



Geotechnical Investigations Report

143-193 Moray Place, Dunedin

Report prepared for:

Dunedin City Council

Report prepared by:

GeoSolve Ltd

Distribution:

Dunedin City Council

GeoSolve Limited (File)

November 2016

GeoSolve Ref: 160658



Quality
ISO 9001



Table of Contents

1	Introduction	1
1.1	General	1
2	Geotechnical Investigations	1
3	Subsurface Conditions	2
3.1	Geological Setting	2
3.1.1	Regional Geology.....	2
3.1.2	Seismicity	2
3.2	Stratigraphy	3
3.3	Groundwater	3
4	Conclusions and Recommendations.....	4
5	Applicability.....	5

1 Introduction

1.1 General

This report presents the results of geotechnical investigations carried out by GeoSolve Ltd in order to determine subsoil conditions and provide geotechnical inputs for a potential commercial development at 143-193 Moray Place, Dunedin.



Figure 1.1 – Site photo, 1432-193 Moray Place (Source: Google Street View)

The investigations detailed in this report were carried out for Dunedin City Council in accordance with GeoSolve Ltd's proposal dated 22 September 2016, which outlines the scope of work and conditions of engagement.

We understand that the proposed development is for a potential hotel complex on the above sites and that several proposals are under consideration.

As no development plans are available, this investigation and report is general in nature and is intended to provide potential developers and their advisors a general overview of the ground conditions at the site. Additional investigations will be required as part of the detailed design of any scheme proposed.

No geotechnical assessment of the data has been carried out and no geotechnical recommendations are provided as the development plans are not defined.

We note that 62 York Place is also potentially part of the hotel development site. A separate report is provided for this site because it may not be applicable to all potential development proposals. The data from that site has been included in the geological cross sections in this report.

2 Geotechnical Investigations

GeoSolve have supervised seven machine boreholes (BH) with Standard Penetration Testing (SPTs) on site from 18-27 October 2016 comprising BH3-8. Note that BH7 was planned but not carried out due to time and budgetary constraints.

Investigation depths for each BH ranged from 7.60-21.28 m in total. BH logs and preliminary cross sections are attached at the end of this report.

An initial desktop review of existing information on the GeoSolve, DCC and Otago Regional Council databases has also been carried out.

3 Subsurface Conditions

3.1 Geological Setting

3.1.1 Regional Geology

The geology of the Dunedin area is dominated by volcanic rock types of basaltic to andesitic composition that were intruded through pre-existing marine sediments during Miocene times. Extensive volcanism at that time produced lava flows and bedded volcanoclastic materials were widely distributed by eruptions.

More recently (Pleistocene times), the hills of Dunedin have been extensively mantled by windblown loess to depths of up to several metres. Watercourses and tidal embayments such as Otago Harbour have locally deposited alluvial, estuarine and marine deposits and generally modified the volcanic landscape by deep incision and sedimentation. Fill and refuse has been placed locally during post-settlement times. Landslips have occurred on steeper hillsides particularly where springs emerge or where fills have been placed.

3.1.2 Seismicity

Dunedin has traditionally been considered to have lower than average seismic activity when compared to other areas in New Zealand, however nearby active faults are known and strong shaking is certain to occur periodically.

McCahon et al¹ states that the earthquake hazard in Dunedin is dominated by relatively infrequent moderate to large earthquakes (magnitude up to M_w 7.5) in eastern Otago, and large to very large earthquakes in the much more seismically active Fiordland and Westland regions.

The nearest active faults with demonstrated Late Quaternary movement history are the Green Island Fault and the Akatore Fault. The Green Island Fault is currently considered to be the cause of the 1974 earthquake that caused damage in Dunedin. It is mapped approximately 5km to the south of the subject site, but its projection is believed to continue through South Dunedin and may run northeast up the harbour in which case it would pass within about 4km of the site. The Akatore Fault has also been projected beneath South Dunedin; the nearest mapped trace of the fault is truncated about 6km southwest of the site, but the fault likely continues beneath South Dunedin and may run northeast up the harbour as well. Sheared fault rocks have been identified in recent drilling near Portsmouth Drive indicating continuation of fault traces up the harbour is very probable.

