# RDAgritech ENGINEERED BY NATURE



16 January 2018

Job Number: 50595

RICHARD NEWMAN C\- CLARK FORTUNE MCDONALD AND ASSOCIATES PO BOX 553 QUEENSTOWN CHANSEN@CFMA.CO.NZ

### STORMWATER DISPOSAL ASSESSMENT

Dear Richard,

RDAgritech were requested to write this letter providing an assessment of stormwater disposal at a proposed subdivision on McDonnell Road, Arrowtown. Richard Newman engaged RDAgritech in a signed Short Form Agreement dated 6 December 2017.

A 13 Lot residential subdivision is proposed on McDonnell Road, Arrowtown that requires a stormwater disposal assessment which will be included in the subdivision Resource Consent. The scope of work required to conduct an onsite stormwater disposal assessment included:

- A nominal 12 hand auger boreholes and associated permeameter testing.
- Reporting on the soil permeability across the lots. This would be suitable for Resource Consent and future Building Consent applications for each dwellings soakage pit sizing.

#### SITE INVESTIGATION

The site investigation and permeameter testing was conducted on 18 December 2017. Seven permeameter tests were conducted across the proposed subdivision and indicated variable results.

The attached site investigation plan indicates the locations where the permeameter testing was conducted. The topography of the site and site specific geotechnical investigation report provided an indication to the locations of varying units.

The site investigation identified three main units with variable soakage. Soakage testing was not conducted within the topsoil layer.

The geology across the site consists of:

- 0.0 0.3m Topsoil
  - o SILT; dark brown; moist; organic
- 0.1 0.5m Loess
  - o SILT; light brown; massive; no organics present; dry
- 0.3 >2.9m Alluvial Deposit
  - Sandy Cobbly GRAVEL; grey/brown; medium to coarse grain sand; fine to coarse sub angular to sub rounded gravel; sub angular to sub rounded cobbles
- 0.3 >3.3m Sand and Silt Alluvium
  - o SAND; grey; fine grain sand; massive; very dense and SILT; brown; massive; medium dense

## RESULTS

The results in Table 1 indicate the permeability/soakage of each test location conducted across the site. TABLE 1 TEST LOCATION AND ASSOCIATED PERMEABILITY

TEST NUMBER (SK)	LOT NUMBER	SOIL TESTED	DEPTH TESTED (M)	SOAKAGE (MM/HOUR)	FACTOR OF SAFETY OF 2.0
1	14	ALLUVIAL DEPOSIT	0.45 – 0.75	65	32.5
2	2	LOESS	0.2 – 0.5	27	13.5
3	13	LOESS	0.2 – 0.5	28	14
4	9	LOESS	0.2 – 0.5	22	11
5	6	LOESS	0.35 – 0.65	18	9
6	11	SILT ALLUVIUM	0.2 – 0.5	0	0
7	13	LOESS	0.2 – 0.5	81	40.5

The results indicate the three varying soil units tested have considerably differing soakage. SK1 conducted into the Alluvial Deposit indicates it is the unit with the greatest soakage. The following tests were not conducted into the Alluvial Deposit as the auger was either unable to penetrate through cobbles within the unit or the gravelly material would collapse into the auger hole.

The Loess material had consistent moderate soakage in four tests across the site. An outlier value was gained within SK7 which indicated a permeability value of 81 mm/hour in the Loess material.

SK6 was conducted into the Silt Alluvium material which indicated no soakage after 15 minutes of a static water level in the hole.

Factor of Safety of 2.0 has been applied as the rate of soakage determined through a soakage test should have an appropriate reduction factor applied to accommodate loss of performance over time in accordance with Section 4.4.7.9 of the QLDC Land Development and Subdivision Code of Practice.

## DISCUSSION AND RECOMMENDATIONS

As indicated in Table 1 above, the soakage of the three units tested was variable across the site.

Due to the high soakage value indicated in SK7, it is likely that the base of the borehole that the permeameter test was conducted in exposed the underlying Alluvial Deposit, this is the reasoning for the increased soakage value.

It is recommended that stormwater from each lot disposes into the Alluvial Deposit which is located directly below the Loess material. Disposing into the Alluvial Deposit will ensure the volume of the required soakage pits remain as minimal as possible.

Each site has a portion of the Alluvial Deposit present in some locations at varying depths. The depth of Alluvial Deposit, height of areas requiring drainage and the required stormwater pipe fall, dictates the depth of soakage pit required. Table 2 below indicates the recommended depth of soak pit base below the surface to ensure Alluvial Deposits are encountered for disposal. Note that the depth of Alluvial Deposits may vary across each Lot compared to the depth encountered in each test pit location.

LOT	TEST PIT	DEPTH TO ALLUVIAL DEPOSIT (M)
2	2	0.4
4	9	0.7
5	9	0.7
6	9	0.7
7	6 & 5	0.4
8	5	0.4
9	4	0.3
10	7	0.2
11	8	NO SOAKAGE
12	3	0.4
13	3	0.4
14	1	0.6

TABLE 2 INDICATES DEPTH TO ALLUVIAL DEPOSIT DETERMINED FROM TEST PITS CONDUCTED

Due to the lack of soakage into the Silt Alluvium, it is recommended that stormwater disposal is not conducted into that particular unit.

Shallow groundwater was exposed within the depression through Lot 7, 8, 10, 11 and 12. It is recommended that stormwater is not disposed into the low lying depression area as groundwater has the potential to inundate the specified soak pit. As indicated on the attached site investigation plan, Lot 11 is indicated to be positioned within poor draining silt alluvium within the low lying depression. It is recommended that a specific design is conducted for stormwater disposal in Lot 11 which could include stormwater harvesting systems or a detention system.

## CONCLUSIONS

Based on the permeability results encountered across the site, there are soils across the subdivision suitable for residential stormwater disposal. Due to the depression throughout the northern portion of the site, it is suggested that the recommendations within the previous sections of this report are adhered to, to ensure a suitable stormwater disposal area is selected.

### APPLICABILITY

This report is only to be used by the parties named above for the purpose that it was prepared and shall not be relied upon or used for any other purpose without the express written consent of the principal and RDAgritech Ltd.

The extent of testing associated with this assessment is limited to discrete locations and variations in ground conditions can occur between and away from such locations. If subsurface conditions encountered during construction differ from those given in this report further advice should be sought without delay.

