



**PINS Document Number:**  
ENO10140/APP/7.5

# **Flood Risk Assessment**

April 2025





# **HELIOS RENEWABLE ENERGY PROJECT**

## **FLOOD RISK ASSESSMENT**

### **ENSO GREEN HOLDINGS D LIMITED**

DOCUMENT REFERENCE NUMBER: 7.5

**PART 5 OF 6**

**APPENDICES 19 - 25**

PFA Document Reference: E216-DOC01-FRA-ISSUE 3.1

APRIL 2025

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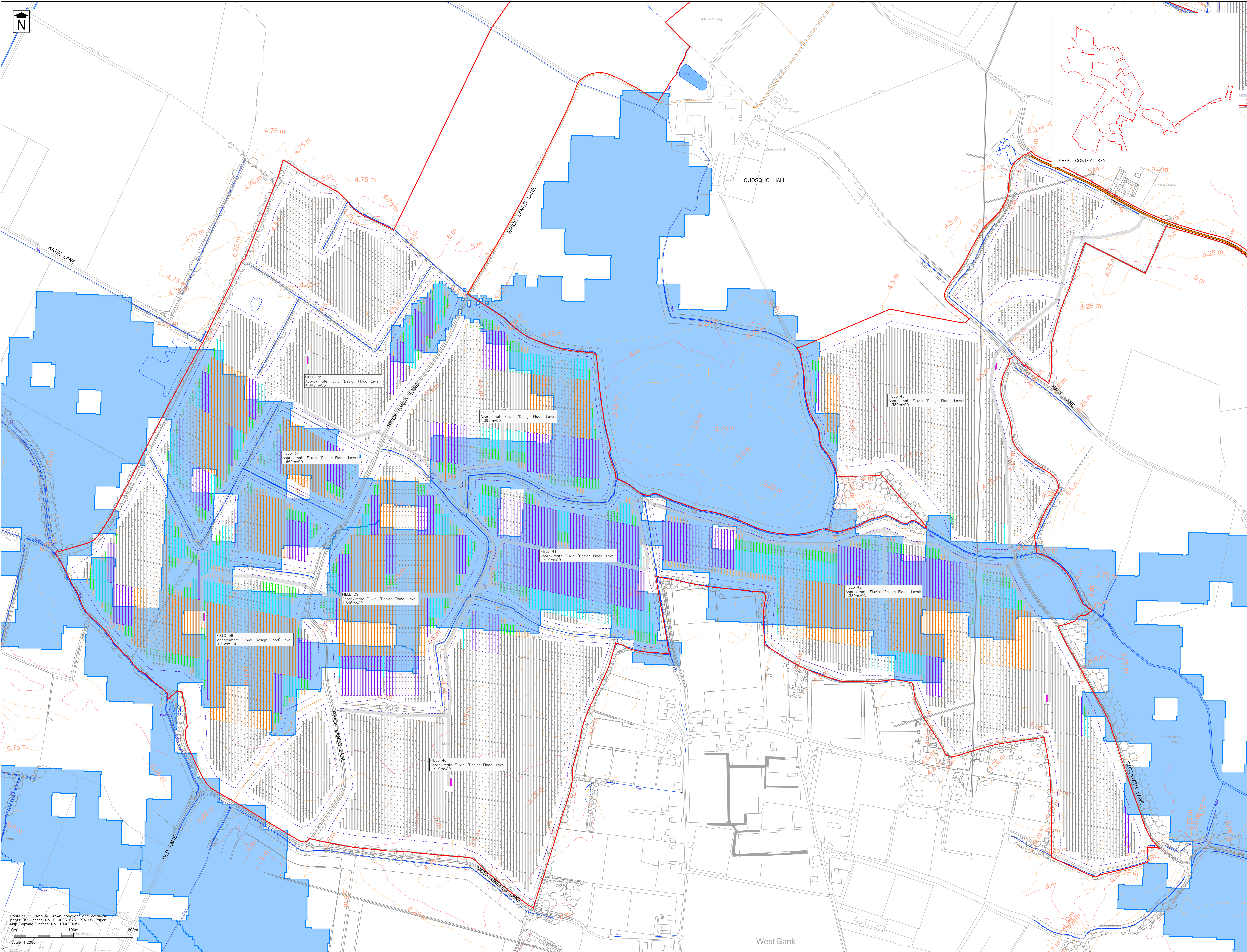
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**For Planning**  
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

- NOTES**
1. Site Boundary based upon Order Limits Location Plan, Enso Energy Drawing No. DK-01-P01 Rev 11, dated 15/02/24.
  2. Drawing based upon Indicative Design, Enso Energy Drawing No. DK-01-P01 Rev 08, dated 15/02/24.
  3. Flood risk data based on the results from the site-specific flood model produced by Aegoo. Details contained in hydraulic Model Technical Note (Document Ref: AEG0851\_Y08\_EnsoEnergy\_03 Rev B dated 25/08/24).
  4. Drawing should be read in conjunction with Flood Risk Assessment produced by PFA Consulting (Document Ref: E216-00001-FRA-Issue 1, June 2024) and Water Environment Supplementary Assessment produced by PFA Consulting (Document Ref: E216-00002-Issue 1, January 2024).
  5. Contains public sector information, licensed under the Open Government Licence v3.0.
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  8. Minimum equipment levels subject to detailed design and will be informed by the Environment Agency approved site-specific flood model produced by Aegoo.
  9. Minimum equipment levels rounded to nearest 0.005m.

- Key**
- Site Boundary
  - Solar Farm Zone
  - Watercourse
  - Contours
- FLUVIAL DESIGN FLOOD EXTENTS**
- 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Higher Central)
- Ref: AEG0851\_ENSO\_BAS\_SCENA\_00100\_CC\_HIGHER\_001\_2\_Max-CLIPPED
- SOLAR ARRAYS AFFECTED BY FLUVIAL DESIGN FLOOD**
- 1P065505EG F TR ID1 PVBlock
  - 1P1285505EG F TR ID2 PVBlock
  - 1P2785505EG F TR ID4 PVBlock
  - 1P5485505EG F TR ID4 PVBlock
  - 1P8185505EG F TR ID4 PVBlock

Rev	Date	Description	Drawn	Check
#	20/12/24	First Issue	BP	MWS

Status

FOR PLANNING

Client

Enso Green Holdings D Ltd

Project

Helios Renewable Energy Project

Drawing Title

**Preliminary Solar Array Support Flood Volume Displacement Assessment Array Assessment**

Drawing No. **E216/165**

Date: December 2024 Scale: 1:2000 @ A0  
E-Mail: @pfapl.com







# E216: Helios Renewable Energy Project

## Preliminary Solar Array Flood Volume Displacement

**Date:** 23.12.24

**Layout Ref:** Figure 3.3 Indicative Design  
Drawing No. DX-01-P47 Rev08  
Dated 15/04/2024

**Notes:**

**Calculations to be read in conjunction with:** Water Environment Supplementary Assessment  
Ref: E216-DOC02-DRAFT 1  
Drawing Nos:

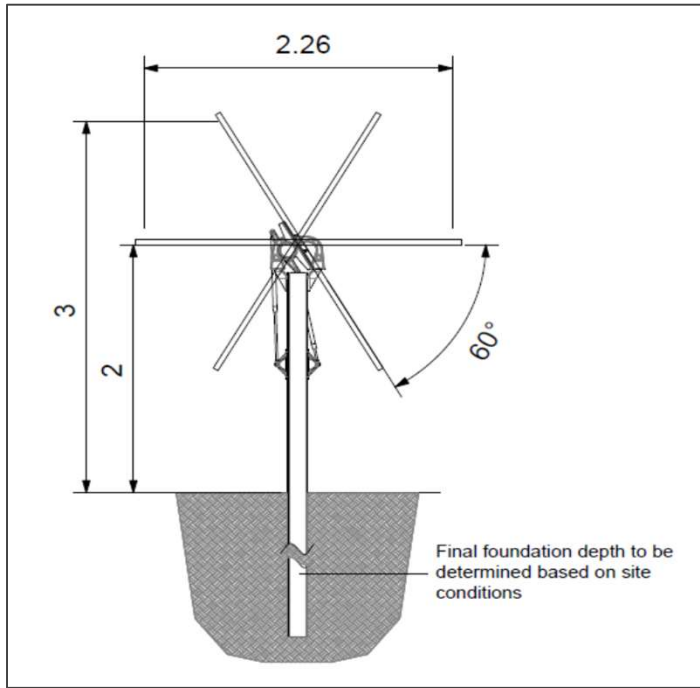
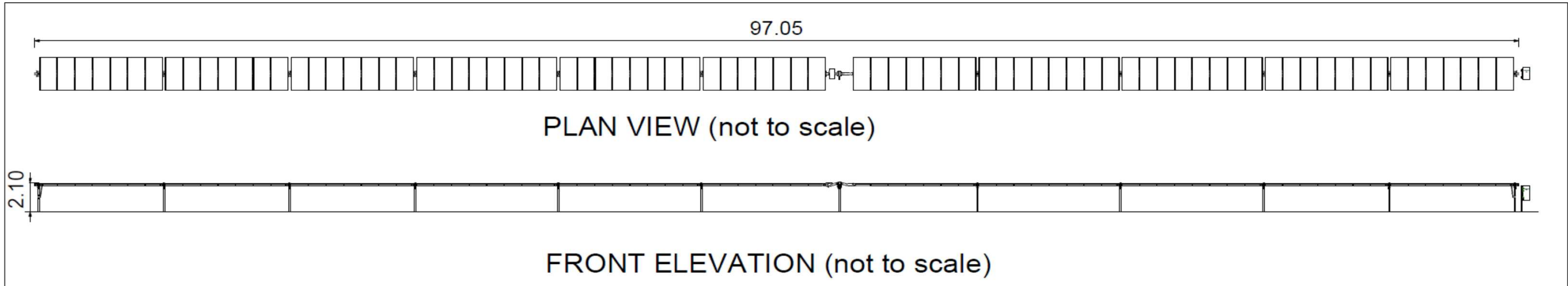
E216/164 Preliminary Solar Array Support Flood Displacement Assessment - Flood Extents

E216/165 Preliminary Solar Array Support Flood Displacement Assessment - Array Assessment



