

McCarthy & Stone Retirement Lifestyles Limited

Proposed Retirement Apartments

at 38-44 London Road, Purbrook, Waterlooville, Hampshire PO7 5LJ

Detailed Drainage Design

Addendum to include results of further CCTV Investigation dated
12/12/2017 and response to Planning Condition, reference permission
APP/17/01141 dated 21/12/2017

Prepared by	Date	Checked by	Date
<i>AD White</i>	23/2/18		

Graham Garner and Partners Ltd
Consulting civil and structural engineers





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**PROPOSED RETIREMENT APARTMENTS
AT
38-44 LONDON ROAD
PURBROOK
WATERLOOVILLE
HAMPSHIRE
PO7 5LJ**

**DETAILED DRAINAGE DESIGN
ADDENDUM**

FOR

McCARTHY & STONE RETIREMENT LIFESTYLES LIMITED

GRAHAM GARNER & PARTNERS LTD

FEBRUARY 2018
8377/01/ACD/CH/DDDA

*The Institution
of Structural
Engineers*



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APPENDICES

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1.0 INTRODUCTION

This addendum should be read in conjunction with GGP Report reference 8377/01/ACD/CH/DDD dated October 2017 and includes the results of further CCTV work confirming the pre-development site conditions, further consultation with Southern Water and updated plans and calculations.

2.0 FURTHER CCTV WORK

Further CCTV work was conducted on 12th December 2017 after the building superstructure had been removed. This investigation permitted access to all areas that had been restricted by the previous buildings.

2.1 Foul Drainage

The public foul manhole chamber, reference 3902, was exposed 1.6 metres to the west of an existing chamber reference FW1. The 3902 chamber was found to be below approximately 300mm of concrete slabs associated with the previous development and the pipe leaving the chamber found to be of 150mm diameter.

Plates 1 & 2 showing chambers 3902 and FW1 and a view inside chamber 3902 are included in Appendix A.

Two areas of surface water drainage connected to this foul drain were also confirmed, one from a gravel area shown in plate 3, the second from a similar size area in the south west corner which was connected to chamber FW1 by a 100mm diameter clay pipe passing over chamber 3902, the broken pipe being visible in plate 1.

2.2 Surface Water Drainage

With access available to the narrow yard area south of the Asphaltic Roofing Supplies building the 150mm diameter pipe has been CCTV surveyed and confirmed to connect to a 225mm diameter pipe in the footpath leading to Southern Water surface water chamber 3854.

3.0 DEVELOPMENT AREAS (UPDATED)

3.1 From the CCTV investigation where surface water has been found to have been connected to the foul sewer and a surface water pipe leaving the site has been confirmed the development areas have been updated.

3.2 Drawing 8377-01-02 has been updated to Revision A, included as Appendix B, and shows the extent of 2764m² of paving confirmed to drain to the existing surface water sewer in the south west part of the site. Surface water drainage found to have been connected to the foul sewer has been excluded.

The drainage from two areas remain unidentified and have therefore not been included in the assessment.

Surface water from the Asphaltic Roofing Supplies building in the north west corner of the site has a series of rain water pipes recorded but no specific drainage system, it is thought these drained either to the foul sewer or to ground where run-off would have likely flowed overland to the south west corner.

The second area is next to the eastern boundary where topographic levels suggest that run-off would flow offsite to the east and from there down the path towards the south west corner. The gully in the entrance from Stokes Road drains to the north.

- 3.3 Drawing 8377-01-06 has been updated to Revision B, included as Appendix C, and now includes balcony areas, intended to be drained to the surface water system.

The total impermeable area is 2685m² including allowance for roof overhang and is 67.7% of the pre-development area representing a significant reduction in run-off from the site.

4.0 SOUTHERN WATER CONSULTATION

- 4.1 The results of further investigation were submitted to Southern Water by email dated 5/1/2018 together with drawing 8377-01-08 showing the proposed sewer connection locations.
- 4.2 Southern Water replied by email dated 5/2/2018 confirming that the proposed foul discharge proposal to MH3902 is acceptable and that the surface water connection is in principle acceptable provided the proposed flow rate does not exceed the pre-development rate.
- 4.3 Following further consultation, Southern Water confirmed by email dated 19/2/2018 that the surface water connection to the south of the site is acceptable.
- 4.4 The email consultation and drawing 8377-01-08 are included as Appendix D.

5.0 PROPOSED DRAINAGE

- 5.1 Foul drainage capacity calculations demonstrate that 100mm diameter pipework has sufficient capacity for in excess of 25 units. As the proposed layout requires two connections, one for the east and one from the west 100mm pipework is adequate throughout. However, 150mm pipework has been specified for downstream pipe sections to minimise sewer depth. Foul drainage capacity calculation is included as Appendix E.

5.2 Surface Water Drainage

5.2.1 The proposed development has total impermeable areas of 2685m² representing 67.7% of the pre-development impermeable area and therefore a significant reduction in run-off from the site for all rainfall events.

5.2.2 Further investigation of the existing site and drainage system confirms that 2764m² of the previous development site drained to the south east corner. This area exceeds the proposed impermeable area for the whole of the proposed development and therefore will be a reduction in run-off to the sewer for all rainfall events.

5.2.3 Flow Reduction

To provide improvement to the existing run-off rates it is proposed to incorporate a modular crate type attenuation tank below a landscaped area and limit the design discharge to 20 litres/second.

This value is below the calculated once in one year rate and therefore represents a significant improvement from the pre-development condition. It is also significantly within the capacity of the receiving sewer.

5.2.4 Micro Drainage Analysis

Flood routing through the proposed storage structure is attached and demonstrates for the one year event the discharge restriction results in 8.9m³ of storage within the tank and for the 100 year event plus 30% allowance for climate change the maximum storage volume is 64.4m³ with maximum outflow of 21.8 litres/second.

Micro Drainage calculations are included as Appendix F.

6.0 PLANNING CONDITION 14, HAVANT BOROUGH COUNCIL APPLICATION NO. APP/17/01141

Within planning consent dated 21/12/17 Condition 14 relates to the surface water drainage provision for the development. The responses to each item are summarised below.

6.1 Confirmation of the existing drainage systems. Refer results of the CCTV Investigation and assessment of the existing contributing areas in section 2 above.

6.2 Infiltration Tests

Site investigation by ACS Testing Ltd has confirmed that the site is underlain by clays of very low permeability and therefore drainage by infiltration systems is not justifiable technically.

This is supported by the presence of an existing extensive drainage system where even the small areas of gravel (pea shingle) surfacing have historically been connected to gully drains connected to the foul drainage system. These connections will be removed as part of the proposed development.

6.3 Treatment of surface water

As infiltration drainage is not technically feasible for paved areas the number of treatment stages is limited. CIRIA 753 The SUDS Manual 2015, clarifies the pollution potential of roofs and residential car parking as very low and low, respectively, Table 26.2.

External paved areas will be drained via trapped pot gullies designed to intercept sediment and hydrocarbons the contributing area to each gully has been designed not to exceed 200m² in line with accepted practice to ensure the interception ability is not compromised.

The removal of vehicle servicing and car sales from the site will provide a significant improvement over the pre-development condition.

6.4 Calculations comparing the existing and proposed surface water run-off rates.

Micro Drainage analysis for the 100 year plus 30% events includes flood routing through the structure on page 5. For the proposed impermeable area at column 4 a peak inflow of 81.4 litres/second occurs at 32 minutes, and at column 5 the peak outflow through the control is 21.8 litres/second at 48 minutes.

The attenuation tank proposed will therefore reduce the peak discharge from the site from 81.4 litres/second to 21.8 litres/second to the public sewer to the south east.

In addition flows from the remaining impermeable areas previously connected to the foul sewers, to the north or believed to discharge overland to the east will all be removed as part of the development.

6.5 Volume Control

The pre-development impermeable area is 3968m² with the post development area of 2685m². The remaining 1283m² will become soft landscaping, much of which will be extensively planted thereby reducing run-off from these areas to zero.

This represents a 32.3% reduction in run-off from all storm periods.

The Micro Drainage calculations include storm durations from 15 minutes to 10080 minutes with the attenuation determined for the most critical duration.

For the 6 hour events storage volumes of 20.1m³ and 13.1m³ are predicted for the summer and winter events respectively. The critical storm for this catchment being the 60 minute winter event requiring storage volume of 64.4m³.

