



DRAINAGE TECHNICAL NOTE SITE B

DATE:	30 May 2023	CONFIDENTIALITY:	Public
SUBJECT:	Surface Water Drainage Strategy (Golf Course)		
PROJECT:	70088068 - Bognor Regis Golf Course	AUTHOR:	Chris Patmore
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1. INTRODUCTION

1.1 Appointment and Brief

WSP UK Ltd (WSP) were appointed by Hallam Land Management Limited to prepare a surface water drainage strategy in support of an application for full planning permission for the proposed relocated Bognor Regis Golf Course – Site B (hereby referred to as the ‘Proposed Development’).

This note is in response to the comments raised by the Arun District Council Drainage Engineer (dated 10 March 2022, 30 September 2022 and 03 May 2023). For ease of reference the responses have been provided at Appendices D, E and F with commentary as to where each point has been addressed.

1.2 The Site

The Proposed Development is located on a greenfield site with an area of approximately 73.7 ha and which lies to the north-east of Middleton-On-Sea between Ancton Way and the A259 (the ‘Site’). The Ordnance Survey coordinates for the Site are 498710, 100990 and the nearest postcode is PO22 6NH. The site location is shown on **Figure 1**.

The site is for the construction of an 18 hole par 4 golf course, a 9 hole par 3, practice greens and a driving range; the formation of a new access onto the A259; the construction of a club house with associated golf club facilities; the construction of a maintenance building and external area of hardstanding; the laying out of a 224 space car park and new roads and paths; new landscape planting, surface water drainage basins and water storage reservoir, and other earthworks and infrastructure. The site general arrangement is shown on **Figure 2**.

The Ryebank Rife flows through the northern section of the Site (flows can be bi-directional flowing east or west depending on storm events) and field drains are connected to this water body (from the north and south of the Ryebank Rife). The Elmer Rife (connects to the Ryebank Rife) also borders the eastern boundary of the Site and outlets to the sea approximately 320 m to the south.

The Site is underlain by superficial River Terrace Deposits. Across the south-east of the Site, Raised Beach Deposits are anticipated to be present and on the eastern extent of the Site are Raise Marine Deposits. These superficial deposits overlie the White Chalk Subgroup (formerly Upper Chalk Formation). The superficial deposits are classed as Secondary A aquifers and the bedrock as a Principal aquifer. A licenced groundwater abstraction point is located at Hobbs New Barn, approximately 110 m north-east of the Site. The Site is not within a groundwater Source Protection Zone (SPZ).

Figure 2 -- Site General Arrangement (extract from European Golf Design drawing 1352.102.01, dated 08.11.21)



1.3 Flood Risk Summary

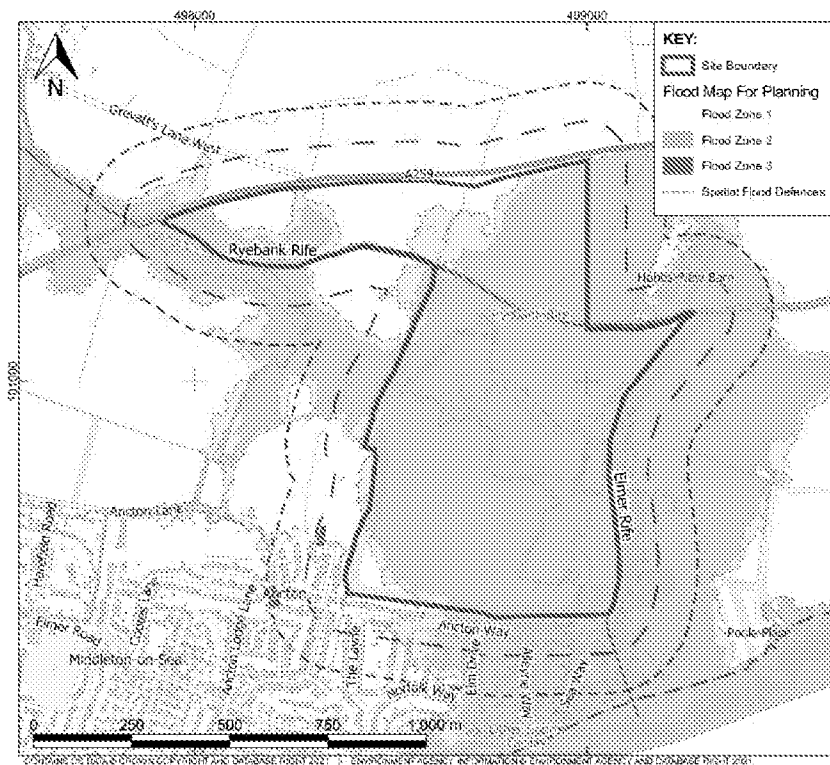
The majority of the development is located in Flood Zone 3, on the Environment Agency's Flood Map for Planning (**Figure 3**), indicating a high risk of fluvial / tidal flooding. The Ryebank Rife, categorised as a main river, flows bi-directionally, but at this location, preferentially from west to east, through the north of the site and the Elmer Rife (also categorised as a main river) flows bi-directionally (south-north) along the eastern boundary of the site. Both of these watercourses are tidally influenced.

Site specific hydraulic modelling has been undertaken for the Ryebank and Elmer Rifes combined with the surface water flood risk via a 1D-2D linked ICM hydraulic model. The model has tested the baseline scenario and has shown that the majority of the site is outside of the 1 in 100 year plus 25% climate change flood extents. The more sensitive parts of the development i.e. the clubhouse and maintenance buildings will be located in areas outside of the floodplain, as will the new access road off of the A259 (Grevatt's Lane).

The Environment Agency's Flood Risk from Surface Water map demonstrates that the risk of surface water flooding to the proposed development is Low and confirmed by the outputs of the WSP 1D-2D linked ICM hydraulic model.

In terms of groundwater, the baseline suggests a high potential flood risk, the nearest borehole log records a water strike at 1.8mbgl in a perched aquifer.

Figure 3 - Environment Agency's Flood Map for Planning



1.4 Mitigation Summary, surface water recycling for irrigation and off-site benefits

To facilitate the development most of the site will be reprofiled to facilitate construction of the golf course. The proposed reprofiling will not result in a loss of floodplain and has been developed with a view to increase floodplain storage if possible.

The golf course will predominantly remain as a greenfield site (excluding car parking, access roads, club house and maintenance depot). As a result, the scheme will not result in an increase in runoff rates from these areas. Although not required for the landscaping and course elements of the overall golf course site, the design will further restrict run off from the site to the QBar value thus offering betterment over the existing situation. The surface water runoff from the new impermeable areas will be collected, treated appropriately (e.g. hydrocarbon interceptor / SuDS) and discharged to the onsite harvesting/irrigation reservoir or discharged at greenfield rates to the Ryebank or Elmer Rife.

Measures, including permeable hardstanding, maintaining flood plains, SUDS basins and controlling runoff rates, are embedded within the development to ensure that it is not exposed to an unacceptable level of flood risk and there is no increase in flood risk elsewhere. The proposed terrain surface has been tested in the site-specific hydraulic model, to confirm this.

Redevelopment offers the potential to manage the greenfield runoff in such a way as to reduce offsite surface water flood risk during the more extreme storm events by controlling site discharges at source. This has a direct benefit to the properties downstream in Elmer as well and in turn will help reduce pressure on the Elmer Pump Station. In addition, including rainwater harvesting for irrigation use during the summer months will further benefit the off-site areas.



To mitigate the residual risk of surface water flooding and design the harvesting and greenfield controls for the development, a comprehensive drainage / SuDS strategy has been developed. This strategy involves attenuating and harvesting the surface water runoff at source, via ponds and swales, prior to discharging to the Elmer Rife and Ryebank Rife.

The introduction of rainwater harvesting on this site is not only in keeping with SuDS principles but offers the site management a way of reducing water demand from mains supplies with the added benefit of lowering the total surface water discharges from the site whilst irrigation is being undertaken. The aim is to divert via pumping rainwater that has seeped into the course landscaped areas and from the hardstanding areas to an irrigation storage lagoon at the north-eastern corner of the site. This water is then used to irrigate the course at a controlled application rate that balances natural losses (transpiration, transpiration and infiltration). Pumping is required, only to lift the collected water into the irrigation lagoon. When the pumps are not operating, the collected rainwater is released at QBar rates into the Ryebank Rife.

Table 1 summarises the resultant surface water discharges from the site from each of the catchment areas and shows the benefits to the surrounding area from a reduction in site generated surface water peak flows.

Table 1 – Proposed Surface Water Outfall – Discharge Rates (Event comparison)

Catchment Ref.	Proposed Peak Discharge Flow - QBar (l/sec)	Existing Catchment (QBar) (l/sec)	Existing 1 in 30 year runoff (l/sec)	Diff. (%)	Existing 1 in 100 year runoff (l/sec)	Diff. (%)	Existing 1 in 100 year runoff (l/sec)	Diff. (%)
1 – North West	21.52	28.84	52.19	-59%	67.21	-68%	94.09	-77%
2 – North East	25.64	27.29	49.39	-48%	63.60	-60%	89.04	-71%
3 - South	64.45	107.99	195.41	-67%	251.66	-74%	352.33	-82%
TOTALS	111.61	164.12	296.99	-62%	382.47	-71%	535.46	-79%



1.5 Aim and Objectives

The proposed surface water drainage strategy outlined in this technical note seeks to demonstrate the Proposed Development can be drained in a sustainable manner, commensurate with local and national policy.

This document has been prepared to summarise the proposed outline strategy at Site B for the management of runoff generated by the golf course landscaping, access, hardstanding and roof areas within the Proposed Development and is to be read in conjunction with the wider surface water drainage and irrigation strategy by European Golf Design (Ref: 1352.406.01 and 1352.410.01; Date: 17/05/2023) and the Flood Risk Assessment by WSP (Ref: 70088068-FRA-V02 Date: 02/02/2022).

