CLEVE HILL SOLAR PARK

ENVIRONMENTAL STATEMENT

VOLUME 1 - CHAPTERS

CHAPTER 10 - HYDROLOGY, HYDROGEOLOGY, FLOOD RISK AND GROUND CONDITIONS

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10 HYDROLOGY, HYDROGEOLOGY, FLOOD RISK & GROUND CONDITIONS

10.1 Introduction

1. This chapter of the ES Statement (ES) evaluates the effects of the Development as described in Chapter 5: Development Description on hydrology, hydrogeology and geology resources.

2. This chapter is supported by the following figures provided in the ES Volume 2:

- Figure 10.1 Hydrology Study Areas;
- Figure 10.2 Solid Geology;
- Figure 10.3 Superficial Geology;
- Figure 10.4 Hydrological Catchments; and
- Figure 10.5 Cumulative Hydrological Catchment.

3. This chapter is also supported by the following Technical Appendices provided in Volume 4:

- Technical Appendix A10.1: Flood Risk Assessment (FRA);
- Technical Appendix A10.2: Ground Investigation; and
- Technical Appendix A10.3: Cleve Hill Solar Park, Kent Phase 1 Preliminary Site Assessment (Curtins 2018).

4. This Chapter also references the following Technical Appendices provided in Volume 4:

- Technical Appendix A5.4: Construction Environmental Management Plan.

5. This chapter includes the following elements:

- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Embedded Development Design;
- Assessment of Potential Effects;
- Mitigation and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

10.1.1 Development Parameters Assessed

6. The Rochdale Envelope parameters for the Development have been considered with respect to the potential effects considered in this Chapter, and worst-case values/scenarios for this are captured by the candidate design, as set out in Chapter 5: Development Description. This chapter reports the assessment of effects associated with the candidate design, therefore.

7. For site access, the Development includes two alternative access routes, one north and one south of the existing substation. However, it is not intended to construct both. Therefore, for the purposes of this chapter, the northern access route has been assessed, as it would result in the maximum addition of impermeable surface.

8. In respect of energy storage technology, the choice of scenario does not affect this assessment and is therefore unspecified.

10.1.2 Study Area

9. The Hydrology Core Study Area includes all areas where construction activity is proposed. A Hydrology Wider Study Area includes 5 km around the Hydrology Core Study Area. Both study areas are shown on Figure 10.1.

10. At distances greater than 5 km within lowland catchments, it is considered that schemes such as solar parks are unlikely to contribute to a hydrological effect, in terms of chemical or sedimentation effects, due to attenuation and dilution over distance of potentially polluting chemicals.

11. A smaller 1 km study area is based on the Hydrology Core Study Area and is used to assess Private Water Supplies.

12. These study areas are defined based on professional judgement and experience assessing similar scale developments within lowland agricultural environments and similar hydrological catchments in England. The study areas were included within the Scoping Report for comment by consultees.

10.1.3 Legislation, Policy and Guidance

13. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[1] establish in broad terms what is to be considered when determining the effects of development proposals on hydrology, hydrogeology and geology resources.

14. The following legislation, guidance and information sources have been considered in carrying out this assessment.

10.1.3.1 Legislative Background

- Water Framework Directive (2000/60/EC)[2] as implemented in England via the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The Water Framework Directive (WFD) establishes a framework for the protection, improvement and sustainable use of all water environments;
- The Groundwater Directive (GWD) (2006/118/EC)[3] as implemented by the Groundwater (Water Framework Directive) (England) Direction 2016[4];
- The Groundwater Daughter Directive to WFD (2006/118/EC) as implemented Environmental Permitting (England and Wales) Regulations 2016;
- The Bathing Water Directive (2006/7/EC)[5] as implemented by the Bathing Water Regulations 2013;
- Flood and Water Management Act 2010[6]; and
- Land Drainage Act 1991[7].

10.1.3.2 Planning Policy

- The NPS EN-1[8]:
  - states that applicants for new energy infrastructure must take into account the potential impacts of climate change, and adopt appropriate mitigation or adaption measures for the lifetime of the proposed infrastructure (paragraph 4.8.6) – this is addressed in section 10.6 and within the FRA (Technical Appendix A10.1);

[1] The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. Available online. http://www.legislation.gov.uk/uksi/2017/572/contents/made Accessed 17/05/2018
[2] European Parliament (2000). "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" ("The Water Framework Directive"). [online] Available at: http://ec.europa.eu/environment/water/water-framework/index_en.html [Accessed 11/03/2018].
[3] https://www.eea.europa.eu/policy-documents/groundwater-directive-gwd-2006-118-ec
[4] https://www.gov.uk/government/publications/the-groundwater-water-framework-directive-england-direction-2016
[5] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0007
[6] https://www.legislation.gov.uk/ukpga/2010/29/contents
[7] https://www.legislation.gov.uk/ukpga/1991/59/contents
[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

- sets out the minimum requirements for a flood risk assessment (paragraph 5.7.5) – this is provided within the Flood Risk Assessment - Technical Appendix A10.1;
- requires consultation on assessment methodologies should be undertaken at early stage with the Environment Agency (EA) (paragraph 5.7.8) – this is detailed in Tables 10.1a and 10.1b;
- states that the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on water quality, water resources and physical modifications to the water environment (paragraph 5.15.2) – this is addressed in section 10.5; and
- sets out requirements for the environmental statement relating to water quality, existing water resources, physical characteristics and impacts on WFD source protection zones (paragraph 5.15.3) – this is addressed in section 10.5.

- NPS EN-5 requires that applicants set out to what extent the proposed development is expected to be vulnerable, and as appropriate, how it would be resilient to flooding, particularly for substations (paragraph 4.4.1) - this is provided within the FRA - Technical Appendix A10.1;
- Revised National Planning Policy Framework (NPPF), paragraphs 155 to 165[9]. This states that for development comprising one hectare or above, the vulnerability to flooding, or the potential to add to flooding elsewhere should be assessed in a Flood Risk Assessment (FRA);
- The National Planning Practice Guidance provides planning guidance on a range of topics including flood risk. PPG ID7 (March 2014) for Flood Risk and Coastal Change provides additional guidance in the implementation of the NPPF in relation to development and flood risk;
- Canterbury District Local Plan Adopted July 2017 - Policy CC4 Flood Risk, Policy CC5 Flood Zones, Policy CC12 Water Quality and Policy CC11 Sustainable Drainage Systems[10];
- Swale Borough Council (2008) Swale Borough Local Plan[11] - Policy E4: Flooding and drainage; and
- Swale Borough Council (2012) Draft Core Strategy Bearing Fruits (March 2012), Policy DM 18 Flooding and Drainage - *"All development proposals in areas of Flood Risk will be required to address the following criteria, following the approach set out in the Swale SFRA and PPS25* (superseded by NPPF) *and supporting Practice Guidance. Should the latter be deleted, the Council will prepare a Supplementary Planning Document based on the same principles to ensure a consistent and rigorous approach to flood risk mitigation*."

10.1.3.3 Pollution Prevention Guidelines (PPGs)

15. Produced by the EA, Pollution Prevention Guidelines (PPGs)[12] give advice on statutory responsibilities and good environmental practice. Each PPG addresses a specific industrial sector or activity.

16. Whilst the PPG documents have now been archived by the EA, they still provide a useful resource for managing on site activities. The following are of relevance to surface water, groundwater, coastal waters and soil resources:

- PPG1: Understanding Your Environmental Responsibilities;
- PPG2: Above ground oil storage tanks;

[9] Ministry of Housing, Communities & Local Government (2018). "Revised National Planning Policy Framework" [online] Available at: https://www.gov.uk/government/collections/revised-national-planning-policy-framework [Accessed 07/11/2018].
[10] https://www.canterbury.gov.uk/downloads/file/467/canterbury_district_local_plan_adopted_july_2017
[11] http://services.swale.gov.uk/LocalPlans/LP_document/index.html
[12] EA, (various), Pollution Prevention Guidelines. PPG 1 to 21 [online]. Available online at: http://www.sepa.org.uk/about_us/publications/guidance/ppgs.aspx. [Accessed 06/03/2018].

- PPG4: Disposal of sewage where no mains drainage is available;
- PPG5: Works and maintenance in or near water;
- PPG6: Working at construction and demolition sites;
- PPG18: Managing fire water and major spillages; and
- PPG21: Pollution incident response planning.

10.1.3.4 Other Guidance

17. Other relevant guidance comprises the following:

- The Construction Industry Research and Information Association (CIRIA) (2015), Environmental Good Practice on Site (C741)[13];
- CIRIA (2001), Control of Water Pollution from Construction Sites (C532)[14];
- CIRIA The SuDS Manual;
- Kent County Council (KCC) - A guide for master planning sustainable drainage into developments[15];
- KCC - Swale Surface Water Management Plan (2012)[16];
- KCC - Local flood risk management strategy (2013)[17];
- KCC - Drainage and Planning Policy Statement (2017)[18];
- Swale Borough Council – Strategic Flood Risk Assessment for Local Development Framework (SFRA) (2009);
- Engineering Design Standard, EDS 07-0106 - Substation Flood Protection (2016)[19];
- Part 1: Thames river basin district - River basin management plan Updated: December 2015[20];
- The Medway Estuary and Swale Strategy (MEASS) 2017[21]; and
- Lower Medway Internal Drainage Board Land Drainage Byelaws – Byelaws 6, 7, 8 10, 14, 15, 17, 18 and 19.

10.2 Assessment Methodology and Significance Criteria

18. This assessment has involved the following elements, further details of which are provided in the following sections:

- Consultation with relevant statutory and non-statutory bodies;
- Desk study, including review of available maps and published information;
- Site walkover;
- Input to design process to minimise effects;
- Identification and evaluation of potential effects;
- Evaluation of the significance of these effects;
- Identification of measures to avoid and mitigate potential effects;
- Assessment of residual effects;
- Evaluation of potential cumulative effects;
- Proposed monitoring; and
- Statement of significance.

[13] The Construction Industry Research and Information Association (CIRIA), (2015), Environmental Good Practice on Site Guide (C741), CIRIA: London.
[14] CIRIA, (2001), Control of Water Pollution from Construction Sites (C532), CIRIA: London.
[15] https://www.kent.gov.uk/waste-planning-and-land/flooding-and-drainage/sustainable-drainage-systems#tab-2
[16] https://www.kent.gov.uk/__data/assets/pdf_file/0011/50015/Swale_SWMP_Stage_1_Report.pdf
[17] https://www.kent.gov.uk/__data/assets/pdf_file/0016/12076/Kent-Local-Flood-Risk-Management-Strategy-Report.pdf
[18] http://www.kent.gov.uk/__data/assets/pdf_file/0003/49665/Drainage-and-Planning-policy-statement.pdf
[19] https://library.ukpowernetworks.co.uk/library/en/g81/Design_and_Planning/Substations_-_Major/General/EDS+07-0106+Substation+Flood+Protection.pdf
[20]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500548/Thames_RBD_Part_1_river_basin_management_plan.pdf
[21] EA. Medway Estuary and Swale Strategy (MEASS) 2017. [online]. Available at:https://consult.environment-agency.gov.uk/ksles/medway-estuary-and-swale-strategy/

10.2.1 Scoping Responses and Consultations

19. Information has been provided by a range of organisations during the assessment, and this is summarised in Table 10.1a Consultation Responses, and 10.1b Consultation Responses Since PEIR. The response to each point raised by consultees is also presented within the table, demonstrating where the design of the Development has changed in response to specific issues indicated by the EA, KCC, Swale Borough Council (SBC) and Lower Medway Internal Drainage Board (IDB), or where the comment has otherwise been addressed in this chapter. Further consultation responses were received following issue of the Preliminary Environmental Information Report (PEIR), and the salient points are summarised in Table 10.1b.

Table 10.1a Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	Action
EA	Scoping response 09/01/2018	The EA made the following comments of relevance to the Hydrology, Hydrogeology Flood Risk & Ground Conditions Chapter.	
		We have no comments to make on the content of the submitted Environmental Impact Assessment scoping study in regards to flood risk. We are satisfied with the flood risk detail contained in the report and would welcome pre-application discussions regarding the flood risk assessment.	Pre-application discussions were held with the EA regarding flood risk. The EA agreed that the North Kent Coastal Model should be re-run to include defence breach analysis in order to design the Development. The results are presented in Technical Appendix A10.1.
		The site is located within an area of land proposed for managed re-alignment within the consultation draft of the forthcoming Medway Estuary and Swale Strategy (MEASS). MEASS will set out specific schemes which will aim to deliver policies set out within the Shoreline Management Plans. The strategy is currently being finalised and is due to be completed in summer 2018. Discussion with the applicant has been had to clarify the planning objectives for the site, and the future managed re-alignment option. It has been discussed that we may not be able to fund maintenance of the existing defences over the next 20 years. Therefore the developer or landowner would need to take on the cost and works associated with maintaining the current standard of defence. We request that this strategy is considered in the EIA, highlighting the potential interaction between MEASS and the solar park proposals.	Whilst the Development is located within Benefit Area 6.2 of the MEASS, Cleve Hill Solar Park has made representations on the consultation draft of the MEASS in February 2018, which outlined that the MEASS is not compatible with the Development.
	Consultation regarding flood defence management 08/05/2018	Three scenarios were set out in terms of the Medway Estuary and Swale Strategy (MEASS) and the site development proposals to provide a solar park: • Plan A outlines the 'without solar park' scenario and is as per the MEASS strategy - MEASS includes	The MEASS scenarios have been taken into account in the assessment. The design of the Development and powers sought within the DCO will ensure that the flood defences protecting the

Consultee	Type and Date	Summary of Consultation Response	Action
		patch and repair / maintenance in Epoch 1 (0 to 20 years) and for managed realignment to begin to be considered in Epoch 2 (from year 20). Maintenance of the defences in the first epoch can only be economically justified due to the benefit of managed realignment in the longer term. • Plan B outlines the scenario in which the solar park is consented and built. The Environment Agency's position in this scenario is to cease maintenance of the defence for the operational lifetime of the development. • Plan C outlines the scenario if the Environment Agency conclude that no managed realignment is possible on the site at any point, due to the infrastructure existing and proposed. The defences would become a 'no active intervention frontage'. Plan C would be most likely to occur if the strategy were to be reappraised at the start of Epoch 2 and if the infrastructure was still in place and preventing managed realignment from taking place. Managed realignment in theory could potentially occur at any point in the second epoch and not necessarily within the early years of that period. The full scope of works required to implement realignment has not been identified... Managed realignment would be subject to consultation with those owning existing electricity assets in Benefit Area 6.2 (e.g. CHSPL, National Grid and Blue Transmission London Array Limited (BT LAL)), feasibility and viability analysis, the approval of an Implementation Plan, and the Environment Agency procuring the necessary funding, land interests and statutory consents to implement the realignment. The flood defences at the site and wider area are not fully shown on the published flood map. The defence line is continuous from Cleve Hill to Nagden and to the south west beyond. We discussed your proposal to extend the CHSP red line boundary to include the flood defences protecting the site, and the inclusion of powers and rights in your DCO to enable CHSPL to undertake maintenance works to the defences. We would not have any concerns or objections with this approach in order to give CHSPL the ability to maintain the defences in the future.	Development can be inspected and maintained by the operator of the Development to ensure their functionality throughout the lifetime of the Development.

