Figure B.J. *Tree 10 (Victorian Blue Gum)*

Figure B.K. *Tree 11 (Spotted Gum)*

Figure B.L. *Tree 12 (Victorian Blue Gum)*

Figure B.M. *Tree 13 (Spotted Gum)*

Figure B.N. *Tree 14 (Victorian Blue Gum)*

Figure B.O. *Tree 15 (Spotted Gum)*

Figure B.P. *Tree 16 (Manna Gum)*

Figure B.Q. *Tree 17 (Manna Gum)*

Figure B.R. *Tree 18 (Manna Gum)*

Figure B.S. *Tree 19 (Victorian Blue Gum)*

Figure B.T. *Tree 20 (Spotted Gum)*

Figure B.U. *Tree 21 (Spotted Gum)*

Figure B.V. *Tree 22 (Spotted Gum)*

Figure B.W. *Tree 23 (Spotted Gum)*

Figure B.X. *Tree 24 (Spotted Gum)*

Figure B.Y. *Tree 25 (Manna Gum)*

Figure B.Z. *Trees 26 -29 (Swamp Paperbarks)*

Figure B.AA. *Tree 30 (Southern Blue Gum)*

Figure B.AB. *Tree 31 & 32 (Swamp Paperbarks)*

Figure B.AC. *Tree 33 (Manna Gum)*

Figure B.AD. *Tree 34 (Manna Gum)*

Figure B.AE. *Tree 35 (Willow Peppermint)*

Figure B.AF. *Tree 36 (Prickly Leaved Paperbark)*

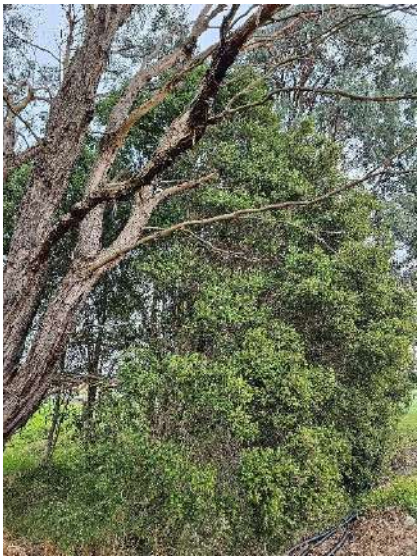


Figure B.AG. *Tree 37 (Prickly Leaved Paperbark)*

Figure B.AH. *Tree 38 (White Bottlebrush)*

Figure B.AI. *Tree 39 (White Bottlebrush)*

Figure B.AJ. *Tree 40 (Prickly Leaved Paperbark)*

Figure B.AK. *Tree 41 (Willow Peppermint)*

Figure B.AL. *Tree 42 (Prickly Leaved Paperbark)*

Figure B.AM. *Tree 43 (Prickly Leaved Paperbark)*

Figure B.AN. *Tree 44 (Prickly Leaved Paperbark)*

Figure B.AO. *Tree 45 (White Bottlebrush)*

Figure B.AP. *Tree 46 (Blackwood)*

Figure B.AQ. *Tree 47 (River She-Oak)*

Figure B.AR. *Tree 48 (Prickly Leaved Paperbark)*

Figure B.AS. *Tree 49 (Blackwood)*

Figure B.AT. *Tree 50 (Prickly Leaved Paperbark)*

Figure B.AU. *Tree 51 (White Bottlebrush)*

Figure B.AV. *Tree 52 (Blackwood)*

Figure B.AW. *Tree 53 (Prickly Leaved Paperbark)*

Figure B.AX. *Tree 54 (White Bottlebrush)*

Figure B.AY. *Tree 55 (Dead Tree)*

Figure B.AZ. *Tree 56 - 62 (Various)*

Figure B.BA. *Tree 63 (Willow Peppermint)*

Figure B.BB. *Tree 64 (Prickly Leaved Paperbark)*

Figure B.BC. *Tree 65 (Common Hawthorn)*

Figure B.BD. *Tree 66 (Swamp Paperbark)*

Figure B.BE. *Tree 67 (White Bottlebrush)*

Figure B.BF. *Tree 68 (Prickly Leaved Paperbark)*

Figure B.BG. *Tree 69 (Red Iron Bark)*

Figure B.BH. *Tree 70 (Common Hawthorn)*

Figure B.BI. *Tree 71 (Willow Leaved Hakea)*

Figure B.BJ. *Trees 72 & 73 (Common Hawthorns)*

Figure B.BK. *Tree 74 (Prickly Leaved Paperbark)*

Figure B.BL. *Tree 75 (Willow Leaved Hakea)*

Figure B.BM. *Tree 76 (Swamp Paperbark)*

Figure B.BN. *Tree 79 (Willow Leaved Hakea)*

Figure B.BO. *Tree 80 (Prickly Leaved Paperbark)*

Figure B.BP. *Tree 81 (Prickly Leaved Paperbark)*

Figure B.BQ. *Tree 82 (Prickly Leaved Paperbark)*

Figure B.BR. *Tree 83 (Willow Leaved Hakea)*

Figure B.BS. *Tree 84 (Prickly Leaved Paperbark)*

Figure B.BT. *Tree 85 (Common Hawthorn)*

Figure B.BU. *Tree 86 (Prickly Leaved Paperbark)*

Figure B.BV. *Tree 87 (River She-Oak)*

Figure B.BW. *Trees 88 - 91 (Common Hawthorns)*

Figure B.BX. *Tree 92 (Willow Leaved Hakea)*

Figure B.BY. *Tree 93 (Dead Tree)*

Figure B.BZ. *Tree 94 (Prickly Leaved Paperbark)*

Figure B.CA. *Tree 95 (River She-Oak)*

Figure B.CB. *Tree 97 (Willow Leaved Hakea)*

Figure B.CC. *Tree 98 (White Bottlebrush)*

Figure B.CD. *Tree 99 (Willow Leaved Hakea)*

Figure B.CE. *Tree 100 (Prickly Leaved Paperbark)*

Figure B.CF. *Tree 101 (Swamp Paperbark)*

Figure B.CG. *Trees 102 & 103 (Common Hawthorns)*

Figure B.CH. *Tree 104 (River She-Oak)*

Figure B.CI. *Tree 105 (Prickly Leaved Paperbark)*

Figure B.CJ. *Tree 106 (Prickly Leaved Paperbark)*

Figure B.CK. *Tree 107 (River She-Oak)*

Figure B.CL. *Tree 108 (Blackwood)*

Figure B.CM. *Tree 109 (Prickly Leaved Paperbark)*

Figure B.CN. *Tree 110 (Dead Tree)*

Figure B.CO. *Tree 111 (White Bottlebrush)*

Figure B.CP. *Tree 112 (Dead Tree)*

Figure B.CQ. *Tree 113 (Late Black Wattle)*

Figure B.CR. *Tree 114 (Common Hawthorn)*

Figure B.CS. *Trees 115 - 117 (Common Hawthorns)*

Figure B.CT. *Trees 118 - 120 (Common Hawthorns)*

Figure B.CU. *Trees 121 - 124 (Common Hawthorns)*

Figure B.CV. *Tree 125 (Dead Tree)*

Figure B.CW. *Trees 126 - 130 (Common Hawthorns)*

Figure B.CX. *Tree 131 (Blackwood)*

Figure B.CY. *Tree 132 (Blackwood)*

Figure B.CZ. *Trees 133 - 137 (Late Black Wattles)*

Figure B.DA. *Trees 138 & 139 (Swamp Paperbarks)*

Figure B.DB. *Trees 140 - 143 (Swamp Paperbarks)*

Figure B.DC. *Tree 144 (Common Hawthorn)*

Figure B.DD. *Tree 145 (Common Hawthorn)*

Figure B.DE. *Tree 146 (Common Hawthorn)*

Figure B.DF. *Tree 147 (Common Hawthorn)*

Figure B.DG. *Tree 148 (Blackwood)*

Figure B.DH. *Trees 149 - 152 (Blackwoods)*

Figure B.DI. *Tree 153 (Plum)*

Figure B.DJ. *Tree 154 (Blackwood)*

Figure B.DK. *Tree 155 (Blackwood)*

Figure B.DL. *Tree 156 (Blackwood)*

Figure B.DM. *Tree 157 (Blackwood)*

Figure B.DN. *Patch A*

Figure B.DO. *Patch B*

Figure B.DP. *Patch C*

Figure B.DQ. *Patch D*

Figure B.DR. *Patch E*

Figure B.DS. *Patch F*

Figure B.DT. *Patch G*

Figure B.DU. *Patch H*

Figure B.DV. *Patch I*

Appendix C. Tree Descriptors

C.A. Botanical Name

C.A.A. The botanical name or binominal name of a plant, consists of the *genus* name followed by the *species* name.

C.A.B. *Genus* is the classificational term used for grouping one or a number of closely related species, all of which share the generic name.

C.A.C. *Species* is the basic unit in the classification of plants. A species is the specific type of plant within the larger grouping of a genus.

C.A.D. If applicable (and if known), the *subspecies* or *cultivar* will also be included in the botanical name.

C.B. Common Name

C.B.A. The colloquial and informal name of a plant. Where a species has several accepted common names (as is often the case), the assessor will select the one most likely to apply in the locale the plant was assessed.

C.C. Origin

C.C.A. The naturally occurring origin of the plant.

Indigenous	The plant occurs naturally within the general area it was assessed.
Native (Vic)	The plant is native to the state of Victoria but does not occur naturally within the area it was assessed.
Native	The plant is native to Australia but does not occur naturally within the state of Victoria.
Exotic	The plant does not occur naturally within Australia.
n/a	The plant is dead and/or the species was not identified.

C.D. Age

C.D.A. The age class of the plant.

Juvenile	The plant is developing rapidly and is still establishing itself in the current location.
Semi-Mature	The plant has established itself in the current location and is still actively growing.
Mature	The plant has reached the expected size for the species and location, and growth has slowed.
Senescent	The plant is mature and in a state of decline.
Dead	The plant is dead.

C.E. Health

C.E.A. The overall health and vigour of the plant.

Good	Foliage of plant is entire, with good colour, very little sign of pathogens and of good density. Growth indicators are good i.e. Extension growth of twigs and wound wood development. Minimal or no canopy dieback (deadwood).
Fair	The plant is showing one or more of the following symptoms; < 25% dead wood, minor canopy dieback, foliage generally with good colour though some imperfections may be present. Minor pathogen damage present, with growth indicators such as leaf size, canopy density and twig extension growth typical for the species in this location.
Fair-Poor	Tree is showing one or more of the following symptoms of tree decline; > 25% deadwood, canopy die back is observable, discoloured or distorted leaves. Pathogens present, stress symptoms are observable as reduced leaf size, extension growth and canopy density.
Poor	Tree is in severe decline; > 50% deadwood, very little foliage, possibly epicormic shoots, minimal extension growth.
Dead	The plant is dead.

C.F. Structure

C.F.A. The overall form and structure of the plant.

Good	Trunk and scaffold branches show good taper and attachment with minor or no structural defects. Tree is a good example of the species with a well-developed form showing no obvious root problems or pests and diseases.
Fair	Tree shows some minor structural defects or minor damage to trunk e.g. bark missing, there could be cavities present. Minimal damage to structural roots. Tree could be seen as typical for this species.
Fair-Poor	The tree or a part thereof is identified as having an increased likelihood of failure. This may include but is not limited to: poor formation of a major union, brittle deadwood, stem decay or a history of limb failures.
Poor	There are major structural defects, damage to trunk or bark missing. Poor structure with likely points of failure. Girdling or damaged roots obvious.

C.G. Useful Life Expectancy (ULE)

C.G.A. The extent of time that the plant is expected to make a positive contribution to the landscape, based on the assumption that the tree and its immediate environment will remain unaltered *(concept created by Jeremy Barrell, 2000)*.

0 Years	The plant no longer contributes to the landscape in a positive way or is a weed species.
< 5 Years	The plant is approaching the end of its ULE and will require removal within 5 years.
5 – 10 Years	The plant appears to be retainable for a further 5 – 10 years.
10 – 20 Years	The plant appears to be retainable for a further 10 – 20 years.
20 – 30 Years	The plant appears to be retainable for a further 20 – 30 years.
30 + Years	The plant appears to be retainable for more than 30 years.

C.H. Arboricultural Value

C.H.A. Arboricultural value encompasses the overall contribution a tree makes to the landscape it is growing in. It does not consider any future modifications to the site such as development.

C.H.B. The size of the tree is often the most influential factor in assessing arboricultural value, and as such the sum of the tree's height + average canopy spread will determine the value in cases where there are no significantly diminishing or augmenting factors to consider.

Height + Width (m)	**Typical Arboricultural Value Rating**
1 – 14	Low
15 – 24	Moderate
25 +	High

C.H.C. Size alone is not always a good indicator of the plant's value and the assessor will consider the following factors before determining a final value:

- *Tree condition (health and structural);*
- *Tree species (and weed status if applicable);*
- *Useful life expectancy;*
- *Risk posed by the tree;*
- *Appropriateness of tree in the given location;*
- *Context of tree in the given location;*
- *Ecological associations;*
- *Any special significance or protection provisions associated with the tree.*

C.H.D. Generally, trees assessed as having a low, moderate, or high arboricultural value will fit the descriptions below:

Arboricultural Value	**Description**
Low	Tree is insignificant in terms of its age or size, or has no long-term potential due to its condition or inappropriateness. Weed species will almost always be assigned a low value.
Moderate	Tree is established and presents in good condition. It is appropriate in the location, but isn't remarkable in any way. Trees that would otherwise be of high value may be demoted to moderate for any of the factors specified above (C.H.C.).
High	Usually, a large tree that is in fair – good condition and contributes positively to the landscape with medium to long-term prospects.

Appendix D. TPZ / SRZ Dimensions

Tree #	TPZ (mm)	SRZ (mm)	Tree #	TPZ (mm)	SRZ (mm)	Tree #	TPZ (mm)	SRZ (mm)
1	4560	2337	**31**	2000	1500	**61**	2000	1500
2	8400	3021	**32**	2000	1500	**62**	2000	1500
3	6120	2645	**33**	4440	2311	**63**	7728	2917
4	10080	3262	**34**	9600	3195	**64**	2511	1819
5	3827	2172	**35**	8160	2985	**65**	2000	1500
6	7680	2910	**36**	2160	1708	**66**	2000	1537
7	6120	2645	**37**	4157	2248	**67**	3360	2056
8	4348	2291	**38**	2000	1500	**68**	2000	1500
9	5160	2462	**39**	2000	1500	**69**	4560	2337
10	2760	1893	**40**	3000	1961	**70**	2000	1500
11	4680	2363	**41**	9000	3110	**71**	3716	2145
12	8040	2966	**42**	2000	1500	**72**	2000	1500
13	4320	2285	**43**	2000	1500	**73**	2000	1500
14	3240	2025	**44**	3840	2175	**74**	3795	2164
15	5160	2462	**45**	2000	1500	**75**	2400	1785
16	3720	2146	**46**	2000	1500	**76**	2000	1500
17	9000	3110	**47**	5961	2616	**79**	2400	1785
18	7320	2852	**48**	2123	1696	**80**	2000	1500
19	2000	1625	**49**	2000	1537	**81**	3055	1975
20	6600	2730	**50**	2640	1858	**82**	2520	1822
21	2123	1696	**51**	2160	1708	**83**	2000	1500
22	4680	2363	**52**	2280	1747	**84**	2736	1886
23	5400	2510	**53**	2000	1625	**85**	2000	1500
24	5160	2462	**54**	2000	1500	**86**	4836	2396
25	8040	2966	**55**	n/a	2612	**87**	5160	2462
26	2000	1500	**56**	2000	1500	**88**	2000	1500
27	2000	1500	**57**	2000	1500	**89**	2000	1500
28	2000	1500	**58**	2000	1500	**90**	2000	1500
29	2000	1500	**59**	2000	1500	**91**	2000	1500
30	2400	1785	**60**	2000	1500	**92**	2400	1785

Table D.A. *TPZ / SRZ dimensions - to be applied as radius from the center of the trunk at ground level* *(continued on next page)*

Tree #	TPZ (mm)	SRZ (mm)	Tree #	TPZ (mm)	SRZ (mm)	Tree #	TPZ (mm)	SRZ (mm)
93	n/a	2268	**124**	2000	1500	**154**	2000	1500
94	4530	2331	**125**	n/a	1785	**155**	2000	1500
95	4200	2258	**126**	2000	1500	**156**	3600	2117
97	2400	1785	**127**	2000	1500	**157**	6788	2763
98	2000	1500	**128**	2000	1500	**PATCH A**	2000 *	1500 *
99	2400	1785	**129**	2000	1500	**PATCH B**	2000 *	1500 *
100	2471	1807	**130**	2000	1500	**PATCH C**	2000 *	1500 *
101	2000	1500	**131**	5040	2438	**PATCH D**	2000 *	1500 *
102	2000	1500	**132**	2760	1893	**PATCH E**	2000 *	1500 *
103	2000	1500	**133**	5880	2601	**PATCH F**	2000 *	1500 *
104	3600	2117	**134**	3000	1961	**PATCH G**	2000 *	1500 *
105	4320	2285	**135**	3240	2025	**PATCH H**	2000 *	1500 *
106	3118	1992	**136**	5949	2614	**PATCH I**	2000 *	1500 *
107	4320	2285	**137**	4080	2231			
108	2000	1500	**138**	2400	1785			
109	2000	1500	**139**	2400	1785			
110	n/a	3110	**140**	2400	1785			
111	2000	1500	**141**	2000	1500			
112	n/a	2510	**142**	2000	1500			
113	3000	1961	**143**	2400	1785			
114	2000	1500	**144**	2000	1500			
115	2000	1500	**145**	2000	1500			
116	2000	1500	**146**	2000	1500			
117	2000	1500	**147**	2000	1500			
118	2000	1500	**148**	4800	2388			
119	2000	1500	**149**	2000	1500			
120	2000	1500	**150**	2000	1500			
121	2000	1500	**151**	2000	1500			
122	2000	1500	**152**	2000	1500			
123	2000	1500	**153**	2000	1500			

** TPZ / SRZ to be applied around entire patch of vegetation at the specified radius from each tree*

Table D.A. *TPZ / SRZ dimensions - to be applied as radius from the center of the trunk at ground level* *(continued from previous page)*

Appendix E. Generic Tree Protection Plan

E.A. Awareness of the Tree Protection Program

E.A.A. All personnel involved in the development process must attend an induction that conveys the importance of the tree protection program and the recommendations of this report.

E.A.B. Each induction must be recorded and stored appropriately.

E.B. Tree Removals

E.B.A. A reputable and insured contractor should be engaged to undertake approved tree removals.

E.B.B. Trees should be clearly marked with paint (or similar) to ensure the contractor does not accidentally remove incorrect trees.

E.B.C. Tree removal methods must not impact on protected trees.

E.B.D. Stump removal methods must not impact on the existing roots of protected trees.

E.C. Tree Pruning

E.C.A. The pruning of any tree under protection should occur on a requisite basis only and must comply with any applicable planning controls.

E.C.B. All pruning must be carried out by a suitably qualified and experienced and qualified arborist (minimum AQF level 3) in accordance with Australian Standards – AS 4373 2007 *(Pruning of Amenity Trees)*.

E.C.C. Pruning of an off-site tree must be undertaken in consultation with the respective landowner(s) and/or comply with current right of abatement laws.

E.D. Installation of Tree Protection Fencing

E.D.A. Following the removal of vegetation from the site, tree protection fencing must be installed to the full extent of the prescribed TPZ(s) prior to any further works occurring within the site *(see E.E. below for permitted exceptions)*.

E.D.B. The tree protection fencing must be a minimum of 1.5 metres high and be constructed of prefabricated wire mesh or high visibility barricade mesh supported by a straining wire.

E.D.C. The tree protection fencing must be fixed so that it cannot be easily shifted by development personnel.

E.D.D. Once erected, tree protection fencing must be maintained in good condition.

E.E. Variations to Tree Protection Fencing

E.E.A. It is not practical or necessary to install tree protection fencing on adjoining properties. In most cases, only portions of a TPZ that occupy the subject site require protection.

E.E.B. Where an endorsed encroachment of a TPZ will occur, the tree protection fencing may be reduced by the minimum extent necessary to facilitate construction. Where it is practical to do so, tree protection fencing should be afforded to the full TPZ when works are not actively occurring in that area.

E.E.C. Tree protection fencing may be reduced to the minimum extent necessary to install scaffolding if ground protection is utilised *(see E.G. below for specifications)*.

E.E.D. The extent and specifications of tree protection fencing on public land (such as a nature strip) should be discussed with the relevant authority prior to installation.

E.F. Tree Protection Fencing Signage

E.F.A. Explanatory signs must be displayed on tree protection fencing that clearly indicates that access is prohibited and provides contact details for the project arborist and/or site supervisor.

E.F.B. Signs must be displayed on each TPZ or at intervals not exceeding five metres.

E.F.C. Signs must remain legible and visible throughout the development phase.

E.G. Ground Protection

E.G.A. When it is not practical to install tree protection fencing, ground protection may be used in some cases.

E.G.B. Ground protection must comprise a 100mm layer of mulch placed below rumble boards to distribute weight and avoid compaction to the soil.

E.H. Restrictions within a TPZ

E.H.A. Development personnel, vehicles, or machinery must not access a TPZ at any time (unless done so in accordance with conditions set out by the project arborist and/or determining authority).

E.H.B. The base area of the TPZ must not be altered by cut, fill, or trenching (unless done so in accordance with conditions set out by the project arborist and/or determining authority).

E.H.C. Building materials and waste must not be stored within a TPZ.

E.I. Installation of Underground Services within a TPZ

E.I.A. If it is not practical to locate all services outside TPZs, they should be bored under the ground at a depth of at least 600mm within a TPZ. Bore pits are to be located outside TPZs (unless approved by the project arborist and/or determining authority).

E.I.B. If boring underground is not feasible or practical, manual excavation of trenches within TPZs may be undertaken in accordance with the conditions detailed in Appendix E.L. Root Pruning (page 63).

E.J. Construction of Boundary & Internal Fences within a TPZ

E.J.A. Construction of boundary and internal fences within a TPZ should be scheduled to occur when there are no other trades working within the site.

E.J.B. Tree protection fencing may be temporarily reduced to the minimum extent necessary to facilitate construction.

E.J.C. Vehicles or machinery must not access the TPZ at any time unless sufficient ground protection has been installed *(see Appendix E.G. Ground Protection, page 62)*.

E.J.D. The existing soil level within a TPZ must not be altered by cut, fill, or trenching (except as below).

E.J.E. Post holes within a TPZ must be carefully dug by hand tool implements and shifted as necessary to avoid the severance of or injury to roots exceeding 50mm in diameter.

E.J.F. No part of the fence may be attached to a tree's trunk or branches. Voids left in the fence to accommodate a tree must consider the future growth of that tree.

E.J.G. Any necessary pruning must be carried out in accordance with Appendix E.C. Tree Pruning *(page 61)*.

E.K. Construction of Driveways within a TPZ

E.K.A. Construction of a driveway within a TPZ should be scheduled to occur when there are no other trades working within the site.

E.K.B. Tree protection fencing may be temporarily reduced to the minimum extent necessary to facilitate construction.

E.K.C. Vehicles or machinery must not access the TPZ at any time unless sufficient ground protection has been installed *(see Appendix E.G. Ground Protection, page 62)*.

E.K.D. The existing soil level within a TPZ must not be altered by cut, fill, or trenching (except as below).

E.K.E. The existing soil level must not be cut or scraped by more than 20mm.

E.K.F. Base fill used to construct the driveway must not exceed a depth of more than 150mm.

E.L. Root Pruning

E.L.A. Any excavation within a TPZ must be directly supervised by the project arborist at all times.

E.L.B. Excavation within a TPZ must be undertaken using non-destructive techniques such as hand digging, air-spade excavation, or hydro excavation. A hydraulic excavator may be used in some cases if approved by the project arborist.

E.L.C. Each root encountered must be carefully dug around and assessed by the project arborist before it is pruned.

Root diameter (mm)	**Maximum number of roots to be cut within the TPZ**
1 – 49	No limit.
50 – 74	To be determined by the project arborist.
75 +	No root pruning permitted unless approved by the responsible authority.

E.L.D. Roots must be severed cleanly with a sharp, disinfected cutting implement. They must not be pulled, ripped, torn, or smashed.

E.L.E. Any root pruning is to be documented and photographed by the project arborist, and a summary provided to the responsible authority on request.

E.L.F. Works must cease immediately if directed by the project arborist, and alternative methods investigated.

E.L.G. Excavated soil must be backfilled once the relevant works are complete, and tree protection fencing re-instated to the original position if it is practical to do so.

E.M. Tree Roots Located outside of a TPZ

E.M.A. If tree roots are encountered outside of a TPZ, they should be protected where it is practical to do so.

E.M.B. If the removal of a tree root outside of a TPZ is required, it must be severed cleanly with a sharp, disinfected cutting implement.

E.M.C. Tree roots located outside of a TPZ must not be pulled, ripped, torn, or smashed.

E.N. Reporting

E.N.A. All personnel involved within the development must report any damage to a tree under protection or a noticeable change in its condition.

E.N.B. Damage to a tree includes any physical injury to its trunk, branches, or roots.

E.N.C. A noticeable change in condition may include: dieback, discolouration, defoliation or wilting of foliage; excessive exudation of fluids from the trunk; pest infestation; limb shed; root plate movement, or a sudden trunk lean.

E.N.D. Reports are to be made through a pre-established chain of command and both the responsible authority and project arborist are to be notified within 48 hours.

E.N.E. Any report by development personnel that relates to the trees should be documented appropriately, and if it is safe to do so, the relevant tree(s) are to be photographed before any further work occurs.

E.N.F. If substantial roots have been severed or there is a concern that a tree has become hazardous, the fall zone of the tree must be immediately cordoned off. At least one person must remain on-site until the hazard has been made safe or the tree has been assessed by a suitably experienced and qualified arborist (minimum AQF level 5) and determined to stable.

