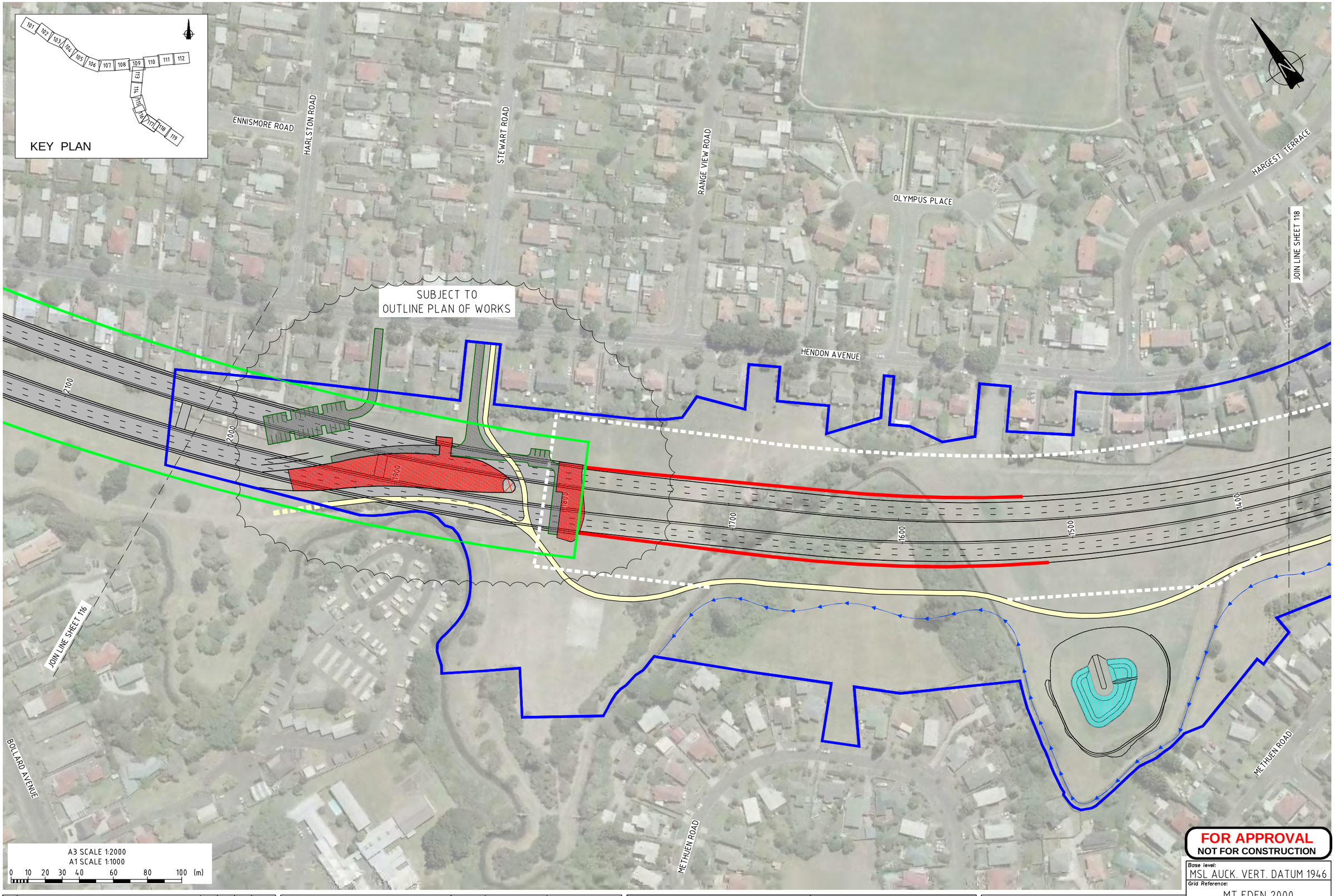
VENT - NORTH	**DWG 004A**
ALTERNATIVE STACK LOCATIONS	Scale 1:1000@A4

01 **Ground level plan**
Scale: 1:1000

VENT - NORTH	**DWG 004B**
ALTERNATIVE STACK LOCATIONS	Scale 1:1000@A4

ANNEXURE F: DRAWING NO. 20.1.11.3-D-N-910-117 AND DRAWING NO.20.1.11-3-D-N-910-115

Drawing Plotted: 03 Feb 2011 12:05



No.	Revision	By	Chk	Appd	Date
G	REVISED FOR STATUTORY APPROVAL	ME			02.02.11
F	ISSUE FOR STATUTORY APPROVAL	BNRB			22.07.10
E	ISSUE FOR CONCEPT DESIGN REPORT	ME			12.07.10
D	ISSUE FOR EPA INFORMATION	ME			25.06.10
C	ISSUE FOR SRT/NZTA REVIEW	ME			31.05.10

Drawing Originator: Beca

Original Scale (A1) 1:1000	Designer	RM
	Reviewer	BM
Reduced Scale (A3) 1:2000	Drafting Checked	BD
	Consultant Approval	AL
	Received by Beca	

NZ TRANSPORT AGENCY WAKA KOTAHI

Project: WATERVIEW CONNECTION PROJECT SH16 / SH20

Title: OPERATION SCHEME PLANS SHEET 17

FOR APPROVAL
NOT FOR CONSTRUCTION

Base level: MSL AUCK. VERT. DATUM 1946
Grid Reference: MT EDEN 2000
Originator No.
Project No.: 20.1.11-3-D-N-910-117
Rev.: G

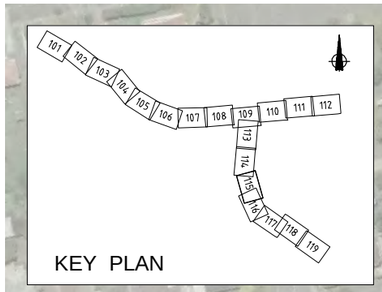
DO NOT SCALE

IF IN DOUBT ASK.

Document No. 20.1.11-3-D-N-910-108_119.dwg

Drawing Plotted: 03 Feb 2011 12:05

XR 08-12- -09-07- - -05-



FOR APPROVAL
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
G	REVISED FOR STATUTORY APPROVAL	ME			02.02.11
F	ISSUE FOR STATUTORY APPROVAL	BNRB			22.07.10
E	ISSUE FOR CONCEPT DESIGN REPORT	ME			12.07.10
D	ISSUE FOR EPA INFORMATION	ME			25.06.10
C	ISSUE FOR SRT/NZTA REVIEW	ME			31.05.10

Drawing Originator: Beca

Original Scale (A1) 1:1000	Designer	RM
	Reviewer	BM
Reduced Scale (A3) 1:2000	Drafting Checked	BD
	Consultant Approval	AL
	Received by Beca	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project: WATERVIEW CONNECTION PROJECT
SH16 / SH20