Yours sincerely

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Ollie Behrent Engineering Geologist

Reviewed by: Alan Hopkins

Attachments: Site Investigation Plan, Permeameter and Borehole Logs SK1-SK7/BH1-BH7, Test Logs TP1-9





Engineering firm: RDAGRITECH LTD PO BOX 1880 QUEENSTOWN Client: Richard Newman C/- Clark Fortune McDonald and Associates Sheet Title:Newman Subdivision Geotech Stormwater Assessment Plan RDAgritech OMB 16/01/18 Scale: NTS

Job No: 50595

Project:	Newman Subdivision Geotech				
Site Location:	McDonnell Road				
Test Number:	SK-1 in BH-1		Test Date:	14-Dec-17	
Operator:	OMB		Test Time:	9:00 a.m.	
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm	
Depth of Auger	Hole:	0.5	Average Hole Ø:	11.5 cm	



### Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	Silt; dark brown; organic	М	Topsoil	none
0.1	ψψψψψψ				
	ψψψψψψ				
0.2	*****	SILT; light brown; moist		Loess	
	*****				
0.3	*****				
	*****				
0.4	*****				
	x.oox.oox.oo	Silty Sandy GRAVEL; light brown; fine to medium grain sand; fine		Alluvial Gravel	
0.5	x.oox.oox.oo	to coarse angular gravel			
	x.oox.oox.oo				
0.6	x.oox.oox.oo				
	x.oox.oox.oo				
0.7		Borehole unable to be conducted as pit walls collapsing			
$\frac{4.4Q}{K_{sat}} = \frac{4.4Q}{K_{sat}}$	$\frac{1.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\frac{2\pi H^2}{65}\right\}}$	$\frac{\left(\frac{r}{H^2}\right) + 0.25}{mm/hr}$			

	0-			
Time	∆ Time (hr)	Water Level (mm)	∆ Water Level (mm)	Permeameter test was conducted between 0.45m and 0.75m Water Level in hole 300mm
4:51:00 p.m.	0	785	0	Δ Water Level
4:51:30 p.m.	0:00:30	748	37	7 60
4:52:00 p.m.	0:00:30	712	36	5
4:52:30 p.m.	0:00:30	676	36	5 50
4:53:00 p.m.	0:00:30	636	40	
4:53:30 p.m.	0:00:30	600	36	
4:54:00 p.m.	0:00:30	556	44	
4:54:30 p.m.	0:00:30	514	42	2 30
4:55:00 p.m.	0:00:30	470	44	1
4:55:30 p.m.	0:00:30	425	45	5 20
4:56:00 p.m.	0:00:30	376	49	a la
4:56:30 p.m.	0:00:30	322	54	10
				4.5 <sup>1</sup> ,0 <sup>2</sup> ,1 <sup>3</sup> ,0 <sup>2</sup>

Project:	Newman Subdivision Geotech				
Site Location:	McDonnell Road				
Test Number:	SK-2 in BH-2		Test Date:	14-Dec-17	
Operator:	OMB		Test Time:	9:15 a.m.	
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm	
Depth of Auger	Hole: (	0.5	Average Hole Ø:	11.5 cm	



Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	SILT; dark brown; organic	М	Topsoil	none
0.1	ψψψψψψ				
	ψψψψψψ				
0.2	ΨΨΨΨΨΨ				
	*****	SILT; light brown; massive; no organics present	D	Loess	
0.3	*****				
	*****				
0.4	*****				
	*****				
0.5	*****				
0.6		End of Borehole			
0.7					
<b>4.4</b> <i>Q</i> <i>K</i> <sub>sat</sub> =	$0.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{2\pi H^2}$	$\frac{\left(\frac{r}{H^2}\right) + 0.25}{\text{mm/hr}} + \frac{r}{H}$			

#### Permeameter Readings Water Level ∆ Water Level Time ∆ Time (hr) Permeameter test was conducted between 0.2m and 0.5m Water Level in hole 300mm (mm) (mm) 9:15:00 a.m. 0 1175 0 ∆ Water Level 35 9:15:15 a.m. 0:00:15 1150 25 0:00:15 9:15:30 a.m. 1125 25 30 0:00:15 9:15:45 a.m. 1100 25 9:16:00 a.m. 0:00:15 1080 20 25 9:16:15 a.m. 0:00:15 1060 20 20 9:16:30 a.m. 0:00:15 1035 25 9:16:45 a.m. 0:00:15 25 1010 15 9:17:00 a.m. 0:00:15 25 985 9:17:15 a.m. 0:00:15 20 965 10 9:17:30 a.m. 0:00:15 940 25 9:17:45 a.m. 0:00:15 915 25 5 0:00:15 9:18:00 a.m. 885 30 0 9:18:15 a.m. 0:00:15 20 865 9:15:45 a.m. 9:15:15 a.m. 9:15:30 a.m. 9:16:00 a.m. 9:16:15 a.m. 9:17:15 a.m. 9:17:30 a.m. 9:17:45 a.m. 9:16:30 a.m. 9:16:45 a.m. 9:17:00 a.m. 9:18:00 a.m. 9:18:15 a.m. 9:18:30 a.m. 9:19:00 a.m. 9:18:45 a.m. 0:00:15 9:18:30 a.m. 845 20 0:00:15 9:18:45 a.m. 825 20 9:19:00 a.m. 0:00:15 803 22

Project:	Newman Subdivision Geotech				
Site Location:	McDonnell Road				
Test Number:	SK-3 in BH-3		Test Date:	14-Dec-17	
Operator:	OMB		Test Time:	9:30 a.m.	
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm	
Depth of Auger	Hole: (	0.5	Average Hole Ø:	11.5 cm	



Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	SILT; dark brown; organic	М	Topsoil	none
0.1	ψψψψψψ				
	ψψψψψψ				
0.2	ΨΨΨΨΨΨ				
	*****	SILT; light brown; massive; no organics present	D	Loess	
0.3	*****				
	*****				
0.4	*****				
	*****				
0.5	*****				
0.6		End of Borehole			
0.7					
$\frac{4.4Q}{K_{sat}} = \frac{4.4Q}{K_{sat}}$	$\frac{0.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{2\pi H^2}}{2\pi H^2}$	$\frac{\left(\frac{r}{H^2}\right) + 0.25}{mm/hr}$			