**Assumptions**

**Typical Detail for Solar Array**  
PV Elevations Drawing No. DX-01-P03 Rev 01 dated 09/01/2024  
*Extracts below*



### Typical Detail for Array Supports

Supplier: Gerdau

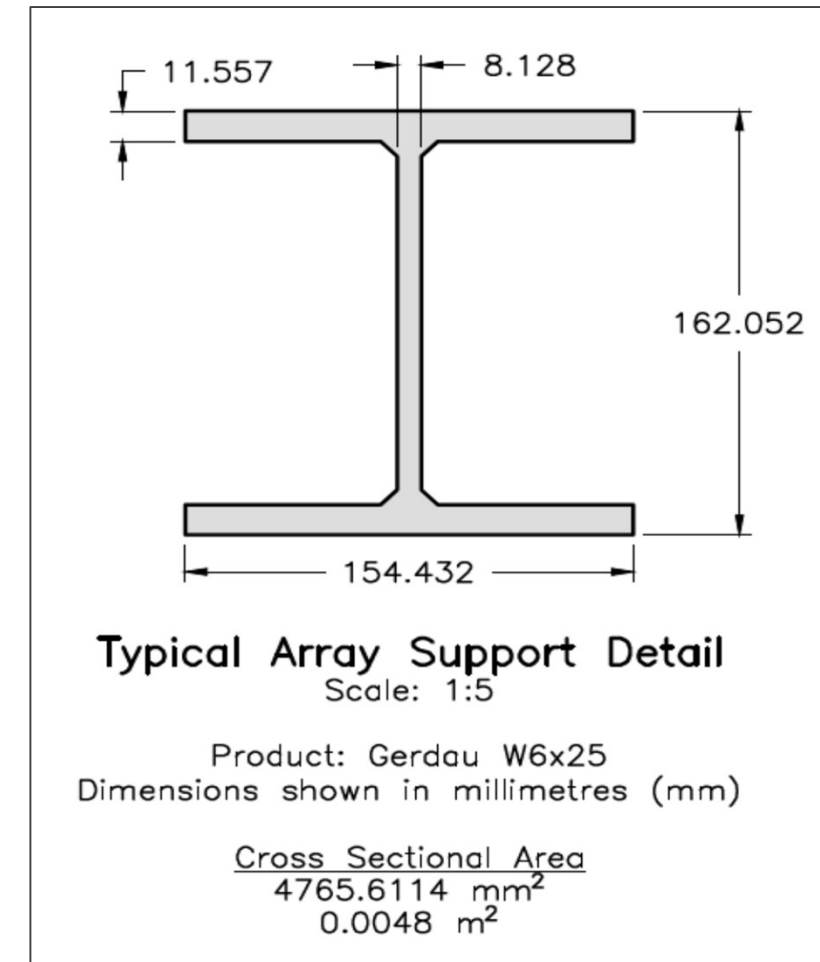
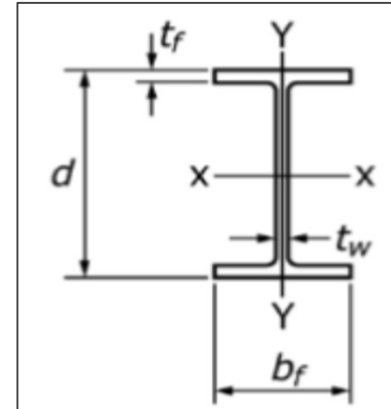
Details: Subject to detailed design

Multiple pile sizes between W6x7 and W6x25. Most of the standard posts will be W6x7, increasing up to W6x9 for edge trackers. Posts at the motor of each tracker will be higher from W6x15 to W6x25

As a precaution W6x25 utilised in calculation (largest cross sectional area)

Typical cross section below (Note: table based on manufacturers specification in square inches)

	Dimensions					
Shape Depth x Linear Weight	Cross- Section Area (A) in. <sup>2</sup>	Depth (d) in.	Flange		Web Thickness (t <sub>w</sub> ) in.	Surface Area, in <sup>2</sup> /ft
			Width (b <sub>f</sub> ) in.	Thickness (t <sub>f</sub> ) in.		
W6x7*	2.07	5.79	3.905	0.160	0.135	316.98
W6x7.75*	2.29	5.82	3.921	0.177	0.151	318.18
W6x8.5	2.52	5.83	3.940	0.195	0.170	318.78
W6x9	2.68	5.90	3.940	0.215	0.170	320.46
W6x10.4*	3.13	5.96	3.970	0.247	0.200	322.72
W6x12	3.55	6.03	4.000	0.280	0.230	325.02
W6x15	4.43	5.99	5.990	0.260	0.230	419.58
W6x16	4.74	6.28	4.030	0.405	0.260	331.74
W6x20	5.87	6.20	6.020	0.365	0.260	425.34
W6x25	7.34	6.38	6.080	0.455	0.320	431.10



Vertical Array Support Cross-Sectional Area	0.0048	m2
Vertical Pile Volume per 0.2m slice	0.00096	m3

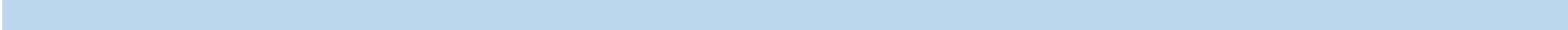
Solar Array Reference	No. of supports/posts per array
1P6@55DEG F TR ID1 PVBlock	3
1P12@55DEG F TR ID2 PVBlock	3
1P14@55DEG F TR ID1 PVBlock	N/A
1P27@55DEG F TR ID4 PVBlock	6
1P54@55DEG F TR ID4 PVBlock	9
1P81@55DEG F TR ID4 PVBlock	12



Field 35		
Max Fluvial 'Design Flood' Level	4.695	mAOD
Lowest Ground Level	4.163	mAOD
Max Flood Depth	0.532	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	32	96
1P12@55DEG F TR ID2 PVBlock	39	117
1P27@55DEG F TR ID4 PVBlock	34	204
1P54@55DEG F TR ID4 PVBlock	29	261
1P81@55DEG F TR ID4 PVBlock	27	324
	Total	1002

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	4.1-4.3	1002	0.962
0.2 - 0.4	4.3-4.5	1002	0.962
0.4 - 0.6	4.5-4.7	1002	0.962
		Total Volume of Floodwaters Displaced (m3)	2.89



Field 36		
Max Fluvial 'Design Flood' Level	4.395	mAOD
Lowest Ground Level	3.744	mAOD
Max Flood Depth	0.651	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	30	90
1P12@55DEG F TR ID2 PVBlock	50	150
1P27@55DEG F TR ID4 PVBlock	42	252
1P54@55DEG F TR ID4 PVBlock	46	414
1P81@55DEG F TR ID4 PVBlock	23	276
	Total	1182

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	3.7-3.9	1182	1.135
0.2 - 0.4	3.9-4.1	1182	1.135
0.4 - 0.6	4.1-4.3	1182	1.135
0.6-0.8	4.3-4.5	1182	1.135
		Total Volume of Floodwaters Displaced (m3)	4.54



Field 37		
Max Fluvial 'Design Flood' Level	4.660	mAOD
Lowest Ground Level	4.284	mAOD
Max Flood Depth	0.376	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	24	72
1P12@55DEG F TR ID2 PVBlock	13	39
1P27@55DEG F TR ID4 PVBlock	5	30
1P54@55DEG F TR ID4 PVBlock	9	81
1P81@55DEG F TR ID4 PVBlock	15	180
	Total	402

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	4.1-4.3	402	0.386
0.2 - 0.4	4.3-4.5	402	0.386
0.4 - 0.6	4.5-4.7	402	0.386
		Total Volume of Floodwaters Displaced (m3)	1.16



Field 38		
Max Fluvial 'Design Flood' Level	4.865	mAOD
Lowest Ground Level	4.303	mAOD
Max Flood Depth	0.562	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	63	189
1P12@55DEG F TR ID2 PVBlock	79	237
1P27@55DEG F TR ID4 PVBlock	78	468
1P54@55DEG F TR ID4 PVBlock	30	270
1P81@55DEG F TR ID4 PVBlock	91	1092
	Total	2256

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	4.3-4.5	2256	2.166
0.2 - 0.4	4.5-4.7	2256	2.166
0.4 - 0.6	4.7-4.9	2256	2.166
		Total Volume of Floodwaters Displaced (m3)	6.50



Field 39		
Max Fluvial 'Design Flood' Level	4.645	mAOD
Lowest Ground Level	4.198	mAOD
Max Flood Depth	0.447	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	26	78
1P12@55DEG F TR ID2 PVBlock	32	96
1P27@55DEG F TR ID4 PVBlock	23	138
1P54@55DEG F TR ID4 PVBlock	48	432
1P81@55DEG F TR ID4 PVBlock	72	864
	Total	1608

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	4.1-4.3	1608	1.544
0.2 - 0.4	4.3-4.5	1608	1.544
0.4 - 0.6	4.5-4.7	1608	1.544
		Total Volume of Floodwaters Displaced (m3)	4.63



Field 40		
Max Fluvial 'Design Flood' Level	4.410	mAOD
Lowest Ground Level	4.236	mAOD
Max Flood Depth	0.174	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	8	24
1P12@55DEG F TR ID2 PVBlock	6	18
1P27@55DEG F TR ID4 PVBlock	1	6
1P54@55DEG F TR ID4 PVBlock	9	81
1P81@55DEG F TR ID4 PVBlock	0	0
	Total	129

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	4.1-4.3	129	0.124
0.2 - 0.4	4.3-4.5	129	0.124
		Total Volume of Floodwaters Displaced (m3)	0.25

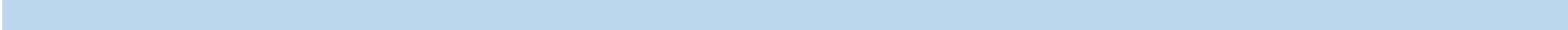




Field 41		
Max Fluvial 'Design Flood' Level	4.410	mAOD
Lowest Ground Level	3.985	mAOD
Max Flood Depth	0.425	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	26	78
1P12@55DEG F TR ID2 PVBlock	44	132
1P27@55DEG F TR ID4 PVBlock	58	348
1P54@55DEG F TR ID4 PVBlock	94	846
1P81@55DEG F TR ID4 PVBlock	0	0
	Total	1404

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	3.9-4.1	1404	1.348
0.2 - 0.4	4.1-4.3	1404	1.348
0.4 - 0.6	4.3-4.5	1404	1.348
0.6 - 0.8	4.5-4.7	1404	1.348
		Total Volume of Floodwaters Displaced (m3)	5.39



Field 42		
Max Fluvial 'Design Flood' Level	4.380	mAOD
Lowest Ground Level	3.923	mAOD
Max Flood Depth	0.457	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	79	237
1P12@55DEG F TR ID2 PVBlock	75	225
1P27@55DEG F TR ID4 PVBlock	69	414
1P54@55DEG F TR ID4 PVBlock	77	693
1P81@55DEG F TR ID4 PVBlock	79	948
	Total	2517

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	3.9-4.1	2517	2.416
0.2 - 0.4	4.1-4.3	2517	2.416
0.4 - 0.6	4.3-4.5	2517	2.416
		Total Volume of Floodwaters Displaced (m3)	7.25



Field 43		
Max Fluvial 'Design Flood' Level	4.380	mAOD
Lowest Ground Level	4.332	mAOD
Max Flood Depth	0.048	m

Array Type	Number of Arrays	Number of Supports
1P6@55DEG F TR ID1 PVBlock	3	9
1P12@55DEG F TR ID2 PVBlock	7	21
1P27@55DEG F TR ID4 PVBlock	3	18
1P54@55DEG F TR ID4 PVBlock	1	9
1P81@55DEG F TR ID4 PVBlock	5	60
	Total	117

Calculation Slice Meters Above Ground Level (0.2m increments) (m)	Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Number of Supports	Volume of Floodwaters Displaced per 0.2m Slice (m3)
0.0 - 0.2	4.3-4.5	117	0.112
		Total Volume of Floodwaters Displaced (m3)	0.11

Check number of Solar Arrays in flood risk area

Array Type	Number of Arrays in Calculations	Number of Arrays from AutoCAD
1P6@55DEG F TR ID1 PVBlock	291	291
1P12@55DEG F TR ID2 PVBlock	345	345
1P27@55DEG F TR ID4 PVBlock	313	313
1P54@55DEG F TR ID4 PVBlock	343	343
1P81@55DEG F TR ID4 PVBlock	312	312
Total	1604	1604

Check for Total Flood Volume Displaced

	Volume of Floodwaters Displaced per Field (m3)
Field 35	2.886
Field 36	4.539
Field 37	1.158
Field 38	6.497
Field 39	4.631
Field 40	0.248
Field 41	5.391
Field 42	7.249
Field 43	0.112
Total	32.711

E216: Helios Renewable Energy Project  
Preliminary Solar Array Support Flood Volume Displacement Assessment

<b>Summary</b>	
<b>Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)</b>	<b>Flood Volume Displaced (m3)</b>
3.7-3.9	1.135
3.9-4.1	4.899
4.1-4.3	7.914
4.3-4.5	10.192
4.5-4.7	6.405
4.7-4.9	2.166
<b>Total</b>	<b>32.711</b>

