

Galway County Council

N6 Galway City Ring Road

Hydraulic Calculations

Reference: Appendix A.10.6

Issue 2 | 28 March 2025

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.






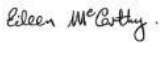
Job number 233985-00

Ove Arup & Partners Ireland Limited

Arup Corporate House
City East Business Park Ballybrit
Galway
Ireland
[arup.com](https://www.arup.com)

Document Verification

Project title N6 Galway City Ring Road
Document title Hydraulic Calculations
Job number 233985-00
Document ref Appendix A.10.6
File reference Appendix A.10.6 Hydraulic Calculations

Revision	Date	Filename	Appendix A.10.6 Hydraulic Calculations_I1		
Issue 1	26 July 2018	Description	Issue 1 Issue for 2018 EIAR		
			Prepared by	Checked by	Approved by
		Name	Alison Orr	Les Brown	Les Brown
		Signature			
Issue 2	28 March 2025	Filename	Appendix A.10.6 Hydraulic Calculations_I2		
		Description	Issue for 2025 RFI Response		
			Prepared by	Checked by	Approved by
		Name	Alison Orr	Les Brown	Eileen McCarthy
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ☒

Contents

1.	Introduction	1
2.	Radius of influence	1
2.1	Karst limestone assessment	1
2.2	Granite and non-karst limestone assessment (Sichardt calculation)	1

Appendices

Annex A – Cross-section A-A	13
-----------------------------	----

1. Introduction

This report is updated to inform the hydrogeology assessment as part of the response to the request by ABP for further information in December 2023 where they requested Galway County Council to “*Update the Environmental Impact Assessment Report*” (EIAR) submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 Galway City Ring Road (GCRR) pursuant to Section 51 of the Roads Act 1993 (as amended).

The updates to this report include the incorporation of material presented during Module 1 of the oral hearing in 2020.

2. Radius of influence

The radius of influence upon groundwater has been assessed for each location along the full alignment of the proposed N6 GCRR where dewatering is proposed. The radius of influence has been calculated for the granite bedrock and the non-karst limestone using the Sichardt calculation. For the karst limestones, the radius of influence is assessed based on groundwater lowering in a karst network.

The calculation is performed for each 100m chainage of the proposed N6 GCRR, which is presented in Table 1 below. Maximum drawdown is calculated as drawdown from the winter groundwater level and the drawdown zone of influence (ZoI) is calculated from the carriageway edge and then converted to a perpendicular measurement from the carriageway centreline.

2.1 Karst limestone assessment

In the scenario where karst was encountered, the potential for head drawdown is very high due to potentially very high connectivity and groundwater could be lowered within the upgradient karst network. To conservatively address the risk for each cutting in limestone, an assessment was made based upon a conduit network with a gradient of 2m/km and the direction of groundwater flow. Based on these factors, it is possible to determine the drawdown in a karst scenario for the full saturated limestone area upgradient and downgradient of the cutting. Thus, the permeability values used in the drawdown calculation for limestone in a karst aquifer are robust.

2.2 Granite and non-karst limestone assessment (Sichardt calculation)

For non-karst a simplified analytical approach detailed in CIRIA (Construction Industry Research and Information Association) Report No 113, ‘Control of groundwater for temporary works’ (SH Somerville, 1986) was used.

The following equation is presented for estimating radius of influence (R_o) for given drawdown (h) and hydraulic conductivity (k):

$$R_o = 3000 h \sqrt{K} \quad (\text{Sichardt equation})$$

Where,

R_o = Radius of influence (m)

h = Drawdown (m)

k = Hydraulic conductivity (m/sec)

The non-karst scenario was assessed on a conservative basis by applying the Sichardt formula and using a conservative non-karst high permeability value of 1.5×10^{-4} m/s. This permeability value was chosen based on field testing and the number of tests in the limestone and the range of permeabilities demonstrated is presented below to illustrate that the value chosen is high. The results of the Sichardt equation are considered

by the authors to be an overestimate of reality but are used in this project to ensure that the assessment of drawdown remains conservative.

In the case of the Castlegar cutting (EW27), which is the only cutting in limestone that has the potential to intersect groundwater (and only at peak groundwater levels) the existing groundwater levels are potentially lowered due to a nearby quarry at Twomile Ditch. Taking into account the potential extent of drawdown as the drawdown occurs at a groundwater high, then the impact of the seasonal drawdown from the proposed N6 GCRR has limited drawdown impact, and as stated this is during peak groundwater high only. A cross-section has been prepared for the Castlegar cutting (EW27) which is included as Annex A – Castlegar Cross-Section A-A).

