

Project Number: 6-CD109.55

DCC Landslide Monitoring Reporting

24 January 2024

CONFIDENTIAL



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2.0	Final submission

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Disclaimer and Limitations

This report (**'Report'**) has been prepared by WSP New Zealand Limited exclusively for Dunedin City Council (**'Client'**) in relation to the landslide monitoring at selected sites in Dunedin (Landslide Monitoring Long-Term SoW DCC Reference 9662). The scope of this report is to present the survey monitoring results and recommendations for future surveys for the site (**'Purpose'**). The findings in this Report are based on and subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information (**'Client Data'**) provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

1 Introduction

WSP New Zealand Limited (WSP) have been commissioned by Dunedin City Council (DCC) to undertake monitoring of 9 landslide sites around Dunedin. The following locations are the 9 landslide sites, which will be referred to as 'the sites' in this report;

- Puketeraki
- Greenacres Street
- Howard Street
- Brighton Road
- Church Hill Road
- Brockville Road
- Dickson Street
- West Abbotsford
- Albany Street

The purpose of monitoring is to identify the trend and magnitude of movements and provide recommendations for future monitoring. This report presents a summary of the observed outcomes from the factual survey conducted at various sites in 2023, along with recommendations for future monitoring and reporting.

2 Survey Monitoring

2.1 Monitoring History

Survey monitoring of each site has been undertaken at various intervals since the respective base surveys. The surveys are typically carried out on a yearly or biennial basis, the frequency dependent on the recent rates of movement. Historically, some sites of increased instability have been surveyed on a more frequent basis, particularly following major storm events or increased ground movement.

In previous years, the total number of sites surveyed totalled 12 sites. Based on priority and criticality, 9 sites were surveyed in 2023.

2.2 Survey Methodology

All the sites monitored in 2023, except Albany Street, used Global Navigation Satellite System (GNSS) observations which is collected using a variety of methods (i.e., combination of static and post-processed kinematic observations). The Albany Street site is monitored using a total station to observe a closed loop network around the George Street-Pitt Street-Queen Street-Albany Street block.

2.3 Field Survey

The quality and redundancy of survey measurements made in the field has been improved in the 2023 round of landslide monitoring surveys, although it is important to note that fundamental equipment choices have remained the same as the previous survey at each site. While we have sought to improve both survey field methodologies and office processing procedures, we have simultaneously kept our approach to be as consistent as

possible to ensure that the data collected is comparable between years. For example, most sites were surveyed using GNSS techniques, but at some sites the GNSS receivers were mounted on tripods when measuring, instead of a free-standing pole. This reduced movement of the GNSS receiver when measuring and ultimately contributed to higher quality measurements and results.

Additional measurements on Albany Street have also been undertaken to include the new survey markers in the network, following destruction of some markers. On other sites (Puketeraki, West Abbotsford, Brockville Road and Church Hill Road) each control marker was measured for longer periods, to improve quality and reliability of base station results. On some sites, the survey was undertaken with additional equipment, allowing us to collect more measurements in the same or less time compared to previous years.

2.4 Survey Accuracies

The reported survey accuracies for the previous surveys as well as the 2023 survey are presented in Table 2-1 below.

Table 2-1: Reported Survey Accuracies for previous surveys and 2023 surveys.

Site	2021/2022	2023
Puketeraki	H ± 20 mm V ± 30 mm	H ± 15 mm V ± 30 mm
Greenacres St	H ± 15 mm V ± 20 mm	H ± 10 mm V ± 15 mm
Howard St	H ± 15 mm V ± 30 mm	H ± 15 mm V ± 25 mm
Brighton Rd	H ± 20 mm V ± 25 mm	H ± 15 mm V ± 25 mm
Church Hill Rd	H ± 15 mm V ± 25 mm	H ± 15 mm V ± 20 mm
Brockville Rd	H ± 15 mm V ± 20 mm	H ± 10 mm V ± 15 mm
Dickson St	H ± 15 mm V ± 25 mm	H ± 15 mm V ± 25 mm
West Abbotsford	H ± 15 mm V ± 20 mm	H ± 10 mm V ± 20 mm
Albany St	H ± 10 mm V ± 10 mm	H ± 10 mm V ± 10 mm

3 Monitoring Results

3.1 Monitoring Displacements Since Previous Survey

A summary of the maximum and average vertical and horizontal displacements since the previous survey are presented in Table 3-1. Refer to Appendix A for vector displacement plans and Appendix B for factual survey data results.

Table 3-1: Displacements since previous survey

Site name	Vertical Movement (mm)		Horizontal Movement (mm)		Date of Latest Survey
	Max	Ave	Max	Ave	
Puketeraki	-57	-28	156	123	Oct-23
Greenacres St	-6	-14	46	37	Oct-23
Howard St	<10	-17	28	<10	Nov-23
Brighton Rd	-9	-6	12	11	Sep-23
Church Hill Rd	<6	<5	16	<5	Oct-23
Brockville Rd	24	7	15	13	Sep-23
Dickson St	14	5	19	<10	Nov-23
West Abbotsford	<5	<-10	<10	<5	Oct-23
Albany St	<10	<-5	<5	<10	Nov-23
Cargill St	Not surveyed in 2023 due to Albany Street Upgrades				

3.2 Monitoring Displacement Since Base Survey

A summary of the maximum and average vertical and horizontal displacements since the base survey has been presented below in Table 3-2.

Table 3-2: Displacements Since Base Survey

Site name	Vertical Movement (mm)		Horizontal Movement (mm)		Date of Base Survey
	Max	Ave	Max	Ave	
Puketeraki	-1036	-357	4028	2387	1992
Greenacres St	-143	-369	1654	1121	Jul-15
Howard St	110	33	219	84	1998
Brighton Rd	-430	-260	1300	485	1998
Church Hill Rd	45	-91	598	302	1997
Brockville Rd	2	0	14	8	Jul-20
Dickson St	52	47	55	35	1997
West Abbotsford	10	0	10	<10	Jun-21
Albany St	<5	-18	33	22	2008, Re-established in 2010
Cargill St ¹	-44	-30	40	-36	2000, Re-established in 2006 and 2013

¹ Values provided are based off 2021 survey information due to interruptions from Albany Street Upgrades.

4 Rainfall Data

A summary of the rainfall data since the initial 2020 survey is presented in Figure 4-1. The rainfall data was retrieved from the NIWA (National Institute of Water and Atmospheric Research) National Climate Database website² using the Musselburgh Station (Agent ID #15752). Mean monthly rainfall was calculated for the Musselburgh Station using data between 1997 and 2023.

A significant rainfall event during July 2022 is evident in Figure 4-1 whereby 234 mm was recorded in the calendar month, including 98 mm on 13 – 14 July and 95 mm on 26 – 28 July 2022. March 2023 had the highest monthly rainfall of 105.8 mm, however there were no significant rainfall events in 2023.