It should be noted the fault terminations shown on fault trace maps are often approximations (owing to lack of data) and the presence of other active faults may be unknown because they may be obscured by overburden soils. Both of these faults are likely to be capable of generating magnitude 7.5 earthquakes in Dunedin. Other known faults that have some potential to cause strong shaking in Dunedin are the Titri Fault and the North Taieri Fault, located roughly 9km and 15km southwest/west of the site, respectively.

The above faults are not included in Table 3.6 of NZS 1170.5:2004 as major faults requiring near fault factors when assessing structural design actions. Recent events in Canterbury have highlighted the issue that previously unidentified faults may be very significant factors in the actual future risk applying to any particular site.

¹ McCahon, I.F., Yetton, M.D., Cook, D.R.L. (1993). The Earthquake Hazard in Dunedin. EQC report 91/56.

Strong ground shaking throughout the South Island is likely to be associated with a rupture of the Alpine Fault, located along the West Coast of South Island. There is a high probability an earthquake with an expected magnitude of over 7.5 will occur along the Alpine Fault within the next 50 years.

Average return periods for shaking intensity are: MM 7 = 100 years, MM 8 = 450 years and MM 9 = >2,500 years. The most recent major earthquake to affect Dunedin occurred in 1974 and produced damage consistent with MM 7 intensity.

3.2 Stratigraphy

An engineering geological model for the site is shown in the cross section appended at the end of this report. More detailed geotechnical description of soils is provided in the attached borehole logs.

Published geological mapping and reporting (Benson, 1968) indicates that the site is likely to be underlain Dunedin Volcanic Group rock, possibly overlain by loess/colluvium. Localised man-made fill soils or alluvial channels are also reported in the vicinity

The generalised subsoil profile at the site comprises a surficial uncontrolled fill layer overlying gravelly and silty slopewash soils.

Uncontrolled fill generally comprised firm or medium dense gravelly SILT and sandy GRAVEL up to 1.5 m in thickness.

The slopewash soils are composed of firm silty CLAY and clayey SILT, locally with some gravel and cobbles. Due to the observed variability within these soils and the lack of shear surfaces or slickensides, these units are inferred to be an accumulation of soils derived from erosion and mass wasting further upslope. The thickness of the slopewash unit also increases in thickness with decreasing elevation on the slope (approximately 3 m near the top compared to 6.5m near the base), typical of a debris fan morphology.

These deposits are underlain by extremely to highly weathered basaltic and basaltic bedrock of the Dunedin Volcanic Group. SPT refusal was generally reached within these units.

3.3 Groundwater

The local water table was observed at approximately 4.00-4.15 m below ground level in BH3 and BH6 and was not observed in any other BHs.

Groundwater levels across the site will need to be confirmed by detailed investigation and design. Piezometers for the purposes of groundwater monitoring have been constructed in BH3, BH5 and BH7(8) to full depth. All other BHs were backfilled upon completion.

4 Conclusions and Recommendations

- The generalised subsoil profile at the site comprises a surficial uncontrolled fill layer overlying slopewash deposits, with volcanic rock underlying the site at moderate depth.
- The local water table was observed at approximately 4.00-4.15 m below ground level in BH3 and BH6 and was not observed elsewhere.
- Further subsurface investigations and geotechnical analysis of earthworks and foundation proposals is required at detailed design stage.

5 Applicability

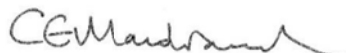
This report has been prepared for the benefit of Dunedin City Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

This report does not provide a detailed geotechnical investigation and assessment of the site and additional investigations and assessment will be required for specific developments on the site.

Please do not hesitate to contact the undersigned if we can provide any assistance at a later stage of the project.

