

Land at Dalefield Way (West) Gravesend

Flood Risk Assessment Note & Preliminary Drainage Strategy

O'Halloran & O'Brien Ltd

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1.0 Introduction

Manhire Associates have been appointed by O'Halloran & O'Brien Ltd to prepare a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy in support of a Planning Application for the redevelopment proposals for open storage (Use Class B8) for the western plot within the larger existing industrial land plot.

The application site is on Dalefield Way, Gravesend, Kent DA12 2JH in an area known as Dalefield Way Industrial Estate. The wider industrial estate includes the offices, workshops and storage areas used by B&T plant hire, O'Halloran & O'Brien & Keady Construction.

This report describes the existing and proposed development, the implications of flooding and the impact the development will have on the flood plan in accordance with the governments guidance document; National Planning Policy Framework (NPPF) and its Planning Practice Guidance (PPG).



Figure 1 - Aerial Image of site.

Proposals are to construct 2969m² of asphalt surfacing and associated drainage that will connect into the overall SuDS system already constructed and provides 9576m² of permeable hardstanding for storage.

The purpose of this report is to provide a review of existing Flood Risk Assessments and to demonstrate to the planning authority and consultees that the industrial element has been assessed and is considered to be safe throughout its design life. It also confirms how surface water run off from the development can be dealt with within the existing sites sustainable drainage network previously constructed for the original development.

2.0 Baseline Parameters

The site and surrounding area has been subject to a number of planning applications, in 1999 an outline application for 165 residential dwellings known as Phase 1 & 2 under ref GR99/168. During the application it was identified that approximately 650m of the watercourse needed improvement to provide the necessary on-line attenuation to accommodate the development.

The above-mentioned measures involved improvement to 650m of the existing watercourse and provision of 2 outfall structures that were limited to the greenfield discharge. The approved works were implemented in early 2003.

The application site was granted consent for industrial development use classes B2 & B8, approval was given to the outline application on the 22 June 2001. A new outline application was permitted on 23rd October 2007 for industrial development classes B2 & B8. In 2013 an application was made to renew the 2007 permission, it was granted on 14th June 2013.

Also, of note there have been a number of planning applications adjoining the application site. In 2013 outline consent was granted for an industrial development of 7,000 sqm of B2 & B8 uses to the east of the application site, and on 14th September 2016 permission was granted for 3 industrial units on that site. To the southeast of the application site outline permission was granted on 27th March 2014 for 130 residential units.

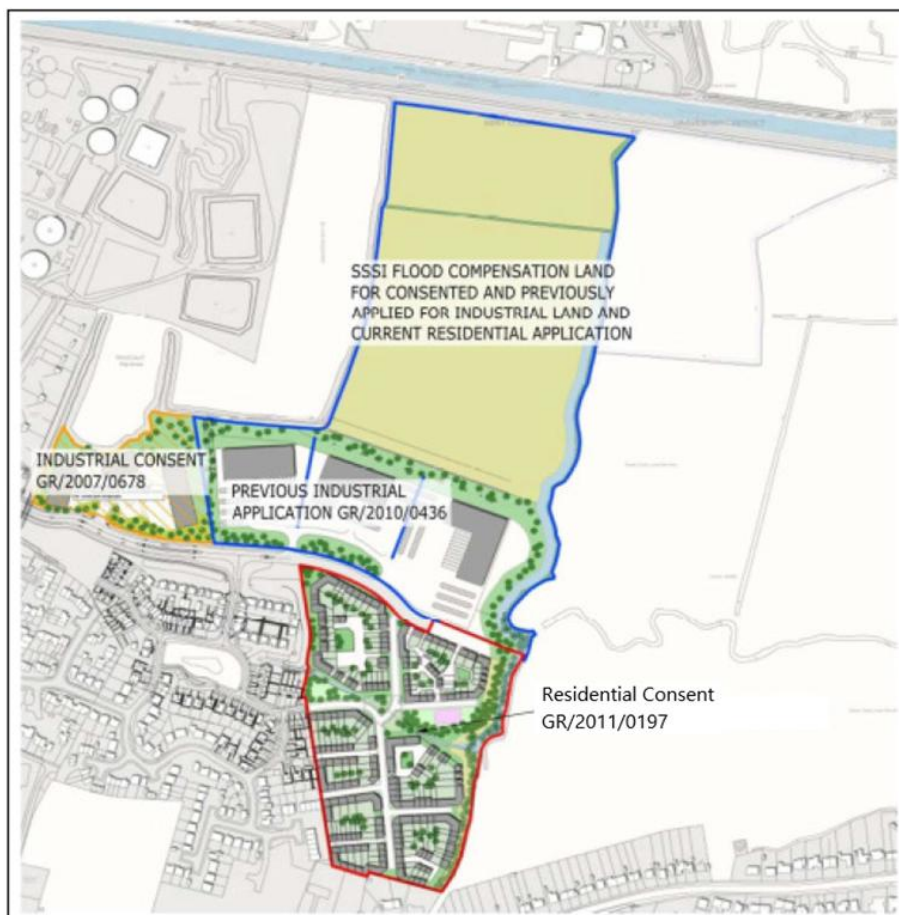


Figure 2 - Extant Planning Applications

3.0 Review of previous Flood Risk Assessments

A site-specific Flood Risk Assessment was prepared for the wider development which included the application site referenced as phase 3a. A site-specific Flood Risk Assessment was prepared for the application site by Ardent Consulting Engineers in July 2007 to support the planning application for consent to implement the Phase 3A industrial development scheme which was previously granted consent in 2001. The 2001 consent expired in 2006 and was re submitted in 2007 (Planning reference GR/2007/0678), this was granted, and renewal of the application was consented in 2013.

The site-specific Flood Risk Assessment prepared by Ardent Consulting Engineers in 2007 established that the site lies within Flood Zone 3 but benefits from flood defences.

During the determination of the neighbouring planning applications 2010/0436 (Industrial) and 2010/0197 (residential) Gravesham Borough Council (BC) identified that portions of the tidal flood defences around Gravesend may be at a lower level than that stated in the HR Wallingford Technical Note MCM57553/01 published in 2007.

A Flood Risk Addendum was prepared to support the Planning Applications and the Hydraulic Modelling, with the latter having been previously approved by the Environment Agency. At that time the proposals were confirmed as being safe. On receipt of the information from Gravesham BC a joint meeting was held with senior representatives of the Council, the Environment Agency and Ardent Consulting Engineers. The meeting was held at the Environment Agency's offices on the 12 October 2011. During this meeting the impact of the lowered defence levels was discussed, and it was agreed that:

- Gravesham Borough Council, would benefit from further evidence to support the Sequential Test for the Site from the Applicant; and,
- The impact of the lowered defences needs to be agreed with the Environment Agency.

