Appendix A

General Arrangement Plan Drawings – Culvert Location

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author | Drafting Check
Designer S.MAGALING | Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

GHD
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GPO Box 667 Hobart TAS 7001
T 61 3 6210 0600 F 61 3 6210 0601
E hbamail@ghd.com W www.ghd.com
www.ghd.com

Project No. 12548571

Client DEPARTMENT OF STATE GROWTH

Project NSTC CONDITION ASSESSMENT

Status FOR INFORMATION Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 1 OF 10

Size A3

Drawing No. 12548571-SK001

Rev A

Plot Date: 3 September 2021 - 3:46 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DrawingsIt\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author | Drafting Check
Designer S.MAGALING | Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH

Project NSTC CONDITION ASSESSMENT

Status FOR INFORMATION Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 2 OF 10

Size A3

Drawing No. 12548571-SK002

Rev A

Plot Date: 3 September 2021 - 3:51 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DRawings\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author | Drafting Check
Designer S.MAGALING | Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Client DEPARTMENT OF STATE GROWTH
Project NSTC CONDITION ASSESSMENT
Status FOR INFORMATION Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 3 OF 10
Size A3
Drawing No. 12548571-SK003
Rev A

Plot Date: 3 September 2021 - 3:53 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DDrawings\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author | Drafting Check
Designer S.MAGALING | Design Check

N

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH

Project NSTC CONDITION ASSESSMENT

Status FOR INFORMATION | Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 4 OF 10

Size A3

Drawing No. 12548571-SK004

Rev A

Plot Date: 3 September 2021 - 4:02 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DrawingsIt\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author | Drafting Check
Designer S.MAGALING | Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH
Project NSTC CONDITION ASSESSMENT
Status FOR INFORMATION
Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 5 OF 10
Size A3
Drawing No. 12548571-SK005
Rev A

Plot Date: 3 September 2021 - 4:02 PM Plotted by: Victoria Jenkins
File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DrawingsIt\12548571-SK001_SK010.dwg

A	ISSUED FOR INFORMATION		
Rev	Description	Checked Approved	Date

Author | Drafting Check
Designer S.MAGALING | Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH
Project NSTC CONDITION ASSESSMENT
Status FOR INFORMATION Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 6 OF 10
Size A3
Drawing No. 12548571-SK006
Rev A

Plot Date: 3 September 2021 - 4:07 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DDrawings\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author
Designer S.MAGALING
Drafting Check
Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH
Project NSTC CONDITION ASSESSMENT
Status FOR INFORMATION
Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 7 OF 10
Size A3
Drawing No. 12548571-SK007
Rev A

Plot Date: 3 September 2021 - 4:11 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DrawingsIssued\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author
Designer S.MAGALING
Drafting Check
Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH

Project NSTC CONDITION ASSESSMENT

Status FOR INFORMATION

Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 8 OF 10

Size A3

Drawing No. 12548571-SK008

Rev A

Plot Date: 3 September 2021 - 4:08 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DrawingsIssued\12548571-SK001_SK010.dwg

Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author
Designer S.MAGALING
Drafting Check
Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH

Project NSTC CONDITION ASSESSMENT

Status FOR INFORMATION

Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 9 OF 10

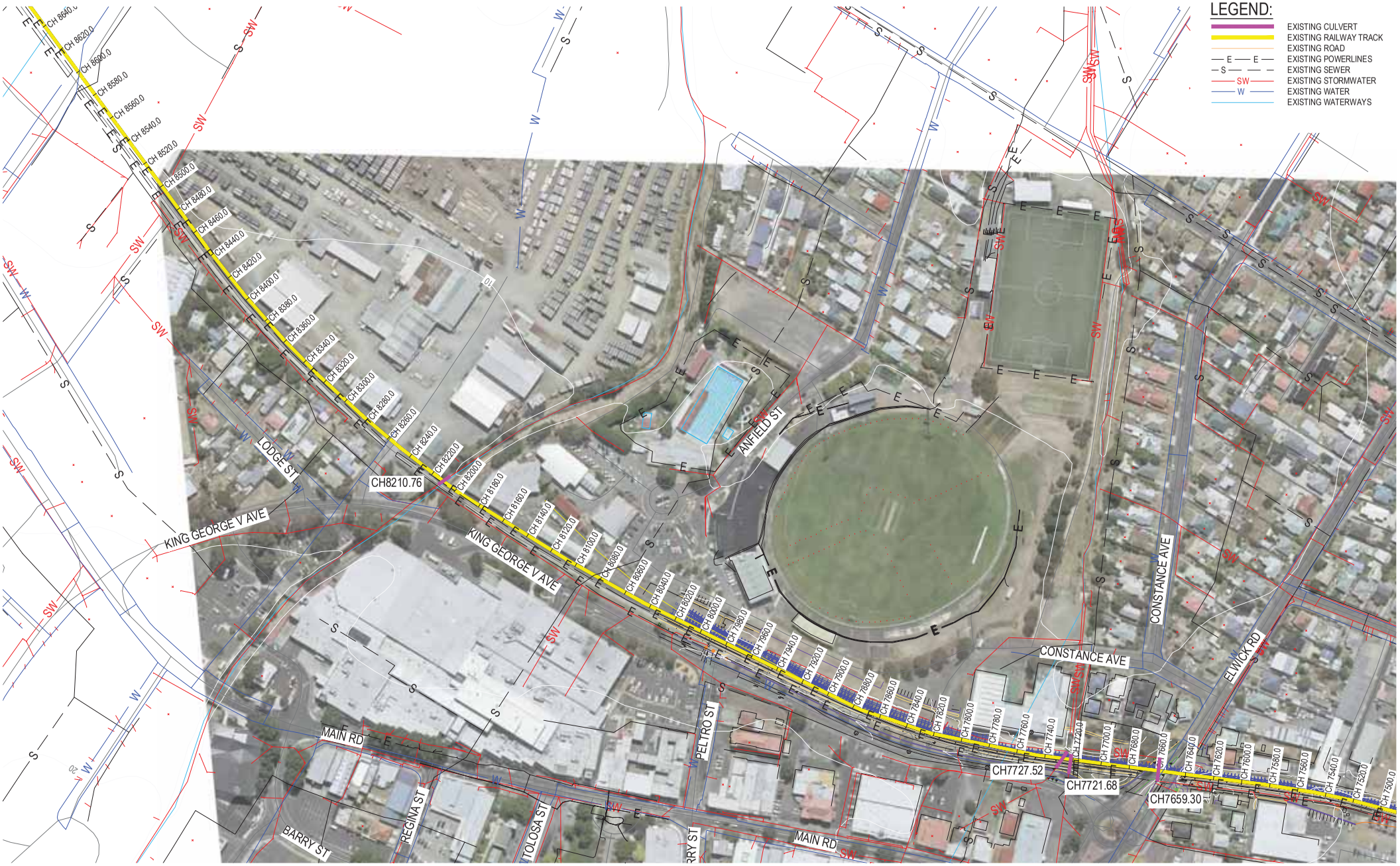
Size A3

Drawing No. 12548571-SK009

Rev A

Plot Date: 3 September 2021 - 4:09 PM Plotted by: Victoria Jenkins

File Name: \\ghdnet\ghd\AU\hobart\Projects\32\12548571\CAD\DRawings\12548571-SK001_SK010.dwg



Rev	Description	Checked	Approved	Date
A	ISSUED FOR INFORMATION			

Author | Drafting Check
Designer S.MAGALING | Design Check

N

0 25 50 75m
SCALE 1:2500 AT ORIGINAL SIZE

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Project No. 12548571

Client DEPARTMENT OF STATE GROWTH
Project NSTC CONDITION ASSESSMENT
Status FOR INFORMATION Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN SHEET 10 OF 10
Size A3
Drawing No. 12548571-SK010
Rev A

Plot Date: 3 September 2021 - 4:10 PM Plotted by: Victoria Jenkins
File Name: \\ghdnet\ghd1\AU\hobart\Projects\32\12548571\CAD\DrawingsIt\12548571-SK001_SK010.dwg

Appendix B

Culvert Data Collection Form

RTA Culvert Data Collection Form

Identification

Culvert Number	ch278	**Date**	26/07/21 10:20AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.8748344, Long:147.33499210000002	left	no
outlet	Lat:-42.87478060000001, Long:147.33514249999996	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity				**Discharge (cu m/s)**	
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	9.6 m	**No of cells**	1
Pipe inside diameter	300 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	1.0 m	**Depth of cover - Outlet**	1.1
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	clear		
Outlet flow	100% blocked	**Inlet flow**	Clear
Outlet condition	vegetation,outlet covered with rocks. no wingwall or headwall, pipe end appears to be damaged		
Inlet condition	grated pit along shared path appears to be in good condition		
Structure condition	pipe_box_damage,joint_damage,no headwall or wingwall at outlet. difficult to assess pipe condition		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	batters are not steep, vegetated		
What routine maintenance is required?	check pipe condition, clear outlet, missing headwall/wingwall		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.87477469999999, Long: 147.33515590000002	Grated pit	-	yes	yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
Yes	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
Yes	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

Yes	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add a comment below**

Risk Assessment Comment	- further inspection may be required if pipe is being used. - existing building on the eastern side - concrete pipe appears to be connected to steel pipe - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet – view towards outlet

Photo Inlet – upstream side

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Batter

Photo Batter

Risk Photos

Risk Photos

Risk Photos

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch494	**Date**	26/07/21 10:51AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.872915999999975, Long:147.33456560000002	left	no
outlet	Lat:-42.87287020000002, Long:147.3346626	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	pvc	**Culvert joints**	cannot be determined on site. outlet covered with dirt and vegetation
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	8.6 m	**No of cells**	1
Pipe inside diameter	150 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.4 m	**Depth of cover - Outlet**	0.7
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	75% blocked		
Outlet flow	100% blocked	**Inlet flow**	50% blocked
Outlet condition	veg,hard to tells at outlet pipe 100% covered by vegetation and dirt, flow path evident		
Inlet condition	grated pit along shared path appears to be in good condition.		
Structure condition	headwall has no wingwall		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat batters on either side		
What routine maintenance is required?	clear outlet of vegetation and dirt. Consider providing wingwalls to avoid dirt from batters moving towards outlet.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.872915999999975, Long:147.33456560000002	Grated pit	-	yes	yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

No	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	- further inspection may be required if pipe is being used. - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch562	**Date**	26/07/21 11:10AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.87230360000001, Long:147.33445500000005	left	no
outlet	Lat:-42.87230410000001, Long:147.3344849	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforcedconcrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	8.4 m	**No of cells**	1
Pipe inside diameter	300 mm	**Cell width**	N/A
Cell height	None	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.25 m	**Depth of cover - Outlet**	0.4 m?
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	No
Has Grates	Yes	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	25% blocked		
Outlet flow	75% blocked	**Inlet flow**	25% blocked
Outlet condition	vegetation. Grated pit appears to be the low point within the area. Possible ponding during heavy rains		
Inlet condition	dirt and dry leaves partially covering pit invert. Scouring		
Structure condition	Dirt and leaves from embankment can easily get into the outlet. Grated pit cover rusty.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	steeper on outlet side, flat on the northern and southern side		
What routine maintenance is required?	clear outlet of dirt and vegetation. Outlet flow direction unclear. Provide treatment for embankment scouring on inlet side		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.87230360000001, Long:147.33445500000005	Grated pit	-	yes	yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
Yes	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add a comment below**
Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch726	**Date**	26/07/21 11:32AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.87072949999998, Long:147.334164	left	no
outlet	Lat:-42.870723699999985, Long:147.33434639999996	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp(?)	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	2.35 m	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	Clear		
Outlet flow	75% blocked	**Inlet flow**	Clear
Outlet condition	vegetation, cannot determine location of outlet. batters are steep and vegetated		
Inlet condition	looks clear of blockages. inlet pit is on other side of fenced cycleway, stagnant water. possible dirt at inlet		
Structure condition	outlet location cannot be determined. inlet pit cover appears to be in good condition		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat		
What routine maintenance is required?	mark outlet location. possibility of clearing outlet may be required, clear outlet of vegetation and debris		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.87072949999998, Long:147.334164	Grated pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- further inspection may be required as outlet was not found during site inspection - separation of pipe at joints evident

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch866	**Date**	26/07/21 11:43AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.8698885, Long:147.33449440000004	left	no
outlet	Lat:-42.86997050000002, Long:147.33466959999998	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	pvc	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot determine lining
Culvert length	None	**No of cells**	cannot be determined
Pipe inside diameter	200 mm (pipe size from pit adjacent to shared path. Pipe size along the road was not determined). CoH GIS shows 450 mm (adopted).	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.4 m (pipe depth from pit adjacent to shared path. Pipe depth along the road was not determined)	**Depth of cover - Outlet**	cannot be determined

Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	Yes	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	vegetation, cannot find outlet due to steep batters and vegetation		
Inlet condition	vegetation, possible dirt and debris. difficult to open pit along the road		
Structure condition	cannot be determined		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat		
What routine maintenance is required?	vegetation on outlet side may need to be cleared. outlet will need to be cleared and marked and pipe condition checked		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.8698885, Long:147.33449440000004	Side entry pit	-	Yes	Yes
	Comment	None			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)

	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- further inspection may be required for pipe condition as outlet not found and pit cover at inlet was difficult to lift - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet – adjacent to the footpath

Photo Inlet – adjacent to the footpath

Photo Inlet – pit adjacent to the footpath appears to flow towards pit along the road

Photo Inlet – pit adjacent to the footpath appears to flow towards pit along the road

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch900 (approx.)	**Date**	26/07/21 11:51AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86961400000001, Long:147.33480540000005	left	no
outlet	Lat:-42.86970600000001, Long:147.33491489999994	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot determine
Culvert length	cannot be determined	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	cannot be determined	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	vegetation,cannot access outlet due to steep batters and vegetation		
Inlet condition	grated pit along shared path appears to be connected to the junction pit adjacent the road. Cannot open junction pit cover to confirm pipe condition.		
Structure condition	Cannot find headwall on outlet side. Junction pit on inlet side appears to be in good confition.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat		
What routine maintenance is required?	clearing of vegetation may need to be required to access outlet for maintenance purposes. outlet may need to be marked. Pipe condition will need to be rechecked.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86961400000001, Long:147.33480540000005	junction pit	-	yes	yes
	Comment	Junction pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- further inspection may be required for pipe condition as outlet not found and pit cover at inlet was difficult to lift - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1017	**Date**	26/07/21 12:04PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86850229999999, Long:147.33574190000002	left	no
outlet	Lat:-42.868501400000014, Long:147.33588650000002	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	vegetation,difficult to access due to steep grades and vegetation. outlet flow path not evident		
Inlet condition	inlet is through junction pit on outer edge of cycleway. Difficult to open pit cover		
Structure condition	Cannot determine location of outlet / headwall/. Manhole / Junction pit appears to be in good condition.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat		
What routine maintenance is required?	outlet may need to be cleared and marked. Outlet location was not determined. Pipe condition will need to be rechecked.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86850229999999, Long:147.33574190000002	Junction pit / Manhole	-	Yes	Yes
	Comment	None			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- further inspection may be required for pipe condition as outlet not found and pit cover at inlet was difficult to lift - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

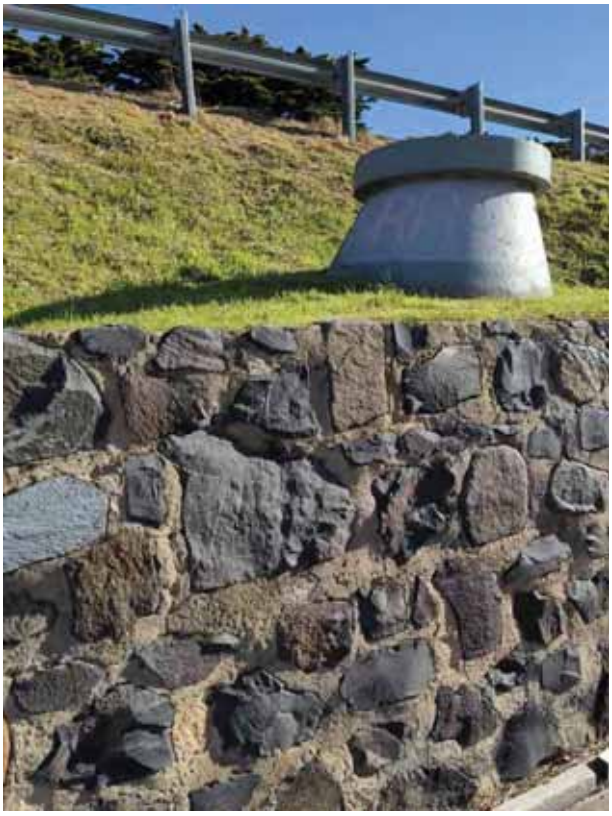

Photo Inlet

Photo Inlet – old inlet before shared path was constructed?

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1137	**Date**	26/07/21 12:19PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86743539999998, Long:147.33591109999998	left	no
outlet	Lat:-42.86744390000001, Long:147.33602599999995	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	10.3 m	**No of cells**	1
Pipe inside diameter	300 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.3 m	**Depth of cover - Outlet**	0.5 m
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	clear		
Outlet flow	75% blocked	**Inlet flow**	Clear
Outlet condition	silt and water covering more than half of outlet. water ponding at outlet. Surrounding areas around the outlet are at a higher level than invert of outlet. outlet adjacent to tree, vegetation		
Inlet condition	located on other side of cycleway. grated pit connected to junction pits upstream		
Structure condition	no headwall or wingwall at outlet		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	batters are flat on either side. batter steepen past 6-7m from track on eastern side		
What routine maintenance is required?	outlet will need to be cleared to ensure flow runs smoothly and to avoid ponding. headwall will need to be provided to ensure batter material does not flow to the outlet during rain events.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86743539999998, Long:147.33591109999998	Junction pit / manhole	-None	Yes	Yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
Yes	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared at outlet to ensure smooth flows and avoid flooding - headwall will need to be installed

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1163	**Date**	26/07/21 12:32PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.866997000000026, Long:147.33591739999997	left	no
outlet	Lat:-42.86700029999997, Long:147.33603849999997	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforcedconcrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	-	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.5 m	**Depth of cover - Outlet**	-
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	25% blocked	**Inlet flow**	Clear
Outlet condition	cannot find outlet due to steep batters and vegetation.		
Inlet condition	grated pit on opposite side of shared path and connected to junction pit upstream, cannot lift lid		
Structure condition	cannot determine outlet location. No headwall found. Grated pit cover at inlet appears to be in good condition		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 3 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat		
What routine maintenance is required?	access to outlet will need to be cleared for maintenance. outlet and pipe condition will need to be rechecked		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.866997000000026, Long:147.33591739999997	Grated pit	-	Yes	Yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- Rock armour does not appear secure and may pose a risk to cyclists and pedestrians over time - Outlet will need to be cleared and marked - condition at joints will need to be assessed for erosion, seepage, etc. Joint connection appears separated from inlet side. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1186	**Date**	26/07/21 12:43PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.866038, Long:147.33630530000005	left	no
outlet	Lat:-42.866170599999975, Long:147.3363604	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	-	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	1.5 m	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	clay and rock	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	100%	**Inlet flow**	Clear
Outlet condition	vegetation, outlet not visible and difficult to access due to steep batters, no visible headwall		
Inlet condition	grated pit appers to be in good condition. located on other end of fenced shared path		
Structure condition	no visible headwall, difficult to assess outlet due to access issues		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2-3 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat. shallow cess drain on left side of track		
What routine maintenance is required?	access to outlet will need to be cleared for maintenance. outlet condition to be rechecked		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.866038, Long:147.33630530000005	Grated pit	-	Yes	Yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
Yes	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	- Outlet will need to be determined, cleared, and marked for maintenance - condition at joints throughout the length of the culvert will need to be assessed for erosion, seepage, etc. Joint connection appears separated from inlet side. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1294	**Date**	26/07/21 12:51PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from the southern end of the line near Royal Hobart Regatta building - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.8660653, Long:147.33637610000005	left	no
outlet	Lat:-42.86608869999998, Long:147.33645490000004	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	-	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	N/A
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	-	**Depth of cover - Outlet**	-
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	access difficult. condition difficult to assess. cannot find outlet,vegetation		
Inlet condition	grated pit appears to be clear of debris and in good condition. located on other side of gated shared path		
Structure condition	headwall or wingwall on outlet side is not visible from top of embankment.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2-3 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat.		
What routine maintenance is required?	access to outlet will need to be cleared for maintenance. culvert condition at outlet will need to be assessed		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.8660653, Long:147.33637610000005	Grated pit	-	Yes	Yes
	Comment	Inlet pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- Outlet will need to be determined, cleared, and marked for maintenance - condition at joints throughout the length of the culvert will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1333	**Date**	29/07/21 11:41AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	None				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.865729199999976, Long:147.33642350000002	left	No
outlet	Lat:-42.86578730000002, Long: 147.3364196	right	No

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	100% blocked	**Inlet flow**	cannot be determined
Outlet condition	cannot find outlet, no visible headwall, vegetation		
Inlet condition	Cannot lift manhole cover		
Structure condition	Manhole cover appears to be in good condition. Outlet covered by vegetation		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 3-4 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat		
What routine maintenance is required?	access to outlet will need to be cleared for maintenance. outlet condition to be rechecked.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.865729199999976, Long:147.33642350000002	Manhole / Junction pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- Outlet will need to be determined, cleared, and marked for maintenance - condition at joints throughout the length of the culvert will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Photo Batter

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1374	**Date**	26/07/21 01:02PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from shared path crossing underneath Tasman Bridge - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Carriageway	Marked on roadside
inlet	Lat:-42.865340300000014, Long:147.33652540000003	left	no
outlet	Lat:-42.865398200000016, Long:147.33698300000003	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	pipe
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	difficult to determine
Culvert length	cannot be determined	**No of cells**	1
Pipe inside diameter	cannot be determined	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.3 m	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	clay and rock	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	75% blocked		
Outlet flow	100% blocked	**Inlet flow**	75% blocked
Outlet condition	cannot find outlet, no visible headwall, area covered with dirt		
Inlet condition	Inlet covered with dirt and dried leaves. Difficult to open pit.		
Structure condition	Inlet pit cover appears to be in good condition, no visible headwall at outlet.		
Road surface condition	- Refer to rail track condition assessment provided separately. - bridge columns on the sides of the track. - Shared path crossing made of wood and concrete		
Batter condition	batters are flat on either side.		
What routine maintenance is required?	outlet will need to be cleared and pipe checked for condition. outlet not found during site inspection		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86537229999999, Long: 147.33657459999995	Grated pit	-	Yes	Yes
	Comment	Inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- further inspection may be required if pipe is being used. - Area underneath Tasman bridge - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - Outlet will need to be determined, cleared, and marked for maintenance

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1491	**Date**	27/07/21 09:40AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to site is from shared path crossing underneath Tasman Bridge - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location - culvert near the general area of the informal parking in front of the Derwent Mercantile Collegiate Rowing Club. site marked by orange guide posts				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on track
inlet	Lat:-42.864487199999985, Long:147.3359805	left	yes
outlet	Lat:-42.864315799999986, Long:147.33615540000005	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	-	**No of cells**	1
Pipe inside diameter	375 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.1 m	**Depth of cover - Outlet**	-
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes

Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	75% blocked		
Outlet flow	Clear	**Inlet flow**	75% blocked
Outlet condition	vegetation, difficult to access outlet to check condition. no headwall or wingwall visible		
Inlet condition	inlet marked by orange guide post. flow coming from another outlet pipe 400mm away that is 75percent blocked. no wingwall or headwall. area covered by dried tree branches, vegetation		
Structure condition	no headwall or wingwall at outlet. Inlet difficult to access due to vegetation		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	batter is flat on either side		
What routine maintenance is required?	inlet will need to be cleared of debris and vegetation. outlet and culvert condition will need to be checked. access will need to be cleared at outlet for maintenance		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- further inspection may be required if culvert is being used. - condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - Outlet will need to be determined, cleared, and marked for maintenance

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet – Upstream outlet 400mm from culvert inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

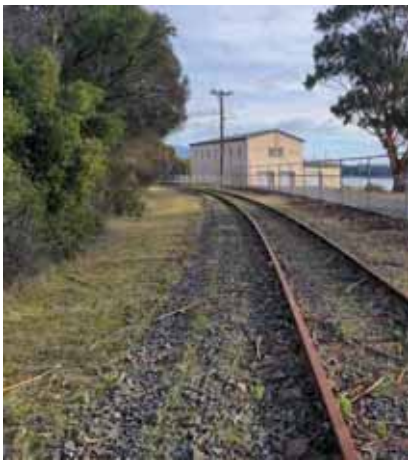

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1825	**Date**	26/07/21 01:23PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.8641432, Long:147.3320834	left	no
outlet	Lat:-42.864020700000026, Long:147.332093	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	13.7 m	**No of cells**	1
Pipe inside diameter	750 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	1.5 m	**Depth of cover - Outlet**	1.0
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	Yes	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	25% blocked		
Outlet flow	25% blocked	**Inlet flow**	Clear
Outlet condition	loose gravel leading to outlet, scouring, cracks and rusting evident inside the pipe, dirt and debris along the outlet,		
Inlet condition	inlet clear during time of inspection. Pit lid difficult to lift		
Structure condition	No headwall/wingwall at outlet. cracks and rusting are evident inside the pipe, loose rock armour		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 3 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat.		
What routine maintenance is required?	pipe condition underneath the track will need to be reassessed. clearing of debris on outlet side may be required. pipe support (i.e. headwall or wingwall) may be required, pipe may need to be replaced.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
1	Lat:-42.8641432, Long:147.3320834	Grated pit	-	Yes	Yes
	Comment	Inlet			
2	Lat:-42.86402770000001, Long:147.3321843	Grated pit	-	Yes	Yes
	Comment	not identified in digital CoH information, located across botanical gardens. pipe is concrete capped on upstream side. Connects a DN300 RCP woth cover at 400mm.			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
Yes	Significant scour erosion of the road fill batters
Yes	Significant scour erosion below the outlet or at the inlet
Yes	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter

	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

Yes	Significant cracking and deformation of the internal walls
Yes	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - consider replacing pipe - reconstruct rock armour along the outlet side

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1886	**Date**	27/07/21 10:24AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86392369999999, Long:147.33139170000004	left	no
outlet	Lat:-42.86376639, Long:147.3314714	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	16.0	**No of cells**	1
Pipe inside diameter	750 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.2 m	**Depth of cover - Outlet**	1.1
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	25% blocked		
Outlet flow	Clear	**Inlet flow**	100% blocked
Outlet condition	no headwall or wingwall. end of culvert damaged. Some rocks found inside the pipe		
Inlet condition	inlet pit covered with dirt. difficult to determine pipe condition on this end. inlet pit on the left side of the shared path. 100mm PVC pipe connected to the pit and coming from the upstream side of the inlet. difficult to lift pit cover		
Structure condition	No headwall/wingwalls,outlet pipe damage. Pipe outlet has cracks, chips and rusting, rock armour does not appear secure		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Flat batter adjacent to the shared path. Batters are steep on the eastern side		
What routine maintenance is required?	pipe condition underneath the track will need to be reassessed. clearing of dirt and debris will be required. pipe support (i.e. headwall or wingwall) may be required, pipe may need to be replaced. inlet condition will need to be reassessed. Rock armour will need to be reconstructed		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86392369999999, Long:147.33139170000004	Grated pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
Yes	Significant scour erosion of the road fill batters
Yes	Significant scour erosion below the outlet or at the inlet
Yes	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

Yes	Significant cracking and deformation of the internal walls
Yes	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - consider replacing pipe - reconstruct rock armour along the outlet side

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

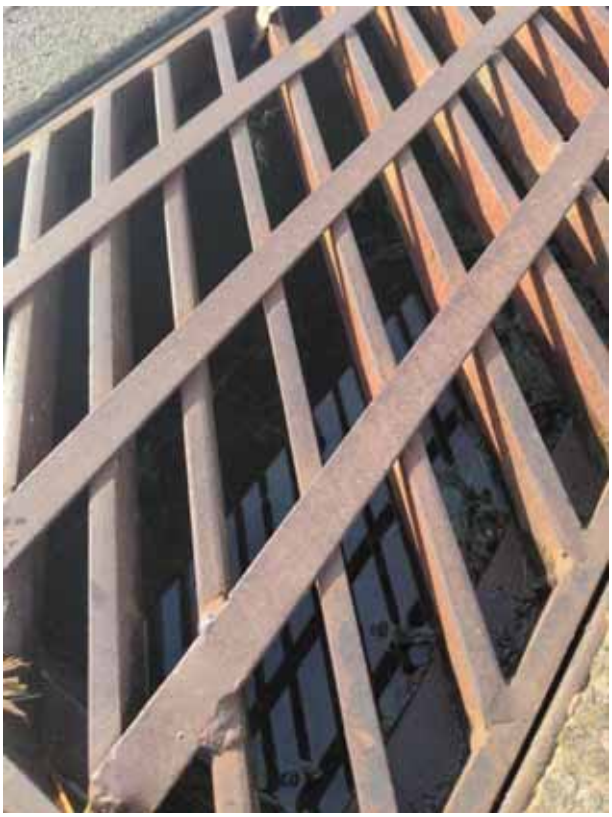

Photo Inlet

Photo Outlet

Photo Outlet

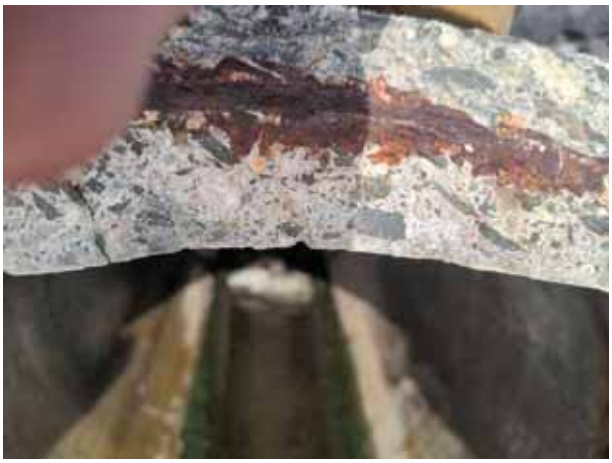

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch1971	**Date**	27/07/21 10:46AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86341340000001, Long:147.33048789999998	left	no
outlet	Lat:-42.8634108, Long:147.33055579999996	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	Steel pipe	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	1
Pipe inside diameter	150 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.7 m	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	75% blocked		
Outlet flow	100% blocked	**Inlet flow**	75% blocked
Outlet condition	vegetation, outlet was not found due to vegetation and debris in the way		
Inlet condition	Vegetation and dirt covering pipe, scour, inlet pit filled with dirt		
Structure condition	cannot find headwall for outlet. covered by vegetation and debris. no evident flow path		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 2 m approx. then steepens on the eastern side. batter on west side that is adjacent to the shared path is flat		
What routine maintenance is required?	outlet will need to be assessed. cannot determine location clearing of debris will be required. pipe support (i.e. headwall or wingwall) may be required, pipe may need to be replaced		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86341340000001, Long:147.33048789999998	Grated pit	-	Yes	Yes
	Comment	Inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
Yes	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
Yes	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - consider replacing pipe - dirt on inlet side comes from steep road batter. Consider adding a rock armour along road batters.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2130	**Date**	27/07/21 11:07AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86221139999998, Long:147.32954010000003	left	no
outlet	Lat:-42.862041799999986, Long:147.32974230000002	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	vegetation, cannot determine location of outlet		
Inlet condition	Pipe from grated pit appears to be connected to manhole / junction pit. Unable to lift manhole cover. Pipe will need to be checked		
Structure condition	grated pit appears to be in good condition. cannot find headwall or wingwall for outlet.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	appears flat on either side. a number of trees on the eastern side towards the beach		
What routine maintenance is required?	pipe condition underneath the track will need to be reassessed. clearing of debris/vegetation on outlet side will be required. pipe support (i.e. headwall or wingwall) may be required.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86221139999998, Long:147.32954010000003	Grated pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - pipe and outlet condition will need to be assessed.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

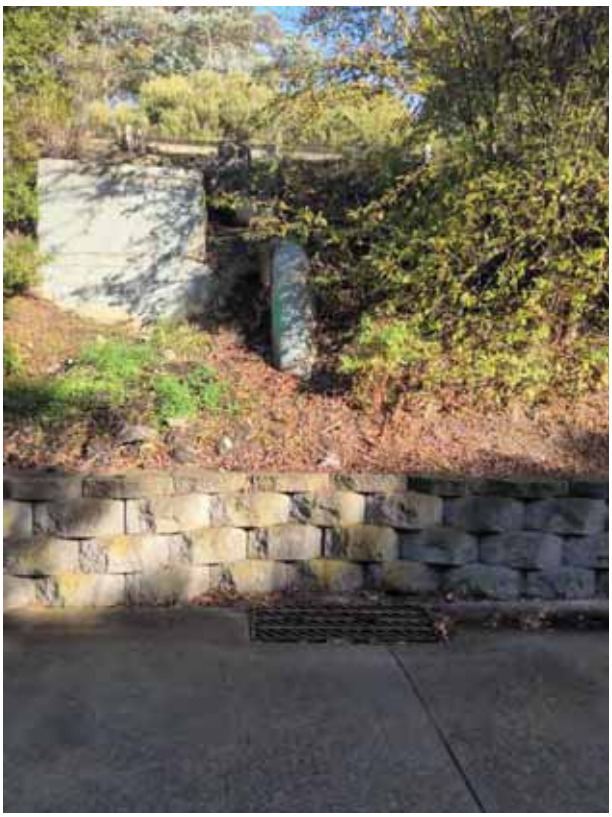

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2243	**Date**	27/07/21 11:18AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.8612928, Long:147.32895140000005	left	no
outlet	Lat:-42.8612473, Long:147.32895410000003	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	butt–unsealed,button flush seal with new pipe poorly jointed
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	10.0 m	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.6 m	**Depth of cover - Outlet**	0.9 m
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	No
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	50% blocked		
Outlet flow	50% blocked	**Inlet flow**	50% blocked
Outlet condition	Tree and vegetation near the headwall. Outlet covered with dirt and debris		
Inlet condition	Inlet grated pit appears to be in good condition. Pit covered with dirt and debris.		
Structure condition	Inlet grated pit appears to be in good condition. Outlet headwall appears to be in good condition. Dirt and debris along the length of the culvert will need to be cleared.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat on western side adjacent to the shared path. Batter steepens on eastern side		
What routine maintenance is required?	pipe condition underneath the track will need to be reassessed. clearing of dirt and debris on both ends will be required. RCP pipe appears to be connected to steel (?) pipe underneath the shared path. pipe may need to be replaced		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.8612928, Long:147.32895140000005	Grated pit	-	Yes	Yes
	Comment	Inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - consider replacing pipe - dirt on the inlet side appears to come from adjacent embankment material

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2344	**Date**	27/07/21 11:35AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – off road

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.86047359999998, Long:147.3283943	left	no
outlet	Lat:-42.86043030000002, Long:147.32844109999996	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	8.0	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.5 m	**Depth of cover - Outlet**	1.2
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	No
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	100% blocked		
Outlet flow	100% blocked	**Inlet flow**	25% blocked
Outlet condition	outlet covered with rocks/ballast material and vegetation. cannot see outlet pipe		
Inlet condition	pit cover appears to be in good condition. Pit invert covered with dried leaves and dirt		
Structure condition	No wingwalls at outlet. area covered with rock and vegetation		
Road surface condition	Refer to rail track condition assessment provided separately ack looks okay		
Batter condition	Batters are flat for about 3 m approx. then steepens on the eastern side towards the river. batter on west side that is adjacent to the shared path is flat.		
What routine maintenance is required?	pipe condition underneath the track will need to be reassessed. clearing of rock and vegetation on outlet side is required. clearing of rock dirt and dried leaved on inlet side is required. pipe support (i.e. wingwall) may be required, inlet condition will need to be assessed.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.86047359999998, Long:147.3283943	Grated pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - consider adding wingwalls to limit rocks/dirt encroaching the outlet.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2516	**Date**	27/07/21 11:49AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.85946439999998, Long:147.32680919999996	left	no
outlet	Lat:-42.85940199999999, Long:147.32686820000004	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	pipe
Barrel or cell construction	Asbestos (?)	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	-	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	cannot be determined
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	1.1 m	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	100% blocked	**Inlet flow**	25% blocked
Outlet condition	vegetation, cannot find outlet		
Inlet condition	Appears to be in good condition. Dirt and debris towards outlet will need to be cleared.		
Structure condition	No evidence of headwall/wingwall at outlet. Clear vegetation to determine location of outlet. Inlet structure appears to be in good condition.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat on left side. steep on right side		
What routine maintenance is required?	outlet and pipe condition will need to be assessed. cannot find outlet, clear debris and vegetation on either side.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.85946439999998, Long:147.32680919999996	Grated pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	- condition at joints will need to be assessed for erosion, seepage, etc. - blockage will need to be cleared to ensure smooth flows and avoid flooding - consider replacing pipe - pipe appears to be separated along the length of the culvert

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2583	**Date**	27/07/21 11:58AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.859011699999996, Long:147.32622849999996	left	no
outlet	Lat:-42.85897110000002, Long:147.32627779999996	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	None				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	pvc and AC (?)	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	11 m	**No of cells**	1
Pipe inside diameter	225 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.5 m	**Depth of cover - Outlet**	1.2
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	Yes	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	50% blocked		
Outlet flow	50% blocked	**Inlet flow**	clear
Outlet condition	Outlet will need to be cleared of debris and dirt		
Inlet condition	Pipe connection appears warped. Pit cover appears in good condition		
Structure condition	Ballast material encroaching outlet side		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Flat on left side. steep on right side		
What routine maintenance is required?	it appears that the existing pipe was extended with a different pipe type when the shared path was constructed. clearing of debris/dirt/vegetation on either side is required. Pipe connection on inlet side will need to be replaced. Appears warped at connection		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.859011699999996, Long:147.32622849999996	Grated pit	-	Yes	Yes
	Comment	Inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
Yes	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe displacement at joints Vegetation, dried leaves, dirt will need to be cleared on the outlet side. Scouring at outlet side

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2630	**Date**	27/07/21 12:11PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.858775200000025, Long:147.32582490000004	left	no
outlet	Lat:-42.85872710000001, Long:147.32586430000003	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	pipe
Barrel or cell construction	steel_reinforcedconcrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	11.0 m	**No of cells**	2
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.2 m	**Depth of cover - Outlet**	1.2 m
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	50% blocked		
Outlet flow	50% blocked	**Inlet flow**	50% blocked
Outlet condition	dirt and vegetation blocking right side outlet pipe. Vegetation along outlet path. Headwall in good condition		
Inlet condition	it appears the inlet is covered with dirt/dried leaves.		
Structure condition	Headwall/endwalls in good condition		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Batters are flat for about 4 m approx. then steepens on the eastern side. batter on west side that is adjacent to the cycleway is flat.		
What routine maintenance is required?	clear outlet of dirt and vegetation it appears that the existing pipe was extended with a different pipe type when the shared path was constructed. clearing of debris/dirt/vegetation on either side is required.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe displacement where the different pipe types connect Vegetation, dried leaves, dirt will need to be cleared on either side. Rock outcrop appears to be secure

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2683	**Date**	27/07/21 12:21PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.858399099999986, Long:147.32535080000002	left	no
outlet	Lat:-42.85838899999999, Long:147.32536249999998	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	None
Barrel or cell construction	steel_reinforced concrete_rcp,ac pipe	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	11.0	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	1.1	**Depth of cover - Outlet**	3.0
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	25% blocked	**Inlet flow**	Clear
Outlet condition	access via walking track parallel the rail track		
Inlet condition	2 materials RCP and AC (?)		
Structure condition	outlet covered with vegetation. crocodile cracks along footpath where outflow goes, wingwall_damage,headwall_damage		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Flat on left side. steep on right side		
What routine maintenance is required?	it appears that the existing pipe was extended with a different pipe type when the shared path was constructed. clearing of debris/dirt/vegetation on either side is required		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
		None	None	None	None
	Comment	None			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
Yes	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe displacement where the different pipe types connect Vegetation, dried leaves, dirt will need to be cleared on either side. Scouring of rock armour surrounding the inlet

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch2892	**Date**	27/07/21 12:32PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway northeast of the Royal Botanical Garden parking lot - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.85712760000001, Long:147.3234933	left	no
outlet	Lat:-42.85707000000002, Long:147.3235366	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforcedconcrete_rcp and AC(?)	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	9.0 m	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.55 mm	**Depth of cover - Outlet**	1.25
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	Clear	**Inlet flow**	Clear
Outlet condition	Clear outlet of dirt and vegetation		
Inlet condition	clear inlet of dirt and dried leaves.		
Structure condition	dirt and vegetation entering outlet because no wingwall constructed, headwall leaning forward		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Approx. 1m flat area before cess drain leading to outlet on right side. flat batter on left side		
What routine maintenance is required?	it appears that the existing pipe was extended with a different pipe type when the shared path was constructed. clearing of debris/dirt/vegetation on either side is required		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
		None	None	None	None
	Comment	None			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
Yes	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
Yes	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe displacement where the different pipe types connect Vegetation, dried leaves, dirt will need to be cleared on either side. rock armour surrounding the inlet appear loose. May pose a risk during heavy rains. Consider replacing culvert

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch3062	**Date**	27/07/21 12:46PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway near Cornelian Bay - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.856510000000014, Long:147.32161329999997	left	no
outlet	Lat:-42.856483000000026, Long:147.32170310000004	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	pipe
Barrel or cell construction	pvc	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	1
Pipe inside diameter	150 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.4 m	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	75% blocked		
Outlet flow	75% blocked	**Inlet flow**	75% blocked
Outlet condition	difficult to locate outlet. cess drain on right side appears to flow to an outlet, but cannot find outlet/headwall, vegetation		
Inlet condition	stagnant water at halfway level of pipe. possibly blocked at end		
Structure condition	cannot find outlet. outlet may be located under walking track and somewhere along existing boat sheds / road		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat on either side. Cess drain on the right side running parallel the track		
What routine maintenance is required?	culvert and outlet condition will need to be checked and cleared of obstructions/dirt. clear inlet side. check pipe blockage causing the stagnant water		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.856510000000014, Long:147.32161329999997	Grated pit	-	Yes	Yes
	Comment	inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Condition

Photo Outlet

Photo Condition

Photo Outlet

Photo Condition

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch3250	**Date**	27/07/21 12:57PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway near Cornelian Bay. Culvert located along the intersection of Queens Walk and Bellevue Parade. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Carriageway	Marked on roadside
inlet	Lat:-42.85592730000002, Long:147.3192858	left	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	4.0 m	**No of cells**	1
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.2	**Depth of cover - Outlet**	0.25
Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	Clear	**Inlet flow**	50% blocked
Outlet condition	vegetation in the way of outflow. length only taken from closest pit to outlet, vegetation		
Inlet condition	Side entry pit filled with dried leaves and debris. part of catchment comes from pipe along Domain Highway. pit connected to junction pit		
Structure condition	Pit covers appear to be in good condition apart from requirement for clearing of debris. top part of outlet headwall has a crack, pipe_box_damage		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat either side		
What routine maintenance is required?	Side entry pit inlet will need to be cleared of dried leaves and debris. outlet will need to be cleared of vegetation. no wingwall or headwall, thus dirt from sides encroaches the outlet path		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.855911900000024, Long: 147.3194019	junction_pit	None	yes	yes
	Comment	difficult to open pit			
	Lat:-42.85585980000002, Long: 147.31916149999995	Side entry pit	None	yes	yes
	Comment	grated pit covered with water and debris. unsure if this leads to junction pit. unsure if there are other pipes connected because it is covered with water and debris			
	Lat:-42.85568790000002, Long: 147.3195323	junction_pit	None	yes	yes
	Comment	difficult to open. bollards along verge where pit and outlet is located. difficult to open			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road

	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe condition underneath the road will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch3624	**Date**	27/07/21 02:47PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway near Bay Road. Culvert located between Bell Street and Bellevue parade. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.854942300000005, Long:147.3151014	left	no
outlet	Lat:-42.854753733999985, Long:147.315169845	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	21	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	Clay and rock	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	manhole cover on outlet side difficult to lift		
Inlet condition	manhole cover on outlet side difficult to lift. Manhole cover was covered with dirt and vegetation.		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	batters steep on either side of the track and shared path. batters approximately 3m high on right side to Bell St. Batters are grassed.		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.854942300000005, Long:147.3151014	Manhole	-	Yes	Yes
	Comment	Inlet manhole			
	Lat:-42.854753733999985, Long:147.315169845	Manhole	-	Yes	Yes
	Comment	Outlet manhole			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch4154	**Date**	28/07/21 09:26AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Risdon Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – on road

	Location: Lat, Long	Road No	C'way Code	Link No	Offset on link (km)	Seg No	Seg Offset)km)	Speed Limit
outlet	Lat:-42.8536121000000 2, Long:147.308895	-	-	-	-	-	-	50
inlet	Lat:-42.8538543999999 9, Long:147.30865429 999994	-	-	-	-	-	-	50

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	34 m	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined

Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	manhole cover on outlet side difficult to lift. pavement cracks appear to be along the pipe direction		
Inlet condition	manhole cover on outlet side difficult to lift.		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately. bridge/track approximately 9.2m high from the road		
Batter condition	Manholes and pipes are along the road. Batters of the track/bridge are steep and grassed.		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.85361210000002, Long:147.308895	Manhole	-	Yes	Yes
	Comment	Inlet – east side of Risdon Road			
	Lat:-42.85385439999999, Long:147.30865429999994	Manhole	-	Yes	Yes
	Comment	Outlet – east side of Risdon Road			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
Yes	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet

	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Batter

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch4194	**Date**	28/07/21 09:49AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Risdon Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – on road

	Location: Lat, Long	Road No	C'way Code	Link No	Offset on link (km)	Seg No	Seg Offset)km)	Speed Limit
inlet	Lat:-42.853844700000025, Long:147.30846810000003	-	-	-	-	-	-	50
outlet	Lat:-42.853458699999976, Long:147.30887040000005	-	-	-	-	-	-	50

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	38 m	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined

Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	Yes	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	manhole cover on outlet side difficult to lift.		
Inlet condition	manhole cover on outlet side difficult to lift.		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately. bridge/track approximately 9.2m high from the road		
Batter condition	Manholes and pipes are along the road. Batters of the track/bridge are steep and grassed.		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.853844700000025, Long:147.30846810000003	Manhole	-	Yes	Yes
	Comment	Inlet – west side of Risdon Road			
	Lat:-42.853458699999976, Long:147.30887040000005	Manhole	-	Yes	Yes
	Comment	Outlet – west side of Risdon Road			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced

	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Batter

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch4349	**Date**	27/07/21 03:13PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway near Risdon Road. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – off road

	Location: Lat, Long	Side of Carriageway	Marked on roadside
inlet	Lat:-42.85317520000001, Long:147.30651239999997	left	no
Outlet	Not found	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	1
Pipe inside diameter	225	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	0.1	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	25% blocked		
Outlet flow	cannot be determined	**Inlet flow**	25% blocked
Outlet condition	cannot locate outlet. cess drain on right side of track		
Inlet condition	cannot lift grate. unsure of flow direction if parallel to shared path or at angle under the track		
Structure condition	pit cover appears to be in good condition.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat on either side and made mostly of ballast material		
What routine maintenance is required?	culvert and outlet condition will need to be checked and cleared of obstructions/dirt.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.85317520000001, Long:147.30651239999997	Grated pit	-	Yes	Yes
	Comment	None			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch5321	**Date**	28/07/21 11:19AM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Albert Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – on road

	Location: Lat, Long	Road No	C'way Code	Link No	Offset on link (km)	Seg No	Seg Offset)km)	Speed Limit
inlet	Lat:-42.847790200000 2, Long:147.29833529 999996	-	-	-	-	-	-	50
outlet	Lat:-42.847763900000 2, Long:147.29865589 999997	-	-	-	-	-	-	50

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	Pipe
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	25.0 m	**No of cells**	cannot be determined
Pipe inside diameter	450 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	0.3 m

Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	cannot be determined		
Outlet flow	25% blocked	**Inlet flow**	cannot be determined
Outlet condition	cannot lift side entry pit cover. water inside pit at time of inspection, although it doesn't appear to be flowing anywhere. outlet might be blocked		
Inlet condition	difficult to open manhole cover. inlet condition will need to be reassessed. a few vegetation in the way of the inlet. located on the left side if the shared path and track		
Structure condition	pit covers appear to be in good condition. invert and outlet may need to be cleared of dirt or debris to ensure smooth flows		
Road surface condition	Refer to rail track condition assessment provided separately. track and road pavement connection may need to be fixed.		
Batter condition	batters are flat and grassed		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.84779020000002, Long:147.29833529999996	Manhole	-	Yes	Yes
	Comment	Inlet			
	Lat:-42.84776390000002, Long:147.29865589999997	Side Entry Pit	-	Yes	Yes
	Comment	Outlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet

	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Road

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch5937	**Date**	28/07/21 12:02PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Saunderland Street intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – on road

	Location: Lat, Long	Road No	C'way Code	Link No	Offset on link (km)	Seg No	Seg Offset)km)	Speed Limit
inlet	Lat:-42.843139699999995, Long:147.2950379	-	-	-	-	-	-	50
outlet	Lat:-42.842814400000001, Long:147.29505289999997	-	-	-	-	-	-	50

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	23.0	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined

Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	25% blocked
Outlet condition	cannot lift pit cover. pit located along centre of the road. Significant pavement cracks along the road		
Inlet condition	inlet partly blocked by dirt and debris. cannot lift pit cover. Cannot assess pipe condition		
Structure condition	Culvert/pipe condition will need to be reassessed. Pavement cracks will need to be assessed and rectified		
Road surface condition	Refer to rail track condition assessment provided separately.		
Batter condition	flat on either side		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.843139699999995, Long:147.2950379	Manhole	-	Yes	Yes
	Comment	Inlet			
	Lat:-42.84281440000001, Long:147.29505289999997	Manhole	-	Yes	Yes
	Comment	Outlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
Yes	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced

	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Road

Photo Batter

Photo Batter

RTA Culvert Data Collection Form

Identification

Culvert Number	ch6405	**Date**	28/07/21 12:28PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Derwent Park Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – on road

	Location: Lat, Long	Road No	C'way Code	Link No	Offset on link (km)	Seg No	Seg Offset)km)	Speed Limit
inlet	Lat:-42.839619500000026, Long:147.29147920000003	-	-	-	-	-	-	50
outlet	Lat:-42.8393102, Long:147.29213990000005	-	-	-	-	-	-	50

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	60.0	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined

Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	cannot lift manhole cover. Manhole located along road carriageway		
Inlet condition	cannot lift manhole cover. Manhole located behind footpath and fence		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately.		
Batter condition	flat batters. ponding near track. no defined cess drain		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.839619500000026, Long:147.29147920000003	Manhole	-	Yes	Yes
	Comment	Inlet			
	Lat:-42.8393102, Long:147.29213990000005	Manhole	-	Yes	Yes
	Comment	Outlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet

	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side Ponding along the track sides is evident. no defined cess drain. ballast material missing along connection to the road

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Road

Photo Batter

Photo Batter

Photo Batter

Photo Batter

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch6660	**Date**	28/07/21 01:00PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Derwent Park Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.83815449999997, Long:147.29016850000005	left	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	cannot be determined	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	Clay and rock	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	cannot locate within rail corridor. outlet possibly within parking area of RSEA safety		
Inlet condition	Manhole cover difficult to open		
Structure condition	cannot locate outlet. Inlet manhole cover appears to be in good condition		
Road surface condition	Refer to rail track condition assessment provided separately.		
Batter condition	flat batters either side made up mostly of ballast material		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.83815449999997, Long:147.29016850000005	Manhole	-	Yes	Yes
	Comment	Inlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side. outlet was not located as it was outside rail corridor

Condition Photographs

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch6677	**Date**	28/07/21 01:11PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway near Derwent Park – Springfield Avenue - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – off road

	Location: Lat, Long	Side of Carriageway	Marked on roadside
outlet	Lat:-42.83755830000001, Long:147.28975890000004	right	no
inlet	Lat:-42.83760790000002, Long:147.28925300000003	left	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforcedconcrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	30 m	**No of cells**	1
Pipe inside diameter	1050 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	None	**Depth of cover - Outlet**	2.6 m
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	Yes	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there **water in the culvert?**			Yes
Barrel flow	Clear		
Outlet flow	Clear	**Inlet flow**	cannot be determined
Outlet condition	vegetation around the grated pit, but appears to be on okay condition aside from the bent grates in the cover. Grated pit cover can easily be opened		
Inlet condition	difficult to lift manhole cover. Pipe condition was not assessed at the inlet.		
Structure condition	Inlet and outlet appear to be in okay condition.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat on either side		
What routine maintenance is required?	inlet side may need to be checked as manhole cover was difficult to open		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.8375805, Long: 147.28978070000005	junction_pit	-	yes	yes
	Comment	pit at the same level as existing surface levels			
	Lat:-42.837780099999975, Long: 147.28947649999998	junction_pit	-	yes	yes
	Comment	pit approximately 3 m from shared path. Approx. 50 mm above existing ground surface			
	Lat:-42.837596899999994, Long: 147.28923469999995	junction_pit	-	yes	yes
	Comment	adjacent to bigger junction pit			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)

	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
Yes	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
Yes	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Exposed reinforcement and iron staining evident on the outlet side of the culvert Joint connections will need to be reassessed. Along the outlet pit, chipping of the concrete connection was observed

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet – joint connection

Photo Outlet

Photo Outlet

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch6839	**Date**	28/07/21 01:42PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Derwent Park Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
outlet	Lat:-42.83644889999999, Long:147.28820710000002	right	no
inlet	Lat:-42.8364469, Long: 147.28821819999996	left	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	34 m	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	Clay and rock	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	manhole cover on outlet side difficult to lift. Manhole cover was covered with dirt during time of inspection. Possible ponding on pit cover because it is at the low point		
Inlet condition	manhole cover on inlet side difficult to lift.		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately.		
Batter condition	flat either side comprised of grassed embankment and ballast material		
What routine maintenance is required?	check pipe condition and clear of blockages if any		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.8364469, Long: 147.28821819999996	manhole	-	Yes	Yes
	Comment	Inlet approx 3m to shared path			
	Lat:-42.83644889999999, Long:147.28820710000002	manhole	-	Yes	Yes
	Comment	Outlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
Yes	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch7037	**Date**	28/07/21 01:54PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Lampton Ave intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location – on road

	Location: Lat, Long	Road No	C'way Code	Link No	Offset on link (km)	Seg No	Seg Offset)km)	Speed Limit
inlet	Lat:-42.835417500000005, Long:147.28620899999999	-	-	-	-	-	-	50
outlet	Lat:-42.835214099999997, Long:147.28634599999998	-	-	-	-	-	-	50

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	24.0	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined

Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	25% blocked
Outlet condition	manhole cover on outlet side difficult to lift. Significant pavement cracks along the road around the manhole. outlet manhole in the middle of the road		
Inlet condition	Weeds growing within pit. manhole cover on inlet side difficult to lift. appears to have stagnant water and dirt inside the side entry pit. inlet SEP partially blocked, unable to verible pipe size and condition		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately.		
Batter condition	flat either side		
What routine maintenance is required?	check pipe condition and clear of blockages if any remediate pavement issues		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.835417500000005, Long:147.28620899999999	Side entry pit	-	Yes	Yes
	Comment	Inlet			
	Lat:-42.83521409999997, Long:147.28634599999998	Manhole	-	Yes	Yes
	Comment	Outlet			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
Yes	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet

	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side. Pavement issues will need to be remediated

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch7420	**Date**	28/07/21 02:22PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway near Elwick Road. Culvert is located on the north side of Esmond Street - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.8333083, Long:147.28272660000005	right	no
outlet	Lat:-42.83328849999998, Long:147.28272949999996	left	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Pavement drainage	**Culvert type**	Pipe
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	10 m	**No of cells**	1
Pipe inside diameter	225 mm	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	0.7 m
Nature of Fill	rock and clay, adjacent to shared path. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No

Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			No
Barrel flow	Clear		
Outlet flow	Clear	**Inlet flow**	cannot be determined
Outlet condition	cannot lift pit cover. pit invert is covered with dirt and grass. Possibly acting as a soakage pit?		
Inlet condition	cannot lift pit cover. Pipe condition was not assessed on the inlet side. Unable to fit in camera to check pipe condition.		
Structure condition	Appears to be in good condition		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	flat on either side. Made of ballast material		
What routine maintenance is required?	culvert and inlet condition will need to be checked and cleared of obstructions/dirt. clear inlet side.		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.83390539999999, Long: 147.28419770000005	Grated pit	-	Yes	No
	Comment	Outlet within rail track corridor			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**

Risk Assessment Comment	Pipe condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	ch7659	**Date**	28/07/21 02:43PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- access to the site is from the intercity cycleway and Elwick Road intersection. - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.832731799999976, Long:147.28001640000002	left	no
outlet	Lat:-42.832702100000006, Long:147.27975060000006	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	cannot be determined
Barrel or cell construction	cannot be determined	**Culvert joints**	cannot be determined
Box culvert types	cannot be determined	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	14.0	**No of cells**	cannot be determined
Pipe inside diameter	cannot be determined	**Cell width**	cannot be determined
Cell height	cannot be determined	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	cannot be determined
Nature of Fill	Underneath road pavement, cannot determine subgrade at this stage	**Is culvert long enough?**	Yes
Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			cannot be determined
Barrel flow	cannot be determined		
Outlet flow	cannot be determined	**Inlet flow**	cannot be determined
Outlet condition	manhole cover on outlet side difficult to lift.		
Inlet condition	manhole cover on inlet side difficult to lift. Pit located along median island		
Structure condition	Manhole cover at appears to be in okay condition. Culvert/pipe condition will need to be reassessed.		
Road surface condition	Refer to rail track condition assessment provided separately.		
Batter condition	Flat on either side		
What routine maintenance is required?	Pipe condition will need to be reassessed. Pit covers difficult to open		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.832731799999976, Long:147.28001640000002	Manhole	-	Yes	Yes
		Inlet			
	Lat:-42.832702100000006, Long:147.27975060000006	Manhole	-	Yes	Yes
		Outlet			
	Lat:-42.83273059999999, Long: 147.28005599999995	Manhole	-	yes	yes
	Comment	pit located along footpath. cannot lift pit cover			
	Lat:-42.832773599999996, Long: 147.28022150000004	inlet_sump	-	yes	yes
	Comment	Grated pit covered with rubbish. pit cover difficult to open. cannot fit in camera to check pit condition. pit cover may need to be changed and cleared of debris			
	Lat:-42.83281390000002, Long: 147.27981590000002	Manhole	-	yes	yes
	Comment	Pit located along pedestrian refuge. Difficult to open			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters

	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter
	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

Culvert Barrel Type

Are any of the following culvert barrel types present?

No	Metal, plastic, brick, stone, terracotta, masonry, timber, composite, or barrel type classified as “Other”

Internal Condition of the culvert

Are any of the following conditions evident within the culvert barrel?

	Significant cracking and deformation of the internal walls
	Evidence of corrosion of steel reinforcement (eg. exposed reinforcement, iron staining, leaching)
	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe and manhole condition will need to be checked. Vegetation, dried leaves, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos – pit east side of Elwick Road

Risk Photos

Risk Photos

Risk Photos

RTA Culvert Data Collection Form

Identification

Culvert Number	Ch7727	**Date**	28/07/21 03:07PM	**Inspector**	sbmagaling
Local Number	None	**Region Code**	None	**Slope Number**	None
Culvert Comment	- 2 parallel pipes along Barossa Creek. Difficult to determine outlet and pipe condition. Will take 2 parallel pipes as one location. Approx. 5 m apart - access to the site is from King George V Avenue and Elwick Road - access unrestricted. track is not gated. - Track gated from shared path. - refer to Appendix A for culvert location				
Requires Rope Access	No				

Culvert Location

	Location: Lat, Long	Side of Track	Marked on roadside
inlet	Lat:-42.83288140000002, Long:147.2787905	left	no
outlet	Lat:-42.83264200000002, Long:147.2790943	right	no

Design Data

Plan Number	None	**Sheet Number**	None	**Pipe/Box Number**	None
Description of Capacity	None			**Discharge (cu m/s)**	None
Flood potential	No signs of previous flooding				

Culvert Details

Purpose	Catchment drainage	**Culvert type**	Pipe
Barrel or cell construction	steel_reinforced concrete_rcp	**Culvert joints**	cannot be determined
Box culvert types	N/A	**Lining**	cannot be determined
Lining Materials	cannot be determined	**Lining Comment**	cannot be determined
Culvert length	33 m	**No of cells**	2
Pipe inside diameter	-	**Cell width**	N/A
Cell height	N/A	**Length of cell**	cannot be determined
Depth of cover – Inlet	cannot be determined	**Depth of cover - Outlet**	2.0 m
Nature of Fill	rock and clay, adjacent to shared path and road. cannot determine subgrade at this stage	**Is culvert long enough?**	Yes

Has Grates	No	**Has Floodgates**	No
Has Tidal Flows	No		

Culvert Condition

During this inspection is there water in the culvert?			Yes
Barrel flow	Clear		
Outlet flow	Clear	**Inlet flow**	cannot be determined
Outlet condition	Vegetation/dirt/debris along the outlet Difficult to access as the area is fenced		
Inlet condition	Unable to open manhole cover		
Structure condition	Outlet side will need to be cleared of vegetation/dirt/debris. Kids were able to access the adjacent smaller pipe at the time of inspection but unable to determine where.		
Road surface condition	Refer to rail track condition assessment provided separately		
Batter condition	Flat on left side. Steep on right side. Mostly consisting of ballast material.		
What routine maintenance is required?	Pit outlet will need to be cleared of existing vegetation/dirt/debris. Pipe condition will need to be assessed		

Drainage Pits

	Location: Lat, Long	Type	Depth	Ped safe	Bike safe
	Lat:-42.8326788, Long: 147.27907960000005	junction_pit	None	yes	yes
	Comment	Along access driveway to Highgrove bathrooms. Unable to open pit cover			
	Lat:-42.83284149999997, Long: 147.27913679999995	junction_pit	None	yes	yes
	Comment	Located along footpath. Unable to open pit cover			

Risk Assessment Checklist

External Conditions

Are any of the following conditions evident at the culvert location?

	Subsidence in the road
	Significant patching of the road above the culvert
	Significant cracking or deformation of the road above the culvert
	Holes or cavities in the road fill around the inlet or outlet or above the culvert
	Embankment failure at the culvert outlet eg slumping, cracking
	Seepage emerging around the outside of the pipe
	Significant scour erosion of the road fill batters
	Significant scour erosion below the outlet or at the inlet
	Headwalls missing or displaced
	Inconsistent flow of water between inlet and outlet
	History of water flow over road
	Squeeze point and/ or locally steep batter

	Occupied buildings downstream that could be at risk (within 100 metres)
	Culvert conveys tidal flows or has floodgates present

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Are any of the following culvert barrel types present?

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	Spalling or delamination of concrete
	Noticeable displacement or separation across joints (butt joints ≥ 20mm, spigot and socket joints ≥ 50mm)
	Evidence of groundwater entering into the pipe
	Evidence of water being lost out of joints or other defects in the pipe
	Evidence of erosion through joints (eg. seepage inflows carrying fines, soil accumulation at joints)
	Bowing of culvert
	Geometry change
Yes	Debris or vegetation inside culvert
	Acid sulfate soils and/or acid bearing rock

Yes	**Detailed Risk Assessment required. If any of the above are present, then tick here and add acomment below**
Risk Assessment Comment	Pipe condition will need to be checked. Vegetation, debris, dirt will need to be cleared on either side.

Condition Photographs

Photo Inlet

Photo Inlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Outlet

Photo Condition

Photo Condition

Photo Condition

Photo Condition

Photo Condition

Photo Road

Photo Road

Photo Batter

Photo Batter

Risk Photos

Risk Photos

Risk Photos

Appendix C

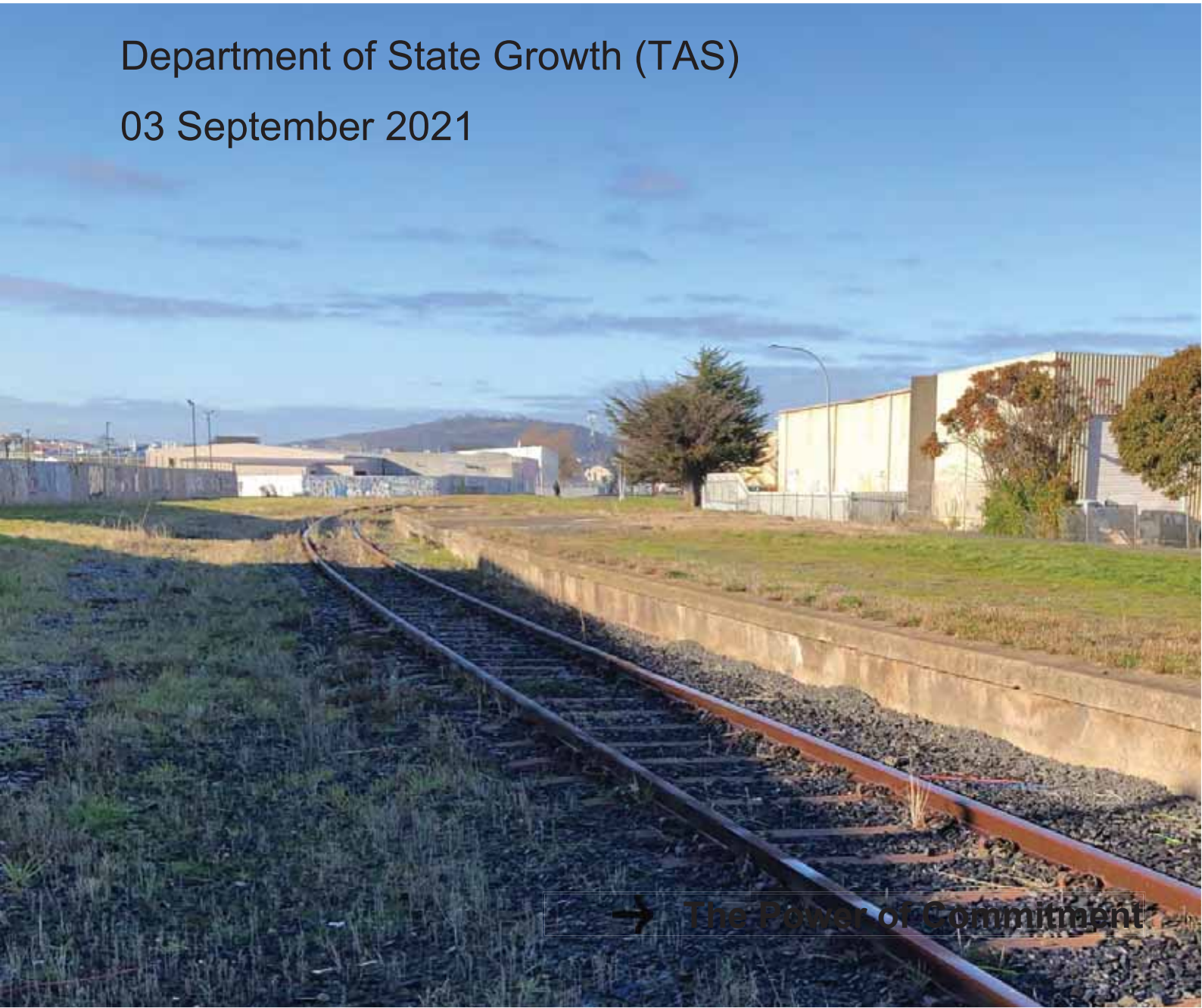
Preliminary Contamination Investigation

Preliminary Contamination Investigation

Northern Suburbs Transit Corridor

Department of State Growth (TAS)

03 September 2021



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Author	Tim Coates
Project manager	David Figuera
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Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
Draft	0.1	T. Coates	N Meskanen				
Draft	0.2	T. Coates	N Meskanen				03/09/21

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Appendices

1. Introduction

The Department of State Growth (DSG) commissioned GHD Pty Ltd (GHD) to undertake a desktop contamination assessment as part of the condition assessment for the proposed Northern Suburbs Transit Corridor.

This report presents the findings of a preliminary (desktop based) contamination assessment of the 8.2 km proposed Northern Suburbs Transit Corridor. Site plans showing the proposed alignment location within relevant municipalities are included in Appendix A.

1.1 Background

The Northern Suburbs Transit Corridor (the Corridor) consists of the decommissioned railway tracks running from Macquarie Point in the south, through Hobart's Northern Suburbs, to Peltro Street in Glenorchy. The Corridor largely consists of a single narrow gauge rail line with wooden or concrete sleepers and ballast.

The report is intended to identify potential contamination or legacy contamination as a result of potentially contaminating activities (PCA) being undertaken within the Corridor or, on lots adjacent to the Corridor. The results of this study are intended to support the condition assessment by identifying areas where potential contamination may be present along the corridor. This assessment has been conducted as a preliminary desktop investigation using GIS-based analyses, information from local and state government databases, and land use history data to identify PCA that have been undertaken on or adjacent the Corridor.

Historic land-use activities that are unlikely to be associated with gross contamination (e.g., certified removal records of USTs with soil sampling, storage of liquid petroleum gas (LPG)), were allocated a low-risk ranking. Historic land-use activities that may be associated with gross contamination (e.g. service stations or bulk fuel storage systems etc) were deemed to require further investigation. The rankings have been used to identify lots that should be subject to more intensive assessment for potential contamination as part of the Corridor condition assessment.

1.2 Objective

The objective of this assessment is to identify locations that may require further assessment to ensure that potential site contamination is identified and managed appropriately. The aim of this assessment is to identify lots that may be located on land that may have been subject to potentially contaminating activities. This included allocation of relative risk rankings to identify which lot locations which should be subject to more intensive assessment.

The project objective is to confirm the condition of the existing Corridor infrastructure to inform the Government of the nature and potential cost of upgrades required to operate a transit service

1.3 Purpose of this report

To describe the process and present the findings of the desktop assessment and provide recommendations for areas within the corridor identified to be at risk of containing contamination.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

1.4 Scope

The scope of work for this preliminary site contamination assessment comprised the following tasks:

– Review of land use mapping, planning information (including zoning and permissible uses), and land use history available through Land Information Systems Tasmanian (LIST[1]) to identify and evaluate potential for contamination within adjacent lots.
– Review of potentially contaminating activities records from the WorkSafe Tasmania dangerous goods register, EPA Tasmania Contaminated sites database/regulated premises records, and local government authority contamination databases from the City of Hobart (CoH) and Glenorchy City Council (GCC).
– Obtain and review historical aerial photography depicting the corridor and surrounds along with parcel, title, and tenure information available in the public domain.
– Review of hydrological, geological, soil and topographical maps depicting the corridor.
– Preparation of this report summarising the findings of the preliminary investigation and the contamination screening assessment and recommend appropriate actions to enable further assessment at lots identified as having a risk of containing contamination.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

2. Preliminary site assessment

2.1 General

A preliminary desktop study was undertaken along the length of the proposed transit corridor. The study entailed a review of contaminated sites registers covering all lots within 30 m of the transit corridor to identify which lots have been subject to potentially contaminating activities.

Registers were then applied to cadastral data to determine the location of adjacent lots and the potential for legacy contamination within the Corridor.

2.2 The rail corridor

The Corridor lies within the local councils of Glenorchy and Hobart and contains a disused freight rail line. There has been no rail traffic on this line (other than maintenance vehicles) since 2014 and no passenger rail traffic since the late 1970s. The study area comprises approximately 8 km of inactive rail between the Macquarie Point (26915/3) and Northgate Shopping Centre, Glenorchy (154423/1). The area is inclusive of ~30 m buffer either side of the existing rail line to inform the condition assessment.

It is understood that the proposed transit infrastructure being considered will comprise a single-track corridor with provisions at stations to allow for passing of vehicles i.e. passing loops. Level crossings will remain functional with traffic signals installed or adjusted if already signalized. The existing Inner-City Cycleway will remain functional and safe, including maintenance of a 4.0 metre width for the cycleway and a 1.0 metre reservation for safety measures. designs include a safety zone on either side of the transit lanes / carriageway which includes a 1.2 m high fence/barrier to prevent ease of access into the transit pathway and reduce potential conflicts.

In July 2020, a Northern Suburbs Transit Corridor – Transport Mode Study Options Assessment Report was completed by Price Waterhouse Coopers (PWC). It considered light rail, rapid bus and trackless tram options.

Important assumptions for the transit corridor are:

– It will be a single-track corridor with dual track at stations i.e. passing loops
– Level crossings will remain functional with traffic signals
– The existing Inner-City Cycleway will remain functional and safe
– For security and safety additional lighting and fencing will be required

2.3 Methodology

To inform this assessment, a high-level desk-top assessment of potential contamination has been undertaken in general accordance with the National Environmental Protection Council (NEPC) (2013) *National Environmental Protection (Assessment of the Site Contamination Measure 1999 (as amended April 2013)*.

The assessment was conducted using a desktop risk-ranking approach. The approach entailed analysis of identified potentially contaminating activities to identify the following items:

– Land use, land tenure, and zoning under local government schemes.
– Historical activity types, the relevant regulative authority, and proximity to the corridor.
– Each PCA was then spatially attributed to a cadastral lot within the relevant LGA based on historical address data in the various registers, records and databases reviewed to inform this report.
– Finally, each site was then allocated a risk ranking based on the results of these parameters, including:
    - Low Risk - sites that have been regulated and managed effectively, or present historical activities that would not lead to gross contamination within adjacent lots; and,
    - Medium or High Risk (Requires Investigation) – sites that present a land use history of PCA including fuel storage, chemical uses, and/or industrial activities with potential contaminates of concern.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

For the purposes of this assessment, fuel storage can be associated with contamination by hydrocarbons, including Total Recoverable Hydrocarbons (TRH) in the C_6-C_{40} chainlengths, benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN), polycyclic aromatic hydrocarbons (PAH), phenols and lead (if leaded petrol was stored). Identification of long-term fuel storage in proximity to the corridor will be regarded as requiring further investigation to confirm location and condition of tanks and potential for any impacts to extend into the corridor.

Records of ammunition storage were identified during a review of information collated for the Project, including the identification of a number of 'ready use ammo lockers' during World War II. However, records of structures housing materials of this type indicate that construction included sufficient structural investment. Similarly, storage depots of this type were typically constructed in port/naval settings. As such, it is considered unlikely that significant contamination relating to ammunition will be present at a majority of sites identified during this assessment.

An assessment of the composition of rail ballast beneath the existing track bed will be required in areas where disturbance and disposal of this material is proposed.

The historical imagery assessed as part of this review (georeferenced to the transit corridor alignment) is available in Appendix B. The WorkSafe records are presented in Appendix C and the EPA Tas records are presented in Appendix D.

2.4 Results

Table 1 summarises the key findings of the desktop review and presents the risk ratings for each of the lots that may require further investigation to assess whether the contamination extends onto the Corridor. Lots identified for further assessment are shown spatially in Appendix A. Note that the figures in Appendix A only indicate lots identified for further investigation (i.e. ranked as Medium or High risk).

It should be noted that this assessment is based on the data at time of capture and the quality of the data sources.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Table 1 Sites requiring further assessment – contamination risk rating assessment

Site ID (in this report)	Address	Easting	Northing	Property ID	Volume	Folio	Parcel authority	LGA	Potentially Contaminating Activity History	Comments / Contamination	Risk ranking
PC#1	1 McVilly Drive, Queens Domain, TAS 7000	527416	5253062	1979812	134037	1	Tasmanian Ports Corporation Pty Ltd	Hobart	Marine Vessel Slipyard history of marine engineering activities – evidence of hydrocarbon loss in historic imagery (1996) staining ground surfaces around the jetty system constructed in 1996 and the slipways. A refueling jetty was identified east of the slipways extending approximately 75 m into the river and a well-bunded above ground fuel storage tank (AST) is located at its entrance (on reclaimed land). Adjacent the AST is an area with a shipping container and small offices which is currently subleased to a marine painter (formerly the water police headquarters). A second jetty of approximately 80 m length was identified which is assumed to be generally utilised for the servicing of vessels. A chemical and oil store was identified at either end of the workshops that are to the south of the AST (and located on the road leading to the waterfront). South-east of these workshops is another laydown area and a third slip. The southern portion of the Domain Slip lot hosts a carpark and a lockable laydown area.	Parcel contains longstanding use as a TasPorts marine slip yard – the parcel is not listed as potentially contaminated location (PCL) under the HCC contaminated sites register, however the site does trigger the PCL code as per the *Hobart Interim Planning Scheme 2015 as* a potentially contaminating activity. EPA database searches revealed no relevant information for the site however, records indicated that the surrounding area was subject to an assortment of potentially contaminating industries and activities including a rubbish dump, wastewater treatment plant, metal foundry, cattle yards, gasworks etc. WorkSafe Tasmania identified one record for the site. This record pertained to the removal of 15 m^2 of non-friable asbestos material from a storage compound at the Domain Slip. Worksafe did not have any records regarding possible fuel storage at the site. A public database search did not reveal any reports of environmental incidents or complaints about items that may have caused pollution. Current land use of the site is identified as a Marine Slip yard. The site contains three (3) operational slips, No. 1 with a 1200t capacity; No. 2 with a 180t capacity, and No. 3 with a 25t capacity. Other services provided include marine engineering, boiler-making, blasting and painting. The Domain Slip was constructed in 1855. It is understood that prior to its construction, boat repairs and maintenance were undertaken on temporary slips in the same location. As such, the slipyard has been used for repair and maintenance of (usually) working boats since at least the mid-nineteenth century. Land uses surrounding the site can be described as follows: North (on bank of river): Naval Training facility Northwest: Train line (disused) and Tasman Highway West: Train line (disused), Tasman Highway Southwest: Train line (disused), Cenotaph Avenue and major intersection on Tasman Highway South: Train line (disused), Anzac Parade and the Cenotaph Southeast: McVilly Drive, public carpark with boat ramps and jetties East: Derwent River Northeast: Derwent River. Other notable surrounding legacy uses include the HMAS Huon Naval Operations Base, which operated as a care and maintenance base for naval vessels until 1994. HCC records indicate the presence of cattle jetties and baths previously operating adjacent to the site. The parcel to the north (135056/2) was also identified as a legacy storage and logistics site for explosives (Victoria powder jetty and magazine). GHD have undertaken a contaminated land and hazardous materials risk assessment of the Domain Slip precinct in the last 5 years (GHD, 2018). The study identified that the site presents some potential contamination risks to both current and potential future receptors. Primary contamination risk sources identified included hydrocarbons (fuel storage, refueling and fuel lines), and lead paint contamination.	Medium – considered unlikely that contamination extends onto Transit Corridor. Requires assessment of likelihood that potential contamination extends onto Corridor.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Site ID (in this report)	Address	Easting	Northing	Property ID	Volume	Folio	Parcel authority	LGA	Potentially Contaminating Activity History	Comments / Contamination	Risk ranking
PC#2	11 Lower Domain Road, Queens Domain, TAS 7000	527017	5254173	5671970	249579	2	DPIPWE (Crown Land Services)	Hobart	Royal Tasmanian Botanical Gardens	Parcel identified as containing a previous Hobart Suburban Rail Station during the period of passenger rail operation (1875-1920). Activities within the gardens are considered unlikely to have resulted in gross legacy contamination.	Low
PC#3	1 Bell Street, New Town, TAS 7008	525729	5255404	2891281	153814	1	Local Government Authority	Hobart	Motor Car Dealers - Engineering & Garages activities between 1970 and 1988 – Possible legacy hydrocarbon contamination (operation under B.R. Bean; H.C. Sleigh/Golden Fleece). Site also operated as a Food distributor and Wholesaler. (W.P.L Food Distributors; Wholesalers Pty Ltd). Structure utilized for activities of these types was demolished in 1997 and replaced with a concrete surface operating as a carpark to support the rezoning and use of the parcel to recreational uses. Asphalt carparking was adjoined subsequently.	Parcel identified as a PCL/contaminated record in the HCC contamination database as containing multiple PCA's. Site functioned as an industrial site prior to decommissioning between 1970 -1988; majority of activities consisted of engineering uses. HCC records indicate hydrocarbons as potential contaminates of concern utilized at the site for a period of industrial operation. Worksafe dangerous goods records and EPA contamination records revealed no relevant information for the site. Current land use of the site is identified as a Local Government Authority Recreational Space. Surrounding land uses for the site are predominated by agriculture and residential – open space looks to have been utilized for pasture to the North of the site. Residential uses surround the site to the west and south. Rail to the south was operational during these periods. The site appears to be utilized for storage prior to the 1960-1970 before converting to industrial uses whereby the site was landscape, paved in sections and infrastructure improved. In late 1970, the surrounding open space was remodeled for recreational purposes, likely to support growing residential surrounding uses. As site is still considered a PCL and sections of the site between the rail line and the concrete slab have likely not been assessed since industrial operation, the site is considered to potentially present legacy contamination.	Medium – requires assessment of likelihood that potential contamination extends onto Corridor.
PC#4	367 Main Road, Glenorchy, TAS 7010	522624	5257713	5383362	243628	1	Private Parcel	Glenorchy	Possible abandoned service station or old bulk fuel storage systems situated at 359 MAIN RD GLENORCHY TAS 7010. Imagery and land use analyses indicate the site featured bulk fuel storage (USTs) for a period. No register of installation or removal date is specified.	Parcel adjoins land which was used for a potentially contaminating activity - Parcel in close proximity to GCC contaminated sites register located on parcel ID 5383362. Parcel 5383362 is located just east of the parcel 5383362 and is situated outside of the 30m buffer. The site is situated a significant distance from the rail corridor. Further analyses on groundwater and surface water flow will be required to determine contaminate transport and fate for this site. Further analyses required.	Medium – requires assessment of likelihood that potential contamination extends onto Corridor.
PC#5	227 Main Road, Derwent Park, TAS 7009	523647	5257099.	0	119569	0	Private Parcel	Glenorchy	Possible abandoned service station or old bulk fuel storage systems @ 231 MAIN RD DERWENT PARK TAS 7009. History of underground bulk fuel storage systems largely unknown.	Parcel adjoins land which was used for a potentially contaminating activity - Parcel in close proximity to GCC contaminated sites register located on parcel ID 5437260. Parcel 5437260 is situated immediately north of the site. Current use is largely unknown – block is the least developed regarding adjacent lots. The area the parcel is situated within is zoned commercial services. Land use to the north is regarded as automotive/garage services; Land to the south is zoned industrial and	Medium - requires assessment of likelihood that potential contamination extends onto Corridor.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Site ID (in this report)	Address	Easting	Northing	Property ID	Volume	Folio	Parcel authority	LGA	Potentially Contaminating Activity History	Comments / Contamination	Risk ranking
										manufacturing and features electrical and automotive services activities. Further information on surrounding fuel storage systems required.	
PC#6	8 Birdwood Avenue, Moonah, TAS 7009	523894	5256778	3192642	163871	2	Private Parcel	Glenorchy	EPA Regulated premises directly adjacent rail corridor – Storage and treatment of controlled wastes operated by Spectran Group Pty Ltd. Possible abandoned service station or old bulk fuel storage systems @ 183 Main Road, Moonah, TAS 7000	Parcel is occupied by an activity regulated under EPN No. 9132 – Activity consists of the storage and treatment of controlled waste (Activity type: Non-inert waste depot). The activity is regarded as a level 2 activity under EMPCA 1994. The parcel also adjoins land which was used for a potentially contaminating activity as identified by the GCC contaminated sites register. Legacy activity at 183 MAIN RD MOONAH TAS 7000 (parcel 5437391), may have included the use of bulk storage fuel systems Site has functioned as an industrial site since ~1960 – Site was likely constructed in tandem with the TasWater owned site to the south east which was constructed during a similar period (Parcel 2163129). Historic imagery of this time also suggests that Parcel 5437391 may have operated as an automotive service station. Surrounding land uses for the site are predominated by manufacturing and industrial uses – TasWater sites adjoin the site from the south; Health precincts and tire manufacturing adjoin from the west; Commercial services and sales adjoin from the north. A service station is located within 150 m of the site to the west with a registered active underground petroleum storage system). Activity on site was largely constructed post-construction of the rail line and operational post-passenger rail operation. The site is therefore considered to require further investigation to determine if contaminants may have migrated onto the Corridor.	High - requires further investigation to assess whether potential contamination extends onto Corridor.
PC#7	Corner Main & Derwent Park Road, Derwent Park, TAS 7009	523732	5256982	1924037	131977	1	Private Parcel	Glenorchy	Sanitarium Health Food Co – food production facilities and manufacturing. Possible legacy sanitary operation contamination.	Parcel activity is listed as a potentially contaminating use under the GCC contaminated sites register. The site also returns a record on the Worksafe Dangerous goods register (DG ID 1915). Site has functioned as a long-standing industrial manufacturing factory since 1950. The site was constructed as a food processing factory in late 1949 before it was decommissioned in 1992. The site was remodeled and transitioned to a motor dealership in mid-1999. Surrounding land use for the site is predominantly industrial – Auto parts manufacturing adjoins the parcel to the north and east; Tire manufacturing and commercial sales occur to the south. The type and extent of legacy site contamination is largely unknown; however, the site was remodeled recently, and site records may be available. More information required to determine contamination status.	Medium - requires assessment of likelihood that potential contamination extends onto Corridor.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Site ID (in this report)	Address	Easting	Northing	Property ID	Volume	Folio	Parcel authority	LGA	Potentially Contaminating Activity History	Comments / Contamination	Risk ranking
PC#8	18 Sunderland Street, Moonah, TAS 7009	524099	5256424	2680900	96554	3	Parks and Wildlife Service	Glenorchy	Possible abandoned service station or old bulk fuel storage systems @ 131 MAIN RD MOONAH TAS 7009 – possible hydrocarbons Site and adjacent sites function as commercial services and manufacturing – ceramic supplies, auto bodyworks panel manufacturing, auto servicing, and stone stockpiling uses occur within close proximity of the site and the rail corridor.	Parcel activity is listed as operating adjacent to a potentially contaminated site under the GCC contaminated sites register. Records from Council indicate that adjoining Parcel 2873331 may have operated with bulk fuel storage systems and may contain legacy hydrocarbon contamination. The adjoining property is identified to be outside of the 30 m buffer established as part of this assessment, but traces of contamination may have migrated off-site from point sources. Parcel 2680900 has operated as a manufacturing use since 1960; Parcel 2873331 has operated within commercial services zones and structures are present in the mid 1940's. Use at this time is largely unknown, and the site may have operated as a service station. Records of bulk fuel storage for the site (potential USTs) were not identified. Surrounding land uses are predominantly commercial; Ceramic supplies and panel manufacturing to the south; auto repairs and supplies to the east; retail and auto supplies to the east and north. Based upon these activities, legacy soil contamination is likely, but the distance between the potentially contaminating activity areas to the Corridor is likely to mitigate these actions.	Medium – requires assessment of likelihood that potential contamination extends onto Corridor.
PC#9	313A Main Road, Glenorchy, TAS 7010 & 315-319 Main Road, Glenorchy, TAS 7010	523059	5257647	7550320; 3367334	120893; 231469	1	Housing Tasmania	Glenorchy	Possible abandoned service station or old bulk fuel storage systems @ 323-325 MAIN RD GLENORCHY TAS 7010 (Parcel 7332948) – Possible hydrocarbon contamination.	Parcels are listed as operating adjacent to a potentially contaminated site under the GCC contaminated sites register. Council records indicate Parcel 7332948 has operated as a service station with bulk fuel storage on site since the 1960's. Evidence of a structure is visible in imagery accessed from 1940 but use is largely unknown. The site currently operates as a Caltex Petrol Station, with a registered UST under the EPA Underground Petroleum Storage Register. Parcel ID's 120893 and 231469 were constructed later; structures visible early to mid-1960. Surrounding land uses are predominantly urban residential and recreational; Commercial services operate within 100 m of the sites including auto repair and maintenance services and a petrol station immediately south; recreational services to the west, the rail corridor to the north, and urban residential to the east. Groundwater prospectivity is considered to be highly porous (intergranular sand and gravel) which is highly vulnerable to pollutant infiltration. Geology of the site consists of Cenozoic cover sequences of poorly consolidated sand and silt and dolerite gravels. Longstanding hydrocarbon contamination may extend into the Corridor.	High – requires further investigation to assess whether potential contamination extends onto Corridor.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Site ID (in this report)	Address	Easting	Northing	Property ID	Volume	Folio	Parcel authority	LGA	Potentially Contaminating Activity History	Comments / Contamination	Risk ranking
PC#10	43 Albert Road, Moonah, TAS, 7009	524293.540377	5256033.90037	2867396	152350	1	Private Parcel	Glenorchy	Identified ERLUR site under Dangerous Goods register ID 2390 – no specific contamination information, land titles, or activity information was available.	Parcel is situated adjacent to the railway and is identified as a registered site on the Environmentally Relevant Land Use Register (ERLUR). Activity for the site is largely unknown; dates and activity types not available on register database – more information needed for contamination assessment.	Medium - requires assessment of likelihood that contamination is present and if so, extends onto Corridor.
PC#11	24 – 26 Station Street, Moonah, TAS 7009	524322.079931	5256100.58951	5447370; 5447389	12552; 15227	1	Private Parcel	Glenorchy	Possible abandoned service station or old bulk fuel storage systems @ 52 ALBERT RD MOONAH TAS 7009 (Parcel 5403773) – Possible hydrocarbon contamination.	Parcels adjoin a site identified as a Potentially Contaminated Location as per the GCC contaminated sites register. Parcel 5403773 is identified as a storage, warehousing and distribution depot. The site is likely to have stored bulk hydrocarbons or potential contaminants of concern – storage methodology (UST, AST), and/or removal is largely unknown. Premises likely constructed mid 1970's or 1980's based on historic imagery analyses. Surrounding land uses include commercial services and urban residential – Retail to the north, south and east; accommodation services to the west. Proximity of the site to the rail corridor is ~100 m; more information required to properly assess contaminant fate.	Medium - requires assessment of likelihood that potential contamination extends onto Corridor.
PC#12	375 Main Road, Glenorchy, TAS 7010	522567	5257767	5388366	67310	3	Private Parcel	Glenorchy	Certified removal of USTs (removal documented for 1998) – Tank removed, and site remediated – Contamination risk unlikely.	Parcel identified adjacent to a site of UST removal in 1998. Removal is documented and certified under the EPA ERLUR site register. Site is unlikely to present legacy contamination under these parameters.	Low
PC#13	11-21 Derwent Park Road, Derwent Park, 7009	523869.428225	5256946.387	7855095	104157	1	Private Parcel	Glenorchy	Storage and supply of gas, chemicals and industrial equipment – Gas tanks likely; chemical contamination possible.	Parcel is identified as a site of a previous LDSL offence under the *Dangerous substances (safe handling) regulations 2009 and* is listed under the EPA ERLUR register. Contaminator identified as BOC Ltd – a compressed and bulk gases, chemicals, and equipment supplier. Details regarding the contaminating activity on record, or the contaminants involved not available – more information required.	Medium - requires assessment of likelihood that potential contamination extends onto Corridor.
PC#14	10-12 Derwent Park Road, Derwent Park, TAS 7009	523795.671499	5257074.46233	7394129	123777	1	Private Parcel	Glenorchy	Multiple ERLUR records available for the site - Kemp & Denning - LPG; Underground Storage Tanks (1974-1987); Sims Metal Ltd - 1x1000 gall U/G tank installed (1974).	Parcel identified to contain multiple EPA ERLUR records – records of LPG tanks, USTs and UG gas tanks operating between mid-1960 and 1990. Tanks on site identified to have been decommissioned in the 1990's; no current USTs identified on site associated with current land use activities. Parcel has operated within a commercial service use area since the late 1960's – use at this time is assumed to be metal works, whereby USTs were installed, likely for gas tanks or LPG. Site operated as a metal recycling/scrap metal repurposing until 1990, whereby Kemp & Denning hardware purchased the parcel. Records of use indicate Kemp & Denning also utilized LPG at the site, Current site use is reserved for commercial purposes (retail); Manufacturing and auto services are located to the north, east and west.	Medium – requires assessment of likelihood that potential contamination extends onto Corridor.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Site ID (in this report)	Address	Easting	Northing	Property ID	Volume	Folio	Parcel authority	LGA	Potentially Contaminating Activity History	Comments / Contamination	Risk ranking
										Locations of specifications of legacy USTs not available – further information required for the site.	
PC#15	82 Hopkins St, Moonah, TAS 7009	524308.52258	5256385.12162	5430982	248502	1	Private Parcel	Glenorchy	Barrengers (glass manufacturing) – records of LPG tank installation.	Parcel recorded in the EPA ERLUR – Activity identified to be glass manufacturing at the identified site between 1980 and 2001. Activity proposed the installation of an LPG tank in the 1980's. Current site use includes the operation of a food processing facility within an industrial/manufacturing zone. Glass manufacturing operates to the east, food processing to the north, urban residential to the south and the rail corridor to the west. No information was available regarding the location and specifications of the LPG tank – more information needed. Current and past uses at the site indicate that contamination may be likely, but extent and fate is largely unknown.	Medium - requires assessment of likelihood that potential contamination extends onto Corridor.
PC#16	227-235 Main Road, Derwent Park, TAS 7009	523640.40667	5257124.16626	5437252	41184	1	Private Parcel	Glenorchy	Possible abandoned service station or old bulk fuel storage systems @ 231 MAIN RD DERWENT PARK TAS 7009 (Parcel ID 5437260) – possible hydrocarbon contamination	Parcels adjoin a site identified as a Potentially Contaminated Location as per the GCC contaminated sites register. Parcel ID 5437260 identified as a warehouse, factory and/or industrial site – site may have stored bulk fuel on site. No records of USTs/ASTs were available in GCC records. The site and adjoining parcels currently operate as an automotive services and manufacturing use. Surrounding land uses include the rail corridor to the east, accommodation to the west, and industrial to the south. No information available regarding records of fuel storage or storage mediums – more information required.	Medium – requires assessment of likelihood that potential contamination extends onto Corridor.

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

3. Conclusions and recommendations

3.1 Conclusions

The assessment identified 16 lots with historical potentially contaminating uses in vicinity to the Northern Suburbs Transit Corridor. Fourteen (14) of the identified lots were identified as having a Medium or High risk of potential contamination and requiring further investigation to assess if potential contamination is likely to or has extended into the Corridor.

3.2 Recommendations

Ballast along the corridor should be sampled and analysed for key analytes to assess material handling and disposal requirements. This should be undertaken on a limited basis to inform decisions regarding disturbance of soils along the corridor, and on a detailed basis following confirmation of areas that will be disturbed.

3.2.1 Low risk rating sites

In regard to contamination issues, two of the lots investigated as part of this study were deemed to have a low contamination risk rating.

Sites with a low risk rating are considered unlikely to contain legacy contamination on the basis of the land-use history. Low risk sites were determined to be adequately managed on a contamination scale, or not regarded to be within the proximity of concern with respect to the transit corridor. These sites are not considered to trigger the requirement to undertake a detailed contamination risk assessment as part of Stage 2 works.

It should be noted that the low risk rating sites have been designated solely on this desktop review.

This report does not recommend a site investigation prior to works for sites identified in the low risk category, as sites with this risk allocation present very little evidence of past contaminating activities/uses.

3.2.2 Sites requiring further assessment

Table 1 above lists the fourteen lots identified as having an elevated risk of contamination being present.

Sites with an elevated risk rating (i.e. Medium or High) potentially contain legacy contamination. Sites of elevated risk were typically attributed to lots where current or historic PCA were identified. The PCAs include the use and/or storage of hydrocarbons and/or chemicals, which may result in contamination. This study recommends that all Medium and High Risk sites o identified in Table 1 (Section 2.4) be further assessed (i.e. as Stage 2 investigations).

It is recommended that further (e.g. Stage 2) investigations be conducted for all sites identified as requiring further investigation i.e. Medium or High Risk sites). The Stage 2 investigations will generally include review of site layout plans, as constructed diagrams, licences and other information that may show the locations where PCAs were carried out, as well as indicate time-frames for these activities and any previous environmental assessment reports or decommissioning reports that may be available for review. A site inspection, and where possible interviews, would also be undertaken to confirm the database information and identify potentially contaminating land-use activities. It is proposed that limited sampling be undertaken at key locations during this process to obtain preliminary information on soil quality (particularly for High Risk sites).

Sites identified as requiring further assessment benefit from completion of the further work to identify and understand the potential contamination at a site-specific level, including potential point-sources and broadscale contamination, potential sensitive receptors, and transport and exposure pathways.

In such cases, assessment of contaminated sites should be undertaken in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) (the ASC NEPM), and the Environmental Management and Pollution Control Act 1994 (EMPCA).

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

4. Limitations

This report has been prepared by GHD for Department of State Growth (DSG) and may only be used and relied on by DSG for the purpose agreed between GHD and DSG as set out in this report.

GHD otherwise disclaims responsibility to any person other than DSG arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by DSG, and public domains/databases, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

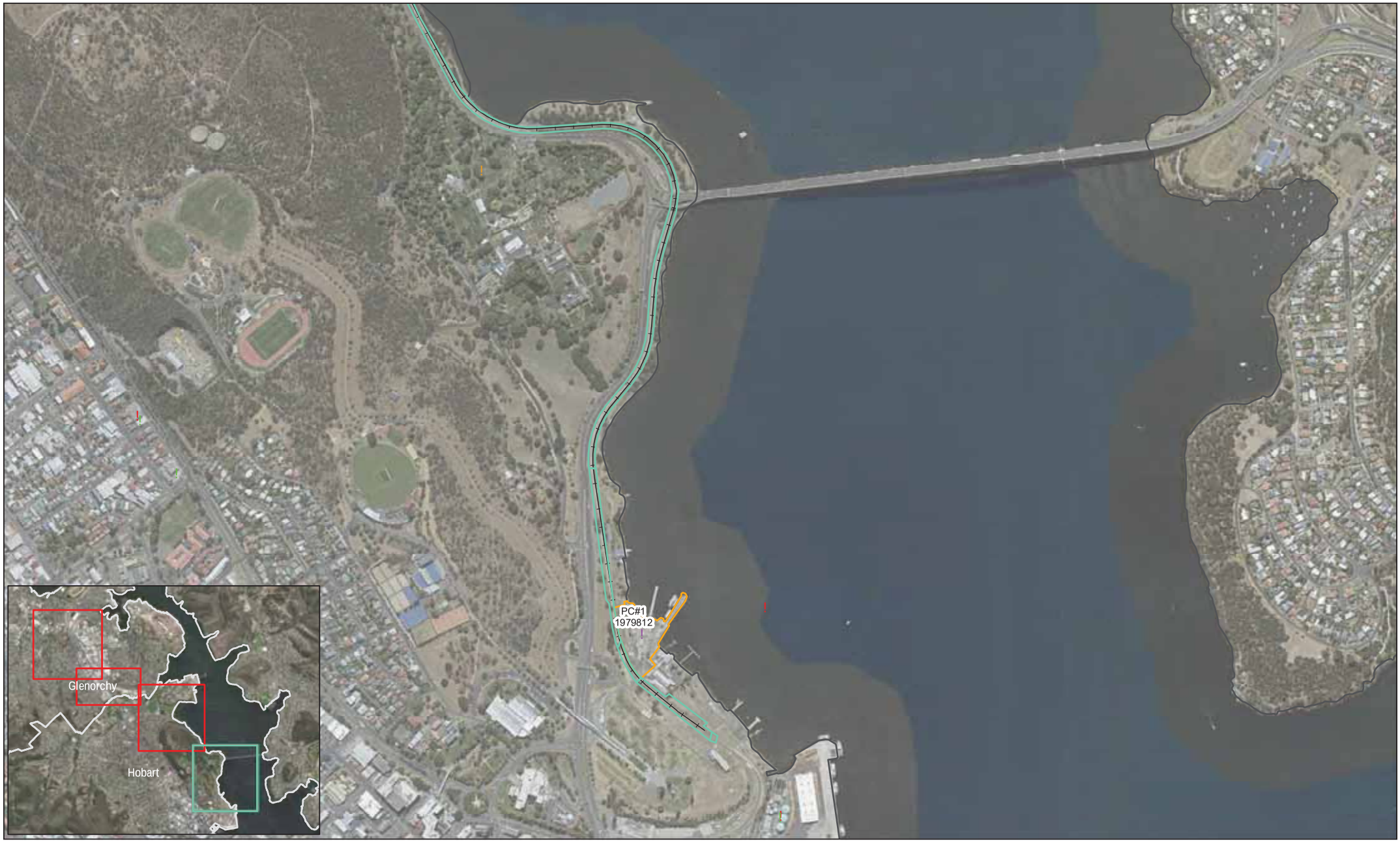
Site conditions (including the presence site contamination) may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This study was conducted entirely from a desktop-based environment and does not factor any site visits, site inspections, testing, or otherwise ground-truthing of results into the results derived. Information pertaining to historical imagery and planning information was sourced exclusively from the Land Information Services Tasmania (LIST). No information that forms the basis of this report was sourced from other entities than those mentioned in this report (including government agencies).

