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25 March 2019

Cabonne Council PO Box 17 Molong NSW 2866

Attn: Jeeva San

Ref: L10776g

Dear Jeeva,

Geotechnical investigation, new reticulation pipeline alignment, Molong NSW

1. Introduction

A new reticulation pipeline is proposed for Molong NSW. The pipeline will be in sections of Molong Street, George Street, Park Street and Edward Place.

A preliminary geotechnical investigation is required to determine subsurface characteristics at the location of the proposed pipeline.

2. Objectives

Envirowest Consulting Pty Ltd was commissioned by Cabonne Council to undertake a preliminary geotechnical investigation at the alignment of the new pipeline.

The aim of the investigation is to describe subsurface ground conditions at the borehole locations including rock or groundwater to the target depth of 2m.

3. Site location

The investigation areas are parts of Molong Street, George Street, Park Street and Edward Place in Molong NSW (Figure 1).

4. Investigation methods

Site inspections and subsurface investigations were undertaken on 21 March 2019. The assessment area was scanned for underground cables and pipes by MrMac cable locating prior to drilling.

The subsurface properties were assessed by constructing 10 boreholes (BH1 to BH10). The borehole locations are outlined in Figure 1. The boreholes were constructed with a truck mounted drill rig and flight auger. The target depth of the borehole was 2m or drill refusal on rock.

Soil conditions were logged for each borehole including soil type, colour, depth, moisture, consistency, density, plasticity and estimated rock strength.

5. Results

5.1 Surface conditions

The surface of the site comprised native grasses, lawn grasses with some bare areas from the presence of gravel and rock.

Limestone rock outcrops were observed in the southern section George Street.

5.2 Subsurface conditions

The borelogs are presented in Appendix 2.

Drill refusal on extremely high strength rock was encountered in the boreholes drilled on the southern section of George Street (BH5 and BH6) at depths from 0.4m to 0.8m. The rock is expected to be limestone. Limestone outcrops were observed approximately 10m east of the proposed alignment.

The target depth of 2m was reached for boreholes BH1 to BH4 and BH7 to BH10. The typical profile for these boreholes was silty sand topsoil over silty clay with gravel and cobbles, weathered limestone rock and clayey gravel. The drilling consistency ranged from stiff to very stiff and hard (weathered rock).

No groundwater was encountered in the profile to the drilling depths.

6. Conclusions

Shallow rock (extremely high strength) was encountered in boreholes BH4 and BH5 at depths from 0.4m. The rock is limestone with an estimated compressive strength of 50MPa. The rock is an excavation limitation.

Weathered rock was encountered in boreholes BH8 to BH10 (Park Street) at depths from 1.7m. The rock was very high strength with an estimated compressive strength of 30MPa. The rock may be an excavation limitation.

Very stiff drilling was observed in boreholes BH1 to BH4 and BH7 to BH10 in clay with medium to coarse gravel and rock fragments. The very stiff drilling strata is not expected to be an excavation limitation.

Large limestone cobbles and boulders may be present within the profile in areas not assessed.

Regards,

Andrew Ruming Environmental Geologist

Checked by: Greg Madafiglio Engineering Geologist

Attachments

Figure 1.Borehole location

Appendix 1. Limitations Appendix 2. Bore logs



e (shown in red) is a separable portion. It is 1400 metres long. Valve installation on pipeline is as per MWH standard drawings. Road

	nd	Figure	1. Site plan and borehole I	ocation
Lege	<u>110</u>	Propose	d reticulation pipeline, Molo	ong NSW
8	Borehole location		Envirowest Consul	ting Pty Ltd
		Job – L10776g	Drawn by: AR from Cabonne Council plan	Date: 25/3/2019

Appendix 1. Limitations of the investigation

The engineering logs describe subsurface conditions only at a specific borehole location and inferred boundaries between geotechnical units may vary.

Ground conditions can vary over relatively short distances and it may be necessary to carry out additional investigations for specific excavation and building sites. Once specific proposals are known a geotechnical review should be undertaken and if necessary additional investigations commissioned to provide the level of information required for assessing design parameters. A geotechnical engineer should be engaged to review subsurface condition during construction stages to confirm that subsurface conditions are consistent with design assumptions.

