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**Project:**  
Gardiner Creek Trail Underpass  
at Toorak Road  
Shared Path Reconstruction  
Feasibility Study

**Prepared for:**  
Boroondara City Council  
**Project:** 226461  
**18 December 2015**

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Title		Title	



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**Appendix A Concept Drawings**

**Appendix B Stakeholder Correspondence, Hydraulic Letter and Lighting Report (abstract)**

**Appendix C Construction Cost Estimate**

# 1. Introduction

## 1.1 Site Context

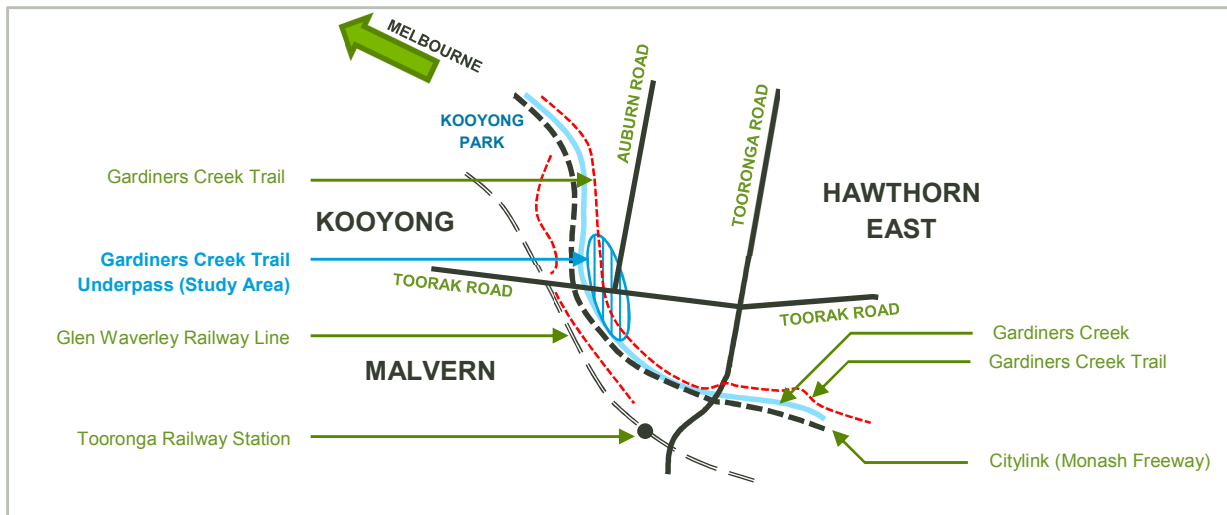
Gardiners Creek Trail is approximately 18 kilometers in length starting from Burnley to Blackburn train station. It is identified as one of Melbourne’s busiest commuter and recreational paths by Bicycle Network. A series of other trails connect to Gardiners Creek Trail including Yarra River Trail, Koonung Trail and Anniversary Trail.

As the trail runs through a number of Councils, they have been constantly improving the trail to encourage pedestrians and bike users to use the trail and provide added safety and security.

Gardiner Creek Trail Underpass is located near the intersection of Auburn Road and Toorak Road. The existing path is located adjacent to Gardiners Creek and Monash Freeway as shown in Figure 1.1.

The study area is located at the underpass.

Figure 1.1 – Locality Map



## 1.2 Study Objectives

City of Boroondara and Bicycle Network have raised safety concerns with the existing Gardiners Creek Trail underpass at Toorak Road. The objective of the study is to determine the feasibility of raising the Gardiner Creek Trail underpass at Toorak Road and improve the shared path approaches to the underpass.

Aurecon has been engaged to provide concept design drawings complemented by an indicative construction cost estimate in the feasibility report for City of Boroondara to seek authority approval and funding at the early stage in the project.



## 2. Methodology

### 2.1 Consultative Process

#### Melbourne Water Consultation

Melbourne Water has been contacted to obtain their advice of the Gardiner Creek flood levels at the underpass location. The study and concept will also refer to the Melbourne Water Shared Pathways Guidelines.

#### VicRoads Consultation

Aurecon has consulted VicRoads in relation to the existing bridge abutment structure and the effect of raising the path level to the abutment.

#### Stakeholders Consultation / Meeting

Aurecon attend relevant meetings upon Council request to discuss the concept design and findings from the study report.

### 2.2 Data Analysis and Reporting

#### Feature Survey

Survey data referenced to Map Grid of Australia (MGA) and Australian Height Datum (AHD). All survey feature points located in 3 dimensions, to an accuracy of +/- 10 millimetres horizontally and vertically. Survey feature points coded to standard VicRoads coding convention, with added logical feature names included in the CAD layer. The Digital Terrain Model (DTM) triangulation and contour generation are to 0.2 metre intervals.

#### Existing Services Desktop Investigation

A MOCS was undertaken to obtain services drawings from the authorities. The location of services were plotted onto the concept and the information used as a part of the design.

#### Field Investigation

An onsite investigation of the study area examined the environment, identified constraints and explored various design options.

#### Preliminary Concept

A preliminary concept of the underpass shared path has been developed considering relevant standards, guidelines and recommendations from appropriate stakeholders. The concept design of the new underpass will be prepared utilising 12D Model software.

#### Final Concept Design and Feasibility Study Report

Aurecon has prepared the final concept and report of feasibility study based on the inputs from stakeholders.

## 3. Standards and Guidelines

### 3.1 Reference Documents

The following standards, guidelines and recommendations were used in the development the shared path concept design and are listed below.

#### Standards Australia

AS 1428.1:2009	Design for access and mobility – General requirements for access – New building works.
AS 1428.2:1992	Design for access and mobility – Enhanced and additional requirements – Buildings and facilities.
AS/NZS 1158.3:2010	Lighting for roads and public spaces – Pedestrian area (Category P) lighting – Performance and design requirements.
AS/NZS 1158.5:2011	Lighting for roads and public spaces – Tunnels and underpasses.

#### Austrroads Guidelines

AGRD06A-09	Guide to Road Design Part 6A: Pedestrian and Cyclist Paths
AP-G88-11	Cycling Aspects of Austrroads Guides
AP-R287-06	Pedestrian-Cyclist Conflict Minimisation on Shared Paths and Footpaths

#### Bicycle Network

Bicycle Network: Good Design Guides (website - 2012)

#### Cycling Resource Centre

Engineering and Planning (website – 2012)

Bicycle Network: Good Design Guides (website - 2012)

#### Melbourne Water

Melbourne Water Shared Pathways Guidelines (2009)

Melbourne Water Constructing Waterway Crossings (2011)

#### VicRoads

Design standards for bicycle facilities (website – 2012)

### 3.2 City of Boroondara

In the project brief, Council has requested the following items to be incorporated in the concept design,

- 3.0m wide shared use path underpass at Toorak Road;
- 3.0m wide shared use path approaches to the underpass;
- 3.0m wide shared use path as per City of Boroondara standard; and
- Safety fencing details at the underpass level and on approaches as required.



## 4. Background and Existing Conditions

### 4.1 Toorak Road Bridge

Toorak road is declared as an arterial road and is constantly busy throughout the day. There is no adequate alternative shared path crossing Toorak Road from the Gardiners Creek Trail. The assessment of the alternative shared path is not evaluated in this report.

The Toorak Road Bridge was believed to be constructed in 1936 with funding from Malvern and Hawthorn Councils, State Government and the Commonwealth Flood Relief Fund at the time. It is believed the previous Melbourne and Metropolitan Board of Works (now City West Water) provided additional funding due to the impact of the 600mm diameter water main. This large water main is currently attached to the bridge underside.

Other attached authority services include telecommunications and electrical conduits. The locations of these existing services are shown on drawing no. SKC-100 in Appendix A.

The bridge structure is maintained by VicRoads.

### 4.2 Gardiners Creek Trail Underpass

In December 2010, a section of path near the subject site was upgraded as part of a major build by the City of Boroondara and VicRoads. Council has adopted a standard path for this section which consists of 3 metre wide path consisting of concrete edging and asphalt surface.

A number of issues with the Gardiners Creek Underpass at Toorak Road which risk the safety of pedestrians and cyclists have been raised.

The poor horizontal alignment from the southern approach direct downhill cyclists into the existing safety handrail at the underpass raises safety concerns due to the sharp curvature as shown on the Figure 4.1. The ends of the safety handrail do not a taper away from the existing path.

The poor vertical alignment is currently lengthy and steep which reduces the reaction time for cyclist to manoeuvre, slow down and stop for any particular reason. The existing longitudinal grades vary from 7% to 13% which is non-compliant with DDA requirements. The shared path approaches and path intersections do not provide adequate sight distance.

There is currently no lighting provided at the underpass which does make pedestrians and cyclists feel safe when using the path at night especially during flooding. Hazards such as unusual and uneven surfaces or obstacles in a poorly lit environment can be a safety concern. Vision impaired and elderly people may become more vulnerable due to these hazards.

Frequent flooding and silt accumulation from Gardiners Creek cause regular maintenance and serious safety hazards to pedestrians and cyclist. The safe alternative path and safety precautions are inadequate at the underpass. The current flood warning signage does not meet the Melbourne Water guidelines for shared pathways.

Figure 4.1 – Gardiners Creek Underpass Concerns



Source: Bicycle Network Victoria: Underpasses – just get under it! (2012)

## 5. Concept Design

Aurecon consulted with relevant stakeholders, Melbourne Water and VicRoads to understand their requirements and conditions for the new shared path. A meeting was held on 24<sup>th</sup> November 2011 with relevant authorities and stakeholders to discuss current issues and concerns for the Gardiner Creek Trail – Toorak Road Underpass project.

Comments and preliminary advice of the requirements and preferred outcome of the shared path upgrade have been received and summarised below.

### 5.1 Current issues on the existing path

1. Steep approach gradients do not meet DDA criteria;
2. Silt and sediment accumulation on the path after major storm events that carries some risks to the path users;
3. Overhead obstruction (water main), approximately 3.0m from current path level will limit the height of raised path level;

### 5.2 Concerns on the proposed path design

- Hydraulic capacity of the creek and flood levels;
- Safety barrier requirements;
- Absolute minimum clearance to the overhead structure and related risk analysis;
- Maintenance vehicle access;
- Ownership of the underpass and duty of maintenance;
- Signage including warning signs;
- Flood activated gate;
- Existing bridge abutment structure;
- Alignment of south approach;
- Cultural heritage buffer;
- Funding of the path upgrade.





### 5.3 VicRoads advice:

- Steep fall and silt build up along the existing shared path are relevant issues that would form VicRoads project evaluation, if the proposal is to be submitted for VicRoads funding consideration;
- There is no existing interim agreement between Melbourne Water and VicRoads regarding shared path;
- Maintenance of shared path is generally not a responsibility of VicRoads, however due to the proximity of the bridge in this case the shared path maintenance is;
- VicRoads Bridge Design and Maintenance teams to be contacted for comments and advice during detailed design stage.

### 5.4 Bicycle Network advice:

- Free draining structure preferred to prevent silt build up and maintenance issue;
- Lack of lighting increases danger level and should be reviewed.


### 5.5 Melbourne Water conditions:

- No increase in flood levels (100 year ARI) or flow velocities as a result of the path or underpass construction;
- Loss of capacity/flood storage due to construction will not be permitted;
- The path and bridge is recommended to be located at or above the 1 in 10 year ARI flood level. This is conditional upon velocity requirements being met for the 1 in 100 year event (velocity x depth ratios less than 0.35). A preliminary HEC-RAS analysis has been undertaken and the underpass will not be able to meet the 1 in 10 year criteria;
- As the path/underpass cannot meet this 1 in 10 year flood level requirement, a package of safety measures should accompany the proposal showing how access to sections of path located below the 1 in 10 year flood level will be prevented in high flow events. This could be through a combination of:
  - confined and fenced drown-out approaches to the particular path section;
  - flood-activated boom gates or other barriers;
  - alternative route signs;
  - depth markers;
  - listing the site with the Emergency Response Team;
  - and/or other measures, of which signage should only be a minor component of the total package;
- Recommend construction methodology includes cantilever path structure, smoothing out of the existing creek surface and some minor channel excavation;
- A HEC-RAS hydraulic model and detailed path design package are required for formal approval;
- Provision of Melbourne Water maintenance vehicle access route;
- Maintenance of shared path is not a responsibility of Melbourne Water;

A hydraulic model using HEC-RAS software has then been developed based on information provided by Melbourne Water to determine the flood levels. Please refer to Appendix B for more details on the hydraulic modelling analysis.

The concept design intent was to elevate the underpass to provide a higher level of flood immunity and at the same time to achieve minimum vertical clearance of 2.5m to an overhead water main.

It is proposed to elevate the underpass using a raised pathway/bridge structure and undertake some minor earthworks beneath the structure to ensure negligible impacts to the conveyance capacity of and flow safety within Gardiners Creek.



VicRoads has provided the original drawings for the Toorak Road Bridge which indicated that the existing shared path was built in the later years (not a part of the original design) and the removal of the existing shared path will not affect the structural integrity of the road bridge support system.

Please refer to Appendix B for the response records and the original drawings of Toorak Road Bridge.

Four different types of underpass bridge and footing structures have been considered and briefly described below:

Option 1: A cantilevered concrete path structure supported by concrete footing adjacent to bridge abutment;

Option 2: A cantilevered concrete path structure supported by concrete piles at mid-span;

Option 3: A steel bridge path structure supported by piles at both ends;

Option 4: A steel bridge path structure supported by anchors and connections to the existing bridge abutment;

A concept design has been undertaken based on relevant design standards and stakeholders requirements/conditions. A longitudinal alignment has been modelled in 12D to show indicative earthworks.

Concept drawings showing different underpass bridge structure options have been prepared and forwarded to relevant authorities for comments and option 1 cantilevered concrete structure is preferred.

## 5.6 Lighting advice.

Preliminary Lighting design advice is not included in this report and has been undertaken by others for Boroondara City Council. However, the following summary items reflect the intent of this preliminary advice (as received from council).

### 5.6.1 Site Observations and Problem.

The physical structure of the underpass inherently reduces the amount of natural lighting along this section of the Gardiners Creek Trail. Flooding during heavy rainfall events leaves a silt build-up on the shared path which is exacerbated by low light conditions. The low level of lighting can increase the risk of a crash as path users may not be able to clearly see the path, other path users or the surrounding features.

### 5.6.2 Suggested Works

- Install StreetLED Eco 18W lights;
- Install 5.5m height path lighting poles;
- Install wall brackets for mounting lights;
- Install distribution cabinet;
- Install steel conduit;
- Install PVC conduit (100 m) – installation of the conduit should be installed as part of the path works to avoid the path to be saw cut to allow for the conduit to be installed under the path for later lighting works;

### 5.6.3 Design Parameters

The path lighting was assessed in accordance with AS1158.3.1-2005 Category P2, and the following locations for installation be considered;

- Three proposed lights to be mounted on the bridge abutment under the structure;
- On the approaches the luminaires at the path junction to maximise the lighting at those conflict points.

#### 5.6.4 Benefits of Proposed Works

The provision of path lighting will ;

- Decrease the likelihood that pedestrians and cyclists will be discouraged from using the Trail during dusk / dark conditions;
- Improve pedestrian and cyclist safety as visibility of the path, other path users and surrounding features will improve under dark conditions;

#### 5.6.5 Crash History

- Two cyclists were injured resulting in concussion and possible facial injuries, damaged helmet and bikes;
- Both cyclists called family members to collect them so the accidents are unlikely to be a recorded statistic;
- The underpass was silted up from the previous bad weather and conditions were reasonably overcast such that light levels at the underpass were not adequate.