Table 1 Calculation performed for each 100m chainage of the proposed N6 GCRR

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
0	10.9	7.9	7.9	Embankment	0.0	1.7	10.7	1.7	10.7
100	12.8	9.7	9.7	Cutting	0.1	2.2	47.7	2.2	47.7
200	17.5	13.8	13.8	Cutting	0.7	2.8	48.2	2.8	48.2
300	21.9	18.3	18.3	Cutting	0.6	2.7	35.9	2.7	35.9
400	27.0	22.8	22.8	Cutting	1.3	3.1	43.5	3.1	43.5
500	30.8	27.3	27.3	Cutting	0.6	2.2	32.7	2.2	32.7
600	31.8	28.8	28.8	Embankment	0.0	2.0	34.5	2.0	34.5
700	33.8	30.8	30.8	Embankment	0.0	2.0	33.3	2.0	33.3
800	37.6	34.6	34.6	Embankment	0.0	2.6	35.4	2.6	35.4
900	38.8	35.8	35.8	Embankment	0.0	2.8	35.9	2.8	35.9
1000	40.0	37.0	37.0	Embankment	0.0	2.0	33.4	2.0	33.4
1100	41.6	38.6	38.6	Embankment	0.0	2.4	37.4	2.4	37.4
1200	47.2	43.3	43.3	Cutting	0.9	2.0	46.4	2.0	46.4
1300	47.9	44.9	44.9	Embankment	0.0	2.5	31.6	2.5	31.6
1400	49.8	46.8	46.8	Embankment	0.0	2.2	79.4	2.2	79.4
1500	49.2	46.2	46.2	Embankment	0.0	1.9	90.9	1.9	90.9
1600	53.0	50.0	50.0	Embankment	0.0	1.0	22.3	1.0	22.3

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
1700	56.9	52.9	52.9	Cutting	1.0	2.9	38.9	2.9	38.9
1800	57.4	54.4	54.4	Embankment	0.0	2.4	41.9	2.4	41.9
1900	57.9	54.9	54.9	Embankment	0.0	1.9	38.4	1.9	38.4
2000	56.4	53.4	53.4	Embankment	0.0	2.4	43.4	2.4	43.4
2100	52.8	49.8	49.8	Embankment	0.0	1.0	44.8	1.0	44.8
2200	50.9	47.9	47.9	Embankment	0.0	1.9	42.3	1.9	42.3
2300	51.9	48.9	48.9	Embankment	0.0	2.1	43.0	2.1	43.0
2400	50.1	46.9	46.9	Cutting	0.2	2.1	38.1	2.1	38.1
2500	48.2	44.7	44.7	Cutting	0.4	1.6	32.1	1.6	32.1
2600	48.9	42.8	42.8	Cutting	3.1	2.5	32.1	2.5	32.1
2700	43.3	40.3	40.3	Embankment	0.0	2.4	72.4	2.4	72.4
2800	41.1	38.1	38.1	Embankment	0.0	1.9	78.9	1.9	78.9
2900	40.5	37.5	37.5	Embankment	0.0	2.3	35.4	2.3	35.4
3000	40.0	37.0	37.0	Embankment	0.0	2.6	36.9	2.6	36.9
3100	39.2	36.2	36.2	Embankment	0.0	2.9	38.1	2.9	38.1
3200	39.3	33.3	33.3	Cutting	3.0	5.1	55.7	5.1	55.7
3300	37.1	30.1	30.1	Cutting	4.0	6.6	65.6	6.6	65.6
3400	36.8	28.8	28.8	Cutting	5.0	7.3	76.1	7.3	76.1

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
3500	36.5	27.6	27.6	Cutting	5.9	7.4	80.1	7.4	80.1
3600	34.8	26.4	26.4	Cutting	5.4	7.5	81.0	7.5	81.0
3700	32.9	25.2	25.2	Cutting	4.7	6.5	75.6	6.5	75.6
3800	31.6	24.0	24.0	Cutting	4.6	7.1	83.4	7.1	83.4
3900	26.4	22.8	22.8	Cutting	0.6	0.6	64.7	0.6	64.7
4000	22.6	19.6	19.6	Embankment	0.0	1.0	40.9	1.0	40.9
4100	23.2	20.2	20.2	Embankment	0.0	2.0	27.3	2.0	27.3
4200	25.1	22.1	22.1	Embankment	0.0	2.5	88.3	2.5	88.3
4300	30.5	27.5	27.5	Embankment	0.0	2.8	46.0	2.8	46.0
4400	38.4	33.6	33.6	Cutting	1.8	1.6	27.5	1.6	27.5
4500	36.7	33.7	33.7	Embankment	0.0	2.9	34.1	2.9	34.1
4600	42.0	37.7	37.7	Cutting	1.3	3.7	42.0	3.7	42.0
4700	43.3	40.8	40.8	Embankment	0.0	1.5	22.9	1.5	22.9
4800	45.4	42.4	42.4	Embankment	0.0	1.2	29.3	1.2	29.3
4900	45.5	42.5	42.5	Embankment	0.0	1.1	27.5	1.1	27.5
5000	47.3	44.3	44.3	Embankment	0.0	2.5	44.2	2.5	44.2
5100	49.9	46.9	46.9	Embankment	0.0	1.6	36.7	1.6	36.7
5200	55.5	52.5	52.5	Cutting	1.3	0.0	0.0	0.0	0.0

