

ENVIRONMENTAL STATEMENT – VOLUME 3 – APPENDIX 12.3

Existing Drainage Systems and Proposed Surface Water Drainage Strategy

Drax Bioenergy with Carbon Capture and Storage

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1. INTRODUCTION

- 1.1.1. Drax Power Limited (the Applicant) intends to install post combustion carbon capture technology on up to two of the existing 660-megawatt electrical ('MWe') biomass power generating units at the Drax Power Station in Selby, North Yorkshire. This will remove approximately 95% of the carbon dioxide from the flue gas, resulting in overall negative emissions of greenhouse gases.
- 1.1.2. The Proposed Scheme comprises an extension to the existing biomass generating units and includes the following:
 - **a.** Carbon capture infrastructure at Drax Power Station on up to two biomass generating units;
 - b. Infrastructure for the treatment and compression of carbon dioxide at Drax Power Station to allow connection to a National Grid carbon dioxide transport and storage system;
 - **c.** Minor vegetation and street furniture management and other works to facilitate access during construction;
 - d. Temporary construction laydown areas;
 - e. Areas for habitat provision; and
 - **f.** Supporting infrastructure required for the Carbon Capture Plant.
- 1.1.3. WSP has been commissioned by the Applicant to prepare an Environmental Statement (ES). This Surface Water Drainage Strategy Report has been produced to support the ES and sits as **Appendix 12.3** to it.

2. PROPOSED DEVELOPMENT LAYOUT

2.1.1. The area of Order Limits and the Proposed Scheme Layout are shown in **Appendix A** and **Appendix B** respectively. It needs to be noted that the Order Limits and the Proposed Scheme Layout have been revised since the consultation with the LLFA in December 2021. During this consultation, it was discussed that the Proposed Scheme will result in a maximum additional impermeable area of 18,600 m². This figure is conservative and provides a worst-case scenario. As such the changes to the Proposed Scheme layout introduced after December 2021, have not resulted in any changes to the extents of the additional impermeable area or require changes to the runoff calculations which were previously submitted to the LLFA and detailed within this report.

3. EXISTING SURFACE WATER DRAINAGE SYSTEM

3.1.1. Surface water runoff is collected across Drax Power Station Site by a network of surface water drains which direct these waters to the "purge", at which point they are joined by all other waters (i.e., treated effluent and cooling water) to be discharged to the water environment via a pumped facility into the River Ouse. Due to the site constraints and continued operations the Applicant wishes to retain, enhance and reuse as much of this network as possible. A plan showing the existing surface water drainage system serving the area of the Proposed Scheme is shown in **Appendix C**.

4. GREENFIELD RUNOFF CALCULATIONS

4.1.1. The greenfield runoff rates were calculated for the maximum potential impermeable area of 18,600 m² which may be introduced by the Proposed Scheme. The rates were calculated based on the FEH Statistical Method using the online HR Wallingford tool¹. The calculated greenfield runoff rates are summarised in Table 4.1 below, and details of the calculations are shown in **Appendix D**.

Table 4.1 - Greenfield Runoff Rates

Return Period	Greenfield Runoff Rate (I/s)			
1 in 1 year	4.91			
QBAR	5.71			
1 in 30 years	9.99			
1 in 100 years	11.88			

¹ https://www.uksuds.com/

5. EXCEEDANCE FLOWS

- 5.1.1. An exceedance flows map has been produced based on the available LiDAR data². The map shows the current situation and indicates the routes of potential exceedance flows. The map is shown in **Appendix E**.
- 5.1.2. The map indicates that exceedance flows which may potentially occur in the areas of the proposed works are likely to pond within the boundary of Drax Power Station Site, rather than be conveyed to the surrounding areas. The map also indicates that potential exceedance flows that may occur in the area of the existing woodyard are likely to be directed towards Carr Dyke, thus to the Selby Area IDB pumping station to the River Ouse, as such no offsite impacts are expected.
- 5.1.3. The changes to the existing surface water drainage infrastructure will not result in increases in the operation of the exceedance flow routes. The Proposed Scheme is therefore not envisaged to affect the existing exceedance flow routes.
- 5.1.4. Furthermore, given that there are no substantial offsite flow routes, it is considered that there is no requirement for Microdrainage modelling of the surface water network (either baseline or proposed). Any ponding that may occur for events greater than the design standards of the existing onsite surface water drainage network will be within Drax Power Station Site and thus not causing any third party impacts. This potential ponding will be gradually drained by the existing surface water drainage system once the capacity becomes available within the system. The Applicant has not experienced flooding from the existing surface water drainage system that prevented operation of Drax Power Station.

² https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

6. PROPOSED SURFACE WATER DRAINAGE SYSTEM

6.1. DRAINAGE HIERARCHY

- 6.1.1. In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained in the most sustainable way. The National Planning Policy Framework (NPPG) hierarchy, in the following order of priority is:
 - a. Into the ground (infiltration);
 - **b.** To a surface water body;
 - c. To a surface water sewer, highway drain, or another drainage system; and
 - d. To a combined sewer.
- 6.1.2. In addition, consideration should be made to the earlier SuDS principal interventions recommended in the SuDS Manual before considering the ultimate discharge pathway. These consist of:
 - a. Reducing and eliminating additional runoff; and
 - **b.** Reuse of runoff and harvesting.
- 6.1.3. For this site the drainage hierarchy is a combination of the above and the drainage scheme for the development shall be in accordance with the following hierarchy
 - a. Reducing and eliminating additional runoff;
 - b. Reuse of runoff and harvesting;
 - **c.** Discharge into the ground (infiltration);
 - **d.** Discharge to a surface water body;
 - **e.** Discharge to a public / third-party surface water sewer (e.g., highway drain, or another drainage system); and
 - f. Discharge to a combined sewer.
- 6.1.4. The approach to incorporating the drainage hierarchy in the proposed surface water drainage strategy is provided below.

REDUCING AND ELIMINATING ADDITIONAL RUNOFF

6.1.5. It is impossible to eliminate additional surface water runoff generated in the Proposed Scheme. However, the opportunities will be sought during detailed design to incorporate soft landscaping areas, where feasible, to reduce the additional runoff.

REUSE OF RUNOFF AND HARVESTING

6.1.6. Surface water runoff will remain being collected across Drax Power Station Site by a network of surface water drains. The drains from the Proposed Scheme will then be directed, as collected surface water, to a new sump and pump arrangement which, under normal operating conditions, will then direct these waters to the existing "northern cooling water reservoir", at which point they will be utilised as cooling water (i.e. not discharged to the River Ouse, as is the current scenario), thus reducing the

- volume of water which needs to be abstracted from the River Ouse (which currently occurs under an abstraction licence) this is a far more sustainable solution. It is currently envisaged that the runoff from the other parts of Drax Power Station Site will be connected to the existing cooling water system, subject to detailed design.
- 6.1.7. After the waters are used in the cooling water they are then directed to the "purge" and pumped into the River Ouse as per the current arrangement. The plan shown in Appendix F indicates the changes to the existing surface water drainage system which would be required to allow for the Proposed Scheme and a new connection between the existing surface water drainage system and the cooling system. Due to the site constraints the existing surface water drainage system will be retained, enhanced and reused as much as possible.

INFILTRATION TO THE GROUND

- 6.1.8. A number of in-situ soil infiltration tests were undertaken as part of the site investigation undertaken to inform the White Rose Carbon Capture and Storage Surface Water and Flood Risk Environmental Statement Chapter³, this was another project associated with Drax Power Station. The results show a very low permeability ranging between 1.1 x 10⁻⁵ m/s and 6.97 x 10⁻⁸ m/s. These results confirm that infiltration techniques are unlikely to be feasible in Drax Power Station Site.
- 6.1.9. Additionally, options for infiltration are not possible due to underlying clay ground conditions and likely high groundwater levels as advised by the Selby Area IDB. Furthermore, the site lies partially within a groundwater Source Protection Zone 3.

DISCHARGE TO SURFACE WATER BODY

6.1.10. No new discharges to surface water body from the Proposed Scheme are envisaged, as generated runoff is proposed to be utilised in the existing cooling water system.

This would result in a reduction of the total discharge from Drax Power Station Site.