## 6. Indicative Construction Cost Estimate.

An indicative construction cost estimate has been prepared based on Option 1 C-section' as discussed during our meeting and sketches provided earlier. Assumptions have been made for costing and these are listed below:

- Assume uniform depth to cut and fill across the width of shared path;
- Assume 200mm depth of existing pavement to be removed under the proposed bridge structure;
- Assume 300mm thickness for the proposed reinforced concrete decking;
- Assume 1.5m deep x 1.2m wide continuous reinforced concrete footing is required;
- Assume standard shared path comprise of 100mm thick concrete slab on 50mm crushed rock bedding;
- Assume 200mm thick concrete on 50mm crushed rock bedding for the Melbourne Water access pavement;
- \$100,000 allowance for lighting;
- No allowance for dewatering;
- No allowance for rock excavation;
- No allowance for landscape works;
- No allowance for reconstruction of existing path to conform to council standard;

A total cost of \$658,750 (incl GST) with 40% contingency estimated for the proposed Gardiners Creek Trail underpass upgrade. Please refer to the attached cost estimate in Appendix C for more details.

## 7. In Principal Approval

The key in-principle approvals for the Gardiners Creek Trail Underpass at Toorak Road are listed below.

### **VicRoads - Contact**

Pirakan Pirakalathanan - Team Leader Investment Strategy  
VicRoads - Metropolitan South East  
12 Lakeside Drive, Burwood East  
T: 03-9881 8028

### **Melbourne Water Contact – (Reference: 208611)**

Michael Thompson - Asset Services  
T: 03-9679 6641  
[assetservices@melbournewater.com.au](mailto:assetservices@melbournewater.com.au)

### **City of Boroondara - Contact**

Bhushan Jani - Senior Transport Engineer, Traffic and Transport  
8 Inglesby Rd, Camberwell, Victoria, 3124  
Telephone: (03) 9278 4518 | Fax: (03) 9278 4512  
[Bhushan.Jani@boroondara.vic.gov.au](mailto:Bhushan.Jani@boroondara.vic.gov.au)

Lighting would need to be installed both on a Council managed land and existing VicRoads overpass bridge. Therefore approvals from both parties would be required. Given that Council has initiated the project, Council will support the installation of lighting.

## 8. Conclusion

The HEC-RAS modelling demonstrates that the proposed shared path structure and excavation works will have a negligible impact on the flood levels and flow velocities. The flood levels upstream of the Toorak Road Bridge are calculated to be within +10mm/-30mm of existing flood levels across the range of storm events modelled. Upstream afflux is limited to a maximum 10mm increase and 100m in extent. The excavation works can be fine-tuned in later stages of design so that the flow regime matches the existing conditions as closely as possible.

Feedback from the relevant authorities has suggested that Option 1 cantilevered concrete path structure will be accepted by most stakeholders, for the following reasons.

For Option 2 and 3, piling is not easy to install due to access, nor is it cost effective. There is a high construction risk of damage to the existing bridge structure due to limited vertical clearance, and it is not cost effective for piling contractors to undertake such work.

For Option 4, anchoring/connection to the existing bridge structure will not be approved by VicRoads as it would have impact on the structural integrity of the existing bridge.

Both Option 3 and 4 require regular maintenance as the proposed decking grate would collect rubbish and debris and cause blockage, leading to access and safety issues.



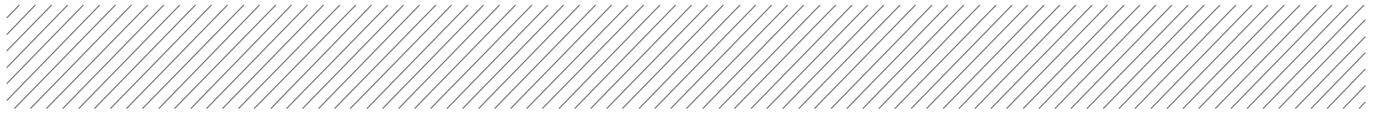
## 9. Recommendations

A free draining cantilevered concrete path structure is recommended for the proposed Gardiners Creek Trail underpass at Toorak Road as this option requires less maintenance, can be constructed under height restrictions, and, as advised by VicRoads and Melbourne Water, is their preferred option.

Hydraulic analysis indicates that the proposed shared pathway structure and associated earthworks can be constructed with negligible impact to the flood levels and flow velocities within Gardiner Creek. The increased elevation provided by the proposed cantilevered path is estimated to provide flood protection to the pathway of somewhere between the 1 in 1 year ARI and 1 in 2 year ARI storm events. As the path does not comply with Melbourne Water safety criteria for a 1 in 2 year ARI storm event or greater, a package of safety measures would need to be implemented for the shared path in detailed design to restrict access during path flooding. These could include;

- Confined and fenced drown-out approaches to the particular path section;
- Flood-activated boom gates or other barriers;
- Alternative route signs;
- Depth markers;
- Listing the site with the Emergency Response Team;
- And/or other measures, of which signage should only be a minor component of the total package

The proposed shared path and the underpass bridge structure based on Option 1 should be further developed in detailed design stage. The exact alignment should be confirmed and formal approval from VicRoads and Melbourne Water obtained. Lighting should also be provided along the underpass to increase safety to users.

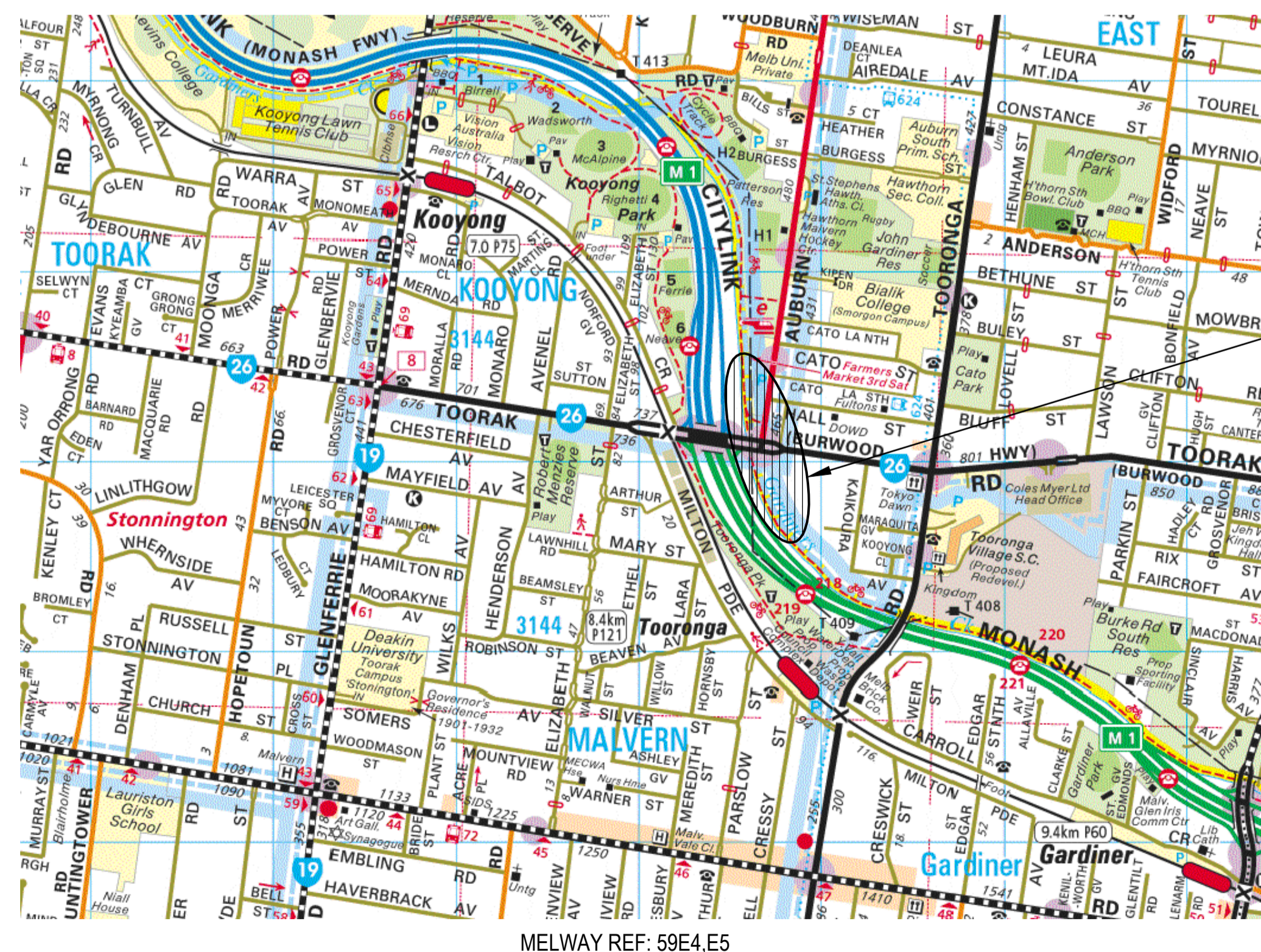


# Appendix A

## Concept Drawings

# GARDINERS CREEK TRAIL UNDERPASS FEASIBILITY STUDY

LOCALITY PLAN



AREA OF WORKS

**DRAWING INDEX**

- SKC-000 COVER SHEET
- SKC-100 CONCEPT PLAN
- SKC-200 CONCRETE BRIDGE STRUCTURE
- SKC-300 STEEL BRIDGE STRUCTURE
- SKC-400 BRIDGE STRUCTURE SECTIONS



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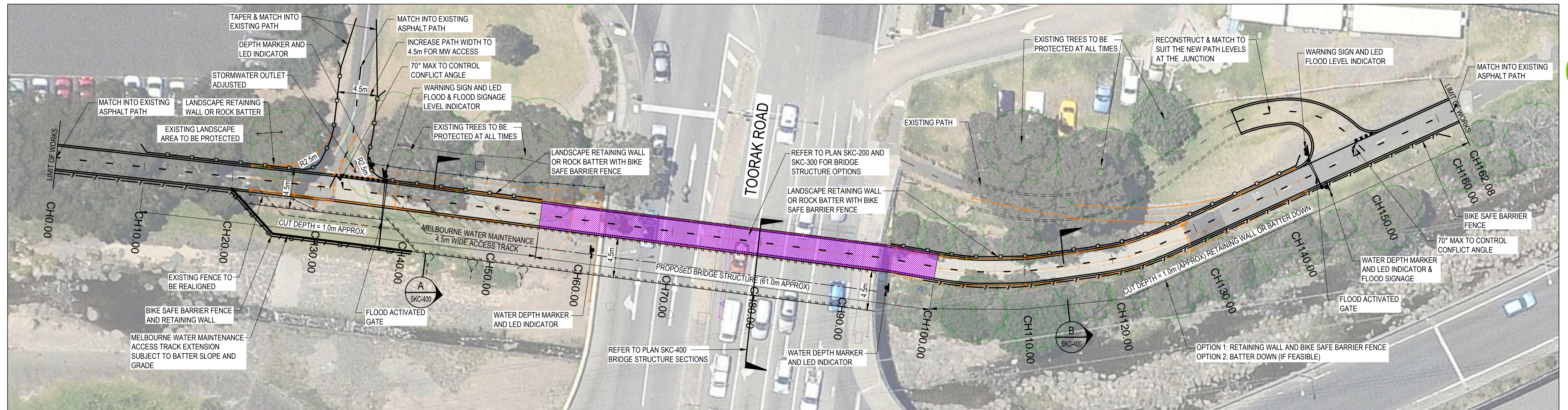
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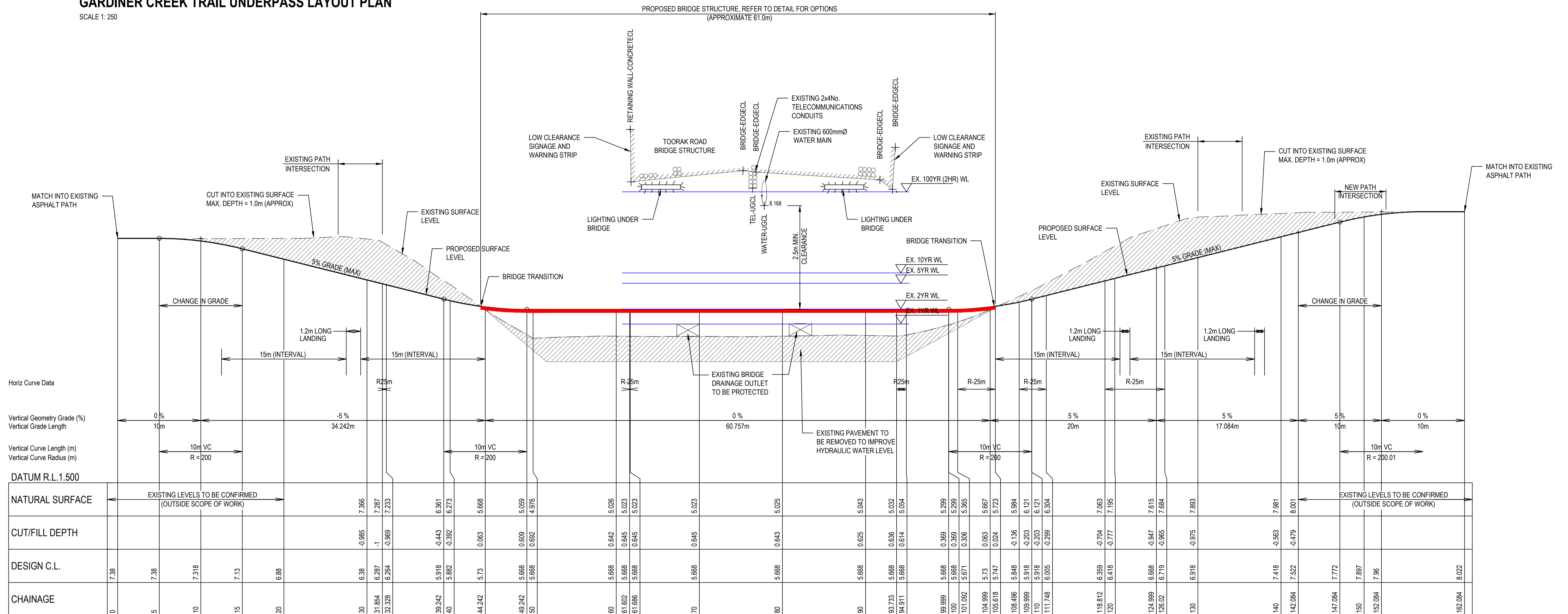
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A1	226461	24.02.12	SKC-000	A