Appendix F. Tree Location Plans

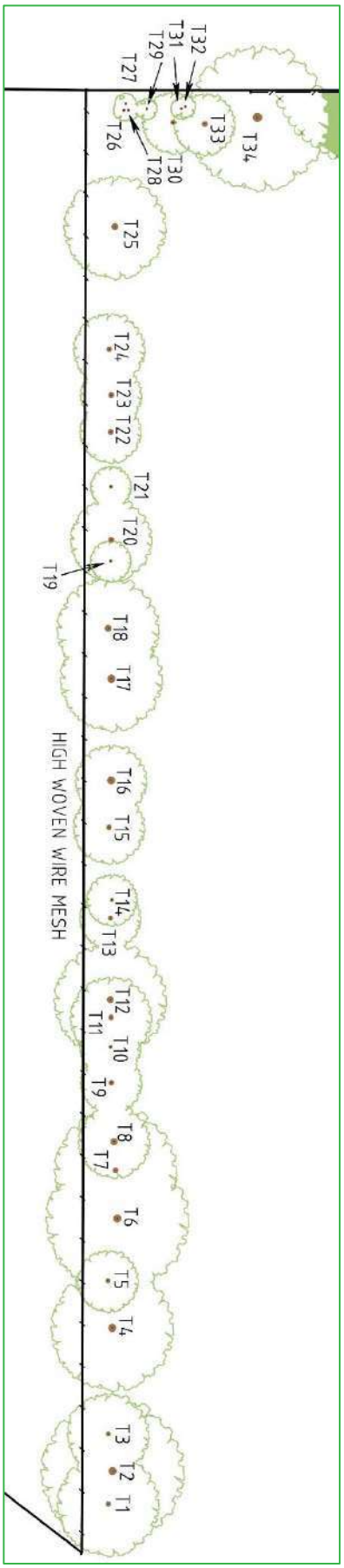


Figure F.A. *Trees 1 – 34*

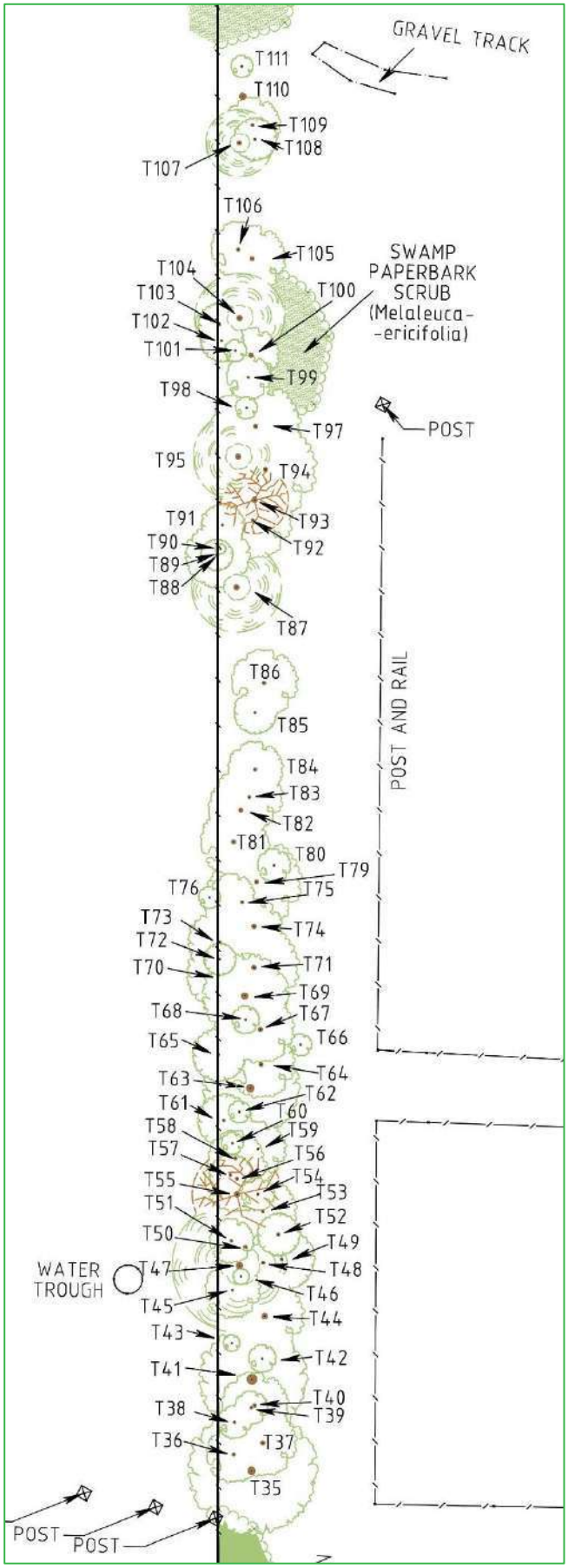


Figure F.B. *Trees 35 – 111*

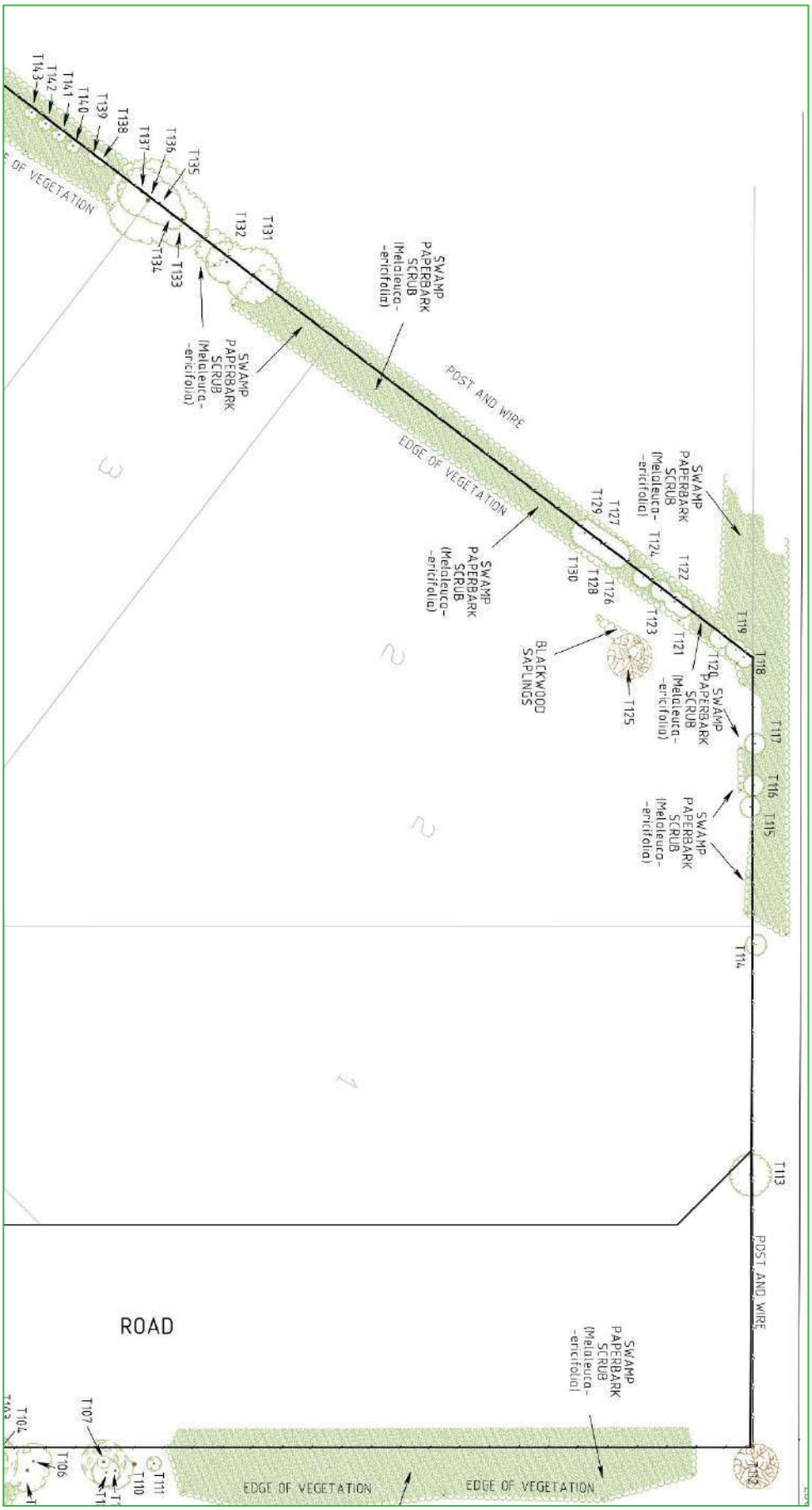


Figure F.C. *Trees 112 – 143*

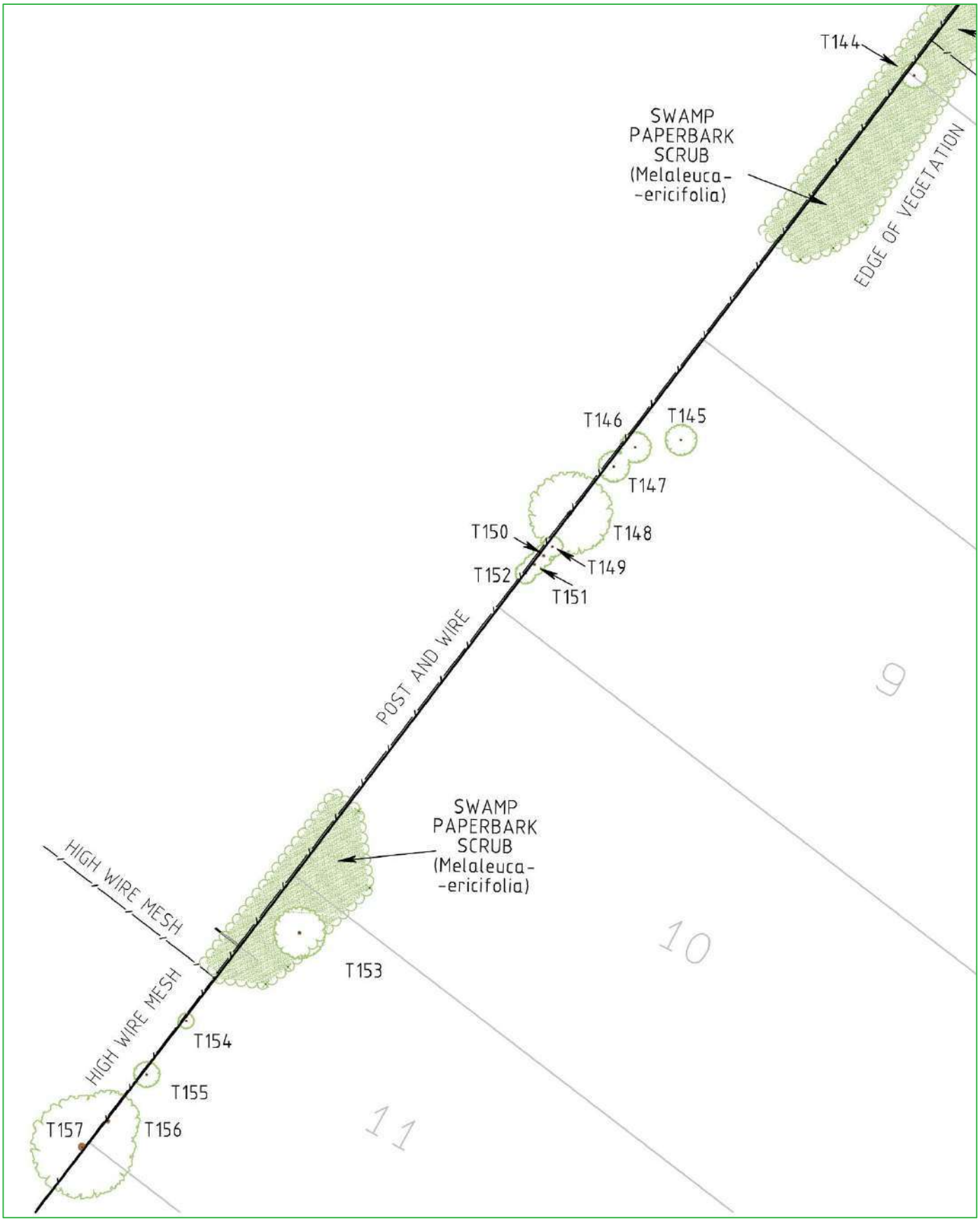


Figure F.D. *Trees 144 – 157*

Appendix G. Assumptions & Limitations

G.A. Assumptions & Limitations

G.A.A. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant / appraiser can neither guarantee nor be responsible for the accuracy of the information provided by others.

G.A.B. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by other than the person to whom it is addressed, without the prior expressed written or verbal consent.

G.A.C. Loss or alteration of any part of this report invalidates the entire report.

G.A.D. The consultant / appraiser shall not be required to give testimony or attend court by reason of this report unless subsequent contractual agreements are made, including payment of a negotiated additional fee for such services.

G.A.E. Neither all nor any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressed written or verbal consent.

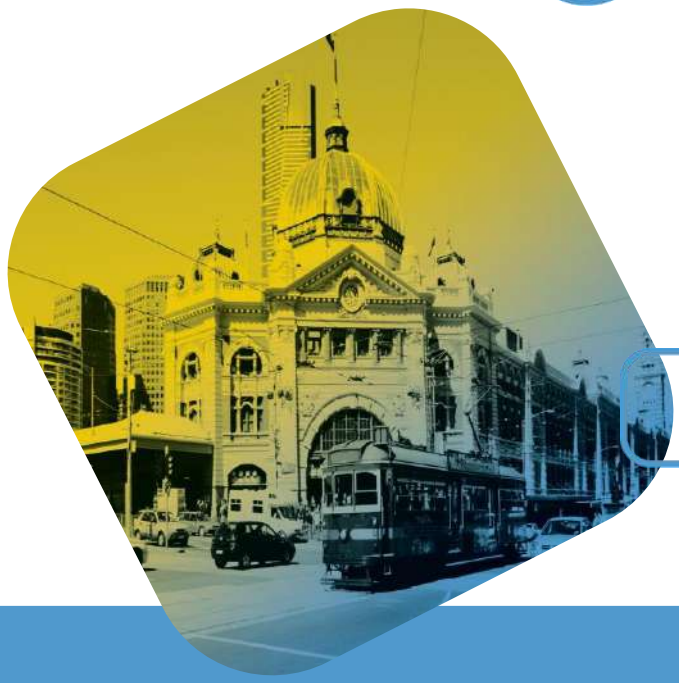
G.A.F. Diagrams, sketches, graphs and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.

G.A.G. Unless expressed otherwise, the information contained in this report covers only those items that were inspected / examined and reflects the condition of those items at the time of inspection; and the inspection is limited to visual examination of accessible items without dissection, excavation, probing or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants of property in question may not arise in the future.

G.A.H. This report and values expressed herein represent the opinion of the consultant / appraiser, and the consultant / appraiser's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of subsequent event, nor upon any finding to be reported.

38°16'10.9"S
145°33'26.8"E

Industrial Subdivision: 6 Link Road, Lang Lang



Traffic and Transport Assessment

15 May 2023
Prepared for JSR

IMP2208021TTA01F02.docx

Impact

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Document Control

Version	Date	Author
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DRAFT	12 December 2022	Jake Townley

Contents

Figures

Appendices

1 IMPACT® Snap Shot

Development Proposition

Location	38°16'10.9"S 145°33'26.8"E	6 Link Road, Lang Lang
Use	Industrial Subdivision	
Yield	14.8 Ha gross estate area	
Access	Access to all 34 lots facilitated from the industrial access road, connecting to the future Bypass Road in two (2) locations. An interim segment of the Bypass Road will be constructed to link the industrial access road to Westernport Road. No access is planned directly to the Bypass Road, other than from Lot A.	

Traffic Considerations

Traffic Generation

Adopted Rates	AM Peak	0.3 movements / 100 sqm of floor area	
	PM Peak	0.3 movements / 100 sqm of floor area	
Project Traffic	AM Peak	267 vehicle movements	160 in / 107 out
	PM Peak	267 vehicle movements	107 in / 160 out

Traffic Impact

The addition of the traffic generated by the proposed development is not expected to have any adverse effect on the road network.

Infrastructure Delivery

Road Connections	The applicant will be responsible for constructing a road link between the northern connection of the industrial access road and Westernport Road. In addition, to facilitate turn around ability for vehicles within the estate prior to the extension of the Bypass Road beyond its connection with the southern extent of the industrial access road, a court-bowl cul-de-sac is proposed.

Conclusion

— The proposed subdivision will result in manageable traffic impacts to the surrounding road network. Accordingly, there are no traffic and transport grounds that should prohibit the issue of a permit.

2 Introduction

2.1 Engagement

IMPACT® have been engaged by JSR to undertake a Traffic and Transport Assessment for the industrial subdivision planned at 6 Link Road, Lang Lang.

2.2 Scope of Engagement

This Traffic and Transport Assessment has been prepared to accompany a town planning submission. In preparing this assessment we have referenced the following:

- Plan of Subdivision prepared by Speedie Development Consultants Pty Ltd;
- Lang Lang Township Strategy, 2009
- Other technical data and documentation as noted within the body of this report.

3 Existing Conditions

3.1 Location

The site is located on the south side of Westernport Road adjacent the Lang Lang Showgrounds Reserve and is bisected by the future bypass road reserve as shown in Figure 1 and Figure 2.

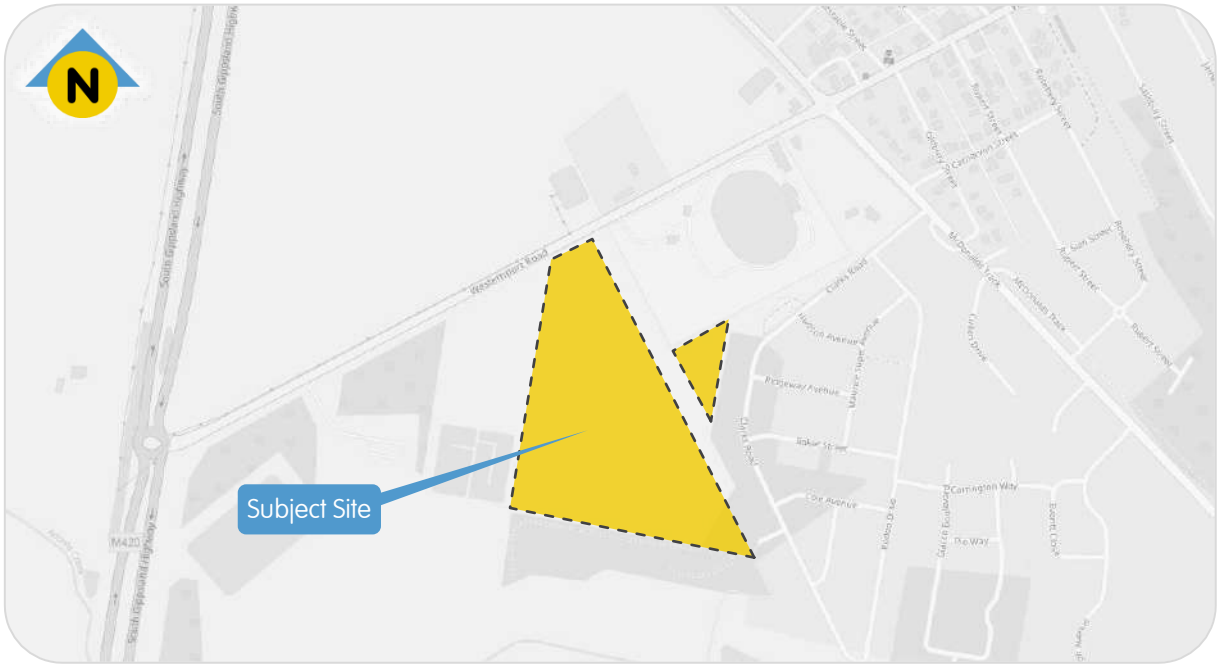


Figure 1 Location of Subject Site

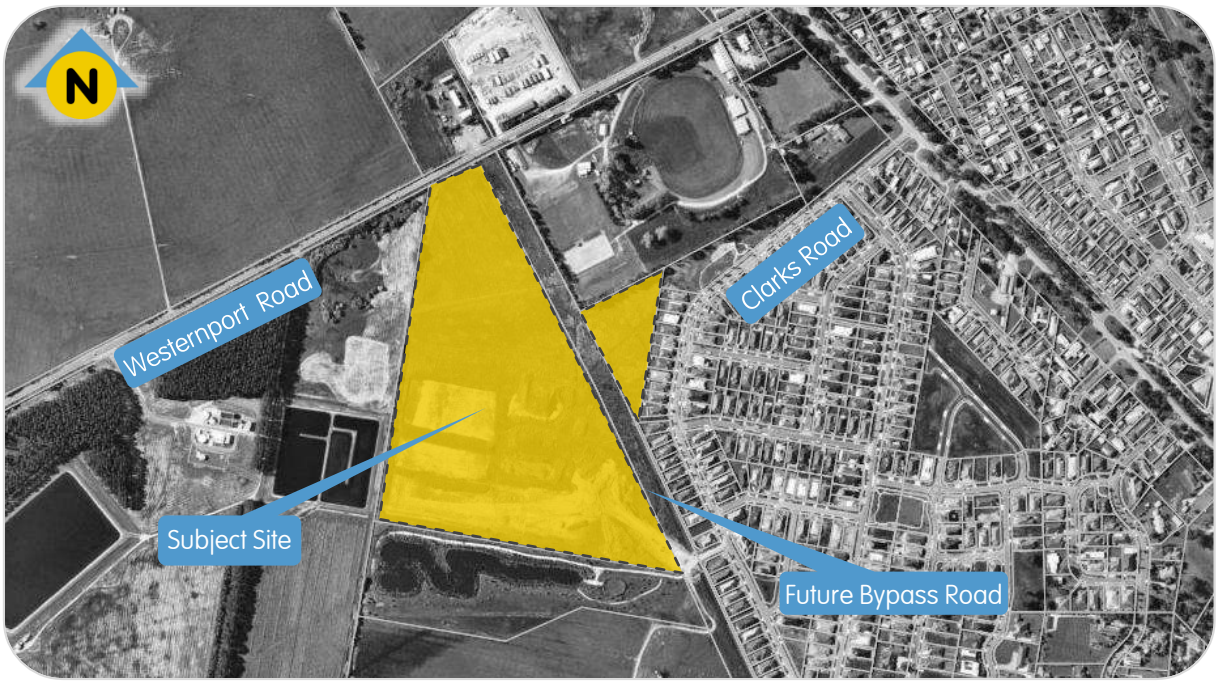


Figure 2 Aerial View of Subject Site

3.2 Planning Zone

The subject site is located within the Industrial 1 Zone (IN1Z) as illustrated in Figure 3.

Figure 3 Land Use Planning Zone

The purpose of this zone is to provide for manufacturing industry, the storage and distribution of goods and associated uses in a manner which does not affect the safety and amenity of local communities.

3.3 Road Network

3.3.1 Westerport Road

Westernport Road functions as a primary arterial road contained within a Transport Zone 2, generally aligned in a south-east to north-west direction between Main S Road in Drouin South and the South Gippsland Highway, approximately 1.5 kilometres west of the subject site.

In the vicinity of the site, Westernport Road operates with a 7.0 metre wide road pavement and is configured with a single lane of traffic in each direction with unsealed shoulders provided on both sides of the carriageway, contained within a 20 metre wide road reserve.

Its typical cross-section is shown Figure 4.

Figure 4 Westernport Road, facing west adjacent the subject site

3.1 Sustainable Transport

3.1.1 Public Transport

The site is removed from existing public transport services. Whilst Pakenham provides for the closest rail station, it requires car transit to access these services. Bus services through Lang Lang provide a connection to Cranbourne rail station.

3.1.2 Bicycle Network

The site has limited, to no access to existing cycling infrastructure. Any existing cycling activity occurs on the road carriageway, with cyclists and vehicles to share this space as required.

4 Proposed Development

4.1 Use and Yield

It is proposed to develop the subject site (14.8 ha) for the purpose of an industrial subdivision.

The subdivision proposes 34 lots ranging from 2,088 sqm to 1.204 ha in addition to a balance lot (Lot A). The subdivision plan is shown below in Figure 5.

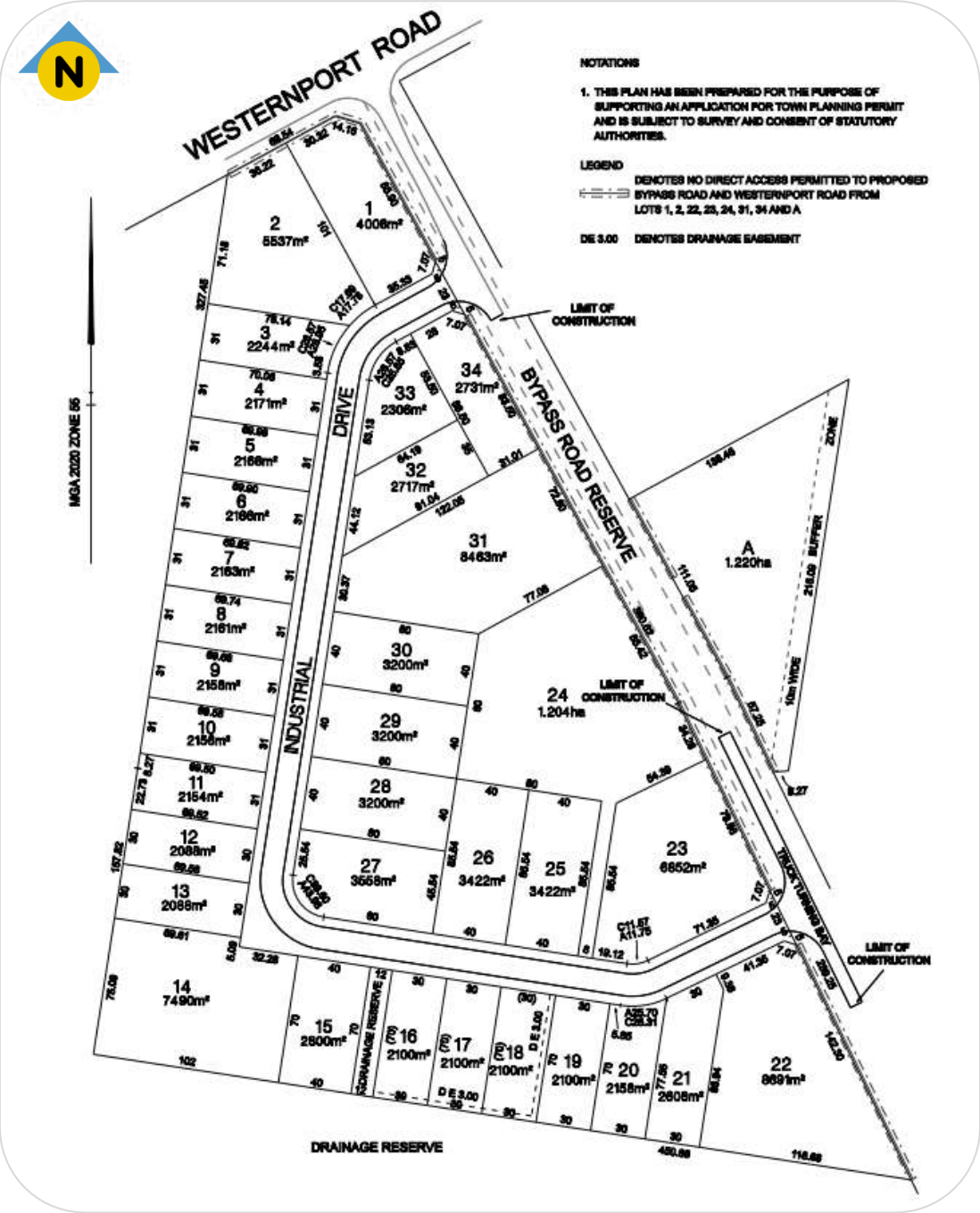


Figure 5 Plan of Subdivision

4.2 Access

An industrial standard access road will be constructed to facilitate vehicle access to all 34 lots. The industrial access road will connect to the future Bypass Road in two locations.

No direct lot access will be permitted to lots via Westernport Road or the Bypass Road however by virtue of the subject site's shape, the provision of the Bypass Road future road reserve (30m width) and presence of residential lots on Clarks Road, the balance lot (Lot A) is not afforded with a suitable road frontage other than from the Bypass Road. Thus Lot A will require vehicle access from the Bypass Road.

A concept plan of the road carriageway design for the industrial road, in addition to swept path analysis demonstrating accessibility for vehicles up to a 26m B-double articulated vehicles, is provided as Appendix A.

Until such time as the Bypass Road is constructed, a road link between the industrial access road and Westernport Road is not provided, thus the applicant will be responsible for constructing this road link between Westerport Road and their northern connection to the industrial access road. In addition, to facilitate turn around ability for vehicles within the estate prior to the extension of the Bypass Road beyond its connection with the southern extent of the industrial access road, a court-bowl cul-de-sac is proposed as shown in Appendix A.

4.3 Road Hierarchy and Cross Sections

The cross section of the industrial access road is detailed below in Figure 6.

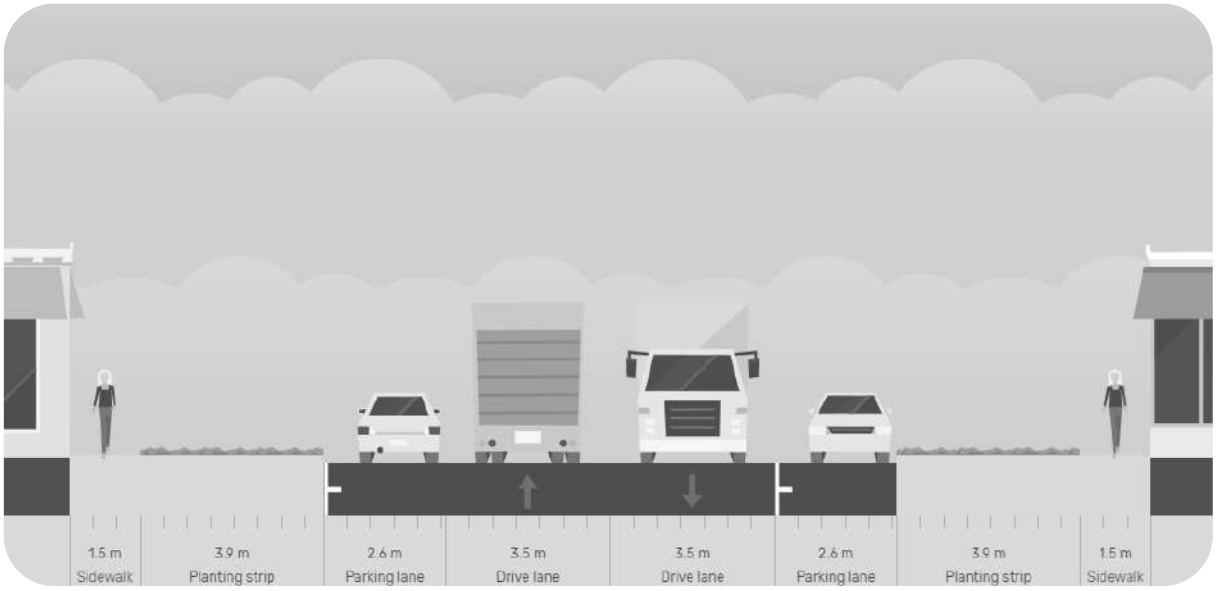


Figure 6 Industrial Access Street Cross Section (23m)

For the purposes of outlining the cross section requirements for the short section of the Bypass Road, between Westernport Road and the northern connection with the industrial access road, a 7.0m wide carriageway has been adopted located centrally within the 30m road reserve, with road flaring designed to accommodate a 26m b-double checking vehicle.

5 Traffic Considerations

5.1 Traffic Generation

Typically, warehouse / industrial uses generate their peak traffic during the early periods of the AM and PM peak period, i.e. between 6:00am and 8:00am and between 3:00pm and 5:00pm.

The proposal outlines a range of lots from 2,088 sqm to 1.204 ha. On balance, the lots will be capable of accommodating a medium to large sized warehouse / industrial use.

On the basis of the above, traffic survey data commissioned by **IMPACT®** of similar sized warehouse / industrial uses likely commensurate with that possible by the proposal, indicate the following AM and PM peak traffic generating characteristics.

- AM Peak 0.3 movements per 100 sqm
  - 60% of vehicle movements being inbound and 40% of movements being outbound; and

- PM Peak 0.3 movements per 100 sqm
  - 40% of vehicle movements being inbound and 60% of movements being outbound.

Adopting a building area of approximately 60% for each lot, the subdivision will yield approximately 89,000 sqm of warehouse / industry / ancillary office floor area.

Application of the above rates to the floor area equates to the following anticipated traffic generation:

- AM Peak: 267 vehicle movements during the AM peak, comprising 160 inbound vehicle movements and 107 outbound vehicle movements; and

- PM Peak: 267 vehicle movements during the PM peak, comprising 107 inbound vehicle movements and 160 outbound vehicle movements.

5.2 Traffic Impact

The quantum of turning movements generated by the proposal and contributed to Westernport Road is not significant and not anticipated to oversaturate the road network.

On the basis of the above, the site generated traffic movements to the surrounding road network is considered moderate in traffic engineering terms and not expected to compromise the operation or efficiency of the network.