7.0 CONCLUSIONS

7.1 The proposed development will:-

- remove surface water flows from the existing foul drainage network.
- will incorporate in excess of 30% soft landscaping which will significantly reduce the volume of run-off from the development site and
- will significantly reduce peak run-off rates to the local drainage network by incorporating controlled discharge by a vortex flow control device and provision of associated stormwater attenuation.

7.2 The proposed drainage layout is detailed on drawing SO-2168-05-DE-20 included as Appendix G.

GGP

A CCTV 12/12/17
Platos 1, 2 & 3



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Project
38-44 London Road
Purbrook

Sub - Section

CCTV 12-12-17.

Job Ref. 8377-01

Sheet No. P1

Prepared AD

Date 12-02-18

Checked

Date



Plate 1. Public FWMH 3902,
(broken corner of cover slab in foreground)



Plate 2, view in MH 3902 chamber,
3 incoming 100dia pipes,
1 outgoing 150dia pipe.



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Sub - Section

CCTV 12-12-17.

Job Ref. 8377-01

Sheet No. P2

Prepared AD

Date 12-02-18

Checked

Date



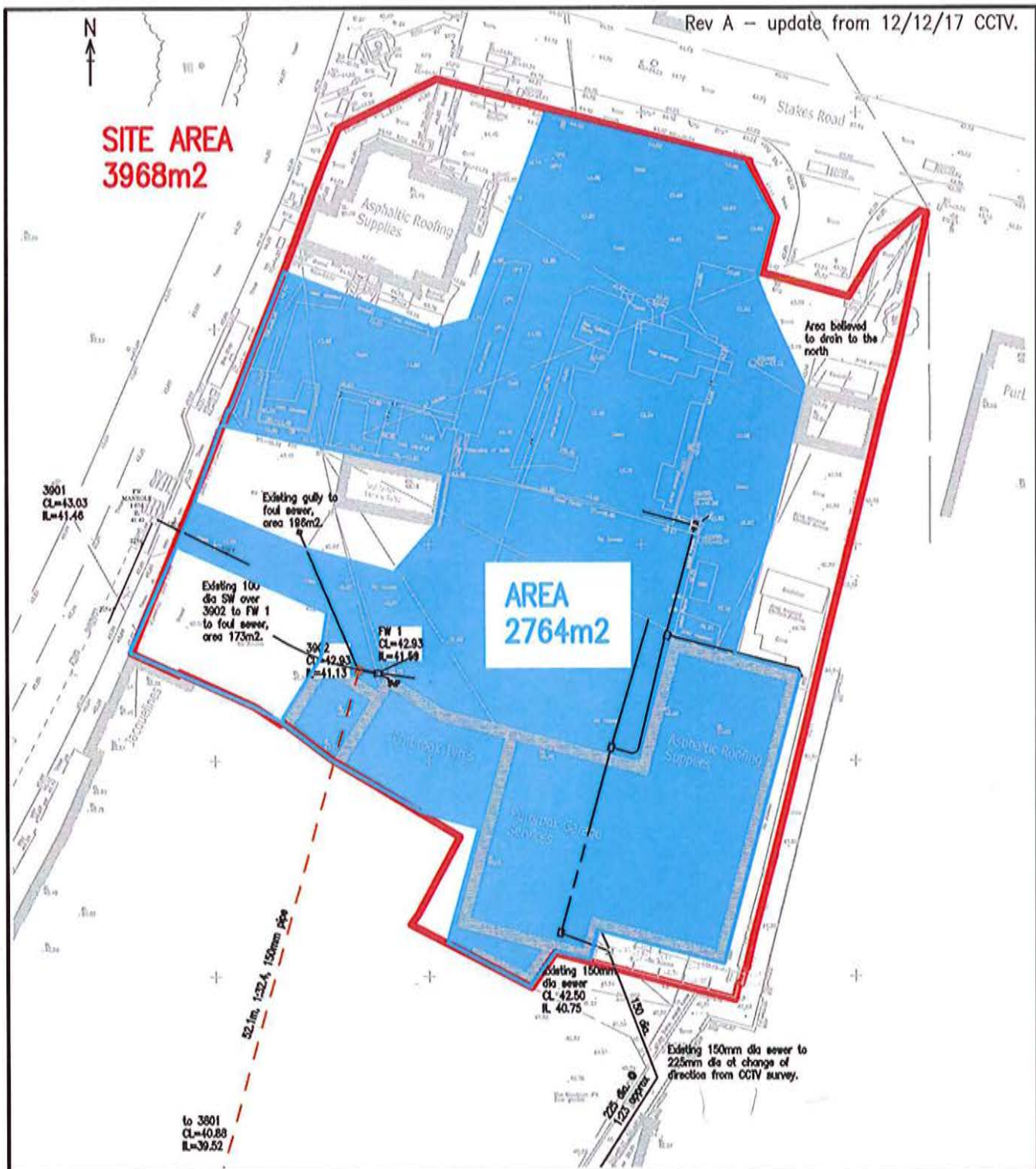
Plate 3,
Gravel area next to site entrance found to drain to FWMH 3902
Note holes in path edging to permit drainage from macadam paved area to drain.

