

Rotorua Lakes Council
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Rotorua

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Attention: Kareen McLaren

Te Whare Taonga o Te Arawa - Rotorua Museum Geothermal Investigation in the Building's South Wing

1 Introduction and background

Tonkin & Taylor Ltd (T+T) has been engaged by the Rotorua Lakes Council (RLC) to investigate the recent geothermal phenomenon experienced in the building's south wing to gain a better understanding of the issue and assess its implication for the building and the museum seismic strengthening project.

It is understood that the south wing (2011 build) part of the building experienced a significant increase in temperature in April 2020. RLC identified that a geothermal bore failure was likely to be the prime cause following testing undertaken on the nearby geothermal bores. The faulty bore was then decommissioned using pressurised grout. The approximate location of the faulty bore is shown on the plan attached in Appendix B. However, an elevated temperature level continues to be recorded in some areas of the building's south wing, albeit they are no longer as high as prior to the decommissioning of the faulty bore.

2 Scope of work

In line with the agreed approach discussed during the site meeting on 5 May 2021 (attended by WSP Project Manager, T+T, Dizhur Consulting, RLC and GNS Science) and our Offer of Service letter dated 7 May 2021, the scope of this investigation comprises:

- 1 Undertaking a camera inspection using closed-circuit television (CCTV) equipment in the vent pipes beneath the basement slab of the building's south wing to assess their conditions.
- 2 Carrying out a number of subsurface temperature readings using Cone Penetration Test (CPT) technique between the museum building and the recently decommissioned geothermal bore to investigate the temperature level in the ground.
- 3 Summarising the findings and recommendations from the investigation in a letter report (this report).

3 CCTV inspection of the vent pipes

The CCTV inspection of the vent pipes beneath the basement slab of the building's south wing was carried out on 2 June 2021 by a pipe CCTV contractor, Intergroup Ltd. A site plan showing the layout of the vent pipe and the pipeline labelling used by the contractor for the purpose of the CCTV inspection is attached in Appendix A.

The majority of the vent pipes were able to be inspected, with the exception of:

- Line V4 running north-south direction – pipe could not be found.
- Line V11 – access to the V11 vent outlet was not identified at the time of inspection.

Additionally, the following pipelines were not able to be inspected for their entire length (i.e. the inspections had to be abandoned before reaching the end of the line):

- Line V3 – pipe deviates down at approximately 6.8 m from the V3 vent outlet, indicating the pipes were potentially laid at different levels and connected via a vertical connecting pipe. The CCTV operator indicated that they could not continue further as it could cause the equipment to become stuck and non-retrievable.
- Line V12 – pipe is disjointed and out of alignment at approximately 10.6 m from the V12 vent outlet, preventing further access for the CCTV equipment.
- Line V13 – inspection had to be abandoned early due to poor visibility. Visibility was lost from 3.4 m onward, which appears to be caused by the presence of heavy steam/mist within the pipe.

The CCTV inspection reports from the CCTV contractor are attached in Appendix A.

From the CCTV inspection, all pipes appear to be PVC type pipe with slot cutting (vent slots) at relatively regular spacing generally at the bottom of the pipe, so the geothermal gas can enter the pipe and be discharged at the outlets located on the sides of the building. A relatively small amount of debris and a few joint defects were observed in the pipes. However, all sections of the pipe that were able to be inspected (i.e. excluding lines V4 (north-south), V11, portions of V3, V12 and V13 that were not able to be inspected) were not showing any sign of blockage.

In Line V12, a small gap appears at the disjointed location, separating the western section of the pipe from the eastern section of the pipe (the vent outlet portion). The section of the pipe to the west of (beyond) the disjointed location also appears to no longer be aligned with the eastern section of the pipe. A portion of what appears to be a black sheet (possibly the gas membrane) could also be seen above the gap. Figure 3.1 and Figure 3.2 provide photographs of the disjointed pipe section in Line V12.



Figure 3.1: Disjointed pipe section in Line V12

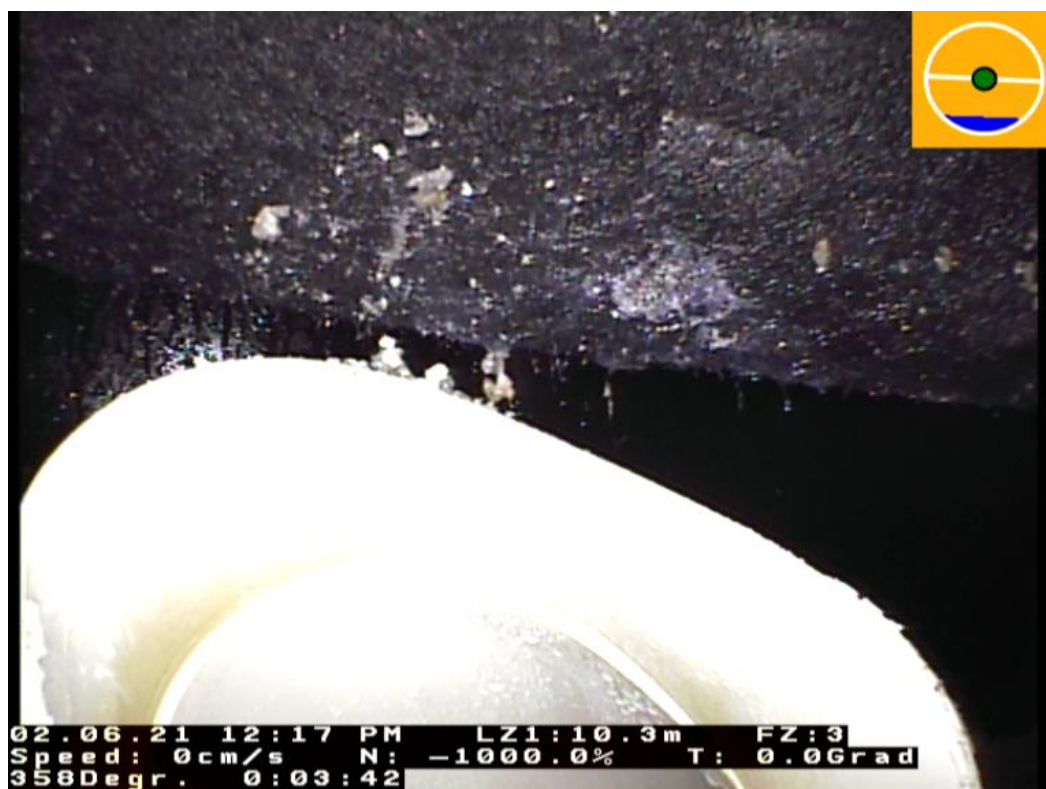


Figure 3.2: Exposed black sheet (possibly the gas membrane) above the gap at the location of the disjointed pipe section in Line V12

4 Subsurface temperature measurements using CPT

A total of thirteen CPTs were carried out on 30 June 2021 in the eastern carpark of the museum (between the faulty geothermal bore and the museum building) to measure the subsurface temperature in the area. The locations of these CPTs are shown on the site plan attached in Appendix B. Most CPTs were able to measure to a depth of 2 m below ground level before the temperature exceeds the temperature allowance for the sensor inside the cone (40°C limit). The temperature measurements were held for 5 minutes at every 1 m depth interval to allow for the temperature inside the cone to stabilise (in line with the cone manufacturer recommendation). The groundwater levels were measured and varied from 1.7 m (at the most southern CPT location) to 2 m below ground level (at the most northern CPT location). All holes were grouted following completion.

Figure 4.1 summarises the subsurface temperature readings from the CPT investigation.