An addendum to the Site-Specific Flood Risk Assessment was prepared by Ardent Consulting Engineers in November 2011, and reissued again in May 2016 following the receipt of new data from the Environment Agency on the existing flood defence crest heights. The Addendum concluded that the existing flood defence infrastructure and alignment of the railway line provide an adequate level of flood defence for the residential and industrial proposals up to 2055. Consequently, the industrial element is considered to be safe throughout its design life.

4.0 Flood Risk

The current flood risk has been reviewed on the EA's flood mapping website and it confirms there has been no change since the 2007 application in that the site is located in flood zone 3 as indicated in figure 3 below, but is still within the area protected by the river defences as indicated in the EA's long term flood risk mapping figure 4 below.

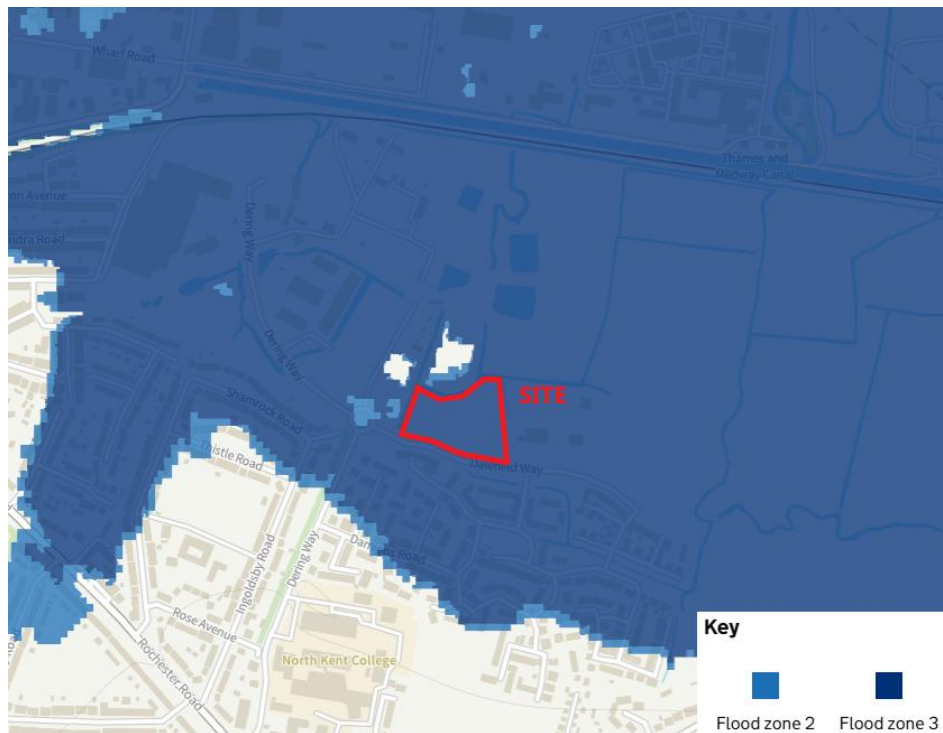


Figure 3 – Flood Maps for Planning

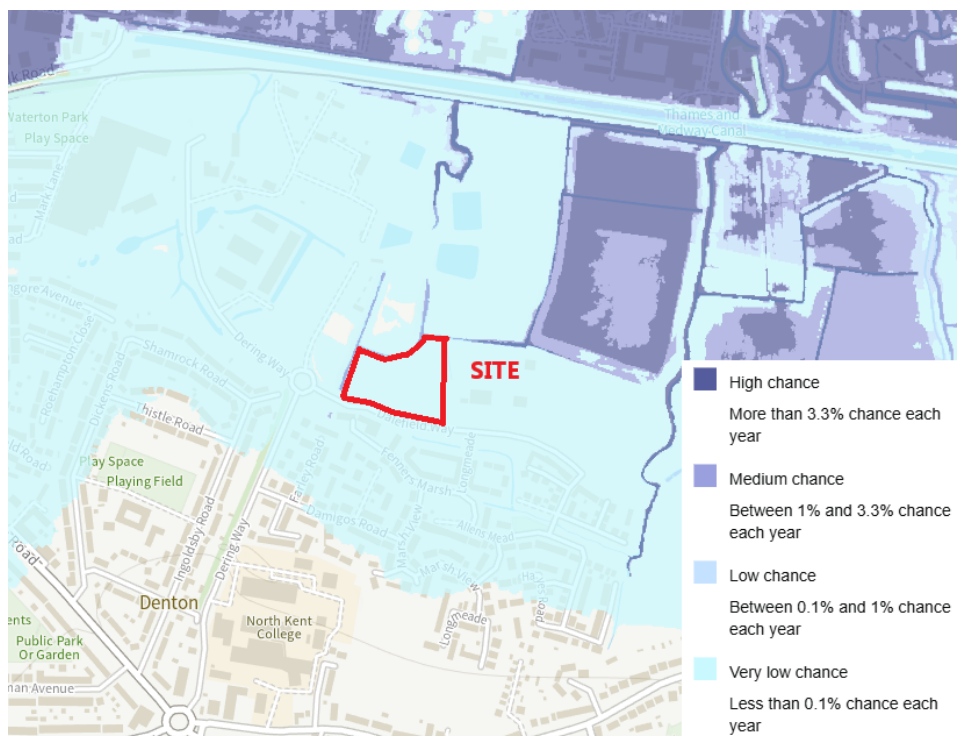


Figure 4 – Long Term Flood Maps

Figure 4 demonstrates that the site is still protected from flooding by the river defences even when climate change allowances have been factored in.

The surface water flood risk has also been reviewed and there is only limited pockets on site where surface water flooding might occur. Figure 5 below shows the extent of surface water flooding in the area of the application site. The surface water flood risk is considered low.