Report prepared by:

Reviewed and authorised for GeoSolve Ltd by:



.....
David Gainsford

.....
Colin Macdiarmid

Engineering Geologist

Senior Geotechnical Engineer

GEO SOLVE

70 Macandrew Road, PO Box 2427, South Dunedin 9044, ph 03 466 402

Appendix A: Site Plan & Cross-sections



Bore hole location



Bore hole location (not drilled)

GEO SOLVE

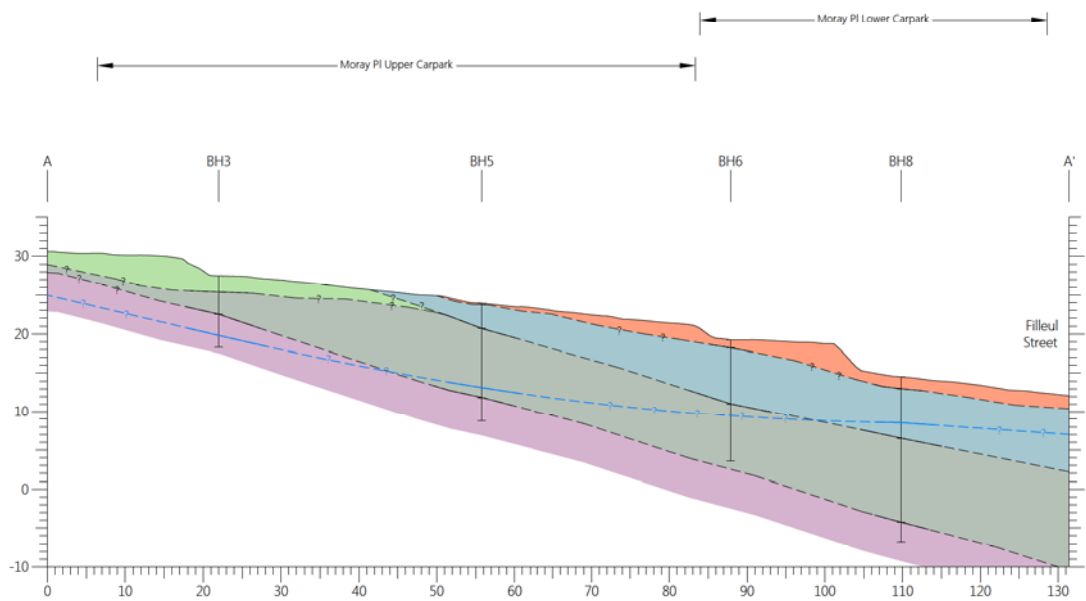
GEOTECHNICAL ENGINEERING • GEOHYDROLOGY & HYDROLOGY
ENGINEERING GEOLOGY • PAVEMENT STRUCTURAL TESTING

DRAWN	RC	11/16
DRAFTING CHECKED	DLAG	11/16
APPROVED	CEM	11/16
FILE:	PDF	
SCALE:	As Shown	
PROJECT No:	160658	

Dunedin City Council
Geotechnical Investigation
143-191 Moray Place, Dunedin
Site Plan

FIG No: Appendix A - Figure 1

REV: 0



Legend:			
 Fill	 Weathered Volcanics	 Geology Confirmed	 WL Confirmed
 Loess	 Volcanic Rock	 Geology Projected	 WL Projected
 Slopewash		 Geology Inferred	 WL Inferred

GEO SOLVE
 GEOTECHNICAL ENGINEERS
 Level 1, 70 MacAndrew Road, South Dunedin
 www.geosolve.co.nz

DRAWN	WCB	16/01/18
DRAFTING CHECKED		
APPROVED		
CADFILE	388618_C37.dwg	
REVISIONS (DATE/REV)	AS SHOWN	
PROJECT No:	160658	

Dunedin City Council
 Geotechnical Investigation
 62 York Place, Dunedin
 Cross Section A

FIG No:
 Figure 2

REV:
 0

Appendix B: Site Borehole Logs



GEOTECHNICAL ENGINEERING • ENGINEERING GEOLOGY
PAVEMENTS • HYDROGEOLOGY • HYDROLOGY

GEOSOLVE LTD

BORE HOLE LOG

BOREHOLE No:

BH3

SHEET 1 OF 1

DRILLED BY: M^cMILLAN'S
LOGGED BY: D GAINSFORD

PROJECT: DCC 143-193 MORAY PLACE

LOCATION: SEE SITE PLAN

CO-ORDINATES: N4917057
E1406089

JOB No: 160658

DIRECTION: VERTICAL

ANGLE FROM HORIZ.: 90°

DRILL TYPE/METHOD/FLUID: SONIC D.T. 45

R.L. GROUND: 33.36m

R.L. COLLAR:

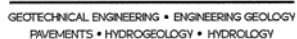
DATUM: GROUND LEVEL

CHECKED: M WALROND

START DATE: 26/10/2016

FINISH DATE: 26/10/2016

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m)	Depth (m)	Graphic Log	Drillers Notes	TESTING		Water Loss (%)	Water Level	Casing	Installation	Core Box	
	SOIL: Classification, colour, consistency / density, moisture, plasticity										Hammer Efficiency: 91.4% Borehole Diameter: 114 mm Liner: NO							
LOESS	0.00m silty GRAVEL; dark grey; fine to medium subangular gravel, well graded; non plastic silt; medium dense, wet		SONIC	100	MOIST	SOFT - FIRM												
	0.05m clayey SILT; light brown-grey mottled orange-brown, low plasticity, localised dark flecks, soft to firm, moist.		SONIC	100														
	2.08m CLAY, brown, high plasticity, firm, moist.		SPT	100														
			SONIC	100														
VOLCANICS	2.65m silty CLAY; brown mottled yellow, orange and black, low plasticity; minor fine to medium subangular gravel, breaks down into sand and non-plastic silt (relict crystals in residual soil), very stiff, moist		SPT	100	VERY STIFF	VERY STIFF												
	2.84-3.04 Crystalline texture		SPT	100														
	3.04m CLAY with minor silt; brown with yellow, pink and brown mottling, stiff, moist		SONIC	100														
	4.00m Becoming saturated		SONIC	100														
			SPT	100														
	4.95m Extremely weathered ROCK; black mottled dark red, brown-yellow and orange, weak to moderately strong; breaks down to non plastic silty clay, moderately strong, saturated		SONIC	100														
			SPT	0														
			SONIC	100														
			SPT	0														
			SONIC	100														
WEATHERED	6.70m Vesicular textures present. Becoming moderately strong to strong.		SPT	0	SATURATED	STRONG												
			SONIC	100														
			SPT	0														
			SONIC	100														
			SPT	0														
			SONIC	100														
			SPT	0														
			SONIC	100														
			SPT	0														
			SONIC	100														
	EOH 9.12m		SONIC	100														
												9.98						



BH ⁴

SHEET 1 OF 2

DRILLED BY: M^CMILLAN'S

LOGGED BY: D GAINSFORD

CHECKED: M WALROND

START DATE: 26/10/2016

FINISH DATE: 26/10/2016

PROJECT: DCC 143-193 MORAY PLACE

LOCATION: SEE SITE PLAN

CO-ORDINATES: N 4917052
E 1406129

JOB No: 160658

DIRECTION: VERTICAL

ANGLE FROM HORIZ.: 90°

R.L. GROUND: 28.74m

R.L. COLLAR:

DATUM: GROUND LEVEL

DRILL TYPE/METHOD/FLUID: SONIC DT45

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m)	Depth (m)	Graphic Log	Drillers Notes	TESTING		Water Loss (%)	Water Level	Casing	Installation	Core Box				
	SOIL: Classification, colour, consistency / density, moisture, plasticity										Hammer Efficiency: 91.4%	Borehole Diameter: 116mm						Liner: n/a			
TOPSOIL	0.00m organic SILT, brown, non plastic, grass and rootlets, soft, moist.		SONIC	100	FIRM		1	0	x		SPT @ 1.52m 3, 3, 5, 5, 7, 7 N = 24										
SLOPEWASH	0.15m gravelly SILT, grey-brown, low plasticity, moderately oxidised, fine to coarse angular gravel (basalt and brick fragments), 60mm Ø cobble at 1.22m, firm to very stiff, moist		SPT	100														1	0	x	
	1.40m Dark brown manganese flecks		SONIC	100														2	0	x	
	2.70m Becoming dark brown. Manganese flecks absent.		SPT	100														3	0	x	
			SONIC	100														4	0	x	
			SPT	100														5	0	x	
			SONIC	100														6	0	x	
			SPT	100														7	0	x	
			SONIC	100														8	0	x	
WEATHERED VOLCANICS	5.80m Becoming wet.		SPT	100														VERY STIFF		9	0
	6.42m clayey SILT; light grey, mottled dark brown and orange-brown, low plasticity, iron and manganese staining, very stiff, moist		SPT	100	10	0	x														
	8.59m CLAY: light brown-purple, mottled yellow, red and orange-brown, high plasticity, rare relict crystalline texture, very stiff, moist (residual soil)		SPT	100			11	0	x		SPT @ 4.56m 2, 3, 3, 6, 7, 9 N = 25										
			SONIC	100			12	0	x		SPT @ 6.08m 2, 3, 4, 6, 6, 7 N = 23										
			SPT	100			13	0	x		SPT @ 7.60m 3, 10, 9, 5, 8, 8 N = 30										
			SONIC	100			14	0	x		SPT @ 9.12m 2, 6, 8, 7, 7, 8 N = 30										

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED.

Survey method: GPS (NZTM)



BH 4

SHEET 2 OF 2

LOGGED BY: D GAINSFORD

CHECKED: M WALROND

START DATE: 26 / 10 / 2016

FINISH DATE: 26/10/2016

PROJECT: DCC 143-193 MORAY PLACE

LOCATION: SEE SITE PLAN

CO-ORDINATES: N 491705Z
E 1406129

JOB No: 160658

DIRECTION: VERTICAL

ANGLE FROM HORIZ.: 90°

R.L. GROUND:

R.L. COLLAR:

DATUM:

DRILL TYPE/METHOD/FLUID: SONIC DT45

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED.

Survey method: GPS (NZTM)

Log Scale 1:50

Survey method: GPS (NZTM)



GEOTECHNICAL ENGINEERING • ENGINEERING GEOLOGY
PAVEMENTS • HYDROGEOLOGY • HYDROLOGY

GEOSOLVE LTD

BORE HOLE LOG

BOREHOLE No:

BH 5

SHEET ... OF ...

DRILLED BY: M^c MILLAN

LOGGED BY: D GAINSFORD

CHECKED: M WALROND

START DATE: 21/10/2016

FINISH DATE: 25/10/2016

PROJECT: DCC 143-143 MOKAY PLACE

LOCATION: SEE SITE PLAN

CO-ORDINATES: N 4917080
E 1406118

JOB No: 160658

DIRECTION: VERTICAL

ANGLE FROM HORIZ.: 90°

R.L. GROUND: 29.28m

R.L. COLLAR:

DATUM: GROUND LEVEL

DRILL TYPE/METHOD/FLUID: SONIC D.T. 45

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m)	Depth (m)	Graphic Log	Drillers Notes	TESTING				
										Hammer Efficiency: 91.4% Borehole Diameter: 114mm Liner: N/A	Water Loss (%)	Water Level	Casing	Installation
FILL	0.00m ASPHALT; black, hard.													
	0.05m clayey SILT; light brown, low plasticity, rare fine angular gravel, broken clay pipe at 0.10m, soft to firm, moist.													
SLOPEWASH	0.19m clayey SILT; light grey, mottled orange-brown, low plasticity, rare fine rounded gravel, soft to firm, moist.	SONIC	100											
	1.52m Becoming stiff	SPT	100		STIFF					SPT @ 1.52m 1, 2, 3, 3, 5, 5 N = 16				
	3.25m silty CLAY; light brown mottled black and dark brown, some fine subangular to subrounded gravel and non-plastic silt, stiff to very stiff, moist	SONIC	100		VERY STIFF									
	4.01m silty CLAY with some gravel; light brown mottled yellow, orange-brown and black, low plasticity, gravel fine to medium, subrounded to subangular, stiff, moist.	SPT	100		STIFF					SPT @ 3.04m 2, 2, 4, 6, 6, 7 N = 23				
VOLCANICS	5.46 - 6.08m Locally wet.	SONIC	100	MOIST										
	6.92m silty CLAY with rare gravel; light red brown, mottled orange-brown and yellow, low to medium plasticity; fine to medium subrounded gravel, stiff, moist	SPT	100		STIFF					SPT @ 4.56m 2, 2, 3, 3, 4, 4 N = 14				
WEATHERED	7.90m Locally includes grey non plastic silt.	SONIC	100		STIFF									
	8.30m Rounded cobble	SPT	100		STIFF					SPT @ 6.08m 2, 3, 5, 5, 5, 5 N = 20				
	8.35m silty CLAY. light brown mottled orange, dark brown and dark grey, low plasticity, rare fine to coarse rounded gravels, stiff, moist.	SONIC	100											
	9.28-9.32m Lens of dark red, low plasticity clay.	SPT	100		STIFF					SPT @ 7.60m 2, 2, 3, 3, 3, 5 N = 14				
		SONIC	100							SPT @ 9.12m 2, 3, 3, 3, 4, 4 N = 14				

