



DRAINAGE TECHNICAL NOTE 1

DATE:	07 February 2022	CONFIDENTIALITY:	Public
SUBJECT:	Surface Water Drainage Strategy (Hardstanding Areas)		
PROJECT:	70088068 - Bognor Regis Golf Course	AUTHOR:	Simon King
CHECKED:	Chris Patmore	APPROVED:	Andy Smith

INTRODUCTION

Appointment and Brief

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

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.

Aim and Objectives

The proposed surface water drainage strategy 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 for the management of runoff generated by the 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: 04/02/2022) and the accompanying Flood Risk Assessment by WSP (Ref: 70088068-FRA-V02 Date: 02/02/2022).

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.



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.

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.

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:

- ✧ 1 % annual probability 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 (40% increase on peak rainfall intensity).

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:

- ✧ 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.

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*



EXISTING SURFACE WATER DRAINAGE REGIME

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 using the Institute of Hydrology 124 method and are summarised in Table 1 below. Full calculations are provided for reference in Appendix A.

Table 1 – Peak Greenfield Runoff Flow Rates

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)	174.8	2.4
50 (1 in 2 year Return Period)	181.1	2.5
3.33 (1 in 30 year Return Period)	465.9	6.3
1 (1 in 100 year Return Period)	655.8	8.9

PROPOSED SURFACE WATER DRAINAGE REGIME

The wider surface water drainage and irrigation strategy by European Golf Design 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.

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



Proposed SuDS Features

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 B.

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.

The carpark has a potential total impermeable area of approximately 0.63 ha and is to drain to the proposed irrigation lake in the north-western part of the Proposed Development, whilst the remaining access road, roof and hardstanding areas have a total impermeable area of approximately 0.92 ha and are to drain to the proposed irrigation lake in the north-eastern part of the Proposed Development.

The parking bays within carparking areas are to be constructed using permeable block paving with a granular subbase. Runoff generated by the carpark is to be drained via the permeable block paving which will provide treatment of surface water prior to discharge to the proposed irrigation lake in the north-western part of the Proposed Development via the wider surface water drainage network. The northern section of the main car park is to be an overflow parking area. This is to utilise a grass reinforcement system such as Grasscrete or similar geogrid, or a bound gravel surfacing, such that it is self-draining. The proposed footpath along the eastern side of the carpark will also be surfaced using permeable materials and will be self-draining.

The proposed access road 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 via the permeable paving or directly into the wider surface water drainage network as appropriate.

Water Quality Management

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 will be reused 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.

Tables 4.3 and 26.1 of The SuDS Manual identify the pollution hazard level associated with the Proposed Development 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 2 below.



Table 2 – Pollution Hazard Level and Indices (from The SuDS Manual)

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Other roofs (typically commercial/industrial roofs)	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	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 3.

Table 3 – Pollution Hazard Mitigation (from The SuDS Manual)

SuDS Measure	Pollution Mitigation Index multiplier	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Permeable Paving	1 x factor	0.70	0.60	0.70
Bio-retention area	1 x factor	0.80	0.80	0.80
Irrigation Storage Basins/Lagoons	0.5 x factor	0.5 x 0.5	0.5 x 0.5	0.5 x 0.6
MINIMUM TOTAL MITIGATION FACTOR		0.95	0.85	1.00

Consequently, the Proposed 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.

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
- ⌘ *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
- ⌘ *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
- ⌘ *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).

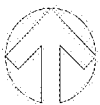


APPENDIX A – GREENFIELD RUNOFF RATES

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>I H 124 Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.370</td> </tr> <tr> <td>Area (ha)</td> <td>73.700</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>708</td> <td>Region Number</td> <td>Region 7</td> </tr> </table> Results l/s <table> <tr> <td>QBAR Rural</td> <td>205.6</td> </tr> <tr> <td>QBAR Urban</td> <td>205.6</td> </tr> <tr> <td>Q100 years</td> <td>655.8</td> </tr> <tr> <td>Q1 year</td> <td>174.8</td> </tr> <tr> <td>Q2 years</td> <td>181.1</td> </tr> <tr> <td>Q5 years</td> <td>263.2</td> </tr> <tr> <td>Q10 years</td> <td>333.1</td> </tr> <tr> <td>Q20 years</td> <td>411.8</td> </tr> <tr> <td>Q25 years</td> <td>441.6</td> </tr> <tr> <td>Q30 years</td> <td>465.9</td> </tr> <tr> <td>Q50 years</td> <td>538.7</td> </tr> <tr> <td>Q100 years</td> <td>655.8</td> </tr> <tr> <td>Q200 years</td> <td>771.0</td> </tr> <tr> <td>Q250 years</td> <td>808.0</td> </tr> <tr> <td>Q1000 years</td> <td>1060.9</td> </tr> </table>			Return Period (years)	100	Soil	0.370	Area (ha)	73.700	Urban	0.000	SAAR (mm)	708	Region Number	Region 7	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
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APPENDIX B – 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.

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

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 for information 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 within the vicinity of any statutory service.

Key:

----- Indicative Proposed Drainage Network

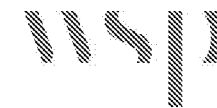
Proposed SuDS Features

- 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
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