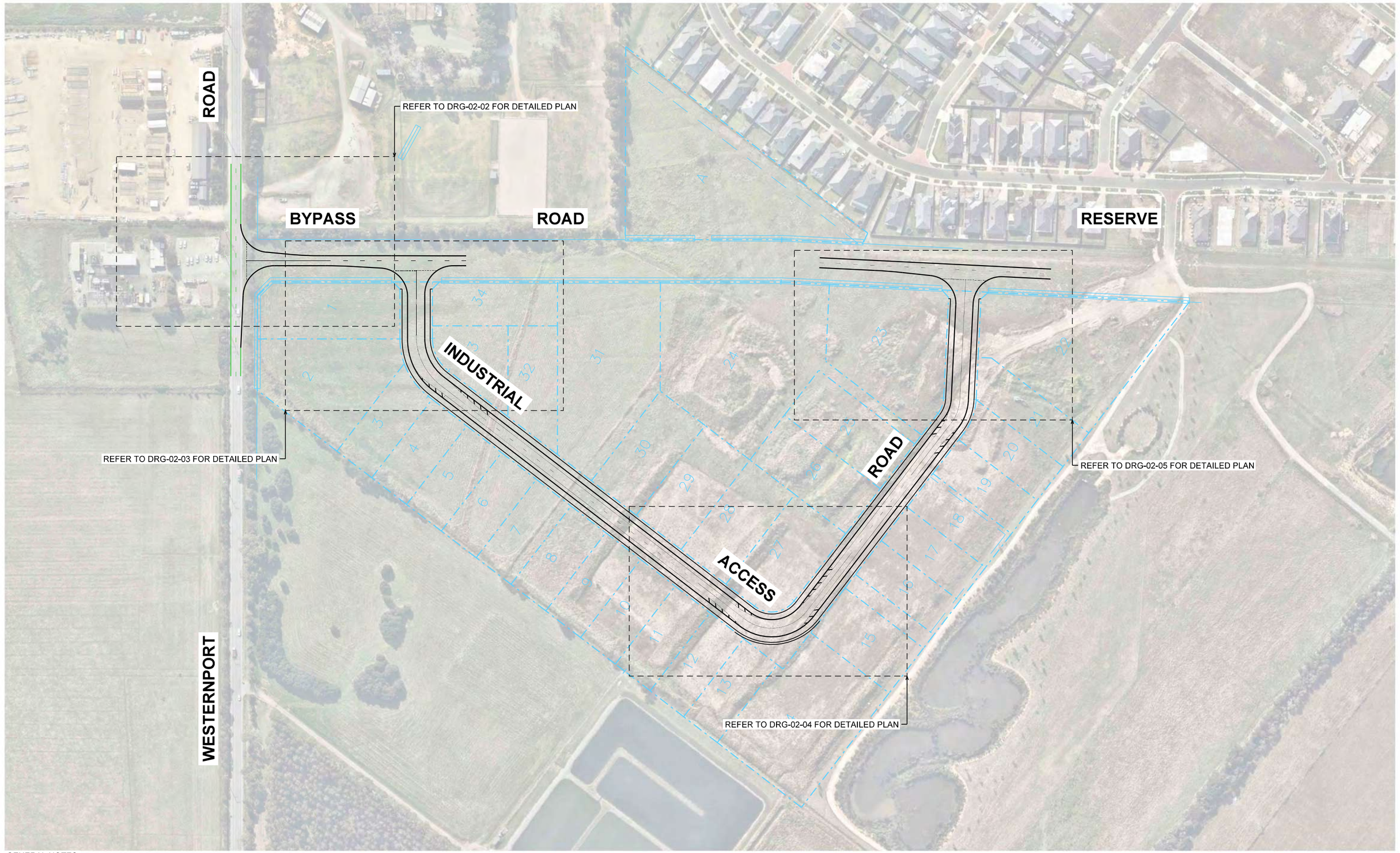
APPENDIX A
Internal Road Alignment Plan

Design Vehicle:

—20m Articulated Semi-trailer Vehicle

Check Vehicle:

—26m Articulated B-double Vehicle



GENERAL NOTES:

1. ALL DIMENSIONS ARE TO FACE OF KERB AND CHANNEL UNLESS NOTED OTHERWISE.
2. DECLARED ROADS - WESTERNPORT ROAD (SPEED ZONE 80KM/H).
   LOCAL ROADS - INDUSTRIAL ACCESS ROAD (SPEED ZONE 50KM/H).
   - BYPASS ROAD RESERVE (SPEED ZONE 50KM/H [TO BE CONFIRMED]).
3. BASE INFORMATION FROM NEARMAP AERIAL PHOTOGRAPHY DATED 14.04.2022 AND SPEEDIE DEVELOPMENT CONSULTANT 12990PlanningMaster-PlanB.dwg DATED 15.12.2022

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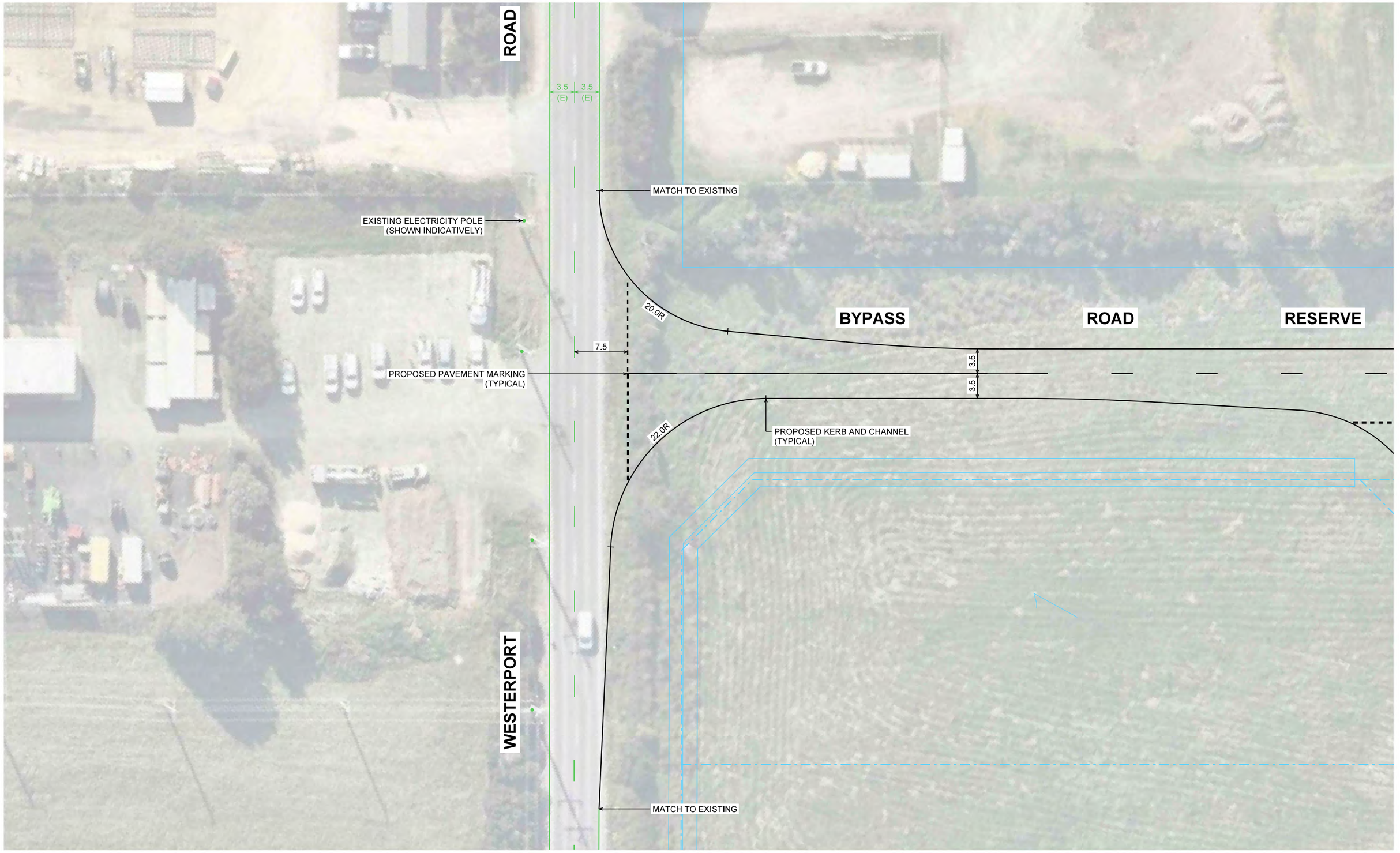

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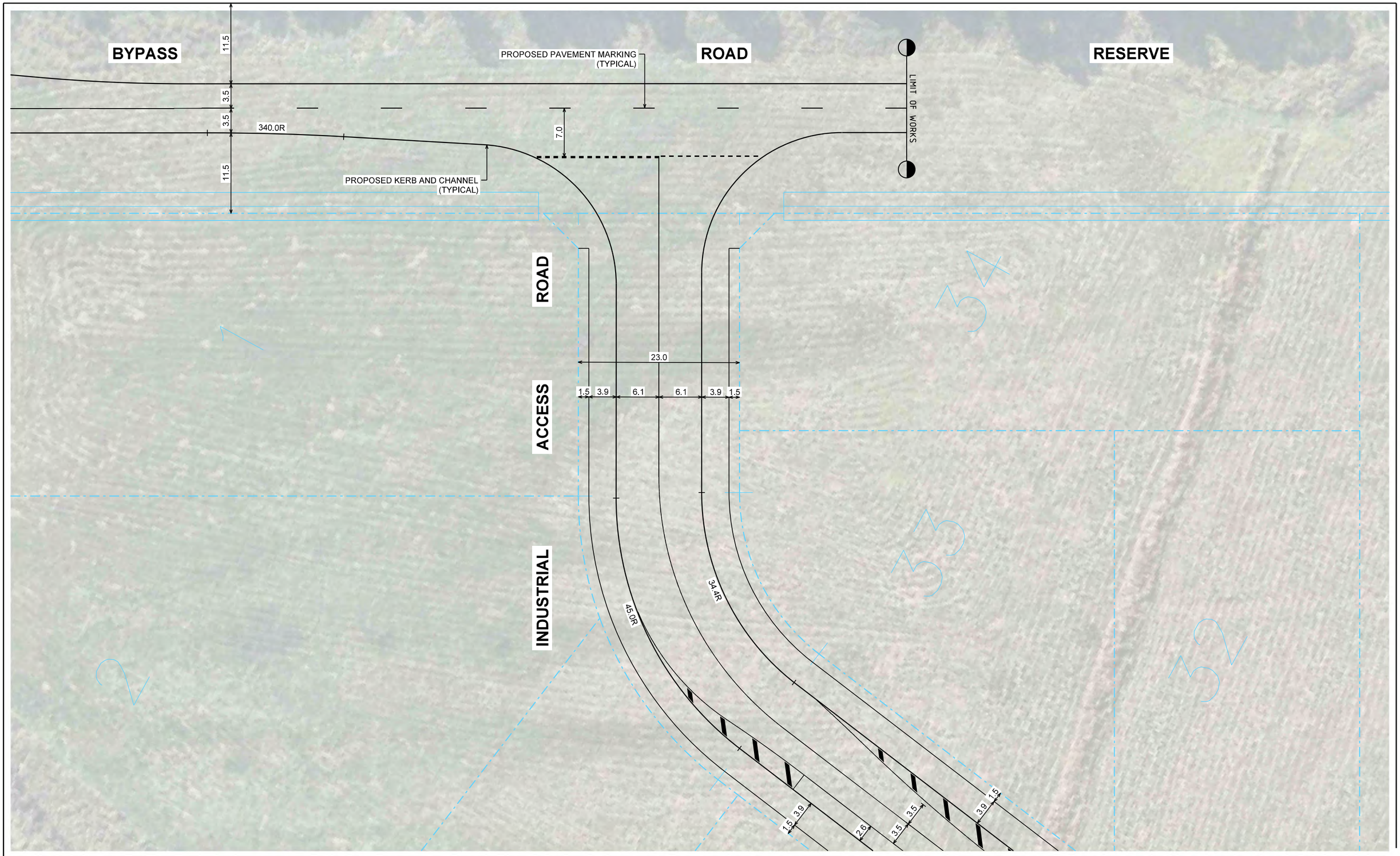

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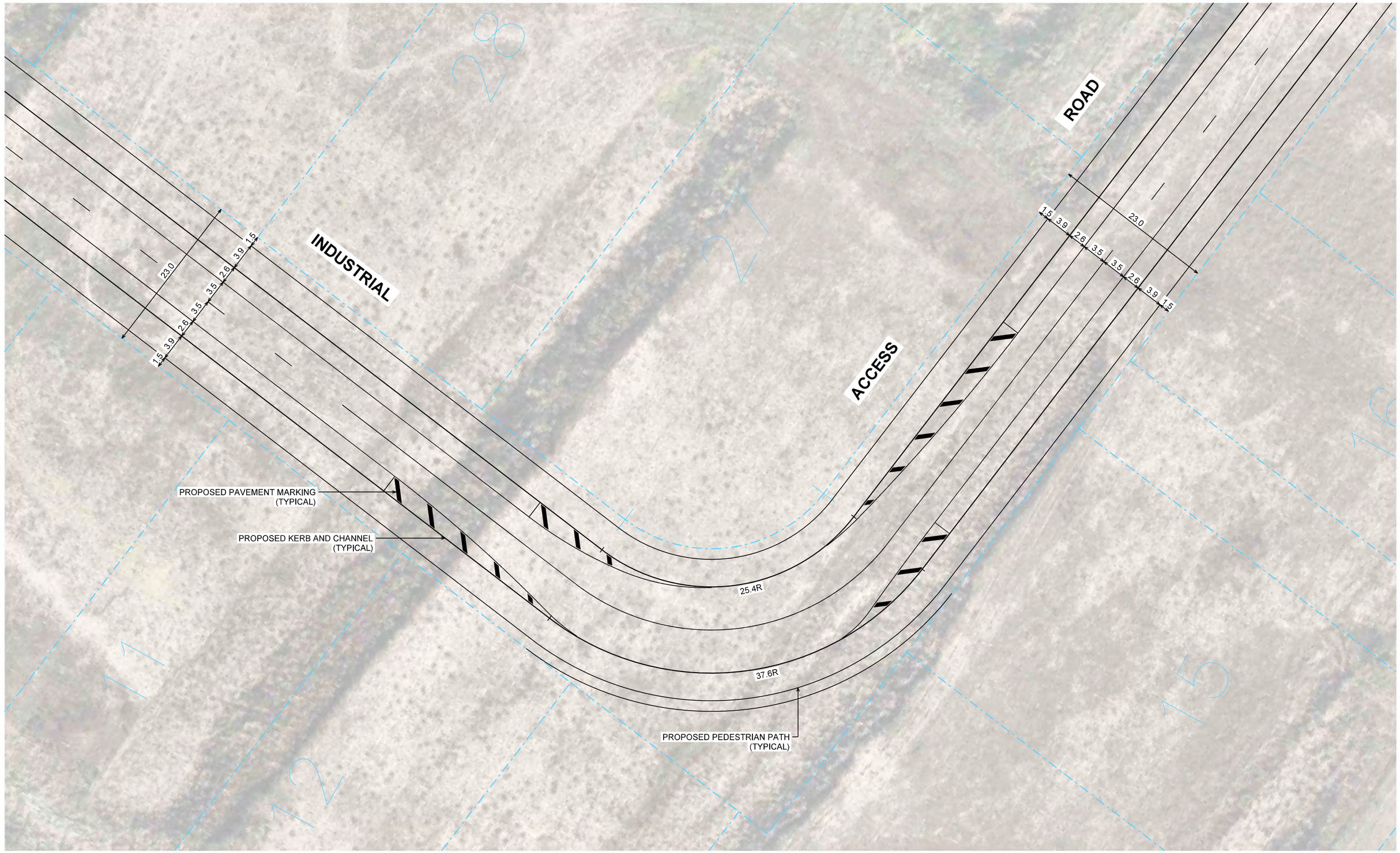

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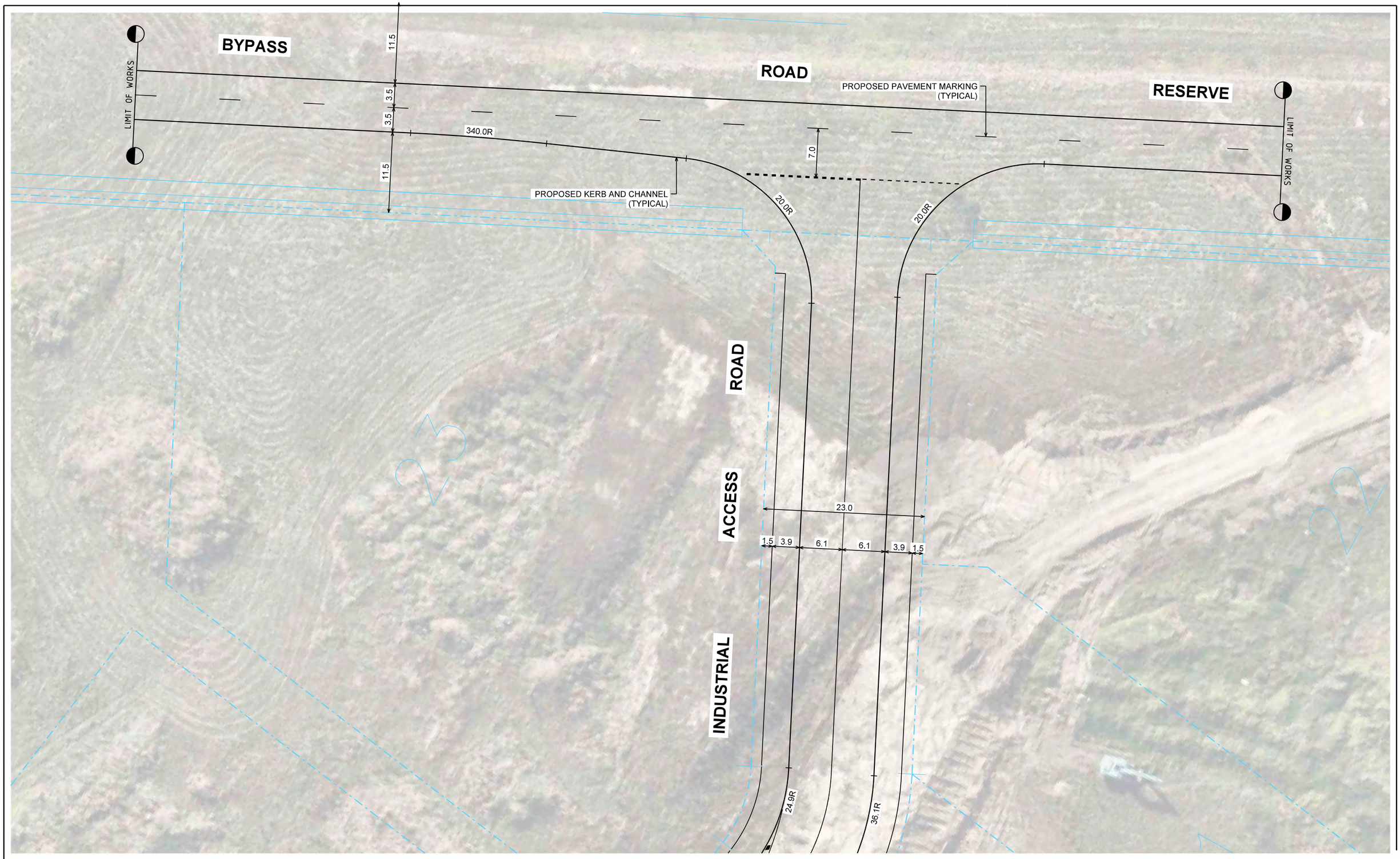

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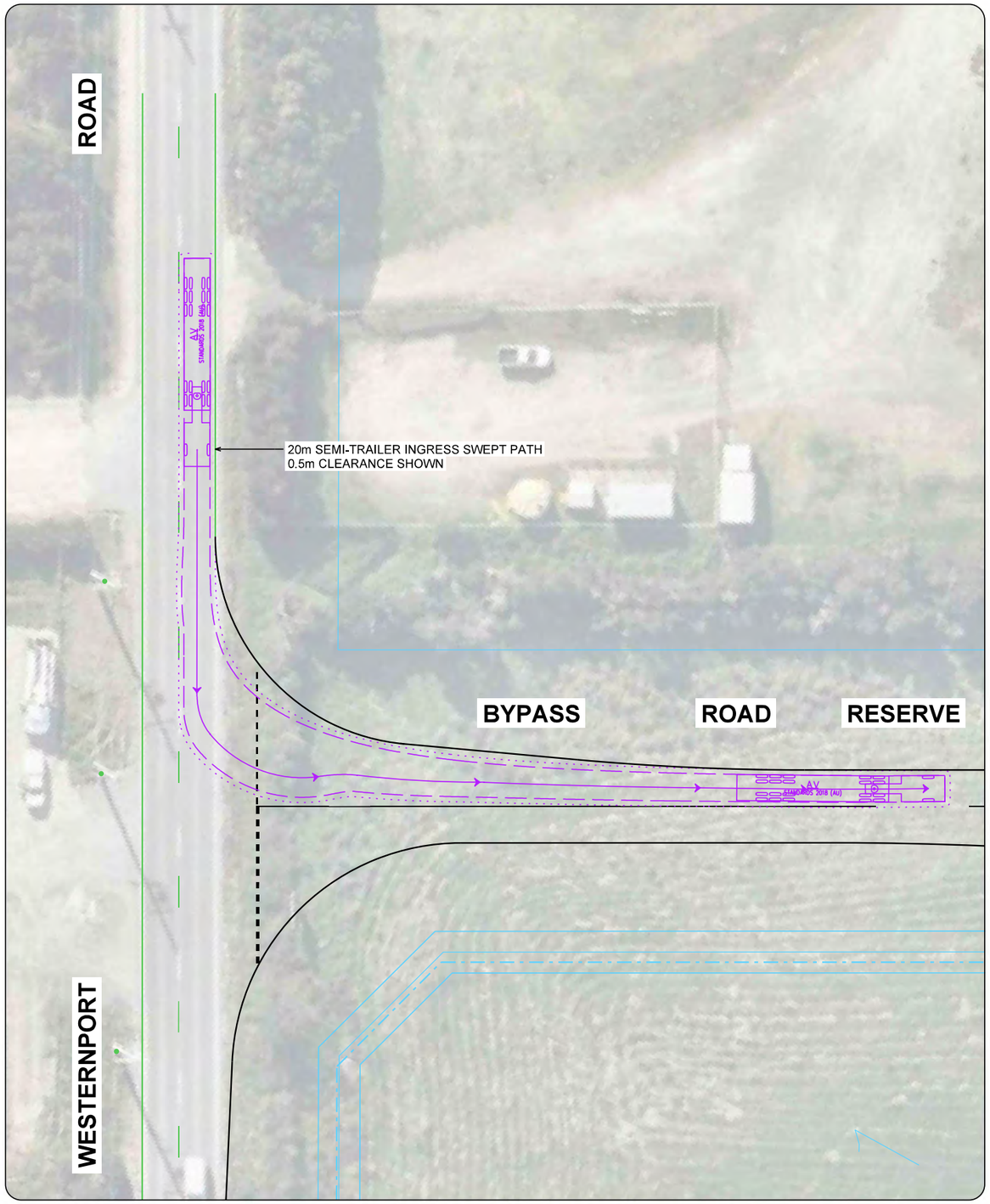

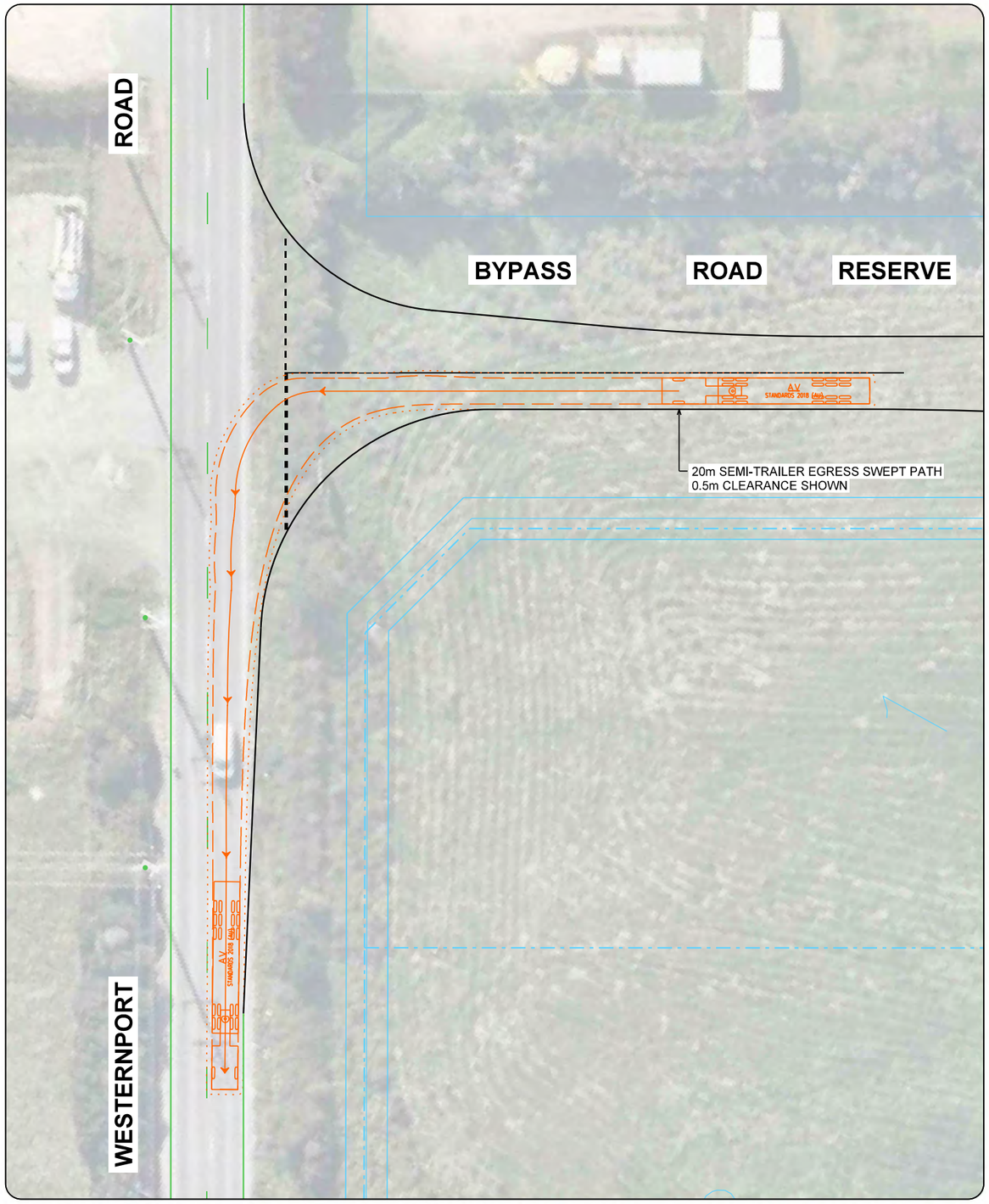

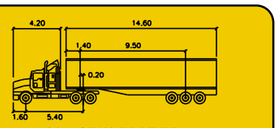

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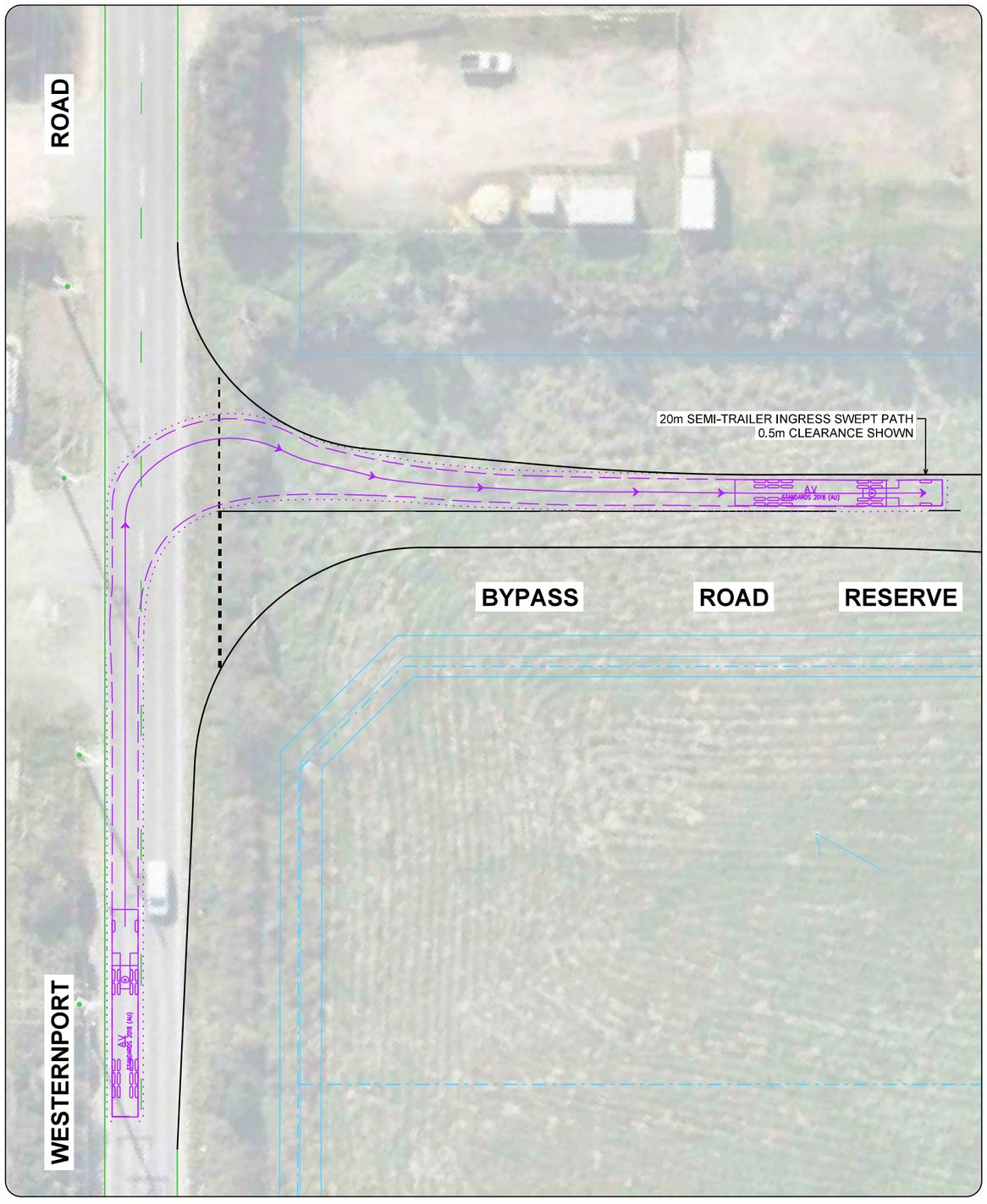