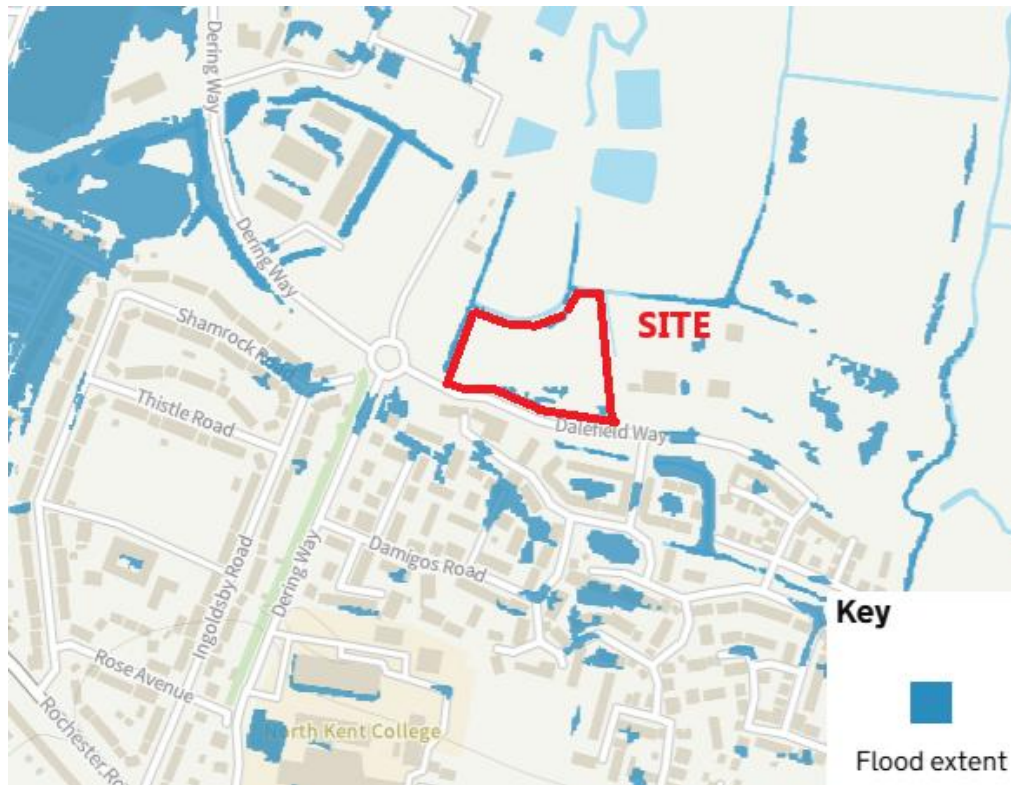


Figure 5 – Surface Water Flood Maps

5.0 Review of Previous Surface Water Drainage Strategy

As part of the various Flood Risk Assessment prepared for the planning applications drainage strategies for each site was included. Buchanan Consulting Engineers prepared an FRA for the allocated site PM9 of the adopted Gravesham Local Plan (1996), planning reference (GR/1999/0168). The application site was part of the PM9 allocated site and also included the erection of 165 dwellings, open space and distributor / estate road.

Buchanans agreed the greenfield runoff rates with Environment Agency and English Nature for the whole allocated site. The greenfield discharge rate was agreed at 7l/s/ha. Drawing M591-07 included in Appendix A shows the discharge rates for the relevant areas of the site. drawing M591/05 rev B included in Appendix B shows the wider ditch and drainage network for the allocated site.

The application site forms part of the 5.15ha catchment area to the west of the allocation. The discharge from this area is 36.05l/s which equals 7l/s/ha. Following applications on this site developed the principles set out in the 1999 application.

Ardent Consulting Engineers prepared the FRA in support of an industrial development on the application site, for a 3,333m² building, 60 parking spaces and service area totalling 9,200m² of impermeable area. Based on discharge rate of 10l/s (7l/s/ha) and a return period of 1in100+20% it was estimated that 455m³ of storage was required to achieve the agreed discharge rate.

6.0 Proposed Drainage Strategy

As described in section 5.0 the existing site drainage networks currently discharges into the watercourses and flood levee corridors that were designed and implemented as part of the site wide strategy and subsequent planning applications for each phase of development.

The proposals seek approval for an impermeable hardstanding of 2,969m² and 9,576m² of permeable hardstanding. The application site is currently covered by a standing area with a permeable surface. The application site has a total area of 1.25ha.

9,576m² of the site will be retained as permeable hardstanding. This existing hardstanding area will be retained and repaired to provide a level surface for external storage of items. The permeability of this area will not be altered by these proposals so the drainage regime for this 9,576m² of the site will allow runoff to soak into the ground as it does currently.

2,969m² of the site will be replaced with an impermeable tarmac construction for storage of materials etc. This area will be positively drained, and a drainage channel will be installed down the middle of the hardstanding and the tarmac surfacing sloped to drain to the channel. The existing and proposed permeable and impermeable paved areas are shown on drawing PSK801 & PSK802 included in Appendix C & D.

The previous 2007 application agreed a discharge rate of 10l/s from the site. This used the agreed discharge rate of 7l/s/ha to set the greenfield rate. For the benefit of this strategy the 7l/s/ha will be used to set the greenfield discharge rate from the application site, the total site area is 1.25ha so this gives a rate of 8.75l/s. This is lower than the approved rate of 10l/s, so for the benefit of this strategy the lower rate will be used.

The 2007 strategy used Cv's 0.75 & 0.84, KCC has requested the calculations are based on Cv's of 1 and current climate change allowances. The EA have published climate change allowances to be factored into the drainage designs. The level of allowance to be applied depends on the development's vulnerability classification, the management catchment area and life expectancy of the development.

The site is a less vulnerable use with life expectancy of 50 years, the PPG guidance recommends the use of the central allowance for the 2050s epoch for development with a lifetime up to 2060. The site is located in the Medway Management Catchment so a climate change allowance of 20% should be factored into the drainage design for a 3.3% and 1% annual exceedance rainfall event.

The drainage strategy has therefore been based on the above principles and to achieve the required discharge rate oversized pipes will be provided under the tarmac hardstanding to attenuate the runoff. The oversized pipes will discharge to the adjacent drain on the eastern boundary of the site. The runoff from the impermeable surfaces will receive no treatment so a petrol interceptor will be installed before discharging to the drain.

The to accommodate a 1 in 100 year storm event plus 20% allowance the oversized pipes has been designed with twin 900mm pipes. A drainage strategy has been prepared for the site and is included in Appendix E as drawing PKS800 rev 01. The full supporting calculations are also included in Appendix F.

7.0 Conclusions

A review of the various Flood Risk Assessments for the site from 1999, 2007 to 2016 and Addendums concluded that the existing flood defence infrastructure and alignment of the railway line provide an adequate level of flood defence for the residential and industrial proposals up to 2055. Consequently, the industrial element is considered to be safe throughout its design life.

As part of the Flood Risk Assessment prepared by Ardent Consulting Engineers in January 2007 & 2011 to support the planning application for consent to implement the industrial development on the application site a surface water drainage strategy was devised to demonstrate that the scheme can be suitably implemented without increasing the level of flood risk when the drainage system experiences a 1:100 year rainfall event (including an additional allowance for any potential climate change impacts).