Title: OPERATION SCHEME PLANS
SHEET 15

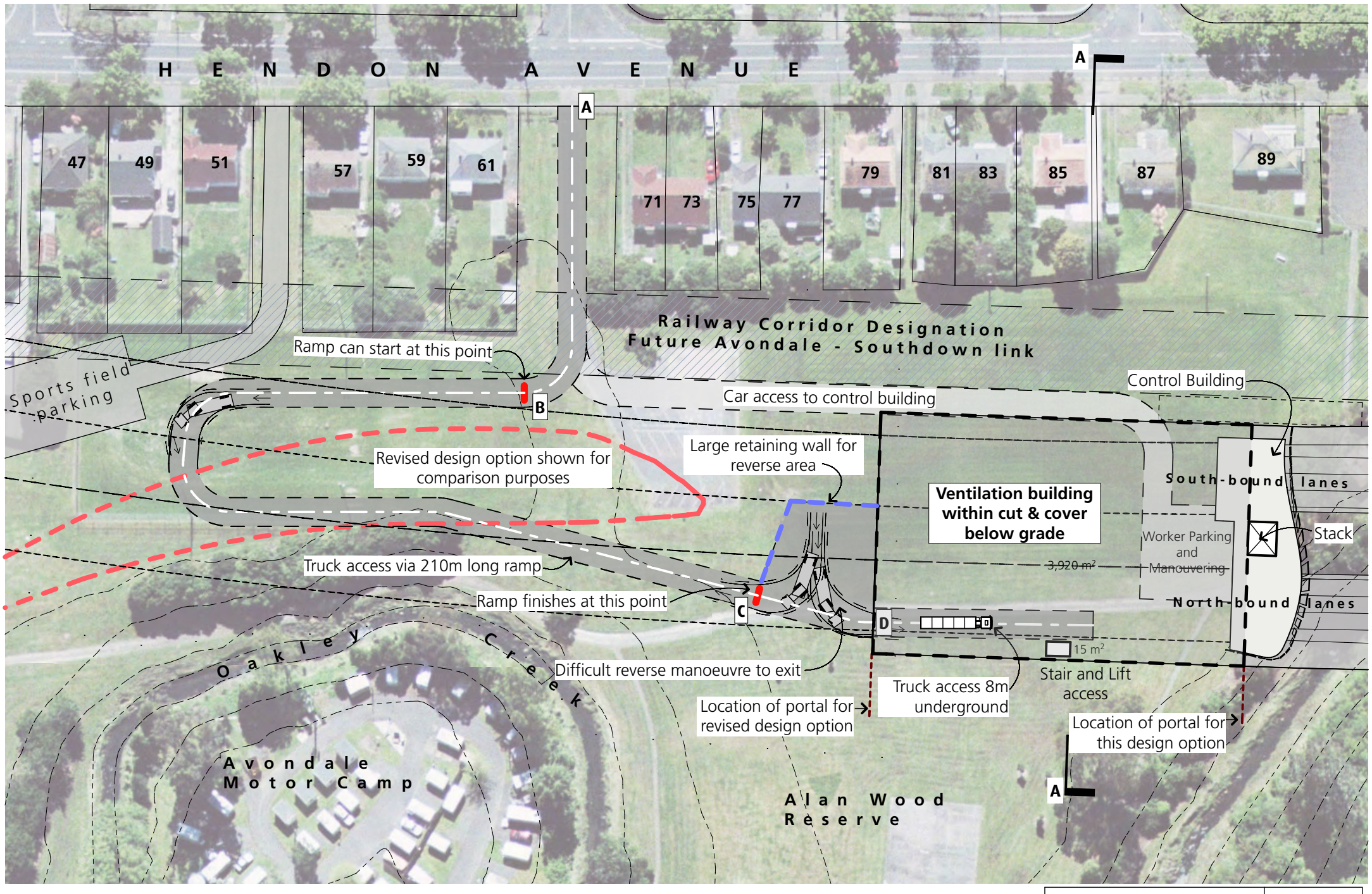
Base level: MSL AUCK. VERT. DATUM 1946
Grid Reference: MT EDEN 2000
Originator No.
Project No. 20.1.11-3-D-N-910-115
Rev. G

Document No. 20.1.11-3-D-N-910-108_119.dwg

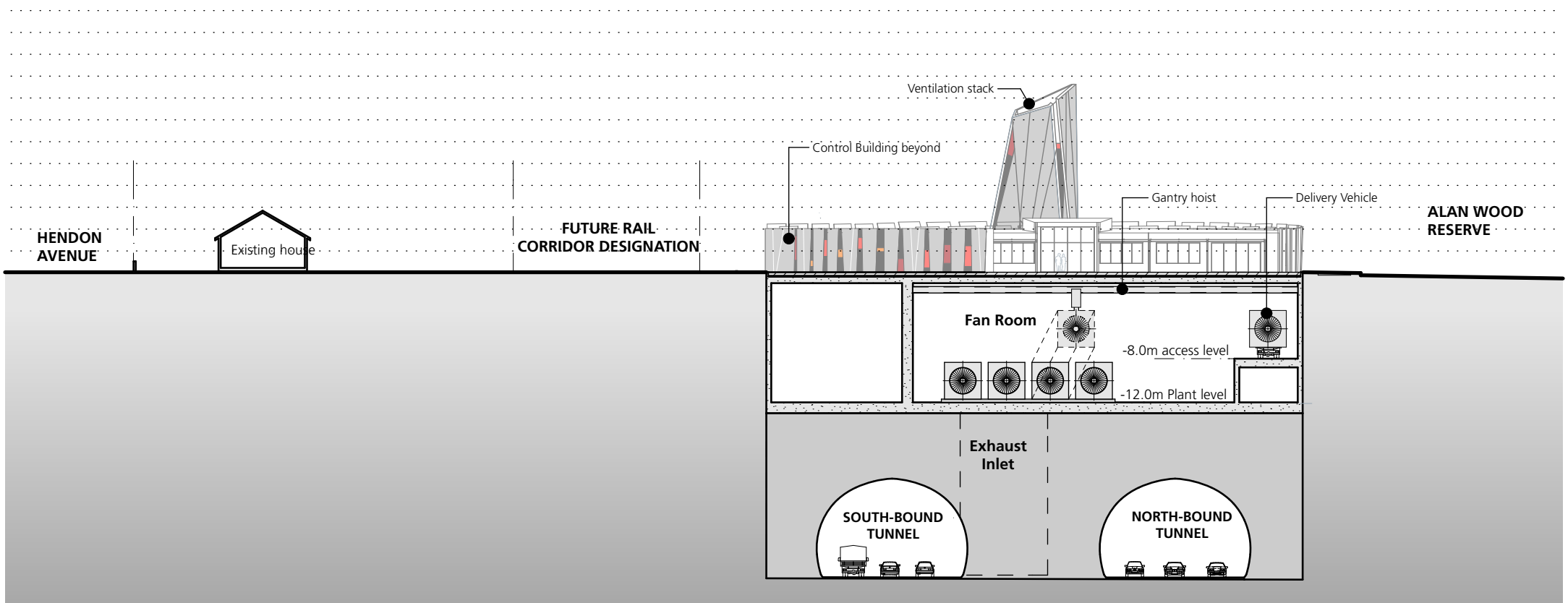
DO NOT SCALE

IF IN DOUBT ASK.