Appendix A summarises each of the comments raised by the Arun District Council Drainage Engineer (dated 10 March 2022, 30 September 2022 and 03 May 2023) and where the response is to be found within this technical note.

1.6 Limitations

WSP has prepared this document in accordance with the instructions of their client Hallam Land Management Limited for their sole and specific use relating solely to the above site. Any person who uses any information contained herein does so at their own risk and shall hold WSP harmless in any event. The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the site.

Third party information has been used in the preparation of this report, which WSP UK Ltd by necessity assumes is correct at the time of writing. Whilst reasonable checks have been made on data sources and the accuracy of the data, WSP UK Ltd accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP. In any event, WSP shall not be liable for any loss or damages arising under or in connection to the use of this report.



2. DRAINAGE STRATEGY REQUIREMENTS

The National Planning Policy Framework¹ (NPPF) states that flood risk to land and property must not be increased as a result of any development at the Site. The accompanying Flood Risk and Coastal Change Planning Practice Guidance² (PPG) states that flood risk should not be increased during any and all storm events up to and including a 1% annual probability event (i.e. an event with a return period of 1 in 100 years) including an appropriate allowance for climate change.

2.1 WATERCOURSES - RIVER PEAK FLOWS

The Environment Agency's Climate Change guidance in place at the time of preparation of this technical note have been used for the assessment of fluvial flood risk within the hydraulic model and mitigation design, this is based on the anticipated design life of the golf course, hence:

- 2080s - Central 25%

Changes in the peak rate and volume of surface water runoff generated by the Proposed Development as a result of any increase in impermeable area could increase the risk of flooding downstream unless sufficient steps are taken to mitigate this risk.

2.2 SURFACE WATER – RAINFALL RUNOFF PEAK FLOWS

Current best practice guidance³ states that runoff volumes and peak discharge rates leaving the Proposed Development should be no greater than the rates that occurred prior to development at the Site. For previously developed sites, attempts should be made to return discharge rates to greenfield runoff rates wherever practicable. Any increase in surface water run-off above the pre-development (or greenfield) volumes must be attenuated prior to discharge from the Proposed Development.

The peak runoff rates and volumes discharged by the Proposed Development must not be greater than those currently discharged for the equivalent rainfall event for each of the following:

- 100 % annual probability rainfall event;
- QBar rainfall event;
- 3.33 % annual probability rainfall event;
- 1 % annual probability rainfall event; and,
- 1 % annual probability rainfall event including an allowance for climate change (45% increase on peak rainfall intensity – updated 2022 values).

The Flood Risk and Coastal Change PPG, Building Regulations Approved Document H⁴ and The SuDS Manual⁵ Section 3.2.3.1 establish a hierarchy for surface water disposal, which encourages an approach based on the use of sustainable drainage systems (SuDS). This hierarchy stipulates that surface water runoff not collected for reuse must be discharged to one or more of the following in order of priority:

¹ Department for Levelling Up, Housing and Communities (2021) *National Planning Policy Framework*;

² Department for Levelling Up, Housing and Communities, and Ministry of Housing, Communities and Local Government (2021) *Planning Practice Guidance – Flood Risk and Coastal Change*;

³ Department for Environment, Food and Rural Affairs (2015) *Non-statutory technical standards for sustainable drainage systems*

⁴ HM Government (2015) *The Building Regulations Part H: Drainage and Waste Disposal*

⁵ CIRIA (2015) C753: *The SuDS Manual*



- Discharge into ground (infiltration); or, where not reasonably practicable,
- Discharge to a surface water body; or, where not reasonably practicable,
- Discharge to a surface water sewer, highway drain, or another drainage system; or, where not reasonably practicable,
- Discharge to a combined sewer.

It should be noted that the wider drainage and irrigation strategy is seeking to reuse surface water within the golf course as much as possible and to provide water quality treatment where required. This is discussed further below.



3. EXISTING SURFACE WATER DRAINAGE REGIME

3.1 Greenfield Runoff Rates

Publicly available British Geological Survey (BGS) mapping⁶ shows the Site to be underlain by superficial deposits of Raised Beach Deposits and River Terrace Deposits which are underlain in-turn by the Lewes Nodular Chalk Formation.

The Site currently drains via a combination of infiltration, formal land-drainage, and overland runoff into the network of surface waterbodies at the Site, including the Ryebank Rife, a Main River which runs from west to east through the northern part of the Site, and its tributaries.

Greenfield runoff rates have been calculated (**Appendix B**) using the FEH method are summarised in **Table 1** below. The existing surface water catchments are shown in **Figure 4**.

Table 1 – Peak Greenfield Runoff Flow Rates Total

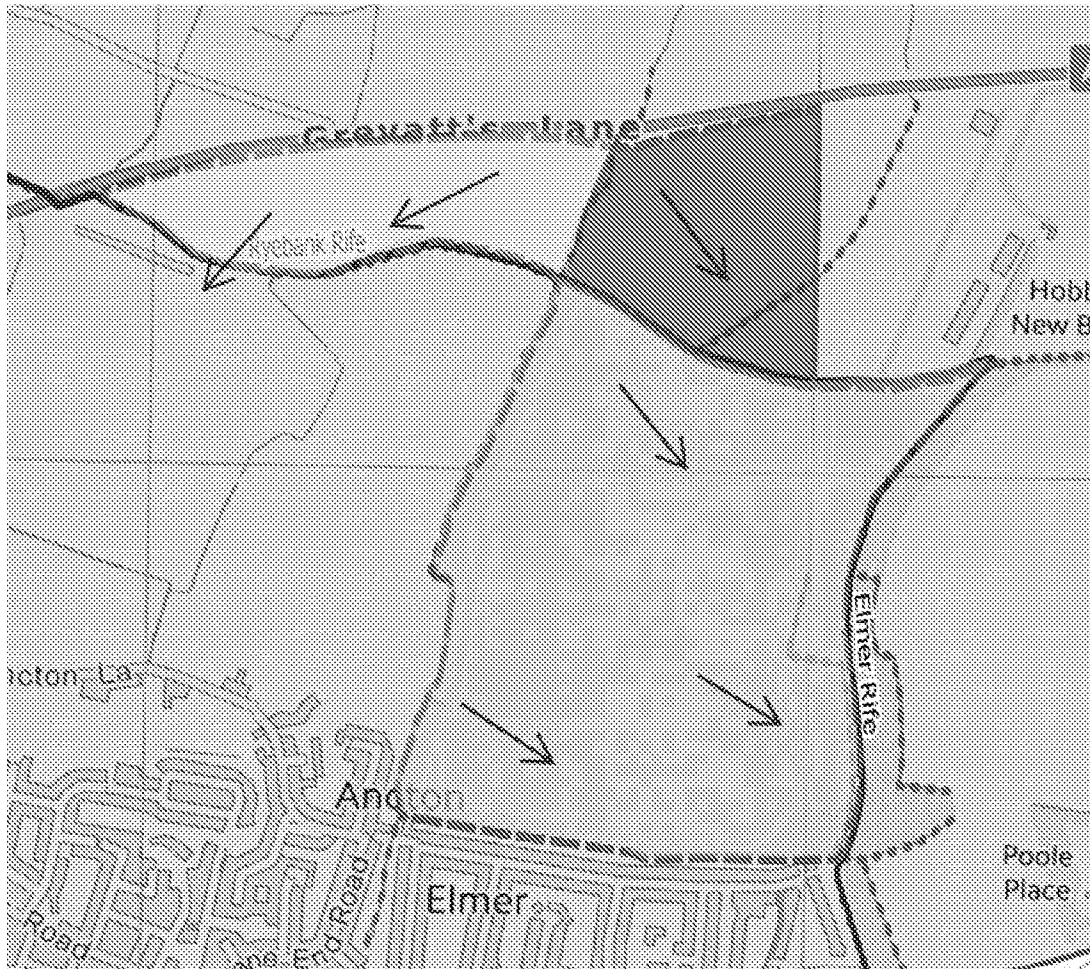
Storm Event Annual Exceedance Probability (%)	Peak Runoff Rate (l/s) Total Site Area (73.7 ha)	Peak Unit Runoff Rate (l/s/ha) Per Hectare (1 ha)
100 (1 in 1 year Return Period)	125.3	1.70
QBar	164.1	2.23
3.33 (1 in 30 year Return Period)	297.0	4.03
1 (1 in 100 year Return Period)	382.5	5.19
1 (1 in 100 year Return Period) + Climate Change	535.5	7.27

Table 2 – Existing Peak Greenfield Runoff Flow Rates Per Catchment

Catchment Ref.	Description	Catchment Area (ha)	Peak Flow 1 in 1 yr (l/sec)	Peak Flow QBar (l/sec)	Peak Flow 1 in 30 yr (l/sec)	Peak Flow 1 in 100 yr (l/sec)	Peak Flow 1 in 100 yr + 40% (l/sec)
1	North West to Ryebank Rife	12.95	22.02	28.84	52.19	67.21	94.09
2	North East to minor watercourse	12.26	20.83	27.29	49.39	63.6	89.04
3	South to Elmer Rife	48.49	82.43	107.99	195.41	251.66	352.33

⁶ British Geological Survey (2021) *Geology of Britain viewer*, accessed January 2022 from <https://mapapps.bgs.ac.uk/geologyofbritain/home.html>

Figure 4 – Existing Catchments and Receiving Watercourses



3.2 Discharge to Ground

As stated above, the nearest borehole log records a groundwater strike at 1.8mbgl in a perched aquifer (NB: it is not noted when this level was recorded and if this was the seasonal highest value). Potential high groundwater is acknowledged in correspondence with Arun DC that states *“this area suffers from high groundwater”* (letter dated 10 March 2023). In addition, the application of a 1m minimum freeboard above the highest recorded “winter” infiltration test result may preclude the widespread use of infiltration measures.