1 Tasmanian Government, The List: http://www.thelist.tas.gov.au. Last accessed 19 February 2021

Appendix A

Sites of Potential Concern



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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Study Area
- LGA Boundaries

Sites of potential contamination risk (ranked by risk)

- Medium
- High

- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

GHD

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	01 Sep 2021

Contamination Assessment Figure 1A

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

O

LEGEND

- Study Area
- LGA Boundaries

Sites of potential contamination risk (ranked by risk)

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- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

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Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number 12548571
Revision A
Date 01 Sep 2021

Contamination Assessment Figure 1B

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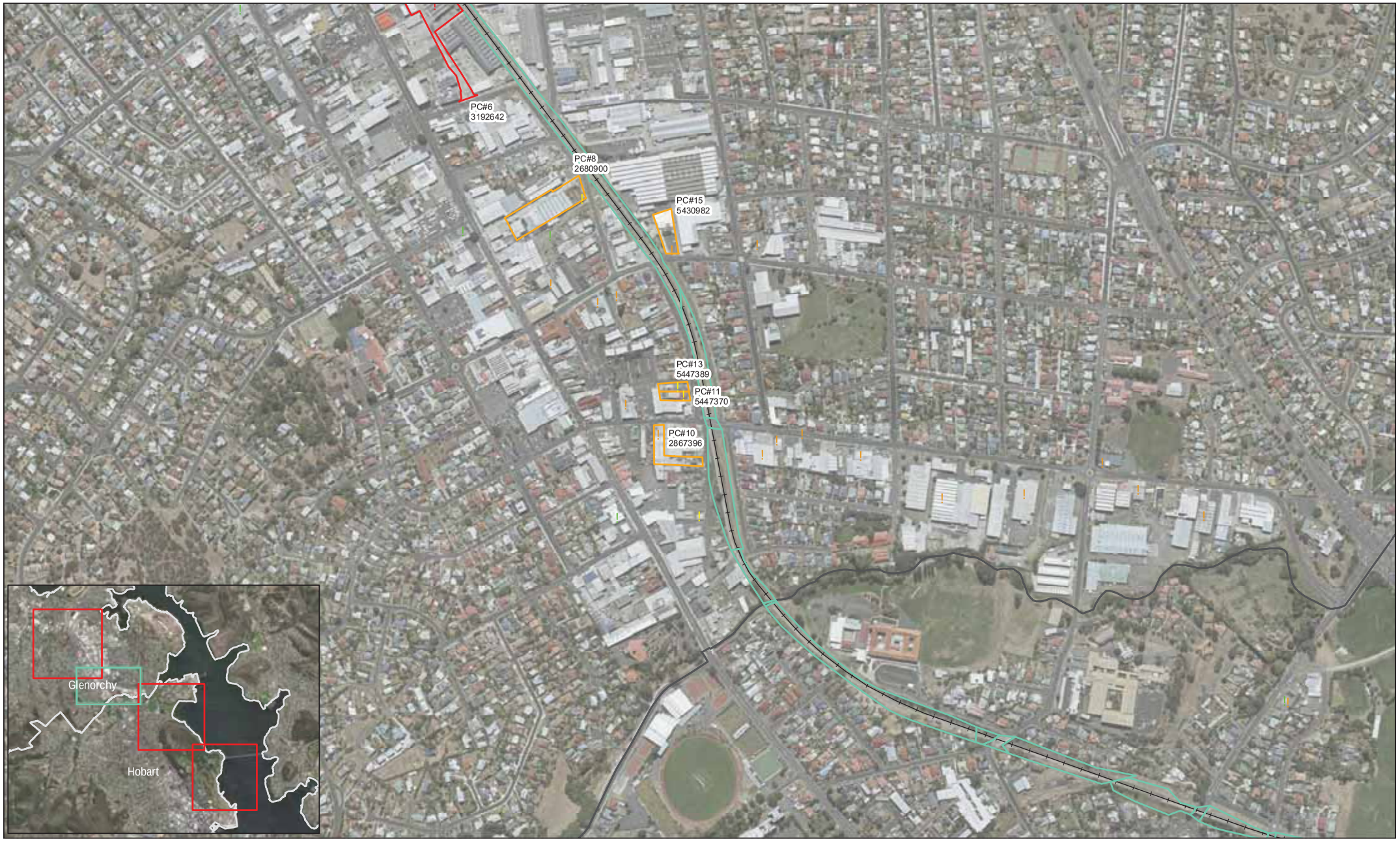

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries

Sites of potential contamination risk (ranked by risk)

- Medium
- High

- HCC Potentially Contaminated Locations
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- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	01 Sep 2021

Contamination Assessment Figure 1C

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Study Area
- LGA Boundaries

Sites of potential contamination risk (ranked by risk)

- Medium
- High

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- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

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Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number 12548571
Revision A
Date 01 Sep 2021

Contamination Assessment Figure 1D

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Appendix B

Historical Imagery

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1940

Figure 1A

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Study Area
- LGA Boundaries
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- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
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Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1940

Figure 1B

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1:6,000 @ A3

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1940

Figure 1C

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1:6,000 @ A3

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1940

Figure 1D

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

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1:8,000 @ A3

0 75 150 225 300

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1960

Figure 1A

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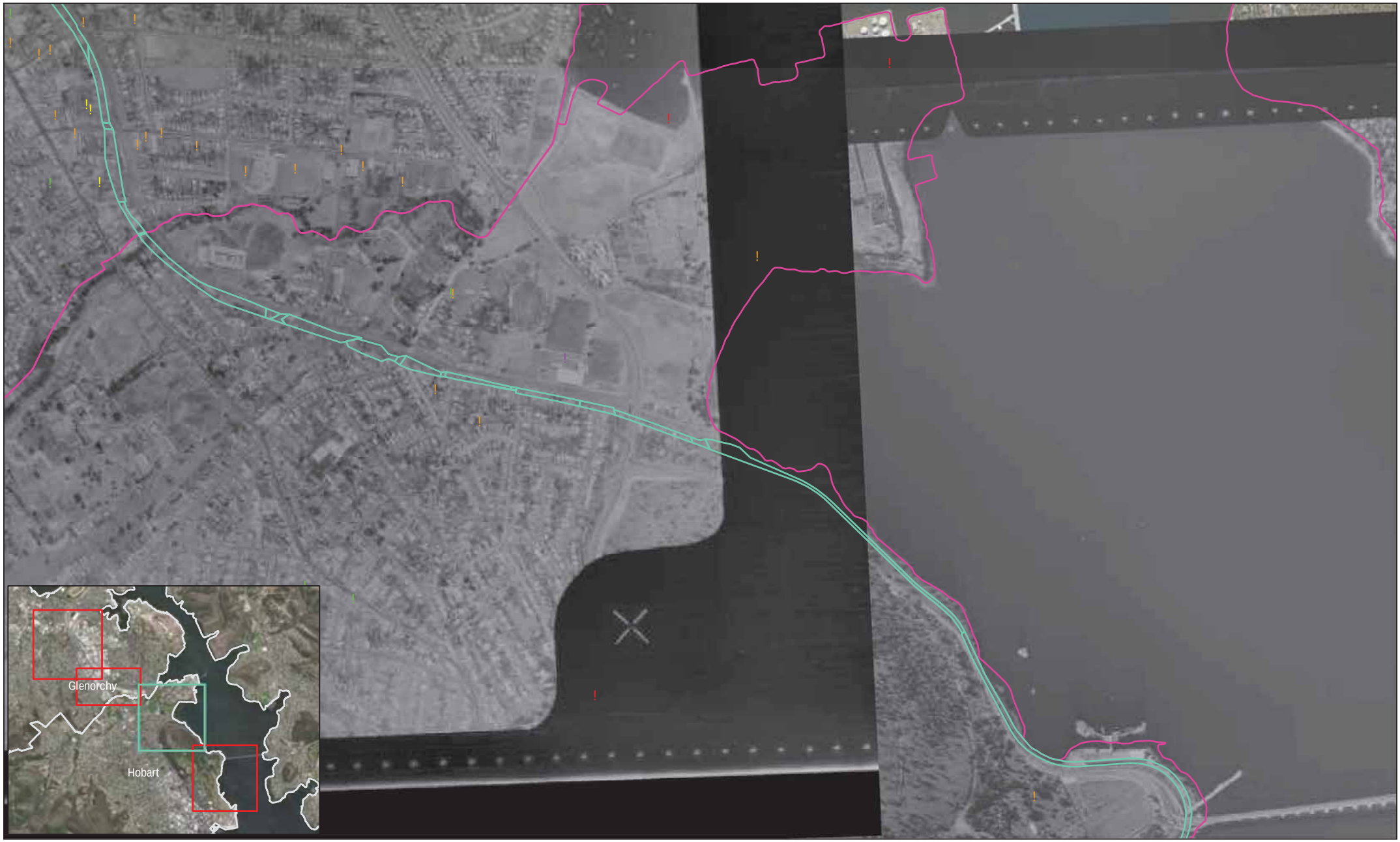
Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com



1:10,000 @ A3

0 90 180 270 360

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

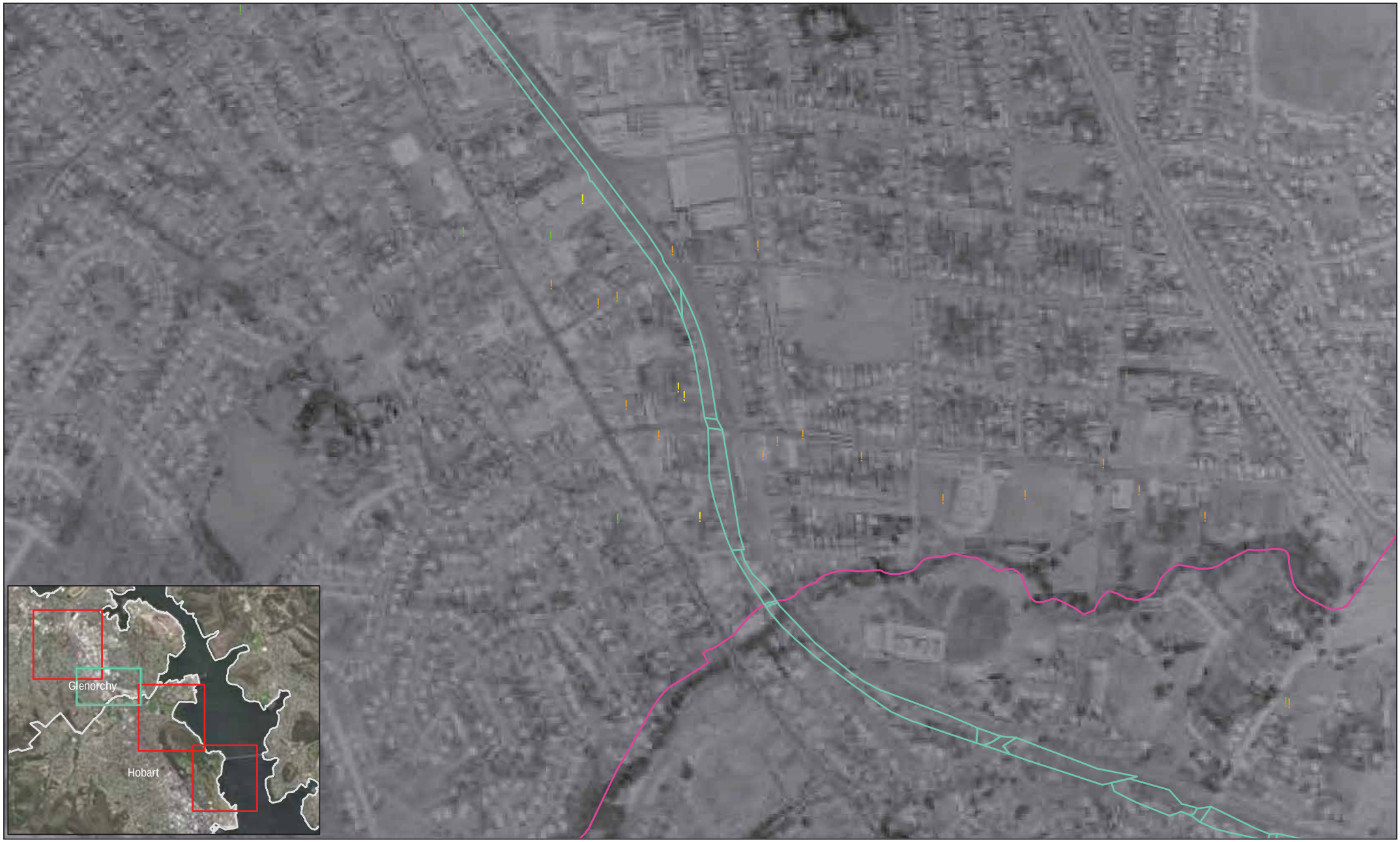
Contamination Assessment - Historical Imagery 1960

Figure 1B

G:\32\12548571GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1960_MB_RevA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com



1:6,000 @ A3

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
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- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1960

Figure 1C

G:\32\12548571\GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1960_MB_RevA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com

1:6,000 @ A3

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
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- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
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Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1960

Figure 1D

G:\32\12548571\GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1960_MB_RevA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com

1:8,000 @ A3

0 75 150 225 300

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1980

Figure 1A

G:\32\12548571\GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1980_MB_RevA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com

1:10,000 @ A3

0 90 180 270 360

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Study Area
- LGA Boundaries
- HCC Potentially Contaminated Locations
- EPA Underground Petroleum Storage Systems
- GCC Contaminated Sites
- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number 12548571
Revision A
Date 03 Sep 2021

Contamination Assessment - Historical Imagery 1980

Figure 1B

G:\32\12548571GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1980_MB_RevA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

2 Salamanca Square, Hobart Tasmania 7000 Australia **T** 61 3 6210 0600 **E** hbamail@ghd.com **W** www.ghd.com

1:6,000 @ A3

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

LEGEND

- Study Area
- LGA Boundaries
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- ERLUR Sites
- EPA RegulatedPremises

Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

Job Number	12548571
Revision	A
Date	03 Sep 2021

Contamination Assessment - Historical Imagery 1980

Figure 1C

G:\32\12548571\GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1980_MB_RevA.mxd

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0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

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Department of State Growth
Northern Suburbs Transit Corridor - Condition Assessment

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Contamination Assessment - Historical Imagery 1980

Figure 1D

G:\32\12548571\GIS\Maps\Deliverables\12548571_NSTC_Historical_Imagery_1980_MB_RevA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:tdcoates

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Appendix C

WorkSafe records

DG Site No	Address on file	File title / Comment
1745	Cnr Main Road & Peltro Street, Glenorchy	Former Police Station – note on file certifying removal of U/G tanks in 1998(?)
0283	Domain Road, Hobart	No title on system
1884	11 Lower Domain Road	Royal Tasmanian Botanical Gardens
2939	27 Queens Walk, Cornelian Bay	Crematorium – Cemetery Trust
4578	44A Bishop Street, New Town	Antique & Modern Firearms
0106	44 Bay Road, New Town	No title on system
0069	71 Risdon Road, New Town	Ampol Service Station
0249	87 Albert Road, Moonah	Bocchino Motors – UST abandoned in accordance with AS1940
2079	95 Albert Road, Moonah	Bells Removals and Storage – prev Stanley Works P/L (records from 1966-84) – at least 2 U/G tanks
2193	65 Albert Road, Moonah	Tasweld
2295	Albert Road, Moonah	BHP Titan – DG removed 1999
2354	44 Albert Road, Moonah	Valern Hotel
2390	43 Albert Road, Moonah	No title on system
3549	97 Albert Road, Moonah	Boral Plaster Board – LPG only
4561	123 Albert Road, Moonah	National Fleet Network – DG storage removed 2005
4686	107 Albert Road, Moonah	Claremont Crash Repairs – likely LPG only
4850	67 Albert Road, Moonah	Ice Tech Tas – tank removed September 2007
2465	Cnr Albert & Bowen Rds, Moonah	WD & HO Wills (Aust) Ltd (records from 1957-1990) – abandonment of 4.5KL U/G tank in accordance with AS1940
1554	60A Hopkins St, Moonah	Moonah Auto Salvage – 2013 file note states U/G tanks still in place but had been filled & fill points to the tanks have been covered over – file closed
0871	75-77 Hopkins St, Moonah	TAFE Hopkins Centre – 2006 stat dec removal of DG
1823	79 Hopkins St, Moonah	No title on system
3425	82 Hopkins St, Moonah (cnr Gormanston Rd)	Barrengers – LPG tank
4621	84 Hopkins St, Moonah	Bright Star Fireworks – all DG removed 2005
0208 & 3390	127 Derwent Park Road, Derwent Park	Besser (parallel to railway line) – LPG only (?) and Pacific Waste Management – A/G diesel & waste oil tanks removed 2000
3681	10 Derwent Park Road	Kemp & Denning – LPG only ?
1319	1/92 Derwent Park Road	Century Yuasa Batteries – DG removed 2005
0768	34 Derwent Park Road	No title on system – opp Chesterman St (?)
1915	Cnr Main & Derwent Park Roads	Sanitarium Health Food Co
2314	Derwent Park Road	No title on system
2970	11-21 Derwent Park Road	BOC Ltd – LDSL as at 2010
3793	14-16 Derwent Park Road	Coates Hire P/L – site closed 2003 - unknown DG storage
1513	90 Derwent Park Road	United Petroleum/Mobil Lutana
Mines R334	94 Derwent Park Road	Richardson's Meat Industries – 1 x 1000 gall U/G tank installed 1967
Mines S533	12 Derwent Park Road	Sims Metal Ltd – 1 x 1000 gall U/G tank installed 1974
3556 & 2242	45 Lampton Ave Derwent Park	Country Bake (1995) – LPG only Telecom Australia – U/G petrol tank decommissioned 1990-91
4552	15 Lampton Ave	Wreckair Hire – A/G diesel tank (record date range 2001-2010)
1155	Lampton Ave (unknown no.)	Housing Department – 2 x 9000L U/G tanks abandoned, filled with concrete July 1995 (date range 1968-95)
0755	6 Lampton Ave	Works Tasmania – 4 O/G tanks & 1 x LPG tank (date range 1991-98)

6693

File No. R 9

DEPARTMENT OF MINES, TASMANIA

NAME OR SUBJECT: Reed Braithwaite Stuart & Lipscombe

ADDRESS: Box 52A Hobart

Tasman Bridge Sites

cancelled.

REED, BRAITHWAITE, STUART & LIPSCOMBE

Registered Office:
23 ELIZABETH STREET,
HOBART.

U.K. Office:
MILFORD MANOR,
SALISBURY, WILTS.

Civil Engineering Contractors

TASMAN BRIDGE

SITE OFFICE:
MONTAGU POINT
G.P.O. BOX 22 A,
HOBART.

CABLES: STRONGWORK
HOBART

TELE.: 4 1542
4 1083

Our Ref.: N.816/JAAC/IB

Your Ref.:

29th August, 1962.

The Chief Inspector,
Department of Mines,
HOBART.

Dear Sir,

Persuant to Article 41 of the Explosives Regulations, we hereby make application for a license for the storage of explosives at our magazine on the site of the Western Approach works to the Tasman Bridge.

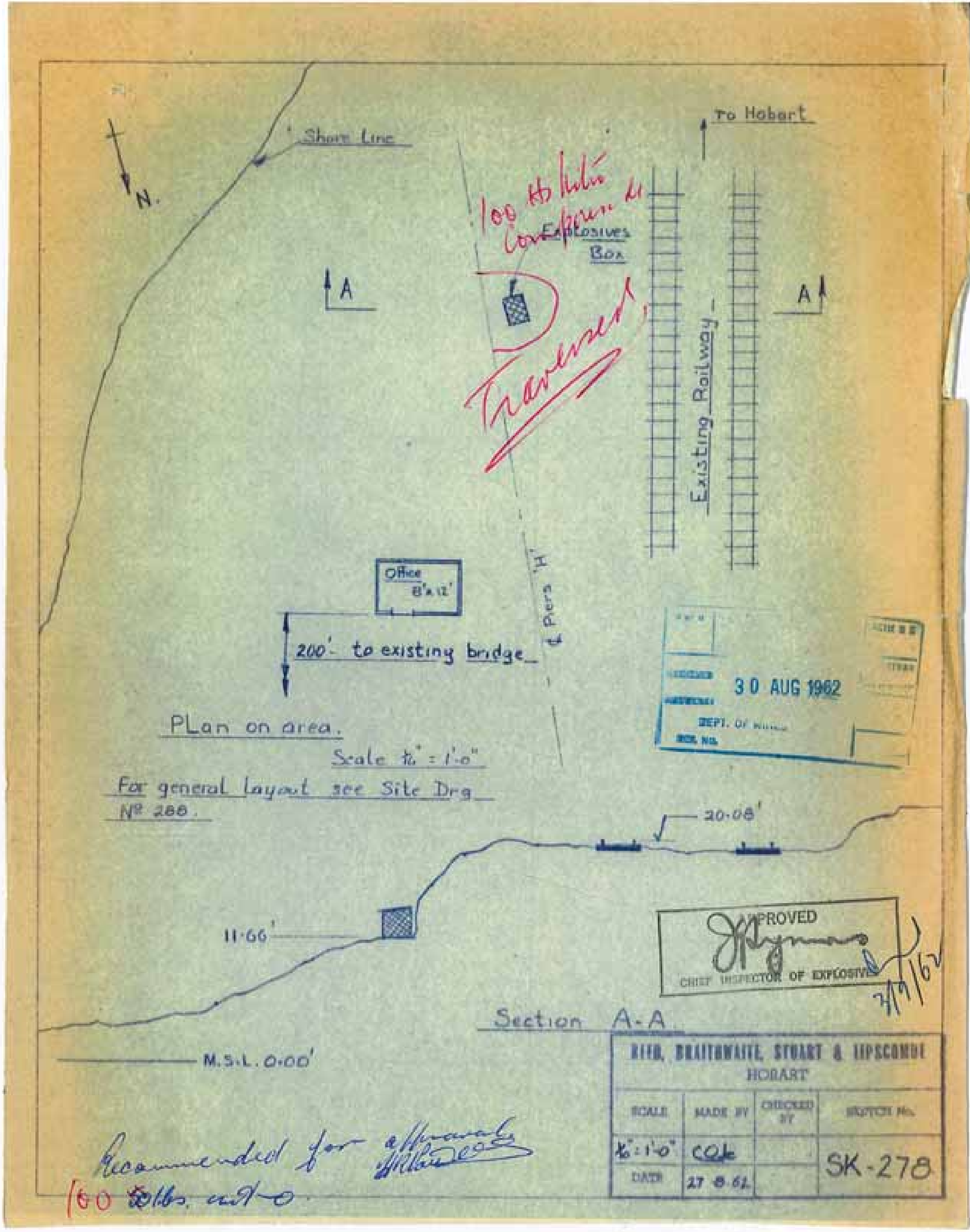
We enclose three copies of our sketch SK.278 showing the location of the magazine together with our cheque for £1. 0. 0d., being the license fee for para (e)(i) of the fourth schedule of said regulations.

We understand that your Mr. Sears, having inspected the magazine, will fill up the necessary form.

Yours faithfully,
for REED, BRAITHWAITE, STUART & LIPSCOMBE,

Project Manager

Encl.


To Hobart
Shore Line
N.
100 lb kilns Conversion to
Explosives Box
Traversed
A
A
Existing Railway
Office 8' x 12'
200' to existing bridge
℄ Piers 'H'
30 AUG 1962
DEPT. OF MINES
Plan on area.
Scale 1/16" = 1'-0"
For general layout see Site Drg No 288.
20.08'
11.66'
APPROVED
CHIEF INSPECTOR OF EXPLOSIVES
7/9/62
Section A-A
M.S.L. 0.00'
REID, BRAITHWAITE, STUART & LIPSCOMBE
HOBART
SCALE
MADE BY
CHECKED BY
SKETCH No.
1/16":1'-0"
COL
DATE
27.8.62
SK-278
Recommended for approval
100 lbs. only

Search Results (Environmentally Relevant Activity)

Site ID: 1412

Address: 94 Derwent Park Rd
Derwent Park 7009

File Number: R398

Held By: Workplace Standards Tasmania

File From: 1983 ***To:*** 1987

Location Status: Unconfirmed

PID:

Comments:

Activity:

Gas Cylinder/Tank

- Benders Spreading
- Richardsons Meat Ind.

Site ID: 1541

Address: 37 Derwent Park Rd
Moonah 7009

File Number: S793

Held By: Workplace Standards Tasmania

File From: 1983 ***To:*** 1985

Location Status: Unconfirmed

PID:

Comments:

Activity:

Gas Cylinder/Tank

Site ID: 2199

Address: (12 Derwent Park Rd)
Derwent Park 7009

File Number: S533

Held By: Workplace Standards Tasmania

File From: 1974 ***To:*** 1987

Location Status: Unconfirmed

PID:

Comments:

Activity:

Underground Storage Tank/s

Ampol
Sims Metal

Search Results (Names Associated With Site)

Site ID: 316

Address: 19 Lampton Ave
Derwent Park 7009

File Number: C584

Held By: Workplace Standards Tasmania

File From: 1973 ***To:*** 1975

Location Status: Unconfirmed

PID:

Comments:

Names Associated With Site:

S.E. Dickins Pty. Ltd.

G.J. Coles & Co. Ltd.

Coles warehouse

gas cyl / tank

Site ID: 1004

Address: Lampton Ave
Derwent Park 7009

File Number: J83

Held By: Workplace Standards Tasmania

File From: 1961 ***To:*** 1979

Location Status: Incomplete Address

PID:

Comments:

Names Associated With Site:

Johns & Waygood Ltd.

H.C. Sleigh/Golden Fleece

John Phoenix

COR/BP

USTs

Site ID: 1102

Address: Lampton Ave
Derwent Park 7009

File Number: M545

Held By: Workplace Standards Tasmania

File From: 1979 ***To:*** 1983

Location Status: Incomplete Address

PID:

Comments:

Names Associated With Site:

Montpelier Foundry

gas cyl / tank

Site ID: 1165

Address: Lampton Ave
Derwent Park 7009

File Number: J160

Held By: Workplace Standards Tasmania

File From: 1975 ***To:*** 1979

Location Status: Incomplete Address

PID:

Comments:

Names Associated With Site: gas cyl / tank

Johns & Waygood Ltd.

Johns Phoenix

Site ID: 1545

Address: 57-61 Lampton Ave
Derwent Park 7009

File Number: S581

Held By: Workplace Standards Tasmania

File From: 1969 ***To:*** 1992

Location Status: Confirmed

PID: 7651869

Comments:

Names Associated With Site:

F.H Stephens Pty. Ltd.

Sea Pak Transport Services Pty. Ltd.

Mayne Stephens (owner)

F.H Stephens Pty. Ltd.

Skyroad Express UST/s
gas cyl / tank

COR/BP

Mayne Stephens (owner)

Site ID: 1630

Address: 67 Lampton Ave
Moonah 7009

File Number: H648

Held By: Workplace Standards Tasmania

File From: 1957 ***To:*** 1986

Location Status: Confirmed

PID: 5390102

Comments:

Names Associated With Site: UST/s

Stewarts & Lloyds Pty. Ltd.

Hobart Supply

Tubemakers of Australia Ltd.

Site ID: 2358

Address: Lampton Ave
Derwent Park 7009

File Number: 0755

Held By: Workplace Standards Tasmania

File From: 1983 ***To:*** 1985

Location Status: Incomplete Address

PID:

Comments: drum/bottle storage (Inflammable liquids)

Names Associated With Site:

Department of Main Roads gas tank/cyl

Lampton Ave Depot

Site ID: 2600

Address: 6 Lampton Ave
Derwent Park 7009

File Number: 9109

Held By: Workplace Standards Tasmania

File From: 1990 ***To:*** 1993

Location Status: Unconfirmed

PID:

Comments:

Names Associated With Site: Explosives

Department of Roads & Transport

Site ID: 2738

Address: 45 Lampton Ave
Derwent Park 7009

File Number: 2242

Held By: Workplace Standards Tasmania

File From: 1979 ***To:*** 1991

Location Status: Confirmed

PID: 5380153 UST/s

Comments:

Names Associated With Site:

Telecom Australia

Appendix D

EPA Tas records

Environment Protection Authority

GPO Box 1550 HOBART TAS 7001 Australia

Enquiries: Contaminated Sites Unit
Phone: +61 3 6165 4599
Email: contaminatedsites@epa.tas.gov.au
Web: www.epa.tas.gov.au
Our Ref: (21/404: D21-72372)
Your Ref 1254571

12 August 2021

Ms Nikki Meskanen
GHD
2 Salamanca Square
HOBART TAS 7000

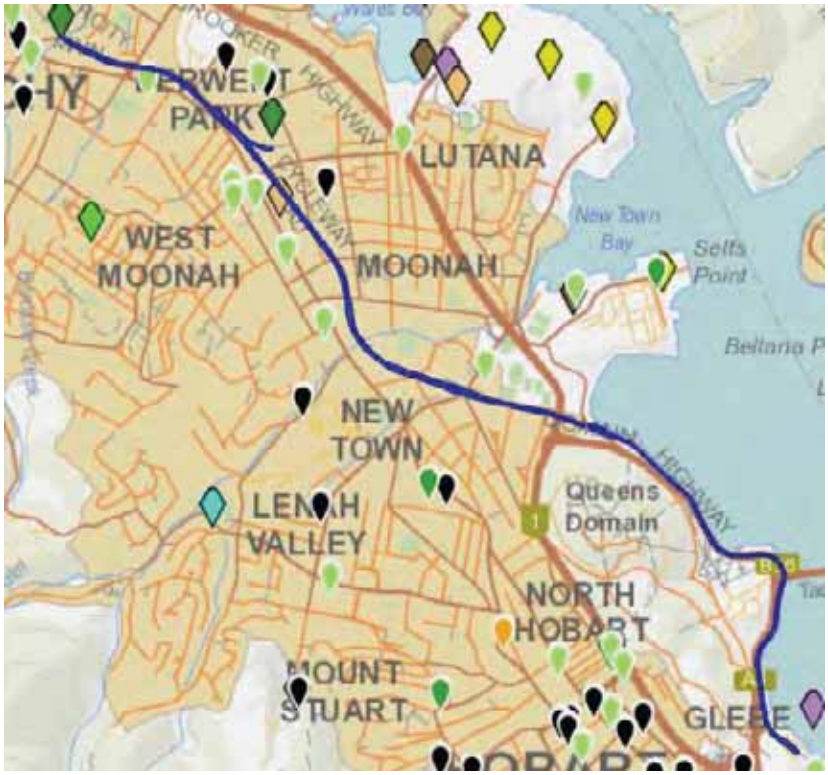
Nikki.meskanen@ghd.com

Dear Ms Meskanen

PROPERTY INFORMATION REQUEST
Rail corridor Macquarie Point to Northgate

On 3 May 2021, the Contaminated Sites Unit received your Request for information relating to the land referred to above ('the Site'). A search of relevant data sources has been undertaken.

The railway corridor would be considered potentially contaminated and the operator would have records regarding the remediation of any incidents or accidents which may have occurred within this Site.



LISTmap snip showing rail corridor with UPSS and Regulated Sites

A summary of EPA records regarding sites within 50m of the corridor.

Current regulated Sites

- Wastewater Treatment Plant at Macquarie Point (20 Hunter Street) regulated by EPA via Permit 3514 as varied Environment Protection Notice (EPN) 8880/1 and EPN 8539/1
- Timber mill at 22 Wright Street Glenorchy regulated by EPA via Permit 68 as varied EPN 7102/3
- Waste Depot at 8 Birdwood Avenue regulated by EPA via Permit Conditions Environmental 9132

Active underground petroleum storage systems (UPSS) are registered at

- 323 – 325 Main Road Glenorchy (Caltex Glenorchy)
- 20 Hunter Street

Whilst no record of contamination at these sites was found during the search, the ongoing storage of fuel is considered a potentially contaminating activity.

EPA hold historic records regarding several sites situated along the corridor which had contamination issues

- The former ANM shed at Pavilion Point circa1996
- 25-31 Main Rd, Moonah - former Service Station and automotive workshop circa 1994
- 178-180 Main Road Moonah - former galvanising yard. This land has since been subdivided, the yard may now be on Birdwood Avenue
- 1-5 Lampton Avenue waste oil refinery circa 1991

Historical WorkSafe Tasmania [WST] records refer to the storage of dangerous goods in underground storage tanks [UST] at the following sites

- Bell Street, New Town — WST file W463 (1980-88)
- 43 Bell Street, New Town — WST File P264 (1970-79)
- 5-9 Main Road, Moonah — WST Files H483 (1976-84) and U15 (1954-65)
- 19-23 Main Road, Moonah — WST File M253 (1960-75)
- 52 Albert Road, Moonah — WST File K209 (1972-86)
- 8 Gormanston Road, Moonah — WST File B939(1949-87)
- 225 Main Road, Derwent Park — WST File 0878 (1977-90)
- 231 Main Road, Derwent Park — WST File M354 (1950-52)
- 12 Derwent Park Road, Derwent Park — WST file S533 (1974-87)
- 139 Main Road, Derwent Park — WST File H118 (1968)
- 315-319 Main Road, Glenorchy — WST File H578 (1958-86)
- 387-391 Main Road, Glenorchy — WST File T227(1960-78) and W64 (1937-75)

EPA archives hold several reports written for Australian National Railway /TasRail approximately 20 years ago regarding the rail network including the former railyards at what is now “Macquarie Point Development estate”.

No other records relating to contamination or potentially contaminating activities at the Site or adjacent properties were found.

The search of records is restricted to those held by EPA and includes records relating to: The *Environmental Management and Pollution Control (Underground Petroleum Storage Systems) Regulations 2020;* Industrial Sites (which are or have been regulated by EPA); historical landfills; and contamination issues reported to the Contaminated Sites Unit. In addition, the Incidents and Complaints database and records relating to the historical storage of dangerous goods (as detailed below) are searched.
Please note that the dangerous goods licensing records referred to by EPA are for sites with underground storage tanks that ceased holding Dangerous Goods Licences prior to 1993. WorkSafe Tasmania hold the records for these Licences after 1993.

The following additional sources of contaminated sites information may also be helpful to you

- The **LIST Map** layers available. https://epa.tas.gov.au/regulation/site-information
    - ***'EPA Regulated Premises'*** identifies the location of Level 2 regulated premises as well as contaminated sites which are currently regulated. Regulatory documents related to each premises are available from this layer
    - ***'EPA Underground Petroleum Storage Systems***' shows sites where EPA has received notification of the registration, temporary decommissioning or permanent decommissioning of underground petroleum storage systems (UPSS) under the *Environmental Management and Pollution Control (Underground Petroleum Storage Systems) Regulations 2020* (UPSS Regulations).

- Local councils issue Development Approvals under the *Land Use Planning and Approvals Act 1993,* Environment Protection Notices and Environmental Infringement Notices, and record complaints. They may hold additional information that may be relevant to a potentially contaminated site.

- WorkSafe Tasmania (1300 366 322 or wstinfo@justice.tas.gov.au) may have issued dangerous goods licences and/or may hold relevant records for the Site and adjoining properties. As the storage of dangerous goods/fuels is an environmentally relevant activity, you may wish to contact them for further information.

EPA does not hold records on all sites that are or may be contaminated. You should consider obtaining a site history to determine the likelihood of contamination. If contamination on the Site or an adjacent property is considered likely, further assessment by a competent environmental assessment practitioner is recommended. Site assessments should be conducted in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, National Environment Protection Council (or as varied).
https://epa.tas.gov.au/regulation/contaminated-sites/identification-and-assessment-of-contaminated-land/contaminated-site-assessment

Please note since 1 July 2015, the Director requires all environmental site assessments and reports, submitted to the Contaminated Sites Unit for consideration, to be prepared by a person certified as a specialist contaminated sites consultant under a scheme approved by the Director.
Effective 30 June 2018, the endorsed scheme is operated by Certified Environmental Practitioners (CEnvP). Consultants certified under this scheme are approved to use the seal **CEnvP Site Contamination**.
https://www.cenvp.org.
Further details are available at: https://epa.tas.gov.au/regulation/contaminated-sites/identification-and-assessment-of-contaminated-land/engaging-a-contaminated-site-assessment-consultant

The *Environmental Management and Pollution Control (Underground Petroleum Storage Systems) Regulations 2020* contain requirements relating to the registration, operation and decommissioning of underground fuel tanks. Information is available at: https://epa.tas.gov.au/regulation/underground-fuel-tanks All underground petroleum storage systems in use after 30 March 2010 are required to be registered

Under the *Right to Information Act 2009* (RTI Act), you are entitled to apply for any records mentioned within this letter such as reports, letters, or other relevant documents. For further information on how the RTI process works and how to request information under the RTI Act please visit the Department of Primary Industries, Parks, Water and Environment website or https://dpipwe.tas.gov.au/about-the-department/governance-policies-and-legislation/right-to-information

If you are purchasing a property, you should consider Part 5A of the *Environmental Management and Pollution Control Act 1994* (EMPCA) which defines and specifies requirements for managing contaminated sites. If there is reason to believe the site is, or is likely to be, contaminated there are certain requirements that you must meet (e.g. notification of a likely contaminated site to the Director, EPA as outlined in section 74B of the EMPCA).

Although all due care has been taken in the preparation of this letter, the Crown gives no warranty, express or implied, as to the accuracy or completeness of the information provided. The Crown and its servants or agents accept no responsibility for any loss or damage arising from reliance upon this letter, and any person relying on the letter does so at their own risk absolutely.

If you have any queries in relation to the matters above, please contact the Contaminated Sites Unit using the details at the head of this correspondence or refer to the EPA website at www.epa.tas.gov.au and click on 'Regulation to locate information on Underground Fuel Tanks and Contaminated Sites.

As you are aware, property searches incur a charge of $486.00. An invoice will be emailed as instructed. If you require this letter and invoice posted, please advise the Contaminated Sites Unit.

Yours sincerely

Liz Canning
SENIOR ENVIRONMENTAL OFFICER - CONTAMINATED SITES

Email: **accountspayableAU@ghd.com**

Attachment: Invoice

ghd.com

The Power of Commitment

Appendix D

Structural Condition Assessment

Risdon Road Rail Bridge Inspection – Level 2

Structure ID	B1	Bridge Name	Risdon Road Bridge

Inspection Date: June 11, 2021

Inspected By	Nik Eduljee, Claudia Turner	Programmed / Exceptional	Exceptional – project based
Road Name	Risdon Road	Crossing	Risdon Road
Bridge Type	Braced 'I' Girder	Asset Owner	-
Construction Material	Wrought Iron	Modified /Widening?	No
Weather / Temp	Rain	Ref. No.	12548571
Project Name	Northern Suburbs Transit Corridor – Condition Assessment		
Overall Rating	Fair	Generally in fair condition, with minor elements exhibiting Condition State 4.	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo numbe/r
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
O	AP	1	GR	1	S	E	1	2	60	5	30	5	Post nearest AB 1 Scoured Kick plate deflected at S1, paint failing and corrosion of verticals (IMG_0122, IMG_0123, IMG_0127)
O	AP	1	FP	1	C	m	5	2				100	Cracked/failed (IMG_0126, IMG_0128)
O	AP	1	GR	2	S	E	1	2	60	35	5		Extended for rail safety - fencing wire used is rusting and possibly undersize (IMG_119)
O	AP	1	R	1	O	E	1	2					Nothing obvious. Condition Rating not given (IMG_0129)
O	AP	1	GR	3	S	E	1	2	60	5	30	5	Paint failing and corrosion of verticals (IMG_119)
O	S	1	FP	1	C	m	19	2		50	50		Mid joint sealant ineffective. Ground down at AB2

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo numbe/r
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
													(IMG_123, IMG_0124)
O	S	1	R	1	O	E	1	2					No comment
O	AP	2	FP	1	C	m	5	2			90	10	Core cracked / failed (IMG_0120)
O	AP	2	R	1	O	E	1	2					No comment (IMG_0119)
O	A	1	WW	1	C	E	1	2		90	10		Generally in good condition. Minor hairline cracks with calcification. Self-healed? Crack at change of direction (significant). Low voltage connection no longer used (IMG_0135 – IMG_0136)
O	A	1	B	1	S	E	4	2		75	25		Debris present. Ledge is damp, possible water leakage through interface. Apparent loss of coating. (IMG_0001 – IMG_0005, IMG_0006, IMG_0008, IMG_0031, IMG_0032, IMG_0037 – IMG_0038, IMG_0040, IMG_0048, IMG_0049, IMG_0051, IMG_0054, IMG_0055 IMG_0062, IMG_0063, 20210611_102748, 20210611_102756, IMG_0066, IMG_0067, IMG_0071, IMG_0072)
O	A	1	J	1	O	E	1	2				100	Ground down/ sealant not effective (IMG_0125)
O	A	1	A	1	C	E	1	2		100			Vertical and horizontal cracking, showing signs of calcification. Appears to be self-healed. 50-100% area affected by fine cracking. Localised delamination at interface with WW2. View partially obstructed by steel end plates. Visible dampness. (IMG_007, IMG_0010, IMG_0041, IMG_0044,

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo numbe/r
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
													IMG_0052, IMG_0062, 20210611_102748, 20210611_102756, IMG_0067 – IMG_0070, IMG_0073 – IMG_0077, IMG_0131 – IMG_0134, 20210611_103416, 20210611_103423, IMG_190 – IMG_192)
O	A	1	WW	2	C	E	1	2	90	10			Minor horizontal and hairline cracks with calcification. Appears to be self-healed. (IMG_0130)
O	S	1	G	1	S	E	4	2		60	40		Paint surface treatment starting to fail, large surface areas showing signs of rusting. Some connections showing early sign of corrosion. Two missing rivets. Splice plates appear in sound condition. Some rusting at single connection plate. Vertical stiffener, approx. mid-span, potential deflection of horizontal plate. (IMG_0100, IMG_104-IMG_109) (IMG_0008, IMG_0013 – IMG_0020, IMG_0030 – IMG_0032, IMG_0036 – IMG_0040 - IMG_0042, IMG_0053, IMG_0059 - IMG_0061, 20210611_102748, 20210611_102756, IMG_0172 – img_1075, IMG_0078, IMG_0079, IMG_0087, IMG_0089 – IMG_0093, 20210611_102748, 20210611_102756, 20210611_105648, 20210611_105648, 20210611_105730, 20210611_105737, IMG_0102, IMG_0103, IMG_193)
O	S	1	HB	1	S	E	6	2	0	100	0	0	All rivets are present, some appear loose. Some corrosion and rust spots. (IMG_0007,

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo numbe/r
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
													IMG_0009, IMG_0021 – IMG_0023, IMG_0026 – IMG_0029, IMG_0050, IMG_0081, IMG_0082, IMG_0086)
O	S	1	HB	2	S	E	6	2	0	100	0	0	Connection plates appear sound. Rust staining and signs of corrosion on bracing members. Rivets present and in good condition. (IMG_0046 - IMG_0047)
O	S	1	VB	1	S	E	5	2		100			Connection plates appear sound. Rust staining and signs of corrosion on bracing members. Rivets present and in good condition. (IMG_0024 – IMG_0026, IMG_0081, IMG_0083, IMG_0085, IMG_0089)
O	S	1	VB	2	S	E	5	2		100			Connection plates appear sound. Rust staining and signs of corrosion on bracing members. Rivets present and in good condition. (IMG_0042, IMG_0110)
O	S	1	D	1	S	E	1	2			100		Some signs of corrosion and pitting. All rivets appear to be present. Stalactites in one location. (IMG_0011, IMG_0012, IMG_0030, IMG_0033 – IMG_0036, IMG_0084, IMG_0085, IMG_0088, IMG_0089)
O	S	1	D	2	S	E	1	2			100		Stalactites forming on all splice locations. Rivet heads showing signs of corrosion. Deflection in end member. (IMG_0053, IMG_0056 – IMG_0058, IMG_0061, 20210611_102748, 20210611_102756, IMG_0090 – IMG_0093, IMG_0096 – IMG_0099, 20210611_105648, 20210611_105653, 20210611_105723,

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo numbe/r
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
													20210611_105648, 20210611_105730, 20210611_105737, IMG_0103, IMG_0165 – IMG_0171)
O	S	1	D	3	S	E	1	2			90	10	Signs of corrosion. All rivets appear present. On overhang outside B4, approx., 2 m from AB2 significant corrosion to suffit steel with section loss condition 4. (IMG_0042 - IMG_0046. IMG_0113 – IMG_0115, 20210611_111050, 20210611_111055, 20210611_111057, 20210611_111101, IMG_0154 – IMG_0159)
O	A	2	WW	1	C	E	1	2	90	10			Moss build-up on capping beam. Low voltage pole restraint. (IMG_0140 – IMG_0145, IMG_0148)
O	A	2	B	1	O	E	4	2		100			Same as AB1, moss around bearing. All seem reasonable. Signs of corrosion, no major issues. (IMG_0079 – IMG_0081, IMG_193 - IMG_0095, IMG_0082, IMG_0111, IMG_0112)
O	A	2	J	1	O	E	1	2				100	Ineffective sealant, ground covered (IMG_0121)
O	A	2	A	1	C	E	1	2	50	50			Minor horizontal and vertical cracking, with classification build up. Appears to have self-healed. Low voltage connection – no longer in use. Landing plate in poor condition with significant corrosion and deflecting. Rust affecting concrete. IMG_0080, IMG_0093 – IMG_0095, IMG_0116, IMG_0117, 20210611_111217,

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo numbe/r
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
													20210611_111218, IMG_0146, IMG_0147, IMG_0160 – IMG_0164)
O	A	2	WW	2	C	E	1	2	90	10			Horizontal crack at capping beam junction on low side. (IMG_0118, IMG_0149 – IMG_0153)

Structure ID		Bridge Name	

Key Photographs

Figure 1 *Approach 1*

Figure 2 *Approach 2*

Figure 3 *North-Eastern Elevation*

Figure 4 *South-Western Elevation*

Figure 5 *Failure of footpath concrete at Approach 1 (typical)*

Figure 6 *Joint Failure at Abutment 2*

Figure 7 *Guardrail 1 with corrosion and deflected kick plate (typical)*

Figure 8 *Build-up and moisture at bearing (typical)*

Figure 9 *Corrosion extending from steel flashing at Deck 3 (typical)*

Figure 10 *Deflection in Deck 2 end member with corrosion (typical)*

Figure 11 *Stalactites on deck soffit (typical)*

Figure 12 *Major cracking at interface between wingwall and wingwall return with spalling*

Appendices

Appendix A

Bridge Element Nomenclature

Structure ID		Bridge Name	

Bridge Element Nomenclature

Code	Name
Group	
A	Abutment
AP	Approach
S	Span
Component	
A	Abutment
B	Bearing
D	Deck
FP	Footpath
G	Girder
GR	Guard rail
HB	Horizontal bracing
J	Joint
R	Railway
VB	Vertical bracing
WW	Wingwall
Material	
C	Concrete
O	Other
S	Steel

New Town Rivulet Bridge Inspection – Level 2

Structure ID	N/A	Bridge Name	New Town Rivulet Bridge

Inspection Date: August 27, 2021

Inspected By	Nik Eduljee, Hasaranga Jinadasa	Programmed / Exceptional	Exceptional – project based
Road Name	Intercity Cycleway/Northern Suburbs Railway	Crossing	New Town Rivulet
Bridge Type	Steel Girder Bridge	Asset Owner	-
Construction Material	Steel girders and sandstone/concrete Abutments	Modified /Widening?	Yes
Weather / Temp	Overcast 7 deg	Ref. No.	12548571
Project Name	Northern Suburbs Transit Corridor – Condition Assessment		
Overall Rating	Very poor	Condition of the sandstone abutments are in very poor condition and require significant repairs. Remainder of the bridge is in fair condition.	