ANNEXURE G: DRAWINGS VENT SOUTH 001 AND 001A



VENT - SOUTH	DWG 001
UNDERGROUND OPTION	Scale: 1:1000@A4

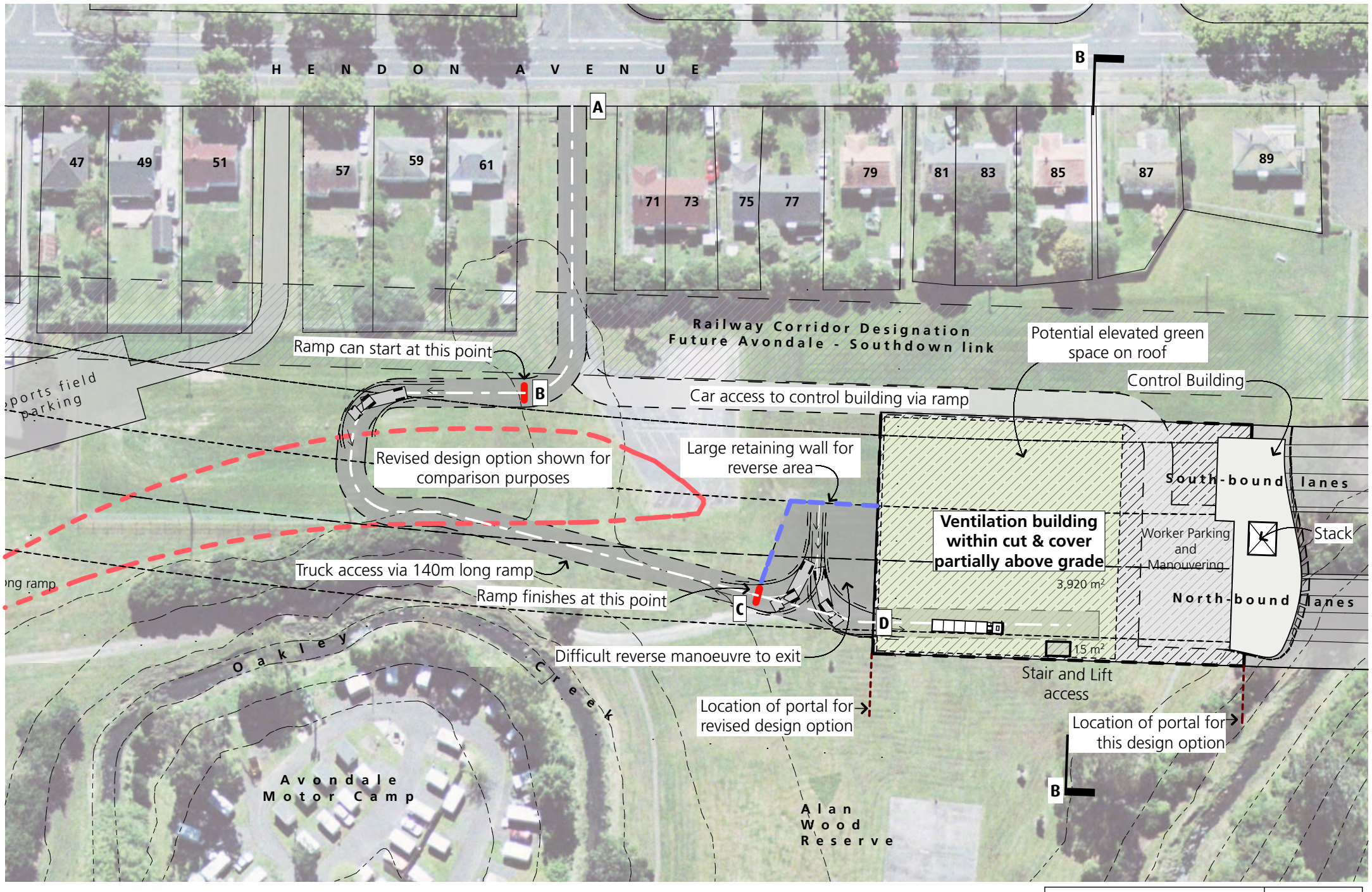


VENT - SOUTH	DWG 001a
UNDERGROUND OPTION: SECTION AA	Scale: 1:500@A4

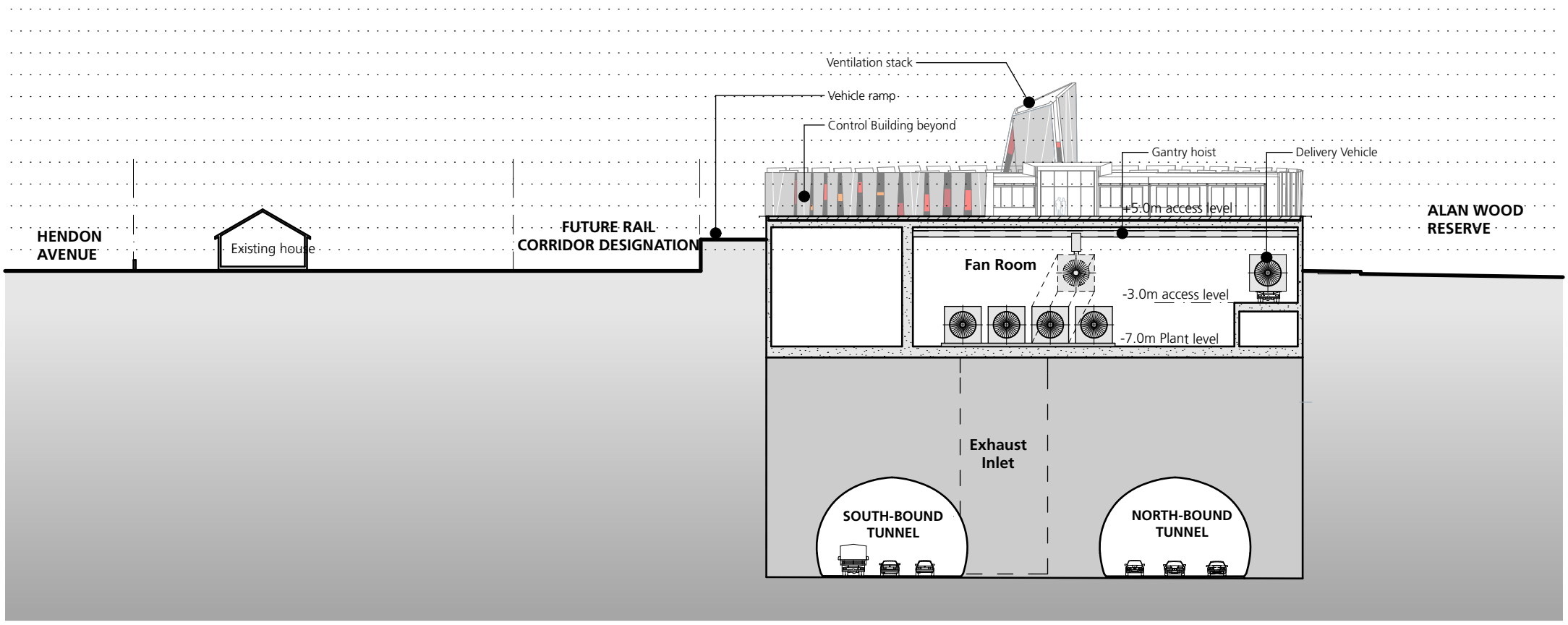
ANNEXURE H: COST COMPARISON FOR THE SOUTHERN VENTILATION BUILDING (BELOW GROUND OPTION)

Building Costs (Full Sub-Contract Including P&G, Margin Etc.)	
Below Ground	18,734,886
Above Ground	8,595,000
	10,139,886