DISCHARGE TO PUBLIC / THIRD-PARTY SURFACE WATER / COMBINED SEWERS

6.1.11. No connection to public or third-party sewers are proposed. There is therefore no impact on the Yorkshire Water assets.

6.2. DESIGN PRINCIPLES

- 6.2.1. Detailed design of the new aspects of the surface water drainage strategy will be in accordance with the following guidance:
 - a. North Yorkshire County Council SuDS Design Guide 2018;

³ White Rose Carbon Capture and Storage Surface Water and Flood Risk Environmental Statement Chapter, by ERM, 2014

- **b.** Alterations to the existing surface water drainage network would ensure continuation of the existing design standards as a minimum for each modified section of the infrastructure; and
- **c.** New surface water drainage networks, where required will be designed for no flooding in 1 in 30 year event and that any flooding from 1 in 100 year event with a climate change allowance⁴ is contained within Drax Power Station Site.

6.3. PUMP RATES

- 6.3.1. The new pump which will convey water from the Proposed Scheme's surface water drainage system to the cooling water system will be sized to have a minimum pump rate of 695 m³/hr which will ensure that there is no offsite flooding for the 1 in 100 year plus climate change event. Higher pumps rates will be required, if areas beyond the Proposed Scheme are to be connected.
- 6.3.2. Any flooding from the surface water drainage system occurring during the 1 in 100 year event with climate change allowance will be contained within Drax Power Station Site. This is demonstrated to be achieved through the analysis of the exceedance flow paths shown in Appendix E.

6.4. PROPOSED POLLUTION PREVENTION MEASURES

- 6.4.1. The Proposed Scheme would include a system of containments to mitigate potential risk of pollution surrounding site area and / or environment.
- 6.4.2. The following areas would include containment measures to collect potentially contaminated surface water runoff:
 - a. Solvent Storage and Make-up System;
 - **b.** Chemicals for Carbon Capture Waste Water Treatment Plant;
 - c. Chemicals for Quench Column; and
 - d. Chemicals for Absorber Column.
- 6.4.3. These areas would be kerbed or bunded to collect surface water runoff. These will be designed in accordance with the COSHH / COMAH / HSE guidance / GPPs requirements at the detailed design stage. Consideration will be given to any additional requirements to prevent damage to the sensitive infrastructure from the debris during flood events. As part of the operating procedures for these areas the discharge valves would be kept closed and the water collected would be tested (the approach is subject to detailed design) to identify if contaminants are present. Where the water meets discharge criteria, the surface water would be discharged in line with the Drax Power Station discharge consent. If the surface water does not meet consent conditions it would either be transferred to the Carbon Capture Waste Water Treatment Plant for treatment or, if contaminant levels are such that they cannot be

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⁴ https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, May 2022`

treated on site, to a storage tank prior to removal and treatment off site under a waste transfer licence to a suitable licensed wastewater treatment facility. The environmental controls to operate these areas would be included in the Drax Power Station environmental management system (EMS) certified in accordance with the ISO 14001.

- 6.4.4. Oil Storage for the Flue gas blower, CO₂ compressor and air compressor unit would be designed in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001. All potentially oil contaminated storm water in these areas would be collected into the oil water drain pit and transferred to the existing oily wastewater system.
- 6.4.5. Rich Solvent / Lean Solvent Heat Exchangers would be individually bunded. The bunds will be designed in accordance with the COSHH / COMAH / HSE guidance / GPPs requirements at the detailed design stage.
- 6.4.6. As part of the detailed design an assessment of the risk for all the tanker / chemical unloading bays will be undertaken, this will determine whether they are designed as fully bunded areas or require suitable protection measures to prevent the entry of any spillages to the on-site surface water drainage systems. The bunds, if required, will be designed in accordance with the COSHH / COMAH / HSE guidance / GPPs requirements at the detailed design stage.
- 6.4.7. There would be additional control measures in accordance with the ISO 14001 certified EMS for the Proposed Scheme in order to control surface water runoff that could become contaminated by chemicals and oil. These would include, but not be limited to, the following:
 - a. A minimum of twice daily checks would be undertaken to inspect for chemical and oil leakage. Furthermore, there is a constant presence of key operative staff at Drax Power Station Site, who wound undertake informal checks as part of their other duties and could undertake immediate rectification / pollution prevention measures as required;
 - **b.** Drip trays, or similar, would be installed under pumps to capture any potential leaks; and
 - **c.** Containment trays / pans and shrouds will be installed for the Plate Heat Exchanger (PHE).
- 6.4.8. Leakage detection systems will be considered for high risk areas during detailed design.
- 6.4.9. The surface water drainage network for the Proposed Scheme will include oil separators as required during detailed design in accordance with the best practice.

POLLUTANTS CONTAINED IN FIRE WATER RUNOFF

6.4.10. In accordance with the existing site operating procedures / emergency plan should a major fire incident occur at Drax Power Station Site, the valve in the main 'purge'

pump (the discharge to the River Ouse) will be closed with fire waters retained within Drax Power Station Site. These will be than treated / transported off site as needed.

6.5. HABITAT PROVISION AREA AND OFF-SITE HABITAT PROVISION AREA

6.5.1. The works proposed in Habitat Provision Area and Off-Site Habitat Provision Area are limited to biodiversity improvements / planting. No increase in impermeable areas or runoff volumes / rates are expected. Therefore, no surface water drainage strategy is required for these areas as the proposals will mimic the existing drainage patterns.

6.6. CONCEPTUAL SURFACE WATER DRAINAGE STRATEGY

6.6.1. The conceptual surface water drainage strategy has been designed in accordance with the above principles and is shown in **Appendix F**. The strategy is based on a principle of reuse of the runoff generated in the Proposed Scheme. **Appendix F** demonstrates that the proposed drainage strategy would require minor changes to the existing surface water drainage network, as such in these instances the current design standards will be retained. In locations where more substantial works are required, than the design standards will be in accordance with design principles specified in Section 6.2 of this report, and pollution prevention measures will be in accordance with Section 6.4.

6.7. SUMMARY

6.7.1. As stated above, the Proposed Scheme will lead to an increase in total impermeable area however, the drainage strategy developed in accordance with the site specific drainage hierarchy will result in a reduction in runoff volume and peak discharge rate to the water environment and include appropriate pollution prevention measures.

7. ESTIMATED PEAK RUNOFF GENERATED IN THE NEW IMPERMEABLE AREAS

- 7.1.1. A peak flow of 695 m³/hr was estimated for the 1 in 100-year 6 hours storm event with 40% climate change allowance⁵ for the indicated new impermeable areas. The estimation was undertaken using Rational Method, as agreed with the Lead Local Flood Authority (LLFA) on 17/12/2021 (**Appendix H**), and based on the following information:
 - **a.** Proposed impermeable area of approximately 18,600m² it should be noted that this is considered to be a very conservative approach indicating a worst-case scenario (and will be updated as refined information becomes available);
 - **b.** 40% climate change allowance⁴;
 - c. FEH2013 Point Rainfall Data; and
 - **d.** Hyetograph derived from ReFH2 outputs.
- 7.1.2. The peak runoff volume calculations are attached to this report in Appendix G.

⁵ https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, May 2022

8. CURRENT ABSTRACTION RATES

- 8.1.1. The water used within the existing cooling system is abstracted from the River Ouse, this is termed "make up water", given that it is abstracted to make up the water lost in the cooling process. Water abstracted from the River Ouse is directed to a sedimentation tank, then a flow balancing tank prior to pumping to the cooling water reservoirs, the need for and rate of is controlled by the levels in the reservoir. The silt collected in the sedimentation tanks is returned to the River Ouse via the purge pump together with the other water discharged from Drax Power Station Site.
- 8.1.2. The volume of abstracted water is divided roughly evenly between the southern and northern cooling towers. The permitted abstraction volume is 470,000 m³/day (19,583 m³/hr). Information on the abstracted water volumes recorded for years 2006 2020 is summarised in the **Table 8.1** below. The same table provides a comparison of the volume of abstracted water required for the northern cooling towers with a peak flow estimated for the 1 in 100-year 6 hours storm event with 40% climate change allowance⁶.
- 8.1.3. **Table 8.1** shows that currently more than 3,000 m³/hr is abstracted, used and stored in the existing cooling system. The Proposed Scheme will not result in any changes to the existing cooling water requirements / operation. The peak runoff of 695 m³/hr from the new impermeable areas makes up only approximately 20% of the total volume of water per hour needed for the cooling process, therefore, even with this water diverted into the northern cooling reservoir, there will be a short fall of more than 2,000 m³/hr, which will need to be abstracted from the River Ouse.
- 8.1.4. The figures shown in **Table 8.1** also provide evidence that the proposed usage of surface water runoff in the cooling system will reduce the volume of water which needs to be abstracted from the river. The remainder of water required for the cooling process will be supplied by surface water runoff generated in other areas of Drax Power Station Site (subject to detailed design) and / or make up water from the River Ouse. This will result in the reduction of surface water discharge during storm events.

