Clifton Scannell Emerson
Associates

Proposed Surface Water Attenuation Overview

Unit 1, M50 Business Park

Client: Creighton Properties LLC

Date: 4th April 2023

Job Number: 22_112

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

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P03	PLANNING	06/07/2023	KO	CD

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1 Introduction

1.1 Background

This Proposed Surface Water Attenuation Overview report has been prepared by Clifton Scannell Emerson Associates (CSEA) on behalf of Creighton Properties LLC in response to Further Information Request No. 3 (E) as issued by South Dublin County Council in response to the application for planning permission submitted for development at Unit 1, M50 Business Park, Ballymount, Dublin 12 (Reg Ref SD22A/0460).

This report has been revised as South Dublin County Council has requested a Clarification of Additional Information on the submitted Further Information Request. South Dublin County Council has requested additional SUDS measures such as rain gardens, green walls, detention basins, filter drains, swales etc be implemented across the site. This report outlines and details the additional SUDS measures which have been incorporated into the design in response to this Clarification of Additional Information.

1.2 Overview

This Proposed Surface Water Attenuation Overview report is to be read in conjunction with the RPT-22_112-004 SuDS Management Plan report. In this report, the areas and runoff coefficients of different surface types are defined. Surface water attenuation is calculated to ensure that the Greenfield runoff rate for the site is maintained at the outfall manhole during the 1 in 100 year critical storm event, inclusive of the climate change allowance.

1.3 Existing Site

The existing site is located in the Urban Fringe/Periurban area of the Green Infrastructure (GI) network of the County. Although the site is not partially or wholly within the Riparian Corridors, urbanisation disrupts the land-water linkages. Surface water runoff from existing hardstanding areas are collected in a sealed system of pipes and gullies and outfalls via a bypass petrol interceptor to the existing M50 Business Park drainage network. There is no existing provision for surface water attenuation thus increasing flood risk within the site and is likely to increase flood risk elsewhere during critical storm events.

2 Additional SUDS Measures

South Dublin County Council has requested additional SUDS measures such as rain gardens, green walls, detention basins, filter drains, swales etc be implemented across the site.

CSEA have reviewed the currently SUDS strategy with the focus on reducing the underground attenuation capacity whilst demonstrating improvements to the overall surface water drainage treatment train by providing additional SUDS means with biodiversity and/or amenity value.

Following this approach, the design team have included the following additional SUDS measures into the scheme:

- Rain Garden
- Additional Green Roof

The above measures have been development as part of a multi-disciplinary design team approach involving architects, landscape architects and civil engineers.

The additional SUDS measures have had a positive effect on the scheme. The treatment train approach has been improved as additional area is now subject to a two stage treatment process. The underground attenuation system has reduced in volume due to the increase in on-site natural SUDS source control features. The scheme has gained an amenity value in the form of a rain garden.

These measures have been revised on the layouts and can be seen on Appendix C, G and H.

In addition, CSEA has completed the appropriate table which provides clear explanations/rationale for selecting/not selecting additional nature SUDS measures. Please refer to Appendix I for further information.

3 Determination of Greenfield Runoff Rate

The allowable discharge rate, Q_{BAR}, is given by the following equation in accordance with the Institute of Hydrology Report No. 124 (IH 124 method):

$$Q_{BAR} = 0.00108AREA^{0.89}SAAR^{1.17}SOIL^{2.17}$$

However, the total site area is less than 50 hectares. Therefore, Q_{BAR} is calculated for 50 hectares and linearly interpolated to 0.86 hectares. See calculations below.

IH 124 method for 50 hectare site area:

AREA = 0.5 km^2 (i.e. 50 ha)
SAAR = 700 mm (Met Eireann SAAR, see Appendix D)
SOIL = 0.3 (SOIL TYPE 2, see Table D1 of Appendix D of Volume 2 of GDSDS)

Q_{BAR} = $0.00108(0.5)^{0.89}(700)^{1.17}(0.3)^{2.17}$
= 0.09 m^3/s for 50 ha site area

Interpolation for 0.86 hectares:

Q_{BAR} = (0.09 m^3/s / 50 ha) x 0.86 ha
= 0.002 m^3/s

Therefore, Q_{BAR} = 1.57 l/s.