#### Permeameter Readings Water Level ∆ Water Level Time ∆ Time (hr) Permeameter test was conducted between 0.2m and 0.5m Water Level in hole 300mm (mm) (mm) 9:30:00 a.m. 0 1100 0 ∆ Water Level 45 9:30:15 a.m. 0:00:15 1060 40 0:00:15 9:30:30 a.m. 1030 30 40 0:00:15 9:30:45 a.m. 1000 30 35 9:31:00 a.m. 0:00:15 970 30 30 9:31:15 a.m. 0:00:15 940 30 9:31:30 a.m. 0:00:15 915 25 25 0:00:15 9:31:45 a.m. 885 30 20 0:00:15 20 9:32:00 a.m. 865 15 9:32:15 a.m. 0:00:15 20 845 9:32:30 a.m. 0:00:15 25 820 10 9:32:45 a.m. 0:00:15 800 20 5 0:00:15 9:33:00 a.m. 775 25 0 9:33:15 a.m. 0:00:15 750 25 9:30:15 a.m. 9:30:30 a.m. 9:30:45 a.m. 9:31:15 a.m. 9:31:30 a.m. 9:32:15 a.m. 9:32:30 a.m. 9:32:45 a.m. 9:33:30 a.m. 9:33:45 a.m. 9:31:00 a.m. 9:31:45 a.m. 9:32:00 a.m. 9:33:00 a.m. 9:33:15 a.m. 9:34:00 a.m. 9:34:15 a.m. 0:00:15 9:33:30 a.m. 730 20 9:33:45 a.m. 0:00:15 715 15 9:34:00 a.m. 0:00:15 690 25 9:34:15 a.m. 0:00:15 665 25

Project:	Newman Subdivision Geotech				
Site Location:	McDonnell Road				
Test Number:	SK-4 in BH-4		Test Date:	14-Dec-17	
Operator:	OMB		Test Time:	9:45 a.m.	
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm	
Depth of Auger	Hole: (	0.5	Average Hole Ø:	11.5 cm	



Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	SILT; dark brown; organic	М	Topsoil	none
0.1	ψψψψψψ				
	ΨΨΨΨΨΨ				
0.2	ψψψψψψ				
	*****	SILT; light brown; massive; no organics present	D	Loess	
0.3	*****				
	*****				
0.4	*****				
	*****				
0.5	*****				
0.6		End of Borehole			
0.7					
$K_{sat} = \frac{4.4Q}{K_{sat}}$	$0.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{2\pi H^2}$	$\left[\left(\frac{r}{H^2}\right) + 0.25\right] + \frac{r}{H}$ mm/hr			

Fermeanieter	leaungs				
Time	∆ Time (hr)	Water Level (mm)	∆ Water Level (mm)	Permeam	eter test was conducted between 0.2m and 0.5m Water Level in hole 300mm
9:45:00 a.m.	0	930	0		Δ Water Level
9:45:15 a.m.	0:00:15	910	20	25 -	
9:45:30 a.m.	0:00:15	890	20		
9:45:45 a.m.	0:00:15	870	20	20 -	•••••
9:46:00 a.m.	0:00:15	850	20		
9:46:15 a.m.	0:00:15	830	20	45	
9:46:30 a.m.	0:00:15	810	20	15 -	
9:46:45 a.m.	0:00:15	790	20		
9:47:00 a.m.	0:00:15	775	15	10 -	
9:47:15 a.m.	0:00:15	758	17		
9:47:30 a.m.	0:00:15	740	18	5 -	
9:47:45 a.m.	0:00:15	725	15		
9:48:00 a.m.	0:00:15	709	16		
9:48:15 a.m.	0:00:15	690	19	0 -	
9:48:30 a.m.	0:00:15	675	15		
9:48:45 a.m.	0:00:15	657	18		15         330         33
9:49:00 a.m.	0:00:15	640	17		9:45: 9:45: 9:46: 9:46: 9:46: 9:47: 9:47: 9:47: 9:47: 9:47: 9:48: 9:48: 9:48: 9:48: 9:48: 9:48: 9:48:

Project:	Newman Subdivision Geotech						
Site Location:	McDonnell Road						
Test Number:	SK-5 in BH-5		Test Date:	14-Dec-17			
Operator:	OMB		Test Time:	10:00 a.m.			
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm			
Depth of Auger	Hole:	0.65	Average Hole Ø:	11.5 cm			



Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	SILT; dark brownl; organic	М	Topsoil	none
0.1	ΨΨΨΨΨΨ				
	ΨΨΨΨΨΨ				
0.2	ΨΨΨΨΨΨ				
	ΨΨΨΨΨΨ				
0.3	ΨΨΨΨΨΨ				
	ΨΨΨΨΨΨ				
0.4	ψψψψψψ				
	ΨΨΨΨΨΨ				
0.5	XXXXXXXXXX	SILT; light brown; massive	D	Loess	
	*****				
0.6	*****				
	*****				
0.7		End of Borehole			
$K_{sat} = \frac{4.4Q}{M}$ Ksat =	$\frac{1.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\frac{2\pi H^2}{18}\right\}}$	$\frac{\left(\frac{r}{H^2}\right) + 0.25}{\text{mm/hr}} + \frac{r}{H}$			

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Time	∆ Time (hr)	Water Level (mm)	∆ Water Level (mm)	Permeamet	er test was conducted between 0.35m and 0.65m	Water Level in hole 300mm					
10:00:00 a.m.	0	854	0		Δ Water Level						
10:00:15 a.m.	0:00:15	844	10	20 -							
10:00:30 a.m.	0:00:15	828	16	18 -		<b>p</b>					
10:00:45 a.m.	0:00:15	814	14	16 -		/					
10:01:00 a.m.	0:00:15	800	14	14 -							
10:01:15 a.m.	0:00:15	790	10	10							
10:01:30 a.m.	0:00:15	778	12	12 -							
10:01:45 a.m.	0:00:15	762	16	10 -	• •						
10:02:00 a.m.	0:00:15	750	12	8 -							
10:02:15 a.m.	0:00:15	738	12	6 -							
10:02:30 a.m.	0:00:15	724	14	Δ -							
10:02:45 a.m.	0:00:15	712	12	2							
10:03:00 a.m.	0:00:15	694	18	2 -							
				0 -		· · · · · ·					
				10:00:15	0,00,00,00,000,000,000,000,000,000,000	15 a.M. a.M. 4000 a.M.					