⁶ https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, May 2022

Table 8.1 - Abstraction Volumes and Rates

Year	Permitted Total Abstraction Volume Current Total Abstraction Volume		Volume of Abstracted Water Required for Northern Cooling Towers only	Scheme Resultant Peak Flow for 1 in 100yr 6hrs Storm Event, incl. 40% Climate Change Allowance	Additional Volume for Northern Towers Cooling Process Required During 100yr 6hrs storm event	
	m³/hr	m³/hr	m³/hr	m³/hr	m³/hr	
2020		6,260	3,130		2,435	
2019		7,306	3,653		2,958	
2018		6,804	3,402		2,707	
2017		6,518	3,259		2,564	
2016		6,039	3,019		2,325	
2015		6,918	3,459		2,764	
2014		7,135	3,567	695	2,873	
2013	19,583	6,495	3,248	695	2,553	
2012		6,473	3,236		2,542	
2011		6,610	3,305		2,610	
2010		7,397	3,699		3,004	
2009		6,644	3,322		2,627	
2008		6,952	3,476		2,781	
2007		6,826	3,413		2,719	
2006		6,769	3,385		2,690	

9. POST-DEVELOPMENT DISCHARGE

- 9.1.1. Construction of the Proposed Scheme and the harvesting of storm water will result in a reduction of water discharged ('purged') from the site during storm events. The purged water is water discharged to the River Ouse and is largely made up of water from the cooling water system which is no longer suitable for re-circulation but remains within the parameters of the current Environmental Permit for discharge of waters to the River Ouse. This water is current replaced by abstracted water, although there are also evaporation losses, hence in the current situation the volume of discharged water is less than the volume of that abstracted.
- 9.1.2. In the baseline scenario during a storm event, the surface water runoff from the entire site is directed to the purge system and is discharged to the River Ouse.
- 9.1.3. In the post-development scenario, surface water from the new impermeable areas and from the rest of Drax Power Station Site (the latter is subject to detailed design, if not feasible the current regime for the area outside of the Proposed Scheme will be maintained) will be directed into the north cooling water reservoirs for use in the cooling process. This will result in substantial reduction in abstraction volumes and rates. Hence, the overall discharge volume to the River Ouse will be reduced (including climate change allowance) as surface water will be harvested with some of it effectively lost through the cooling process. Considering this and given the rapid usage of water in the cooling towers, as evidenced in Table 2 against the increase in impermeable areas, the overall impact will be no increase in a peak flow increase to the River Ouse during the large magnitude events and the reduction in runoff volume from all other lesser events.
- 9.1.4. In the unlikely scenario (given the high rate of water use) of the reservoirs being full during a storm event then excess surface water will be routed to purge and discharged to the River Ouse as is currently the case. It should be noted that the abstracted water currently is and will remain to be directed to a sedimentation tank, then a flow balancing tank prior to pumping to the cooling water reservoirs, the rate of which is controlled by the levels in the reservoir. Considering this, surface water runoff directed to the cooling reservoirs will reduce the need for water abstraction from the river, so the double counting of flows from the surface water runoff and abstracted flows from the River Ouse is unlikely to happen.

10. APPROVAL IN PRINCIPLE

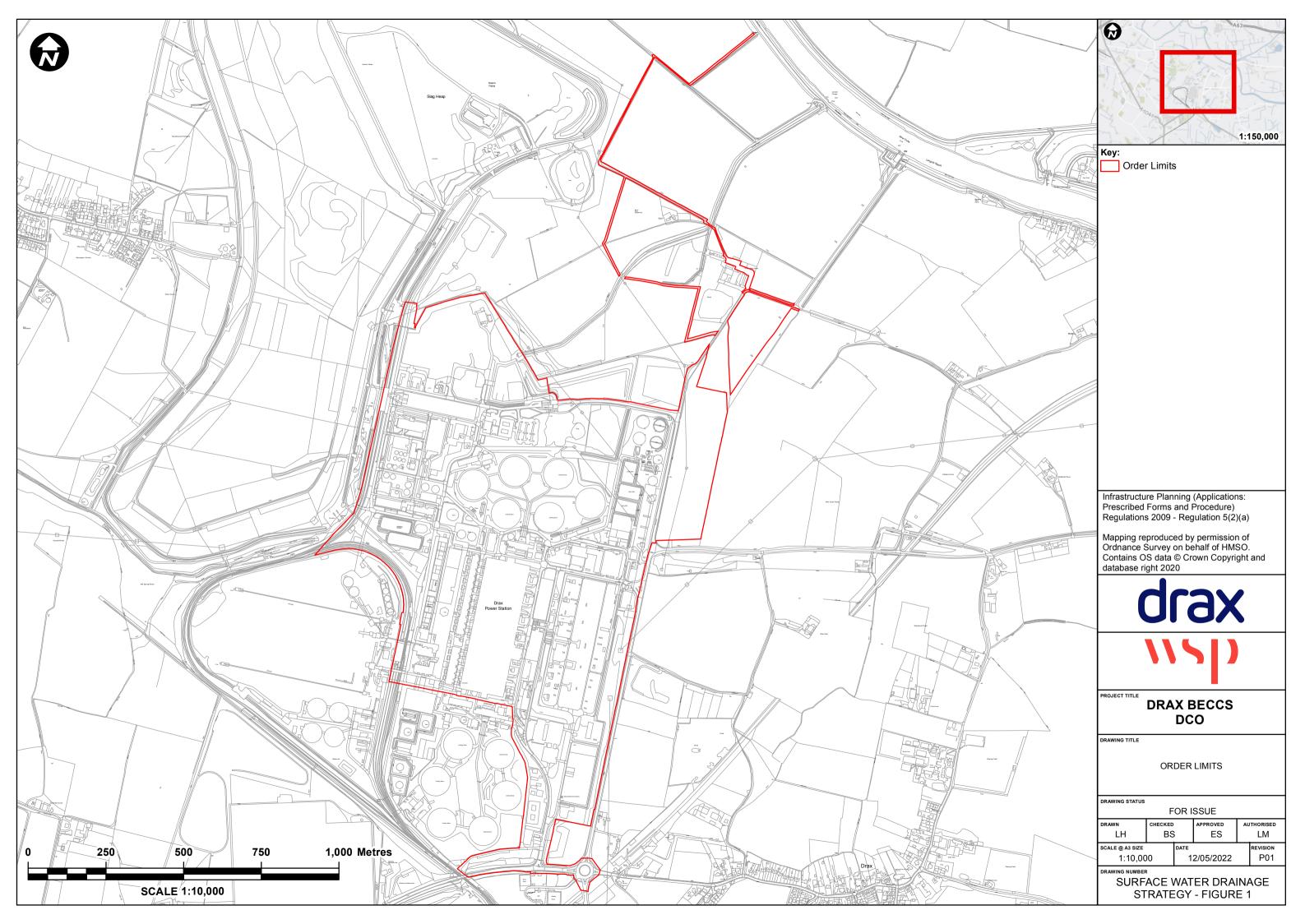
- 10.1.1. As part of the consultation, the LLFA reviewed the information provided in this report and confirmed that the proposed surface water drainage strategy is accepted in principle. The confirmation letter from the LLFA is shown in **Appendix I**.
- 10.1.2. The LLFA also requested further information on design standards and drainage layout, and calculations. These are provided in Section 6 (design standards and drainage layout), and Sections 4 and 7 (greenfield and post-development calculations respectively).
- 10.1.3. It is envisaged that the Proposed Scheme will not increase the existing discharge rate from Drax Power Station Site to the Selby Area IDB drainage network or include new outfalls into their assets. Therefore, the proposal meets the drainage requirements of the Selby Area IDB.
- 10.1.4. As part of the consultation with the Environment Agency, they stated that surface water drainage strategy is a matter for the LLFA / IDB. No further consultation on that matter with the Environment Agency is therefore required.