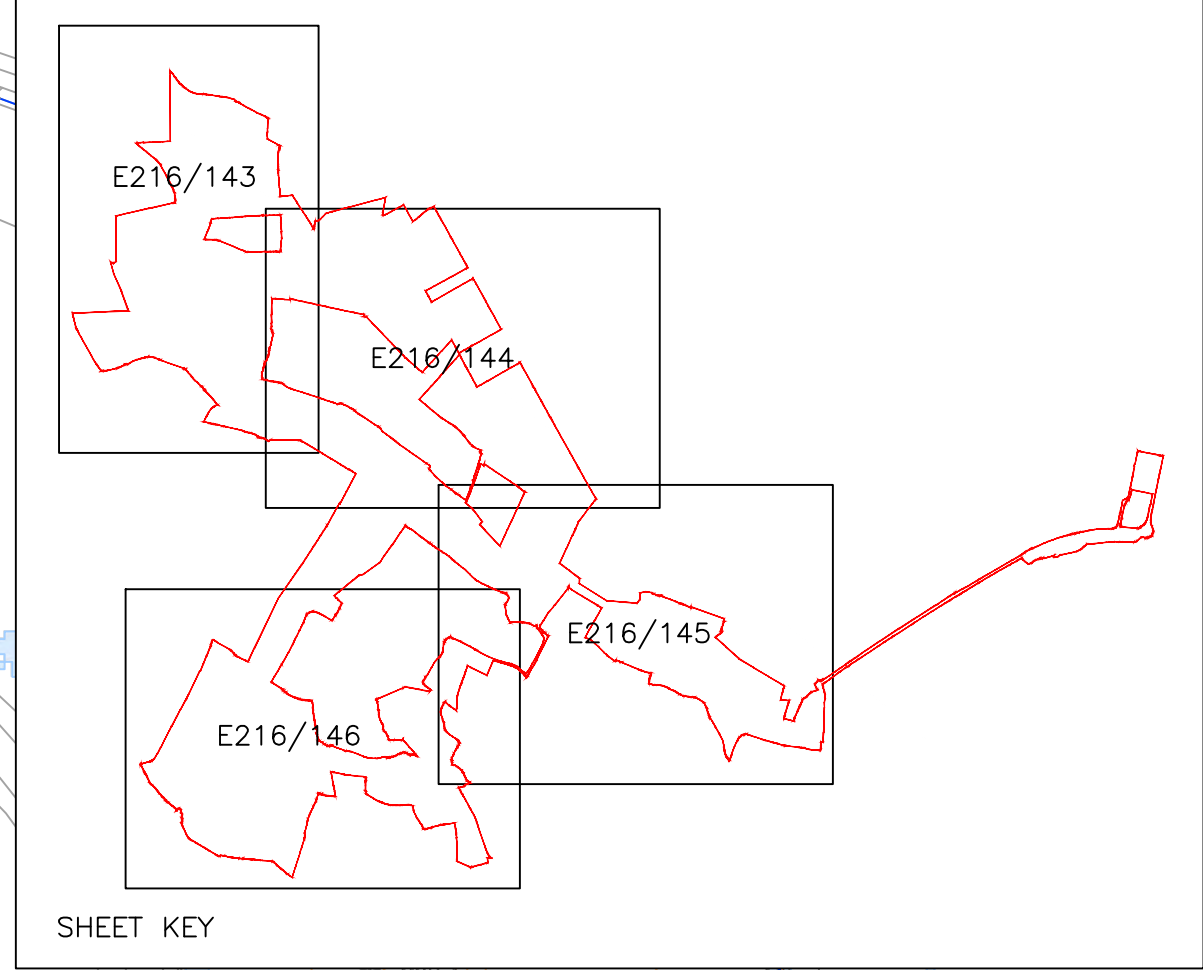
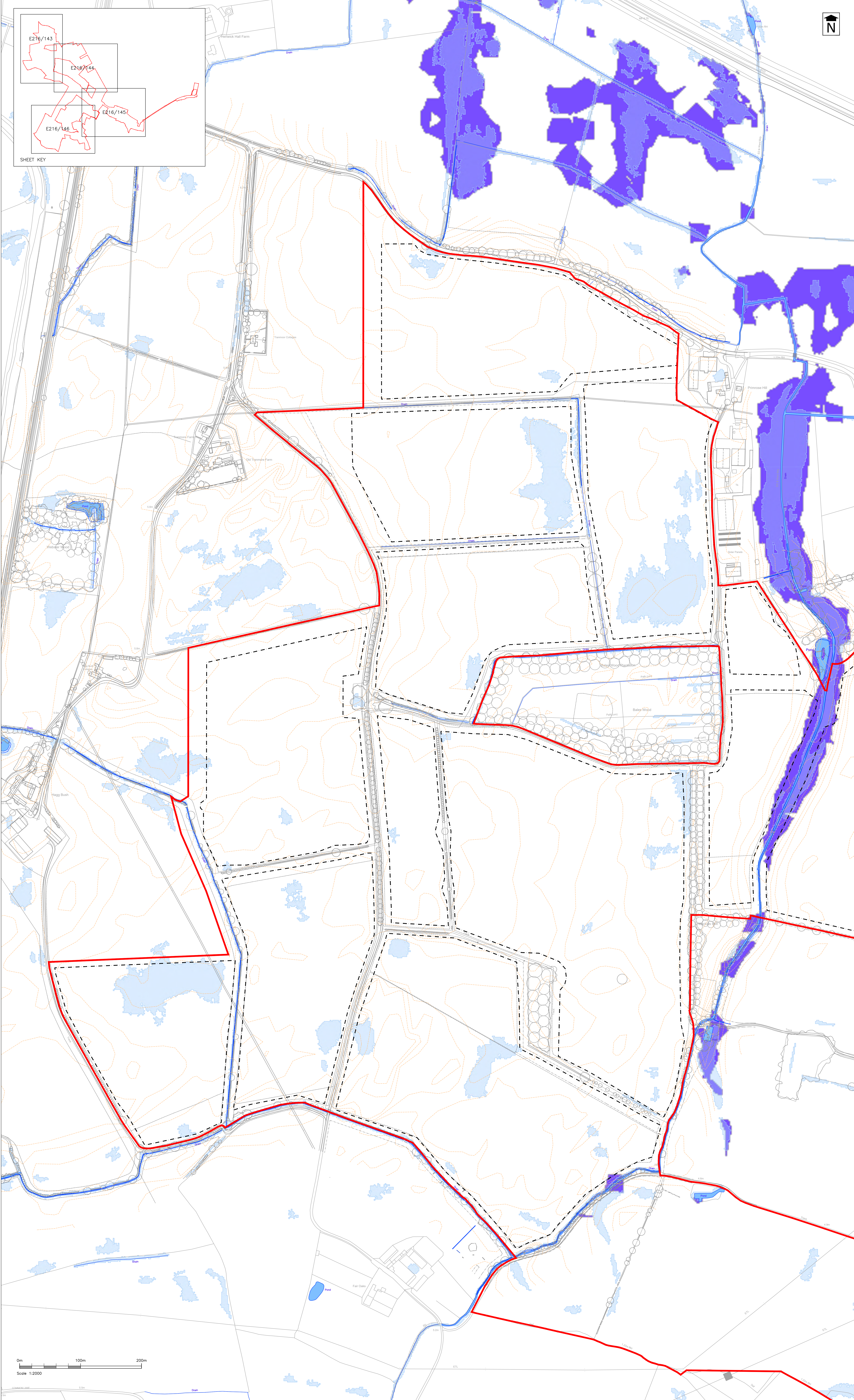
<b>Operational area of the site affected by the fluvial design flood</b>	
356963.50	m2
35.696	Ha

*Note: Operational area = area within security fence*

<b>Change in flood level in operational area of the site (m)</b>	
$\text{Flood Depth (m)} = \frac{\text{Flood Volume Displaced (m3)}}{\text{Operational area of the site affected by the fluvial design flood (m2)}}$	
0.00009164	m
0.09	mm







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#### NOTES

1. Site Boundary based upon Order Limits Location Plan, Enso Energy Drawing No. DX-01-P01 Rev 11, dated 15/02/24.
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3. Flood risk data based on the results from the all-weather flood model produced by Ageas. Details contained in Hydraulic Model Technical Note (Document Ref: AEG0851\_YOB\_EnsoEnergy\_03 Rev A dated 16/05/24).
4. Drawing should be read in conjunction with Flood Risk Assessment produced by PFA Consulting (Document Ref: E216-0001-FA-Issue 1, June 2024).
5. Low risk of surface water flooding is the extent of flooding from surface water that could result from a flood with a 0.1% chance of happening in any given year. Based on the Risk of Flooding from Surface Water (RoFSW) dataset.
6. Fluvial 'Design Flood' is the 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Higher Central) flood event (Ref: AEG0851\_ENSO\_BAS\_SCENA\_00100\_CC\_HIGHER\_051\_d\_Max-CUPPED).
7. Fluvial 'Credible Maximum Scenario Sensitivity Test' 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Upper End) flood event (Ref: AEG0851\_ENSO\_BAS\_SCENA\_00100\_CC\_UPPER\_051\_d\_Max-CUPPED).
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#### Summary of Flood Mitigation Measures

The Proposed Development extends into areas of elevated flood risk from the fluvial 'design flood'. The Proposed Development would be designed to appropriately safe in the fluvial 'design flood' without increasing flood risk elsewhere. The Proposed Development would be designed to be resilient to the fluvial 'credible maximum scenario sensitivity test' flood event with the implementation of adaptation measures where necessary at the appropriate time.

The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed CEMP, OEMP or DEMP and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk.
- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stop position which would be a minimum of a 0.3m above the fluvial 'design flood' level or the stop position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater.
- Panel supports and security fencing in flood risk areas would be securely piled into ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event.
- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris.
- Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.
- Substation and BESS Compound will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood'.
- The level of ancillary control equipment will be raised at least 0.3m (and up to 0.6m) above existing ground level to manage residual risk.
- As an adaptation measure the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation.
- The Flood Management Strategy for the Site will keep under review the need to implement a level for level floodplain compensation scheme for the Substation and BESS Compound to mitigate the effect of the earth flood defence bund. A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible.
- Onsite watercourses are retained and existing watercourse crossings are utilised where possible within the Proposed Development.
- Where possible all development (including security fencing) is at least 7m from the onsite ordinary watercourses in accordance with Safety Area (SA) byelaws. Additional consents may be required for watercourse crossings (site access or services) and landscape planting where this is not achieved.

#### Key

- Site Boundary
- - - Solar Farm Zone
- - - Substation and BESS Compound
- Watercourse
- Contours

#### Onsite Flood Hazards

- Low Risk Surface Water Flood Extents
- Fluvial 'Design Flood' Extents
- Flood Depths >0.6m Fluvial 'Credible Maximum Scenario Sensitivity Test'

NOTE: Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.