Project:	Newman Subdivision Geotech						
Site Location:	McDonnell Road						
Test Number:	SK-6 in BH-6		Test Date:	14-Dec-17			
Operator:	OMB		Test Time:	10:15 a.m.			
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm			
Depth of Auger	Hole: (	0.5	Average Hole Ø:	11.5 cm			



Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	SILT; dark brown; organic; 50 mm rootlets	М	Topsoil	none
0.1	ΨΨΨΨΨΨ				
	ΨΨΨΨΨΨ				
0.2	ΨΨΨΨΨΨ				
	XXXXXXXXXX	SILT; light brown; massive; rootlets throughout		Silt Alluvium	
0.3	XXXXXXXXXX				
	XXXXXXXXXX				
0.4	*****				
	XXXXXXXXXX				
0.5	XXXXXXXXXX				
0.6	comment	End of Borehole Unable to drain. Dispose stormwater into gravels located within Test Pit 7			
$\kappa_{sat} = \frac{4.4Q}{K_{sat}}$	$\frac{0.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{2\pi H^2}}{2\pi H^2}$	$\left[\left(\frac{r}{H^2}\right) + 0.25\right] + \frac{r}{H}$ mm/hr			

Time	∆ Time (hr)	Water Level (mm)	∆ Water Level (mm)	Permeamet	ter test was conducted between 0.2m and 0.5m	Water Level in hole 300mm
10:15:00 a.m.	0	1100	0		A Water Level	
10:15:15 a.m.	0:00:15	1100	0	1 -		
10:15:30 a.m.	0:00:15	1100	0	0.9 -		
10:15:45 a.m.	0:00:15	1100	0	0.8 -		
10:16:00 a.m.	0:00:15	1100	0	0.7		
10:16:15 a.m.	0:00:15	1100	0	0.7		
10:16:30 a.m.	0:00:15	1100	0	0.6 -		
10:16:45 a.m.	0:00:15	1100	0	0.5 -		
10:17:00 a.m.	0:00:15	1100	0	0.4 -		
10:17:15 a.m.	0:00:15	1100	0	0.3 -		
10:17:30 a.m.	0:00:15	1100	0	02 -		
10:17:45 a.m.	0:00:15	1100	0	0.2		
				0.1 -		
				0 -		●᠇●᠇●᠇●᠇
				10:15:00	arti 10.15 arti 10.15 40.00 arti 10.16 10.16 10.16 10.17	0°21.1521.13021.4521.1

Project:	Newman Subdivision Geotech						
Site Location:	McDonnell Road						
Test Number:	SK-7 in BH-7		Test Date:	14-Dec-17			
Operator:	OMB		Test Time:	10:30 a.m.			
Auger Ø:	10 cm		Permeameter Ø ID:	4.2 cm			
Depth of Auger	Hole: (	0.5	Average Hole Ø:	11.5 cm			



Auger Log

DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	GROUND WATER
	ψψψψψψ	SILT; dark brown; organic	М	Topsoil	none
0.1	ψψψψψψ				
	ΨΨΨΨΨΨ				
0.2	ψψψψψψ				
	*****	SILT; light brown; massive; no organics present	D	Loess	
0.3	*****				
	XXXXXXXXXXXX				
0.4	*****				
	*****				
0.5	*****				
0.6	comment	End of Borehole			
0.7					
$K_{sat} = \frac{4.4Q}{K_{sat}}$	$\frac{0.5 \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left\{\frac{2\pi H^2}{81}\right\}}$	$\frac{\left(\frac{r}{H^2}\right) + 0.25}{mm/hr}$			

Time	∆ Time (hr)	Water Level (mm)	∆ Water Level (mm)	Permeame	ter test was conducted between 0.2m and 0.5m	Water Level in hole 300mm			
10:30:00 a.m.	0	1100	0		Δ Water Level				
10:30:15 a.m.	0:00:15	1000	100	120 -					
10:30:30 a.m.	0:00:15	930	70						
10:30:45 a.m.	0:00:15	860	70	100 -	•				
10:31:00 a.m.	0:00:15	790	70						
10:31:15 a.m.	0:00:15	720	70	80 -					
10:31:30 a.m.	0:00:15	655	65						
10:31:45 a.m.	0:00:15	590	65	60 -		<b>* `` `` `` • • • •</b>			
10:32:00 a.m.	0:00:15	530	60						
10:32:15 a.m.	0:00:15	460	70	40 -					
10:32:30 a.m.	0:00:15	400	60						
10:32:45 a.m.	0:00:15	340	60	20 -					
10:33:00 a.m.	0:00:15	280	60						
				0 -		· · · · · · · · · · · · · · · · · · ·			
				10:30:15	a.n. a.n. 4 a.n. a.n. 40.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31.10.31	1,123,17,123,11,123,10,2,11, 10,31,30,21,11,2,11,123,10,2,11,			

		TP-	-1		TEST PIT LOG		A . • . 1
JOB	NUM	BER:	5059	95 PRO.	ECT: Newman Subdivision Geotech	<b>U</b>	Agritech
<u> </u>				LOC	ATION: McDonnell Road, Arrowtown		ENGINEERED BY NATURE
CO-C		NATES:					
FLFV		N:	one Pidii		m OPERATOR: Luke		
DAT	JM:				COMPANY: C'n'R Earthwork	EQU	IIP.: 8T excavator
			EI	NGINEERING	DESCRIPTIONS		GEOLOGICAL
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION
				ΨΨΨΨΨΨ	SILT; brown; organic; 50 mm rootlets throughout, organic	D	Topsoil
				xxxxxxxxx	SILT; light brown; massive; rootlets throughout; medium dense to		Loess Colluvium
			0.4	XXXXXXXXXX XXXXXXXXXX			
				xxxxxxxxx xOooxOoo	Silty cobbly GRAVEL; light brown; fine to coarse, sub angular to su	5	Alluvial Deposit
			0.8	xOooxOoo	rounded gravel; sub angular to sub rounded cobbles; very dense		
				x0oox0oo			
			1.2	x0oox0oo	Sandy Cobbly GRAVEL: grey/brown: medium to coarse grain sand		Alluvial Deposit
				.000.000.	fine to coarse sub angular to sub rounded gravel; sub angular to		
				.000.000. .000.000.	sub rounded cobbles		
			1.6	.000.000.			
				.000.000. .000.000.			
			2.0	.000.000.			
			2.0	.000.000. .000.000.			
				.000.000.			
			2.4	.000.000.	End of test pit, unable to excavate further due to sides of test pit		
			2.8		collapsing		
			3.2				
			2.6				
отн	ER CC	DMMENTS	:	_		Logg	ed By: MJD
						Chec	ked Date: 13-Feb-18
PHO	to re	EF.:				Shee	et: 1 of 1