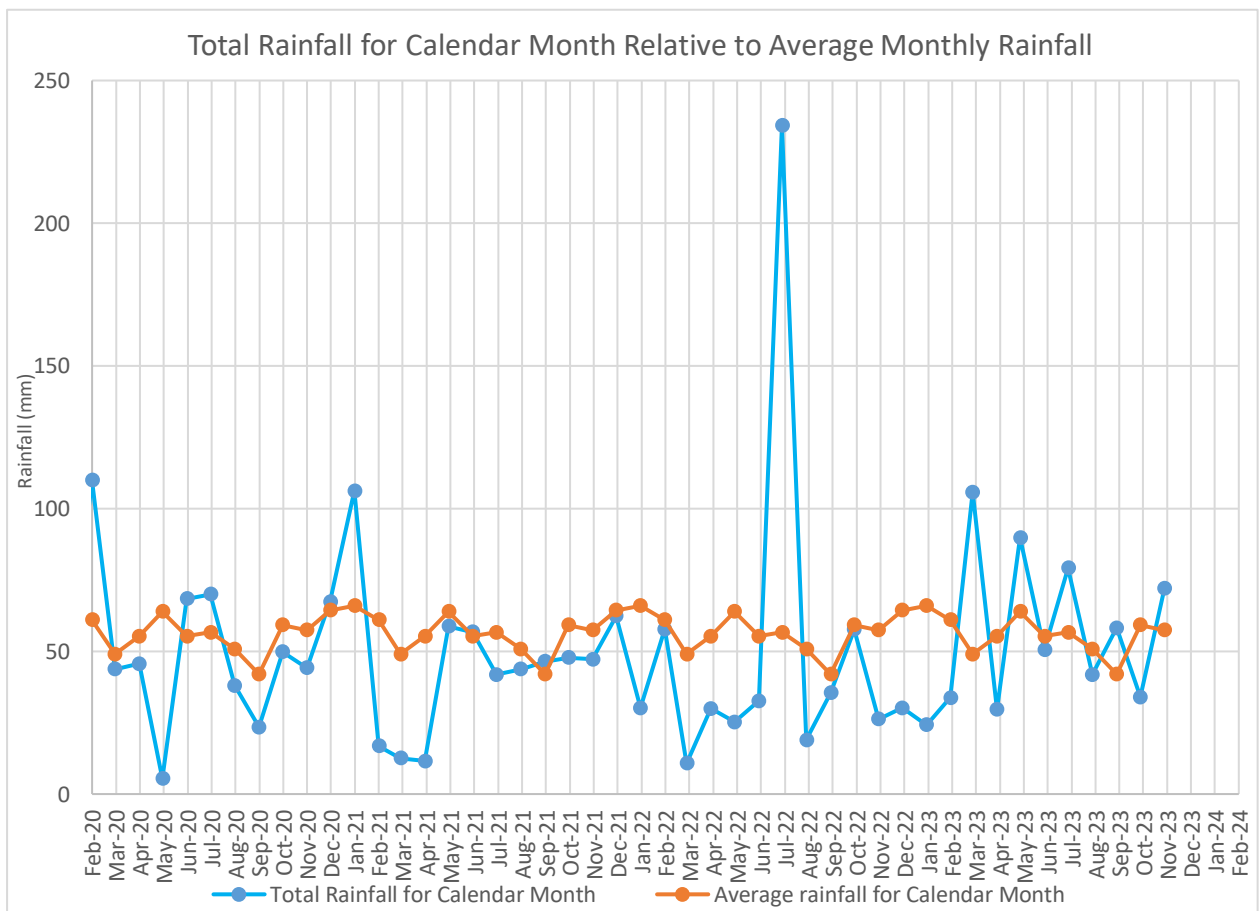


Figure 4-1 Measured monthly rainfall compared with average monthly rainfall (CliFlo.niwa.co.nz).

² <https://cliflo.niwa.co.nz/>

5 Recommendations

A summary of each site and its monitoring displacement are summarized in Table 5-1, with recommendations for each site summarized in Table 5-2.

Table 5-1: Summary of monitoring displacement for each site

Site name	Summary of information
Puketeraki	Maximum displacement since base survey: -1036 mm vertical, 4028 mm horizontal. The average rate of horizontal movement (123 mm) since the previous survey is greater than the average rate of movement from 2020-2022 (30 – 60 mm per year). Average vertical deformations less than accepted survey accuracy. Consequence of damage to the services and utilities present in the vicinity of the landslide, should continue to be monitored for damage.
Greenacres Street	Maximum displacement since base survey: -143 mm vertical, 33 mm horizontal. Average horizontal movement since previous survey (2021) within accuracy (37 mm), with a significant decrease in yearly movement rates since base survey. Vertical deformations less than survey accuracy, decreasing in rate similarly to vertical movement.
Howard Street	Maximum displacement since base survey: 110 mm vertical, 219 mm horizontal. Minor vertical movement since previous survey, with a maximum horizontal movement of 28 mm. Average vertical and horizontal movements are both less than accepted survey accuracy. Clear movement of landslide towards harbour since base survey. Consequence is damage to residential dwellings.
Brighton Road	Maximum displacement since base survey: -430 mm vertical, 1300 mm horizontal. Average horizontal and vertical movements less than the accepted survey accuracy since previous survey. Semi-rural location of slip, with consequence of damage to residential dwellings, however no discernible movement recorded since previous survey.
Church Hill Road	Maximum displacement since base survey: 45 mm vertical, 598 mm horizontal. Average and maximum vertical and horizontal movements since previous survey less than accepted accuracy, no discernible movement.
Brockville Road	Maximum displacement since base survey: 2 mm vertical, 14 mm horizontal. Average horizontal and vertical movements less than accepted survey accuracy. Consequence of damage to residential dwellings and a school, however no discernible movement since previous survey recorded.
Dickson Street	Maximum displacement since base survey: 52 mm vertical, 55 mm horizontal. Minimal/negligible displacements since previous survey. Positive vertical deformation is being reported which is atypical for landslides.

West Abbotsford	Maximum displacement since base survey: 10 mm vertical, 10 mm horizontal. Minimal/negligible maximum movements since previous survey (<5 mm vertical, <10 mm horizontal). Both average and maximum movements are less than accepted survey accuracy.
Albany Street	Maximum displacement since base survey: <5 mm vertical, 33 mm horizontal. Displacements since previous survey have been minimal (<10 mm maximum vertical, <5 mm maximum horizontal), and average movements are also less than accepted accuracy. 3 survey marks were removed due to the George St upgrades, will be reinstalled.
Cargill Street	Maximum displacement since base survey: -44 mm vertical, 40 mm horizontal. Information from 2021 survey is provided as this site was not surveyed in 2023 due to interruptions from Albany Street Upgrades. Previous surveys suggest an average long-term rate of settlement since base survey (2000) is 1.4 mm/year. Since 2018, the rate has been shown to increase to 4 mm/year, though it is thought this increase may be due to survey error and not an accurate reflection of ground movement.