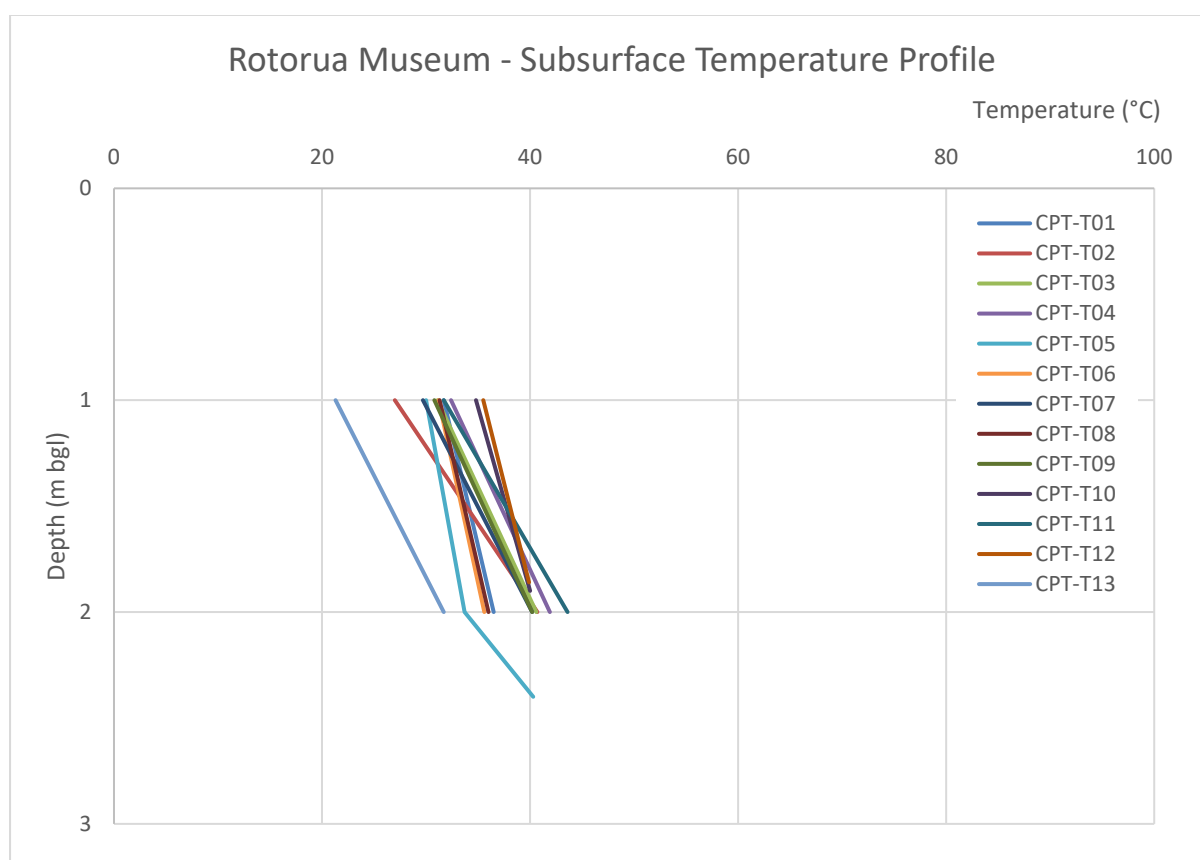


Figure 4.1: Subsurface temperature profile from 30 June 2021 CPT investigation

Additionally, we also measured the amount of gas 1 m depth below ground level at the CPT locations using Geotech GA5000 Landfill Gas Meter. The results are summarised in Table 4.1.

Table 4.1: Gas measurements at 1 m depth below ground level at each CPT location

CPT no	Gas				
	CH ₄ (%) (Methane)	CO ₂ (%) (Carbon dioxide)	O ₂ (%) (Oxygen)	CO (ppm) (Carbon monoxide)	H ₂ S (ppm) (Hydrogen sulphide)
CPT-T01	0.1	32.9	11.4	12	>1,000
CPT-T02	0.1	31.7	13.1	9	>1,000
CPT-T03	0	22	16.1	4	73
CPT-T04	0	21.2	16.1	14	232
CPT-T05	0	13.3	18.3	3	624
CPT-T06	0.1	15.6	18.2	5	>1,000
CPT-T07	0.1	9.6	19.2	3	0
CPT-T08	0.1	27.2	15	12	503
CPT-T09	0.1	2.5	20.5	0	0
CPT-T10	0.1	11	18.2	5	8
CPT-T11	0.1	28.8	11.5	6	404
CPT-T12	0.2	21.6	15.6	8	119
CPT-T13	0.4	8.9	19.2	4	31

5 Assessment and recommendation

Based on the information obtained from the CCTV inspection, the subsurface temperature measurements and our review of the available historical information, the following assessments and recommendations have been made:

- 1 From the 30 June 2021 subsurface temperature readings, the temperatures within the upper 2 m of the ground across the eastern carpark area of the museum appear to be relatively uniform and are not significantly different to the ground temperature readings reported in the Terrane Consultants' report¹ from December 2007. Figure 5.1 provides superimposed plots comparing the temperature readings from Terrane Consultants December 2007 report and the subsurface temperature readings undertaken on 30 June 2021. This evidence suggests that currently the level of geothermal activity in the ground appears to be similar to the level that has been experienced in the past (prior to the incident in April 2020). This may be the typical subsurface temperature for the area.

¹ Terrane Consultants Ltd (December 2007) *Rotorua Bath House Government Gardens Rotorua. Proposed South Wing Extension. Site Investigation Report*. File Ref. 3278.r2.

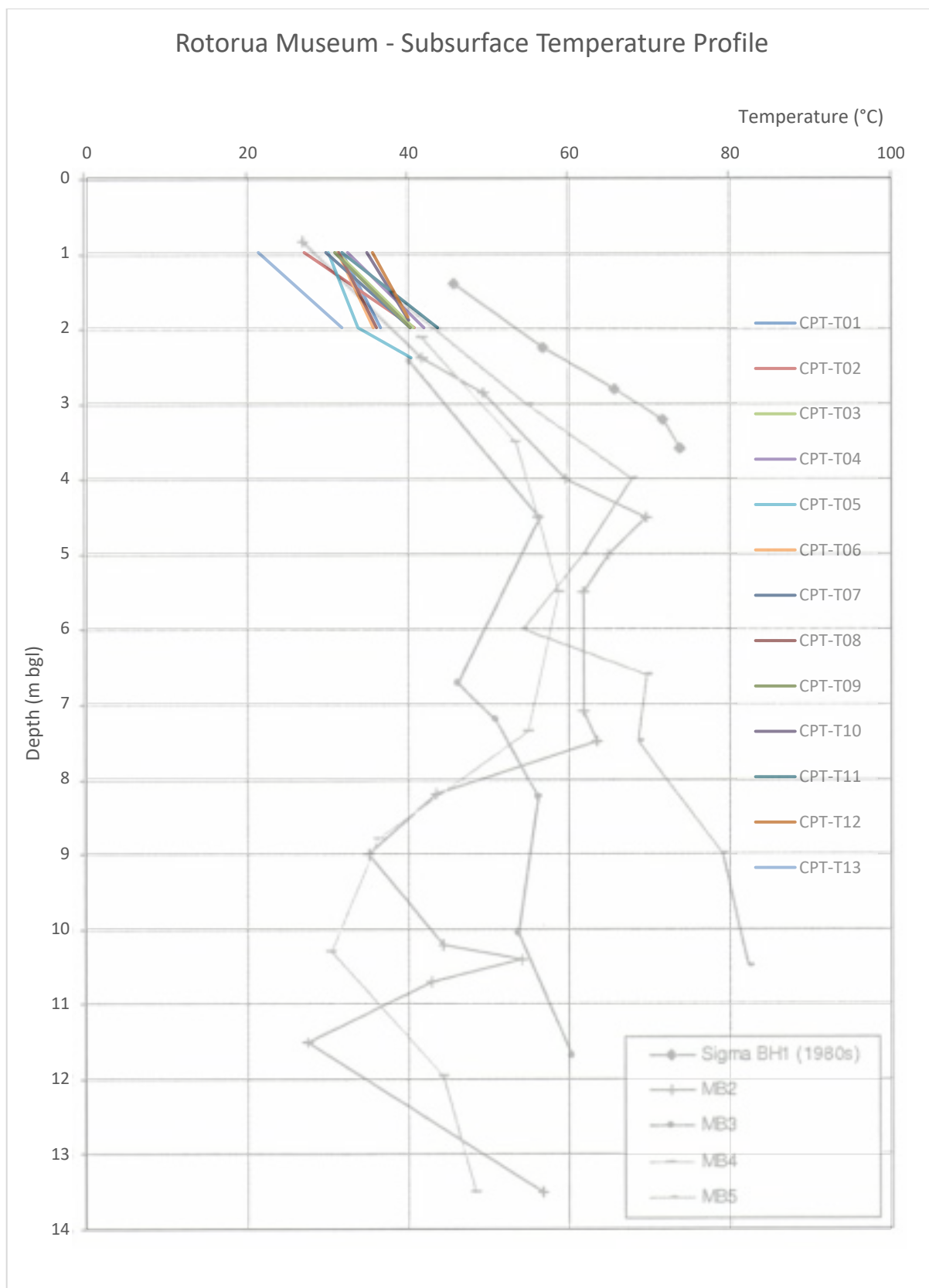


Figure 5.1: Comparisons between the ground temperature readings from Terrane Consultants December 2007 report (black lines) and the subsurface temperature readings undertaken on 30 June 2021 (coloured lines)

- 2 The location of the gap in Line V12 appears to coincide with the area where the elevated temperature is currently experienced in the building's south wing. However, with the information we have available to date, there is not enough evidence to suggest that the gap is the cause of the elevated temperature in the building. The gap may have caused a movement to the gas membrane somewhere, which potentially may lead to the slab being exposed to the ground and the heat. However, to investigate this, the gas membrane will need to be exposed so it can be inspected (i.e. requires removal of the concrete slab). This may not be practical and is likely to attract high cost.

The area where the elevated temperature is currently experienced in the building's south wing also appears to coincide with the toilet area, where extensive plumbing network is present. The plumbing as-built plan also indicates an HDPE pump well is located within this area (see Figure 5.2 below). The drawing indicates that the pump well extends into the ground below the gas membrane. It is possible that this provides a path for the heat to enter the building as well as travel through the plumbing network. Additionally, with the museum being closed, there is also significantly less (or close to zero) water (which could act as a coolant) circulating in the system.