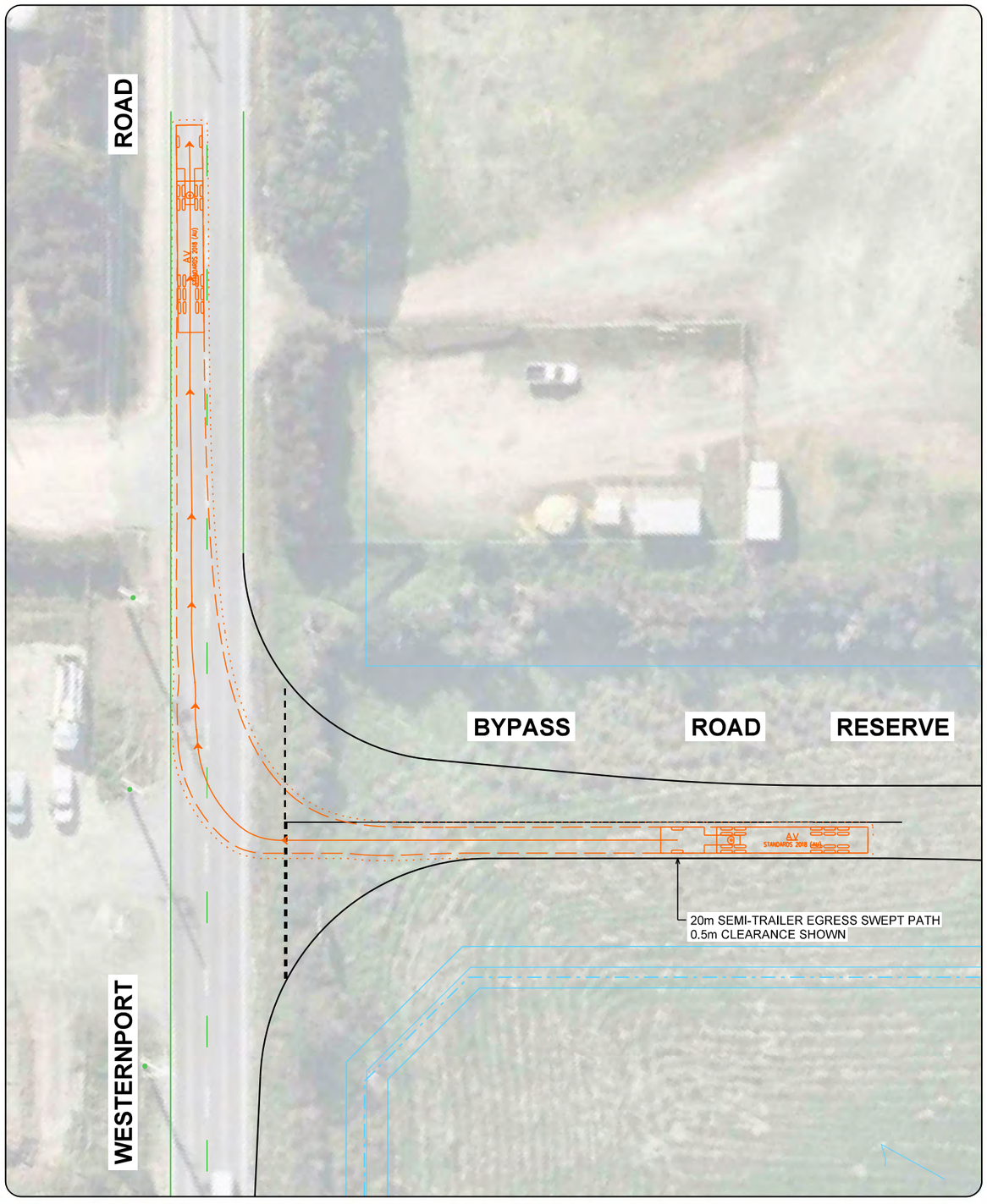

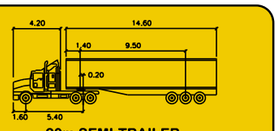

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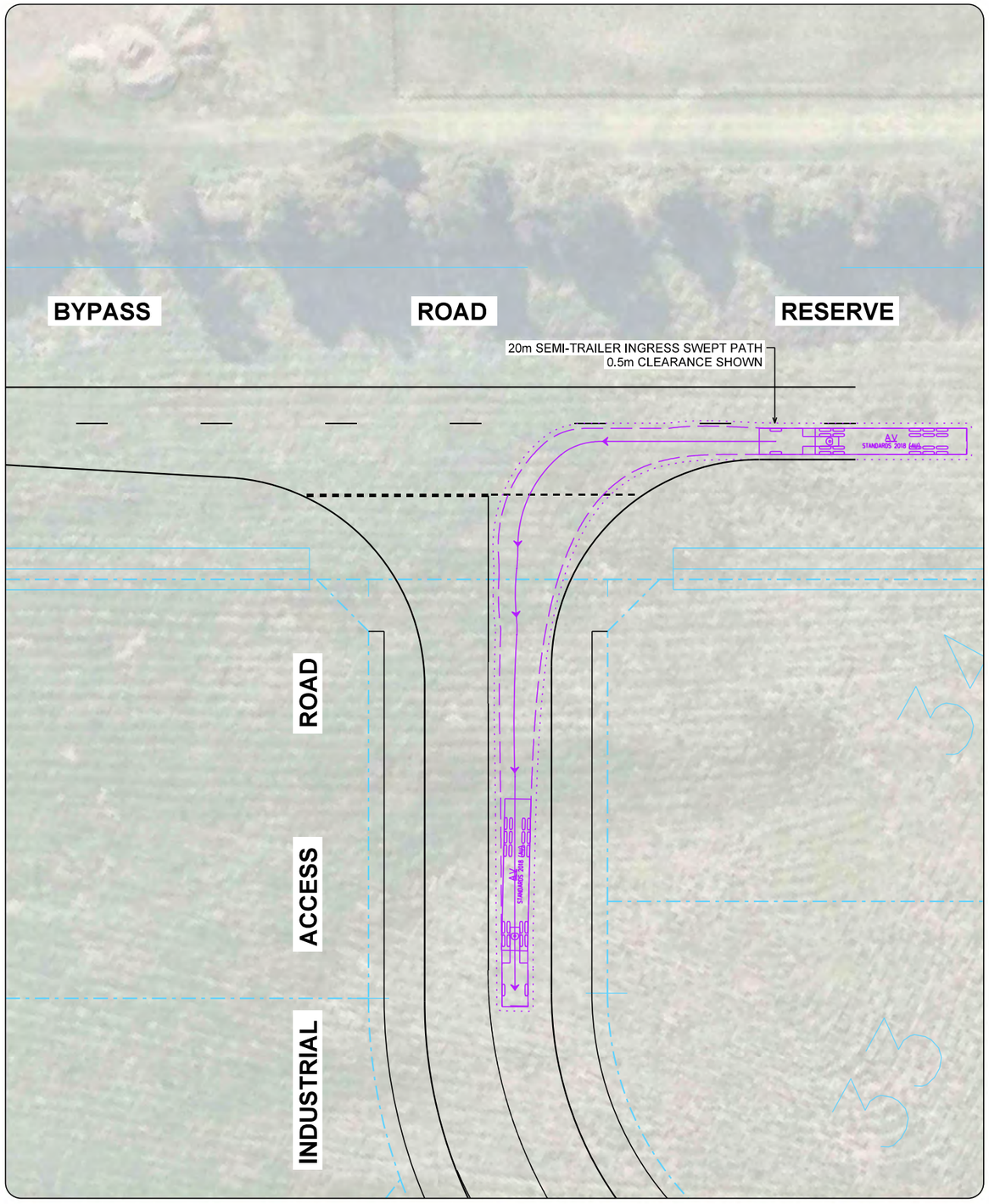

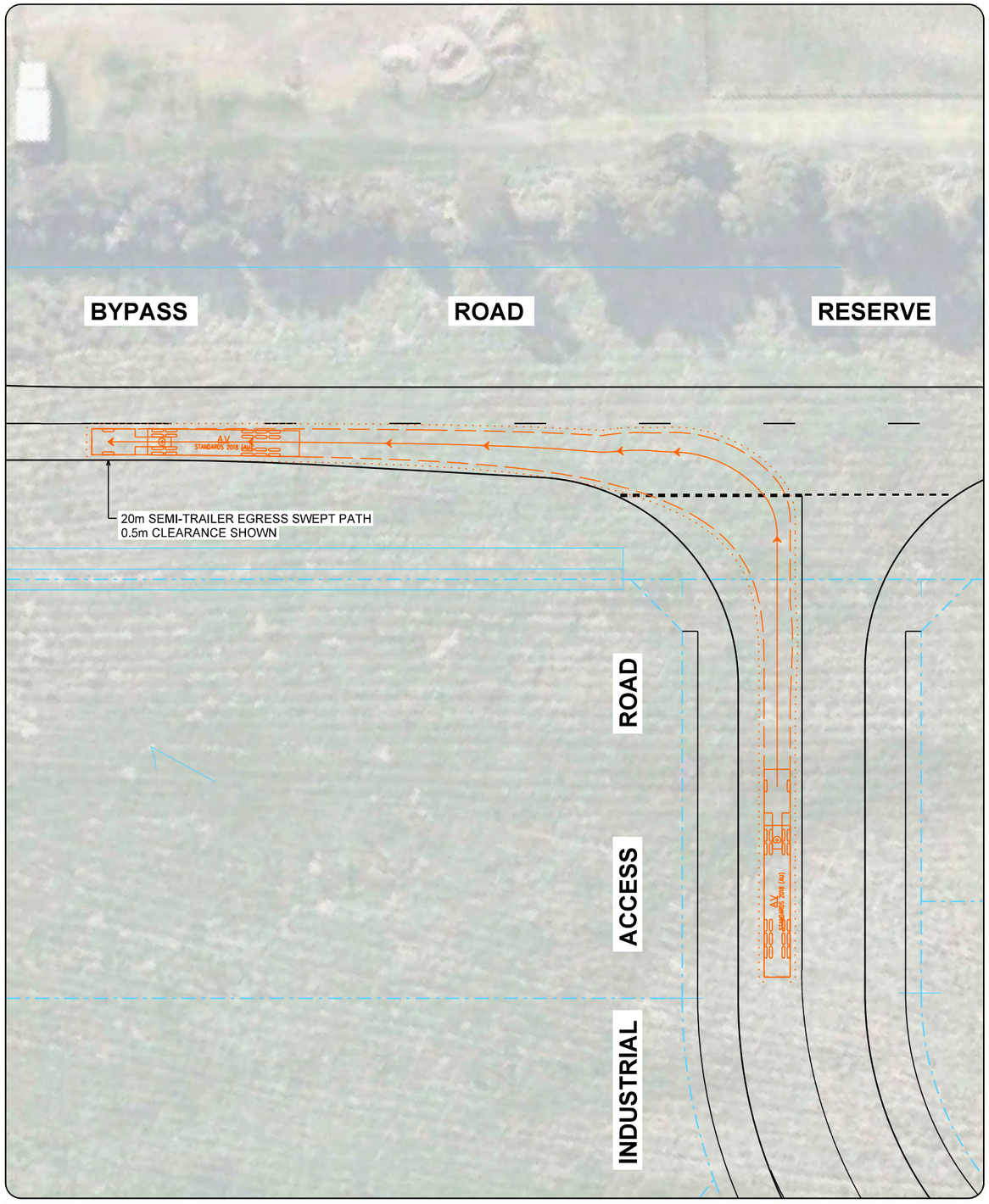

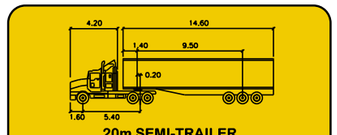

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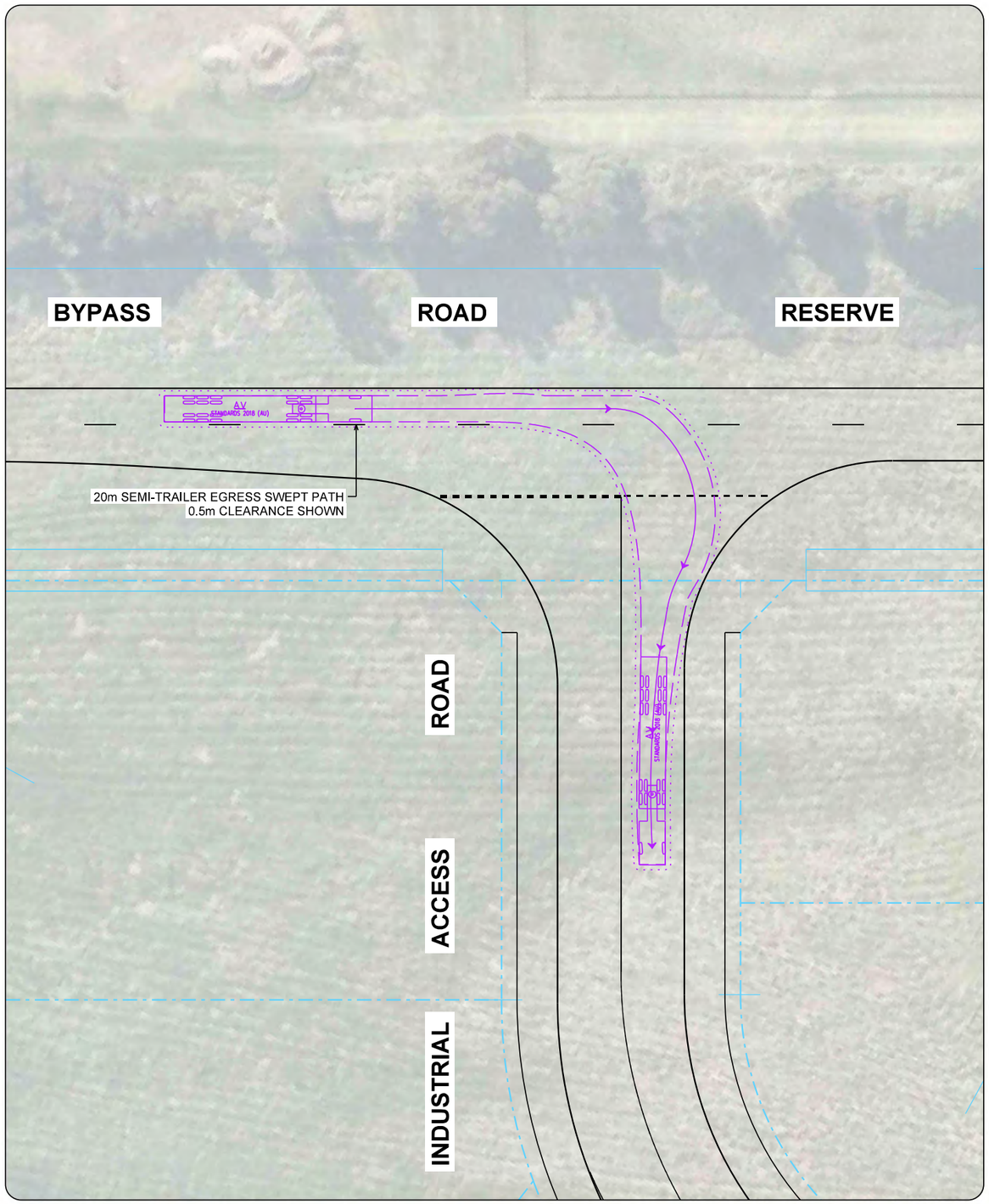

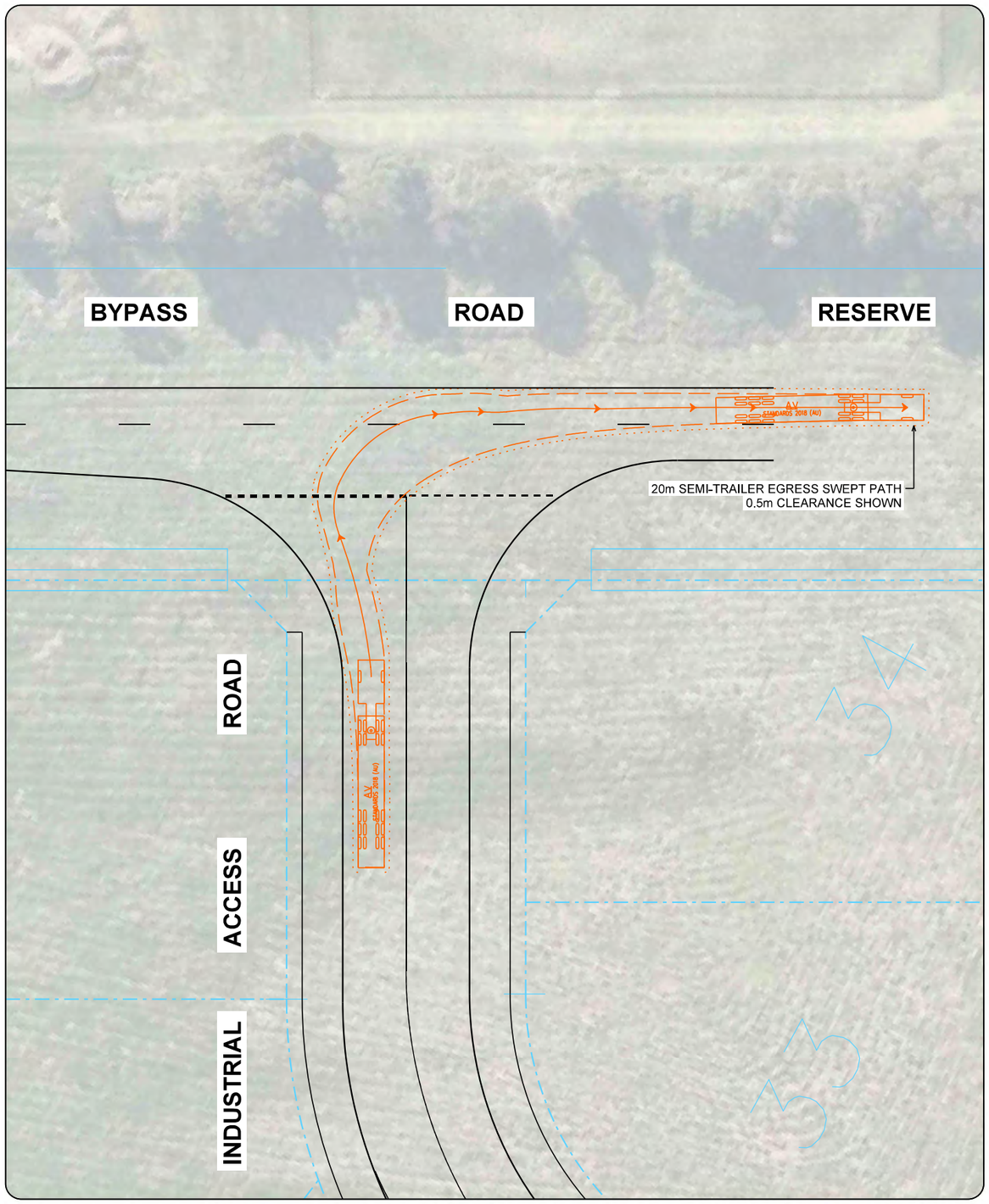

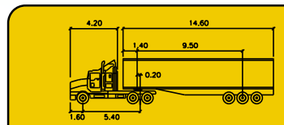

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TRACTOR TRACK	: 2.50	ARTICULATING ANGLE	: 72.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
create@impactaustralia.com.au
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SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

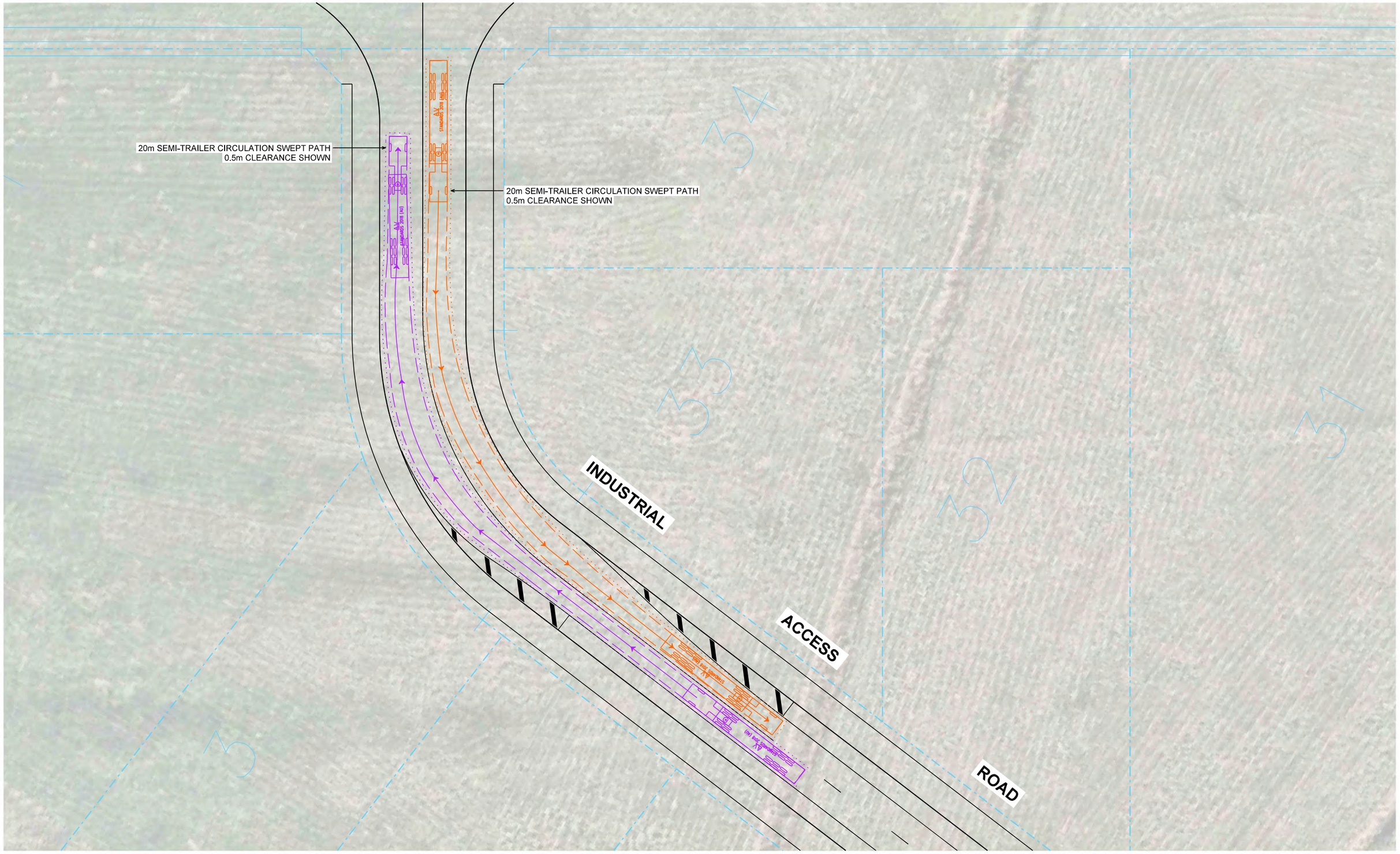
Revision Description
ISSUED FOR INFORMATION

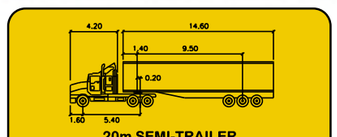
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
20m SEMI-TRAILER DESIGN VEHICLE

Drawing Number
IMP2208021 - DRG-02-09

Revision
C

15/05/2023 11:39:56 AM





20m SEMI-TRAILER

METERS

TRACTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 28.3
TRACTOR TRACK	: 2.50	ARTICULATING ANGLE	: 72.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
create@impactaustralia.com.au
Impactaustralia.com.au

SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

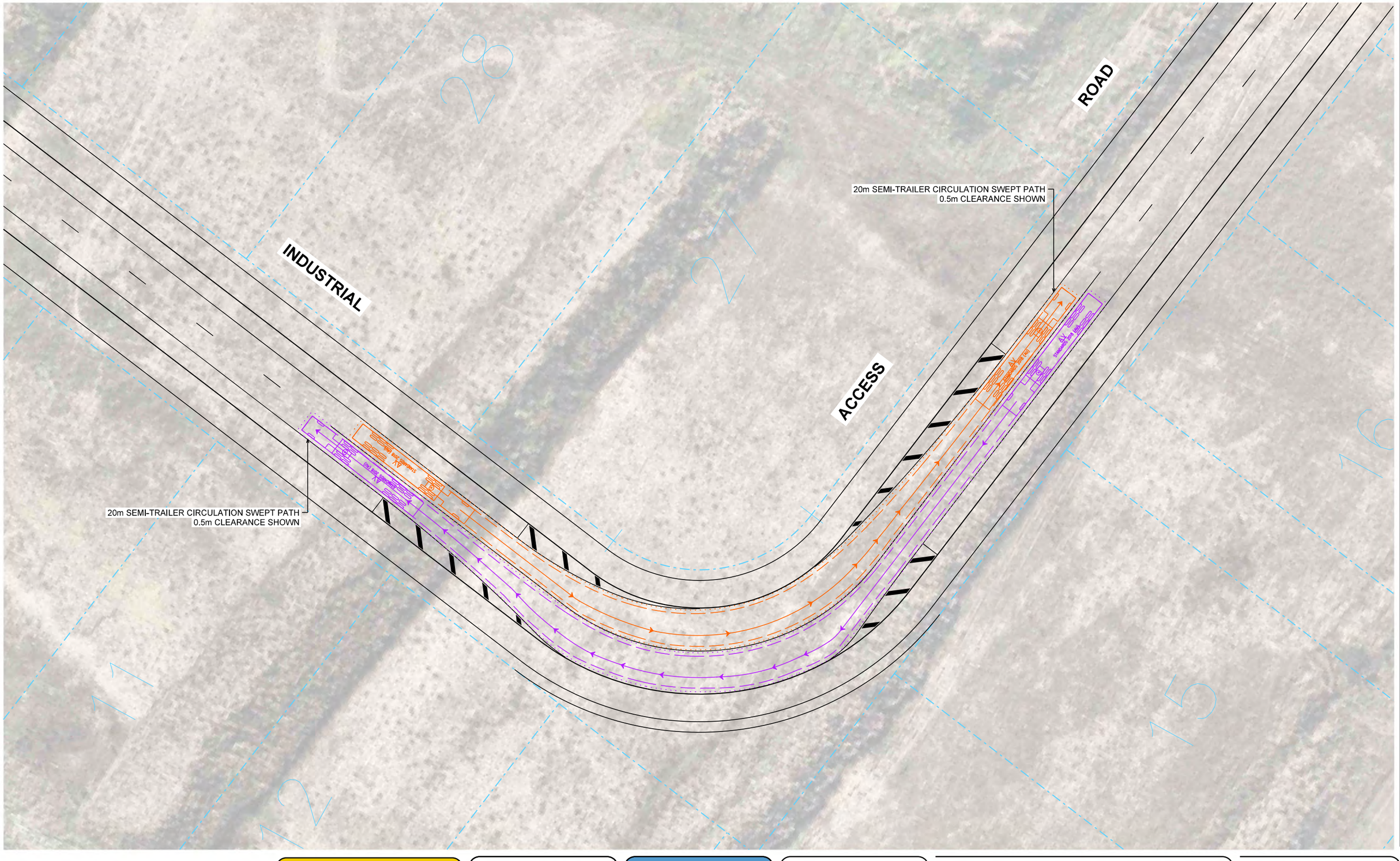
Revision Description
ISSUED FOR INFORMATION

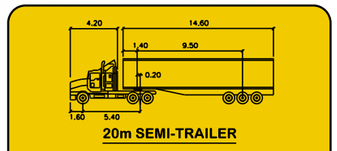
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
20m SEMI-TRAILER DESIGN VEHICLE

Drawing Number
IMP2208021 - DRG-02-10

Revision
C

15/05/2023 11:39:57 AM





20m SEMI-TRAILER

METERS

TRACTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 28.3
TRACTOR TRACK	: 2.50	ARTICULATING ANGLE	: 72.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

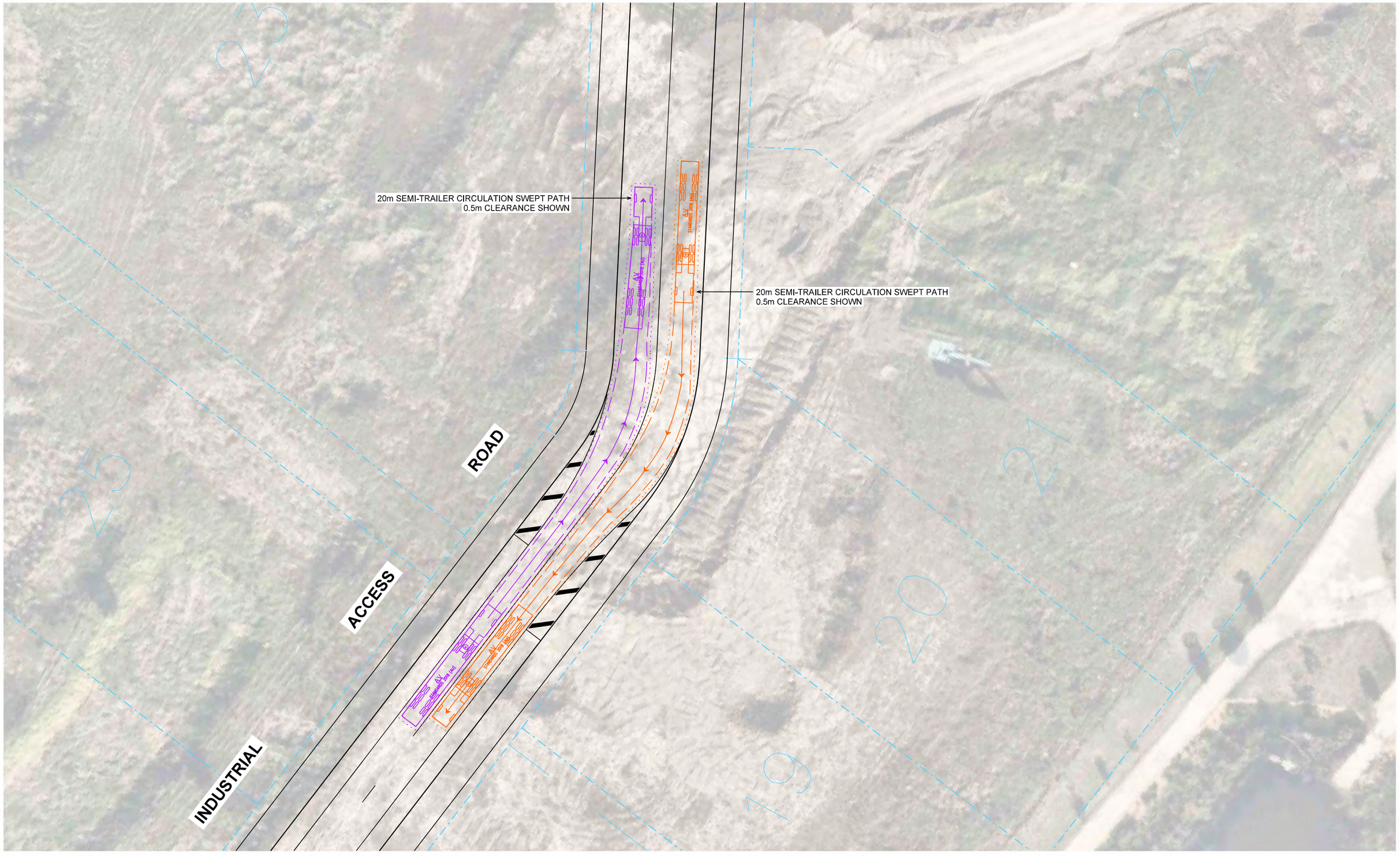
Revision Description
ISSUED FOR INFORMATION

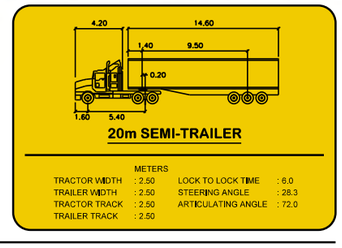
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
20m SEMI-TRAILER DESIGN VEHICLE

Drawing Number
IMP2208021 - DRG-02-11

Revision
C

15/05/2023 11:39:58 AM





METERS			
TRACTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 28.3
TRACTOR TRACK	: 2.50	ARTICULATING ANGLE	: 72.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

