



Project: Dentholme, Cragg Road, Cleator Moor, CA25 5PR	Job No. 0010121	Sheet No. FHD - 01 A
	Prepared: MRV	Date: Jan. 2022
Title: New Flats And Houses Below Ground Drainage Design	Checked:	Date:

1.0 - Rainwater Drainage

1.1 - Design Data

Main Roof - Pitch - $32\frac{1}{2}^\circ$ - To Second Floor

External - Car Park - Tarmac
Paving - To Rear Of Driveways

Rainfall Intensity

AD 4 - Gutters And Downpipes - Pigs. 1 = $0.016 \text{ Lt/Sec./m}^2$
Paving And Driveways - " 2 = $0.012 \text{ Lt/Sec./m}^2$
United Utilities = $50 \text{ mm/Hr} = 0.0139 \text{ Lt/Sec./m}^2$

1.2 - Gutters And Downpipes

For Main Roof - Front And Rear Slopes

$$\text{Area} = 103.6 \text{ m}^2$$

$$\text{Rainwater Flow} = 103.6 \times 1.33 \times 0.016 = 2.21 \text{ Lt/Sec.}$$

Provide - A 125mm GUTTER FLOWING TO 2ND OUTLET,
75mm ϕ MIN. AT EITHER END OF BUILDING,

For Annex - Rear Roof Slope

$$\text{Area} = 15.9 \text{ m}^2$$

$$\text{Rainwater Flow} = 15.9 \times 1.58 \times 0.016 = 0.40 \text{ Lt/Sec.}$$

Provide - A 100mm GUTTER FLOWING TO A 63mm ϕ MIN.
OUTLET

For Annex - Front Roof Slope

$$\text{Area} = 45.6 \text{ m}^2$$

$$\text{Rainwater Flow} = 45.6 \times 1.33 \times 0.016 = 0.97 \text{ Lt/Sec.}$$

Provide - A 125mm GUTTER FLOWING TO A 75mm ϕ MIN.
OUTLET



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1.3 - Below Ground Drainage

For Main Roof

$$\text{Flow / Outlet} = 103.6 \times 0.5 \times 1.33 \times 0.0139 = 0.96 \text{ Lt/Sec.} - 4N^{\circ} \text{ OUTLETS TOTAL}$$

For Annex Rear Roof

$$\text{Flow / Outlet} = 15.9 \times 1.58 \times 0.0139 = 0.35 \text{ Lt/Sec.} - 1N^{\circ} \text{ OUTLET}$$

For Annex Front Roof

$$\text{Flow / Outlet} = 45.6 \times 1.33 \times 0.0139 = 0.84 \text{ Lt/Sec.} - 1N^{\circ} \text{ OUTLET}$$

For Car Park

$$\text{Area} = 238.7 \text{ m}^2$$

$$\text{Rainwater Flow} = 238.7 \times 0.0139 = 3.32 \text{ Lt/Sec.}$$

For Paved Area

$$\text{Area} = 8.40 \text{ m}^2$$

$$\text{Rainwater Flow} = 8.40 \times 0.0139 = 0.12 \text{ Lt/Sec.} - \text{To } 4N^{\circ} \text{ Areas}$$



Project: Dentholme, Cragg Road, Cleator Moor, CA25 5PR	Job No. 0010121	Sheet No. FHD-03
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2.0 - Foul Drainage

2.1 - Design Data

Based on BS EN 752:2008 - System III

Discharge Rates	WASH BASIN	= 0.30 Lt/Sec.
	Shower	= 0.40 " "
	BATH	= 1.30 " "
	WC - GUT	= 1.50 " "
	KITCHEN SINK	= 1.30 " "
	L/MACHINE	= 0.60 " "
	DISH WASHER	= 0.20 " "

$$\text{Flow Rate} = Q_{\text{DN}} = K/\sqrt{D_0} \quad K = 0.50 - \text{For DWELLINGS}$$

2.2 - SVP Usage

SVP Type 1

Bath = 1.30
WC = 1.50
Basin = 0.30

$$= 3.10 \text{ Lt./Sec.}$$

$$\therefore Q_{\text{DN}} = 0.5/\sqrt{3.1} = 0.88 \text{ Lt./Sec.}$$

$$\therefore Q_{\text{max}} = 1.50 \text{ Lt./Sec. For W.C.}$$

SVP Type 2

1N° WC	=	1.50
1N° BASIN	=	0.30
1N° SHWR	=	0.40
2N° KIT. SINK	= 2 x 1.30	= 2.60
2N° L. MACHINE	= 2 x 0.60	= 1.20
2N° D. WASHER	= 2 x 0.20	= 0.40

$$= 6.40 \text{ Lt./Sec.}$$



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$$\therefore Q_{WW} = 0.5 \sqrt{6.40} = 1.27 \text{ Lt/Sec.}$$