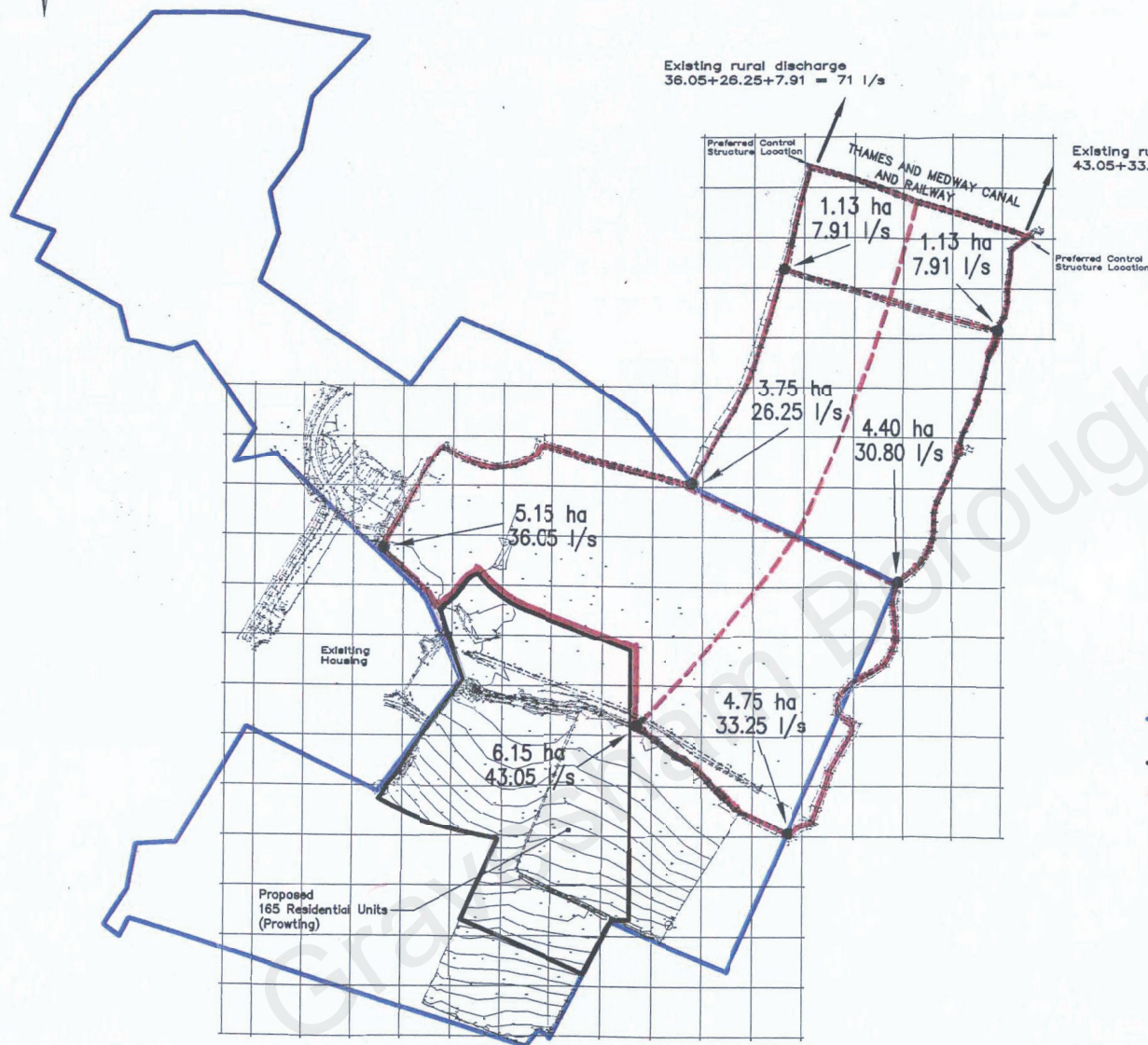
Surface Water run-off from the site will freely discharge into the receiving open channel watercourses and will be restricted to 8.75 litres/sec as set by the overall strategy for the allocated site.

To meet the agreed discharge rate attenuation of the runoff from the impermeable surfacing will be provided in twin 900mm diameter oversized pipes, this will discharge to the adjacent ditch at the greenfield restricted rate via a petrol inceptor.

The introduction of 2969m² of asphalt surfacing and 9576m² of permeable hardstanding will have no adverse impact on the existing watercourses and flood levee corridors.

The overall conclusion of the initial FRA's remain applicable to overall flood risk within the terms and requirements of National Planning Policy Framework.

Appendix A – Site Wide Agreed Greenfield Rates



Key

- Development Area Boundary PM9 as per Gravesham Local Plan
- Proposed Site Boundary (165 Units)
- Assumed Contributing Natural Catchment

NOTES:

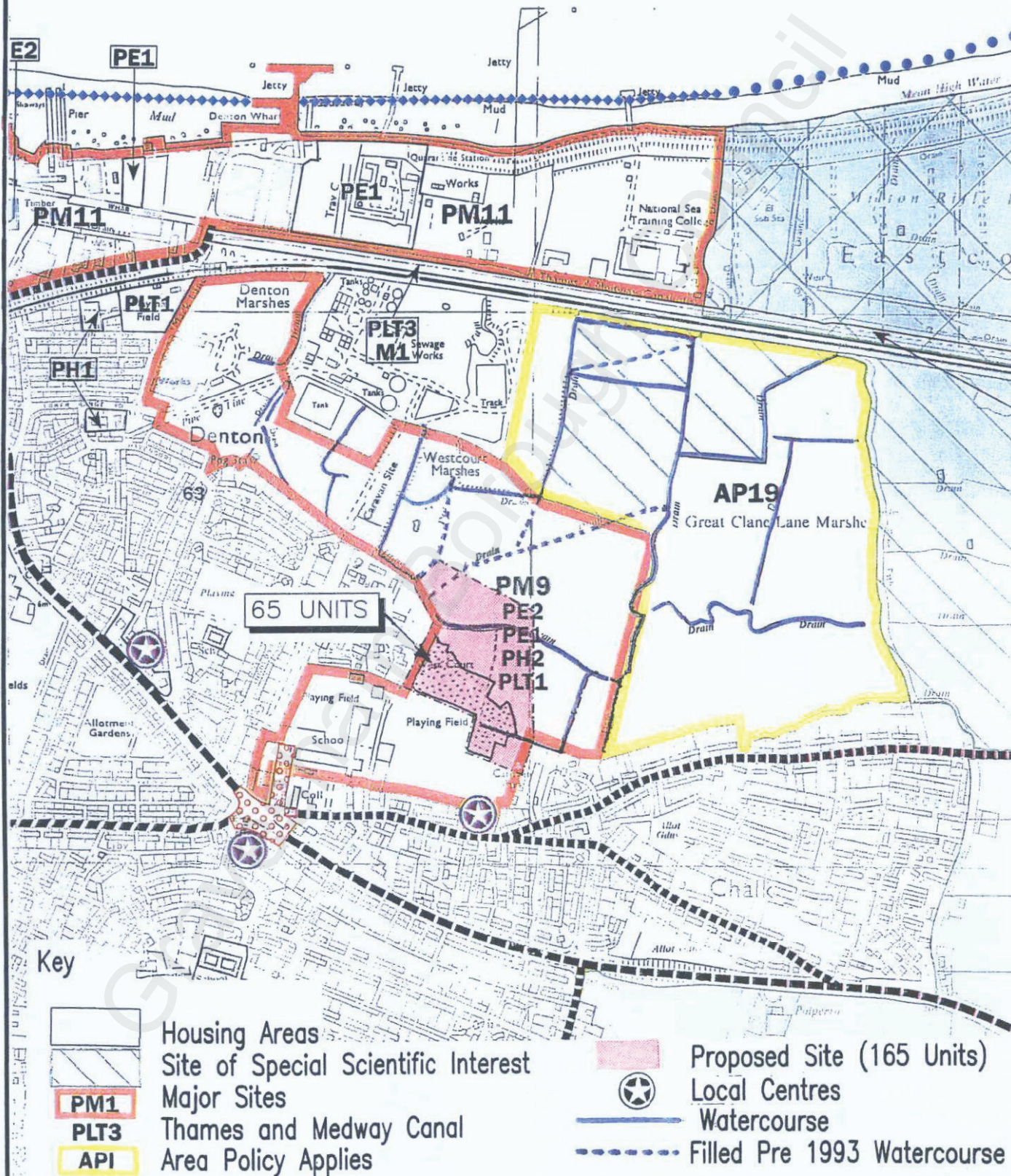
1. DRAWING TO BE READ IN CONJUNCTION WITH SUPPORTING CALCULATIONS AND TECHNICAL SUBMISSIONS TO THE ENVIRONMENT AGENCY – FEBRUARY 1999.
2. DRAWING TRANSCRIBED FROM GRAVESHAM BOROUGH COUNCIL PROPOSALS MAP 1992 AND SITE SURVEY UNDERTAKEN –
3. ALLOWABLE DISCHARGES ARE BASED UPON 7 L/S/ha AS AGREED WITH THE ENVIRONMENT AGENCY –

