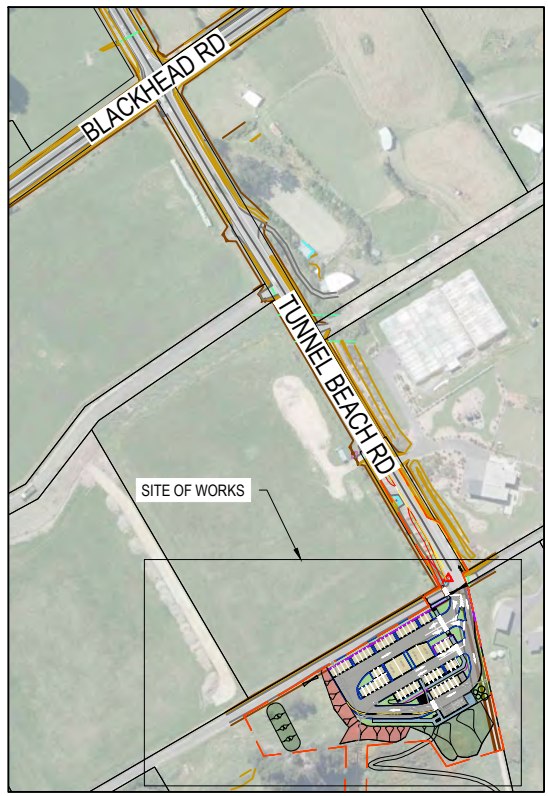




LEGEND	
	CHIP SEALED SURFACING
	GRAVEL SURFACING
	ACCESS PATH
	LANDSCAPING (REFER DRAWING 3336298-AL-010)
	CUT SLOPE
	FILL SLOPE
	RETAINING WALL
	DISH CHANNEL

No.	Revision	By	CHK	Appd	Date
B	FOR RESOURCE CONSENT	JK	AS	JT	9.11.20
A	FOR CLIENT REVIEW	CG	AS	JT	30.10.20

Drawing Originator:

Original Scale (A1)	Design	CG	18.09.20	Approved For Construction*
1:250	Drawn	CG	18.09.20	
Reduced Scale (A3)	Design Checker	OD	18.09.20	Date
1:500	Design Checker	JK	18.09.20	

* Refer to Revision 1 for Original Signature

Client:

DUNEDIN CITY COUNCIL *kaunihera a-rohe o Ōtepoti*

Project: **DUNEDIN CITY COUNCIL TUNNEL BEACH CAR PARK**

Title: **LAYOUT PLAN**

RESOURCE CONSENT NOT FOR CONSTRUCTION

Discipline	CIVIL
Drawing No.	3336298-CA-010
Rev.	B



B	FOR RESOURCE CONSENT	JK	AS	JT	9.11.20
A	FOR CLIENT REVIEW	CG	AS	JT	30.10.20
No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Beca

Original Scale (A1)	Design	CG	18.09.20	Approved For Construction*
1:250	Drawn	CG	18.09.20	
	Design Verifier	OD	18.09.20	
Reduced Scale (A3)	Design Check	JK	18.09.20	Date
1:500				
	* Refer to Revision 1 for Original Signature			

Client:

DUNEDIN CITY COUNCIL kaunihera a-rohe o Ōtepoti

Project:

DUNEDIN CITY COUNCIL
TUNNEL BEACH
CAR PARK

Title:

TUNNEL BEACH RD
ACCESS PATH
LAYOUT PLAN

RESOURCE CONSENT
NOT FOR CONSTRUCTION

Discipline	CIVIL
Drawing No.	3336298-CA-011
Rev.	B

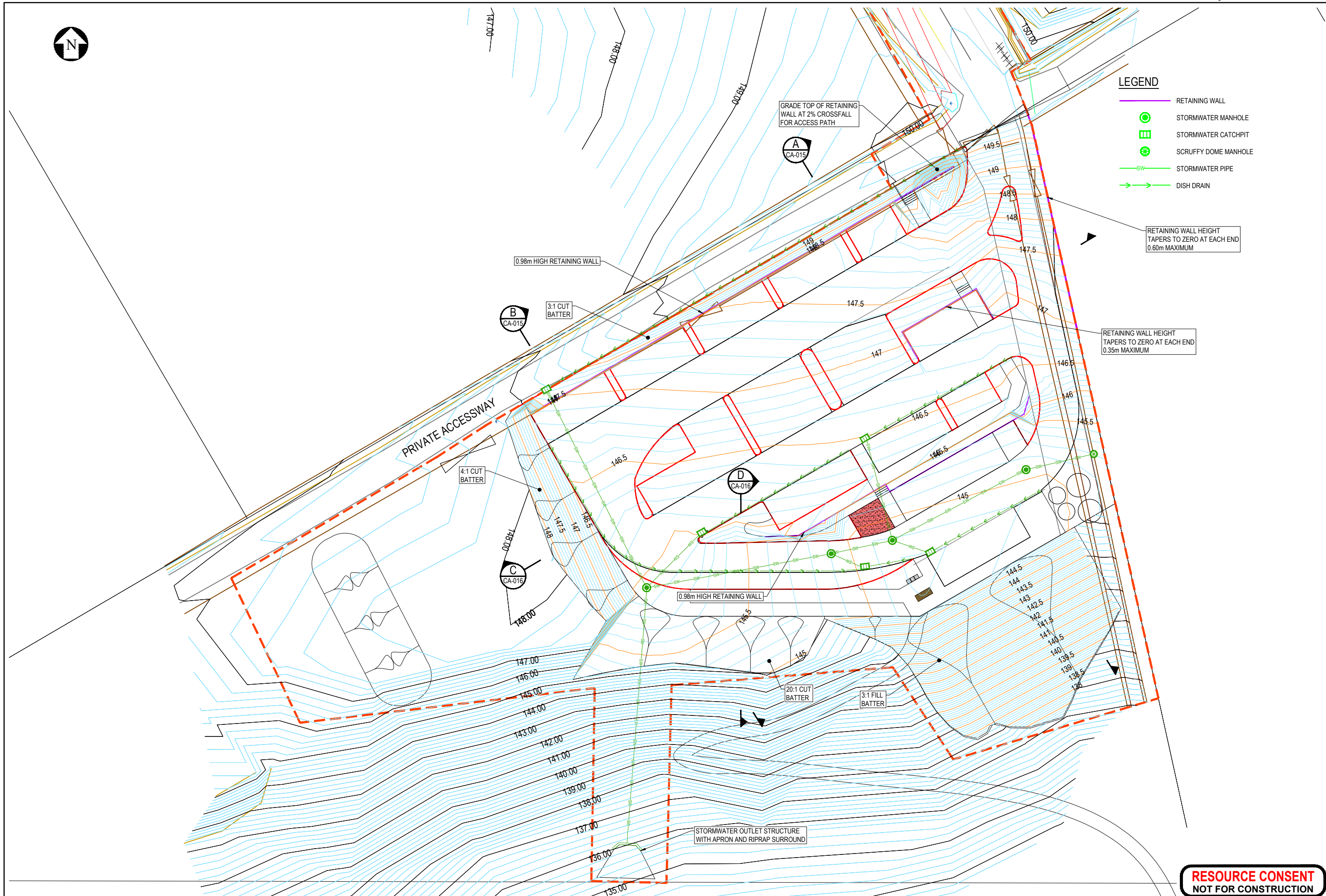


LEGEND

- RETAINING WALL
- STORMWATER MANHOLE
- STORMWATER CATCHPIT
- SCRUFFY DOME MANHOLE
- STORMWATER PIPE
- DISH DRAIN

RETAINING WALL HEIGHT
TAPERS TO ZERO AT EACH END
0.60m MAXIMUM

RETAINING WALL HEIGHT
TAPERS TO ZERO AT EACH END
0.35m MAXIMUM



RESOURCE CONSENT
NOT FOR CONSTRUCTION

B	FOR RESOURCE CONSENT	JK	AS	JT	9.11.20
A	FOR CLIENT REVIEW	CG	AS	JT	30.10.20
No.	Revision	By	CHK	Appd	Date