		TP-	-2		TEST PIT LOG	D		
JOB	NUM	BER:	5059	95 PRO.	IECT: Newman Subdivision Geotech	R	D	Agritech
<u> </u>				LOCA	ATION: McDonnell Road, Arrowtown		I	ENGINEERED BY NATURE
CO-C		NATES:	Sito Plan		HOLE STARTED: 14-Dec-17			
FLEV		N·	one Pidii		m OPERATOR: Luke			
DAT	JM:				COMPANY: C'n'R Earthwor	k	EQU	IP.: 8T excavator
			EI	NGINEERING	G DESCRIPTIONS	<u> </u> !		GEOLOGICAL
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOU WEATHERING, SECONDARY AND MINOR COMPONEN	JR, ITS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION
				ψψψψψψ	SILT; brown; organic; 50 mm rootlets throughout, organic		D	Topsoil
				ΨΨΨΨΨΨ xxxxxxxx	SILT; light brown; massive; rootlets throughout; medium d	ense		Loess Colluvium
			0.4		Cilty apply CDAVEL light browns find to operate sub-operation	ar to cub		Allunial Danasit
				x000x000	rounded gravel; sub angular to sub rounded cobbles; medi		Alluvial Deposit	
			0.8	.000.000.	Sandy Cobbly GRAVEL; grey/brown; medium to coarse grai		Alluvial Deposit	
				.000.000.	sub rounded cobbles; medium dense to very dense			
				.000.000. 000.000				
			1.2	.000.000.				
				.000.000.				
				.000.000.				
			1.6	.000.000. 000.000				
				.000.000.				
			2.0	.000.000.				
				.000.000.				
				.000.000. .000.000.				
			2.4	.000.000.				
				.000.000.	End of test pit, unable to excavate further due to test pit w	alls		
			2.0		collapsing	ano		
			2.8					
			3.2					
			3.6					
			4.0			' I		
			<del>.</del>					
OTH	ER CC	DMMENTS	:				Logge	ed By: MJD
							Chec	ked Date: 13-Feb-18
PHO	to re	EF.:					Shee	et: 1 of 1

		TP-	-3		TES	ST PIT L	.OG	D	D	A
JOB	NUM	BER:	5059	95 PRO	JECT:	Newman Subdivis	on Geotech	K	D	Agritech
				LOC	ATION:	McDonnell Road,	Arrowtown		E	ENGINEERED BY NATURE
CO-ORDINATES: HOLE STARTED: 14-Dec-17										
FLFV		N:	one Pidii		m	OPERATOR:	Luke			
DAT	JM:					COMPANY:	C'n'R Earthwo	rk	EQUI	IP.: 8T excavator
			E	NGINEERIN	G DESCRIPTION	NS				GEOLOGICAL
STRENGTH TESTING	STRENGTH TESTING GROUNDWATER SAMPLES DEPTH (m) GRAPHIC LOG			PARTICL WEATHE	SOIL / ROCK CLA E SIZE CHARACTERIS RING, SECONDARY A	SSIFICATION, FICS,PLASTICITY, COLO ND MINOR COMPONE	UR, NTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	
				ΨΨΨΨΨΨ ΨΨΨΨΨΨ	SILT; brown; or	rganic; 50 mm rootle	ts throughout, organic		D	Topsoil
			0.4	xxxxxxxxx	SILT; light brow	vn; massive; rootlets	throughout; medium o	lense		Loess Colluvium
			0.4	xxxxxxxx xOooxOoo xOooxOoo xOooxOoo xOooxOoo	xxxxxxx DooxOoo Silty cobbly GRAVEL; light brown; fine to coarse, sub angular to sub rounded gravel; sub angular to sub rounded cobbles; medium dense to dense DooxOoo DooxOoo					Alluvial Deposit
			1.2	.000.000 .000.000. .000.000. .000.000.	Sandy Cobbly ( fine to coarse s sub rounded co	GRAVEL; grey/brown sub angular to sub rc obbles; medium den		Alluvial Deposit		
			2.0	.000.000.	End of test pit, collapsing	, unable to excavate t	urther due to test pit v	valls		
			2.4							
			2.8							
			3.2							
			3.6							
<u>ст.</u>										
OTH	ек сс	JIVIIVIENTS							Logge	ed By: MJD
PHO	to re	EF.:							Shee	t: 1 of 1

TP-4					TEST PIT LOG	D	D	A
JOB NUMBER: 50595 CO-ORDINATES:				95 PRO. LOC/	JECT: Newman Subdivision Geotech ATION: McDonnell Road, Arrowtown HOLE STARTED: 14-Dec-17	K	L I	Agritech ENGINEERED BY NATURE
Refer Investigation Site Plan HOLE FINISHED: 14-Dec-17								
ELEV	ATIO	N:			m OPERATOR: Luke			
DAT	JM:				COMPANY: C'n'R Earthwo	rk	EQUI	IP.: 8T excavator
			13	NGINEERING	G DESCRIPTIONS			GEOLOGICAL
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOU WEATHERING, SECONDARY AND MINOR COMPONEI	JR, NTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION
				ΨΨΨΨΨΨ ΨΨΨΨΨΨ	SIL1; brown; organic; 50 mm rootlets throughout, organic		D	Topsoil
				xxxxxxxx	SILT; light brown; massive; rootlets throughout; medium d	ense		Loess Colluvium
			0.4	xOooxOoo xOooxOoo	Silty cobbly GRAVEL; light brown; fine to coarse, sub angul rounded gravel; sub angular to sub rounded cobbles; dens	ar to sub e		Alluvial Deposit
			0.8	.000.000. .000.000. .000.000.	Sandy Cobbly GRAVEL; grey/brown; medium to coarse gra fine to coarse sub angular to sub rounded gravel; sub angu sub rounded cobbles; medium dense to very dense	in sand; ılar to		Alluvial Deposit
			1.2	.000.000. .000.000. .000.000. .000.000.				
			1.6	.000.000. .000.000. 000.000				
			2.0	.000.000. .000.000.	End of test pit unable to excavate further, test pit walls co	ollansing		
						Judpanig		
			2.4					
			2.8					
			3.2					
			3.6					
			4.0					
отн	ER CC	OMMENTS:					Logge	ed By: MJD
							Check	ked Date: 13-Feb-18
PHO	to re	F.:		Shee	t: 1 of 1			