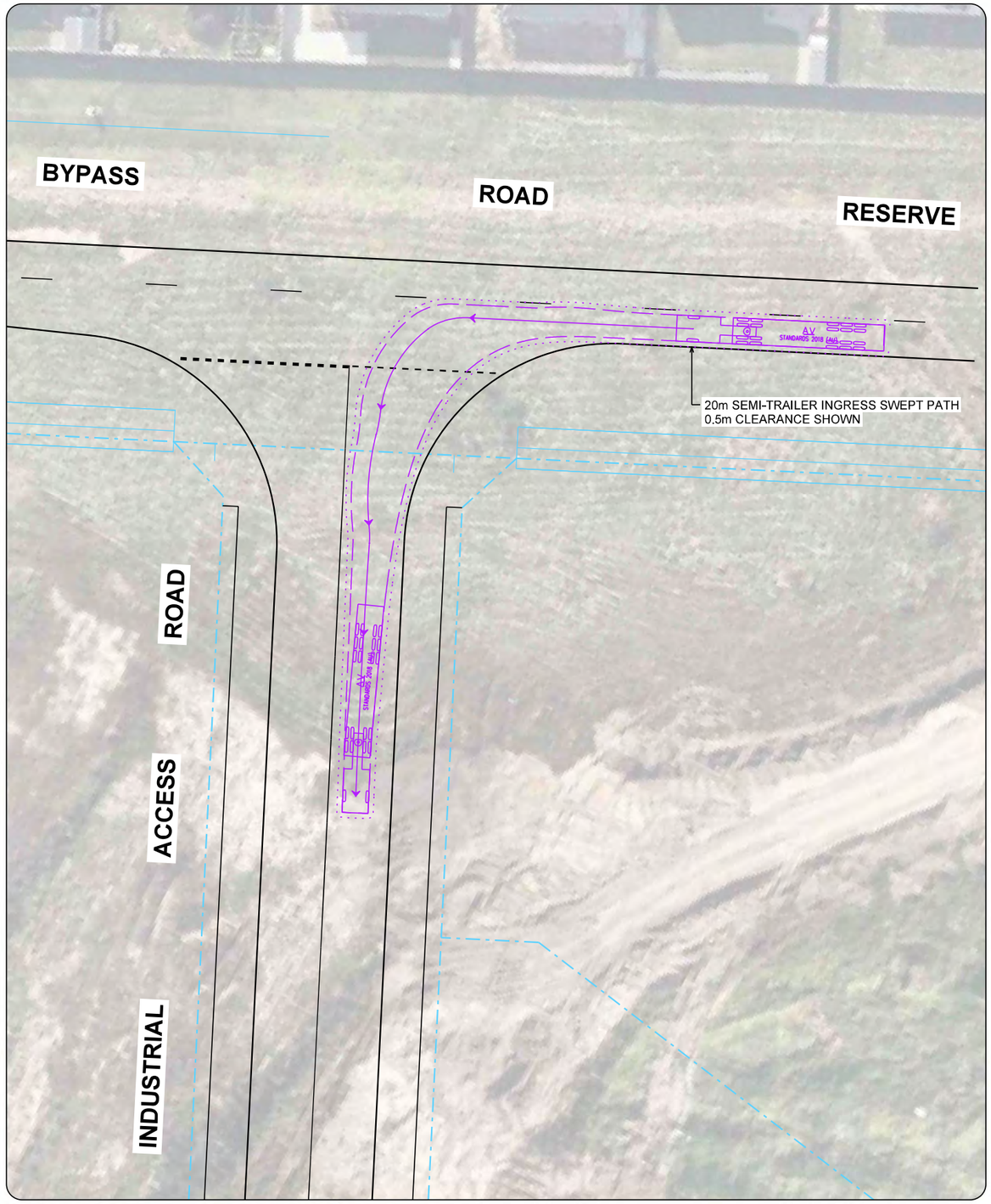
Revision Description
ISSUED FOR INFORMATION

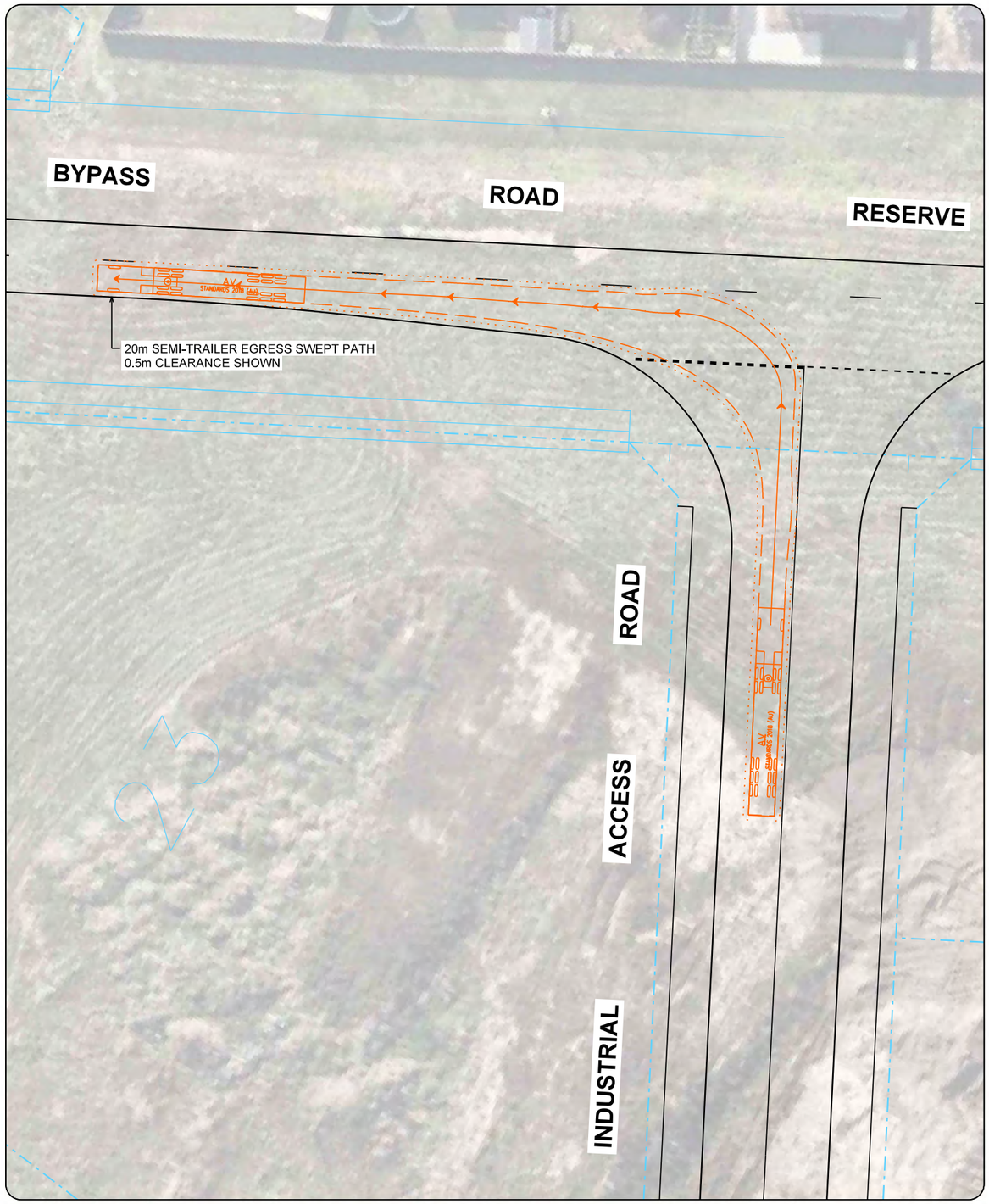
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
20m SEMI-TRAILER DESIGN VEHICLE

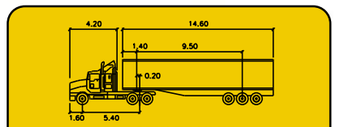
Drawing Number
IMP2208021 - DRG-02-12

Revision
C

15/05/2023 11:39:58 AM







20m SEMI-TRAILER

METERS			
TRACTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 28.3
TRACTOR TRACK	: 2.50	ARTICULATING ANGLE	: 72.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 76 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
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Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

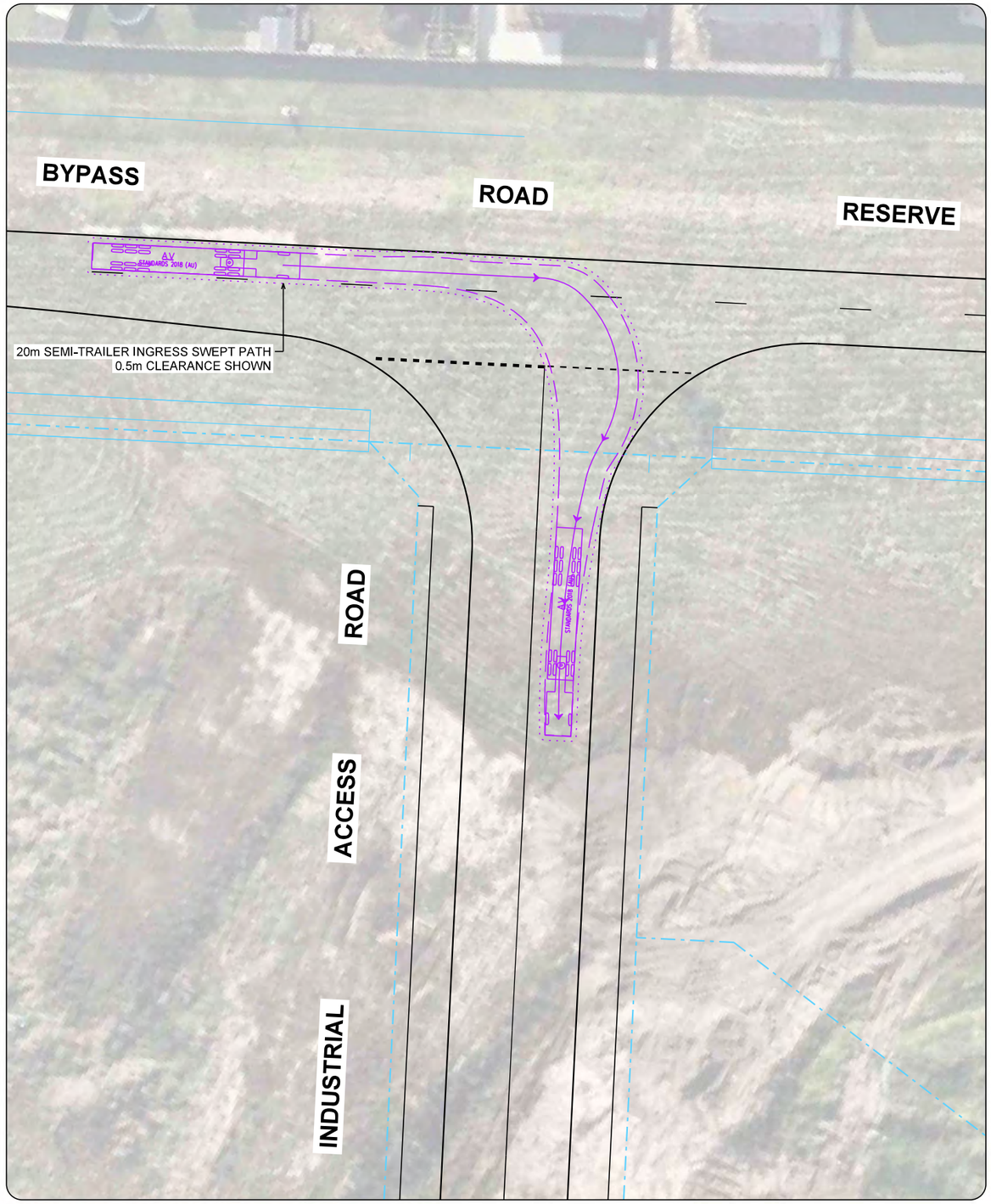
Revision Description
ISSUED FOR INFORMATION

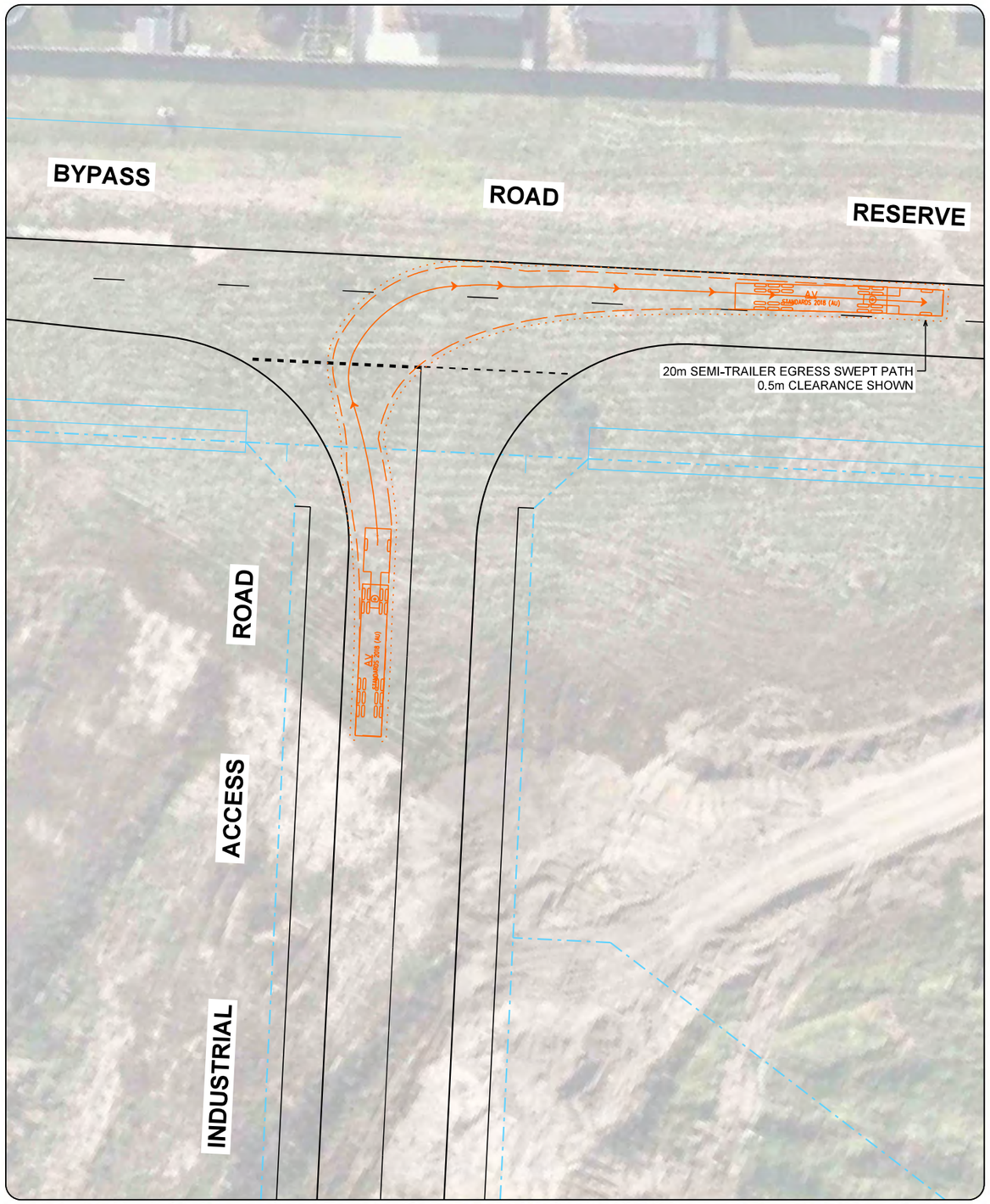
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
20m SEMI-TRAILER DESIGN VEHICLE

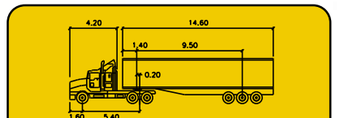
Drawing Number
IMP2208021 - DRG-02-13

Revision
C

15/05/2023 11:39:59 AM







20m SEMI-TRAILER

METERS			
TRACTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 28.3
TRACTOR TRACK	: 2.50	ARTICULATING ANGLE	: 72.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
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SCALE
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Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

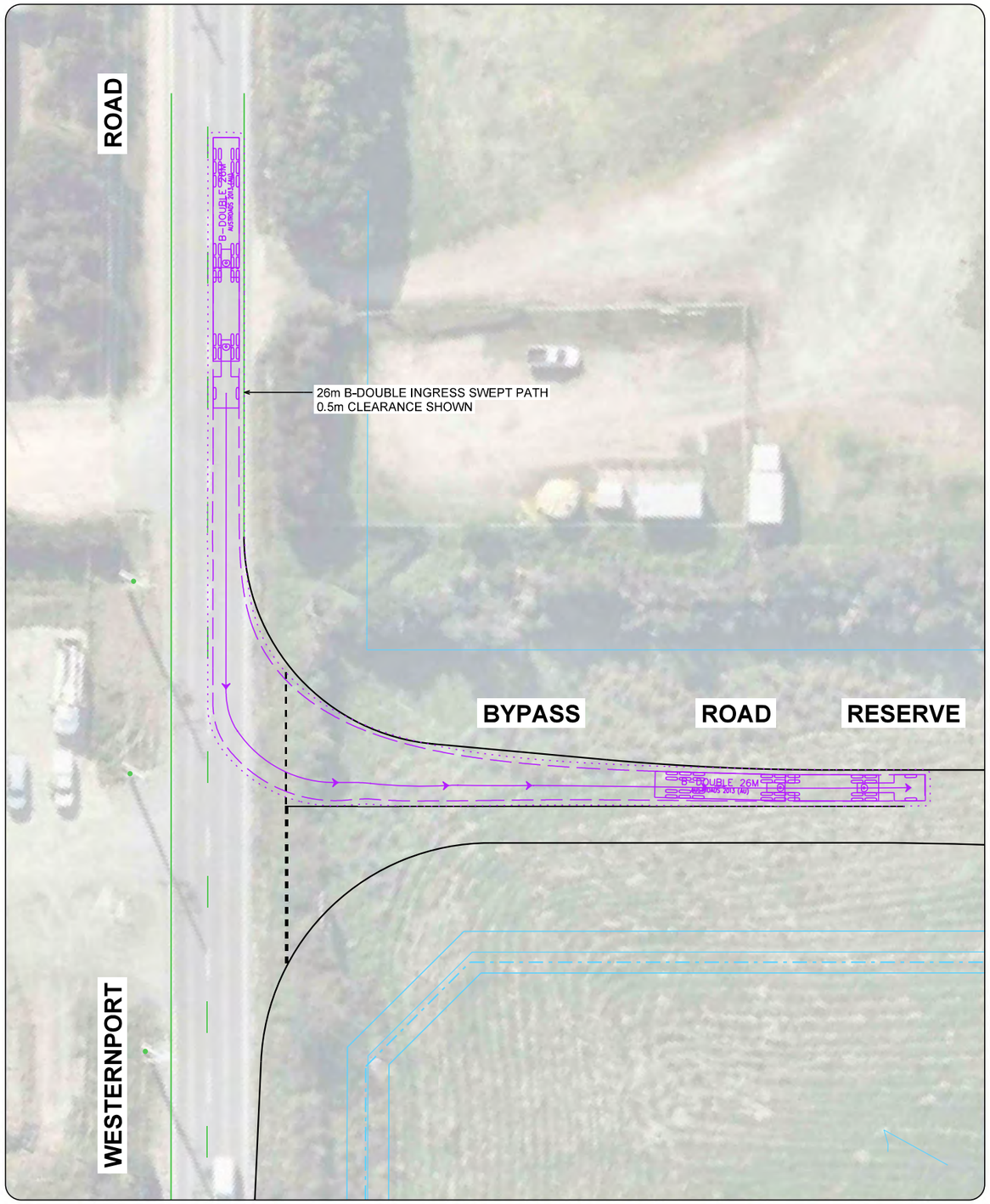
Revision Description
ISSUED FOR INFORMATION

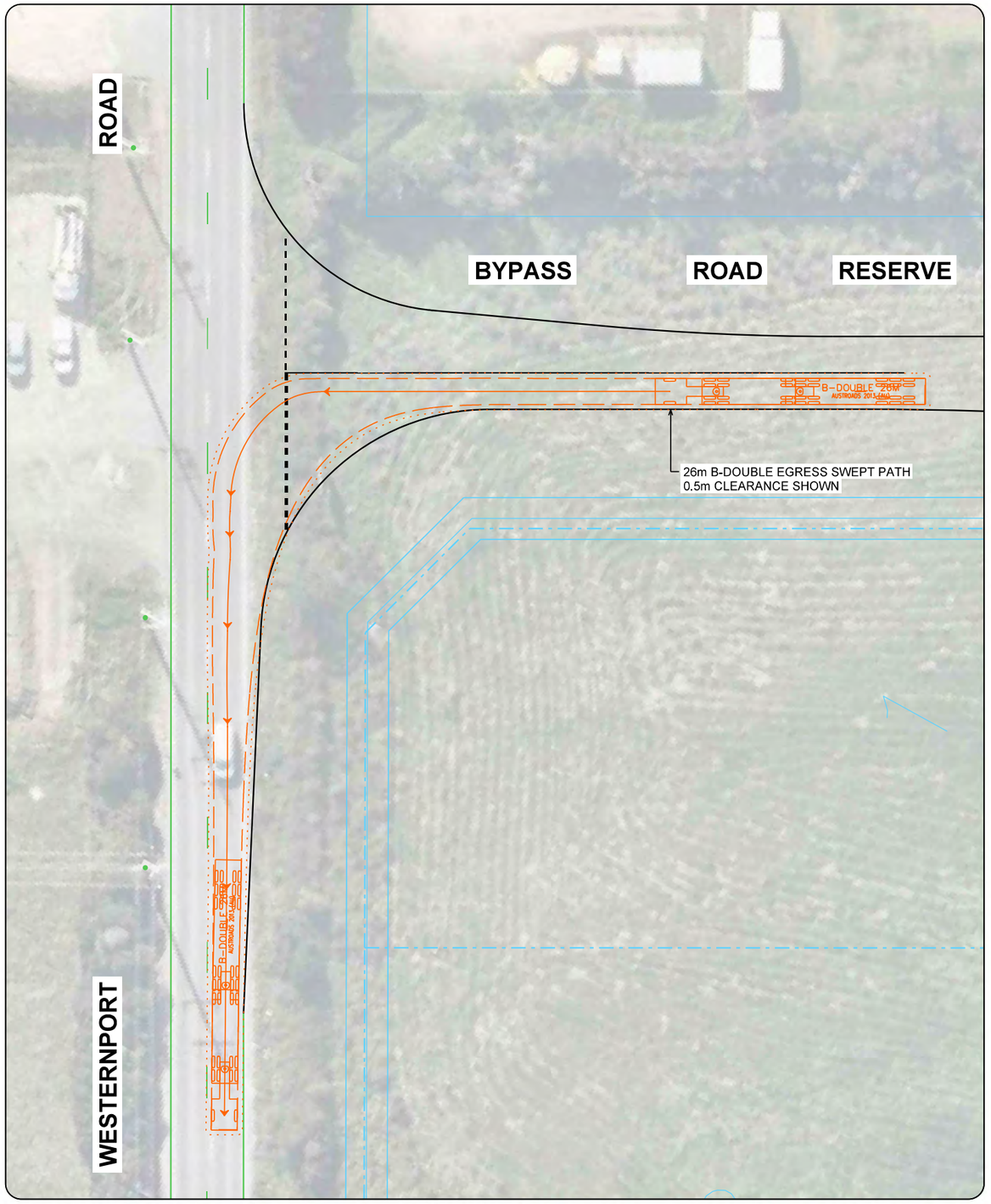
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
20m SEMI-TRAILER DESIGN VEHICLE

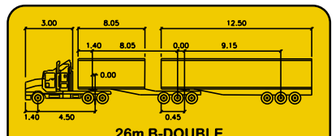
Drawing Number
IMP2208021 - DRG-02-14

Revision
C

15/05/2023 11:40:00 AM







26m B-DOUBLE

	METERS		METERS
TRACKTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 23.4
TRACKTOR TRACK	: 2.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
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Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

Revision Description
ISSUED FOR INFORMATION

Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
26m B-DOUBLE CHECK VEHICLE

Drawing Number
IMP2208021 - DRG-02-15

Revision
C

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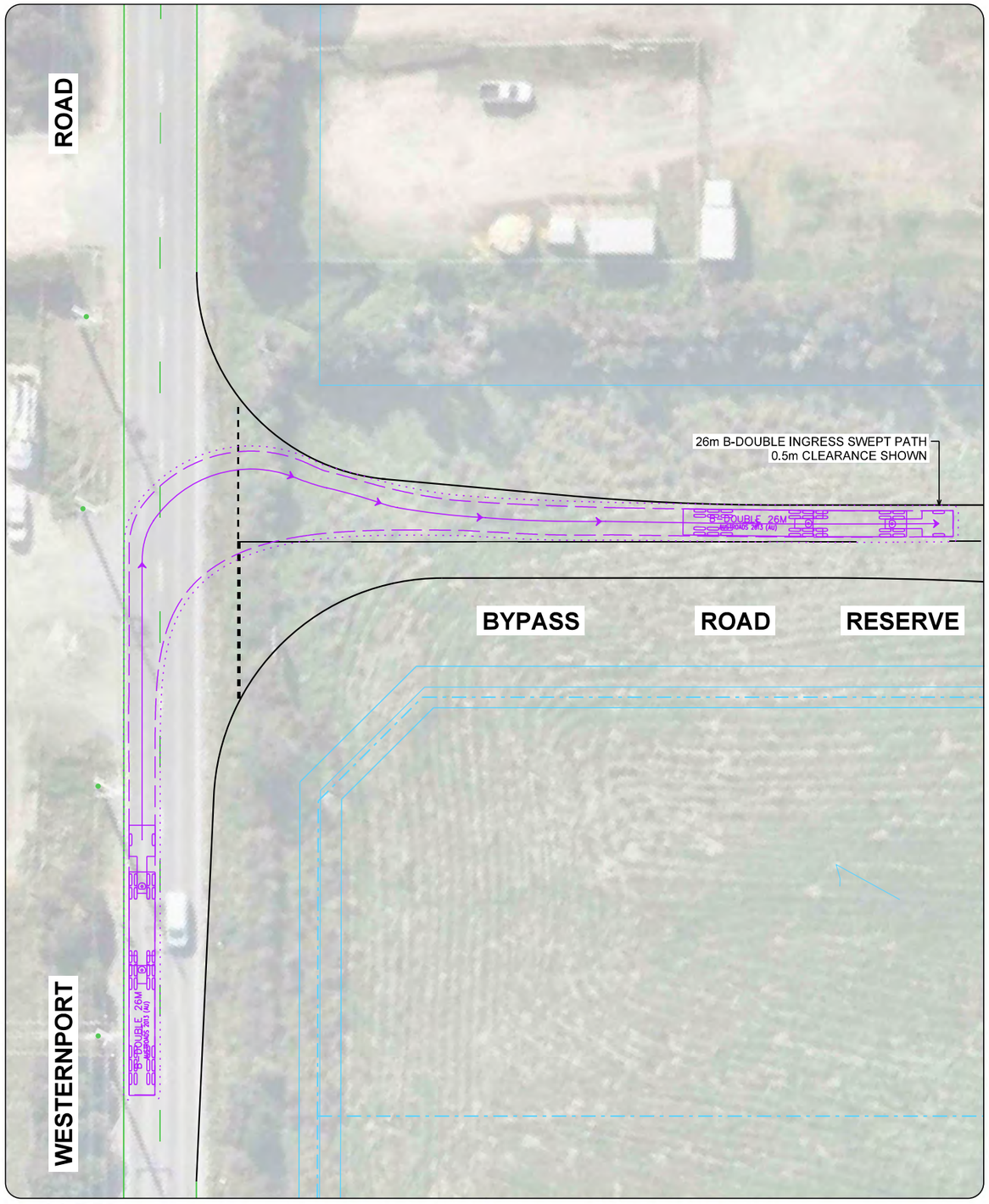

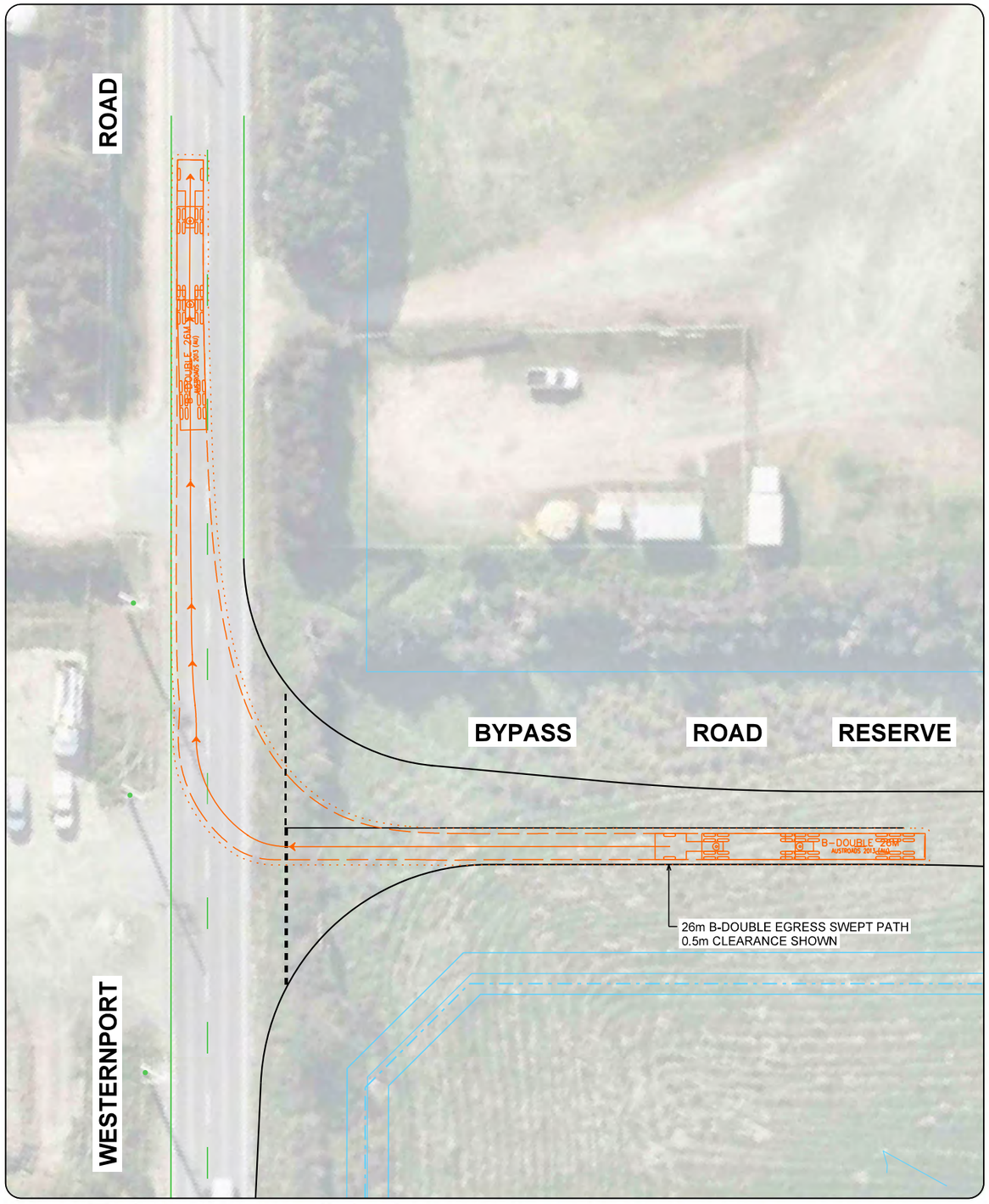

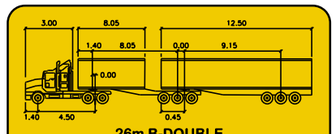

26m B-DOUBLE

	METERS		METERS
TRACKTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 23.4
TRACKTOR TRACK	: 2.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