The building's air conditioning system should be able to control the temperature in the building. A cooling / heat exchange system for the slab could also be considered as an additional measure. However, this is likely to attract high cost.

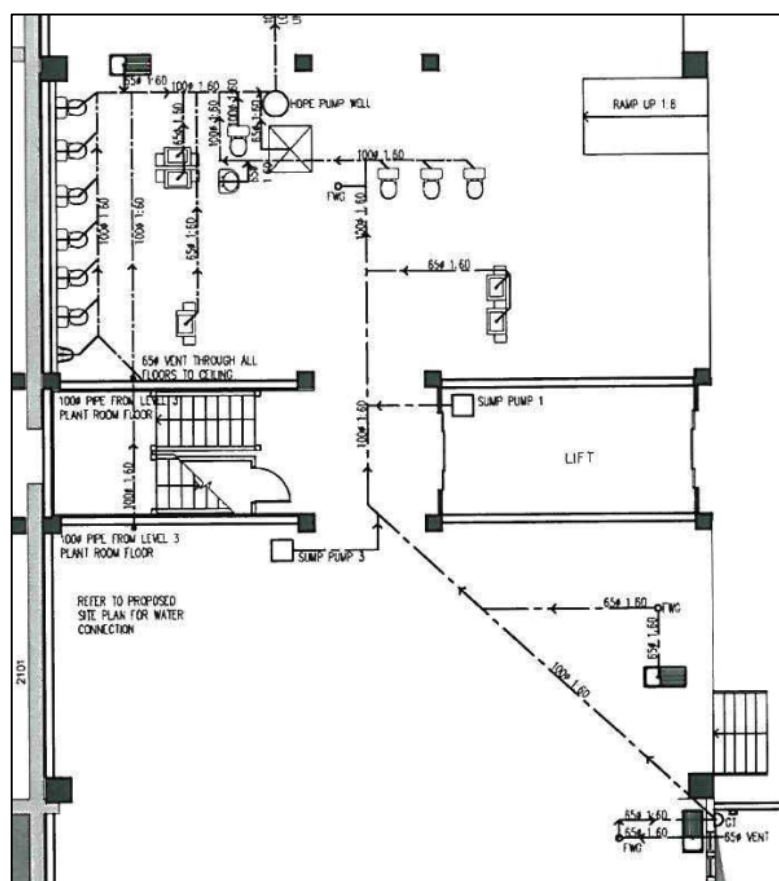


Figure 5.2: As-built plumbing plan²

² Sigma Consultants Ltd (24 June 2009) *Rotorua Museum of Art + History Stage 3 South Wing Addition. Plumbing Plan Level 0 - Basement*. Drawing no. A (74) 1840. Revision 1. Job number 8129.

- 3 As per the RFP document³, it is understood that during the temperature incident in April 2020, RLC also observed elevated CO₂ and H₂S gases inside the building. Geothermal gases are present in the ground as noted in Table 4.1. The presence of gases inside the building indicates that the gas membrane beneath the slab may have been compromised allowing gases to seep through cracks and gaps into the building. As noted in Point 2 above, the gas membrane will need to be exposed to investigate its condition. This is likely to attract high cost and may be challenging from a practicality point of view. We have had a discussion with Dizhur Consulting regarding potential options that could be implemented to minimise the gas ingress through the cracks and gaps. Dizhur Consulting suggests that a sealant product could be applied over the cracks and gaps. However, it is recommended that RLC, Dizhur and T+T should have a discussion before proceeding. Undertaking a gas detection and monitoring exercise may be useful beforehand to identify the areas that require the remedial work.
- It is also recommended that gas alarms (that work in a similar way as smoke alarms) be installed in the building (if have not already been). This could notify the occupants of a gas leak and would allow them to be evacuated from the building safely.

6 Applicability

This report has been prepared for the exclusive use of our client Rotorua Lakes 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, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:



Sutejo Tjokro
Senior Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:

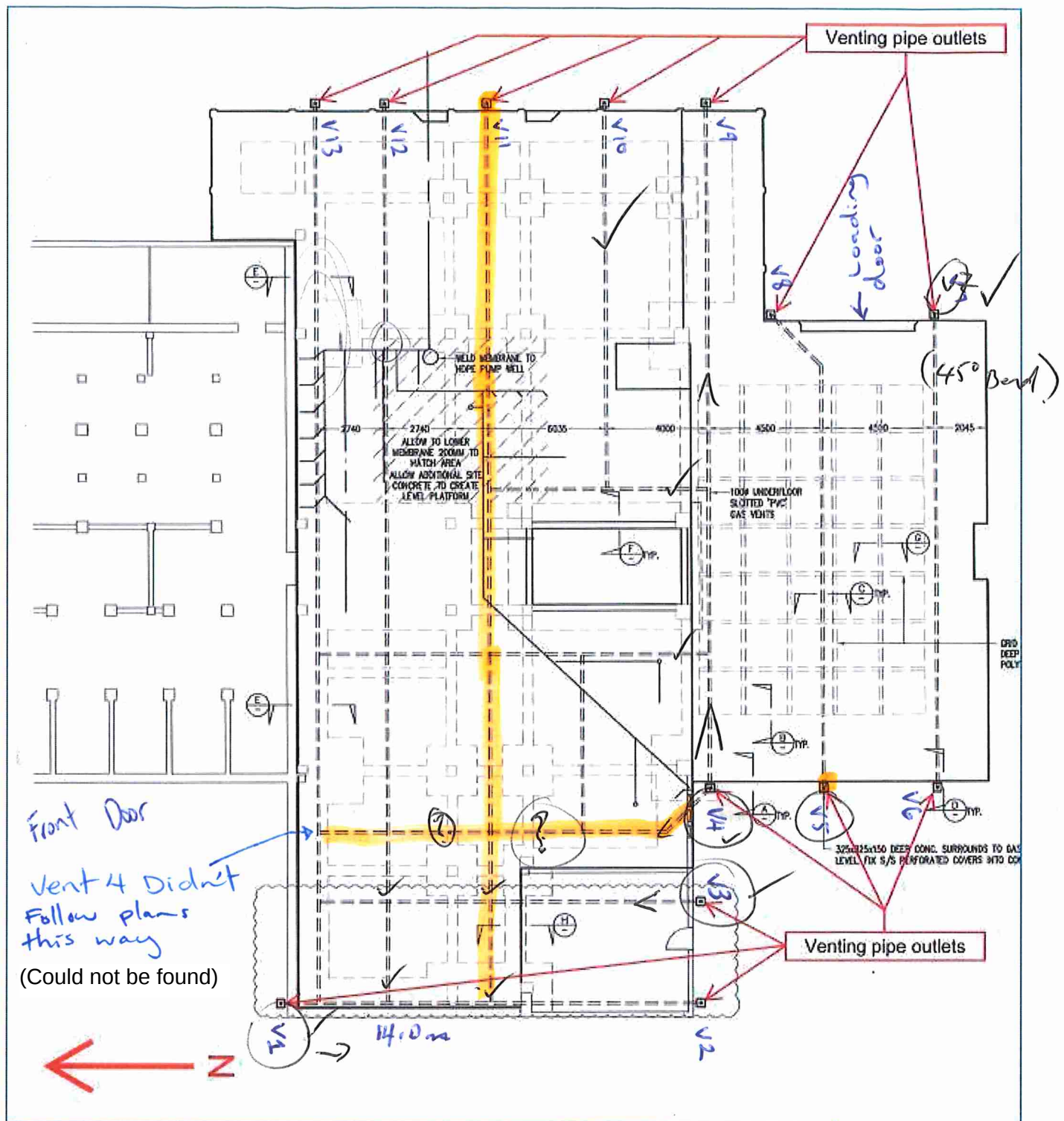


Craig Davanna
Project Director

\\ttgroup.local\files\akl\projects\1017126\issueddocuments\20210730 geothermal inv rpt\20210730_building south wing geothermal inv rpt.docx

³ WSP (23 April 2021) *Request for Price – Briefing. Rotorua Museum Development Project: Geotechnical and Geological Engineering Service Request*. Ref 2-82142.00.

Appendix A: Vent pipe CCTV inspection reports



* V1 to V2. ✓

* V3 to End ✓

V4 North WA? (Could not be found)

V4 to V9 ✓

(V5 - unable to find. (under stairs)?)

V6 to V7 ? ✓ → V5-to-V8. ? ✓

V7 to 6V ✓

V8 to V5 ✓

V10 to End ✓

V11 - ^{under} Stairs ?

V12 to End (Disjoint 10.6m)

V13 to End.