It should be noted that the existing watercourses are also subject to tide locking which, when considering the granular nature of the soils, also confirms the presence of high local groundwater levels.

For the site drainage strategy, WSP and European Golf Design (EGD) have proposed the conservative option of a positively drainage system that would not preclude infiltration but does not rely on it. If infiltration is proven to be viable it is likely to be only via shallow elements (pervious pavements etc.) and may thus further reduce off-site surface water discharges. Investigation and recording of groundwater levels would be recommended in order to also consider any residual floatation impacts of deeper basins where lining will be required to separate site drainage from groundwater. The basins will need to consider a gravity overflow route to the receiving watercourses. This is discussed further in the sections below.



4. PROPOSED SURFACE WATER DRAINAGE REGIME

4.1 Main Golf Course

The wider surface water drainage and irrigation strategy by EGD proposes the reuse of the majority of surface water runoff generated by the Proposed Development to ensure a sufficient supply of water is provided to facilitate sustainable irrigation of the proposed golf course.

The majority of surface water runoff generated by the wider golf course will be intercepted at source and pumped to the proposed irrigation lakes for reuse, whilst the remainder will continue to drain via a combination of infiltration and overland runoff at greenfield rates. All surface water generated by the hardstanding areas within the Proposed Development will be reused with a regulated overflow provided from the proposed irrigation lakes in accordance with the drainage hierarchy to ensure that there would be no increase in runoff from the Proposed Development.

All hardstanding areas within the Proposed Development are to be drained via SuDS features which discharge to the wider surface water drainage network and thus to the proposed irrigation lakes located within the north-eastern and north-western parts of the Proposed Development. Water within the irrigation lakes is to be extracted for the purposes of irrigation, with high level overflows to the adjacent surface waterbodies when the lakes are full. For further details on the design and operation of the proposed irrigation lakes please see the accompanying surface water drainage and irrigation strategy by European Golf Design (Drawing Ref. 1352.405.01 Rev C). The layout for the golf course drainage is contained as **Appendix C**.

The golf course area can be divided into 9 main catchments where surface water is managed, collected and discharged. Catchment 4A includes the hardstanding areas around and including the club house. These are discussed in sections below. The catchments are shown in **Figure 5** below and detailed in **Table 3**.

The runoff calculations from each catchment have been calculated using the FEH method and volumes calculated for the 6-hour event peak storm for the 1 in 100 year plus 40% event. Attenuation is to be provided on site to accommodate this volume with outflows to the receiving watercourses restricted to QBar.

Appendix C contains a marked-up plan showing the location of 7 proposed outfalls and resultant QBar restricted flow rates from the proposed scheme. This drawing is also shown in **Figure 6** below.

Rainwater harvesting is to be utilised for Catchment 4 (4A, 4B and 4C) during the summer months only. This is illustrated in **Table 4** below. As can be seen, the drainage strategy is precautionary and taken into consideration the worst-case operational situation where:

- Extreme rainfall is during the winter months (Oct through to Feb) when no rainwater harvesting is undertaken; and
- As a result, the on-site pumps are not being used to divert water to the irrigation lake and need to discharge (restricted to QBar) to the receiving watercourses.

It should also be noted that Outfall 4 is only used to drain down the irrigation reservoir and as a result would be rarely used and not be at the same time as Outfalls 5 and 6, which would operate during winter months (when not collecting rainwater for irrigation) or if the pumps fail during harvesting months.



Figure 5 -- Proposed Site Catchment Areas (Extract from Drawing Ref. 1352.405.01 Rev C -- Appendix C)



Figure 6 -- Proposed Site Outfall Locations and flow rates (Extract from Drawing Ref. 1352.405.01 Rev C -- Appendix C)





Table 3 – Proposed Surface Water Catchments

Catchment Ref.	Description	Catchment Area (ha)	Peak Flow 1 in 1 yr (l/sec)	Peak Flow QBar (l/sec)	Peak Flow 1 in 30 yr (l/sec)	Peak Flow 1 in 100 yr + 40% (l/sec)	Vol. 1 in 100 yr + 40% (m ³)
1	Golf Course (Hole 5) – direct discharge to watercourse	1.57	2.42	3.17	5.93	10.66	140
2	Golf Course (Holes 3, 4, 6 & 8) – direct discharge to watercourse	6.32	9.74	12.76	23.89	42.92	567
3	Golf Course (Holes 1, 2 & 9) – direct discharge to watercourse	2.77	4.27	5.59	10.47	18.81	248
4A	Golf Course (Hole 1 & Practice Ground), Car park, access road, club house – discharge to main irrigation basin via pumping station 4A or via Informal Basin 4A to watercourse	12.70	19.58	25.64	48.01	86.25	1,139
4B	Golf Course (Holes 10, 17 & 18) – discharge to main irrigation basin via pumping station 4B or via Basin 5	8.96	13.81	18.09	33.87	60.85	802
4C	Golf Course (Holes 2, 3, 4, 6, 9, 12, 13) – discharge to main irrigation basin via pumping station 4C or via Informal Basin 4C to watercourse	18.42	28.39	37.19	69.63	125.09	1,651
5	Golf Course (Holes 5, 6 & 7) – discharge to Basin 5 then to basin 6 then to basin 7 and then watercourse	7.57	11.67	15.28	28.62	51.41	679



Table 3 – Proposed Surface Water Catchments (continued)

Catchment Ref.	Description	Catchment Area (ha)	Peak Flow 1 in 1 yr (l/sec)	Peak Flow QBar (l/sec)	Peak Flow 1 in 30 yr (l/sec)	Peak Flow 1 in 100 yr + 40% (l/sec)	Vol. 1 in 100 yr + 40% (m ³)
6	Golf Course (Hole 11) – discharge to Basin 6 then to basin 7 and then watercourse (includes discharge from Catchment 5)	1.38	2.13	2.79	5.22	9.37	124
7	Golf Course (Holes 14, 15, 16 & 17) – discharge to Basin 6 then to basin 7 and then watercourse (includes discharge from Catchment 5)	14.01	21.59	28.29	52.96	95.14	1,256

Table 4 – Proposed Rainwater Harvesting Strategy

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Peak Water Usage / Day (m ³)	0	0	47	94	375	753	941	753	188	0	0	0
Total Monthly Water Usage / Day (m ³)	0	0	1,459	2,823	11,668	22,584	29,171	23,337	5,646	0	0	0

NB: These are estimate peak figures only assuming good quality water (equal to potable) and do not include weather fluctuations.

The above figures are budgetary only and subject to golf course / landscape irrigation system design / installation and seasonal weather variations and do not account for seasonal precipitation.

For the design, WSP has considered each catchment in terms of the attenuation requirements based on the surface area of the proposed basins (considered as an impermeable surface) and flows restricted to QBar where possible. The resultant storage and flow rates are detailed in **Table 5** below.

From the various catchments there will be a number of outfalls into the surrounding watercourses. These are listed below along with the contributing catchments and design runoff rates. Where flows are directed through other catchments (the case of 4B, 5, 6 and 7) these are described in the table and the sum of the QBar rates are used as the limiting flow values.

Volumes quoted are for the full greenfield rainfall volume with no allowance for infiltration or losses on site. Thus, a worst-case volume that could assume a fully saturated catchment.

As described above, not all these outfalls would be utilised during a storm event. The discharge scenarios for summer (harvesting) and winter (no harvesting) are outlined in **Tables 6, 7 and 8** below along with a comparison with existing greenfield runoff rates. Please note that for a worst-case multiple pump failure the discharge would be similar to that of a winter period, with no discharge from the harvesting/irrigation lagoon.



Table 5 – Proposed Surface Water Flow Rates and Attenuation Volumes

Outfall Ref.	Catchment Ref.	Description	Basin Surface Area (m ²)	Peak Discharge Flow - QBar (l/sec)	Total rainfall Vol. 1 in 100 yr + 40% 60 min event (m ³)	Attenuation water depth (mm) above static water level
1	1	Basin 1	575	3.17	140	240
2	2	Basin 2	10,810	12.76	567	50
3	3	Basin 3	3,960	5.59	248	60
4	4A, 4B & 4C (when harvesting)	Irrigation Basin – drain down only (rate based on existing catchment only – no allowance for additional catchments being discharged at this point)	9,870	25.64	3,592	365
5	4A	Informal Basin 4A – only in winter months and pump failure	2,260	25.64	1,139	500
Basin 5	4B	Basin 5 – only in winter months and pump failure	18,120	18.09	803	140
6	4C	Informal Basin 4B – only in winter months and pump failure	3,300	37.19	1,650	500
7	4B & 5	Basin 5	18,120	18.09 + 15.28 = 33.37	803 + 680 = 1,483	80
	4B, 5 and 6	Basin 6	3,495	33.37 + 2.79 = 36.16	1,483 + 124 = 1,607	Vol. passed through
	4B, 5, 6 and 7	Basin 7	5,640	36.16 + 28.29 = 64.45	1,607 + 1,255 = 2,862	510



Table 6 – Proposed Surface Water Outfall – Discharge Rates (Option 1 – Winter Months)