B 8377-01-02A
Existing impermeable areas



Scale 1:500

Date	AD
------	----



C 8377-01-06B
Proposed impermeable areas



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Project

38-44 London Road, Purbrook

Sub-Section

Impermeable Areas
Proposed Development
Scale 1:500

Job ref 8377-01

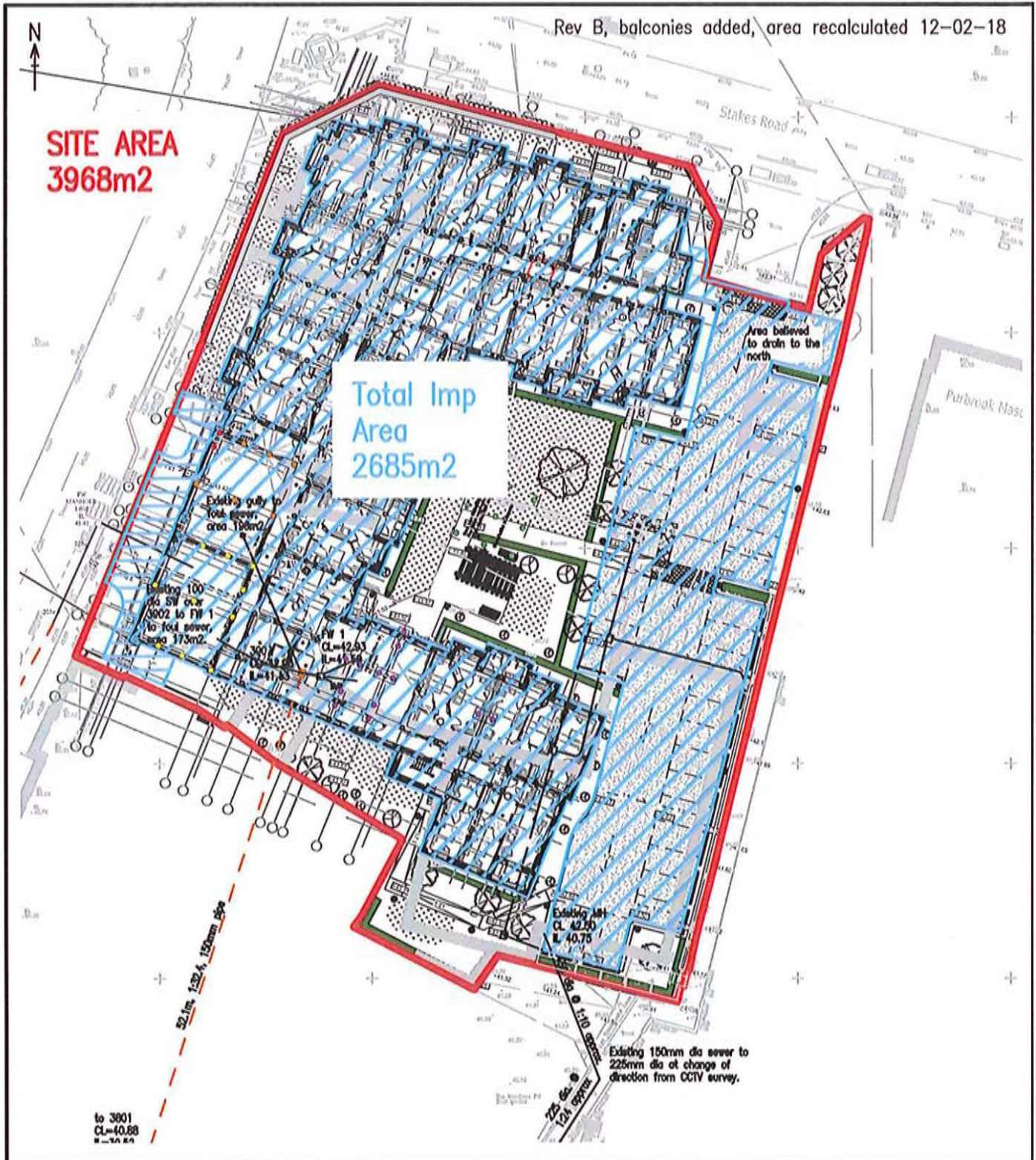
Sheet No.06B

Prepared AD

Date 05/10/17

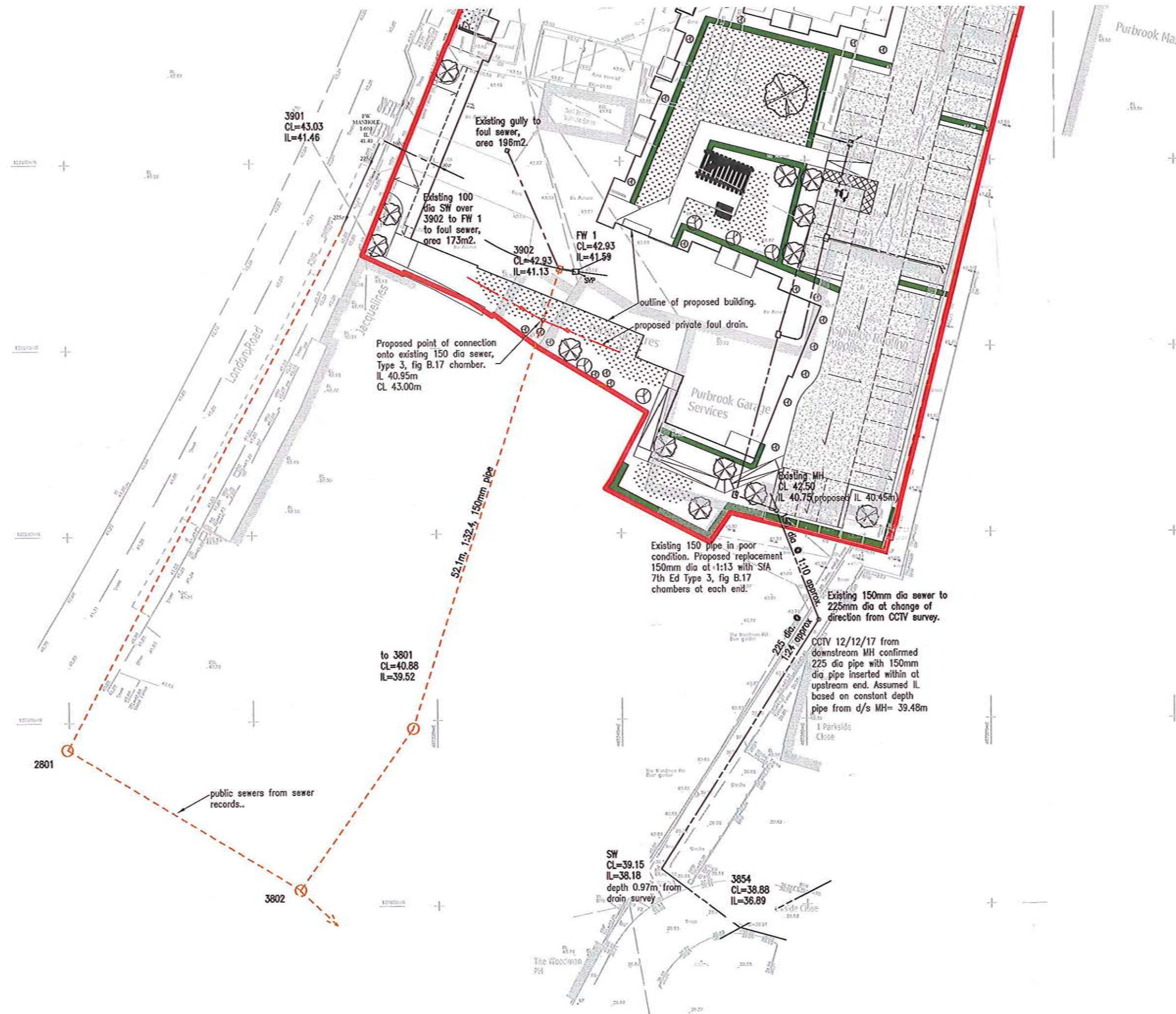
Checked

Date



D 8377-01-08
Off-site sewers and proposed connections

Email consultation with Southern Water
5/1/18, 5/2/18, 9/2/18 & 19/2/18



Notes:

THIS DRAWING IS NOT TO BE SCALED

1. Cross-references

This drawing is to be read in conjunction with all relevant architects' and engineers' drawings and specifications. Any inconsistencies or errors should be referred to the engineer immediately and confirmed in writing.

revision	suffix	Revision details	Date

Client
McCarthy & Stone
Later Life. Greater Life

Architect
kenn scaddan associates

Job title
38-44 London Road
Purbrook

Drawing title
Offsite Sewers and
proposed connection locations

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DATE	05/06/17	SCALE	AS SHOWN	1:200	DRAWN	AD
DRAWING No 8377-01-08						

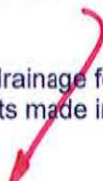
Tony Dilke

From: Karpezo, Marta <Marta.Karpezo@southernwater.co.uk>
Sent: 19 February 2018 11:35
To: Tony Dilke
Cc: 'Tim Beckett'
Subject: RE: 38-44 London Road, Purbrook, APP/15/00896

Dear Tony

Thank you for your email.

*SW CONNECTION
ACCEPTABLE*



I have analysed the information provided regarding existing impermeable areas and the drainage found on site That may be reflecting the pre-development discharge (taking into account your comments made in a discussion Over the phone).

I can confirm that we can assume the existing surface water run off discharge to public surface water sewer located to The south in the areas of around 20 l/s.

In the light of the above, please provide full drainage layout illustrating the outcome of our discussions.

Can I please highlight that the details of the exact location of any public apparatus on site and any constructions, landscaping and hardscaping in the stand off distance shall be presented to fulfil our requirement in terms of sufficiency of information to recommend discharge of drainage condition.

Kind Regards

Marta Karpezo
Technical Co-ordinator
Developer Services
Southern House, Sparrowgrove, Otterbourne, Hant SO21 2SW
Tel: 01962716278
Email: marta.karpezo@southernwater.co.uk
Web: www.southernwater.co.uk

From: Tony Dilke [mailto:Tony.Dilke@ggpl.co.uk]
Sent: 09 February 2018 10:12
To: Karpezo, Marta
Subject: RE: 38-44 London Road, Purbrook, APP/15/00896

Dear Marta,

Thank you very much for your reply. Unfortunately I have been off sick this week and was not able to respond sooner.

With regard to our proposals you are correct in identifying that in our submission to the LPA we indicated connection to 3901 and in our submission to yourselves following on site investigation is to 3902. The reason for this is that at the time of submission to the LPA the 3901 connection appeared feasible to a c.225 diameter pipe and the sewer record indicated the pipe from 3902 to be 100mm diameter. As the 100mm diameter pipe would require 100mm upstream pipework at steeper gradients the 3901 connection was preferred to minimise pipe depths.

Now that the further site investigation has revealed the existence of a 150mm diameter pipe from 3902 it is preferable to connect to this chamber if acceptable to Southern Water.

Regarding surface water it is of course in our interests to discharge at the highest rate that is acceptable to you as this will minimise our on-site attenuation requirements. Until we had confirming information that the existing site discharged in the way that it does we adopted a cautious approach and included attenuation based on a hydrobrake design flow of 20l/sec which would in practice mean a peak flow of about 24l/sec at surcharge condition. We are quite willing to continue with the design flow limit of 20l/sec if this will provide a worthwhile reduction to offsite flows.

I trust that the above clarifies our current proposals. If you could kindly confirm your preferred foul point of connection and surface water discharge rate we will update our proposals with the LPA accordingly, something that I am being pressed to do as my client is keen to commence on site asap.

Please do not hesitate to telephone if there is anything that you wish to discuss.

Regards
Tony.

Anthony C Dilke
Director
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From: Karpezo, Marta [mailto:Marta.Karpezo@southernwater.co.uk]
Sent: 05 February 2018 12:46
To: Tony Dilke
Subject: Re: 38-44 London Road, Purbrook, APP/15/00896

Dear Tony

Thank you for your email and please accept apology in delay of response.