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED

Survey method: GPS (NZTM)





GEOTECHNICAL ENGINEERING • ENGINEERING GEOLOGY
PAVEMENTS • HYDROGEOLOGY • HYDROLOGY

GEOSOLVE LTD

BORE HOLE LOG

BOREHOLE No:

BH 6

SHEET 1 OF 2

DRILLED BY: M. MILLANS

LOGGED BY: D. GAINSFORD

CHECKED: M. WALKER

START DATE: 18/10/2016

FINISH DATE: 18/10/2016

PROJECT: DCL 143-173 MORAY PLACE

JOB No: 160658

R.L. GROUND: 24.44m

LOCATION: SEE SITE PLAN

DIRECTION: VERTICAL

R.L. COLLAR:

CO-ORDINATES: N 4917072

ANGLE FROM HORIZ.: 90°

DATUM: GROUND LEVEL

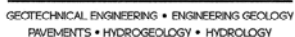
E 1406154

DRILL TYPE/METHOD/FLUID: SONIC D.T. 45

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m)	Depth (m)	Graphic Log	Drillers Notes	TESTING				
										Hammer Efficiency: 91.4%, Borehole Diameter: 114mm Liner: N°0	Water Loss (%)	Water Level	Casing	Installation
FILL	0.00m gravelly SILT; brown mottled red and black; non plastic silt fine angular gravel and brick fragments; firm, moist	SONIC	100	MOIST	VERY STIFF	1	1	X		SPT @ 1.52m 2, 3, 5, 7, 7, 8 N = 27				
	0.27m clayey SILT; light grey-brown, mottled orange-brown; low plasticity, firm to stiff, moist.	SPT	100											
SLOPEWASH	0.80m gravelly SILT; brown mottled grey and red; non plastic silt; fine angular gravel and brick fragments; firm, moist.	SONIC	100	WET	STIFF TO V. STIFF	2	2	X		SPT @ 3.04m 2, 3, 5, 5, 5, 6 N = 21				
	1.00m clayey SILT; light brown-grey mottled orange-brown; low plasticity; rare white and black clay inclusions and fine subangular basalt gravel; very stiff, moist	SPT	100											
	1.82m Occasionally with black manganese flecks	SONIC	100											
	2.90m silty CLAY; light brown mottled orange, low plasticity, frequent iron and manganese oxidation; firm to stiff, moist.	SPT	0											
	3.04 - 3.34 SPT disturbance in core.	SONIC	100											
	3.24m Becoming soft and wet with rare fine subrounded basalt gravels	SPT	0											
	3.91m 6mm thick laminations visible	SONIC	100											
	4.30 - 4.56m Locally soft and saturated.	SPT	0											
	4.62m clayey SILT; light brown mottled orange-brown, dark brown and black, low plasticity, manganese and iron oxidation throughout, stiff, saturated.	SONIC	100											
	5.46 - 5.76m Minor rounded to subrounded fine basalt gravel	SPT	0											
WEATHERED VOLCANICS	5.80m Becoming light brown-grey	SONIC	100	SATURATED	FIRM	6	6	X		SPT @ 6.08m 3, 5, 5, 8, 7, 8 N = 28				
	6.08m Becoming very stiff	SPT	0											
	6.95m gravelly CLAY; brown, mottled black and orange-brown, high plasticity; fine angular to subangular gravel, poorly graded, soft to firm, saturated.	SONIC	100											
	7.43 - 7.53m Gravel locally rounded, fine to coarse, wet.	SPT	0											
	7.60m CLAY with rare gravel; brown, high plasticity; fine subrounded basalt gravel, firm, saturated.	SONIC	100	FIRM	FIRM	7	7	X		SPT @ 7.60m 1, 2, 2, 2, 3, 3 N = 10				
	8.20m CLAY with rare silt and gravel, brown mottled orange, red, black and yellow, high plasticity, relict crystalline texture (residual soil), firm, saturated.	SPT	100											
		SONIC	100											
		SPT	100	FIRM	FIRM	8	8	X		SPT @ 9.12m 1, 0, 2, 2, 2, 3 N = 9				
		SONIC	100											