Outfall Ref.	Catchment Ref.	Comment	Proposed Peak Discharge Flow - QBar (l/sec)	Existing Catchment QBar (l/sec)	Difference (l/sec)	Difference (%)
1	1	Discharge to Watercourse	3.17	28.84	- 7.32	25% reduction on QBar
2	2	Basin 2	12.76			
3	3	Basin 3	5.59			
	Existing NW to Ryebank Rife		21.52	27.29	- 1.65	6% reduction on QBar
4	4A, 4B & 4C (when harvesting)	Irrigation Basin – drain down only	0.00			
5	4A	Informal Basin 4A – only in winter months and pump failure	25.64			
Basin 5	4B	Basin 5 – only in winter months and pump failure	18.09	107.99	- 43.54	40% reduction on QBar
6	4C	Informal Basin 4B – only in winter months and pump failure	37.19			
7	4B & 5	Basin 5	33.37			
	4B, 5 and 6	Basin 6	36.16	164.12	- 52.51	32% reduction on total QBar
	4B, 5, 6 and 7	Basin 7	64.45			
	Existing S to Elmer Rife		64.45			
TOTALS			111.61	164.12	- 52.51	32% reduction on total QBar

Table 7 – Proposed Surface Water Outfall – Discharge Rates (Option 2 – Summer Months)

Outfall Ref.	Catchment Ref.	Comment	Proposed Peak Discharge Flow - QBar (l/sec)	Existing Catchment QBar (l/sec)	Difference (l/sec)	Difference (%)
1	1	Discharge to Watercourse	3.17	28.84	- 7.32	25% reduction on QBar
2	2	Basin 2	12.76			
3	3	Basin 3	5.59			
	Existing NW to Ryebank Rife		21.52	27.29	- 1.65	6% reduction on QBar
4	4A, 4B & 4C (when harvesting)	Irrigation Basin – drain down only and overflow	25.64			
5	4A	Informal Basin 4A – only in winter months and pump failure	0.00			
Basin 5	4B	Basin 5 – only in winter months and pump failure	0.00	107.99	- 43.54	40% reduction on QBar
6	4C	Informal Basin 4B – only in winter months and pump failure	0.00			
7	4B & 5	Basin 5	33.37			
	4B, 5 and 6	Basin 6	36.16	164.12	- 52.51	32% reduction on total QBar
	4B, 5, 6 and 7	Basin 7	64.45			
	Existing S to Elmer Rife		64.45			
TOTALS			111.61			

As can be seen, by formalising the flow controls betterment can be reached against the existing greenfield runoff for the catchment as a whole and within the existing sub-catchments.



When considering the same controlled discharge rate controls against all storm events the comparison below can be made and the further betterment can be achieved.

Table 8 – Proposed Surface Water Outfall – Discharge Rates (Event comparison)

Outfall Ref.	Catchment Ref.	Proposed Peak Discharge Flow - QBar (l/sec)	Existing Catchment QBar (l/sec)	Existing 1 in 30 year runoff (l/sec)	Diff. (%)	Existing 1 in 100 year runoff (l/sec)	Diff. (%)	Existing 1 in 100 year runoff (l/sec)	Diff. (%)
1	1	21.52	28.84	52.19	-59%	67.21	-68%	94.09	-77%
2	2								
3	3								
4	4A, 4B & 4C (when harvesting)	25.64	27.29	49.39	-48%	63.60	-60%	89.04	-71%
5	4A								
Basin 5	4B	64.45	107.99	195.41	-67%	251.66	-74%	352.33	-82%
6	4C								
7	4B, 5, 6 and 7								
TOTALS		111.61	164.12	296.99	-62%	382.47	-71%	535.46	-79%

4.2 Proposed SuDS Features for Hardstanding Areas

Within the northern part of the site, the hardstanding areas associated with the buildings, car park and hardstanding areas need to be attenuated at source if possible. These areas all fall within the catchment associated with Pumping Station 4A with flows directed to the harvesting/irrigation lagoon.

The proposed surface water drainage strategy for the road, roof and hardstanding areas within the Proposed Development is shown on drawing 70088068-WSPX-ZZ-ZZ-SK-DR-001-P01 in **Appendix D**.

These potentially impermeable areas within the Proposed Development are located to the north of the Ryebank Rife and consist of the main access road, clubhouse, maintenance area, practice range building and carpark. The carpark is separated from the remaining hardstanding areas by an existing drainage ditch which flows from north to south alongside the proposed access road before its confluence with the Ryebank Rife. These areas are all located within the golf course catchment 4A and are further expanded in **Table 9**.

The carpark has a potential total impermeable area of approximately 0.51 ha (formal parking) with 0.9 ha as overflow parking and is to drain to the proposed irrigation lake in the north-eastern part of the Proposed Development, along with the remaining access road, roof and hardstanding areas making a total



impermeable area of approximately 1.37 ha draining to the proposed irrigation lake in the north-eastern part of the Proposed Development.

The formal car parking area (area 5,100m²) includes parking bays within the car parking areas that are to be constructed using permeable block paving with a granular subbase. This equates to a surface area of permeable paving of approximately 2,230m². Runoff generated by the car park is to be directed to the bays and drained via the permeable block paving which will provide treatment of surface water prior to discharge to the proposed irrigation lake in the north-eastern part of the Proposed Development via the wider surface water drainage network. The storage volume provided within the paving equates to 510m³ within a 350mm Type 3 high void ration sub-base across the whole car park area. A flow restriction device will be incorporated to maximise the attenuation storage within the sub-base. This will be controlled to existing Qbar flow rates (1.28 l/sec). This is a very low rate and care will need to be taken to ensure that the flow control device is maintained to prevent blockages.

The northern section of the main car park (area 900m²) is to be an overflow parking area surfaces with a grass reinforcement system such as Grasscrete or similar geogrid, or a bound gravel surfacing with a sub-base material, such that it is self-draining. No direct discharge to the network is proposed although attenuation volume would be provided due to its construction.

The proposed footpath along the eastern side of the carpark will also be surfaced using permeable materials and will also be self-draining.

The proposed access road (area 1,710m²) is also to be constructed using permeable block paving or porous asphalt with a bio-retention area located within the centre of the proposed roundabout turning area adjacent to the clubhouse. Runoff generated by the access road will be drained via the permeable paving and bioretention area collected and directed south to the main site drainage, whilst runoff generated by the roofs and hardstanding areas associated with the proposed buildings will drain partially to the permeable paving or directly into the wider surface water drainage network as appropriate. The storage volume provided within the paving equates to 170m³ within a 350mm Type 3 high void ration sub-base across the whole access road area.

Roof drainage from the club house is to be incorporated with the access road drainage and the rain garden feature within the access road providing additional attenuation. A flow restriction device will be incorporated to maximise the attenuation storage within the sub-base. The combined flow from the access road and club house will be controlled to existing Qbar flow rates (<1.00l/sec). This is a very low rate and care will need to be taken to ensure that the flow control device is maintained to prevent blockages.

Due to potential pollution impacts from roads sections (although classed as low risk in CIRIA C753 – see water quality section below), it is proposed to line the pervious pavements to prevent direct migration of any pollutants to the underlying soils and groundwater.

Pervious surfaces are to be designed to accommodate the 1 in 100 year plus 40% climate change allowances within their structure.

The practice range roof and the maintenance building will have their drainage directed towards the main Catchment 4A network. Due to the relative size of these buildings individual flow controls are likely to be significantly lower than recommended practical limits (<0.5 l/sec). Thus, the discharge from these areas is to be accommodated within the network to discharge to the main irrigation storage lake adjacent to the maintenance building.

Table 9 summarises the hardstanding drainage measures as shown on **Figure 7**.