Rev	Date	Description	Drawn	Check
#	04/06/24	First Issue	BP	SAM

Status **FOR PLANNING**

Client

**Enso Green Holdings D Ltd**

Project

**Helios Renewable Energy Project**

Drawing Title

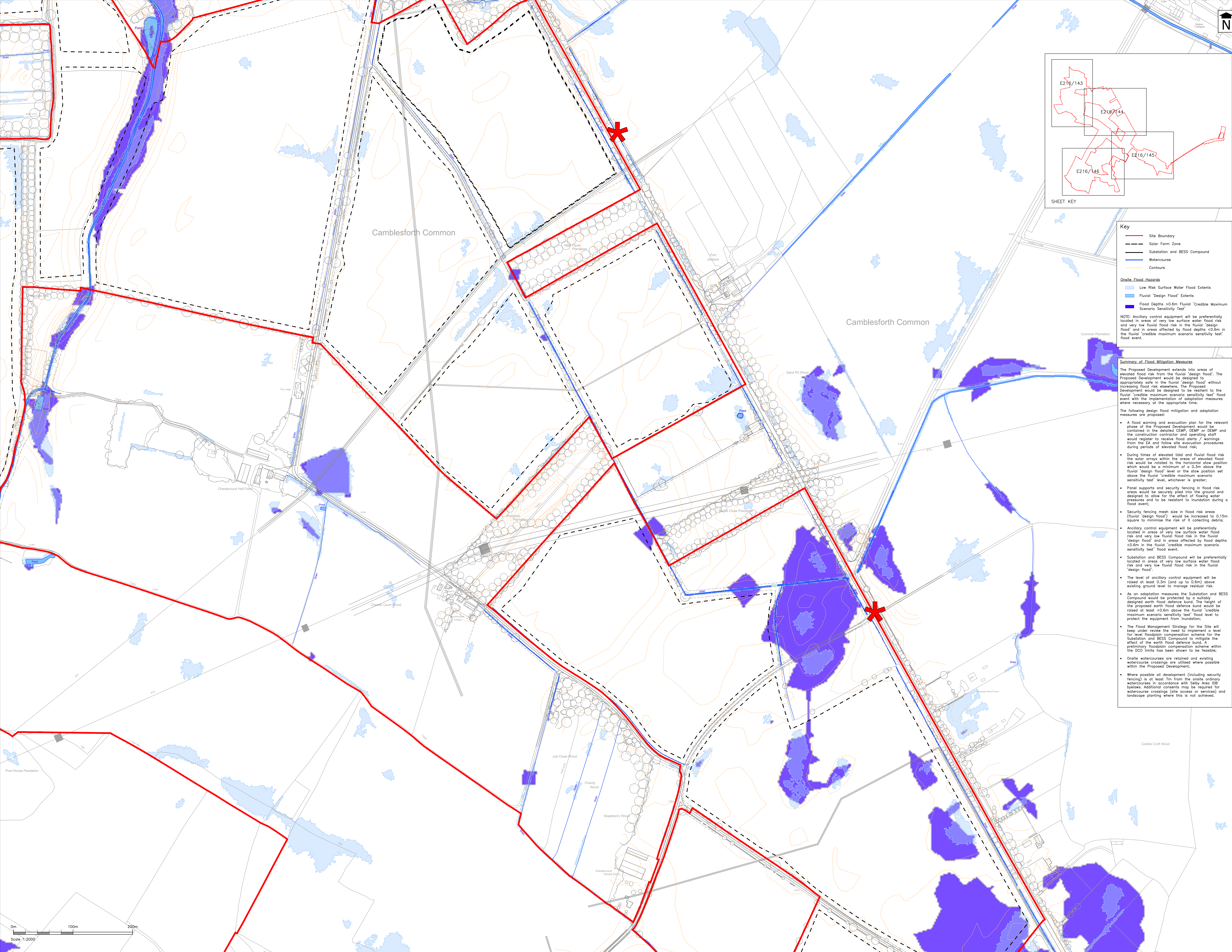
**Onsite Flood Hazards  
Sheet 1 of 4**

Drawing No. **E216/143**

Date: June 2024 Scale: 1:2000 @ A0

E-Mail: [bp@pfapl.com](mailto:bp@pfapl.com)





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  7. Fluvial 'Credible Maximum Scenario Sensitivity Test' 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Upper Ensl) flood event (Ref: AEG0851\_ENSO\_BAS\_SCENA\_Q0100\_CC\_UPPER\_051\_d\_Max-CLIPPED).
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**Key**

- Site Boundary
- Solar Farm Zone
- Substation and BESS Compound
- Watercourse
- Contours

**Onsite Flood Hazards**

- Low Risk Surface Water Flood Extents
- Fluvial 'Design Flood' Extents
- Flood Depths >0.6m Fluvial 'Credible Maximum Scenario Sensitivity Test'

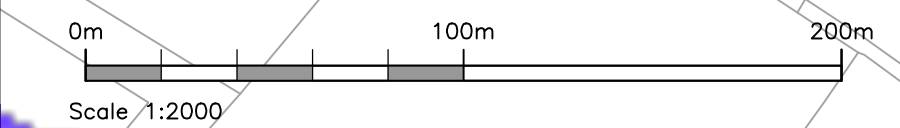
**NOTE:** Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.

**Summary of Flood Mitigation Measures**

The Proposed Development extends into areas of elevated flood risk from the fluvial 'design flood'. The Proposed Development would be designed to appropriately site in the fluvial 'design flood' without increasing flood risk elsewhere. The Proposed Development would be designed to be resilient to the fluvial 'credible maximum scenario sensitivity test' flood event with the implementation of adaptation measures where necessary of the appropriate time.

The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed CDM, O&M or D&M and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk;
- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stow position which would be a minimum of 0.3m above the fluvial 'design flood' level or the stow position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater;
- Panel supports and security fencing in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event;
- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris;
- Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event;
- Substation and BESS Compound will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood'.
- The level of ancillary control equipment will be raised at least 0.3m (and up to 0.6m) above existing ground level to manage residual risk.
- As an adaptation measures the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation;
- The Flood Management Strategy for the Site will keep under review the need to implement a level for level floodplain compensation scheme for the Substation and BESS Compound to mitigate the effect of the earth flood defence bund. A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible;
- Onsite watercourses are retained and existing watercourse crossings are utilised where possible within the Proposed Development;
- Where possible all development (including security fencing) is at least 7m from the onsite ordinary watercourses in accordance with Setback Area (SBA) below. Additional consents may be required for watercourse crossings (site access or services) and landscape planting where this is not achieved.



Rev	Date	Description	Drawn	Check
#	04/06/24	First Issue	BF	SAM

Status

FOR PLANNING

Client

Enso Green Holdings D Ltd

Project

Helios Renewable Energy Project

Drawing Title

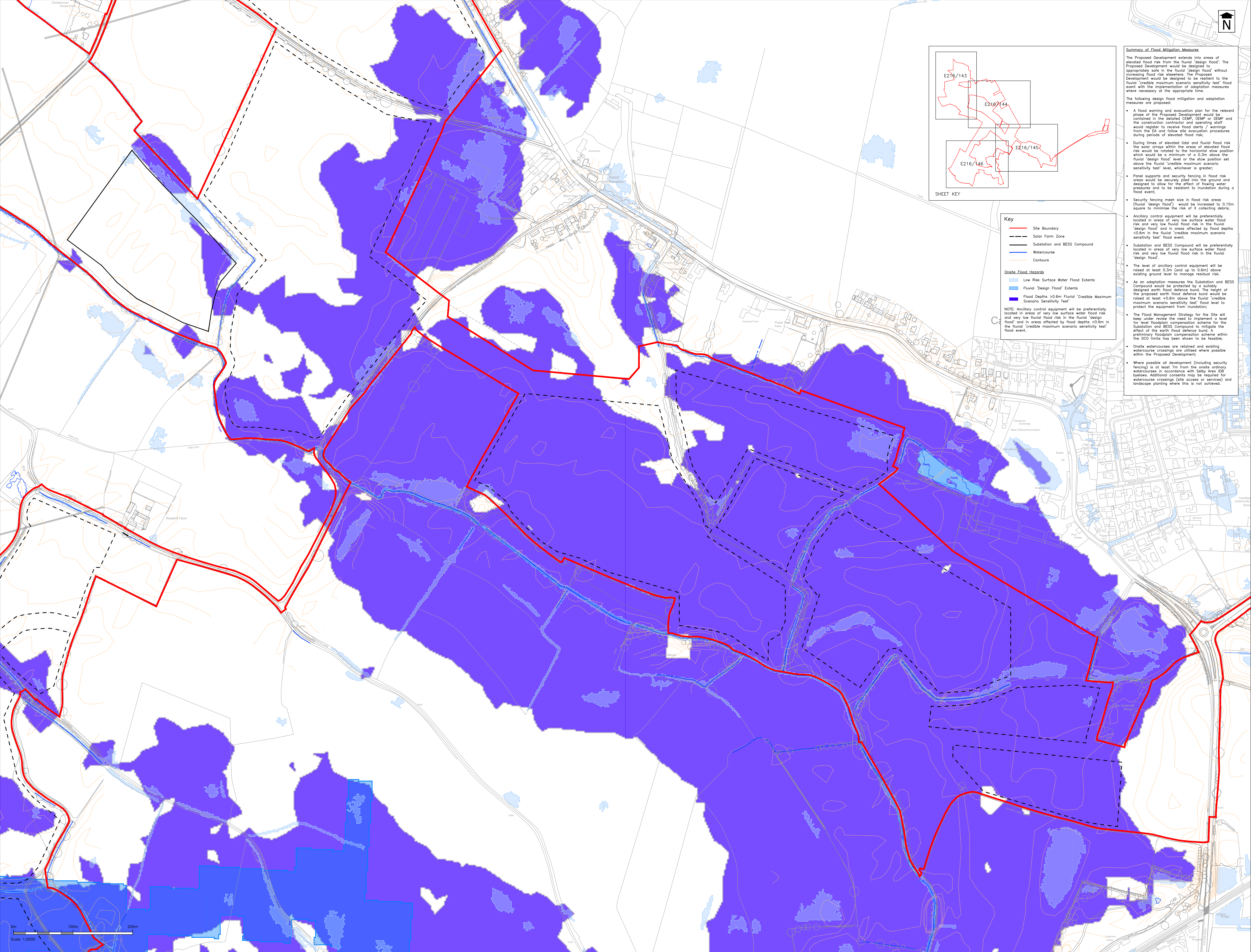
Onsite Flood Hazards  
Sheet 2 of 4

Drawing No. E216/144

Date: June 2024 Scale: 1:2000 @ A0

E-Mail: @pfapl.com





**Key**

- Site Boundary
- Solar Farm Zone
- Substation and BESS Compound
- Watercourse
- Contours

**Onsite Flood Hazards**

- Low Risk Surface Water Flood Extents
- Fluvial 'Design Flood' Extents
- Flood Depths >0.6m Fluvial 'Credible Maximum Scenario Sensitivity Test'

**NOTE:** Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.

**Summary of Flood Mitigation Measures**

The Proposed Development extends into areas of elevated flood risk from the fluvial 'design flood'. The Proposed Development would be designed to appropriately safe in the fluvial 'design flood' without increasing flood risk elsewhere. The Proposed Development would be designed to be resilient to the fluvial 'credible maximum scenario sensitivity test' flood event with the implementation of adaptation measures where necessary at the appropriate time.

The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed CDM, DMAP or DMAP and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk.
- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stow position which would be a minimum of a 0.3m above the fluvial 'design flood' level or the stow position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater.
- Panel supports and security fencing in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event.
- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris.
- Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.
- Substation and BESS Compound will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood'.
- The level of ancillary control equipment will be raised at least 0.3m (and up to 0.6m) above existing ground level to manage residual risk.
- As an adaptation measures the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation.
- The Flood Management Strategy for the Site will keep under review the need to implement a level for low level floodplain compensation scheme for the Substation and BESS Compound to mitigate the effect of the earth flood defence bund. A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible.
- Onsite watercourses are related and existing watercourse crossings are utilised where possible within the Proposed Development.
- Where possible all development (including security fencing) is at least 7m from the onsite ordinary watercourses in accordance with Selly Area IDB byelaws. Additional consents may be required for watercourse crossings (site access or services) and landscape planting where this is not achieved.