Consultee	Type and Date	Summary of Consultation Response	Action
		The Inspectorate notes that a Construction Environmental Management Plan (CEMP) is to be produced. Where the ES relies upon mitigation measures which would be secured through the CEMP, it should be demonstrated (with clear cross-referencing) where each measure is set out in the CEMP. The Applicant should append a draft copy/outline of this document to the ES and/or demonstrate how it will be secured.	This Chapter provides clear cross referencing wherever embedded design in the Outline CEMP is referred to.
		The ES should assess the impacts which may result in likely significant effects on designated sites which are hydrologically linked to the Proposed Development. The ES should justify the choice of sensitive receptors, the study area applied and seek to agree this with relevant consultees.	Potential effects on designated sites are considered in section 10.5.1 of this Chapter. The study area and justification was set out in the scoping report and is presented in section 10.2.5 of this Chapter.
		In relation to impacts from increased surface water run-off, the Inspectorate considers that impacts on water quality as a result of soil erosion should be assessed in the ES.	Potential effects from increased run-off are considered in section 10.5.1.8 of this Chapter.
		If the Proposed Development includes works that may affect the existing drainage regime including ditches these should be assessed in the ES. In particular the assessment should focus on upgrades to or construction of crossing points, including any crossings required temporarily for construction.	A watercourse crossing Inventory is provided as part of the Outline CEMP and outlines the location and proposed crossing type. Details of drainage improvements and set-back distances from IDB maintained assets is also addressed within this Chapter.
		The ES should explain the relationship between the Proposed Development and any relevant water bodies in relation to the current relevant River Basin Management Plan. If the Proposed Development has the potential to impact upon any WFD water bodies these should be assessed. Impacts during construction, operation and decommissioning of the Proposed Development should be considered. The Applicant's attention is drawn to the Inspectorate's Advice Note Eighteen: The WFD.	An assessment of the potential effects from the Development on receptors relating to the River Basin Management Plan and the WFD is presented in section 10.5.1 of this Chapter. Full cognisance has been taken of the Inspectorate's Advice Note Eighteen: The WFD.
		The Inspectorate notes the discussions between the Applicant and the Environment Agency regarding flood depths - it has been agreed that the coastal flood model should be re-run to include a breach scenario for the 1 in 200 year tidal event plus appropriate uplifts for climate change. The flood depths derived from the breach scenario will inform the design of the critical electrical infrastructure (such as the substation) with an appropriate freeboard allowance for climate change. All elements of the Proposed Development, including	Flood modelling has informed the design of the Development. The results are presented in Technical Appendix A10.1 and in section 10.5.1.8 of this Chapter. All elements of the Proposed Development, including dimensions, aredescribed within the Development Description chapter of the ES

Consultee	Type and Date	Summary of Consultation Response	Action
		dimensions, should be described within the Project Description chapter of the ES.	
		The Inspectorate notes the comments from Kent County Council (the Lead Local Flood Authority (LLFA)) regarding the need for additional sensitivity testing at the 40% level for climate change. This should be discussed and agreed with the LLFA and the Environment Agency.	Climate change allowances of 40% increase over the present day have been included in the assessment of surface water flooding and are presented within the FRA. The climate change allowance to be applied to flood modelling was discussed and agreed with the Environment Agency in 2017.
		The Inspectorate notes that surface water is not identified as a potential source of flooding. The Inspectorate advises that potential impacts from surface water flooding should be considered in the FRA. The Inspectorate notes that Kent County Council has also recommended that the scope of the FRA includes potential impacts from surface water flooding.	The site is essentially flat, has limited impermeable surfaces within the site and drained by a series of ditches. However, surface water flooding is considered within the FRA – provided as Technical Appendix A10.1.
		The conclusions of the FRA should be agreed with the Environment Agency and Kent County Council prior to submission of the DCO application, with evidence of such agreement provided - for example in a Statement of Common Ground.	The EA have been consulted regarding the methdology for the tidal modelling and provided the results from the breach modelling. KCC will be provided with the FRA prior to submission of the DCO application, and relevant inclusions made in a Statement of Common Ground.
KCC	Scoping response 09/01/2018	With respect to Magnitude Criteria Table 8.2 (pg. 60), a "major" magnitude of change should include any severe impacts on surface water quality caused by erosion and not relate solely to impacts on groundwater. KCC requests that this is made clearer in all the statements relating to water quality.	Magnitude criteria outlined in Table 10.3 covers potential effects to surface water from all sources of pollution.
		The FRA Methodology (section 8.4.6, pg. 62) provides a summary of the elements within the FRA. KCC will require a Drainage Strategy that forms part of the FRA with clear definition of any culverts, extent of impermeable surfaces and mitigation provided to control surface flow from the area of solar panels. As the Environment Agency climate change allowance is a range from 20% to 40%, KCC will also require a sensitivity check for the higher allowance of 40%.	These aspects have been included within the FRA. Outline SuDS measures are provided in Technical Appendix A10.1 and A5.4. SuDS will be designed to release surface water at greenfield rates. A Watercourse Crossing Inventory (WCI) is presented in sections 11 and 12 of Technical Appendix A5.4. Outline details of the proposed upgrades and new culverts are oultined in Technical Appendix A5.4.
Swale Borough Council (SBC)	Scoping response 25/01/2018	SBC stated "I can confirm that the Borough Council has no comments to make on the Scoping Report for this project."	No action required.

Consultee	Type and Date	Summary of Consultation Response	Action
Southern Water	Scoping response 04/01/2018	Southern Water's current sewerage records do not show any public sewers to be crossing the above site.	This information has been used to inform the assessment and the location of public sewers has not influenced the design of the Development.
		There are no public surface water sewers located within the vicinity of the site and alternative methods of disposing of the surface water should be investigated i.e. soakaways, ditches or local water courses	SuDS meaaures will ensure that the compond discharges to the existing drainage diteches onsite at greenfield rates.
		Southern Water requires a formal application for a connection to the public foul sewerage and water main to be made by the applicant or developer.	The Development will not require the disposal of surface or foul water by Southern Water infrastructure.
SBC Environmental Health Department	Other – Data requests Private Water Supply (PWS) request 27/11/2017	Provided details of four PWS within 2 km of the Development.	Private Water Supplies are considered in section 10.5.1.12.
Canterbury City Council (CCC)	Other – Data requests PWS request 16/11/2017	No Private Water Supplies exist within the jurisdiction of CCC within 2 km of the Development.	No action required.
Lower Medway Internal Drainage Board	Other – Data requests 19/12/2017	Provided information on IDB adopted watercourses within the Development site. Stated that any structure proposed within the 8 m byelaw margin will need IDB Land Drainage Consent.	The 8 m byelaw margin has informed the design of the Development. Any crossing of IDB adopted watercourses / drains will be designed in consultation with the IDB and the Developer will apply for IDB Land Drainage Consent for these.

Table 10.2b Summary of Section 42 Consultation Responses

Date	Consultee and Response	Action
July 2018	**Canterbury City Council**	
	Drainage/Flood Risk Relevant policies from the Canterbury District Local Plan are missing from the list of planning policies in Section 10.2.2 of Chapter 10. In addition, no details of surface water drainage have been included within the report.	Relevant policies from the Canterbury District Local Plan have been included within the ES Chapter 10 and the FRA (ES Technical Appendix A10.1). Surface water drainage will be dealt with by measures such as promoting vegetation and wildflower mix growth under the panels to promote soil cohesion and reduce the risk of soil erosion. The compound that houses the substation and battery park will contain a permeable road surface with an underdrain that flows

Date	Consultee and Response	Action
		to a surface water drain with a non-return valve (at the north of the compound) into an existing drainage ditch draining north.
July 2018	**CPRE Kent**	
	Flood risk We have serious concerns over the quality of the Flood Risk Assessment and the Flood Modelling Document which inform Chapter 10 of the PEIR, inter alia the use of the term 'depth' to describe flooding when any qualified assessor of flood risk would expect to see flood modelling described in relation to Ordnance Datum. We also have been unable to establish with any clarity the underlying engineering and meteorological assumptions which have informed the flood risk modelling, and we trust that these deficiencies will be addressed in the full Development Consent Order application in order that the impacts of this project can adequately be assessed.	The FRA submitted with the PEIR refers to modelled flood depth in metres AOD throughout the document. Flood levels in metres AOD are referenced throughout the FRA (ES Technical Appendix A10.1) and in ES chapter 10, section 10.5.1.9 Critical Infrastructure (substation and battery storage area) (also the same sections of the PEIR). The depth measurements are relative to ground level, which was derived from a topographical survey. Modelling parameters are provided in section 2 of the JBA costal flood modelling report which forms Appendix 1 of the FRA and these were agreed with the Environment Agency prior to the model being re-run.
	We are also concerned about the proposed conflict with the Environment Agency's Medway Estuary and Swale Strategy and the managed retreat proposed for this section of the Graveney Marshes.	"The EA's ""The Medway Estuary and Swale Strategy - A Summary of Consultation Responses - Report – MMD-347800-S-RE-005-C"", section 4.2 (Comments on specific Benefit Areas) document states that, "Should the plans for the solar farm at Cleve Hill be approved and this moves forward to construction, the following will replace the current policy: • We [the EA] will not take responsibility for continued maintenance of the defences in this area. • A Managed Realignment site would be proposed in the longer term following the lifetime of the solar farm". As such, the Development is not in conflict with most recent version of the MEASS.
	Soil micro-climate and hydrology There are few references to studies dedicated to the impact of solar technology on wetland hydrology. Those that are quoted deal, for the most part, with site preparation and installation works and are therefore confined to the first 2 to 3 years of the life of the scheme. These, however, highlight some issues of special concern, including soil compaction by heavy plant. In the case of Cleve Hill, underlain by alluvium and London Clay, this could lead to 'panning' and water-logging, with its implications for soil water quality and biodiversity throughout the site.	The Cleve Hill Solar Park Microclimate & Vegetation Desk-Based Study, Technical Appendix A5.3 of the ES and PEIR, section 2.3 (Effects on soil moisture) concluded that soil moisture at Cleve Hill is likely to be high variable but overall will probably be higher under east-west PV arrays due to reduced wind speeds, lower evaporation and reduced transpiration. Depending on weather conditions during construction, temporary roadways (e.g., plastic matting) may be utilised to access parts of the Development site during construction to avoid excessive soil disturbance or compaction. During the operational phase,

Date	Consultee and Response	Action
		activity on the Development site will be minimal and would be restricted principally to vegetation and livestock management (the Development site is expected to be grazed by sheep), equipment / infrastructure maintenance and servicing including cleaning and replacement of any components that fail, and monitoring to ensure the continued effective operation of the Development.
	The dimensions and spacing of the panels will create a partial canopy covering approximately 40% of the site. This will reduce the evapo-transpiration component of the water balance, thereby increasing the total effective rainfall entering the soil profile. This increase in net infiltration could be sufficient to produce year-round water-logging, leading to profound ecological changes, and long-term damage to the agricultural potential of this area of marsh. Furthermore any measures to improve the drainage infrastructure could carry an increased risk of soil erosion.	The areas of the site proposed for solar panels are currently used for arable farming, in which it would be expected that the ground is bare earth, or effectively bare earth (i.e., seeded or seedlings only) for at least c. 30 to 40 % of the time. With the Development, a level of vegetation will exist on a permanent basis across the site. The ES, Technical Appendix A5.3, Microclimate and Vegetation Desk-Based Study, sets out the likely vegetation under the panels. Between and around the panels, grass and wildflower mix will be seeded and maintained, as set out in the ES, Technical Appendix A5.2, Landscape and Biodiversity Management Plan. The vegetation will assist with preventing run-off and soil erosion, and increasing transpiration, relative to a bare-earth arable scenario.
	There is a lack of sufficient base-line data for a comprehensive assessment of the hydrological implications of the installed solar panel array. This should take the form of a programme of measurements of rainfall, evapo-transpiration, soil moisture and surface runoff for a trial solar panel site covering a period of not less than 3 years, in order to achieve at least an approximation to the long-term average annual water balance for the site. We would also recommend concurrent ecological and habitat surveys of the trial plot.	The ES, including chapter 10, identifies and assesses the likely significant effects, as required and as informed by Scoping. Further to this, we comment as follows: The Cleve Hill Solar Park Microclimate & Vegetation Desk-Based Study, Technical Appendix A5.3 of the ES and PEIR, section 2.3 (Effects on soil moisture) concluded that soil moisture at Cleve Hill is likely to be highly variable but overall will probably be higher under east-west PV arrays due to reduced wind speeds, lower evaporation and reduced transpiration. Given that agricultural fields at the site remain tilled for substantial parts of the year a trial study is unlikely to give representative results of the conditions that would be present during the operational phase of the Development, where land under the PV arrays would be allowed to naturally vegetate and be grazed by livestock. As vegetation becomes established under the PV arrays there is likely to be a decrease in surface water runoff rates and a reduction in the potential for sediment and agricultural chemicals (e.g., phosphates and nitrates) to transfer into the wider hydrological catchment compared to the baseline scenario.
	We also recommend at least one adjacent undisturbed and fully instrumented control plot of	Please see answer to previous point.

Date	Consultee and Response	Action
	similar dimensions to the trial site. Full details and guidance on the evaluation programme could be sought from IOH at Wallingford who would also be available to consult on the interpretation of the outputs from the hydrological and ecological programmes. There are 'small plot' runoff models which could possibly be adapted for the Cleve Hill situation.	
June 2018	**Environment Agency**	
	Flood risk We have no concerns in terms of flood risk to the proposed development at this site. The submitted Flood Risk Assessment (Technical Appendix A10.1: Flood Risk Assessment (FRA)) details the development proposals and outlines flood risk mitigation measures. We are satisfied with the application of the Exception Test in relation the site layout and design and have reviewed the tidal flood modelling undertaken and have no concerns with this.	No action required.
	As you are aware we are currently completing the Medway Estuary and Swale Strategy (MEASS). This will set out our plan for the management of the coastline for the next 100 years. The proposed plan for the Cleve Hill site is to provide managed realignment in the second epoch of the strategy (years 20-50). Managed realignment would create set back defences inland of their current position in order to provide intertidal habitat.	Whilst the second epoch of the MEASS will coincide with the presence of the Development the EA have acknowledged that managed realignment will not occur until the Development has been decommissioned.
	The proposed policy options set out within MEASS are based on government policy and treasury rules for allocation of public funding. All flood defence spending must be based on the cost / benefit of either building or maintaining an asset. The strategy shows that publicly funded maintenance of the defences at Cleve Hill is not economically viable without the associated justification of managed realignment in the future. We therefore expect major infrastructure owners such as Cleve Hill Solar Park Ltd to undertake maintenance of the defences whilst occupying the site. In the case of Cleve Hill Solar Park, we would expect this to come into effect once construction / use of the site commences.	With the presence of the solar park, the EA expects to cease maintenance of the defences earlier, on the basis that the maintenance will be carried out by the main beneficiaries of it (those who own assets which are protected by the coastal defences).
July 2018	**Graveney with Goodnestone Parish Council**	
	8. Hydrology, Hydrogeology, Flood Risk and Ground Conditions The CHSP site is within Environment Agency's (EA) Flood Zone 3a and therefore at high flood risk. The flood risks on this site are sea flooding, tidal flooding and surface water flooding. We are pleased to see that flood risk has been the subject of extensive analysis and consultation with the statutory authorities.	No action required.

Date	Consultee and Response	Action
	The EA's draft Medway Estuary and Swale Strategy (MEASS) has recently been the subject of consultation. It proposes to "hold the line" along the Graveney Marshes frontage (area BA6.2 in the Strategy) by maintaining the existing coastal defences for the next 20 years, but then switching to a "managed realignment policy" allowing the site to mitigate against coastal squeeze elsewhere. In effect, this would mean the gradual replacement of arable farmland with coastal grazing marsh which could be flooded at times. Other areas would be protected by new flood embankments. "Managed realignment" will not only mitigate the biodiversity impacts of coastal squeeze, it will also reduce flood risk elsewhere along the North Kent coast as sea levels rise.	The EA's "The Medway Estuary and Swale Strategy - A Summary of Consultation Responses - Report – MMD-347800-S-RE-005-C", section 4.2 (Comments on specific Benefit Areas) document states that, "Should the plans for the solar farm at Cleve Hill be approved and this moves forward to construction, the following will replace the current policy: • We [the EA] will not take responsibility for continued maintenance of the defences in this area. • A Managed Realignment site would be proposed in the longer term following the lifetime of the solar farm". As such, the Development is not in conflict with most recent version of the MEASS.
	We understand that the EA and CHSP have agreed that CHSP will take on maintenance of the coastal defences for the life of the solar farm (up to 40 years?) and this is reflected in the extension of the proposed DCO site boundary up to the sea wall.	See response above.
	We are concerned as to how this arrangement will be secured and maintain the expected standards of flood protection over the life of the MEASS (up to the year 2118). Accordingly, we would like further information on how CHSP's commitment to flood protection will be secured. Will CHSP provide a financial bond to ensure that flood defence funding is available if they vacate the site? What will be the approach to coastal flood risk management once decommissioning of the solar development occurs?	The Environment Agency's MEASS strategy sets out an anticipated approach to coastal flood risk management over the next 100 years. Without the presence of the solar park, the EA expects to cease maintenance of the existing defences sometime between 20 and 50 years in the future in order to facilitate a managed realignment of the existing defences on the site. With the presence of the solar park, the EA expects to cease maintenance of the defences earlier, on the basis that the maintenance will be carried out by the main beneficiaries of it (those who own assets which are protected by the coastal defences). No formal commitment to providing flood protection is required from CHSP, as it is clearly in their interests to maintain them in order to protect the solar farm as an asset. Powers will be sought in the Development Consent Order for the operator of the solar farm to be able to effectively take over the EA's maintenance role on the flood defence. The MEASS is expected to set out a "Plan B" scenario should the Development be constructed, which is likely to shift the expected timescales for managed realignment to between 50 and 100 years in the future. The majority of Cleve Hill Solar Park is designed to withstand an overtopping of the existing defences taking into account future projections of sea level rise and extreme events. Only the electrical compound is designed to withstand a breach of the existing defences. It is therefore clearly in the asset owner's interest to maintain the

Date	Consultee and Response	Action
		current standard of defences, to at least the same standard that the EA currently do. This represents a significant investment in maintaining the current standard of protection over the operational lifetime of the project. Upon decommissioning, decisions relating to coastal flood risk management and specifically the ongoing maintenance of the defences in this area would revert to the EA, in consultation with any beneficiaries at that time. It is also relevant that the EA do not currently have an obligation to maintain the existing defences.
	Surface water flooding is also a concern. Our concern is based on two points: · The PEIR says that groundwater is evident about 1 metre below the surface and so the "normal" range of SUDS (sustainable drainage) measures are not likely to be effective over much of the site.	Due to the presence of groundwater at 1 m depth infiltration SuDS are unlikely to be effective and have therefore been discounted as a viable option to attenuate surface water. SuDS proposed are to attenuate surface water run-off rates before discharge back into the hydrological network not to serve as infiltration structures. SuDS also serve to manage the quality of run-off and limit the potential for pollution and have been demonstrated to be effective in environments with low permeability. The area in which the Development is located is essentially flat and is drained by a series of agricultural ditches, meaning that any ponding surface water is unlikely to be transferred to adjacent land.
	The design and layout of the solar arrays comprises large blocks of mounting structures and arrays without intervening gaps and the "drip lines" associated with "traditional solar array layouts (the surface area to drip line length ratio is much smaller).	Each table of panels will comprise several PV modules, with dimensions typically as set out in the ES chapter 5. Each module will be of the order of 1m by 2m, and water will drip off each module (there will be small gaps between modules). This means that the surface area to drip line length ratio will be the same as for "traditional" solar array layouts, which use the same modules. Theoretically the introduction of PV panels will increase the run off rates due to the presence of the impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Core Study Area it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed.
	The combination of these two points suggests that rain water will drain off hard surfaces at fewer points and will go onto ground with very limited capacity to absorb it. The PEIR (pp 10-39) says that "surface water run off rates will potentially	Due to the presence of groundwater at 1 m depth infiltration SuDS are unlikely to be effective and have therefore been discounted as a viable option to attenuate surface water. SuDS proposed are to