ANNEXURE I: DRAWINGS VENT SOUTH 002 AND 002A

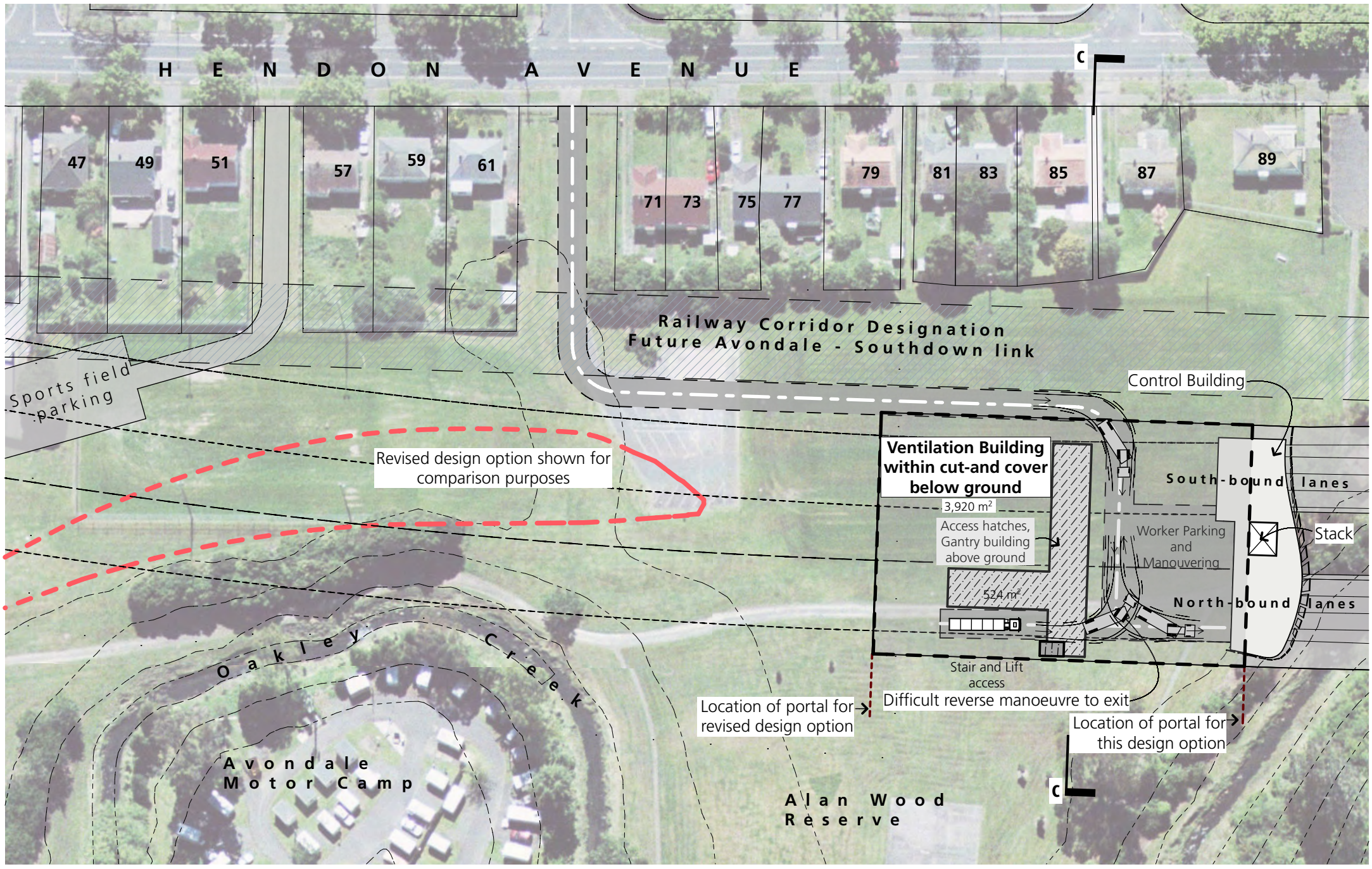


VENT - SOUTH	DWG 002
PARTIAL UNDERGROUND OPTION	Scale: 1:1000@A4

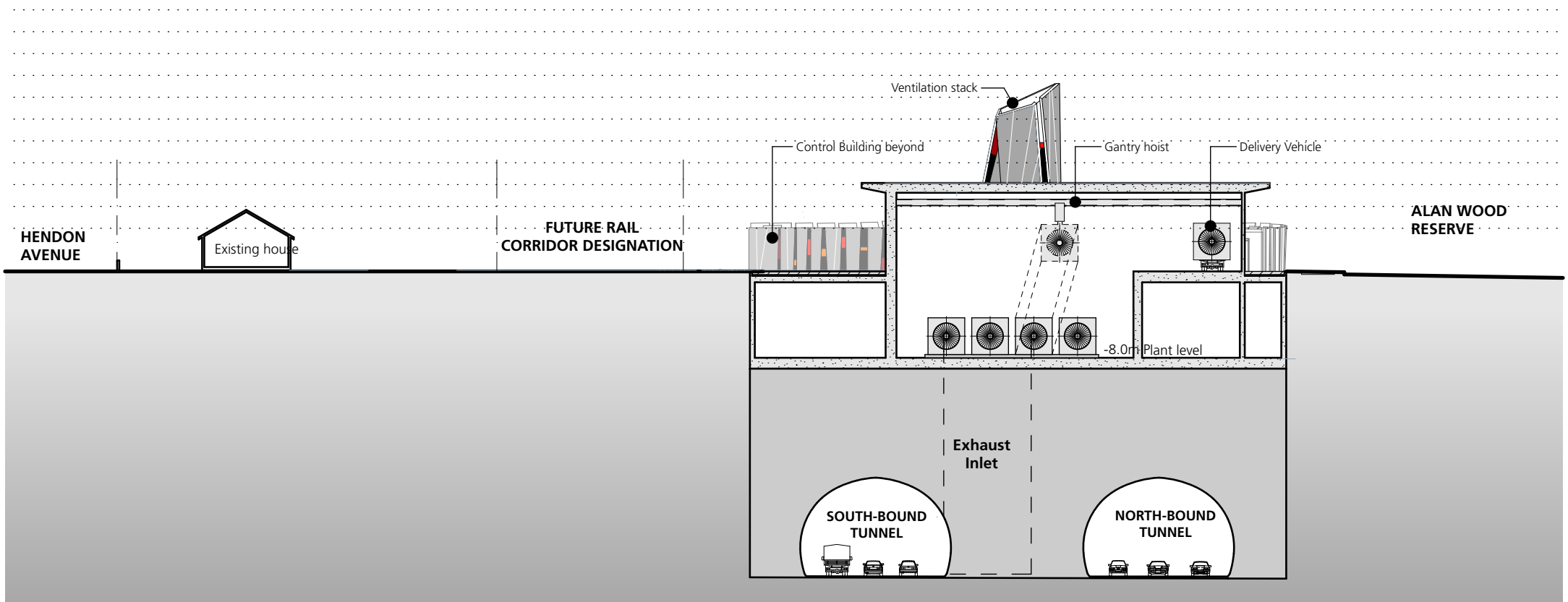


VENT - SOUTH	DWG 002a
PARTIAL UNDERGROUND OPTION: SECTION BB	Scale: 1:500@A4

ANNEXURE J: DRAWINGS VENT SOUTH 003 AND 003A



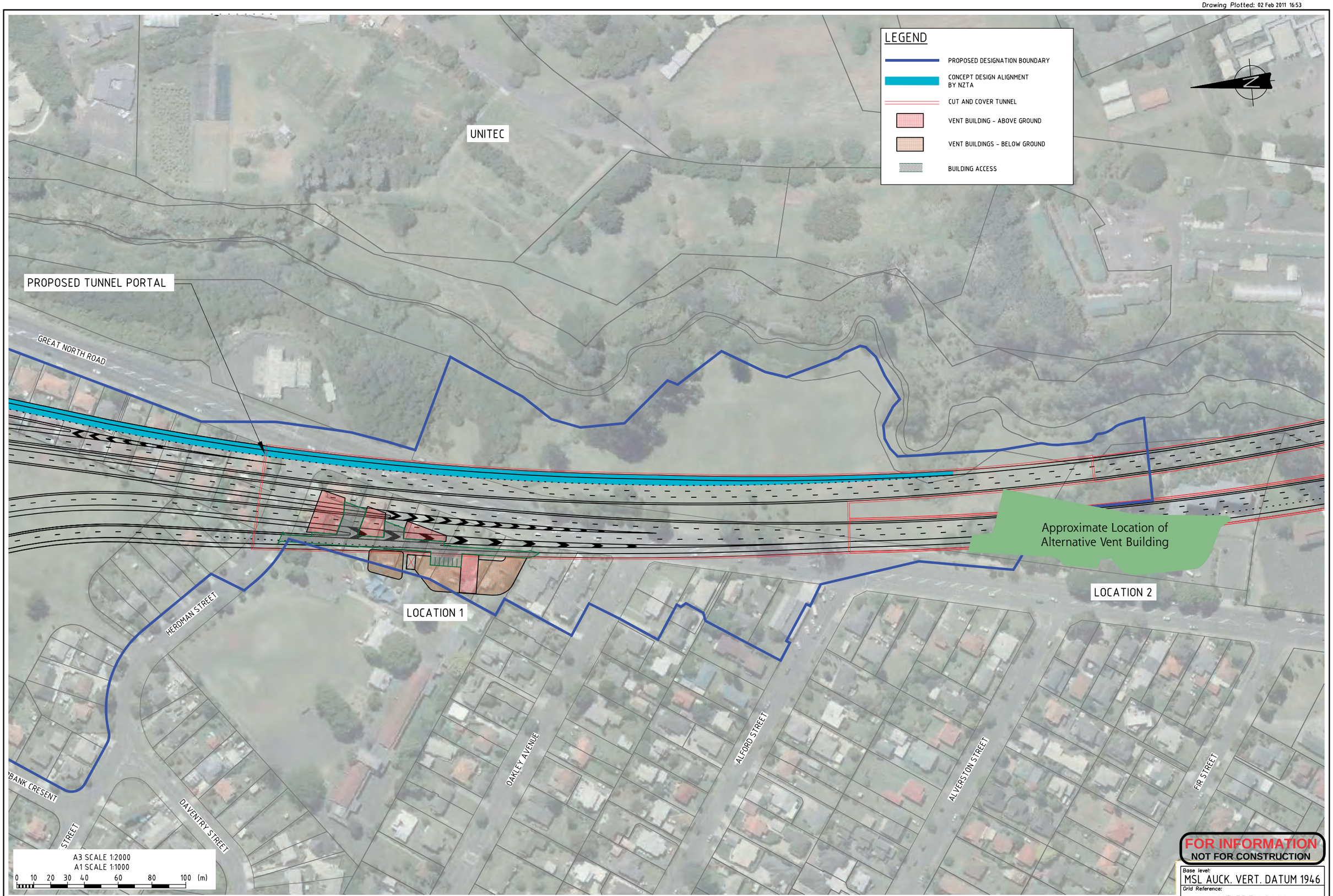
VENT - SOUTH	DWG 003
PARTIAL UNDERGROUND, SERVICED BY GANTRY OPTION	Scale: 1:1000@A4