Scale 1:5000	Date February 1999	Client Prowing Homes	Job Title Proposed Development PM9	Buchanan Consulting Engineers Newcombe House 43-45 Notting Hill Gate London W11 3QD Telephone 0171 309 9055 Fax 0171 309 9056	
Drawn SAF	Checked SAP		Drawing Title Predevelopment Catchment Boundaries and Associated Allowable Discharge	Job No. M591	Drawing No. M591-07

Appendix B — Existing Drainage Network



River Thames
Gravesend Reach

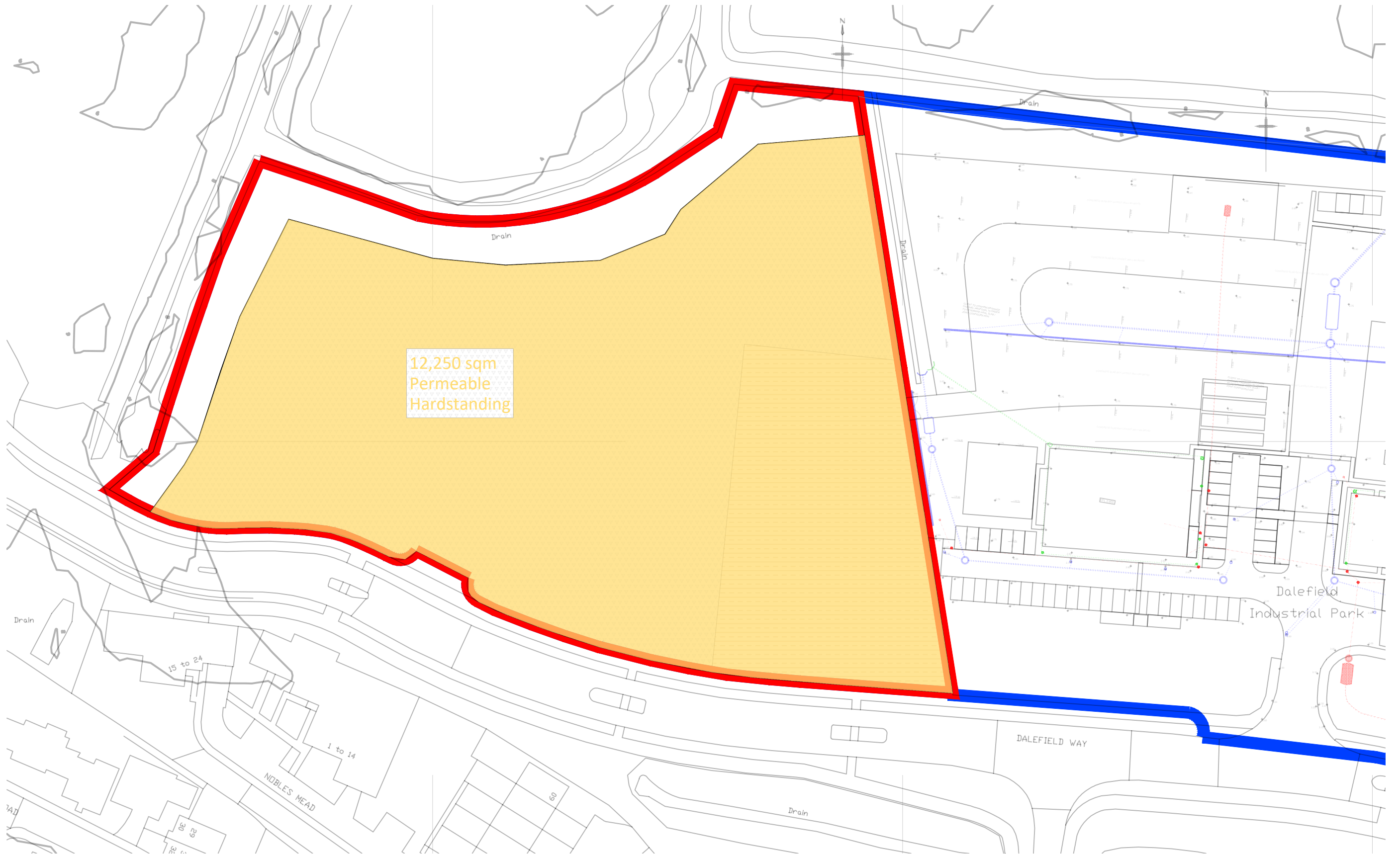


Scale NTS
Date December 1998
Drawn SAF

Job Title Proposed Development PM9
Drawing Title Watercourse Location Plan

Buchanan Consulting Engineers
NEWCOMBE HOUSE
43-45 NOTTING HILL GATE LONDON W11 3QD
Tel. 0171 309 9055 Fax. 0171 309 9058
Job No M591 Drawing No M591/05 B