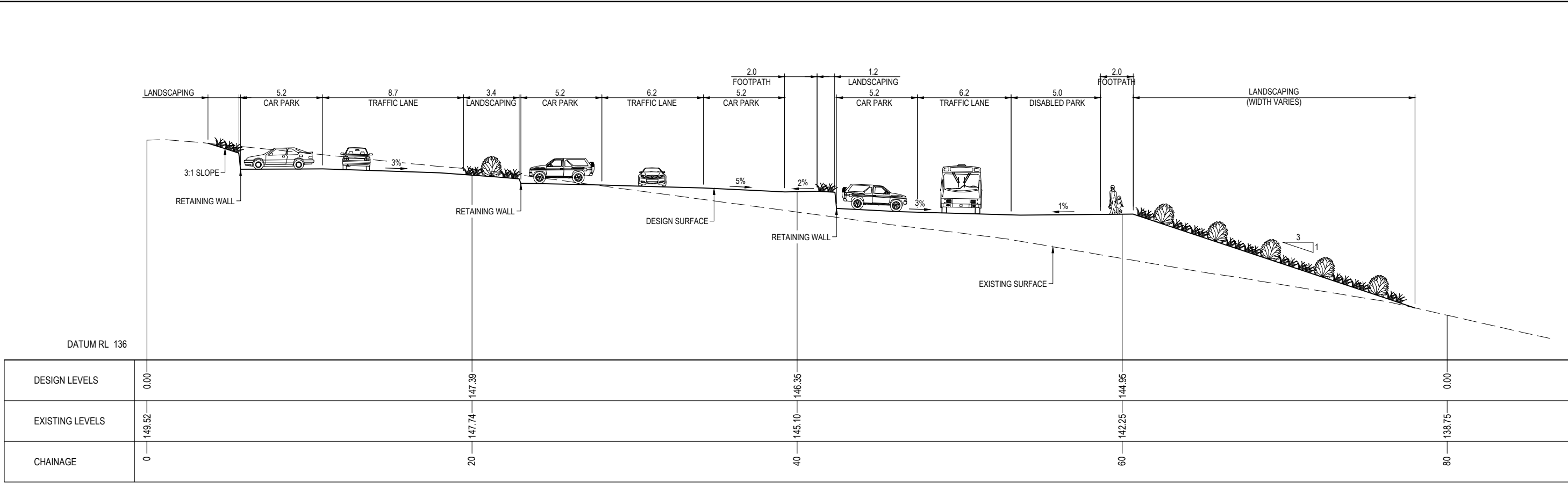
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Reduced Scale (A3)	Design Checker	MC	18.09.20	Date
1:500	Design Check	JK	18.09.20	
	* Refer to Revision 1 for Original Signature			



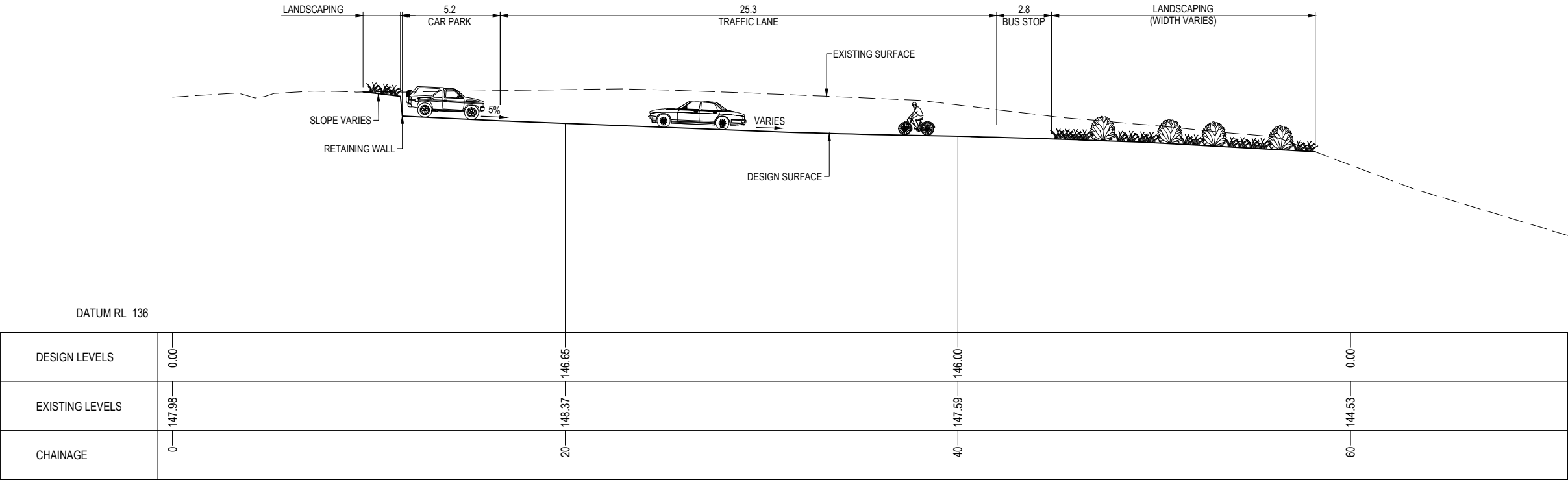
Project: DUNEDIN CITY COUNCIL
TUNNEL BEACH
CAR PARK

Title: DESIGN
CONTOUR PLAN

Discipline	CIVIL
Drawing No.	3336298-CA-012
Rev.	B



A TYPICAL SECTION
CA-012 SCALE 1:125 AT A1



B TYPICAL SECTION
CA-012 SCALE 1:125 AT A1

B	FOR RESOURCE CONSENT	JK	AS	JT	9.11.20
A	FOR CLIENT REVIEW	CG	AS	JT	30.10.20
No.	Revision	By	CHK	Appd	Date



Original Scale (A1)	Design	CG	18.09.20	Approved For Construction*
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Reduced Scale (A3)	Design Verifier	OD	18.09.20	Date
1:250	Design Check	JK	18.09.20	
	* Refer to Revision 1 for Original Signature			

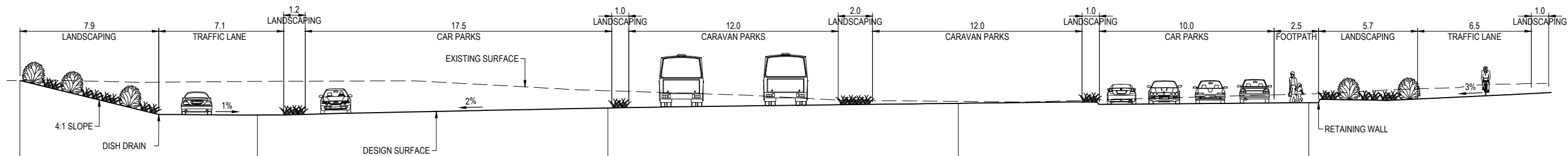


Project: DUNEDIN CITY COUNCIL
TUNNEL BEACH
CAR PARK

Title: TYPICAL SECTIONS
SHEET 1 OF 2

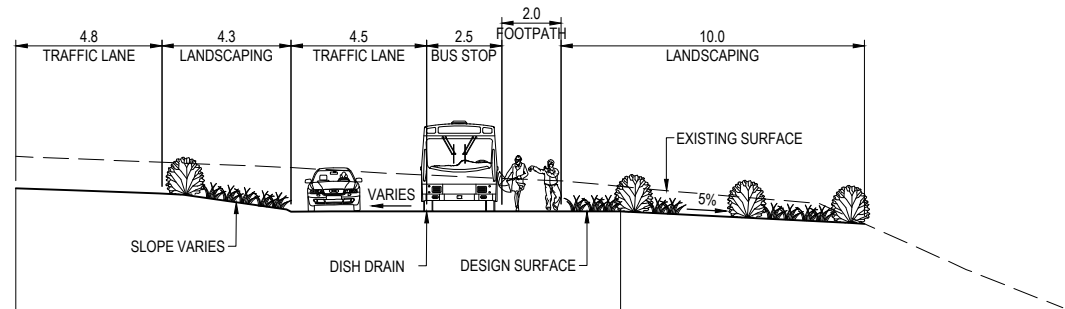
RESOURCE CONSENT
NOT FOR CONSTRUCTION

Discipline	CIVIL
Drawing No.	3336298-CA-015
Rev.	B



DESIGN LEVELS	148.20	146.22	146.61	146.88	146.92
EXISTING LEVELS	148.20	148.14	147.60	146.99	147.43
CHAINAGE	6.45	20	40	60	80

C TYPICAL SECTION
CA-012 SCALE 1:125 AT A1



DESIGN LEVELS	146.30	145.53	0.00
EXISTING LEVELS	147.35	146.36	0.00
CHAINAGE	0	20	40

D TYPICAL SECTION
CA-012 SCALE 1:125 AT A1

B	FOR RESOURCE CONSENT	JK	AS	JT	9.11.20
A	FOR CLIENT REVIEW	CG	AS	JT	30.10.20
No.	Revision	By	Chk.	Appd.	Date



Original Scale (A1)	Design	CG	18.09.20	Approved For Construction*
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Reduced Scale (A3)	Design Verifier	OD	18.09.20	Date
1:250	Design Check	JK	18.09.20	
	* Refer to Revision 1 for Original Signature			



Project: DUNEDIN CITY COUNCIL
TUNNEL BEACH
CAR PARK

Title: TYPICAL SECTIONS
SHEET 2 OF 2

Discipline	CIVIL
Drawing No.	3336298-CA-016
Rev.	B

RESOURCE CONSENT
NOT FOR CONSTRUCTION



LEGEND

STORMWATER MANHOLE

SCRUFFY DOME MANHOLE

SINGLE SUMP/ MUDTANK

DISH DRAIN

STORMWATER PIPE

EXISTING 1m CONTOURS

PROPOSED 100mm CONTOURS

PROPOSED 500mm CONTOURS

B	FOR RESOURCE CONSENT	JK	MC	JT	9.11.20
A	FOR CLIENT REVIEW	JB	MC	JT	30.10.20
No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Beca