Figure 7 -- Proposed Site Hardstanding Areas -- Drainage Strategy

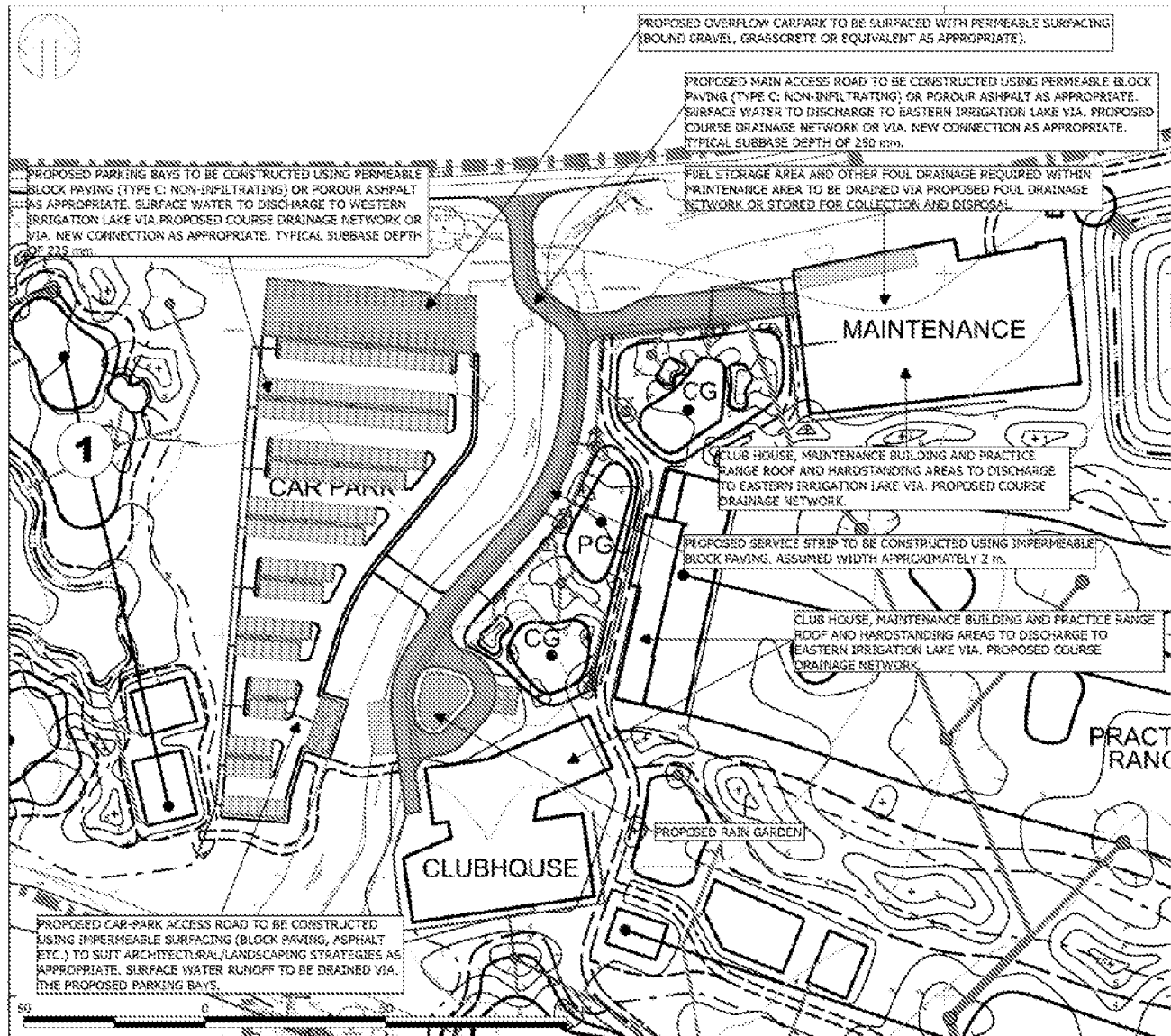


Table 9 – Proposed Surface Water Hardstanding Features

Feature	Description	Catchment Area (m ²)	Peak Flow QBar) (l/sec)	Vol. 1 in 100 yr + 40%) (l/sec)
Car Parking (224 spaces)	Permeable paving – attenuated flows directed to collection drains and to Catchment 4 Pumping Station 4A	5,100	12.75	510
Overflow Car Parking	Reinforced grass	900	2.25	90
Site Access Road	Permeable paving and rain garden within turning area – attenuated flows directed to collection drains and to Catchment 4 Pumping Station 4A	1,710	4.28	171
Club House	Roof and hardstanding directed partly to access road rain garden and partly directly to Catchment 4 Pumping Station 4A	1,450	3.63	145
Practice Range Roof	Roof directed via swale to Catchment 4 Pumping Station 4A	1,500	3.75	150
Maintenance Building	Roof and hardstanding directed to Catchment 4 Pumping Station 4A	3,060	7.65	306
TOTALS		13,720	34.30	1,372

4.3 Culvert diversion

Currently crossing the proposed 9-hole course part of the site (North-western part of the site) is a culverted section of a minor watercourse between the northern site boundary, culverted beneath Grevatts Lane and the site to discharge into Ryebank Rife at the site's southern boundary. This watercourse flows south from fields to the north and has been referenced as "West Field Drain". Its current route is shown below on **Figure 8**.

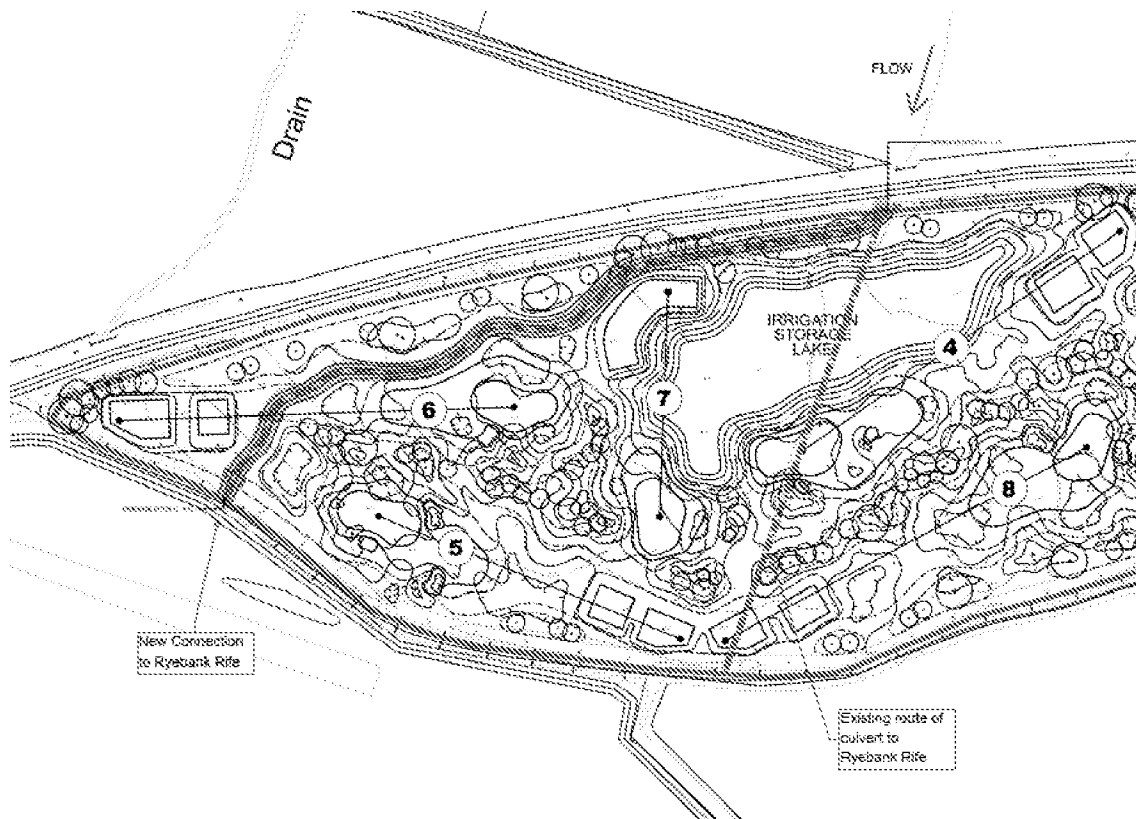
As part of the scheme, it is proposed to divert the route of the culverted section of the watercourse. In line with best practice, Environment Agency policy and following discussions with Arun District Council Drainage Engineer it is proposed that the section through the site is not only diverted to assist with the course layout and root protection zones, but that it is "daylighted" into an open watercourse. This can then be integrated into the scheme design along with providing improvements to the water environment, increased flood capacity, amenity and landscaping. The new route is also highlighted on **Figure 8**.

The example photographs below show the likely appearance of the diverted watercourse through the site. The principles have been discussed with Arun District Council along with the suggested longitudinal gradient of the diversion to ensure existing flows are maintained. Much of the watercourse is to be laid at a gradient of 1 in 300 falling towards the South-West with the last 20m section close to Ryebank Rife steeper to meet existing watercourse levels. The maximum depth of the realigned watercourse is 2m below existing ground levels. By introducing a two-stage profile, a shallow (600mm deep) section is maintained to convey everyday flow with a shallower sided upper stage for extreme flow conditions. A typical section through this diversion is shown in **Figure 9**.



A further advantage of this diversion is maintenance of the watercourse. As an open feature access will be available throughout its length as it is integrated into the landscaping of the golf course. A minimum 8m is available either side of the new route with no buildings or structures adjacent to the route.

Figure 8 – Existing and Proposed West Field Drain routes



Photographs 1 and 2 – Example watercourse through Golf Course

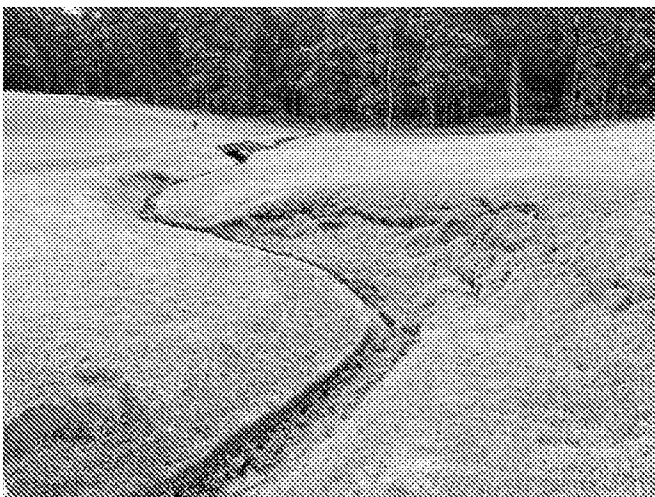
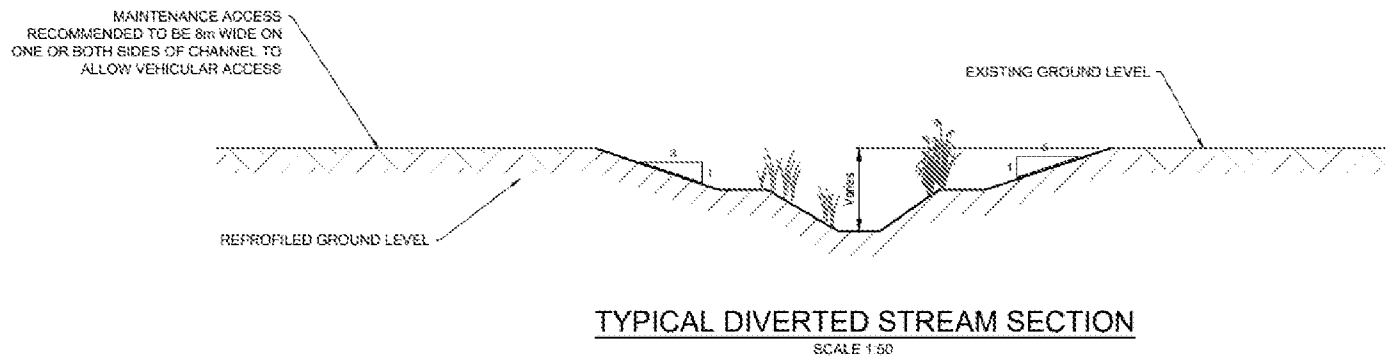




Figure 9 -- Suggested Profile of Proposed West Field Drain diversion





5. WATER QUALITY MANAGEMENT

5.1 Main Golf Course

Although essentially replacing the existing farmland the golf course offers additional pollution mitigation by means of the on-site attenuation and inherent treatment process this provides.