Table 5-2: Recommendations for each site

Reporting Level	Minimum Criteria	Sites ¹	Recommendations
1	Sites with displacements greater than the survey accuracy since previous survey.	<ul style="list-style-type: none"> Puketeraki Greenacres St 	Site walkover and qualitative geological risk assessment. Observations to be presented in a site-specific report with high level interpretation of the geologic setting.
2	Sites with average displacements greater than the survey accuracy since base survey	<ul style="list-style-type: none"> Howard St Brighton Rd Church Hill Rd 	Site walkover and high-level assessment of observable deformation. Brief description of observations and discussion of the survey network to be presented in a combined report.
3	Sites with negligible/no displacements	<ul style="list-style-type: none"> Brockville Rd Dickson St West Abbotsford Albany St 	Continued survey monitoring and/or visual monitoring.

¹ Presented in descending order of criticality

Appendices

Appendix A: Monitoring displacement vector plans
Appendix B: Factual Survey Data



Appendix A

Monitoring Displacement Vector Plans

LEGEND

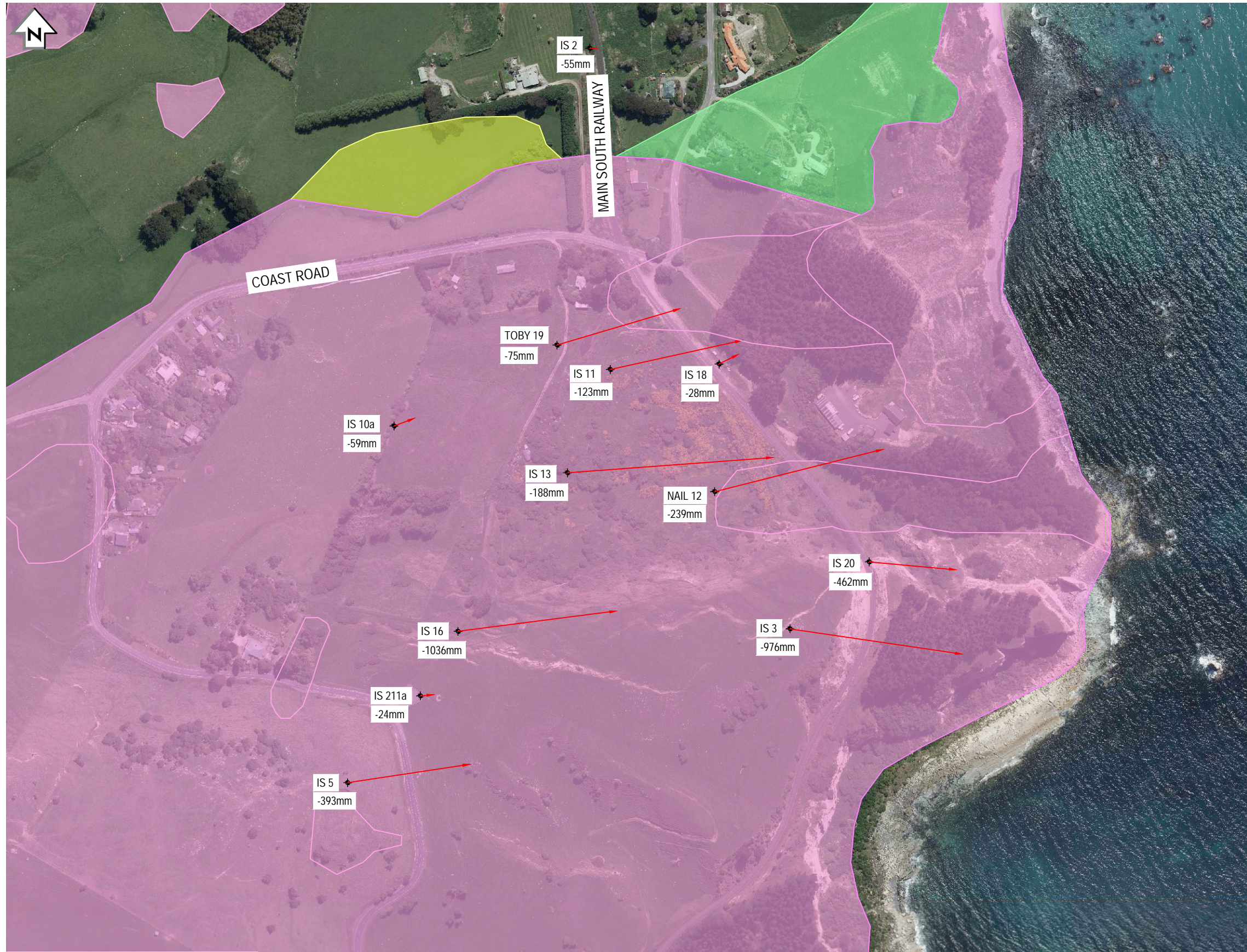
LANDSLIDE - OTAGO REGION (CERTAINTY)

- DEFINITE
- LIKELY
- POSSIBLE
- NOT ASSESSED
- NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON "REVISED LANDSLIDE DATABASE FOR THE COASTAL SECTOR OF THE DUNEDIN CITY DISTRICT" BY BARRELL, D.J.A., SMITH LITTLE, B., GLASSEY, P.J. GNS SCIENCE CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL HAZARDS PORTAL.

OTHER

- +/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT SINCE THE BASE SURVEY
- CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)
- SURVEY MARKER



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1:4000 @ A3

REVISION	AMENDMENT	APPROVED	DATE



Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

SURVEY

SCALES		ORIGINAL SIZE	
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DRAWN	J. W.	APPROVED	C.H.
DRAWING VERIFIED	C.H.	APPROVED DATE	08/11/2023
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PROJECT DUNEDIN CITY COUNCIL PUKETERAKI LONG TERM LANDSLIDE MONITORING			
TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS PUKETERAKI			
WSP PROJECT NO. 6-CD109.55	PROJ-ORIG-VOL-LOC-TYPE 6-CD109.55	SHEET NO. C01	REVISION A

LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

DEFINITE

LIKELY

POSSIBLE

NOT ASSESSED

NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON "REVISED LANDSLIDE DATABASE FOR THE COASTAL SECTOR OF THE DUNEDIN CITY DISTRICT" BY BARRELL, D.J.A., SMITH LITTLE, B., GLASSEY, P.J. GNS SCIENCE CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL HAZARDS PORTAL.

OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT SINCE THE BASE SURVEY

CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)

SURVEY MARKER

1:1000 @ A1
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REVISION	AMENDMENT	APPROVED	DATE
A	2023 DEFORMATION MONITORING DATA	CH	09/10/2023

wsp
Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

SURVEY

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DRAWN	DESIGNED	APPROVED	
D. MOFFAT			
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE	
C.H			
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PROJECT			
DUNEDIN CITY COUNCIL			
GREENARCRES STREET			
LONG-TERM LANDSLIDE MONITORING			
TITLE			
CUMULATIVE LANDSLIDE DISPLACEMENTS			
GREENARCRES STREET			
WSP PROJECT NO.	PROJ-ORIG-VOL-LOC-TYPE	SHEET NO.	REVISION
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LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

DEFINITE

LIKELY

POSSIBLE

NOT ASSESSED

NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON "REVISED LANDSLIDE DATABASE FOR THE COASTAL SECTOR OF THE DUNEDIN CITY DISTRICT" BY BARRELL, D.J.A., SMITH LITTLE, B., GLASSEY, P.J. GNS SCIENCE CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL HAZARDS PORTAL.

OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT SINCE THE BASE SURVEY

CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)

SURVEY MARKER

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REVISION	AMENDMENT	APPROVED	DATE
A	2023 DEFORMATION MONITORING DATA	DM	15/11/2023

Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

SURVEY

SCALES		ORIGINAL SIZE
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J.WILLIAMS	C.H	C.H.
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D.M.	C.H.	15/11/2023

CUMULATIVE SURVEY RESULTS 2023

PROJECT		
DUNEDIN CITY COUNCIL		
HOWARD STREET		
LONG-TERM LANDSLIDE MONITORING		
TITLE		
CUMULATIVE LANDSLIDE DISPLACEMENTS		
HOWARD STREET		
WSP PROJECT NO.	PROJ-ORIG-VOL-LOC-TYPE	SHEET NO.
6-CD109.55	6-CD109.55	C01
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LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

DEFINITE

LIKELY

POSSIBLE

NOT ASSESSED

NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON
"REVISED LANDSLIDE DATABASE FOR THE COASTAL
SECTOR OF THE DUNEDIN CITY DISTRICT" BY BARRELL,
D.J.A., SMITH LITTLE, B., GLASSEY, P.J. GNS SCIENCE
CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED
FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL
HAZARDS PORTAL.

OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT
SINCE THE BASE SURVEY

CUMULATIVE HORIZONTAL DISPLACEMENT SINCE
THE BASE SURVEY
(1:1000 SCALE)

SURVEY MARKER



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REVISION	AMENDMENT	APPROVED	DATE
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Dunedin Office
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New Zealand

SURVEY

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D. MOFFAT			
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE	
C.H.			
CUMULATIVE SURVEY RESULTS 2023			

PROJECT DUNEDIN CITY COUNCIL BRIGHTON ROAD LONG-TERM LANDSLIDE MONITORING			
TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS BRIGHTON ROAD			
WSP PROJECT NO. 6-CD109.55	PROJ-ORIG-VOL-LOC-TYPE 6-CD109.55	SHEET NO. C01	REVISION A

LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

DEFINITE

LIKELY

POSSIBLE

NOT ASSESSED

NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON "REVISED LANDSLIDE DATABASE FOR THE COASTAL SECTOR OF THE DUNEDIN CITY DISTRICT" BY BARRELL, D.J.A., SMITH LITTLE, B., GLASSEY, P.J. GNS SCIENCE CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL HAZARDS PORTAL.

OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT SINCE THE BASE SURVEY

CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)

SURVEY MARKER

REVISION	AMENDMENT	APPROVED	DATE
A	2023 DEFORMATION MONITORING DATA	CH	19/10/2023

wsp
Dunedin Office
+64 3 471 5500
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Dunedin 9016
New Zealand

SURVEY

SCALES	ORIGINAL SIZE
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J.W.	C.H.
DRAWING VERIFIED	APPROVED DATE
C.H.	19/10/2023

CUMULATIVE SURVEY RESULTS

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TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS CHURCH HILL ROAD			
WSP PROJECT NO. 6-CD109.55	PROJ-ORIG-VOL-LOC-TYPE 6-CD109.55	SHEET NO. C01	REVISION A

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LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

- DEFINITE
- LIKELY
- POSSIBLE
- NOT ASSESSED
- NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON "REVISED LANDSLIDE DATABASE FOR THE COASTAL SECTOR OF THE DUNEDIN CITY DISTRICT" BY BARRELL, D.J.A., SMITH LITTLE, B., GLASSEY, P.J. GNS SCIENCE CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL HAZARDS PORTAL.

OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT SINCE THE BASE SURVEY

CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)

SURVEY MARKER



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Dunedin Office
+64 3 471 5500
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New Zealand

SURVEY

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PROJECT DUNEDIN CITY COUNCIL BROCKVILLE ROAD LONG TERM LANDSLIDE MONITORING			
TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS BROCKVILLE ROAD			
WSP PROJECT NO.	PROJ-ORIG-VOL-LOC-TYPE	SHEET NO.	REVISION
6-CD109.55	6-CD109.55	C01	A

LEGEND

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- DEFINITE
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OTHER

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- CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)
- SURVEY MARKER



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REVISION	AMENDMENT	APPROVED	DATE
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Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

SURVEY

SCALES			ORIGINAL SIZE
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D.M.	D.M.	D.M.	
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE	
D.M.		14/11/2023	
CUMULATIVE SURVEY RESULTS 2023			

PROJECT DUNEDIN CITY COUNCIL DICKSON STREET LONG-TERM LANDSLIDE MONITORING			
TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS DICKSON STREET			
WSP PROJECT NO.	PROJ-ORIG-VOL-LOC-TYPE	SHEET NO.	REVISION
6-CD109.55	6-CD109.55	C01	A

LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

DEFINITE

LIKELY

POSSIBLE

NOT ASSESSED

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OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT SINCE THE BASE SURVEY

CUMULATIVE HORIZONTAL DISPLACEMENT SINCE THE BASE SURVEY (1:1000 SCALE)

SURVEY MARKER

1:1250 @ A1
1:2500 @ A3

REVISION	AMENDMENT	APPROVED	DATE
A	2023 DEFORMATION MONITORING DATA	CH	01/11/2023

Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

SURVEY

SCALES		ORIGINAL SIZE
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DRAWN	SURVEYED	APPROVED
J.W.	C.H	C.H.
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
C.H	S.K	01/11/2023

CUMULATIVE SURVEY RESULTS 2023

PROJECT DUNEDIN CITY COUNCIL WEST ABBOTSFORD LONG-TERM LANDSLIDE MONITORING			
TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS WEST ABBOTSFORD			
WSP PROJECT NO.	PROJ-ORIG-VOL-LOC-TYPE	SHEET NO.	REVISION
6-CD109.55	6-CD109.55	C01	A

Original sheet size A1 (841x594) Plot Date 2024-01-10 at 2:11:17 pm \\corp.pbwan.net\ANZ\Projects\NZ\6c16-CD109.55 LTES Long-term Landslide Monitoring\Home\03_Delivery\Site Plans - DWG\Z1649506_C500 West abbotsford.dwg Layout1

LEGEND

LANDSLIDE - OTAGO REGION (CERTAINTY)

DEFINITE

LIKELY

POSSIBLE

NOT ASSESSED

NO INFORMATION

INDICATIVE LANDSLIDE EXTENTS ARE BASED ON 'REVISED LANDSLIDE DATABASE FOR THE COASTAL SECTOR OF THE DUNEDIN CITY DISTRICT' BY BARRELL, D.J.A, SMITH LYTTLE, B., GLASSEY, P.J. GNS SCIENCE CONSULTANCY REPORT 2017/41, JULY 2017, SOURCED FROM THE OTAGO REGIONAL COUNCIL (ORC) NATURAL HAZARDS PORTAL.