11. CONCLUSIONS

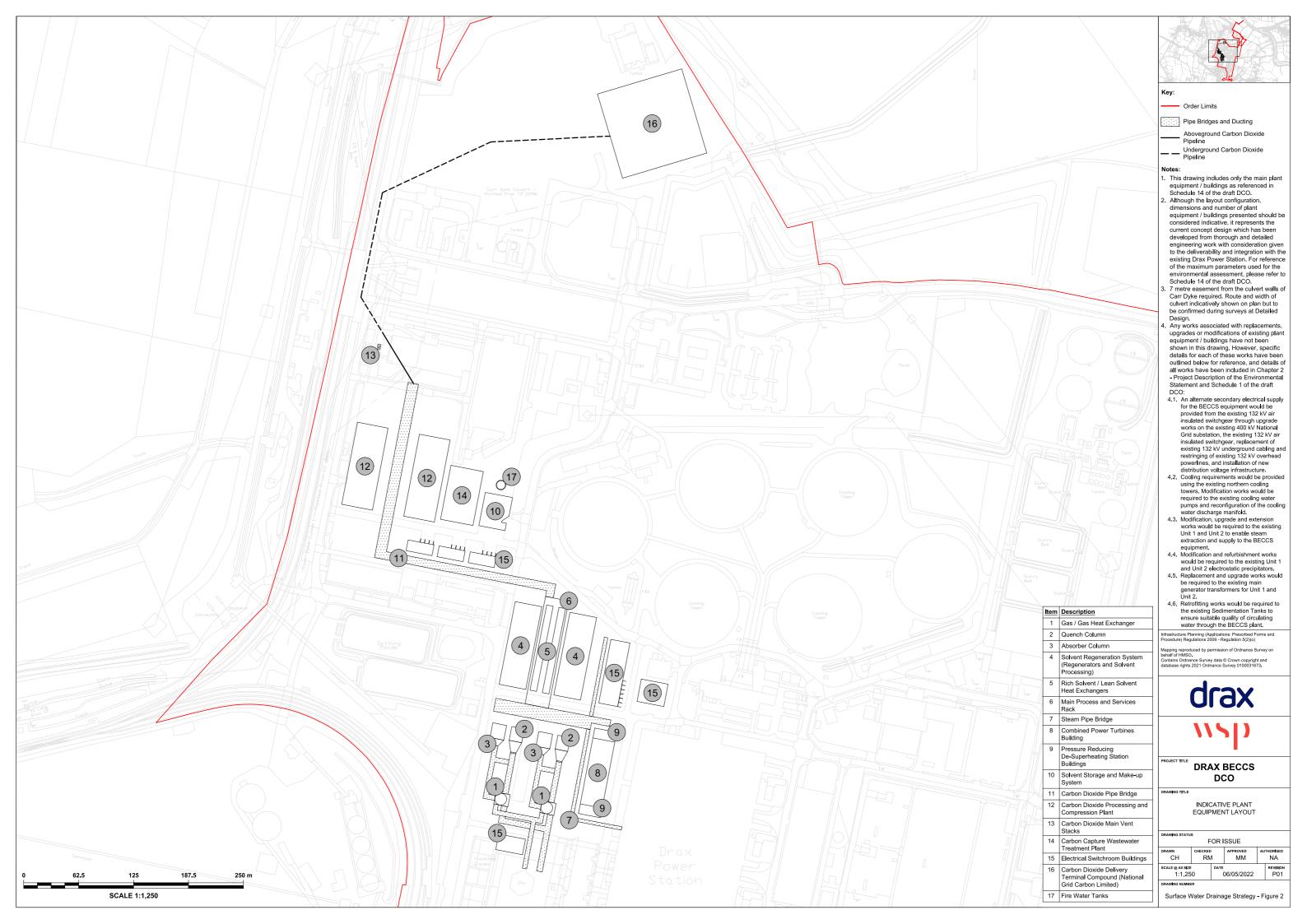
11.1.1. This report demonstrates that the additional surface water runoff that will be generated as a result in the change in impermeable areas as part of the BECCS scheme will be collected, stored and used within the cooling water process, with no increase in discharge off site. Furthermore, the Proposed Scheme may result in a decrease in surface water runoff from the wider Drax Power Station Site, especially for the more frequent events. This is because it is expected that surface water from the other parts of Drax Power Station Site, where feasible, will also be connected into the northern cooling water reservoir and used in the cooling process. This is a more sustainable option than abstracting water from the River Ouse.