VENT - SOUTH	DWG 003a
PARTIAL UNDERGROUND, SERVICED BY GANTRY OPTION: SECTION CC	Scale: 1:500@A4

ANNEXURE K: DRAWING NO. 20.1.11-D-C-109-440

Drawing Plotted: 02 Feb 2011 16:53



No.	Revision	By	Chk	Appd	Date
A	ISSUED FOR INFORMATION	ME			02.02.11

Drawing Originator:

Original Scale (A1) 1: 1000
Reduced Scale (A3) 1: 2000

Design Engineer	AW
Review Engineer	BM
Drafting Checked	ME
Consultant Approval	AL
Received by Beca	

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project: WATERVIEW CONNECTION PROJECT
SH16 / SH20

Title: OPTION DEVELOPMENT
CONCEPT DESIGN
IMPACTS ON NORTH VENT BUILDING

FOR INFORMATION
NOT FOR CONSTRUCTION

Base level: MSL AUCK. VERT. DATUM 1946
Grid Reference: MT EDEN 2000
Originator No.
Project No. 20.1.11-#-D-C-109-440 Rev. A

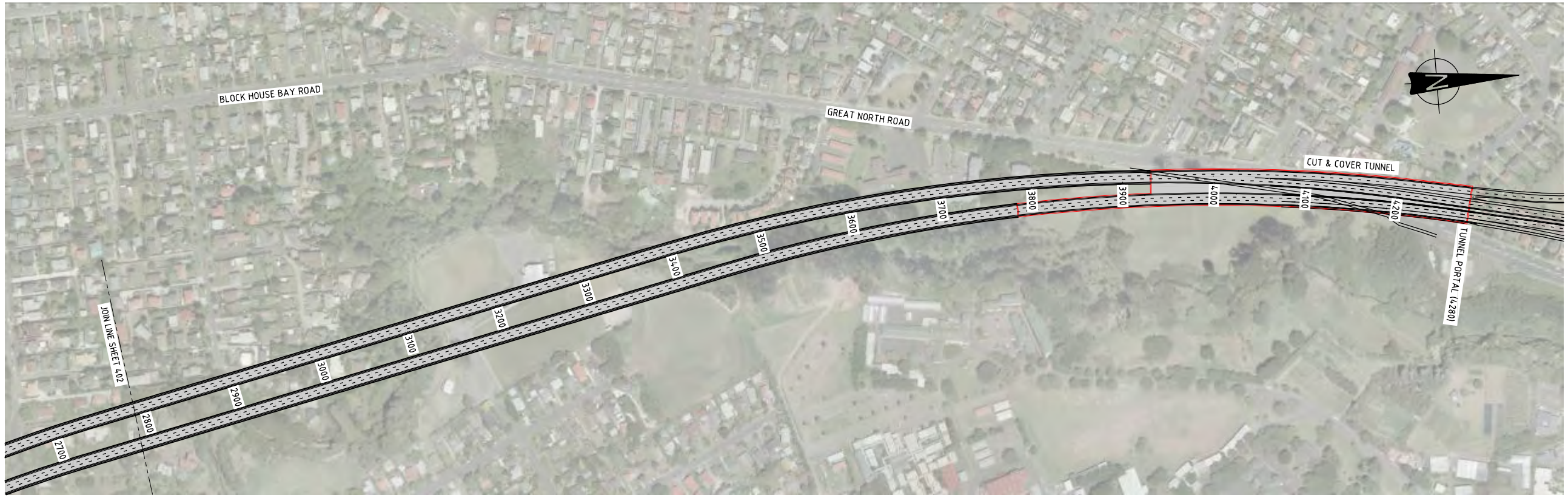
DO NOT SCALE

IF IN DOUBT ASK.

T:\Waterview\beca p\CAD\20111-3\DWG\100_Road\109\20.1.11-3-D-C-109-440.dwg, 440, 2/02/2011 4:53:51 p.m., mle, 1:2