**GARDINER CREEK TRAIL UNDERPASS LAYOUT PLAN**

SCALE 1: 250



**LONGITUDINAL SECTION**

SCALE H 1:250  
SCALE V 1:50

Horiz Curve Data		Vertical Geometry Grade (%)		Vertical Curve Length (m)		Vertical Curve Radius (m)	
0	10	0%	5%	10m VC	10m VC	R=200	R=200
10	20	5%	0%	10m VC	10m VC	R=200	R=200
20	30	0%	5%	10m VC	10m VC	R=200	R=200
30	40	5%	0%	10m VC	10m VC	R=200	R=200
40	50	0%	5%	10m VC	10m VC	R=200	R=200
50	60	5%	0%	10m VC	10m VC	R=200	R=200
60	70	0%	5%	10m VC	10m VC	R=200	R=200
70	80	5%	0%	10m VC	10m VC	R=200	R=200
80	90	0%	5%	10m VC	10m VC	R=200	R=200
90	100	5%	0%	10m VC	10m VC	R=200	R=200
100	110	0%	5%	10m VC	10m VC	R=200	R=200
110	120	5%	0%	10m VC	10m VC	R=200	R=200
120	130	0%	5%	10m VC	10m VC	R=200	R=200
130	140	5%	0%	10m VC	10m VC	R=200	R=200
140	150	0%	5%	10m VC	10m VC	R=200	R=200
150	160	5%	0%	10m VC	10m VC	R=200	R=200
160	170	0%	5%	10m VC	10m VC	R=200	R=200
170	180	5%	0%	10m VC	10m VC	R=200	R=200
180	190	0%	5%	10m VC	10m VC	R=200	R=200
190	200	5%	0%	10m VC	10m VC	R=200	R=200

DATUM R.L. 1.500	
NATURAL SURFACE	EXISTING LEVELS TO BE CONFIRMED (OUTSIDE SCOPE OF WORK)
CUT/FILL DEPTH	
DESIGN C.L.	
CHAINAGE	



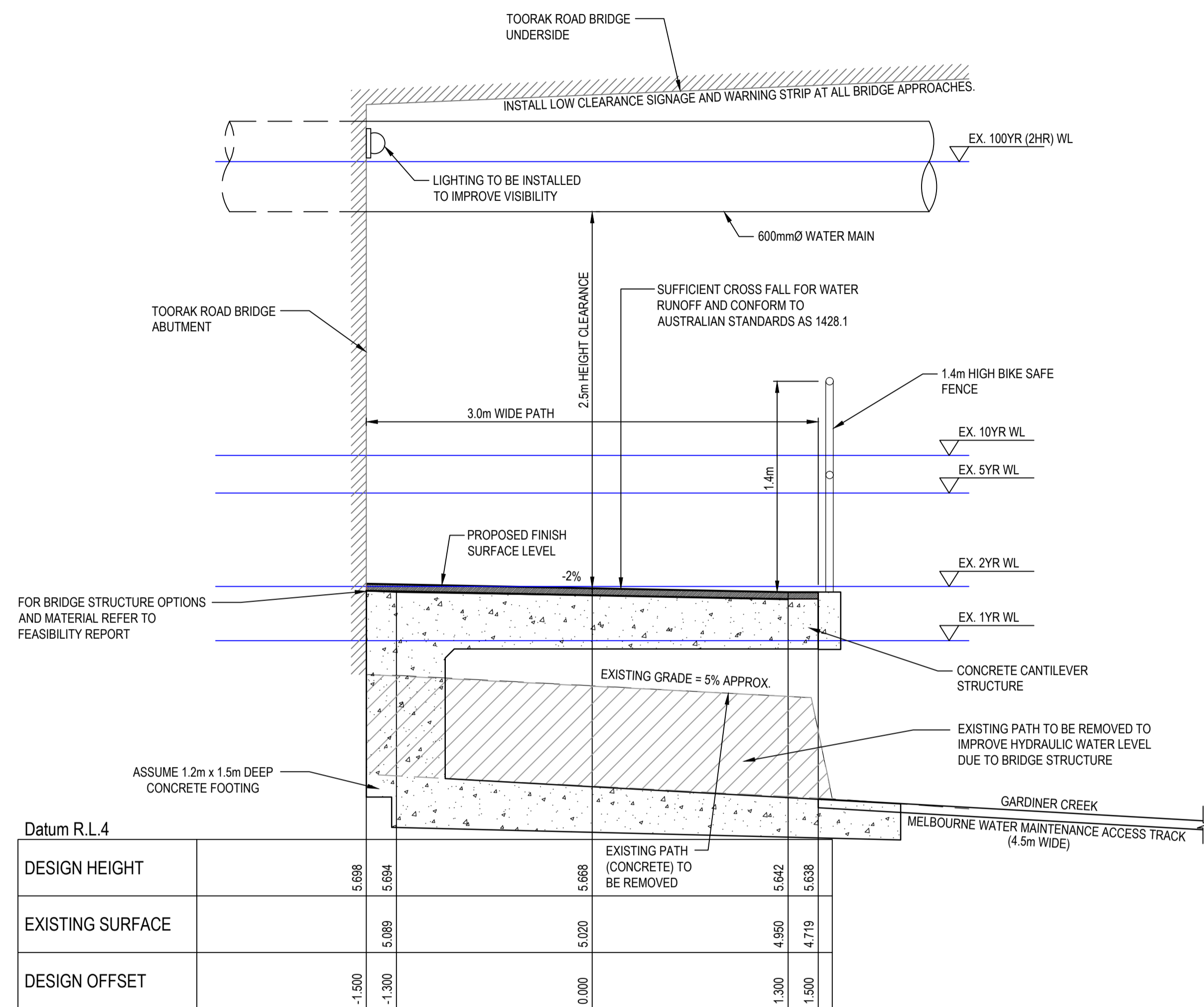
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B	21.09.15	REVISED ISSUE FOR INFORMATION	
A	24.02.12	FOR INFORMATION ONLY	M.DANG

DRAWN	DESIGNED
R.BALBASTRO	M.DANG
CHECKED	
APPROVED	
DATE	

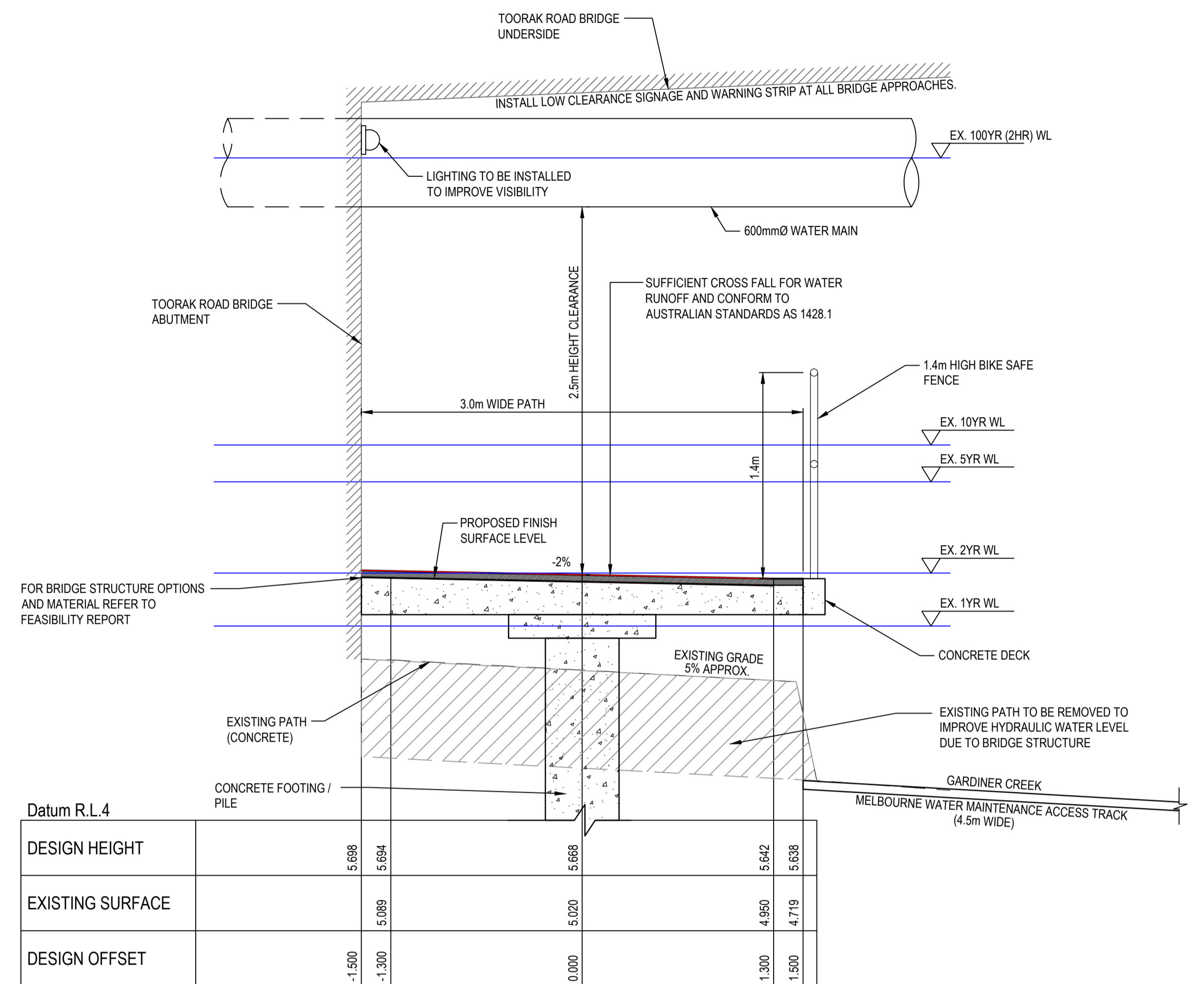
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GARDINERS CREEK TRAIL UNDERPASS FEASIBILITY STUDY
TITLE
CONCEPT PLAN

CONCEPT
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PROJECT No.
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DRAWING No.
SKC-100
SIZE
A1
REV
B





OPTION 1: C-SECTION  
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SCALE V 1:25



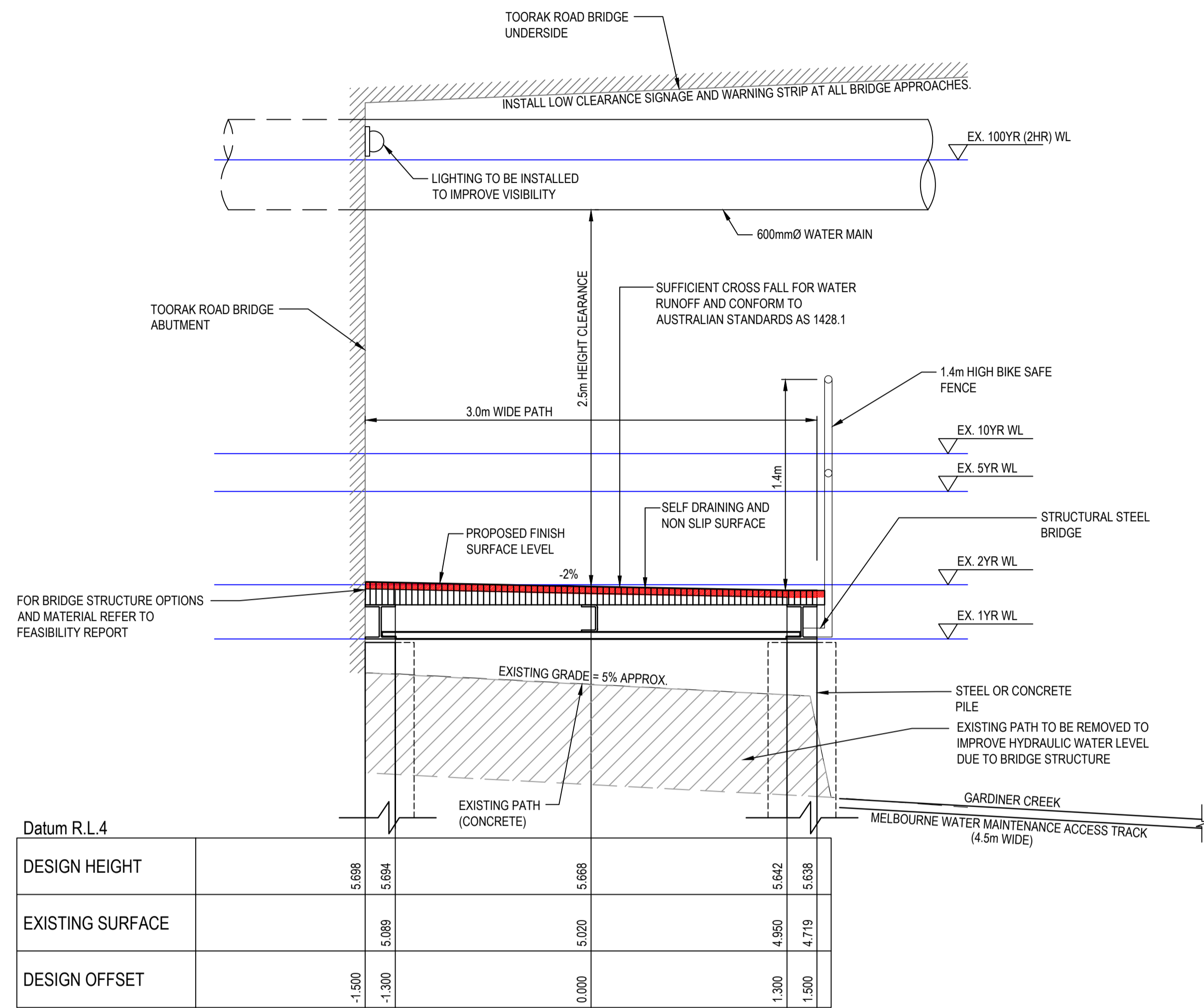
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SCALE H 1:25  
SCALE V 1:25

REV	DATE	REVISION DETAILS	APPROVED
C	21.09.15	REVISED ISSUE FOR INFORMATION	
B	11.05.15	REVISED ISSUE	
A	24.02.12	FOR INFORMATION ONLY	M.DANG