With regards to your foul discharge proposals (discharge to manhole MH3902) – these are acceptable, However the foul drainage layout recently commented on by us to the planning authority was indicating Discharge to manhole MH3901.

With regards to your surface water drainage proposals – in principle the discharge of flows at rates no greater Than existing is acceptable. In order for us to fully assess the level of existing flows please provide the CCTV survey Plan showing positive drainage, connections and discharge of surface water to public network.

**FW CONNECTION
ACCEPTABLE**



Please clarify also the proposed attenuated discharge rate – previous pan indicates 20 l/s; the below email indicates 38.4 l/s.

Kind Regards

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Email: marta.karpezo@southernwater.co.uk
Web: www.southernwater.co.uk

From: Tony Dilke
Sent: 05 January 2018 15:05
To: developerservices@southernwater.co.uk
Cc: 'Tim Beckett'
Subject: 38-44 London Road, Purbrook, APP/15/00896

Dear Sirs,

38-44 London Road, Purbrook, APP/15/00896,
Southern Water ref PLAN-019763

Further to your letter dated 26/09/2017 to the LPA, Havant Borough Council we write with additional information regarding the existing sewer network and request your consideration of our desired points of connection to the public foul and surface water sewer systems. We also refer you to a capacity check to Opus International dated 17/06/15 in connection with a previous development proposal by the same Client.

Foul Drainage.

Your correspondence indicates that there is available capacity to manhole reference SU67083010 to the north west which is up-gradient of the development and the development discharge will therefore require pumping. Recent drainage investigations on site have revealed that foul drainage from the previous development connected to chamber 3902 which has been discovered below approximately 400mm of oversite concrete. Photographs 1 shows chamber 3902 in the foreground and the ductile iron cover and FW 1 behind and photograph 2 shows the internal arrangement of chamber 3902.

Various surface water connections were found to connect to this system, mainly from a 100mm clay pipe that passed over chamber 3902 and can be seen in photo 1 and also from one of the 100mm diameter connections to chamber 3902 which connected to a gully below a chamber lid in a gravel area shown in photo 3. Note the holes drilled through the path edging permitting water from the adjacent paved area to drain to the gravel area.

We conservatively estimate the combined area to be 369m² which would have produced a runoff discharge of 5.1l/sec based on 50mm per hour rainfall. As the proposed design flow based on SFA residential flows is 2l/sec using 4000 l/dwelling/day we consider that proposed flows will not exceed pre-development flows and therefore request continued use of the sewer from chamber 3902. The proposed point of connection being via a new Type 3 inspection chamber located within a landscape area 5.7m downstream of chamber 3902, with the existing chamber and 5.7m of pipe being abandoned.

Surface Water.

We note your comments regarding surface water in the area. However our investigations have revealed much of the pre-development site to be drained to a 150mm and 225mm surface water sewer in the south east corner of the site leading to public sewer chamber 3854.

We have conservatively estimated the runoff area to this system to be 2764m² which excludes the Asphaltic Roofing Supplies building area which we believe connected to the foul sewer and an area along the eastern boundary which appeared to drain to a series of blocked sewers leading towards higher ground to the north and Stakes Road. We understand that this system historically surcharged and drained overland towards the south east corner either to the drainage system there or onto the path beyond the eastern boundary. We have not included these areas in our pre-development assessment.

The pre-development design flow for 2764m², based on 50mm/hour is 38.4 l/sec.

The capacity of a 150mm pipe at 1:10 is 56 l/sec and a 225mm diameter at 1:24 is 106 l/second. The existing system therefore appears adequate for the pre-development flows.

CCTV shows that the 150mm pipe is connected into the end of the 225mm pipe and there are no other connections until the 225mm pipe reaches Chamber 3854.

Our proposed point of connection could therefore be to the existing chamber within the site boundary with a discharge rate not exceeding the existing of 38.4 l/sec. However due to the poor condition of the existing pipe we would prefer to relay the 150mm pipe to a new Type 3 chamber at the head of the 225 pipe in the footpath next to Nr 1, Parkside Close and reduce the upstream invert level by 0.3m to provide additional cover to the proposed pipe. To incorporate allowance for climate change we will restrict the surface water discharge by a vortex type flow control device within the site and include associated on site attenuation.

A site plan including our assessment of contributing areas, reference 8377-01-02A and layout drawing showing the above proposal, reference 8377-01-08 are attached.

We look forward to hearing from you at your earliest convenience, should there be anything further that we can provide please do not hesitate to contact us.

Regards
Tony.

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E Foul drainage capacity check
Reference 8377-1-F1



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Project

38-44 LONDON RD
 PURBROOK

Sub - Section

FULL DRAINAGE

ON SITE CAPACITY

Job Ref.

8377-1

Sheet No.

F1

Prepared

Ad

Date

5/6/17

Checked

Date

	total nr of apartments	= 43.	
	Pipe capacities		
	100 mm Ø @ 1:80 Capacity =	6.3	l/sec
	150 mm Ø @ 1:150 Capacity =	15.0	l/sec.
	Design flows		
	App Doc H1, Appendix H1-A.		
		flows	
	number of dwellings	15	4.6 l/sec
		20	5.1 l/sec.
		25	5.4 l/sec
	The proposed drainage network divides the flows to the east and west from public MH 3302.		
	min pipe size for 25 properties = 100 mm dia @ 1:80. Therefore 100 mm pipework adequate throughout.		
	provide 150 mm diameter at min 1:150 as necessary to minimise pipe depths.		

F Micro Drainage Analysis

1 year return period, 15 to 10080 minutes duration,
Winter & summer, P1-P6

100 year return period, 15 to 10080 minutes duration,
Winter & summer, P1-P7

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
1yr

Date 05/06/17

File 8377 purbrook 1 year crat...

Designed By AD

Checked By

CADS

Storage Design W.11.2



Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	15.2	0.0	15.2	40.9523	0.1522	0.0	8.0	O K
30 Summer	15.6	0.0	15.6	40.9603	0.1602	0.0	8.4	O K
60 Summer	14.7	0.0	14.7	40.9463	0.1462	0.0	7.6	O K
120 Summer	12.3	0.0	12.3	40.9193	0.1193	0.0	6.2	O K
180 Summer	10.6	0.0	10.6	40.8998	0.0998	0.0	5.2	O K
240 Summer	9.3	0.0	9.3	40.8858	0.0858	0.0	4.5	O K
360 Summer	7.5	0.0	7.5	40.8658	0.0658	0.0	3.4	O K
480 Summer	6.2	0.0	6.2	40.8518	0.0518	0.0	2.7	O K
600 Summer	5.5	0.0	5.5	40.8403	0.0402	0.0	2.1	O K
720 Summer	4.9	0.0	4.9	40.8313	0.0312	0.0	1.6	O K
960 Summer	4.2	0.0	4.2	40.8188	0.0187	0.0	1.0	O K
1440 Summer	3.3	0.0	3.3	40.8038	0.0038	0.0	0.2	O K
2160 Summer	2.5	0.0	2.5	40.8000	0.0000	0.0	0.0	O K
2880 Summer	2.0	0.0	2.0	40.8000	0.0000	0.0	0.0	O K
4320 Summer	1.5	0.0	1.5	40.8000	0.0000	0.0	0.0	O K
5760 Summer	1.3	0.0	1.3	40.8000	0.0000	0.0	0.0	O K
7200 Summer	1.1	0.0	1.1	40.8000	0.0000	0.0	0.0	O K
8640 Summer	1.0	0.0	1.0	40.8000	0.0000	0.0	0.0	O K
10080 Summer	0.9	0.0	0.9	40.8000	0.0000	0.0	0.0	O K
15 Winter	16.2	0.0	16.2	40.9703	0.1702	0.0	8.9	O K
30 Winter	16.2	0.0	16.2	40.9708	0.1707	0.0	8.9	O K
60 Winter	14.6	0.0	14.6	40.9443	0.1442	0.0	7.5	O K
120 Winter	11.1	0.0	11.1	40.9058	0.1058	0.0	5.5	O K
180 Winter	9.1	0.0	9.1	40.8833	0.0833	0.0	4.3	O K
240 Winter	7.7	0.0	7.7	40.8678	0.0678	0.0	3.5	O K
360 Winter	5.9	0.0	5.9	40.8468	0.0468	0.0	2.4	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	29.65	13
30 Summer	19.73	21
60 Summer	12.80	36
120 Summer	8.16	68
180 Summer	6.24	98
240 Summer	5.15	128
360 Summer	3.90	190
480 Summer	3.20	250
600 Summer	2.74	312
720 Summer	2.42	370
960 Summer	1.98	492
1440 Summer	1.50	734
2160 Summer	1.13	0
2880 Summer	0.93	0
4320 Summer	0.70	0
5760 Summer	0.58	0
7200 Summer	0.50	0
8640 Summer	0.44	0
10080 Summer	0.39	0
15 Winter	29.65	13
30 Winter	19.73	22
60 Winter	12.80	38
120 Winter	8.16	70
180 Winter	6.24	100
240 Winter	5.15	132
360 Winter	3.90	194