Each part of the course directs collected rainwater to one of a number of on-site basins. The majority of these have permanent water bodies as part of the design. The exception will be the informal basins co-located with the harvesting pumps.

Tables 4.3 and 26.1 of The SuDS Manual identify the pollution hazard level associated with the development types but not generally with open space and green uses. WSP has extrapolated the golf course as falling under the 'Very Low (equivalent to Residential roofs)' and that the simple index approach is appropriate for the assessment of the proposed discharge to surface waters.

The simple index approach is based on pollution hazard indices for different land use types and their associated pollution hazard level. The pollution hazard level and the related indices for the land-uses within the Proposed Development are detailed in **Table 10** below.

Table 10 – Pollution Hazard Level and Indices (from The SuDS Manual) for Golf Course

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs– <i>Golf Course greens and open space.</i>	Very Low	0.2	0.2	0.05

Table 26.4 of The SuDS Manual give the mitigation indices for several different treatment options prior to discharge to surface waters. The mitigation indices for the proposed basins (taken as a 'detention basins' and 'ponds' for the purposes of this assessment) are indicated below in **Table 11**.

Table 11 – Pollution Hazard Mitigation (from The SuDS Manual) – Golf Course

SuDS Measure	Pollution Mitigation Index multiplier	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Informal Storage Basins – <i>4A and 4C</i>	1.0 x factor	0.5	0.5	0.6
or				
Lagoons – <i>all other basins</i>	1.0 x factor	0.7	0.7	0.5
MINIMUM TOTAL MITIGATION FACTOR (using lowest factors)		0.5	0.5	0.6

Consequently, passing all surface water through at least a detention basin provides sufficient treatment of surface water prior the intended reuse for the purposes of irrigation and, in the case of the proposed overflows from the basins, discharging surface water to the wider network of surface waterbodies.



5.2 Hardstanding Areas

Treatment of runoff generated by the access road and hardstanding areas within the Proposed Development is to be designed in accordance with the requirements of The SuDS Manual as all runoff from these areas will be harvested for reuse for irrigation and, due to vehicular use, may contain pollutants that need to be treated and contained prior to the use of the water for irrigation.

If not harvested, then any surplus water or diverted water from these areas will pass through Informal Basin 4A before being discharged to the local watercourse.

Tables 4.3 and 26.1 of The SuDS Manual identify the pollution hazard level associated with the proposed hardstanding, car parking and roof areas as being either 'Low (other roofs)' or 'Low (low traffic loads and non-residential car parking with infrequent change)' and that the simple index approach is appropriate for the assessment of the proposed discharge to surface waters.

The simple index approach is based on pollution hazard indices for different land use types and their associated pollution hazard level. The pollution hazard level and the related indices for the land-uses within the Proposed Development are detailed in **Table 12** below.

Table 12 – Pollution Hazard Level and Indices (from The SuDS Manual) – hardstanding areas

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Other roofs (typically commercial/industrial roofs) – <i>maintenance building, practice range roof, Club House.</i>	Low	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements day – <i>access road, car parking areas and footways.</i>	Low	0.5	0.4	0.4

Table 26.4 of The SuDS Manual give the mitigation indices for several different treatment options prior to discharge to surface waters. The mitigation indices for the proposed permeable paving and bioretention area and the irrigation lakes (taken as a 'detention basins' for the purposes of this assessment) are indicated below in **Table 13**.

Table 11 – Pollution Hazard Mitigation (from The SuDS Manual)

SuDS Measure	Pollution Mitigation Index multiplier	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Permeable Paving - <i>access road, car parking areas</i>	1 x factor	0.70	0.60	0.70
Bio-retention area - <i>access road, car parking areas + Club House</i>	1 x factor	0.80	0.80	0.80
Irrigation Storage Basins/Lagoons - <i>all</i>	0.5 x factor	0.5 x 0.5	0.5 x 0.5	0.5 x 0.6
MINIMUM TOTAL MITGATION FACTOR (using lowest factors)		0.95	0.85	1.00

Consequently, the development provides sufficient treatment of surface water prior the intended reuse for the purposes of irrigation and in the case of the proposed overflows from the irrigation lakes discharging surface water to the wider network of surface waterbodies.

The maintenance area will include chemical storage and re-fuelling areas, these will be appropriately bunded with any surface water collected and discharged to the foul sewer or tankered off-site for treatment as appropriate, dependant upon the final foul drainage connection and permit from Southern Water.



6. MAINTENANCE AND ADOPTION

Regular inspection and maintenance is required to ensure the effective long term operation of SuDS; these requirements are detailed in The SuDS Manual. The general maintenance regime of the proposed strategy is outlined below:

Permeable paving

- ✧ Ownership / adoption: Private (Golf Club)
- ✧ *Maintenance requirement:* Brushing and vacuuming three times per year; removal of weeds, repair any broken blocks / damaged areas; maintain vegetation; 3 monthly inspection of poor operation and/or weed growth; annual inspection of silt accumulation and inspection chambers.

Bioretention Area

- ✧ Ownership / adoption: Private (Golf Club)
- ✧ *Maintenance requirement:* Quarterly inspection for siltation and ponding, assessment of plants for infection, inspection of outlets for blockage, removal of litter and of sediment from inlets; annual inspection of underdrains; infilling of holes or scour in the filter, replacement of plants, raking of surface mulch and removal of filter medium/vegetation as required.

Irrigation Lakes

- ✧ Ownership / adoption: Private (Golf Club)
- ✧ *Maintenance requirement:* Monthly removal of litter and debris; monthly grass cutting and vegetation management; annual sediment removal and management of wetland plants; re-seed areas of poor growth and prune trees every 1 – 3 years; remove sediment from forebay every 3 - 10 years; monthly inspection for blockages and physical damage; 6 monthly inspection for silt accumulation and functioning of mechanical devices (where necessary).



APPENDIX A – ARUN DISTRICT COUNCIL DRAINAGE ENGINEER COMMENTS

Comments dated 10 March 2022

Comment

Response

Engineers comments in respect to surface water drainage:

1. The applicant is encouraged to read our guidance notes/requirements on surface water drainage design: <https://www.watkins.co.uk/surfacewater/>
2. It is appreciated that the scheme predominantly relies on water recycling/reuse. For any areas not being recycled, then the hierarchy for sustainable drainage must be followed with infiltration fully investigated for those parts of the system where it can be utilised. Winter infiltration testing and winter groundwater monitoring must be undertaken, it is advised that the applicant discusses the extent of this monitoring with us at the earliest opportunity. Infiltration tests must be carried out in accordance with BRE365, CIRIA R156 or a similar approved method and cater for the 1 in 10 year storm event plus 40% on stored volumes, between the invert of the entry pipe to the soakaway, and the base of the structure. It must also have provision to ensure that there is capacity in the system to contain below ground level the 1 in 100 year storm event plus 40% on stored volumes, as an allowance for climate change. Adequate freeboard must be provided between the base of the soakaway structure and the highest recorded annual groundwater level identified in that location. This area suffers from high groundwater, so any infiltration structures will need be shallow. Groundwater data will also be required to support floatation calculations of any lined basins. The finally agreed flood plain extents may affect the areas in which effective suds can be employed and this will need to be discussed further once known.
3. Any discharges to watercourses must be restricted to QBAR for all storm events

1 – The guidance has been considered in the development of the surface water drainage strategy

2- Please refer to Section 3.2

3- Please refer to Section 4, Table 5

4. The system will need to be designed for the worst case scenario i.e. winter conditions when the use of irrigation will be less. Adequate storage must be contained within the system to accommodate the 1 in 100 year storm event + 40% allowance for climate change. In basins, this storage is to be provided above standing water level/outflow invert level and should not take account of any storage reduction due to irrigation operations.
5. As envisaged, ground reprofiling is likely in order to facilitate the golf course. It is important that existing natural catchment areas and discharge points to watercourses are respected, to ensure that flood risk is not increased.
6. The existing watercourses are prone to tide locking, this will therefore need to be taken into account in any design i.e. possible surcharged outfalls.
7. The use of permeable paved areas is welcomed and should be utilised wherever possible. Additional means of water treatment may be necessary depending on any chemical treatments the golf course itself may receive. This can be discussed once more details are known.
8. It is acknowledged that pumping is required for the golf course irrigation system. It is also noted that the proposed course drainage system relies on a series of pumping stations to transfer flows to the reservoirs. Pumping is not considered sustainable and the applicant is encouraged to investigate an alternative scheme to negate the need for pumping (other than for the irrigation system). This is likely to require reservoirs being dug into the ground and repositioned to suitable locations to allow gravity inflows. It is also unclear, but it is assumed that the drainage system will be draining groundwater via perforated pipes. If this is the case, careful consideration will need to be given to quantifying flows and therefore storage required. It is presumed that the pumping stations will not operate in the winter when irrigation is not required – perhaps this can be confirmed.