Original Scale (A1)	Design	JB	04.09.20	Approved For Construction*
1:250	Drawn	JB	04.09.20	
Reduced Scale (A3)	Design Verifier	MC	17.09.20	Date
1:500	Design Check	JK	17.09.20	
	* Refer to Revision 1 for Original Signature			

Client:

DUNEDIN CITY COUNCIL

kaunihera a-rohe o Ōtepoti

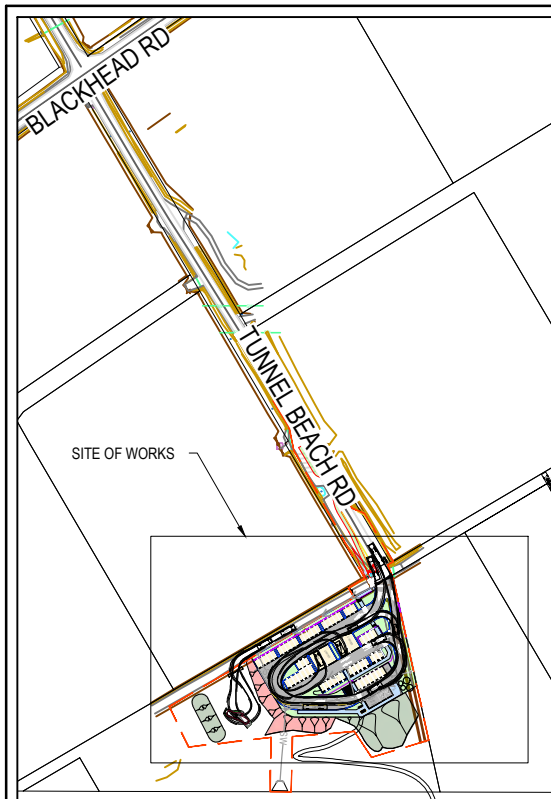
Project:

DUNEDIN CITY COUNCIL
TUNNEL BEACH
CAR PARK

Title:

PROPOSED STORMWATER
LAYOUT

Discipline	CIVIL
Drawing No.	3336298-CA-020
Rev.	B

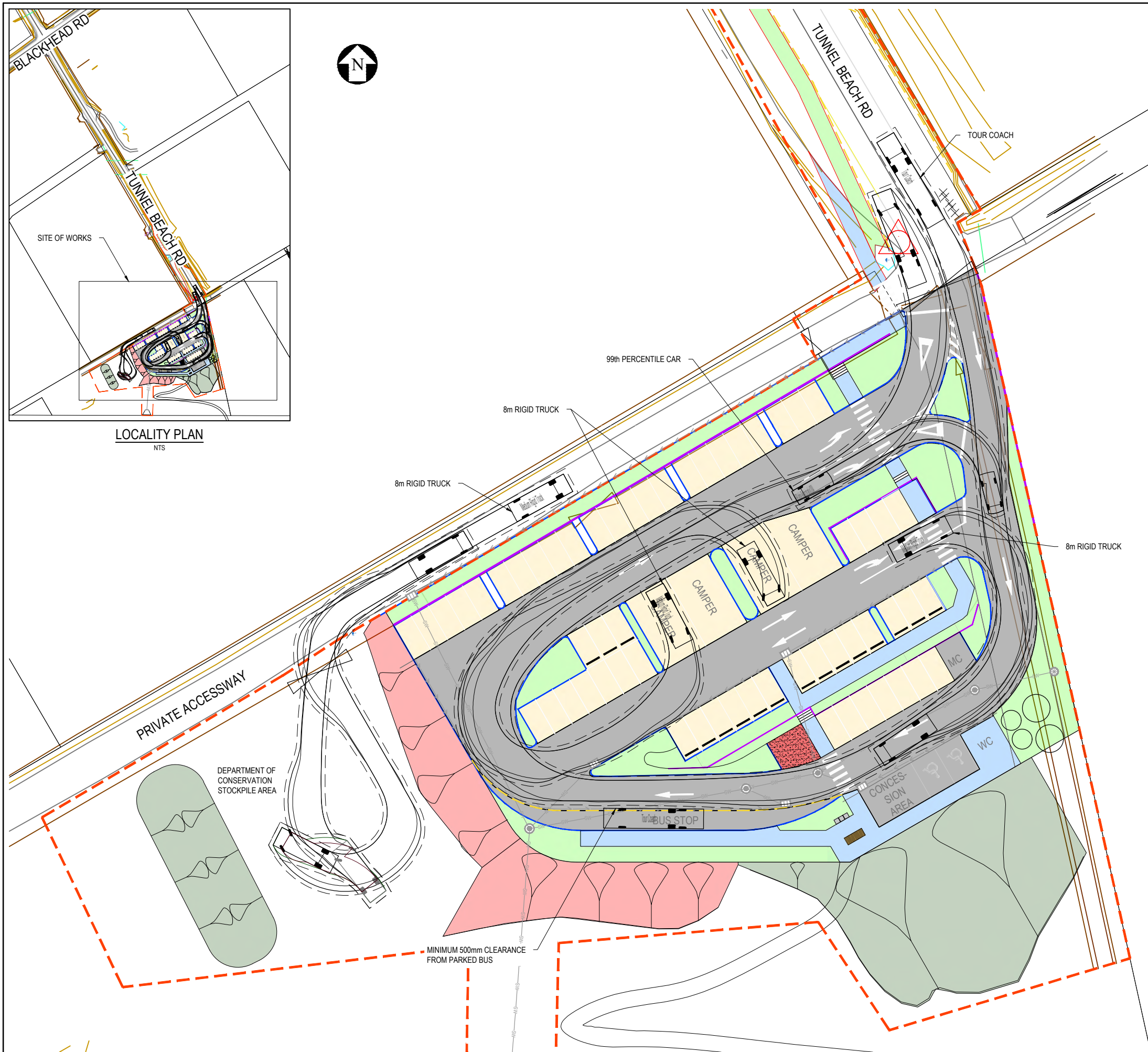


LOCALITY PLAN
NTS



LEGEND

- VEHICLE BODY OUTLINE
- 500mm CLEARANCE ENVELOPE



No.	Revision	By	CHK	Appd	Date
B	FOR RESOURCE CONSENT	JK	AS	JT	9.11.20
A	FOR CLIENT REVIEW	CG	AS	JT	30.10.20



Original Scale (A1)	Design	CG	18.09.20	Approved For Construction*
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Reduced Scale (A3)	Design Checker	OD	18.09.20	Date
1:500	Design Checker	JK	18.09.20	

* Refer to Revision 1 for Original Signature



Project: DUNEDIN CITY COUNCIL
TUNNEL BEACH
CAR PARK

Title: VEHICLE TRACKING PLAN

RESOURCE CONSENT
NOT FOR CONSTRUCTION

Discipline	CIVIL
Drawing No.	3336298-CA-030
Rev.	B



MARSHALL DAY
Acoustics 

TUNNEL BEACH CARPARK
ASSESSMENT OF NOISE EFFECTS
Rp 001 20200809 | 30 September 2020

Project: **TUNNEL BEACH CARPARK**

Prepared for: **Dunedin City Council**
% Beca
229 Moray Place
Dunedin 9016

Attention: **James Taylor (Beca)**

Report No.: **Rp 001 20200809**

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Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Approved	-	-	30 September 2020	A Johns	J Farren

SUMMARY

Proposed activities on site can comply with the District Plan noise limits

Noise emissions from vehicle movements on-site are predicted to comply with the applicable District Plan noise limits during peak activity.

We consider the noise effects associated with the proposed carpark to be acceptable

The predicted carpark noise levels range between 31 - 54 dB $L_{Aeq}(15 \text{ min})$ at the nearest dwellings when peak activity occurs.

We understand that the carpark gate will be locked at 2200 hours, therefore no activity will occur on-site during the night-time period.

Noise levels will maintain an appropriate level of residential amenity for all nearby residents and potential adverse noise effects are considered acceptable as a result. Furthermore, we do not anticipate any adverse noise effects on horses as a result of car parking activity.

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APPENDIX A GLOSSARY OF TERMINOLOGY

APPENDIX B DUNEDIN CITY COUNCIL TUNNEL BEACH CAR PARK, LAYOUT PLAN

1.0 INTRODUCTION

Marshall Day Acoustics (MDA) has been engaged by Beca to assess the noise-related effects of the proposed new carpark off Tunnel Beach Road.

The carpark will replace the existing roadside carparking, near the DOC walking track to Tunnel Beach.

This report provides:

- a review of the proposed carpark usage with respect to noise generation;
- an assessment of compliance against the applicable District Plan permitted activity noise limits for the underlying zone; and
- discussion of the potential noise effects on nearby residents and horses, in the context of other relevant guidance from national and international environmental noise standards.