Date	Consultee and Response	Action
	increase by 37.6% over the baseline". We are concerned that, in intense rainfall events, this could cause surface water flooding problems and would like reassurance that this will be properly handled and in particular will not cause problems for adjacent land owners. Even in current conditions, surface water sometimes sits on the land for days on end.	attenuate surface water run-off rates before discharge back into the hydrological network not to serve as infiltration structures. SuDS also serve to manage the quality of run-off and limit the potential for pollution and have been demonstrated to be effective in environments with low permeability. Theoretically the introduction of PV panels will increase the run off rates due to the presence of the impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the core Study Area it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed. Additionally, the area in which the Development is located is drained by a series of agricultural ditches, meaning that any ponding surface water is unlikely to be transferred to adjacent land.
July 2018	**GREAT Graveney**	
	The CHSP site is within Environment Agency's (EA) Flood Zone 3a and therefore at high flood risk. The flood risks on this site are sea flooding, tidal flooding and surface water flooding. The flood risk has been the subject of extensive analysis and consultation with the statutory authorities.	No action required.
	The EA's draft Medway Estuary and Swale Strategy (MEASS) has recently been the subject of consultation. It proposes to "hold the line" along the Graveney Marshes frontage (area BA6.2 in the Strategy) by maintaining the existing coastal defences for the next 20 years , but then switching to a "managed realignment policy" allowing the site to mitigate against coastal squeeze elsewhere. In effect, this would mean the gradual replacement of arable farmland with coastal grazing marsh which could be flooded at times. Other areas would be protected by new flood embankments. "Managed realignment" will not only mitigate the biodiversity impacts of coastal squeeze, it will also reduce flood risk elsewhere along the North Kent coast as sea levels rise.	The Environment Agency's "Medway Estuary and Swale Strategy - A Summary of Consultation Responses - Report – MMD-347800-S-RE-005-C", section 4.2 (Comments on specific Benefit Areas) states that, "Should the plans for the solar farm at Cleve Hill be approved and this moves forward to construction, the following will replace the current policy: • We will not take responsibility for continued maintenance of the defences in this area. • A Managed Realignment site would be proposed in the longer term following the lifetime of the solar farm". As such, the Development is not in conflict with most recent version of the MEASS. Under the MEASS the preferred option is to allow managed retreat after the decommissioning of the Development.

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	CHSP have attempted to influence the consultation on the MEASS without even yet having applied for a DCO. The area from Faversham to Seasalter is identified in the Shoreline Management Plan as an area where Managed Realignment could lead to biodiversity opportunities – specifically by changing from its current agricultural purpose to a more dynamic habitat such as saltmarsh (p22 IGSF-SMP-Report.pdf[1]). The specific SMP information for the land says: "Realignment would create a coast that will not require ever increasing expenditure to maintain in the coming centuries, create important brackish and saline habitats, negate the impact of coastal squeeze and reduce the risk of uncontrolled flooding." (p73 Statement_4a07A.pdf[2]). If this land is no longer available for this environmentally-enhancing habitat creation purpose, then other land will be required instead.	See previous point.
	It appears that EA and CHSP have discussed that CHSP would take on maintenance of the coastal defences for the life of the solar farm (up to 40 years ?) and this is reflected in the extension of the proposed DCO site boundary up to the sea wall.	No action required.
	Without a DCO in place, what gives the CHSP grounds for trying to influence Kent's flood strategy?	CHSPL is seeking to secure the existing level of protection which the Development site benefits from throughout the operational lifetime of the Development. CHSPL is not seeking to influence Kent's flood strategy.
	What will CHSP do to compensate for the waste of time and unnecessary disruption to the MEASS consultation in the event that a DCO is not granted?	CHSPL responded to the EA MEASS consultation as part of their wider public consultation on the strategy. The response has prompted the EA to consider alternative proposals in respect of different scenarios in the MEASS which is one of the reasons for undertaking such a consultation.
	What alternative land will CHSP make available to offset the loss of these future important habitats?	The EA is responsible for producing and implementing the MEASS.
	The area proposed for the solar facility is currently part of the Environment Agency's	This is a partial sentence, it is unclear what the point was to respond to.
	How will this arrangement be secured to maintain the expected standards of flood protection over the life of the MEASS (up to the year 2118)?	The Environment Agency's MEASS strategy sets out an anticipated approach to coastal flood risk management over the next 100 years. Without the presence of the solar park, the EA expects to cease maintenance of the existing defences sometime between 20 and 50 years in the future in order to facilitate a managed realignment of the existing defences on the site. With the presence of the solar park, the EA expects to cease maintenance of the defences earlier, on the basis that the maintenance will be carried out by the main beneficiaries of it (those who own assets which are protected by the coastal defences), as it is clearly in their interests to do so. The

Date	Consultee and Response	Action
		MEASS is expected to set out a "Plan B" scenario should the Development be constructed, which is likely to shift the expected timescales for managed realignment to between 50 and 100 years in the future. The majority of Cleve Hill Solar Park is designed to withstand an overtopping of the existing defences taking into account future projections of sea level rise and extreme events. Only the electrical compound is designed to withstand a breach of the existing defences. It is therefore clearly in the asset owner's interest to maintain the current standard of defences, to at least the same standard that the EA currently do. This represents a significant investment in maintaining the current standard of protection over the operational lifetime of the project. Upon decommissioning, decisions relating to coastal flood risk management and specifically the ongoing maintenance of the defences in this area would revert to the EA, in consultation with any beneficiaries at that time. It is also relevant that the EA do not currently have an obligation to maintain the existing defences.
	How will CHSP's commitment to flood protection be secured?	Flood defence maintenance is an integral part of the DCO application and is likely to be the subject of DCO Requirement(s), the NSIP equivalent of planning conditions.
	Surface water flooding is also a concern. Concerns are based on two points:	No action required.
	·The PEIR says that groundwater is evident about 1 metre below the surface and so the "normal" range of SUDS (sustainable drainage) measures are not likely to be effective over much of the site	Due to the presence of groundwater at 1 m depth infiltration SuDS are unlikely to be effective and have therefore been discounted as a viable option to attenuate surface water. SuDS proposed are to attenuate surface water run-off rates before discharge back into the hydrological network not to serve as infiltration structures. SuDS also serve to manage the quality of run-off and limit the potential for pollution and have been demonstrated to be effective in environments with low permeability.
	The design and layout of the solar arrays comprises large blocks of mounting structures and arrays without intervening gaps and the "drip lines" associated with "traditional solar array layouts" (the surface area to drip line length ratio is much smaller)	Each table of panels will comprise several PV modules, with dimensions set out in the ES chapter 5. As per the candidate design, each module will be of the order of 1m by 2m, and water will drip off each module (there will be small gaps between modules). This means that the surface area to drip line length ratio will be the same as for "traditional" solar array layouts, which use the same modules. Theoretically the introduction of PV panels will increase the run off rates due to the presence of the

Date	Consultee and Response	Action
		impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Site it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed.
	The combination of these two points suggests that rain water will drain off hard surfaces at fewer points and will go onto ground with very limited capacity to absorb it. The PEIR (page 10-39) says that "surface water run-off rates will potentially increase by 37.6% over the baseline".	Theoretically the introduction of PV panels will increase the run off rates due to the presence of the impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Site it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed.
	What strategies would be employed when, in intense rainfall events, surface water flooding will present problems?	The site infrastructure is designed to remain above and function to a 1:1000 year plus climate change wave overtopping scenario, therefore it is unlikely an intense rainfall event could replicate the same water level. Due to the flat topography and implementation of seeding the Development area with grass and wildflower the strategy in the event of an intense rainfall event is for the surface water to infiltrate.
	How will the prevention of flooding of adjacent land be dealt with?	There are no plans to increase the height of the existing flood defences, therefore the coastal risk to adjacent land is the same as the baseline scenario. Theoretically the introduction of PV panels will increase the surface water run off rates due to the presence of the impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Site it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed.
July 2018	**Kent County Council**	
	KCC as Lead Local Flood Authority (LLFA) notes that within Volume 1, Chapter 10 of the PEIR report, environmental effects such as increased	The PEIR assessed the potential for surface water pollution measures such as silt trap and buffer strips which will minimise

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	surface water runoff and potential transfer of pollutants to surface water during construction are mentioned. However, there is no elaboration of what these effects will be and no mention of surface water drainage. KCC recommends full consideration is given to the method of removing pollutants and to the cleanliness of the water discharged from the site, when compiling the Flood Risk Assessment/Drainage Strategy.	sedimentation and erosion; further details of these measures are outlined in the ES, Technical Appendix A5.4, sections 2, 6 and 7. These measures will protect the hydrological environment during the construction phase. Subsequent communication with KCC has indicated that attenuation for the compound is unlikely to be required and that measures such as seeding the entirety of the area under the PV arrays is likely to be sufficient to control surface water run-off rates compared to the baseline scenario.
June 2018	**Marine Management Organisation**	
	The MMO was established by the Marine and Coastal Access Act 2009 (the "2009 Act") to make a contribution to sustainable development in the marine area and to promote clean, healthy, safe, productive and biologically diverse oceans and seas.	No action required.
	The responsibilities of the MMO include the licensing of construction works, deposits and removals in English inshore and offshore waters and for Welsh and Northern Ireland offshore waters by way of a marine licence1. Inshore waters include any area which is submerged at mean high water spring ("MHWS") tide. They also include the waters of every estuary, river or channel where the tide flows at MHWS tide. Waters in areas which are closed permanently or intermittently by a lock or other artificial means against the regular action of the tide are included, where seawater flows into or out from the area.	No action required.
	In the case of Nationally Significant Infrastructure Projects ("NSIPs"), the 2008 Act enables Development Consent Order's ("DCO") for projects which affect the marine environment to include provisions which deem marine licences.	No action required.
	As a prescribed consultee under the 2008 Act, the MMO advises developers during pre-application on those aspects of a project that may have an impact on the marine area or those who use it. In addition to considering the impacts of any construction, deposit or removal within the marine area, this also includes assessing any risks to human health, other legitimate uses of the sea and any potential impacts on the marine environment from terrestrial works.	No action required.
	Where a marine licence is deemed within a DCO, the MMO is the delivery body responsible for post-consent monitoring, variation, enforcement and revocation of provisions relating to the marine environment. As such, the MMO has a keen interest in ensuring that provisions drafted in a deemed marine licence ("dML") enable the MMO to fulfil	No action required.

Date	Consultee and Response	Action
	these obligations.	
	It is proposed that the Cleve Hill Solar Park would consist of solar photovoltaic panels, along with inverters and cables and battery storage. The electricity generated and stored would connect to the existing National Grid substation, located to the east of the proposed Cleve Hill Solar Park site, from where it will enter the national grid. An area of the site to the north east of the site is proposed to be dedicated as a managed habitat area for birds. Maintenance works may also be required during the operational lifetime of the project to the sea defence beneath the Saxon Shore Way, which is located along the north and west boundaries of the site. Although not initially consulted on the scoping completed as part of this development, a change of site boundary means that the works now fall partially below Mean High Water Springs, and therefore within the MMO's remit.	No action required.
	The MMO has reviewed the consultation documents received 31/05/2018 and sets out our initial comments below. The MMO reserves the right to make further comments on the Project throughout the pre-application process and may modify its present advice or opinion in view of any additional information that may come to our attention.	No action required.
	1.1. It is understood that the MMO were not consulted on the original scoping opinion for the project, as the site boundary was entirely above MHWS. It has subsequently been identified that there is a requirement to maintain coastal flood defences as set out in section 5.2 of the Preliminary Environmental Information Report (PEIR) (May 2018). These flood defence works are below MHWS, therefore fall under the remit of the MMO.	No action required.
	1.2. The MMO understands that the applicant is in discussions with the Environment Agency with regard to the above flood defence works. Should these works be carried out by, or on behalf of the Environment agency, it is possible that they would be exempt from requiring a Marine Licence, and therefore would withdraw MMO's obligations relating to any potential DCO.	CHSPL considers that the DCO may modify the EA's marine licence exemption so that it applies to CHSPL for the purposes of maintenance works to the flood defence. The MMO agrees that a DCO may modify existing legislation. However, the MMO has not decided whether it supports or opposes the modification of the exemption and has invited CHSPL to include a deemed marine licence (DML) in the DCO. Therefore, the draft DCO included with the application proposes two solutions for consideration by the Secretary of State in this regard: (a) it includes an exemption from the requirement for a Marine Licence in respect of undertaking maintenance works to these defences; and

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		(b) as an alternative, it includes a DML.
	1.3. It is up to the applicant to determine whether the activity satisfies the exempted activities criteria – this can be found on the MMO website at: https://www.gov.uk/government/publications/marine-licensing-exempted-activities/marine-licensing-exempted-activities.	See comment above.
	1.4. Should the works below Mean High Water Springs not meet the above criteria, then MMO would look to carry out its obligations relating to post-consent monitoring, variation, enforcement and revocation of provisions relating to the marine environment. Should this be the case, we would recommend early engagement with the MMO to ensure our requirements are fully met within any potential DCO with a view to agreeing a Statement of Common Ground prior to the commencement of Examination, should the application be Accepted.	See comment above – the Applicant has continued consultation with the MMO up to the point of submission of the application.
July 2018	**Lower Medway IDB**	
	Generally I have no issue with the solar park idea. The design and any proposed works need to take into account that IDB Land Drainage Consent will be needed for any works within 8m of the IDB adopted watercourse. You need to be mindful of the Board Byelaws which I have attached for your information. Any culverting or alterations to any of the ditches and water bodies on the site will also require the LMIDB's written consent.	The Development has been designed in accordance with the IBD byelaws. Land Drainage Consent applications will be made by the contractor before construction commences as appropriate.
July 2018	**The Faversham Society**	
	These marshes are a protective floodplain for Faversham. The seawall is currently the responsibility of the Environment Agency and therefore under democratic control. If the Agency were to delegate responsibility to the operators of the site for the flood defences, they would be able to raise the height of the wall at will in order to protect their assets. This lack of public accountability for such important actions is unacceptable. We also have concerns about the impact of insulating such a large area of land from inundation – most particularly on increasing the flood risk in Faversham town - already prone to flooding. The marsh area has long been a coastal floodplain which protects Faversham.	The Site does not act as functional floodplain and is protected by existing flood defences to the north and west, and hence does not store flood water and protect Faversham from flooding. The EA currently have responsibility for the maintenance of the defences and have agreed that the operator of the Development should economically contribute to the future maintenance of the defences. Given that the existing defences provide a level of protection up to the 1:1000 year flood event, there is no requirement for the defences to be raised beyond their current height.
	Proper quantitative modelling of the long-term risks of the flooding of our town and surrounding villages is required.	The ES, Technical Appendix A10.1 includes an appendix that provides robust quantitative modelling of the current and future flood risk for the Site. The methodology and the conclusions of this assessment have been approved by the EA as the competent regulatory body responsible for commenting on tidal flood

Date	Consultee and Response	Action
		risk. The protection from flooding of the Site will not affect off-site locations relative to the baseline situation.
	In addition, it is our understanding that a large battery area (apparently the size of 15 football pitches) that developers intend to construct, will be built so as to block the existing drainage ditch which separates Graveney and Cleve Marshes. Moreover, the whole area is to be surrounded by a high earth bund. This will increase the risk of flash-flooding across and more particularly beyond the site in the downpours that are occurring with increasing frequency.	The proposed compound dimensions are set out in the ES, chapter 5. A section of drainage ditch will be diverted to accommodate the compound. As outlined in the ES, chapter 10, section 10.5, the diverted ditch dimensions will be the same or better than the baseline scenario, i.e. the existing ditch, ensuring no loss of flow conveyance. The earth bund will protect the compound in the unlikely event of a breach in the existing flood wall to the north of the Site. Measures to control surface water run-off to greenfield rates within the compound area are outlined in Technical Appendix A10.1 of the ES. Additionally, the outer facing slopes of the bund will be planted and vegetated, which is likely to limit the potential for rainwater to be transferred rapidly to the surrounding area, therefore there will be no increase in surface water run-off rates from the compound.
	Developers propose to create what they have called 'grazing land' under the panels with a mix of grasses and wildflower species. They propose the grazing of sheep. Even if this were to prove possible, such plans are less than adequate compensation for the loss of such a large, grazing marsh so productive of wildlife.	The ES, chapter 8 (Ecology) sets out that there will be a net biodiversity gain from the Development. The solar panel areas are principally on areas of land currently used for arable farming.
	The solar panels will prevent the soil from absorbing rainwater and will concentrate the flows so that rainwater will cascade onto the ground, causing soil erosions and general degradation. Moreover, the Society has yet to be assured that the ground beneath the panels will have sufficient sunlight to permit much vegetation and therefore animal life beneath the canopy of panels. We have seen no evidence to allay our fear that a 'desert' will be created over a very large area. Comparison with other solar panel sites is of little relevance because of the size, height and density of panels proposed for Cleve Hill.	The solar panels will not 'prevent soil from absorbing rainwater' as the panels will not be placed directly on the ground. The same area of soil will be available for infiltration. Theoretically the introduction of PV panels will increase the run off rates due to the presence of the impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Site it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed.
	The site is in a high-risk area for flooding, being in flood zone 3a. Therefore, the Sequential Test and the Exception Test have been applied. At paragraph 101 of the NPPF advises: 'The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower	The ES, Technical Appendix A10.1 (FRA), section 8.1, concludes that the Development meets the requirements set out in Table 3 of the Planning Practice Guidance and meets the requirements of the Sequential Test. The Environment Agency has accepted this finding in a separate consultation response.