Check whichever is greater for the maximum discharge rate of Q_{bar} or 2 l/s/ha in accordance with Criterion 4.3 of Table 6.3 of Volume 2 the GDSDS.

Q_{BAR} = 1.57 l/s

2 l/s/ha = 1.73 l/s for 0.86 ha site

Therefore, the maximum allowable discharge for the site is **1.73 l/s** at a design head of **2.0m**. Discharge from the site will be controlled by means of an online hydrobrake vortex control (Unit Reference SHE-0053-1730-2000-1730). Details of the hydrobrake proposed are provided in **Appendix A**.

4 Coefficients of Runoff for Contributing Impermeable Areas

The proposed development contains the following impermeable areas:

Roof Area (A_{RF})	= 0.221 ha
Green Roof Area (A_{GRF})	= 0.007 ha
Concrete Area (A_{CONC})	= 0.216 ha
Gravel Area (A_{GRAV})	= 0.028 ha
Grasscrete Area (A_{GCRETE})	= 0.147 ha
Roof Draining to Rain Garden(A_{RFRG})	= 0.012 ha

Section 8.4.4.1 of the 'SDCC SuDS explanatory design and evaluation guide' states that the runoff co-efficient of 0.95 for roofs and 0.9 for paved areas would be accepted by SDCC where no more detailed assessment is undertaken and notes that the designer must evaluate the runoff coefficient for the types of surfaces contributing to the storage location. As there are a number of other surfaces with varying co-efficient of runoff contributing to the design of the attenuation system CSEA have undertaken a review of best practice in relation to co-efficient of run-off for various surfaces and have located detailed guidance for same in Table 9 of the German standard DIN 1986-100:2016-12 (refer to **Appendix B,** note text is in German). The run-off co-efficients adopted are outlined below:

Roof Coefficients of Runoff (C_{RF})	= 0.95
Green Roof Coefficients of Runoff (C_{GRF})	= 0.40
Concrete Coefficients of Runoff (C_{CONC})	= 0.90
Gravel Coefficients of Runoff (C_{GRAV})	= 0.70
Grasscrete Coefficients of Runoff (C_{GCRETE})	= 0.30
Rain Garden Coefficients(C_{RFRG})	= 0.30

Therefore, total impermeable are for the site is calculated as follows:

$$\text{Total Impermeable Area} = A_{RF} \times C_{RF} + A_{GRF} \times C_{GRF} + A_{CONC} \times C_{CONC} + A_{GRAV} \times C_{GRAV} + A_{GCRETE} \times C_{GCRETE} + A_{RFRG} \times C_{RFRG}$$

$$= 0.221 \times 0.95 + 0.007 \times 0.40 + 0.216 \times 0.90 + 0.028 \times 0.70 + 0.147 \times 0.30 + 0.012 \times 0.3$$

$$= 0.475 \text{ ha}$$

Refer to **Appendix C** for the drawing showing the different surface types, areas, and respective runoff coefficients.

5 Required Surface Water Attenuation Storage

In order to account for climate change, an additional allowance of 20% in rainfall intensities have been allowed as per Section 8.4.6.4 of SDDCC Sustainable Drainage Explanatory Design & Evaluation Guide which exceeds the requirements of Table 6.1 of Volume 2 of the GDSDS (10%).

Analysis of the 1 in 30 year storm event yields a critical required storage volume of 347.165 m^3 during the critical 1440 minute storm event. Similarly, analysis of the 1 in 100 year storm event yields a critical required storage volume of 518.537 m^3 during the 1440 minute storm event. See **Appendix D** for analysis the 1 in 30 and 1 in 100 year storm event.