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
5300	59.0	53.3	53.3	Cutting	2.7	1.5	36.1	1.5	36.1
5400	59.5	54.7	54.7	Cutting	1.8	3.1	49.5	3.1	49.5
5500	63.9	55.6	55.6	Cutting	5.3	4.9	61.5	4.9	61.5
5600	59.4	56.5	56.5	Embankment	0.0	1.5	42.6	1.5	42.6
5700	59.5	56.5	56.5	Embankment	0.0	1.4	24.4	1.4	24.4
5800	56.7	53.7	53.7	Embankment	0.0	2.8	40.3	2.8	40.3
5900	57.4	54.4	54.4	Cutting	0.0	1.6	29.9	1.6	29.9
6000	54.5	51.5	51.5	Embankment	0.0	1.8	38.8	1.8	38.8
6100	56.3	53.3	53.3	Embankment	0.0	0.8	37.4	0.8	37.4
6200	53.0	50.0	50.0	Embankment	0.0	2.0	46.0	2.0	46.0
6300	57.2	54.2	54.2	Embankment	0.0	0.8	36.1	0.8	36.1
6400	54.8	51.8	51.8	Embankment	0.0	1.2	83.1	1.2	83.1
6500	59.7	56.7	56.7	Embankment	0.0	0.0	0.0	0.0	0.0
6600	60.2	57.2	57.2	Embankment	0.0	1.6	32.0	1.6	32.0
6700	58.8	55.8	55.8	Embankment	0.0	2.5	36.8	2.5	36.8
6800	59.6	56.2	56.2	Cutting	0.3	0.0	0.0	0.0	0.0
6900	55.6	52.6	52.6	Embankment	0.0	1.5	48.9	1.5	48.9
7000	60.3	57.3	57.3	Embankment	0.0	2.4	44.8	2.4	44.8

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
7100	61.6	58.6	58.6	Embankment	0.0	2.3	50.8	2.3	50.8
7200	58.9	55.9	55.9	Embankment	0.0	2.0	54.8	2.0	54.8
7300	61.5	58.5	58.5	Embankment	0.0	0.1	79.6	0.1	79.6
7400	63.9	60.9	60.9	Embankment	0.0	0.1	104.4	0.1	104.4
7500	63.1	60.1	60.1	Embankment	0.0	2.2	72.8	2.2	72.8
7600	64.1	61.1	61.1	Embankment	0.0	1.8	78.8	1.8	78.8
7700	69.2	62.9	62.9	Cutting	3.3	3.1	96.5	3.1	96.5
7800	68.9	60.1	60.1	Cutting	5.8	9.0	138.1	9.0	138.1
7900	73.8	56.5	56.5	Cutting	14.4	11.6	145.3	11.6	145.3
8000	67.0	52.5	52.5	Cutting	11.5	11.5	128.4	11.5	128.4
8100	59.3	48.5	48.5	Cutting	7.9	7.5	87.3	7.5	87.3
8200	50.8	44.5	44.5	Cutting	3.3	3.8	55.8	3.8	55.8
8300	42.4	39.4	39.4	Embankment	0.0	0.0	0.0	0.0	0.0
8400	32.3	29.3	29.3	Embankment	0.0	0.0	0.0	0.0	0.0
8500	27.6	24.6	24.6	Embankment	0.0	0.0	0.0	0.0	0.0
8600	23.9	20.9	20.9	Embankment	0.0	0.0	0.0	0.0	0.0
8700	25.1	22.1	22.1	Embankment	0.0	0.0	0.0	0.0	0.0
8800	27.0	24.0	24.0	Embankment	0.0	0.0	0.0	0.0	0.0