**PFA consulting**

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**For Planning**  
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- NOTES**
- Site Boundary based upon Order Limits Location Plan, Enso Energy Drawing No. DX-01-P01 Rev 11, dated 15/02/24.
  - Drawing based upon Parameter Plan, Enso Energy Drawing No. DX-01-P02 Rev 11, dated 15/04/24.
  - Flood risk data based on the results from the site-specific flood model produced by Aegise. Details contained in Hydraulic Model Technical Note (Document Ref: AEG0851\_Y08\_EnsoEnergy\_03 Rev A dated 16/05/24).
  - Drawing should be read in conjunction with Flood Risk Assessment produced by PFA Consulting (Document Ref: E216-DDC01-FRA-Issue 1, June 2024).
  - Low risk of surface water flooding is the extent of flooding from surface water that could result from a flood with a 0.1% chance of happening in any given year. Based on the Risk of Flooding from Surface Water (RoFSW) dataset.
  - Fluvial 'Design Flood' is the 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Higher Central) flood event (Ref:AEG0851\_ENSO\_BAS\_SCENA\_Q0100\_CC\_HIGHER\_051\_d\_Max-CLIPPED).
  - Fluvial 'Credible Maximum Scenario Sensitivity Test' 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Upper End) flood event (Ref: AEG0851\_ENSO\_BAS\_SCENA\_Q0100\_CC\_UPPER\_051\_d\_Max-CLIPPED).
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Rev	Date	Description	Drawn	Check
#	04/06/24	First Issue:	BF	SAM

Status

**FOR PLANNING**

Client

**Enso Green Holdings D Ltd**

Project

**Helios Renewable Energy Project**

Drawing Title

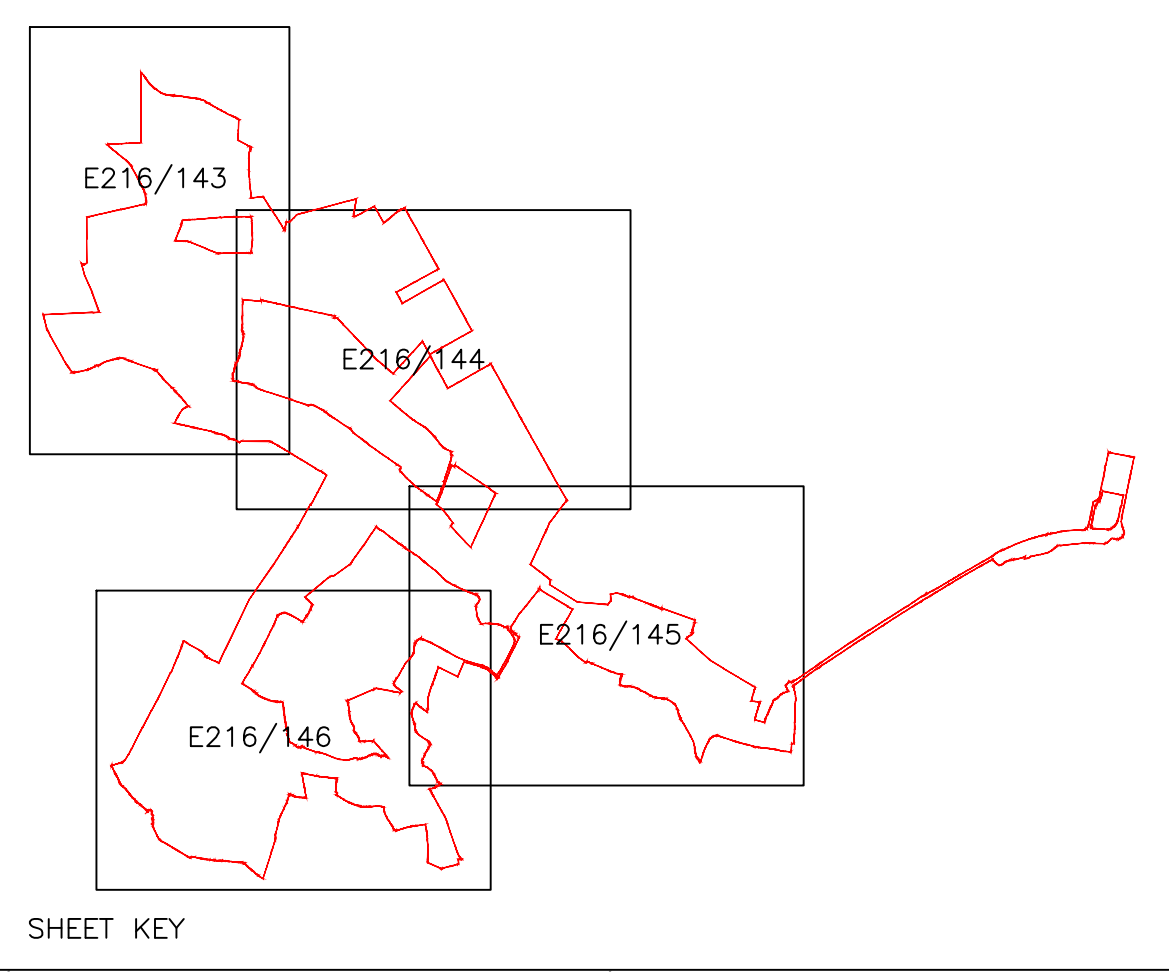
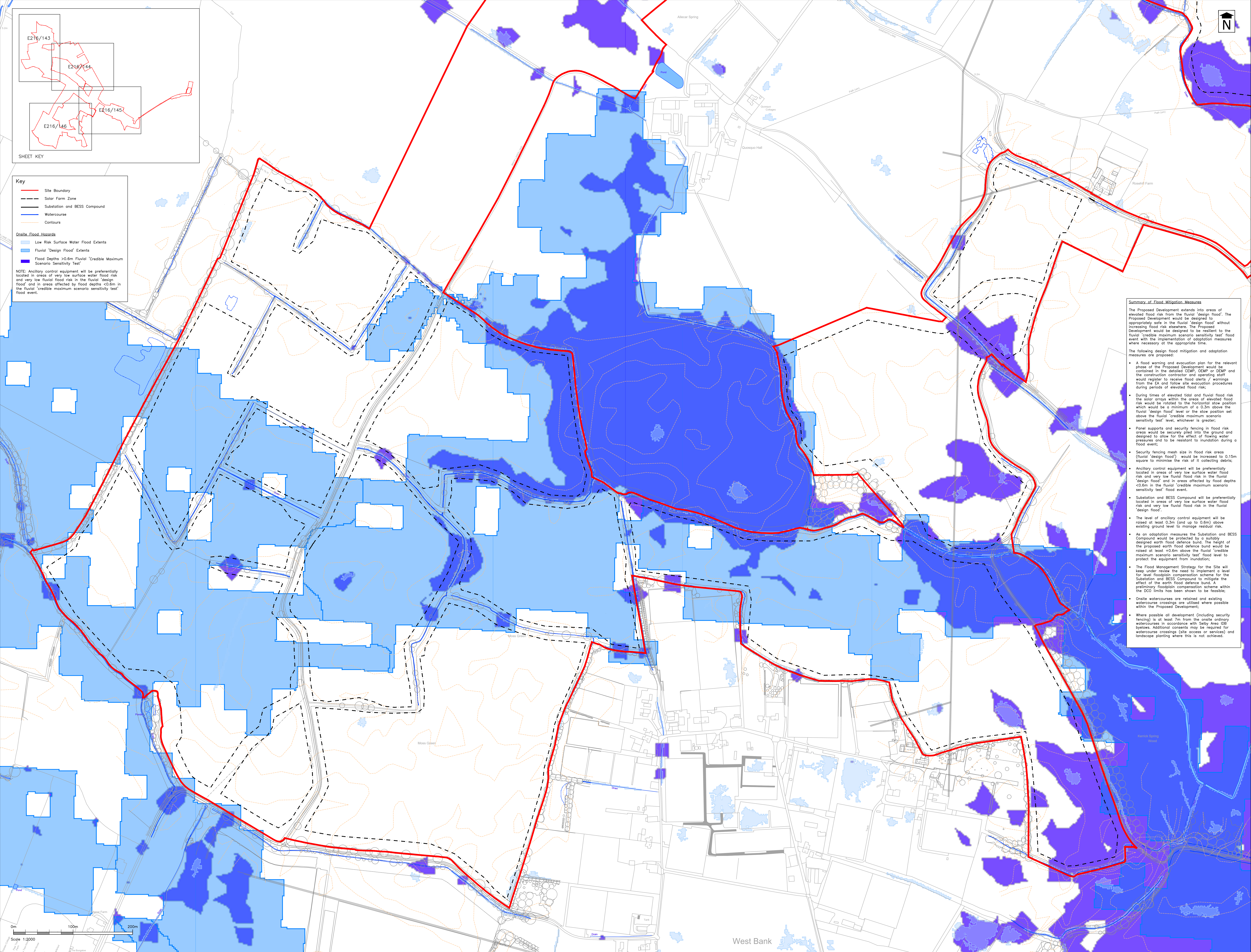
**Onsite Flood Hazards  
Sheet 3 of 4**

Drawing No. **E216/145**

Date: June 2024 Scale: 1:2000 @ A0

E-Mail: [bf@pfapl.com](mailto:bf@pfapl.com)





**Key**

- Site Boundary
- Solar Farm Zone
- Substation and BESS Compound
- Watercourse
- Contours

**Onsite Flood Hazards**

- Low Risk Surface Water Flood Extents
- Fluvial 'Design Flood' Extents
- Flood Depths >0.6m Fluvial 'Credible Maximum Scenario Sensitivity Test'

NOTE: Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.

**Summary of Flood Mitigation Measures**

The Proposed Development extends into areas of elevated flood risk from the fluvial 'design flood'. The Proposed Development would be designed to appropriately site in the fluvial 'design flood' without increasing flood risk elsewhere. The Proposed Development would be designed to be resilient to the fluvial 'credible maximum scenario sensitivity test' flood event with the implementation of adaptation measures where necessary at the appropriate time.

The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed CLMP, O&M or D&M and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk;
- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stow position which would be a minimum of 0.3m above the fluvial 'design flood' level or the stow position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater;
- Panel supports and security fencing in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event;
- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris;
- Ancillary control equipment will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event;
- Substation and BESS Compound will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood';
- The level of ancillary control equipment will be raised at least 0.3m (and up to 0.6m) above existing ground level to minimise residual risk;
- As an adaptation measures the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least 0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation;
- The Flood Management Strategy for the Site will keep under review the need to implement a level for level floodplain compensation scheme for the Substation and BESS Compound to mitigate the effect of the earth flood defence bund. A preliminary floodplain compensation scheme within the OGD limits has been shown to be feasible;
- Onsite watercourses are retained and existing watercourse crossings are utilised where possible within the Proposed Development;
- Where possible all development (including security fencing) is at least 7m from the onsite ordinary watercourses in accordance with Selly Area OGD byelaws. Additional consents may be required for watercourse crossings (site access or services) and landscape crossings where this is not achieved.