Abandoned Due to Steam
1.8m



CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V1-V2

03/06/2021

08 19:26

1

START

FINISH

Manhole/Node
St No. & Location
Depth

V1
0 Rotorua museum
0



V2
0 Rotorua museum
0

Structural Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
1	0.07	1	1	1

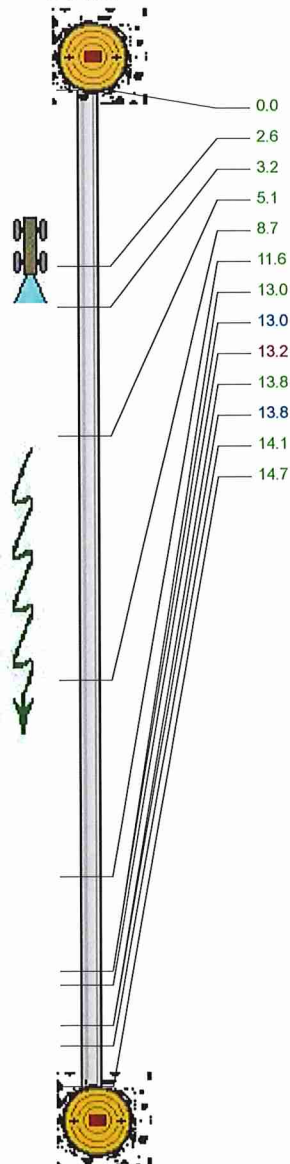
Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
16	1.09	8	4	16

Drawing No	Line No	Area	System	Tape No	Weather
				V1-V2-02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	14.7	RORY	

Comments: Asset used for steam venting

U/S MH



0.0	Inspection Starts, (V1)	0
2.6	Line Deviates Left	0
3.2	Line Deviates Left	0
5.1	Lateral OK, at 9 o'clock	0
8.7	Lateral OK, at 9 o'clock	0
11.6	Lateral OK, at 9 o'clock	0
13.0	General Comment, (Geothermal build up at vent cuts)	0
13.0	Debris - Silty, Small, (Gravel and dirt)	8
13.2	Joint Faulty, Small, at 4 o'clock, (Joint faulty pipe split)	1
13.8	General Comment, (staining on pipe wall)	0
13.8	Debris - Silty, Small, (Dirt)	8
14.1	Line Deviates Up	0
14.7	Inspection Ends, (V2)	0

V1 to V2

Protocol of recordings

Date 02/06/2021
Recording Rotorua Bath House Steam Vents

Picture 001

Video 00:05:20
Distance 13.20 m



Picture 002

Video 00:05:56
Distance 13.90 m





CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V3-End

03/06/2021

08 54:05

2

START

Manhole/Node
St No. & Location
Depth

V3
0 Rotorua museum
0

FINISH

End of line
0 Rotorua museum
0



Structural Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
0	0	0	1	0

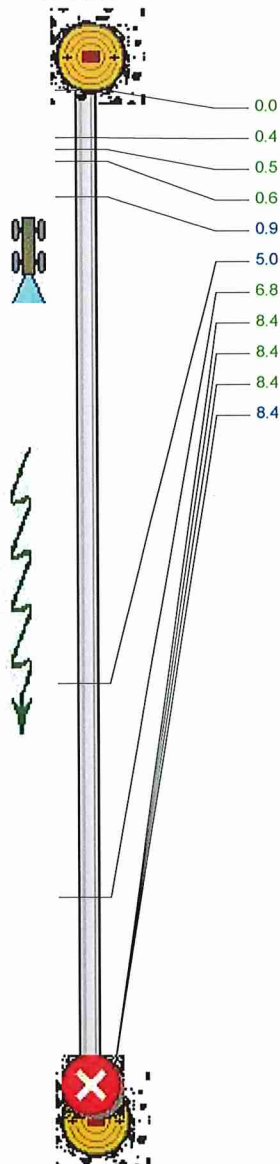
Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	2.86	8	4.2	24

Drawing No	Line No	Area	System	Tape No	Weather
				V3-End_02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	8.4	RORY	

Comments: Asset used for steam venting

U/S MH



0.0	Inspection Starts, (V3)	0
0.4	Line Deviates Left	0
0.5	Line Deviates Down	0
0.6	General Comment, (Vent cut warped)	0
0.9	Debris - Silty, Small, (Dirt)	8
5.0	Debris - Silty, Small, (Dirt)	8
6.8	Line Deviates Down	0
8.4	Line Deviates Right	0
8.4	Inspection Abandoned, (Couldnt continue further)	0
8.4	General Comment, (No acces to end of line)	0
8.4	Debris - Silty, Small, (Sulphur dust)	8

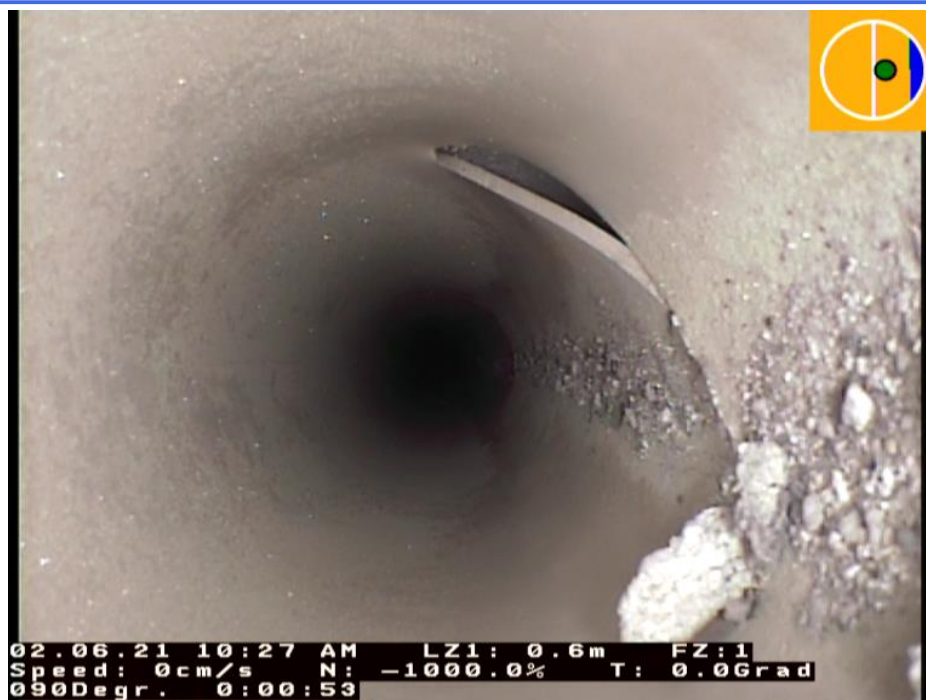
V3 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua Bath House v3