DRAWN	DESIGNED
R.BALBASTRO	M.DANG
CHECKED	
APPROVED	
DATE	

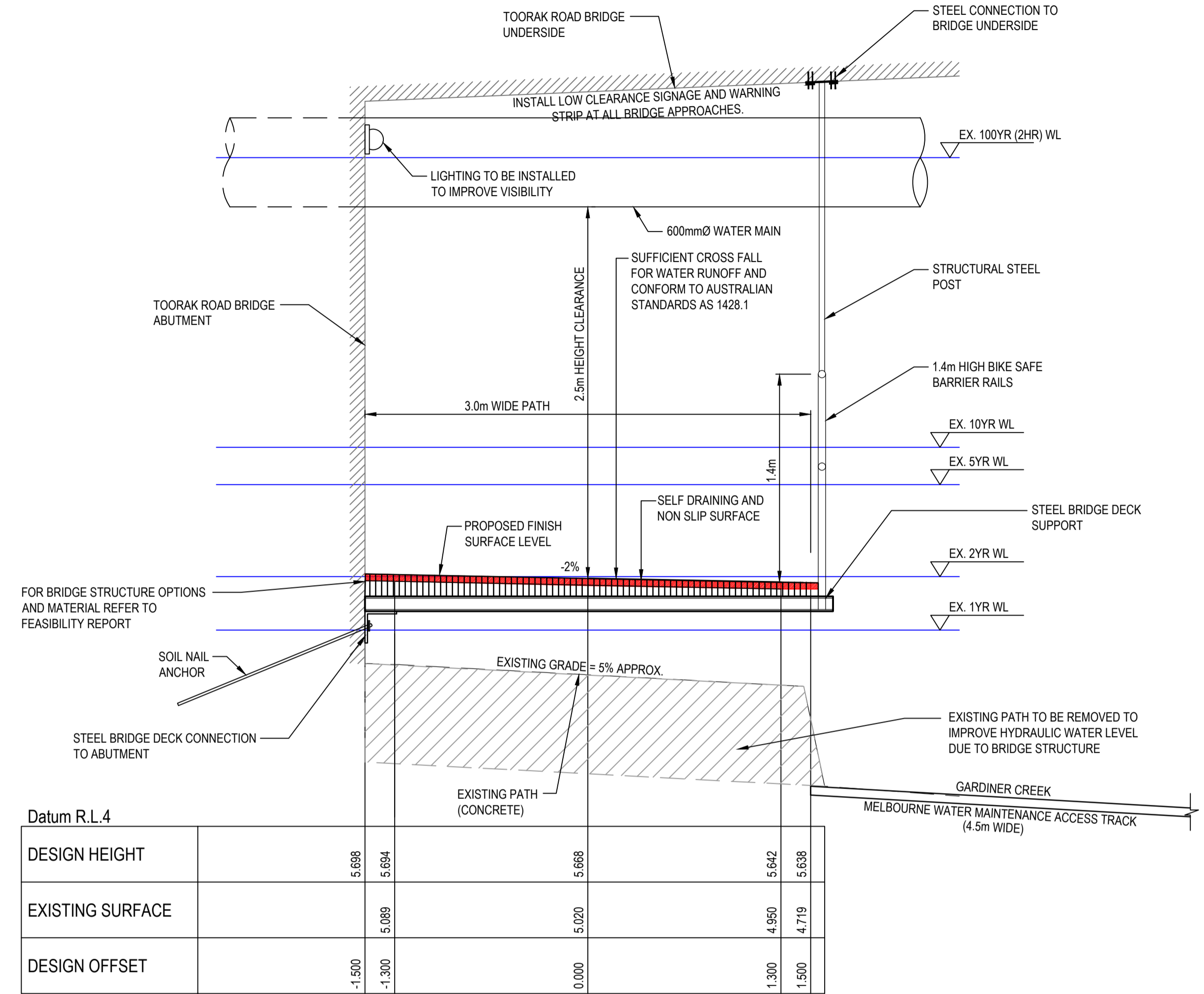
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TITLE
CONCRETE BRIDGE STRUCTURE

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DRAWING No.	SKC-200
SIZE	A1
REV	C



Datum R.L.4						
DESIGN HEIGHT		5.698	5.694	5.688	5.642	5.638
EXISTING SURFACE		5.089		5.020	4.950	4.719
DESIGN OFFSET		-1.500	-1.300	0.000	1.300	1.500

OPTION 3: STEEL BRIDGE STRUCTURE FOUNDATION SUPPORTED  
SCALE H 1:25  
SCALE V 1:25



Datum R.L.4						
DESIGN HEIGHT		5.698	5.694	5.688	5.642	5.638
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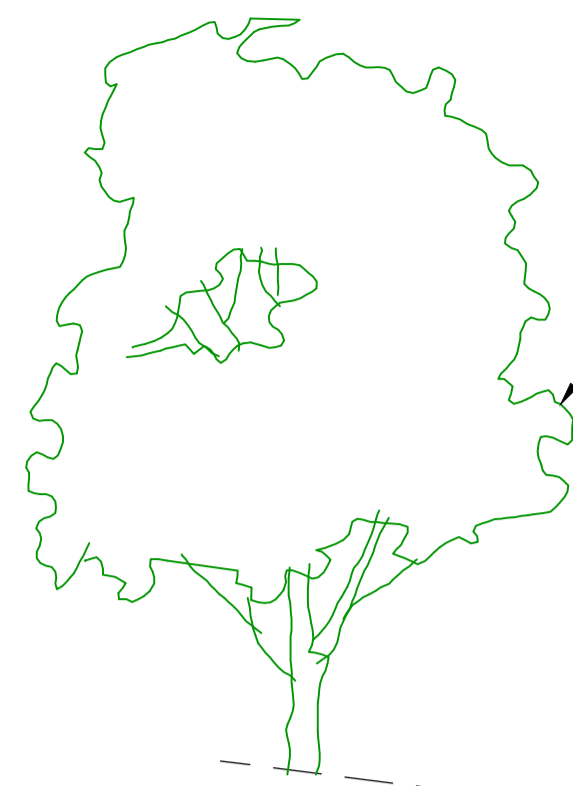
OPTION 4: STEEL BRIDGE STRUCTURE BRIDGE SUPPORTED  
SCALE H 1:25  
SCALE V 1:25

REV	DATE	REVISION DETAILS	APPROVED
B	11.05.15	REVISED ISSUE	A.HSU
A	24.02.12	FOR INFORMATION ONLY	M.DANG

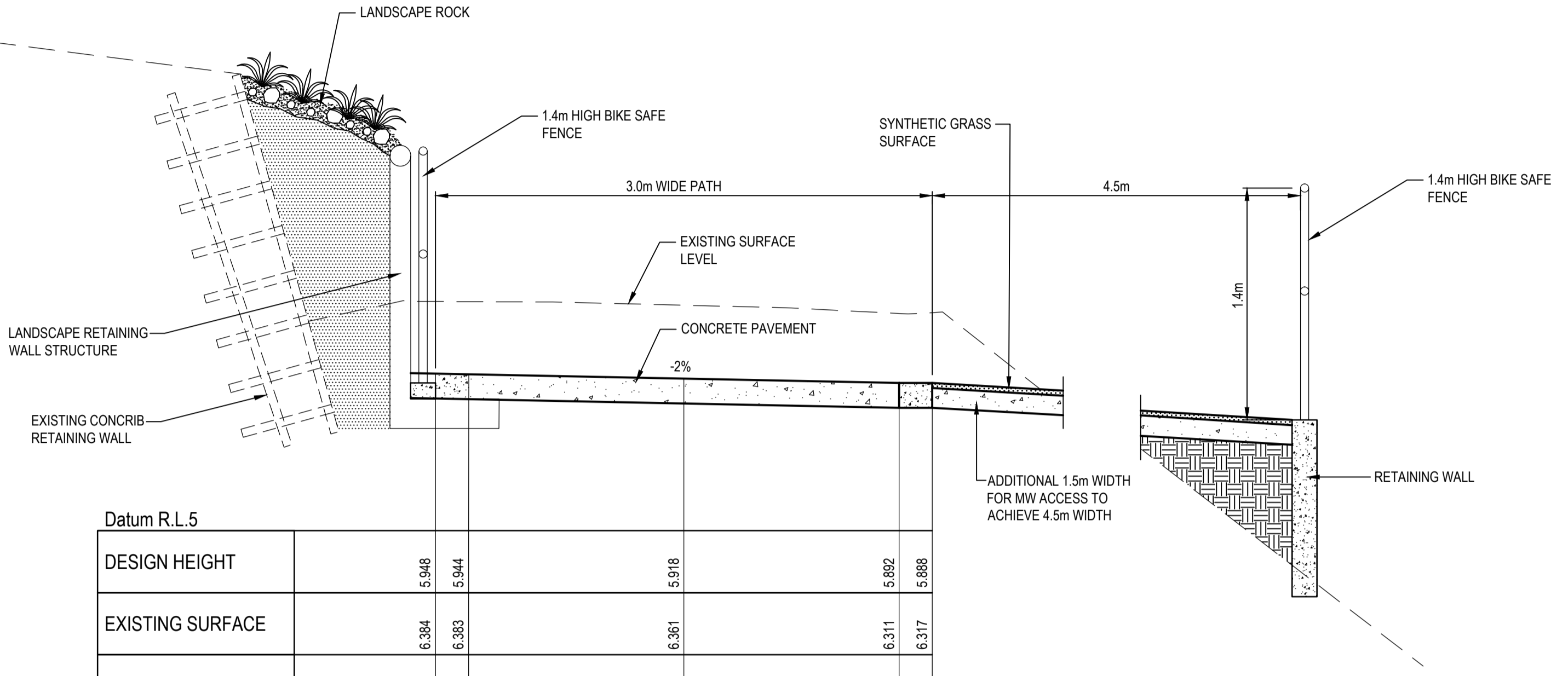
DRAWN	DESIGNED
R.BALBASTRO	M.DANG
CHECKED	
APPROVED	
DATE	

PROJECT
GARDINERS CREEK TRAIL UNDERPASS FEASIBILITY STUDY
TITLE
STEEL BRIDGE STRUCTURE

CONCEPT NOT FOR CONSTRUCTION	
PROJECT No. 226461	
SCALE AS SHOWN	SIZE A1
DRAWING No. SKC-300	REV B



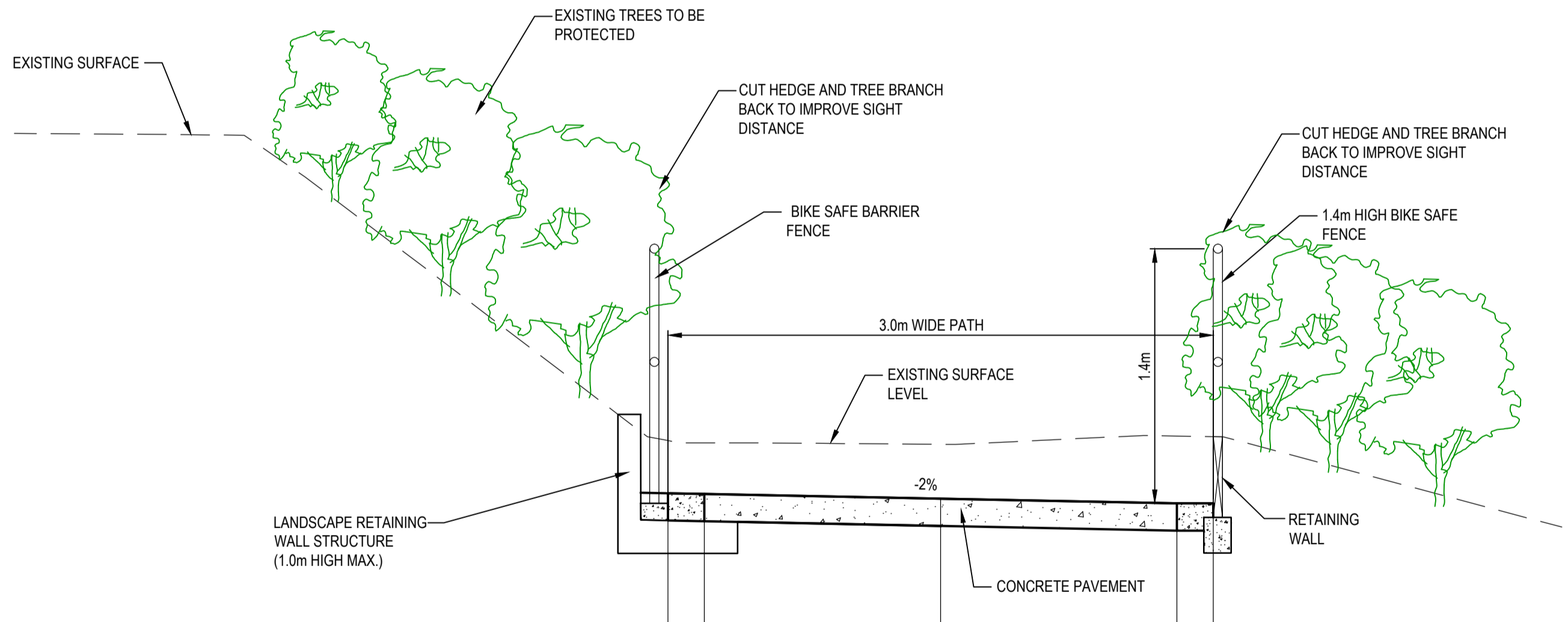
EXISTING TREE TO BE PROTECTED



Datum R.L.5

DESIGN HEIGHT	5.948	5.944	5.918	5.892	5.888
EXISTING SURFACE	6.384	6.383	6.361	6.311	6.317
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**SECTION A**  
SCALE H: 1:25  
SCALE V: 1:25



Datum R.L.5

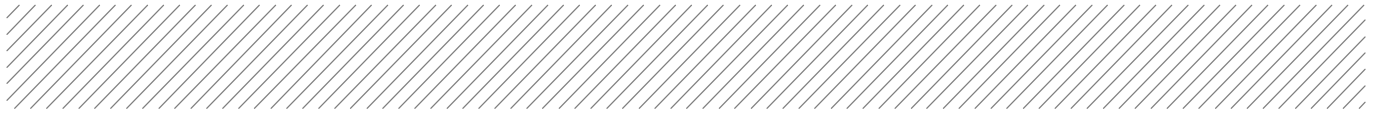
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EXISTING SURFACE	6.325	6.313	6.304	6.350	6.346
DESIGN OFFSET	-1.500	-1.300	0.000	1.300	1.500

**SECTION B**  
SCALE H: 1:25  
SCALE V: 1:25

C:\p1\F\CD\01\A\1\26461\CONSTRUCT\26461\CONSTRUCT\26461\LEGEND\_26461.DWG, 26461.DWG, 26461.DWG



CLIENT			REV		DATE	REVISION DETAILS	APPROVED	DRAWN	DESIGNED	PROJECT		CONCEPT	
								R.BALBASTRO	M.DANG	GARDINERS CREEK TRAIL UNDERPASS		NOT FOR CONSTRUCTION	
								CHECKED		GARDINERS CREEK TRAIL UNDERPASS		PROJECT No.	
								APPROVED		FEASIBILITY STUDY		226461	
								DATE		TITLE		SCALE	SIZE
			C	21.09.15		REVISED ISSUE FOR INFORMATION				BRIDGE STRUCTURE SECTIONS		AS SHOWN	A1
			B	11.05.15		REVISED ISSUE						DRAWING No.	REV
			A	24.02.12		FOR INFORMATION ONLY	M.DANG					SKC-400	C



# Appendix B

## Stakeholder

### Correspondence, Hydraulic

### Letter and Lighting Report

### (abstract)

**From:** Graeme Stone [<mailto:graemes@bicyclenetwork.com.au>]  
**Sent:** Thursday, 1 December 2011 10:17 AM  
**To:** Erik Andriansyah  
**Cc:** Bart Sbeghen; Arlen Keen; Bhushan Jani ([Bhushan.Jani@boroondara.vic.gov.au](mailto:Bhushan.Jani@boroondara.vic.gov.au))  
**Subject:** Gardiners Creek Trail - Toorak Road Underpass DRAFT

Erik,

As stated at the meeting I think a free draining structure would eliminate the main problem which is silt build up during floods and also eliminate the need for an instant maintenance response after heavy rain. (We received a message on Monday from a member who is concerned about the silt at Toorak Rd being a danger following weekend rain. I forwarded it on to VicRoads.)

Suitable products to consider are as below: (recognising that the substructure to support these will be a design issue) Also there may be other ways to ensure silt does not deposit. No doubt you will have most design info at your fingertips but the Bicycle Network Victoria web site re 'Building better paths' at <https://www.bv.com.au/general/bike-futures/40159/> may be of interest. There is a cross reference to Austroads section 7.6.2 re drainage and crossfall.