Appendix A contains a glossary of acoustic terminology.

2.0 SITE & ACTIVITY DESCRIPTION

2.1 Site Locality

The site and surrounding properties are all in the *Rural Residential Zone*, under the Second Generation Plan (2GP).

The nearest noise sensitive activities are shown on the aerial image below:

1. 25 Tunnel Beach Road, notional boundary¹ of dwelling;
2. 31 Tunnel Beach Road, notional boundary (in this case, the site boundary) of dwelling;
3. 40 Tunnel Beach Road, notional boundary of dwelling;
4. 40 Tunnel Beach Road, site boundary (paddock contains horses).

Figure 1: Aerial view of proposal and surrounding properties



¹ Defined in the 2GP (appeals version) as a line 20m from any side of a residential building, or the site boundary where this is closer to the residential building.

2.2 Activity Description

The proposed 64-bay carpark (including four designated camper parks) is shown in Figure 2. The layout plan in its entirety is attached in Appendix B.

There is a dedicated bus bay to the south area of the carpark. We understand that the existing carpark on Tunnel Beach Road will be replaced by landscaping.

Figure 2: Excerpt from the Layout Plan, prepared By Beca, 18 September 2020



Noise from the carpark will comprise the arrival/departure and manoeuvring of vehicles on chip seal and gravel. The majority of vehicles will be light vehicles, with a small proportion of buses and campervans.

We understand that the carpark gates will be locked between 2200 and 0700 hours.

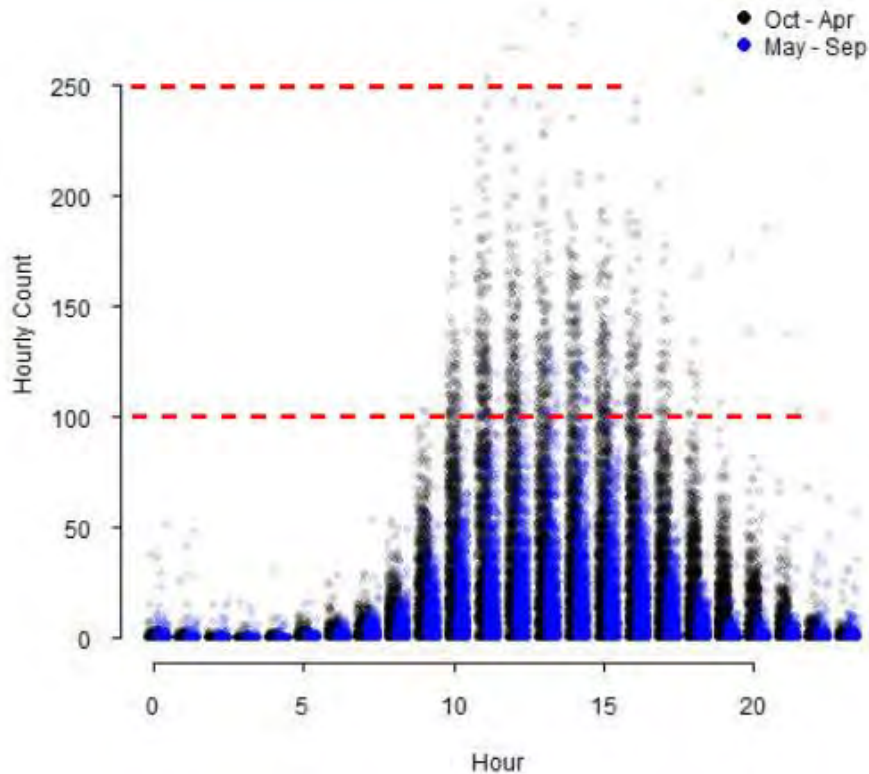
2.2.1 Carpark usage

We understand that the number of people accessing the walkway is not anticipated to change with the proposed carpark. There is no data available to us on the existing number of traffic movements on Tunnel Beach Road, but comprehensive data is available relating to the number of visitors accessing the walking track.

From the hourly visitor counts provided by the Department of Conservation (DOC), and shown in Figure 3, we have made the following assumptions for the daytime and evening 'peak-hour' activity:

- Up to 250 visitors within a daytime 'peak-hour' comprised of **3 buses** (100 visitors) and **60 private vehicles** (150 people).
- Up to 100 visitors within an evening 'peak-hour' comprised of **40 private vehicles** (100 people).

Figure 3: Hourly number of visitors²



3.0 NOISE PERFORMANCE STANDARDS

This section provides a summary of the applicable District Plan permitted activity noise limits in addition to other commonly used guidance to assist with assessing potential adverse noise effects.

3.1 Second Generation Plan (2GP)

The applicable noise limits for the Rural residential Zone are set out in Chapter 9 of the Dunedin City Council's Second Generation Plan (2GP). The applicable limits are provided in Table 1 below.

We understand that the 2GP daytime and evening noise limits are operative (i.e. not subject to appeal). The 2GP night-time limit is under appeal. As no activity will occur in the carpark after 2200 hours the night-time limits are not relevant to this assessment and provided for reference only.

Table 1: Second Generation District Plan (2GP)

Assessment Location	District Plan Noise Limits		
	Daytime 07:00 to 19:00 hrs	Evening 19:00 to 22:00 hrs	Night-time* 22:00 to 07:00 hrs
At the notional boundary of noise sensitive activities in a Rural Residential Zone	55 dB LAeq (15min)	50 dB LAeq (15min)	40 LAeq (15min) 70 LAmax
* The night-time limits listed in the 2GP are still under appeal (the appeal relates to a request to increase the night-time noise emission limits).			

² Excerpt from Tunnel Beach Walkway Technical Report

3.1 NZS 6802:2008 Guideline Residential Upper Limits

The latest version of New Zealand environmental noise assessment standard NZS 6802:2008 “Acoustics - Environmental Noise” refers to the guideline noise limits listed below.

NZS 6802:2008 states that these guideline noise limits offer reasonable protection of health and amenity where the use of land is for residential purposes. The guideline noise limits should generally not be exceeded at any point within the boundary of a residential site:

- Daytime: 55 dB $L_{Aeq(15\text{ min})}$
- Night-time: 45 dB $L_{Aeq(15\text{ min})}$ and 75 dB L_{AFmax}

3.2 World Health Organisation Guidelines

The World Health Organisation (WHO) Guideline Values for Community Noise (Berglund and Lindvall, 1999) provide guidelines for environmental noise exposure. For community or environmental noise, the critical health effects (those effects which occur at the lowest exposure levels) are sleep disturbance and annoyance.

These Guideline Values are the exposure levels that represent the onset of the effect for the general population.

Table 2: WHO Guideline Values for the critical health effects of community or environmental noise

Specific Environment	Critical health effect(s)	dB LAeq	Time base (hours)	dB LAFmax
Outdoor living area	Serious annoyance, daytime & evening	55	16	-
	Moderate annoyance, daytime & evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

3.3 Recommended Assessment Criteria

The applicable daytime noise limit in the 2GP is consistent with the guidance of both NZS 6802:2008 and the WHO for upper limits for noise generated in residential areas. Between 1900 to 2200 hours the 2GP noise limit is 50 dB L_{Aeq} , which allows for further protection against the onset of annoyance during the evening.

Based on the above, we consider that noise effects from the proposed activity will be acceptable if noise levels comply with the underlying 2GP permitted activity noise limits, as set out in Table 1.

Noise is to be measured in accordance with New Zealand Standard NZS 6801:2008 “Acoustics – Measurement of environmental sound” and assessed in accordance with the provisions of New Zealand Standard NZS 6802:2008 “Acoustics - Environmental Noise”.

4.0 EFFECTS OF VEHICLE NOISE ON HORSES

There is very little published guidance on the effects of vehicle noise on animals. However, a case study³ observed that horses in stables exposed to 54-70 dB $L_{Aeq(15min)}$ generally show little response.

This research supports our own observations of horses and other livestock, which show that these animals do not appear to be bothered by noise as they graze beside busy roads or under flight paths near airports.

Considering the presence of the existing carpark area, which is approximately 180 m from the horse paddock, represented by the site boundary of 40 Tunnel Beach Road (marker 4 on Figure 1), we expect the horses to be already familiar with traffic noise during the daytime and evening and do not anticipate any adverse effects as a result.

5.0 PREDICTED NOISE LEVELS

5.1 Noise Sources

Predicted noise levels are based on the peak activity described in Section 2.2.1, using source noise measurements previously undertaken in and near car parks for aspects such as engine noise on start-up and vehicle movement.

Table 3 provides a summary of the source noise levels that form the basis of our predictions.

Table 3: Vehicle Noise Levels

Item	Description	Noise Level dB		Measurement Reference Distance (m)
		L_{Aeq}	L_{AE}	
Bus	Pass-by at ~5 km/h	-	88	2
Light vehicle	Pass-by at ~10 km/h	70	-	3
Light vehicle	Car start-up and reverse	76	-	0.5
Light vehicle	Door slam	78	-	3

³ Huybregts, N. 2008. "Protecting Horses from Excessive Music Noise - A Case Study".