TP-5					TEST PIT LOG	D		A	
JOB	NUM	BER:	5059	95 PRO	PROJECT: Newman Subdivision Geotech				
				LOC	ATION: McDonnell Road, Arrowtown		ł	ENGINEERED BY NATURE	
CO-0	DRDIN	ATES:			HOLE STARTED: 14-Dec-17				
Refe	r Inve	estigation S	Site Plan		HOLE FINISHED: 14-Dec-17				
ELEV	ATIO	N:							
DAT	JM:				COMPANY: C'n'R Earthwol	rk	EQU	IP.: 8T excavator	
			EI	NGINEERIN	G DESCRIPTIONS			GEOLOGICAL	
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOU WEATHERING, SECONDARY AND MINOR COMPONE!	JR, NTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	,
				ΨΨΨΨΨΨ	SILT; brown; organic; 50 mm rootlets throughout, organic		D	Topsoil	
			0.4	xxxxxxxxx	SILT; light brown; massive; rootlets throughout; medium d	ense		Loess Colluvium	
			0.4	xxxxxxxxx xOooxOoo xOooxOoo xOooxOoo xOooxOoo	Silty cobbly GRAVEL; light brown; fine to coarse, sub angul rounded gravel; sub angular to sub rounded cobbles; dens	ar to sub e		Alluvial Deposit	
			1.2	x0oox0oo .0oo.0oo. .0oo.0oo. .0oo.0oo. .0oo.0oo	Sandy Cobbly GRAVEL; grey/brown; medium to coarse gra fine to coarse sub angular to sub rounded gravel; sub angu sub rounded cobbles; dense to very dense	in sand; ılar to		Alluvial Deposit	
			1.6	.000.000. .000.000. .000.000. .000.000.					
			2.0	.000.000. .000.000. .000.000. .000.000.					
			2.8	.000.000. .000.000.					
			3.2	.000.000.	End of test pit, unable to excavate further due to boulder i of test pit	n base			
			3.6						
			4.0						
OTH	ER CC	DMMENTS	:				Logge	ed By: MJD	
							Checl	ked Date: 13-Feb-18	
PHO	to re	EF.:					Shee	t: 1 of 1	

TP-6					TEST PIT LOG		A . • 1	
1 BOL	NUM	BER:	5059	95 PRO	JECT: Newman Subdivision Geotech	KD	Agritech	
LOC					ATION: McDonnell Road, Arrowtown		ENGINEERED BY NATURE	
CO-C	RDIN	IATES:			HOLE STARTED: 14-Dec-17			
Refe	r Inve	stigation S	ite Plan		HOLE FINISHED: 14-Dec-17			
ELEV	ATIO	N:			m OPERATOR: Luke			
DATI	JM:				COMPANY: C'n'R Earthwork	EQU	JIP.: 8T excavator	
			EI	NGINEERIN	G DESCRIPTIONS		GEOLOGICAL	
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN DEFECTS, STRUCTURE, FORMATION	Ν,
		1	1	ΨΨΨΨΨΨ	SILT; brown; organic; 50 mm rootlets throughout, organic	D	Topsoil	Τ
					Silty GRAVEL; light brown; fine to coarse, sub angular to sub	M	Alluvial Deposit	-
			0.4	хоохоохоо	ounded gravel; medium dense			4
				XXXXXXXXXX XXXXXXXXX	SILT; brown; massive; medium dense		Silt Alluvium	
				XXXXXXXXXX				
			0.8	****				
				XXXXXXXXX				
				XXXXXXXXXX				
			1.2	XXXXXXXXX XXXXXXXXXX				
				XXXXXXXXXX				
				*****				
	_		1.6	XXXXXXXXXX				
	$\vee$		1.0	XXXXXXXXX	SAND: grey; fine grain sand; massive; very dense	w	Sand Alluvium	4
			2.0					
			24		End of test pit, unable to excavate further due to possibly encountering bedrock. Base of test pit not visible as groundwat	er		
			2		INNOW occurred			
			2.8					
			3.2		the state of the state			
			3.6					
					A Rever by Common and C			
			4.0					
OTH	ER CC	) MMENTS:		J	1	Logg	jed By: MJD	
						Chec	cked Date: 13-Feb-18	
PHO <sup>-</sup>	ΓO RE					Shee	et: 1 of 1	