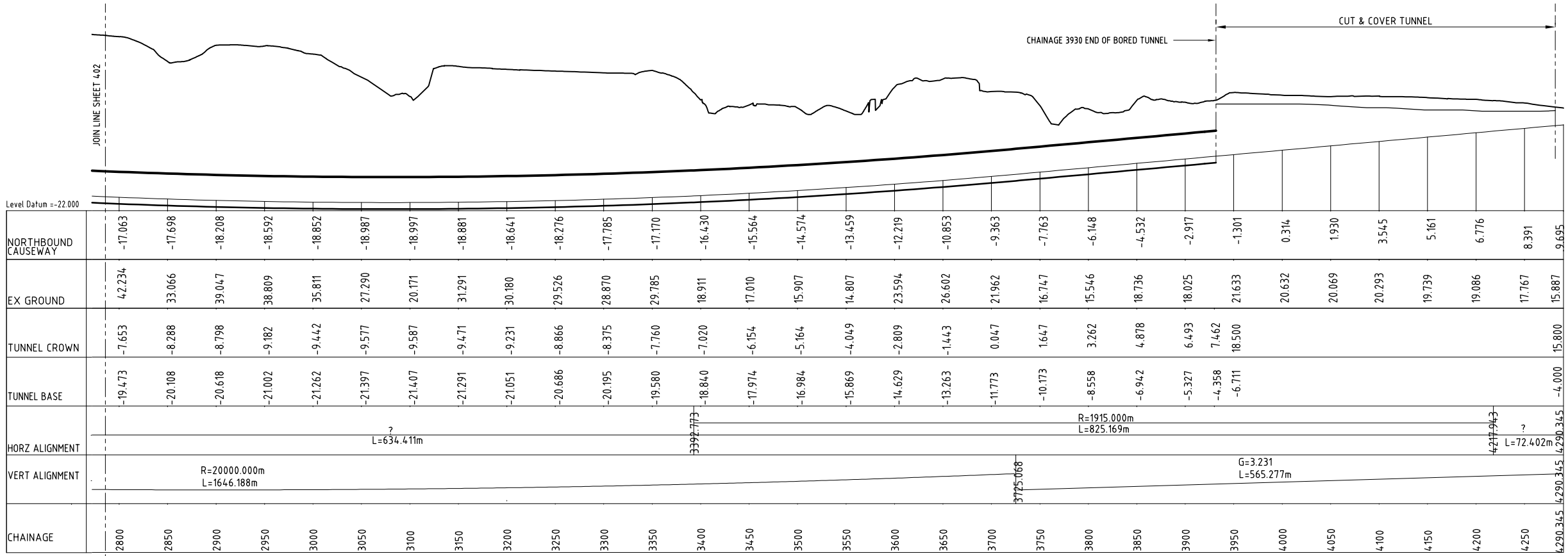
Document No. 20.11-3-D-C-109-440.dwg

ANNEXURE L: DRAWING NO. 20.1.11-3-D-C-1-2-403



PLAN- SH20

SCALE 1:2500 AT A1



CHAINAGE	NORTHBOUND CAUSEWAY	EX GROUND	TUNNEL CROWN	TUNNEL BASE
2800	-17.063	42.234	-7.653	-19.473
2850	-17.698	33.066	-8.288	-20.108
2900	-18.208	39.047	-8.798	-20.618
2950	-18.592	38.809	-9.182	-21.002
3000	-18.852	35.811	-9.442	-21.262
3050	-18.987	27.290	-9.577	-21.397
3100	-18.997	20.171	-9.587	-21.407
3150	-18.881	31.291	-9.471	-21.291
3200	-18.641	30.180	-9.231	-21.051
3250	-18.276	29.526	-8.866	-20.686
3300	-17.785	28.870	-8.375	-20.195
3350	-17.170	29.785	-7.760	-19.580
3400	-16.430	18.911	-7.020	-18.840
3450	-15.564	17.010	-6.154	-17.974
3500	-14.574	15.907	-5.164	-16.984
3550	-13.459	14.807	-4.049	-15.869
3600	-12.219	23.594	-2.809	-14.629
3650	-10.853	26.602	-1.443	-13.263
3700	-9.363	21.962	0.047	-11.773
3750	-7.763	16.747	1.647	-10.173
3800	-6.148	15.546	3.262	-8.558
3850	-4.532	18.736	4.878	-6.942
3900	-2.917	18.025	6.493	-5.327
3950	-1.301	21.633	7.462	-4.358
4000	0.314	20.632	18.500	-6.711
4050	1.930	20.069		
4100	3.545	20.293		
4150	5.161	19.739		
4200	6.776	19.086		
4250	8.391	17.767		
4290.345	9.695	15.887	15.800	-4.000

LONG SECTION - SH20 NORTHBOUND

1:2500 HORIZ AT A1
1:500 VERT AT A1

A3 SCALE 1:5000
A1 SCALE 1:2500
0 100 200 300 (m)

No.	Revision	By	Chk	Appd	Date
C	ISSUE FOR STATUTORY APPROVAL	BNRB			22.07.10
B	ISSUE FOR CONCEPT DESIGN REPORT	ME			12.07.10
A	ISSUE FOR SRT/NZTA REVIEW	BNRB			22.06.10

Drawing Originator: Beca

Original Scale (A1) 1: 2500	
Reduced Scale (A3) 1: 5000	
Design Engineer	RP
Review Engineer	RM
Drafting Checked	BD
Consultant Approval	AL
Received by Beca	

NZ TRANSPORT AGENCY WAKA KOTAHI

Project: WATERVIEW CONNECTION PROJECT SH16 / SH20

Title: LONG SECTIONS SH20 NORTHBOUND SHEET 3

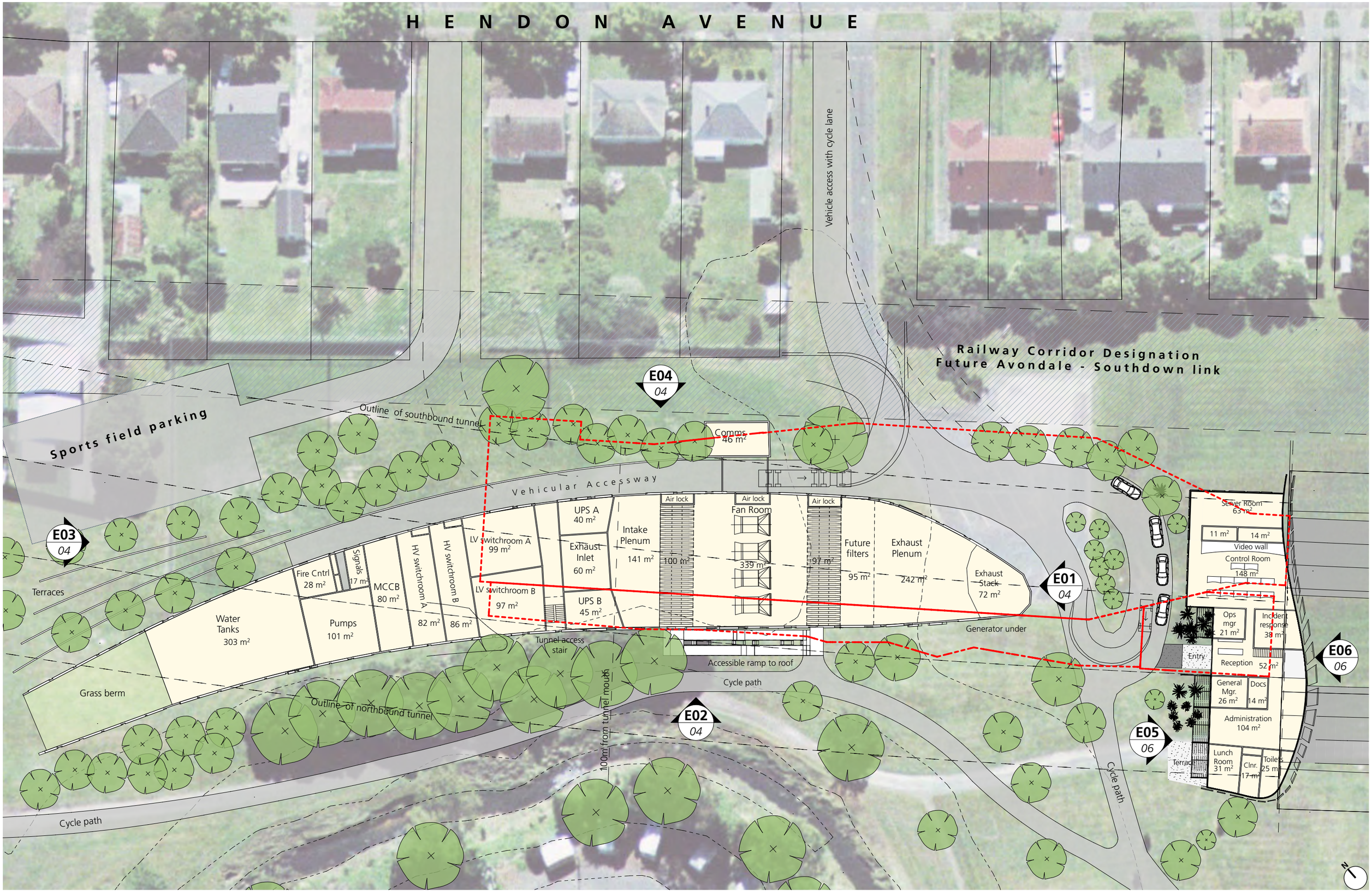
FOR APPROVAL
NOT FOR CONSTRUCTION

Base level: MSL AUCK. VERT. DATUM 1946
Grid Reference: MT EDEN 2000
Originator No.
Project No. 20.1.11-3-D-C-102-403
Rev. C

ANNEXURE M: CONSTRUCTION PROGRAMME

Construction Elements by Sector	Year																							
	1				2				3				4				5				6			
Te Atatu Interchange																								
Northbound Works																								
Southbound Works																								
Causeway and Whau Bridges																								
Bridge Work																								
Coastal Works Eastbound																								
Coastal Works Westbound																								
Great North Road Interchange																								
Earthworks & Columns																								
Bridge Construction																								
Landscaping																								
SH16 Great North Road to St Lukes																								
Eastbound Lane Widening																								
Westbound Lane Widening																								
Tunnel																								
Excavate & Establish Southern Portal																								
Driven Tunnel Northwards																								
Cut and Cover Tunnel																								
Excavate & Establish Northern Portal																								
Driven Tunnel Southwards																								
Mechanical & Electrical Works																								
Commissioning																								
SH20 from Tunnel to Maioro																								
Richardson Road Bridge																								
Bulk Earthworks																								
Road Works																								
Pedestrian / cycle Facilities																								
Landscaping																								