Date	Consultee and Response	Action
	probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.'	
	The site is vulnerable to flooding by the sea and is defended from flooding at present by the sea wall. The developers state that they have considered the need for a connection to the National Grid and they have found no other site in Kent that is suitable that is within flood zones 1 or 2. The Faversham Society considers that part of the reason they have found this to be the case is that the proposal is so large that only a site in this location can satisfy the requirement.	Section 8.1 of the FRA submitted as part of the PEIR concludes that it is considered that the Development meets the requirements set out in Table 3 of the Planning Practice Guidance and meets the requirements of the Sequential Test.
	Given your intention to take ownership of the seawall, how does the Environment Agency retain responsibility and accountability for environmental protection?	CHSPL is seeking to secure the necessary rights to undertake maintenance of the seawall, CHSPL is not seeking ownership of the seawall. The EA will retain responsibility and accountability for environmental protection through existing (and future) legislation such as the Environmental Protection Act.
	How does the Environment Agency retain responsibility and accountability for flood protection of Faversham and the surrounding area?	There are three tiers of coastal defence planning which guide EA and lead local flood authority decision making in respect of flood protection: Shoreline Management Plans identifying general policies and general implementation; Strategy (the MEASS in the case of Faversham and the surrounding area, which is expected to take into account the potential presence of the Development) which identifies the nature and timing of works to be undertaken; and Schemes which are the design and construction of capital works and maintenance.
	Are the developer's proposals for managing the seawall consistent with the Medway Estuary and Swale flood and coastal risk management strategy?	The EA's "The Medway Estuary and Swale Strategy - A Summary of Consultation Responses - Report – MMD-347800-S-RE-005-C", section 4.2 (Comments on specific Benefit Areas) document states that, "Should the plans for the solar farm at Cleve Hill be approved and this moves forward to construction, the following will replace the current policy: • We [the EA] will not take responsibility for continued maintenance of the defences in this area. • A Managed Realignment site would be proposed in the longer term following the lifetime of the solar farm". As such, the Development is not in conflict with most recent version of the MEASS.

23. The following consultation has also been undertaken with consultees regarding the design of the Development, outlined in Table 10.1c.

Table 10.1c: Additional Consultation Undertaken

Consultee	Type and Date	Summary of Consultation Response	Action
KCC - Sustainable Drainage Team - Flood & Water Management	Telephone and email 01/08/2018 15/08/2018	Discussed the principles of the proposed drainage design and the acceptability of the current scheme. KCC advised contact with Lower Medway IDB to confirm no attenuation volume was required for the compound before discharging into their assets.	Lower Medway IDB were contacted to discuss the principles ofthe drainage measures prtoposed onsite. The feedback from discussions with the IDB were relayed to KCC for completness.
Lower Medway IDB	Telephone and email 08/08/2018	Discussed the principles of the proposed drainage design and the acceptability of the current scheme. Lower Medway IDB confirmed that proposed wildflower mix was an accepatble approach for the wider scheme and that attenuation volume is not required for the compound drainage design.	The compound drainage design and the propsals for a wildflower mix as a means to reduce surface water run-off rates has been infiormed by the discussion with the IDB.

10.2.2 Scope of Assessment

24. The key issues for the assessment of potential effects on the hydrological and hydrogeological resources relating to the Development include:

- Potential chemical pollution effects on the hydrological environment;
- Potential erosion and sedimentation effects on the hydrological environment;
- Potential impediments to stream flow;
- Potential effects on private water supplies;
- Potential changes in soil interflow patterns;
- Potential for the compaction of soils; and
- Potential for an increase in runoff and flood risk.

25. Effects during construction, operation and decommissioning have been assessed, as well as potential cumulative effects.

10.2.2.1 Elements Scoped Out of Assessment

26. The Phase 1 habitat survey has not identified any sensitive groundwater communities within the Core Study Area. Additionally, decades of agricultural practices have changed the function of the superficial geology cover. As such, effects on groundwater fed habitats have been scoped out of this assessment.

27. Southern Water provided maps showing an absence of their assets within the Core Study Area within their scoping response.

28. Given the absence of Southern Water assets within the Hydrological Core Study Area, potential effects on public water supplies have been scoped out of this assessment.

10.2.3 Baseline Survey Methodology

10.2.3.1 Desk Study

29. The desk study included:

- Identification of underlying geology and hydrogeology;
- Collation of data provided through consultations;
- Identification of groundwater vulnerability;
- Assessment of topography and slope characteristics;
- Identification of catchments, watercourses, springs and water features;
- Collation of data provided through consultations; and
- Collation of flood plain information and water quality data.

30. Reference was also made to the following sources of information:

- The Ordnance Survey (OS) 1:50,000 Landranger Map (Sheets 179 and 178);
- OS 1:25,000 Map (Digital);
- National River Flow Archive (NRFA)[22];
- EA Flood map for planning, 2018[23];
- Meteorological Office Rainfall Data[24]; and
- The British Geological Survey (BGS) Geology Map (Digital[25]).

10.2.3.2 Site Walkover

31. A site walkover was undertaken on 30th and 31st January 2018 to visually inspect surface water features and to obtain an understanding of the local topography and hydrological regime.

32. The site walkover covered the Hydrology Core Study Area, and an area of 300 m to the east to visually inspect flood defences. Weather conditions during the site walkover were changeable with minor precipitation events and extended periods of dry weather, whilst the preceding week had persistent rainfall.

33. Visits to properties identified to be served by Private Water Supplies were undertaken on 31st January 2018.

10.2.4 Methodology for the Assessment of Effects

34. The methodology outlined in this section of the ES has been developed by Arcus in consultation with the EA and Natural England. The assessment is based on a source-pathway-receptor methodology, where the sensitivity of the receptors and the magnitude of potential change upon those receptors identified within the study areas.

10.2.4.1 Sensitivity

35. The sensitivity of the receiving environment is defined as its ability to absorb an effect without perceptible change and can be classified as high, moderate or low. These classifications are dependent on factors such as the quality of the subsurface water within the receptor, their purpose (e.g., whether used for drinking, fisheries, *etc*.) and existing influences, such as land-use.

36. These criteria are outlined in Table 10.2 and are based on professional judgement and experience.

[22] Centre for Ecology and Hydrology (undated), National River Flow Archive. Available online at: http://nrfa.ceh.ac.uk/ [Accessed 06/03/2018].
[23] EA, (2017), Flood map for planning. Available online at: https://flood-map-for-planning.service.gov.uk/ [Accessed 01/02/2018].
[24] Met Office. Available online at: http://www.metoffice.gov.uk/public/weather/climate [Accessed 06/03/2016].
[25] Available for purchase from BGS at http://www.bgs.ac.uk/products/onshore/home.html?src=topNav [Accessed 06/03/201608/10/2018].

Table 10.2 Receptor Sensitivity Criteria

Receptor Sensitivity	Sensitivity Description
High	• A large, medium or small water body with an EA Quality classification of "High" or "Good" and / or a Current Chemical Quality classification of "Good"; • The hydrological receptor and downstream environment has limited capacity to attenuate natural fluctuations in hydrochemistry and cannot absorb further changes without fundamentally altering its baseline characteristics / natural processes; • The hydrological receptor is of high environmental importance or is designated as having national or international importance, such as Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs); • The hydrological receptor is designated for supporting ecological interest; • The hydrological receptor acts as an active floodplain or other flood defence; • The hydrological receptor will support abstractions for public water supply or private water abstractions for more than 25 people; • Abstractions used for the production of mass produced food and drinks. • Areas containing geological or geomorphological features considered to be of national importance (e.g., SSSIs); and / or • Local groundwater constitutes a valuable resource because of its high quality and yield, e.g., aquifer(s) of local or regional value, statutorily designated nature conservation sites (e.g., SACs and SSSIs) dependent on groundwater.
Moderate	• A large, medium or small water body with an EA Quality classification of "Moderate"; • The hydrological receptor and downstream environment will have some capacity to attenuate natural fluctuations in hydrochemistry but cannot absorb certain changes without fundamentally altering its baseline characteristics / natural processes; • The hydrological receptor is of regional environmental importance (such as Local Nature Reserves), as defined by the EA or NE; • The hydrological receptor does not act as an active floodplain or other flood defence; • The hydrological receptor supports abstractions for public water supply or private water abstractions for up to 25 people; • Areas containing geological features of designated regional importance including Regionally Important Geological/geomorphological Sites (RIGS), considered worthy of protection for their historic or aesthetic importance; • Aquifer of limited value (less than local) as water quality does not allow potable or other quality sensitive uses. Exploitation of local groundwater is not far-reaching; and / or • Local areas of nature conservation known to be sensitive to groundwater effects.
Low	• A large, medium or small water body with a EA Quality classification of "Poor" or "Bad" and / or a Current Chemical Quality classification of "Fail"; • The hydrological receptor and downstream environment will have capacity to attenuate natural fluctuations in hydrochemistry but can absorb any changes without fundamentally altering its baseline characteristics / natural processes; • The hydrological receptor is not of regional, national or international environmental importance; • The hydrological receptor is not designated for supporting freshwater ecological interest;

	• The hydrological receptor does not act as an active floodplain or other flood defence; • The hydrological receptor is not used for recreational use; • The hydrological receptor does not support abstractions for public water supply or private water abstractions; • Geological features or geology not protected and not considered worthy of specific protection; and • Poor groundwater quality and / or very low permeability make exploitation of groundwater unfeasible. Changes to groundwater not expected to affect local ecology.

10.2.4.2 Magnitude

39. The magnitude is determined by the timing, scale, size and duration of the potential effect resulting from the Development. The magnitude of potential effects can be classified as major, moderate, minor or negligible, as outlined in Table 10.3.

Table 10.3 Criteria for Determining Magnitude

Magnitude of Effect	Magnitude Description
High	• A short or long term major shift in hydrochemistry or hydrological conditions sufficient to negatively change the ecology of the receptor. This change would equate to a downgrading of an EA Quality classification by two classes, e.g., from "High" to "Moderate"; • A sufficient material increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with NPPF paragraphs 155 to 165); • A major (greater than 50 %) or total loss of a geological receptor or peat habitat site, or where there would be complete severance of a site such as to fundamentally affect the integrity of the site (e.g., blocking hydrological connectivity); • Major permanent or long term negative change (i.e., degradation of quality) to groundwater quality or a reduction in the available yield; • Major permanent or long term negative change to geological receptor; • Changes to quality or water table level will cause harm local ecology or will lead to flooding issue; • A major permanent or long term negative change to geological receptor, such as the alteration of pH or drying out of peat; and / or • Changes to groundwater quality or water table level that will negatively alter local ecology or will lead to a groundwater flooding issue.
Moderate	• A short or long term non-fundamental change to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change would equate to a downgrading of a EA water quality classification by one class, e.g., from "Good" to "Moderate"; • A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water; • A loss of part (approximately 15 % to 50 %) of a geological receptor or peat habitat site, major severance, major effects to its integrity as a feature, or disturbance such that the value of the site would be affected, but could still function; • Changes to the local groundwater regime may slightly affect the use of the receptor; • The yield of existing supplies may be reduced or quality slightly deteriorated; and / or • Fundamental negative changes to local habitats may occur, resulting in impaired functionality.

Magnitude of Effect	Magnitude Description
Low	• A detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change would not reduce the EA Current Ecological Quality classification; • A marginal increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with NPPF paragraphs 155 to 165); • A detectable but non-material effect on the receptor (up to 15 %) or a moderate effect on its integrity as a feature or where there would be a minor severance or disturbance such that the functionality of the receptor would not be affected; and / or • Changes to groundwater quality, levels or yields that do not represent a risk to existing baseline conditions or ecology.
Negligible[26]	• No perceptible changes to the baseline hydrochemistry or hydrological environment; • No change to the SEPA water quality classification; • No increase in the probability of flooding onsite and offsite; • A slight or negligible change from baseline condition of geological resources; and • Change hardly discernible, approximating to a 'no change' in geological condition.

10.2.4.3 Significance

40. The predicted significance of the effect is determined through a standard method of assessment and based on professional judgement, considering both the sensitivity of receptor and the magnitude of the potential effect as defined in Table 10.4. Effects of moderate significance or greater are considered significant in terms of the EIA Regulations.

Table 10.4 Significance Matrix

	Sensitivity of Resource or Receptor		
Magnitude of Effect	High	Moderate	Low
High	Major	Major	Minor
Moderate	Major	Moderate	Minor
Low	Moderate	Minor	Negligible
Negligible	Negligible	Negligible	Negligible

10.2.5 Cumulative Assessment Methodology

41. A cumulative effect is considered to be an additional effect on hydrological resources arising from the Development in combination with other proposed developments (either under construction, consented but not built or at application stage) likely to affect the hydrological environment. At distances greater than 5 km, it is considered that schemes are unlikely to contribute to a cumulative hydrological effect due to attenuation and dilution over distance of potentially polluting chemicals. Therefore, for the purposes of the assessment of potential cumulative effects on the immediate catchment and hydrological regime, only proposed developments within approximately 5 km of the Development have been considered. These developments have been identified through consultation with the relevant local authorities and statutory consultees, and are discussed in more detail in section 10.7.

[26]Negligible magnitude of change includes magnitude of effects that would be assessed as no change to the baseline scenario.

42. The methodology followed to assess cumulative effects is the same as that used for the Development in isolation.

10.2.6 Assessment Limitations

43. All data considered necessary to identify and assess the potential significant effects resulting from the Development was available and was used in the assessment reported in this chapter.

44. Baseline conditions were ascertained through site visits undertaken during a variety of weather conditions.

10.2.7 Embedded Development Design

45. Embedded Development design measures are set out within the Outline Construction Environmental Management Plan (CEMP; provided as Technical Appendix A5.4). The outline CEMP provides a framework for a final CEMP to be provided for approval as secured under the DCO, which will set out specific measures which relate to this Development. They will comprise good practice methods and works that are established and effective measures to which the Applicant will be committed through the development consent. Although the Outline CEMP is a draft and will evolve to take account of consultee feedback and detailed design prior to the construction phase, there is sufficient confidence in the effectiveness of the measures set out in the Outline CEMP for them to be treated as part of the Development for the purposes of this assessment. Measures and procedures outlined in the Outline CEMP will be adopted and incorporated into a single working document to be agreed with statutory consultees and the planning authority following consent by way of an appropriately worded planning condition. For ease of reference through this chapter, reference to specific sections in the Outline CEMP, detailing the appropriate embedded design measures, are provided.

46. Accordingly, the identification of likely significant effects from the Development is considered following implementation of the measures in Technical Appendix A5.4.

47. Arcus hydrology team has provided services for a large number of pre-construction, under construction and operational solar farm developments and has worked closely with statutory agencies such as the EA, Natural England, other regulatory bodies and Local Authorities to develop appropriate survey and assessment methods.

48. This approach has received positive comments from consultees for proposing appropriate embedded design on a project specific basis.

49. Conclusions, therefore, state whether the residual significance will be major, moderate, minor or negligible, once appropriate mitigation (beyond that specified in the Outline CEMP) has been implemented. This assessment relies on professional judgment to ensure that the effects are appropriately assessed.

50. A residual effect is considered to be a likely significant effect in accordance with the EIA Regulations if assessed as moderate or major following the preceding methodology.

10.2.7.1 Good Practice

51. Good practice will be followed in all aspects of construction, operation and decommissioning, specifically through a Pollution Prevention Plan (PPP), which will be incorporated into a final CEMP (based on the Outline CEMP presented in Technical Appendix A5.4), which under the draft DCO would have to be approved by the local planning authority in consultation with the EA prior to commencement of the construction phase.

52. The PPP will set out measures to be employed to avoid or mitigate potential pollution for all phases of the Development, and will also include an Incident Plan to be followed should a pollution event occur. This plan will be produced following consultation and agreement with EA and all appropriate personnel working on the construction site will be trained in its use. The Construction Project Manager will have specific responsibility for implementation of the CEMP.

53. Method statements will also be applied, which will follow the principles laid out in relevant CIRIA guidance and the principles of the archived EA Pollution Prevention Guidelines.

10.3 Baseline Conditions

10.3.1 Topography and Land Use

54. Topography within the Hydrology Core Study Area is generally flat. Data obtained from a topographical survey indicates that the majority of levels across the Hydrology Core Study Area vary between 1 m Above Ordnance Datum (AOD), in the northern section of the Hydrology Core Study Area, and 4.5 m AOD in the south. Isolated areas, such as those the south of the Core Study Area (in proximity to Graveney Hill), slope up to 15 m AOD.

55. The Hydrology Core Study Area is predominantly used for intensive arable farming in large fields, mostly divided by parallel drainage ditches draining from south to north, before discharging into a land drain to the north.

56. All land within the Hydrology Core Study Area is used for arable farming and winter stubble with exposed soils was evident across the majority of the Hydrology Core Study Area during the site walkover.

57. Habitats are described in detail in Chapter 8: Ecology.

58. There are a number of existing access tracks within the Hydrology Core Study Area, with the majority being located adjacent to land drains, as shown in Plate 10.1.