$$\therefore Q_{max} = 1.50 \text{ Lt/Sec. For W.C.}$$

SVP TYPE 3

3 ^{NO} WC	=	3 x 1.50	=	4.50
3 ^{NO} BASIN	=	3 x 0.30	=	0.90
2 ^{NO} SINK	=	2 x 0.40	=	0.80
1 ^{NO} BATH	=		=	1.30
1 ^{NO} K. SINK	=		=	1.30
1 ^{NO} W. MACHINE	=		=	0.60
1 ^{NO} D. WASHER	=		=	0.20
				<u>9.60 Lt/Sec.</u>

$$\therefore Q_{WW} = 0.5 \sqrt{9.60} = 1.55 \text{ Lt/Sec.}$$

$$Q_{max} = 1.55 \text{ Lt/Sec.}$$

SVP TYPE 4

1 ^{NO} K. SINK	=	1.30
1 ^{NO} W. MACHINE	=	0.60
1 ^{NO} D. WASHER	=	0.20
		<u>2.10 Lt/Sec.</u>

$$Q_{WW} = 0.5 \sqrt{2.10} = 0.73 \text{ Lt/Sec.}$$

$$Q_{max} = 1.30 \text{ Lt/Sec. - For Kitchen Sink}$$



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3.0 - PIPE SIZING - SURFACE WATER

From RWP1 to RWP2 - Max. Flow = 0.84 Lt/Sec.

" RWP2 to RWP3 - Max. Flow = 0.84 + 0.96 = 1.80 Lt/Sec

" RWP3 to IC2 & MH1 - Max Flow = 0.84 + (2 x 0.96) = 2.76 Lt/Sec

" RWP4 to IC3 - Max. Flow = 0.35 Lt/Sec.

" IC3/RWP5 to IC4/RWP6 - Max. Flow = 0.35 + (2 x 0.96) + (4 x 0.12) = 2.75 Lt/Sec.

" IC4 to MH1 - Max. Flow = 2.75 Lt/Sec.

" MH1 to MH2 - Max. Flow = 2.76 + 2.75 + 3.32 = 8.83 Lt/Sec.

Provide - An OSMA DRAIN 110φ FOR ALL FLOW RATES LESS THAN 4.5 Lt/Sec. FOR A 1:200 FALL AND 160φ FOR A 1:200 FALL FOR GREATER FLOW RATES.

4.0 - PIPE SIZING - FOUL WATER

For SVP TO FIRST IC - Max. Flow = 1.55 Lt/Sec. - 110φ OSMA DRAIN @ 1:80 FALL

From IC7 to IC9 - Max. Flow = 1.55 + 1.30 = 2.85 Lt/Sec. - 110φ OSMA DRAIN @ 1:80 FALL

" IC9 to IC10 - " " " = 2.85 + 1.50 + 1.50 = 5.85 Lt/Sec. - 160φ " " @ 1:150 FALL

" IC10 to IC11 - " " " = 5.85 + 1.50 + 1.50 = 8.85 Lt/Sec - 160φ " " " " " "

" IC11 to IC12 - " " " = 8.85 + 1.50 = 10.35 Lt/Sec - 160φ " " " " "

" IC12 to IC13 - " " " = 10.35 + 1.50 + 1.50 = 13.35 Lt/Sec. - 150φ ULTRA RIB " "

" IC13 to IC14 - " " " = 13.35 + 1.5 = 14.85 Lt/Sec - 225φ " " " "

" IC14 to IC15 - " " " = 14.85 + 1.5 + 1.5 = 17.85 Lt/Sec - 225φ " " " "

" IC15 to MH3 - " " " = 17.85 + 1.5 + 1.5 = 20.85 Lt/Sec. - 225φ " " " "



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S.0 - ADJUSTMENTS TO ORIGINAL SCHEME

S.1 - ALTERATIONS REQUIRED

ON FURTHER INVESTIGATION, THE SCHEDULED MANHOLE AT THE EDGE OF THE SITE ON TROVINGS ROAD WAS FOUND TO BE A HIGHWAY DRAIN RATHER THAN A CONNECTION TO A COMBINED SEWER AS INDICATED ON DRAINAGE MAPS FOR THE AREA.

THE FOUL AND SURFACE WATER FOR THE FLATS WILL NOW CONNECT TO A MANHOLE IN CRAGG ROAD. THIS DRAINAGE WILL ALSO CATER FOR THE NEW AMENITY BLOCK FOUL AND SURFACE WATER DRAINAGE.

THE DISCHARGE RATE FOR SURFACE WATER WILL BE RESTRICTED TO 5L/SEC. AS REQUIRED BY UNITED UTILITIES. THE FLOW WILL BE RESTRICTED AND STORAGE PROVIDED BY USING CHUTES BENEATH THE CAR PARK TO THE FLATS.