Appendix C – Existing Site Area Plan



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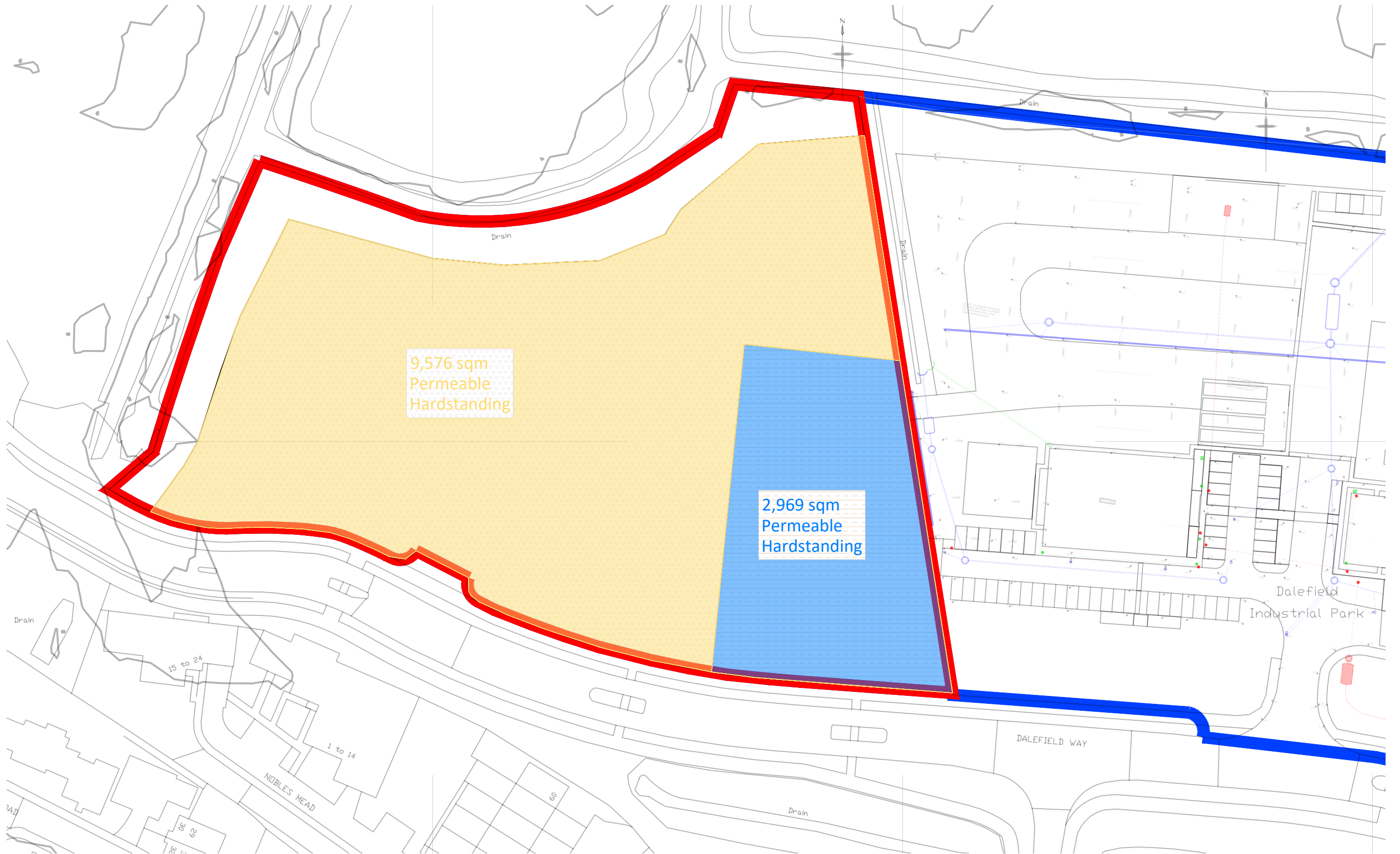
NOTES

REV	DATE	DESCRIPTION	BY

PROJECT **LAND AT DALEFIELD WAY
(WEST) GRAVESEND**
TITLE **EXISTING HARDSTANDING AREAS**

PROJECT NO	24054
DRG NO	PSK801
DATE	OCT 25
REV	00
BY	GMC
CHK	—

Appendix D – Proposed Site Area Plan



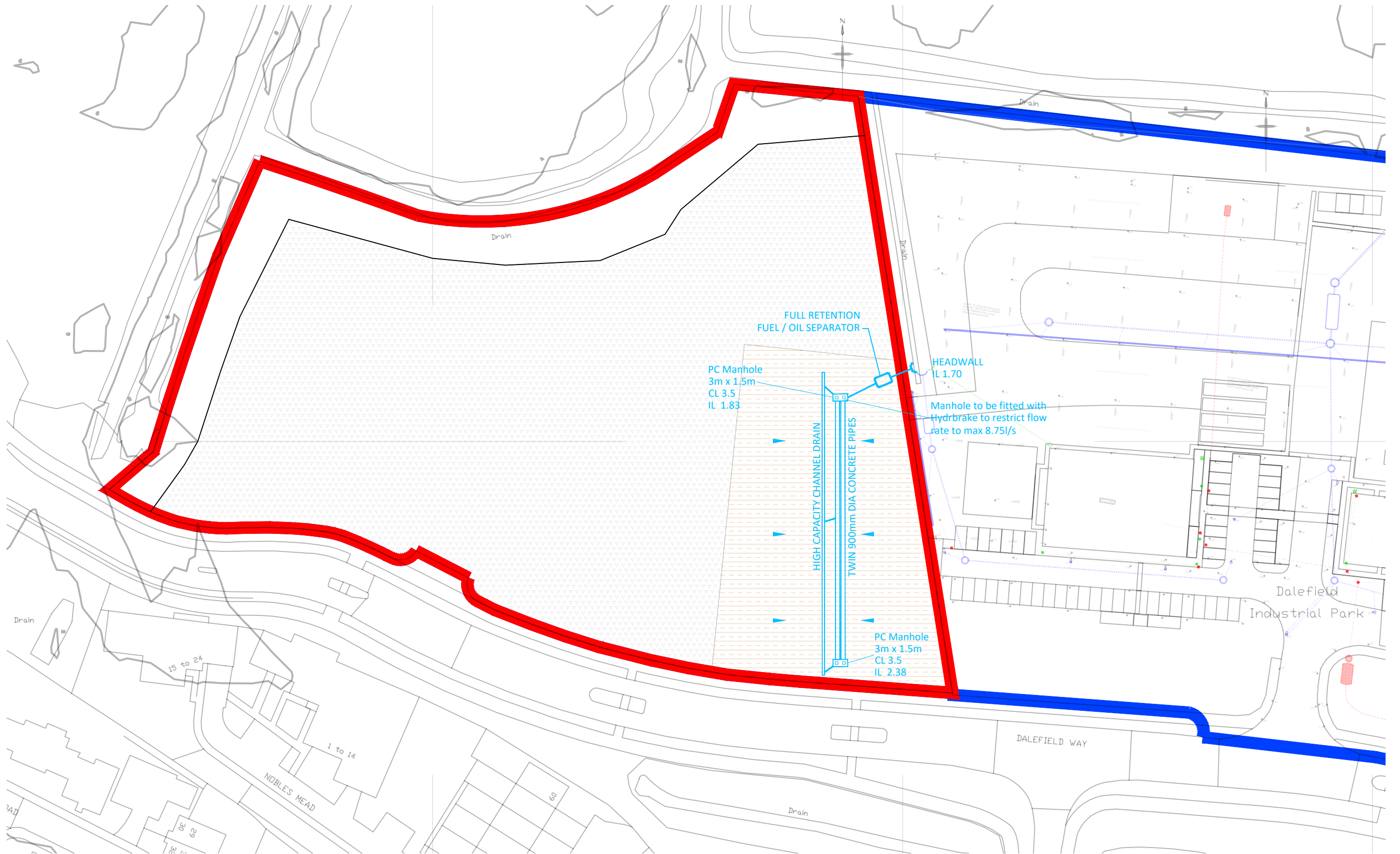


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NOTES				REV				PROJECT		PROJECT NO	
				REV	DATE	DESCRIPTION	BY	LAND AT DALEFIELD WAY (WEST) GRAVESEND		24054	
								TITLE		DRG NO	
								PROPOSED HARDSTANDING AREAS		PSK802	
										DATE	
										OCT 25	
										REV	
										00	
										BY	
										GMC	
										CHK	
										-	