APPENDICES

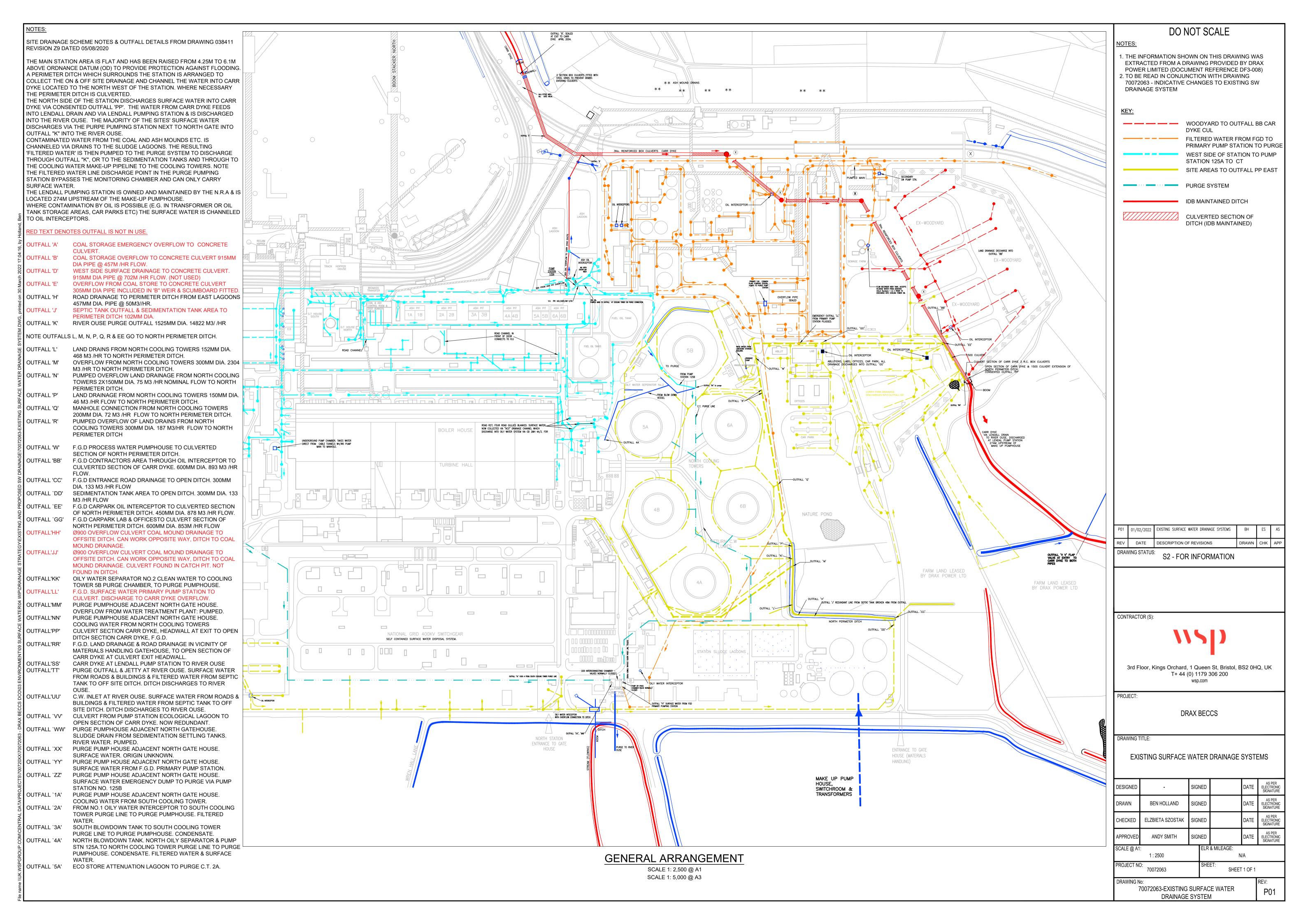
APPENDIX A – ORDER LIMITS

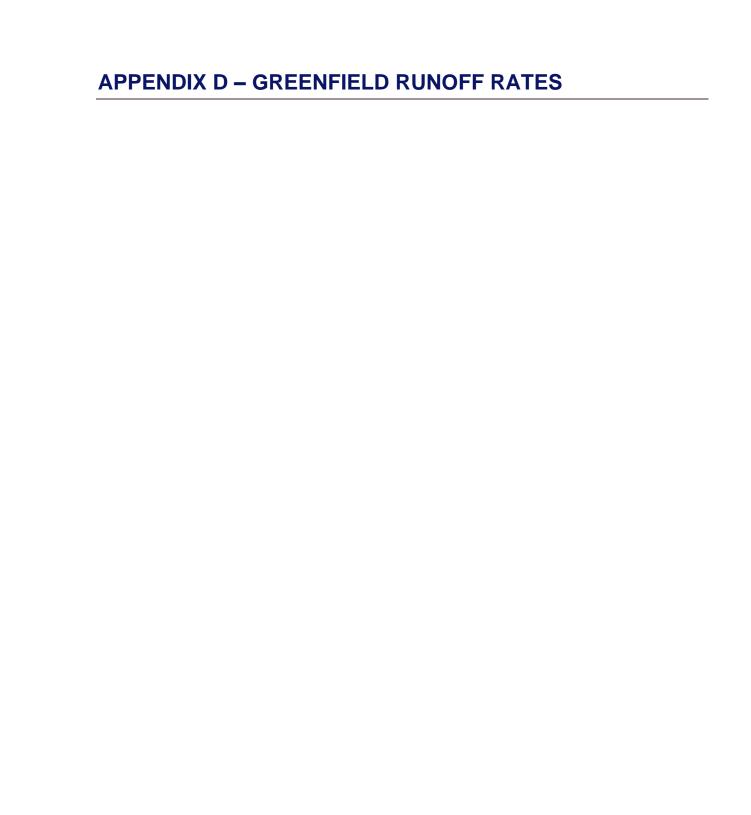


APPENDIX B – INDICATIVE SITE LAYOUT



APPENDIX C – EXISTING SURFACE WATER DRAINAGE SYSTEM







Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Elzbieta Szostak Drax Power Station_BECCS				Site Details				
Site name:						Latitude:	53.74127° N		
Site location: Drax, North Y						Longitude:	0.99745° W		
in line with Environmer SC030219 (2013), the (Defra, 2015). This info the drainage of surface	nt Agency g e SuDS Ma ormation on e water run	guidance nual C7: greenfie off from	e "Rainfall runoff n 53 (Ciria, 2015) a eld runoff rates m	nanagement for de nd the non-statute	ory standards for SuDS	Reference: Date:	4293586361 Mar 23 2022 16:53		
		ach	FEH Statistica	al					
					Notes				
	1.86				(1) Is Q _{BAR} < 2	.0 l /s/ha?			
Runoff estimation appr Site characteristics Total site area (ha): 1.86 Methodology QMED estimation method: BFI and SPR method: HOST class: BFI / BFIHOST: QMED (I/s): QBAR / QMED factor:		Calcu	late from BFI a	and SAAR	When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set				
BFI and SPR method:		Specify BFI manually		ly	at 2.0 l/s/ha.				
HOST class:		N/A							
BFI / BFIHOST:			325		(2) Are flow rates < 5.0 I/s?				
Q _{MED} (I/s):) A () ()		501/		
Q _{BAR} / Q _{MED} facto	r:	1.06	3		Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other				
Hydrological ch	aracteris	stics	Default	Edited			consent flow rates may be set ddressed by using appropriate		
SAAR (mm):			597	597	drainage elem	•	duressed by using appropriate		
Hydrological region	n:		3	3	(0) 000 (000	NIOOT OO	•		
Hydrological character SAAR (mm): Hydrological region: Growth curve factor 1 yea			0.86	0.86	(3) Is SPR/SPF	RHOS1 ≤ 0.3	?		
Growth curve factor 30 years:		rs:	1.75	1.75	Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.				
Growth curve factor 100 years:		ars:	2.08	2.08					
Growth curve factor 200 years:		ars:	2.37	2.37					

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Default

Greenfield runoff rates

Q_{BAR} (I/s):

1 in 1 year (l/s):

1 in 30 years (l/s):

1 in 100 year (l/s):

1 in 200 years (l/s):