General site comments: No access to Abutment 2

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo number
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
O	AP	1	GR	1	S	E	1	2		100			Impact damage along the length of the fence (20210827_094928, 20210827_095110)
O	AP	1	RW	1	C	E	1	2		100			(20210827_095110)
O	AP	1	FP	1	C	m		2	100				Minor undermining due to erosion near the joint (20210827_094928)
O	AP	1	GR	2	S	E	1	2		100			Minor damages at the base of the fence. Top mesh removed halfway along S1 (20210827_095234, 20210827_095725)
O	AP	1	R	1	O	E	1	2	100				Right section of the bridge is utilised as a rail bridge. The deck is covered by ballast (20210827_095938)

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect / Location of defect / Size and severity`` / Photo number
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
O	AP	1	RW	2	C/O	E	1	2		50		50	Section of the retaining wall utilises timber sleepers. Timber sleepers have experienced heavy degradation, likely due to burns (20210827_100905)
O	S	1	FP	1	C	E	1	2	100				(20210827_094928)
O	S	1	R	1	O	E	1	2	100				The deck is covered by ballast (20210827_095938)
O	AP	2	FP	1	C	E	1	2	100				(20210827_095725)
O	AP	2	R	1	O	E	1	2	100				The deck is covered by ballast (20210827_095938)
O	AP	2	RW	1	C	E	1	2	100				The bridge only has a retaining wall one side of AP2 (20210827_100017)
O	A	1	WW	1	O	E	1	2				100	Significant cracking and mortar loss with vegetation growing through the cracking. Past repairs, in the form of repointing, is evident (20210827_100453)
O	A	1	B	1	S	E	6	2			100		Loose/missing nuts. Minor surface rusting (20210827_102120, 20210827_102125, 20210827_102140, 20210827_102148, 20210827_102158)
O	A	1	A	1	O	E	1	2		10	40	50	Sandstone wall. Significant loss of mortar, organic build up, mortar cracking (20210827_100419, 20210827_100425)

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo number
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
M	A	1	A	2	C	E	1	2	90		10		Intentional damage under the pedestrian footpath due to cast in timber (20210827_100823, 20210827_101030)
O	A	1	FP	1	T/S	m		2		80	10	10	Pedestrian footpath attached to A1. Surface rusting and section loss on the steel support members. Minor rotting of the timber deck (20210827_100254, 20210827_101015, 20210827_101030, 20210827_101231, 20210827_101305, 20210827_101307)
O	A	1	GR	1	T/S	E	1	2	100				Guard rail for the pedestrian footpath (20210827_102644)
M	A	1	F	1	C	E	1	2		100			Fines have been washed away, member in good condition (20210827_101047, 20210827_101128)
O	S	1	G	1	S	E	6	2	95	5			Minor rust spotting on G1 G2, G3, G4, G5, in good condition Minor rust spotting on G6 Some form of electrical attachment on G5 and G6 (20210827_102300, 20210827_102304, 20210827_102308)
O	S	1	XG	1	S	E	4	2	100				(20210827_102300, 20210827_102308)
O	S	1	D	1	S	E	1	2	95	5			Missed cut and shut, minor rusting

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments: Type of defect Location of defect Size and severity`` Photo number
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	
													(20210827_103033, 20210827_103122)
O	S	1	D	2	S	E	1	2	100				(20210827_103151)
O	S	1	D	3	S	E	1	2	80		20		Corroded/missing bolt heads, significant joints rusting, pitting/loss of connection, likely underneath ballast. (20210827_103205, 20210827_103213, 20210827_103229, 20210827_103242)
O	S	1	D	4	S	E	1	2	100				(20210827_103550)
O	S	1	D	5	S	E	1	2	95	5			Minor staining. Missed cut and shut (20210827_103345, 20210827_103416, 20210827_103425)
O	A	2	B	1	S	E	6	2		100			Visibility limited due to debris, the bolts that are visible appear to be in good condition (20210827_103550, 20210827_103559)
O	A	2	WW	1	O	E	1	2				100	Significant cracking. The wall appears to be on a lean (20210827_103845)
O	A	2	A	1	O	E	1	2				100	Repairs present in significant areas but still at risk, significant cracking and section loss. Visible bulging (20210827_104026)
M	A	2	A	2	C	E	1	2	90		10		Intentional defects, signs of undermining at the riverbed (20210827_104052)
M	A	2	WW	2	C/O	E	1	2	100				(20210827_104220)

Structure ID		Bridge Name	

Component Data						Units (Lm, m2, each)	Quantity	Exposure classification	Quantity per condition state				Comments:
Orig / Mod (O/M)	Group	Group Number	Component	Component Number	Component Material (P,C,S,T,O)				1	2	3	4	Type of defect Location of defect Size and severity`` Photo number
O	S	1	W	1	O	E	1	2	100				Generally natural surface, concrete overpour at A2 (20210827_104052)

Structure ID		Bridge Name	

Key Photographs

Figure 1 *Approach 1*

Figure 2 *Approach 2*

Figure 3 *South-Western Elevation*

Figure 4 *Deteriorated sandstone wall at Abutment 1*

Figure 5 *Deteriorated sandstone wall and wingwall movement at Abutment 2*

Figure 6 *Bulging in the sandstone wall at Abutment 2*

Figure 7 *Deteriorated bolts connecting the girders to the deck*

Figure 8 *Inadequate bolts at the bearings (typical)*

Appendices

Appendix A

Bridge Element Nomenclature

Structure ID		Bridge Name	

Table 1 Bridge Element Nomenclature

Code	Name
Group	
A	Abutment
AP	Approach
S	Span
Component	
A	Abutment
B	Bearing
D	Deck
F	Footing
FP	Footpath
G	Girder
GR	Guard rail
R	Railway
RW	Retaining wall
W	Waterway
WW	Wingwall
XG	Cross girder
Material	
C	Concrete
O	Other
S	Steel

Appendix E

Geotechnical Hazard Plans

Paper Size ISO A4

0 0.25 0.5 0.75 1

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

O

GHD

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Northern Suburbs Transit Corridor
Condition Assessment

Project No. 12548571
Revision No. A
Date 31/08/2021

Geotechnical Hazard Plans

Figure 1

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Figure 1 of 11

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Kilometers

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Geotechnical Hazard Plans

Figure 2 of 11

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Kilometers

Map Projection: Transverse Mercator
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Geotechnical Hazard Plans

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Kilometers

Map Projection: Transverse Mercator
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Kilometers

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Geotechnical Hazard Plans

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Kilometers

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Geotechnical Hazard Plans

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Geotechnical Hazard Plans

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0 0.025 0.05 0.075 0.1

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Northern Suburbs Transit Corridor
Condition Assessment

Project No. 12548571
Revision No. A
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Geotechnical Hazard Plans

Figure 9 of 11

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0 0.025 0.05 0.075 0.1

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Northern Suburbs Transit Corridor
Condition Assessment

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Geotechnical Hazard Plans

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Appendix F

Geotechnical Hazard Summary

Geotechnical Hazard Summary

OBJECT ID	TYPE	KPS (Start)	KPS (End)	Hazard Type	Hazard/Object Description & Notes
1	POLYGON	0.55	0.74	Cutting	Dolerite cutting western side of transit corridor, approximately 2.5 metres high.
2	POINT	0.55		Cutting	Dolerite cutting on western side of transit corridor.
3	POINT	0.61		Cutting	Weathered dolerite cutting, high strength, blocky on western side of corridor. Approximately 2.5 metres high.
4	POINT	0.62		Cutting	Weathered dolerite cutting, high strength, blocky on western side of corridor. Approximately 2.5 metres high.
5	POINT	0.63		Adjacent feature	Cracked abutment on pedestrian overpass.
6	POINT	0.74		Cutting	End of dolerite cutting western side of transit corridor.
7	POINT	0.80		Cutting	Weathered dolerite cutting, high strength, on western side of corridor. Approximately 2.5 metres high.
8	POINT	0.81		Widening	Narrowing corridor, difficult for widening.
9	POINT	0.83		Drainage feature	Culvert 279
10	POINT	0.84		Formation	Rail embankment eastern side comprised of gravelly clay fill. Embankment approximately 1.5 to 2.0 metres high.
11	POINT	0.89		Formation	Embankment steep on eastern side, significant earthworks required for widening.
12	POINT	0.94		Widening	Narrow corridor, significant earthworks required for widening.
13	LINE	0.97		Widening	Room on eastern side for widening.
14	POINT	1.05		Drainage feature	Culvert 494
15	POINT	1.11		Drainage feature	Culvert 562
16	POINT	1.12		Widening	Steep batter adjacent to cycle path.
17	LINE	1.12	1.19	Widening	Room on eastern side for widening.
18	POINT	1.18		Slope stability	Existing retaining walls adjacent to access ramp and cycle way, western side.
19	POLYGON	1.28	1.31	Slope stability	Potential embankment instability, trees planted for additional stability. Culvert covered in vegetation.
20	LINE	1.28	1.37	Widening	Embankment steep on eastern side, significant earthworks required for widening.
21	POINT	1.29		Drainage feature	Culvert 726
22	POLYGON	1.31	1.34	Slope stability	Potential embankment instability on eastern side. Steep embankment, rock evident at base.
23	POINT	1.38		Drainage feature	Culvert 866
24	LINE	1.39	1.47	Widening	Narrow corridor, embankment drops off approx. 1:1 on eastern side. Significant earthworks required for widening., Possible small failures/slips, small trees planted for additional stability.
25	POINT	1.41		Drainage feature	Culvert 900

OBJECT ID	TYPE	KPS (Start)	KPS (End)	Hazard Type	Hazard/Object Description & Notes
26	LINE	1.48	1.86	Widening	Steep road cutting adjacent to cycle path (road fill over dolerite). Formation drops off steep on eastern side, significant earthworks required for widening.
27	POINT	1.57		Drainage feature	Culvert 1070
28	POINT	1.57		Slope stability	Small embankment slip, scoop shape
29	LINE	1.67	1.88	Slope stability	Small retaining wall at base of road embankment, adjacent to cycle path. Approximately 0.6 metres high.
30	POINT	1.68		Drainage feature	Culvert 1138
31	POLYGON	1.70	1.77	Slope stability	Potential slope instability including rock falls. Dolerite ledge at base.
32	POINT	1.73		Drainage feature	Culvert 1163
33	POLYGON	1.80	1.88	Widening	Steep and narrow embankment, difficult for widening. Dolerite outcropping at base.
34	POINT	1.83		Drainage feature	Culvert 1186
35	POINT	1.84		Drainage feature	Culvert 1294
36	POINT	1.87		Drainage feature	Culvert 1374
37	POINT	1.87		Widening	Bridge piers for Tasman Bridge overpass. Would obstruct widening works.
38	POINT	1.94		Slope stability	Retaining wall on western side for adjacent pedestrian and cycle access ramp. Approximately 1 metre high and 20 metres long.
39	LINE	1.96	2.06	Cutting	Road embankment adjacent to transit corridor on western side. Comprises dolerite cobbles and clay over weathered dolerite, approximately 3.5 to 4 metres high.
40	POINT	2.04		Drainage feature	culvert 1409
41	LINE	2.08	2.23	Cutting	Weathered dolerite cutting on western side of corridor. High strength, jointed. Approximately 4 to 5 metres high.
42	POINT	2.12		Slope stability	Minor rock fall, dolerite cobbles and boulders.
43	POINT	2.18		Slope stability	Minor rock fall, dolerite cobbles and boulders. Trees and shrubs also fallen from cutting face.
44	POINT	2.20		Slope stability	Minor rock fall, dolerite cobbles and gravel. Dolerite is highly jointed and dips unfavourably out of the cutting face.
45	POINT	2.25		Sub grade	Soft ground predominantly on the western side of the transit corridor. Saturated silty sub grade, for approximately 20 to 25 metres.
46	LINE	2.38	2.51	Slope stability	Sea wall adjacent to formation on the eastern side of the transit corridor, about 1.5 to 2 metres from edge of ballast. Approximately 2 metres high, and 1H:1.5V.
47	POINT	2.38		Drainage feature	Culvert 1824
48	POINT	2.43		Drainage feature	Culvert 1886
49	POINT	2.45		Adjacent feature	Existing rail platform, adjacent to cycle path on western side of transit corridor.
50	POINT	2.52		Widening	Narrow corridor, significant earthworks required for widening.
51	POINT	2.52		Drainage feature	Culvert 1971

OBJECT ID	TYPE	KPS (Start)	KPS (End)	Hazard Type	Hazard/Object Description & Notes
52	POLYGON	2.55	2.70	Slope stability	Retaining wall adjacent to cycle path. Approximately 0.7 to 0.8 metres high
53	POINT	2.68		Drainage feature	Culvert 2129
54	LINE	2.70	2.80	Widening	Narrow corridor. Embankment drops off to beach, approximately 1H:1V, well vegetated. Difficult for widening.
55	POINT	2.79		Drainage feature	Culvert 2248
56	LINE	2.82	2.85	Widening	Narrow corridor. Embankment drops off towards beach. Access track halfway down embankment on eastern side, difficult for widening.
57	POINT	2.82		Formation	Ballast thicker for approximately 10 metres on eastern side. Ballast layer up to 1.5 metres thick.
58	POINT	2.87		Formation	Thicker section of ballast and rock fill, approximately 10 metres wide and up to 1.5 metres thick.
59	POINT	2.90		Drainage feature	Culvert 2343
60	LINE	3.04	3.38	Widening	Narrow corridor. Embankment drops off to beach. Difficult for widening.
61	POINT	3.07		Drainage feature	Culvert 2515
62	LINE	3.13	3.19	Cutting	Weathered dolerite cutting adjacent to cycle track. Highly fractured, high strength. Approximately 2 metres high.
63	POINT	3.13		Drainage feature	Culvert 2583
64	POINT	3.18		Drainage feature	Culvert 2583
65	POINT	3.23		Drainage feature	Culvert 2683
66	POINT	3.44		Drainage feature	Culvert 2891
67	LINE	3.45	3.73	Cutting	Sandstone cutting adjacent to cycle path, 1H:1V. Approximately 3 to 4 metres high.
68	LINE	3.46	3.64	Widening	Narrow corridor. Embankment drops off towards beach. Access track to Cornelian Bay adjacent to embankment on eastern side, difficult for widening.
69	POINT	3.61		Drainage feature	Culvert
70	POINT	3.70		Adjacent feature	Existing rail platform, eastern side.
71	LINE	3.83	4.04	Slope stability	Retaining wall adjacent to cycle path, approximately 0.8 metres high.
72	LINE	4.06	4.42	Formation	Embankment on northern side, slope 25 degrees, up to approximately 2.5 metres high. Grassed.
73	POINT	4.18		Drainage feature	Culvert/manhole Ch 3620
74	POINT	4.32		Adjacent feature	Pedestrian level crossing
75	POLYGON	4.43	4.57	Adjacent feature	Existing rail platform
76	LINE	4.59	4.69	Formation	Steep embankment northern side creating narrow corridor. Slope 40 degrees and up to 8 metres high. Grassed. Gravel/ballast and earthfall construction evident.
77	LINE	4.61	4.70	Formation	Steep embankment, grassed, slope 30 to 35 degrees. Vegetated with wattles, possible shallow roots. Evidence of rock/earth fill in slope.
78	LINE	4.64	4.69	Adjacent feature	Recent works to connect new power poles. Not related to slope instability.

OBJECT ID	TYPE	KPS (Start)	KPS (End)	Hazard Type	Hazard/Object Description & Notes
79	POINT	4.70		Formation	Settlement cracking in concrete slabs on southern abutment.
80	POINT	4.71		Adjacent feature	Bridge abutment, cracked concrete.
81	POINT	4.72		Formation	North abutment concrete settlement cracks and displaced slabs. Approximately 20 mm displacement.
82	LINE	4.73	4.88	Slope stability	Steep embankment, approximately 40 degrees vegetated with grasses and weeds. Hummocky slope possibly related to small instabilities within embankment.
83	LINE	4.73	4.89	Formation	Embankment, long grasses/vegetation obscure view of slope surface
84	LINE	4.75	4.80	Formation	Settlement of existing rail track, tension cracks observed. Maximum 0.3 metres vertical displacement on south side. Inward rotation of left rail (north bound).
85	POINT	4.76		Slope stability	Leaning light tower.
86	POINT	4.77		Slope stability	Displacement of concrete slabs. Vertical displacement up to 20 mm, laterally up to 40 mm.
87	POLYGON	4.78	4.81	Formation	Tension cracking in adjacent cycle path.
88	POINT	4.84		Slope stability	Leaning light tower.
89	LINE	4.91	5.28	Slope stability	Retaining wall adjacent to cycle path, steel post timber waler. No obvious overturning. Some bulging of timbers, up to 1.2 metres high, generally 0.6 to 1.0 metres. Cutting behind wall is up to 4.5-5.0 metres high on western end. Slope angle approximately 40-45 degrees.
90	POINT	4.99		Slope stability	Slope remediation adjacent to cycle path. Fence at crest leaning outward.
91	LINE	5.00	5.06	Slope stability	Overturning fence posts.
92	LINE	5.07	5.09	Adjacent feature	Undermining at toe of southern bridge abutment.
93	POINT	5.08		Widening	Bridge piers for overpass. Would obstruct widening works.
94	LINE	5.12	5.17	Slope stability	Debris at toe of small cutting, slope approximately 30 to 35 degrees. Gravel sand silt mixture.
95	LINE	5.37	5.53	Formation	Embankment, up to 2 metres high. Variable slope angle between 25 and 30 degrees.
96	POLYGON	5.43	5.47	Formation	Additional ballast. Slight increase of ballast under and around track. Possible bulging on downstream face.
97	POINT	5.47		Adjacent feature	New school building.
98	POLYGON	5.49	5.53	Formation	Additional ballast, settlement of rail line. Widening of downstream face, inclusion of bench. Post in image is 0.95 metres high.
99	POINT	5.64		Adjacent feature	Pedestrian level crossing.
100	LINE	5.66	5.70	Adjacent feature	Existing rail platform, northern side.
101	LINE	5.73	5.85	Adjacent feature	Existing rail platform, southern side.
102	POINT	5.86		Adjacent feature	Numerous underground services including Gas, signal box.
103	POINT	5.88		Adjacent feature	Level crossing
104	POINT	5.92		Widening	Room for widening transit corridor.
105	POINT	6.33		Widening	Room for widening transit corridor.

OBJECT ID	TYPE	KPS (Start)	KPS (End)	Hazard Type	Hazard/Object Description & Notes
106	LINE	6.41	6.47	Formation	Small embankment, approximately 1.0 to 1.5 metres high. Gentle grassed slope.
107	POINT	6.49		Adjacent feature	Level crossing
108	POINT	6.51		Adjacent feature	High pressure gas line
109	POINT	6.55		Formation	Room for widening transit corridor.
110	LINE	6.88	6.94	Slope stability	Gabion rock wall installed adjacent to formation, 0.8 metres high. Failed at midsection, replaced with heavier duty baskets.
111	POINT	6.92		Adjacent feature	Repaired gabion baskets, heavy duty.
112	POINT	6.96		Adjacent feature	Level crossing, switching and signage.
113	LINE	6.99	7.03	Slope stability	Small retaining wall, concrete.
114	LINE	7.05	7.16	Formation	Settlement at the back of the building adjacent to the transit corridor.
115	POINT	7.15		Adjacent feature	Minor repairs to adjacent cycleway.
116	POINT	7.16		Widening	Narrow corridor between adjacent buildings and cycleway (approximately 8.5 metres).
117	LINE	7.20	7.22	Slope stability	0.5 metre high small retaining structure, concrete.
118	POINT	7.22		Adjacent feature	SW manhole
119	LINE	7.24	7.38	Adjacent feature	Existing rail platform.
120	POINT	7.24		Adjacent feature	SW manhole
121	POINT	7.29		Adjacent feature	Overturning platform
122	LINE	7.35	7.39	Formation	Grassed embankment, slope 20 degrees and approximately 1.0 metre high.
123	POINT	7.39		Adjacent feature	SW manhole
124	LINE	7.49	7.57	Widening	Narrow corridor between adjacent private land and cycleway (approximately 9.0 metres).
125	POINT	7.59		Adjacent feature	Level crossing, switching boxes and signal signs.
126	LINE	7.60	7.74	Adjacent feature	TasGas pipeline.
127	POINT	7.61		Adjacent feature	Optus, tpg, Telstra services.
128	POINT	7.74		Adjacent feature	Pedestrian level crossing.
129	LINE	7.75	7.95	Cutting	Grassed slope adjacent to cycleway, approximately 25 degrees and about 2.0 metres high.
130	LINE	7.76	7.93	Cutting	Grassed slope adjacent to corridor, up to 20 degrees, approximately 1.5 to 2.0 metres high (typically <20 degrees).
131	POINT	7.85		Widening	Narrow corridor between toe of adjacent cutting and cycleway (approximately 8.0 metres).
132	POINT	7.96		Widening	Narrow corridor between adjacent buildings and cycleway (approximately 7.0 metres).
133	LINE	7.97	8.03	Widening	Narrow corridor between adjacent buildings and cycleway.
134	LINE	8.03	8.09	Formation	Rail embankment slope approximately 20 to 25 degrees and about 1.0 metre high.
135	LINE	8.15	8.19	Formation	Rail embankment 1.2 metres high, unretained grass slope

OBJECT ID	TYPE	KPS (Start)	KPS (End)	Hazard Type	Hazard/Object Description & Notes
136	POINT	8.21		Adjacent feature	Level crossing
137	LINE	8.22	8.37	Formation	Rail embankment slope approximately 25 to 30 degrees and up to 2.0 metre high.
138	LINE	8.27	8.27	Widening	Very narrow corridor, difficult to widen (maximum overall width approximately 4.5 to 5.0 metres).
139	POINT	8.28		Adjacent feature	Sandstone headwall and culvert protection.
140	POINT	8.28		Adjacent feature	Storm water junction/basin.
141	LINE	8.34	8.36	Other geotechnical	Seepage from North side of rail line. Saturated underfoot with ponding water adjacent to building. Minor slope failure at crest.
142	LINE	8.39	8.51	Other geotechnical	Ponding water in drain.
143	LINE	8.51	8.54	Adjacent feature	Existing rail platform.

Appendix G

Geotechnical Photo Summary

Appendix A –Geotechnical hazard photos

KPS 0.55 (Object ID 2)

KPS 0.61 (Object ID 3)

KPS 0.62 (Object ID 4)

KPS 0.63 (Object ID 5)

KPS 0.74 (Object ID 6)

KPS 0.80 (Object ID 7)

KPS 0.81 (Object ID 8)

KPS 0.83 (Object ID 9)

KPS 0.84 (Object ID 10)


KPS 0.89 (Object ID 11)

KPS 0.94 (Object ID 12)

KPS 0.97 (Object ID Line 13)

KPS 1.05 (Object ID 14)

KPS 1.11 (Object ID 15)

KPS 1.12 (Object ID 16)

KPS 1.12 (Object ID Line 17)

KPS 1.18 (Object ID 18)

KPS 1.28 (Object ID Polygon 19)

KPS 1.28 (Object ID Line 20)

KPS 1.29 (Object ID 21)

KPS 1.31 (Object ID Polygon 22)

KPS 1.38 (Object ID 23)

KPS 1.39 (Object ID Line 24)

KPS 1.41 (Object ID 25)



KPS 1.48 (Object ID Line 26)


KPS 1.57 (Object ID 27)


KPS 1.57 (Object ID 28)


KPS 1.67 (Object ID Line 29)


KPS 1.68 (Object ID 30)



KPS 1.70 (Object ID Polygon 31)


KPS 1.73 (Object ID 32)


KPS 1.80 (Object ID polygon 33)

KPS 1.83 (Object ID 34)


KPS 1.84 (Object ID 35)

KPS 1.87 (Object ID 36)

KPS 1.87 (Object ID 37)

KPS 1.94(Object ID 38)

1.96 (Object ID Line 39)

KPS 2.04 (Object ID 40)

KPS 2.08 (Object ID Line 41)

KPS 2.12 (Object ID 42)

KPS 2.18 (Object ID 43)


KPS 2.20 (Object ID 44)



KPS 2.25 (Object ID 45)


KPS 2.38 (Object ID Line 46)

KPS 2.38 (Object ID 47)

KPS 2.43 (Object ID 48)

KPS 2.45(Object ID 49)

KPS 2.52 (Object ID 50)

KPS 2.52 (Object ID 51)

KPS 2.55 (Object ID Polygon 52)

KPS 2.68 (Object ID 53)



KPS 2.70 (Object ID Line 54)

KPS 2.79 (Object ID 55)


KPS 2.82 (Object ID Line 56)

KPS 2.82 (Object ID 57)

KPS 2.87 (Object ID 58)

KPS 2.90 (Object ID 59)

KPS 3.04 (Object ID Line 60)

KPS 3.07(Object ID 61)


KPS 3.13 (Object ID Line 62)

KPS 3.13 (Object ID 63)


KPS 3.23 (Object ID 65)

KPS 3.44 (Object ID 66)

KPS 3.45 (Object ID Line 67)

KPS 3.46 (Object ID Line 68)

KPS 3.70 (Object ID 70)


KPS 3.83 (Object ID Line 71)

KPS 4.06 (Object ID Line 72)


KPS 4.18 (Object ID 73)


KPS 4.32 (Object ID 74)


KPS 4.43 (Object ID Polygon 75)



KPS 4.59 (Object ID Line 76)


KPS 4.64 (Object ID Line 78)

KPS 4.70 (Object ID 79)

KPS 4.71 (Object ID 80)

KPS 4.72 (Object ID 81)

KPS 4.73 (Object ID Line 82)

KPS 4.73 (Object ID Line 83)

KPS 4.75 (Object ID Line 84)

KPS 4.76 (Object ID 85)



KPS 4.77 (Object ID 86)




KPS 4.78 (Object ID Polygon 87)

KPS 4.84 (Object ID 88)

KPS 4.91 (Object ID Line 89)

KPS 4.99 (Object ID 90)

KPS 5.00 (Object ID Line 91)

KPS 5.07 (Object ID Line 92)

KPS 5.08 (Object ID 93)

KPS 5.12 (Object ID Line 94)

KPS 5.37 (Object ID Line 95)

KPS 5.43(Object ID polygon 96)

KPS 5.47 (Object ID 97)

KPS 5.49 (Object ID Polygon 98)

KPS 5.64 (Object ID 99)

KPS 5.66 (Object ID Line 100)

KPS 5.73(Object ID Line 101)

KPS 5.86 (Object ID 102)


KPS 5.88 (Object ID 103)


KPS 5.92 (Object ID 104)


KPS 6.33(Object ID 105)


KPS 6.41 (Object ID Line 106)


KPS 6.49 (Object ID 107)

KPS 6.51 (Object ID 108)


KPS 6.55 (Object ID 109)

KPS 6.88 (Object ID Line 110)

KPS 6.92(Object ID 111)

KPS 6.96 (Object ID 112)

KPS 6.99 (Object ID Line 113)


KPS 7.05 (Object ID Line 114)


KPS 7.15 (Object ID 115)


KPS 7.16 (Object ID 116)


KPS 7.20 (Object ID Line 117)

KPS 7.22 (Object ID 118)




KPS 7.24 (Object ID Line 119)

KPS 7.24 (Object ID 120)


KPS 7.29 (Object ID 121)


KPS 7.35 (Object ID Line 122)


KPS 7.39 (Object ID 123)


KPS 7.49 (Object ID Line 124)


KPS 7.59 (Object ID 125)

KPS 7.60 (Object ID Line 126)

KPS 7.61 (Object ID 127)


KPS 7.74 (Object ID 128)

KPS 7.75 (Object ID Line 129)



KPS 7.76 (Object ID Line 130)


KPS 7.85 (Object ID 131)

KPS 7.96 (Object ID 132)


KPS 7.97 (Object ID Line 133)


KPS 8.03 (Object ID Line 134)



KPS 8.15 (Object ID Line 135)

KPS 8.21 (Object ID 136)

KPS 8.22 (Object ID Line 137)

KPS 8.27 (Object ID Line 138)


KPS 8.28 (Object ID 139)




KPS 8.28 (Object ID 140)

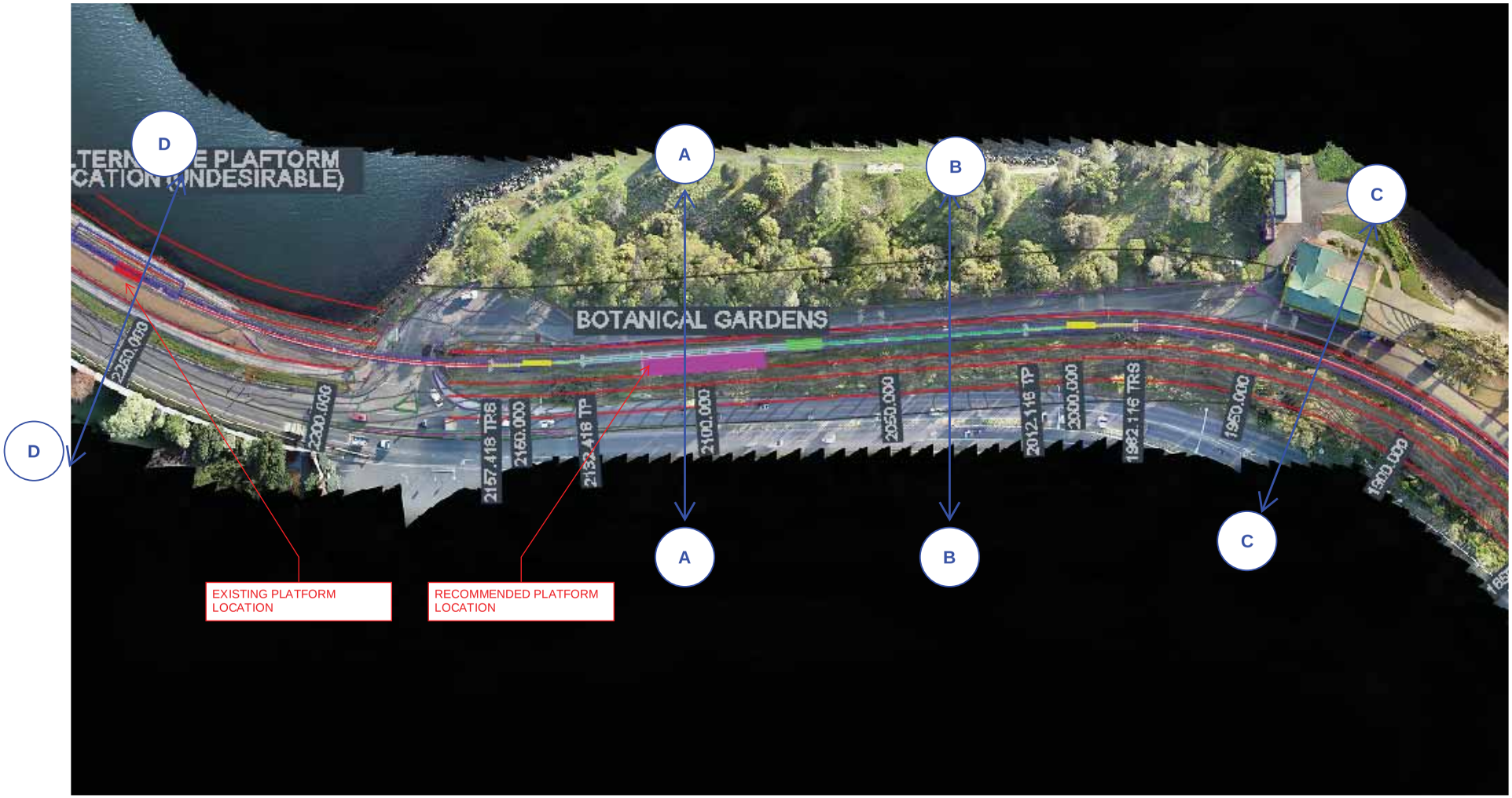
KPS 8.34 (Object ID Line 141)

KPS 8.39 (Object ID Line 142)

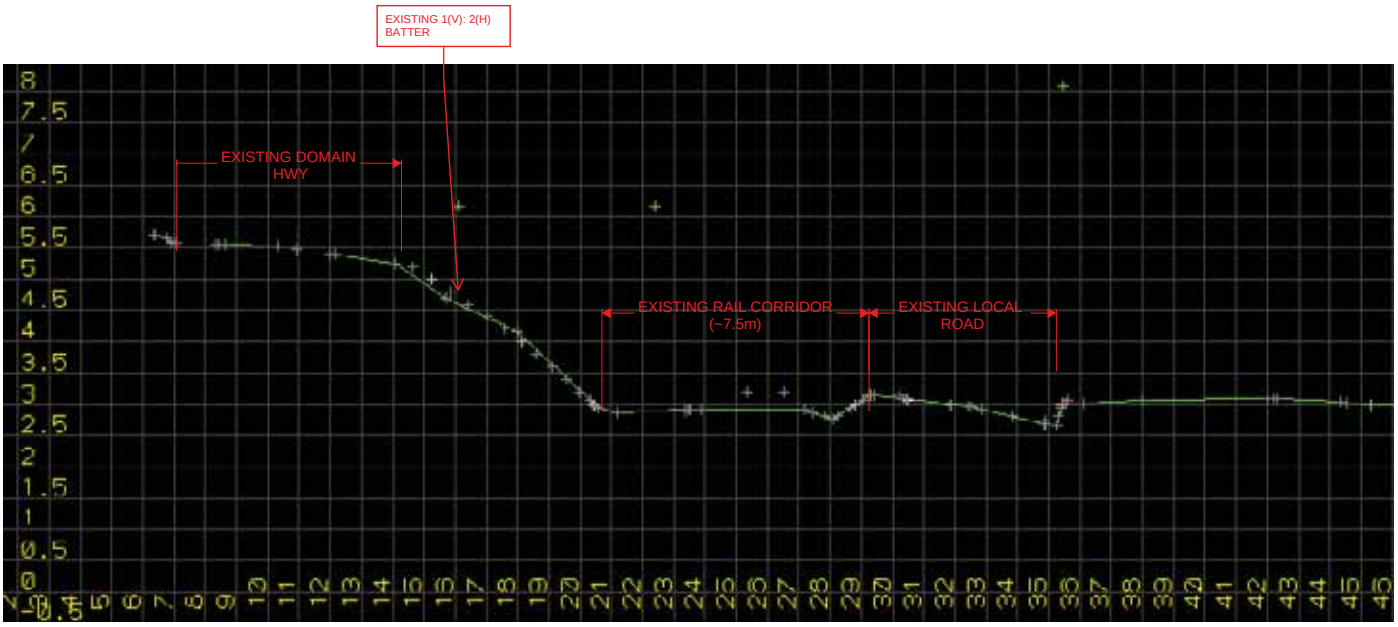
KPS 8.51 (Object ID Line 143)

Appendix H

Critical Sections Assessment


D
A
B
C
D
A
B
C
BOTANICAL GARDENS
2250.000
2200.000
2157.416 TR6
2160.000
2153.416 TP
2100.000
2050.000
2012.116 TP
2000.000
1982.116 TR8
1950.000
1900.000
EXISTING PLATFORM LOCATION
RECOMMENDED PLATFORM LOCATION

SECTION A-A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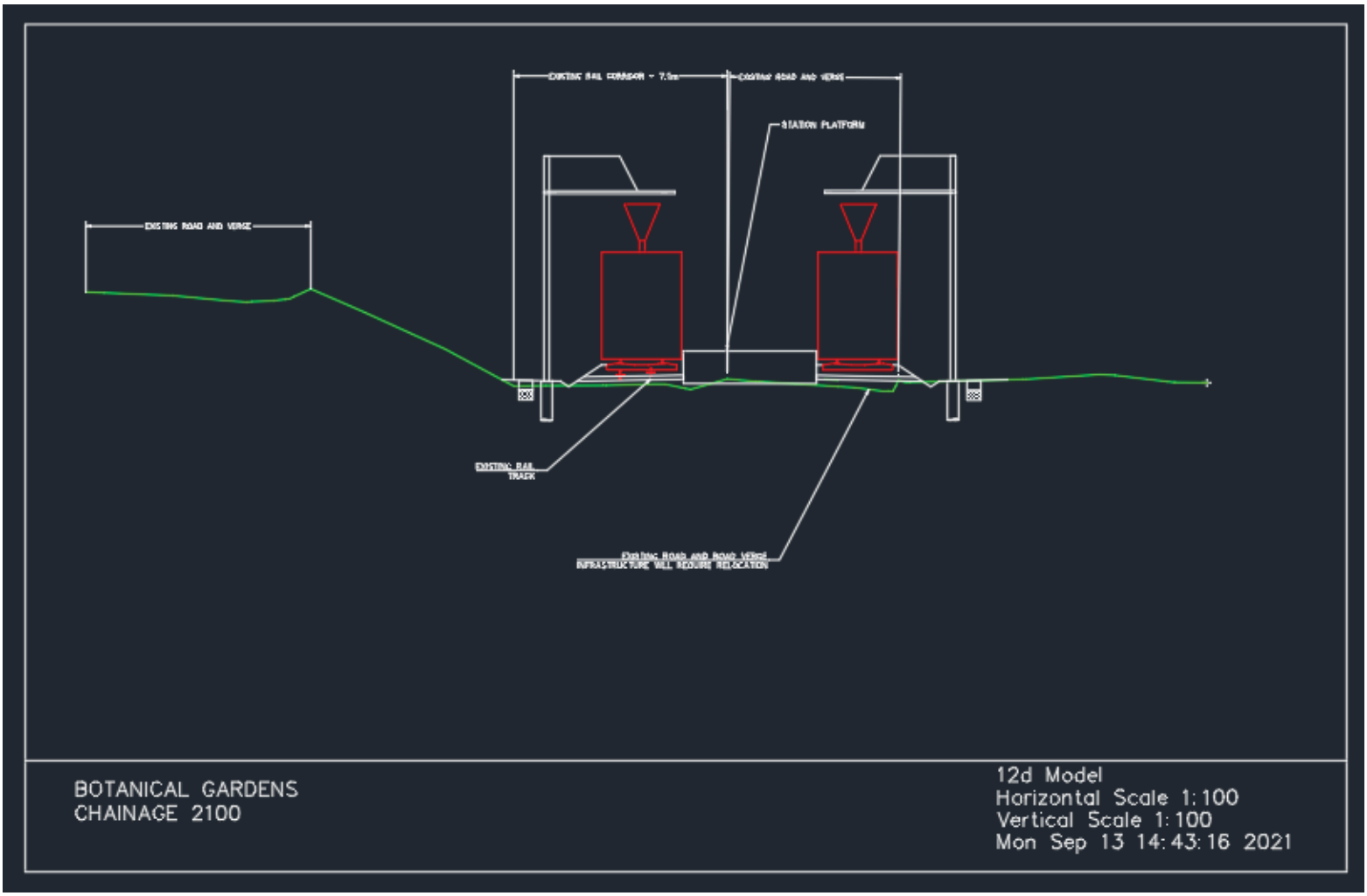
EXISTING DOMAIN HWY
EXISTING RAIL CORRIDOR (~7.5m)
EXISTING LOCAL ROAD


EXISTING ROAD AND VERGE
STATION PLATFORM
EXISTING RAIL TRACK
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CHAINAGE 2100
12d Model
Horizontal Scale 1:100
Vertical Scale 1:100
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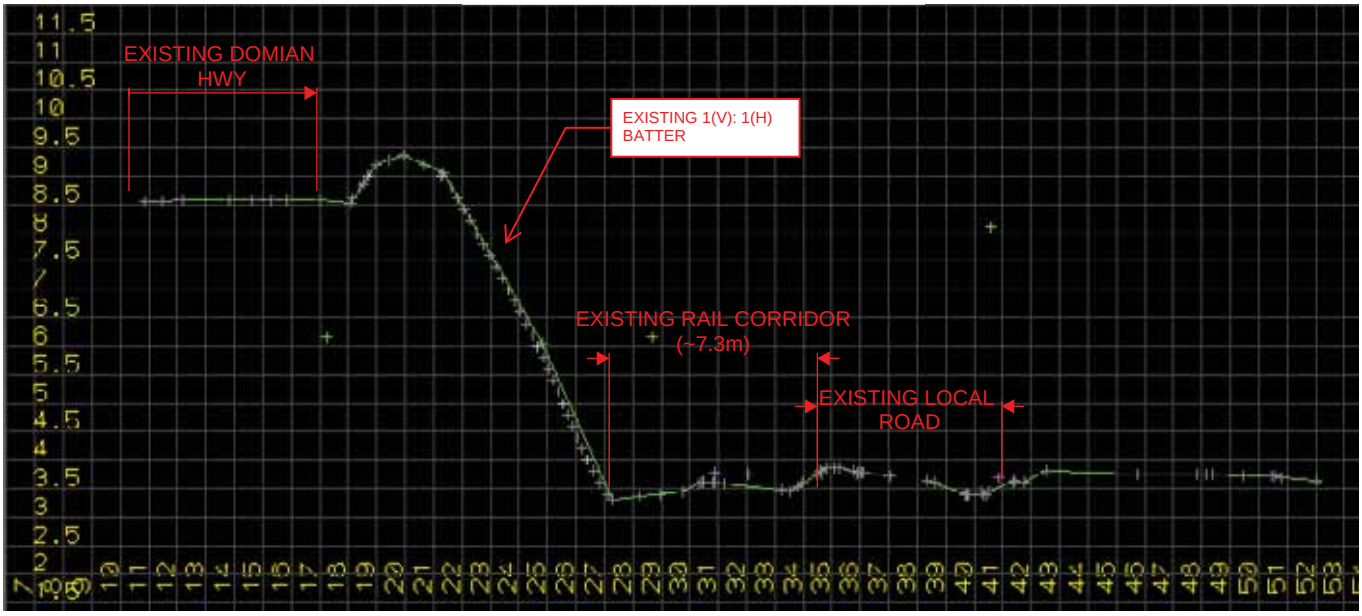
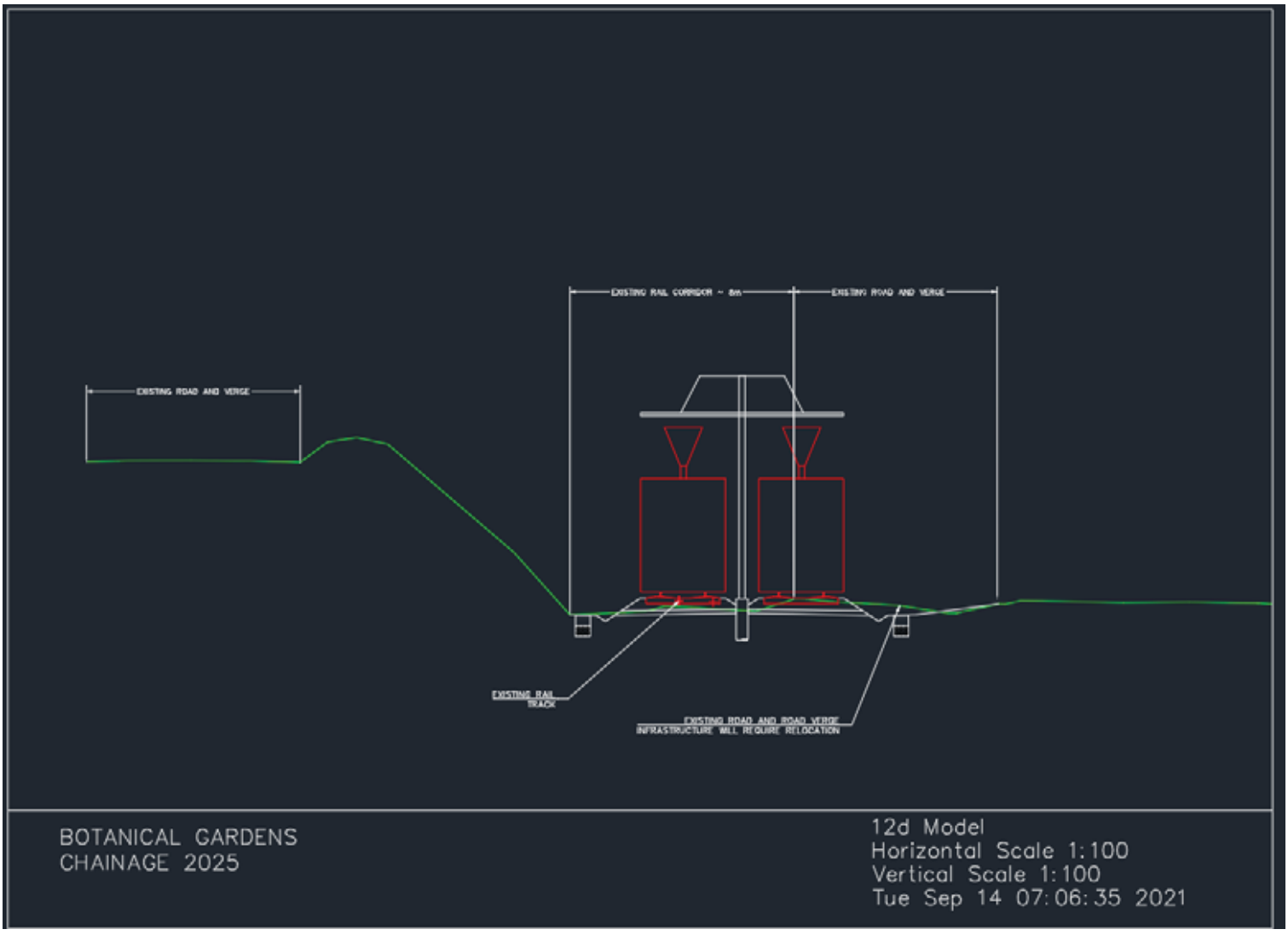
SECTION B-B


EXISTING DOMIAN HWY
EXISTING 1(V): 1(H) BATTER
EXISTING RAIL CORRIDOR (~7.3m)
EXISTING LOCAL ROAD


EXISTING RAIL CORRIDOR ~ 8m
EXISTING ROAD AND VERGE
EXISTING ROAD AND VERGE
EXISTING RAIL TRACK
EXISTING ROAD AND ROAD VERGE INFRASTRUCTURE WILL REQUIRE RELOCATION
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CHAINAGE 2025
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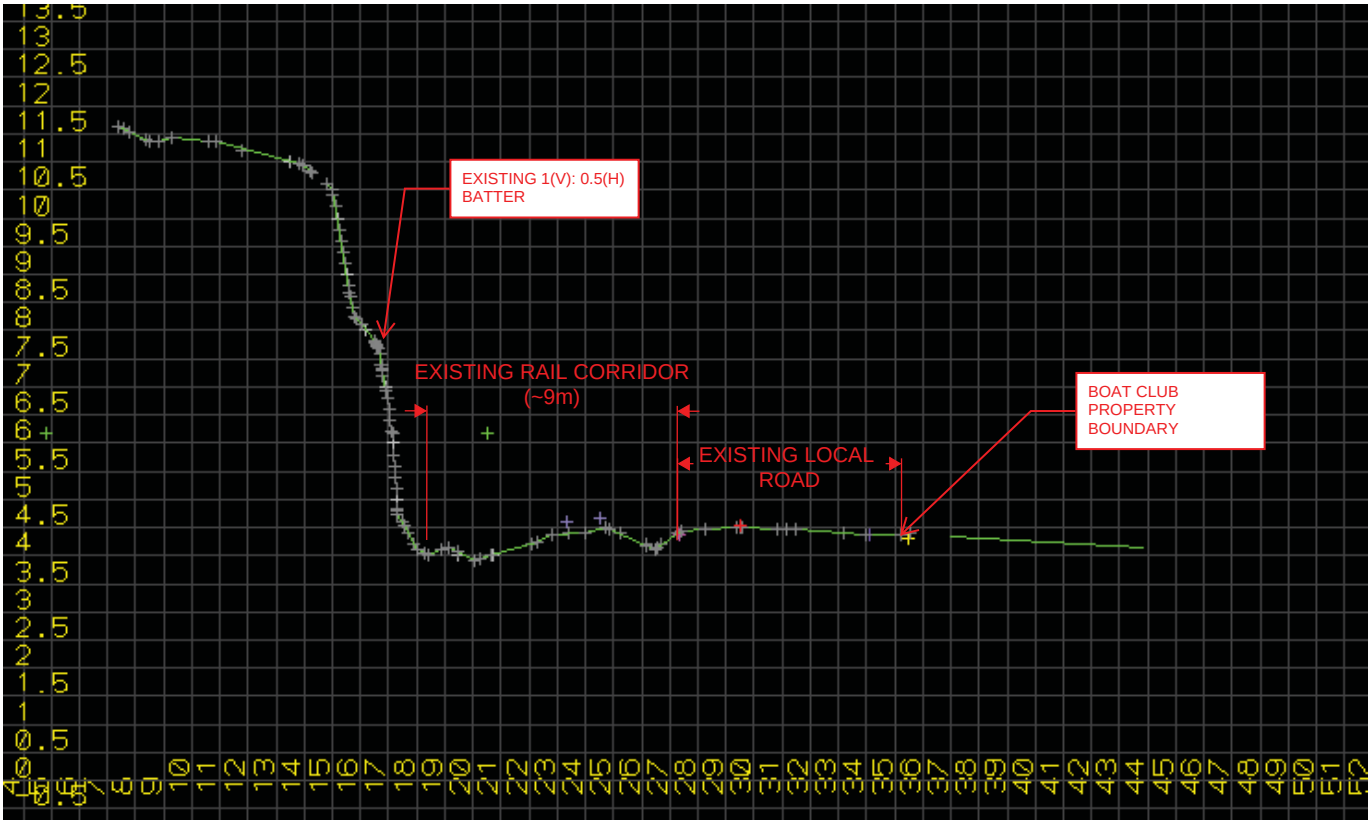
Vertical Scale 1:100
Tue Sep 14 07:06:35 2021

SECTION C-C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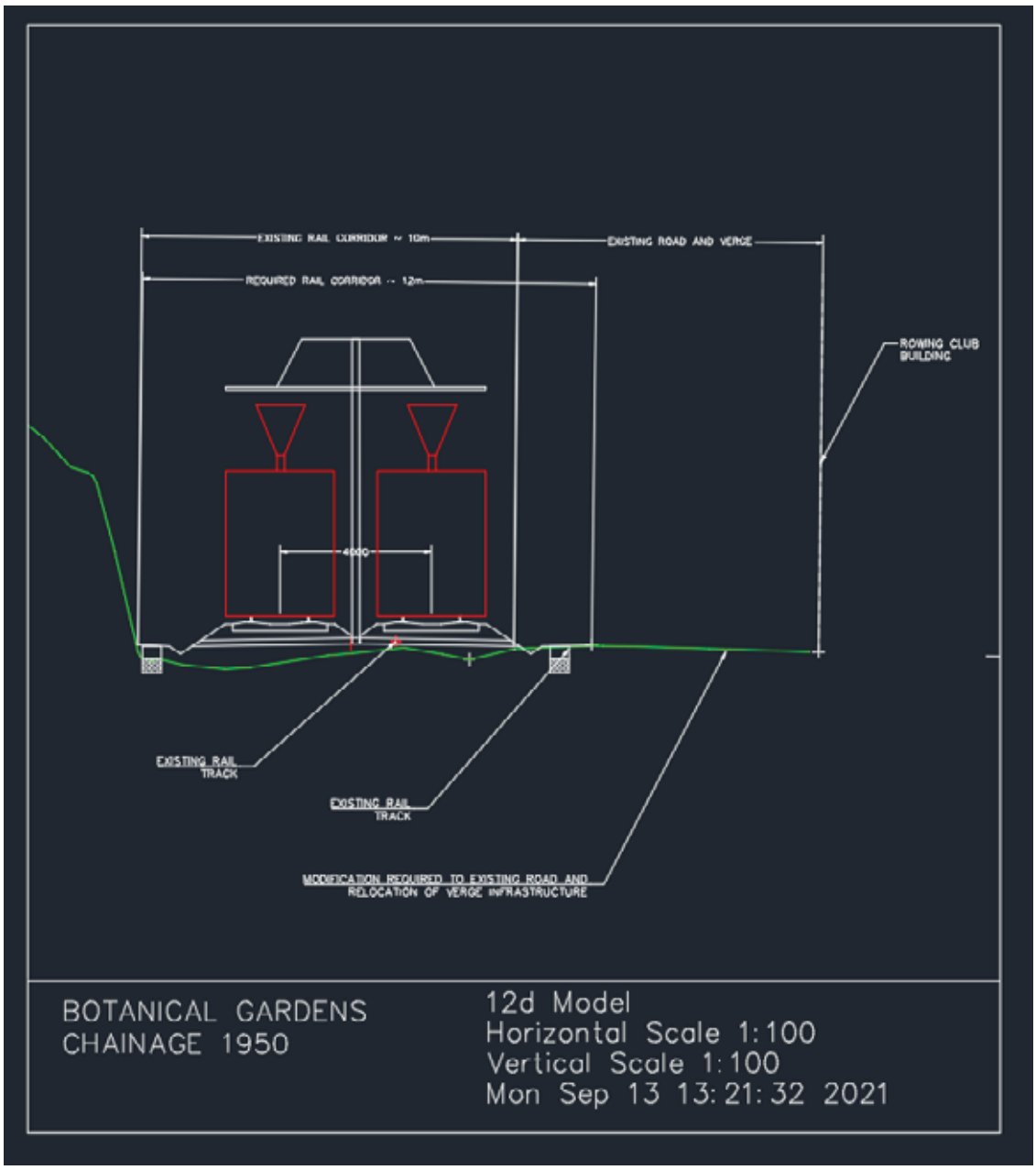
EXISTING RAIL CORRIDOR (~9m)
EXISTING LOCAL ROAD
BOAT CLUB PROPERTY BOUNDARY