4- Please refer to Section 4, Table 6

5- Section 4

6- Section 4

7- Section 5

8- Section 4 (pumping is only used for irrigation when required. All surface water is controlled for volume and runoff rates)

<u>Engineers comments in respect to land drainage:</u> 1. The Elmer Rife is located on the eastern boundary of the site and the Ryebank Rife passes through the site on a west-east line. Both of these watercourses are designated 'main river' and therefore the environment Agency should be consulted. 2. Numerous 'ordinary' watercourses are contained within the site or on the boundaries. All watercourses need to be suitably accommodated, ensuring a 3m buffer both sides for maintenance access and to ensure compliance with hour land drainage byelaws. Excessive culverting will be resisted. Examples are across the fairway of hole no.1 and to the north west of the club house. However, there also appears to be an alternative proposal shown for the watercourse crossing hole no.1 fairway, which involves it being diverted - this would be the preference. 3. A proposed watercourse diversion is noted just east of the proposed access onto the A259. Land Drainage Consent will be required for this work and any other non-maintenance works associated with 'ordinary' watercourses. 4. At the southern end of the site there are watercourses that have been historically filled in and replaced with a land drainage system in part. Elmer Sands estate to the south, has suffered significant historical flooding in the past and remains at risk. To reduce this risk, we would expect a positively drained cut off ditch to be created on the southern boundary to intercept any exceedance flows that may flow overland (after the land is reprofiled to accommodate the golf course) onto the estate. This will need to be carefully designed to ensure that flows are controlled to the Elmer Rife. Ordinary watercourses exist in the south east corner of the site and could form part of this proposal but this is subject to further discussion. 2 ©2020 WSP LIMITED. 001810230. 5. Numerous other land drains are known to exist on the development site, as a result of farming practices. These will need further consideration once their locations/ extents have been established. 6. There is little doubt that other improvements works will be required to the numerous ordinary watercourses. This can be discussed further at a later date, where a walkover site meeting would be beneficial.	1- Noted 2- Noted and incorporated – Culvert diversion discussed in Section 4.3 3- Noted 4- Section 4 5- Noted 6 - Noted
In mind of the above, please could the following conditions and informatives be applied; PCENG02, PCENG03, PCENG04, INFORM02, INFORM03	Noted



Comments dated 03 May 2023	
Comment	Response
Further to the previous comments provided in March 2022 and July 2022, no additional information has been received from the applicant that fully address these items. As such we would refer to the comment per the email of the 10th March 2022.	This technical note is a consolidated response to previous comments
In addition to this, no clear surface water drainage proposals are provided for this site. We appreciate that proposed 3D ground modelling is provided but more information needs to be provided on where the proposed development impermeable areas are draining to, attenuation provisions and where the surface water is ultimately being discharge to. The surface water calculations need to be provided to demonstrate that the run-off from these areas can be accommodated within the proposed attenuation features. In addition, clear information on the modelled fluvial flood level in relation to the attenuation features needs to be provided and surface water calculations need to demonstrate the impact of joint probability events. This is to ensure that the quantum of development proposed at outline stage is achievable and that the surface water drainage proposals comply in not increasing the risk of flooding elsewhere or onsite. In addition to this the locations of the proposed SuDS must clearly be outside of the impacts of the modelled fluvial flood extents	Refer to Section 4 for drainage strategy and Section 1.3
The current strategy outlines that run-off from the site will be restricted to greenfield rates to the existing watercourse but does not explore the opportunity for on-site infiltration. A Hierarchical approach to the disposal of surface water should be undertaken with priority to infiltration of surface water. Infiltration testing must be carried out to assess the opportunities for infiltration to ground. Winter infiltration testing is required to support infiltration drainage techniques and should be carried out in January/February (subject to agreement) and at agreed locations/depths/ Furthermore winter groundwater monitoring is required to support the basins designs and ensure there is no loss in attenuation capacity as a result of high groundwater levels.	Refer to Section 3.2
There is an existing culvert which runs through the site and would conflict with the locations of some of the ponds. It is also been advised that this existing culvert is blocked/collapsed. The drainage and site layout proposals will need to provide proposals for diverting this culvert and clearly demonstrating the route of this diversions with associated invert levels. We would encourage the applicant to investigate opportunities to open up this culvert to a watercourse as part of the diversion proposals.	Section 4.3
Once further information is provided on the risk of surface water flooding and impact to the surrounding areas, as well as clarity on the development surface water drainage proposals as well as the responses to the comments made per the email of the 10th March 2022, then we will be able to review the proposals further	Noted

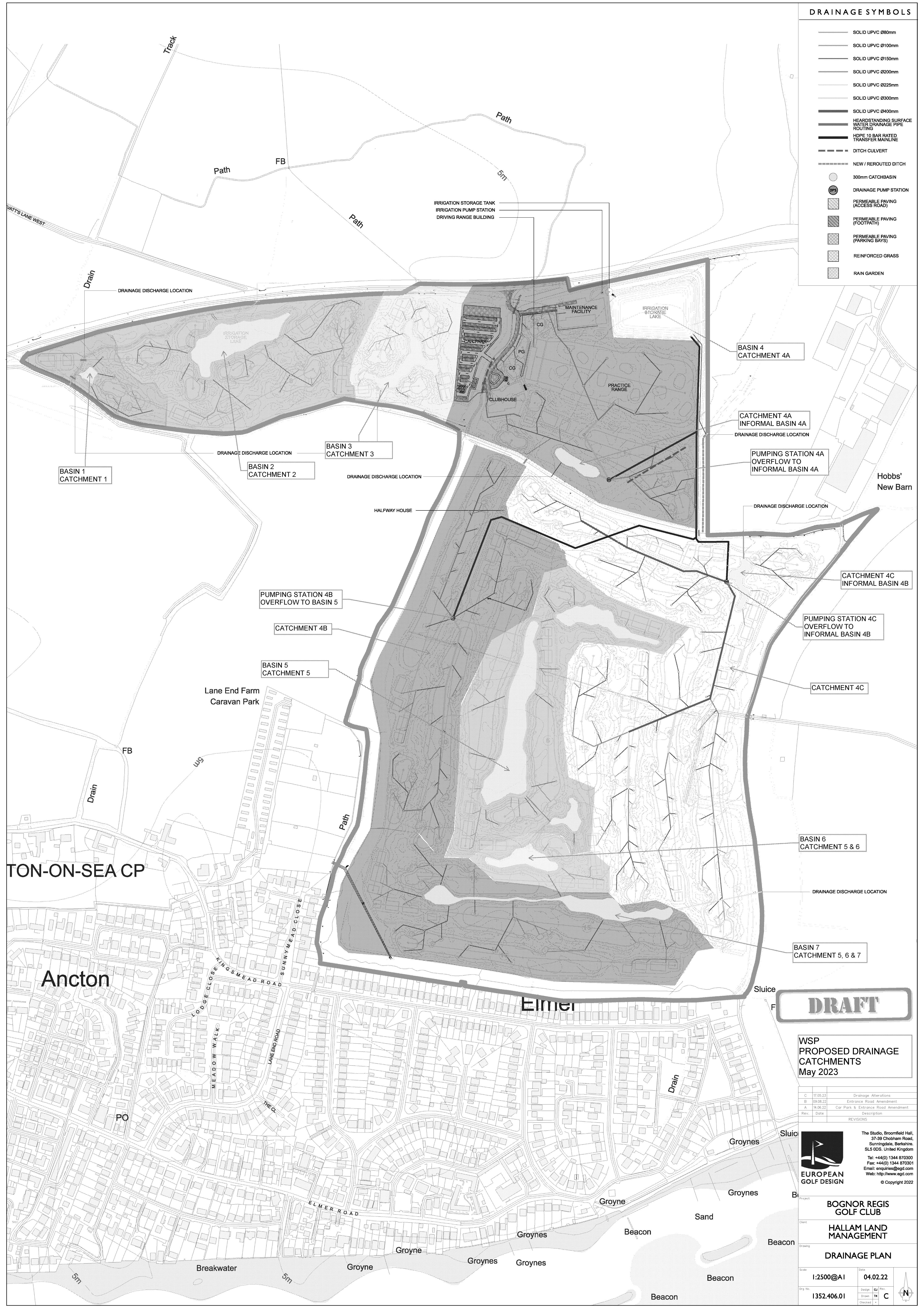


APPENDIX B – GREENFIELD RUNOFF RATES

WSP Group Ltd		Page 1
.	Bognor Regis Golf Club	
.	SW Drainage Strategy	
.	Greenfield Runoff Rates	
Date 31/01/2022	Designed by SEK	
File	Checked by	
XP Solutions		Source Control 2019.1
<u>IH 124 Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.370 Area (ha) 73.700 Urban 0.000 SAAR (mm) 708 Region Number Region 7 Results l/s QBAR Rural 205.6 QBAR Urban 205.6 Q100 years 655.8 Q1 year 174.8 Q2 years 181.1 Q5 years 263.2 Q10 years 333.1 Q20 years 411.8 Q25 years 441.6 Q30 years 465.9 Q50 years 538.7 Q100 years 655.8 Q200 years 771.0 Q250 years 808.0 Q1000 years 1060.9		
©1982-2019 Innovyze		



APPENDIX C – GOLF COURSE LAYOUTS



DRAINAGE SYMBOLS

- SOLID UPVC Ø80mm
- SOLID UPVC Ø100mm
- SOLID UPVC Ø150mm
- SOLID UPVC Ø200mm
- SOLID UPVC Ø225mm
- SOLID UPVC Ø300mm
- SOLID UPVC Ø400mm
- HEADSTANDING SURFACE WATER DRAINAGE PIPE ROUTING
- HDPE 10 BAR RATED TRANSFER MAINLINE
- DITCH CULVERT
- NEW / REROUTED DITCH
- 300mm CATCHBASIN
- DRAINAGE PUMP STATION
- PERMEABLE PAVING (ACCESS ROAD)
- PERMEABLE PAVING (FOOTPATH)
- PERMEABLE PAVING (PARKING BAYS)
- REINFORCED GRASS
- RAIN GARDEN

DRAFT

WSP
PROPOSED DRAINAGE
CATCHMENTS
May 2023

C	17.05.23	Drainage Alterations
B	09.08.22	Entrance Road Amendment
A	14.06.22	Car Park & Entrance Road Amendment
Rev.	Date	Description