Envirowalk (seen in Diamond Creek on bridges)  
<http://www.envirowalkgrating.com/>

Replas' Enduroplank (seen in City of Wyndham and many other locations) and Enduromesh: (Probably a better product for this site than Enduroplank as is similar to Envirowalk. Not aware of local installations)  
[http://www.replas.com.au/products/enduroplank/item/enduromesh?category\\_id=3](http://www.replas.com.au/products/enduroplank/item/enduromesh?category_id=3)

Rocla's PermaTrak (Seen in City of Wyndham – along side Skeleton Creek at Palmers Rd)  
[http://www.rocla.com.au/Popup\\_Gallery.php?id=18&category=PermaTrak](http://www.rocla.com.au/Popup_Gallery.php?id=18&category=PermaTrak)

The other key item not on your list is **lighting**. The lack of lighting currently substantially increases the danger level if there is any hazard on the path and/or riders coming the other way.

You have probably already seen design information on Boardwalks which can be found on Bicycle Network Victoria's web pages at -  
<https://www.bv.com.au/general/bike-futures/42436/>

And re Underpasses at  
<https://www.bv.com.au/general/bike-futures/92775/>

Regards,  
Graeme Stone  
Facilities Project Officer  
(Tuesdays)



**BICYCLE**  
NETWORK  
VICTORIA

Level 4, 246 Bourke St, Melbourne VIC 3000  
Em: [graemes@bicyclenetwork.com.au](mailto:graemes@bicyclenetwork.com.au) (03) 8376 8870  
freecall: 1800 639 634 (country callers) [bicyclenetwork.com.au](http://bicyclenetwork.com.au)

Follow us:   

## Amy Hsu

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**From:** Erik Andriansyah  
**Sent:** Wednesday, 7 December 2011 10:21 AM  
**To:** Minh Dang  
**Subject:** FW: Gardiners Creek Trail - Toorak Road Underpass

-----Original Message-----

From: Ranjith.Gamage@roads.vic.gov.au [mailto:Ranjith.Gamage@roads.vic.gov.au]  
Sent: Wednesday, 7 December 2011 10:15 AM  
To: Erik Andriansyah  
Cc: Bhushan Jani (Bhushan.Jani@boroondara.vic.gov.au); graemes@bv.com.au; Lee Quach  
Subject: Re: Gardiners Creek Trail - Toorak Road Underpass

Hi Erik,

I was away on annual leave and couldn't get back to you promptly. Sorry about the delayed response.

It is worth quantify the first two issues at this stage as they have significant importance in project evaluation process, if this proposal be submitted for VicRoads funding consideration.

As I knew there is no agreement between Melbourne Water and VicRoads regarding shared path; may be with councils. VicRoads does not maintain shared paths and as discussed in the meeting I will find out the limits of VR responsibility in this section for you.

You may require to contact VicRoads Bridge Design and Maintenance teams when you get into the design process. Please contact me to find the appropriate officers by then.

Regards,

Ranjith Gamage  
Senior Transport Integration Officer  
VicRoads, Metro South East Region  
Tel : 03 9881 8914  
Fax: 03 9887 7590  
ranjith.gamage@roads.vic.gov.au  
www.vicroads.vic.gov.au

From: Erik Andriansyah <Erik.Andriansyah@aurecongroup.com>  
To: Lee Quach <Lee.Quach@melbournewater.com.au>, "Ranjith.Gamage@roads.vic.gov.au" <Ranjith.Gamage@roads.vic.gov.au>, "graemes@bv.com.au" <graemes@bv.com.au>  
Cc: "Bhushan Jani (Bhushan.Jani@boroondara.vic.gov.au)" <Bhushan.Jani@boroondara.vic.gov.au>  
Date: 29/11/2011 11:16 AM  
Subject: Gardiners Creek Trail - Toorak Road Underpass

Ext: Business Area:  
Fax: Internet:  
File Name: File Description:

## Amy Hsu

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**From:** Erik Andriansyah  
**Sent:** Tuesday, 21 February 2012 8:45 AM  
**To:** Minh Dang  
**Subject:** FW: Gardiners Creek Trail - Toorak Road Underpass  
**Attachments:** 2007\_09\_19 Hydraulic Modelling Of Gardiners Creek\_Bridge\_Warrigal Rd to Glenferrie Rd - Final 19th September 2007\_Report.pdf; Toorak Road Underpass.zip

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**From:** Lee Quach [mailto:Lee.Quach@melbournewater.com.au]  
**Sent:** Tuesday, 31 January 2012 10:46 AM  
**To:** Erik Andriansyah  
**Cc:** Bhushan Jani; Keith Boniface; George Tsemtsidis  
**Subject:** RE: Gardiners Creek Trail - Toorak Road Underpass

Hi Erik and Bhushan

So sorry for the delay in getting back to you about Melbourne Water's conditions for the Gardiners Creek Trail – Toorak Road Underpass. Things were very hectic before Christmas and I have been working in another team but am back now.

Following on from our meeting on the 24<sup>th</sup> November, 2011 please find below a list of Melbourne Water conditions relating to the hydrology and hydraulics of the path/underpass along Gardiners Creek at Toorak Road, Glen Iris.

### **Melbourne Water conditions relating to the paths:**

- There is no increase in flood levels (100 year ARI) or flow velocities as a result of the path or underpass construction.
- Loss of capacity/flood storage due to construction will not be permitted.
- The path and bridge is recommended to be located at or above the 1 in 10 year ARI flood level (conditional upon velocity requirements being met for the 1 in 100 year event (velocity x depth ratios less than 0.35). A preliminary HEC RAS analysis has been undertaken and the underpass will not be able to meet the 1 in 10 year criteria.
- As the path/underpass cannot meet this 1 in 10 year flood level requirement, a package of safety measures should accompany the proposal showing how access to sections of path located below the 1 in 10 year flood level will be prevented in high flow events. This could be through a combination of:
  - confined and fenced down-out approaches to the particular path section;
  - flood-activated boom gates or other barriers;
  - alternative route signs;
  - depth markers;
  - listing the site with the Emergency Response Team;
  - and/or other measures, of which signage should only be a minor component of the total package

Melbourne Water has worked closely with Boroondara on the Warrigal Road underpass and the adopted construction methodology to that underpass (ie canter-levering the concrete path, smoothing out of the channel and some minor channel excavation) was acceptable to Melbourne Water. The canter-levered design for that underpass ensured that flood conveyance was not compromised and a similar design for Toorak Road is preferable to Melbourne Water.

As discussed in the meeting, Melbourne Water was to provide Aurecon with a HEC Ras Model. Whilst Melbourne Water are currently updating our flood mapping of Gardiners Creek using TuFlow, for the purposes of this project a HEC Model will suffice.

Please find attached a current HEC Ras model of Gardiners Creek from Warrigal Road to Glenferrie Road. This HEC Ras model has been developed as part of the M1 Upgrade Project. I have also attached the accompanying SKM report which outlines the key parameters used in the development of the model. I have removed some of the old files so within the HEC Ras model you will now find the following files

- **Geometry File:** Gardiners Creek\_FWY Widening – ie. the MW existing geometry updated to include the proposed widening of the FWY bridge
- **Flow File:** 100yr\_plus low flow 241111 – ie. 2 hour steady state flow file for the 100 year and proportional low flows (based on MWs design guidelines for engineered systems) for the 10 year, 5 year, 2 year and 1 year events.
- **Plan File:** Toorak Rd Underpass 241111 - i.e. the MW existing geometry updated to include the proposed widening of the FWY bridge

Since the M1 model was developed for comparative analysis, no calibration was conducted (see Section 5.2 page 11 paragraph 2 of the Report).

The model provides the entire extent from Glenferrie Road to Warrigal Road. The Toorak Road Bridge sits at XS 7.5. I suggest as part of your modelling you delete all the XS upstream of say Tooronga Road and have a model that runs from Tooronga Road to Glenferrie Road (to ensure the same starting water conditions). The distance between the model XS is fairly sparse so similar to what was requested at Warrigal Road new survey XS some 10 metres apart should be inserted into the HEC Ras model to ensure a better representation of what the conditions are.

You will need to provide MW the model back showing the existing and proposed conditions (see point below) once you are ready to formally submit the proposal.

**Prior to formal approval of the path and bridge, Melbourne Water require:**

- 1) The exact alignment in digital format (DXF or Mapinfo) of the alignment of the path with the proposed finished levels.
- 2) Digital format (DWG/DXF or Mapinfo) of the cross section locations.
- 3) A HEC-RAS Model or similar computations (existing vs. developed) must be submitted to Melbourne Water to show that the proposal does not increase flood levels or stream velocities.
- 4) Detailed design plan showing the existing and proposed long section and cross sections (highlighting any cut/fill) must be submitted to Melbourne Water prior to approval. The layout plan should also indicate the 100 year ARI flood level/extent.

The formal submission will need to be addressed to George Tsemtsidis – Asset Services at Melbourne Water and this team will co-ordinate MWs response.

I think that is all the information you requested but if you need anything else please do not hesitate to contact me.

Cheers

**Lee Quach**

Program Leader Strategic Projects | Floodplain Services  
100 Wellington Pde East Melbourne VIC 3002  
Ph: 03 9235 1528 | F: 03 9235 7168  
**MelbourneWater**<sup>®</sup>

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**From:** Erik Andriansyah [<mailto:Erik.Andriansyah@aurecongroup.com>]  
**Sent:** Monday, 30 January 2012 10:36 AM  
**To:** Lee Quach  
**Cc:** Bhushan Jani ([Bhushan.Jani@boroondara.vic.gov.au](mailto:Bhushan.Jani@boroondara.vic.gov.au))  
**Subject:** FW: Gardiners Creek Trail - Toorak Road Underpass

Dear Lee,



3 June 2013



Rob Day  
Aurecon  
Level 8, 850 Collins Street  
DOCKLANDS VIC 3008

Dear Rob,

**RE: PROPOSED SHARED PATH**  
**LOCATION: Gardiner Creek Trail – Toorak Road, Hawthorn**  
**MW REFERENCE: 208611**

I thank you for your email and attached plans of 6 May 2013 regarding the proposed shared pathway along Melbourne Water's Gardiners Creek.

Melbourne Water **requires further information** to the proposal, subject to the following conditions:

1. Prior to construction of the pathway, Melbourne Water requires independent Engineers Certification in meeting Path Standards. Please refer to Austroads Guide to Traffic Engineering Practice Part 14 – Bicycles (1999).

Post construction, Melbourne Water will require evidence that the pathway has been constructed to the above pathway standards.

2. Please note that Melbourne Water will not maintain this path. The path, where it is subject to inundation, should be designed with a free draining cross-fall towards the creek (i.e no curb should be used). The preferred path option would be a concrete cantilevered structure with no 'kerb' on the side.
3. The minor localised affluxes are acceptable.
4. The proposed path should be located above the 1 in 10 year ARI flood level. If this cannot be achieved, Melbourne Water will require a package of safety measures to accompany the proposal. Please see Melbourne Water's 'Shared Pathways Guidelines' for further details:  
[www.melbournewater.com.au/content/planning\\_and\\_building/construction\\_near\\_melbourne\\_water\\_assets/shared\\_pathways.asp](http://www.melbournewater.com.au/content/planning_and_building/construction_near_melbourne_water_assets/shared_pathways.asp)
5. Flood warning signs shall be placed at sections that encroach within the floodway during certain events. Alternative routes shall be indicated during times of inundation of the pathway.
6. The path will need to be set into the natural surface level of the existing ground so that the hydraulics of the floodplain are not altered.

7. The paths shall be designed to ensure that the surface runoff does not cause any erosion of the floodway embankments or pondage within the floodway
8. The path shall be designed to cater for Melbourne Water's Maintenance Machinery.
9. **Prior to commencement of construction, a Site Environmental Management Plan (SEMP) is to be submitted to Melbourne Water.**

**The SEMP must address the following:**

- Sediment and silt management controls
- Vegetation management techniques
- Access tracks
- Spoil stockpiling
- Machinery/ Plant locations
- Exclusion fencing around native vegetation/ habitat

10. **Prior to commencement of construction, a Work Method Statement and a Risk Task Assessment must be submitted outlining the general construction technique to be adopted.**

**The statement must address the following:**

- OH&S measures in place to reduce risk
- Safe work practices
- Process for machinery to access the creek
- Diversion of flows for low and high flows
- Evacuation procedure during times of high flows and fire danger periods

**Melbourne Water will await a detailed submission demonstrating compliance with the above conditions. Please note that further conditions (including fees) will be applicable upon formal approval by Melbourne Water.**

For further enquiries regarding this matter please contact me on 9679 6641 or email [assetservices@melbournewater.com.au](mailto:assetservices@melbournewater.com.au), quoting the above reference.

Yours sincerely,



Michael Thompson  
Asset Services

**Aurecon Australia Pty Ltd**  
ABN 54 005 139 873  
Aurecon Centre  
Level 8, 850 Collins Street  
Docklands VIC 3008  
PO Box 23061  
Docklands VIC 8012  
Australia

**T** +61 3 9975 3000  
**F** +61 3 9975 3444  
**E** melbourne@aurecongroup.com  
**W** aurecongroup.com



6 May 2013

Bhushan Jani  
Transport Engineer  
City of Boroondara  
Inglesby Rd, Camberwell  
Victoria, 3124

Dear Bhushan,

## **RE: Gardiners Creek Trail at Toorak Road Underpass – Hydraulic Modelling**

### **Background**

Aurecon was engaged by the City of Boroondara to undertake a feasibility and concept design study for improvements to the shared path at this location.

Frequent inundation is a key issue for the path. The frequent inundation leads to sediment build up on the path which is hazardous to cyclists using the path.

The concept design is to elevate the path to provide a higher level of flood immunity however the maximum height of the path is governed by the vertical clearance to an overhead water main.

It is proposed to elevate the path using a raised pathway structure and undertake some minor earthworks beneath the structure to ensure negligible impacts to the conveyance capacity of and flow safety within Gardiners Creek.

### **Hydraulic Modelling Approach**

Subsequent to finalising the concept designs, Aurecon has undertaken hydraulic modelling of the proposed cantilevered pathway and associated works as requested by Melbourne Water.

Aurecon utilised a HEC-RAS model of Gardiners Creek and design flows supplied by Melbourne Water for this purpose.

The following amendments were made to the HEC-RAS model.

- Feature Survey was undertaken of Gardiners Creek (with sections taken at 10m intervals) for approximately 100m upstream and downstream of the Toorak Road bridge. These sections were added to the HEC-RAS model.
- The location of the Toorak Road bridge within the existing HEC-RAS model is approximately 125m upstream of its actual location due to the limited resolution of the existing HEC-RAS model. Aurecon amended the existing model to reflect the actual location of the bridge.
- It is noted that the existing HEC-RAS model is georeferenced to the AMG coordinate datum instead of the MGA datum, so the relevant spatial transformations have been applied.

The manning's coefficients from the existing model have been retained.

### **HEC-RAS Limitations**

A number of options have been proposed within the concept design, consisting of a simple pedestrian pathway decking and safety fencing, supported by various structural systems. From a modelling point of view, all of the options conceptually consist of a bridge structure located beneath another (road)

bridge structure. HEC-RAS does not model multiple horizontal obstructions to flow or overhanging banks.

The following approach was adopted to overcome these limitations inherent in HEC-RAS. Aurecon agreed this approach in discussion with Keith Boniface from Melbourne Water.

The pedestrian pathway structure was modelled as a series of 4 vertical obstructions with an equivalent surface area and obstructed area to that of the pedestrian path structure. This is deemed to be conservative as the obstructions impact the flow cross section at a lower elevation.

The various structural systems proposed for the pedestrian path have varying surface areas and obstructed areas. The surface area and obstructed area modelled in HEC-RAS is representative of all options.