ANNEXURE N: PLANS SHOWING CHANGES TO THE VENTILATION BUILDING LAYOUTS



outline of building shown on lodged plans

Construkt
Urban Design & Architecture

Construkt Architects Ltd
15 Graham St, Auckland NZ
PO Box 90 451, AMC, Auckland NZ
Tel +64 (0)9 373 4900
Fax +64 (0)9 373 4904
Email info@construkt.co.nz

PROJECT TITLE
Waterview Connection

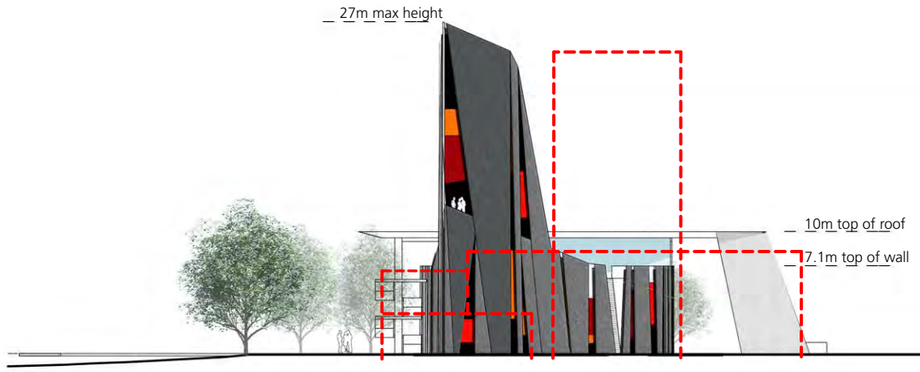
CLIENT
NZ TRANSPORT AGENCY
WAKA KOTAHI

DRAWN	SD, NL
PLOTTED	11:32AM 10/11/10
CHECKED	
SCALE	to scale @ A3

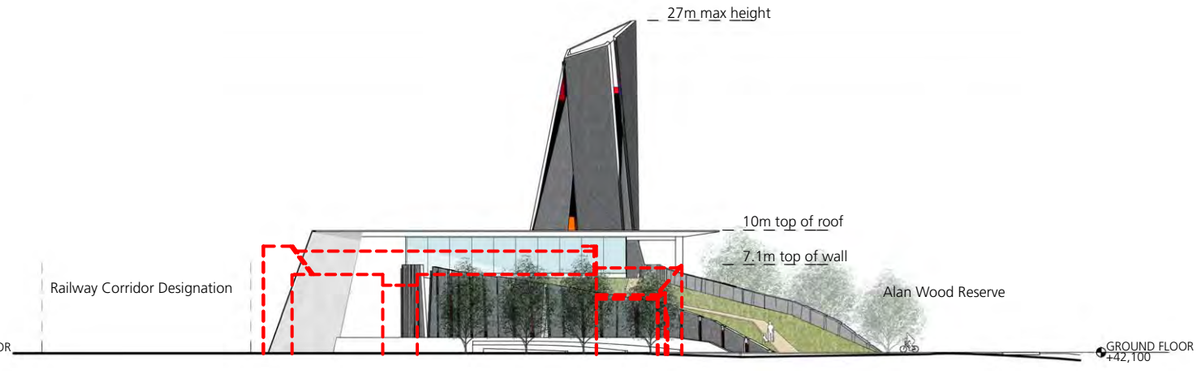
DRAWING
3

TITLE
South Portal - Ground Floor Plan - Lodged Plan overlay
SCALE 1:500

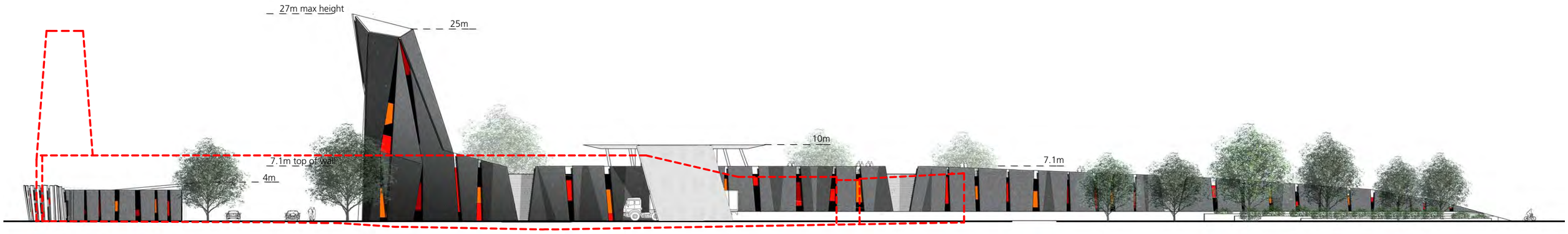
REVISION
A



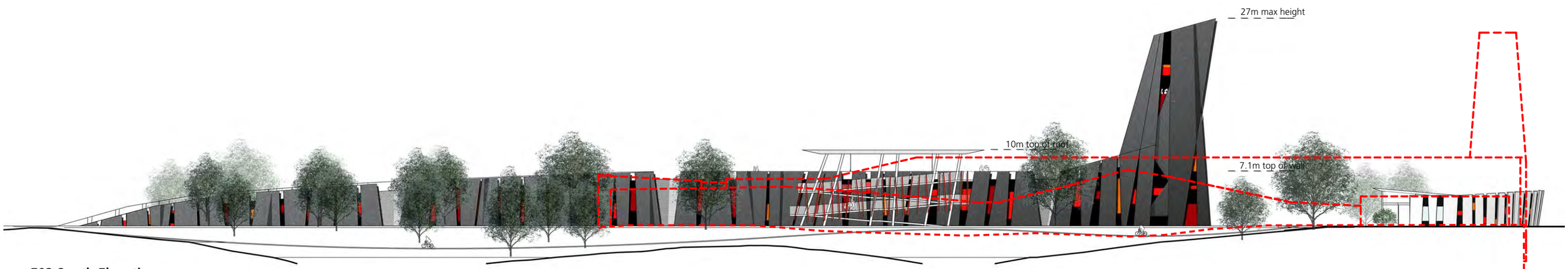
E01 East Elevation



E03 West Elevation



E04 North Elevation



E02 South Elevation

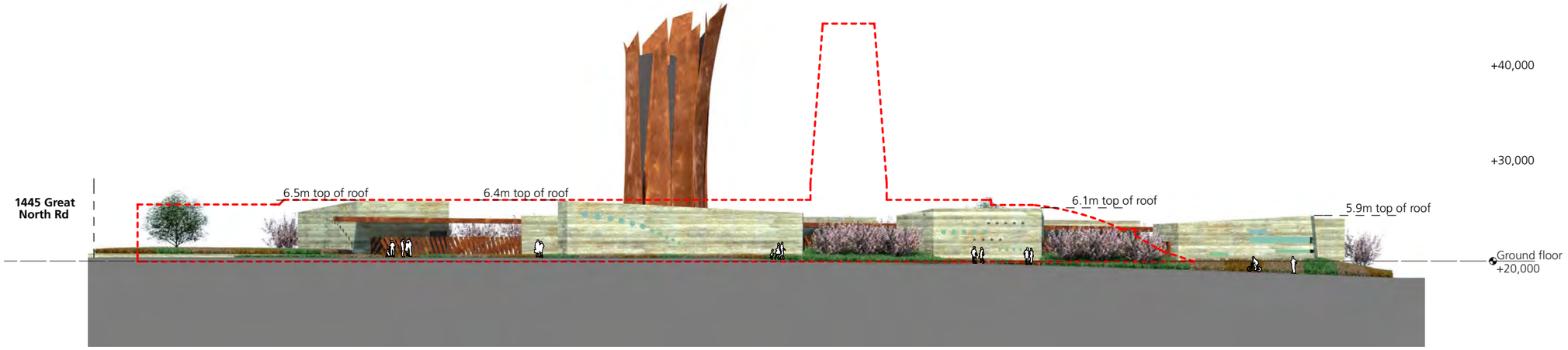
outline of building shown on lodged plans