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- NOTES**
- Site Boundary based upon Order Limits Location Plan, Enso Energy Drawing No. DX-01-P01 Rev 11, dated 15/02/24.
  - Drawing based upon Parameter Plan, Enso Energy Drawing No. DX-01-P02 Rev 11, dated 15/04/24.
  - Flood risk data based on the results from the site-specific flood model produced by Aegre. Details contained in Hydraulic Model Technical Note (Document Ref: AEG0851\_Y08\_EnsoEnergy\_03 Rev A dated 16/03/24).
  - Drawing should be read in conjunction with Flood Risk Assessment produced by PFA Consulting (Document Ref: E216-DD001-FRA-Issue 1, June 2024).
  - Low risk of surface water flooding is the extent of flooding from surface water that could result from a flood with a 0.1% chance of happening in any given year. Based on the Risk of Flooding from Surface Water (RoFSW) dataset.
  - Fluvial 'Design Flood' is the 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Higher Central) flood event (Ref:AEG0851\_ENSO\_BAS\_SCENA\_00100\_CO\_C\_HIGHER\_051\_d\_Max-CLIPPED).
  - Fluvial 'Credible Maximum Scenario Sensitivity Test' 1% AEP (1 in 100 RP) Fluvial Defended + Climate Change (Upper End) flood event (Ref: AEG0851\_ENSO\_BAS\_SCENA\_00100\_CO\_C\_UPPER\_051\_d\_Max-CLIPPED).
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Rev	Date	Description	Drawn	Check
#	04/06/24	First Issue	BF	SAM

Status **FOR PLANNING**

Client  
**Enso Green Holdings D Ltd**

Project  
**Helios Renewable Energy Project**

Drawing Title  
**Onsite Flood Hazards  
Sheet 4 of 4**

Drawing No. **E216/146**

Date: June 2024 Scale: 1:2000 @ AO

E-Mail: [bf@pfaplcl.com](mailto:bf@pfaplcl.com)







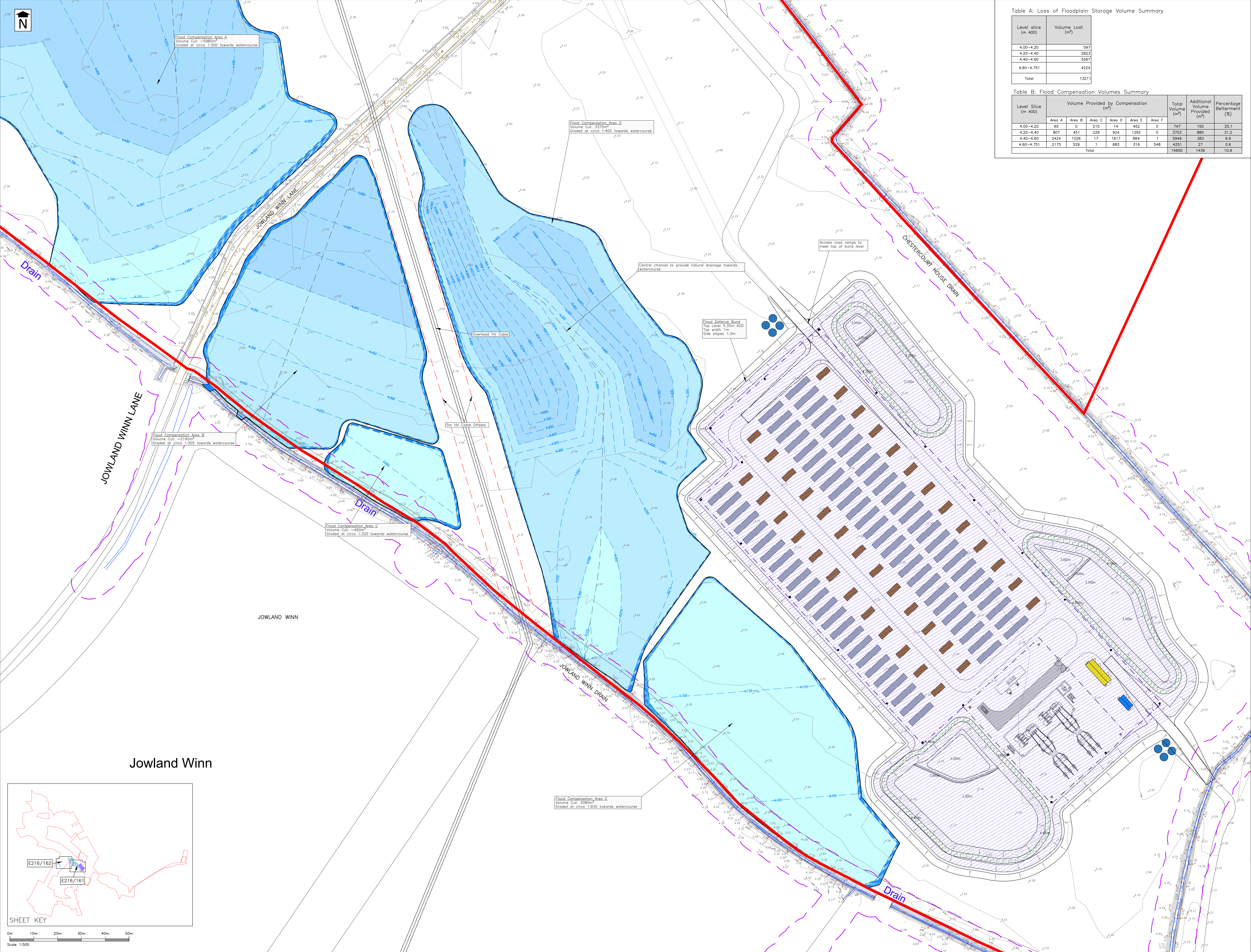


Table A: Loss of Floodplain Storage Volume Summary

Level slice (m AOD)	Volume Lost (m³)
4.00-4.20	597
4.20-4.40	2823
4.40-4.60	5567
4.60-4.751	4224
Total	13211

Table B: Flood Compensation Volumes Summary

Level Slice (m AOD)	Volume Provided by Compensation (m³)						Total Volume (m³)	Additional Volume Provided (m³)	Percentage Betterment (%)
	Area A	Area B	Area C	Area D	Area E	Area F			
4.00-4.20	65	215	14	452	0	0	747	150	25.1
4.20-4.40	807	451	229	924	1292	0	3703	880	31.2
4.40-4.60	2424	1026	17	1617	864	1	5949	383	6.9
4.60-4.751	2175	529	1	683	316	548	4251	27	0.6
Total							14650	1439	10.9

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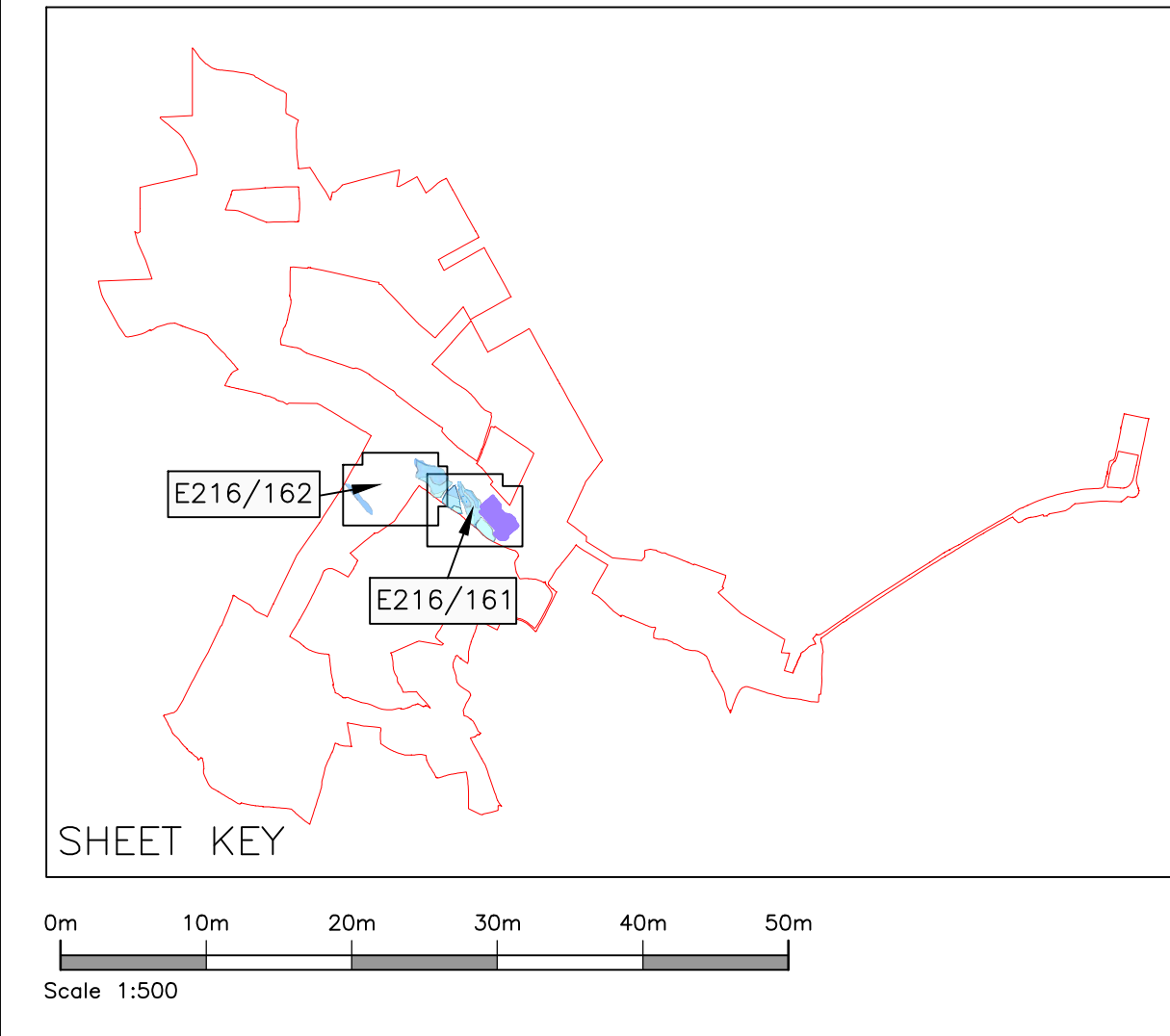
For Planning  
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**KEY**

- Site Boundary
- 7m Watercourse Maintenance Buffer
- Watercourse
- SUDS Feature Earthworks
- Existing Levels (LIDAR DTM / Survey)
- Flood Defence Bund
  - Top Level: 5.35m AOD
  - Top Width: 1m
  - Side Slopes: 1:3m
  - Assumed flood level: 4.75m AOD
- Area protected by Flood Defence Bund / Flood storage volume lost
- Floodplain Compensation Area Earthworks

- NOTES**
- Drawing based on Substation/BESS Block Plan, produced by Enso Energy, Drawing No. 0X-01-P42, Rev 01 (Dated 01/02/24).
  - Drawing based on Topographical Survey, produced by Storm Geomatics, Drawing Nos. 851/15 and 851/16 (Dated: 09/10/2023).
  - Drawing is based on 1m DTM LIDAR Data. Environment Agency copyright and/or database right 2022.
  - Surface water drainage for the BESS area subject to detailed design and technical approval.
  - Drawing to be read in conjunction with Flood Risk Assessment (including drainage strategy), Document Reference: E216-DOC01-FRA.
  - As an adaptation measure the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect equipment from inundation.
  - As an adaptation measure a level for level and volume floodplain compensation scheme would be implemented to mitigate the effect of the earth flood defence bund on the potential fluvial flood risk at the end of the decommissioning period (the fluvial 'credible maximum scenario sensitivity test' flood).
  - Earth flood defence bund is indicative only and subject to detailed design and technical approval.
  - Floodplain compensation areas are preliminary and subject to detailed design and technical approval.
  - A preliminary floodplain compensation scheme within the DCO limits is shown to be feasible on Drawing Nos. E216/161-162 Rev A based on outputs from the Environment Agency approved site-specific flood modelling.
  - A detailed Flood Management Strategy containing details of the flood defence bund and floodplain compensation scheme adaptation measures based on the outputs of the Environment Agency approved site-specific flood model would be secured by a suitably worded DCO Requirement.
  - No bulking factor has been applied to earthworks volumes stated.