THIS SECTION SHALL COVER THE DRAINAGE CALCULATIONS FOR THE SECTION BETWEEN THE FLATS TO THE MANHOLE IN CRAGG ROAD.

S.2 - FOUL DRAINAGE

FOR LEISURE ROOMS - 4N° TOWN

SVP TYPE 1 - 2N° TOWN

WC = 1.50

BASIN = 0.30

Shower = 0.40

$$= 2.20 \text{ Lt/Sec.} \times 2 \text{ N}^{\circ} = 4.40 \text{ Lt/Sec.}$$

$$\therefore Q_{WW} = 0.5 \sqrt{4.40} = 1.05 \text{ Lt/Sec.}$$

$$\therefore Q_{max} = 1.50 \text{ Lt/Sec. for WC}$$

S.3 - PIPE SIZING - FOUL WATER

FOR MU3 TO IC16 - MAX. FLOW = 20.85 Lt/Sec. - 225p ULTRA MB @ 1:150 FALL

" IC17 TO DRAIN - " " = 1.50 Lt/Sec - 110p OSMA DRAIN @ 1:80 FALL

" IC18 TO DRAIN - " " = " " " " " "

" IC16 TO MU4 - " " = 20.85 + 1.5 + 1.5 = 23.85 Lt/Sec - 225p ULTRA MB @ 1:150 FALL



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M4 to M5 - Max. Flow = 23.85 L/sec - 225d ultra HD C 1:150 Fall

Silt - Surface Water - Spa Block

Use 2nd RWP TO FLAT ROOF AREAS

Drainage Area = 38.96 m²

Rainwater Flow = 38.96 x 0.016 = 0.63 L/sec.

Provide - A 115mm GUTTER ON ROOF FALLS TO 2nd 63d DOWNPIPES

For PIPE TO MANHOLE

Max. Flow = 76.41 x 0.016 = 1.23 L/sec.

Provide - A 110d Osma Down C 1:200 Fall

S.S - Surface Water Attenuation

SURFACE WATER DRAINAGE SHALL BE ATTENUATED TO LIMIT FLOW TO LIT/sec. OVERALL

THE FLOW FROM THE SPA BUILDING SHALL NOT BE ATTENUATED BUT ALLOWED FOR IN THE DESIGN

∴ Outflow For Design = 5.0 - 1.23 = 3.77 L/sec.

Use UK WATKINS FORD ASSESSMENT - Return period = 20 yrs

Storm Dur. (h)	MS-60 (mm)	Z ₁	(MS-D) x Z ₁	Z ₂	MS-D (mm)	Intensity (mm/h)
0.083	20	0.38	7.6	1.39	10.56	127.28
0.167	20	0.50	10.0	1.41	14.10	84.43
0.25	20	0.68	13.6	1.43	19.45	77.80
0.50	20	0.81	16.2	1.44	23.33	46.66
1	20	1.00	20.0	1.45	29.00	29.00
2	20	1.30	26.0	1.44	37.44	18.72
4	20	1.60	32.0	1.41	45.12	11.28
6	20	1.82	36.4	1.39	50.60	8.44
10	20	2.10	42.0	1.37	57.54	5.75
24	20	2.66	53.2	1.33	70.76	2.95
48	20	3.13	62.6	1.31	82.00	1.71



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STORAGE VOLUMES - TOTAL EFFECTIVE AREA = SLOP. 1.2 AND 1.3 = 223.6 m² - ROOF
= 247.1 m² - CURB PARK/PAVING

Storm Run. (h)	INTENSIM (mm/h)	VOLUME (m ³)	OUTFLOW VOL. (m ³)	STORAGE (m ³)
0.083	127.28	4.97	1.13	3.84
0.167	84.43	6.64	2.27	4.37
0.25	77.80	9.16	3.39	5.77
0.50	46.66	10.98	6.78	4.20
1	29.00	13.65	13.57	0.08
2	18.72	17.62	27.14	-9.52
4	11.28	21.24	54.29	-33.05
6	8.44	23.84	81.43	-57.59
10	5.75	27.06	135.72	-108.66
24	2.95	33.33	325.73	-292.40
48	1.71	38.63	651.46	-612.83

Storage Required = 5.77 m³

Provide - Wavin Aqua-Cem Eco Units, 8m LONG, 1.0m WIDE,
2 NO UNITS NEEDED

For Flow Restriction

Allowable Flow = 3.77 ltr/sec

∴ Pipe Diameter Req'd = $(3.77 \times 0.1^3 \times 4 / \pi)^{1/2} = 0.07m$ DIA.

Provide - A 68mm DIA. PIPE TO RESTRICT FLOW