EXISTING RAIL CORRIDOR ~ 10m
EXISTING ROAD AND VERGE
REQUIRED RAIL CORRIDOR ~ 12m
ROWING CLUB BUILDING
4000
EXISTING RAIL TRACK
EXISTING RAIL TRACK
MODIFICATION REQUIRED TO EXISTING ROAD AND RELOCATION OF VERGE INFRASTRUCTURE
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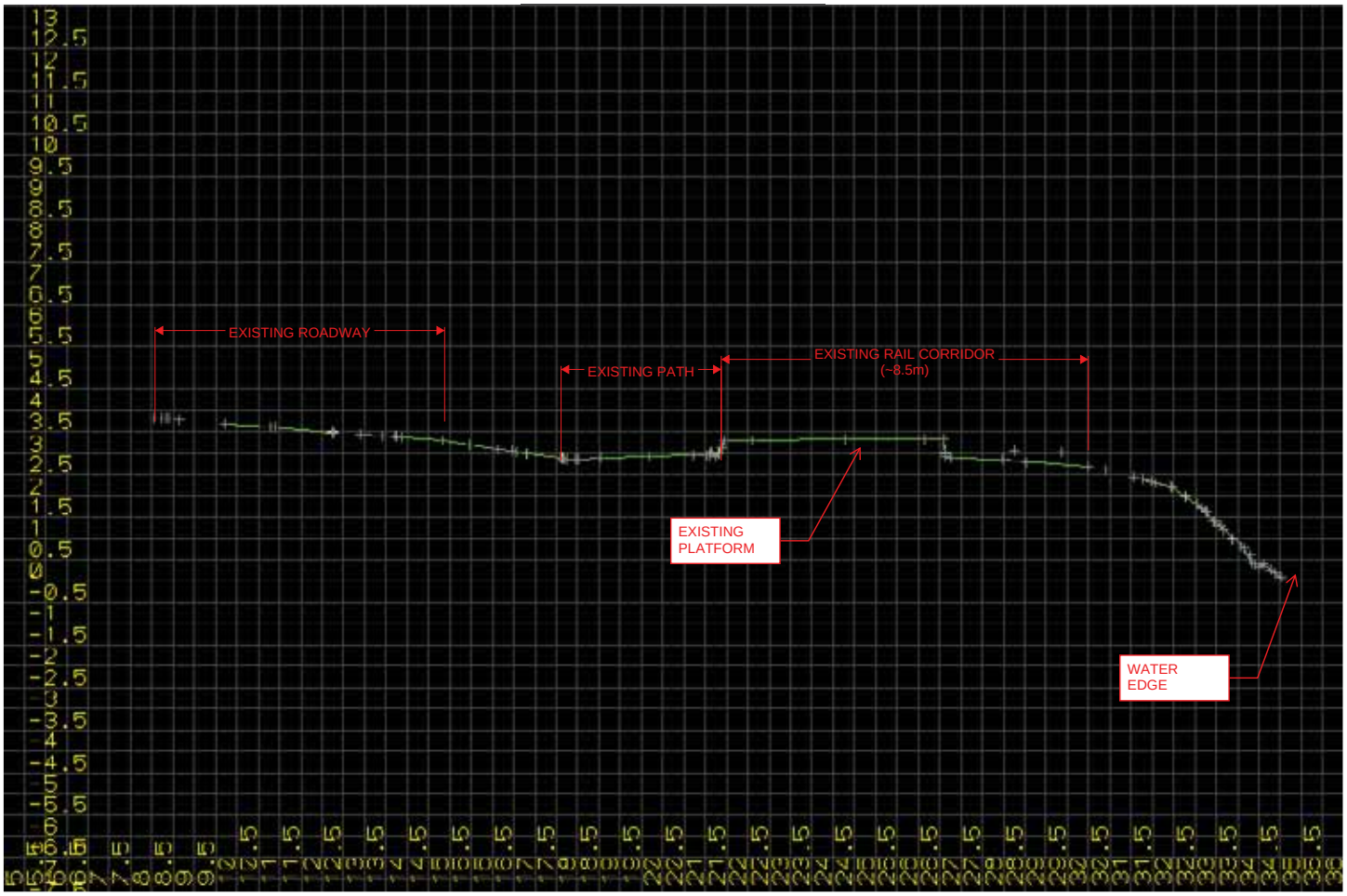
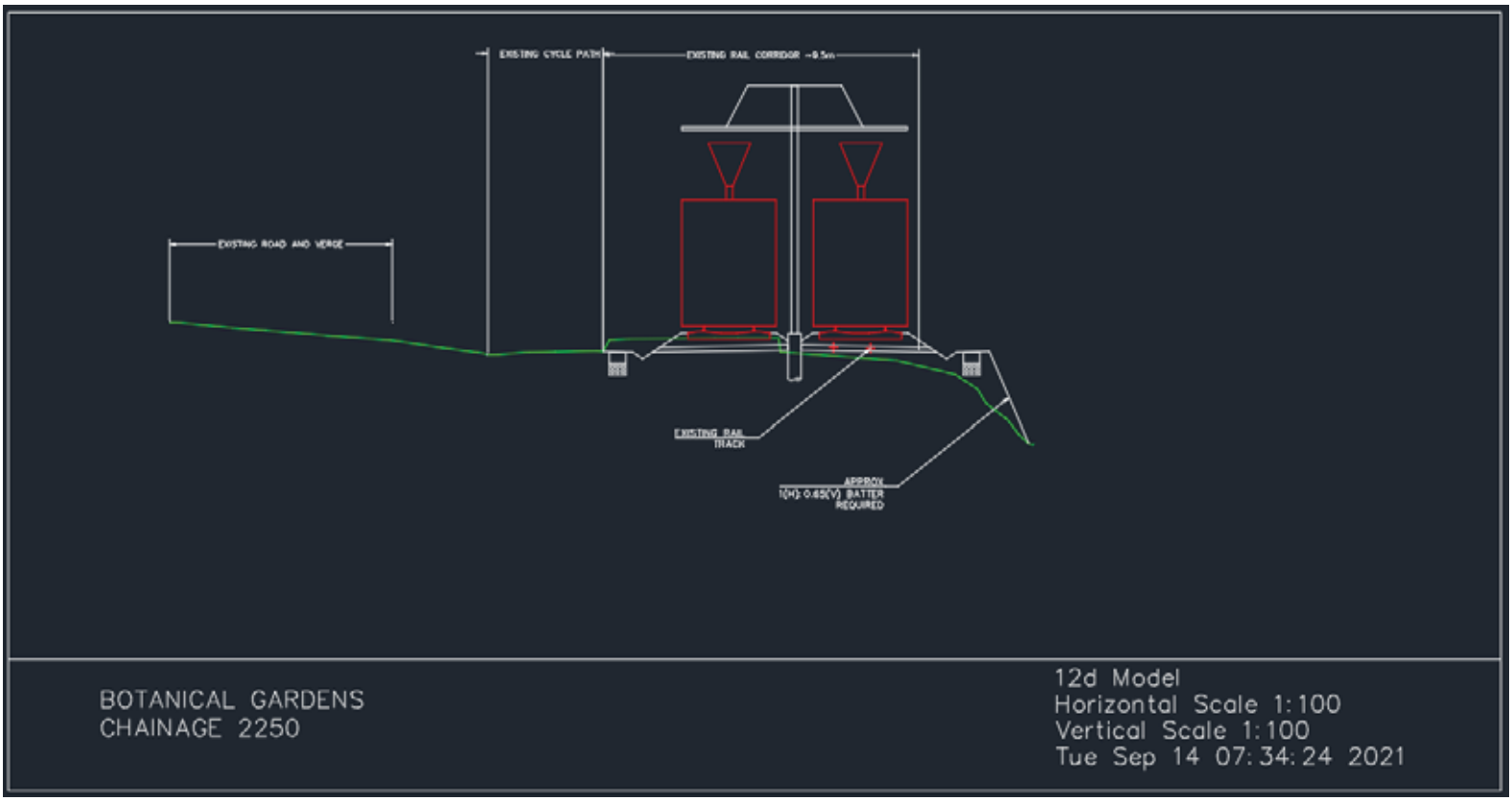
CHAINAGE 1950
12d Model
Horizontal Scale 1:100
Vertical Scale 1:100
Mon Sep 13 13:21:32 2021

SECTION D-D





BOTANICAL GARDENS
CHAINAGE 2250

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Vertical Scale 1:100
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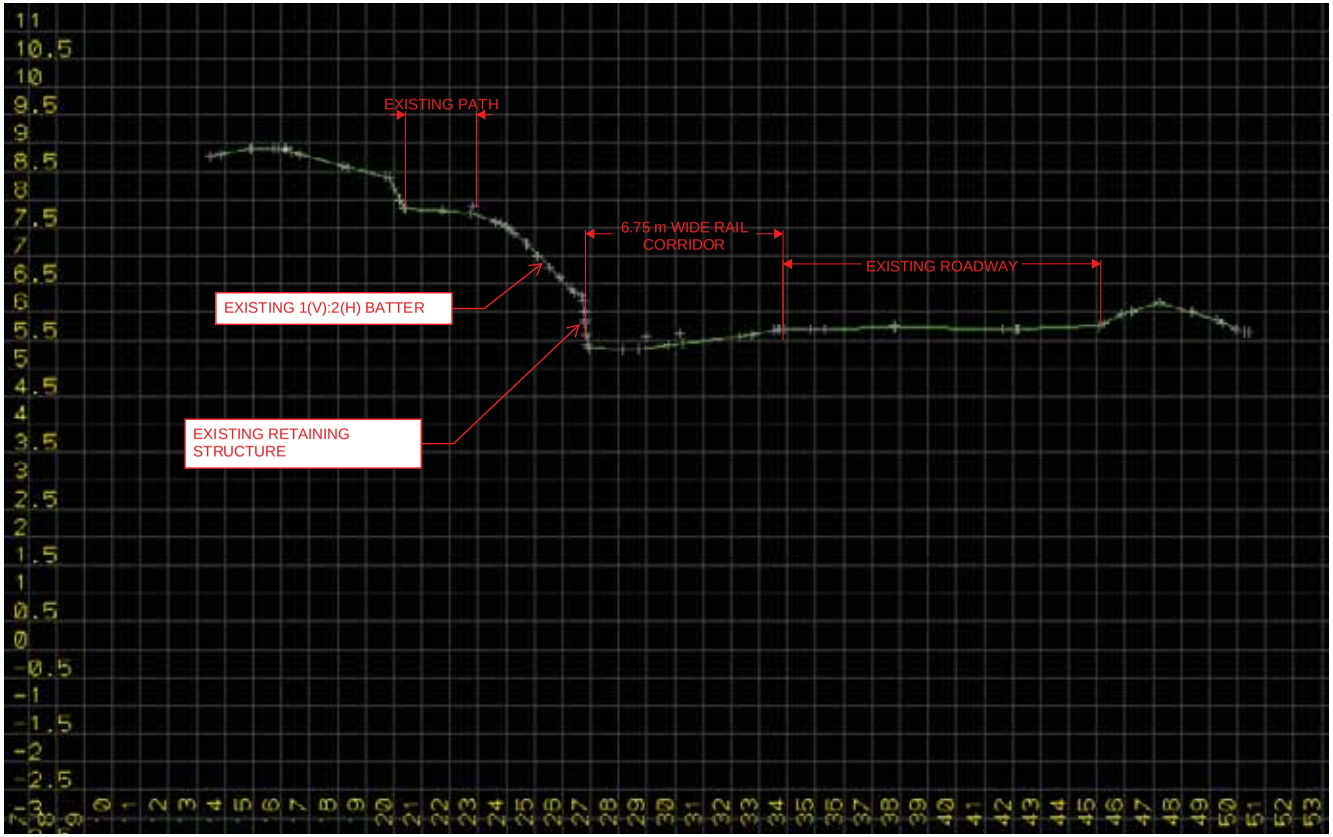
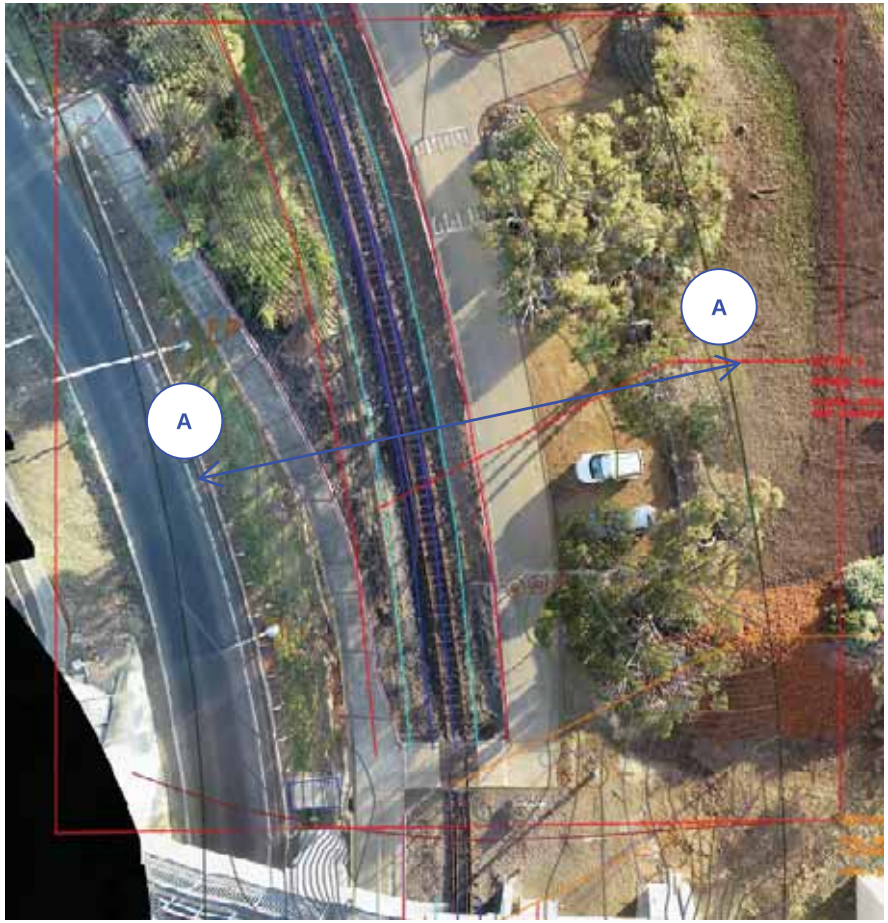
SECTION 2 - CH. 1766

SECTION A-A



PLAN VIEW



SECTION 2

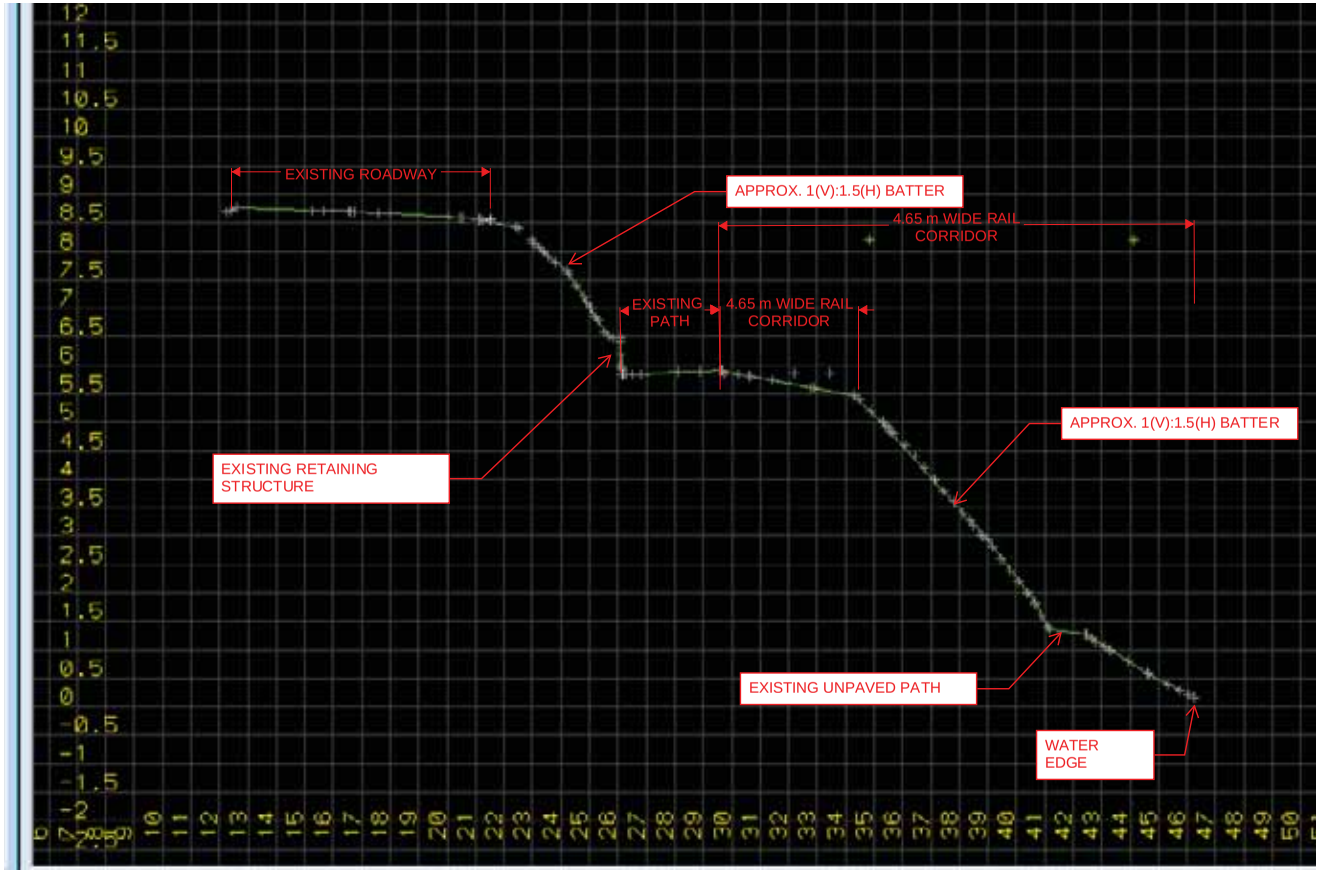
EXISTING RAIL CORRIDOR CONSTRAINED BY RETAINING STRUCTURE AND EXISTING ROADWAY.

APPROX. EXISTING CORRIDOR WIDTH = 6.75m
APPROX. EXISTING BATTER = 1(V):2(H)

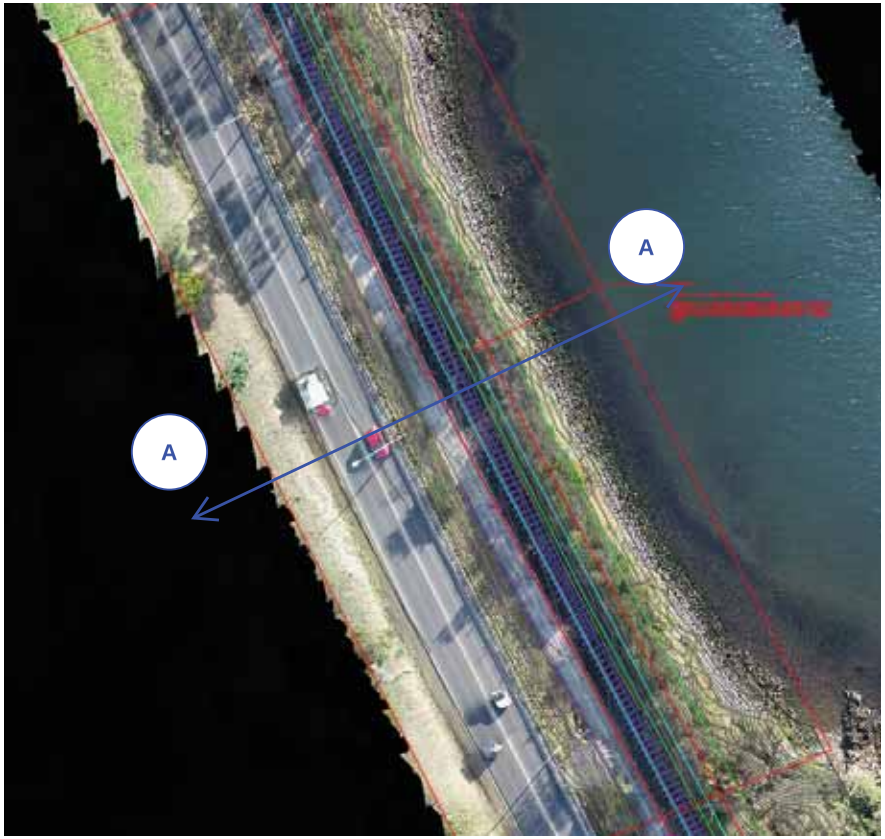
RISK: RELOCATION AND REINSTATEMENT OF RETAINING STRUCTRE OR EXISTING ROAD REQUIRED TO WIDEN RAIL CORRIDOR.

SECTION 3 - CH. 2563

SECTION A-A



PLAN VIEW



SECTION 3

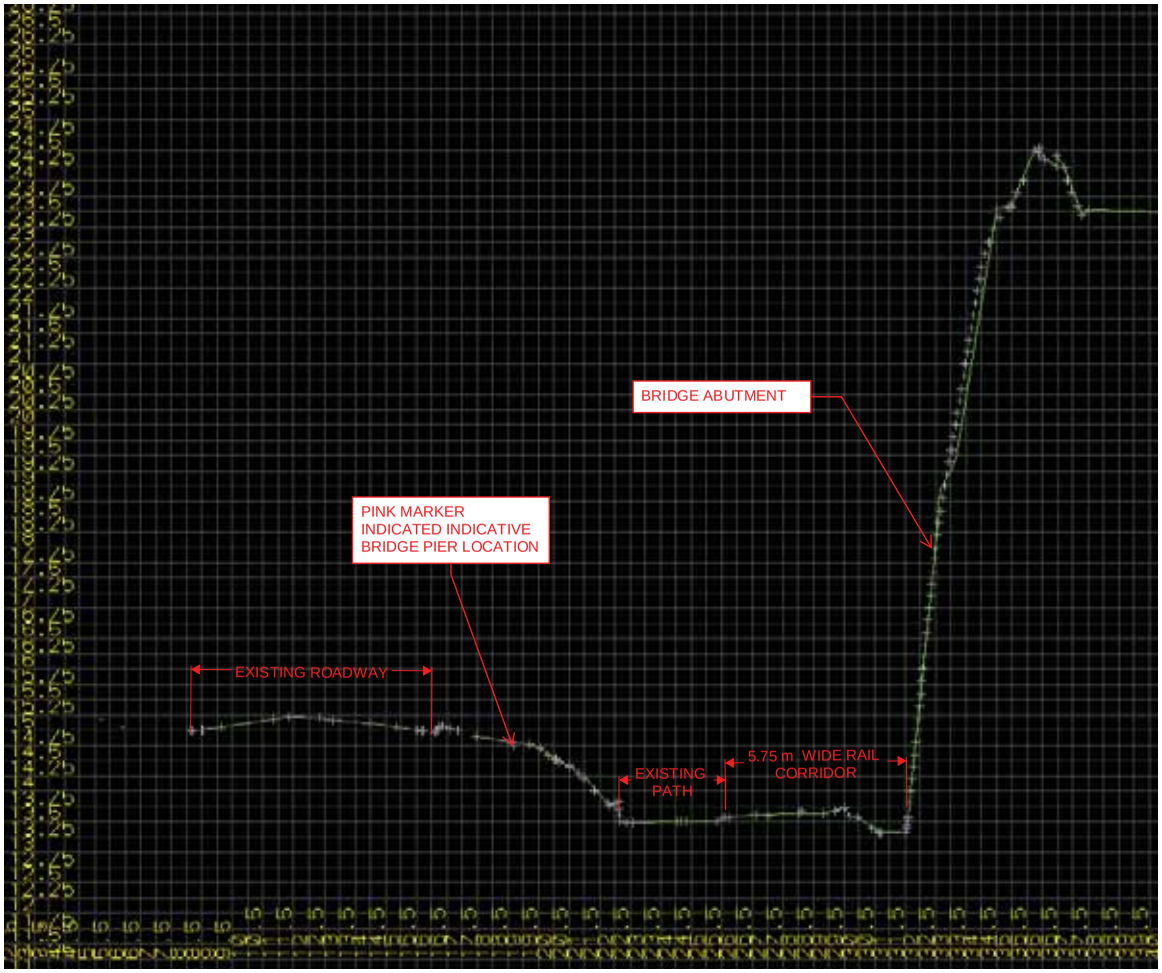
EXISTING RAIL CORRIDOR CONSTRAINED BY STEEP EMBANKMENTS / ROCK FACE BATTERS.

APPROX. EXISTING CORRIDOR WIDTH = 4.65m
APPROX. EXISTING BATTER = 1(V):1.5(H)

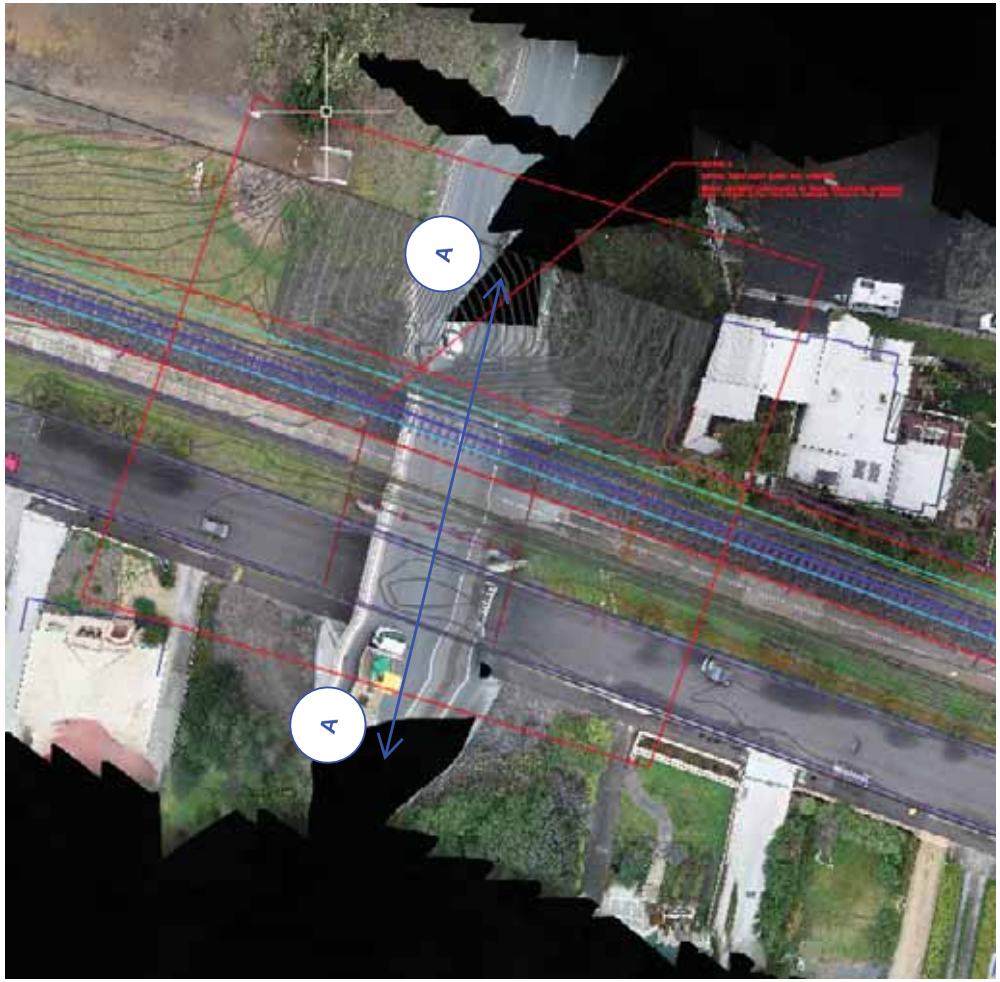
RISK: SIGNIFICANT RETAINING STRUCTURES AND POTENTIAL DETRAILMENT INFRASTRUCTRE REQUIRED TO ACCOMMODATE REQUIRED INCREASED RAIL CORRIDOR WIDTH.

SECTION 4 - BROOKER HIGHWAY ROAD
BRIDGE - CH. 3851

SECTION A-A



PLAN VIEW



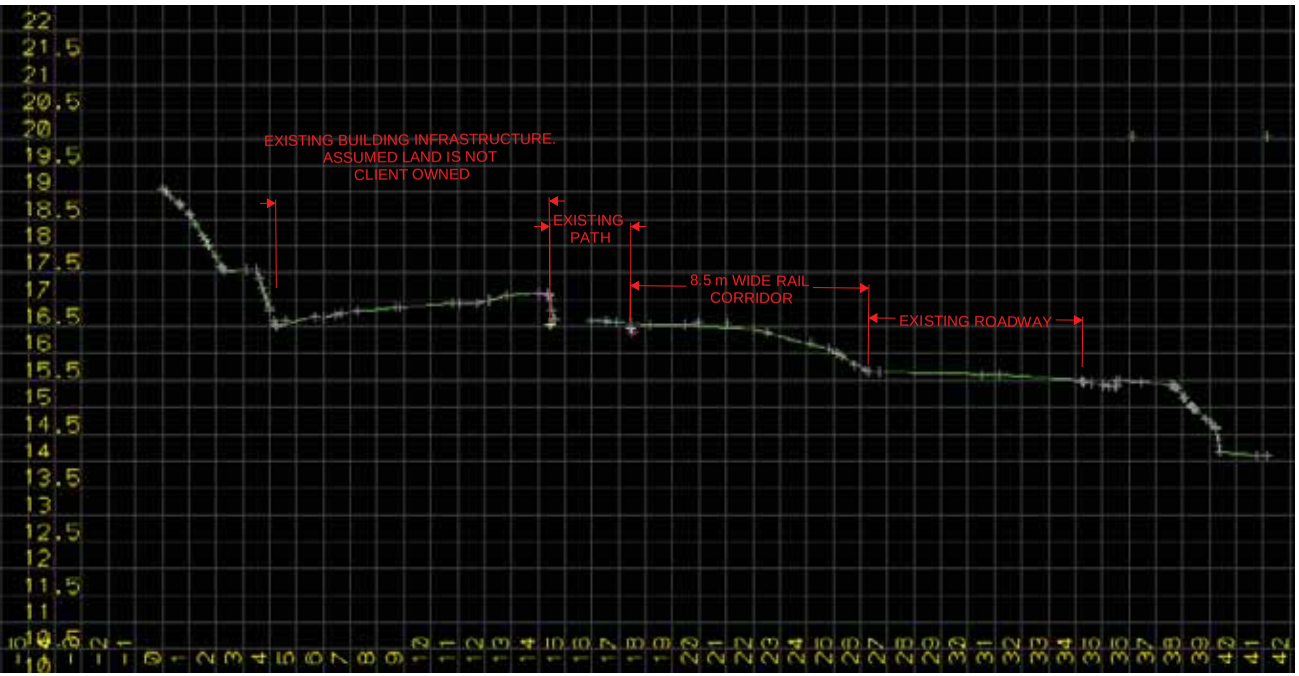
SECTION 4

EXISTING RAIL CORRIDOR CONSTRAINED BETWEEN BROOKER HWY BRIDGE SUPERSTRUCTURE (BRIDGE ABUTMENT AND PIERS) AND THE EXISTING PATH AND ROADWAY.

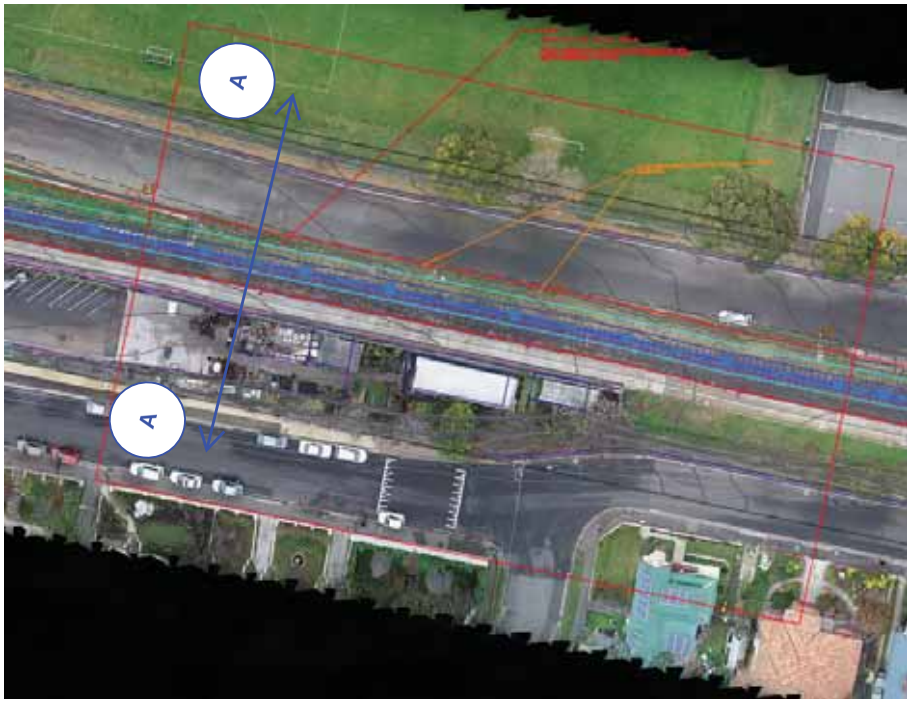
APPROX. EXISTING CORRIDOR WIDTH = 5.75m

RISK: CURRENTLY BRIDGE ABUTMENT FALLS WITHIN STRUCTURAL CLEARANCE ZONE AS PER YARRA TRAM STANDARD DWG T9000. POTENTIAL MODIFICATION FOR BRIDGE SUPERSTRUCTURE AND/OR PATH TO ACCOMMODATE REQURIED RAIL CORRIDOR WIDTH AND CLEARANCE- MORE INVESTIGATION REQUIRED.

SECTION A-A



PLAN VIEW



SECTION 5

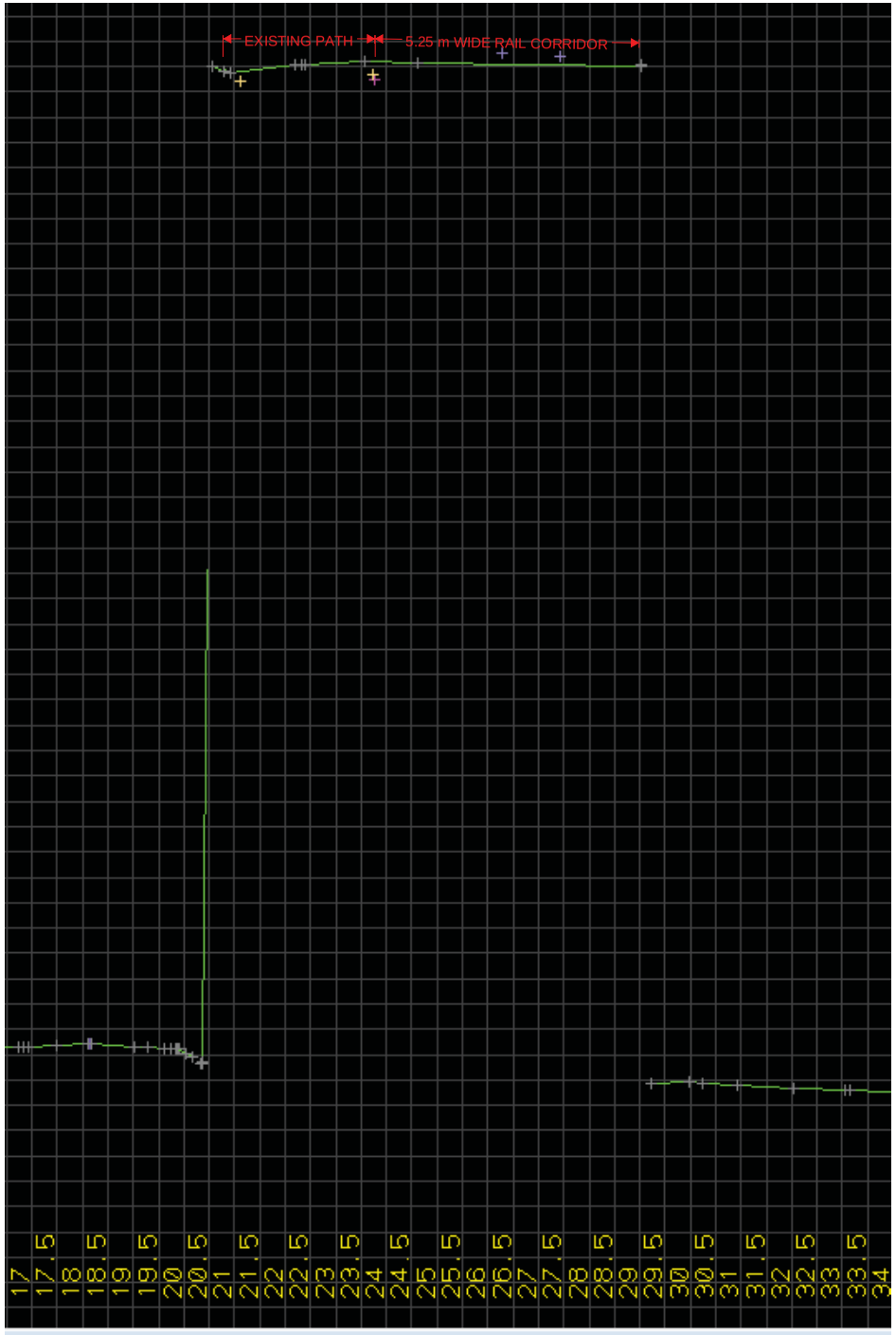
PROPOSED RAIL CORRIDOR FOOTPRINT FALLS FLUSH WITH THE EDGE OF THE EXISTING ADJACENT BELL STREET ROAD EDGE, CLASHING WITH MULTIPLE ROAD VERGE INFRASTRUCTURE. IT IS ASSUMED THE EXISTING CYCLE PATH BACKS ONTO EXISTING BUILDING INFRASTRUCTRE ON PRIVATE PROPERTY.

APPROX. EXISTING CORRIDOR WIDTH = 8.5 m

RISK: POTENTIAL LAND AQUISITION OF THE PROPERTIES ON THE SOUTH SIDE OF THE RAIL CORRIDOR REQUIRED TO LOCALLY SHIFT THE CYCLE PATH AND RAIL CORRIDOR FOOTPRINT BEYONE BELL STREET ROAD VERGE.

SECTION 6 - RISDON ROAD RAIL BRIDGE - CH. 4530

SECTION A-A



PLAN VIEW

SECTION 6

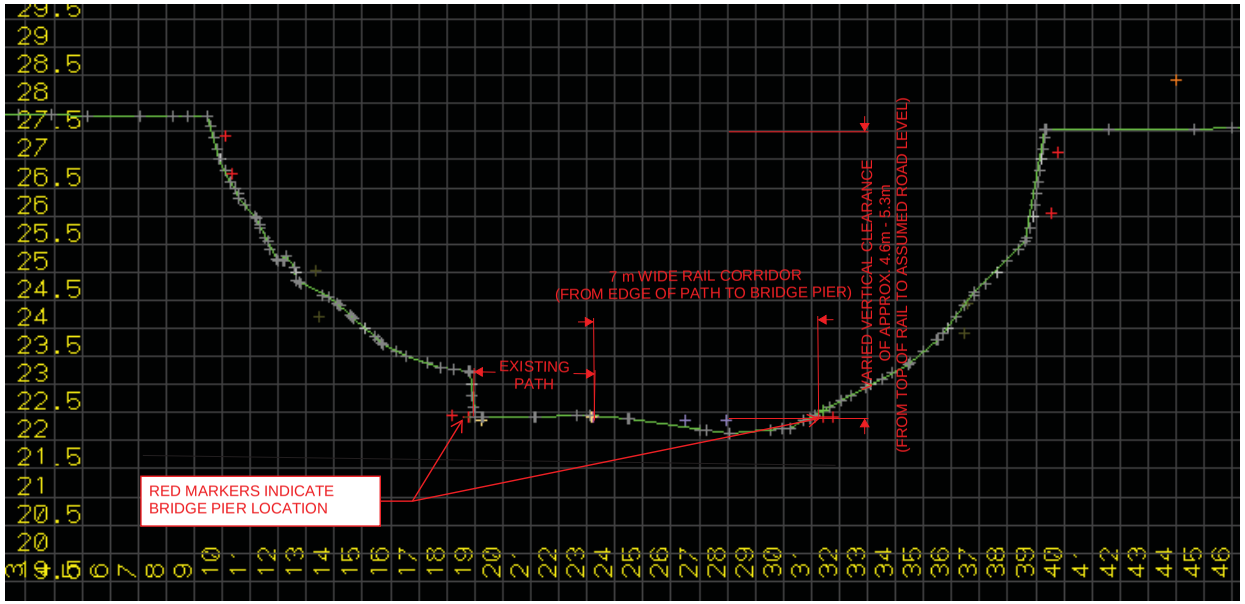
EXISTING BRIDGE WIDTH IS INSUFFICIENT TO ACCOMMODATE THE REQUIRED RAIL CORRIDOR WIDTH ADOPTED IN THIS INVESTIGATION. ADDITIONALLY EXISTING 1(V):1.5(H) EMBANKMENTS WILL NEED TO BE STEEPENED ON THE APPROACH AND DEPARTURE FROM THE RAIL BRIDGE TO ACCOMMODATE THE WIDER RAIL CORRIDOR.

APPROX. EXISTING CORRIDOR WIDTH = 5.25 m

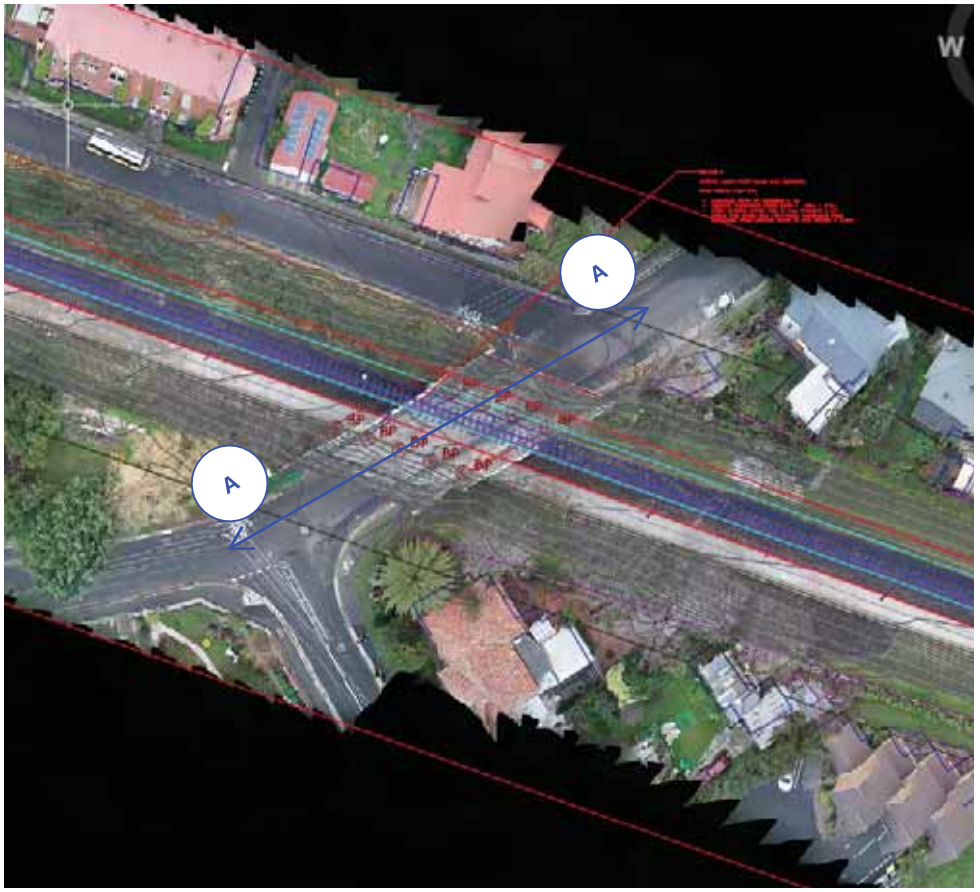
RISK: IN ADDITION TO THE OUTCOME OF A STRUCTURAL CAPACITY ASSESSMENT THE EXISTING RAIL BRIDGE WILL REQUIRE UPGRADING AND WIDENING TO ACCOMMODATE THE MINIMUM GEOMETRIC AND CLEARANCE REQUIREMENTS.

SECTION 7 - TOWER ROAD BRIDGE - CH. 4891

SECTION A-A



PLAN VIEW



SECTION 7

EXISTING RAIL CORRIDOR RUNS FLUSH BETWEEN THE EXISTING CYCLE PATH AND TOWER ROAD BRIDGE PIERS. POTENTIAL FOR BRIDGE PIERS TO FALL WITHIN THE RAIL STRUCTURAL CLEARANCE ZONE (SUBJECT TO FURTHER DESIGN OF RAIL ALIGNMENT)

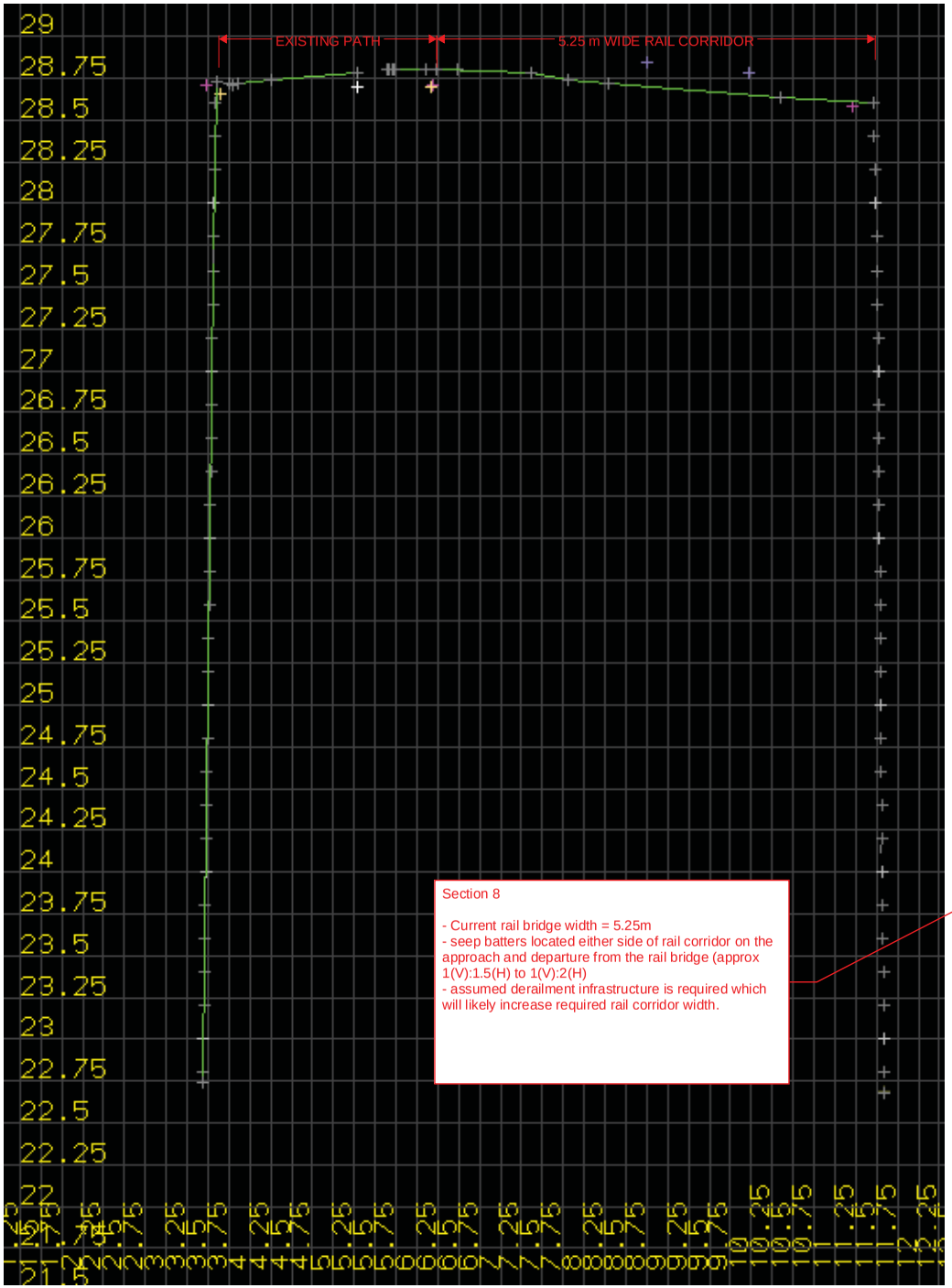
ADDITIONALLY EXISTING VERTICAL CLEARANCE OF 4.6m DOES NOT COMPLY WITH THE MINIMUM VERTICAL CLEARNACEN FROM TOP OF RAIL RO BRIDGE SOFFIT AS PER AS 5100.1 AND YARRA TRAM REQUIREMENTS FOR A MINIMUM 5m TROLLY OVERHEAD WIRE HEIGHT AS THE SUPPORT POINTS

APPROX. EXISTING CORRIDOR WIDTH = 7 m

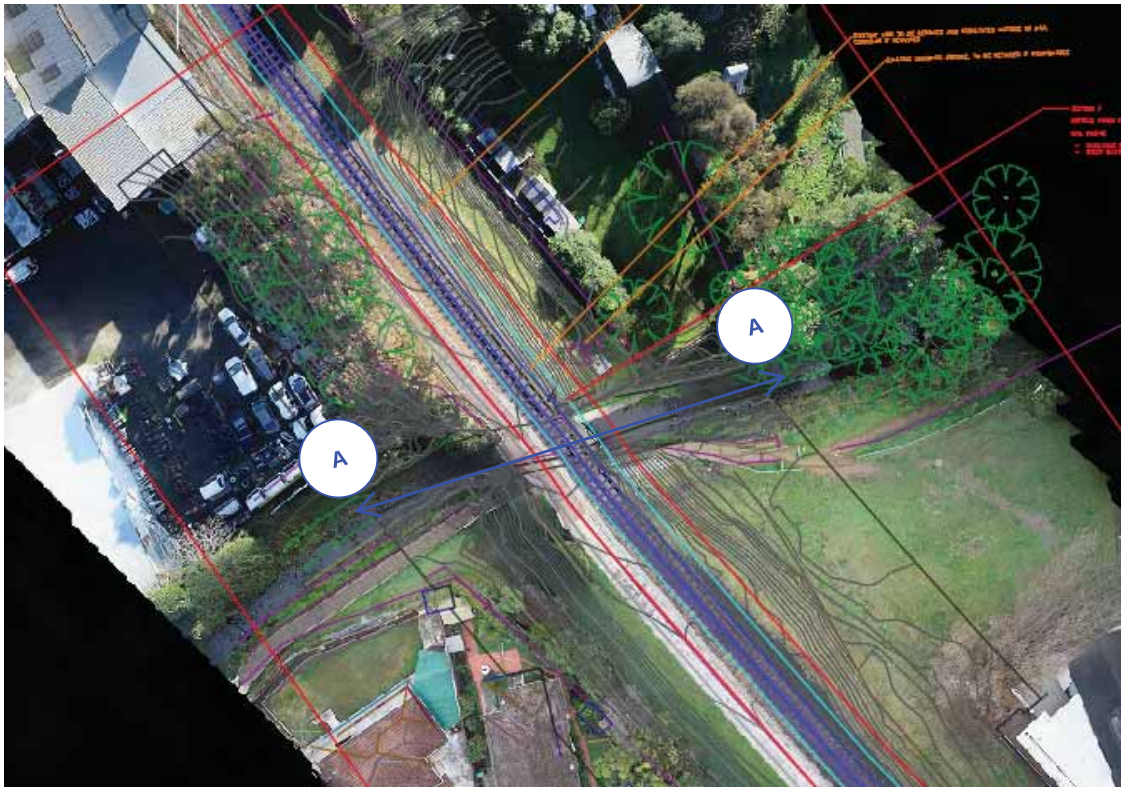
RISK: THE RAIL ALIGNMENT WILL NEED TO BE LOWERED TO ACHIEVE THE MINIMUM VERTICAL CLEARANCE REQUIRED FROM TOP OF RAIL TO BRIDGE SOFFIT. THIS WILL INCREASE THE OVERALL EARTHWORKS FOOTPRINT IMPACTING EXISTING BRIDGE PIERS / SUPERSTRUCTURE AND CYCLE PATH.