As a result, the required surface water storage is **518.537** m^3 during the critical 1440 minute of the 1 in 100 year storm event. This is a reduction of 14.0m^3 in attenuation volume due to the additional SuDS features.

Considering the site constraints and underground service congestion, 3 no. StormTech™ systems by Cubic M^3 or similar is being proposed. These systems have been modified to use storage volume within the gravel media rather than tanked storage where possible. See **Appendix E** for further details.

6 Surface Water Network Flooding Check for Critical Storm Event

The critical storm event occurs during the 1440 minute of the 1 in 100 year storm event for which 513.976 m^3 of surface water attenuation storage is required. During this storm event the Top Water Level (TWL) = 66.60 m in the surface water network.

As a result, the surface water volume of **518.537 m^3** is stored in the network as follows:

- Attenuation A1
  - Cover Level (CL) = 67.47 m
  - Invert Level (IL) = 64.88 m
  - Plan Area = 96.55 m^2
  - Top of Attenuation System level = 66.56 m
  - Top Water Level (TWL) during Critical Storm = 66.56 m
  - Storage Volume Contribution during Critical Storm = 63.3 m^3 (100 % of Capacity)
- Attenuation A2 (Inclusive of additional 127 m^3 Porous Stone)
  - Cover Level (CL) = 67.52 m
  - Invert Level (IL) = 64.68 m
  - Plan Area = 357.77 m^2
  - Top of Attenuation System level = 66.48 m
  - Top Water Level (TWL) during Critical Storm = 66.48 m
  - Storage Volume Contribution during Critical Storm = 297.2 m^3 (100 % of Capacity)
- Attenuation A3
  - Cover Level (CL) = 66.61 m
  - Invert Level (IL) = 65.03 m
  - Attenuation System Plan Area = 169.85 m^2
  - Top of Attenuation System level = 66.09 m
  - Top Water Level (TWL) during Critical Storm = 66.09 m
  - Storage Volume Contribution during Critical Storm = 105.8 m^3 (100 % of Capacity)
- Manhole Storage
  - Top Water Level (TWL) during Critical Storm = 66.60 m
  - Storage Volume Contribution during Critical Storm = 34.965 m^3 (53 % of Capacity)
- Pipes Storage
  - Top Water Level (TWL) during Critical Storm = 66.19 m
  - Storage Volume Contribution during Critical Storm = 17.618 m^3 (92 % of Capacity)
- Total Provided Storage (during Critical Storm) = Attenuation A1 + Attenuation A2 + Attenuation A3 + Manhole Storage + Pipe Storage
  = 63.3 + 297.2 + 105.8 + 34.965 + 17.618
  = 518.88 m^3

As the proposed drainage system, inclusive of the attenuation systems provided as outlined above, has greater capacity that the estimated storage volume required during the critical1440 minute during the 1 in 100 year storm event it can be concluded that the site will not be subject to flooding during the critical storm period.

Refer to **Appendix G** for the drawing showing surface water attenuation capacity during 1440 minute of 1 in 100 year critical storm event. Refer to **Appendix H** for the drawing demonstrating the SuDS treatment train and proposed source and site controls.

7 Conclusion

This report provides a comprehensive response to the Clarification of Additional Information on the submitted Further Information Request. South Dublin County Council has requested additional SUDS measures be implemented across the site. The addition of the green roofs, and rain garden, whilst adding amenity value to the scheme, has been incorporated into the site. These additional SUDS measures have reduced the underground storage by 14.0m^3 and in addition, the surface water drainage treatment train has been improved as an addition 150m^2 is now subject to a two-stage treatment process.

In addition, CSEA has completed the appropriate table which provides clear explanations/rationale for selecting/not selecting additional nature SUDS measures. Please refer to Appendix I for further information.