Construkt Urban Design & Architecture	Construkt Architects Ltd 15 Graham St, Auckland NZ PO Box 90 451, AMC, Auckland NZ Tel +64 (0)9 373 4900 Fax +64 (0)9 373 4904 Email info@construkt.co.nz	PROJECT TITLE **Waterview Connection**	CLIENT NZ TRANSPORT AGENCY WAKA KOTAHI	DRAWN PLOTTED CHECKED SCALE	SD, NL 11:32AM 10/11/10 to scale @ A3	DRAWING **5**	TITLE **South Portal - Street Elevations - Lodged Plan overlay** SCALE 1:500	REVISION **A**

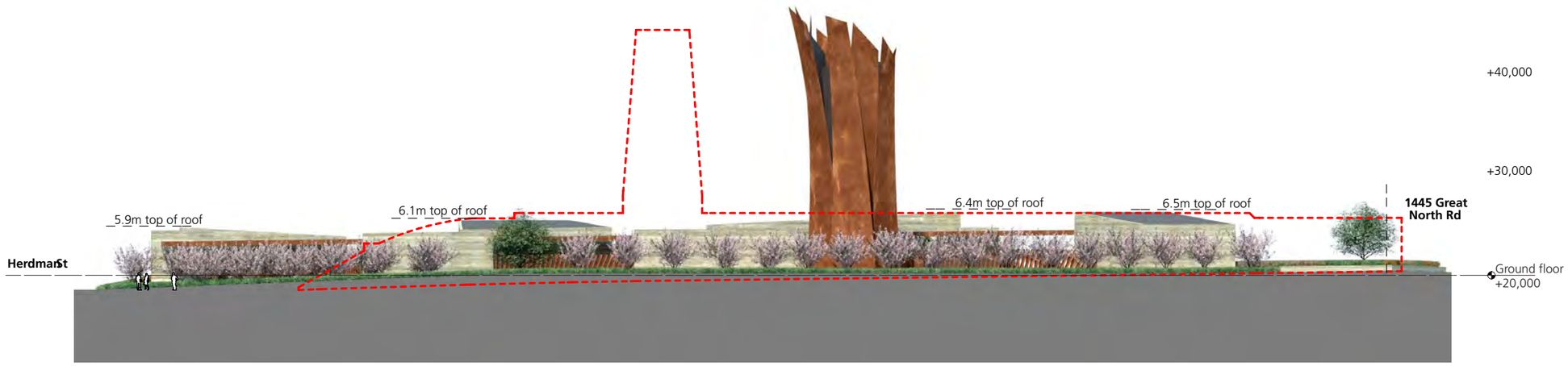
Construkt Urban Design & Architecture	Construkt Architects Ltd 15 Graham St, Auckland NZ PO Box 90 451, AMC, Auckland NZ Tel +64 (0)9 373 4900 Fax +64 (0)9 373 4904 Email info@construkt.co.nz	PROJECT TITLE **Waterview Connection**	CLIENT NZ TRANSPORT AGENCY WAKA KOTAHI	DRAWN / SD, NL PLOTTED / 11:32AM 10/11/10 CHECKED / SCALE / to scale @ A3	DRAWING 10	TITLE **North Portal - Basement Floor Plan - Lodged Plan overlay** SCALE 1:500	REVISION A

outline of building shown on lodged plans

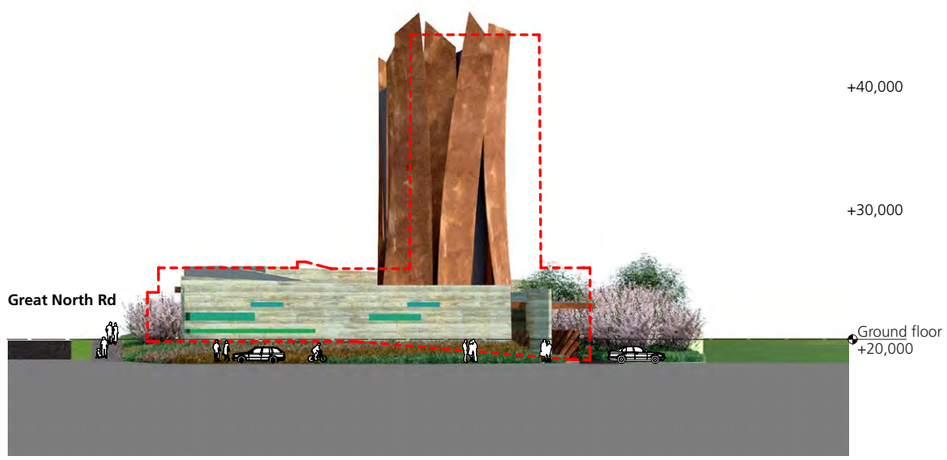
Construkt Urban Design + Architecture	Construkt Architects Ltd 15 Graham St, Auckland NZ PO Box 90 451, AMC, Auckland NZ Tel +64 (0)9 373 4900 Fax +64 (0)9 373 4904 Email info@construkt.co.nz	PROJECT TITLE **Waterview Connection**	CLIENT NZ TRANSPORT AGENCY WAKA KOTAHI	DRAWN PLOTTED CHECKED SCALE	SD, NL 11:32AM 10/11/10 to scale @ A3	DRAWING 12	TITLE **North Portal - Ground Floor Plan - Lodged Plan overlay** SCALE 1:500	REVISION A



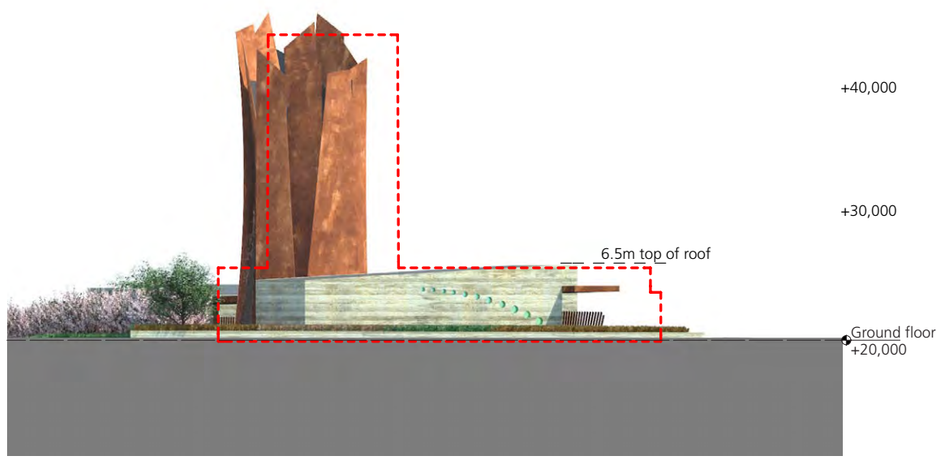
E01 Great North Road Elevation



E02 Waterview Primary School Elevation



E03 Herdman Street Elevation



E04 South Elevation

outline of building shown on lodged plans

Construkt
Urban Design & Architecture

Construkt Architects Ltd
15 Graham St, Auckland NZ
PO Box 90 451, AMC, Auckland NZ
Tel +64 (0)9 373 4900
Fax +64 (0)9 373 4904
Email info@construkt.co.nz

PROJECT TITLE
Waterview Connection

CLIENT
NZ TRANSPORT AGENCY
WAKA KOTAHI

DRAWN	SD, NL
PLOTTED	11:32AM 10/11/10
CHECKED	
SCALE	to scale @ A3

DRAWING
14

TITLE
North Portal - Street Elevations - Lodged Plan overlay
SCALE 1:500

REVISION
A