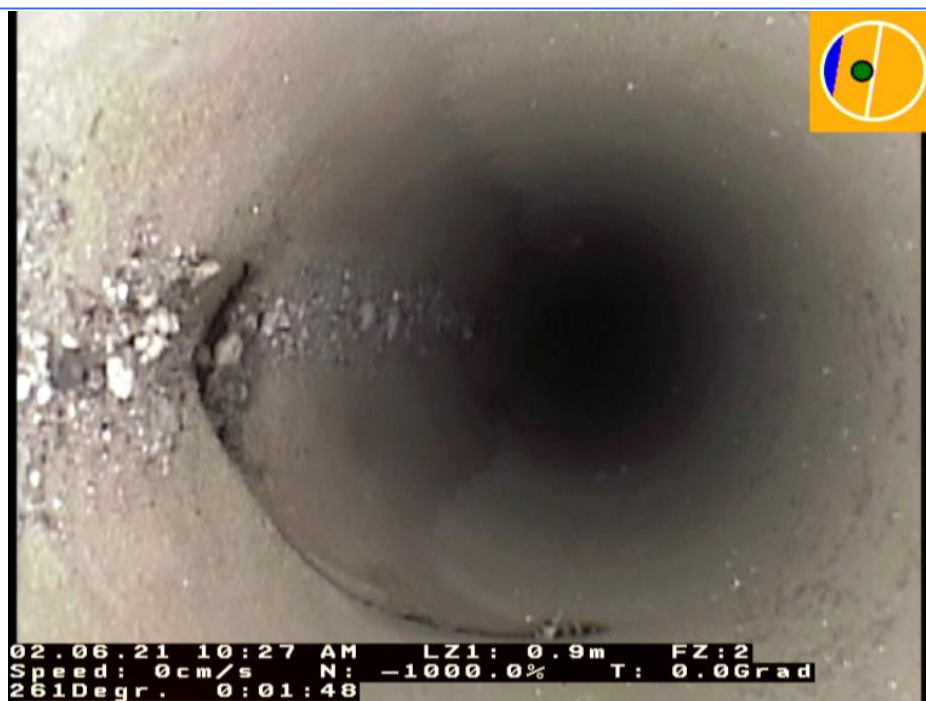
Picture 001

Video 00:00:54
Distance 0.60 m



Picture 002

Video 00:01:48
Distance 0.90 m



V3 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua Bath House v3

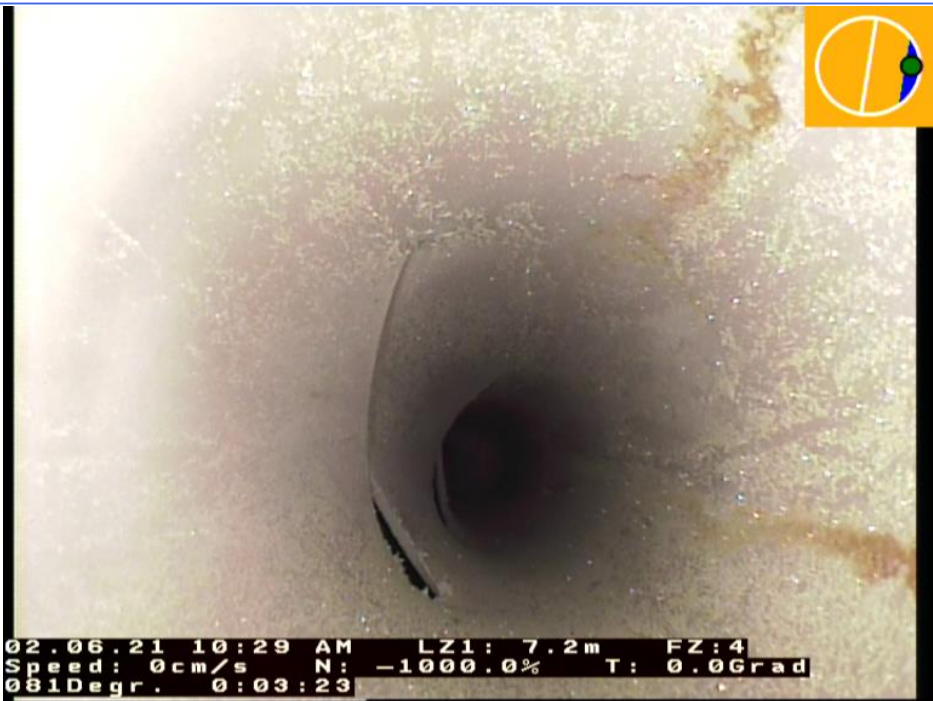
Picture 003

Video 00:02:44
Distance 6.80 m



Picture 004

Video 00:03:23
Distance 7.20 m



V3 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua Bath House v3

Picture 005

Video 00:03:37
Distance 7.50 m



Picture 006

Video 00:04:14
Distance 8.40 m





CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V4-End

03/06/2021

09 14:22

3

START

Manhole/Node
St No. & Location
Depth

V4
0 Rotorua museum
0

FINISH

End of line
0 Rotorua museum
0



Structural Pipe Grade

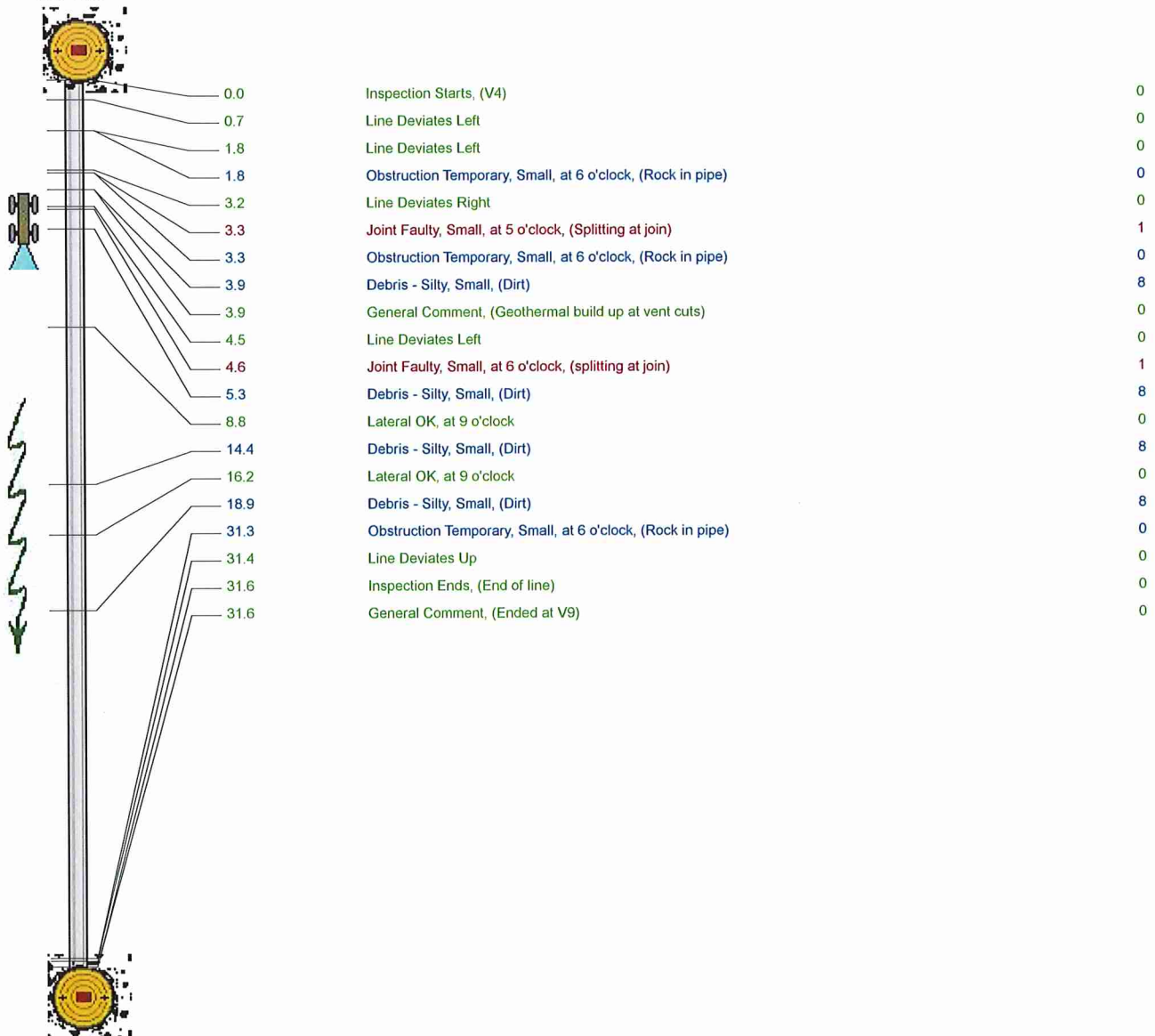
Peak	Mean	Average	Pipe Grd	Total
1	0.06	1	1	2

Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	1.01	4.57	3	32

Drawing No	Line No	Area	System	Tape No	Weather
				V4-End_02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	31.6	RORY	
Comments: Asset used for steam venting					

U/S MH



V4 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v4 to end

Picture 001

Video 00:01:03
Distance 1.80 m



Picture 002

Video 00:01:27
Distance 3.10 m



V4 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v4 to end

Picture 003

Video 00:01:40
Distance 3.30 m



Picture 004

Video 00:01:46
Distance 3.30 m



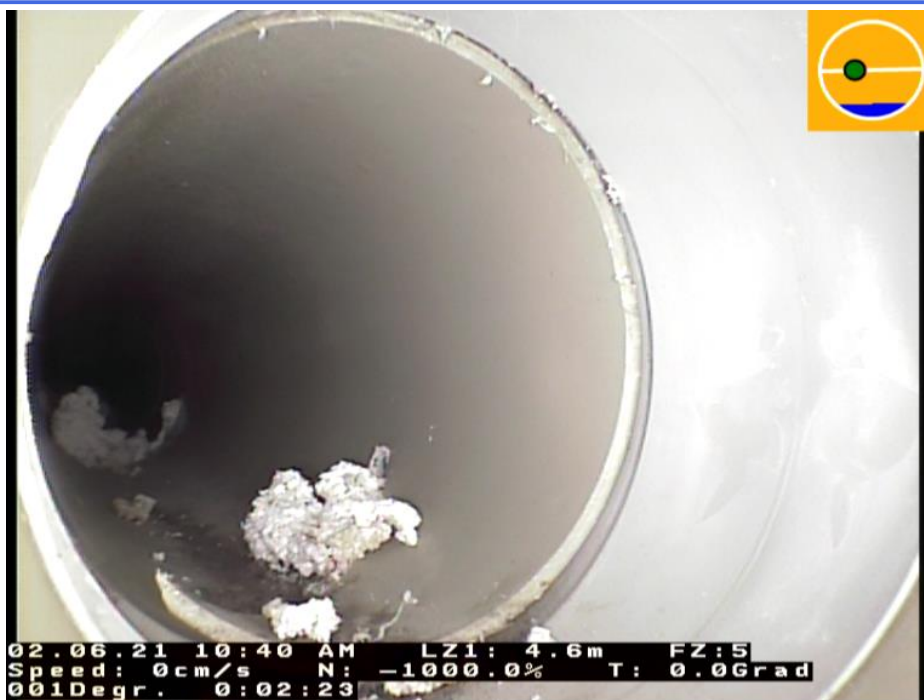
V4 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v4 to end