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED.

Survey method: GPS (NZTM)



BH 6

SHEET 2 OF 2

DRILLED BY: M^CMILLAN'S

LOGGED BY: D. GAINSFORD

CHECKED: M WALROND

START DATE: 18/10/2016

FINISH DATE: 18/10/2016

PROJECT: DCC 143-193 MORAY PLACE

LOCATION: SEE SITE PLAN

CO-ORDINATES: N 4917072
E 1406154

JOB No: 160658

DIRECTION: VERTICAL

ANGLE FROM HORIZ.: 90°

R.L. GROUND: 24.44m

R.L. COLLAR:

DATUM: GROUND LEVEL

DRILL TYPE/METHOD/FLUID: SONIC DT45

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED

Survey method: GPS (NZTM)

PROJECT: DCC 143-193 MORAY PLACE

LOCATION: SEE SITE PLAN

CO-ORDINATES: N4917084

E1406175

JOB No: 160658

DIRECTION: VERTICAL

ANGLE FROM HORIZ.: 90°

R.L. GROUND: 19.69m

R.L. COLLAR:

DATUM: GROUND LEVEL

DRILL TYPE/METHOD/FLUID: SONIC D.T. 45

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m)	Depth (m)	Graphic Log	Drillers Notes	TESTING				
										Hammer Efficiency: 91.4%	Borehole Diameter: 114mm	Liner: NO	Water Loss (%)	Water Level
	SOIL: Classification, colour, consistency / density, moisture, plasticity													
FILL	0.00m SAND; black, fine with some non-plastic silt, medium dense, moist.	SONIC	100											
	0.10m sandy GRAVEL; black, gravel fine, angular, poorly graded; sand, fine to medium, medium dense, moist.													
	0.25m gravelly SILT; black-dark grey, non-plastic silt, fine to medium, angular gravel; firm, moist													
	1.52m SILT with some clay; light brown mottled light grey and black, low plasticity, firm, moist	SPT	100											
SLOPEWASH	2.30m Becoming light grey, mottled orange, brown and black.	SONIC	100											
	4.38m silty CLAY; light grey-brown mottled orange-brown, low to medium plasticity, firm, moist, minor manganese and iron flecks.	SPT	100											
	5.02m - 5.22m Lens of fine to medium subangular basalt gravel, with cobble	SONIC	100											
	5.50m Becoming light grey, mottled orange-brown	SPT	100											
	6.02m silty CLAY; light brown, mottled grey, yellow-brown, orange and black, low to medium plasticity, firm, moist, rare fine subangular basalt gravels.	SONIC	100											
	7.06 - 7.12m Lens of basalt cobbles, subangular to subrounded	SPT	100											
	7.12 - 7.36m Lens of fine to coarse, subangular to subrounded basalt gravel	SONIC	100											
	7.36m CLAY, light brown, minor orange-brown mottling, soft, moist, rare fine to medium subrounded quartz gravels.	SPT	100											
WEATHERED VOLCANICS	7.90m Becoming wet.	SONIC	100											
	8.03m CLAY, light brown mottled purple, red and white, high plasticity, relict crystalline texture (fine angular gravels, break down to non-plastic silt), soft, moist	SPT	100											
	9.12m - 9.57m SPT disturbance in core. Becoming soft to firm.													