Jowland Winn



Rev	Date	Description	Drawn	Check
#	07/06/24	First Issue	BF	SAM
A	24/03/25	Notes updated to reflect the mechanism for the delivery of adaptation measures agreed with the Environment Agency.	BF	MWS

Status  
**FOR PLANNING**

Client  
**Enso Green Holdings D Limited**

Project  
**Helios Renewable Energy Project**

Drawing Title  
**Preliminary Floodplain Compensation Scheme Sheet 1 of 2**

Drawing No. **E216/161** Rev A  
Date: June 2024 Scale: 1:500 @ A0  
E-Mail: [bf@pfapl.com](mailto:bf@pfapl.com)



Table A: Loss of Floodplain Storage Volume Summary

Level slice (m AOD)	Volume Lost (m³)
4.00-4.20	597
4.20-4.40	2823
4.40-4.60	5567
4.60-4.751	4224
Total	13211

Table B: Flood Compensation Volumes Summary

Level Slice (m AOD)	Volume Provided by Compensation (m³)						Total Volume (m³)	Additional Volume Provided (m³)	Percentage Betterment (%)
	Area A	Area B	Area C	Area D	Area E	Area F			
4.00-4.20	65	0	215	14	452	0	747	150	25.1
4.20-4.40	807	451	229	924	1292	0	3703	880	31.2
4.40-4.60	2424	1026	17	1617	864	1	5949	383	6.9
4.60-4.751	2175	529	1	683	316	548	4251	27	0.6
Total							14650	1439	10.9



- KEY**
- Site Boundary
  - 7m Watercourse Maintenance Buffer
  - Watercourse
  - SuDS Feature Earthworks
  - Existing Levels (LiDAR DTM / Survey)
  - Flood Defence Bund
  - Top Level: 5.35m AOD
  - Top Width: 1m
  - Side Slopes: 1:3m
  - Assumed Flood level: 4.75m AOD
  - Area protected by Flood Defence Bund / Flood storage volume lost
  - Floodplain Compensation Area Earthworks

**NOTES**

- Drawing based on Substation/BESS Block Plan, produced by Enso Energy, Drawing No. DX-01-P42, Rev 01 (Dated 01/02/24).
- Drawing based on Topographical Survey, produced by Storm Geomatics, Drawing Nos. 651/15 and 651/16 (Dated: 09/10/2023).
- Drawing is based on 1m DTM LiDAR Data. Environment Agency copyright and/or database right 2022.
- Surface water drainage for the BESS area subject to detailed design and technical approval.
- Drawing to be read in conjunction with Flood Risk Assessment (including drainage strategy), Document Reference: E216-DOCD-FRA.
- As an adaptation measure the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial credible maximum scenario sensitivity test' flood level to protect equipment from inundation.
- As an adaptation measure a level for level and volume floodplain compensation scheme would be implemented to mitigate the effect of the earth flood defence bund on the potential fluvial flood risk at the end of the decommissioning period (the fluvial 'credible maximum scenario sensitivity test' flood).
- Earth flood defence bund is indicative only and subject to detailed design and technical approval.
- Floodplain compensation areas are preliminary and subject to detailed design and technical approval.
- A preliminary floodplain compensation scheme within the DCO limits is shown to be feasible on Drawing Nos. E216/161-162 Rev A based on outputs from the Environment Agency approved site-specific flood modelling.
- A detailed Flood Management Strategy containing details of the flood defence bund and Floodplain compensation scheme adaptation measures based on the outputs of the Environment Agency approved site-specific flood model would be secured by a suitably worded DCO Requirement.
- No bulking factor has been applied to earthworks volumes stated.



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**NOTES**

- 

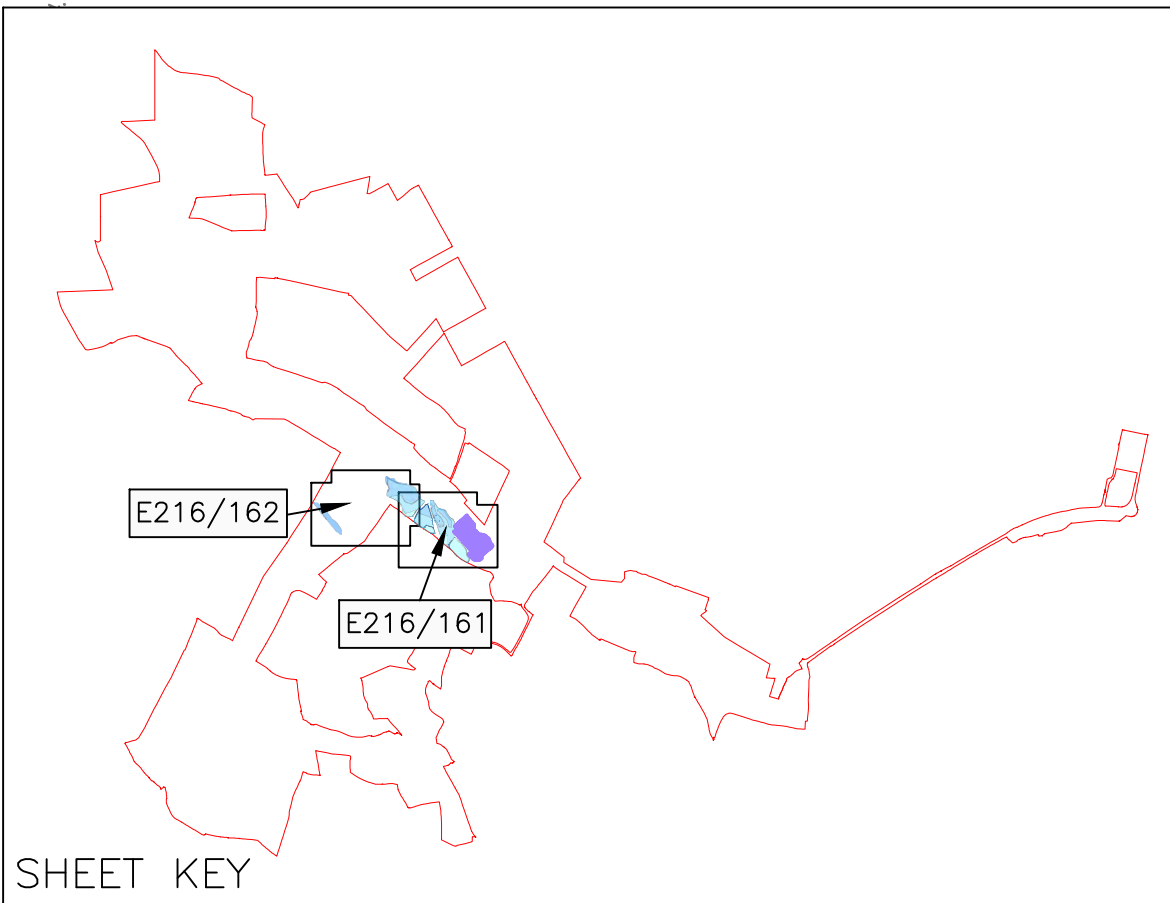
Flood Compensation Area A  
Volume Cut: ~5980m³  
Graded at circa 1:300 towards watercourse

Flood Compensation Area E  
Volume Cut: ~1270m³  
Graded at circa 1:400 towards track

Atkinson Wood  
Path (un)

Drain

JOWLAND WINN LANE



SHEET KEY  
0m 10m 20m 30m 40m 50m  
Scale 1:500

Rev	Date	Description	Drawn	Check
#	07/06/24	First Issue	BF	SAM
A	24/03/25	Notes updated to reflect the mechanism for the delivery of adaptation measures agreed with the Environment Agency.	BF	MMWS

Status  
**FOR PLANNING**

Client  
**Enso Green Holdings D Limited**

Project  
**Helios Renewable Energy Project**

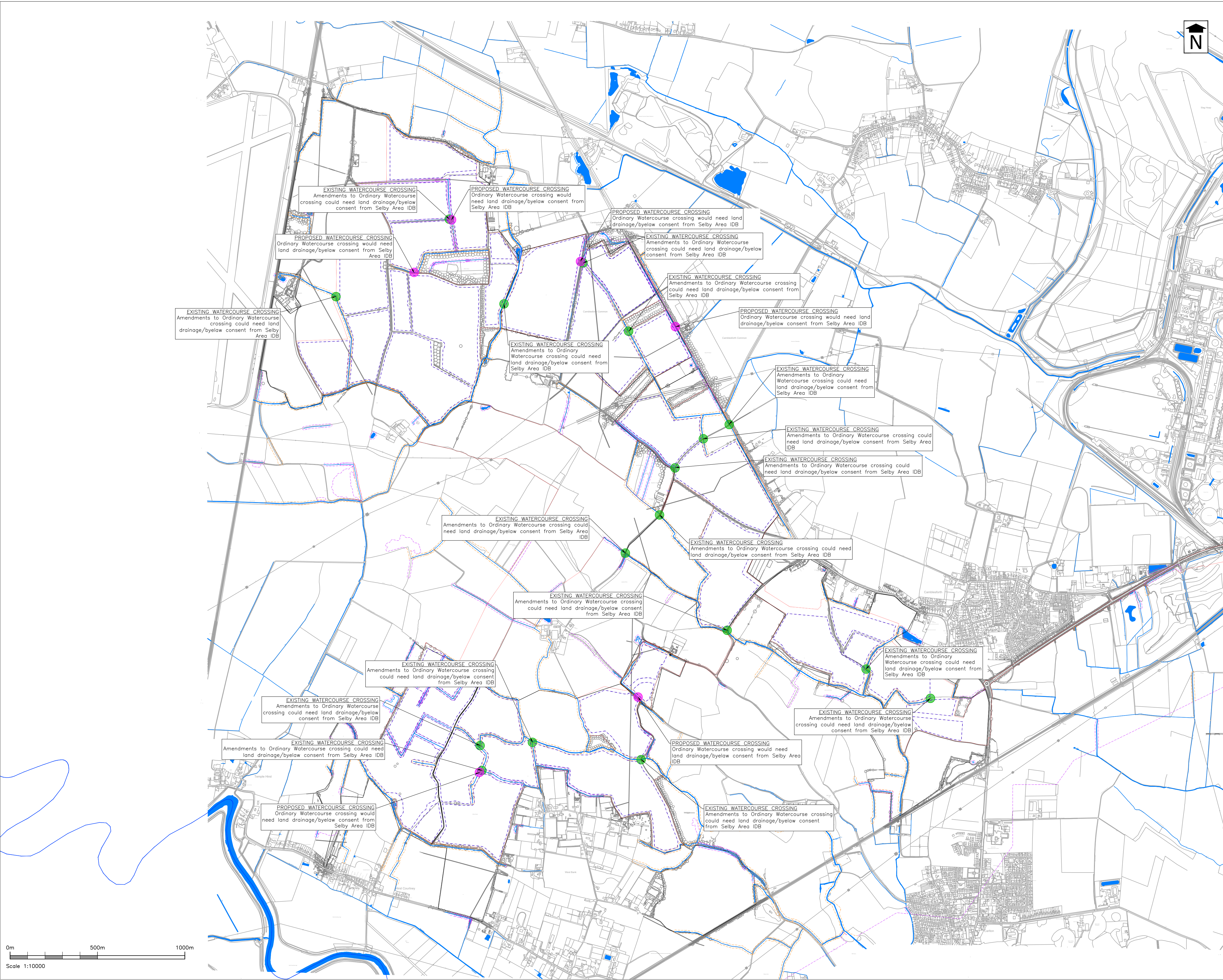
Drawing Title  
**Preliminary Floodplain Compensation Scheme Sheet 2 of 2**

Drawing No. **E216/162** Rev A  
Date: June 2024 Scale: 1:500 @ A0  
E-Mail: [bf@pfaplac.com](mailto:bf@pfaplac.com)









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- KEY**
- Site Boundary
  - Security Fence
  - Statutory Main River
  - Watercourse (IDB and/or Ordinary)
  - 7m Ordinary Watercourse Buffer
  - 7m IDB Watercourse Buffer
  - Watercourse Crossing – Proposed
  - Watercourse Crossing – Existing

- NOTES**
- Drawing based on Topographical Survey, produced by Above Surveying Ltd., drawing number DRAX LINEWORK ("CAD") (Dated 6th May 2022).
  - Drawing based on Parameter Plan by Enso Energy, Drawing No. DX-01-P02 Rev09 Parameter Plan (Dated 07.02.24)
  - Drawing based on Site Layout, produced by Enso Energy, Drawing No. DX-01-P01 Rev10 Site Boundary (Dated 07.02.24)
  - Approximate Top of Bank based on LIDAR data at 0.1m intervals. 7m buffers based on the approximate top of bank data. Top of Bank will need to be accurately verified.
  - Contains public sector information licensed under the Open Government Licence v3.0.
  - 7m watercourse buffer in accordance with Selby Internal Drainage Board byelaw (Byelaw 10: No person without the previous consent of the Board shall erect any building or structure, whether temporary or permanent, or plant any tree, shrub, willow or other similar growth within 7 metres of the landward toe of the bank where there is an embankment or wall or within 7 metres of the top of the batter where there is no embankment or wall, or where the watercourse is enclosed within 7 metres of the enclosing structure).

Rev	Date	Description	Drawn	Check
#	01/09/22	First Issue.	IS	MWS
A	27/04/23	Parameters plan updated and watercourse crossing locations reappraised.		BF
B	02/08/23	IDB buffers added.	BF	BF
C	23/08/23	Update to Red Line Boundary	IS	BF
D	14/02/24	Update to Red Line Boundary	JS	BF

Status  
**FOR PLANNING**

Client  
**Enso Green Holdings D Ltd**

Project  
**Helios Renewable Energy Project**

Drawing Title  
**Watercourse Buffers**

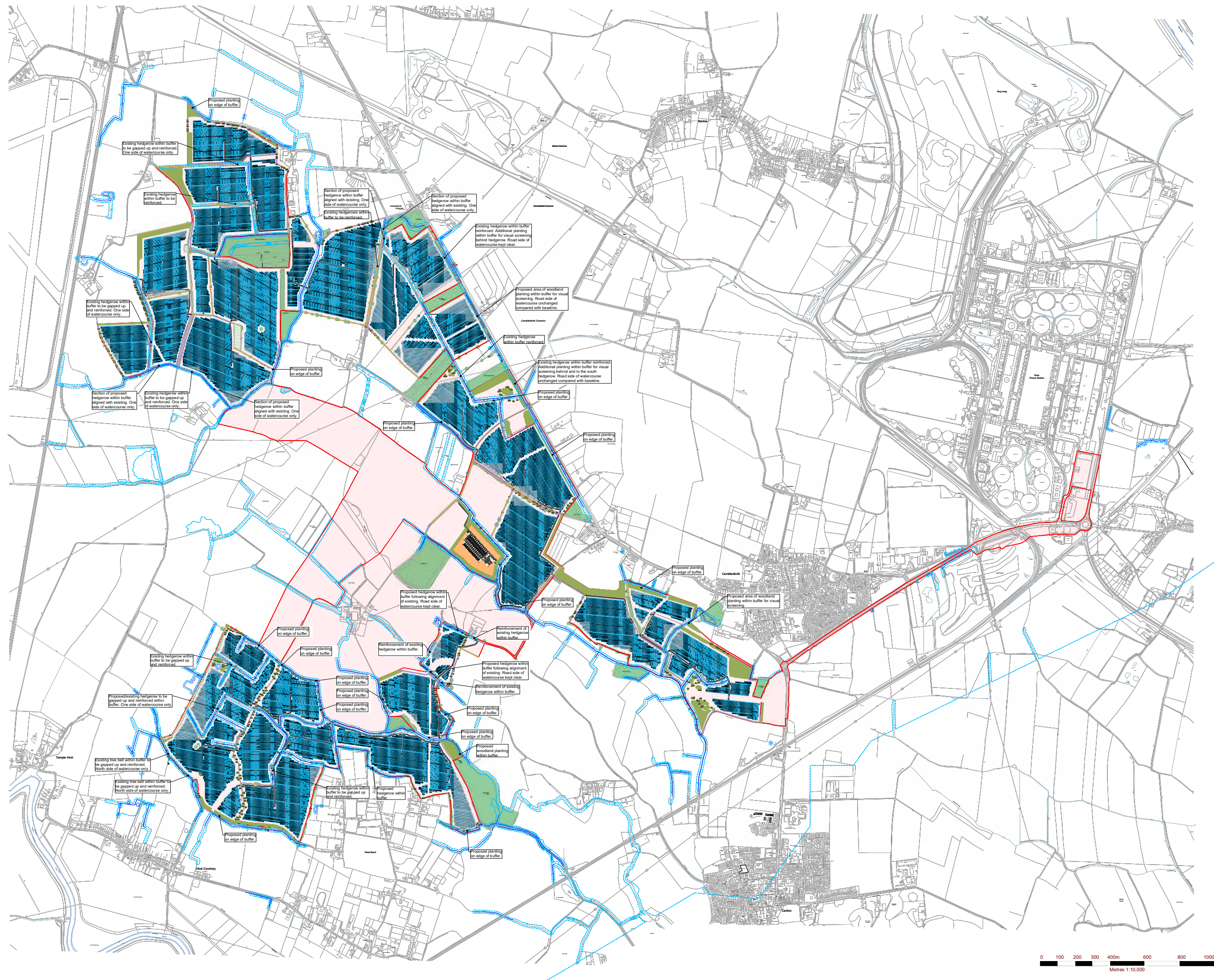
Drawing No. **E216/06** Rev D

Date: September 2022 Scale: 1:10,000 @ A1  
E-Mail: @pfaplcl.com


















KEY

- |   |   |
|---|---|
|  | Site Boundary   |
|  | Existing watercourses   |
|  | 7m watercourse buffers  |
|  | Existing surveyed trees and vegetation                                    |
|  | Proposed planting - tree, scrub, hedgerows and scrapes                    |
|  | Existing woodland to be reinforced with native planting where appropriate |
|  | Existing field boundary hedgerow to be reinforced with new planting       |
|  | Proposed hedgerow   |
|  | Historic field boundary hedgerow to be reinstated                         |



Project Title: Helios Renewable Energy Project

Drawing Title:

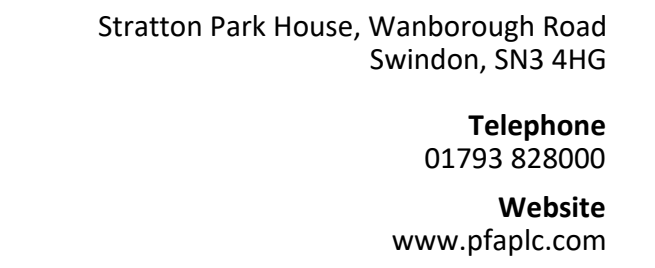
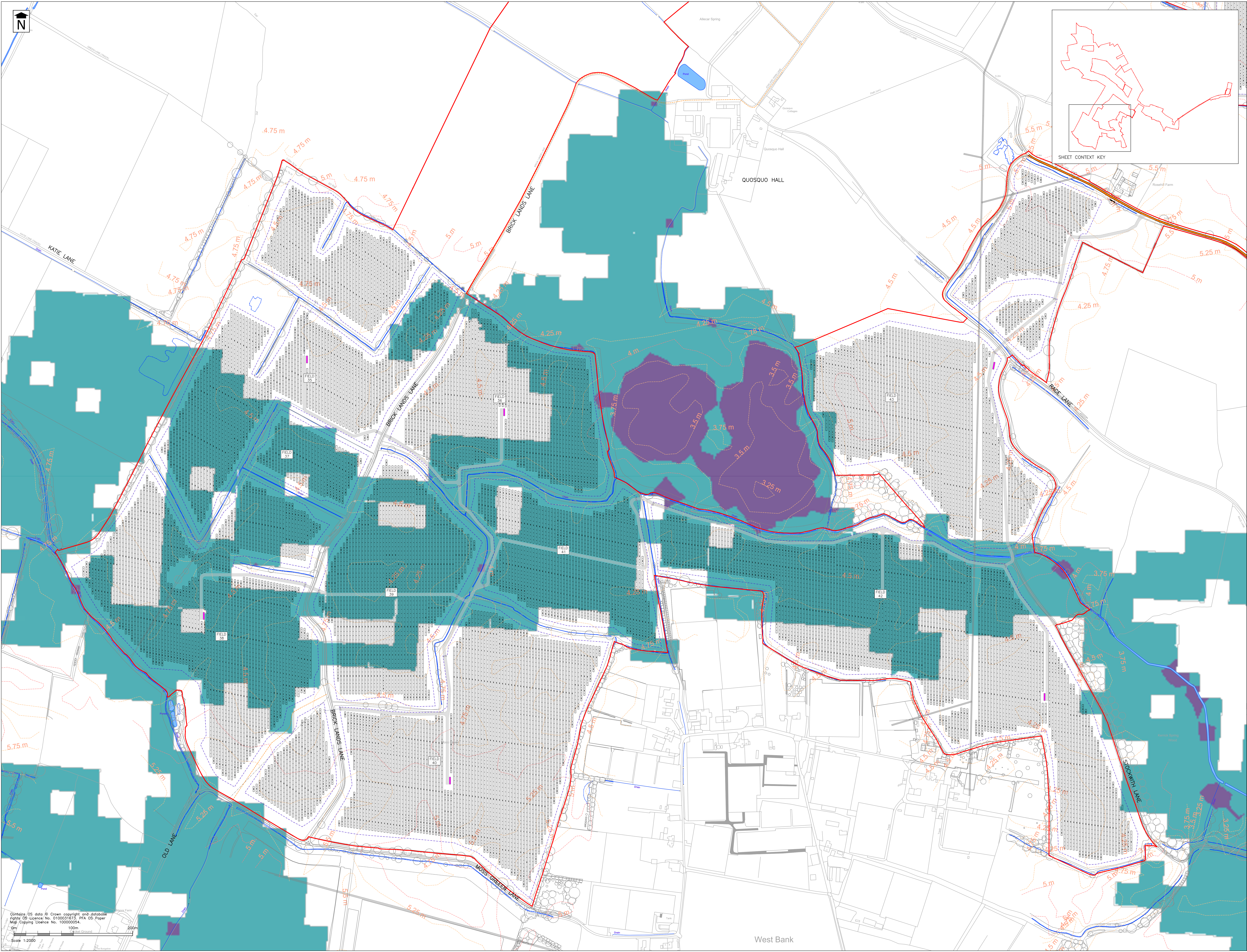
**Watercourse Buffers**

DRWG No: 012006.00001.101	Rev: 01	Sht no: -
Drawn by: HD	Checked by: SM	
1:10,000 @ A1	Date: JUNE 2024	









Planning  
This drawing is produced for the purposes of supporting planning application and should not be relied upon for order, pricing, or construction purposes.

## NOTES

- Site Boundary based upon Order Limits Location  
Plan, Energy Drawing No. DX-01-P01 Rev 11,  
dated 15/02/24.
- Drawing based upon Indicative Design, Energy  
Drawing No. DX-01-P47 Rev 08, dated 15/04/24.
- Flood risk data based on the results from the  
latest flood risk model produced by Argecon  
Details contained in Hydraulic Model Technical Note  
(Document Ref: AEG0081\_V08\_Energy03 Rev B  
dated 25/09/24).
- Drawing should be read in conjunction with Flood  
Risk Assessment produced by FFA Consulting  
(Document Ref: E216-00001-PFA-issuing 1, June  
2024) and Water Environment Supplementary  
Assessment produced by FFA Consulting (Document  
Ref: E216-00002-issuing 1, January 2024)
- Contains public sector information licensed under  
the Open Government Licence v3.0.
- Contains OS data © Crown copyright and database  
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## ey

-  Site Boundary  
 Solar Farm Zone  
 Watercourse  
 Contours  
 Solar Arrays (Indicative)

Detailed Flood Depths (m)  
 AEP (1 in 100 RP) Fluvial Defended  
 Climate Change (Higher Central)  
 f: AEG0851\_ENSO\_BAS\_SCENA\_Q0100\_CC  
 HIGHER\_051\_d\_Max-CLIPPED

Date	Description	Drawn	Che
2/01/25	First Issue.	BF	MW

US

nt

**also Green Holdings D Ltd**

## elios Renewable Energy Project

Following Title

**Fluvial 'Design Flood'**  
**Simplified Flood Depths**  
**>0.9m**

Following No. **E216/155**

Issue: January 2025	Scale: 1:2000 @ A0
Email: [REDACTED]@pfaplc.com	