Revision Description
ISSUED FOR INFORMATION

Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
26m B-DOUBLE CHECK VEHICLE

Drawing Number
IMP2208021 - DRG-02-16

Revision
C

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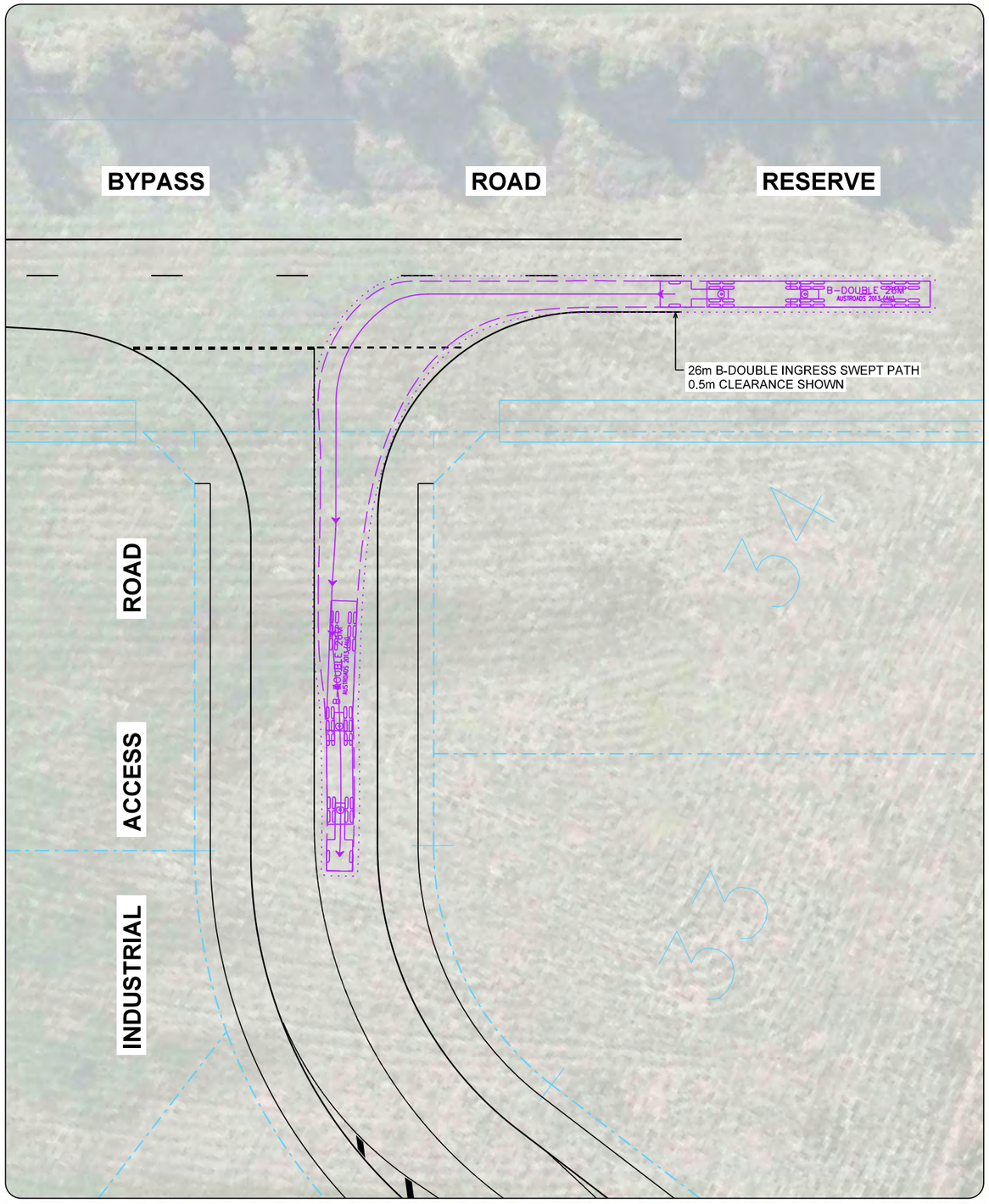

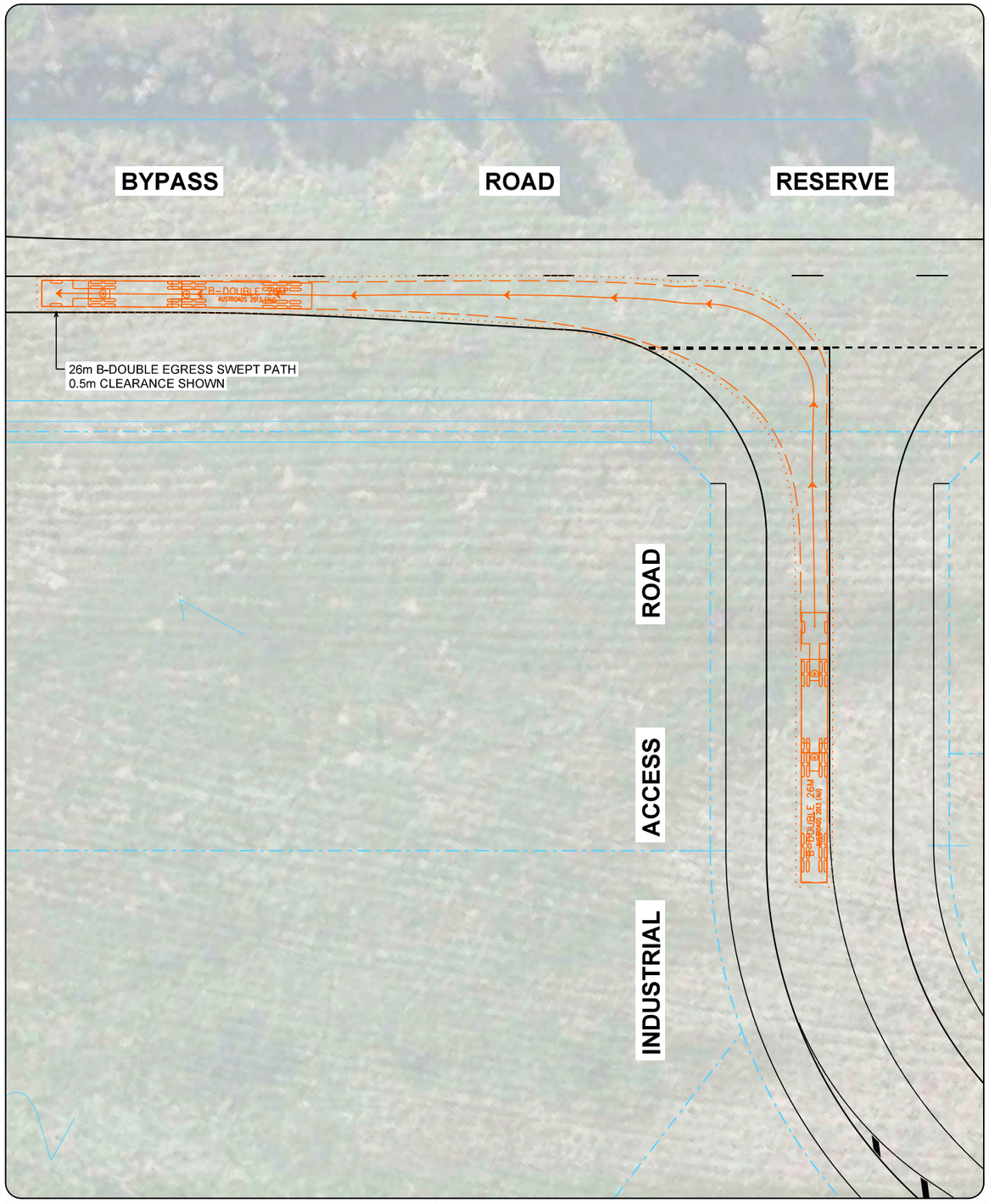

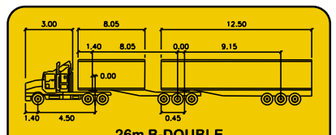

26m B-DOUBLE

	METERS		METERS
TRACKTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 23.4
TRACKTOR TRACK	: 2.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
create@impactaustralia.com.au
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SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

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WH / SM

Revision Description
ISSUED FOR INFORMATION

Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
26m B-DOUBLE CHECK VEHICLE

Drawing Number
IMP2208021 - DRG-02-17

Revision
C

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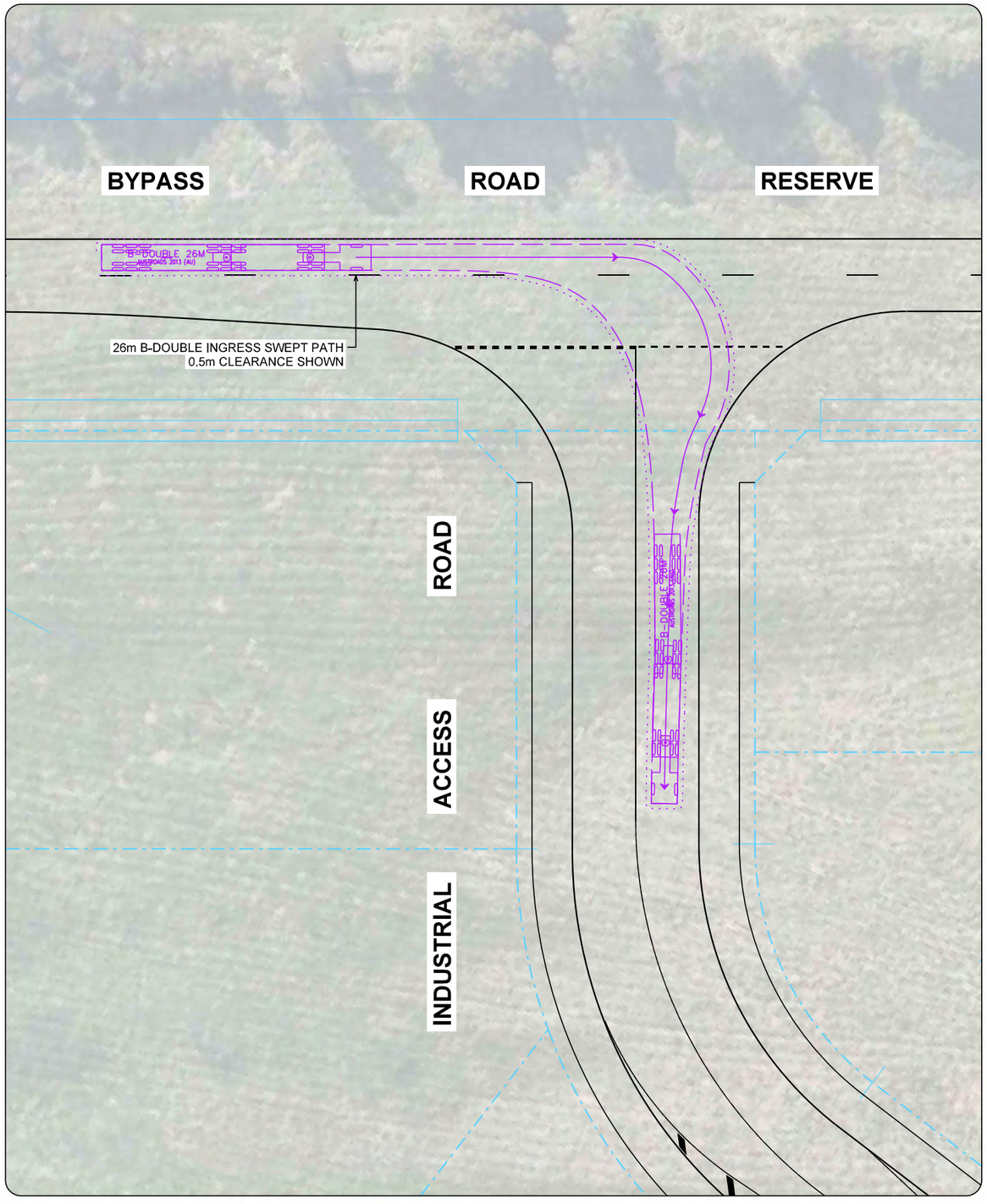

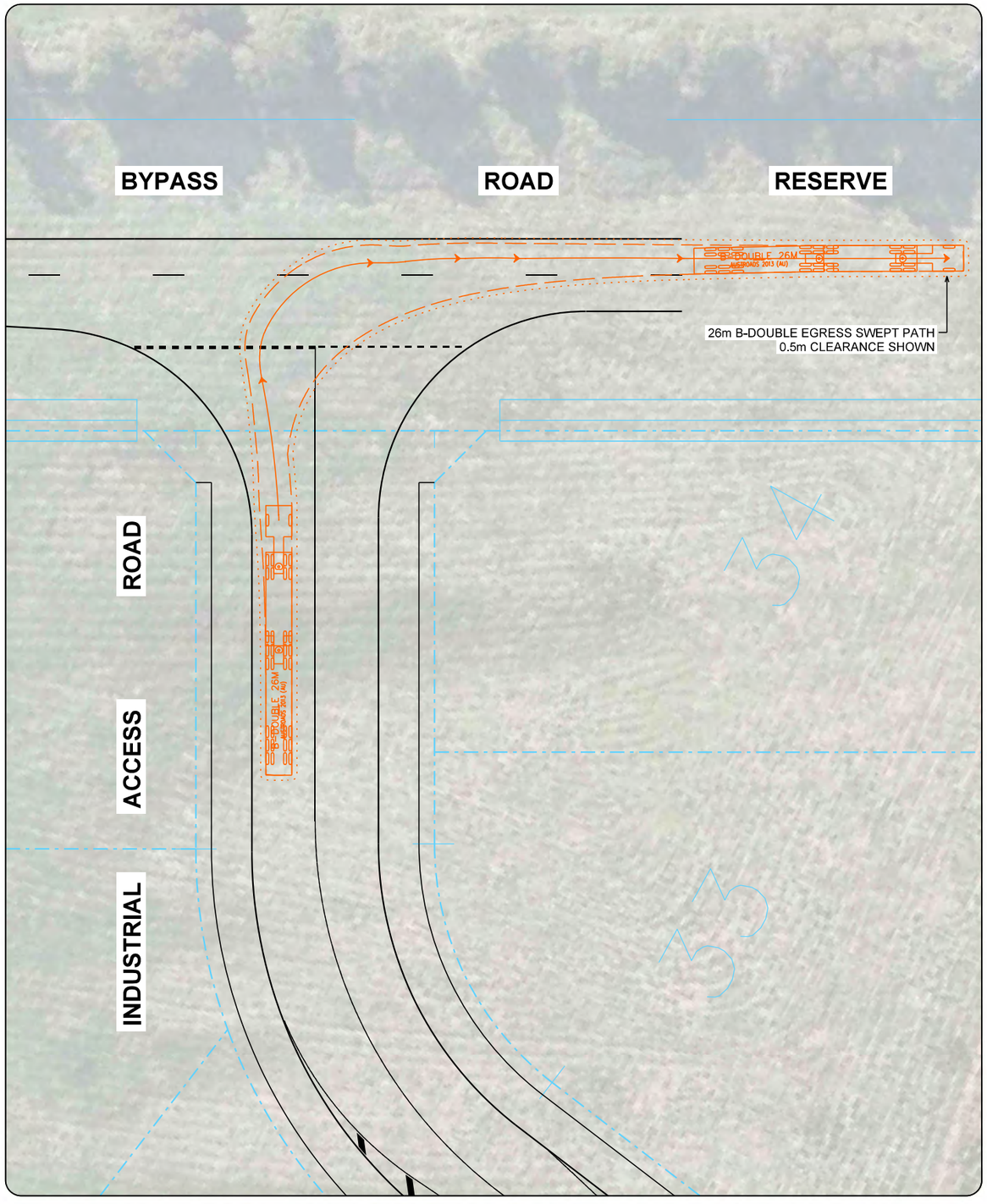

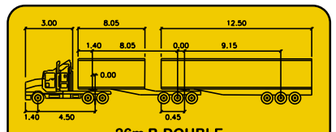

26m B-DOUBLE

	METERS		METERS
TRACKTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 23.4
TRACKTOR TRACK	: 2.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
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Client
JOB SITE RECYCLERS

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

Drawn / Approved
WH / SM

Status
PRELIMINARY

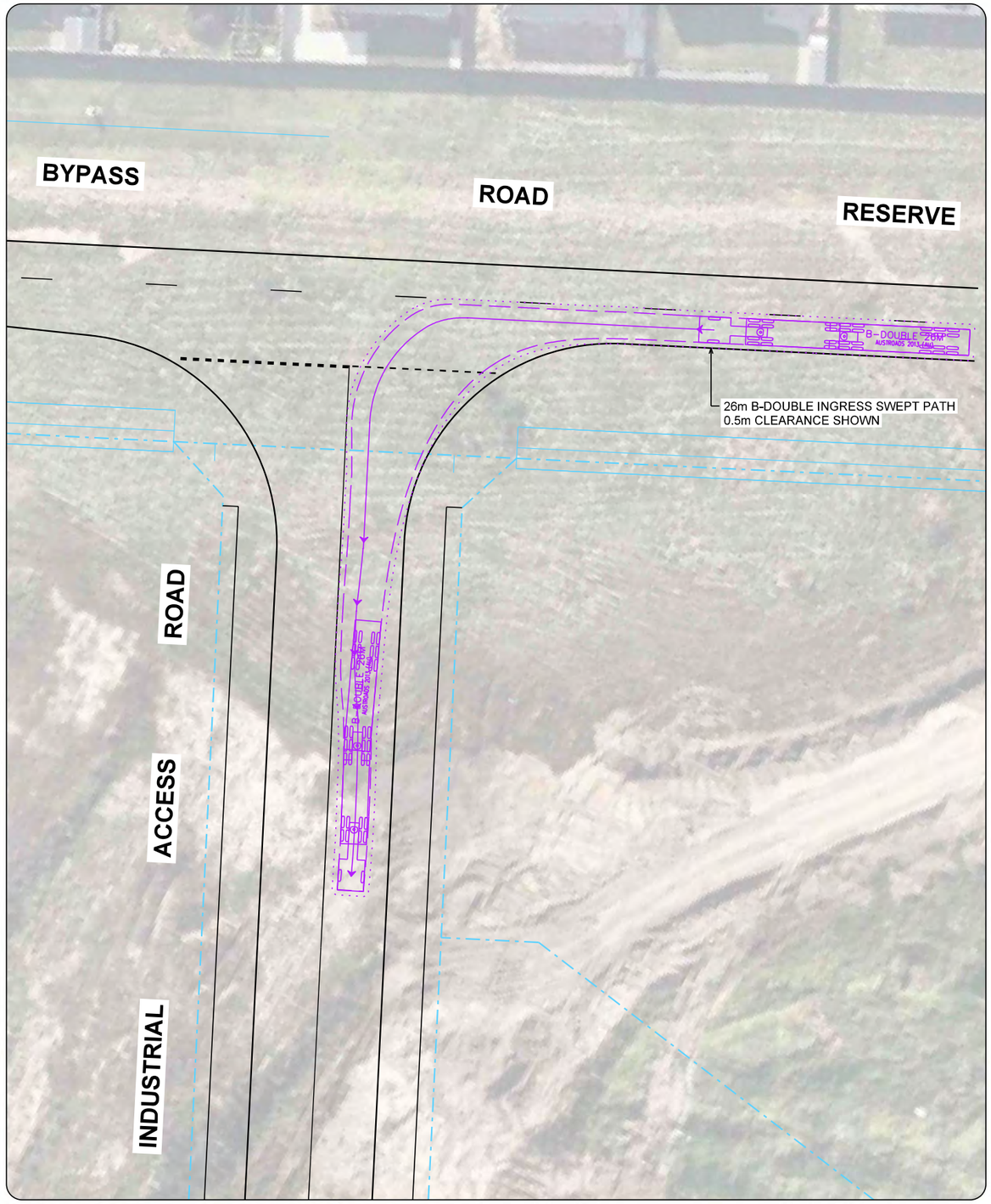
Revision Description
ISSUED FOR INFORMATION

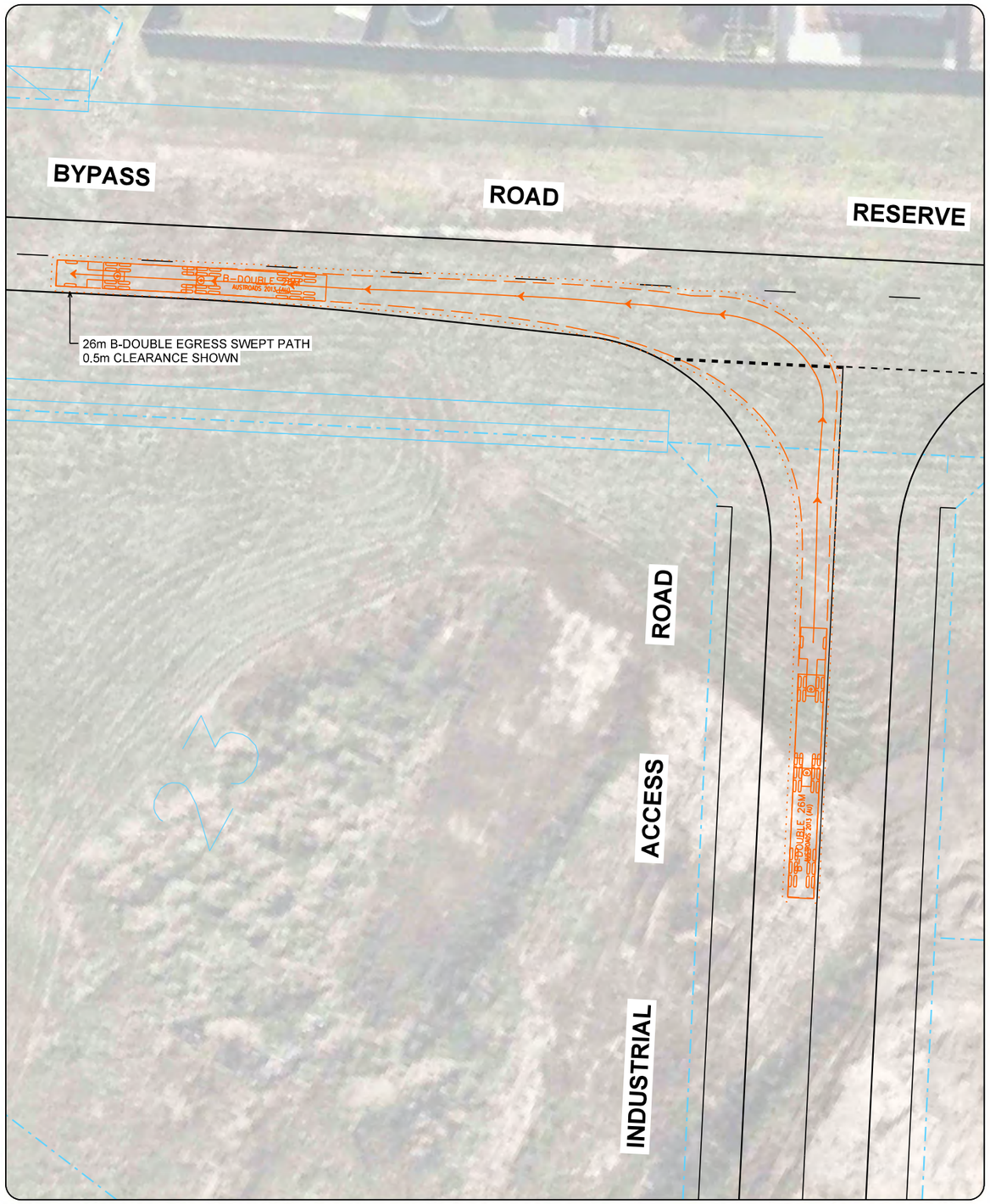
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
26m B-DOUBLE CHECK VEHICLE

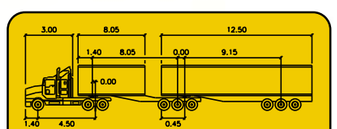
Drawing Number
IMP2208021 - DRG-02-18

Revision
C

15/05/2023 11:40:05 AM







26m B-DOUBLE

	METERS		METERS
TRACKTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 23.4
TRACKTOR TRACK	: 2.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
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LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

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WH / SM

Status
PRELIMINARY

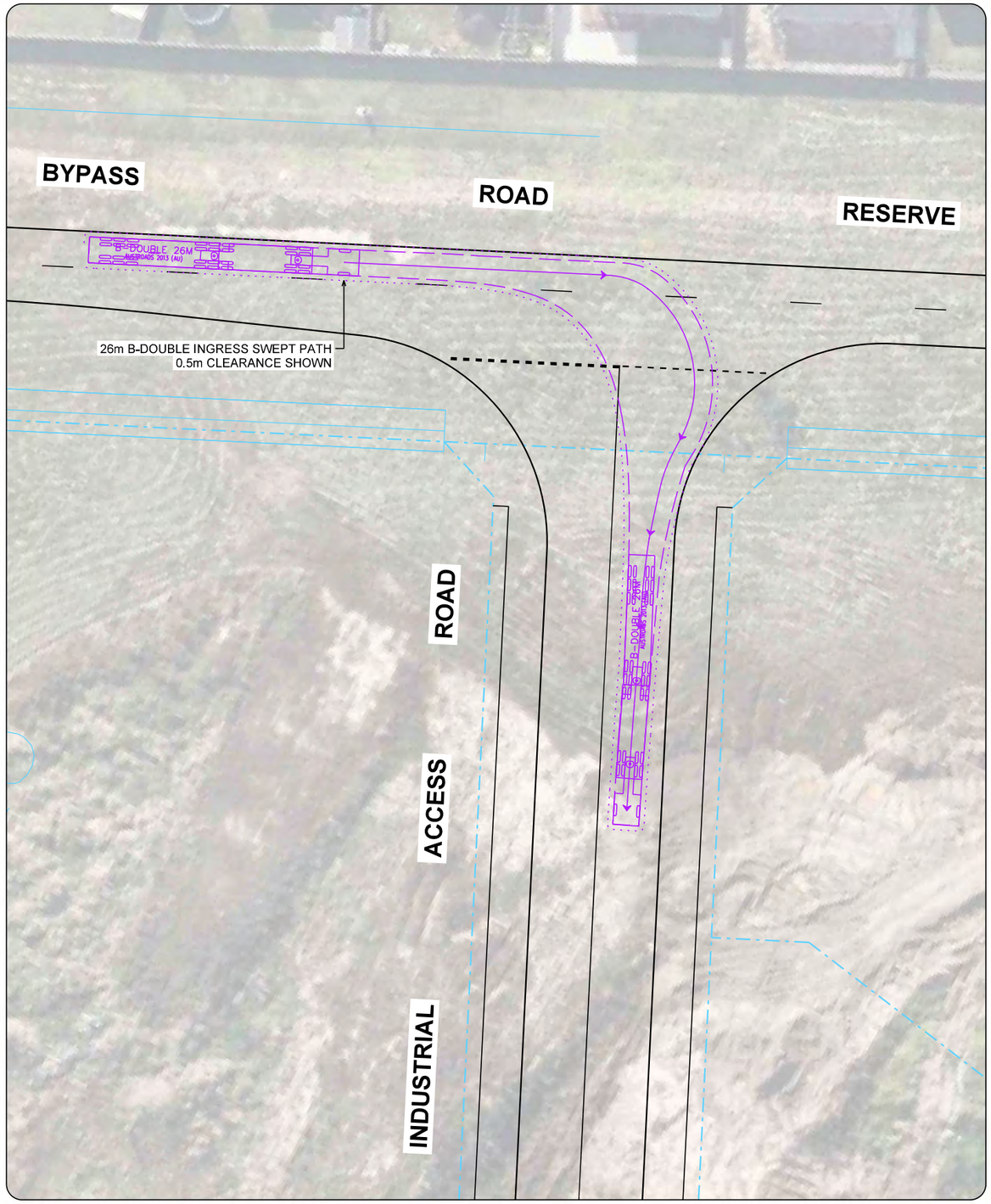
Revision Description
ISSUED FOR INFORMATION

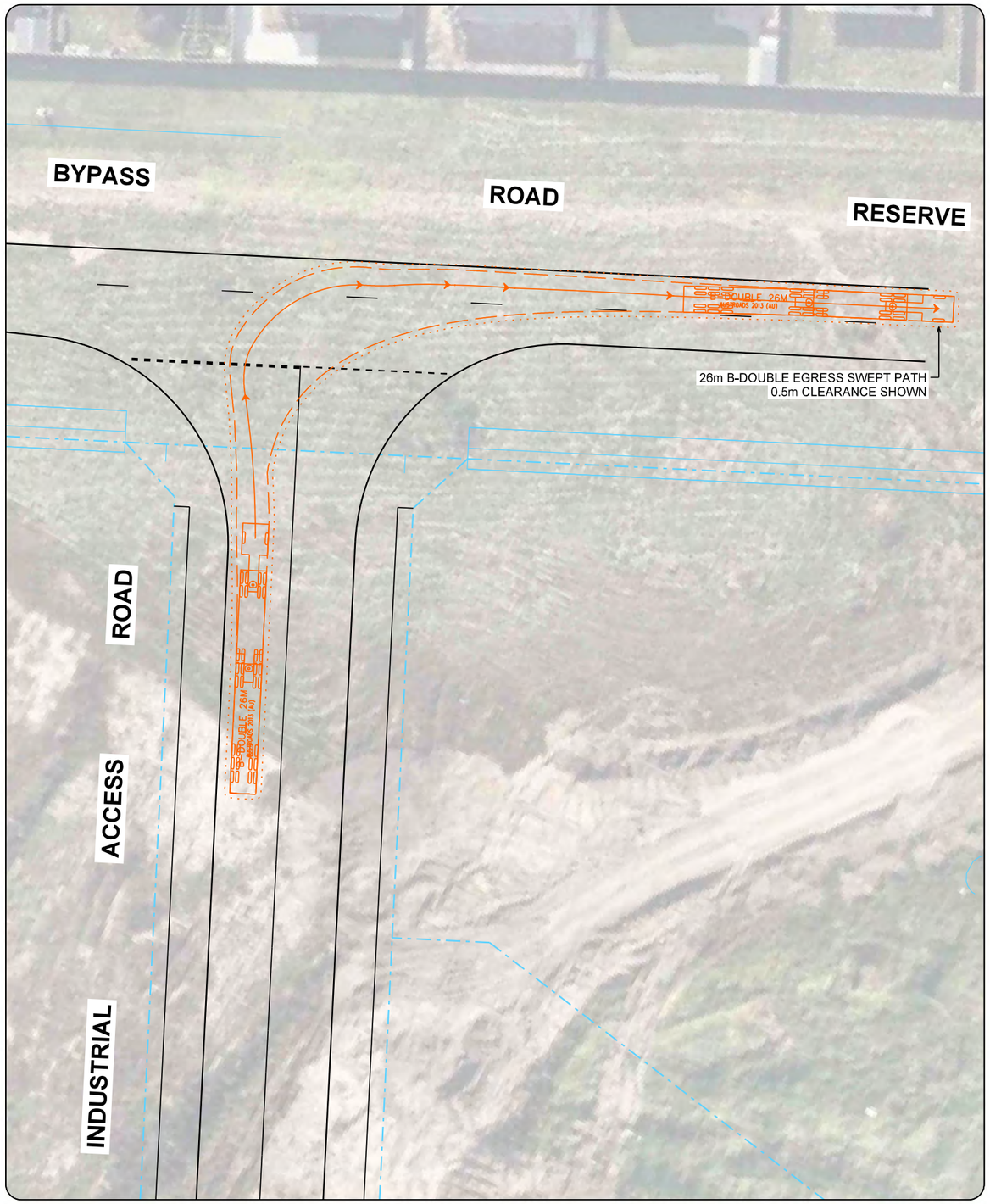
Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
26m B-DOUBLE CHECK VEHICLE

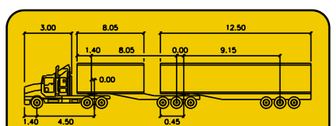
Drawing Number
IMP2208021 - DRG-02-19

Revision
C

15/05/2023 11:40:06 AM







26m B-DOUBLE

	METERS		METERS
TRACKTOR WIDTH	: 2.50	LOCK TO LOCK TIME	: 6.0
TRAILER WIDTH	: 2.50	STEERING ANGLE	: 23.4
TRACKTOR TRACK	: 2.50	ARTICULATING ANGLE	: 70.0
TRAILER TRACK	: 2.50		

IMPACT TRAFFIC ENGINEERING PTY LTD
ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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MELWAY ONLINE REF:

SCALE
1:500 @ A3

Client
JOB SITE RECYCLERS

Status
PRELIMINARY

Project
INDUSTRIAL SUBDIVISION
6 LINK ROAD, LANG LANG
CARDINIA SHIRE

Date
2023-05-15

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WH / SM

Revision Description
ISSUED FOR INFORMATION

Title
TRAFFIC AND TRANSPORT ASSESSMENT
SWEPT PATH ANALYSIS
26m B-DOUBLE CHECK VEHICLE

Drawing Number
IMP2208021 - DRG-02-20

Revision
C

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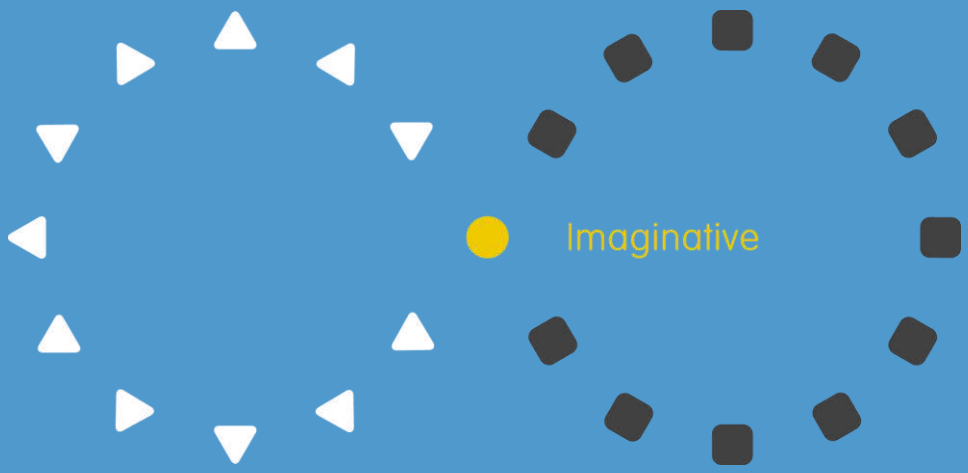
Imaginative

Westernport Industrial Estate

6 Link Road, Lang Lang

Stormwater Management Strategy

23rd March 2023

Report by: **Stormy Water Solutions Consulting Pty Ltd**

[redacted]

Document Verification

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Note that for the purposes of this report, Stormy Water Solutions (**SWS**) consists of two business entities being:

- Stormy Water Solutions (ABN 95 656 703 998) – Valerie Mag (Principal), and
- Stormy Water Solutions Consulting Pty Ltd (ABN 57 650 394 899) – Michael Mag (Director and Senior Hydrologic Engineer)

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Contents

1 Introduction

Stormy Water Solutions Consulting Pty Ltd (**SWS**) has been engaged by JSR Lang Lang Pty Ltd (the **Client**) to prepare a stormwater management strategy (**SMWS**) for the development proposed at 6 Link Road, Lang Lang (the **Subject Land**).