SECTION 8 - CH. 5359

SECTION A-A



PLAN VIEW



SECTION 8

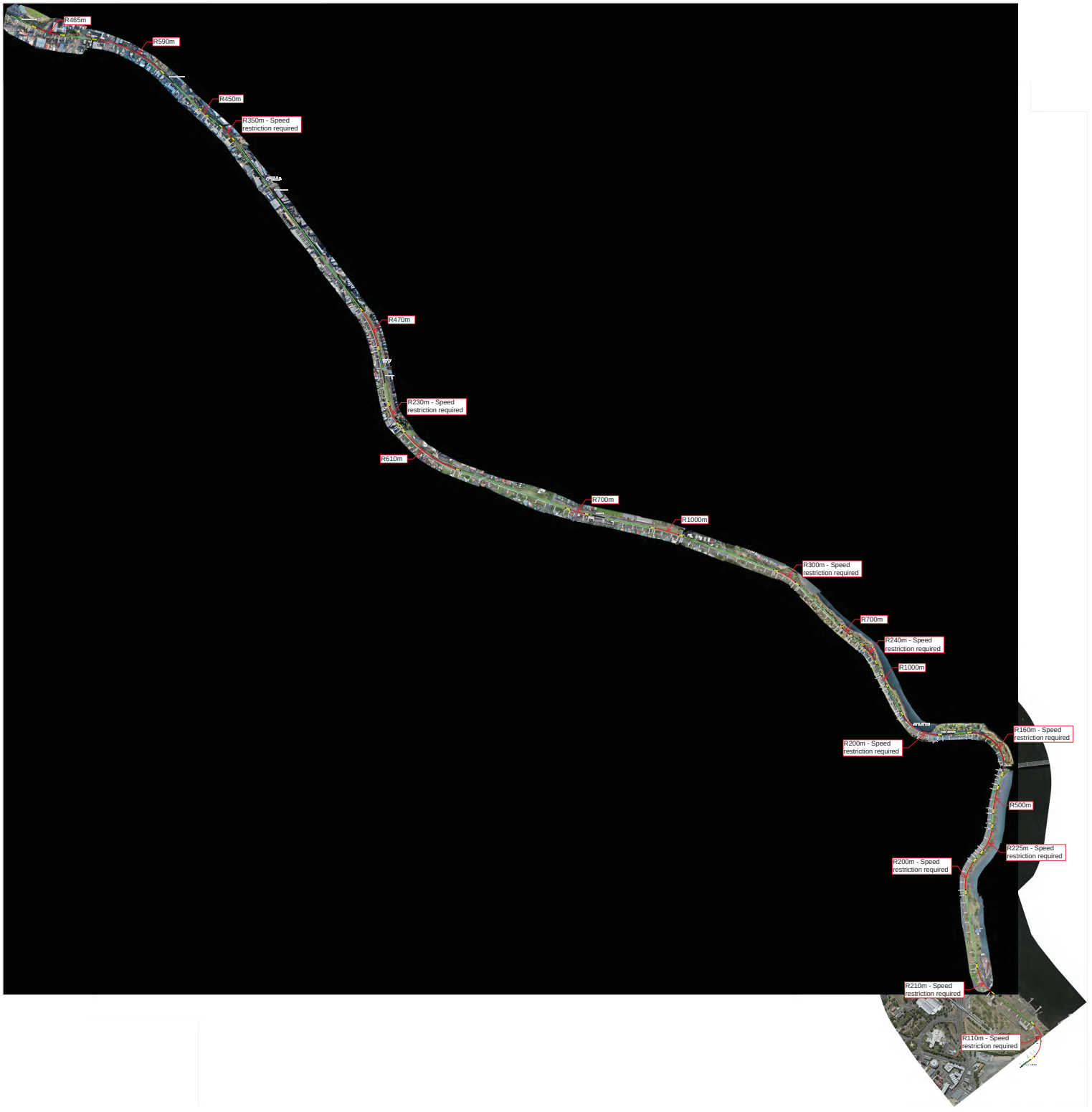
EXISTING BRIDGE WIDTH IS INSUFFICIENT TO ACCOMMODATE THE REQUIRED RAIL CORRIDOR WIDTH ADOPTED IN THIS INVESTIGATION. ADDITIONALLY EXISTING 1(V):1.5(H) EMBANKMENTS WILL NEED TO BE STEEPENED ON THE APPROACH AND DEPARTURE FROM THE RAIL BRIDGE TO ACCOMMODATE THE WIDER RAIL CORRIDOR.

APPROX. EXISTING CORRIDOR WIDTH = 5.25 m

RISK: IN ADDITION TO THE OUTCOME OF A STRUCTURAL CAPACITY ASSESSMENT THE EXISTING RAIL BRIDGE WILL REQUIRE UPGRADING AND WIDENING TO ACCOMMODATE THE MINIMUM GEOMETRIC AND CLEARANCE REQUIREMENTS.

Appendix I

Horizontal Rail Alignment


R465m
R590m
R450m
R350m - Speed restriction required
R470m
R230m - Speed restriction required
R610m
R700m
R1000m
R300m - Speed restriction required
R700m
R240m - Speed restriction required
R1000m
R160m - Speed restriction required
R200m - Speed restriction required
R500m
R225m - Speed restriction required
R200m - Speed restriction required
R210m - Speed restriction required
R110m - Speed restriction required

Appendix J

Existing Vertical Rail Alignment

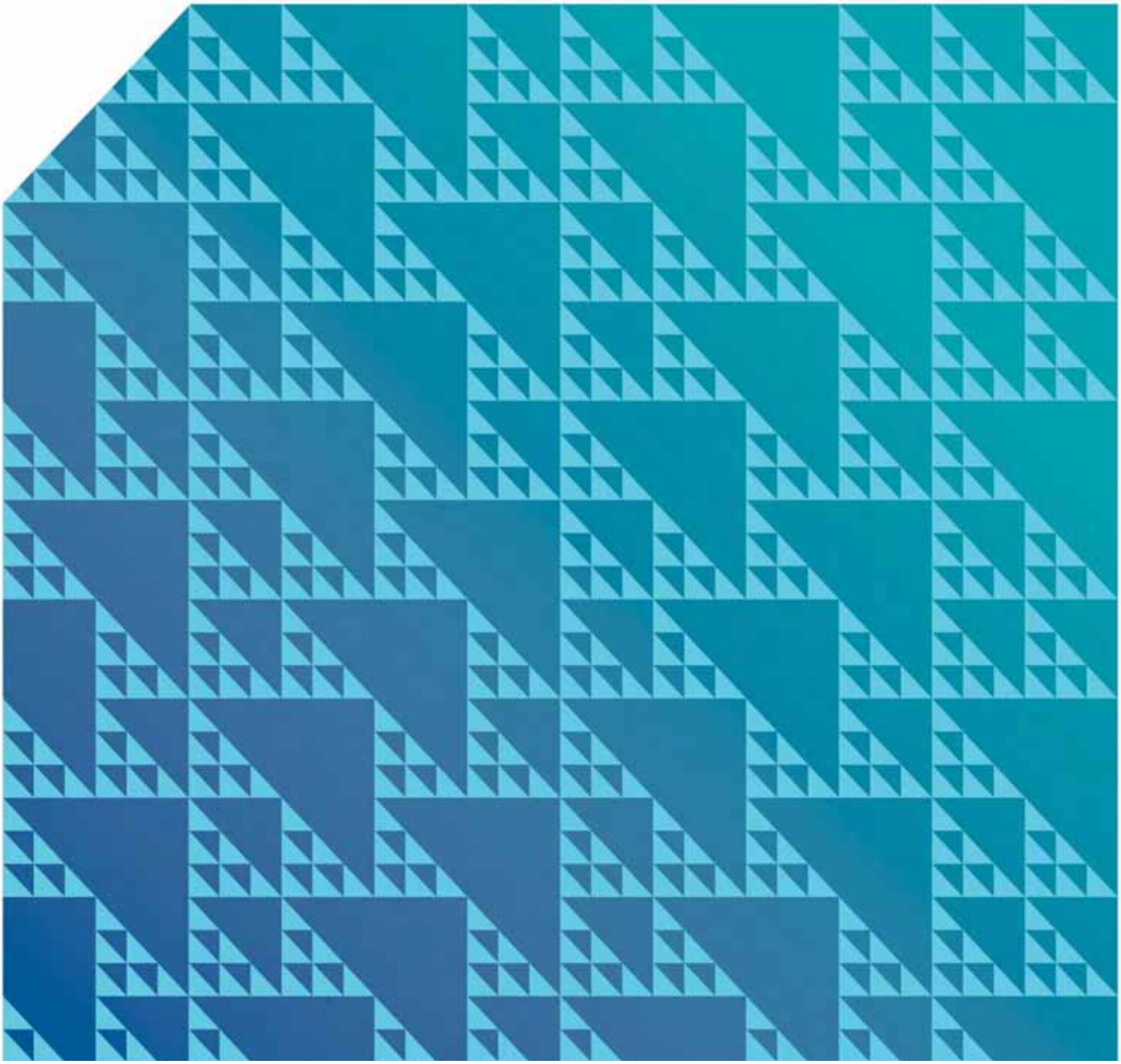
Appendix K

Consultation and Feedback Report

Northern Suburbs Transit Corridor
Condition Assessment

September 2021

Consultation and Feedback Report



Australian Government

BUILDING OUR FUTURE

Tasmanian Government

Contents

Executive summary

The Northern Suburbs Transit Corridor Condition Assessment project is the first stage of a broader corridor activation project. The project involved an engineering condition assessment of the Corridor from Macquarie Point to Northgate, Glenorchy, which will be used to inform future detailed design works for the Corridor.

As part of the Hobart City Deal, the Australian Government committed $25 million funding toward the Urban Congestion Fund. The intention is for this $25 million to be spent on mode neutral corridor activation works with the aim of tendering the work in October 2021 and construction starting in early 2022.

In July 2020, the *Northern Suburbs Transit Corridor Transport Mode Study Options Assessment* report was completed. It assessed light rail, rapid bus and trackless tram options and recommended further consideration of two transport modes: light rail and bus rapid transit.

From June 2021 to September 2021, the Department consulted organisations and utilities regarding any known issues or plans within the vicinity of the Corridor. These discussions indicated there was overall support for the project. TasRail, City of Hobart, Glenorchy City Council and some utilities indicated a desire to be consulted further as the project progresses to the Development[1] phase.

Feedback provided by the organisations and utilities has been considered by the project team and included where possible into the *Northern Suburbs Transit Corridor Condition Assessment* report.

Project overview

The Corridor consists of the decommissioned railway tracks running from Macquarie Point through to the Glenorchy municipal boundary at the Derwent River.

The railway tracks were previously used as the Hobart to Brighton passenger and freight train line, which operated between 1875 and 1978. From 1978, the Corridor operated as a freight route until 2014 when it was decommissioned.

In 2019, the Tasmanian Government formed a Northern Suburbs Transit Corridor Working Group to progress the activation of the Corridor and a future submission to Infrastructure Australia to deliver a new transit mode.

In July 2020, the *Northern Suburbs Transit Corridor Transport Mode Study Options Assessment r*eport was completed. It assessed light rail, rapid bus and trackless tram options and recommended further consideration of two transport modes: light rail and bus rapid transit.

The Northern Suburbs Transit Corridor Condition Assessment project is the first stage of a broader corridor activation project. The project has assessed the condition of the existing corridor infrastructure to inform the cost of upgrades required to operate a future transit service.

It involved a detailed and comprehensive engineering condition assessment of the Corridor from Macquarie Point to Northgate, Glenorchy, which will be used to inform future detailed design works for the Corridor.

The study also included developing a prioritised $25 million works schedule as a basis for the start of Corridor activation work in 2022.

[1] *The Australian Government Department of Infrastructure and Regional Development defines project phases for land transport infrastructure as: Identification, Scoping, Development, Delivery and Post-completion.*

Consultation objectives

The engagement objectives for the project were:

- To identify and engage productively with all impacted and interested stakeholders.
- To explain to stakeholders the objectives of the engagement and the project.
- To provide updates to key stakeholders to maintain an open and ongoing relationship.
- To inform residents and businesses of the initial disruption for surveying, as well as the benefits of the future activation project.

Project location

While the Corridor runs from Macquarie Point to the Glenorchy municipal boundary at the Derwent River, the condition assessment only examined the Corridor from Macquarie Point to Northgate, Glenorchy. The Corridor is owned and maintained by TasRail.

It falls within the City of Hobart and Glenorchy City Council local government areas in the Clark electorate.

Image 1 *Northern Suburbs Transit Corridor: Source - Department of Infrastructure, Transport, Regional Development and Communications (Feb 2019) Hobart City Deal. p. 19*

Consultation outline

Stakeholder	Date	Method	Objective
Adjacent residents and businesses to the Corridor	31 May 2021	Letter	Introduce project and notify of site survey
All	31 May 2021	Website	Introduce project and notify of site survey
City of Hobart	24 June 2021	Meeting	Introduce project and ascertain any known issues or plans within the vicinity of the Corridor
Tasmanian Transport Museum	24 June 2021	Meeting	Introduce project and ascertain any known issues or plans within the vicinity of the Corridor
Glenorchy City Council	25 June 2021	Meeting	Introduce project and ascertain any known issues or plans within the vicinity of the Corridor
Optus NBN TasmaNet TPG Networks TasNetworks TasWater Department of Primary Industries, Parks, Water and Environment TasGas	July, August, September 2021	Email and phone call	Introduce project and ascertain any known issues or plans within the vicinity of the Corridor based on Dial Before You Dig enquiry
TasRail	12 August 2021	Meeting	Introduce project and ascertain any known issues or plans within the vicinity of the Corridor

Feedback summary

The information provided to adjacent residents and businesses to the Corridor to introduce the project and notify of the site survey yielded no feedback about the project.

Other organisations were generally supportive. Feedback from each organisation is summarised below.

City of Hobart

- Recommended construction of a common services trench along the length of Corridor for running conduits. Conduits could be multipurpose and save money.
- Recommended consideration of digital connectivity.
- Suggested directional lighting through the Corridor.

- City of Hobart currently pays TasNetworks to manage the lighting through the Corridor. Taking ownership of the lighting would come at a cost, which would have to be paid to TasNetworks.
- Ongoing concern was ownership of the Intercity Cycleway.
- Identified areas of concern relating to drainage of the Corridor, especially near the Botanical Gardens.

Tasmanian Transport Museum

- Has completed a condition assessment of 4.4 km of Corridor, which found it could operate if the wooden sleepers were progressively replaced with steel sleepers.
- Area at New Town near Risdon Road originally had the rail running on a viaduct, which was filled in and is now subsiding.
- The Corridor has the most varied set of sleepers in the rail network due to the frequency of level crossings that require track circuits. Track circuit infrastructure includes wood and concrete.
- Believed a wider Corridor would be needed for rapid bus and unauthorised vehicles getting in the way of rapid bus would be an issue. The advantage of the Corridor was the cattle grid mechanism that prevented this.
- Believed the narrow gauge was suitable for light rail and confirmed it would be quicker for any given turn radius than standard gauge and no Disability Discrimination Act compliance issues.
- Corridor near Botanical Gardens has substandard drainage.
- Plans to use the Corridor to run a Chigwell service for 12 to 18 months to prove it can be commercially viable. Tasmanian Transport Museum believed if a Chigwell service proves viable and enjoyable for people, then people will ask when will trains run to Hobart.

Glenorchy City Council

- Has plans for new pedestrian crossings through the Corridor, with proposed locations out of the scope of the project area.
- Ongoing concern with the ownership of the Intercity Cycleway.

TasRail

- Currently owns and maintains the Corridor, including Intercity Cycleway. The Corridor falls under Tasmania's existing rail legislation.
- Indicated the rail line is not on an engineered formation and was laid more than 100 years ago. Believed it would be required to remove all the track and bring it up to standard if light rail were the chosen transport mode.
- Indicated that when trains were used in the Corridor, there were ongoing issues with formation and drainage. The tight curves of the Corridor make cant[2] an issue when travelling, which can make for an uncomfortable travel experience.
- TasRail did not use asbestos breaks when trains used Corridor and could not comment if previous operators used asbestos.
- When trains last operated on the track, TasRail had issues with power poles being erected either within the Corridor or too close to the Corridor. Since 2017 TasRail has had a formal permit system in place for services and utilities.

[2] *The rate of change in height between the two rails.*

Utilities

- Optus, TPG Networks, Telstra and TasWater were contacted to understand any known issues or expansion plans. No feedback was provided.
- NBN, who has assets in the vicinity of the Corridor, indicated it has a co-development program to identify alignment between NBN's planned construction and third-party construction projects. If new infrastructure is planned, NBN could investigate whether installing NBN conduits and pits at the same time is possible. NBN requested contacting them when more project information was known.
- TasmaNet, who has assets in the vicinity of the Corridor, indicated it had no plans to upgrade its network. Its main cable was a single fibre optic cable at Hopkins Street. TasmaNet requested contacting them when more project information was known.
- TasNetworks, who has assets in the vicinity of the Corridor, has several cables crossing under the Corridor. There is a mixture of 11 kV and 415 V low voltages cables. There are also overhead lines from low voltage through to 33 kV and a 110 kV overhead transmission line on the western side of Risdon Road. In most locations the cables are in conduits at 0.9 m deep. Where there is only low voltage the conduits are in at 0.6 m. TasNetworks has several empty conduits that have been proactively installed at major junctions and crossings to allow for future development. TasNetworks requested contacting them when more project information was known.
- The Department of Primary Industries, Parks, Water and Environment completed a search of the Aboriginal Heritage Register and advised there is registered Aboriginal heritage present within the Corridor. The area around Cornelian Bay and the Domain is rich in Aboriginal heritage and includes dozens of shell midden and artefact sites, including at least five sites that have been intersected by the construction of the railway line itself. The Department of Primary Industries, Parks, Water and Environment recommended an Aboriginal heritage assessment be completed to identify whether the proposed project or related infrastructure will impact on Aboriginal heritage and to offer avoidance and mitigation advice.
- TasGas, who has assets in the vicinity of the Corridor, indicated it has a high pressure pipe running underneath the Corridor from the Hobart Showground to Moonah, which is the main gas artery to the whole of Hobart. The depth of the high pressure steel pipe is anywhere from 1.2 – 2.0 m underground. TasGas would require more information about the design for the corridor (depending on chosen transport mode) and need to complete an assessment before a decision regarding relocation is made. Preference is for no relocation due to its importance in the gas network.

Feedback outcome

Feedback provided by the organisations and utilities has been considered by the project team and included where possible into the *Northern Suburbs Transit Corridor Condition Assessment* report.

Next steps

The next step of activating the Corridor should involve identifying the transport mode that will be used to inform future detailed design works.

Further consultation with organisations and utilities is recommended to progress feedback where required. As projects within the Corridor progress, especially those in Development and Delivery phases, additional stakeholders should be added to the scope of engagement such as bus operators, pedestrians and cyclists.

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Appendix L

Corridor development P50/P90 estimate and Prioritised Work Schedule

Northern Suburbs Transit Corridor

Strategic Cost Estimate Report

Department of State Growth (TAS)

19 October 2021

→ **The Power of Commitment**

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Author	Lyndon Black
Project manager	David Figueira
Client name	Department of State Growth (TAS)
Project name	Northern Suburbs Transit Corridor - Condition Assessment
Document title	Northern Suburbs Transit Corridor | Strategic Cost Estimate Report
Revision version	Rev [00]
Project number	12548571

Document status

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			Name	Signature	Name	Signature	Date
S3	0	L. Black	T. Beumer		T. Beumer		19.10.21

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Appendices

1. Introduction

1.1 Purpose of this report

The purpose of this report is to provide the background information, decisions and data which influenced the concept cost estimate. This report refers to and must be read in conjunction with the Condition Assessment Report produced by GHD.

1.2 Scope and limitations

This report: has been prepared by GHD for Department of State Growth (TAS) and may only be used and relied on by Department of State Growth (TAS) for the purpose agreed between GHD and Department of State Growth (TAS) as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Department of State Growth (TAS) arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has prepared the Cost Estimate set out in Section 4 of this report (“Cost Estimate”) using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD including but not limited to escalation rate; quantities; rates; risks and construction methodology.

The Cost Estimate has been prepared for the purpose of providing the background information, decisions and data which influenced the cost estimate and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works/project can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

GHD has prepared this report on the basis of information provided by Department of State Growth (TAS) and others who provided information to GHD (including Government authorities), which GHD has not independently

verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.2.1 Scope

The scope as defined by the brief is as follows.

Corridor Development Cost Estimates

A cost estimate (preferably to a P50/P90 level of accuracy) should be developed for all costs necessary to establish the Corridor ready for either:*

- *Construction of ballasted track (ballast, sleepers & rail) as required for light rail OR*
- *Construction of pavement suitable for the rapid bus or trackless trams, with concrete pavement at turning locations and stations*

The costs should include:

- *Removal and disposal of all redundant equipment and materials*
- *Repair and/or new construction of bridge structures as appropriate*
- *Repair and/or new construction of drainage structures (including culverts, open drains etc) as appropriate*
- *Repair and/or new construction of the Corridor formation*
- *Repair and/or new construction of Corridor fencing as appropriate*
- *Repair and/or new construction of Corridor lighting as appropriate*
- *Repair and/or new road crossing fixtures or equipment as appropriate*
- *Repair and/or new pedestrian crossing fixtures or equipment as appropriate*

**P50/P90 strategic cost estimate as per the Guidance Note Overview, 2018 and Cost Estimation Guidance Note, 2018, Department of Infrastructure, Transport, Cities and Regional Development (or most recent revision).*

A Corridor Development Cost Estimate Report will be developed including the cost estimate and basis of estimate. A risk workshop may be required to establish contingent risks necessary for P50/P90 determinations.

Prioritised Works Schedule

The Consultant is to prepare a fully costed detailed works schedule for the development of the Corridor that is prioritised and achievable within a budget of $25 million. For prioritisation, work is to start at Glenorchy and head towards Hobart until the $25 million of funding is fully expended.

1.3 Assumptions

Assumptions other than those noted in this report are included in the comments of the estimate.

1.3.1 Construction Methodology

It is unknown at this point in time how the full project is to be delivered – either in work packages over several years or as one major project. There are also alternatives how work packages are to be defined and delivered – either in sections of the corridor, or specific work along the entire corridor length (eg culvert upgrades; demolition of existing above ground infrastructure etc).

[redacted]

The estimate includes reconstruction of this road and car parks as it does provide amenity for walkers and cyclists and is the cycleway between the Tasman Bridge and the Intercity Cycleway. Access and connection of the walkways off the Tasman Bridge to the cycleway north of the bridge needs to be considered in conjunction with the

work the Department of State Growth (TAS) is currently doing with the Tasman Bridge Pathways and Railing Upgrade project.

1.3.1.1 Bridges

Item 4.0 - Structural Repair of the Risdon Road Rail Bridge and New Town Rivulet Bridge has been separated from the overall cost estimate. This is because the rail assessment has determined that neither bridge is currently wide enough to accommodate the existing cycleway and transit corridor. As such, the estimate includes replacement of both bridges under Item 5.0 – Corridor Widening. Indicative outturn costs for individual bridge replacement is listed in Table 1.1. This is based on the assumption that each replacement is an individual project as opposed to the estimate by Stage which includes all three bridges within the same project/section.

Table 1.1 Indicative Bridge Replacement Outturn Cost Estimates

Bridge	Base Estimate	P50 Contingency	P90 Contingency	P50 Total	P90 Total
Risdon Rd Rail Bridge	8,048,250	12,378,000	16,622,000	20,426,250	24,670,250
New Town Rivulet Bridge	2,747,850	4,121,000	5,226,000	6,868,850	7,973,850

Each Bridge includes the following tasks:

– Demolition and removal of the existing bridge
– Supply and construction of new bridge
– Widening and strengthening approach embankments incl retaining structures as required. Significant embankment stabilisation is required for Risdon Rd Rail Bridge as described in the Condition Assessment Report
– Construction Preliminaries
    - Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)
    - Independent Quality Assurance Verifier (Spec Clause 160.A3)
    - Road Safety Audits
    - Maintenance during Defects Liability Period
    - Provision of Environmental Completion Audit
    - Environmental Management
    - Traffic Management
– Client Costs
    - Design & Documentation
    - Design Applications, Permits, Fees, Advertising etc.
    - DSG PM/Overhead
    - Construction Contract Management
    - Insurances
– High level contingent risk assessment

An alternative to replacement of the bridges would be to relocate the cycleway off these bridges – perhaps building smaller crossing bridges adjacent or a road crossing at Risdon Road. The feasibility and costs of this would need further investigation. It also may result in finding that width of neither bridge is currently suitable as a transit bridge when considering services and safety infrastructure which will require bridge replacement anyway.

Item 3.0 Structural Protection allows for pier protection of a number of bridges that cross the corridor. During further investigation and design, it may be determined that the remaining width after protection has been installed is insufficient to allow the transit corridor in which case, these bridges may need to be replaced. Estimated

construction cost (excluding design, risk, contingency etc) for replacement of these bridges is noted in Table 1.2 and is not included in the current estimate.

Table 1.2 Estimated Bridge Replacement Costs In lieu of Protection

Bridge	Estimated Construction Cost
3.01a Bellevue Parade	3.2M
3.01b Tower Road Bridge	3.0M

It should be noted that Bellevue parade Bridge may be replaced in the next 2-6 years as part of the Brooker Highway and Domain Highway interchange project.

1.3.2 Quantities

Many volume quantities have been assumed as there has been limited or no investigative works or design at this stage.

Independent Quality Assurance Verifier costs have been determined based on an average contractor spend of $80,000 per week. This is to reflect the constricted brownfield site, limited access to the corridor and anticipated nature of work packages.

Construction Contract Management is based on 2.5% of the total construction cost.

1.3.3 Rates

Rates are expected to be representative of the size and type of project being undertaken and that market conditions at the time of tendering will be comparable to those prevailing when historical tendered rates were obtained.

2. Source Information

2.1 Quantities

Quantities have been derived from plan areas only using aerial imagery and Google Street View. Some works have been described in the Condition Assessment Report.

2.2 Source of Rates

Rates are based on experience of historical data and industry experience in Tasmania at this point in time by means of previous Department of State Growth (TAS) tender schedules and 2021 Digital Rawlinsons Australian Construction Handbook.

Caution is necessary when using historical data as no project is exactly the same, the full background and scope of historical projects are in most cases not fully known by the Estimator and historical Contractor's rates include perceived risk which may or may not be present in the current project. Rates also tend to be weighted so that activities undertaken first are higher than what it actually costs the Contractor so that a positive cash flow is generated at the start of a project.

2.3 Lead Time Escalation

In 2013, BIS Shrapnel was engaged by the Department of Infrastructure and Regional Development to update and extend a suite of state and territory jurisdiction composite road construction indices, with forecasts, for standard road projects from which escalation rates can be derived.

The outcome from the escalation analysis was published in Forecasts from Road Construction Cost Escalation Forecast to 2023 - Escalation, December 2013 Update (BIS Shrapnel Pty Limited). An extract is shown in Table 2.1.

Table 2.1 Tasmanian Escalation Forecast (BIS Shrapnel)

BISS Updated Actuals and Forecasts for Tasmania																	
	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Road Construction Outturn Cost Index (RCOCI) - TAS (BISS)	0.0%	6.9%	9.6%	1.3%	1.3%	6.7%	1.5%	1.3%	-2.1%	-3.8%	1.1%	5.0%	2.2%	3.3%	3.0%	2.6%	3.0%
Source: BIS Shrapnel, ABS Data, Aquenta,AIP, CRU, LME																	

Based on the BIS Shrapnel report, escalation has been forecast up to 2037. The calculation is included in Figure 2 and Table 2. Due to the unknown scoping and timing of the project, escalation has not been applied to any of the outputs from the estimate at this time. However, once work packages and timing have been developed in more detail, escalated project total outturn costs for any given year can be applied.

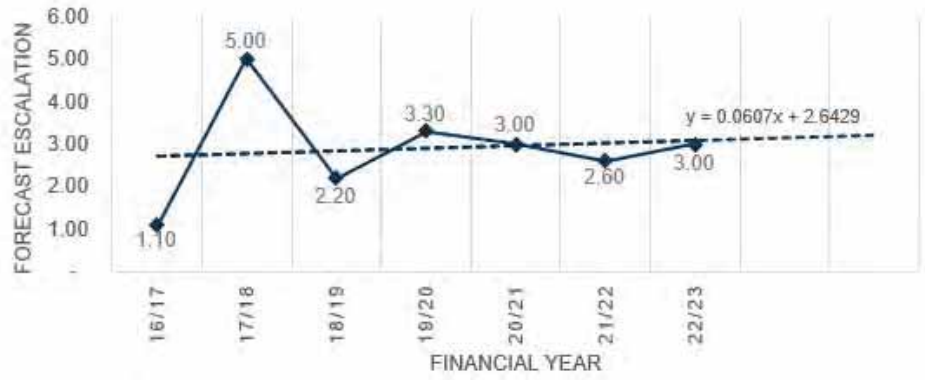


Figure 2.1 BIS Shrapnel Forecasting Trendline

Table 2.2 Tasmanian Escalation Forecast (GHD)

Year	Forecast Escalation	Year	Forecast Escalation
18/19	2.20%	28/29	3.43%
19/20	3.30%	29/30	3.49%
20/21	3.00%	30/31	3.55%
21/22	2.60%	31/32	3.61%
22/23	3.00%	32/33	3.68%
23/24	3.13%	33/34	3.74%
24/25	3.19%	34/35	3.80%
25/26	3.25%	35/36	3.86%
26/27	3.31%	36/37	3.92%
27/28	3.37%		

It is to be noted that this calculation is based on data prior to the global pandemic and should be reviewed in light of more recent data if available.

2.4 Client Costs

Client costs have been determined as follows:

– Costs incurred to date have been included at the rate incurred.
– Department of State Growth (TAS) staff time has been approximated on the basis of 6.8% of the estimated project outturn P50 cost. This is costs incurred from staff time only and costs such as application and permit

fees, advertising etc. are not included. This was as directed by the Department of State Growth (TAS) on 24 July 2015.

2.5 Risk

Risks have been identified by means of review of Appendix 10 of Evans and Peck Best Practice Cost Estimation Standard for Publicly Funded Road and Rail Construction - May 2011 and investigations described in the Condition Assessment Report,

Only risks that have been deemed to have a significant impact on the project cost has been included in the estimate. Smaller risks have been accommodated in the contingent risk item “Unidentified Risks”.

3. Methodology

The estimate has been developed based on Evans and Peck Best Practice Cost Estimation Standard for Publicly Funded Road and Rail Construction, May 2011.

For a detailed explanation on methodology of stochastic estimates developed by GHD and how the information is presented, refer to Appendix A.

4. Estimate

The details of the current Total Outturn Cost Estimate by Section is provided in Appendix B and summarised in Table 4.1. A graphical representation is shown in Figure 4.2.

Appendix B provides the calculations and presentation of the cost estimate in the following order:

– Summary
– Estimate
– Contingent Risk Costs
– @Risk Reports

4.1 Comments on Estimate

The contingency is outside the nominal bounds noted in Evans & Peck due to the very early nature of the scope. The scope is not sufficiently defined to develop a construction cost estimate and further definition is required. In addition, no investigations have been undertaken (geotechnical, environmental, etc). As the scope is further defined, it is expected that the construction costs will increase (due to increased definition of scope and information), and the contingency will reduce as risks and unknowns are clarified.

With the current understanding, the most significant work relates to bridge replacements in Section 5 (New Town) to accommodate the required widening, and the passing loop adjacent the botanical gardens (Section 2). Major cost items are shown in Figure 4.1.

Figure 4.1 Major Cost Items (Construction Cost excl. Preliminaries)

Table 4.1 Total Outturn Cost Estimates by Section

	Section	1 McVilly Dr	2	3	4	5	6	7	8 Peltro St	TOTAL per Works
	Chainage	200-999	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-8000	
Base Estimate										
1.0	Miscellaneous Costs	1,245,881	1,948,236	1,176,061	2,130,456	2,999,981	2,993,731	2,993,731	2,993,731	18,481,807
2.0	Drainage (Section 2.4.6)	518,853	572,350	592,019	831,521	1,327,589	665,801	650,792	626,718	5,785,642
3.0	Structural Protection	-	67,025	352,575	352,575	475,835	-	-	-	1,248,010
5.0	Corridor Widening (Section 4.1.5)	674,786	1,227,972	317,245	946,275	15,047,316	2,315,826	683,552	1,772,442	22,985,414
6.0	Passing Loops (Section 4.1.7)	-	6,614,000	-	-	-	3,386,261	-	-	10,000,261
7.0	Removal/Disposal	145,860	219,850	172,400	172,400	172,400	219,850	219,850	172,400	1,495,010
TOTAL per Section		2,585,380	10,649,432	2,610,299	4,433,227	20,023,121	9,581,469	4,547,925	5,565,290	59,996,144
P50 Construction Contingency										
1.0	Miscellaneous Costs	296,676	535,822	202,186	554,595	913,267	915,204	910,227	903,756	5,231,733
2.0	Drainage (Section 2.4.6)	129,079	141,518	143,639	197,608	309,894	160,241	241,192	226,390	1,569,562
3.0	Structural Protection	-	26,480	61,851	62,648	82,126	-	-	-	233,105
5.0	Corridor Widening (Section 4.1.5)	183,930	316,559	103,982	258,946	3,667,316	585,573	187,378	448,822	5,752,506
6.0	Passing Loops (Section 4.1.7)	-	1,920,955	-	-	-	737,787	-	-	2,658,742
7.0	Removal/Disposal	56,987	82,564	68,338	68,693	68,513	82,539	82,501	68,368	578,503
TOTAL per Section		666,673	3,023,898	579,995	1,142,489	5,041,116	2,501,343	1,421,298	1,647,336	16,024,149
P50 Risk Contingency		2,500,871	2,544,505	2,444,793	2,563,097	2,495,281	2,500,434	2,541,080	2,514,621	20,104,682
TOTAL P50 Cost Estimate		**5,752,924**	**16,217,836**	**5,635,087**	**8,138,814**	**27,559,518**	**14,583,246**	**8,510,303**	**9,727,248**	**96,124,975**
P90 Construction Contingency										
1.0	Miscellaneous Costs	566,407	1,158,716	406,005	1,168,721	2,120,528	2,129,476	2,117,037	2,127,023	11,793,913
2.0	Drainage (Section 2.4.6)	78,003	85,012	86,472	115,170	177,833	112,968	168,551	161,750	985,758
3.0	Structural Protection	-	73,180	129,882	131,062	156,145	-	-	-	490,268
5.0	Corridor Widening (Section 4.1.5)	373,917	684,908	183,712	452,442	6,414,185	1,308,684	376,933	993,512	10,788,293
6.0	Passing Loops (Section 4.1.7)	-	4,484,307	-	-	-	1,507,739	-	-	5,992,046
7.0	Removal/Disposal	106,756	145,420	130,152	129,250	129,762	144,702	145,766	130,433	1,062,241
TOTAL per Section		1,125,082	6,631,542	936,222	1,996,646	8,998,452	5,203,570	2,808,287	3,412,718	31,112,519
P90 Risk Contingency		4,290,512	4,449,199	4,063,872	4,469,979	4,286,307	4,190,228	4,247,418	4,201,936	34,199,451
TOTAL P90 Cost Estimate		**11,168,519**	**27,298,577**	**10,635,181**	**14,605,439**	**40,844,277**	**23,977,044**	**15,566,008**	**17,341,901**	**161,436,946**

4.0	Structural Repair			244,705
	Base Estimate	P50	P90	
	Construction Contingency	56,561	108,237	
	Risk Contingency	129,717	233,254	
	Total	430,983	586,196	

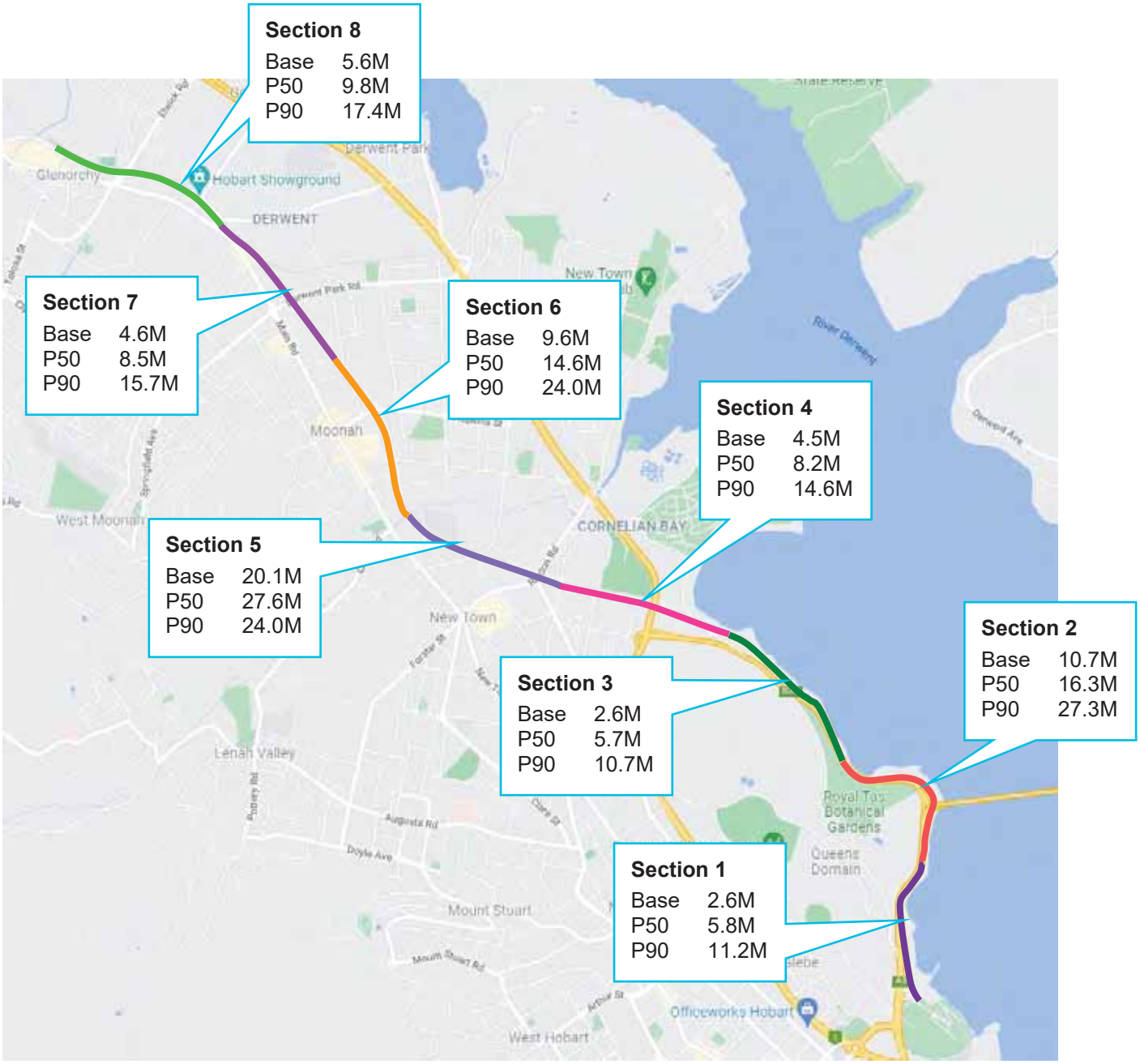


Figure 4.2 Total Outturn Cost Estimates by Section

5. Prioritised Works Schedule

For simplicity and comparison of similar sections of corridor, the corridor has been split into eight equal sections (excluding Section 1 which starts at CH. 200). As the design progresses, these sections may be better defined by geographical elements such as road crossing.

The brief specified that for prioritisation, work is to start at Glenorchy (Section 8) and head towards Hobart (Section 1) until the $25 million of funding is fully expended.

Following this direction and using the P50 costs, the proposed budget would allow for work in the first two sections only (Section 7 and 8) which would be from Peltro Street to Birdwood Avenue in Glenorchy with an estimated P50 cost of $18,237,551. These packages would include fencing, lighting, services relocation, drainage and widening.

Alternatively, specific work packages could be tendered that cover the full length of the corridor. These could include items noted in Table 5.1.

Table 5.1 Possible Work Packages

Work Package	Comments
Removal of existing and installation of new security fencing	To fence entire corridor, would require clearing/demolition and land acquisition so design would need to be progressed enough to allow certainty of extents. In addition, preferable to install fencing last to minimise damage during construction.
Services relocation and installation of underground works for future lighting	Depending on where services are to be relocated, if at outside of corridor, would require clearing/demolition and land acquisition so design would need to be progressed enough to allow certainty of extents.
Upgrading of culverts	Existing culverts can be upgraded, though if culverts require extending due to increased width, preferable to do at same time as upgrade. Would require clearing/demolition and land acquisition so design would need to be progressed enough to allow certainty of extents.
Removal of existing rail infrastructure – platforms, ballast, sleepers and rail	Can be done without design but as discussed Concept Assessment Report, due to ballast contamination, EPA prefer material to be used close to where removed and not taken offsite. Advice from State Growth indicates there are legislative and other obstacles in removing the rail infrastructure as well as maintaining the corridor as a rail corridor once infrastructure has been removed.

Cost Estimate of the above work packages is summarised in Table 5.3 and included as Appendix C.

The potential benefits/disadvantages of either method is reviewed in Table 5.2.

Table 5.2 Method Advantages/Disadvantages

Method	Advantages	Disadvantages
By Section	Larger contractors with higher level of processes (QA, HSE etc) required to do work due to contract value and variety of work scope	Depending on timing, all large contractors are busy on existing projects so potentially no tenderers or inflated tender prices.
	Design and approvals can be staged as construction progresses. Doesn't require full design of corridor before commencement.	If different contractors construct different sections, may have disputes over demarcation or responsibility if items don't work/tie in correctly
	Contaminated material can be easily kept within works	Works not visible to larger Hobart community as visibility restricted to residents/travellers adjacent section under construction only.
By Work Package	'Early Works' packages may be let	Design needs to be completed (or nearly completed) for entire corridor prior to letting construction contracts
	Visibility throughout entire corridor	Smaller work packages contingent on larger packages being done first (such as widening)
	Smaller or specialised contractors may be used for specific work packages	More difficult to manage contaminated material
	Responsibility for aspect/service (ie power/light etc) by one contractor	

5.1 Design and Documentation Component

Design costs vary depending on the total construction value but are mainly based on 5% of the construction cost. GHD has been requested by State Growth to work up an actual design fee to encompass all investigation and design work to provide a concept design that can be more accurately estimated. This is outside the scope of this estimate.

Design fees in this estimate are shown in Table 5.4 and exclude any contingency. There are no design fees for the removal/disposal of existing track infrastructure as it is assumed that this can be dealt with in-house by State Growth.

Table 5.3 Total Outturn Cost Estimates by Package

		Base Estimate	Construction Contingency		Risk Contingency		TOTAL	
			P50	P90	P50	P90	P50	P90
Full Corridor Work Packages								
A	Removal of existing and installation of new security fencing	2,174,163	2,417,390	2,791,635	706,862	1,165,545	5,298,415	6,131,342
B	Services relocation and installation of underground works for future lighting	10,365,778	13,537,097	19,771,709	3,379,665	5,591,314	27,282,541	35,728,801
C	Upgrading of Culverts	5,785,642	7,120,808	9,576,299	1,898,237	3,125,862	14,804,687	18,487,803
D	Crossing upgrades	8,551,125	10,605,898	13,206,201	2,799,530	4,643,621	21,956,552	26,400,947
E	Removal of existing rail infrastructure – platforms, ballast, sleepers and rail	1,802,990	2,679,770	3,584,317	594,070	986,546	5,076,830	6,373,852

Table 5.4 Estimated Design and Documentation Fees

		% used	Section	1	2	3	4	5	6	7	8	TOTAL per Works
				McVilly Dr							Peltro St	
			Chainage	200-999	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-8000	
1.0	Miscellaneous Costs	5%		45,332	68,297	44,722	75,517	102,142	101,892	101,892	101,892	**641,686**
2.0	Drainage (Section 2.4.6)	5%		20,045	22,112	22,901	32,172	51,328	25,781	25,166	24,215	**223,721**
3.0	Structural Protection	10%		4,975	26,125	26,125	35,385	-	-	-	-	**92,610**
5.0	Corridor Widening (Section 4.1.5)	5%		26,114	47,508	11,864	36,237	581,125	89,558	26,483	68,535	**887,425**
6.0	Passing Loops (Section 4.1.7)	5%		-	245,710	-	-	-	128,651	-	-	**374,360**
7.0	Removal/Disposal	0%		-	-	-	-	-	-	-	-	**-**
TOTAL per Section				**96,466**	**409,752**	**105,612**	**179,311**	**734,595**	**345,882**	**153,542**	**194,642**	2,219,802
4.0	Structural Repair	10%		-	-	-	-	18,255	-	-	-	18,255

Appendices

Appendix A

Stochastic Estimating Methodology

A-1 Statistical Definitions

A-1-1 Normal Distribution

A normal distribution, sometimes called the bell curve, is a distribution that occurs naturally in many situations. A bell curve has a small percentage of the points on both tails and the bigger percentage on the inner part of the curve. In the standard normal model, about 5 percent of your data would fall into the “tails” (coloured darker orange in the image below) and 90 percent will be in between. For example, for test scores of students, the normal distribution would show 2.5 percent of students getting very low scores and 2.5 percent getting very high scores. The rest will be in the middle; not too high or too low. The shape of the standard normal distribution looks like this:

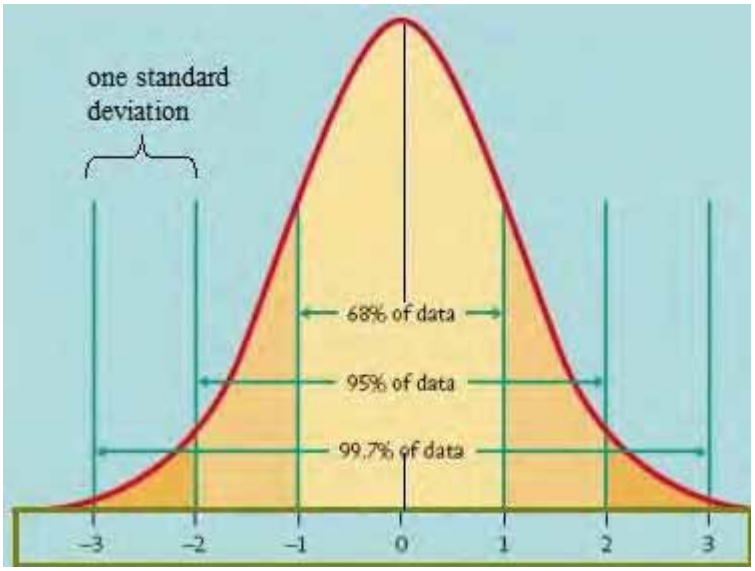


Image credit: University of Virginia.

Figure 5.1 Standard Normal Distribution Model

A-1-2 PERT Distribution

The PERT distribution produces a bell-shaped curve that is nearly normal. It has been extended to the maximum (“Upper” in the Cost Estimate) and minimum (“Min” in Cost Estimate) and given strict definitions for the mean and variance.

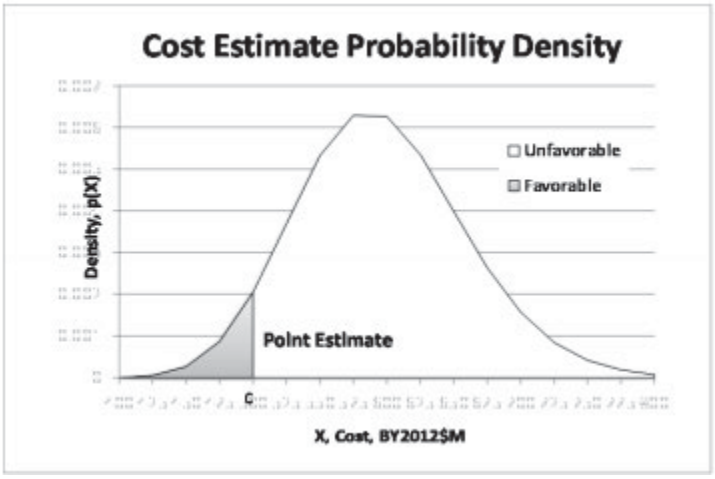


Image credit: NASA.

Figure 5.2 PERT Distribution Model

PERT distributions are used for “known” or bounded risks (inherent risk) such as quantities and rates where there is minor uncertainty on the final values. We know roughly what these should be and are confident that they will not exceed assumed bounds.

A-1-3 LogNormal Distribution

The lognormal distribution differs from the normal distribution in several ways. A major difference is in its shape. Where the normal distribution is symmetrical, a lognormal one is not. Because the values in a lognormal distribution are positive, they create a right skewed curve.

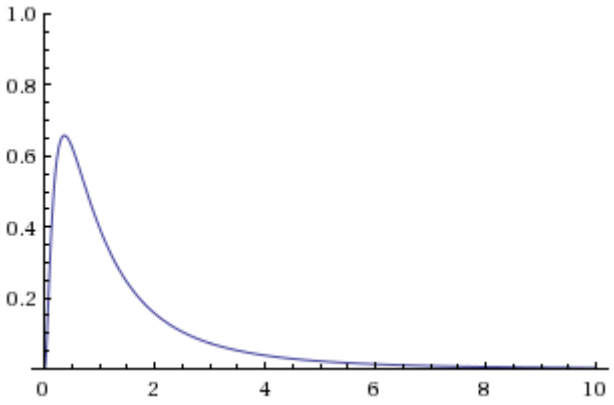


Figure 5.3 LogNormal Distribution Model

LogNormal distributions are used for unknown or unquantifiable risks (contingent risk). These are risks that if they occur, it is difficult to ascertain their true value at the time of estimating and could exceed perceived upper limits. For example, when aboriginal heritage artefacts were discovered at the Jordan River bridge on the Brighton Bypass project, the outcome cost an additional $20M. This does not guarantee that contingent risks will identify and capture all risk costs (there is always the chance of a black swan - an event or occurrence that deviates beyond what is normally expected of a situation and is extremely difficult to predict).