Appendix E – Proposed Drainage Strategy



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NOTES

REV	DATE	DESCRIPTION	BY	PROJECT	LAND AT DALEFIELD WAY (WEST) GRAVESEND	PROJECT NO	24054
						DRG NO	PSK800
				TITLE	PRELIMINARY DRAINAGE STRATEGY	DATE	MAY 25
						REV	01
						BY	GMC
						CHK	—

Appendix F – Drainage Calculations

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.298	1.950	Type C	6.705	2.380	3.424	566891.588	173558.554
S2	0.000	1.800	Type A	6.705	1.832	4.573	566889.941	173613.345
S3	0.000	1.350	Type C	0.000	1.700	-2.000	566902.711	173616.641

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	2.380	S2	1.832	Circ	2No. 0.9mØ	54.816	100.0	0.600	3.424	3.973
1.001	S2	1.832	S3	1.700	Circ	0.3mØ	13.189	100.0	0.600	4.573	-2.000

Outfall Details

Outfall Manhole S3 : Free Discharge

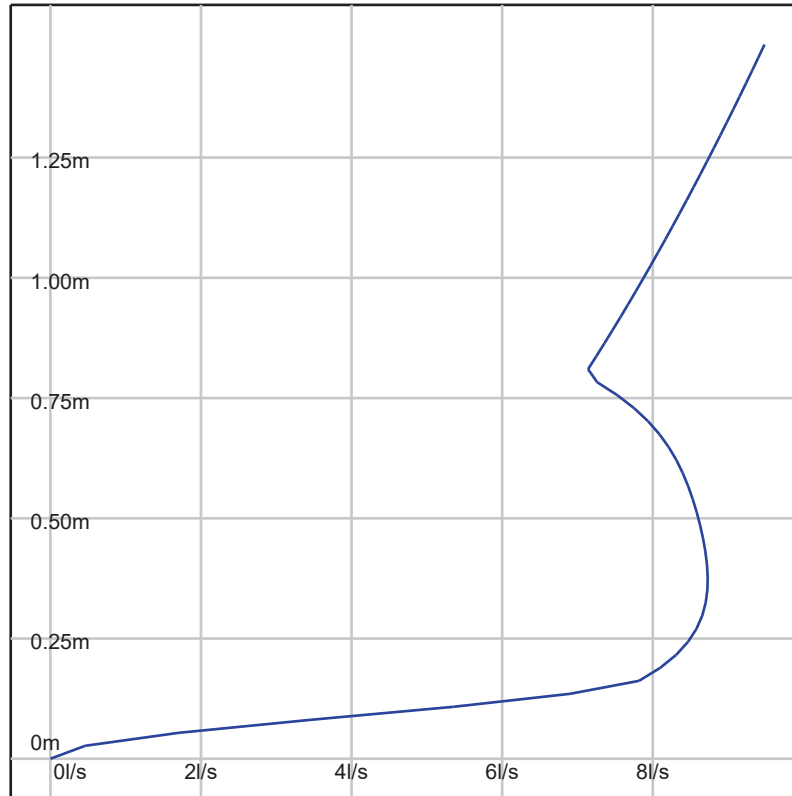
Flow Control Details

Controls within Manhole S2

Hydro-Brake® Optimum Control at Manhole S2

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0133-8750-1250-8750	1.250	8.750	0.000	0.371	8.730	0.797	7.088