1.1 The Subject Land

Figure 1 shows a locality of the Subject Land with the current zonings and overlays.

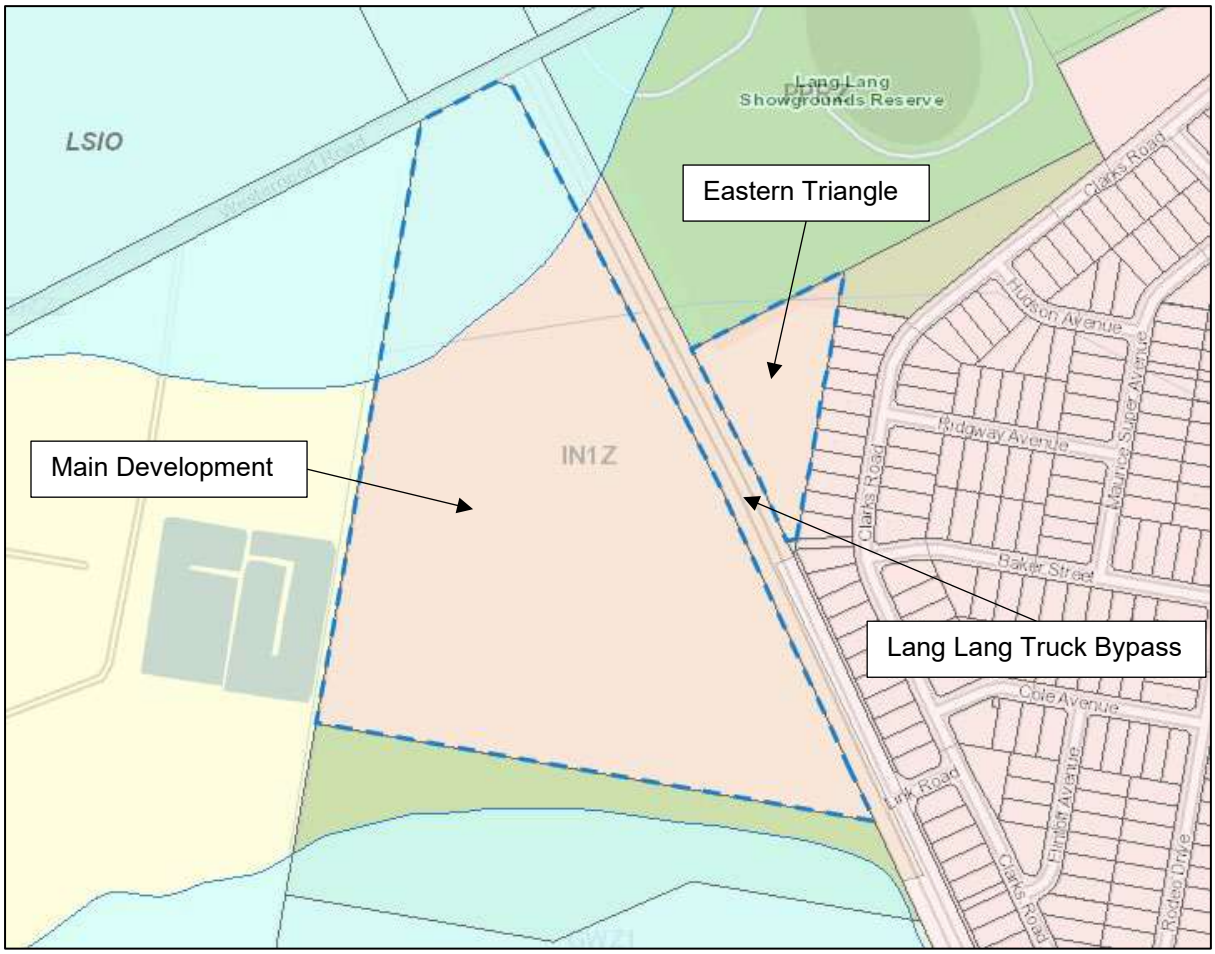

Figure 1 **Subject Land Locality and current zonings.**
Source: https://mapshare.vic.gov.au/vicplan/, 17/10/22

The Subject Land is currently zoned Industrial Zone 1 (**IN1Z**). The Subject Land is impacted along its northern boundary by a Land Subject to Inundation (**LSIO**) overlay.

As shown in Figure 1, the Subject Land is bisected by Parcel R1/PS728287, which is understood to have been set aside for the future Lang Lang truck bypass. As defined in Figure 1, the two sections of the Subject Land, herein are referred to:

West of the future Lang Lang Truck Bypass: the **Main Development**; and

East of the future Lang Lang Truck Bypass: the **Eastern Triangle**.

1.2 The Development Proposal

Figure 2 shows the development proposal which is generally assumed within this SWMS.

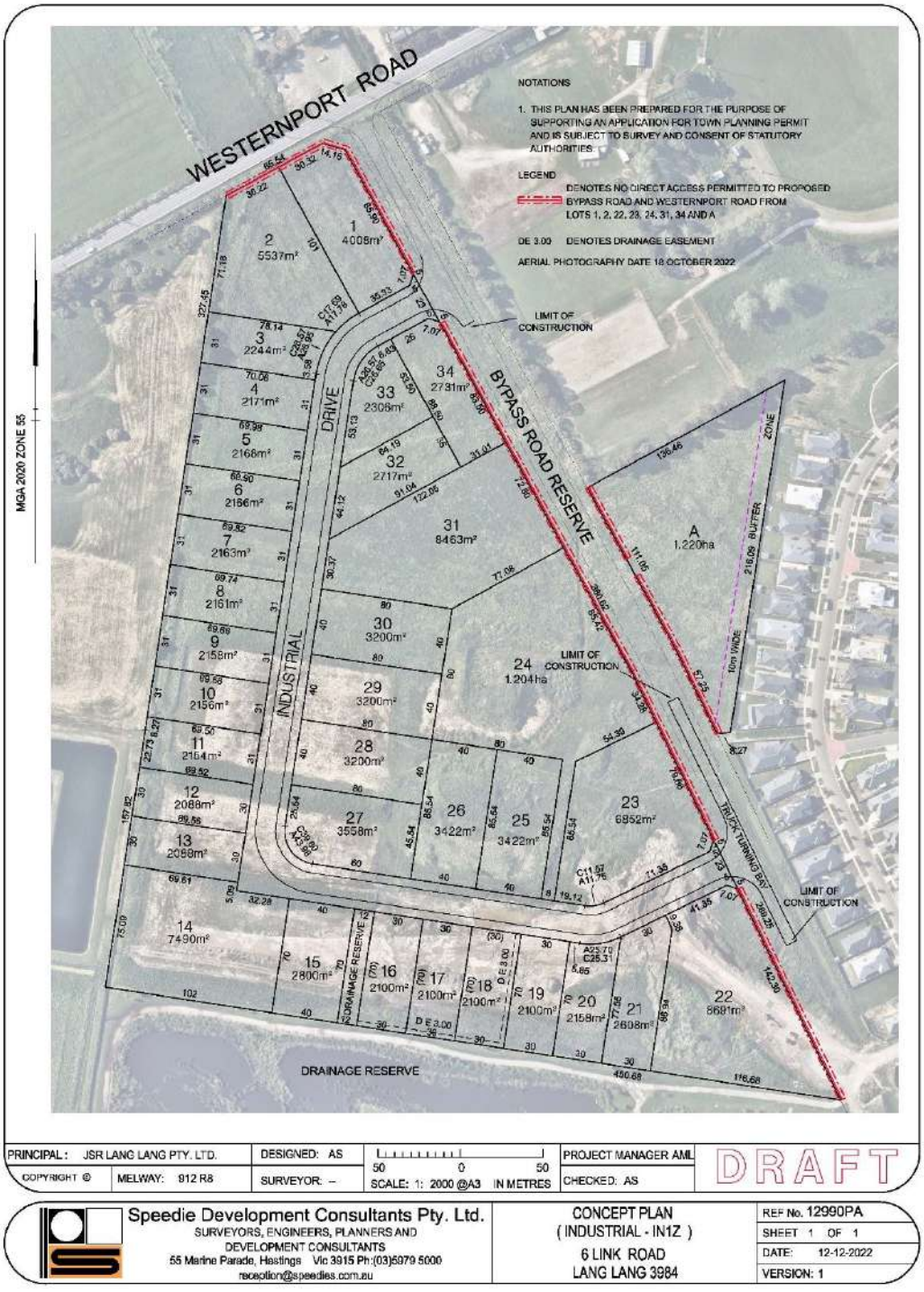

Figure 2 Development Proposal for the Subject Land.
Source: Speedie Development Layout

Overall, the Development Proposal is for approximately 35 industrial allotments, ranging in size from roughly 0.2 ha to 1.2 ha.

2 Sources of Information

2.1 Background Reports, Information and Designs

The formulation of this functional design has utilised information from the following sources relating to designs, existing features and/or current works in the broader catchments and/or Subject Land. Information obtained from each source below is described in more detail in subsequent parts of this report where required.

- "McDonalds Track, Lang Lang, Stormwater Management Strategy, June 2010, Rev A, 21/06/2010, Beveridge Williams" (the **2010 McDonalds Track SWMS**);
- Melbourne Water Corporation flood mapping results of Adams Creek through 170 McDonalds Track, Lang Lang, Dated 02/09/2016 (the **2016 MWC Adams Creek Flood Mapping**);
- "170 McDonalds Track, Lang Lang, Retarding Basin / Wetland Functional Design, 11/01/2018, Rev A, Stormy Water Solutions" (the **2018 Wetland Design Report**);
- The drawing set "170 McDonalds Track, Lang Lang, Retarding Basin / Wetland Functional Design, 1781/SWS/1-4, Rev B, 9/02/2018" (the **2018 Wetland Design Drawings**);
- The following information provided by Speedie Development Consultants:
    - The drawing set "Summerfields Estate Wetland / Retarding Bain, drawings 10240WL, sheets 1 to 18, As constructed, Rev C, 25/5/2018" (the **Wetland As Cons**);
    - Feature Survey (the **Survey**); and
    - The drawing "Site Fill Levels, Industrial Park, Westernport Road, Lang Lang, V02, 15/08/2022" (the **Fill Plan**);
    - The drawing "Concept Plan, 6 Link Road Lang Lang, V1, 12/12/2022" (the **Speedie Development Layout**);
    - The drawing set "Westernport Industrial Estate – Westernport Road, Lang Lang, Cardinia Shire Council. 12990 E, undated" (the **Preliminary Speedie Development Design**);
    - The drawing set "Cardinia Shire Council, Lang Lang Truck Bypass, 10240TB, sheets 1 to 13, undated" (the **Preliminary Speedie Bypass Design**);
- Nearmap aerial imagery;
- LiDAR information captured in February 2012;
- A site visit performed by SWS staff on the 30/09/2022; and
- Publicly available cadastral information obtained from https://datashare.maps.vic.gov.au/.

2.2 Manuals and Guidelines

Where applicable, the designs developed will be consistent with the following Manuals or Guidelines:

1. CSIRO (1999). "*Urban Stormwater Best Practice Environmental Management Guidelines.*" CSIRO PUBLISHING, Melbourne (**BPEMG**);
2. Melbourne Water (2005). "*WSUD Engineering Procedures: Stormwater Melbourne"*, CSIRO Publishing (the **WSUD Engineering Procedures**);

3. Growth Areas Authority (2011). “Engineering Design and Construction Manual for Subdivision in Growth Areas”, April 2011 (the **EDCM**);
4. Melbourne Water (2018). “*MUSIC Guidelines – Input parameters and modelling approaches for MUSIC users in Melbourne Water’s service area”,* Melbourne Water (the **MUSIC Tool Guidelines**);
5. DELWP (2019), “*Guidelines for Development in Flood Affected Areas*”, February 2019, DELWP (the **DELWP Flood Guidelines**);
6. A Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) (2019), “*Australian Rainfall and Runoff: A Guide to Flood Estimation”*, Commonwealth of Australia. (**ARR 2019**);
7. Melbourne Water (2020). “*Wetland Design Manual, Part A2: Deemed to Comply Criteria*.”, (the **Wetland Design Manual**);
8. Environmental Protection Agency Victoria (2021), ‘*Urban Stormwater Management Guidance*’, publication 1739.1, June 2021 (the **Updated Guidance**); and
9. Melbourne Water (2022). “*MUSIC (Model for Urban Stormwater Improvement Conceptualisation) Guideline – Draft”, May 2022,* Melbourne Water (the **Draft MUSIC Guidelines**).

3 Background

3.1 The 2010 McDonalds Track SWMS

The Subject Land was originally part of the SWMS for the broader McDonalds Track Lang Lang development as described within the 2010 McDonalds Track SWMS. Figure 3 details the recommendations of the 2010 McDonalds Track SWMS with the approximate locations Subject Land and the Lang Lang Truck Bypass highlighted magenta.

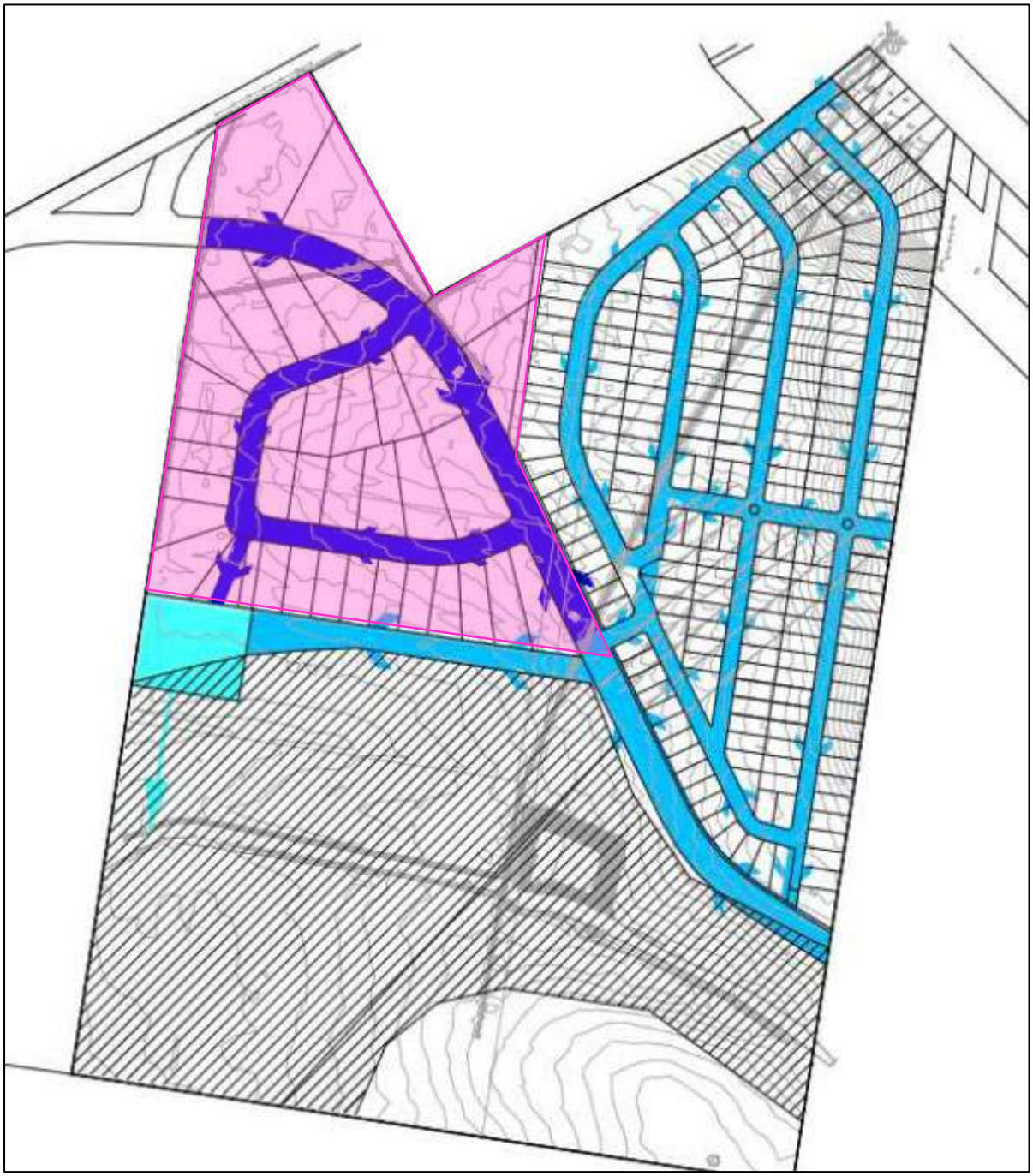

Figure 3 **Extract of Figure 9 of the 2010 McDonalds Track SWMS with the approximate location of the Subject Land and the Lang Lang Truck bypass highlighted Magenta.**

The 2010 McDonalds Track SWMS called for all of the Subject land and the Lang Lang Truck bypass to discharge south into a future stormwater treatment wetland / retarding basin adjacent to Adams Creek.

3.2 The 2018 Wetland Design Report

The 2018 Wetland Design Report details the functional design of the stormwater treatment wetland which was proposed to service the broader development of McDonalds Track Lang Lang (which includes the Subject Land).

As shown in Figure 4 and 5, the 2018 Wetland Design Report assumed, and provided for, all of the Subject land and the Lang Lang Truck bypass to discharge south into a future stormwater treatment wetland / retarding basin adjacent to Adams Creek.

Within the 2018 Wetland Design Report, the wetland was sized assuming a Fraction Impervious ($\mathbf{F_{imp}}$) of 0.90 for the Subject Land. The MUSIC Tool Guidelines states that a F_{imp} of 0.90 is a reasonable representation for a IN1Z zone development.

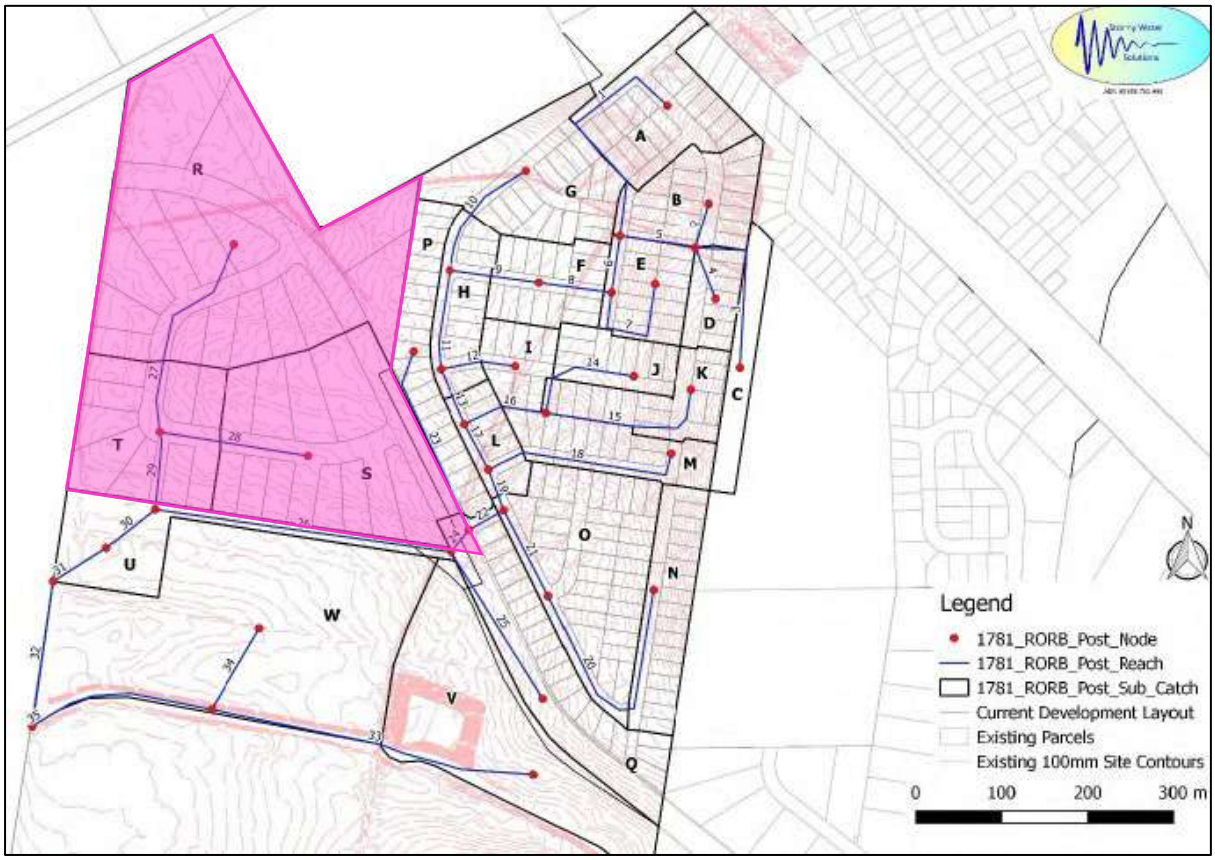

Figure 4 **Extract of Figure B.1 of the 2018 Wetland Design Report, which is the catchment plan. The approximate location of the Subject Land and the Lang Lang Truck bypass is highlighted Magenta.**

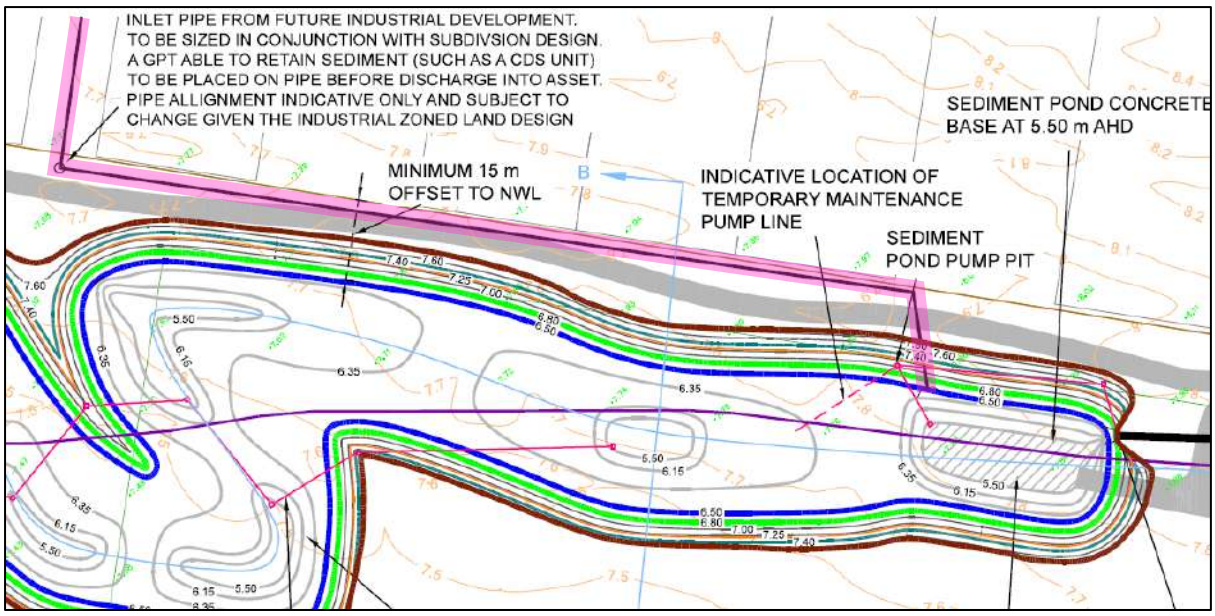

Figure 5 **Extract of drawing 1781/SWS/1 from the of the 2018 Wetland Design Drawings showing the proposed pipe (highlighted Magenta) which was to service the Subject Land (and the Lang Lang Truck Bypass) in the Sediment Pond.**

3.3 Site features

3.3.1 Survey

Figure 6 details the conditions of the Subject Land (based on the Survey) prior to any of the Wetland works and the 'dumping' of the excess fill on the Subject Land. Prior to the works and the 'dumping' of the fill, the Subject Land drained via shallow channels to a main channel along the western boundary. This main channel conveyed the Subject lands runoff South to Adams Creek.

Across the Subject Land, the surface graded between approximately 7.6 to 9.2 m AHD at a grade of roughly 1V:150H.

The Survey also indicates that the existing road level of Westernport Road is at approximately 8.40 m AHD.

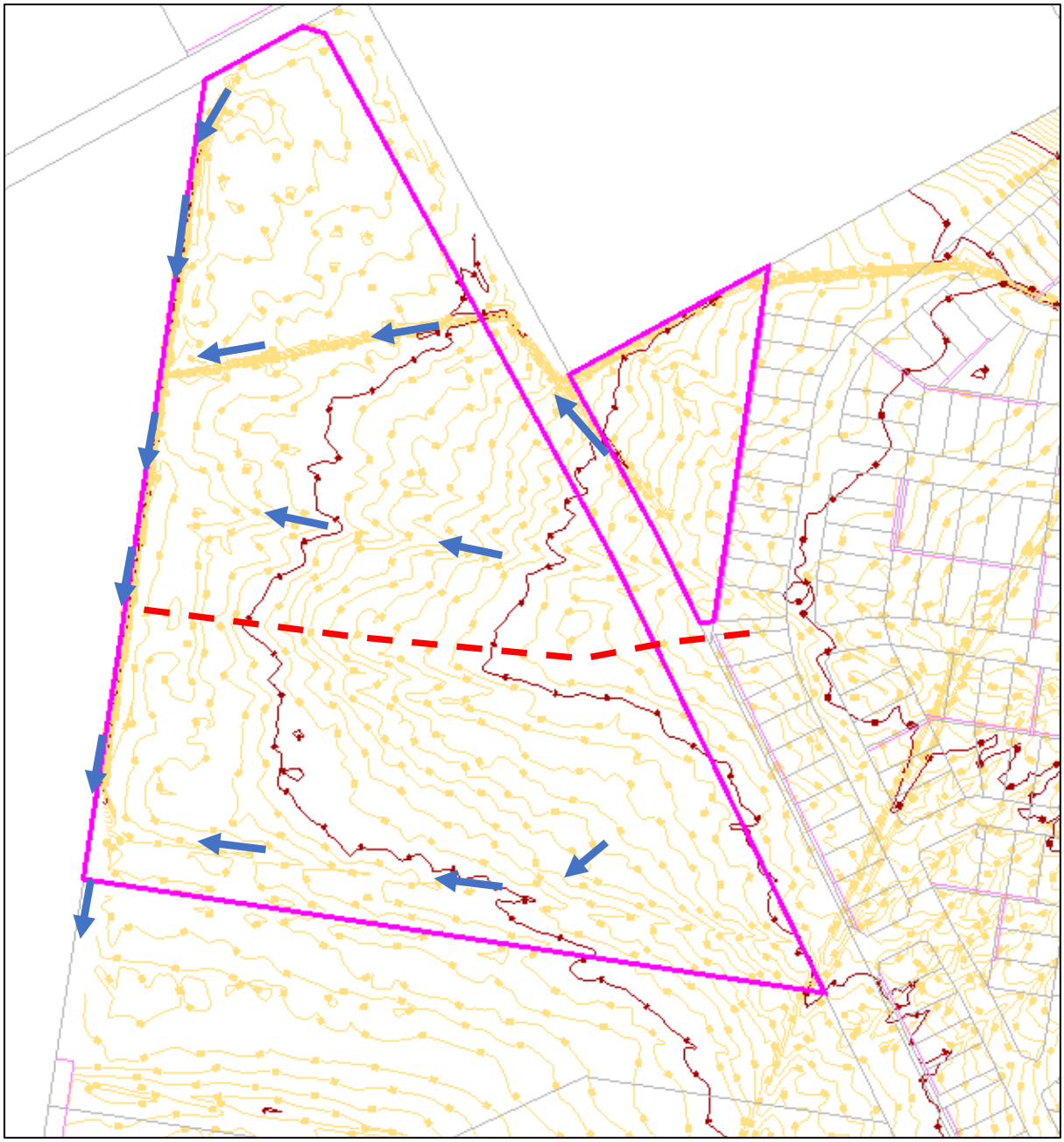

Figure 6 Site Conditions as per the Survey (prior to the fill dumping on the Subject Land)

3.3.2 Site Visit Observations and Nearmap

As of the date of the Site Visit undertaken by SWS staff in the preparation of this SWMS, the sediment basin and wetland proposals of the 2018 Wetland Design Report have been constructed. These proposals are detailed in the Wetland As Cons.