Edited

5.71

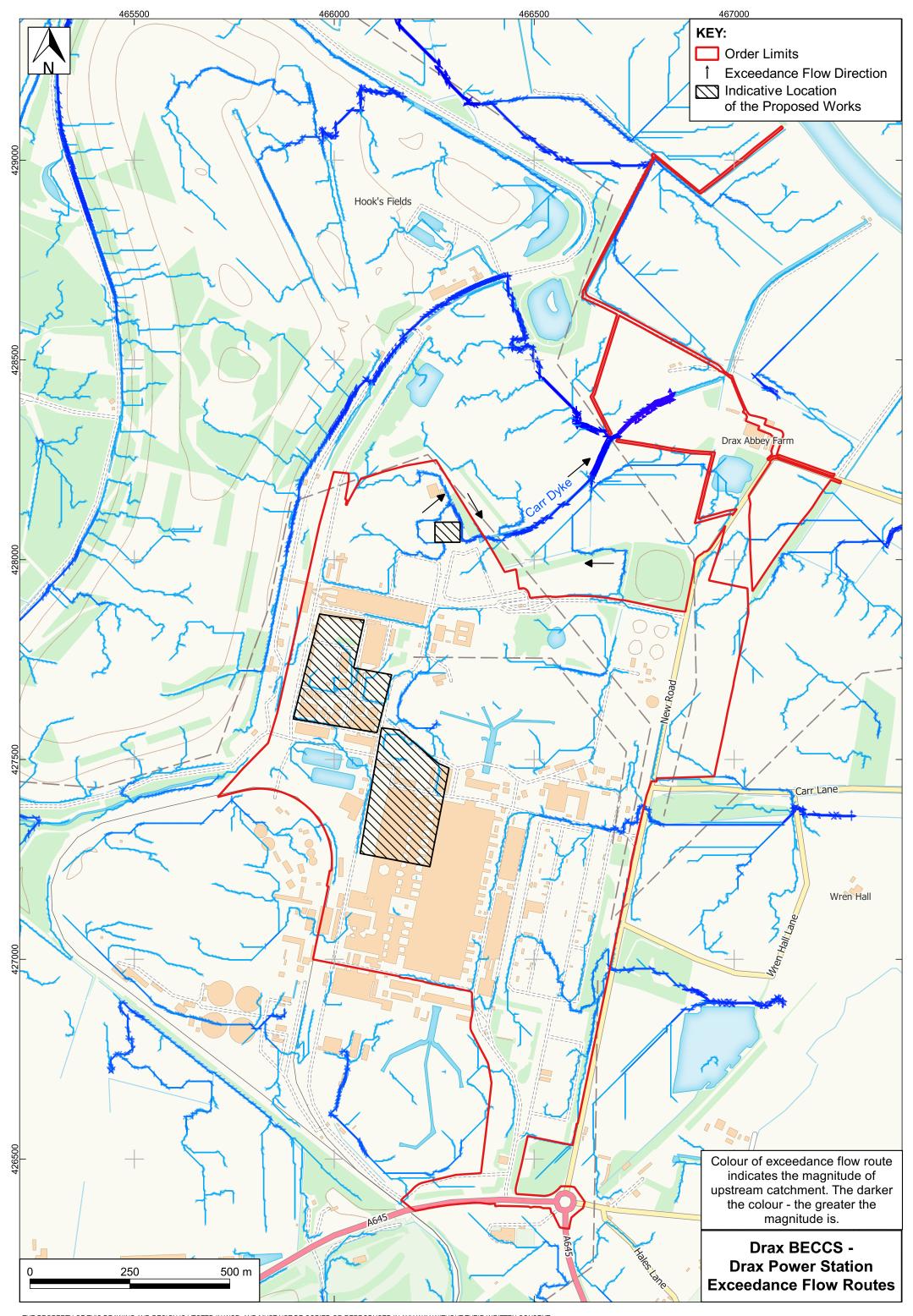
4.91

9.99

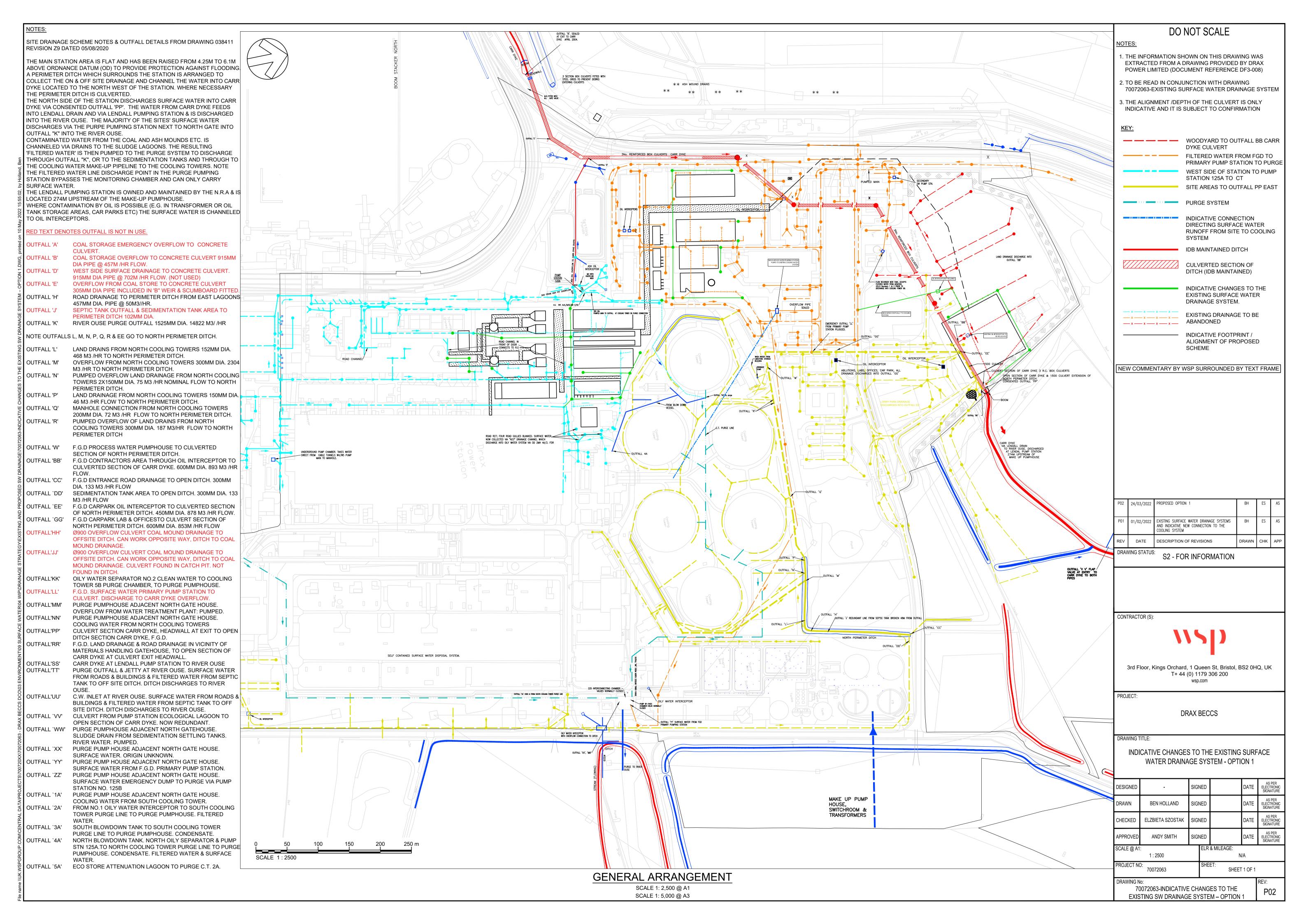
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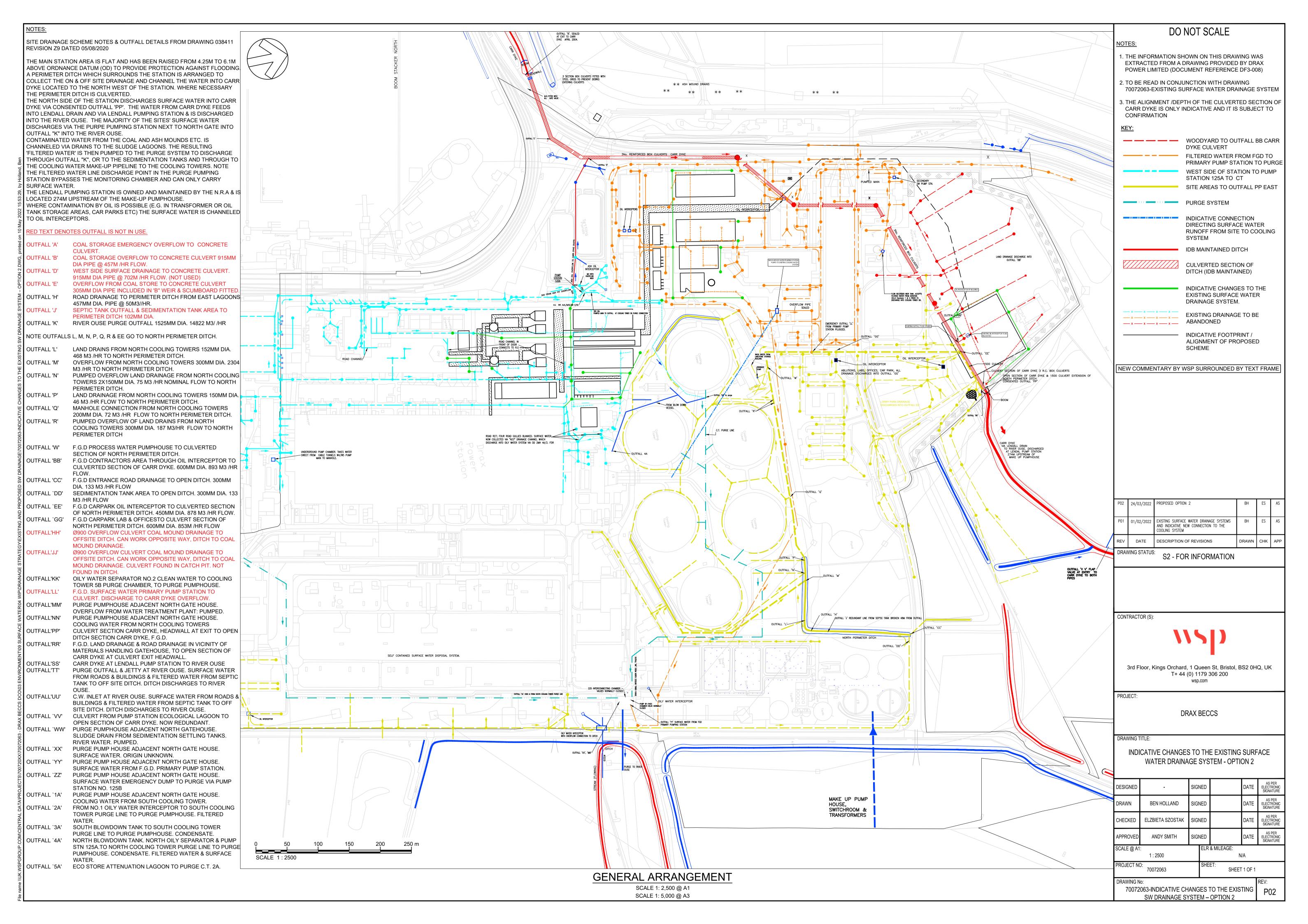
13.53

APPENDIX E – EXCEEDANCE FLOWS



APPENDIX F – PROPOSED CHANGES TO EXISTING SURFACE WATER DRAINAGE SYSTEM TO ALLOW FOR THE PROPOSED SCHEME

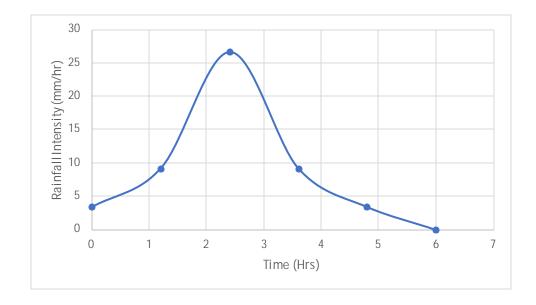




APPENDIX G – PEAK RUNOFF RATES

Drax BECCS 6hr 100 year Hyetograph

3
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2
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3
)
6



T(hrs)	Rainfall Inten	sity mm/hr
	0	3.430
1.	2	9.186
2.	4	26.637
3.	6	9.186
4.	8	3.430
	6	0

Drax BECCS 6hrs storm 100-year ReFH2 Outputs

						Direct		
	100 year	Urban net	Dural not	Sowor	Total net	runoff	Baseflow	Total flow
	design	rain mm	rain mm	:	rain mm	m3/s (100	m3/s (100	
	rainfall -	(100 year) -		:			year) -	•
	i	urbanised					, ,	year)-
T:	!			1		!	urbanised	!
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02:24:00				ģ		<u> </u>	ļ	
03:36:00				ļ		ķ	ļ	ò
04:48:00				 		ļ	<u> </u>	<u> </u>
06:00:00	0		0	0		<u> </u>	ļ	\$
07:12:00			0			ļ	ļ	1.3056
08:24:00	l		0	ķ	0	<u> </u>		L
09:36:00			0	ļ	0	ļ	ļ	{
10:48:00	0	0	0	0	0	L	i	<u> </u>
12:00:00	0	0	0	0	0	0.3824	 	<u>.</u>
13:12:00	0	0	0	0	0	0.2435	0.2289	0.4724
14:24:00	0	0	0	0	0	0.1197	0.2287	0.3484
15:36:00	0	0	0	0	0	0.0362	0.2244	
16:48:00	0	0	0	0	0	0.0071	0.218	0.2251
18:00:00	0	0	0	0	0	0.0001	0.2111	0.2112
19:12:00	0	0	0	0	0	0	0.2044	0.2044
20:24:00	0	0	0	0	0	0	0.1978	0.1978
21:36:00	0	0	0	0	0	0	0.1915	0.1915
22:48:00	0	0	0	0	0	0	0.1853	0.1853
24:00:00	0	0	0	0	0	0	0.1794	¢
25:12:00	0	0	0	0	0	0	0.1736	0.1736
26:24:00	0	0	0	0	0	0	0.168	0.168
27:36:00	0	0	0	0	0	0	ļ	{
28:48:00	0	0	0	0	0	0	0.1574	0.1574
30:00:00	0	0	0	0	0	0	 	\
31:12:00	ļ	0	0	0	0	0		0.1475
32:24:00	0	0	0	0	0	0	 	·
33:36:00			0	ļ	0	·	- 1000	0.1382
34:48:00	0		0	ļ	0	0		<u> </u>
36:00:00	0		0	ļ	0	0	ļ	0.1295
37:12:00	0	-	0		0	0		0.1253
38:24:00	0		0		0	0		<u> </u>
39:36:00			0		0			
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42:00:00	0		0	ļ	0	0	 	0.1130
43:12:00			0	<u> </u>	0	0		0.1065
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45:36:00	0		0		0	0		·
46:48:00				ļ <u>-</u>			ļ	0.0997
}	0		0	ķ	0	0	 	}
48:00:00				ļ	0	<u> </u>	ļ	}
49:12:00	0	0	0	0	0	0	0.0904	0.0904

50:24:00	0	0	0	0	0	0	0.0875	0.0875
51:36:00	0	0	0	0	0	0	0.0847	0.0847
52:48:00	0	0	0	0	0	0	0.082	0.082
54:00:00	0	0	0	0	0	0	0.0794	0.0794
55:12:00	0	0	0	0	0	0	0.0768	0.0768
56:24:00	0	0	0	0	0	0	0.0744	0.0744
57:36:00	0	0	0	0	0	0	0.072	0.072
58:48:00	0	0	0	0	0	0	0.0697	0.0697
60:00:00	0	0	0	0	0	0	0.0674	0.0674
61:12:00	0	0	0	0	0	0	0.0653	0.0653
62:24:00	0	0	0	0	0	0	0.0632	0.0632
63:36:00	0	0	0	0	0	0	0.0612	0.0612
64:48:00	0	0	0	0	0	0	0.0592	0.0592
66:00:00	0	0	0	0	0	0	0.0573	0.0573

Drax BECCS

SW runoff generated in the proposed impermeable area - Rational Method

$Q = 2.78 \times C \times i \times A$

i - intensity (mm/hr)

A - area (ha)

Q - peak flow (I/s)

C - runoff coefficient

1 unitless I peak intensity for 6hrs 100 year event* = 26.637 mm/hr climate change allowance 40%

i for 6hrs 100 year event* with CC 37.29 mm/hr =

New impermeable area** 18613.1 m2 = 1.86 ha

Q= 192.96 I/s 694.6713 m3/hr

^{*}obtained from 6hrs 100yr hyetograph based on FEH rainfall point data (Intensity -Duration - Frequency data) and ReFH2

^{**}very conservative approach, received from Drax on 20/12/2021

APPENDIX H – MINUTES FROM THE MEETING WITH THE LLFA



AGENDA & MEETING NOTES

PROJECT NUMBER	EN010120	MEETING DATE	17 December 2021
PROJECT NAME	Drax BECCS DCO	VENUE	Virtual - Teams
CLIENT	Drax Power Limited	RECORDED BY	ES
MEETING SUBJECT	Existing and Proposed Surface Water Drainage	Strategy	

PRESENT	Meirion Jones (LLFA)
	Jim Doyle (Drax)
	Chris Summers (Drax)
	Teresa Crampton (Drax)
	Andy Smith (WSP)
	Maria Marsh (WSP)
	Elzbieta Szostak (WSP)
APOLOGIES	Jenny Blyth (Drax)
	Nicola Ashworth (WSP)
	Louise Markose (WSP)
DISTRIBUTION	As above
CONFIDENTIALITY	Confidential

ITEM	SUBJECT	ACTION	DUE
	Everyone on the call introduced themselves.		
	Andy Smith (AS) showed the existing and proposed site layout and explain the Proposed Development.		
	AS explained that currently surface water runoff generated within the power station boundary is collected by complex drainage system and eventually pumped out of the site to the River Ouse.		
	AS/ Chris Summers (CS) also explained the proposed surface water drainage strategy which consists of redirection of surface water runoff from the entire site, including the new impermeable areas, to the existing cooling system. The proposed approach will reduce the amount of water which needs to be abstracted from the River Ouse for the cooling process.		
	Meirion Jones (MJ) asked whether there is sufficient storage in the existing cooling system to manage the additional runoff flows. MJ stated that evidence that existing cooling system is of sufficient capacity to manage severe/prolonged storm events needs to be provided to the LLFA.		

CS provided details on the existing abstraction and discharge rates. CS stated that there are losses due to evaporation from the cooling towers.

MJ advised that it is likely that the existing drainage/cooling systems are likely to be constructed in the 70s, and the LLFA requires evidence that the existing systems are able to manage the current rainfalls. MJ stated that potentially Microdrainage model of the existing drainage system may be required to check if there is any flooding from the existing system, and whether the flooded water can be kept within the site boundary. Teresa Crampton (TC) advised that new drainage system will be appropriately sized to the current standards.

TC also advised that Drax Ltd is very keen to reuse surface water runoff generated in the power station site as it will reduce the amount of water abstracted from the River Ouse.

MJ stated that the LLFA expects to see indicative figures, evidence, information on approximate new impermeable areas, exceedance flows etc to support Drax statements so they can make appropriate decision.

AS stated, that ideally Drax Ltd would like to achieve Agreement in Principle (AiP) in terms of surface water drainage strategy in January 2022, so less work is required at the DCO stage.

MJ advised that it needs to be ensured that the proposed drainage strategy is enforceable and complement the narrative.

TC stated that no detailed drainage design is available at this stage of the project. TC advised that more detailed information on the proposed drainage strategy will be available during DCO examination period at the end of 2022. TC also advised that final drainage layouts will be available at the later stage of the project, and only drainage statement is available at the current stage.

Jim Doyle (JD) stated that it needs to be clear what information and when is required by the LLFA.

MJ stated that the following information is expected to support DCO:

- Information on the management of the surface water runoff for up to and including the 1 in 100 year rainfall event;
- Information how the exceedance flows will be managed;
- Indicative drawings; and
- Supported calculations.

WSP / Drax will submit further information on the surface water drainage strategy, to aid MJ in being in a position to support the Scheme.

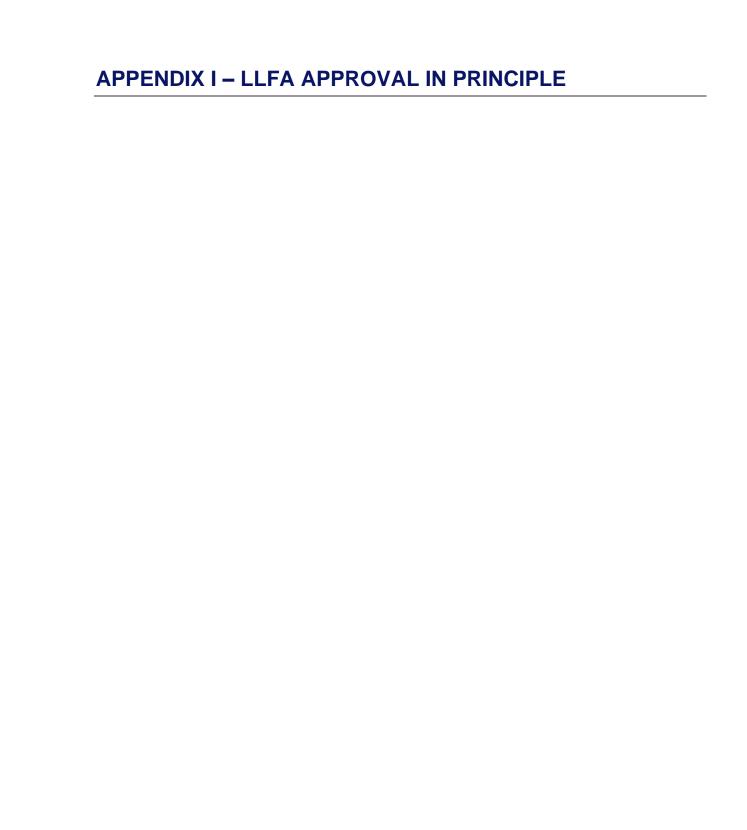
MEETING NOTES

ES stated that no such detailed information on the drainage strategy was provided and accepted for a DCO for the Drax Repower project in 2018. MJ stated that the NPPF was revised since the Repower project and in his view more robust drainage information is now required to be provided.

Post Meeting Note – For Repower DCO the information submitted was limited to drawings showing the proposed new buildings and the existing drainage which neds to be abandoned/diverted, as well as new pipelines which connects to the existing drainage system. No substantial consultation was required with the LLFA.

NEXT MEETING

An invitation will be issued if an additional meeting is required.



Szostak, Elzbieta

From: Meirion Jones

Sent: 08 March 2022 18:11
To: Szostak, Elzbieta

Cc: Smith, Andy; Marsh, Maria; Markose, Louise; Ashworth, Nicola; Wilks Daly, Aidan;

Jim Doyle; Jenny Blyth; Christopher Summers; Stocks, Matt; Emily Mellalieu

Subject: RE: Drax BECCS - additional drainage information

Filed: -1

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\03 Environment\09 Surface Water\02 Comms\Consultation\LLFA\220308 181052

- Meirion Jones - RE Drax BECCS - additional drainage information.msg

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\03 Environment\09 Surface Water\02 Comms\Consultation\LLFA

Dear Elzbieta,

Thank you for the additional information that you sent through.

I agree that the document demonstrates a reasonable approach to the management of surface water and is in line with what we discussed and as such the LLFA would give its agreement in principle to the strategy.

I am concerned however that the document does not fully cover off the requirements of Paragraph 169 of the NPPF and it leaves a lot to be covered in the DCO examination period. Having discussed with others at the authority post meeting, I confirm the LLFA would still comment on any DCO examination based on the NPPF requirements and local SuDS design guide. I have added comments in red where further information would be needed in relation to the NPPF and where our local design guide fits in this process.

- 169. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
- (a) take account of advice from the lead local flood authority;

Submission must follow North Yorkshire County Council SuDS design guide 2018 – there would need to be a requirement to submit information as set out in point 8.2 i.e drainage layout and calculations.

(b) have appropriate proposed minimum operational standards;

More detailed drainage calculations specific to proposal would need to be submitted to demonstrate any proposed operational standard. There is a note in the minutes of the meeting the new drainage system will be appropriately sized to the current standards. The current standards are set out in the DEFRA Non-Statutory Technical Standards for sustainable drainage systems and also set out in our SuDS design guide, i.e. no flooding in 1 in 30 and any flooding from 1 in 100+CC contained on site. This needs to be evidenced as part of the DCO submission.

- (c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- (d) where possible, provide multifunctional benefits

I trust the above is of assistance in that we can agree in principle that there is a reasonable approach to the management of surface water that does not increase flood risk elsewhere, but further information is still necessary before we would be comfortable recommending that the proposal meets NPPF requirements and local design guide for the purpose of the DCO examination.

Kind Regards Meirion

Meirion Jones

Senior Flood Risk Management Engineer

Mr Meirion Jones FdSc BSc (Hons) | Senior Flood Risk Management Engineer | Development Management Team | Business and Environmental Services | North Yorkshire County Council | East Block | County Hall | Racecourse Lane | Northallerton | DL7 8AH | Tel: 01609 535378 | Email:Floodriskmanagement@northyorks.gov.uk



From: Szostak, Elzbieta

Sent: 07 March 2022 10:25

To: Meirion Jones

Subject: RE: Drax BECCS - additional drainage information

Good morning Meirion,

I hope my email finds you well.

Can you please advise when we can expect a response from you on the additional information sent to you in February – as per my email below.

Thank you!

I look forward to hearing from you.

Regards

Ela

Elzbieta Szostak

MSc, MCIWEM Engineer Water Risk Management and Engineering, WEI



Kings Orchard, 1 Queen Street, Bristol, BS2 0HQ

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From: Szostak, Elzbieta Sent: 28 February 2022 12:00

To: Meirion Jones

Subject: RE: Drax BECCS - additional drainage information

Good morning Meirion,

I was wondering whether you had time to check the additional information we have provided in relation to the existing and proposed surface water drainage systems, and whether you have any comments.

I look forward to hearing from you.

Regards

Ela

From: Szostak, Elzbieta

Sent: 17 February 2022 17:52

To: Meirion Jones

Subject: Drax BECCS - additional drainage information

Good afternoon Meirion,

Following up our meeting in December 2021, please find attached additional information on the existing and proposed surface water drainage systems as agreed.

I also attached the Minutes from the meeting in December for your records.

We hope that the attached information provide further clarification and sufficient evidence to allow you to accept the proposed surface water drainage strategy.

If you would like to discuss it or require any further information, please do not hesitate to contact me.

I look forward to hearing from you.

Regards

Ela

MSc, MCIWEM Engineer Water Risk Management and Engineering, WEI



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https://www.northyorks.gov.uk/coronavirus-advice-and-information

Access your county council services online 24 hours a day, 7 days a week at www.northyorks.gov.uk.

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North Yorkshire County Council.