Appendix A - Flow Control Device Details

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	1.730
Flush-Flo™	0.233	1.105
Kick-Flo®	0.473	0.907
Mean Flow		1.271

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 49 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

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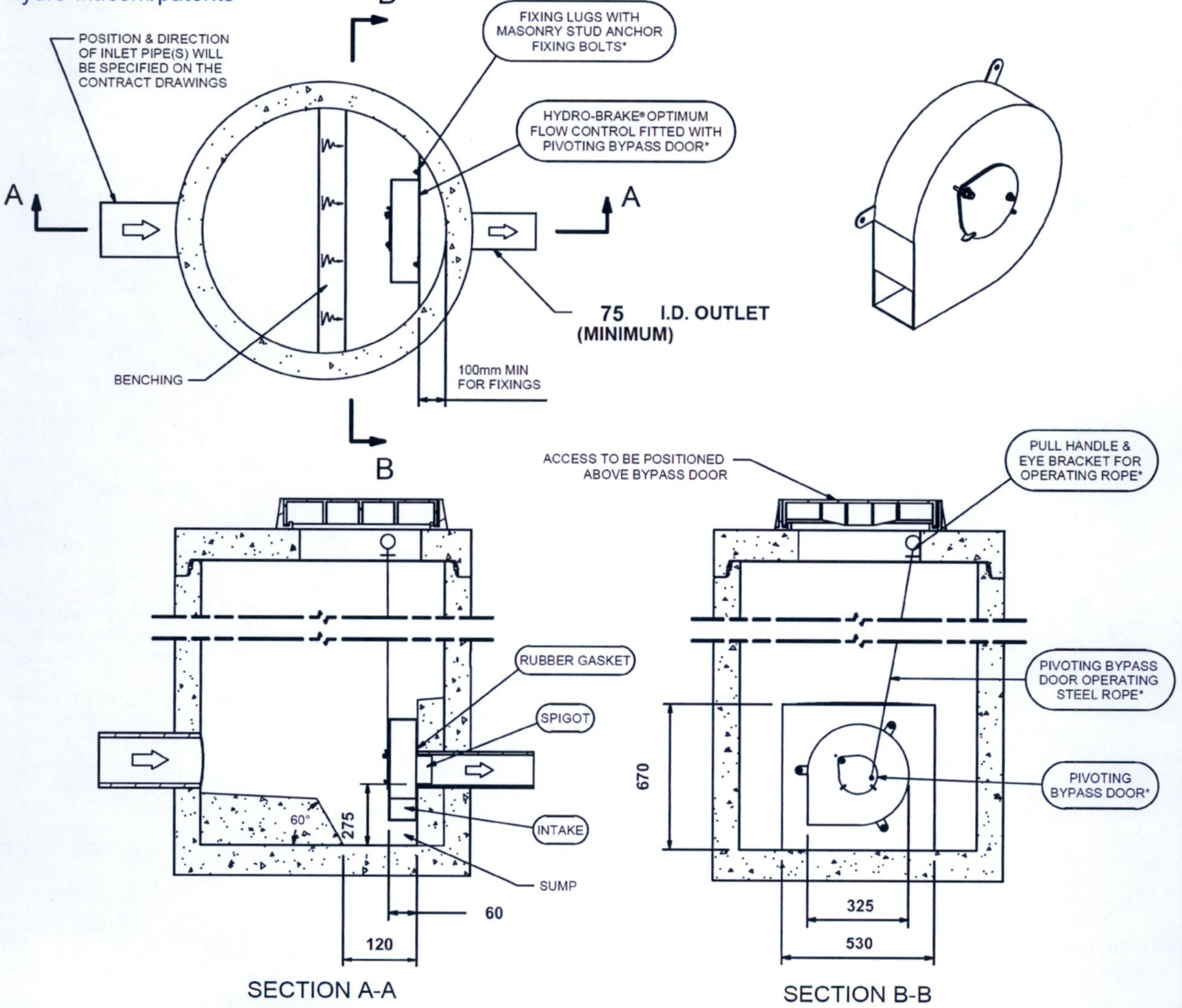