Some excavation of the existing pedestrian pathway and underlying in-situ material is necessary in order to mitigate the impact of the cantilevered bridge on the cross-sectional area and flow velocities of Gardiners Creek. This excavation has been reflected in the HEC-RAS model sections, however will be confirmed at detailed design stage.

## **Results**

The HEC-RAS modelling demonstrates that the proposed pedestrian bridge structure and excavation works will have a negligible impact on the flood levels and flow velocities. The flood levels upstream of the Toorak Road Bridge are calculated to be within +10mm/-30mm of existing flood levels across the range of storm events modelled. Upstream afflux is limited to a maximum 10mm increase and 100m in extent. The excavation works can be fine-tuned in later stages of design so that the flow regime matches the existing conditions as closely as possible.

## **Recommendations**

The proposed pedestrian pathway structure and associated earthworks can be constructed with negligible impact to the flood levels and flow velocities within Gardiner Creek.

The maximum height of the pedestrian path is governed by the required clearance to an overhead water main however the increased elevation provided by the proposed cantilevered path is estimated to provide flood protection to the pedestrian pathway of somewhere between the 1 in 1 year ARI and 1 in 2 year ARI storm events.

When creek levels exceed the height of the cantilevered pedestrian path, the path will quickly become unsafe and as the path does not comply with Melbourne Water safety criteria for a 1 in 2 year ARI storm event or greater, a package of safety measures will need to be implemented for the shared path in detailed design to restrict access during path flooding. These may include measures such as:

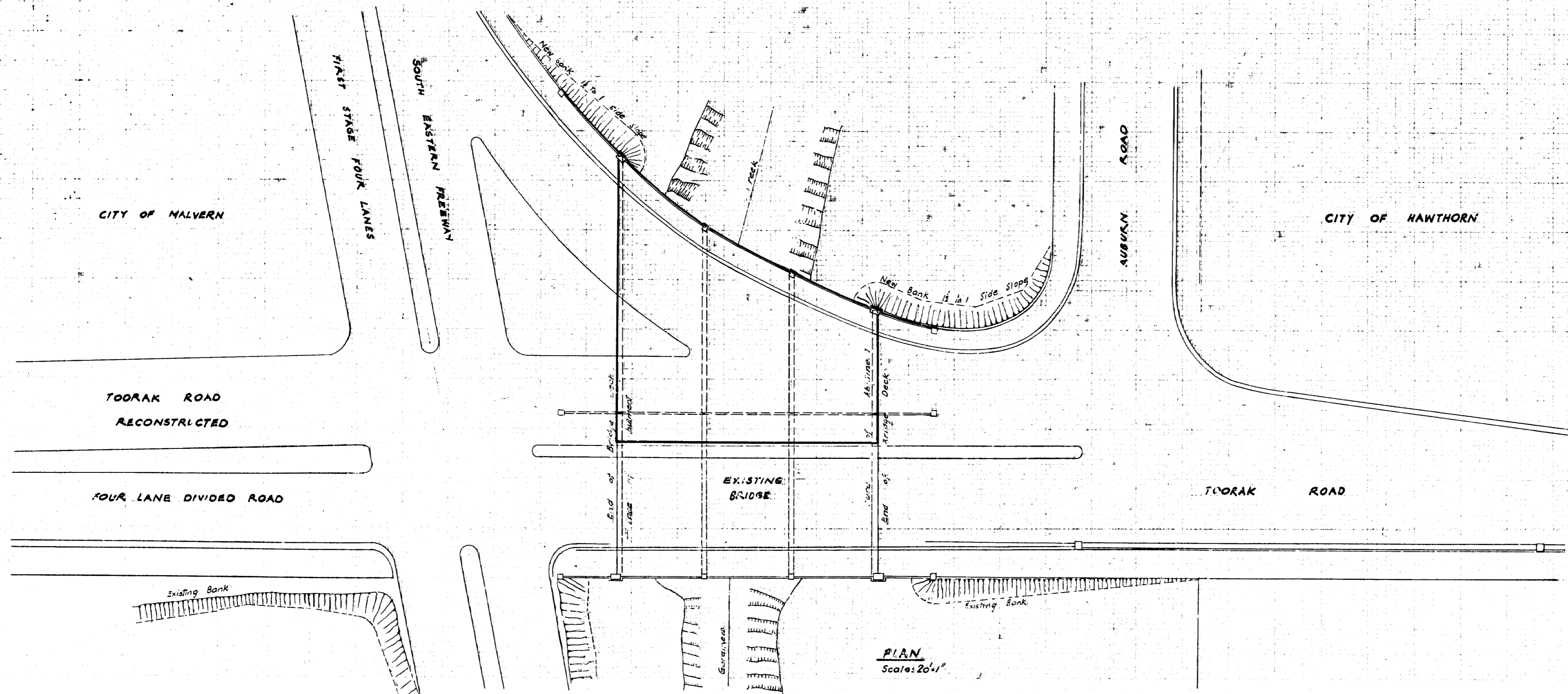
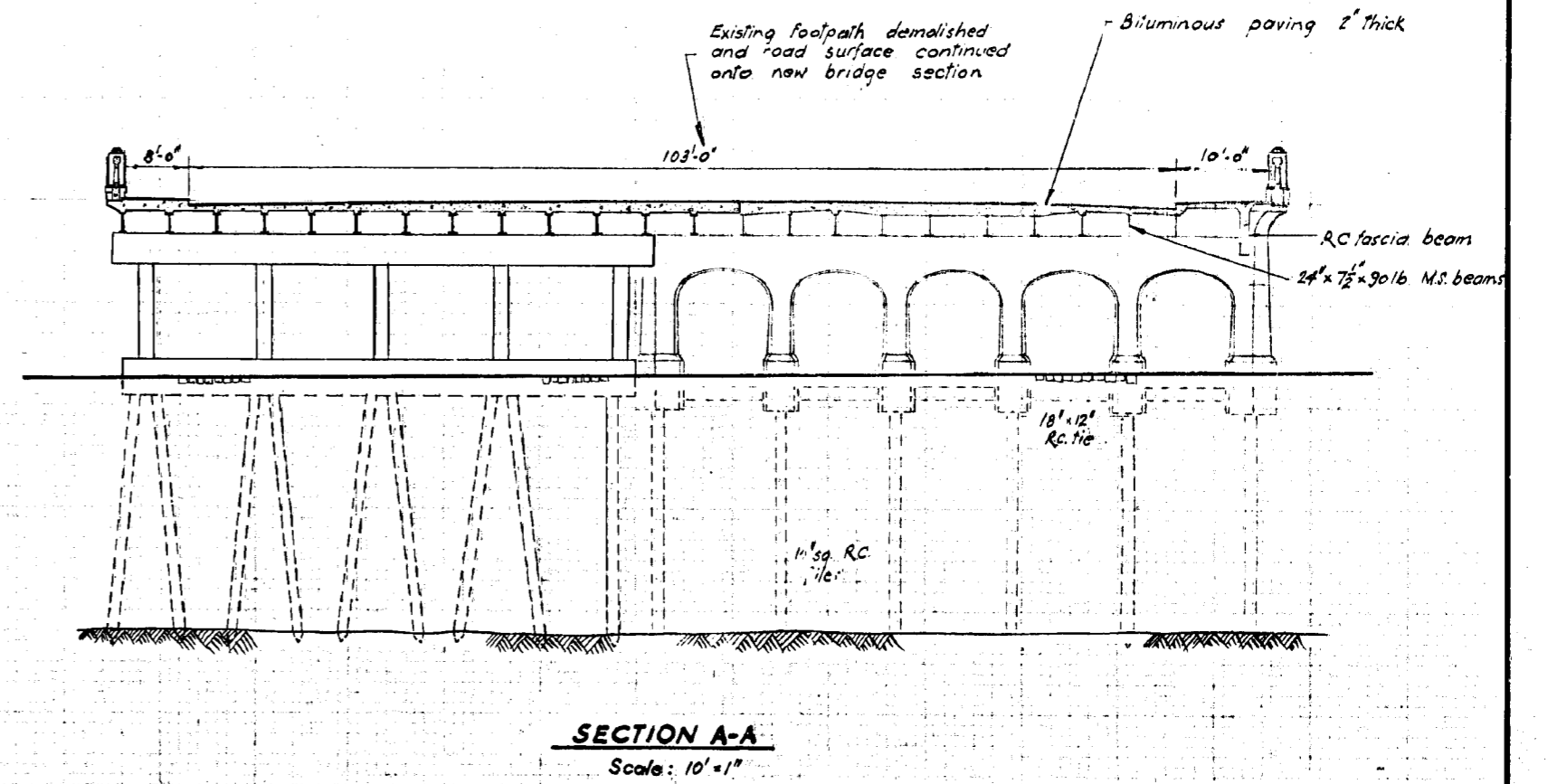
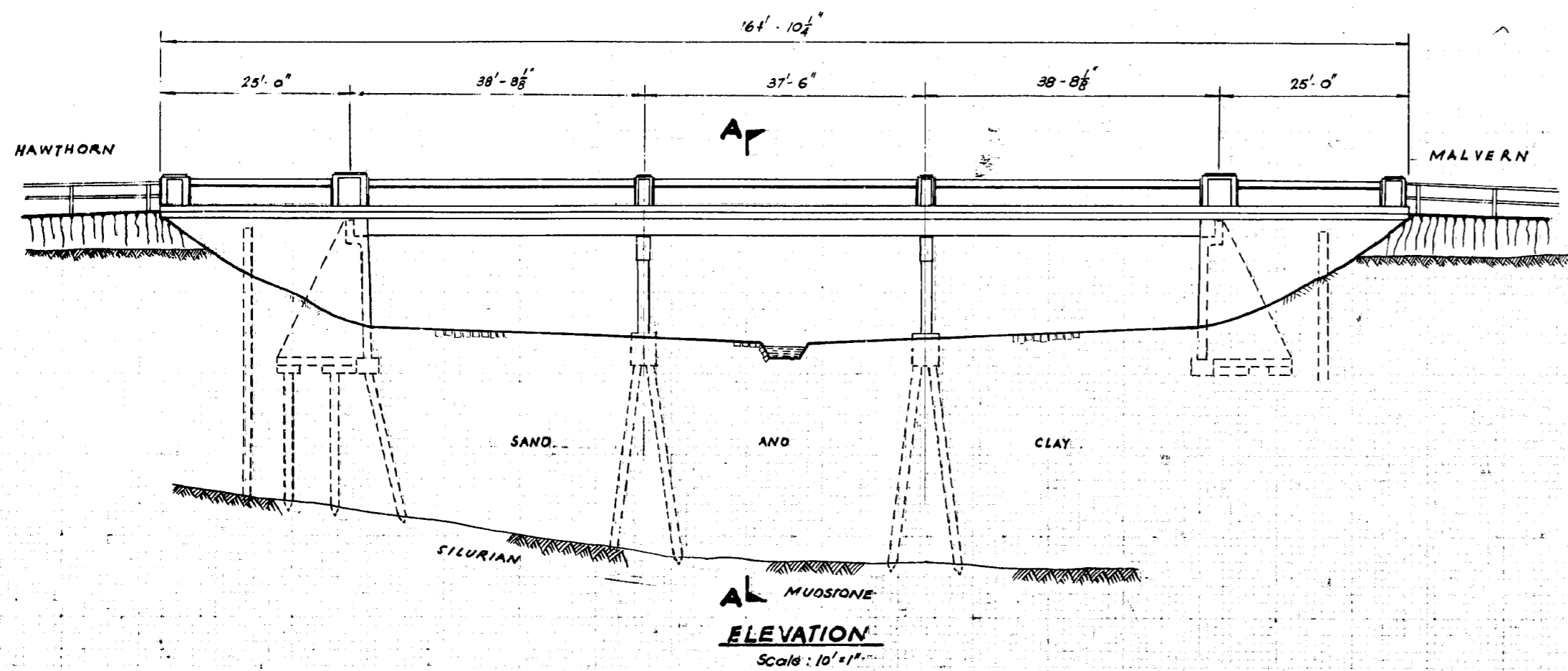
- Confined and fenced down-out approaches to the particular path section;
- Flood-activated boom gates or other barriers;
- Alternative route signs;
- Depth markers;
- Listing the site with the Emergency Response Team;
- And/or other measures, of which signage should only be a minor component of the total package

Whilst the pedestrian pathway structure can not be modelled exactly within HEC-RAS, a structure of representative surface area and obstructed area has been included within the HEC-RAS modelling and this approach is thought to provide adequate accuracy of the flood level and flow velocity impacts.

In-principle approval for the proposal will be sought from Melbourne Water, and further modelling can be undertaken during design development to refine the structural system details and determine the earthworks requirements.

Regards,

**Rob Day**  
Senior Civil Engineer  
Land Development Services  
Aurecon



E			
D			
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B			
A			
INDEX	DATE	REVISION	APPD