Graham Garner And Partners		Page 2
10 Station Approach Broadstone Dorset BH18 8AX	38-40 London Road Purbrook 1yr	
Date 05/06/17 File 8377 purbrook 1 year crat...	Designed By AD Checked By	
CADS	Storage Design W.11.2	

Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
480 Winter	4.9	0.0	4.9	40.8308	0.0307	0.0	1.6	O K
600 Winter	4.3	0.0	4.3	40.8203	0.0202	0.0	1.0	O K
720 Winter	3.8	0.0	3.8	40.8123	0.0123	0.0	0.6	O K
960 Winter	3.1	0.0	3.1	40.8018	0.0018	0.0	0.1	O K
1440 Winter	2.4	0.0	2.4	40.8000	0.0000	0.0	0.0	O K
2160 Winter	1.8	0.0	1.8	40.8000	0.0000	0.0	0.0	O K
2880 Winter	1.5	0.0	1.5	40.8000	0.0000	0.0	0.0	O K
4320 Winter	1.1	0.0	1.1	40.8000	0.0000	0.0	0.0	O K
5760 Winter	0.9	0.0	0.9	40.8000	0.0000	0.0	0.0	O K
7200 Winter	0.8	0.0	0.8	40.8000	0.0000	0.0	0.0	O K
8640 Winter	0.7	0.0	0.7	40.8000	0.0000	0.0	0.0	O K
10080 Winter	0.6	0.0	0.6	40.8000	0.0000	0.0	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
480 Winter	3.20	254
600 Winter	2.74	314
720 Winter	2.42	374
960 Winter	1.98	490
1440 Winter	1.50	0
2160 Winter	1.13	0
2880 Winter	0.93	0
4320 Winter	0.70	0
5760 Winter	0.58	0
7200 Winter	0.50	0
8640 Winter	0.44	0
10080 Winter	0.39	0

Graham Garner And Partners		Page 3
10 Station Approach Broadstone Dorset BH18 8AX	38-40 London Road Purbrook 1yr	
Date 05/06/17 File 8377 purbrook 1 year crat...	Designed By AD Checked By	
CADS	Storage Design W.11.2	

Rainfall Details

Region	ENG+WAL	Cv (Winter)	0.840
Return Period (years)	1	Shortest Storm (mins)	15
M5-60 (mm)	20.000	Longest Storm (mins)	10080
Ratio-R	0.350	Summer Storms	Yes
Cv (Summer)	0.750	Winter Storms	Yes

Time / Area Diagram

Total Area (ha) = 0.269

Time (mins)	Area (ha)
from: to:	
0 4	0.269

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
1yr

Date 05/06/17

File 8377 purbrook 1 year crat...

Designed By AD

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Storage Design W.11.2



Tank/Pond Details

Invert Level (m) 40.800 Ground Level (m) 42.450

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	52.3	0.30	52.3	0.60	52.3	0.90	52.3	1.20	52.3
0.10	52.3	0.40	52.3	0.70	52.3	1.00	52.3		
0.20	52.3	0.50	52.3	0.80	52.3	1.10	52.3		

Hydro-Brake Outflow Control

Design Head (m) 1.000 Hydro-Brake Type MD6 Invert Level (m) 40.750
Design Flow (l/s) 20.0 Diameter (mm) 182

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	6.1	0.60	20.2	1.60	24.0	2.60	30.4	5.00	42.2	7.50	51.7
0.20	15.1	0.80	19.5	1.80	25.4	3.00	32.7	5.50	44.3	8.00	53.4
0.30	20.4	1.00	20.1	2.00	26.7	3.50	35.3	6.00	46.2	8.50	55.0
0.40	21.3	1.20	21.2	2.20	28.0	4.00	37.8	6.50	48.1	9.00	56.6
0.50	20.9	1.40	22.6	2.40	29.2	4.50	40.0	7.00	49.9	9.50	58.2

Pipe Overflow Control

Pipe Diameter (m) 0.225 Roughness (mm) 0.600 Invert Level (m) 42.050
Slope (1:x) 20.0 Entry Loss Coef 0.500
Length (m) 10.000 Coef of Contraction 0.600

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
1yr

Date 05/06/17

File 8377 purbrook 1 year crat...

Designed By AD

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Storage Design W.11.2



Flood Routing through Storage Structure

Storm Duration 30 Mins (Winter)

Total Volume over Overflow (Spill Flow) 0.0m³

Time (mins)	Level (m)	Depth (m)	Inflow (l/s)	Control (l/s)	Overflow (l/s)	Outflow (l/s)	Volume (m³)
1	40.800	0.000	0.4	0.4	0.0	0.4	0.0
2	40.800	0.000	1.5	1.5	0.0	1.5	0.0
3	40.800	0.000	2.8	2.8	0.0	2.8	0.0
4	40.801	0.001	4.2	3.1	0.0	3.1	0.0
5	40.802	0.002	5.1	3.2	0.0	3.2	0.1
6	40.805	0.005	5.5	3.3	0.0	3.3	0.2
7	40.807	0.007	5.8	3.5	0.0	3.5	0.4
8	40.810	0.010	6.3	3.7	0.0	3.7	0.5
9	40.814	0.014	7.5	3.9	0.0	3.9	0.7
10	40.819	0.019	9.3	4.2	0.0	4.2	1.0
11	40.826	0.026	11.8	4.6	0.0	4.6	1.4
12	40.836	0.036	15.0	5.2	0.0	5.2	1.9
13	40.849	0.049	18.7	6.0	0.0	6.0	2.5
14	40.865	0.065	22.5	7.4	0.0	7.4	3.4
15	40.883	0.083	26.0	9.0	0.0	9.0	4.3
16	40.903	0.103	28.6	10.8	0.0	10.8	5.4
17	40.923	0.123	29.5	12.6	0.0	12.6	6.4
18	40.941	0.141	28.6	14.2	0.0	14.2	7.4
19	40.955	0.155	26.0	15.3	0.0	15.3	8.1
20	40.965	0.165	22.5	15.9	0.0	15.9	8.6
21	40.970	0.170	18.7	16.2	0.0	16.2	8.9
22	40.971	0.171	15.0	16.2	0.0	16.2	8.9
23	40.968	0.168	11.8	16.0	0.0	16.0	8.8
24	40.962	0.162	9.3	15.7	0.0	15.7	8.5
25	40.954	0.154	7.5	15.3	0.0	15.3	8.0
26	40.944	0.144	6.3	14.6	0.0	14.6	7.6
27	40.935	0.135	5.8	13.7	0.0	13.7	7.1
28	40.926	0.126	5.5	12.9	0.0	12.9	6.6
29	40.918	0.118	5.1	12.2	0.0	12.2	6.2
30	40.910	0.110	4.2	11.5	0.0	11.5	5.7
31	40.901	0.101	2.8	10.7	0.0	10.7	5.3
32	40.892	0.092	1.5	9.8	0.0	9.8	4.8
33	40.882	0.082	0.4	9.0	0.0	9.0	4.3
34	40.872	0.072	0.0	8.1	0.0	8.1	3.8
35	40.864	0.064	0.0	7.3	0.0	7.3	3.3
36	40.856	0.056	0.0	6.6	0.0	6.6	2.9
37	40.848	0.048	0.0	6.0	0.0	6.0	2.5
38	40.842	0.042	0.0	5.6	0.0	5.6	2.2
39	40.836	0.036	0.0	5.2	0.0	5.2	1.9
40	40.830	0.030	0.0	4.8	0.0	4.8	1.6
41	40.825	0.025	0.0	4.5	0.0	4.5	1.3
42	40.820	0.020	0.0	4.2	0.0	4.2	1.0
43	40.815	0.015	0.0	3.9	0.0	3.9	0.8
44	40.810	0.010	0.0	3.7	0.0	3.7	0.5
45	40.806	0.006	0.0	3.4	0.0	3.4	0.3
46	40.803	0.003	0.0	3.2	0.0	3.2	0.1
47	40.800	0.000	0.0	0.0	0.0	0.0	0.0