OTHER

+/- Xmm = CUMULATIVE VERTICAL DISPLACEMENT

CUMULATIVE HORIZONTAL DISPLACEMENT

SURVEY MARKER

REVISION	AMENDMENT	APPROVED	DATE
A	2023 ALBANY STREET LANDSLIDE MONITORING	D.M.	13/11/2023

Dunedin Office
+64 3 471 5500
Private Bag 1913
Dunedin 9016
New Zealand

SURVEY

SCALES			ORIGINAL SIZE
			A1
DRAWN	DESIGNED	APPROVED	
D.M.	D.M.	D.M.	
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE	
D.M.		13/11/2023	
CUMULATIVE SURVEY RESULTS 2023			

PROJECT DUNEDIN CITY COUNCIL ALBANY STREET LONG-TERM LANDSLIDE MONITORING			
TITLE CUMULATIVE LANDSLIDE DISPLACEMENTS ALBANY STREET			
WSP PROJECT NO.	PROJ-ORIG-VOL-LOC-TYPE	SHEET NO.	REVISION
6-CD109.55	6-CD109.55	C01	A

Original sheet size A1 (841x594) Plot Date 2024-01-10 at 3:37:03 pm \\corp.pbwan.net\ANZ\Projects\NZ\6c16-CD109.55 LTES Long-term Landslide Monitoring\Home\03_Delivery\Site Plans - DWG\Albany St.dwg Layout1

Appendix B

Factual Survey Data



Puketeraki Street Survey Data

Dated: 30/10/2023 Survey 35

Survey Accuracy: H ±15mm V ±30mm

Additional survey data				Present to Previous (29/07/2022)					Present to Control (08/03/2010)					
Pin #	Northing	Easting	Height	dN	dE	Bearing	Dist	dRL	dN	dE	Bearing	Dist	dRL	
103 - Iron Tube	823271.253	428653.839	35.139	0.000	0.000		0.000	0.000	0.000	0.000		0.000	0.000	FIXED
105 - Iron Spike	823234.574	428647.600	36.280	-0.007	0.000	180	0.007	-0.006	-0.008	0.012	125.311	0.015	0.020	CHECK
106 - Iron Spike	823236.387	428641.765	36.828		New Control Point Placed for future use as a local base									
150 - EW5H	824788.53	428718.02	17.565	0.001	0.009	84	0.009	-0.027	0.001	0.009	-0.027	0.009	-0.027	CHECK
151 - EW5J	824154.784	429113.649	15.307		New Control Point Introduced for future use									
201 - Iron Spike	824938.252	428913.025	10.256	0.003	0.005	59	0.006	0.008	0.002	-0.001	0.008	0.002	-0.012	CHECK
DUND	797475.885	424425.433	387.014	0.000	0.002	90		0.005						Check CORS
OUSD	799072.959	417735.023	26.249											Check CORS
SUTT	825243.795	388833.698	417.525											Check CORS
211a - Iron Spike	822439.429	428317.907	156.462	0.011	0.131	85	0.131	-0.024				0.131	-0.024	IS Free Basestation
2	823064.956	428481.608	70.530	0.008	0.011	54	0.014	-0.001	0.001	0.102	89.438	0.102	-0.055	OIT 2
3	822503.925	428676.846	112.504	-0.021	0.138	99	0.140	-0.050	-0.492	3.344	98.373	3.380	-0.976	OIS 3
5	822355.636	428249.008	184.292	0.020	0.111	80	0.113	-0.036	0.375	2.475	81.385	2.503	-0.393	OIS 5
10a	822700.08	428292.31	111.396	0.037	0.123	73	0.128	-0.031	0.195	0.525	69.624	0.560	-0.059	OIS 10a
11	822754.875	428502.361	86.459	0.013	0.050	75	0.052	-0.009	0.560	2.530	77.516	2.591	-0.123	OIS 11
12	822637.074	428603.760	66.420	0.034	0.133	76	0.137	0.005	0.820	3.268	75.918	3.369	-0.239	NAIL 12
13	822655.083	428462.065	86.367	0.013	0.155	85	0.156	-0.019	0.298	4.017	85.754	4.028	-0.188	OIS 13
16	822501.889	428355.942	131.111	0.016	0.134	83	0.135	-0.057	0.410	3.200	82.694	3.226	-1.036	OIS 16



18	822760.070	428606.734	69.512	0.007	0.007	45	0.010	-0.036	0.134	0.263	63.001	0.295	-0.028	OIT 18
19	822778.616	428451.220	88.213	0.032	0.088	70	0.094	-0.001	0.697	2.353	73.491	2.454	-0.075	TOBY 19
20	822568.720	428753.016	69.778	-0.020	0.144	98	0.145	-0.057	-0.148	1.616	95.233	1.623	-0.462	OIS 20



Greenacres Street Survey Data
Dated: 3/10/2023

Survey Accuracy: H ±10mm V ±15mm

Survey Data					Present to Previous Survey					Present to Original				
Point ID	Easting	Northing	Elevation	Feature Code	mE	mN	Bearing	Dist	mZ	mE	mN	Bearing	Dist	mZ
DUN D	424425.439	797475.867	386.925	Base Station										
IS1	424790.723	798547.54	94.358	IS1	-0.014	0.038	339.775	0.040	-0.008	-0.310	0.138	293.997	0.339	-0.246
IS2	424789.188	798582.98	86.448	IS2	0.001	0.046	1.245	0.046	-0.006	0.269	1.632	9.360	1.654	-0.687
IS3	424843.108	798601.57	80.945	IS3	0.001	0.003	18.435	0.003	-0.006	-0.003	0.014	347.905	0.014	0.002
IS4	424785.355	798643.37	72.451	IS4	-0.002	0.035	356.730	0.035	-0.018	-0.090	1.461	356.475	1.464	-0.466
IS5	424775.025	798727.46	55.621	IS5						-0.213	1.179	349.759	1.198	-0.143
IS6	424769.423	798756.7	49.655	IS6	0.002	0.027	4.236	0.027	-0.025	-0.170	0.933	349.674	0.948	-0.303
ISA	424705.907	798523.73	100.971	ISA	-0.002	-0.001	243.435	0.002	-0.005	-0.012	0.008	303.690	0.014	-0.003
ISB	424818.747	798719.71	59.36	ISB	-0.004	0.005	321.340	0.006	-0.009	0.013	0.023	29.476	0.026	0.008
X75	424540.137	800500.72	7.271	X75	0.002	0.003	33.690	0.004	0.007	0.002	-0.003	146.310	0.004	0.001