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
8900	14.8	11.8	11.8	Embankment	0.0	0.0	0.0	0.0	0.0
9000	15.7	12.7	12.7	Embankment	0.0	0.0	0.0	0.0	0.0
9100	16.4	13.4	13.4	Embankment	0.0	0.0	0.0	0.0	0.0
9200	10.6	7.6	7.6	Embankment	0.0	0.0	0.0	0.0	0.0
9300	5.9	2.9	2.9	Embankment	0.0	0.0	0.0	0.0	0.0
9400	6.0	3.0	3.0	Embankment	0.0	0.0	0.0	0.0	0.0
9500	13.3	10.3	10.3	Embankment	0.0	0.0	0.0	0.0	0.0
9600	12.9	9.9	9.9	Embankment	0.0	0.0	0.0	0.0	0.0
9700	16.6	13.6	13.6	Embankment	0.0	0.0	0.0	0.0	0.0
9800	9.7	6.7	6.7	Embankment	0.0	0.0	0.0	0.0	0.0
9900	11.9	8.9	8.9	Embankment	0.0	0.0	0.0	0.0	0.0
10000	19.5	16.5	16.5	Embankment	0.0	0.0	0.0	0.0	0.0
10100	20.0	17.0	17.0	Embankment	0.0	0.0	0.0	0.0	0.0
10200	22.9	19.9	19.9	Embankment	0.0	0.0	0.0	0.0	0.0
10300	10.8	7.8	7.8	Embankment	0.0	0.0	0.0	0.0	0.0
10400	18.1	15.1	15.1	Embankment	0.0	0.0	0.0	0.0	0.0
10500	14.4	11.4	11.4	Embankment	0.0	0.0	0.0	0.0	0.0
10600	16.5	13.5	13.5	Embankment	0.0	0.0	0.0	0.0	0.0

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
10700	14.0	11.0	11.0	Embankment	0.0	0.0	0.0	0.0	0.0
10800	14.2	10.0	14.2	Cutting	1.3	0.0	0.0	0.0	0.0
10900	21.5	9.8	21.5	Cutting	8.7	0.0	0.0	0.0	0.0
11000	23.9	10.6	23.9	Cutting	10.3	0.0	0.0	0.0	0.0
11100	27.9	11.5	27.9	Cutting	13.5	0.0	0.0	0.0	0.0
11200	32.6	12.3	32.6	Tunnel	17.3	0.0	0.0	0.0	0.0
11300	39.8	13.1	39.8	Tunnel	23.7	0.0	0.0	0.0	0.0
11400	24.2	13.9	24.2	Tunnel	7.3	0.0	0.0	0.0	0.0
11500	15.3	12.3	15.3	Embankment	0.0	0.0	0.0	0.0	0.0
11600	12.2	9.2	12.2	Embankment	0.0	0.0	0.0	0.0	0.0
11700	14.8	20.6	14.8	Embankment	0.0	0.0	0.0	0.0	0.0
11800	50.9	23.3	23.3	Cutting	24.6	0.0	0.0	0.0	0.0
11900	34.9	25.0	25.0	Cutting	7.0	0.0	0.0	0.0	0.0
12000	25.7	22.7	22.7	Embankment	0.0	0.0	0.0	0.0	0.0
12100	23.5	20.5	20.5	Embankment	0.0	0.0	0.0	0.0	0.0
12200	21.0	18.0	18.0	Embankment	0.0	0.0	0.0	0.0	0.0
12300	14.1	11.1	11.1	Embankment	0.0	0.0	0.0	0.0	0.0
12400	11.1	8.1	8.1	Embankment	0.0	0.0	0.0	0.0	0.0

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
12500	22.0	19.0	19.0	Embankment	0.0	0.0	0.0	0.0	0.0
12600	28.3	21.6	21.6	Cutting	3.7	0.0	0.0	0.0	0.0
12700	31.4	20.8	20.8	Cutting	7.6	0.0	0.0	0.0	0.0
12800	28.2	20.1	20.1	Cutting	5.1	0.0	0.0	0.0	0.0
12900	23.6	19.4	19.4	Cutting	1.2	0.0	0.0	0.0	0.0
13000	18.1	15.1	15.1	Embankment	0.0	0.0	0.0	0.0	0.0
13100	28.4	19.8	19.8	Cutting	5.6	3.0	146.6	3.0	146.6
13200	35.7	20.7	20.7	Cutting	12.0	2.9	147.9	2.9	147.9
13300	35.1	21.6	21.6	Cutting	10.5	2.5	131.2	2.5	131.2
13400	34.4	22.5	22.5	Cutting	8.9	3.1	152.2	3.1	152.2
13500	32.4	23.4	23.4	Cutting	6.0	2.5	129.2	2.5	129.2
13600	30.3	24.1	24.1	Cutting	3.2	1.7	98.7	1.7	98.7
13700	21.6	18.6	18.6	Embankment	0.0	0.0	0.0	0.0	0.0
13800	16.9	13.9	13.9	Embankment	0.0	0.0	0.0	0.0	0.0
13900	18.7	15.7	15.7	Embankment	0.0	0.0	0.0	0.0	0.0
14000	18.3	15.3	15.3	Embankment	0.0	0.0	0.0	0.0	0.0
14100	30.8	27.8	27.8	Embankment	0.0	0.0	0.0	0.0	0.0
14200	46.7	35.6	35.6	Cutting	8.1	0.0	0.0	0.0	0.0