Plate 10.1 Existing Access Tracks within Hydrology Core Study Area

59. Areas of hardstanding were observed in the southern section of the Hydrology Core Study Area, as shown in Plate 10.2.

Plate 10.2 Hardstanding in the southern section of the Hydrology Core Study Area

60. The London Array Substation is located immediately to the south of the Hydrology Core Study Area, while the export cables from the London Array Offshore Wind Farm and 400 kV electrical transmission lines and associated pylons traverse the central section of the Hydrology Core Study Area.

61. Corrugated plastic drainage pipes were observed discharging into a lateral drainage ditch within the export cable corridor, indicating manmade drainage infrastructure has been introduced into this area, as shown in Plate 10.3.

Plate 10.3 Corrugated plastic drainage pipes and markers draining export cable corridor

62. No other land drainage pipes were observed within the Hydrology Core Study Area, with the exception of an IDB maintained drain (identified by the IDB as Graveney Church Drain) in the south.

63. Watercourses, land drains and associated catchments are illustrated in Figure 10.4.

10.3.2 Climate

64. The National River Flow Archive (NRFA) reports Average Annual Rainfall (AAR) of 721 mm at the White Drain at Fairbrook Farm gauging station[27], approximately 2.6 km south of the Hydrology Core Study Area. This is a typical value for the region, with the Great Stour at Wye gauging station[28] approximately 17 km south of the Core Study Area, reporting 751 mm AAR.

65. As monthly long-term climate data is not freely available from the NRFA, long term average rainfall data (1981 to 2000) obtained by the Meteorological Office at the Faversham gauging station[29], approximately 4.2 km to the southwest of the Hydrology Core Study Area, are presented in Table 10.5.

Table 10.5 Long-term average rainfall data (1981 to 2000), Faversham gauging station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	62.2	42.2	41.3	42.9	50.0	39.0	40.0	51.2	61.6	83.2	68.8	63.4

66. The Centre for Ecology and Hydrology provide more recent rainfall data[30] estimates for the Wider Study Area as shown in Table 10.6.

[27] http://nrfa.ceh.ac.uk/data/station/spatial/40015
[28] http://nrfa.ceh.ac.uk/data/station/spatial/40008
[29] https://www.metoffice.gov.uk/public/weather/climate/u10eu40xb
[30] https://eip.ceh.ac.uk/apps/rainfall/gb.html

Table 10.6 2015 rainfall data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	64.2	41.3	14.4	10.4	39.5	16.7	53	103.5	76.4	42.5	42.6	44.6

10.3.3 Solid Geology

67. An illustration of the solid geology is shown in Figure 10.2.

68. Information from the British Geological Survey (BGS) mapping indicates that the Hydrology majority of the Core Study Area is underlain by clay and silt of the London Clay formation. Minor sections in the west and south are underlain by sand and gravel of the Harwich formation.

69. The scoping response from KCC indicates that the Hydrology Core Study Area is within a Minerals Safeguard Area (MSA) with the safeguarded economic minerals being Sub-Alluvial River Terrace Deposits and Brickearth (Faversham - Sittingbourne Area).

70. No geological faulting exists within the Hydrology Core Study Area.

71. BGS data indicates that no mass movement of solid geology has occurred within the Hydrology Core Study Area.

72. Trial pits and boreholes were sunk within the Hydrology Core Study Area by F Howland Associates Limited in March 2018. The borehole logs indicate that clay layers ware encountered at depths between 0.3 m and 0.7 m BGL. SI/GI borehole logs and trial pit logs are presented in Technical Appendix A10.2.

10.3.4 Superficial Geology

73. A map of the superficial geology is shown in Figure 10.3.

74. BGS superficial data shows that the majority of the Hydrology Core Study Area is underlain by Alluvium (clay, silt, sand and peat) with a minor section in the south underlain by Head.

75. Site observations indicate that soils underlying the Hydrology Core Study Area are relatively homogenous and contain sand and clay, as shown in Plate 10.4.

Plate 10.4 Agricultural Clay soils within the Hydrology Core Study Area

76. SI/GI borehole logs and trial pit logs confirm that superficial cover consists of clays with gravel and sand to depths of between 7.5 m and 10.0 m BGL. SI/GI borehole logs and trial pit logs are presented in Technical Appendix A10.2.

10.3.5 Contaminated Land

77. Desk studies have not highlighted landfill sites within the Hydrology Core Study Area[31], however records show that the historical use of the Hydrology Core Study Area may give rise to isolated areas of contamination, primarily in relation to dwellings that have been built at Crown Cottages and Cleve Farm.

78. The Cleve Hill Solar Park, Kent Phase 1 Preliminary Site Assessment, provided in Technical Appendix A10.3, notes that there is potential for contamination from the demolition of Cleve Cottage.

79. Additionally, the historic use of sheepwashes within the Hydrology Core Study Area is noted in the report as a potential source of contamination.

80. Historic mapping[32] indicates that seven sheepfolds are present in the Hydrology Core Study Area and are all located immediately adjacent to drainage ditches.

10.3.6 Hydrogeology

81. The Hydrogeological Map of England and Wales (1:625,000 scale) (1977), shows the study area to be underlain by rocks described as "*Rocks with essentially no groundwater - Predominantly clayey sequence up to 140 m thick confining underlying aquifers. Occasional springs at base have very hard water*".

[31] EA Landfill Map Dataset
[32] https://www.old-maps.co.uk/#/Map/601500/161500/12/100762

82. The EA Groundwater Protection dataset[33] indicates that the Hydrology Core Study Area lies outside Protection Zones 1, 2 and 3.

83. The superficial deposits of Alluvium are classified as a Secondary Undifferentiated Aquifer, with the bedrock geology of the London Clay formation classified as unproductive strata.

84. The EA River Basin Management Plan (RBMP) map does not attribute a quality or ecological class to the groundwater body underlying the Hydrology Core Study Area.

85. A small section of the Core Study Area (in the west of the Site) and the Hydrology Wider Study Area is classified as the North Kent Tertiaries groundwater unit, which has an overall classification for 2016 as 'Poor'[34]. The groundwater body is noted as a Drinking Water Protected Area but cites groundwater abstraction from agriculture and industry as reasons for not achieving 'good' RBMP status and reasons for deterioration[35]. Whilst the minor area is classed as the North Kent Tertiaries groundwater unit it is sufficiently district from the wider groundwater unit as it is separated by Faversham Creek.

10.3.7 Surface Hydrology

86. There are no natural watercourses within the Hydrology Core Study Area.

87. Faversham Creek is located immediately to the west of the Hydrology Core Study Area, and drains from south to north before discharging into Whitstable Bay Coastal waters, as shown in Plate 10.5.

Plate 10.5 Faversham Creek with flood defence embankments (looking south)

88. Faversham Creek drains the Thames area of the River Basin Management Plan, and specifically White Drain and Lakes of the Kent North Management Catchment[36].

89. EA River Basin Management Plan data indicates that White Drain and Lakes has an Overall Waterbody Classification Level of 'Poor' for 2016 (Waterbody ID GB106040018560)[37].

[33] EA Groundwater Protection Zone Dataset [online] Available at: http://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue [Accessed 11/04/2018].
[34] http://environment.data.gov.uk/catchment-planning/WaterBody/GB40602G500200
[35] http://environment.data.gov.uk/catchment-planning/WaterBody/GB40602G500200
[36] http://environment.data.gov.uk/catchment-planning/ManagementCatchment/3063
[37] http://environment.data.gov.uk/catchment-planning/OperationalCatchment/3537

90. Whilst the intertidal area to the immediate north of the Hydrology Core Study Area is not designated as a Bathing Water area, West Beach at Whitstable, approximately 3.7 km east is designated for "Good" current water quality classification[38].

91. Figure 10.4 shows the main surface watercourses and their associated catchments within the Hydrology Wider Study Area.

10.3.8 Site Drainage

92. There are no natural watercourses within the Hydrology Core Study Area, which is drained by a network of anthropologically made cross drainage ditches which range from 1 m to 3 m in width and from 1 m to 2 m in depth.

93. During the site walkover, water levels within all ditches was low with very little flow observed. Several smaller ditches were stagnated and heavily vegetated with rushes and least duckweed, suggesting that flow has been slow for long periods and that the catchment does not respond rapidly to influxes of water.

94. All drains within the Hydrology Core Study Area discharge into a larger drain maintained by the IDB (within the Hydrology Core Study Area), which conveys water to Whitstable Bay Coastal waters via Nagden Sluice.

95. As part of the Graveney Marsh Water Level Management Plan (WLMP) the EA operate the Nagden Sluice (EA Asset ID: 265437), which consists of a tidal flap, a culvert through the defence and an in-channel stop board structure, as shown in Plate 10.6.

Plate 10.6 Nagden Sluice (EA Asset ID: 265437)

96. Nagden Sluice serves as the tidal outfall point for the majority of land drainage within the Hydrology Core Study Area and acts as the final water level control structure for Graveney Marsh[39].

[38] https://environment.data.gov.uk/bwq/profiles/profile.html?site=ukj4202-12100
[39] Email communication with EA

10.3.9 Hydrological Regime and Surface Water Morphology

97. The hydrological regime within the Hydrology Core Study Area is typical of lowland agricultural plains, primarily being drained by deep man-made ditches with slow water being transferred slowly to the wider hydrological system. All infrastructure is located within the catchment of the IDB drain to the north of the Hydrology Core Study Area, which in turn discharges into Whitstable Bay Coastal waters.

10.3.10 Surface Water Continuity

98. Surface drainage ditches in the Hydrology Core Study Area appear to be relatively continuous and free from natural blockages (such as trees / brash), although some ditches are heavily vegetated or stagnant, promoting the growth of weeds.

99. Several manmade concrete flow controls were observed within the Hydrology Core Study Area, as shown in Plate 10.7.

Plate 10.7 Manmade flow control structures within drains

100. Additionally, removable flow controls were observed within the IDB drain to the north of the Hydrology Core Study Area (draining east to west), as shown in Plate 10.8.

Plate 10.8 Removable flow control structure within IDB drain north of the Hydrology Core Study Area

10.3.11 Flooding

101. The Hydrology Core Study Area is classified by the EA as being located in Flood Zone 3a, an area described as having a "high probability" of flooding in the National Planning Practice Guidance "(the PPG")[40] section 'Flood Risk and Coastal Change', Table 1: *Flood Zones* but is identified as being located in an "Area Benefitting from Defences", as identified on the EA flood map.

102. The Hydrology Core Study Area is afforded flood protection in the form of a raised embankment with a concrete wall. Plate 10.9 shows a typical example with the concrete sea wall sitting on a clay bund with the seaward side protected by a block work apron.

[40] Department for Communities and Local Government (DCLG) (2014). "National Planning Practice Guidance" [online] Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/ [Accessed 02/03/2018].

Plate 10.9 Flood defences north of the Hydrology Core Study Area

103. The flood wall has a wave return profile and is in 'Good' and 'Fair' condition[41], although short sections are affected by differential settling. At the Sportsman Pub, approximately 50 m east of the Hydrology Core Study Area, the defence is a grass covered clay bund with a crest level of 5.7 m AOD that is set back but protected by a beach and high shingle ridge[42].

104. As outlined within section 7.3.9 of the North Kent Coastal Modelling Volume 2 - Isle of Grain, Medway, Swale up to and including Whitstable, the embankment and wall to the north of the Core Study Area provides protection from flooding up to the 1:1,000 year return period (2012 tidal).

105. Historical timber groynes are intermittently placed along the length of the defences but in most cases these do little to control beach movement[43].

106. Section 5.4.2 of the SFRA outlined details on flood defences within the area surrounding the Development. The defences around the mouth of Faversham Creek immediately northwest of the Core Study Area have a standard of protection up to a 1 in 100 year event while Faversham Creek is protected from tidal flooding up to a 1 in 10 year event.

10.3.12 Public Water Supplies

107. Desk studies have not identified any public water supply abstractions or Southern Water infrastructure within the Hydrology Core Study Area.

[41] EA condition rating (2015).
[42] http://www.se-coastalgroup.org.uk/media/north-kent/main-report.pdf
[43] http://www.se-coastalgroup.org.uk/media/north-kent/main-report.pdf

10.3.13 Private Water Supplies

108. During consultation at the scoping stage, SBC identified three abstractions for private water supply within 1 km of the Hydrology Core Study Area.

109. CCC responded to a data request stating that no PWS are registered within 1 km of the Hydrology Core Study Area, within their jurisdiction, while observations and anecdotal evidence from the site visit indicate that the Sportsman Pub has a PWS to supplement its mains water supply.

110. PWS within 1 km of the Hydrology Core Study Area include:

- Hollowshore House and The Shipwright's Arms, approximately 290 m southwest of the Hydrology Core Study Area;
- Edward Vinson Plant Ltd, approximately 685 m south of the Hydrology Core Study Area; and
- Ham Farm, approximately 790 m south west of the Hydrology Core Study Area.

111. More details and the assessment of these supplies is provided in section 10.5.1.12 of this Chapter.

10.3.14 Abstractions and Discharge Consents

112. Desk studies have indicated that there are five surface water abstractions in the east of the Hydrology Core Study Area, with 29 surface water abstractions recorded within 500 m of the Hydrology Core Study Area, all of which are used for general agriculture and authorised by the Environment Agency – Southern Region (as identified in Technical Appendix A10.3).

113. There are two discharge consents within 500 m of the Hydrology Core Study Area, both granted by the Environment Agency. Both are sewage releases, one into an unnamed tributary of the Swale (fresh water stream/river) and the other into a pond with no outlet.

10.3.15 Designations and Fisheries

10.3.15.1 Designations

114. There are 12 statutory designations relating to water within the Hydrology Wider Study Area, identified through the use of Natural England and JNCC GIS datasets, as shown in Table 10.7.

Table 10.7 Designations within the Hydrology Wider Study Area

Statutory Designated Sites			
Site Name	**Distance and Direction from the Hydrology Core Study Area**	**Description**	**Hydrologically Linked to Development?**
The Swale Ramsar/SSSI/SPA	Adjacent to the north, east and west	Complex of estuarine habitats (mudflats, saltmarsh and grazing marsh) supporting internationally notable assemblages of invertebrates, higher plants, and birds.	Yes – via Nagden Sluice
South Bank of the Swale Local Nature Reserve (LNR)	Adjacent to the north and west		Yes – via Nagden Sluice
The Swale Estuary	Approximately 10 m to the west, and	Designated as a Marine Conservation Zone in January 2016, the site is considered to be highly biodiverse	Yes – via Nagden Sluice

Statutory Designated Sites			
Site Name	**Distance and Direction from the Hydrology Core Study Area**	**Description**	**Hydrologically Linked to Development?**
Marine Conservation Zone (MCZ)	70 m to the north	and is known to be an important spawning and nursery ground for various fish species.	
Oare Marshes LNR	300 m to the north west	Traditional grazing marsh in Kent with reedbed and saltmarsh dissected by freshwater and brackish dykes.	Yes – via Nagden Sluice and then Whitstable Bay Coastal Waters
The Swale National Nature Reserve (NNR)	1.4 km to the north	Coast and grazing marsh habitats supporting significant populations of water birds.	Yes – via Nagden Sluice
Seasalter Levels LNR	1.5 km to the east	Part of the North Kent coast freshwater grazing marsh, it is also a valuable wetland site for wintering and migratory wildfowl.	No – outside surface water catchment and separated by railway line.
Foxes Cross Bottom LNR	3.5 km to the east	A mosaic of neutral grassland with scrub, native broadleaved woodland and other valuable habitats such as ponds, wet ditches and hedgerows.	No – outside surface water catchment and separated by railway line.
Ellenden Wood SSSI	3.6 km to the east	Coincident with part of the Blean Complex SAC, notified for its ancient woodland habitat supporting diverse flora, invertebrate and breeding bird community.	No – outside surface water catchment and separated by railway line.
Blean complex SAC	3.6 km to the east	Ancient woodland, specifically the Annex 1 habitat: Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli.	No – outside surface water catchment and separated by railway line.
Elmley NNR	4.3 km to the north west	Wide expanse of grazing marsh, divided by ditches and frequent shallow surface flooding which that home to large numbers of wintering wildfowl and breeding waders.	No – outside surface water catchment and separated by Whitstable Bay Coastal waters.
Blean Woods NNR	4.4 km to the south-east	Part of the largest ancient woodland in southern Britain, supporting diverse flora, invertebrate and bird populations.	No – outside surface water catchment and separated by railway line.
Church Woods, Blean SSSI	4.4 km to the south-east	Coincident with part of the Blean Complex SAC, notified for its ancient woodland habitat supporting diverse flora and invertebrates.	No – outside surface water catchment and separated by railway line.

115. All hydrologically-dependent designations are considered to be hydrologically disconnected from the Hydrology Core Study Area (in terms of surface and sub-surface water effects, as development is proposed in areas that are hydrologically down-gradient) or are of sufficient distance to remain unaffected by the Development, with the exception of the Swale Ramsar/SPA/SSSI/MCZ, South Bank of the Swale LNR and Oare Marshes LNR.

10.3.15.2 Fisheries

116. Section 4.1 of the Classification Of Bivalve Mollusc Production Areas In England And Wales - Sanitary Survey Report, Swale and Thames (Sheppey)[44] notes that there is a causeway approximately 595 m to the west of the mouth of Faversham Creek (770 m north west from the Hydrology Core Study Area) which allows easy access to the lower intertidal, where oysters of a market size are held prior to harvest. There is also another area, approximately 130 m to the north of the Hydrology Core Study Area, where the substrate is less muddy off the Graveney Marshes, where Hollowshore Fisheries also grow stocks of Pacific oysters. There are some Pacific oysters in Faversham Creek, but Hollowshore Fisheries do not require these to be classified due to the '*poorer water quality up this creek*'.