A-1-4 “Alt” Distributions

The difference between each distribution and their respective "Alt" distributions is the attribution of "tails" to the probability distributions (usually the minimum and maximum are assumed to be a P10 and P90 respectively) tor the "Alt" distribution. For example, this means that with a PertAlt distribution, the model samples 10% above the "worst" case (which is actually a P90) and 10% below the "best" case (the P10) during the simulation, producing a wider range than when Pert distributions are used.

A-2 How Monte Carlo Simulation Works

Monte Carlo simulation performs risk analysis by building models of possible results by substituting a range of values—a probability distribution—for any factor that has inherent uncertainty. It then calculates results over and over, each time using a different set of random values from the probability functions. Depending upon the number of uncertainties and the ranges specified for them, a Monte Carlo simulation could involve thousands or tens of thousands of recalculations before it is complete. Monte Carlo simulation produces distributions of possible outcome values.

By using probability distributions, variables can have different probabilities of different outcomes occurring. Probability distributions are a much more realistic way of describing uncertainty in variables of a risk analysis.

A-3 Reading the Outputs

A-3-1 Histogram

The histogram is a plot of outcome for every iteration or calculation undertaken in a Monte Carlo simulation. This is used by the software to show the value of the P50 and P90 which is also shown on the graph.

A-3-2 Regression Tornado Graph

Tornado graphs provide a simple summary of the degree of influence each input variable has on the amount of uncertainty of an output. In a Tornado graph, input variables are ordered from top down according to the degree of influence they have. Put simply, big bars need more attention; small bars don't.

The main idea is that the longer the bar or the larger the coefficient, the greater the impact that particular input has on the output that you are analysing.

A graph with "regression coefficients" does not express them in terms of actual dollars or other units. Rather, they are scaled or "normalised" by the standard deviation of the output and the standard deviation of that input.

A-4 @Risk

Stochastic modelling was undertaken using Palisade @Risk version 8.0 software. The sections below describe the particular analysis undertaken.

A-4-1 Distributions

Two distributions were applied to items within the estimate.

– PertAlt was applied to inherent risks where uncertainty was within known bounds (i.e. quantities, rates, item costs)
– LogNormalAlt was applied to contingent risk severity (cost) values.

The value of each contingent risk item was calculated by a combination of the frequency of expected occurrence and the severity for each occurrence sampled.

A-4-2 Simulation Settings

The following simulation settings were set for calculation of the estimate:

– Number of Iterations 10,000
– Number of Simulations 1
– Sampling Type Latin Hypercube
– Generator Mersenne Twister
– Initial Seed Fixed @ 1

Appendix B

Cost Estimate by Section

Appendix C

Cost Estimate by Work Package

ghd.com

The Power of Commitment

	Section	1	2	3	4	5	6	7	8	TOTAL per Works
		McVilly Dr							Peltro St	
	Chainage	200-999	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-8000	
Base Estimate										
1.0	Miscellaneous Costs	1,245,881	1,948,236	1,176,061	2,130,456	2,999,981	2,993,731	2,993,731	2,993,731	**18,481,807**
2.0	Drainage (Section 2.4.6)	518,853	572,350	592,019	831,521	1,327,589	665,801	650,792	626,718	**5,785,642**
3.0	Structural Protection	-	67,025	352,575	352,575	475,835	-	-	-	**1,248,010**
5.0	Corridor Widening (Section 4.1.5)	674,786	1,227,972	317,245	946,275	15,047,316	2,315,826	683,552	1,772,442	**22,985,414**
6.0	Passing Loops (Section 4.1.7)	-	6,614,000	-	-	-	3,386,261	-	-	**10,000,261**
7.0	Removal/Disposal	145,860	219,850	172,400	172,400	172,400	219,850	219,850	172,400	**1,495,010**
TOTAL per Section		**2,585,380**	**10,649,432**	**2,610,299**	**4,433,227**	**20,023,121**	**9,581,469**	**4,547,925**	**5,565,290**	59,996,144
P50 Construction Contingency										
1.0	Miscellaneous Costs	296,676	535,822	202,186	554,595	913,267	915,204	910,227	903,756	**5,231,733**
2.0	Drainage (Section 2.4.6)	129,079	141,518	143,639	197,608	309,894	180,241	241,192	226,390	**1,569,562**
3.0	Structural Protection	-	26,480	61,851	62,648	82,126	-	-	-	**233,105**
5.0	Corridor Widening (Section 4.1.5)	183,930	316,559	103,982	258,946	3,667,316	585,573	187,378	448,822	**5,752,506**
6.0	Passing Loops (Section 4.1.7)	-	1,920,955	-	-	-	737,787	-	-	**2,658,742**
7.0	Removal/Disposal	56,987	82,564	68,338	68,693	68,513	82,539	82,501	68,368	**578,503**
TOTAL per Section		**666,673**	**3,023,898**	**579,995**	**1,142,489**	**5,041,116**	**2,501,343**	**1,421,298**	**1,647,336**	16,024,149
P50 Risk Contingency		2,500,871	2,544,505	2,444,793	2,563,097	2,495,281	2,500,434	2,541,080	2,514,621	20,104,682
TOTAL P50 Cost Estimate		**5,752,924**	**16,217,836**	**5,635,087**	**8,138,814**	**27,559,518**	**14,583,246**	**8,510,303**	**9,727,248**	96,124,975
P90 Construction Contingency										
1.0	Miscellaneous Costs	566,407	1,158,716	406,005	1,168,721	2,120,528	2,129,476	2,117,037	2,127,023	**11,793,913**
2.0	Drainage (Section 2.4.6)	78,003	85,012	86,472	115,170	177,833	112,968	168,551	161,750	**985,758**
3.0	Structural Protection	-	73,180	129,882	131,062	156,145	-	-	-	**490,268**
5.0	Corridor Widening (Section 4.1.5)	373,917	684,908	183,712	452,442	6,414,185	1,308,684	376,933	993,512	**10,788,293**
6.0	Passing Loops (Section 4.1.7)	-	4,484,307	-	-	-	1,507,739	-	-	**5,992,046**
7.0	Removal/Disposal	106,756	145,420	130,152	129,250	129,762	144,702	145,766	130,433	**1,062,241**
TOTAL per Section		**1,125,082**	**6,631,542**	**936,222**	**1,996,646**	**8,998,452**	**5,203,570**	**2,808,287**	**3,412,718**	31,112,519
P90 Risk Contingency		4,290,512	4,449,199	4,063,872	4,469,979	4,286,307	4,190,228	4,247,418	4,201,936	34,199,451
TOTAL P90 Cost Estimate		**11,168,519**	**27,298,577**	**10,635,181**	**14,605,439**	**40,844,277**	**23,977,044**	**15,566,008**	**17,341,901**	161,436,946

4.0	Structural Repair	P50	P90	
	Base Estimate			**244,705**
	Construction Contingency	56,561	108,237	
	Risk Contingency	129,717	233,254	
	Total	430,983	586,196	

Item		Unit	Rate	Rate Range		Quantity Range		Section	Actual Quantities								Actual Cost								Comments
				Min %	Upper %	Min %	Upper %	Chainage	1 McVilly Dr 200-999	2 1000-1999	3 2000-2999	4 3000-3999	5 4000-4999	6 5000-5999	7 6000-6999	8 Petro St 7000-8000	1 McVilly Dr 200-999	2 1000-1999	3 2000-2999	4 3000-3999	5 4000-4999	6 5000-5999	7 6000-6999	8 Petro St 7000-8000	
1.0	**Miscellaneous Costs**																**1,245,881**	**1,948,236**	**1,176,061**	**2,130,456**	**2,999,981**	**2,993,731**	**2,993,731**	**2,993,731**	
1.0.1	Concept Design (current engagement)	Item		100	110												42,986	42,986	42,986	42,986	42,986	42,986	42,986	42,986	
1.0.2	Removal of existing fencing (both sides of corridor)	m	6.15	80	150	70	150		800	1,000	1,000	1,000	1,000	1,000	1,000	1,000	4,920	6,150	6,150	6,150	6,150	6,150	6,150	6,150	
1.0.3	Supply and installation of new fencing (both sides of corridor)	m	184	90	130	70	150		800	1,000	1,000	1,000	1,000	1,000	1,000	1,000	147,200	184,000	184,000	184,000	184,000	184,000	184,000	184,000	
1.0.4	Supply and installation of lighting	m	500	70	200	90	120		800	1,000	1,000	1,000	1,000	1,000	1,000	1,000	400,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	
1.0.5	Services Alterations	Item		50	500												200,000	500,000	50,000	500,000	1,000,000	1,000,000	1,000,000	1,000,000	
1.0.6	Preliminaries																								
1.0.6.1	Construction Preliminaries																								
1.0.6.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item															15,042	23,803	14,803	23,803	33,803	33,803	33,803	33,803	
1.0.6.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250												25,000	37,500	25,000	37,500	55,000	55,000	55,000	55,000	
1.0.6.1c	Maintenance during Defects Liability Period	Item		50	500												36,500	36,500	36,500	36,500	36,500	36,500	36,500	36,500	
1.0.6.1d	Inspection of buildings	No	900	80	150	100	110					166	166	166	166	166				149,400	149,400	149,400	149,400	149,400	On average, assume five houses per 30 m for length of corridor
1.0.6.1e	Provision of Environmental Completion Audit	Item		100	400												5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
1.0.6.1f	Environmental Management	Item		50	500												10,000	10,000	10,000	5,000	10,000	5,000	5,000	5,000	
1.0.6.1g	Traffic Management	Item		80	200												20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	
1.0.6.2	Client Costs																								
1.0.6.2a	Design & Documentation	Item		50	500												45,332	68,297	44,722	75,517	102,142	101,892	101,892	101,892	
1.0.6.2b	Design Applications, Permits, Fees, Advertising etc.	Item		90	300												10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
1.0.6.2c	DSG PM/Overhead	Item		70	200												201,000	318,000	189,000	348,000	493,000	492,000	492,000	492,000	
1.0.6.2d	Construction Contract Management	Item		90	200												19,000	30,000	19,000	30,000	43,000	43,000	43,000	43,000	
1.0.6.2e	Insurances	Item		80	200												3,900	6,000	3,900	6,600	9,000	9,000	9,000	9,000	
1.0.6.2f	Service Authority fees and charges	Item		70	500												60,000	150,000	15,000	150,000	300,000	300,000	300,000	300,000	
2.0	**Drainage (Section 2.4.6)**																**518,853**	**572,350**	**592,019**	**831,521**	**1,327,589**	**665,801**	**650,792**	**626,718**	
2.0.1	Steel Reinforced Concrete pipes in new works					90	150																		
2.0.1a	300mm dia pipe	m	200	80	150																				
2.0.1b	375mm dia pipe	m	250	80	150					10								2,500							
2.0.1c	450mm dia pipe	m	250	80	150				9	10		20					2,150	2,500		5,000					
2.0.1d	525mm dia pipe	m	425	80	150																				
2.0.1e	600mm dia pipe	m	450	80	150																				
2.0.1f	750mm dia pipe	m	600	80	150				46	16	18		128				27,840	9,600	10,800		76,800				
2.0.1g	900mm dia pipe	m	850	80	150				20	64		8					17,000	54,400		6,800					
2.0.1h	1050mm dia pipe	m	950	80	150						59			100					56,050			95,000			
2.0.1i	1200mm dia pipe	m	1150	80	150																				
2.0.1j	1500mm dia pipe	m	1750	80	150							63								110,250					
2.0.1k	≥ 1800mm dia pipe	m	2500	80	150								76								190,000				
2.0.2	Material excavated and replaced below pipe footings	m³	180	80	150	50	500		3	4	3	4	8	6	5	4	540	720	540	720	1,440	1,080	900	720	
2.0.3	Removal of pipes ≤ 600mm dia	m	50	80	150	90	120		47	52	44	35	30	25			2,330	2,600	2,200	1,750	1,500	1,250			
2.0.4	Removal of pipes > 600mm dia	m	800	80	150	90	120			16		21	72					12,800		16,800	57,600				
2.0.5	Remove endwalls ≤ 600mm dia	No	350	80	150	100	100		10	8	8	6	2	2			3,500	2,800	2,800	2,100	700	700			
2.0.6	Remove endwalls > 600mm dia	No	1500	80	150	100	100			2		2	4					3,000		3,000	6,000				
2.0.7	Construction of endwalls					100	100																		
2.0.7a	300mm dia pipe	No	2000	80	150																				
2.0.7b	375mm dia pipe	No	3000	80	150					2								6,000							
2.0.7c	450mm dia pipe	No	4000	80	150				2	2		4					8,000	8,000		16,000					
2.0.7d	525mm dia pipe	No	5500	80	150																				
2.0.7e	600mm dia pipe	No	6000	80	150																				
2.0.7f	750mm dia pipe	No	7000	80	150				10	2	4		8				70,000	14,000	28,000		56,000				
2.0.7g	900mm dia pipe	No	8000	80	150				4	8		4					32,000	64,000		32,000					
2.0.7h	1050mm dia pipe	No	9000	80	150						10			8					90,000			72,000			
2.0.7i	1200mm dia pipe	No	11000	80	150																				
2.0.7j	1500mm dia pipe	No	13500	80	150							6								81,000					
2.0.7k	≥ 1800mm dia pipe	No	15000	80	150								4								60,000				
2.0.8	Unknown dia culverts					90	150																		
2.0.8.1	Steel Reinforced Concrete pipes in new works		852																						
2.0.8.1a	Ch 5937.06	m												23								19,596			
2.0.8.1b	Ch 6404.54	m													60								51,120		
2.0.8.1c	CH 6660.00 approx.	m													30								25,560		
2.0.8.1d	Ch 6839.34	m													34								28,968		
2.0.8.1e	Ch 7036.96	m														24								20,448	
2.0.8.1f	Ch 7659.30	m														14								11,928	
2.0.8.1g	Ch 7727.52	m														33								28,116	
2.0.8.1h	Ch 7721.69	m														33								28,116	
2.0.8.2	Removal of pipes	m	425			80	200							23	124	104						9,775	52,700	44,200	
2.0.8.3	Remove endwalls	No	925			100	200							2	6	8						1,850	5,550	7,400	
2.0.8.4	Construction of endwalls	No	7600			100	200							2	6	8						15,200	45,600	60,800	
2.0.9	Additional drainage along track	Item		20	500												164,000	183,000	191,000	276,000	451,000	217,000	211,000	202,000	
2.0.10	Preliminaries																								
2.0.10.1	Construction Preliminaries																								
2.0.10.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item															6,547	7,318	7,628	11,028	18,021	8,669	8,428	8,075	
2.0.10.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250												12,500	12,500	12,500	17,500	30,000	15,000	15,000	15,000	
2.0.10.1c	Maintenance during Defects Liability Period	Item		50	500												36,500	36,500	36,500	36,500	36,500	36,500	36,500	36,500	
2.0.10.1d	Provision of Environmental Completion Audit	Item		100	400												5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
2.0.10.1e	Environmental Management	Item		50	500												13,000	15,000	15,000	22,000	36,000	17,000	17,000	16,000	
2.0.10.2	Client Costs																								
2.0.10.3	Design & Documentation	Item		80	150												20,045	22,112	22,901	32,172	51,328	25,781	25,166	24,215	
2.0.10.4	DSG PM/Overhead	Item		70	200												87,000	96,000	99,000	139,000	222,000	111,000	109,000	105,000	
2.0.10.5	Construction Contract Management	Item		90	200												9,000	10,000	10,000	14,000	23,000	11,000	11,000	11,000	
2.0.10.6	Insurances	Item		80	200												1,900	2,000	2,100	2,900	4,700	2,400	2,300	2,200	

Item		Unit	Rate	Rate Range		Quantity Range		Section	Actual Quantities								Actual Cost								Comments
				Min %	Upper %	Min %	Upper %	Chainage	1 McVilly Dr 200-699	2 1000-1999	3 2000-2999	4 3000-3999	5 4000-4999	6 5000-5999	7 6000-6999	8 Petro St 7000-8000	1 McVilly Dr 200-999	2 1000-1999	3 2000-2999	4 3000-3999	5 4000-4999	6 5000-5999	7 6000-6999	8 Petro St 7000-8000	
3.0	**Structural Protection**																	**67,025**	**352,575**	**352,575**	**475,835**				
3.0.1	Pier Protection																								
3.0.1a	Bellevue Parade	Item		80	180															200,000					
3.0.1b	Tower Road Bridge	Item		80	180																200,000				
3.0.1c	Tasman Bridge	Item		80	180														200,000						
3.0.2	Preliminaries																								
3.0.2.1	Construction Preliminaries																								
3.0.2.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item																-	4,000	4,000	4,000				
3.0.2.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250													-	7,500	7,500	7,500				
3.0.2.1c	Road Safety Audits	No	1000	90	200	50	200						2								2,000				
3.0.2.1d	Maintenance during Defects Liability Period	Item		50	500													39,750	39,750	39,750	39,750				
3.0.2.1e	Inspection of buildings	No	900	80	150	100	110		-				34								30,600				
3.0.2.1f	Provision of Environmental Completion Audit	Item		100	400													5,000	5,000	5,000	5,000				
3.0.2.1g	Environmental Management	Item		50	500													5,000	5,000	5,000	15,000				
3.0.2.1h	Traffic Management	Item		80	200													-	-	-	50,000				
3.0.2.2	Client Costs																								
3.0.2.2a	Design & Documentation	Item		70	300													4,975	26,125	26,125	35,385				
3.0.2.2b	DSG PM/Overhead	Item		70	200													12,000	59,000	59,000	80,000				
3.0.2.2c	Construction Contract Management	Item		90	200													-	5,000	5,000	5,000				
3.0.2.2d	Insurances	Item		80	200													300	1,200	1,200	1,600				
4.0	**Structural Repair**																				**244,705**				
4.0.1	Risdon Road Rail Bridge (Section 3.3.1.5)																								
4.0.1a	Bridge structure repair	Item		70	200																40,000				
4.0.2	New Town Rivulet Bridge (Section 3.3.2.5)																								
4.0.2a	Bridge structure repair	Item		50	200																25,000				
4.0.3	Preliminaries																								
4.0.3.1	Construction Preliminaries																								
4.0.3.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item																			1,300				
4.0.3.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250																2,500				
4.0.3.1c	Road Safety Audits	No	1000	90	200	50	200						4								4,000				
4.0.3.1d	Maintenance during Defects Liability Period	Item		50	500																39,750				
4.0.3.1e	Provision of Environmental Completion Audit	Item		100	400																5,000				
4.0.3.1f	Environmental Management	Item		50	500																15,000				
4.0.3.1g	Traffic Management	Item		80	200																50,000				
4.0.3.2	Client Costs																								
4.0.3.2a	Design & Documentation	Item		70	300																18,255				
4.0.3.2b	DSG PM/Overhead	Item		70	200																41,000				
4.0.3.2c	Construction Contract Management	Item		90	200																2,000				
4.0.3.2d	Insurances	Item		80	200																900				
5.0	**Corridor Widening (Section 4.1.5)**																**674,786**	**1,227,972**	**317,245**	**946,275**	**15,047,316**	**2,315,826**	**683,552**	**1,772,442**	
5.0.1	Corridor widening at CH. 320 - 380 EO Item 5.0.8								-																
5.0.2	Corridor widening at CH. 2130 - 2255 EO Item 5.0.8																								
5.0.2a	Clearing & Grubbing	m²	0.75	90	200	50	150					250							188						
5.0.2b	Earthworks	m³	25	80	150	50	300					500							12,500						
5.0.2c	Retaining wall	m²	285	90	250	50	150					250							71,250						
5.0.3	Corridor widening at CH. 3480 (Brocker Hwy Road Bridge) EO Item 5.0.8																								
5.0.3a	Modify cycle path to suit widening	Item		80	500															20,000					
5.0.4	Corridor widening at CH. 3780 – 3880 EO Item 5.0.8																								
5.0.4a	Earthworks	m³	25	80	150	50	200					250								6,250					
5.0.4b	Demolition of existing structures	Item		80	200															47,500					[redacted]
5.0.4c	Lateral shift of cycleway	m	320	50	200	80	150					70								22,400					
5.0.5	Corridor widening at CH. 4030 – 4380 (Risdon Rd Rail Bridge) EO Item 5.0.8																								
5.0.5a	Demolish existing	Item		90	150																100,000				Assume cannot widen existing. Existing bridge is over 100 yrs - at end of design life
5.0.5b	New bridge	Item		70	200																3,675,000				
5.0.5c	Widen and strengthen embankment incl retaining structures as required	Item		50	500																2,000,000				non-based estimate
5.0.6	Corridor widening at CH. 4380 – 4730 (Tower Rd Rail Bridge) EO Item 5.0.8																								
5.0.6a	Earthworks	m³	25	80	150	80	200						3,150								78,750				
5.0.6b	Retaining structures	Item		50	300																300,000				
5.0.6c	Bridgeworks	Item		80	500																1,000,000				
5.0.7	Corridor widening at CH. 4930 – 5055 (Waterway Rail Bridge)																								
5.0.7a	Demolish existing	Item		90	150																100,000				Assume cannot widen existing
5.0.7b	New bridge	Item		90	200																1,575,000				
5.0.7c	Widen embankment incl retaining structures as required	Item		80	500																250,000				non-based estimate
5.0.8	General widening and formation construction to suit required width																								Assumes general widening remains within existing corridor and no further acquisition is required except where noted in localised sections above
5.0.8a	Clearing & Grubbing	m²	0.75	90	200	50	150		1,838	2,298	2,298	2,298	2,298	2,298	2,298	2,300	1,378	1,723	1,723	1,723	1,723	1,723	1,723	1,725	
5.0.8b	Earthworks	m³	25	80	150	50	300		1,103	1,379	1,379	1,379	1,379	1,379	1,379	1,380	27,566	34,466	34,466	34,466	34,466	34,466	34,466	34,500	
5.0.9	Upgrade Road/Pedestrian Crossings	No	400000	90	250	100	150		1	2	-	1	2	4	1	3	400,000	800,000		400,000	800,000	1,600,000	400,000	1,200,000	
5.0.10	Preliminaries																								
5.0.10.1	Construction Preliminaries																								
5.0.10.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item															8,579	16,724	2,403	10,647	198,299	32,724	8,724	24,725	
5.0.10.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250												15,000	27,500	5,000	17,500	310,000	52,500	15,000	40,000	
5.0.10.1c	Road Safety Audits	No	1500	90	250	100	200					3	3							4,500	4,500				
5.0.10.1d	Maintenance during Defects Liability Period	Item		50	500												39,750	39,750	39,750	39,750	39,750	39,750	39,750	39,750	
5.0.10.1e	Provision of Environmental Completion Audit	Item		100	400												5,000	5,001	5,002	5,003	5,004	5,005	5,006	5,007	
5.0.10.1f	Environmental Management	Item		50	500												10,000	10,000	50,000	15,000	80,000	10,000	10,000	10,000	
5.0.10.1g	Traffic Management	Item		80	300												15,000	15,000	15,000	100,000	50,000	15,000	15,000	15,000	For Tower Rd, assume access via New Town High School. Possibility to undertake work during school holidays to minimise traffic/site management
5.0.10.2	Client Costs																								
5.0.10.2a	Land Acquisition	Item		80	200																1,020,000				[redacted] Assume no cost for transference from DPIPWE owned land
5.0.10.2b	Design & Documentation	Item		90	250												26,114	47,508	11,864	36,237	581,125	89,558	26,483	68,535	For general widening, assume topo survey, civil design and documentation. services relocation (where required) covered under Item 1.0.5 and 1.0.6.2f
5.0.10.2c	Design Applications, Permits, Fees, Advertising etc.	Item		90	500														10,000	10,000	40,000				Assume general widening is exempt
5.0.10.2d	DSG PM/Overhead	Item		70	200												113,000	205,000	53,000	158,000	2,508,000	386,000	114,000	296,000	Upper limit allows for representations for bridge replacements
5.0.10.2e	Construction Contract Management	Item		90	200												11,000	21,000	4,000	14,000	248,000	41,000	11,000	31,000	
5.0.10.2f	Insurances	Item		80	200												2,400	4,300	1,100	3,300	47,700	8,100	2,400	6,200	

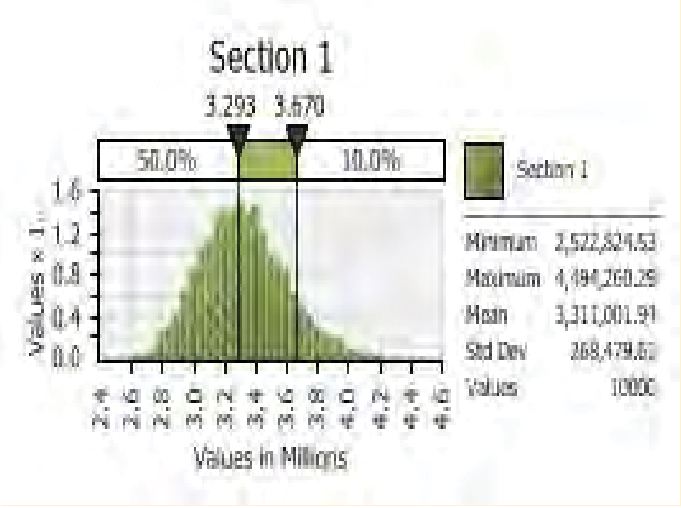
Item		Unit	Rate	Rate Range		Quantity Range		Section	Actual Quantities								Actual Cost								Comments
				Min %	Upper %	Min %	Upper %	Chainage	1 McVilly Dr 200-999	2 1000-1999	3 2000-2999	4 3000-3999	5 4000-4999	6 5000-5999	7 6000-6999	8 Petro St 7000-8000	1 McVilly Dr 200-999	2 1000-1999	3 2000-2999	4 3000-3999	5 4000-4999	6 5000-5999	7 6000-6999	8 Petro St 7000-8000	
6.0	**Passing Loops (Section 4.1.7)**																	**6,614,000**				**3,386,261**			
6.0.1	ID 1 CH. 5150 - 6255																								
6.0.1a	Clearing & Grubbing	m²	0.75	90	200	50	150							6,630								4,973			
6.0.1b	Earthworks	m³	25	80	150	50	300							3,978								99,450			
6.0.1c	Services Relocations	Item		50	300																	1,000,000			non-based estimate
6.0.1d	Road crossings on new line	No	400000	90	250	100	100							3								1,200,000			
6.0.2	ID 2 CH. 1430 - 1760																								
6.0.2a	Clearing & Grubbing	m²	0.75	90	200	50	150			6,000								4,500							
6.0.2b	Earthworks	m³	25	80	150	50	300			3,600								90,000							
6.0.2c	Tree removal	No	3000	85	135	50	200			50								150,000							
6.0.2d	Construction of 6m wide access road	m	400	80	150	90	120			420								168,000							
6.0.2e	Construction of sealed carparks	No	12000	80	150	100	100			2								24,000							
6.0.2f	[redacted]	[redacted]		[redacted]		[redacted]												[redacted]							[redacted]
6.0.2g	Services Relocations - Power	Item		50	300													1,000,000							Relocate existing overhead to underground. Relocate existing submains @ approx. CH. 1430.
6.0.2h	Reclamation between CH. 1860 - 1940 & build to formation level	m²	700	50	500	80	150			2,800								1,960,000							non-based estimate
5.0.8	Preliminaries																								
5.0.8.1	Construction Preliminaries																								
5.0.8.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item																91,190				46,088			
5.0.8.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250													142,500				72,500			
5.0.8.1c	Road Safety Audits	No	1500	90	250	100	200			3				9				4,500				13,500			
5.0.8.1d	Maintenance during Defects Liability Period	Item		50	500													36,500				36,500			
5.0.8.1e	Provision of Environmental Completion Audit	Item		100	400													5,000				5,000			
5.0.8.1f	Environmental Management	Item		50	500													50,000				15,000			
5.0.8.1g	Traffic Management	Item		80	300													25,000				80,000			ID 2 - assume road closed for duration of work & vehicles will enter highway from existing junction so no major TM required.
5.0.8.2	Client Costs																								
5.0.8.2a	Land Acquisition	Item		80	200																				
5.0.8.2b	Design & Documentation	Item		90	250													245,710				128,651			
5.0.8.2c	Design Applications, Permits, Fees, Advertising etc.	Item		90	500													15,000							Upper limit allows for representations
5.0.8.2d	DSG PM/Overhead	Item		70	200													1,103,000				565,000			
5.0.8.2e	Construction Contract Management	Item		90	200													114,000				58,000			
5.0.8.2f	Insurances	Item		80	200													22,100				11,600			
5.0.8.2g	Service Authority fees and charges	Item		50	500													200,000				50,000			Allowance for design fees. Relocation costs included in Item 6.0.2g
7.0	**Removal/Disposal**																**145,860**	**219,850**	**172,400**	**172,400**	**172,400**	**219,850**	**219,850**	**172,400**	
7.0.1	Remove existing platforms	No	37500	90	200	95	200			1				1	1			37,500				37,500	37,500		
7.0.2	Removal of existing ballast, sleepers & rail	m	90	90	300	95	110		800	1,000	1,000	1,000	1,000	1,000	1,000	1,000	72,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	For full corridor: Labour = 7 men @ $100/hr x 8 hrs/day x 5 days/week x 4 weeks/month x 4 months = 448,000 Equipment – several hi-rail trucks, excavator, tipper truck = Allow 250,000
7.0.3	EO 7.0.2 for remediation of contaminated ballast	m	20	95	1000	95	110		800	1,000	1,000	1,000	1,000	1,000	1,000	1,000	16,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	
7.0.4	Preliminaries																								
7.0.4.1	Construction Preliminaries																								
7.0.4.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	Item															1,760	2,950	2,200	2,200	2,200	2,950	2,950	2,200	
7.0.4.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	Item		90	250												5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
7.0.4.1c	Provision of Environmental Completion Audit	Item		100	400												5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
7.0.4.1d	Environmental Management	Item		50	500												10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
7.0.4.1e	Traffic Management	Item		80	200												7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	Minimal TM required at entry/exit to corridor and crossings
7.0.4.2	Client Costs																								
7.0.4.2a	DSG PM/Overhead	Item		70	200												25,000	37,000	29,000	29,000	29,000	37,000	37,000	29,000	
7.0.4.2b	Construction Contract Management	Item		90	200												3,000	4,000	3,000	3,000	3,000	4,000	4,000	3,000	
7.0.4.2c	Insurances	Item		80	200												600	900	700	700	700	900	900	700	

Contingent Risk

Description	Section	Average Frequency of Occurrence (%)	Estimated No. Occurrences	Comment	Severity of Occurrence						Distribution
					Optimistic		Most Likely		Pessimistic		
					$	Description	$	Description	$	Description	
Acid Sulfate Soils (Section 2.5.2)											
Acid Sulfate Soils encountered	5	50%	1	100m length. Low probability of occurance (6-70%)	5,000	Minor remediation	15,000	Medium remediation	50,000	Major remediation	LogNormalAlt
Acid Sulfate Soils encountered	8	50%	1	60m length. Low probability of occurance (6-70%)	5,000	Minor remediation	15,000	Medium remediation	50,000	Major remediation	LogNormalAlt
Landslide Susceptibility (Section 2.5.3)											
Landslide remediation required	5	50%	1	CH. 4160	50,000	Minor remediation, minimal construction impact/protection	100,000	Medium remediation, medium construction impact/protection	500,000	Major remediation, major construction impact/protection	LogNormalAlt
Landslide remediation required	4	50%	2	CH. 3480; CH. 3040	50,000	Minor remediation, minimal construction impact/protection	100,000	Medium remediation, medium construction impact/protection	500,000	Major remediation, major construction impact/protection	LogNormalAlt
Landslide remediation required	2	50%	2	CH. 1520-1640;CH. 1160	50,000	Minor remediation, minimal construction impact/protection	100,000	Medium remediation, medium construction impact/protection	500,000	Major remediation, major construction impact/protection	LogNormalAlt
Landslide remediation required	1	50%	1	CH. 500	50,000	Minor remediation, minimal construction impact/protection	100,000	Medium remediation, medium construction impact/protection	500,000	Major remediation, major construction impact/protection	LogNormalAlt
Contamination (Section 2.6.3)											
Contaminated soil encountered	1	50%	1	Medium Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Contaminated soil encountered	4	50%	1	Medium Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Contaminated soil encountered	6	50%	4	Medium Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Contaminated soil encountered	7	50%	5	Medium Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Contaminated soil encountered	7	80%	1	High Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Contaminated soil encountered	8	50%	1	Medium Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Contaminated soil encountered	8	80%	2	High Level contamination	10,000	Minor remediation	25,000	Medium remediation	80,000	Major remediation	LogNormalAlt
Impact of COVID-19. Pressure on government to release a large number of work packages at once to stimulate the economy saturates the market, limited tenderers due to workforce impacts during lockdown.	All	100%	1		8,999,422	Increase in expected tender price by 15%	17,998,843	Increase in expected tender price by 30%	35,997,687	Increase in expected tender price by 60%	LogNormalAlt
Unidentified Risks	All			Accommodation of smaller risks not specifically identified in the risk register	599,961	1% of construction cost	1,199,923	2% of construction cost	2,999,807	5% of construction cost	PertAlt