5.2 Summary of Predicted Noise Levels

Table 4 summarises the calculated noise levels associated with carpark activity as received at the nearest notional and site boundaries.

Noise levels from car door slams will not exceed 60 dB L_{Amax} at the notional boundary of any dwelling and are calculated to be 47 dB L_{Amax} at the horse paddock (site boundary of 40 Tunnel Beach Road).

Table 4: Predicted Activity Noise levels

Assessment Location	Daytime (0700 – 1900 hours)		Evening (1900 – 2200 hours)	
	Noise level dB L_{Aeq} (15 min)	2GP Noise limit dB L_{Aeq} (15 min)	Noise level dB L_{Aeq} (15 min)	2GP Noise limit dB L_{Aeq} (15 min)
1. 25 Tunnel Beach Road, notional boundary of dwelling	41	55	34	50
2. 31 Tunnel Beach Road, notional boundary (in this case, the site boundary) of dwelling;	54	55	49	50
3. 40 Tunnel Beach Road, notional boundary of dwelling;	31	55	< 25	50
4. 40 Tunnel Beach Road, site boundary (paddock contains horses).	33	-	< 25	-

The predicted carpark noise levels at the nearest dwelling are 54 dB L_{Aeq} (15 min) during peak daytime activity, which includes the arrival and departure of a bus. During the evening period, from 1900 to 2200 hours, predicted noise levels are up to 49 dB L_{Aeq} (15 min) at the nearest dwelling.

The District Plan permitted activity noise limits will be achieved at all noise-sensitive assessment locations during peak carpark activity.

6.0 DISCUSSION

We have calculated the noise levels arising from the proposed carpark activity, including noise generated by the arrival and departure of a bus. As predicted in Table 4, noise levels comply with the District Plan permitted activity noise limits and achieve WHO and NZS6802:2008 guideline values for reasonable protection of health and amenity in residential areas.

Horses in the paddock to the west of the carpark (at the site boundary of 40 Tunnel Beach Road) may experience noise levels of up to 33 dB L_{Aeq} (15 min) and 47 dB L_{Amax} . Horses are not likely to show any response to vehicle noise levels of this magnitude and we do not anticipate any adverse effects as a result.

Noise levels will increase at 40 Tunnel Beach Road as a result of the proposed carpark. However, the predicted noise level at the site boundary is significantly below the WHO Guideline Value, 50 dB L_{Aeq} , provided to protect communities from the onset of moderate annoyance in outdoor living spaces.

APPENDIX A GLOSSARY OF TERMINOLOGY

Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dB	<u>Decibel</u> The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of $P_r=20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
$L_{\text{Aeq}}(t)$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 <i>"Acoustics – Measurement of environmental sound"</i>
NZS 6802:2008	New Zealand Standard NZS 6802:2008 <i>"Acoustics – Environmental Noise"</i>
SEL or L_{AE}	<u>Sound Exposure Level</u> The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
SPL or L_p	<u>Sound Pressure Level</u> A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing ($20 \mu\text{Pa}$ RMS) and expressed in decibels.
SWL or L_w	<u>Sound Power Level</u> A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

APPENDIX B DUNEDIN CITY COUNCIL TUNNEL BEACH CAR PARK, LAYOUT PLAN



Appendix F – Parking Photo's

Memorandum

To: Dunedin City Council
From: James Taylor
Copy:
Subject: Existing Parking at Tunnel Beach Road

Date: 1 October 2020
Our Ref: 3336298-1141558477-62



Figure 1



Figure 2



Figure 3



Figure 4

Memorandum



Figure 5



Figure 6



Figure 7



Figure 8

Memorandum



Figure 9



Figure 10



Figure 11



Figure 12

Memorandum



Figure 13



Figure 14



Figure 15



Figure 16

Memorandum



Figure 17



Figure 18



Figure 19



Figure 20

Memorandum



Figure 21



Figure 22



Figure 23



Figure 24

Memorandum



Figure 25



Figure 26



Figure 27



Figure 28

Memorandum



Figure 29



Figure 30



Figure 31



Figure 32

Memorandum



Figure 33



Figure 34



Figure 35



Figure 36

Memorandum



Figure 37



Figure 38



Figure 39



Figure 40

Memorandum



Figure 41



Figure 42



Figure 43



Figure 44

Memorandum



Figure 45



Figure 46



Figure 47



Figure 48

Appendix G – Stormwater Assessment



PRE-DEVELOPMENT CATCHMENT
SCALE 1:1000 (A3)



POST-DEVELOPMENT CATCHMENT
SCALE 1:1000 (A3)

A		FOR INFORMATION	JB	MC	JT	18.09.20
No.	Revision		By	CHK	Appd	Date

Drawing Originator:

Beca

Original Scale (A1)	Design	JB	04.09.20	Approved For Construction*
1:250	Drawn	JB	04.09.20	
Reduced Scale (A3)	Design Verifier	MC	15.09.20	Date
1:500	Design Check	MC	18.09.20	

* Refer to Revision 1 for Original Signature

Client:

DUNEDIN CITY COUNCIL kaupihera a-rohe o Ōtepoti

Project:

TUNNEL BEACH CAR PARK

Title:

SUB-CATCHMENT PLAN

RESOURCE CONSENT
NOT FOR CONSTRUCTION

PRELIMINARY
NOT FOR CONSTRUCTION

Discipline: **CIVIL**

Drawing No: **3336298-CA-100**

Rev: **A**



LAYOUT
SCALE 1:500 (A3)

RESOURCE CONSENT
NOT FOR CONSTRUCTION

PRELIMINARY
NOT FOR CONSTRUCTION

Revision		By	CHK	Appd	Date
A FOR INFORMATION		JB	MC	JT	18.09.20
No.					

Drawing Originator:

Original Scale (A1)	Design	JB	04.09.20	Approved For Construction*
1:250	Drawn	JB	04.09.20	
Reduced Scale (A3)	Design Verifier	MC	15.09.20	
1:500	Design Check	MC	18.09.20	Date

* Refer to Revision 1 for Original Signature

Client:

kaunihera
a-rohe o
ōtepoti

Project: TUNNEL BEACH
CAR PARK

Title: SUB-CATCHMENT PLAN

Discipline	CIVIL
Drawing No.	3336298-CA-100
Rev.	A

Pre Development Runoff - Oveview

This spreadsheet is used for determining the pre-development runoff flowing into the existing overland flowpath at tunnel beach. Refer to drawing 3336298-CA-099 for catchment area.

Inputs and Assumptions

Contributing catchment has been determined using DCC Lidar Data

Catchment on drawing 3336298-CA-099

Rainfall intensity from HIRDS V4 RCP 8.5 2081 - 2100

Runoff coefficients from Table 1, Section 2- New Zealand Building Code
Clause E1 Surface Water. Medium soakage soil with pasture and grass cover
C= 0.3

10min Time of Concentration
(See Time of Concentration TAB)

Summary

Catchment ID	Peak Flowrate, Q (L/s)					
	2yr	5yr	10yr	20yr	50yr	100yr
Existing	133	192	240	295	379	454

Rational Method $Q=CiA$

This workbook has been developed to facilitate the Rational Method calculations. *Queensland Urban Drainage Manual, 3rd edition 2013 & Applied Hydrology, ven Te Chow*

Basically, Rational Method is a simplistic methodology for estimating the maximum flow rate suitable for design purpose. The method represents a steady inflow-outflow condition of the watershed during the peak intensity of the design storm.

Any storage features having sufficient volume (such as detention ponds, channels with significant volume, and floodplain storage) that they do not completely fill and reach a steady inflow-outflow condition during the duration of the design storm cannot be properly represented with the rational method. When these features are present, an alternate rainfall-runoff method is required that accounts for the time-varying nature of the design storm and/or filling/emptying of floodplain storage.