This report has been prepared for the use of the client to achieve the objectives given the client requirements and cost constraints. The level of confidence of the conclusion reached is governed by the scope of the investigation and the availability and quality of existing data. Where limitations or uncertainties are known, they are identified in the report. No liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been predicted using the scope of the investigation and the information obtained.

The investigation identifies the actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of the investigation and its likely impact on the proposed development. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, and no sub surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock or time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. It is thus important to understand the limitations of the investigation and recognise that Envirowest Consulting Pty Ltd are not responsible for these limitations.

This report including data contained and its findings and conclusions remain the intellectual property of Envirowest Consulting Pty Ltd. This report should not be used by persons or for purposes other than stated and not reproduced without permission.

Appendix 2. Bore logs



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BH4

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AD/T							-		SP	SILTY GRAVEL, p coarse gravel	bale yellow to pale	grey with	D	н				
							-	000	GC	CLAYEY GRAVEI rock and cobbles	_, red brown with li	mestone	D	н				0.70: Hard drilling. Extremely high
							1-	-		Hole Terminated a Refusal	at 0.80 m							strength limestone cobbles (estimated compressive strength 50MPa).
										Refusal								compressive strength 50MPa).
		leth/	d	Por	netra	tion			Vater		Samples and Tee	ts		Noistu			lition	Consistency/Relative Density
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Borehole No.

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Mothed		Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Be Plasticity, Sensitivity, Additio	dding, onal	Moisture Condition	Consistency Relative Density	F Pend	Pocke etron UCS (kPa)		r Structure and Additional Observations
Γ								-	200 000 000 000	SP GC	SILTY GRAVEL, pale yellow to pale coarse gravel	erey with						0.00: Limestone outcrops nearby
-						+		-	000		CLAYEY GRAVEL, red brown with rock and cobbles	limestone	├──		+			0.40: Hard drilling. Extremely high strength limestone cobbles (estimated
					Ban						Pole Terminated at 0.50 m Refusal							Conscienterent/Bolditive Density
	AS RR WB	AS - Auger Screwing RR - Rock Roller WB- Washbore							⊻ Lev > Infl ⊲ Pa ▼ Co	vel (Dat ow rtial Los mplete	e) U - Undisturbed Sample D - Disturbed Sample SPT - Standard Penetrati s Loss	ion Test	Δ	D M W	- [- N - V	Dry Aoist Vet		VS - Very Soft S - Soft F - Firm VSt - Very Stiff H - Hard Fr - Friable
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Borehole No.

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Mathad	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Ma Fraction, Co Plasticity	terial Description blour, Structure, Br , Sensitivity, Additi	edding, onal	Moisture Condition	Consistency Relative Density	Pene (Pock etror UCS (kPa	et mete 3 1)	er Structure and Additional Observations
F					-	-	<u> </u>	8000	SP	SILTY GRAVEL,	pale grey with coa	arse gravel				3 0	2 4	0.00: Limestone outcrops nearby
\mid		-			\rightarrow	─	<u> </u>	000	GC	CLAYEY GRAVE rock and cobbles	EL, red brown with	limestone						0.30: Hard drilling. Extremely high
										Hole Terminated Refusal	s at 0.40 m							strength limestore cobbles (estimated compressive strength 50MPa).
Dirio con o con							-											
	<u>M</u> AS - A RR - R WB- W <u>S</u> C	letho uger ock F /asht uppo - Ca	o <u>d</u> Scre Roller Dore	wing	enetra No re ranc re G	tion esistanc ging to fusal <u>raphic</u> Core indica	Log/Co recove ates ma	⊻ Le > Infl ⊲ Pa ⊲ Co o <u>re Los</u> tred (ha aterial)	<u>Vater</u> vel (Dat low rtial Los mplete <u>ss</u> atching	e) U - D - SPT- Loss	Samples and Te Undisturbed Sample Disturbed Sample Standard Penetra Classification Sym and Soil Descript	<u>sts</u> ble tion Test <u>nbols</u>	<u>Moisture Conditio</u> D - Dry M - Moist W - Wet <u>Plastic Limit</u> < PL = PL < PL					Consistency/Relative Density VS Very Soft S - Soft F - Firm VSt - Very Stiff H - Hard Fr - Friable VL - Very Loose L Loose MD - Medium Dense D Decoco
			Ū			- Core	loss				Classification Sys	tem	< PL					VD - Very Dense