Hydro-Brake® Optimum Control at S2



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_566811_173616_v5_1_0.xml
Summer (Cv: 0.75)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Periods (yrs) + Climate Change: (1, +0%), (10, +0%), (30, +0%), (30, +20%), (100, +0%), (100, +20%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Summer	13.907	0.00	-1.28	30Yr+20% 15Min Summer	91.817	0.00	-4.17
1Yr 30Min Summer	9.003	0.00	-0.74	30Yr+20% 30Min Summer	59.608	0.00	-1.92
1Yr 60Min Summer	5.561	0.00	-0.46	30Yr+20% 60Min Summer	36.866	0.00	-0.97
1Yr 120Min Summer	4.426	0.00	0.00	30Yr+20% 120Min Summer	22.376	0.00	-0.28
1Yr 180Min Summer	3.771	0.00	0.00	30Yr+20% 180Min Summer	16.610	0.00	-0.05
1Yr 240Min Summer	3.144	0.00	0.00	30Yr+20% 240Min Summer	13.384	0.00	-0.03
1Yr 360Min Summer	2.447	0.00	0.00	30Yr+20% 360Min Summer	9.856	0.00	-0.02
1Yr 480Min Summer	2.029	0.00	0.00	30Yr+20% 480Min Summer	7.935	0.00	0.00
1Yr 600Min Summer	1.727	0.00	0.00	30Yr+20% 600Min Summer	6.702	0.00	0.00
1Yr 720Min Summer	1.502	0.00	0.00	30Yr+20% 720Min Summer	5.835	0.00	0.00
1Yr 960Min Summer	1.210	0.00	0.00	30Yr+20% 960Min Summer	4.698	0.00	0.00
1Yr 1440Min Summer	0.892	0.00	0.00	30Yr+20% 1440Min Summer	3.461	0.00	0.00
1Yr 2160Min Summer	0.657	0.00	0.00	30Yr+20% 2160Min Summer	2.543	0.00	0.00
1Yr 2880Min Summer	0.531	0.00	0.00	30Yr+20% 2880Min Summer	2.034	0.00	0.00
1Yr 4320Min Summer	0.401	0.00	0.00	30Yr+20% 4320Min Summer	1.484	0.00	0.00
1Yr 5760Min Summer	0.334	0.00	0.00	30Yr+20% 5760Min Summer	1.191	0.00	0.00
1Yr 7200Min Summer	0.293	0.00	0.00	30Yr+20% 7200Min Summer	1.014	0.00	0.00
1Yr 8640Min Summer	0.265	0.00	0.00	30Yr+20% 8640Min Summer	0.897	0.00	0.00
1Yr 10080Min Summer	0.245	0.00	0.00	30Yr+20% 10080Min Summer	0.814	0.00	0.00
10Yr 15Min Summer	58.140	0.00	-1.17	100Yr 15Min Summer	98.007	0.00	-4.03
10Yr 30Min Summer	37.385	0.00	-1.09	100Yr 30Min Summer	64.152	0.00	-0.94
10Yr 60Min Summer	23.009	0.00	-0.73	100Yr 60Min Summer	39.969	0.00	-0.06
10Yr 120Min Summer	14.366	0.00	-0.09	100Yr 120Min Summer	24.020	0.00	-0.56
10Yr 180Min Summer	10.807	0.00	-0.05	100Yr 180Min Summer	17.819	0.00	-0.05
10Yr 240Min Summer	8.689	0.00	-0.04	100Yr 240Min Summer	14.457	0.00	-0.03
10Yr 360Min Summer	6.397	0.00	0.00	100Yr 360Min Summer	10.809	0.00	-0.02
10Yr 480Min Summer	5.138	0.00	0.00	100Yr 480Min Summer	8.829	0.00	0.00
10Yr 600Min Summer	4.315	0.00	0.00	100Yr 600Min Summer	7.555	0.00	0.00
10Yr 720Min Summer	3.733	0.00	0.00	100Yr 720Min Summer	6.651	0.00	0.00
10Yr 960Min Summer	2.978	0.00	0.00	100Yr 960Min Summer	5.430	0.00	0.00
10Yr 1440Min Summer	2.171	0.00	0.00	100Yr 1440Min Summer	4.033	0.00	0.00
10Yr 2160Min Summer	1.588	0.00	0.00	100Yr 2160Min Summer	2.951	0.00	0.00
10Yr 2880Min Summer	1.274	0.00	0.00	100Yr 2880Min Summer	2.336	0.00	0.00
10Yr 4320Min Summer	0.947	0.00	0.00	100Yr 4320Min Summer	1.661	0.00	0.00
10Yr 5760Min Summer	0.776	0.00	0.00	100Yr 5760Min Summer	1.298	0.00	0.00
10Yr 7200Min Summer	0.671	0.00	0.00	100Yr 7200Min Summer	1.080	0.00	0.00
10Yr 8640Min Summer	0.601	0.00	0.00	100Yr 8640Min Summer	0.936	0.00	0.00
10Yr 10080Min Summer	0.550	0.00	0.00	100Yr 10080Min Summer	0.835	0.00	0.00
30Yr 15Min Summer	76.514	0.00	-2.91	100Yr+20% 15Min Summer	117.609	0.00	-0.98
30Yr 30Min Summer	49.673	0.00	-3.35	100Yr+20% 30Min Summer	76.982	0.00	0.95
30Yr 60Min Summer	30.722	0.00	-2.93	100Yr+20% 60Min Summer	47.962	0.00	2.00
30Yr 120Min Summer	18.646	0.00	-0.12	100Yr+20% 120Min Summer	28.824	0.00	-1.66
30Yr 180Min Summer	13.842	0.00	-0.05	100Yr+20% 180Min Summer	21.383	0.00	-0.09
30Yr 240Min Summer	11.154	0.00	-0.03	100Yr+20% 240Min Summer	17.348	0.00	-0.03
30Yr 360Min Summer	8.213	0.00	-0.03	100Yr+20% 360Min Summer	12.971	0.00	-0.02
30Yr 480Min Summer	6.612	0.00	0.00	100Yr+20% 480Min Summer	10.595	0.00	-0.01
30Yr 600Min Summer	5.585	0.00	0.00	100Yr+20% 600Min Summer	9.067	0.00	-0.01
30Yr 720Min Summer	4.862	0.00	0.00	100Yr+20% 720Min Summer	7.981	0.00	0.00
30Yr 960Min Summer	3.915	0.00	0.00	100Yr+20% 960Min Summer	6.516	0.00	0.00
30Yr 1440Min Summer	2.884	0.00	0.00	100Yr+20% 1440Min Summer	4.840	0.00	0.00
30Yr 2160Min Summer	2.119	0.00	0.00	100Yr+20% 2160Min Summer	3.541	0.00	0.00
30Yr 2880Min Summer	1.695	0.00	0.00	100Yr+20% 2880Min Summer	2.803	0.00	0.00
30Yr 4320Min Summer	1.237	0.00	0.00	100Yr+20% 4320Min Summer	1.993	0.00	0.00
30Yr 5760Min Summer	0.992	0.00	0.00	100Yr+20% 5760Min Summer	1.558	0.00	0.00
30Yr 7200Min Summer	0.845	0.00	0.00	100Yr+20% 7200Min Summer	1.296	0.00	0.00

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
30Yr 8640Min Summer	0.748	0.00	0.00	100Yr+20% 8640Min Summer	1.124	0.00	0.00
30Yr 10080Min Summer	0.678	0.00	0.00	100Yr+20% 10080Min Summer	1.002	0.00	0.00

Simulation Results

Return Period Yrs: 1.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Summer	9	2.422	0.042	17.642		OK
S2	120 min Summer	68	2.020	0.188	6.905		OK
S3	120 min Summer	68	1.750	0.050	6.982		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	30 min Summer	19	S1	S2	0.108	0.356	15.740	0.004	OK
1.001	120 min Summer	68	S2	S3	0.050	0.894	6.982	0.063	OK

Return Period Yrs: 10.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	60 min Summer	46	2.494	0.114	7.930		OK
S2	60 min Summer	47	2.494	0.662	2.472		Surcharged
S3	120 min Summer	126	1.756	0.056	8.730		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	44	S1	S2	0.382	0.456	48.398	0.012	OK
1.001	180 min Summer	92	S2	S3	0.056	0.954	8.730	0.079	OK

Return Period Yrs: 30.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	60 min Summer	52	2.662	0.282	8.639		OK
S2	60 min Summer	54	2.665	0.834	1.799		Surcharged
S3	600 min Summer	342	1.756	0.056	8.730		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	54	S1	S2	0.545	0.493	64.674	0.016	OK
1.001	15 min Summer	8	S2	S3	0.056	0.954	8.730	0.079	OK

Return Period Yrs: 30.0

Climate Change %: 20

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	60 min Summer	56	2.808	0.428	9.065		OK
S2	60 min Summer	52	2.810	0.978	28.132		Surcharged
S3	120 min Summer	199	1.756	0.056	8.730		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	56	S1	S2	0.664	0.535	88.726	0.022	OK
1.001	120 min Summer	199	S2	S3	0.056	0.954	8.730	0.079	OK

Return Period Yrs: 100.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	60 min Summer	60	2.877	0.497	5.066		OK
S2	60 min Summer	55	2.885	1.053	15.431		Surcharged
S3	960 min Summer	578	1.756	0.056	8.730		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	60	S1	S2	0.698	0.516	96.392	0.024	OK
1.001	180 min Summer	253	S2	S3	0.056	0.954	8.730	0.079	OK

Return Period Yrs: 100.0

Climate Change %: 20

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	60 min Summer	60	3.092	0.712	8.818		OK
S2	60 min Summer	56	3.093	1.261	1.982		Surcharged
S3	240 min Summer	332	1.756	0.056	8.730		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	60 min Summer	60	S1	S2	0.806	0.505	105.891	0.027	OK
1.001	240 min Summer	332	S2	S3	0.056	0.954	8.730	0.079	OK