Assumptions & Limitations of the Rational Method

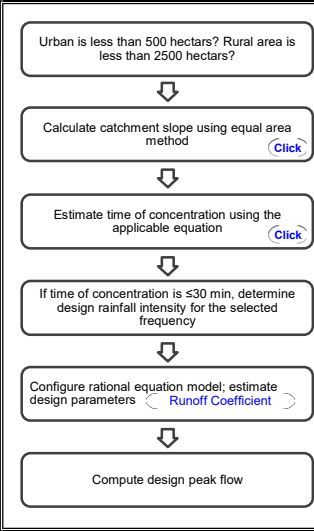
- It assumes that the rainfall duration is the same as the time of concentration and the return period of rainfall intensity is the same as the peak runoff.
- It is suitable for sizing drainage systems within urban catchments of up to 500 ha in area or rural catchments of up to 2500 ha in area.
- It provides the peak flow rate only and it does not produce a full design hydrograph.
- It is not suitable for catchments with significant floodplain storage, detention basins, or catchments with wide spread use of on-site detention systems.
- It is applicable if time of the concentration for the catchment area is less than the duration of peak rainfall intensity. The method is not suitable for catchments with a time of concentration greater than 30 minutes where a high degree of reliability is required in the hydrologic analysis.
- It assumes rainfall intensity is uniform throughout the duration of the storm and is distributed uniformly over the drainage area.
- The minimum duration to be used for computation of rainfall intensity is 10 minutes. If the time of concentration calculated for the catchment is less than 10 minutes, then 10 minutes should be

Inputs
Results

Catchment ID	Catchment Area, A (m²)			Weighted C	Time of Conc., Tc (min) Refer to Time of Conc. sheet	Rainfall Intensity, I (mm/hr)						Peak Flowrate, Q (m³/s)					
	Impervious	Pervious	Total			2yr	5yr	10yr	20yr	50yr	100yr	2yr	5yr	10yr	20yr	50yr	100yr
	Existing		45000	0.30	10	35.50	51.10	64.00	78.60	101.00	121.00	0.13	0.19	0.24	0.29	0.38	0.45
												0.00	0.00	0.00	0.00	0.00	0.00
												0.00	0.00	0.00	0.00	0.00	0.00
												0.00	0.00	0.00	0.00	0.00	0.00
												0.00	0.00	0.00	0.00	0.00	0.00

Runoff Coefficients (C)	
Impervious	Pervious

Procedure for using the Rational Method



<https://hirds.niwa.co.nz/>

Post Development Runoff (Carpark Only) - Overview

This spreadsheet is used for determining the runoff that is discharged by the proposed carpark at Tunnel Beach. Refer to drawing 3336298-CA-099 for catchment wider catchment plan and 3336298-CA-099 for sub-catchment plan.

Inputs and Assumptions

Contributing catchment has been determined using proposed 3D design surface (dated: 04:09:2020)

See 3336298-CA-099 for sub-catchment plan.

Rainfall intensity from HIRDS V4 RCP 8.5 2081 - 2100

Runoff coefficients from Table 1, Section 2- New Zealand Building Code
Clause E1 Surface Water

Time of concentration assumed as 10min as car park sub-catchment very small

Summary

Catchment ID	Peak Flowrate, Q (L/s)					
	2yr	5yr	10yr	20yr	50yr	100yr
A1	4.6	6.7	8.3	10.2	13.2	15.8
A2	5.5	8.0	10.0	12.3	15.8	18.9
A3	3.3	4.7	5.9	7.2	9.3	11.1
A4	7.3	10.6	13.2	16.3	20.9	25.0
A5	4.4	6.3	7.9	9.7	12.5	15.0
TOTAL	25.2	36.2	45.4	55.8	71.6	85.8

Rational Method Q=CiA

This workbook has been developed to facilitate the Rational Method calculations. *Queensland Urban Drainage Manual, 3rd edition 2013 & Applied Hydrology, ven Te Chow*

Basically, Rational Method is a simplistic methodology for estimating the maximum flow rate suitable for design purpose. The method represents a steady inflow-outflow condition of the watershed during the peak intensity of the design storm.

Any storage features having sufficient volume (such as detention ponds, channels with significant volume, and floodplain storage) that they do not completely fill and reach a steady inflow-outflow condition during the duration of the design storm cannot be properly represented with the rational method. When these features are present, an alternate rainfall-runoff method is required that accounts for the time-varying nature of the design storm and/or filling/emptying of floodplain storage.

Assumptions & Limitations of the Rational Method

- It assumes that the rainfall duration is the same as the time of concentration and the return period of rainfall intensity is the same as the peak runoff.
- It is suitable for sizing drainage systems within urban catchments of up to 500 ha in area or rural catchments of up to 2500 ha in area.
- It provides the peak flow rate only and it does not produce a full design hydrograph.
- It is not suitable for catchments with significant floodplain storage, detention basins, or catchments with wide spread use of on-site detention systems.
- It is applicable if time of the concentration for the catchment area is less than the duration of peak rainfall intensity. The method is not suitable for catchments with a time of concentration greater than 30 minutes where a high degree of reliability is required in the hydrologic analysis.
- It assumes rainfall intensity is uniform throughout the duration of the storm and is distributed uniformly over the drainage area.
- The minimum duration to be used for computation of rainfall intensity is 10 minutes. If the time of concentration calculated for the catchment is less than 10 minutes, then 10 minutes should be

Inputs	
Results	

Catchment ID	Hydrological Data																	
	Catchment Area, A (m²)				Weighted C	Time of Conc., Tc (min)	Rainfall Intensity, I (mm/hr)						Peak Flowrate, Q (L/s)					
	Asphalt	Gravel	Landscape	Total			2yr	5yr	10yr	20yr	50yr	100yr	2yr	5yr	10yr	20yr	50yr	100yr
A1	488	16	155	659	0.71	10	35.50	51.10	64.00	78.60	101.00	121.00	4.63	6.66	8.34	10.25	13.17	15.77
A2	423	302	171	896	0.63	10	35.50	51.10	64.00	78.60	101.00	121.00	5.54	7.98	9.99	12.27	15.76	18.88
A3	288	11	271	570	0.58	10	35.50	51.10	64.00	78.60	101.00	121.00	3.27	4.71	5.90	7.24	9.30	11.15
A4	482	464	345	1291	0.58	10	35.50	51.10	64.00	78.60	101.00	121.00	7.35	10.58	13.25	16.27	20.91	25.05
A5	324	296	74	694	0.64	10	35.50	51.10	64.00	78.60	101.00	121.00	4.39	6.33	7.92	9.73	12.50	14.98
TOTAL	2005	1089	1016	4110	0.62	10	35.50	51.10	64.00	78.60	101.00	121.00	25.18	36.25	45.40	55.75	71.64	85.83

Runoff Coefficients (C)		
Asphalt	Gravel	Landscape
0.85	0.50	0.30

Procedure for using the Rational Method

Urban is less than 500 hectares? Rural area is less than 2500 hectares?

↓

Calculate catchment slope using equal area method [Click](#)

↓

Estimate time of concentration using the applicable equation [Click](#)

↓

If time of concentration is ≤30 min, determine design rainfall intensity for the selected frequency

↓

Configure rational equation model; estimate design parameters [Runoff Coefficient](#)

↓

Compute design peak flow

<https://hirds.niwa.co.nz/>

Description

This spreadsheet is used for determining the velocity in the existing overland flowpath that the proposed carpark is to discharge to, both pre and post development. Refer to drawing 3336298-CA-099 for locality.

Inputs and Assumptions

Cross section based off LIDAR data. LIDAR data sourced from DCC and is based on 2015 LIDAR survey with 10m grid spacing

Longitudinal fall: 40%

Based on LIDAR data (shown on drawing 3336298-CA-099)

Mannings n: 0.12

(CCC's WWDG Table 22-1, assuming "Open Channel - Excavated, Channels not maintained, Dense weeds as high as flow depth ")

Pre development 10% AEP Runoff = 200 L/s
(Runoff spreadsheet)

Post development 10% AEP Runoff = 240 L/s
(Runoff spreadsheet). For simplicity, carpark runoff was added directly to total pre-development runoff.

Summary

The overland flowpath currently experiences a velocity of approximately 0.84m/s during a 10% AEP event. Post development this increases to approximately 0.88m/s.

The addition of a carpark provides minimal increased risk of erosion downstream.

Beca Infrastructure Ltd

Project Description

Pre Development

Job No 3365018

INPUTS

Case (A or B)

b

Case A

Flow (m³/s)

Water level (m)

Case B

Slope (S_o)

0.4000

Water level (m)

0.129458

Channel Geometry		Mannings "n" value	Sinuosity
x (m)	y (m)		
0.00	4.20	0.12	
27.00	0.00	0.12	
44.00	0.77	0.12	
55.00	4.20	0.12	
-1.00			

The table can input 10 (x,y) co-ordinates.

The (x,y) pairs should be in order

Terminate list by making x = -1.0

Compounding the boundary roughness can be determined by a number of methods. See adjacent Table in which:

Selected Method (1-7) 3

Methods 1 & 2 are weighting methods. Methods 3 & 4 have a theoretical basis, but can underpredict flow.

Method 5 is theoretically based and has compared well with actual river data.

Method 6 is commonly used but can overpredict flow considerably.

Method 7 is similar to Method 6 but reduces the overprediction.

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.

Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m ³ /s)	0.201
Velocity (m/s)	0.840
S _o or S _f	0.4000
Energy Coeff.	1.00
Energy (m)	0.165
Froude No	1.054
Bed Stress (Pa)	253.109
Equivalent "n"	0.120
Equivalent k _s (mm)	N/A

Critical Flow Conditions

Flow (m ³ /s)	0.190
Velocity (m/s)	0.797
Energy (m)	0.162

Geometry for wetted conditions

WL (m)	0.129
Area (A-m ²)	0.239
Width (B-m)	3.690
Perimeter (P-m)	3.703

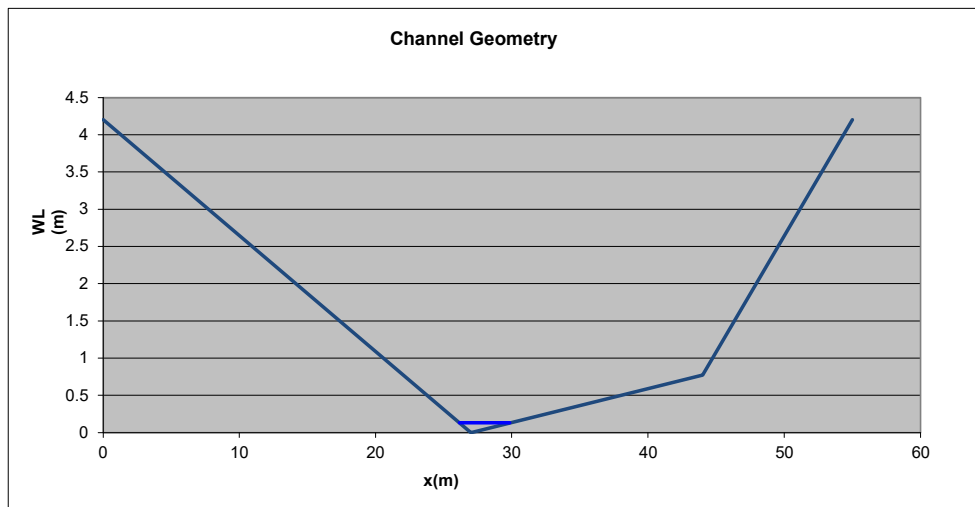
Typical "n" values

Concrete	0.014
Gunit	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5

Method for compound section

- Proportion "n" to wetted perimeter. US Geological Survey Method.
 $n = (\sum (P_i n_i + \dots) / P)$
- Proportion "1/n" to wetted perimeter.
 $n = P / \sum (P_i / n_i + \dots)$
- Flow distribution assessed on velocity and energy gradient common to all parts of the channel. $n = (\sum (P_i n_i^{1.5} + \dots) / P)^{1/1.5}$
- Total resisting shear force is the sum of the individual forces.
 $n = (\sum (P_i n_i^2 + \dots))^{0.5} / P^{0.5}$
- This method assumes a logarithmic velocity distribution in each sub-section.
 $\ln(n) = \sum (P_i R_i^{1.5} \ln(n_i) + \dots) / \sum (P_i R_i^{1.5})$
- Flow based on the conveyance of section of the channel contributing.
 $Q = \sum A_i (A_i P_i)^{2/3} S_o^{1/2} / n$
- Flow based on Method 6 but adjusted for discrepancy with sectionalisation.

	Flow (m ³ /s)	Velocity (m/s)	S _o or S _f	Energy (m)	Equivalent "n"
1	0.201	0.84	0.400	0.165	0.120
2	0.201	0.84	0.400	0.165	0.120
3	0.201	0.84	0.400	0.165	0.120
4	0.201	0.84	0.400	0.165	0.120
5	0.201	0.84	0.400	0.165	0.120
6	0.202	0.85	0.400	0.166	0.119
7	0.201	0.84	0.400	0.165	0.120



Beca Infrastructure Ltd

Project Description

Post Development

Job No 3365018

INPUTS

Case (A or B)

b

Case A

Flow (m³/s)

Water level (m)

Case B

Slope (S_o)

0.4000

Water level (m)

0.138593

Channel Geometry		Mannings "n" value	Sinuosity
x (m)	y (m)		
0.00	4.20	0.12	
27.00	0.00	0.12	
44.00	0.77	0.12	
55.00	4.20	0.12	
-1.00			

The table can input 10 (x,y) co-ordinates.

The (x,y) pairs should be in order

Terminate list by making x = -1.0

Compounding the boundary roughness can be determined by a number of methods. See adjacent Table in which:

Selected Method (1-7) 3

Methods 1 & 2 are weighting methods. Methods 3 & 4 have a theoretical basis, but can underpredict flow.

Method 5 is theoretically based and has compared well with actual river data.

Method 6 is commonly used but can overpredict flow considerably.

Method 7 is similar to Method 6 but reduces the overprediction.

Sinuosity is the relative length of that flow channel element compared to other elements and input S_o.

Default value is 1.0.

OUTPUTS

Normal Flow Conditions

Flow (m ³ /s)	0.241
Velocity (m/s)	0.879
S _o or S _f	0.4000
Energy Coeff.	1.00
Energy (m)	0.178
Froude No	1.066
Bed Stress (Pa)	270.969
Equivalent "n"	0.120
Equivalent k _s (mm)	N/A

Critical Flow Conditions

Flow (m ³ /s)	0.226
Velocity (m/s)	0.824
Energy (m)	0.173

Geometry for wetted conditions

WL (m)	0.139
Area (A-m ²)	0.274
Width (B-m)	3.951
Perimeter (P-m)	3.965

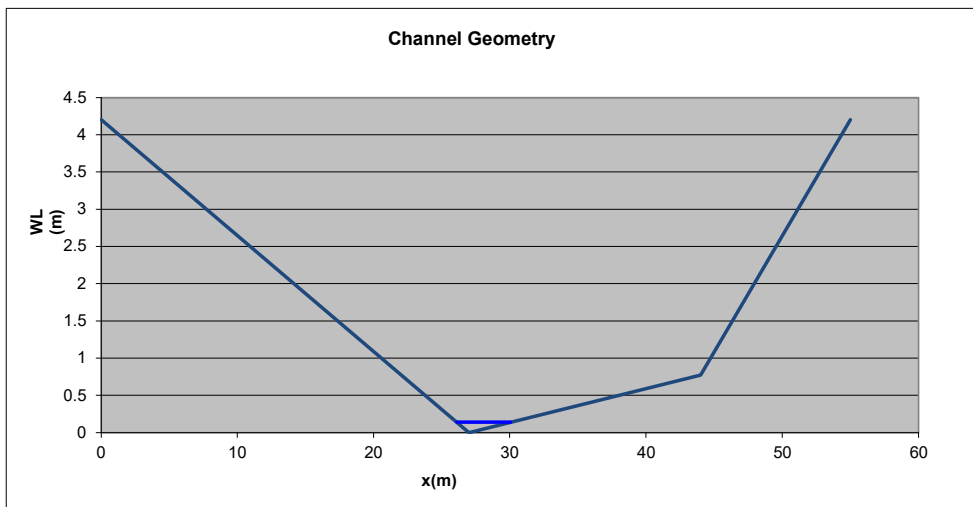
Typical "n" values

Concrete	0.014
Gunit	0.017
Smooth earth	0.02
Clean channel	0.03
Natural Channel	0.035-0.065
Floodplain	0.05-0.15
Overland flow (grass)	0.2-0.5

Method for compound section

- Proportion "n" to wetted perimeter. US Geological Survey Method.
 $n = (\sum(P_i n_i + \dots) / P)$
- Proportion "1/n" to wetted perimeter.
 $n = P / \sum(P_i / n_i + \dots)$
- Flow distribution assessed on velocity and energy gradient common to all parts of the channel. $n = (\sum(P_i n_i^{1.5} + \dots) / P)^{1/1.5}$
- Total resisting shear force is the sum of the individual forces.
 $n = (\sum(P_i n_i^2 + \dots))^{0.5} / P^{0.5}$
- This method assumes a logarithmic velocity distribution in each sub-section.
 $\ln(n) = \sum(P_i R_i^{1.5} \ln(n_i) + \dots) / \sum(P_i R_i^{1.5})$
- Flow based on the conveyance of section of the channel contributing.
 $Q = \sum A(A/P)^{2/3} S_o^{1/2} / n$
- Flow based on Method 6 but adjusted for discrepancy with sectionalisation.

	Flow (m ³ /s)	Velocity (m/s)	S _o or S _f	Energy (m)	Equivalent "n"
1	0.241	0.88	0.400	0.178	0.120
2	0.241	0.88	0.400	0.178	0.120
3	0.241	0.88	0.400	0.178	0.120
4	0.241	0.88	0.400	0.178	0.120
5	0.241	0.88	0.400	0.178	0.120
6	0.243	0.89	0.400	0.179	0.119
7	0.241	0.88	0.400	0.178	0.120



7 August 2020

Beca
DUNEDIN

Attention: James Taylor

Preliminary Statement – Dunedin City Council
Proposed car park and track upgrade – Tunnel Beach Road, Dunedin

In regards to information received 21 July 2020. We have reviewed the information supplied to date, which at this stage of the project is limited. Our preliminary comments are as follows:

For Te Rūnanga o Ōtākou the issues would most likely focus on:

- Management and mitigation measures to be considered for archaeological/cultural heritage values in the surrounding area
- Management and mitigation measures to be taken on sediment run-off during any earthworks.
- Management of excess excavated material.
- Management and mitigation measures to be taken on effects to the vegetation in the proposed area of works
- Management and mitigation measures to be taken regarding the visual and environmental impact of the cultural landscape
- Te Rūnanga o Ōtākou would request the preparation and adoption of a robust Environmental and Construction and Operation plan to be adhered to, to mitigate adverse construction and operation impacts.