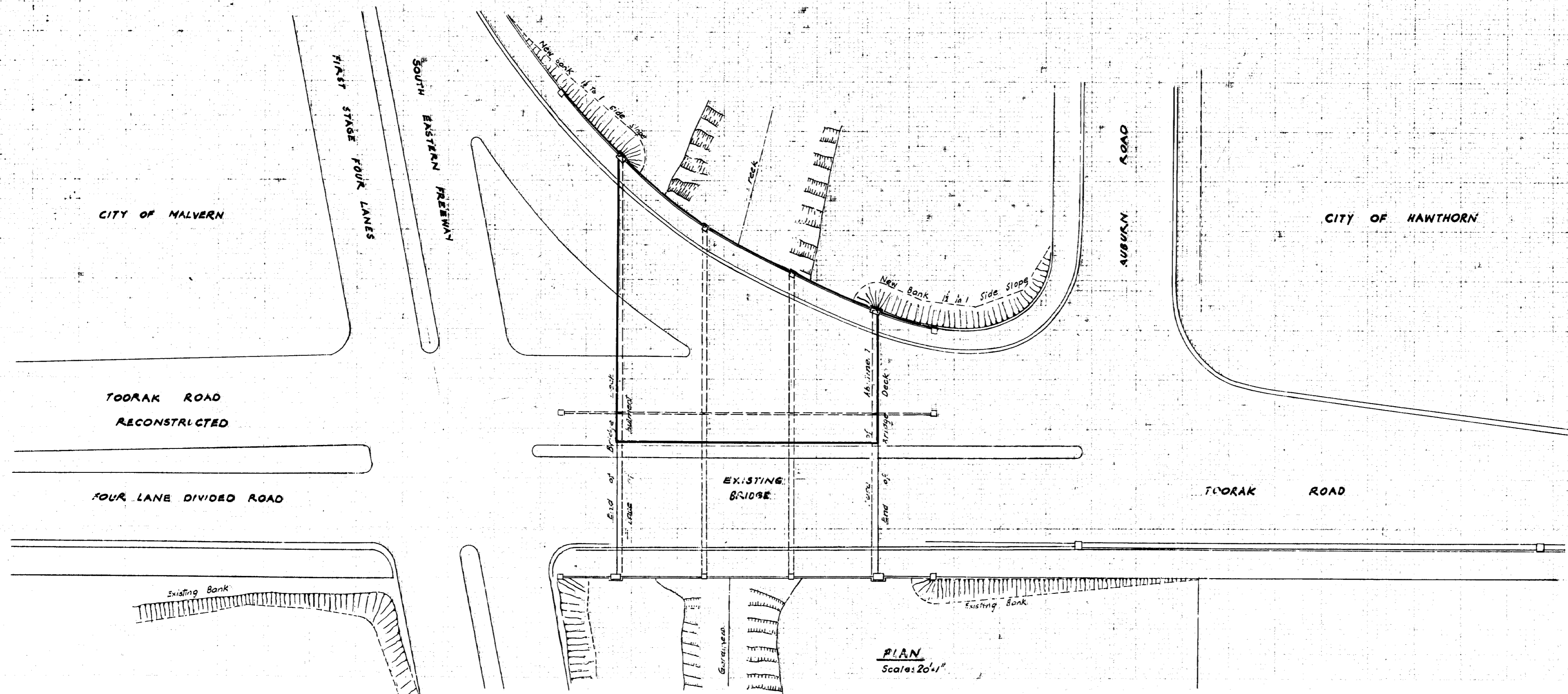
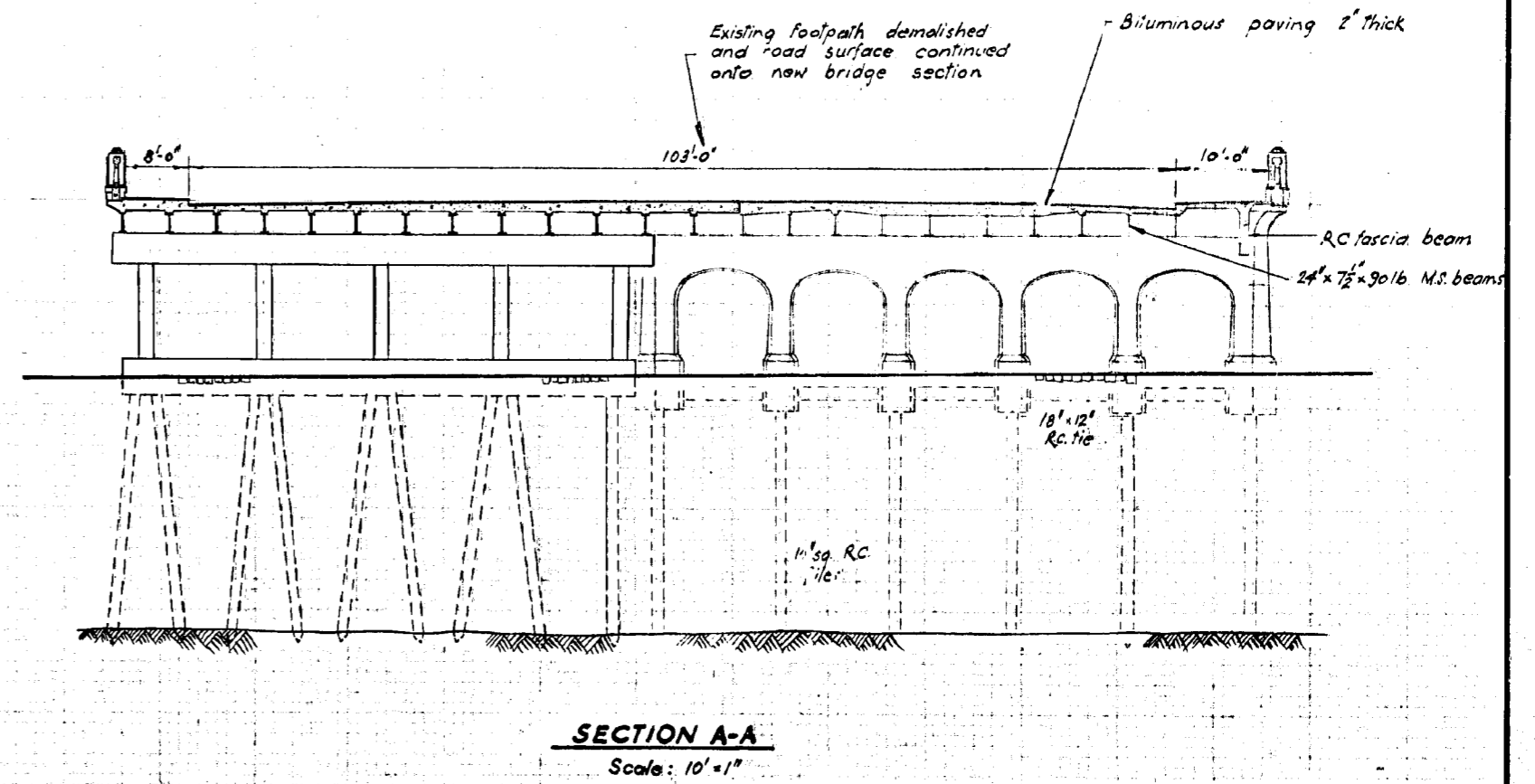
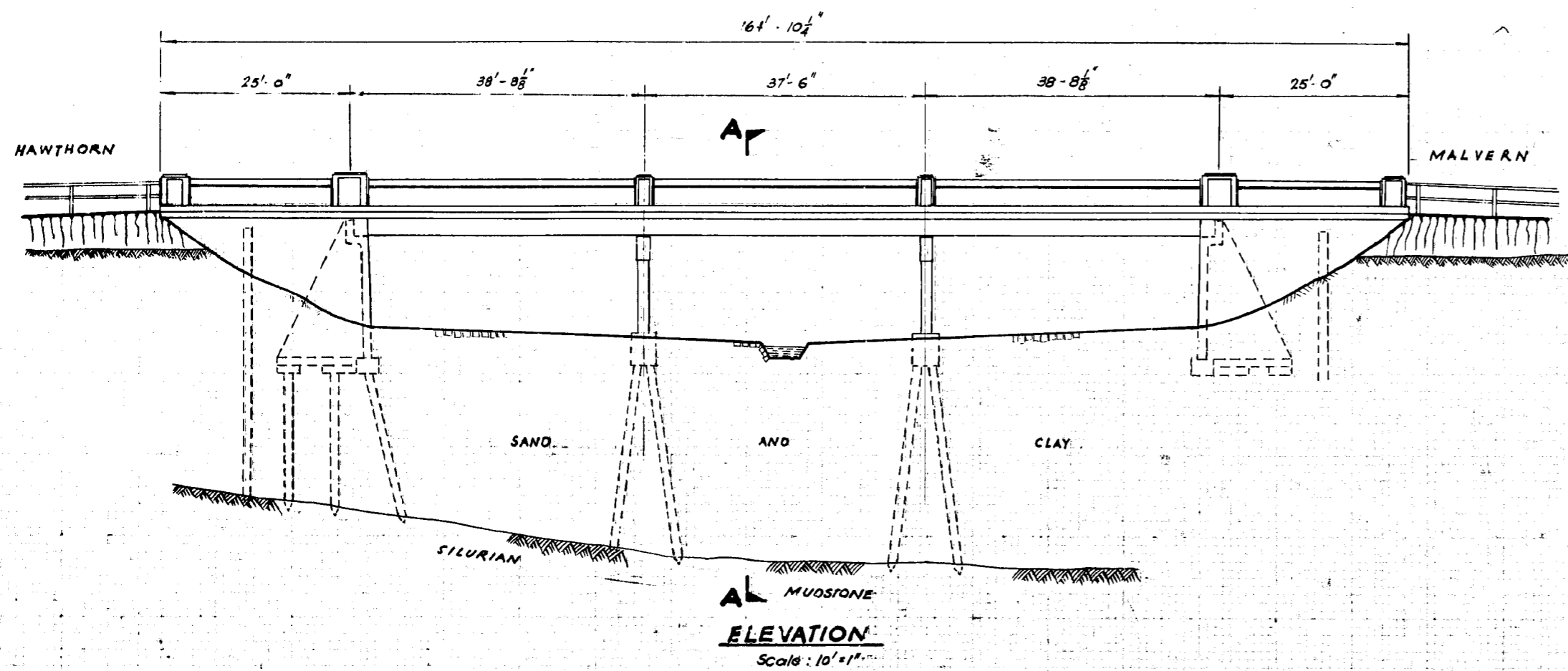
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FOR EXISTING BRIDGE DETAILS REFER TO DRG No. S22-026-1001

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TRACED	///	CONTRACT NO.:	
CHECKED	///	BOO PLAN NO.:	
CHIEF PLANNER	///	SUPERVISING ENGINEER	PB LB

M.M.B.W. PLANNING AND HIGHWAYS BRANCH  
SOUTH EASTERN FREEWAY  
PROPOSED TOORAK RD. BRIDGE OVER GARDINERS CREEK

SCALE:	AS SHOWN
SHEET	OF
DRAWING NO.	
S22-026-1002	

201677



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INDEX	DATE	REVISION	APPD

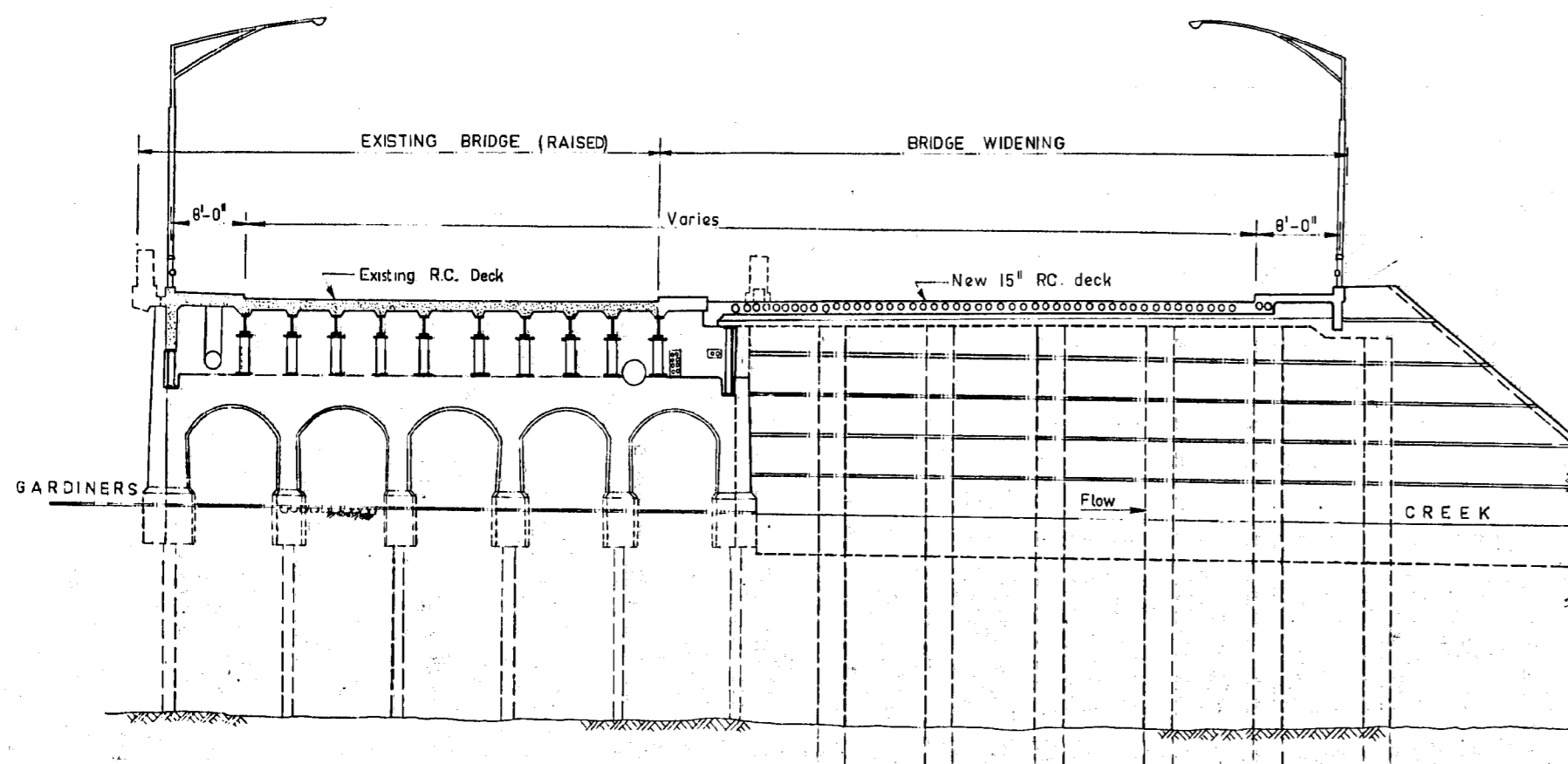
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FOR EXISTING BRIDGE DETAILS REFER TO DRG No. S22-026-1001

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CHECKED	///	BOO PLAN NO.:	
CHIEF PLANNER	///	SUPERVISING ENGINEER	PB LB

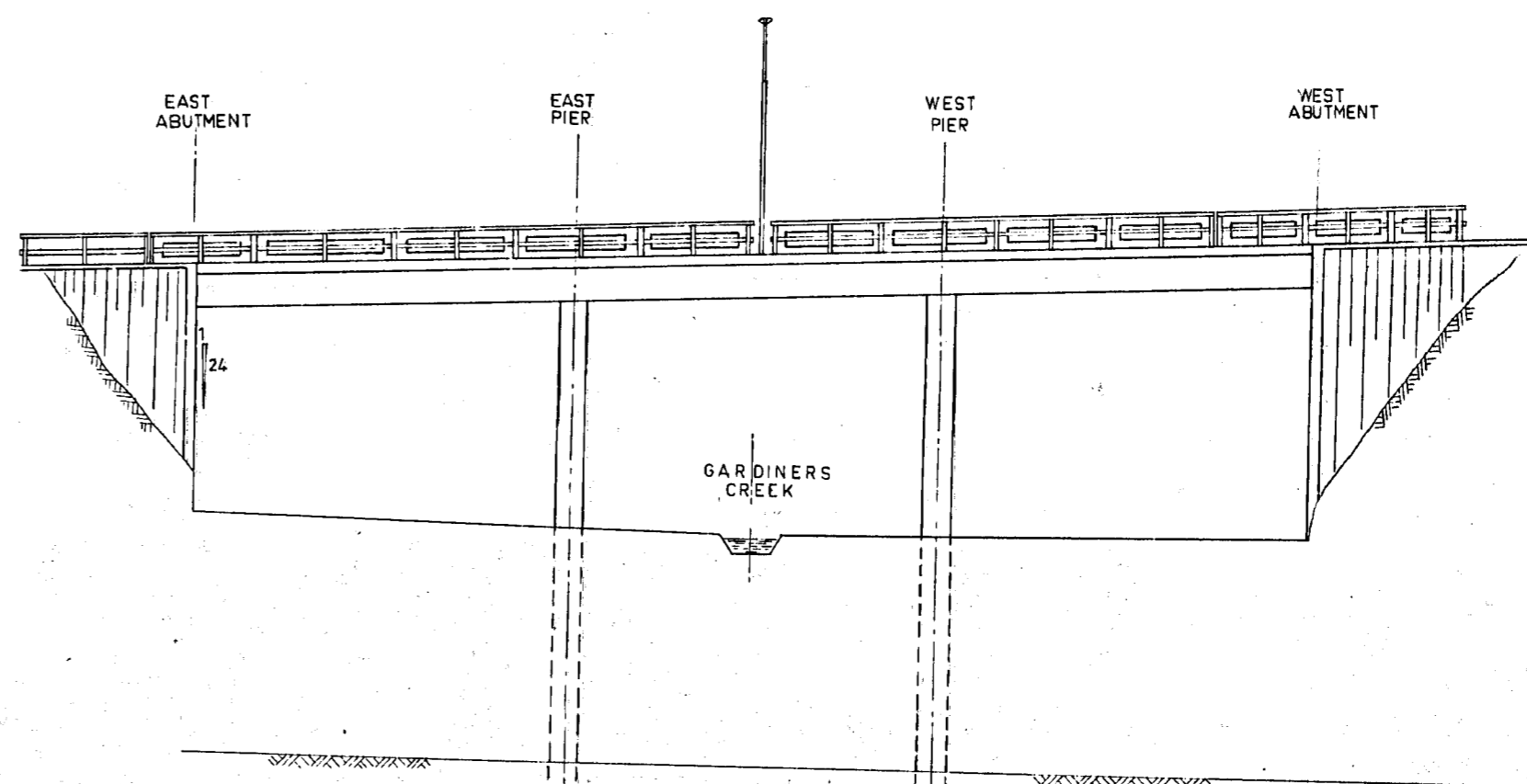
M.M.B.W. PLANNING AND HIGHWAYS BRANCH  
SOUTH EASTERN FREEWAY  
PROPOSED TOORAK RD. BRIDGE OVER GARDINERS CREEK