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED.

Survey method: GPS (NZTM)



GEOTECHNICAL ENGINEERING • ENGINEERING GEOLOGY
PAVEMENTS • HYDROGEOLOGY • HYDROLOGY

GEOSOLVE LTD

BORE HOLE LOG

BOREHOLE No:

BH 8

SHEET 2 OF 2

DRILLED BY: McMILLAN'S

LOGGED BY: D GAINSFORD

CHECKED: M WALROND

START DATE: 17/10/2016

FINISH DATE: 19/10/2016

PROJECT: DCC 143-193 MOKAY PLACE

JOB No: 160658

R.L. GROUND: 19.69m

LOCATION: SEE SITE PLAN

DIRECTION: VERTICAL

R.L. COLLAR:

CO-ORDINATES: N4917084

ANGLE FROM HORIZ.: 90°

DATUM: GROUND LEVEL

E1406175

DRILL TYPE/METHOD/FLUID: SONIC DT45

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity	Sampling Method	Core Recovery (%)	Moisture Condition	Strength/Density Classification	RL (m)	Depth (m)	Graphic Log	Drillers Notes	TESTING				
										Hammer Efficiency: 91.4%, Borehole Diameter: 114mm Liner: N30	Water Loss (%)	Water Level	Casing	Installation
VOLCANICS	10.25m silty CLAY; orange-brown with light grey-brown and black veining, non-plastic, stiff, moist	SONIC	100											
	10.43m silty CLAY; light brown to dark brown, mottled orange, black, yellow and red, low plasticity, rare fine to medium subrounded basalt gravel, stiff, moist	SPT	100											
	10.64-11.10m SPT disturbance													
	10.71m silty CLAY; light brown mottled orange-brown, non plastic to low plasticity, very stiff, moist	SONIC	100											
	11.05m Becoming mottled light grey													
	11.36m silty CLAY; purple-brown with white, red and black mottling, low plasticity, relict crystalline texture, stiff, moist	SPT	100											
	11.87m silty CLAY; orange-brown mottled brown, low plasticity, highly oxidised, rare fine sand, firm, moist	SPT	100											
	12.16-12.32m Locally purple, high plasticity													
	13.15m CLAY with minor gravel; purple with minor orange-brown, white and red flecks (relict crystalline texture); high plasticity, fine subangular gravel breaks down to non-plastic silt, stiff, to very stiff, moist	SONIC	100											
	13.72m Purple-black angular-subangular cobbles	SPT	100											
WEATHERED	13.90m Purple-black angular-subangular cobbles													
	13.98-14.55m Locally soft and saturated													
	14.20-14.50m Includes fine to cobble, angular gravels of weathered basalt.													
	14.55m gravelly CLAY; light brown mottled red, white and black, non plastic to low plasticity, minor silt and fine sand, relict crystalline textures, fine to medium, subangular to angular gravel, breaks down to non-plastic silt; stiff, wet.	SONIC	100											
	15.15m silty CLAY; brown-red, low plasticity, rare fine black sand (crystals); rare fine to medium angular, black basalt gravel and red, yellow or orange-brown mottling; stiff, moist.	SPT	0											
		SPT	100											
	16.72-17.02m SPT disturbance.	SONIC	0											
	17.02m Locally with some white, fine, angular gravels (crystals)	SONIC	100											
		SPT	0											
	18.24m Becoming very stiff.	SPT	0											
	18.78m Extremely to highly weathered ROCK; red-brown mottled black, yellow and orange, crystalline texture, massive, highly fractured, breaks down to clayey GRAVEL with some silt, strong, moist	SONIC	100											
	19.27m Moderately weathered ROCK; orange-brown mottled black, 0-30mm defect spacing, very strong, moist.													
	20.60m Unweathered ROCK, black basalt, 10-50mm defect spacing, extremely strong, moist	SPT	0											
	21.28m													

COMMENTS: ALL SPT 'N' VALUES ARE UNCORRECTED.

Survey method: GPS (NZTM)