117. The Wildlife Trust identify that the Swale Estuary MCZ also contains greater pipefish[45].

10.3.16 Do Nothing Scenario

118. In the absence of the Development it is likely that the future baseline hydrochemistry conditions for all watercourses within the study will remain relatively constant, and that agricultural practices will continue to contribute to nitrates and phosphates entering the hydrological environment. This is likely to promote eutrophication as seen within the drainage ditches during the site walkover.

119. As outlined in Table 10.1a, the EA present three scenarios regarding the Core Study Area in relation to the MEASS. In the absence of the Development it is likely that the flood defences to the north of the Hydrology Core Study Area will be maintained for the next 20 years and then the EA may implement managed realignment of the defences with construction of new setback embankments, whereby the land behind the defences would be allowed to flood. This scenario relies on the implementation of measures outlined in the MEASS, which has yet to be agreed as part of the next stage of the MEASS.

120. Chapter 8: Ecology identifies that "no substantial habitat modifications or changes that could influence ecological interest at the Site are foreseen".

10.3.17 Information gaps

121. All data considered necessary to identify and assess the potential significant effects resulting from the Development as currently proposed were available and used in the assessment reported in this chapter.

10.3.18 Sensitivity of Receptors to Construction Effects

122. The sensitivities of the identified receptors, and their relationship to the potential effects from all phases of the Development, are outlined in Table 10.8.

[44] The Centre for Environment, Fisheries & Aquaculture Science (Cefas) (November 2013).
[45] http://www.wildlifetrusts.org/MCZ/the-swale-estuary

Table 10.8 Sensitivity of Hydrological Receptors

Receptor	Potential Effects	Sensitivity	Comment
Watercourses and Drainage Ditches	Increased run-off, erosion and sedimentation, stream flow impediments and pollution as a result of construction groundworks and chemical handling / storage.	High	Whilst the catchment in which the Development is located has Overall Waterbody Classification Level of 'Poor', the receptor is considered High sensitivity as drainage ditches within the Core Study Area drain into Whitstable Bay Coastal waters (overall receiving waterbody), which is designated as The Swale Ramsar/SPA/SSSI, South Bank of the Swale LNR and NNR, The Swale Estuary MCZ. Whitstable Bay Coastal waters is noted for fisheries interest (oysters). Abstractions from drainage ditches used for agricultural irrigation.
Coastal Waters	Erosion, sedimentation and pollution as a result of construction groundworks and chemical handling / storage.	High	Considered High sensitivity as Whitstable Bay Coastal waters is designated as The Swale Ramsar/SPA/SSSI. Whitstable Bay Coastal waters is noted for fisheries interest (oysters).
Groundwater	Pollution as a result of erosion and sedimentation from construction activities and uncontained spills from chemical handling / storage.	High	Considered High sensitivity as hydrocarbon pollution in bedrock fissures has a lengthy attenuation period. Groundwater is also used for potable and agricultural supply. Small section in west of site classed as a Drinking Water Protected Area.
Near-surface water	Diversion of near-surface flows as a result of track construction and the installation of turbine foundations / hardstanding.	High	Considered High sensitivity as near-surface water supplies flow to the drains within the Core Study Area, which in turn discharge into Whitstable Bay Coastal waters (classed as a High sensitivity receptor).
Soils / Superficial geology	Pollution as a result of track construction and chemical handling / storage.	Moderate	Considered Moderate sensitivity as the receptor has some capacity to filter and attenuate most potentially polluting chemicals and sediment over time.
Solid Geology (bedrock)	Loss of strata as a result of excavations.	Moderate	Considered Moderate sensitivity as the receptor is part of a Minerals Safeguarding Area. The bedrock underlying the Development is not of limited resource across England and can function normally throughout all phases of the Development.
Private Water Supplies	Pollution as a result of erosion and sedimentation from construction activities and uncontained spills from chemical handling / storage. Depletion or displacement of PWS source as a result of Development infrastructure.	Moderate	Considered Moderate sensitivity as the individual supplies support abstraction for up to 25 people.

10.4 Embedded Development Design

123. The following minimum buffer zone distances have been established for all infrastructure (with the exception of fence crossings, culverts and access tracks) and drainage ditches onsite:

- Non-IDB maintained ditches: 5 m; and
- IDB maintained ditches: 8 m.

124. Beyond this, the separation of construction ground-works from drainage ditches has been maximised, particularly from the IDB maintained ditches onsite.

125. The existing network of access tracks which serve the agricultural operations have been utilised, where possible, limiting the requirement to disturb soils and limit felling operations to access the Development. Where new access tracks are required they have been designed to avoid crossing drainage ditches, where possible. Further description of this is provided in Chapter 5: Development Description.

126. Ground preparation is necessary to establish a clean seed bed into which a grass seed mix can be sown. It is assumed that large-scale, mechanical ground preparation will not be possible once the solar arrays are installed. Grassland will be established by directly sowing a seed mix into the prepared ground prior to the construction phase.

127. The Outline CEMP, in Technical Appendix A5.4, describes water management measures and water quality monitoring measures that are embedded into the design of the Development to control surface water run-off and drain hardstanding and other structures during the construction and operation of the Development. This will include a PPP to be implemented for the Development.

128. The 5 m buffer of non-IDB maintained drains, the 8 m buffer of IDB drains, in conjunction with the measures set out in the Outline CEMP, will be sufficient to avoid potential effects on the hydrological and hydrogeological resource, as the effectiveness of the construction measures has been demonstrated on several solar farm construction sites for which Arcus have provided technical advice. The selected buffer distances from drains has also proved to be an effective sediment control measure for access track upgrades for a large scale construction project, on flat agricultural land, for which Arcus recently provided construction advice in proximity to IDB assets[46].

129. It is also noted that, currently, the fields within the Hydrology Core Study Area are typically used for arable farming, and are ploughed to within a closer distance of the ditches than the separations proposed for the Development. The "with Development" scenario is therefore likely to be better in terms of drainage than the baseline scenario. The "with Development" scenario also does not include application of nitrates to the land, which is carried out periodically in the baseline scenario, and this will lead to further improvements in water quality in the "with Development" scenario compared to the baseline scenario.

130. Access to the solar PV array during construction and operation will be taken from grassed tracks accessed from the spine road. Some temporary roadways may be used if conditions permit. This limits the potential for increased surface water runoff rates and sedimentation effects during construction.

131. Regarding flood risk, outputs from flood modelling (detailed in Technical Appendix A10.1) have informed the design of the Development. Based on a flood defence breach scenario for the 1 in 200 and 1 in 1,000 year event (projected for the lifetime of the Development), the following embedded design has been implemented:

[46] Goole Fields II Windfarm, Goole, East Riding of Yorkshire.

- Critical infrastructure within the Development (the electrical compound) has been designed to be resistant to a 1 in 1,000 year plus climate change (year 2070) defended breach (breach 2) event. To achieve the required level of protection, an uninterrupted flood protection bund with a height of 5.3 m AOD will encircle the substation and battery storage compound to protect the critical infrastructure against this type of event;
- Non-flood sensitive infrastructure forming the wider development (PV arrays, cabling, inverters and transformer stations) has been designed to be resilient to a 1 in 1,000 year plus climate change (year 2070) defended (wave overtopping) event; and
- A freeboard allowance of 300 mm has been applied to maximum flood depths for the 1 in 1,000 year breach scenario for the substation, in accordance with Table 2 of the Engineering Design Standard, EDS 07-0106 Substation Flood Protection (2016) and ETR138.

132. The design of the Development has ensured that the flood defences protecting the Development can be inspected and maintained by the operator of the Development to ensure their functionality throughout the lifetime of the Development.

10.5 Assessment of Potential Effects

133. The effect of the Development on hydrological receptors has been considered for the construction, operation and decommissioning phases of the Development. Effects occurring during construction and decommissioning are considered to be short term effects, with those occurring as a result of the operational phase of the Development being considered to be long term effects.

10.5.1 Potential Construction Effects

134. The nature and magnitude of effects that could result from construction activities, as described in Chapter 5: Development Description, are assessed in the following paragraphs, which includes:

- The use of existing access tracks from the current agricultural operations for the construction of the Development;
- Installation of the PV module array and racking system;
- Construction of a new access spine road, hardstandings, security fencing, CCTV masts, an electrical compound and permanent pyranometers;
- Construction of a bund around the electrical compound;
- Construction of substation foundations and a temporary construction compound within the electrical compound; and
- Installation of cabling linking to the Development substation.

10.5.1.1 Chemical Pollution

135. Potential effects involved with the management of construction are more a risk management issue, with the effects being assessed should the risk be realised. Should the Development proceed as described in Chapter 5: Development Description, i.e., with no spills, there would be no effects.

136. Potential risks include the spillage or leakage of chemicals, fresh concrete, foul water, fuel or oil, during use or storage onsite. These pollutants have the potential to adversely affect soils, subsurface water quality, soils, surface water quality, and groundwater, and hence effects on the biodiversity of receiving watercourses.

Surface Hydrology

137. Watercourses, drainage ditches and coastal waters could be at risk from a pollution incident during construction and these receptors are considered to be of high sensitivity.

138. Buffer distances between proposed construction works and watercourses and drainage ditches have been maximised to reduce the potential for chemical pollutants to be transferred to the water environment.

139. Measures such as absorbent spill pads / kits and other measures highlighted within sections 3 and 4 of the Outline CEMP found in Technical Appendix A5.4 will effectively limit the uncontained release of chemicals to minor fugitive releases (if at all). These would be minimised through best practice construction methods such as vehicle speed limits and regular vehicle and machine maintenance.

140. Therefore, effects on watercourses, drainage ditches and coastal waters, of high sensitivity, have the potential to be of negligible magnitude and therefore (in accordance with Table 10.4) of negligible significance.

141. As such there will be no effect on The Swale Ramsar/SSSI/SPA. This is not significant in terms of the EIA Regulations.

Groundwater, Near-surface water and Bedrock

142. Pollutants coming into contact with bedrock also have the potential to indirectly alter the pH of the groundwater resource. pH and chemical alterations to bedrock are difficult to rectify due to the fractured nature of the rock and the lengthy attenuation and dispersal of chemicals. As noted previously, due to the underlying geology consisting of alluvium, groundwater is unlikely to be present near the surface, meaning there is limited potential for pollutants to come into contact with groundwater. Measures such as spill pads, impermeable geotextile membranes and measures described within Technical Appendix A5.4 will effectively limit the uncontained release of chemicals to minor fugitive releases. Therefore, effects on bedrock and groundwater have the potential to be of negligible magnitude for a receptor of moderate (bedrock) and high (groundwater) sensitivity and therefore (in accordance with Table 10.4) of negligible significance. This is not significant in terms of the EIA Regulations.

10.5.1.2 Erosion and Sedimentation

Surface Hydrology

143. Erosion and sedimentation can occur from excavations, de-watering, ground disturbance and overburden stockpiling, the largest element of which, within the Development, would be the bunded substation compound. Sediment entering watercourses and drainage ditches has the potential to affect water quality, ecology and flood storage capacity.

144. As a result of the embedded design of the Development, such as the decision to seed the Core Study Area with a grass mix and allow the site to vegetate before construction phase and the overland distance between construction areas and drainage ditches (with the exception of the diverted drainage ditch) and the flat topography within the Hydrology Core Study Area, overland flow generation is likely to be minimal and any silt generated during construction will be entrained within cut off ditches before reaching watercourses and land drains, with the exception of the eight new ditch crossings.

145. Measures such as silt trap and buffer strips will minimise sedimentation and erosion; further details of these measures are outlined in sections 2, 6 and 7 of Technical Appendix A5.4.

146. Other SuDS measures, such as the use of settlement lagoons, swales and interception bunds, will effectively prevent sediment entering watercourses via drainage ditches adjacent to access tracks.

147. The site will be seeded with a suitable grass seed mix prior to the construction phase. This will assist in entraining sediment in run-off prior to it reaching ditches onsite.

148. Furthermore, the presence of flow control infrastructure within the drainage ditches within the Hydrology Core Study Area, will facilitate sediment dropping out of suspension as flows are generally low.

149. Where new crossings and upgrades to existing crossings are required then works will be isolated from the water environment by coffer dams and over pumping. This will limit the potential for sediment and siltation to be transferred into the coastal waters. Methods for over pumping are outlined in section 2.7 of Technical Appendix A5.4.

150. As such, there will be limited potential for sediment or erosion effects on watercourses in the Hydrology Core Study Area, including the hydrology and water quality of onsite watercourses and drainage ditches, and therefore coastal waters (including associated designations such as the Swale Ramsar, SSSI and SPA).

151. For these reasons, the magnitude of this effect will be negligible. Given the high sensitivity of the watercourses and coastal waters and negligible magnitude of effects, the significance of effects associated with erosion and sedimentation is assessed as being negligible. This is not significant in terms of the EIA Regulations.

Sub-surface Hydrology

152. Sediment also has the potential to change near-surface water flow in superficial geology deposits by creating a physical barrier within naturally occurring drainage micropores. Sediment entering near-surface water in superficial deposits also has the potential to impact on groundwater quality within bedrock deposits / fissures.

153. The site will be seeded with a suitable grass seed mix prior to the construction phase. The promotion of managed vegetation growth will assist in promoting restraining the soil (at the surface) and increasing the strength of the soil mass (at depth)[47] and reducing the potential for sediment to enter sub-surface hydrology compared to the baseline scenario of tilled agricultural fields.

154. Additionally, measures described in Technical Appendix A5.4, such as impermeable ground membrane layers and bunded areas, will effectively prevent sediment entering sub-surface water in superficial deposits (and groundwater). For these reasons, the magnitude of this effect will be negligible. Given the high sensitivity of near-surface water and groundwater and negligible magnitude of effect, the significance of the effect associated with erosion and sedimentation is considered to be negligible. This is not significant in terms of the EIA Regulations.

10.5.1.3 Impediments to Flow

155. The access tracks will only require the installation of 10 new watercourse crossings and the upgrade or reuse of 14 existing crossings across all sections of the Development. Additionally, the use of the existing access track which serves the agricultural operations has minimised the requirement to install new watercourse crossings, therefore minimising the potential for impediment to flow.

156. The minimisation of the number of proposed watercourse crossings and the re-use of the existing watercourse crossings reduces one of the main activities that could give

[47] D. Cazzuffi & E. Crippa (2005). "*Shear strength behaviour of cohesive soils reinforced with vegetation*" . Millpress Science Publishers/IOS Press

rise to impediment of flows. Additionally, measures described in section 5.4 of Technical Appendix A5.4, such as the use of a wide box culverts, where appropriate, are likely to prevent impediments to flow being created. An indicative culvert design is shown in section 11 of Technical Appendix A5.4, detailed design will be carried out at the construction phase and will be agreed with Lower and Upper Medway IDB and the EA.

157. One drainage ditch will be required to be diverted around the bunded substation compound to the east and connected to an existing drain, affecting a length of approximately 320 m. The drainage ditch to be diverted is heavily vegetated with common reed and blanket weed, as shown in Plate 10.10.

Plate 10.10 Ditch to be diverted at compound

158. As far as practicable, the dimensions (width and depth) of the redirected ditch will be kept as close to the baseline scenario to ensure conveyance of water, unless agreed with consultees. It should be noted that the final length of the drainage ditch diversion will be greater than the original stretch and therefore is likely to have a small beneficial effect in terms of flow conveyance and carrying capacity.

159. The existing drainage ditch within the compound will be filled in and a new 600 mm surface water sewer will be installed leading to a standard 300 mm pipe with a pumping head near the outfall (northern section of the compound), which flows into an existing drainage ditch north of the compound. The drainage design can be found in Technical Appendix A10.1.

160. Therefore, the effects on watercourses and drainage ditches and coastal waters of high sensitivity are considered to be of negligible magnitude and, therefore of negligible significance. This is not significant in terms of the EIA Regulations.

10.5.1.4 Changes in Soil Interflow Patterns

161. Some excavations, such as those for the bunded substation compound, may need temporary sub-surface water controls, such as physical cut-offs or de-watering. These temporarily divert flows away from the excavation, and temporarily lower the local water table and sub-surface water levels in the superficial geology. Localised temporary changes to soil interflow patterns may therefore arise.

162. Foundations for the substation and hardstandings also have the potential to change sub-surface water flow by creating physical barriers within naturally occurring drainage macropores in soil.

163. No substantial impediments to near-surface water flow will be created as the detailed site drainage design will take into account any severance of saturated areas to ensure hydrological connectivity is maintained.

164. The Development will involve the installation of arrays of photovoltaic cells arranged on galvanised steel mounting racks.

165. The racking system posts will be driven into the ground to a depth of approximately 1 to 2 m.

166. It is considered that installing racking system posts to a depth of 2 m will have a negligible effect on the displacement or change in sub-surface water flow underlying the Development, due to the thin nature of the supporting frame, as shown in Plate 10.11.

Plate 10.11 Typical thin Racking System driven into ground

167. Consequently, effects on soil (moderate sensitivity receptor) and near-surface water (high sensitivity receptor) are considered to be of negligible magnitude and therefore negligible significance. This is not significant in terms of the EIA Regulations.