SCALE:	AS SHOWN
SHEET	OF
DRAWING NO.	
S22-026-1002	

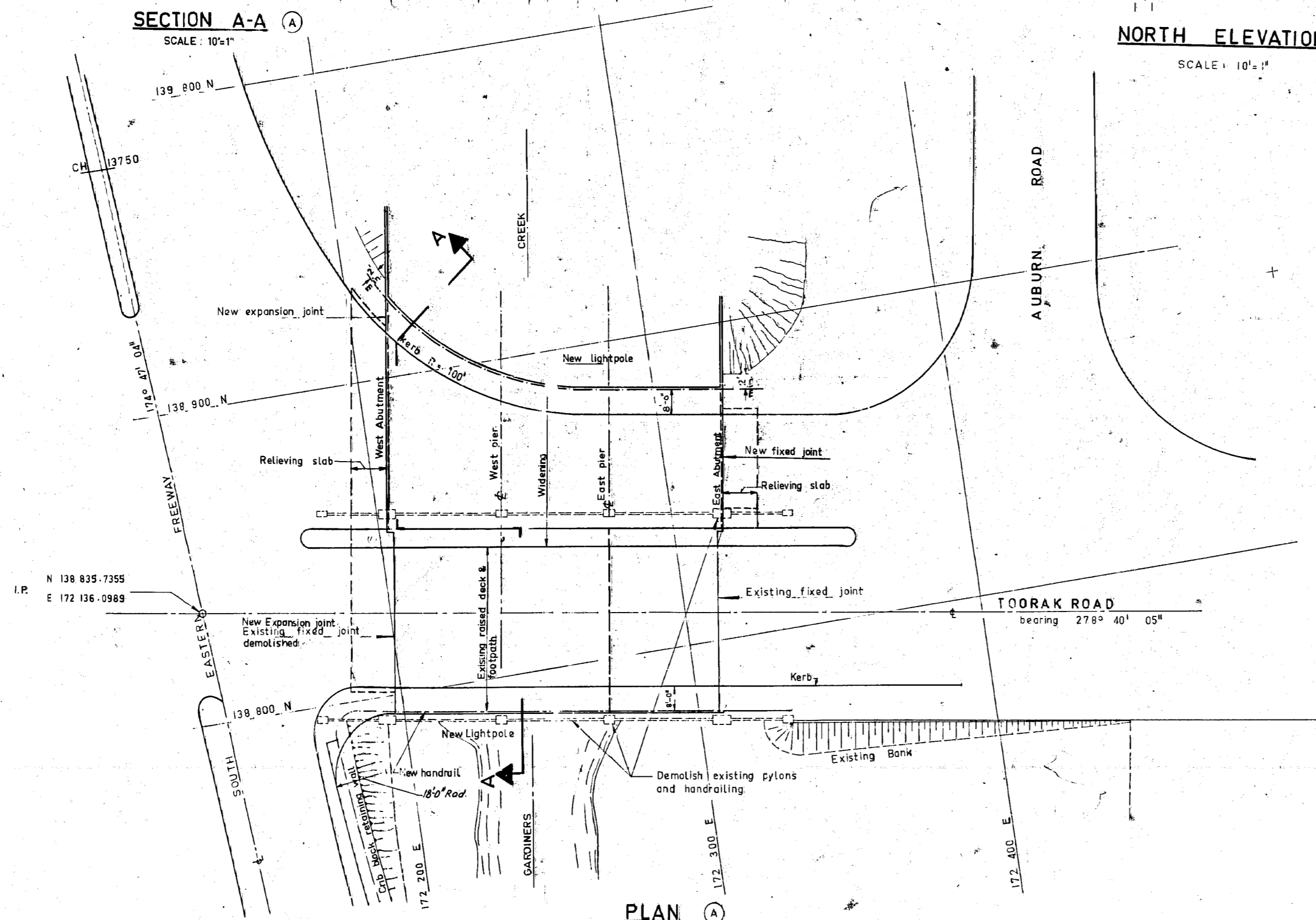
201677



**SECTION A-A (A)**  
SCALE: 10'-1"



**NORTH ELEVATION (A)**  
SCALE: 10'-1"



**PLAN (A)**  
SCALE: 20'-1"

201678

E			
D			
C			
B			
A	14-7-69	All views marked (A) amended.	JAS
INDEX	DATE	REVISION	APPD.

GENERAL NOTES

DESIGNED	CONTRACT No.
CHECKED	JOB. No.
DRAWN J. B. 21-10-68	FILE No.
TRACED A.F. 14-11-68	
CHECKED K.A.O. 14-7-69	
F.B.	L.B.

**M. M. B. W. PLANNING AND HIGHWAYS BRANCH**  
SPECIAL PROJECT N° 3 — SOUTH EASTERN FREEWAY — SECTION 2  
**TOORAK ROAD BRIDGE WIDENING**  
GENERAL ARRANGEMENT

SCALE: AS SHOWN
SHEET 34 OF 41
DRAWING No: P3-3034

A



**NOTE: Below mentioned Appendix diagrams are not part of this report and are listed as a reference to the original abstract – not supplied for this report.**

### **Site Observations and Problem Diagnosis**

The physical structure of the underpass inherently reduces the amount of natural lighting along this section of the Gardiners Creek Trail. This issue is exacerbated at dusk / dawn and under overcast conditions.

The underpass is susceptible to flooding during heavy rainfall events which leaves a silt build-up on the shared path which is exacerbated by low light conditions.

The low level of lighting can increase the risk of a crash as path users may not be able to clearly see the path, other path users or the surrounding features.

### **Description of Works**

It is proposed to illuminate the approaches of the Gardiners Creek Trail underpass at Toorak Road and the underpass itself by undertaking the following works:

- Install StreetLED Eco 18W lights (5);
- Install 5.5m height path lighting poles (2);
- Install wall brackets for mounting lights (3);
- Install distribution cabinet (1);
- Install steel conduit (60 m); and,
- Install PVC conduit (100 m) – installation of the conduit may require the path to be saw cut to allow for the conduit to be installed under the path.

Attachment A shows the proposed installation locations for the above items.

### **Design Parameters**

The path lighting was assessed in accordance with AS1158.3.1-2005 Category P2.

Category P2 has an average horizontal illuminance of 3.5 lux and is suitable for shared paths where there is high pedestrian / cycle activity and there is a medium risk of crime (Tables 2.2 & 2.6).

The results of the assessment indicates that the three proposed lights to be mounted on the bridge abutment under the structure has an average illuminance of above 10 lux. On the approaches the design philosophy was to install the luminaires at the path junction to maximise the lighting at those conflict points. Subsequently, the south ramp has an average illuminance of 7 lux whilst the north ramp has an average illuminance of 4 lux. The average illuminance results for the north approach are lower because of the steeper grade of the ramp.

Refer to Attachment B for 3D rendering of the proposed lighting levels at the Gardiners Creek Trail underpass at Toorak Road.

### **Benefits of Proposed Works**

The provision of path lighting will decrease the likelihood that pedestrians and cyclists will be discouraged from using the Trail during dusk / dark conditions.

The path lighting will also improve pedestrian and cyclist safety as visibility of the path, other path users and surrounding features will improve under dark conditions.

This is particularly beneficial in overcast conditions or during the winter period when the sun sets at an earlier time.

### **Crash History**

Council have provided the following information below (reported by members of the public) regarding a recent crash at the site.

Two cyclists were injured. A 30 year old commuter cyclist (riding with a friend) had a concussion and possible facial injuries (bleeding from the face and the nose appeared swollen).

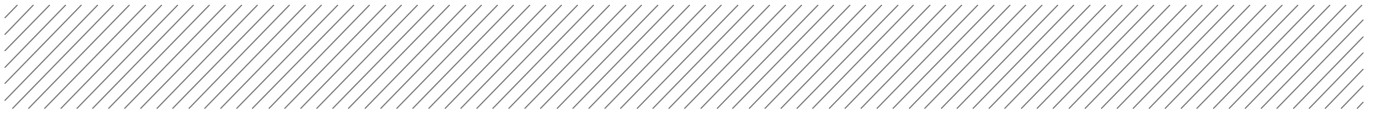
The second cyclist was a year 10 student riding with his father. He also had a concussion, complained of jaw pain and was disoriented. His helmet was broken and the frame of his carbon fibre Colnago bike was snapped at the headset.

Both cyclists called family members to collect them so the accidents are unlikely to be a recorded statistic.

The underpass was silted up from the previous day's bad weather and conditions were reasonably overcast such that light levels at the underpass were not adequate (about 5.30pm). These factors are likely to have contributed to the crash.

### **Cost Estimate**

A risk based cost estimate of the proposed treatment works has been prepared using the VicRoads VR\_CostSim spreadsheet and includes a contingency within the estimate. The estimated cost of the works is \$115,000 and the complete risk-based cost estimate is included in Attachment C.



# Appendix C

## Construction Cost Estimate

**Gardiners Creek Trail Underpass - Feasibility Cost Estimates**

Date: 18-May-2015

Revision 2

**Based on Option 1 Cantilever Concrete Path Structure**

ITEM	Bridge Works	Unit	Rate (excl GST)	Quantity	Amount
1.0	<b>Bridge Structure</b> includes cantilevered concrete decking and continuous footing based on Option 1				
1.1	Site establishment costs and setting out	item	\$10,000	1	\$10,000
1.2	Site Preparation - clearing and grubbing	item	\$15,000	1	\$15,000
1.3	Earthworks (assume total volume of 170 cubic meter cut for dsiposal)	item	\$3,000	1	\$3,000
1.4	Concrete cantilever path (assume 300mm thick)	sq. m	\$85	183	\$15,555
1.5	Concrete footing (assume 1.2m W x 1.5m D)	cub. m	\$580	110	\$63,800
1.6	Non-Slip Surface Coating	sq. m	\$15	183	\$2,745
1.7	Bike safe fence, 1.4m height	lin. m	\$300	60	\$18,000
2.0	<b>Shared Path</b>				
2.1	Traffic control - diversion of pedestrian access	No.	\$2,000	1	\$2,000
2.2	Asphalt Overlay (30mm size 14 Type V asphalt )	sq. m	\$20	305	\$6,100
2.3	Concrete Pavement with reinforcement (assume 100mm thick F=40MPa)	sq. m	\$50	305	\$15,250
2.4	Crushed rock bedding (assume 50mm thick compacted class 3 FCR)	sq. m	\$8	305	\$2,440
2.5	Bike safe fence, 1.4m height	sq. m	\$265	180	\$47,700
2.6	Retaining wall (assume 200mm thick x 1m height)	lin. m	\$550	80	\$44,000
2.7	Landscape retaining wall (assume 200mm thick x 1m height)	lin. m	\$550	90	\$49,500
3.0	<b>Alternative Path</b>				
3.1	Council Standard Concrete Shared path (100mm depth)	sq. m	\$100	90	\$9,000
3.2	Crushed rock bedding (assume 50mm depth)	sq. m	\$12	90	\$1,080
4.0	<b>Additional MW Access</b>				
4.1	Synthetic Grass Surface	sq. m	\$100	77	\$7,700
4.2	Concrete Pavement (assume 200mm)	sq. m	\$80	77	\$6,160
4.3	Crushed rock bedding (assume 50mm)	sq. m	\$12	303	\$3,636
4.4	Bike safe fence, 1.4m height	lin. m	\$265	24	\$6,360
4.5	Retaining Wall (assume 200mm thick x 1m height)	lin. m	\$550	24	\$13,200
5.0	<b>General</b>				
5.1	Demolition - Existing pavement under bridge and alternative path	sq. m	\$20	215	\$4,300
5.2	Tree works - cut back branch and trim hedge	item	\$2,000	1	\$2,000
5.3	Linemarking	lin. m	\$10	233	\$2,330
6.0	<b>Drainage Works</b>				
6.1	Existing stormwater outlet adjustment	no.	\$2,500	1	\$2,500
7.0	<b>Authority Fees (Indicative only) and Provisional Items</b>				
7.1	Melbourne Water Approval	item	\$1,000	1	\$1,000
7.2	VicRoads Approval	item	\$4,000	1	\$4,000
7.3	Council Permits (TBC)	item	-		
7.4	Environmental Management Plan	item	\$5,000	1	\$5,000
7.5	Work Method Statement	item	\$2,000	1	\$2,000
7.6	Risk Task Assessment	item	\$1,000	1	\$1,000
7.7	Lighting - Provisional	item	\$115,000	1	\$115,000
7.8	Flood Warning system - Provisional	item	\$50,000	1	\$50,000
7.9	Geotechnical investigation, report and design for footing construction (Provisional)	item	\$15,000	1	\$15,000
8.0	Civil and structural Design documents for construction (Provisional)	item	\$30,000	1	\$30,000
8.1	Construction Supervision (assume 8 weeks design period) (Provisional)	item	\$6,000	1	\$6,000
8.2	Council tendering and construction contractor nomination (Provisional)	item	\$5,000	1	\$5,000
8.3	Flora and fauna investigation (TBC)	item	\$5,000	1	\$5,000
8.4	Cultural Heritage Study (TBC)	item	\$5,000	1	\$5,000
8.0	<b>ASSET RECORDING</b> by Accredited Quality Assured Company provision of "As Constructed" information in accordance to the Melbourne Water Retail Agencies requirements and specifications.				
	Asset recording	Item	\$1,500	1	\$1,500

<b>Sub Total</b>	\$598,856
<b>Contingency 40%</b>	\$239,542
<b>Total excl. GST</b>	\$658,741.60

**Note:**

No allowance for landscape works, dewatering and rock excavation.  
No allowance for maintenance and establishment period

GST (10%)	\$59,885.60
<b>Total incl. GST</b>	\$718,627.20

**Disclaimer**

Assumptions have been made to size the proposed pavement and retaining wall structures and the volume of earthworks for costing purpose. These assumptions shall be reviewed at detailed design stage to confirm the final costing. Since Aurecon has no control over the cost of labour, materials, equipment or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, any indication of costs is made on the basis of Aurecon's experience and qualifications and represents its best judgment as an experienced and qualified professional consultant, familiar with the relevant industry, but Aurecon cannot and does not guarantee that proposals, bids or actual construction costs will not vary from cost indications given.



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