UDB NUMBER:         10393         PROJECT:         Newman Subclivition Geoded.         Newman Subclivition Geoded.           CO-ORDINATFS:         HOLE FINISHED:         14-0e-17         Newman Subclivition Geoded.         Newman Subclivition Geoded.           DAILUM:         MOLE FINISHED:         14-0e-17         Newman Subclivition Geoded.         Newman Subclivition Geoded.           DAILUM:         m         COMPANY:         C/n/R Larthwork         COUPS: 81 excountor           S011/ RDCK F0 ASSERDATION, NUMBER:         Non-ORDINATY:         C/n/R Larthwork         COUPS: 81 excountor           9010 0000000000000000000000000000000000	TP-7					TEST PIT LOG			A
UDCATION: MCDONEI Road, Arrowwn         NOLNEERED BY NATURE           CO-ORDINATES: HOLF FINISTED: 14-Dec-17           HOLF FINISTED: 14-Dec-17           PERSINFERNO DESCRIPTIONS         OPERATOR: Luke           DATUM: CniR Earthwork FOULP : 8T excentre           OPERATOR: Luke           DATUM: CniR Earthwork FOULP : 8T excentre           OPERATOR: Luke           OPERATOR: CniR Earthwork FOULP : 8T excentre           OPERATOR: CniR Earthwork FOULP : 8T excentre           OPERATOR: CniR Earthwork FOULP : 8T excentre           OPERATOR: SECONDARY AND MINOR COMPORENTS           OPERATOR: SECONDARY AND MINOR COMPORENTS      OPERATOR: SECONDARY AND MINOR COMPORENTS           OPERATOR: SECONDARY AND MINOR COMPORENTS           OPERATOR: SECONDARY AND MINOR COMPORENTS           OPERATOR: SECONDARY AND MINOR COMPORENTS           OPERATOR: SECONDARY AND MINOR COMPORENTS           OPERATOR: SECONDARY AND MINOR COMPORENTS <td>JOB I</td> <td>NUM</td> <td>BER:</td> <td>5059</td> <td>95 PRO.</td> <td>ECT: Newman Subdivision Geotech</td> <td>K</td> <td>U,</td> <td>Agritech</td>	JOB I	NUM	BER:	5059	95 PRO.	ECT: Newman Subdivision Geotech	K	U,	Agritech
CO-ORDINATES:     HOLE STATED:     14-Dec-17       Refer Investigation Site Plan     HOLE HINSHLD:     14-Dec-17       MOLE HINSHLD:     Luke       DATUM:     C// REAT/DUAL     FQUIP: RT excavator       Image: State Dual Dual State Dual State Dual Du						TION: McDonnell Road, Arrowtown		E	ENGINEERED BY NATURE
Electrino         UNCLE TRUSHED:         14 dec.17           DATUM:         PERATOR:         Luke           DATUM:         C/MPANY:         C/MPANY:         C/MPANY:           DATUM:         ENCINEERING DESCRIPTIONS         EQUID: 8T excavator           USY 000000         If G         If G         G           USY 0000000         If G         If G         G         GEDL/ROCK CLASSFICATION, PARTICLE SIZE CHARACTERSTICS.PLASTICTY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS         If G         DIL/ ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION           USY 0000000         If G         If G <td>CO-C</td> <td>RDIN</td> <td>IATES:</td> <td></td> <td></td> <td>HOLE STARTED: 14-Dec-17</td> <td></td> <td></td> <td></td>	CO-C	RDIN	IATES:			HOLE STARTED: 14-Dec-17			
PHYANIDN:       ILKR         DATUM:       COMPANY:       CIN'R Farthwork       FQUIP: 8T excavator         OPENDING       ENGINEERING DESCRIPTIONS       GEOLOGICAL       GEOLOGICAL         OPENDING       Image: Source of the state of the st	Refe	r Inve	estigation S						
UNITY         EVENTION         EVENTION         EVENTION         Generation         Generation         Generation           1	ELEV DATI	ΑΠΟΙ	N:	/		ID · QT excellator			
Under Extinct Excision DECOMPTION 2         Operation 2 <t< td=""><td></td><td>JIVI.</td><td></td><td>FI</td><td></td><td></td><td></td><td>LUU</td><td></td></t<>		JIVI.		FI				LUU	
VIDUAD         USD 0000         USD 00000         USD 000000         USD 0000000         USD 00000000         USD 00000000         USD 00000000         USD 000000000000000000000000000000000000					VGINELINIA				GLOLOGICAL
Image: Construction of the second s	STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUF WEATHERING, SECONDARY AND MINOR COMPONENT	R, TS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION
0.4     Modewide Modewide Noombook Noomb					ψψψψψψ	SILT; brown; organic; 50 mm rootlets throughout, organic	1	D	Topsoil
0.4         x00x0000         dense to dense         afficiency         Alluvial Deposit           0.0         0.0         0.0         Socordoo         Alluvial Deposit         Alluvial Deposit           0.0         0.0         0.0         Socordoo         Socordoo         Alluvial Deposit           0.0         0.0         0.0         Socordoo         Socordoo         Alluvial Deposit           0.0         0.0         0.0         Socordoo         Socordoo         Socordoo           0.00         0.0         Socordoo         Socordoo         Socordoo         Alluvial Deposit           1.12         0.00.00         Socordoo         Socordoo         Socordoo         Socordoo           0.00.00         Socordoo         Socordoo         Socordoo         Socordoo         Socordoo           0.00.00         Socordoo         Socordoo         Socordoo         Socordoo         Socordoo           0.00.000         End of test pit, unable to excavate further due to dense material         Image: Socordoo         Socordoo         Socordoo           3.2         3.2         Image: Socordoo         Socordoo         Socordoo         Socordoo         Socordoo         Socordoo         Socordoo         Socordoo         Socordoo         Soc					ΨΨΨΨΨΨ xOooxOoo	Silty cobbly GRAVEL; light brown; fine to coarse, sub angula	r to sub		Alluvial Deposit
Image: Construction of the construction of				0.4	x0oox0oo x0oox0oo	rounded gravel; sub angular to sub rounded cobbles; mediu	ım		
0.8         x00xx00o         Sandy Cobbly GRAVEL; grey/brown; medium to coarse grain sand; -00x 00x0,					x0oox0oo	aense to aense			
Image: Constraint of the				0.8	xOooxOoo xOooxOoo				
1.0         .000.000.         fine to coarse sub angular to sub rounded gravel; sub angular to sub rounded cobbles; very dense         .000.000.           1.2         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .000.000.         .000.000.         .000.000.         .000.000.           .3.2         .3.6 <td< td=""><td></td><td></td><td></td><td></td><td>.000.000.</td><td>Sandy Cobbly GRAVEL; grey/brown; medium to coarse grain</td><td>n sand;</td><td></td><td>Alluvial Deposit</td></td<>					.000.000.	Sandy Cobbly GRAVEL; grey/brown; medium to coarse grain	n sand;		Alluvial Deposit
1.2       .000.000.         .000.000.					.000.000. .000.000.	fine to coarse sub angular to sub rounded gravel; sub angula sub rounded cobbles; very dense	ar to		
Image: Construction of the second o				1.2	.000.000.	· · · · · · · · · · · · · · · · · · ·			
1.6       .000.000. .000.000. .000.000. .000.000.					.000.000.				
1.3       .000.000.         .000.000.000.       .000.000.         .000.000.000.000.       .000.000.000.         .000.000.000.000.000.000.000.       .000.000.000.000.000.         .000.000.000.000.000.000.000.000.000.0				16	.000.000.				
Operation       Operation       Operation       Operation       Operation         Operation       Operation       Operation       Operation       Operation         2.4       Operation       Operation       Operation       Operation         2.4       Operation       Operation       Operation       Operation         3.2       3.6       Operation       Operation       Operation         3.6       3.6       Operation       Operation       Operation         OTHER COMMENTS:       Operation       Operation       Operation         PHOTO REF:       Operation       Operation       Operation				1.0	.000.000.				
2.0         .000.000.           2.4         End of test pit, unable to excavate further due to dense material           2.8					.000.000. 000.000.				
2.4       End of test pit, unable to excavate further due to dense material       Image: Constraint of the section of the				2.0	.000.000.				
2.8       3.2         3.2       3.6         4.0       4.0         OTHER COMMENTS:       Logged By:       MJD         Checked Date:       13-Feb-18         PHOTO REF:       Sheet:       1 of 1				24		End of test pit, unable to excavate further due to dense mat	terial		
2.8       3.2         3.6       3.6         4.0       4.0         OTHER COMMENTS:       Logged By:       MJD         Checked Date:       13-Feb-18         PHOTO REF:       Sheet:       1 of 1				2					
3.2     3.6       3.6     4.0       OTHER COMMENTS:     Logged By:       MID       Checked Date:     13-Feb-18       PHOTO REF:     Sheet:     1 of 1				2.8					
3.2     3.2       3.6     3.6       4.0     4.0         OTHER COMMENTS:     Logged By:     MJD         Checked Date:     13-Feb-18   PHOTO REF:									
3.6     3.6       4.0       OTHER COMMENTS:       Logged By:     MJD       Checked Date:     13-Feb-18       PHOTO REF:     Sheet:     1 of 1				3.2			The second secon		
3.6         3.6           4.0         4.0           OTHER COMMENTS:         Logged By:           MID           Checked Date:         13-Feb-18           PHOTO REF:         Sheet:         1 of 1									
3.6     4.0       4.0     4.0       OTHER COMMENTS:     Logged By:       MJD       Checked Date:     13-Feb-18       PHOTO REF:     Sheet:     1 of 1							-		
4.0     4.0       OTHER COMMENTS:     Logged By:       MJD       Checked Date:     13-Feb-18       PHOTO REF:     Sheet:     1 of 1				3.6					
4.0     4.0       OTHER COMMENTS:     Logged By:       MJD       Checked Date:     13-Feb-18									
OTHER COMMENTS: Logged By: MJD Checked Date: 13-Feb-18 PHOTO REF : Sheet: 1 of 1				4.0					
OTHER COMMENTS: Logged By: MJD Checked Date: 13-Feb-18 PHOTO REF : 1 of 1									
PHOTO REF ·	OTH	ER CC	)MMENTS:				ŀ	Logge	ed By: MJD
	рно-	TO RF						Checı Shee	ed Date: 13-۲ер-18 +- 1 of 1