Across the southern sections of the Main Development region of the Subject Land, large quantities of fill have been 'dumped' in preparation for development of the Subject Land as shown in Figure 8 and 9.

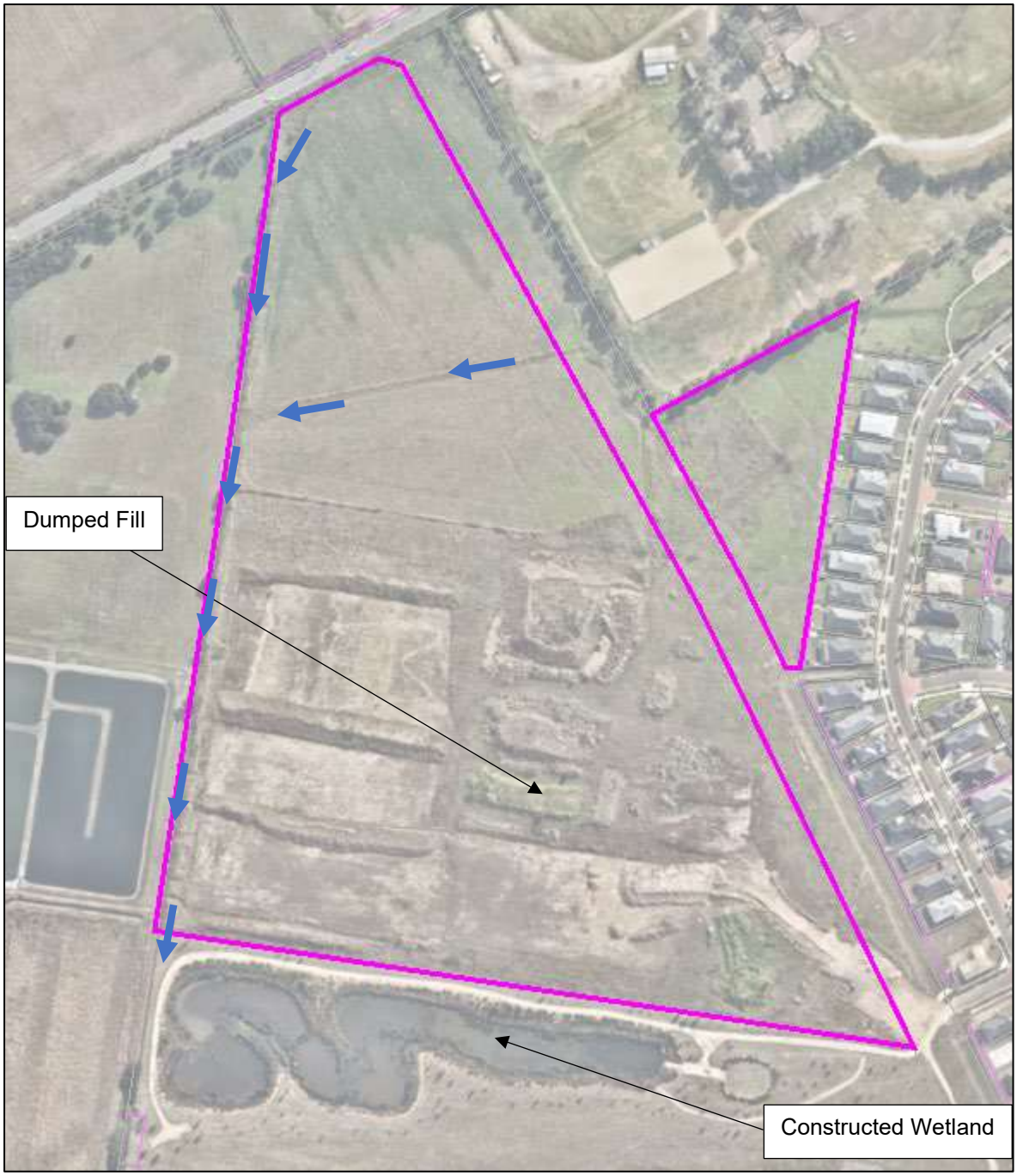

Figure 7 **Nearmap of the Subject Land. Dated 14/04/2022**

Figure 8 **Site Visit observation of the southern section of the Main Development region of the Subject Land showing 'dumped' fill**

At the site visit, the Eastern Triangle region of the Subject Land appeared to be generally unimpacted by the 'dumped' fill as shown in Figure 9.

Figure 9 **Site Visit observation of the Eastern Triangle region of the Subject Land showing it generally free of 'dumped' fill**

3.4 Flood Level Information

3.4.1 2010 Map and LSIO

The 2010 McDonalds Track SWMS provides a Melbourne Water Corporation (**MWC**) 1% AEP flood map of the Subject Land dated 9/04/2010 as shown in Figure 10. This map is generally reflective of the LSIO shown in Figure 1. The map specifies a 1% AEP flood level estimates of:

- between 7.54 and 8.46 m AHD across the southern section of the Subject Land (fronting Adams Creek); and
- between 7.94 and 8.35 m AHD across the northern section of the Subject Land (fronting Westernport Road)

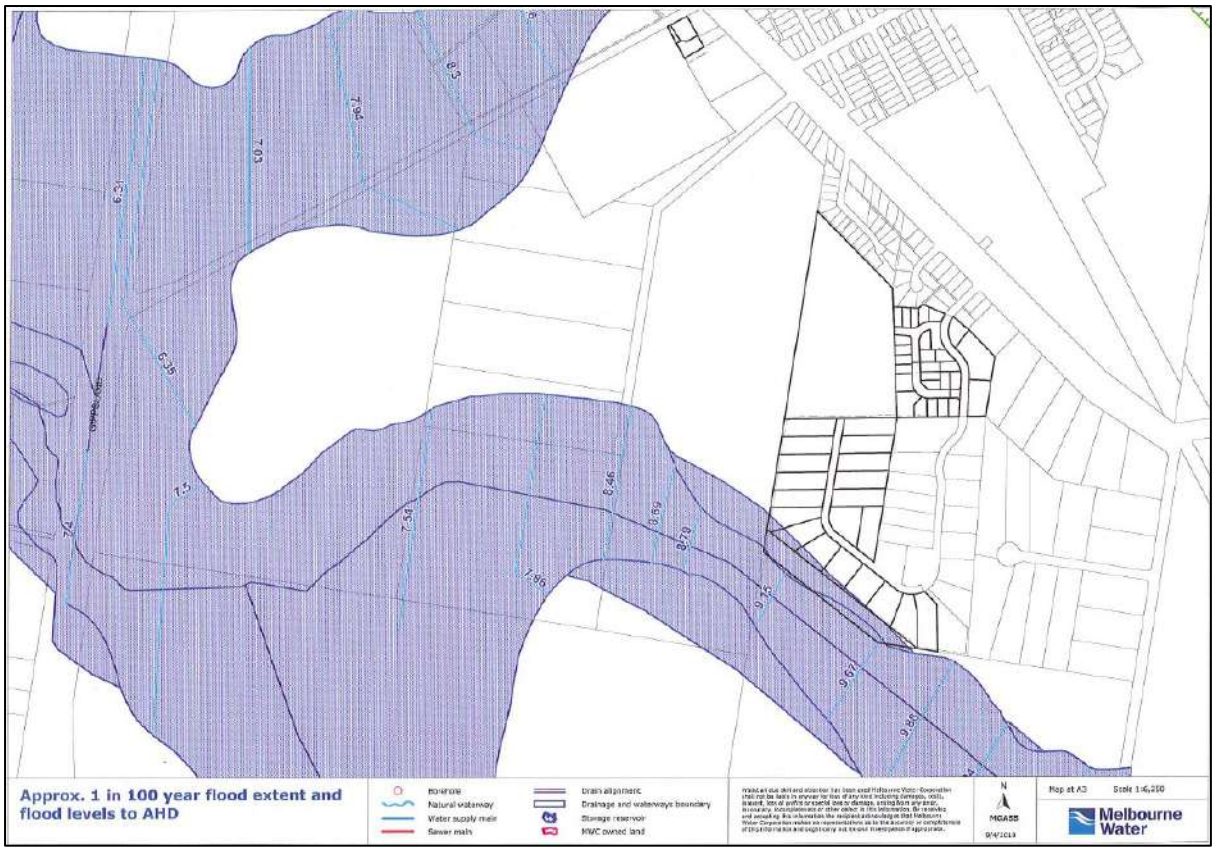

Figure 10 Extract of Appendix B of the 2010 McDonalds Track SWMS

3.4.2 2016 Map

In the preparation of the 2018 Wetland Design Report, SWS was provided with a revised MWC 1% AEP flood map of the Subject Land as shown in Figure 11, which is dated 02/09/2016.

The 2016 MWC Adams Creek Flood Mapping specifies a 1% AEP flood level estimates of:

- between 7.52 and 8.55 m AHD across the southern section of the Subject Land (fronting Adams Creek); and
- No inundation along the north of the northern section of the Subject Land (fronting Westernport Road) where the LSIO is located. This is because the high level of Westernport Road forms a barrier to flows being directed south.

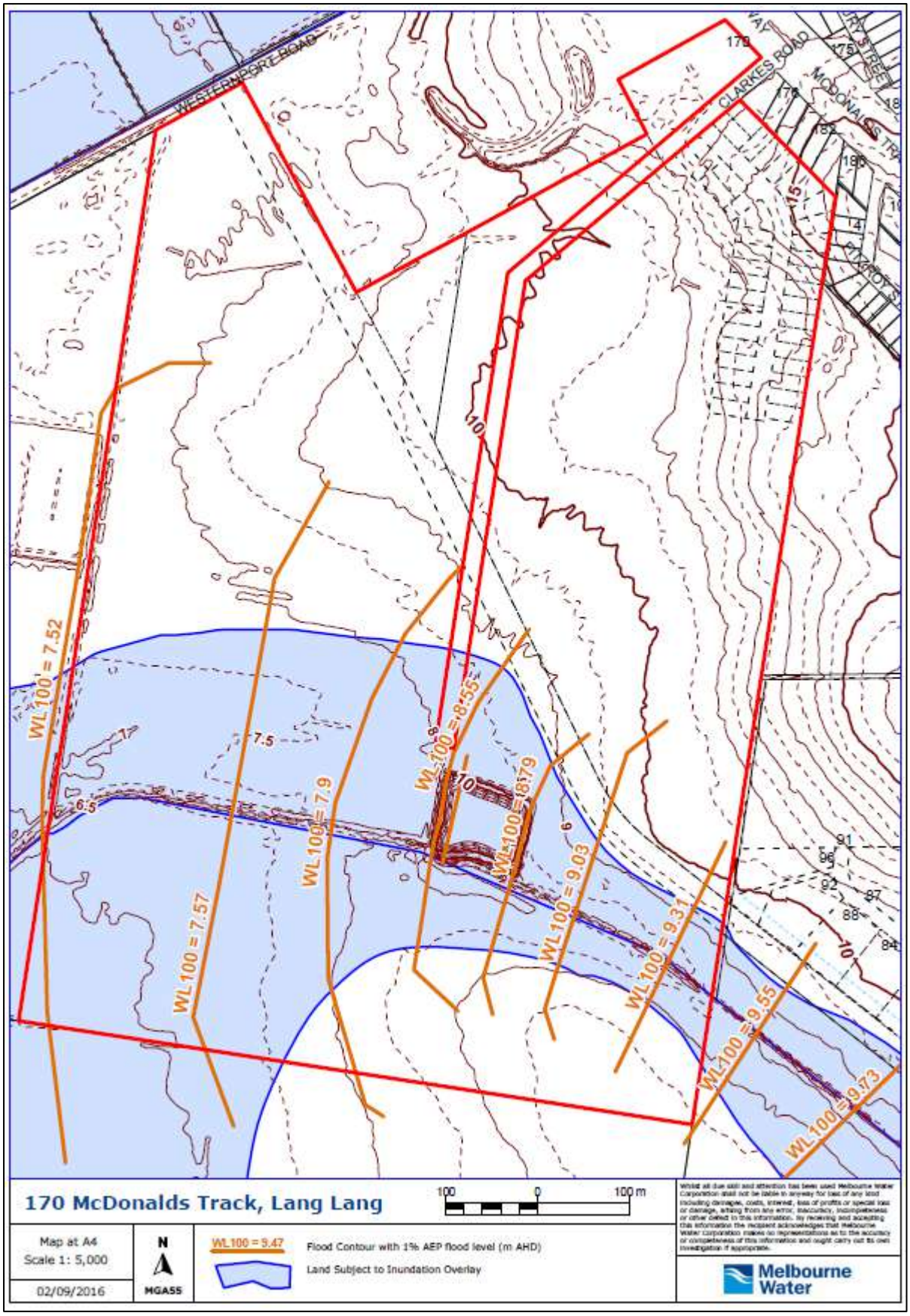

Figure 11 **The 2016 MWC Adams Creek Flood Mapping**

3.4.3 Flood Level Certificate

Given the current LSIO differs from the flood mapping shown in Figure 11, a flood level certificate was sought from the MWC. This certificate, MWA-1270080, states "*Information available at Melbourne Water indicates that the property is not subject to flooding from Melbourne Water's drainage system*".

Thus, there are not expected to be any impacts due to subdivision proposals filling within the existing LSIO as the LSIO is no longer expected to be applicable to the Subject Land.

Appropriate fill freeboard requirements should be incorporated on land adjacent to the two local flood plains north and south of the Subject Land.

4 Development Requirements

The following summarises the design requirements for subdivision of the Subject Land given Clause 53.18-4 of the Cardinia Planning Scheme and the requirements of the EDCM.

4.1 Hydrologic

Standard W1 of the Cardinia Planning Scheme requires that the stormwater management system be "*designed to ensure that flows downstream of the subdivision site are restricted to pre-development levels unless increased flows are approved by the relevant drainage authority and there are no detrimental downstream impacts*".

For the overall McDonalds Track development, the 2018 Wetland Design Report showed that the flows to Adams Creek, from the overall McDonalds Track development, which included the Subject Land (as industrial) as shown in Figure 4, could be retarded to pre-development rates via the use of the wetland / retarding basin.

Given the wetland / retarding basin has been constructed (see Figure 7 and the Wetland As Cons), it is assumed that the hydrologic requirements for subdivision of the Subject Land are met and do not need to be achieved unless an alternative outfall is proposed.

4.2 Stormwater Treatment

Standard W1 of the Cardinia Planning Scheme requires that the stormwater management system be "*designed to meet the current best practice performance objectives for stormwater quality as contained in the Urban Stormwater - Best Practice Environmental Management Guidelines"*.

The BPEMG design targets as per Table 1 are adopted within this SWMS.

Table 1 BPEMG Performance Objectives

Pollutant:	**Objective:**
Total Suspended Solids (**TSS**)	80% retention of the typical urban annual load;
Total Phosphorus (**TP**)	45% retention of the typical urban annual load;
Total Nitrogen (**TN**)	45% retention of the typical urban annual load;
Litter	70% reduction of the typical urban annual load; and
Flows	Maintain discharges for the 1.5-year ARI at pre-development levels

For the overall McDonalds Track development, the 2018 Wetland Design Report showed that the flows to Adams Creek, from the overall McDonalds Track development, which included the Subject Land (as industrial) as shown in Figure 4, could achieve BPEMG treatment via the use of the wetland / retarding basin.

Given the wetland / retarding basin has been constructed (see Figure 7 and the Wetland As Cons), it is assumed that the stormwater treatment requirements for subdivision of the Subject Land are met at a catchment wide scale and do not need to be achieved at the Subject Land scale, provided a gross pollutant trap is provided prior to discharge into the sediment basin as specified within the 2018 Wetland Design Report.

It is also noted that in June 2021 the Environment Protection Authority Victoria (**EPA Vic**) released updated 'urban stormwater management guidance' (EPA Vic 2021) (referred to as the **Updated Guidance** herein). The updated guidance is clear that it does not impose compliance obligations. Rather, the updated guidance provides quantitative performance objectives for urban stormwater which set an objective that should be aimed to be met as far as 'reasonably practicable'.

For the Subject Land, which is partially within the Lang Lang River priority area, and using Lang Lang rainfall (band 800-900 mm/yr based on long term averages from the nearby gauge 086063), the updated guidance provides the following performance objective (in addition to those within the BPEMG):

> Reduce the mean annual runoff volume (**MARV**) generated from post-development impervious areas by:
>
> a. 64% using harvesting (i.e. re-use) and evapotranspiration; and
> b. 14% using infiltration.

However, satisfying either target is not deemed reasonably practicable to achieve herein as the stormwater treatment solution for the Subject Land was developed in 2018, prior to the release of the Updated Guidance.

4.3 Hydraulic

Consistent with Table 14 of the EDCM, the future minor (piped) drainage system is assumed to have a 10% AEP capacity herein.

Similarly, the Gap flow estimate (1% AEP minus the 10% AEP) will be shown to meet the requirements of the DELWP Flood Guidelines.

The DELWP Flood Guidelines specifies that roadways within industrial subdivisions, when intending to act as an overland flow path in the 1% AEP event, should meet the safety criteria specified in Table 2. These targets have been adopted within this SWMS (if a road is proposed to convey flows).

Table 2 DELWP Flood Guidelines Safety Limits - Industrial

Hydraulic Characteristic	Limit
Maximum Depth (**D**)	≤ 0.50 m
Maximum Velocity (**V**)	≤ 2.00 m/s
The product of the Maximum Depth and Maximum Velocity (**V×D**)	≤ 0.40 m^2/s

5 Speedie Development Consultants Proposals

Speedie Development Consultants have developed preliminary drainage designs for the Subject Land and surrounds.

5.1 Main Development Section

Speedie Development Consultants have advised that in order to drain the Main Development section of the Subject Land consistent with the 2018 Wetland Design Report, while providing suitable cover to pipes and providing a building level of at least 9.15 m AHD fronting the wetland (which is 600 mm above the largest 1% AEP Adams Creek flood level (Figure 11)), in the order of 1.0 metres of fill fronting the wetland is to be provided.

To drain the entirety of the Main Development section of the Subject Land towards the wetland, this fill then grades up to the north, resulting in the order of 3.4 metres of fill being required places across the Main Development section of the Subject Land.

Along the boundaries of the Main Development section of the Subject Land, a 1V:4H batter is proposed back down to the natural surface level.

The Preliminary Speedie Development Design details the Speedie Development Consultants proposal.

5.2 Lang Lang Truck Bypass

Speedie Development Consultants have also provided the Preliminary Speedie Bypass Design with the Preliminary Speedie Development Design. Together, these drawing set detail the preliminary proposals of the future Lang Lang Truck Bypass.

Due to the proposed filling of the Main Development Section west of the bypass, is proposed to drain the northern most section of 430 metres of bypass road north towards Westernport Road as shown in Figure 12. This catchment is approximately 1.2 ha. Speedie Development Consultants have advised that sending less catchment from the bypass road towards Westernport road is not feasible in terms of road grading requirements given the existing level of Westernport Road.

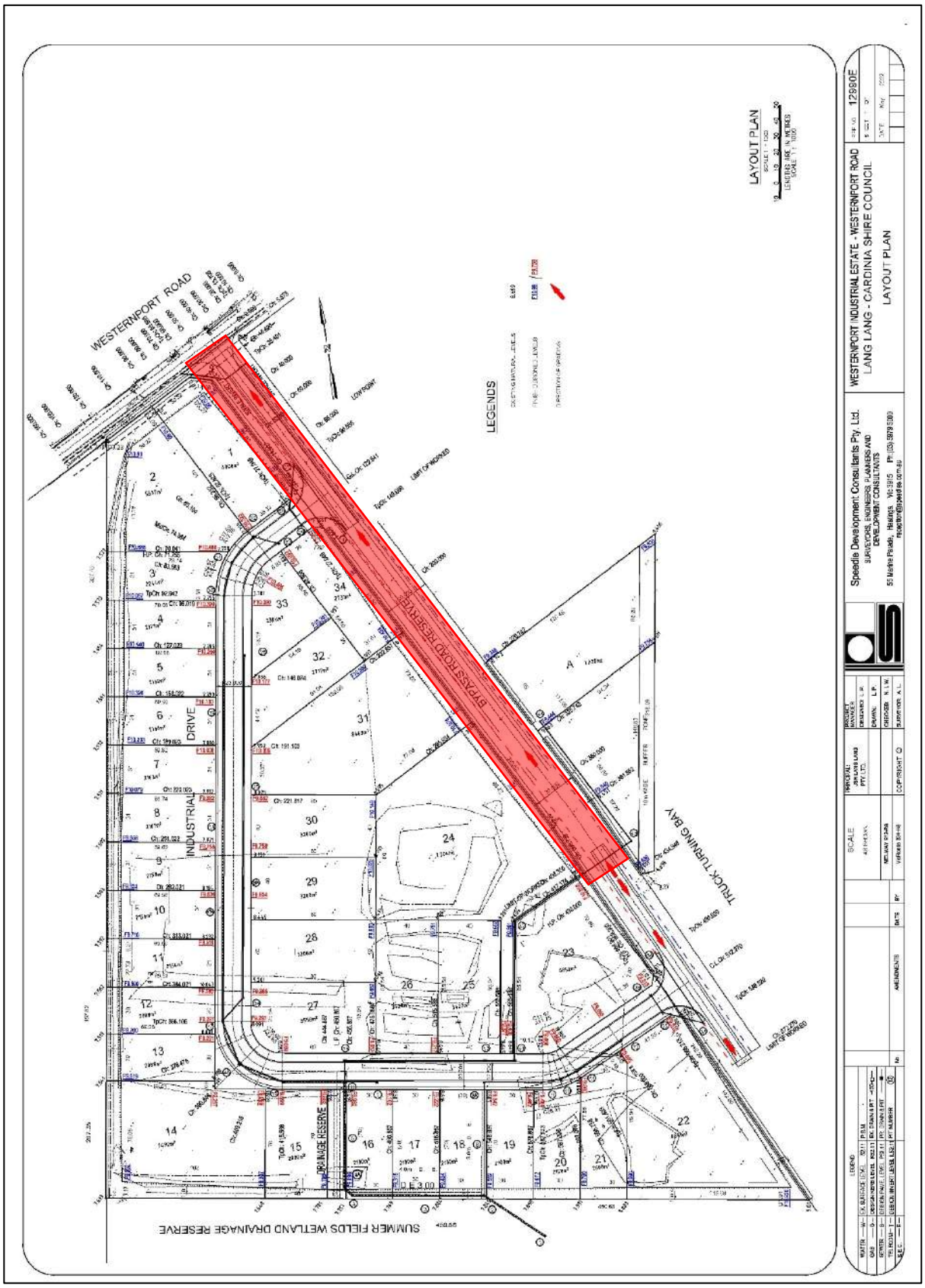

Figure 12 **Extract of the Preliminary Speedie Development Design showing the catchments (red) proposed to drain north towards Westernport Road**

6 Stormwater Management Strategy

Drawing 2261/SWMS/1 details the proposed SWMS. The sections below describe specific aspects of the SWMS.

6.1 Internal Subdivisional Drainage - Minor

Internal subdivisional drainage will be designed at the detailed design stage (by others). However, it is expected to follow the general pipe alignments shown in drawing 2261/SWMS/1.

Key aspects of these pipe alignments are:

- That the pipes into the (already constructed) sediment basin are at an invert level of 6.35 m AHD, which is 150 mm below the expected normal water level (**NWL**) of the constructed wetland asset; and
- That a section of 1% AEP pipe is provided across the bypass road to enable the Eastern Triangle of the Subject Land to be serviced within the existing wetland.

6.2 Internal Subdivisional Drainage – Major

The only road within the Subject Land is expected to be a 23 metre wide road.

Appendix D shows that if a 23 metre wide road reserve at 1V:300H was to convey the 1% AEP gap flows from the entire Subject Land, that the DELWP Flood Guidelines are satisfied.

6.3 Drainage Reserve

The Speedie Development Layout nominates a 12 metre wide, 70 metre long drainage reserve to convey 1% AEP gap flows from the road system towards the wetland reserve.

As shown in drawing 2261/SWMS/1 and Appendix D, within this reserve there is proposed:

- A 2 metre wide path; and
- A grassed swale (0.5 metres base, 1V:5H batters, 1V;100H longitudinal grade) to convey the 1% AEP gap flow estimate.

Appendix D shows that this grassed swale is suitably sized to convey the 1% AEP gap flow estimate to the wetland.

6.4 Flood Impacts

6.4.1 Flood Levels

As discussed within Section 5.1, the Main Development section of the Subject Land will be filled to at least 9.15 m AHD. At this level, at least 600 mm of freeboard is provided from the 1% AEP flood level estimate shown in Figure 11. This will also provide at least 600 mm freeboard to the flooding on the north side of Westernport road (to future building floor levels).

6.4.2 Flows

The 2018 Wetland Design Report shows that the existing wetland ensures that the pre-development 1% AEP flow estimates into Adams Creek are not exceeded provided all of the Subject Land drains into the wetland. Hence, no additional flood storage provisions are proposed for the Subject Land.

However, unlike the 2018 Wetland Design Report, the current Speedie Development Consultants proposals for the bypass road drains a 1.2 ha catchment north towards Westernport Road. Appendix B shows that this additional bypass road catchment increases the flows expected in the table drain along the southern side of Westernport Road from 0.25 m^3/s to 0.30 m^3/s.

Appendix C shows that the existing table drain adjacent to Westernport Rd can suitably convey a flow of 0.30 m^3/s, with only a 0.03 m depth increase and at least 150 mm freeboard to the road. Hence there are no detrimental downstream impacts due to the Speedie Development Consultants proposals.

6.5 Stormwater Treatment

Stormwater treatment for the Subject Land is provided in the existing wetland. The 2018 Wetland Design Report shows that this wetland was designed (and sized to meet standard W1) assuming full industrial development of the Subject Land.

Thus, no additional tertiary stormwater treatment proposals are proposed for the Subject Land.

Consistent with the 2018 Wetland Design Report, a simple gross pollutant trap (for litter) is proposed upstream of the sediment basin on the new 10% AEP pipe from the development. Specifications for this gross pollutant trap will be undertaken at the detailed design stage.

7 Concluding Remarks

The concept designs developed and presented within this report (and its associated Appendices) present how the stormwater expected to be generated by the Subject Land can be managed into the future.

Generally, the Subject Land's development proposals match the assumptions made within the 2018 Wetland Design Report, and hence, by discharging into this wetland, the developments flood storage and BPEMG requirements (detailed in Section 4) are satisfied by the wetland which has already been constructed.

8 References

Allison, R. A., T. Walker, F. H. S. Chiew, I. C. O'Neill and T. A. McMahon (1998). *From roads to rivers: gross pollutant removal from urban waterways (Technical Report No. 98/6)*. Melbourne, Cooperative Research Centre for Catchment Hydrology.

Nearmap (2022). *Areal imagery for locations and dates shown on Figures where applicable*.

Willing and Partners Pty Ltd (1992), *Design Guidelines for Gross Pollutant Traps*, prepared for ACT Planning Authority, Department of Environment, Land and Planning, Project No. 3015.

Note: Also see Sections 2.1 and 2.2 of this report.

9 Abbreviations, Descriptions and Definitions

The following table lists some common abbreviations and drainage system descriptions and their definitions which may be referred to in this report.

Abbreviation / Descriptions	Definition
AHD - Australian Height Datum	Common base for all survey levels in Australia. Height in metres above mean sea level.
ARI - Average Recurrence Interval.	The average length of time in years between two floods of a given size or larger. A 100 Year ARI event has a 1 in 100 chances of occurring in any one year.
AEP – Annual Exceedance Probability	The chance of a storm (flow) of that magnitude (or larger) occurring in a given year. $\boldsymbol{AEP = 1 - e^{(\frac{-1}{ARI})}}$. i.e. 18.13% AEP = 5 Year ARI
BPEMG	Best Practice Environmental Management Guidelines. See CSIRO (1999)
EY – Exceedances per year	The amount of times a storm (flow) of that magnitude is expected to be exceeded per year. i.e. 4 EY = 3 Month ARI
m^3/s -cubic metre/second	Unit of discharge usually referring to a design flood flow along a stormwater conveyance system
MUSIC	Hydrologic computer program used to calculate stormwater pollutant generation in a catchment and the amount of treatment which can be attributed to the WSUD elements placed in that catchment
Retarding basin	A flood storage dam which is normally empty. May contain a lake or wetland in its base
NWL - Normal Water Level	Water level of a wetland or pond defined by the lowest invert level of the outlet structure
NSL – Natural Surface Level	The surface level of the natural (existing) surface before works.
RORB	Hydrologic computer program used to calculate the design flood flow (in m^3/s) along a stormwater conveyance system (e.g. waterway)
Sedimentation basin (Sediment pond)	A pond that is used to remove coarse sediments from inflowing water mainly by settlement processes.
Swale	A small shallow drainage line designed to convey stormwater discharge. A complementary function to the flood conveyance task is its WSUD role (where the vegetation in the base acts as a treatment swale).
TED	The top level of water stored for treatment within a wetland before bypass occurs
TSS	Total Suspended Solids – a term for a particular stormwater pollutant parameter
TP	Total Phosphorus – a term for a particular stormwater pollutant parameter
TN	Total Nitrogen – a term for a particular stormwater pollutant parameter
WSUD - Water Sensitive Urban Design	Term used to describe the design of drainage systems used to: ○ Convey stormwater safely ○ Retain stormwater pollutants ○ Enhance local ecology ○ Enhance the local landscape and social amenity of built areas
Wetland	WSUD element which is used to collect TSS, TP and TN. Usually incorporated at normal water level (NWL) below which the system is designed as shallow marsh, marsh, deep marsh and open water areas.

Appendix A Concept SWMS Drawings