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
14300	54.8	39.5	39.5	Cutting	12.3	0.0	0.0	0.0	0.0
14400	56.9	42.5	56.9	Cutting	11.4	0.0	0.0	0.0	0.0
14500	57.5	44.5	57.5	Cutting	10.0	0.0	0.0	0.0	0.0
14600	57.5	45.6	57.5	Cutting	9.0	0.0	0.0	0.0	0.0
14700	57.3	45.6	57.3	Cutting	8.7	0.0	0.0	0.0	0.0
14800	56.8	44.6	56.8	Cutting	9.1	0.0	0.0	0.0	0.0
14900	54.2	42.9	54.2	Cutting	8.3	1.6	48.6	0.0	0.0
15000	53.3	41.7	53.3	Tunnel	8.6	2.7	25.6	0.0	0.0
15100	53.2	41.0	53.2	Tunnel	9.2	3.3	27.5	0.0	0.0
15200	52.0	40.3	52.0	Cutting	8.7	3.9	58.8	0.0	0.0
15300	48.8	40.7	48.8	Cutting	5.1	3.4	49.3	0.0	0.0
15400	46.7	42.8	46.7	Cutting	0.9	1.3	29.9	0.0	0.0
15500	47.0	44.0	47.0	Embankment	0.0	0.0	0.0	0.0	0.0
15600	46.0	43.0	46.0	Embankment	0.0	0.8	35.4	0.0	0.0
15700	43.6	40.6	43.6	Embankment	0.0	1.9	45.4	0.0	0.0
15800	42.7	39.7	42.7	Embankment	0.0	1.8	38.1	0.0	0.0
15900	41.7	38.7	41.7	Embankment	0.0	1.2	34.6	0.0	0.0
16000	41.8	38.8	41.8	Embankment	0.0	0.5	39.6	0.0	0.0

Ch.	Ground level mOD	Construction Dewatering level mOD	Operation Dewatering level mOD	Embankment / Cutting / Tunnel	Depth of cutting m BGL	Construction Phase Drawdown		Operation Phase Drawdown	
						Vertical m	Zol radius from centreline m	Vertical m	Zol radius from centreline m
16100	41.3	38.3	41.3	Embankment	0.0	0.5	33.8	0.0	0.0
16200	41.5	38.3	38.3	Cutting	0.2	0.3	39.9	0.3	39.9
16300	39.9	34.7	34.7	Cutting	2.2	1.3	84.1	1.3	84.1
16400	36.5	32.0	32.0	Cutting	1.5	0.9	56.5	0.9	56.5
16500	33.8	30.3	30.3	Cutting	0.6	0.0	0.0	0.0	0.0
16600	34.8	29.4	29.4	Cutting	2.4	0.0	0.0	0.0	0.0
16700	36.7	29.3	29.3	Cutting	4.4	0.0	0.0	0.0	0.0
16800	38.9	29.1	29.1	Cutting	6.8	0.0	0.0	0.0	0.0
16900	32.7	28.7	28.7	Cutting	1.0	0.0	0.0	0.0	0.0
17000	32.4	28.3	28.3	Cutting	1.1	0.0	0.0	0.0	0.0
17100	32.5	27.7	27.7	Cutting	1.8	0.0	0.0	0.0	0.0
17200	33.1	26.9	26.9	Cutting	3.2	0.0	0.0	0.0	0.0
17300	29.1	26.0	26.0	Cutting	0.1	0.0	0.0	0.0	0.0
17400	28.0	25.0	25.0	Cutting	0.1	0.0	0.0	0.0	0.0
17500	27.1	23.8	23.8	Cutting	0.3	0.0	0.0	0.0	0.0

Annex A – Cross-section A-A