Picture 005

Video 00:02:23
Distance 4.60 m



Picture 006

Video 00:02:33
Distance 4.60 m



V4 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v4 to end

Picture 007

Video 00:02:49
Distance 5.30 m



Picture 008

Video 00:09:37
Distance 31.30 m





CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V6-V7

03/06/2021

09 38:07

4

START

Manhole/Node
St No. & Location
Depth

V6
0 Rotorua museum
0



FINISH

V7
0 Rotorua museum
0

Structural Pipe Grade

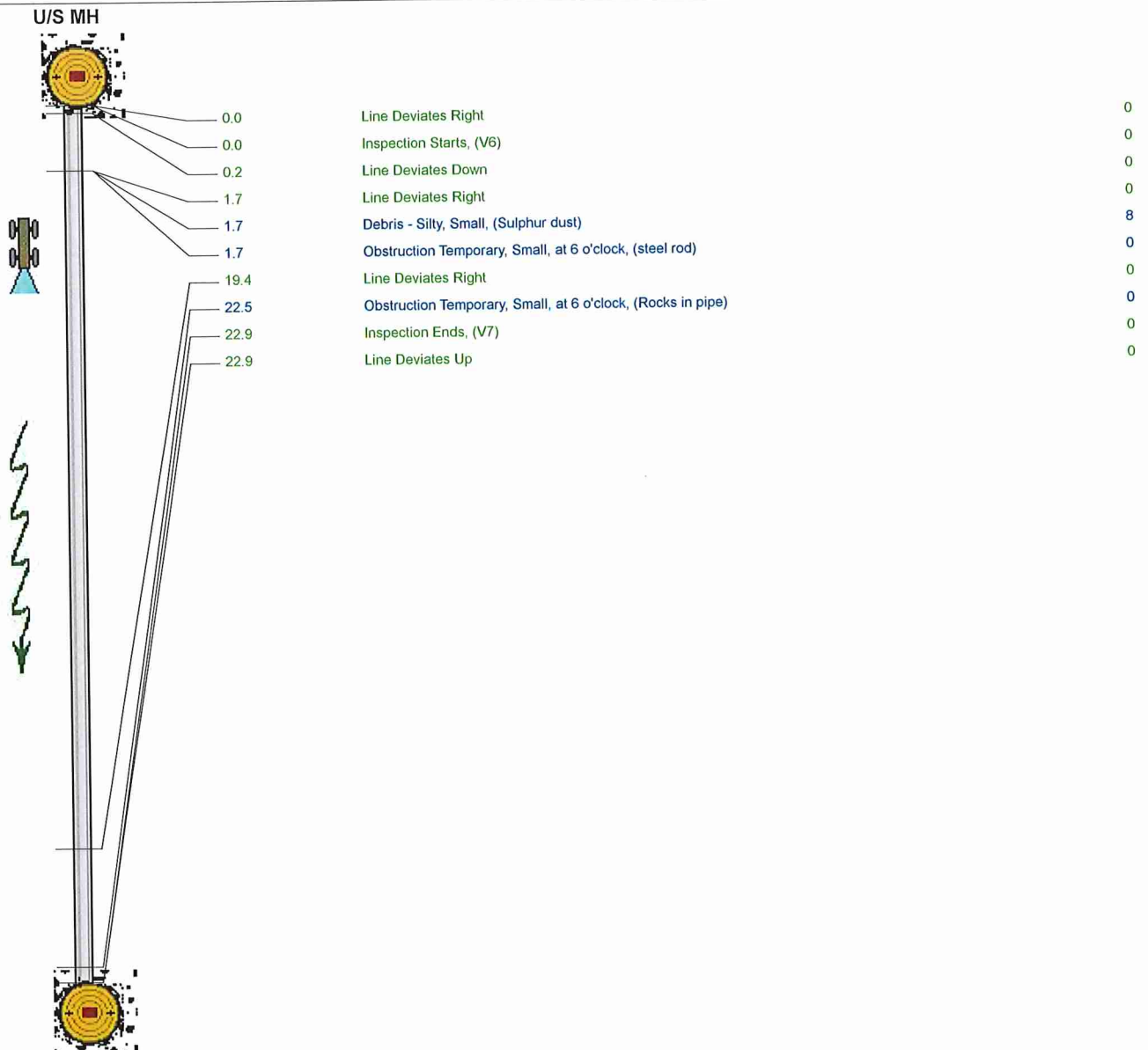
Peak	Mean	Average	Pipe Grd	Total
0	0	0	1	0

Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	0.35	2.67	3	8

Drawing No	Line No	Area	System	Tape No	Weather
				V6-V7_02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	22.9	RORY	

Comments: Asset used for steam venting



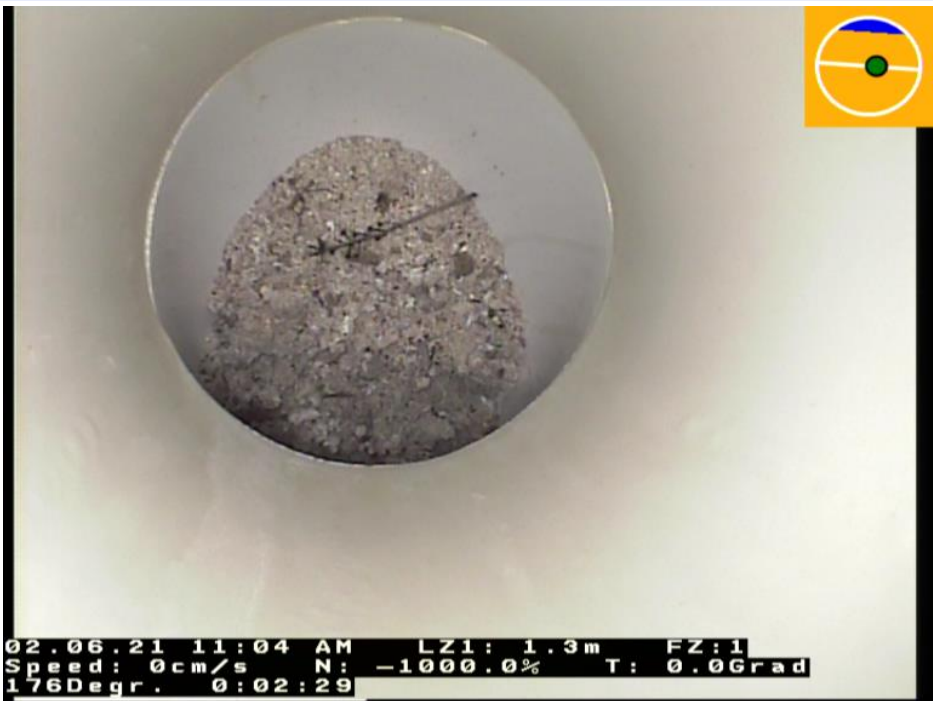
V6 to V7

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house V6 to V7

Picture 001

Video 00:02:29
Distance 1.30 m



Picture 002

Video 00:03:03
Distance 1.70 m





INTERGROUP

CCTV Pipe Inspection Report

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V7-V6

03/06/2021

10 22:04

5

START

Manhole/Node
St No. & Location
Depth

V7
0 Rotorua museum
0



FINISH

V6
0 Rotorua museum
0

Structural Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
10	0.45	10	2	10

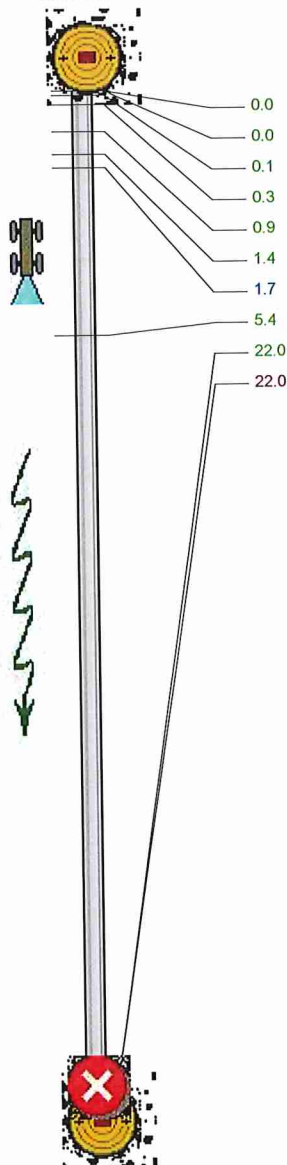
Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
0	0	0	1	0

Drawing No	Line No	Area	System	Tape No	Weather
				V7-V6_02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	22	RORY	

Comments: Asset used for steam venting

U/S MH



Line Deviates Right
Inspection Starts, (V7)
Line Deviates Down
Line Deviates Right
Line Deviates Down
Line Deviates Right
Obstruction Temporary, Small, at 6 o'clock, (Rocks in pipe)
Line Deviates Left
Inspection Abandoned, (couldnt continue)
Obstruction Permanent, Small, at 6 o'clock, (Rocks in pipe)