E	Engi	nee	rin	g Log - I	Boi	reho	ole				Project I	No.:		1()77	6		
Γ	Clien	t:		Cabon	ine C	Counc	il				Comme	nced	:	2′	1-0:	3-20	019	I
	Proje	ct Na	ime:	Molon	g pip a	oeline					Complet	ed:		2	1-0: □	3-20	019	
	Hole	Posit	ion:	Smith	y Stre	et 55H	1 6740)22 63	36153	i	Checker	d By:		G	M			
F	Drill I	Node	lano	d Mounting:	ΕV	/H au	ger dri	ll rig		Inclination: -90°	RL Surfa	ace:	No	o su	rve	y		
	Hole	Diam	eter	:	75	mm				Bearing:	Datum:		AH	ID			Ope	erator: TB
			Drill	ling Informa	tion					Soil Descrip	otion							Observations
	Method Penetration	Support	Water	Samples Tests Remarks	Recoverv	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, B Plasticity, Sensitivity, Addit	edding, iional	Moisture Condition	Consistency Relative Density	l Per	Pocl letro UC (kP	ket omei S a)	ter	Structure and Additional Observations
							-	\bigotimes	GM	FILL, silty gravel, yellow brown		D	VSt					
							-	× ×	CI	SILTY CLAY, yellow brown with fin medium gravel	ie to	D	St					
	ADT								CH	SILTY CLAY, dark brown to brown gravel	with coarse	м	St to VSt					
							2-	x		Hole Terminated at 2.00 m								
EHOLE 1 10776.GPJ < <drawingfile>> 21-03-2019 16-47 10.0.000 DageLub and In Situ Tool - DGD Lb: Envirowest 1.00 2017-10-24 Pgr Envirowest 1.00 2017-10-24</drawingfile>																		
0 LIB.GLB Log IS AU BORE	AS - 7 RR - 1 WB- 1	AS - Auger Screwing R- Rock Roller WB- Washbore							Vater vel (Dat low rtial Los mplete	e) U - Undisturbed Samples D - Disturbed Samples SPT - Standard Penetra s Loss	<u>≥sts</u> ple ≩ ition Test	Δ	Moistu D M W Plas	re C	Dry Mois Wet	ditio st t	<u>on</u>	Consistency/Relative Density VS - Very Soft S - Soft F - Firm VSt - Very Stiff H - Hard Fr - Friable
Support Graphic Log/ C - Casing - Core record indicates r C - Core loss - Core loss						raphic Core indica Core	Log/C recove ates ma loss	ore Los red (ha aterial)	<u>ss</u> itching	<u>Classification Syr</u> <u>and Soil Descrip</u> Based on Unified Classification Sys	<u>nbols</u> <u>tions</u> Soil stem			< F = F < F	יב יב יב			VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense



E	Engi	nee	rin	g Log	- Bo	reho	ole					Project N	No.:		10	776	6		
	Clien Proje	it: ect Na	ime:	Cat Mol	onne (ong pi	Counc	il					Commer Complet	nced: ed:		21 21	-03· -03·	-20 ⁻	19 19	
	, Hole Hole	Loca Posit	tion: ion:	: Mol Edv	long vard Pl	ace 5	5H 674	4033 6	633610)3		Logged Checked	By: I By:		AF Gl	R И			
ľ	Drill I Hole	Mode	l and	d Mountin	g: E\ 75	/H au	ger dri	ll rig		Inclination Bearing:	: -90°	RL Surfa	ace:	No A H	sur Sur	vey	,	nerator: TB	
$\left \right $	TIDIE	Diam	Drill	ling Infori	mation	,				Dearing.	Soil Descript	tion						Observations	
ŀ								_						/ nsity					
	Method Penetratior	Support	Water	Sampl Tests Remar	es s ks	RL (m)	Depth (m)	Graphic Log	Group Symbol	Mate Fraction, Colo Plasticity, \$	rial Description our, Structure, Be Sensitivity, Additio	dding, mal	Moisture Condition	Consistency Relative De	Pen 2000	ocke etron UCS (kPa	et nete)) 00000000000000000000000000000000	r Structure and Additional Observation	ons
ſ							-		GM	FILL. silty gravel, y	ellow brown		D	St					
							-	× × ×	SM	SILTY SAND, yelk	ow brown with gra	vel	D	St					
	ADI						1	× ×	CI	SILTY CLAY, grey from 1.3m	brown with coars	e gravel	м	St to VSt					
							-	X 000	GC	CLAYEY GRAVEL yellow brown	and WEATHER	ED ROCK,	D	н				1.80: Hard drilling on weathered (estimated compressive strength	rock
								-		Hole Terminated a Target depth	at 2.00 m							\40MPa)	,
24							-	-											
00 2017-10-2							3-												
Envirowest 1.							-												
7-10-24 Prj: E							4-												
est 1.00 201																			
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E 1 10776.GI							-	-											
J BOREHOL		Metho	<u>od</u> Soro	wing -	Penetra	ntion		<u> </u>	Vater	<u> </u>	Samples and Tes	sts	<u></u>	Aoistui	re Co	ondi	tion	Consistency/Relative D	ensity
B Log IS AL	RR - Rock Roller WB- Washbore							≚ Le ⊳ Infl ⊲ Pa	vel (Dat low rtial Los	e) 0 - 0 D - D SPT - Si is	isturbed Sample tandard Penetration	on Test		M W	- L - N - V	Noist Vet		S - Very Solt S - Soft F - Firm VSt - Very Stiff	
1.00 LIB.GL		_		Ľ	//////////////////////////////////////	raphic	Log/C	Co	mplete <u>ss</u>	Loss	assification Svm	bols		<u>Plas</u>	stic I	Limi	t	H - Hard Fr - Friable VL - Very Loose	
Core loss						Core indic	recove ates ma loss	ered (ha aterial)	itching	ar B	ased on Unified Sciences	ons Soil em		:	< P = P < P	L L L		∟ - Loose MD - Medium Den D - Dense VD - Very Dense	se



E	Engiı	nee	rin	g Log - E	Bo	reho	ole				Р	roject N	lo.:		10	776		
Γ	Clien	t:		Cabon	ne (Counc	il				С	ommen	ced:		21	-03-	-201	19
	Proje	ct Na	ime:	Molong	ı pip	eline					С	omplete	ed:		21	-03-	-201	19
	Hole	Loca Posit	ion:	Edward	l I Pla	ace 5	5H 674	4016 6	633606	51	C	hecked	By:		GN	Л		
┢	Drill N	/lode	lano	d Mounting:	E٧	/H au	ger dri	ll rig		Inclination: -90	° R	L Surfa	ce:	No	sur	vey		
	Hole	Diam	eter	:	75	mm				Bearing:	D	atum:		AH	ID		0	perator: TB
			Drill	ing Informat	ion					Soil D	escription	n						Observations
	Method Penetration	Support	Water	Samples Tests Remarks	Recoverv	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Desc Fraction, Colour, Struc Plasticity, Sensitivity	iption ture, Beddir , Additional	ng, I	Moisture Condition	Consistency Relative Density	Pene (00 00	ocke etron UCS [kPa]	et nete	r Structure and Additional Observations
							-	X	GM	FILL. silty gravel, pale yellor roots	v brown and	d tree	D	St				
Ę	ADIT	 					- 1-	× ×	SM	SILTY SAND, yellow brown and tree roots	with fine gr	avel	D	St				
							-	× ×	CI	SILTY CLAY, grey brown to gravel		ROCK	D	VSt				
					_		2-		GC	yellow brown		RUCK,	D	н		_		1.80: Hard drilling on weathered rock (estimated compressive strength \40MPa)
							-			Target depth								(11111-1)
							-	-										
7-10-24							-											
1.00 201							-	-										
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017-10-2		i –					4-											
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J> C(į –					-	-										
10776.0							-	-										
HOLE 1							-											
SLB Log IS AU BORE	AS - A RR - F WB- \	Metho Auger Rock I Vashl	od Scre Rollei bore	wing	etra lo re ranç re	<u>tion</u> esistan ging to fusal	ce	⊻ Le ^v ⊳ Infl ⊲ Pa	<u>Vater</u> vel (Dat low rtial Los	e) U - Undisturbe D - Disturbed S SPT - Standard F	and Tests d Sample Sample enetration	Test	Δ	<u>loistui</u> D M W	r <u>e Co</u> - C - N - V	ondi Dry Noist Vet	tion	Consistency/Relative Density VS - Very Soft S - Soft F - Firm VSt - Very Stiff H - Here
.00 LIB.(V///,	ے۔ م	ranhic	Loa/C	✓ Co ore Los	mplete ss	Loss		-		<u>Plas</u>	stic L	imit	t	Fr - Friable VL - Very Loose
Support C - Casing						_ Core indic:	recove	ered (ha aterial)	itching	<u>Classificati</u> and Soil D	on Symbol escriptions	<u>15</u>		:	< Pl = Pl	L		L - Loose MD - Medium Dense
C - Casing indicates m						- Core	loss			Based on Classificat	Jnified Soil on System			·	< Pl	<u> </u>		D - Dense VD - Very Dense