Te Rūnanga o Ōtākou would request the following be conditions of any resource consents (but not limited to) :-

- That the Heritage New Zealand Pouhere Taonga Archaeological Discovery Protocol (attached) should be adhered to in undertaking earthworks.
- That any planting of the Tunnel Beach Track should be native plants appropriate for the area and be tended until self sustaining.

The whole of the Otago coastline / Te Tai-o-Ārai-te-uru of Te Waipounamu and the wider landscape in the area of Tunnel Beach has many significant sites/landscapes of past activities and traditions of mana whenua.

Te Tai-o-Ārai-te-uru / Otago Coastline – Our tupuna were great ocean travellers. The tempestuous nature of the coastal waters off Otago are a constant reminder of the exploits of our voyaging tupuna and their illustrious waka.

The coastal waters and processes were integral to the way of life our tupuna enjoyed. Our belief system binds and identifies kinships across Moananui-a-Kiwa, reinforces the centrality of Takaroa to those beliefs and influences the way we relate to and manage our marine resources now and in the future.

The marine environment is a moving force, a reminder of the power of Takaroa. The interconnection of the land and sea environments is consistent with the Ki Uta Ki Tai philosophy. The coastal waters are a receiving environment for freshwater, gravels and sediment from the terrestrial landscape (ki uta) which are important to maintain natural process and the domain of Takaroa.

The coast of Otago is named “Te Tai o Arai-te-uru”, after the ancient waka Atua, famed for its cargo of kumara and taro calabashes and the many illustrious passengers on board. Arai-te-uru foundered south of Moeraki at the mouth of Waihemo.

The wreckage and survivors of this waka are marked by numerous landmarks almost for the length of the Otago Coast. The boulders on Moeraki coast (Kai Hinaki) and the Moeraki pebbles are all associated with the cargo of gourds, kumara and taro seeds which were spilled when the Arai Te Uru foundered.

Kaikorai Stream / Kaikarae – was a well known freshwater stream and lagoon used by local Kāi Tahu as a traditional mahinga kai, particularly for tuna (eel) and pātiki (flounder).

Kaikarae was dug by the Waitaha explorer Rākaihautū with his kō (Polynesian digging stick) named Tūwhakaroria. Upon arriving at Whakatū (Nelson) in the Uruao waka, Rākaihautū divided his people into two groups. His son, Rākihōia took one party to explore the coastline and Rākaihautū led the other party through the interior of Te Waipounamu and down to Murihiku (Southland), using his kō to dig out most of the fresh water lakes of Te Waipounamu. While travelling back up the island, Rākaihautū and his party stopped at the mouth of a stream to eat and their food was a recently killed seabird known as karae. This particular location and stream was named Kaikarae.

Pounui-a-Hine / White Island – located a short distance off Te Tai-o-Ārai-te-uru (Otago Coastline). This island is surrounded by a rocky reef that can sometimes be seen at low tide. During the 1879 Smith Nairn Royal Commission of Inquiry into the Ngāi Tahu land claims, Ngāi Tahu kaumātua recorded Pounui-a-Hine as an island located off Whakahekerāu (St Clair Beach) that was not sold to the Crown.

Whakahekerāu - is the Māori name for Saint Clair Beach in Ōtepoti (Dunedin).

At this stage of the proposed project, Te Rūnanga o Ōtākou cautiously support the proposed car park and Tunnel Beach track upgrade/re-alignment, and reserve the right to reconsider its position in light of additional information and/or research.

Please note that this reply is made without prejudice, and should **not** be seen as written approval.

Thank you for seeking our feedback at this early stage and encourage consultation throughout the development of the above proposal.

Nāku noa, nā



Tania Richardson
Consents Officer



HERITAGE NEW ZEALAND
POUHERE TAONGA

Heritage New Zealand Pouhere Taonga Archaeological Discovery Protocol

Under the Heritage New Zealand Pouhere Taonga Act (2014) an archaeological site is defined as any place in New Zealand that was associated with human activity that occurred before 1900 and provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand. For pre-contact Maori sites this evidence may be in the form of bones, shells, charcoal, stones etc. In later sites of European/Chinese origin, artefacts such as bottle glass, crockery etc. may be found, or evidence of old foundations, wells, drains or similar structures. Burials/koiwi tangata may be found from any historic period.

In the event that an unidentified archaeological site is located during works, the following applies;

1. Work shall cease immediately at that place and within 20m around the site.
2. The contractor must shut down all machinery, secure the area, and advise the Site Manager.
3. The Site Manager shall secure the site and notify the Heritage New Zealand Regional Archaeologist. Further assessment by an archaeologist may be required.
4. If the site is of Maori origin, the Site Manager shall notify the Heritage New Zealand Regional Archaeologist and the appropriate iwi groups or kaitiaki representative of the discovery and ensure site access to enable appropriate cultural procedures and tikanga to be undertaken, as long as all statutory requirements under legislation are met (*Heritage New Zealand Pouhere Taonga Act, Protected Objects Act*).
5. If human remains (koiwi tangata) are uncovered the Site Manager shall advise the Heritage New Zealand Regional Archaeologist, NZ Police and the appropriate iwi groups or kaitiaki representative and the above process under 4 shall apply. Remains are not to be moved until such time as iwi and Heritage New Zealand have responded.
6. Works affecting the archaeological site and any human remains (koiwi tangata) shall not resume until Heritage New Zealand gives written approval for work to continue. Further assessment by an archaeologist may be required.
7. Where iwi so request, any information recorded as the result of the find such as a description of location and content, is to be provided for their records.
8. Heritage New Zealand will determine if an archaeological authority under the *Heritage New Zealand Pouhere Taonga Act 2014* is required for works to continue.

It is an offence under S87 of the *Heritage New Zealand Pouhere Taonga Act 2014* to modify or destroy an archaeological site without an authority from Heritage New Zealand irrespective of

whether the works are permitted or a consent has been issued under the Resource Management Act.

Heritage New Zealand Regional archaeologist contact details:

Dr Matthew Schmidt
Regional Archaeologist Otago/Southland
Heritage New Zealand
PO Box 5467
Dunedin
Ph. +64 3 470 2364, mobile 027 240 8715
Fax. +64 3 4773893
mschmidt@heritage.org.nz

Appendix I – Tunnel Beach Car Park Operational Plan



DUNEDIN | kaunihera
CITY COUNCIL | a-rohe o
Ōtepoti

Tunnel Beach Car Park Management Plan

1 Introduction

Dunedin City Council (DCC) Parks and Recreation Services (PARS) have developed a Tunnel Beach Car Park Management Plan (CPMP) for the management of the car park and facilities at 30 Tunnel Beach Road, Green Island.

2 Objectives

This CPMP is a *'living document'*. It will be periodically reviewed and updated to ensure that operations and management of the Tunnel Beach Car Park and facilities are efficient and effective. The objective of the management activities are set out below:

- To maintain the car park and facilities to a safe condition.
- To ensure the car park is accessible for visitors during the hours of operation.
- To manage waste generated on site.

3 Operational tasks

The following tasks have been identified as necessary to meet the objectives of this operational CPMP.

3.1 To maintain the car park and facilities to a safe condition

3.1.1 PARS will carry out inspections and maintenance of the car park in accordance with the Council asset management plans.

3.1.2 PARS will provide facilities (such as seating or fencing) where there is a demonstrated need.

3.1.3 PARS will remove facilities (such as seating or fencing) in accordance with asset management standards, or where the facilities are not in keeping with the car park, or where there is no longer a demonstrated need.

3.2 To ensure the car park is accessible for visitors during the hours of operation

3.2.1 PARS will provide a gated entrance/exit. The car park operating hours will be:

- Autumn/Winter 9am – 5pm
- Spring/Summer 8am – 9pm

3.2.2 PARS will review operating times based on use.

3.3 To manage waste generated on site

3.3.1 DCC Waste and Environmental Solutions will collect rubbish from site. The frequency for rubbish collection is as follows:

- Spring/Summer 3 days per week
- Autumn/winter once per week

3.3.2 DCC Waste and Environmental Solutions will consider additional collections and/or future bins based on use.

3.3.3 Council will remove rubbish bins in accordance with asset management standards, or where there is no longer a demonstrated need, or where Council changes their waste management strategy, for example a carry-in/carry-out policy.

3.3.4 DCC Property Services will provide two self-contained wet vault toilets for the convenience of visitors.

3.3.5 DCC Property Services will operate the opening and closing of toilets in co-ordination with the operating hours for the car park.

3.3.6 DCC Property Services will clean toilets in accordance with the cleaning programme. The frequency for cleaning is as follows:

- Spring/Summer Twice daily clean
- Autumn/Winter Once daily clean

3.3.7 DCC Property Services will consider additional cleaning or a reduction in cleaning based on use.

3.3.8 DCC Property Services will carry out inspections and maintain the toilets in accordance with the Council asset management plans.

Appendix J – Written Approvals