0
0
0
0
0
0
0
0
0
0
10



INTERGROUP

CCTV Pipe Inspection Report

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V8-V5

03/06/2021

10 37:59

6

START

Manhole/Node
St No. & Location
Depth

V8
0 Rotorua museum
0



FINISH

V5
0 Rotorua museum
0

Structural Pipe Grade

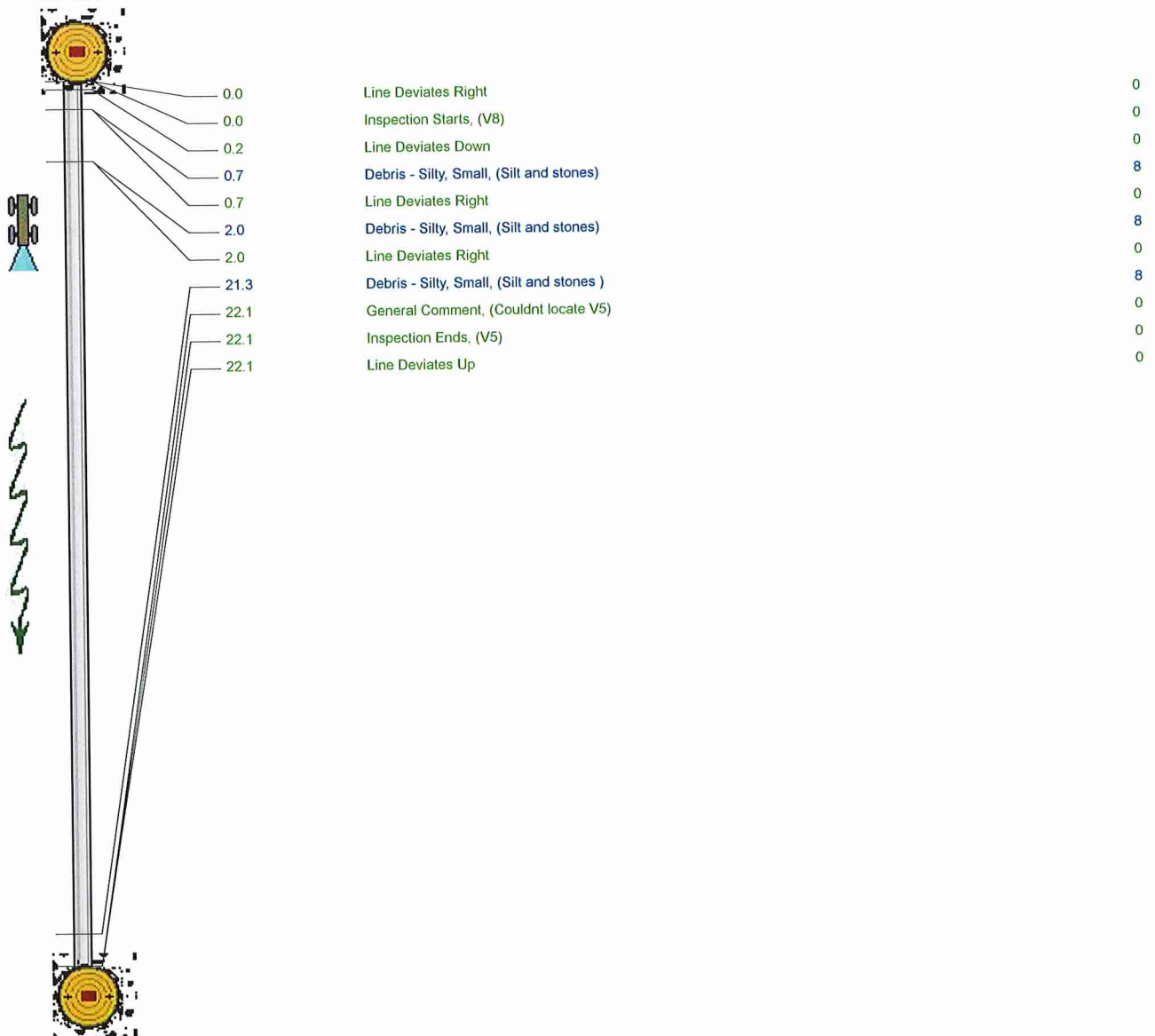
Peak	Mean	Average	Pipe Grd	Total
0	0	0	1	0

Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	1.09	8	3	24

Drawing No	Line No	Area	System	Tape No	Weather
				V8-V5_02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	22.1	RORY	
Comments:	Asset used for steam nenting				

U/S MH



V8 to V5

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v8 to v5

Picture 001

Video 00:00:20
Distance 0.30 m



Picture 002

Video 00:02:35
Distance 21.30 m





CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V10-End of line

03/06/2021

10 53:02

7

START

Manhole/Node
St No. & Location
Depth

V10
0 Rotorua museum
0

FINISH

End of line
0 Rotorua museum
0



Structural Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
0	0	0	1	0

Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	1.43	8	3.4	24

Drawing No

Line No

Area

System

Tape No

Weather

Year Laid

Material

Lining

Use

Type

Shape

Width

Diameter

Line Length

Operator

CP

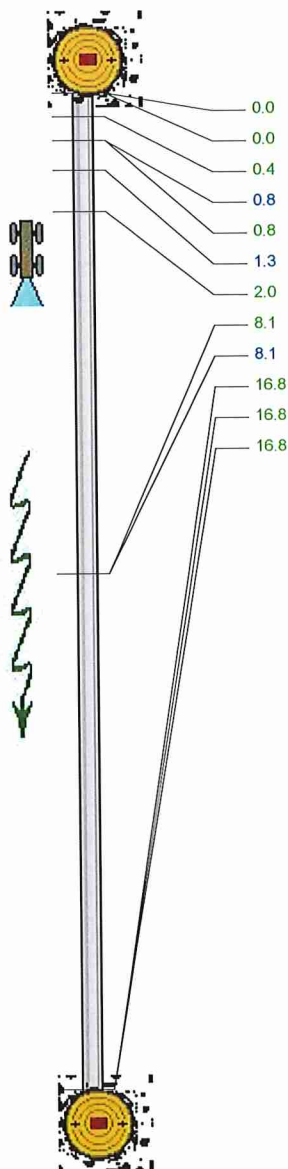
100

16.8

RORY

Comments: Asset used for steam venting

U/S MH



Line Deviates Right	0
Inspection Starts, (V10)	0
Line Deviates Down	0
Debris - Silty, Small, (Silt, leaves, stones)	8
Line Deviates Right	0
Debris - Silty, Small, (silt, stones, leaves)	8
General Comment, (Vent cuts warped)	0
General Comment, (geothermal dirt at vent cuts)	0
Debris - Silty, Small, (Dirt)	8
Inspection Ends, (End of line)	0
Line Deviates Left	0
Line Deviates Right	0

V10 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v10 to eol

Picture 001

Video 00:00:59
Distance 0.80 m



Picture 002

Video 00:01:37
Distance 1.30 m





CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V12-End of line

03/06/2021

11 39:49

8

START

Manhole/Node

V12

St No. & Location

0 Rotorua museum

Depth

0

FINISH

End of line

0 Rotorua museum

0

Structural Pipe Grade

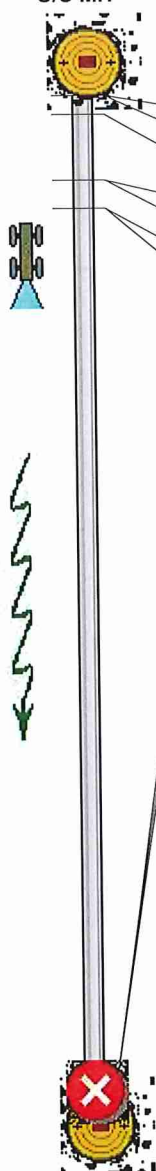
Peak	Mean	Average	Pipe Grd	Total
45	4.25	45	5	45

Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	1.51	8	3.4	16

Drawing No	Line No	Area	System	Tape No	Weather
				V12-End_02062021	Dry
Year Laid	Material	Lining	Use	Type	
	PVC		X		
Shape	Width	Diameter	Line Length	Operator	
CP		100	10.6	RORY	
Comments: Asset used for steam venting					

U/S MH



0.0

Line Deviates Right

0

0.0

Inspection Starts, (V12)

0

0.2

Line Deviates Down

0

0.9

Debris - Silty, Small, (Silt and stones)

8

0.9

Line Deviates Right

0

1.2

Debris - Silty, Small, (stones,leaves)

8

1.2

General Comment, (wiped lense of camera)

0

10.6

Inspection Abandoned, (joint displaced couldnt continue)

0

10.6

General Comment, (ground vissible)