Peak inflow
= peak run-off
from impermeable
areas
= 29.5 l/sec

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
1yr

Date 05/06/17

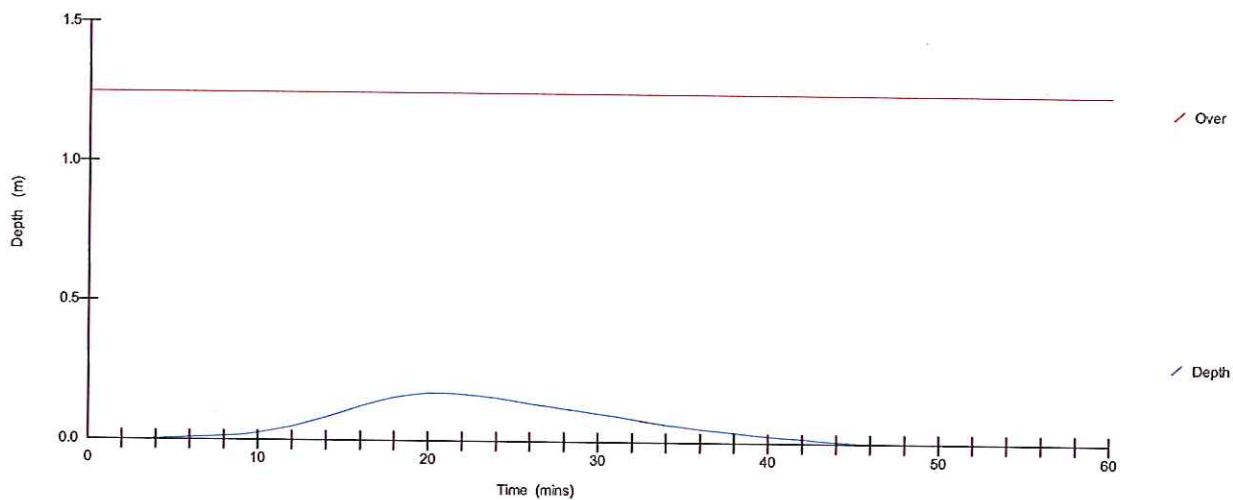
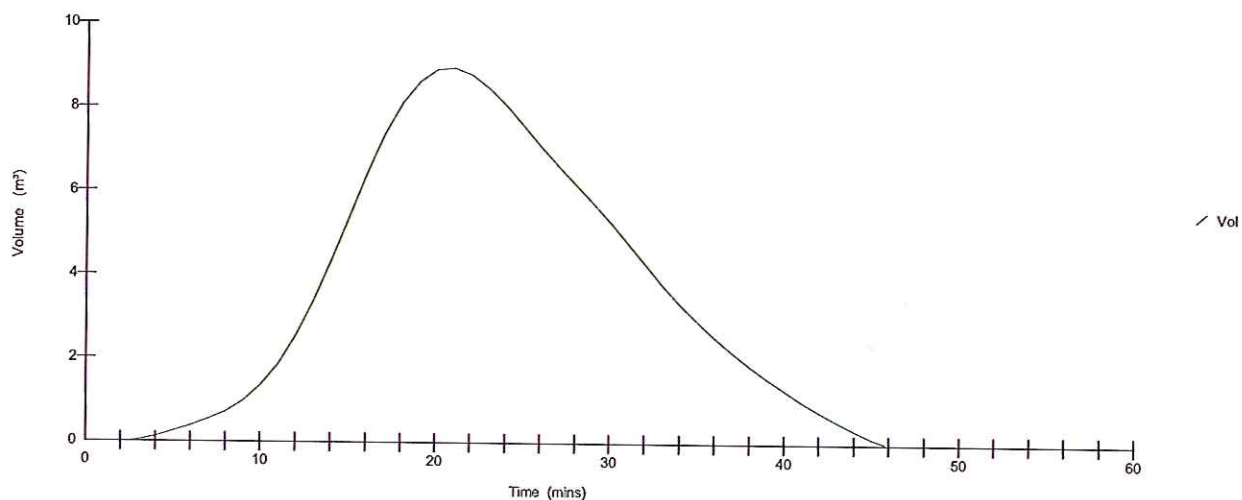
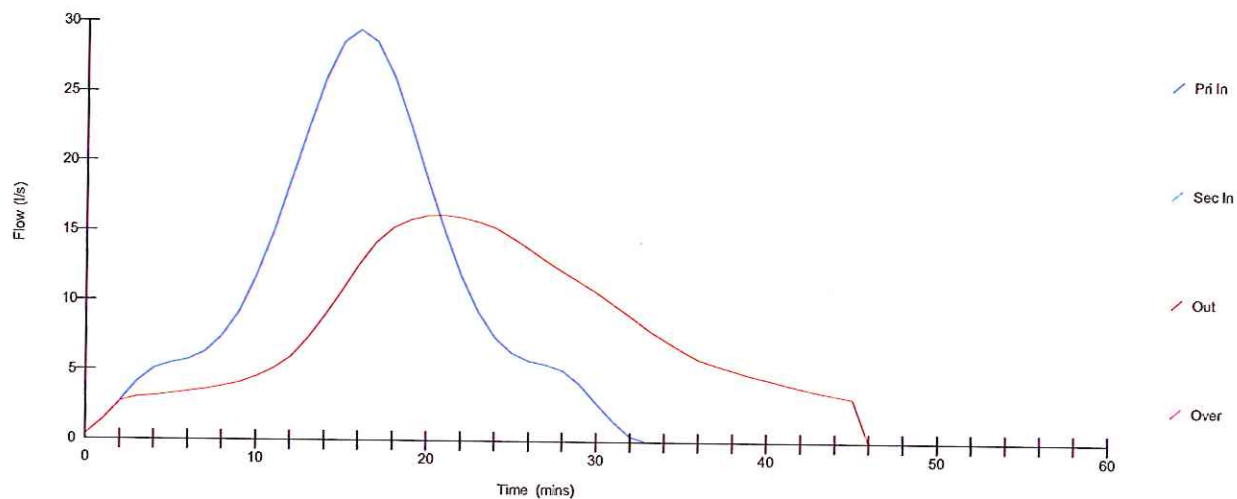
File 8377 purbrook 1 year crat...

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Storage Design W.11.2

Storm Duration 30 Mins (Winter)

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
100 yr + 30%

Date 13-02-18

File 8377 purbrook 100+30% ...

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Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	21.3	0.0	21.3	41.7198	0.9198	0.0	48.1	O K
30 Summer	21.3	0.0	21.3	41.8663	1.0663	0.0	55.8	O K
60 Summer	21.2	0.0	21.2	41.8833	1.0833	0.0	56.6	O K
120 Summer	21.2	0.0	21.2	41.7398	0.9398	0.0	49.1	O K
180 Summer	21.2	0.0	21.2	41.5798	0.7798	0.0	40.8	O K
240 Summer	21.3	0.0	21.3	41.4233	0.6233	0.0	32.6	O K
360 Summer	21.3	0.0	21.3	41.1838	0.3837	0.0	20.1	O K
480 Summer	20.5	0.0	20.5	41.0638	0.2637	0.0	13.8	O K
600 Summer	18.4	0.0	18.4	41.0113	0.2112	0.0	11.0	O K
720 Summer	16.4	0.0	16.4	40.9753	0.1752	0.0	9.2	O K
960 Summer	13.7	0.0	13.7	40.9348	0.1348	0.0	7.0	O K
1440 Summer	10.1	0.0	10.1	40.8948	0.0948	0.0	5.0	O K
2160 Summer	7.4	0.0	7.4	40.8643	0.0643	0.0	3.4	O K
2880 Summer	5.8	0.0	5.8	40.8463	0.0462	0.0	2.4	O K
4320 Summer	4.3	0.0	4.3	40.8203	0.0203	0.0	1.0	O K
5760 Summer	3.4	0.0	3.4	40.8063	0.0063	0.0	0.3	O K
7200 Summer	2.8	0.0	2.8	40.8000	0.0000	0.0	0.0	O K
8640 Summer	2.5	0.0	2.5	40.8000	0.0000	0.0	0.0	O K
10080 Summer	2.2	0.0	2.2	40.8000	0.0000	0.0	0.0	O K
15 Winter	21.2	0.0	21.2	41.8538	1.0538	0.0	55.1	O K
30 Winter	21.8	0.0	21.8	42.0373	1.2373	0.0	64.3	O K
60 Winter	21.8	0.0	21.8	42.0398	1.2398	0.0	64.4	O K
120 Winter	21.2	0.0	21.2	41.8078	1.0078	0.0	52.7	O K
180 Winter	21.3	0.0	21.3	41.5538	0.7538	0.0	39.4	O K
240 Winter	21.3	0.0	21.3	41.3072	0.5072	0.0	26.5	O K
360 Winter	20.4	0.0	20.4	41.0508	0.2507	0.0	13.1	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	125.36	16
30 Summer	83.39	27
60 Summer	52.32	44
120 Summer	31.42	78
180 Summer	23.18	112
240 Summer	18.63	142
360 Summer	13.66	198
480 Summer	10.94	252
600 Summer	9.20	312
720 Summer	7.98	370
960 Summer	6.37	490
1440 Summer	4.63	734
2160 Summer	3.35	1100
2880 Summer	2.67	1468
4320 Summer	1.94	2192
5760 Summer	1.54	2896
7200 Summer	1.30	0
8640 Summer	1.12	0
10080 Summer	1.00	0
15 Winter	125.36	16
30 Winter	83.39	29
60 Winter	52.32	46
120 Winter	31.42	84
180 Winter	23.18	118
240 Winter	18.63	148
360 Winter	13.66	194