IMPORTANT: (oval symbol) LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0053-1730-2000-1730 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve. **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International ®

DATE	30/08/2022 09:26
SITE	Unit 1, M50 Business Park
DESIGNER	Kyle Brill
REF	22_112

SHE-0053-1730-2000-1730

Hydro-Brake® Optimum

Technical Specification		
Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	1.730
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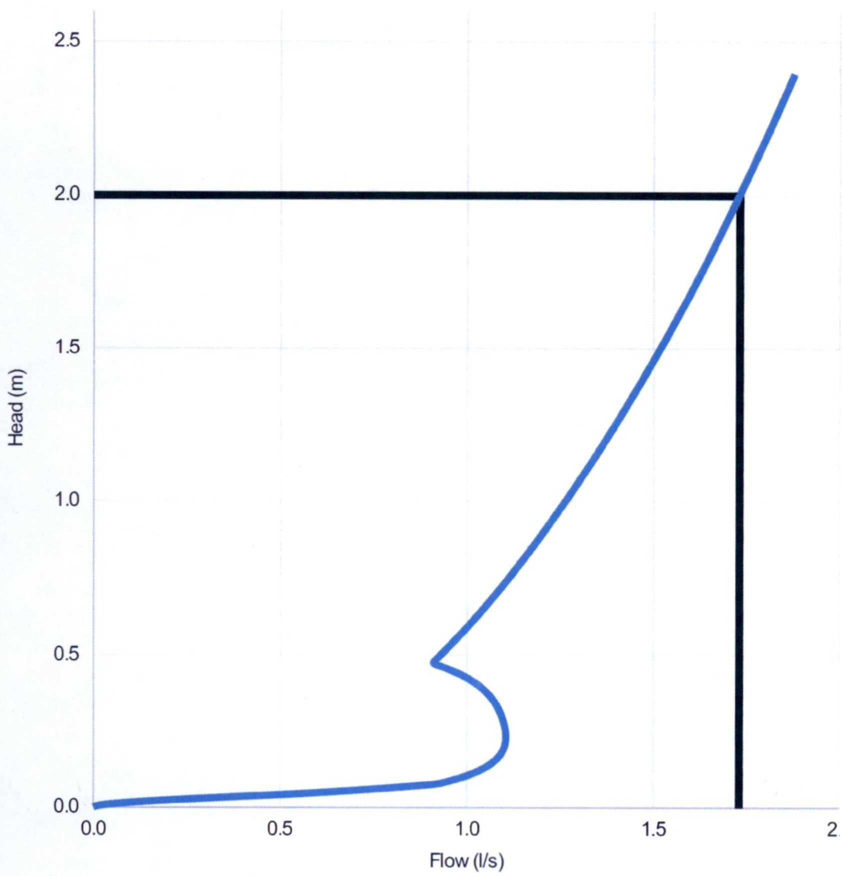
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.069	0.839
0.138	1.057
0.207	1.103
0.276	1.100
0.345	1.075
0.414	1.016
0.483	0.915
0.552	0.970
0.621	1.022
0.690	1.071
0.759	1.117
0.828	1.161
0.897	1.204
0.966	1.244
1.034	1.283
1.103	1.321
1.172	1.358
1.241	1.393
1.310	1.427
1.379	1.461
1.448	1.493
1.517	1.525
1.586	1.556
1.655	1.586
1.724	1.616
1.793	1.645
1.862	1.674
1.931	1.702
2.000	1.729

DESIGN ADVICE

!