@Risk Outputs - Construction

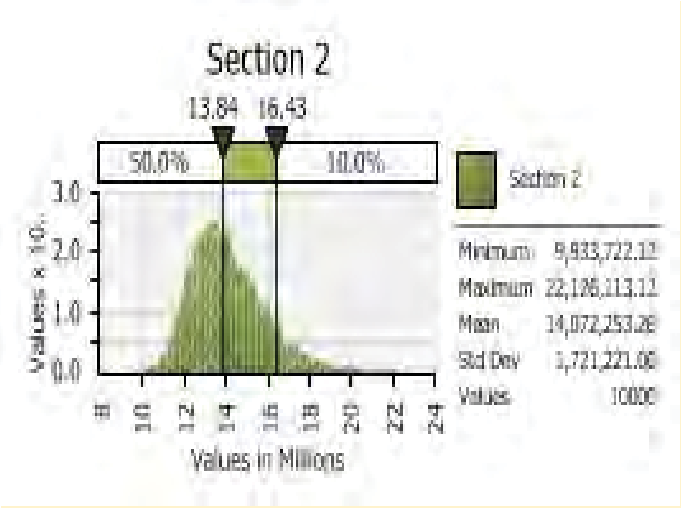
Section 1 - CH. 200 - 999



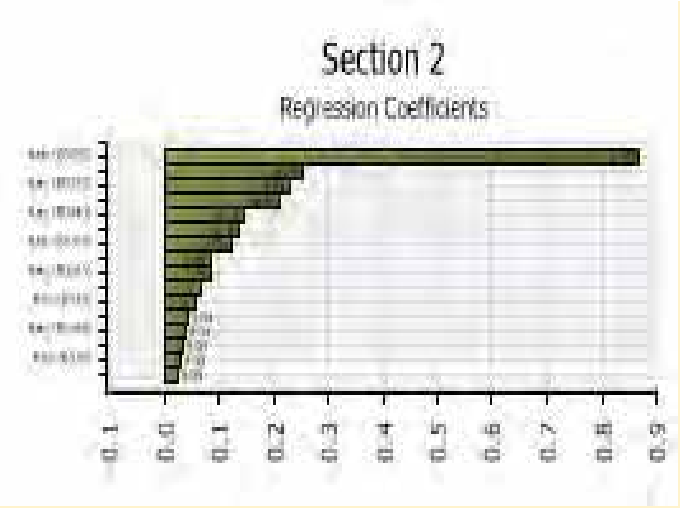
Histogram

Regression Tornado

Section 2 - CH. 1000 - 1999

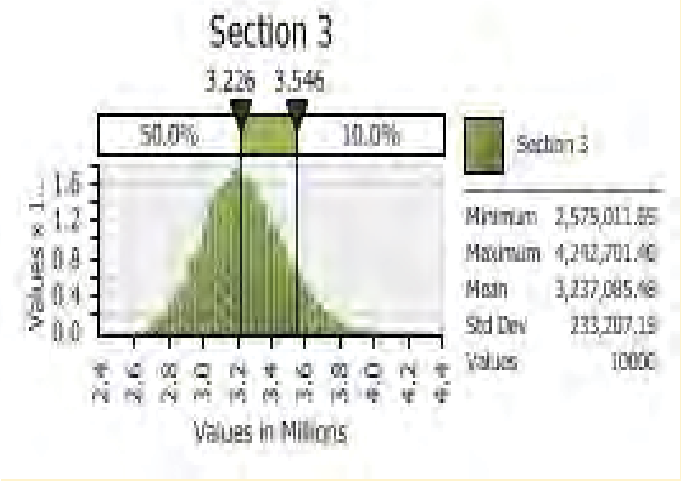


Histogram

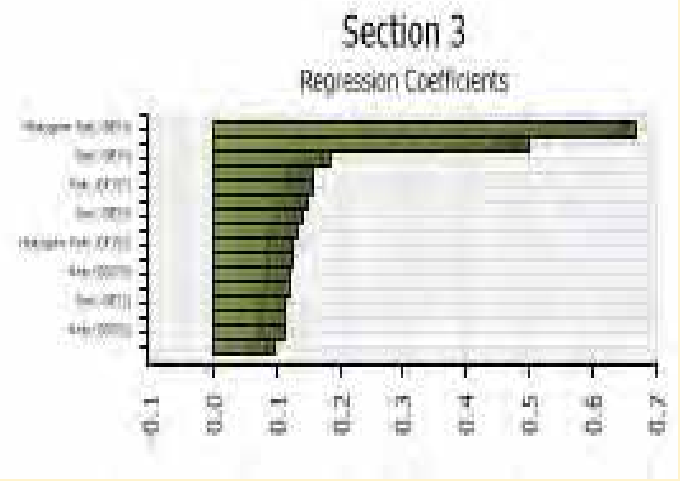


Regression Tornado

Section 3 - CH. 2000 - 2999

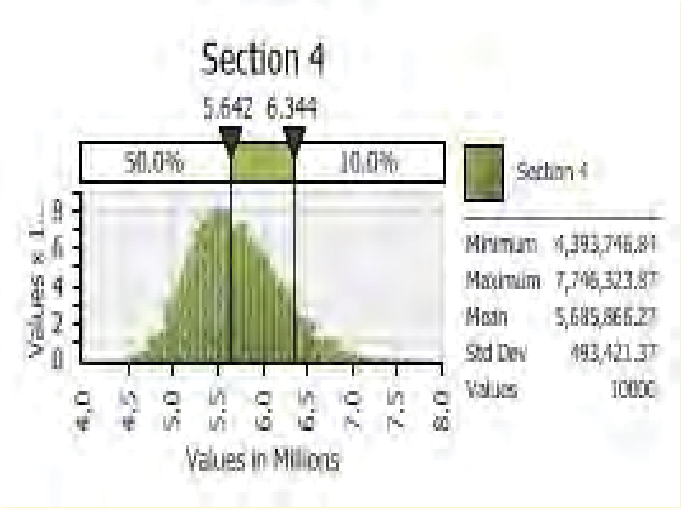


Histogram

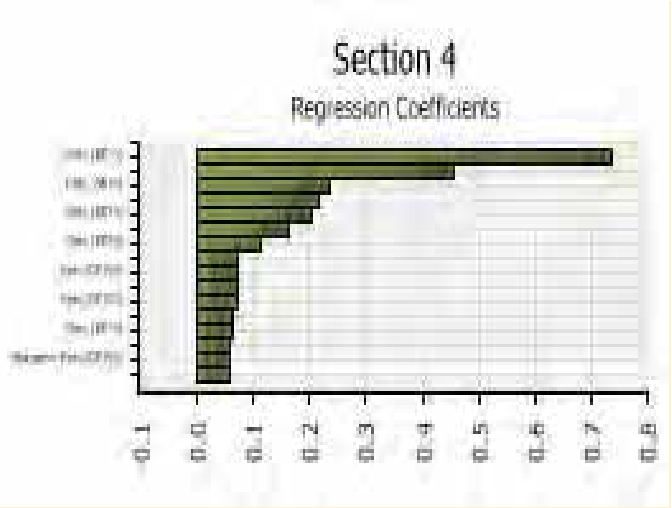


Regression Tornado

Section 4 - CH. 3000 - 3999

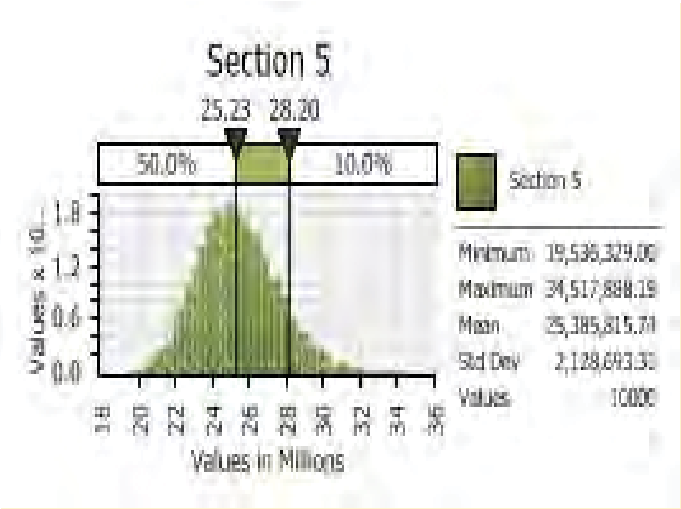


Histogram

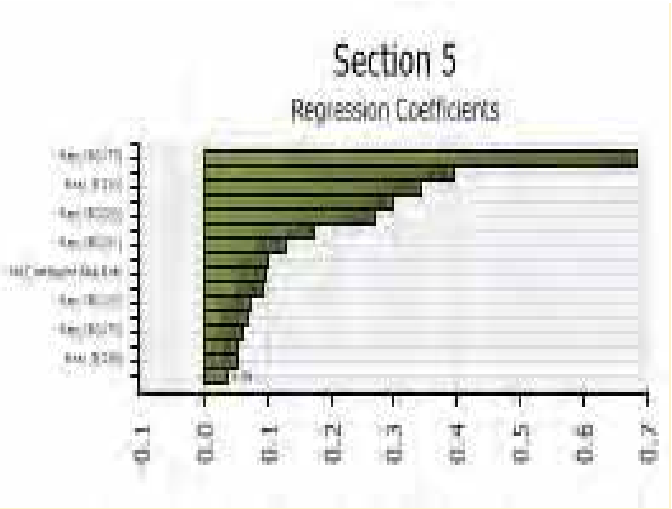


Regression Tornado

Section 5 - CH. 4000 - 4999

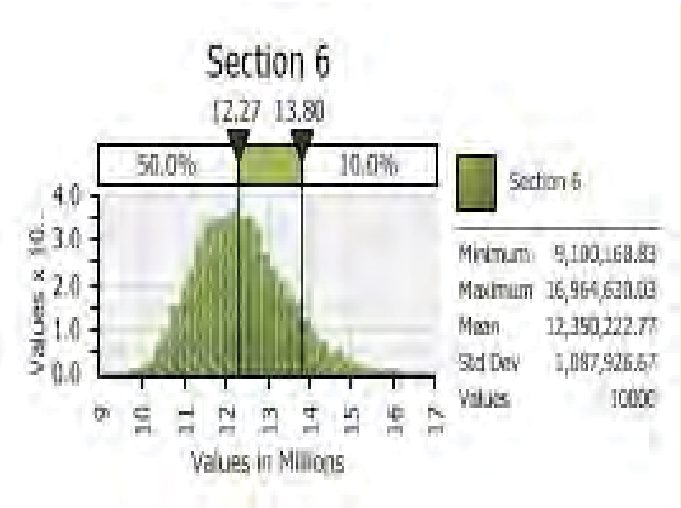


Histogram

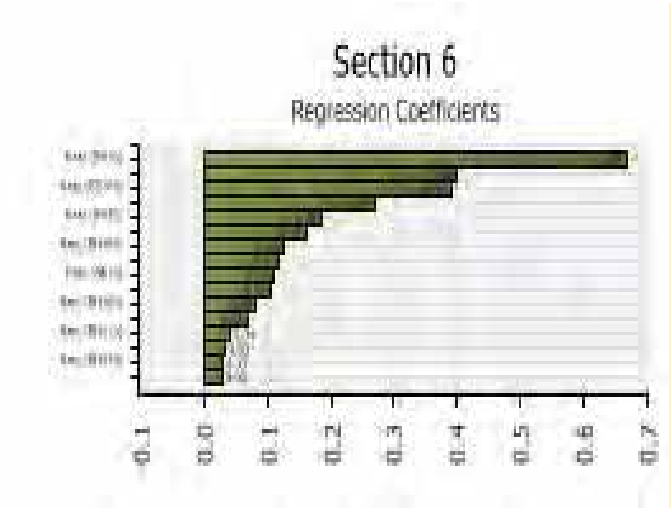


Regression Tornado

Section 6 - CH. 5000 - 5999

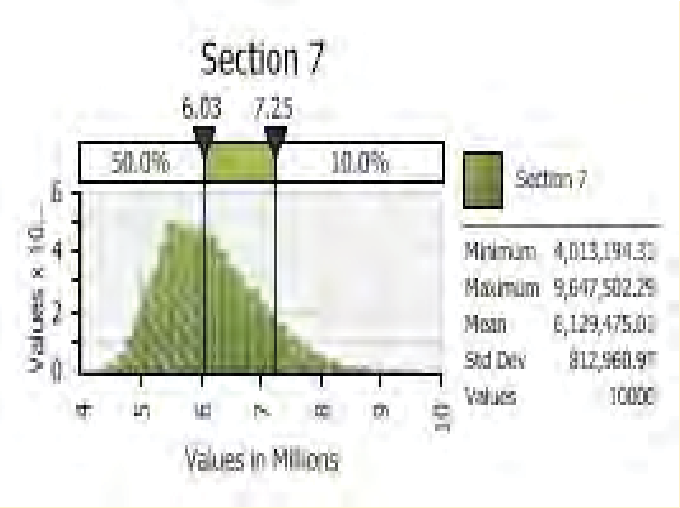


Histogram

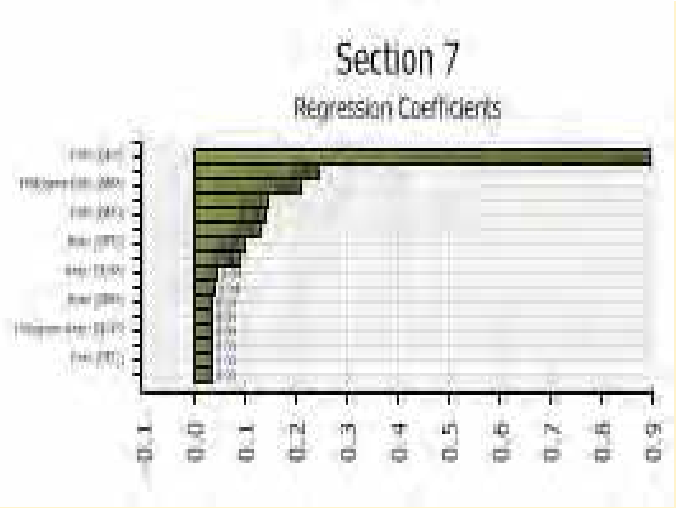


Regression Tornado

Section 7 - CH. 6000 - 6999

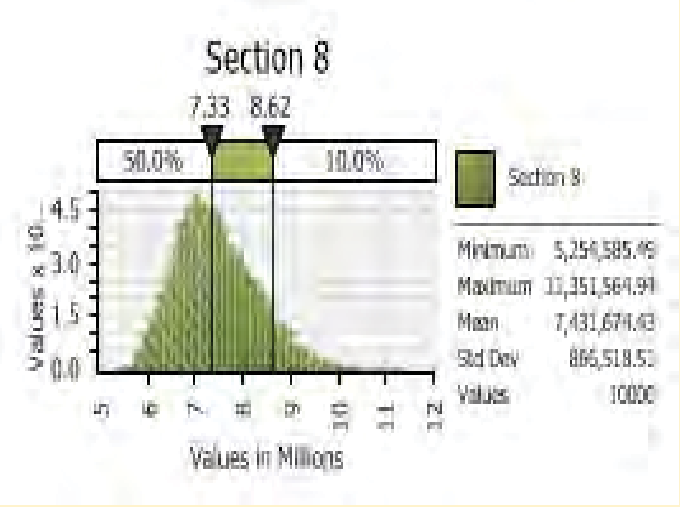


Histogram

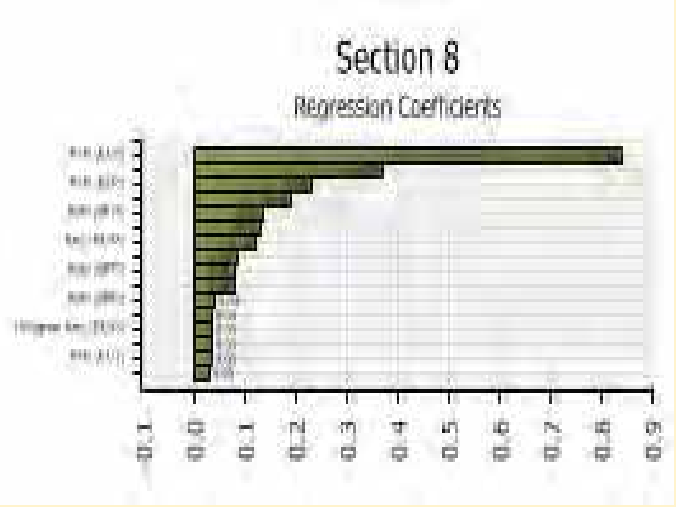


Regression Tornado

Section 8 - CH. 7000 - 8000



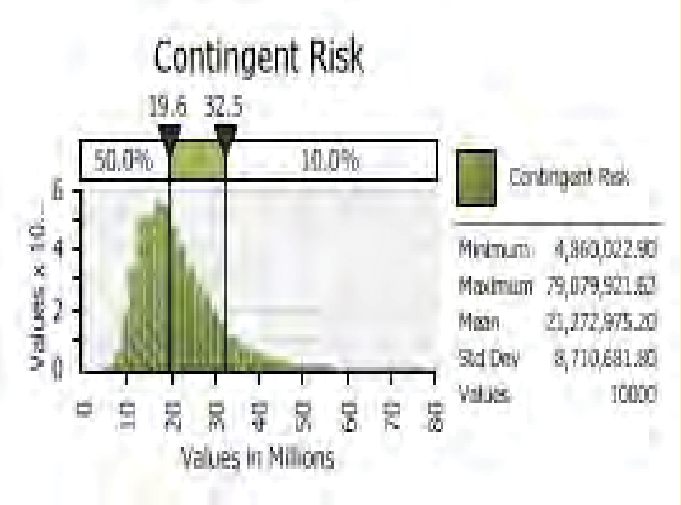
Histogram



Regression Tornado

@Risk Outputs - Contingent Risk

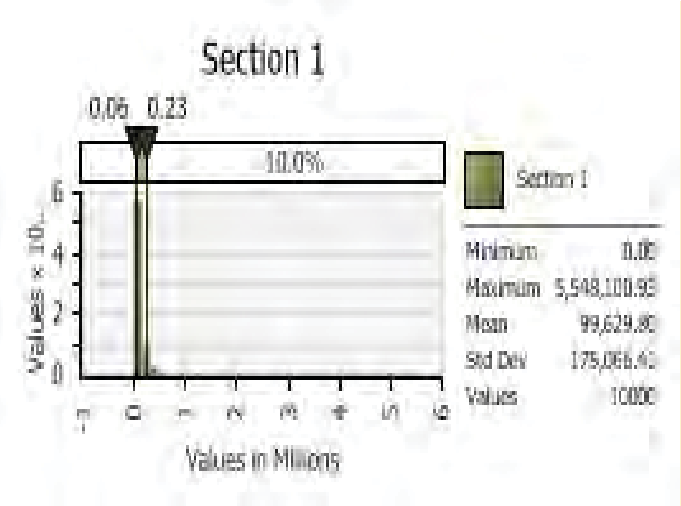
Overall Corridor



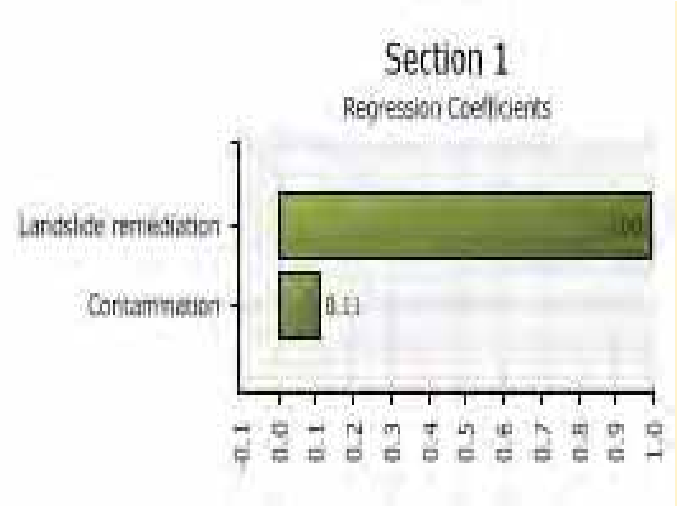
Histogram

Regression Tornado

Section 1 - CH. 200 - 999

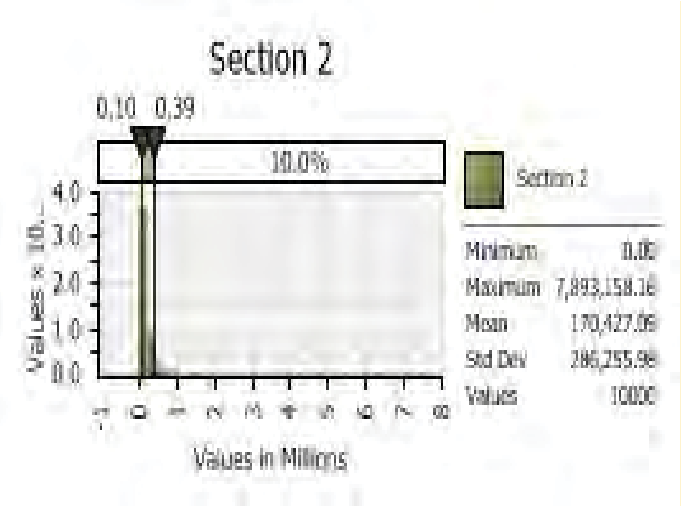


Histogram

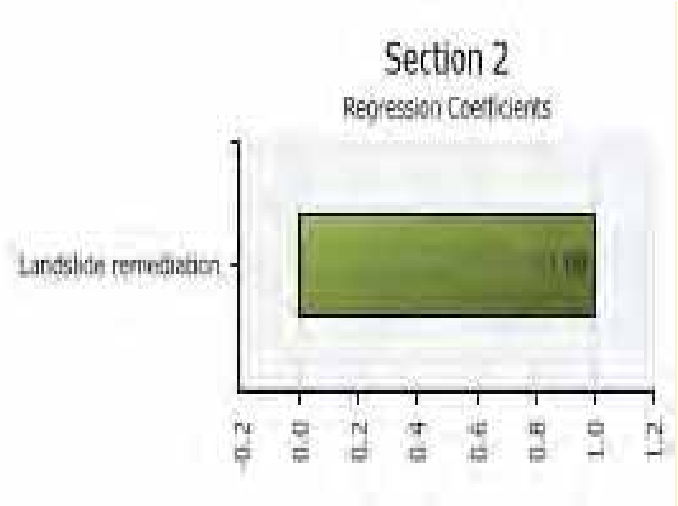


Regression Tornado

Section 2 - CH. 1000 - 1999



Histogram



Regression Tornado

Section 3 - CH. 2000 - 2999

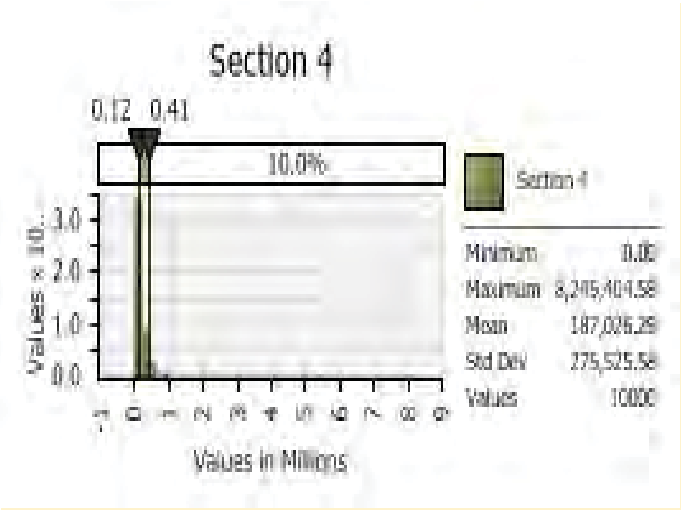
No Contingent Risk

Histogram

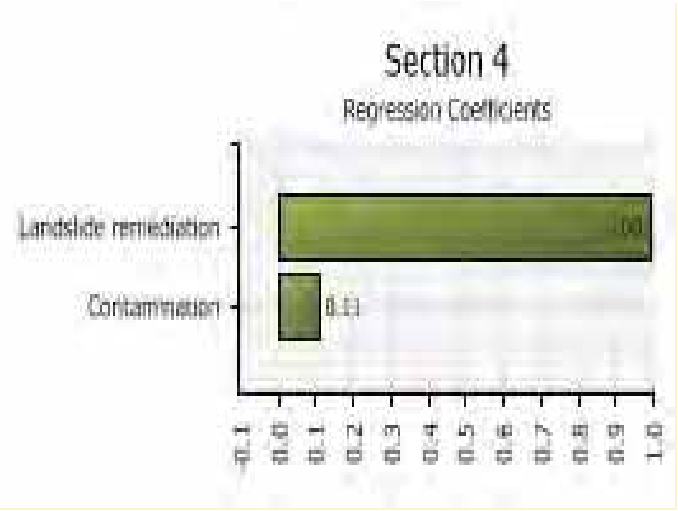
No Contingent Risk

Regression Tornado

Section 4 - CH. 3000 - 3999

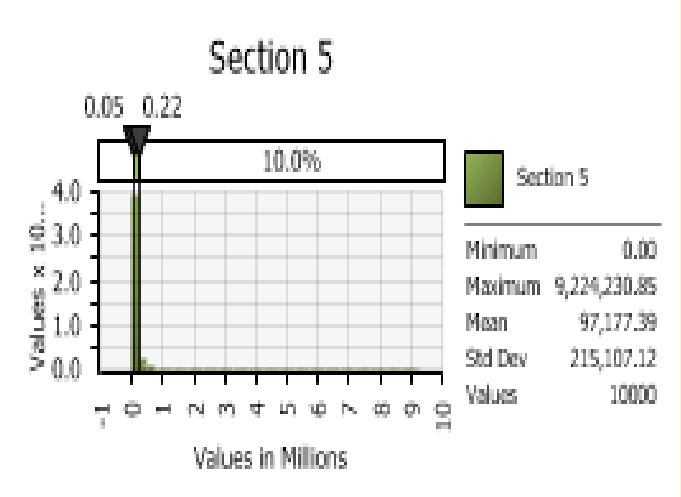


Histogram

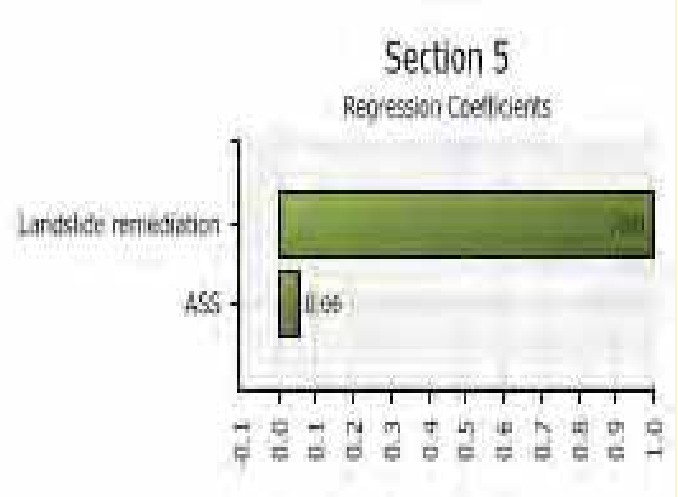


Regression Tornado

Section 5 - CH. 4000 - 4999

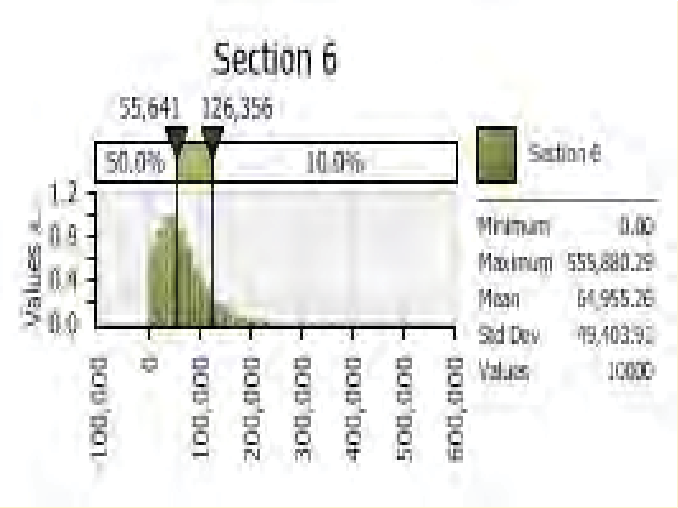


Histogram

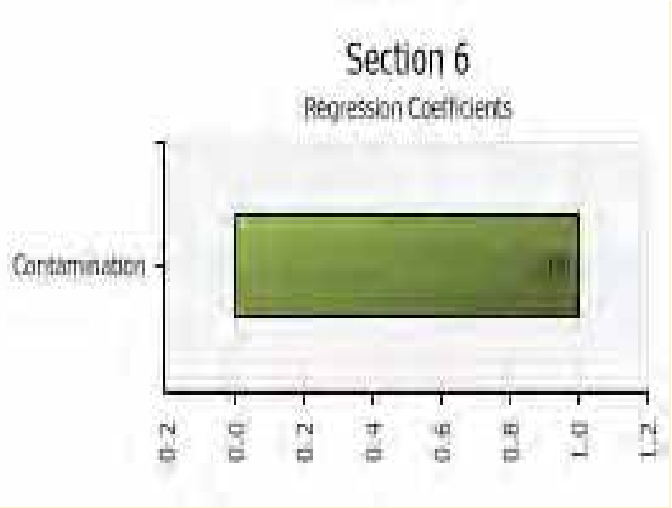


Regression Tornado

Section 6 - CH. 5000 - 5999

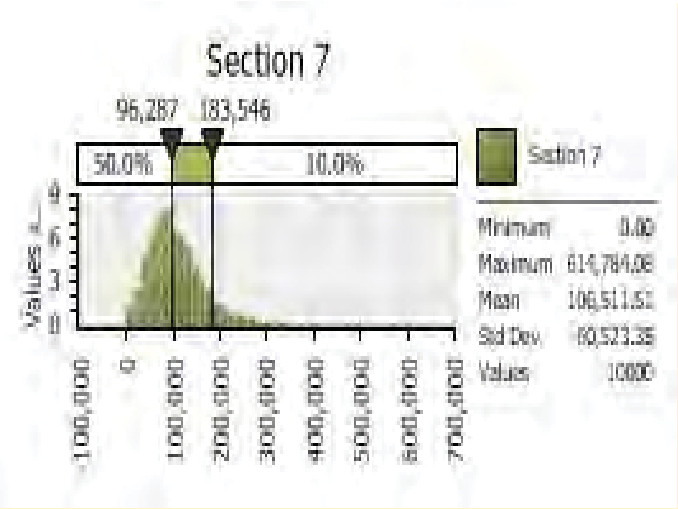


Histogram

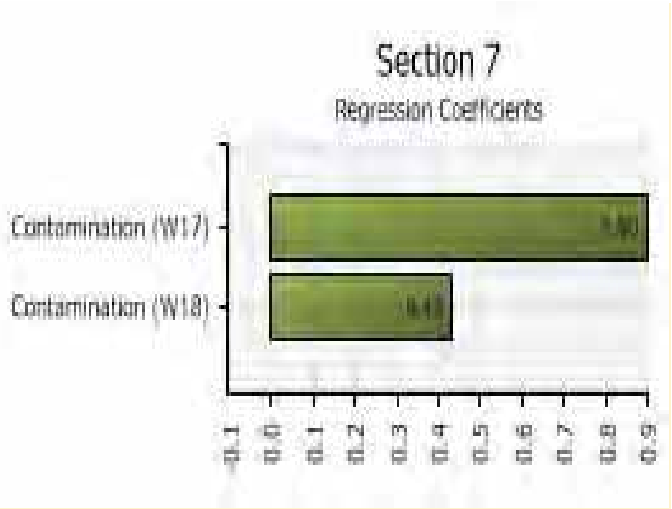


Regression Tornado

Section 7 - CH. 6000 - 6999

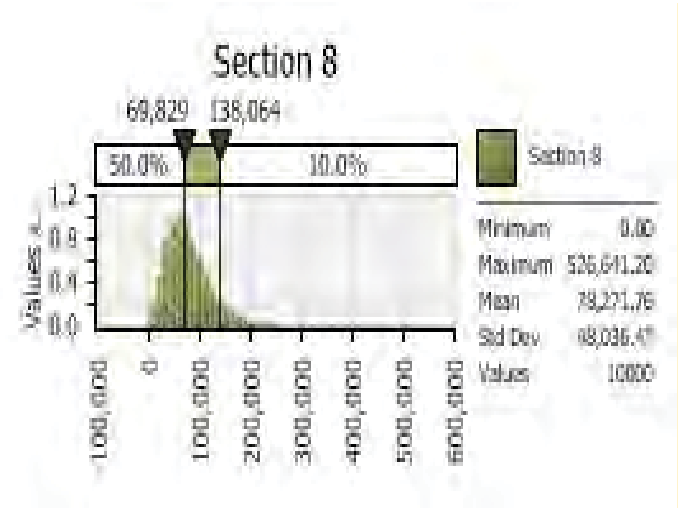


Histogram

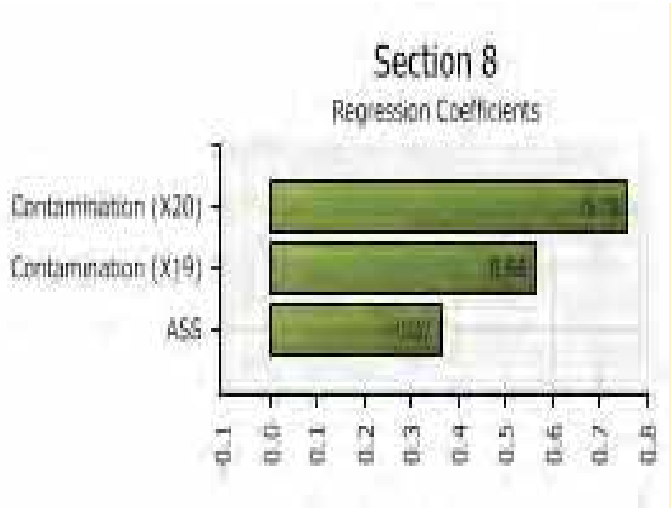


Regression Tornado

Section 8 - CH. 7000 - 8000



Histogram



Regression Tornado

		Base Estimate	Construction Contingency		Risk Contingency		TOTAL	
			P50	P90	P50	P90	P50	P90
Full Corridor Work Packages								
A	Removal of existing and installation of new security fencing	2,174,163	2,417,390	2,791,635	706,862	1,165,545	5,298,415	6,131,342
B	Services relocation and installation of underground works for future lighting	10,365,778	13,537,097	19,771,709	3,379,665	5,591,314	27,282,541	35,728,801
C	Upgrading of Culverts	5,785,642	7,120,808	9,576,299	1,898,237	3,125,862	14,804,687	18,487,803
D	Crossing upgrades	8,551,125	10,605,898	13,206,201	2,799,530	4,643,621	21,956,552	26,400,947
E	Removal of existing rail infrastructure – platforms, ballast, sleepers and rail	1,802,990	2,679,770	3,584,317	594,070	986,546	5,076,830	6,373,852

Item		Qty	Unit	Rate	Quantity Range		Rate Range		Cost	Comments	Distribution
					Min %	Upper %	Min %	Upper %			
A	**Removal of existing and installation of new security fencing**									Does not include earthworks, retaining walls or noted acquisition to allow fencing to be constructed at final boundary at correct level.	
A.1	Removal of existing fencing (both sides of corridor)	7800	m	6.15	70	150	80	150	47,970.00		PertAlt
A.2	Supply and installation of new fencing (both sides of corridor)	7800	m	184.00	70	150	90	130	1,435,200.00		PertAlt
A.3	Preliminaries										
A.3.1	Construction Preliminaries										
A.3.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	1	Item	29,663.40					29,663.40		
A.3.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	1	Item	47,500.00			90	250	47,500.00		PertAlt
A.3.1c	Maintenance during Defects Liability Period	1	Item	36,500.00			50	500	36,500.00		PertAlt
A.3.1d	Provision of Environmental Completion Audit	1	Item	5,000.00			100	400	5,000.00		PertAlt
A.3.1e	Environmental Management	1	Item	25,000.00			50	500	25,000.00	Allow $5K per section	PertAlt
A.3.1f	Traffic Management	1	Item	50,000.00			80	200	50,000.00	Minimal TM required at entry/exit to corridor and crossings	PertAlt
A.3.2	Client Costs										
A.3.2a	Design & Documentation	1	Item	89,629.42			50	500	89,629.42	Allowance for fencing set out plans & technical spec	PertAlt
A.3.2b	DSG PM/Overhead	1	Item	363,000.00			70	200	363,000.00		PertAlt
A.3.2c	Construction Contract Management	1	Item	38,000.00			90	200	38,000.00		PertAlt
A.3.2d	Insurances	1	Item	6,700.00			80	200	6,700.00		PertAlt
B	**Services relocation and installation of underground works for future lighting**									Does not include earthworks, retaining walls or noted acquisition to allow underground services to be located at final boundary or at correct level.	
B.1	Supply and installation of lighting underground services	7800	m	285.00	90	120	70	200	2,223,000.00		PertAlt
B.2	Services Alterations	1	Item	5,250,000.00			50	500	5,250,000.00		PertAlt
B.3	Preliminaries										
B.3.1	Construction Preliminaries										
B.3.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	1	Item	149,460.00					149,460.00		
B.3.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	1	Item	470,000.00			90	250	470,000.00		PertAlt
B.3.1c	Maintenance during Defects Liability Period	1	Item	36,500.00			50	500	36,500.00		PertAlt
B.3.1d	Provision of Environmental Completion Audit	1	Item	5,000.00			100	400	5,000.00		PertAlt
B.3.1e	Environmental Management	1	Item	25,000.00			50	500	25,000.00	Allow $5K per section	PertAlt
B.3.1f	Traffic Management	1	Item	50,000.00			80	200	50,000.00	Minimal TM required at entry/exit to corridor and crossings	PertAlt
B.3.2	Client Costs										
B.3.2a	Design & Documentation	1	Item	208,117.90			50	500	208,117.90	Services relocation, engagement with service authorities, lighting design and documentation	PertAlt
B.3.2b	DSG PM/Overhead	1	Item	1,728,000.00			70	200	1,728,000.00		PertAlt
B.3.2c	Construction Contract Management	1	Item	187,000.00			90	200	187,000.00		PertAlt
B.3.2d	Insurances	1	Item	33,700.00			80	200	33,700.00		PertAlt
C	**Upgrading of Culverts**										
C.1	Steel Reinforced Concrete pipes in new works	1	Item	887,202.00			80	150	887,202.00		PertAlt
C.2	Removal of pipes & endwalls	1	Item	244,905.00			80	150	244,905.00		PertAlt
C.3	Construction of endwalls	1	Item	758,600.00			80	150	758,600.00		PertAlt
C.4	Additional drainage along track	1	Item	1,895,000.00			20	500	1,895,000.00		PertAlt
C.5	Preliminaries										
C.5.1	Construction Preliminaries										

Item		Qty	Unit	Rate	Quantity Range		Rate Range		Cost	Comments	Distribution
					Min %	Upper %	Min %	Upper %			
C.5.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	1	Item	75,714.14					75,714.14		
C.5.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	1	Item	130,000.00			90	250	130,000.00		PertAlt
C.5.1c	Maintenance during Defects Liability Period	1	Item	292,000.00			50	500	292,000.00		PertAlt
C.5.1d	Provision of Environmental Completion Audit	1	Item	40,000.00			100	400	40,000.00		PertAlt
C.5.1e	Environmental Management	1	Item	151,000.00			50	500	151,000.00		PertAlt
C.5.2	Client Costs										
C.5.3	Design & Documentation	1	Item	223,721.06			80	150	223,721.06		PertAlt
C.5.4	DSG PM/Overhead	1	Item	968,000.00			70	200	968,000.00		PertAlt
C.5.5	Construction Contract Management	1	Item	99,000.00			90	200	99,000.00		PertAlt
C.5.6	Insurances	1	Item	20,500.00			80	200	20,500.00		PertAlt
D	**Crossing upgrades**										
D.1	Upgrade Road/Pedestrian Crossings	14	Item	400,000.00	100	150	90	250	5,600,000.00		PertAlt

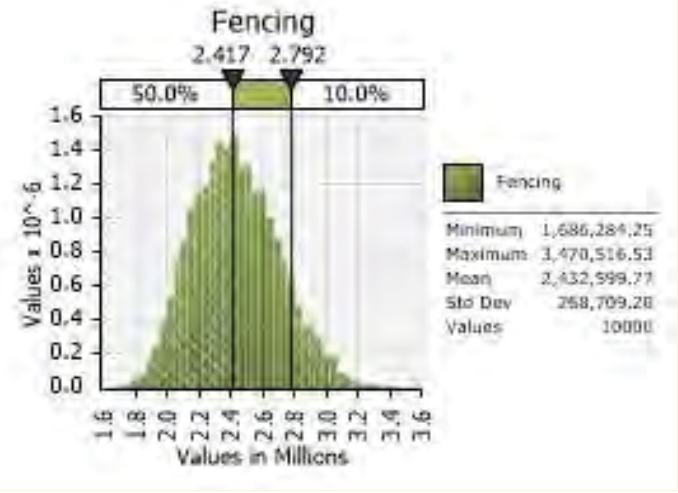
Item		Qty	Unit	Rate	Quantity Range		Rate Range		Cost	Comments	Distribution
					Min %	Upper %	Min %	Upper %			
D.2	Preliminaries										
D.2.1	Construction Preliminaries										
D.2.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	1	Item	112,000.00					112,000.00		
D.2.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	1	Item	350,000.00			90	250	350,000.00		PertAlt
D.2.1c	Road Safety Audits	28	No	1,500.00	100	200	90	250	42,000.00	2 audits per crossing	PertAlt
D.2.1d	Maintenance during Defects Liability Period	1	Item	36,500.00			50	500	36,500.00		PertAlt
D.2.1e	Inspection of buildings	70	No	900.00	100	110	80	150	63,000.00	Allow on average 5 houses per crossing	PertAlt
D.2.1f	Provision of Environmental Completion Audit	1	Item	5,000.00			100	400	5,000.00		PertAlt
D.2.1g	Environmental Management	1	Item	70,000.00			80	300	70,000.00	Allow 5K/crossing	PertAlt
D.2.1h	Traffic Management	1	Item	350,000.00			80	200	350,000.00	Allow 25K/crossing	PertAlt
D.2.2	Client Costs										
D.2.3	Design & Documentation	1	Item	331,425.00			70	300	331,425.00		PertAlt
D.2.4	DSG PM/Overhead	1	Item	1,426,000.00			70	200	1,426,000.00		PertAlt
D.2.5	Construction Contract Management	1	Item	140,000.00			90	200	140,000.00		PertAlt
D.2.6	Insurances	1	Item	25,200.00			80	200	25,200.00		PertAlt
E	**Removal of existing rail infrastructure – platforms, ballast, sleepers and rail**										
E.1	Remove existing platforms	3	No	37,500.00	95	200	90	200	112,500.00		PertAlt
E.2	Removal of existing ballast, sleepers & rail	7800	m	90.00	95	110	90	300	702,000.00		PertAlt
E.3	EO E.2 for remediation of contaminated ballast	7800	m	50.00	95	110	95	1000	390,000.00		PertAlt
E.4	Preliminaries										
E.4.1	Construction Preliminaries										
E.4.1a	Contract Establishment and Mobilisation including fully operational site office and amenities. (Max 2% of Tender Sum)	1	Item	24,090.00					24,090.00		
E.4.1b	Independent Quality Assurance Verifier (Spec Clause 160.A3)	1	Item	47,500.00			90	250	47,500.00		PertAlt
E.4.1c	Provision of Environmental Completion Audit	1	Item	40,000.00			100	400	40,000.00		PertAlt
E.4.1d	Environmental Management	1	Item	80,000.00			50	500	80,000.00		PertAlt
E.4.1e	Traffic Management	1	Item	60,000.00			80	200	60,000.00	Minimal TM required at entry/exit to corridor and crossings	PertAlt
E.4.2	Client Costs										
E.4.2a	DSG PM/Overhead	1	Item	306,000.00			70	200	306,000.00		PertAlt
E.4.2b	Construction Contract Management	1	Item	34,000.00			90	200	34,000.00		PertAlt
E.4.2c	Insurances	1	Item	6,900.00			80	200	6,900.00		PertAlt

Contingent Risk

Description	Section	Average Frequency of Occurrence (%)	Estimated No. Occurrences	Comment	Severity of Occurrence						Distribution
					Optimistic		Most Likely		Pessimistic		
					$	Description	$	Description	$	Description	
Impact of COVID-19. Pressure on government to release a large number of work packages at once to stimulate the economy saturates the market, limited tenderers due to workforce impacts during lockdown.	A	100%	1		326,124	Increase in expected tender price by 15%	652,249	Increase in expected tender price by 30%	1,304,498	Increase in expected tender price by 60%	LogNormalAlt
Unidentified Risks	A			Accommodation of smaller risks not specifically identified in the risk register	21,742	1% of construction cost	43,483	2% of construction cost	108,708	5% of construction cost	PertAlt
Impact of COVID-19. Pressure on government to release a large number of work packages at once to stimulate the economy saturates the market, limited tenderers due to workforce impacts during lockdown.	B	100%	1		1,554,867	Increase in expected tender price by 15%	3,109,733	Increase in expected tender price by 30%	6,219,467	Increase in expected tender price by 60%	LogNormalAlt
Unidentified Risks	B			Accommodation of smaller risks not specifically identified in the risk register	103,658	1% of construction cost	207,316	2% of construction cost	518,289	5% of construction cost	PertAlt
Impact of COVID-19. Pressure on government to release a large number of work packages at once to stimulate the economy saturates the market, limited tenderers due to workforce impacts during lockdown.	C	100%	1		867,846	Increase in expected tender price by 15%	1,735,693	Increase in expected tender price by 30%	3,471,385	Increase in expected tender price by 60%	LogNormalAlt
Unidentified Risks	C			Accommodation of smaller risks not specifically identified in the risk register	57,856	1% of construction cost	115,713	2% of construction cost	289,282	5% of construction cost	PertAlt
Impact of COVID-19. Pressure on government to release a large number of work packages at once to stimulate the economy saturates the market, limited tenderers due to workforce impacts during lockdown.	D	100%	1		1,282,669	Increase in expected tender price by 15%	2,565,338	Increase in expected tender price by 30%	5,130,675	Increase in expected tender price by 60%	LogNormalAlt
Unidentified Risks	D			Accommodation of smaller risks not specifically identified in the risk register	85,511	1% of construction cost	171,023	2% of construction cost	427,556	5% of construction cost	PertAlt
Impact of COVID-19. Pressure on government to release a large number of work packages at once to stimulate the economy saturates the market, limited tenderers due to workforce impacts during lockdown.	E	100%	1		270,449	Increase in expected tender price by 15%	540,897	Increase in expected tender price by 30%	1,081,794	Increase in expected tender price by 60%	LogNormalAlt
Unidentified Risks	E			Accommodation of smaller risks not specifically identified in the risk register	18,030	1% of construction cost	36,060	2% of construction cost	90,150	5% of construction cost	PertAlt

@Risk Outputs - Construction

A - Removal of existing and installation of new security fencing



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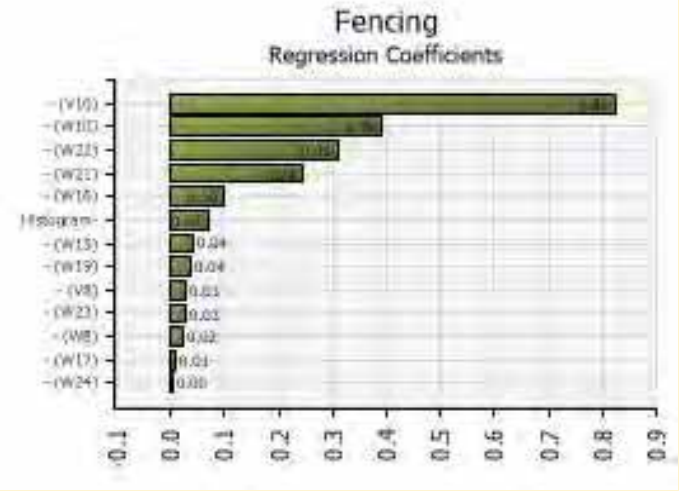
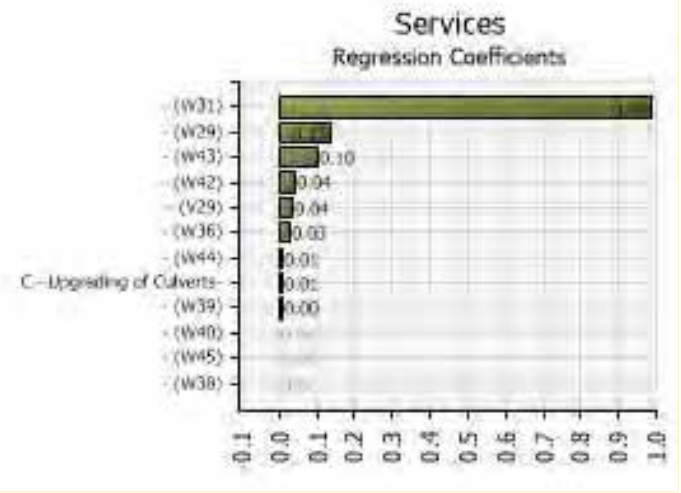


Regression Tornado

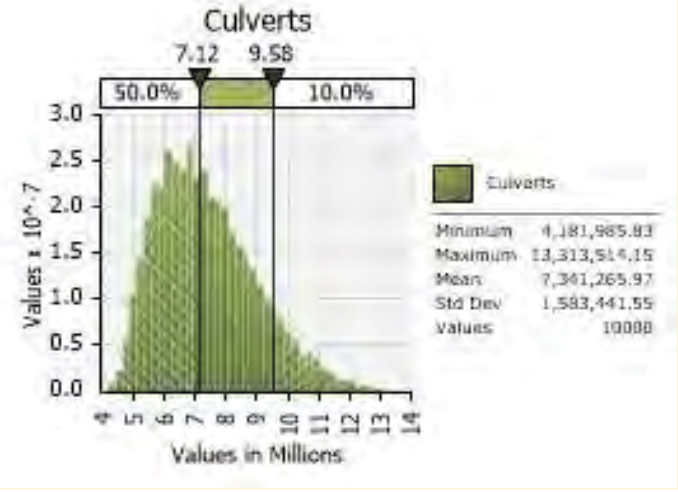
B - Services relocation and installation of underground works for future lighting

Histogram



Regression Tornado

C - Upgrading of Culverts



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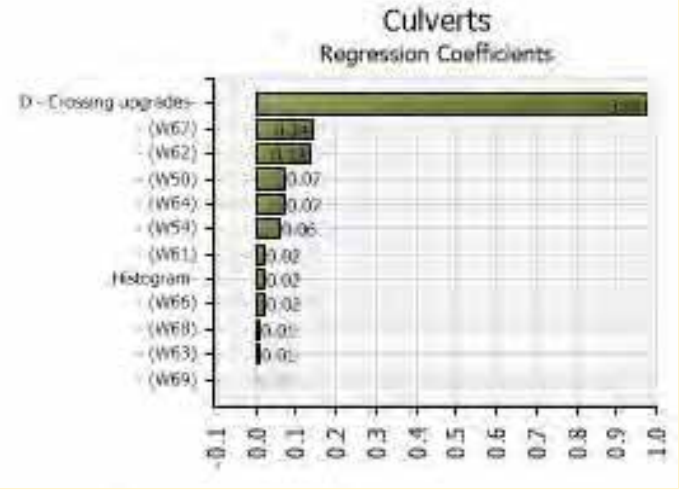
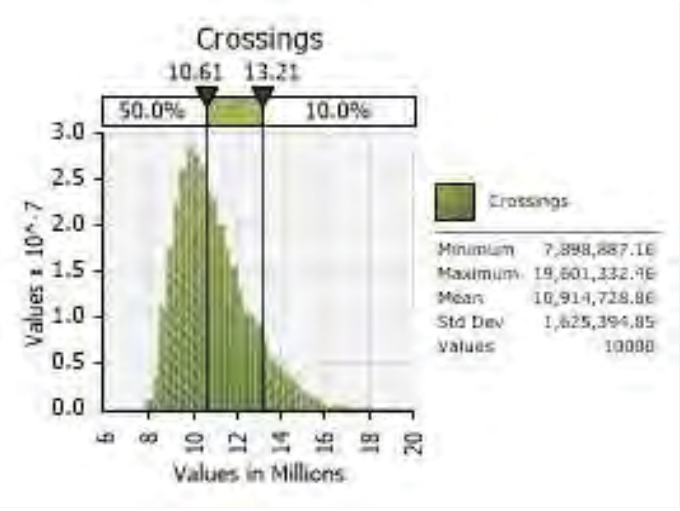


Regression Tornado

D - Crossing upgrades



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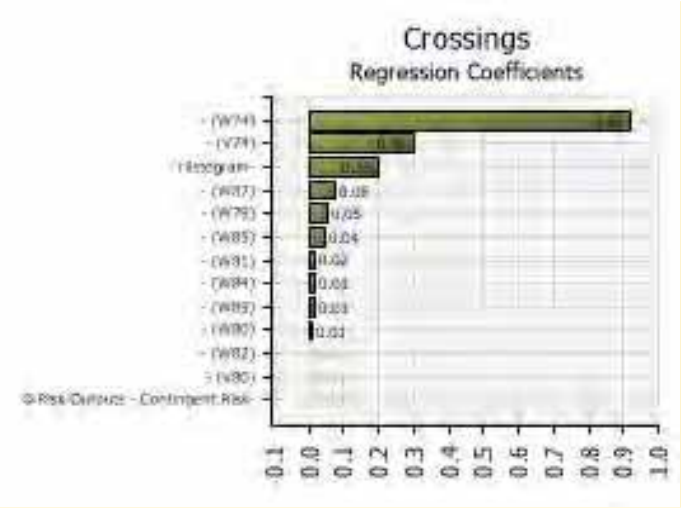
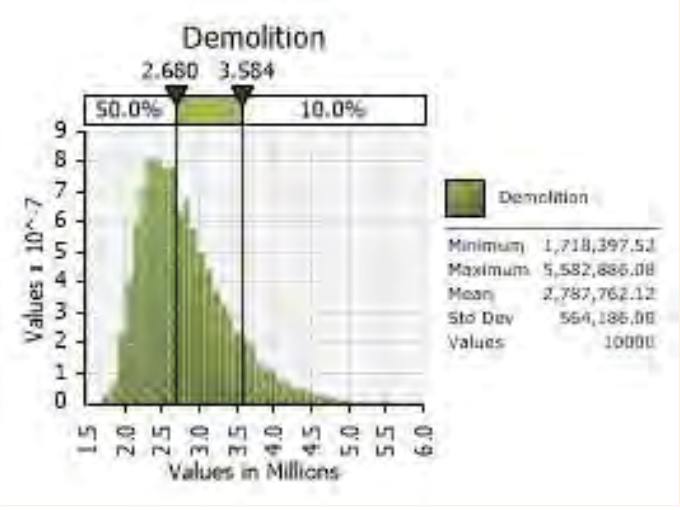


Regression Tornado

E - Removal of existing rail infrastructure – platforms, ballast, sleepers and rail



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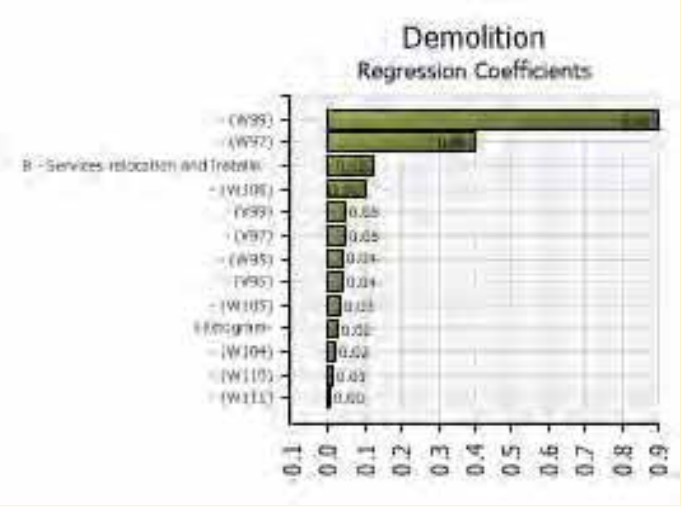
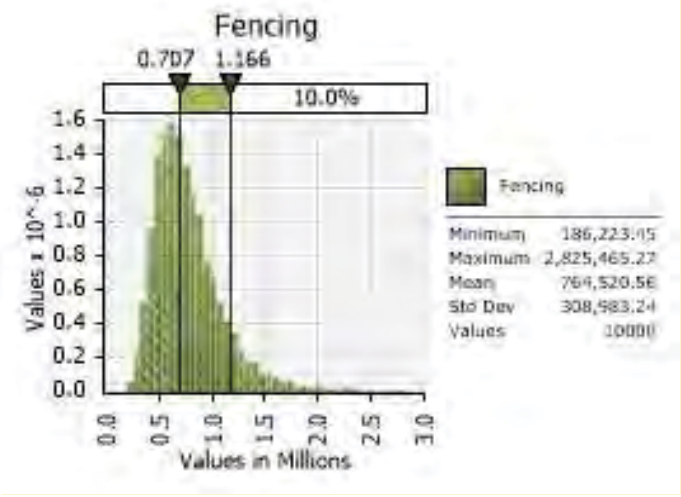


Regression Tornado

@Risk Outputs - Contingent Risk

A - Removal of existing and installation of new security fencing



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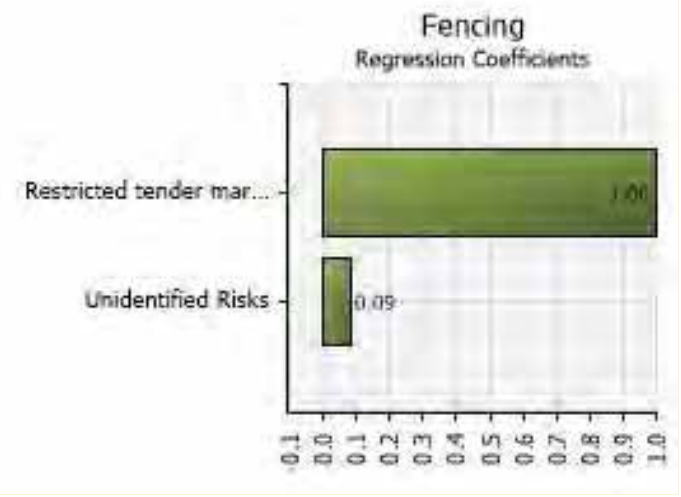
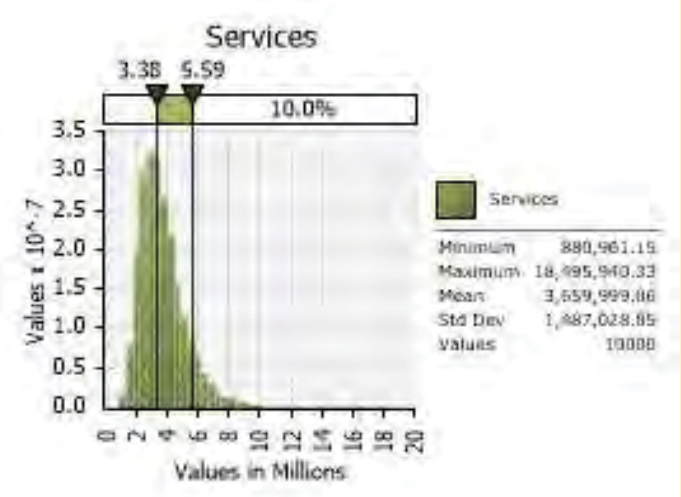


Regression Tornado

B - Services relocation and installation of underground works for future lighting



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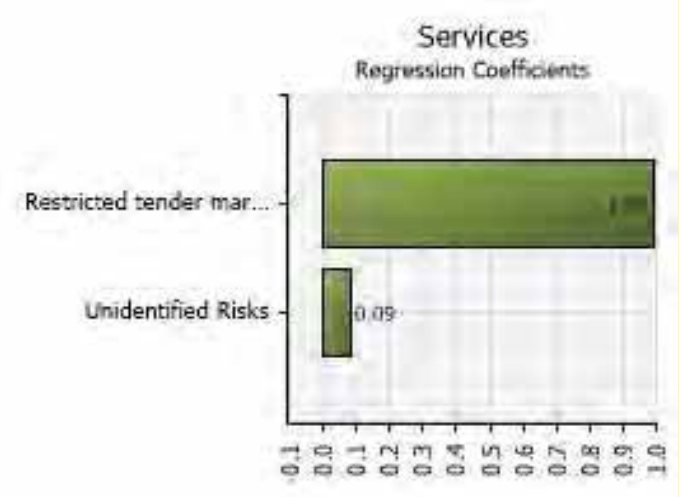
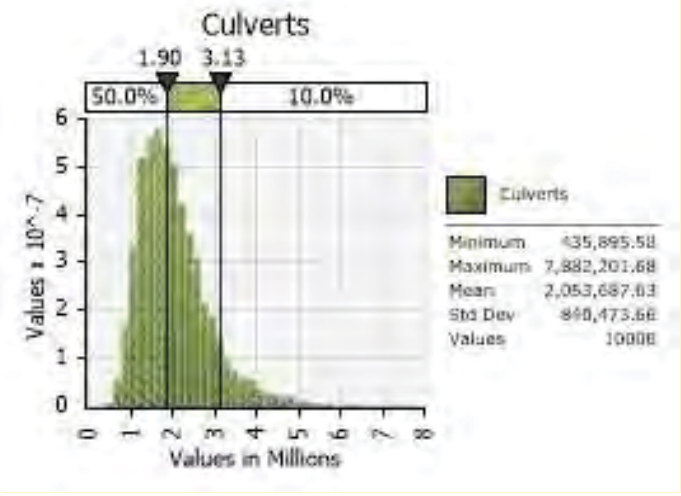


Regression Tornado

C - Upgrading of Culverts



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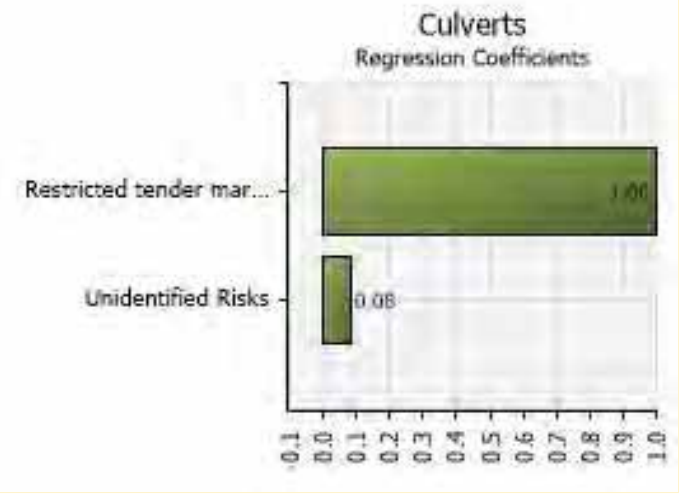
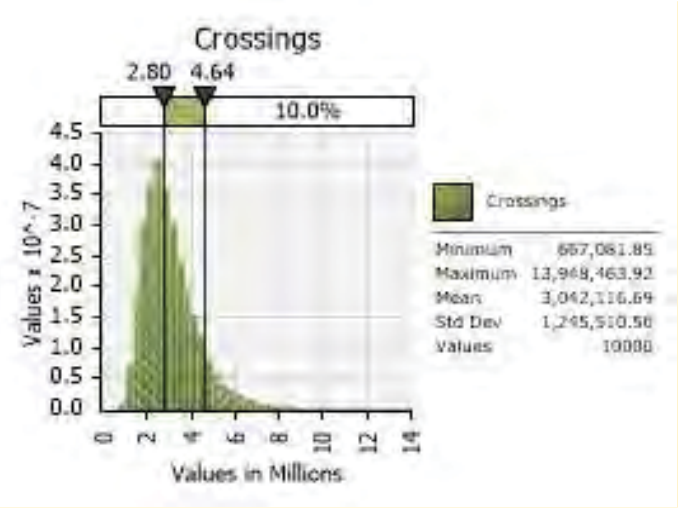


Regression Tornado

D - Crossing upgrades



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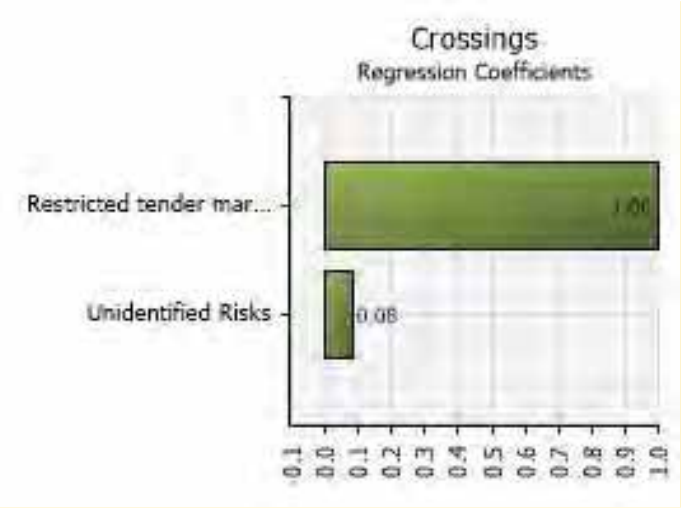
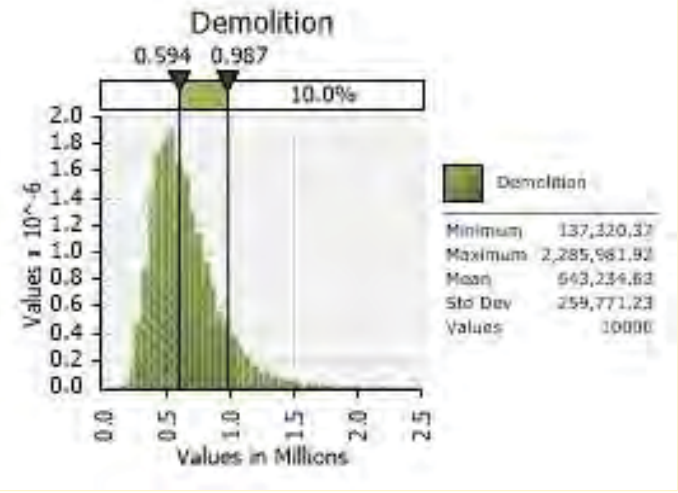


Regression Tornado

E - Removal of existing rail infrastructure – platforms, ballast, sleepers and rail



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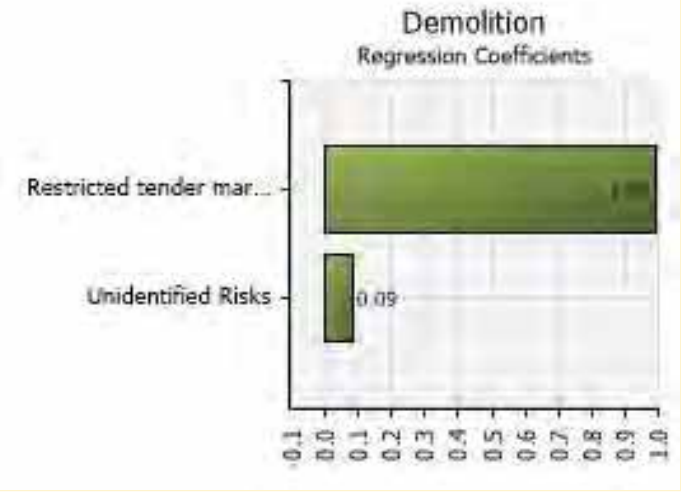

Regression Tornado

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