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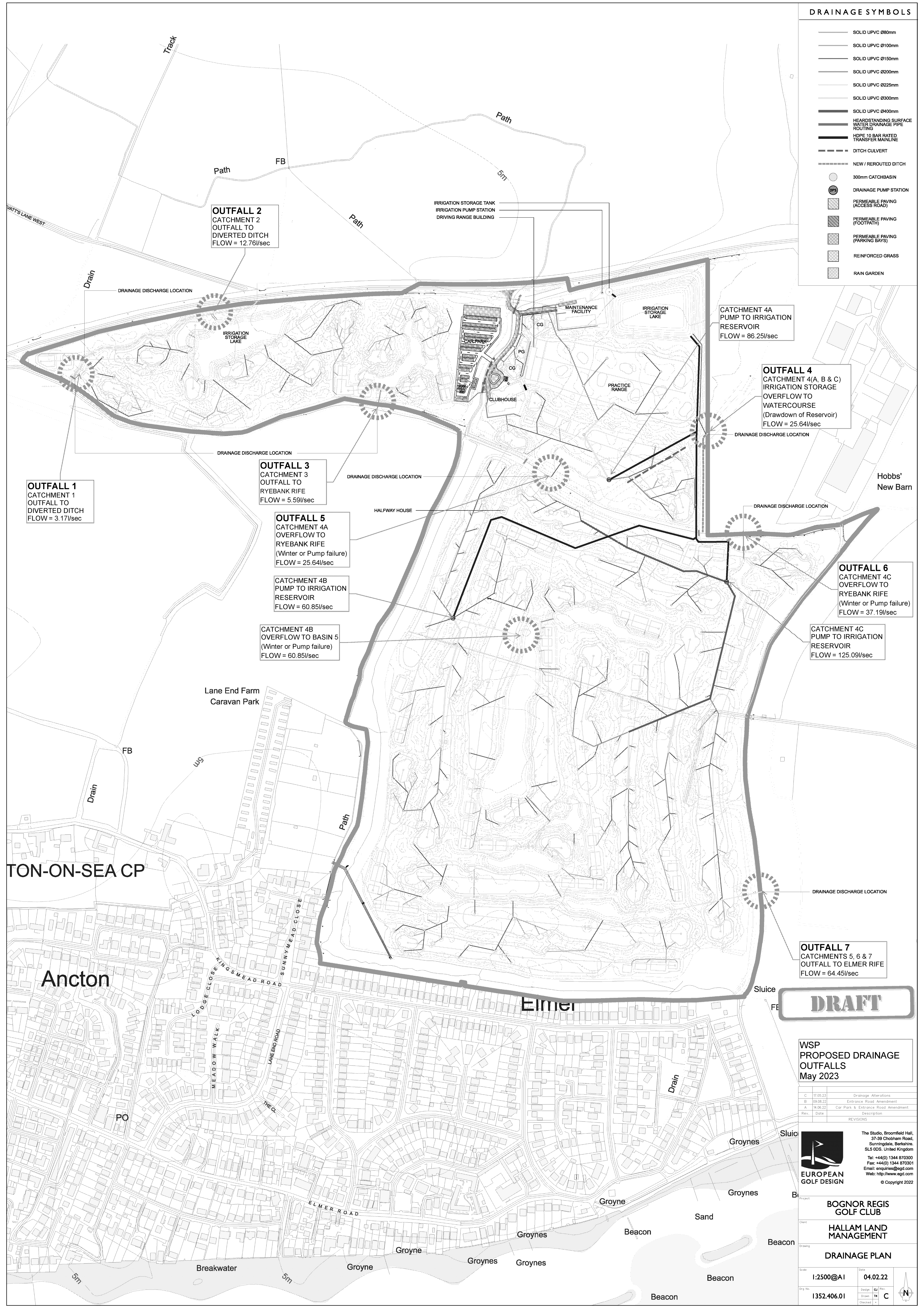
BOGNOR REGIS
GOLF CLUB

HALLAM LAND
MANAGEMENT

DRAINAGE PLAN

Scale	1:2500@A1	Date	04.02.22
Orig. No.	1352.406.01	Design	GD
		Drawn	TK
		Checked	C





DRAINAGE SYMBOLS

- SOLID UPVC Ø80mm
- SOLID UPVC Ø100mm
- SOLID UPVC Ø150mm
- SOLID UPVC Ø200mm
- SOLID UPVC Ø225mm
- SOLID UPVC Ø300mm
- SOLID UPVC Ø400mm
- HEADSTANDING SURFACE WATER DRAINAGE PIPE ROUTING
- HDPE 10 BAR RATED TRANSFER MAINLINE
- DITCH CULVERT
- NEW / REROUTED DITCH
- 300mm CATCHBASIN
- DRAINAGE PUMP STATION
- PERMEABLE PAVING (ACCESS ROAD)
- PERMEABLE PAVING (FOOTPATH)
- PERMEABLE PAVING (PARKING BAYS)
- REINFORCED GRASS
- RAIN GARDEN

DRAFT

WSP
PROPOSED DRAINAGE
OUTFALLS
May 2023

C	17.05.23	Drainage Alterations
B	09.08.22	Entrance Road Amendment
A	14.06.22	Car Park & Entrance Road Amendment
Rev.	Date	Description



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BOGNOR REGIS
GOLF CLUB

HALLAM LAND
MANAGEMENT

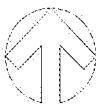
DRAINAGE PLAN

Scale	1:2500@A1	Date	04.02.22
Design	GD	Rev.	C
Drawn	TK	Checked	
Orig. No.	1352.406.01		





APPENDIX D – SURFACE WATER DRAINAGE STRATEGY DRAWING (HARDSTANDING AREAS)



PROPOSED OVERFLOW CARPARK TO BE SURFACED WITH PERMEABLE SURFACING (BOUND GRAVEL, GRASSCRETE OR EQUIVALENT AS APPROPRIATE).

PROPOSED MAIN ACCESS ROAD TO BE CONSTRUCTED USING PERMEABLE BLOCK PAVING (TYPE C: NON-INFILTRATING) OR POROUR ASPHALT AS APPROPRIATE. SURFACE WATER TO DISCHARGE TO EASTERN IRRIGATION LAKE VIA. PROPOSED COURSE DRAINAGE NETWORK OR VIA. NEW CONNECTION AS APPROPRIATE. TYPICAL SUBBASE DEPTH OF 250 mm.

FUEL STORAGE AREA AND OTHER FOUL DRAINAGE REQUIRED WITHIN MAINTENANCE AREA TO BE DRAINED VIA PROPOSED FOUL DRAINAGE NETWORK OR STORED FOR COLLECTION AND DISPOSAL.

PROPOSED PARKING BAYS TO BE CONSTRUCTED USING PERMEABLE BLOCK PAVING (TYPE C: NON-INFILTRATING) OR POROUR ASPHALT AS APPROPRIATE. SURFACE WATER TO DISCHARGE TO WESTERN IRRIGATION LAKE VIA. PROPOSED COURSE DRAINAGE NETWORK OR VIA. NEW CONNECTION AS APPROPRIATE. TYPICAL SUBBASE DEPTH OF 225 mm.

MAINTENANCE

CLUB HOUSE, MAINTENANCE BUILDING AND PRACTICE RANGE ROOF AND HARDSTANDING AREAS TO DISCHARGE TO EASTERN IRRIGATION LAKE VIA. PROPOSED COURSE DRAINAGE NETWORK.

PROPOSED SERVICE STRIP TO BE CONSTRUCTED USING IMPERMEABLE BLOCK PAVING. ASSUMED WIDTH APPROXIMATELY 2 m.

CLUB HOUSE, MAINTENANCE BUILDING AND PRACTICE RANGE ROOF AND HARDSTANDING AREAS TO DISCHARGE TO EASTERN IRRIGATION LAKE VIA. PROPOSED COURSE DRAINAGE NETWORK.

PROPOSED RAIN GARDEN

CLUBHOUSE

PRACT RANG

PROPOSED CAR-PARK ACCESS ROAD TO BE CONSTRUCTED USING IMPERMEABLE SURFACING (BLOCK PAVING, ASPHALT ETC.) TO SUIT ARCHITECTURAL/LANDSCAPING STRATEGIES AS APPROPRIATE. SURFACE WATER RUNOFF TO BE DRAINED VIA. THE PROPOSED PARKING BAYS.

Do not scale - Use only figured dimensions
The contractor is to check all dimensions on site and report any discrepancies to the site Supervisor
This drawing is to be read in conjunction with other standard documentation

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Note:

This plan is furnished as a general guide only and the Statutory undertakers concerned state that no warranty as to its correctness is given or implied. It must not be relied upon in the construction or other works made in the vicinity of such services.

Key:

Indicative Proposed Drainage Network

Proposed SuDS Features

- Permeable Paving (Parking Bays)
- Permeable Paving (Access Road)
- Impermeable Paving (Service Strip)
- Permeable Surfacing (Bound Gravel, Grasscrete or equivalent)
- Rain Garden

P02	02/02/2022	SEK	INCORPORATING COMMENTS	CP	AS
P01	28/01/2022	SEK	ISSUE FOR COMMENT	CP	AS
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:

S1 - FOR COORDINATION



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wsp.com

CLIENT:

HALLAM LAND MANAGEMENT LIMITED

PROJECT:

BOGNOR REGIS GOLF COURSE

TITLE:

INDICATIVE SURFACE WATER DRAINAGE SKETCH

DRAWN:	SEK	CHECKED:	CP	APPROVED:	AS
PROJECT No:	70088068	SCALE @A3:	1:1,000	DATE:	02/02/2022
DRAWING No:	70088068-WSP-ZZ-ZZ-SK-DR-001-P01	REV:	P02		