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DATE	30/08/2022 09:26
Site	Unit 1, M50 Business Park
DESIGNER	Kyle Brill

SHE-0053-1730-2000-1730

Appendix B Table 9 of DIN 1986-100:2016-12 (German Standard)

14.2.3 Abflussbeiwerte

Tabelle 9 — Abflussbeiwerte *C* zur Ermittlung des Regenwasserabflusses

Nr.	Art der Flächen Die Abflussbeiwerte beziehen sich ausschließlich auf Flächen, die potentiell einen Abfluss zum Entwässerungssystem haben.	Spitzenabflussbeiwert C_s	Mittlerer Abflussbeiwert[c] C_m Berechnung von V_{RRR}
1	Wasserundurchlässige Flächen, z. B. Dachflächen — Schrägdach		
	— Metall, Glas, Schiefer, Faserzement	1,0	0,9
	— Ziegel, Abdichtungsbahnen	1,0	0,8
	— Flachdach (Neigung bis 3° oder etwa 5 %		
	— Metall, Glas, Faserzement	1,0	0,9
	— Abdichtungsbahnen	1,0	0,9
	— Kiesschüttung	0,8	0,8
	— Begrünte Dachflächen[a]		
	— Extensivbegrünung (> 5°)	0,7	0,4
	— Intensivbegrünung, ab 30 cm Aufbaudicke (≤ 5°)	0,2	0,1
	— Extensivbegrünung, ab 10 cm Aufbaudicke (≤ 5°)	0,4	0,2
	— Extensivbegrünung, unter 10 cm Aufbaudicke (≤ 5°)	0,5	0,3
	Verkehrsflächen (Straßen, Plätze, Zufahrten, Wege)		
	— Betonflächen	1,0	0,9
	— Schwarzdecken (Asphalt)	1,0	0,9
	— befestigte Flächen mit Fugendichtung, z. B. Pflaster mit Fugenverguss	1,0	0,8
	Rampen		
	— Neigung zum Gebäude, unabhängig von der Neigung und der Befestigungsart	1,0	1,0
2	**Teildurchlässige und schwach ableitende Flächen, z. B. Verkehrsflächen (Straßen, Plätze, Zufahrten, Wege)**		
	— Betonsteinpflaster, in Sand oder Schlacke verlegt, Flächen mit Platten	0,9	0,7
	— Pflasterflächen, mit Fugenanteil > 15 %, z. B. 10 cm × 10 cm und kleiner oder fester Kiesbelag	0,7	0,6
	— wassergebundene Flächen	0,9	0,7
	— lockerer Kiesbelag, Schotterrasen, z. B. Kinderspielplätze	0,3	0,2
	— Verbundsteine mit Sickerfugen, Sicker-/Drainsteine	0,4	0,25
	— Rasengittersteine (mit häufigen Verkehrsbelastungen, z. B. Parkplatz)	0,4	0,2
	— Rasengittersteine (ohne häufige Verkehrsbelastungen, z. B. Feuerwehrzufahrt)	0,2	0,1
	Sportflächen mit Dränung		
	— Kunststoff-Flächen, Kunststoffrasen	0,6	0,5
	— Tennenflächen	0,3	0,2
	— Rasenflächen	0,2	0,1
3	**Parkanlagen, Rasenflächen, Gärten**		
	— flaches Gelände	0,2[b]	0,1
	— steiles Gelände	0,3[b]	0,2

[a] Siehe auch [7] für die Planung, Ausführung und Pflege von Dachbegrünungen, die dort genannten Werte sind C_s-Werte

[b] Bei diesen Flächen ist für den Überflutungsnachweis ein möglicher höherer Abflussbeitrag je nach örtlichen Gegebenheiten (z. B. Gefälle, Boden, Vegetation) zu prüfen.

[c] Aufgrund der Anwendung einer einheitlichen Wiederkehrzeit (T = 2 a) und des begrenzten Anwendungsspektrums für die Bemessung von V_{RRR} wird hier jeweils nur ein Wert für C_m genannt. Die in den DWA-Regelwerken genannten Wertespektren beziehen sich auf unterschiedliche Wiederkehrzeiten und Planungssituationen.