Graham Garner And Partners		Page 2
10 Station Approach Broadstone Dorset BH18 8AX	38-40 London Road Purbrook 100 yr + 30%	
Date 13-02-18 File 8377 purbrook 100+30% ...	Designed By AD Checked By	
CADS	Storage Design W.11.2	

Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
480 Winter	16.3	0.0	16.8	40.9818	0.1817	0.0	9.5	O K
600 Winter	14.4	0.0	14.4	40.9428	0.1428	0.0	7.5	O K
720 Winter	12.5	0.0	12.6	40.9223	0.1223	0.0	6.4	O K
960 Winter	10.1	0.0	10.1	40.8943	0.0943	0.0	4.9	O K
1440 Winter	7.4	0.0	7.4	40.8643	0.0643	0.0	3.3	O K
2160 Winter	5.3	0.0	5.3	40.8378	0.0377	0.0	2.0	O K
2880 Winter	4.2	0.0	4.2	40.8198	0.0197	0.0	1.0	O K
4320 Winter	3.1	0.0	3.1	40.8008	0.0008	0.0	0.0	O K
5760 Winter	2.5	0.0	2.5	40.8000	0.0000	0.0	0.0	O K
7200 Winter	2.1	0.0	2.1	40.8000	0.0000	0.0	0.0	O K
8640 Winter	1.3	0.0	1.8	40.8000	0.0000	0.0	0.0	O K
10080 Winter	1.6	0.0	1.6	40.8000	0.0000	0.0	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
480 Winter	10.94	254
600 Winter	9.20	310
720 Winter	7.98	370
960 Winter	6.37	492
1440 Winter	4.63	728
2160 Winter	3.35	1088
2880 Winter	2.67	1468
4320 Winter	1.94	2180
5760 Winter	1.54	0
7200 Winter	1.30	0
8640 Winter	1.12	0
10080 Winter	1.00	0

Graham Garner And Partners		Page 3
10 Station Approach Broadstone Dorset BH18 8AX	38-40 London Road Purbrook 100 yr + 30%	
Date 13-02-18 File 8377 purbrook 100+30% ...	Designed By AD Checked By	
CADS	Storage Design W.11.2	

Rainfall Details

Region	ENG+WAL	Cv (Winter)	0.840
Return Period (years)	100	Shortest Storm (mins)	15
M5-60 (mm)	26.000	Longest Storm (mins)	10080
Ratio-R	0.350	Summer Storms	Yes
Cv (Summer)	0.750	Winter Storms	Yes

Time / Area Diagram

Total Area (ha) = 0.269

Time (mins)	Area (ha)
from: to:	
0 4	0.269

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
100 yr + 30%

Date 13-02-18

File 8377 purbrook 100+30% ...

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Tank/Pond Details

Invert Level (m) 40.800 Ground Level (m) 42.450

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	52.3	0.30	52.3	0.50	52.3	0.90	52.3	1.20	52.3
0.10	52.3	0.40	52.3	0.70	52.3	1.00	52.3		
0.20	52.3	0.50	52.3	0.80	52.3	1.10	52.3		

Hydro-Brake Outflow Control

Design Head (m) 1.000 Hydro-Brake Type MD6 Invert Level (m) 40.750
Design Flow (l/s) 20.0 Diameter (mm) 182

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	6.1	0.60	20.2	1.60	24.0	2.60	30.4	5.00	42.2	7.50	51.7
0.20	15.1	0.80	19.5	1.80	25.4	3.00	32.7	5.50	44.3	8.00	53.4
0.30	20.4	1.00	20.1	2.00	26.7	3.50	35.3	6.00	46.2	8.50	55.0
0.40	21.3	1.20	21.2	2.20	28.0	4.00	37.8	6.50	48.1	9.00	56.6
0.50	20.9	1.40	22.6	2.40	29.2	4.50	40.0	7.00	49.9	9.50	58.2

Pipe Overflow Control

Pipe Diameter (m) 0.225 Roughness (mm) 0.600 Invert Level (m) 42.050
Slope (1:x) 20.0 Entry Loss Coef 0.500
Length (m) 10.000 Coef of Contraction 0.600

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10 Station Approach Broadstone Dorset BH18 8AX	38-40 London Road Purbrook 100 yr + 30%	
Date 13-02-18 File 8377 purbrook 100+30% ...	Designed By AD Checked By	
CADS	Storage Design W.11.2	

Flood Routing through Storage Structure

Storm Duration 60 Mins (Winter)

Total Volume over Overflow (Spill Flow) 0.0m³

Time (mins)	Level (m)	Depth (m)	Inflow (l/s)	Control (l/s)	Overflow (l/s)	Outflow (l/s)	Volume (m ³)
2	40.800	0.000	2.3	2.3	0.0	2.3	0.0
4	40.805	0.005	7.8	3.4	0.0	3.4	0.3
6	40.820	0.020	12.5	4.2	0.0	4.2	1.0
8	40.839	0.039	14.3	5.4	0.0	5.4	2.1
10	40.858	0.058	14.6	6.8	0.0	6.8	3.1
12	40.875	0.075	14.9	8.3	0.0	8.3	3.9
14	40.890	0.090	16.0	9.6	0.0	9.6	4.7
16	40.906	0.106	18.8	11.1	0.0	11.1	5.5
18	40.927	0.127	23.5	13.0	0.0	13.0	6.6
20	40.956	0.156	30.4	15.4	0.0	15.4	8.2
22	40.998	0.198	39.2	17.7	0.0	17.7	10.4
24	41.056	0.256	49.3	20.5	0.0	20.5	13.4
26	41.134	0.334	60.0	21.1	0.0	21.1	17.4
28	41.235	0.435	70.1	21.0	0.0	21.0	22.7
30	41.357	0.557	78.1	20.2	0.0	20.2	29.2
32	41.495	0.695	81.4	19.7	0.0	19.7	36.3
34	41.632	0.832	78.1	19.8	0.0	19.8	43.5
36	41.757	0.957	70.1	20.1	0.0	20.1	50.0
38	41.859	1.059	60.0	20.7	0.0	20.7	55.4
40	41.937	1.137	49.3	21.1	0.0	21.1	59.4
42	41.989	1.189	39.2	21.5	0.0	21.5	62.2
44	42.022	1.222	30.4	21.7	0.0	21.7	63.8
46	42.040	1.240	23.5	21.8	0.0	21.8	64.4
48	42.037	1.237	18.8	21.8	0.0	21.8	64.3
50	42.023	1.223	16.0	21.7	0.0	21.7	63.8
52	42.006	1.206	14.9	21.6	0.0	21.6	63.1
54	41.991	1.191	14.6	21.5	0.0	21.5	62.3
56	41.975	1.175	14.3	21.4	0.0	21.4	61.4
58	41.957	1.157	12.5	21.2	0.0	21.2	60.5
60	41.931	1.131	7.8	21.1	0.0	21.1	59.2
62	41.895	1.095	2.3	20.9	0.0	20.9	57.3
64	41.850	1.050	0.0	20.6	0.0	20.6	54.9
66	41.803	1.003	0.0	20.4	0.0	20.4	52.4
68	41.756	0.956	0.0	20.1	0.0	20.1	50.0
70	41.710	0.910	0.0	20.0	0.0	20.0	47.6
72	41.665	0.865	0.0	19.8	0.0	19.8	45.2
74	41.619	0.819	0.0	19.7	0.0	19.7	42.9
76	41.574	0.774	0.0	19.6	0.0	19.6	40.5
78	41.529	0.729	0.0	19.6	0.0	19.6	38.1
80	41.484	0.684	0.0	19.8	0.0	19.8	35.8
82	41.439	0.639	0.0	19.9	0.0	19.9	33.4
84	41.393	0.593	0.0	20.1	0.0	20.1	31.0
86	41.346	0.546	0.0	20.3	0.0	20.3	28.6
88	41.299	0.499	0.0	20.6	0.0	20.6	26.1
90	41.252	0.452	0.0	20.9	0.0	20.9	23.6
92	41.204	0.404	0.0	21.1	0.0	21.1	21.1
94	41.155	0.355	0.0	21.3	0.0	21.3	18.6
96	41.107	0.307	0.0	20.9	0.0	20.9	16.0
98	41.059	0.259	0.0	20.5	0.0	20.5	13.6
100	41.014	0.214	0.0	18.5	0.0	18.5	11.2
102	40.974	0.174	0.0	16.4	0.0	16.4	9.1
104	40.939	0.139	0.0	14.1	0.0	14.1	7.3
106	40.910	0.110	0.0	11.5	0.0	11.5	5.8
108	40.886	0.086	0.0	9.3	0.0	9.3	4.5
110	40.867	0.067	0.0	7.6	0.0	7.6	3.5
112	40.851	0.051	0.0	6.1	0.0	6.1	2.7