0

10.6

Joint Displaced, Large

45

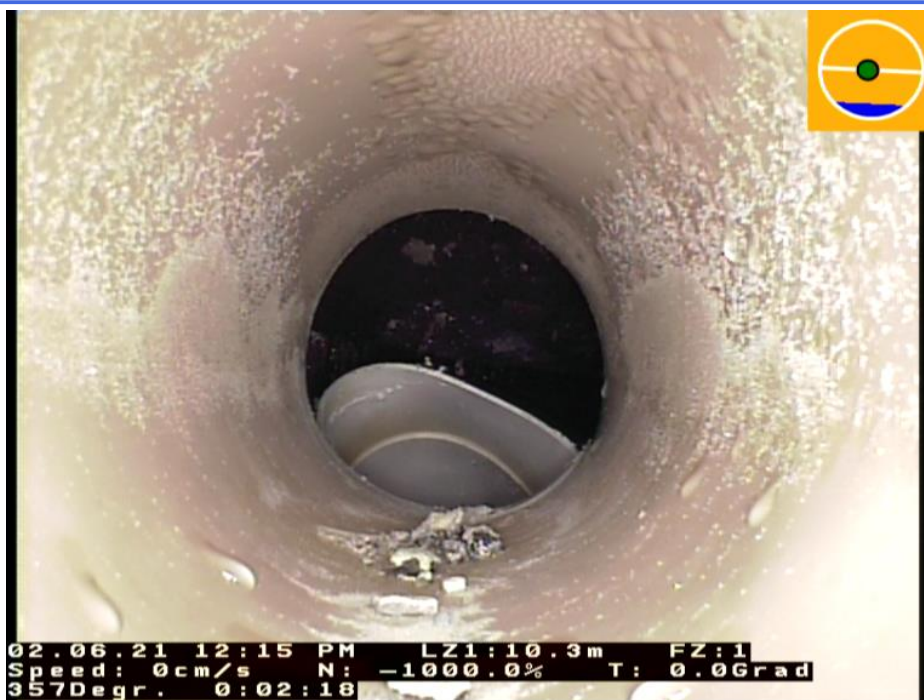
V12 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v12 2

Picture 001

Video 00:02:19
Distance 10.30 m



Picture 002

Video 00:03:37
Distance 10.30 m



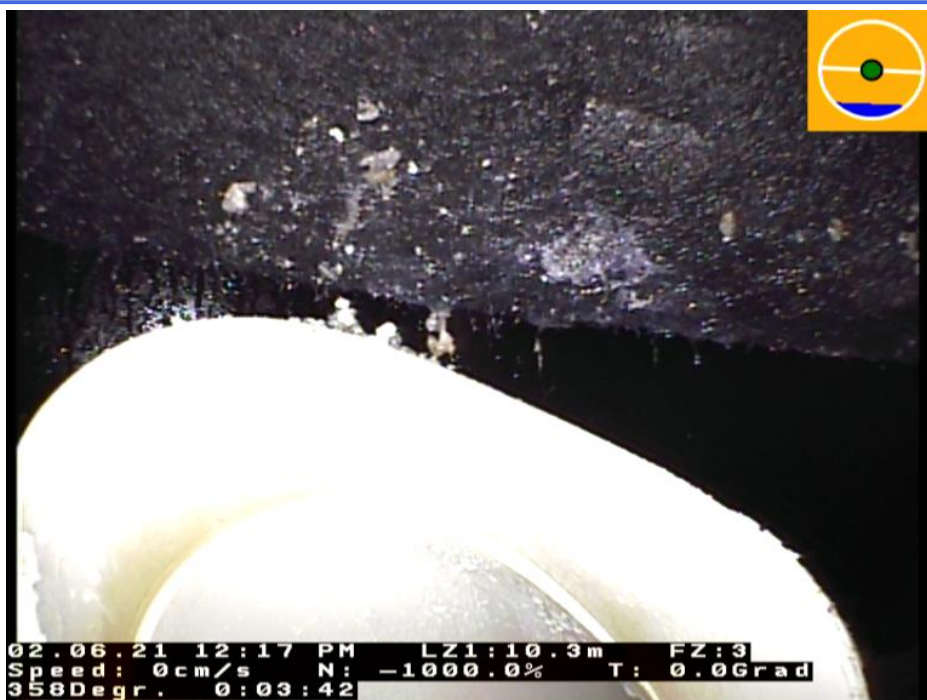
V12 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v12 2

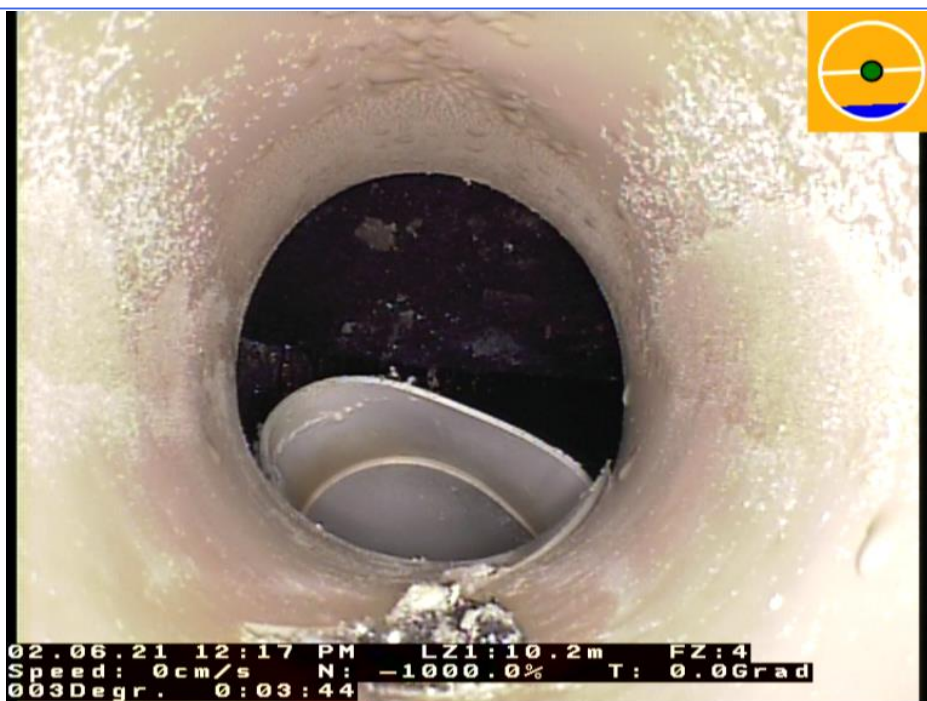
Picture 003

Video 00:03:42
Distance 10.30 m



Picture 004

Video 00:03:44
Distance 10.20 m



V12 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v12 2

Picture 005

Video 00:04:09
Distance 10.60 m



Picture 006

Video 00:04:49
Distance 10.60 m





CCTV Pipe Inspection Report

INTERGROUP

Catchment

Contract No

Asset Number

Date

Time

SurveyID

V13-End of line

03/06/2021

12 03:51

9

START

Manhole/Node
St No. & Location
Depth

V13
0 Rotorua museum
0



FINISH

End of line
0 Rotorua museum
0

Structural Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
0	0	0	1	0

Service Pipe Grade

Peak	Mean	Average	Pipe Grd	Total
8	0.47	4	3	8

Drawing No

Line No

Area

System

Tape No

Weather

V13-End_02062021

Dry

Year Laid

Material

Lining

Use

Type

PVC

X

Shape

Width

Diameter

Line Length

Operator

CP

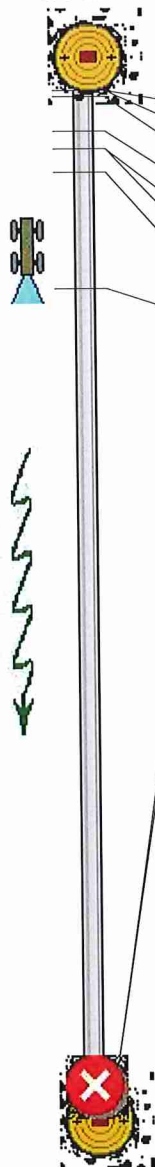
100

17.1

RORY

Comments: Asset used for steam venting

U/S MH



Line Deviates Right

Inspection Starts, (V13)

Line Deviates Left

Line Deviates Down

Debris - Silty, Small, (Silt, stones)

Line Deviates Right

Obstruction Temporary, Small, at 6 o'clock, (Stone in pipe)

General Comment, (visibility lost)

General Comment, (left camera to climatise didnt change visibility)

Inspection Abandoned, (visibility lost due to steam)

0
0
0
0
8
0
0
0
0
0

V13 to END

Protocol of recordings

Date 02/06/2021
Recording Rotorua bath house v13

Picture 001

Video 00:01:00
Distance 1.00 m



Appendix B: Subsurface temperature testing location plan

Underground Temperature Testing Plan

30 June 2021

Active geothermal bore
(still operational)

Faulty geothermal bore 2020
(grouted and decommissioned recently)

Abandoned geothermal bores (decommissioned in the past)

0 5 10m

Scale 1:250 (in A4)

RR10654

RR12152

RR1043

RR500

CPT-T11



CPT locations for temperature testing

CPT-T01

CPT-T03

CPT-T06

CPT-T07

CPT-T02

CPT-T04

CPT-T05

CPT-T09

CPT-T10

CPT-T12

CPT-T13

CPT-T08

Approximate location of staircase

Building extents

Southern Extension
(2012)