Howard Street Survey Data Dated 06/11/2023

Survey Accuracy: H ± 15 mm V ± 25 mm

Additional survey data					Present to previous					Present to Control (Data derived from Previous Surveys)				
Point Number	Northing	Easting	Height	Code	dN	dE	Azim.	Dist	dRL	dN	dE	Azim.	Dist	dRL
	NZGD49	NZGD49												
A23K	698553.386	323584.279	8.399	I NO 3	0.003	-0.001	342	0.003	0.006	0.003	-0.001	342	0.003	-0.005
DUND	697311.104	324412.321	386.734	DUND	0.000	0.000	FIXED		0.000	0.000	0.000	FIXED		0
OUSD	698908.139	317721.854	25.914	OUSD	-0.001	-0.005	259	0.005	-0.001	-0.002	-0.006	252	0.006	0.002
IS 101	699022.346	324432.492	6.958	IS 101	0.000	-0.001	270	0.001	-0.005	-0.002	-0.002	225	0.003	0
N 102	699035.011	324463.925	7.047	Nail 102	0.000	-0.001	270	0.001	-0.002	-0.001	-0.003	252	0.003	-0.003
IS 106	700292.691	324573.454	7.515	IS 106										
N 402	698762.740	324484.266	24.776	Nail 103										
IS4	698161.927	323756.591	88.182	ISIV	-0.006	0.005	140	0.008	-0.015	0.001	0.000	0	0.001	0.057
IS7A	698021.217	324014.469	168.587	IS7A	0.000	-0.006	270	0.006	0.003	0.017	-0.003	350	0.017	0.110
IT8B	698363.316	324109.644	97.334	IT8B	0.009	-0.001	354	0.009	-0.008	0.055	-0.191	286	0.199	0.026
IS9	698265.249	323937.599	87.557	IS9	0.001	-0.008	277	0.008	-0.015	0.099	-0.104	314	0.144	0.031
IS12	698564.108	323849.764	21.221	IS12	0.003	0.001	18	0.003	-0.008	0.000	0.003	90	0.003	0.031
IS14	698385.050	323947.442	60.580	IS14	-0.005	-0.004	219	0.006	-0.033	0.204	-0.079	339	0.219	0.011
IS18	698489.747	323898.086	35.415	IS18	0.007	-0.007	315	0.010	-0.010	0.022	-0.001	357	0.022	0.058
IS 51	698396.332	323856.051	43.541	IS51	0.003	-0.005	301	0.006	-0.014	0.012	-0.025	295	0.028	0.035
IS 52	698388.208	323779.255	41.059	IS52	0.008	-0.006	323	0.010	-0.014	0.028	-0.003	353	0.028	0.067
IS 53	698544.470	323694.698	8.695	IS53	0.007	-0.001	352	0.007	-0.008	0.053	-0.008	351	0.054	0.031
IS 54	698497.793	323955.613	33.115	IS54	-0.018	-0.022	231	0.028	-0.062	0.011	-0.012	311	0.016	-0.006
IS 55	698629.989	323833.208	11.450	IS55	-0.002	0.000	180	0.002	-0.015	0.002	-0.021	275	0.021	0.043
IS 60	698263.203	324011.787	88.849	IS60	0.006	-0.004	326	0.007	-0.025	0.147	-0.101	326	0.178	-0.066



Brighton Road Survey Data
Dated: 26/9/23

Survey Accuracy: H ± 15 mm V ± 25 mm

Additional survey data				Present to Previous					Present to Original				
Mark	mN	mE	Height	dN	dE	Azim.	Dist	dRL	dN	dE	Azim.	Dist	dRL
M1	MARK DESTROYED												
M2	791646.872	405758.442	18.363	-0.009	-0.005	209	0.010	0.003	-0.349	-0.009	181	0.349	-0.029
M3	791699.347	405741.420	42.957	-0.011	-0.003	195	0.011	-0.008	-0.599	0.091	171	0.624	0.026
M4	791698.057	405771.730	41.365	-0.010	-0.003	197	0.010	-0.004	-0.952	0.262	165	1.017	-0.252
M5	791702.215	405806.510	38.441	-0.012	-0.002	189	0.012	-0.006	-1.213	0.598	154	1.303	-0.431
M6	791722.516	405763.654	46.381	-0.007	-0.002	196	0.007	-0.007	-0.808	0.254	163	0.758	-0.346
M7	791767.561	405767.382	62.406	-0.006	-0.002	198	0.006	-0.004	-0.032	-0.002	184	0.032	-0.004
M8	791516.984	405763.210	14.835	-0.012	-0.003	194	0.012	-0.009	-0.024	0.012	153	0.027	-0.034
ISI - (FIXED)	791550.227	405748.121	13.675	0.000	0.000	-	0.000	0.000	0.000	0.000	-	0.000	0.000
ISII	791540.487	405693.769	13.749	-0.007	-0.007	225	0.010	-0.002	-0.009	0.024	111	0.026	0.002
ISIII	791542.175	405779.189	13.533	-0.008	-0.004	207	0.009	-0.004	-0.023	-0.006	195	0.024	-0.021
ISA	791694.277	406325.520	14.785	-0.011	-0.008	216	0.014	-0.003	-0.147	0.035	167	0.151	-0.004
ISB	791667.089	405627.610	26.528	-0.012	-0.005	203	0.013	-0.020	-0.001	0.030	92	0.030	-0.014
ISC	791825.954	405811.477	73.059	-0.006	-0.002	198	0.006	-0.005	-0.028	0.084	108	0.089	-0.007
OUSD	799071.946	417735.572	29.095	-0.024	-0.002	185	0.024	-0.008	-0.024	-0.002	185	0.024	-0.008
BD5W	793063.313	409229.759	20.335	-0.005	-0.004	219	0.006	0.010	-0.005	-0.004	219	0.006	0.010
DUND	797474.875	424425.975	389.869	-0.025	-0.004	189	0.025	-0.005	-0.025	-0.004	189	0.025	-0.005



Church Hill Road Survey Data
Dated 06/10/2023 SURVEY21

Survey Accuracy: H ±15mm V ±20mm

Additional survey data				Present to previous				Present to Control (Data derived from Base Survey) (June 1997)					
Pin #	Northing	Easting	Height	dN	dE	Bearing	Dist	dRL	dN	dE	Bearing	Dist	dRL
Trig A2	694110.915	311761.550	189.291	0.000	-0.005	270	0.005	0.015	0.005	- 0.002	338	0.005	0.004
SS WEIR ST (BD5U)	694507.274	310627.825	21.312	0.001	-0.006	279	0.006	-0.013	0.007	- 0.001	352	0.007	0.000
IS 1	695294.190	311497.215	20.613	-0.006	-0.004	214	0.007	-0.014	0.000	0.000	-	-	0.000
IS 2	694566.570	310599.975	15.807	0.000	0.000	-	-	-0.014	0.000	0.000	-	-	-0.014
Mark 05	694943.898	311300.295	47.508	0.015	-0.005	342	0.016	-0.011	0.552	- 0.197	340	0.586	-0.024
Mark 06	694803.850	311350.072	64.532	0.006	-0.005	320	0.008	0.000	0.568	- 0.186	342	0.598	-0.067
Mark 07	694861.503	311393.697	60.868	0.005	-0.009	299	0.010	-0.022	0.395	- 0.185	335	0.436	-0.250
Mark 11	694900.046	311520.724	56.442	0.002	-0.002	315	0.003	0.005	0.031	0.008	14	0.032	0.045
Mark 12	694606.317	311682.490	125.690	0.011	-0.005	336	0.012	0.017	0.025	- 0.010	338	0.027	0.019
Mark 13	694510.858	311716.825	144.904	0.007	-0.009	308	0.011	0.007	0.044	0.005	6	0.044	0.014
Mark 14	694678.090	311502.622	105.634	-0.004	-0.009	246	0.010	0.012	0.115	- 0.025	348	0.118	0.020
Mark 15	695013.378	311491.011	40.884	-0.006	-0.003	207	0.007	-0.020	-0.006	- 0.003	207	0.007	-0.020
Mark 16	694986.960	311417.026	38.773	-0.003	-0.003	225	0.004	-0.017	-0.003	- 0.003	225	0.004	-0.017



Brockville Street Survey Data

Dated: 8/08/23 Survey 4

Survey Accuracy: H ± 10 mm V ± 15 mm

Survey data				Present to previous					Present to original				
Point id	Easting	Northing	Height	<i>E</i>	<i>N</i>	<i>Horizontal</i>	Bearing	Height	<i>E</i>	<i>N</i>	<i>Horizontal</i>	Bearing	Height
OUSD	417735.027	799072.945	26.150	0.000	0.000	0.000	86	0.000	0.000	0.000			0.000
IS Frasers G.	413294.396	799712.153	283.446	0.012	-0.001	0.012	87	0.014	0.007	-0.005	0.009	126	0.005
IS Dalziel Rd	413509.329	800234.210	291.860	0.008	-0.004	0.009	88	-0.005	0.009	-0.002	0.009	103	0.000
IS Reservoir	412926.755	799127.934	308.739	0.008	-0.009	0.012	89	0.015	0.004	-0.014	0.015	164	-0.003
MIS1	414105.552	799322.149	235.937	0.015	-0.001	0.015	90	-0.012	0.006	0.000	0.006	90	0.020
MIS2	414314.931	799430.219	199.049	0.010	-0.006	0.012	121	0.010	0.007	-0.004	0.008	120	0.013
MIS3	414532.874	799551.172	174.728	0.011	-0.008	0.014	126	0.005	0.002	0.006	0.006	18	0.008
MIS4	414692.806	799541.128	167.045	0.011	-0.004	0.012	110	0.000	0.007	0.004	0.008	60	0.004
MIS5	414731.226	799443.714	157.167	0.003	-0.006	0.007	153	0.016	0.005	-0.006	0.008	140	-0.007
MIS6	414660.993	799411.239	171.846	0.010	-0.009	0.013	132	0.024	0.004	-0.005	0.006	141	0.006
MIS7	414606.565	799276.204	162.007	0.011	-0.008	0.014	126	0.005	0.011	-0.008	0.014	126	-0.004
MIS8	414448.587	799218.929	174.575	0.014	-0.005	0.015	110	0.009	-0.004	0.003	0.005	307	-0.039



Dickson Street Survey Data
Dated: 6/11/2023

Survey Accuracy: H \pm 15mm V \pm 25mm

Additional Survey Data					Present to Previous					Present to Control				
Point Number	Northing	Easting	Height	Code	dN	dE	Azim.	Dist	dRL	dN	dE	Azim.	Dist	dRL
	NZGD49	NZGD49	Intl1924											
106	700292.691	324573.455	7.512	IS 106						0.000	0.000	#DIV/0!	0.000	-0.002
A23K	698553.387	323584.278	8.392	I NO 3	-0.011	0.008	144	0.014	-0.025	0.004	-0.002	333	0.004	-0.012
DUND	697311.104	324412.321	386.734	DUND	0.000	0.000	#DIV/0!	0.000	0.000	0.000	0.000	#DIV/0!	0.000	0.000
OUSD	698908.138	317721.854	25.913	OUSD	-0.002	-0.003	236	0.004	0.007	-0.003	-0.006	243	0.007	-0.002
101	699022.346	324432.492	6.959	IS101	-0.004	0.000	180	0.004	0.003	-0.002	-0.002	225	0.003	0.001
102	699035.008	324463.927	7.049	NAIL 102	-0.004	-0.002	207	0.004	-0.001	-0.004	-0.001	194	0.004	-0.001
1	698974.516	324733.969	33.649	ISI	-0.007	0.001	172	0.007	0.000	-0.017	-0.014	219	0.022	0.052
2B	698762.739	324484.266	24.775	NAIL 2B	0.003	-0.001	342	0.003	-0.002	0.000	-0.001	270	0.001	-0.006
5	699088.879	325008.994	136.525	ISV	0.001	0.005	79	0.005	0.014	0.011	-0.007	328	0.013	0.052
6	699121.113	324811.367	79.072	ISVI	0.004	-0.001	346	0.004	0.006	-0.038	-0.040	226	0.055	0.040
8	699034.430	324842.041	75.686	ISVIII	-0.002	0.006	108	0.006	0.005	-0.030	-0.033	228	0.045	0.049
9B	699013.498	324570.345	20.992	ISIXB	0.001	-0.001	315	0.001	0.003	0.008	-0.002	346	0.008	0.023
21	699121.891	324588.096	24.983	ISXXI	-0.002	0.005	112	0.005	-0.004	-0.006	-0.012	244	0.014	0.008
22	698870.905	324795.954	52.158	ISXXII	0.009	0.001	6	0.009	0.002	-0.008	-0.006	219	0.010	0.044
31	698991.120	324636.024	23.471	ISXXXI	0.000	0.001	90	0.001	-0.001	0.000	0.001	90	0.001	-0.001
32	698981.975	324681.414	28.275	ISXXXII	0.002	-0.001	333	0.002	-0.001	0.002	-0.001	333	0.002	-0.001
33	698954.318	324793.346	49.583	ISXXXIII	0.019	0.002	6	0.019	0.008	0.019	0.002	6	0.019	0.008
34	699016.243	324787.805	48.635	ISXXXIV	-0.008	0.009	132	0.012	-0.011	-0.008	0.009	132	0.012	-0.011
35	699067.825	324791.792	66.738	ISXXXV	0.007	0.007	45	0.010	-0.002	0.007	0.007	45	0.010	-0.002