10 Station Approach
Broadstone
Dorset BH18 8AX

38-40 London Road
Purbrook
100 yr + 30%



Date 13-02-18

Designed By AD

File 8377 purbrook 100+30% ...

Checked By

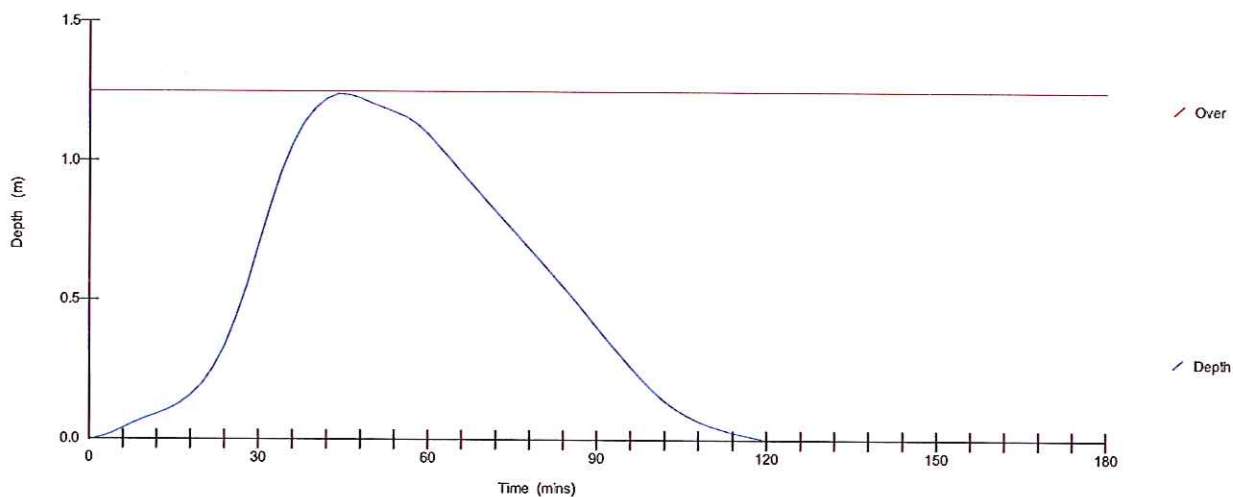
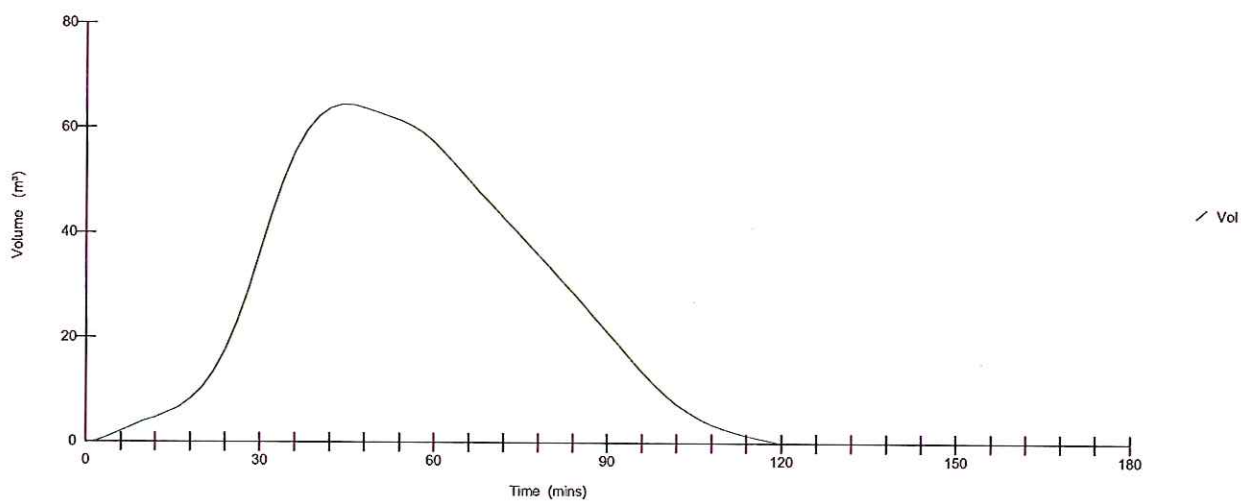
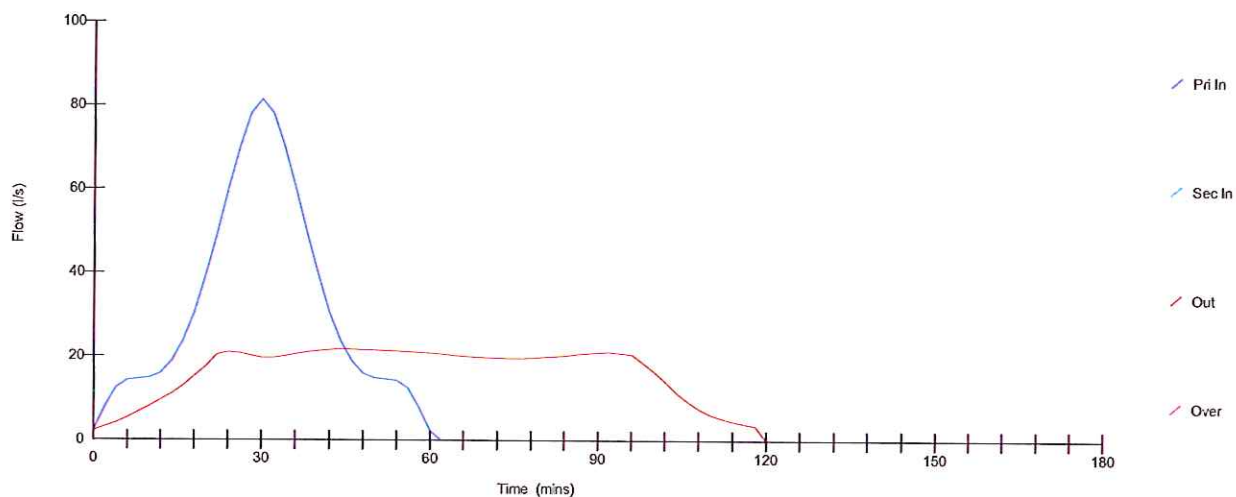
CADS

Storage Design W.11.2

Flood Routing through Storage Structure

Storm Duration 60 Mins (Winter)

Time (mins)	Level (m)	Depth (m)	Inflow (l/s)	Control (l/s)	Overflow (l/s)	Outflow (l/s)	Volume (m ³)
114	40.838	0.038	0.0	5.3	0.0	5.3	2.0
116	40.826	0.026	0.0	4.6	0.0	4.6	1.4
118	40.817	0.017	0.0	4.1	0.0	4.1	0.9
120	40.808	0.008	0.0	3.5	0.0	3.5	0.4
122	40.800	0.000	0.0	0.0	0.0	0.0	0.0

Storm Duration 60 Mins (Winter)

G Drawing SO-2168-05-DE-20