10.5.1.5 Compaction of Soils

168. Construction of access tracks and movement of construction traffic, in the absence of construction good practice, can lead to compaction of the soil. This can reduce soil permeability, potentially leading to increased run-off rates and increased erosion. The superficial geology underlying the Development is generally of low permeability and is in agricultural use, so the effects of compaction would not result in a substantial increase in runoff from existing conditions.

169. In order to maintain the current level, it is necessary to ensure that construction methods do not seriously disrupt the established drainage network and that no areas are surcharged, either by water discharge or spoil.

170. Maintenance of existing drainage infrastructure is critical to avoid compaction of soils, therefore all existing drainage network channels, such as those draining the substation / compound of the existing Cleve Hill Substation, will be maintained and where necessary, channelled below the proposed spine road construction, as described in section 5 of Technical Appendix A5.4. Drainage ditches on the upslope of the road are likely to be required on side-long ground. If required, the ditches will be constructed with small dams and cross drains where necessary in order for water to drain below the road at regular intervals and that concentrated discharges to soil on the down slope side of the road are avoided, as outlined in section 2 and 5 of Technical Appendix A5.4.

171. Existing access tracks have been used in the design where practicable, further reducing the potential for soil compaction. Furthermore, the percentage of the Hydrology Core

Study Area proposed for the construction of new access tracks is small (approximately 0.30 %[48]).

172. Depending on weather conditions during construction, temporary roadways (e.g., plastic matting) may be utilised to access parts of the Development site during construction to avoid excessive soil disturbance or compaction. During the operational phase, activity on the Development site will be minimal and would be restricted principally to vegetation and livestock management (the Development site will be grazed by sheep), equipment/infrastructure maintenance and servicing including cleaning and replacement of any components that fail, and monitoring to ensure the continued effective operation of the Development.

173. For these reasons, the magnitude of this effect will be negligible. Given the moderate sensitivity of soils and negligible magnitude of effect, the significance of effects associated with the compaction of soils is considered to be negligible. This is not significant in terms of the EIA Regulations.

10.5.1.6 Bedrock Excavation

174. Bedrock is located at depths of over 10 m BGL in the Hydrology Core Study Area.

175. Excavated material required for the Development will be obtained offsite for new access tracks and laydown areas.

176. The bund around the electrical compound will be formed largely from excavated material taken from the footprint of the compound itself. The inside of the bund will be c. 80 cm lower than the existing ground level, as a result of stripping topsoil, excavating the useful clays from underneath for structural use in the bund, then replacing the topsoil. The excavation for this will not reach down to bedrock, however.

177. The foundations for the substation will not require excavations depths that would interact with bedrock.

178. The PV racking system and fencing will not be driven to depths that will interact with bedrock.

179. For this reason, there will be no loss of bedrock and the effect will be negligible. Given the moderate sensitivity (as set out in Table 10.4) and negligible magnitude of effect, the significance of effects associated with the loss of bedrock is negligible. This is not significant in terms of the EIA Regulations.

10.5.1.7 Migration of Pollutants from Contaminated Land

180. Desk studies have identified minor areas of potentially contaminated land within the Hydrology Core Study Area.

181. A Conceptual Site Model & Qualitative Risk Assessment is presented within section 6 of Technical Appendix A10.3 which identifies that potential contaminants within the Hydrology Core Study Area (from various Sheepwashes on site) would have medium consequences should they enter surface water and mild consequences should they enter groundwater. It is noted that the likelihood of contaminants entering these receptors is assessed as unlikely and that the 'Risk Rating' is classed as Low for surface water and Very Low for groundwater.

182. Excavations in proximity to the seven historical sheepfolds will be tested and appropriate action taken (if required) in accordance with The Environmental Protection Act 1990.

[48] Approximately 1.48 ha of new spine road in 492 ha total Development Area.

183. Given the isolated areas of potential contamination in the Hydrology Core Study Area and the outcomes of the Conceptual Site Model & Qualitative Risk Assessment, effects associated with contaminated land are therefore considered to be of negligible magnitude for receptors of high sensitivity (watercourses, drainage ditches, coastal waters and groundwater) in accordance with Table 10.4, and not significant in terms of the EIA Regulations.

10.5.1.8 Increase in Runoff and Flood Risk

Flood Risk

184. The Development is located in Flood Zone 3a but in an area that benefits from flood defences, in the form of a raised embankment with and concrete wall which offer protection up to the 1 in 1,000 year tidal event.

185. A Flood Risk Assessment is provided in Technical Appendix A10.1. The FRA concludes that with the implementation of design measures, such as a bund around the critical infrastructure and the raising of the bottom edge of the PV arrays, the Development will be safe for its operation lifetime, even in the event of a breach in the flood defences to the north.

186. The Cleve Hill Solar Park Coastal Flood Modelling report[49], provided within Technical Appendix 10.1, presented a total of 16 flood scenarios including 1 in 200 and 1 in 1,000 year events for present day (taken as 2017 as per the date of the existing flood model being re-run) and 2070 using the following scenarios:

- Defended – assumes that the existing flood defences are in place and are structurally sound;
- Defended Breach 1 – assumes a 100 m section of the flood defence is removed in the northwest of the Site and simulates tidal ingress through this breach location;
- Defended Breach 2 – assumes a 100 m section of the flood defence is removed in the northeast of the Site and simulates tidal ingress through this breach location; and
- Undefended – assumes the flood defences are not in place.

187. The 1 in 200 and 1 in 1,000 year flood events have been used to design the Development to in accordance with guidance on flood risk and coastal change[50], Engineering Design Standard, EDS 07-0106 Substation Flood Protection (2016)[51] and ETR138[52] the NPS and the NPPF. Freeboard is an allowance applied to flood levels to account for residual uncertainty in flood modelling.

188. A freeboard allowance of 300 mm has been applied to maximum flood depths for the 1 in 1,000 year breach scenario for the substation, in accordance with Table 2 of the Engineering Design Standard, EDS 07-0106 Substation Flood Protection (2016) and ETR138.

189. Government guidance on flood risk and coastal change[53] states that proposed flood sensitive developments should be designed to be resilient against tidal flooding with a 0.5% annual probability (a 1 in 200 chance of occurring each year).

[49] JBA (2018)
[50] https://www.gov.uk/guidance/flood-risk-and-coastal-change
[51] https://library.ukpowernetworks.co.uk/library/en/g81/Design_and_Planning/Substations_- Major/General/EDS+07-0106+Substation+Flood+Protection.pdf
[52] Energy Networks Association publish Engineering Technical Report (ETR) 138 – Resilience to Flooding of Grid and Primary Substations
[53] https://www.gov.uk/guidance/flood-risk-and-coastal-change#design-flood

190. Cleve Hill Solar Park Limited requested that the Development should be designed to be resilient to a 0.1% annual probability (a 1 in 1,000 chance of occurring each year) event to provide an increased level of protection to the Development.

191. To achieve this, the developable area of the site has been split into separate development parcels, and the substation and battery storage compound area. The design of the Development has been informed by using maximum flood depths above ground level (AGL) or flood levels AOD in each specific area of the site, and applying an additional freeboard allowance to identify the required level of protection.

192. Different model scenarios have been used to obtain different depths for critical infrastructure (flood sensitive equipment, long lead time, high cost items critical to operation) and for the wider development (non-flood sensitive equipment such as the PV array mounting structures).

10.5.1.9 Critical Infrastructure (substation and battery storage area)

193. The critical infrastructure within the Development (the substation and battery storage compound) has been designed to be resistant to a 1 in 1,000 year plus climate change (year 2070) defended breach (breach 2) event.

194. The breach scenario 2 event has been used as it results in a greater flood depth than breach scenario 1 and is therefore considered to be a more conservative approach to site design.

195. To achieve the required level of protection, an uninterrupted flood protection bund with a height of 5.316 m AOD will encircle the substation and battery storage compound to protect the critical infrastructure against this type of event.

196. To derive the flood protection level, flood data from the JBA Cleve Hill Solar Park Coastal Flood Modelling report was imported into a GIS model and the maximum flood levels within the substation and battery storage compound area was obtained. This derived a maximum flood level of 5.016 m AOD. With the addition of 300 mm freeboard this results in a flood protection level for critical infrastructure in the substation and battery storage compound area of 5.316 m AOD.

10.5.1.10 Wider Development

197. Non-flood sensitive infrastructure forming the wider development (PV arrays, cabling, inverters and transformer stations) has been designed to be resilient to a 1 in 1,000 year plus climate change (year 2070) defended (wave overtopping) event.

198. The wave overtopping event has been used as the design scenario for the wider development rather than a breach scenario, as the PV arrays and associated ancillary infrastructure have resilience to flooding and are likely to be able to operate without replacement once floodwaters have subsided.

199. To achieve the required level of protection, the lowest electrical connections for flood sensitive equipment such as the PV arrays, cable connections and inverters will be located above the identified flood protection levels in each development parcel. This will result in the bottom edge of the PV panels being located at the flood protection level. The transformers will be designed to have the ability to float (secured by a fixed tether) during a 1 in 1,000 year overtopping flood event.

200. To derive the required flood protection levels, flood data from the JBA Cleve Hill Solar Park Coastal Flood Modelling report was imported into a GIS model and the maximum flood levels within each development parcel were obtained. This derived a range of maximum flood depths AGL within each land parcel from 0 m to 1.8 m. The minimum height of the bottom edge of PV panels and therefore all other electrical connections was set to 1.2 m AGL. With the addition of a 300 mm freeboard allowance, flood

protection levels for non-flood sensitive infrastructure therefore range from 1.2 m to 2.1 m AGL.

201. With the implementation of design measures, such as a bund around the critical infrastructure and the raising of the bottom edge of the PV arrays, the Development will be safe for its operation lifetime, even in the event of a breach in the flood defences to the north.

10.5.1.11 Increase in Runoff

202. Access to the solar PV array during construction and operation will be taken from grassed tracks accessed from the spine road, limiting the requirement for new hardstanding.

203. The Type 2 aggregate used for the new spine road / access track will be permeable, as shown in Plate 10.12.

Plate 10.12 Typical Type 2 aggregate at a solar farm[54,55]

[54] Arkwright Solar Farm, Duckmanton . Arcus Drainage Inspection 2017.
[55] Malmaynes Solar Farm, Medway. Arcus Drainage Inspection 2016.

204. The PV arrays have the potential to concentrate rainfall under the drip lines. Research in the United States by Cook & McCuen[56], suggested that the increase in run-off rates would not be great but is an increase nonetheless. Other studies quantified this increase ranging from 1.5 % to 8.6 %, depending on site specific parameters.

205. Topography within the Core Study Area, and especially where PV arrays are proposed, is essentially flat, meaning rainfall will not drain quickly down slope and will preferentially infiltrate where it lands under the drip line.

206. The FRA presents calculations suggesting that, should the PV arrays prevent infiltration of water into the soil beneath the PV panels, they would have the potential to increase surface water run-off rates by approximately 41.62 % compared to the baseline scenario.

207. However, the solar panels will be located above the ground, rather than on it, and will not prevent soil from absorbing rainwater as the panels will not be placed directly on the ground. The same area of soil will therefore be available for infiltration.

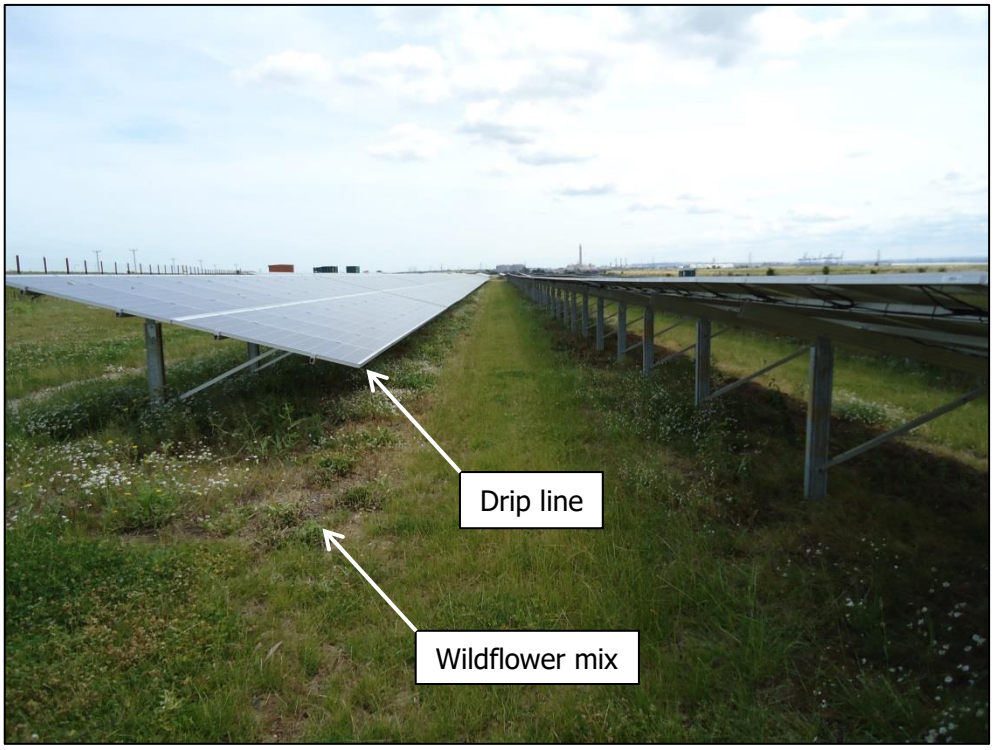
208. Once rainfall has fallen off a PV panel, the water will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Hydrological Core Study Area it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed. There will be no increase in run-off as a result of the PV arrays, therefore.

209. According to the candidate design, each solar PV module will be of the order of 1 m by 2 m, and water will drip off each module (there will be small gaps between modules).

210. As such, the area under the drip lines will be seeded with a suitable grass / flower mix, as shown in Plate 10.13, to prevent rilling (incisions in soil caused by concentrated water flow) and any associated increase in surface water run-off rates.

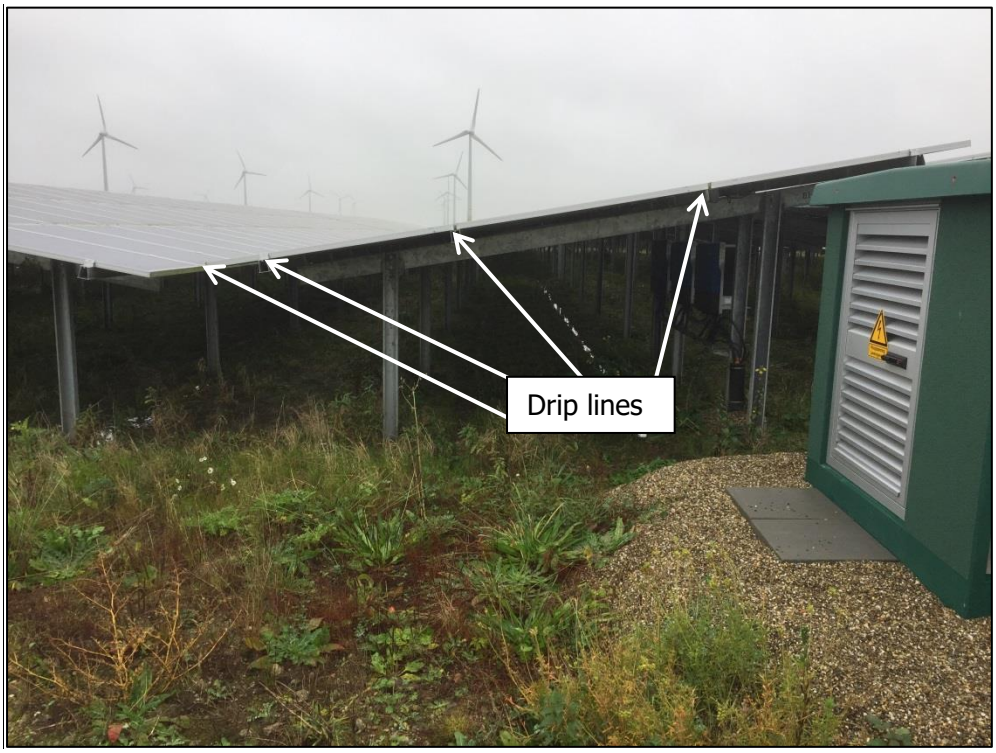
[56] "Hydrologic Response of Solar Farms" J. Hydrol. Eng., 18(5), 536–541. 2013

Plate 10.13 Established wildflower mix under PV drip line[57]



211. Plate 10.14 shows drip lines on a similar PV table arrangement to that for the Development.

Plate 10.14: East West PV arrangement and drip lines after heavy rainfall[58]



[57] Malmaynes Solar Farm, Medway. Arcus Drainage Inspection 2016.
[58] Delfzijl Solarpark, Netherlands. Arcus site visit 2017.

212. Land under the PV arrays would be allowed to naturally vegetate and be grazed by livestock. As vegetation becomes established under the PV arrays there is likely to be a decrease in surface water runoff rates and a reduction in the potential for sediment and agricultural chemicals (e.g., phosphates and nitrates) to transfer into the wider hydrological catchment compared to the baseline scenario. Theoretically the introduction of PV panels will increase the run off rates due to the presence of the impermeable PV modules that rainfall can directly fall on, however once rainfall has fallen off the PV panel any flow will be able to spread and flow along the ground under the PV panels. Given the flat nature of the Site it is likely that rain falling on each row of solar panels would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed.

213. With the implementation of suitable planting (such as a wildflower or grass mix) the ground cover is unlikely to generate surface water run-off rates beyond the baseline scenario.

214. As such, effects associated with run-off are assessed as negligible and are therefore considered to be of negligible magnitude for receptors of high sensitivity (watercourses, drainage ditches and coastal waters) in accordance with Table 10.4, and not significant in terms of the EIA Regulations.

10.5.1.12 Effects on PWS

215. Table 10.9 details PWS within 1 km of the Hydrology Core Study Area.

Table 10.9 Private Water Supplies within 1 km of the Hydrology Core Study Area

Receptor	Source of supply	In / outside Development catchment	Distance from Development infrastructure	Comment
Hollowshore House and The Shipwright's Arms	Groundwater from a depth of 350 m below ground level.	Outside – on opposite bank of Faversham Creek and draw water from Lambeth Groundwater Group.	290 m south west of nearest PV arrays.	Artesian well. Tested every 6 months. Supplies Shipwright's Arms and two properties. No treatment due to purity of water. Source and infrastructure confirmed with resident of Hollowshore House.
Edward Vinson Plant Ltd	Groundwater from a depth of 95 m below ground level.	Inside – draws water from just inside Thames Groundwater Group on the boundary with the Lambeth Groundwater Group.	685 m south of PV arrays.	Borehole. May to September usage is approximayely 18 m3 per hour and in use 24 hours a day. Source and infrastructure confirmed with Managing Director of Edward Vinson Plant Ltd.
Ham Farm Ham Road	Groundwater from a depth of 350 m below ground level.	Outside – on opposite bank of Faversham Creek and draw water from Lambeth Groundwater Group.	790 m south west of nearest PV arrays.	Artesian well. Used to fill agricultural ditches. Not used for potable or livestock drinking supply. Houses supplied by mains water infrastructure. Source and infrastructure confirmed with resident of Ham Farm.

216. During the site walkover, private water supply infrastructure was noted immediately to the north of the Sportsman Pub, approximately 1.3 km from the nearest infrastructure

at the Development (PV racking system). The proprietor of the Sportsman Pub stated that a shallow well draws water from a depth of 6 feet (1.8 m) BGL, which occasionally ran dry in summer months but had not done so since a recent upgrade. Several water utilities markers were observed approximately 60 m north east of the Sportsman Pub and the proprietor confirmed that the pub is also served by a mains water supply.

217. A BGS borehole record[59] at the Sportsman Pub indicates that water was stuck at 7 ½ feet (2.2 m) which corresponds to a layer of London Clay which is overlain by Alluvium. As such, the supply is likely to be drawing water from a perched groundwater layer that is prevented from infiltrating further by a thick layer of clay.

218. Given the shallow abstraction depth at the Sportsman Pub, the substantial distance between the Development infrastructure and the abstraction point and the proposed embedded Development design it is considered that the Development will not impact upon the quality or quantity of water abstracted at this PWS.

219. As all private water supplies are located outside the near surface water catchment of which the Development is located or that they draw on groundwater from a substantial depth, the supplies or are considered to be hydrologically disconnected from the Development (in terms of surface and sub-surface water effects, as development is proposed in areas that are hydrologically down-gradient) or are of sufficient distance to remain unaffected by the Development.

220. As such, effects on PWS will be of negligible magnitude and therefore of negligible significance.

10.5.2 Potential Operational Effects

221. Potential effects associated with the operation of the Development are:

- Increased or decreased run-off rates;
- Continued or decreased erosion and sedimentation from runoff from areas of hardstanding and the PV panels;
- Alterations to natural flow pathways from runoff from areas of hardstanding;
- Reduced chemical loading of watercourses associated with the cessation of nitrate application; and
- A risk of a pollution event from minor spills from maintenance vehicles.

222. The nature of these effects has been discussed in relation to the construction phase. As there would be substantially less activity during operation, and as there is unlikely to be any significant ground disturbance during operation, the magnitude of these effects is similarly reduced, with the exception of rainfall run-off from the PV modules which will remain the same as during the construction phase.

223. Land under the PV arrays would be allowed to naturally vegetate following seeding with a wildflower or grass mix and be grazed by livestock. As vegetation becomes established under the PV arrays there is likely to be a decrease in surface water runoff rates and a reduction in the potential for sediment and agricultural pesticides (phosphates and nitrates) to transfer into the wider hydrological catchment compared to the baseline scenario, where agricultural fields remain tilled for substantial parts of the year.

224. Whilst alterations to natural flow pathways will not be introduced during the operational phase, any changes during construction will continue through operation, as the majority of infrastructure will remain in place. Alterations to natural flow pathways will be reduced through adopting good practice design and construction, as set out in the

[59] http://scans.bgs.ac.uk/sobi_scans/boreholes/624226/images/12578344.html

Outline CEMP, such as cross drainage, use of shallow drainage ditches and prevention of blockages, as discussed in Technical Appendix A5.4.

225. As outlined in Table 10.1b, the EA state that managed realignment will begin to be considered in Epoch 2 (from year 20), but that no managed realignment would occur if the infrastructure (the Development and other existing electricity infrastructure) was still in place. As such, impediments to coastal flows as part of managed realignment will not occur during the operation phase of the Development.

226. As a result, the magnitude and significance of all effects associated with operation of the Development are assessed as being negligible, and not significant in terms of the EIA Regulations.

10.5.3 Potential Decommissioning Effects

227. Potential effects of decommissioning the Development are similar in nature to those during construction, as some ground-work would be required to remove substation and battery storage foundations and hardstanding to approximately 1 m below ground level. These effects would be substantially lesser in magnitude than during construction, and would be controlled by a CEMP, as discussed previously. Where infrastructure would be left in place, drainage features would also remain where this is compatible with the CEMP.

228. As a result, the magnitude and significance of all effects associated with decommissioning are assessed as being negligible, and not significant in terms of the EIA Regulations.

10.6 Mitigation and Residual Effects

229. With the embedded design measures described in Technical Appendix A5.4 in place, all identified potential effects have been assessed as being of negligible significance, and therefore not significant in terms of the EIA Regulations.

230. No further mitigation is proposed.

10.7 Cumulative Effect Assessment

231. The methodology followed to assess the cumulative impacts is the same as that used for the Development in isolation.

232. A cumulative effect is considered to be an additional effect on hydrological resources (within the same hydrological catchment) arising from the Development in addition to the combination of other developments likely to affect the hydrological environment. At distances greater than 5 km, it is considered that schemes are unlikely to contribute to a cumulative hydrological effect due to attenuation and dilution over distance of potentially polluting chemicals. Therefore, for the purposes of the assessment of potential cumulative effects on the immediate catchment and hydrological regime, only proposed developments, which require large scale construction / excavation, within approximately 5 km of the Development site have been considered.

10.7.1 Cumulative Developments within 5 km (consented or under construction)

233. Cumulative developments have been identified within 5 km of the Core Study Area are listed in Table 2.2 *Potential Cumulative Developments* in Chapter 2: Environmental Impact Assessment and are shown on Figure 2.1.

234. Only developments that are located within the catchment of the stretch of Whitstable Bay Coastal waters to the north of the Development, as shown in Figure 10.5, are considered within this section and this forms the cumulative development hydrology study area.

235. Beyond this identified catchment, factors such as dilution and dispersion of sediment and contaminates will occur, meaning pollutant inputs into the coastal waters to the north of the Development would be small and unlikely to contribute towards a cumulative effect.

236. Table 10.10 provides details of cumulative sites within the cumulative study area (see section 10.2.5) and considered within this assessment.

Table 10.10 Cumulative Developments within 5 km of the Hydrology Core Study Area

Site No.	Cumulative Development Address	Planning Ref	Status	Distance and Direction from Development site	Summary of Development
1	Land At Oare Gravel Works, Ham Road, Faversham, Kent, ME13 7TS	SW/14/0257	Permitted	1 km southwest	Residential development for 330 dwellings.
2	Land at, and adjacent to, Site D, Oare Creek, Faversham, Kent, ME13 7TX	KCC/SW/0090/2018	Awaiting Decision	1.1 km southwest	Redevelopment of an existing waste management facility and inclusion of additional land into a waste management use (part retrospective)
3	Abbey Fields Farm Abbeyfields Faversham Kent	15/505437/FULL / 17/503317/FULL	Permitted - Operational	1.2 km south	15/505437/FULL - Solar farm with associated works. 17/503317/FULL - to extend the operational period of the solar farm to 40 years.
4	Land To The East Of Ham Road Faversham Kent ME13 7ER	16/504575/OUT	Awaiting Decision	1.7 km south	Outline application for residential development (30 units) including access and parking, together with public open space and drainage.
5	Land North Of Graveney Road Faversham Kent ME13 8UJ	16/508643/FULL	Permitted	2.7 km south	105 residential units, comprising 72 houses and 33 flats, and associated, parking, landscaping and open space.
6	Ospringe Brickworks Sumpter Way Faversham Kent ME13 7NT	17/502604/REM / 14/502729/OUT	Permitted / Awaiting Decision	3.1 km southwest	Demolition of brick making and drying shed, 2 stores, existing site office and a cottage; Construction of up to 250 dwellings, new vehicular access and roundabout on Western Link, public open space and associated infrastructure.

Site No.	Cumulative Development Address	Planning Ref	Status	Distance and Direction from Development site	Summary of Development
7	Land At Perry Court London Road Faversham Kent ME13 8YA	15/504264/OUT / 17/506603/REM	Permitted / Awaiting Decision	3.9 km south	Outline application for a mixed use development comprising: up to 310 dwellings, 11,875sqm of B1a floor space; 3,800sqm of B1b floor space; 2,850sqm of B1c floor space; a hotel (up to 3,250sqm) of up to 100 bedrooms including an ancillary restaurant; a care home (of up to 3,800sqm) of up to 60 rooms and ancillary floor space; a local convenience store of 200sqm; 3 gypsy pitches and associated landscaping.
8	Land Opposite Greenways Brogdale Road Faversham Kent ME13 8YA	SW/13/1567 / 16/506644/REM	Permitted	4 km south	SW/13/1567 -Outline application for erection of 63 dwellings, open space, pedestrian and vehicular access, car parking, landscaping and associated works. 16/506644/REM-Reserved Matters application approval being sought for Access, Appearance, Landscaping, Layout and Scale and in relation to conditions 1, 5, 9 and 12 of the outline approval.
9	Land At Preston Fields Salters Lane Faversham Kent ME13 8YD	16/508602/OUT	Awaiting Decision	4.1 km south	Outline application for erection of up to 250 dwellings with all matters reserved except for access.

243. Operational or built developments are considered to form part of the baseline for the purposes of cumulative assessment.

10.7.2 Predicted Cumulative Effects

244. The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Development. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist, as activities that could be potentially detrimental to the hydrological environment are greatly reduced during the operational phase of developments (e.g., excavation works, concrete pouring, *etc.*).

245. Assuming commencement of the construction of the Development in 2021, lasting for approximately 24 months, this will not coincide with the construction phase of the following development (which is already operational) and therefore there is unlikely to be potential for cumulative effects as a result of the following development:

- Site 3 - Abbey Fields Farm Abbeyfields Faversham Kent – site operational.

246. Inspection of OS mapping and aerial photography indicates that the following cumulative sites appear to have no surface watercourses within 1 km and have

therefore been discounted due to the lack of a surface water hydrological linkage with Whitstable Bay Coastal waters:

- Site 7 - Land At Perry Court;
- Site 8 - Land Opposite Greenways; and
- Site 9 - Land At Preston Fields.

247. As such, the above developments have been discounted from this assessment.

10.7.2.1 Construction Phase

248. The following developments involve large scale construction, are located within the catchment of Whitstable Bay Coastal waters and the hydrological link is outlined below:

- Site 1 - Oare Gravel Works, Ham Road - via Oare Creek;
- Site 2 - Site D, Oare Creek;
- Site 4 - Land To The East Of Ham Road - via Oare Creek;
- Site 5 - Land North Of Graveney Road - Faversham Creek; and
- Site 6 - Ospringe Brickworks, Sumpter Way - via Faversham Creek.

249. The above sites will all involve substantial earthworks during the construction phase, and the primary cumulative effects are likely to be the potential for sedimentation, pollution effects on Whitstable Bay Coastal waters and an increase in flow rates associated with increased run-off from new hardstanding areas.

250. Whilst there is a possibility of sediment and pollutants, such as hydrocarbons from the underground oil tanks, migrating offsite from the above developments and being transferred to Oare Creek and Faversham Creek and then to Whitstable Bay Coastal waters, the EA and other relevant consultees have stipulated several construction control measures as part of the planning conditions for the developments 1, 4, 5 and 6 [60,61,62,63]. Development 2 is a waste site and would be subject to an Environmental Permit from the Environment Agency, the terms of which can be relied on to reduce risk of pollution to a nominal level.

251. These include conceptual site models for contamination, remediation strategies, bunding around the sites, surface water drainage schemes and no infiltration of surface water to ground.

252. These construction measures will limit the potential for contaminants and sediment to be transferred to surface watercourses and ultimately Whitstable Bay Coastal waters.

253. All sites also include a SuDS strategy to restrict surface water run-off sates and assist in the removal of sediment and pollutants from the site.

254. As set out in section 10.5 of this chapter, measures presented within Technical Appendix A5.4 will limit the potential for sediment and pollutants to be transferred from the Development to Whitstable Bay Coastal waters.

255. The increase in flow rates is considered to be of negligible magnitude for the Development.

[60] Oare Gravel Works, Ham Road - https://pa.midkent.gov.uk/online-applications/files/84F707072FA6960FF9FFE14EB02E4812/pdf/SW_14_0257-Environment_Agency-3110651.pdf
[61] Land To The East Of Ham Road - https://pa.midkent.gov.uk/online-applications/files/8F0ED8F57BF4B20FD2C129B76E1B8E95/pdf/16_504575_OUT-Environment_Agency-3584649.pdf
[62] Land North Of Graveney Road - https://pa.midkent.gov.uk/online-applications/files/48AB28D0C3C86C35F597D2672CA9A6E5/pdf/16_508643_FULL-Environment_Agency-3897357.pdf
[63] Ospringe Brickworks, Sumpter Way - https://pa.midkent.gov.uk/online-applications/files/7DB678CB6B734907355E4235BC97CA6B/pdf/14_502729_OUT-ENVIRONMENT_AGENCY_EMAIL_08.10.2014-2667611.pdf

256. Given this, the magnitude of cumulative effects during the construction phase of the Development and the above listed sites will be negligible and, therefore, of negligible significance.

257. This is not significant in terms of the EIA Regulations.

10.7.2.2 Operational Phase

258. It is anticipated that there will be a minor reduction in the potential for increase in flow rates during the operational phase of all developments, when compared to the construction phase, due to the reduction in overall hardstanding areas post-construction due the removal of temporary roads and the installation of SuDS systems at the cumulative sites. Therefore, the magnitude of cumulative effects during the operational phase will be negligible, and the significance of these effects will also be negligible, being not significant in terms of the EIA Regulations.

10.7.3 Residual Cumulative Effects

259. No significant residual cumulative effects are predicted.

10.8 Summary of Effects

260. This chapter has identified no likely significant adverse effects, following the embedded measures (outlined in Technical Appendix A5.4) in the design of the Development.

261. Table 10.11 summarises the predicted effects of the Development on the hydrology and hydrogeology resources.

Table 10.11 Predicted effects of the Development

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
Construction				
Watercourses, drainage ditches, coastal waters and near-surface water	Chemical Pollution	Negligible	None	Negligible
Watercourses, drainage ditches, coastal waters and Near-surface water	Erosion and Sedimentation	Negligible	None	Negligible
Watercourses and drainage ditches	Impediments to Flow	Negligible	None	Negligible
Soils and near-surface water	Changes in Soil Interflow Patterns	Negligible	None	Negligible
Soils	Compaction of Soil	Negligible	None	Negligible
Watercourses, drainage ditches, coastal waters and near-surface water	Migration of Pollutants from Contaminated Land	Negligible	None	Negligible
Watercourses and drainage ditches	Increase in Run-off	Negligible	None	Negligible
PWS	Changes in quality or quantity of supply	Negligible	None	Negligible
Operation				
Watercourses, drainage ditches,	Chemical Pollution	Negligible	None	Negligible

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
coastal waters and near-surface water				
Watercourses, drainage ditches, coastal waters and Near-surface water	Increased Run-off Rates / Volume	Negligible	None	Negligible
Watercourses, drainage ditches, coastal waters and Near-surface water	Erosion and Sedimentation	Negligible	None	Negligible
Soils and near-surface water	Alterations to natural flow pathways	Negligible	None	Negligible
Watercourses, drainage ditches, coastal waters and Near-surface water	Risk of a Pollution Event from Minor Spills from Maintenance Vehicles	Negligible	None	Negligible
Decommissioning				
Watercourses, drainage ditches, coastal waters and Near-surface water	Chemical Pollution	Negligible	None	Negligible
Watercourses, drainage ditches, coastal waters and Near-surface water	Erosion and Sedimentation	Negligible	None	Negligible
Soils and near-surface water	Changes in Soil Interflow Patterns	Negligible	None	Negligible
Soils	Compaction of Soil	Negligible	None	Negligible

10.9 Statement of Significance

262. This chapter has assessed the significance of effects of the Development on hydrology, hydrogeology flood risk and ground conditions. The Development has been assessed as having the potential to result in effects of negligible significance.

263. Given that only effects of moderate significance or greater are considered significant in terms of the EIA Regulations, the potential effects on hydrology, hydrogeology, flood risk and ground conditions are considered to be not significant.