West Abbotsford Survey Data
Dated 25/10/2023 SURVEY 3

Survey Accuracy: H ±10mm V ±20mm

Additional survey data				Present to previous					Present to control				
<i>POINT</i>	<i>NORTHING</i>	<i>EASTING</i>	<i>HEIGHT</i>	<i>d N</i>	<i>d E</i>	<i>Δ Z</i>	<i>Brng</i>	<i>Dist</i>	<i>d N</i>	<i>D E</i>	<i>Δ Z</i>	<i>Brng</i>	<i>Dist</i>
AG1C	795714.092	410340.258	13.483	0.000	0.000	-0.016	-	0.000	0.000	0.000	-0.016	-	0.000
OUSD	799072.948	417735.014	26.157	0.002	-0.006	0.001	288.435	0.006	-0.006	- 0.007	0.009	229	0.009
C25W	795472.378	412098.471	29.596	0.004	0.005	-0.005	51.340	0.006	-0.002	0.001	-0.005	153	0.002
IS 1	795459.028	411510.389	20.851	0.004	-0.002	-0.001	333.435	0.004	0.001	0.002	0.000	63	0.002
IS 2	795778.253	410907.781	42.538	0.003	0.000	0.005	0.000	0.003	-0.007	0.002	0.004	164	0.007
IS 3	795749.442	411890.873	28.812	0.000	-0.001	-0.003	270.000	0.001	-0.009	- 0.001	0.007	186	0.009
IS 4	796329.832	411648.235	95.136	0.003	0.002	-0.009	33.690	0.004	-0.008	0.004	-0.002	153	0.009
AP 11	795922.092	411195.488	55.026	-0.001	-0.003	-0.003	252	0.003	-0.007	0.002	0.003	164	0.00728011
AP 12	795942.768	411123.583	54.725	0.004	0.001	0.000	14	0.004	-0.006	0.003	0.010	153	0.006708204
AP 13	795893.485	411257.179	51.039	0.004	0.000	-0.015	0	0.004	-0.004	0.001	-0.008	166	0.004123106
AP 14	795862.599	411169.221	50.541	0.001	0.004	-0.008	76	0.004	-0.005	0.006	-0.001	130	0.00781025
AP 15B	795822.249	411053.235	46.263	-	-	-							
AP 16	795802.356	411345.860	45.415	0.004	0.000	-0.016	0	0.004	-0.005	0.002	-0.005	158	0.005385165
AP 17	795749.623	411192.591	39.221	-	-	-			-0.007	0.005	0.007	144	0.008602325
AP 18	795696.023	411399.095	37.547	0.002	-0.004	-0.005	297	0.004	-0.006	0.001	0.001	171	0.006082762
AP 19	-	-	-	-	-	-							
AP 20	795620.268	411177.114	30.943	0.002	0.002	-0.008	45	0.003	-0.009	0.005	0.001	151	0.010
AP 21	795700.239	411031.830	35.906	0.002	0.005	0.002	68	0.005	-0.005	0.008	0.001	122.0053831	0.009433981
AP 22	795568.807	411065.827	27.977	0.003	0.005	-0.012	59	0.006	-0.002	0.008	-0.001	104.0362434	0.008246211



Albany Street Survey Data													
Dated: 11/10/2023 Survey 11													
Survey Accuracy: H ±10mm V ±10mm													
				Present to Previous					Present to Control (08/03/2010)				
Pin #	Northing	Easting	Height	dN	dE	Bearing	Dist	dRL	dN	dE	Bearing	Dist	dRL
	(NZGD2000 Nth Taieri)		(Otago Metric Datum)										
SS 13G		DESTROYED											
ALP 5		DESTROYED											
SS 9G		DESTROYED											
Nail 1	799381.730	417371.268	127.242	0.000	0.000	1	0.000	0.000	0.000	0.000	1	0.000	0.000
Nail 100	799267.870	417439.791	111.369										
Nail 101	799472.943	417534.893	114.670										
Nail A	799462.689	417479.015	125.235	0.008	-0.005	5	0.009	0.003	0.008	-0.005	5	0.009	0.003
BP 2 SO 590919	799527.301	417556.593	115.465										
Nail 102	799458.866	417495.220	120.708										
Nail 103	799479.219	417484.013	124.653										
ALP 4	799489.074	417413.249	136.902	-0.004	-0.004	225	0.006	0.000	-0.013	0.019	124	0.023	-0.016
ALP 6	799457.078	417488.761	122.911	0.008	-0.006	127	0.010	0.001	0.003	0.007	67	0.008	-0.006
ALP 200	799451.536	417396.934	134.491	-0.001	-0.008	187	0.008	0.004	-0.007	0.007	135	0.010	-0.002
ALP 201	799461.714	417401.003	135.301	0.001	-0.003	162	0.003	0.008	-0.010	0.007	145	0.012	0.001
ALP 202	799469.128	417404.006	135.714	0.000	0.000	#DIV/0!	0.000	-0.004	-0.013	0.026	117	0.029	-0.017
ALP 203	799476.765	417407.081	136.282	-0.001	-0.001	225	0.001	-0.002	-0.015	0.027	119	0.031	-0.021
ALP 204	799487.043	417411.199	136.973	-0.003	-0.001	252	0.003	0.002	-0.018	0.022	129	0.028	-0.013
PIN 205	799493.070	417413.572	137.179	-0.007	-0.001	262	0.007	-0.002	-0.016	0.029	119	0.033	-0.032
PIN 206	799499.057	417416.092	137.442	-0.005	0.000	270	0.005	-0.004	-0.021	0.025	130	0.033	-0.038
ALP 207	799505.009	417418.685	137.654	-0.004	-0.009	204	0.010	-0.008	-0.022	0.022	135	0.031	-0.029
ALP 208	799512.419	417421.347	138.426	-0.001	-0.009	186	0.009	-0.003	-0.023	0.021	138	0.031	-0.027
ALP 209	799519.686	417424.171	139.203	-0.002	-0.013	189	0.013	-0.004	-0.023	0.019	140	0.030	-0.031
ALP 210	799530.101	417427.882	140.501	0.004	-0.020	169	0.020	-0.003	-0.015	0.006	158	0.016	-0.023
ALP 211	799539.196	417431.443	141.257	0.001	-0.018	177	0.018	-0.008	-0.010	-0.007	215	0.012	-0.023
PIN 212	799480.856	417431.710	133.514	-0.002	-0.003	220	0.004	-0.004	-0.005	0.021	103	0.022	-0.021
PIN 213	799471.368	417455.556	129.526	0.005	-0.003	124	0.005	0.003	0.003	0.018	81	0.018	-0.004



PIN 214A	799464.574	417472.633	126.602	0.007	-0.004	120	0.008	-0.001	-0.005	0.009	117	0.010	-0.008
216		DESTROYED											