TP-8					TEST PIT LOG	D			
JOB I	NUM	BER:	5059	95 PRO.	IECT: Newman Subdivision Geotech	K	D	Agritech	
				LOC	ATION: McDonnell Road, Arrowtown			ENGINEERED BY NATURE	
CO-C	RDIN	IATES:			HOLE STARTED: 14-Dec-17				
Reter	r Inve	stigation S	ite Plan		HOLE FINISHED: 14-Dec-17				
		N:		-k	FOU				
	JIVI.		FI			ĸ	LUL		
,		[						GLOLOGICAL	_
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOU WEATHERING, SECONDARY AND MINOR COMPONEN	JR, NTS	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION	
				ΨΨΨΨΨΨ	SILT; brown; organic; 50 mm rootlets throughout, organic		D	Topsoil	
					SILT; light brown; massive; rootlets throughout; dense to v	ery		Loess Colluvium	
			0.4	*****	dense				
	$\nabla$		0.8	XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXX					
					SAND; grey; fine grain sand; massive		W	Sand Allivium	
			1.2						
			1.6						
			2.0		End of test pit, test pit filled with groundwater to 800 mm	below			
					the surface whilst logging.				
			24						
			2.4						
			2.8						
			3.2						
			26						
			5.0						
			4.0						
ОТН	ER CC	) DMMENTS:	i :	<u> </u>			Logge	ed By: MJD	
	-						Chec	ked Date: 13-Feb-18	
PHO	to re	 EF.:			Shee	et: 1 of 1	_		

TP-9					TEST PIT LOG			A
JOB I	NUM	BER:	5059	95 PRO	IECT: Newman Subdivision Geotech	K	U,	Agritech
				LOC	ATION: McDonnell Road, Arrowtown		E	ENGINEERED BY NATURE
CO-C	DRDIN	IATES:			HOLE STARTED: 14-Dec-17			
Refe	r Inve	estigation S	ite Plan					
ELEV		N:			-011			
DAT	JIVI:				COMPANY: C'n'R Earthwork	t	LQUI	IP.: 81 excavator
			EI	NGINEERIN	G DESCRIPTIONS			GEOLOGICAL
STRENGTH TESTING	GROUNDWATER	SAMPLES	DEPTH (m)	GRAPHIC LOG	SOIL / ROCK CLASSIFICATION, PARTICLE SIZE CHARACTERISTICS,PLASTICITY, COLOUR, WEATHERING, SECONDARY AND MINOR COMPONENTS	, S	MOISTURE CONDITION	SOIL / ROCK TYPE, ORIGIN, DEFECTS, STRUCTURE, FORMATION
				ΨΨΨΨΨΨ	SILT; brown; organic; 50 mm rootlets throughout, organic		D	Topsoil
					SILT; light brown; massive; rootlets throughout			Loess Colluvium
			0.4	XXXXXXXXX				
				xxxxxxxxxxxx				
			0.0	xxxxxxxxx				
			0.8	xOooxOoo xOooxOoo	Silty cobbly GRAVEL; light brown; fine to coarse, sub angular rounded gravel; sub angular to sub rounded cobbles; mediun	to sub m		Alluvial Deposit
				хОоохОоо				
			1.2	xOooxOoo	SAND: grev: fine grain sand: massive: medium dense		W	Sand Alluvium
							••	
			1.6					
			2.0					
	$\vee$							
			2.4					
			2.8					
			3.2					
					End of test pit, target depth encountered			
			3.6					
ОТЫ			<u>I</u>				000	
		VIVIVIEINIS:						red Date: 12 Ech 19
рн∩		ΞĘ·					Shee	t. 1 of 1
PHOIO KEF.:								1011