Borehole No.

BH10

E	Eng	ine	e	rin	g Log ·	- Во	reh	ole				Project N	lo.:		107	776		
ſ	Clie	ent:			Cab	onne	Coun	cil				Commen	iced:		21-	-03-	201	9
	Pro	ject e Lc	Nai ocat	me: ion:	Molo Molo	ong pij ona	peline	•				Complete	ed: 3v:		21- AR	-03- :	201	9
	Hol	e Po	ositi	on:	Park	Stree	et 55⊦	l 6740	67 633	36008		Checked	By:		GN	1		
	Dril Hol	l Mo e Di	del am	anc eter	d Mounting	g: E\ 75	VH au 5 mm	iger dri	ill rig		Inclination: -90° Bearing:	RL Surfa Datum:	ce:	No AH	sur D	vey	0	perator: TB
			L	Drill	ing Inform	nation					Soil Descrip	tion						Observations
	Method	Penetration	Support	Water	Sample Tests Remark	s s	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Be Plasticity, Sensitivity, Additio	edding, onal	Moisture Condition	Consistency Relative Density	Pene Jene () ()	ocke trom JCS kPa)	et neter) } 000	r Structure and Additional Observations
ſ										GM	FILL. silty gravel, yellow brown		D	VSt				
										SM	SILTY SAND, yellow brown with gra	avel	D	St				
	ADIT							1-	×	CI	SILTY CLAY, yellow brown with coa	arse gravel	D	VSt				
										GC		to dark		Ц				1.80: Hard drilling on weathered rock
$\left \right $		////						2-	000		yellow Hole Terminated at 2.00 m		0	п				(estimated compressive strength 40MPa)
2017-10-24								3-	-		Target depth							
Prj: Envirowest 1.002									-									
west 1.00 2017-10-24								4-	-									
ol - DGD Lib: Enviro								5-	-									
el Lab and In Situ To									-									
:47 10.0.000 Datge								6-	-									
le>> 21-03-2019 16									-									
i.GPJ < <drawingfi< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>7-</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></drawingfi<>								7-	-									
DLE 1 1077(-									
3.GLB Log IS AU BOREH	AS - RR - WB-	Method Penetration AS - Auger Screwing RR - Rock Roller WB- Washbore refusal							\searrow Le \bigcirc Inf \bigcirc Pa	Vel (Dat vel (Dat low rtial Los mplete	L Samples and Te. te) U - Undisturbed Samp D - Disturbed Sample SPT - Standard Penetrat ss Loss	s <u>ts</u> vle ion Test	Δ	loistur D M W	<u>e Co</u> - D - M - W	ondit ry loist /et	tion	Consistency/Relative Density VS - Very Soft S - Soft F - Firm VSt - Very Stiff H - Hard
Support Graphic Log C - Casing Core recording						<u>G</u>	Core	e recove ates ma e loss	ered (ha aterial)	ss atching	<u>Classification Sym</u> <u>and Soil Descripti</u> Based on Unified Classification Syst	i bols ions Soil tem		<u>Plas</u> = 	E PL	<u>imit</u> - -		Fr - Friable VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense