ANNEX 2A.5: EXPLANATORY TECHNICAL NOTE

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ATKINS
Member of the SNC-Lavalin Group

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1. Introduction

This document has been prepared to provide further background related to the surface water management proposals for Sizewell C (SZC) nuclear power station Enabling Works Basic Design (EWBD). This note provides responses to the technical queries raised by Suffolk County Council (SCC) and aims to provide information where available for the following sections. The items numbered below correspond to the Surface Water Drainage Action Plan:

1. Control Document – outside of scope and excluded from this technical note.
2. Infiltration figures – selection
3. Treatment Indices
4. Perimeter Swale – Space allocation
5. Basin Design for Treatment
6. Calculation of Impermeable / Permeable areas
7. Review of Hydrological Catchment
8. Basin Design (sizes)
9. Operational Infrastructure

2. Infiltration parameters – selection

The infiltration results gathered over a number of years give indications across the site of a range of infiltration values. It is recognised that tests were not all carried out according to BRE 365 and therefore may not be fully comparable to each other.

The approach in the design has always been one of caution. The infiltration value chosen for each attenuation basin was on the following basis:

1. The lowest infiltration value within the WMZ being considered.
2. Values that were technically not reliable were discounted.
3. Value was chosen from all the confirmed results.
4. Value was chosen from all the years that testing occurred.

In certain situations, Suffolk County Council (SCC) have informed us that an infiltration rate of 10 mm/hr (2.78x10-6 m/s) is used as a low operational figure. In general, the rates selected in the proposed design are below this low operational figure, with only 3 zones slightly over.

This approach gave the following figures:

WMZ 1: 8.31x10-6 m/s (2015 Structural Soils Limited, Test WMZ20). WMZ 1 – Currently the basin base level is within 1.0 m of the groundwater level and therefore no infiltration has been included within the modelling.

WMZ 2: 7.55x10-6 m/s (2017 Structural Soils Limited, Test TP-WMZ-23)

9.38x10-6 m/s not confirmed 2021 result. WMZ 2 -The value chosen for this zone equates to 27.2 mm/hr. The figure obtained in 2021 is still to be confirmed (6.64x10-6 m/s, 23.9 mm/hr) and is only marginally more conservative. We consider our value a good choice amongst the range and uncertainty.

WMZ 3: 1.34x10-6 m/s (2020 Fugro, Test WMZ3_2020-3-TP-A)

No 2021 results available. WMZ 3 – This value chosen is very low (4.8 mm/hr) and is below the SCC minimum.

WMZ 4: 7.76x10-6 m/s (2017 Structural Soils Limited, Test TP-WMZ-21)

1.90x10-5 to 1.40x10-6 m/s not confirmed 2021 results. WMZ 4 – The value chosen is significantly lower than the other values being considered. The 2021 figures have a range with one value being lower (1.4x10-6 m/s, 5.0 mm/hr). We consider our value a good choice amongst the range and uncertainty.

WMZ 5: 1.24x10-6 m/s (2017 Structural Soils Limited, Test TP-BP-4)

1.14x10-4 to 2.20x10-5 m/s not confirmed 2021 results. WMZ 5 – The value chosen is much less than other values in this area and less than the 10 mm/hr figure (1.24x10-6 m/s, 4.5 mm/hr). The 2021 figure are considerably more than previous results.

WMZ 6: 5.58x10-6 m/s (2020 Fugro, Test WMZ6_2020-2-PIT)

2.09x10-5 to 7.05x10-6 m/s not confirmed 2021 results. WMZ 6 – The value chosen is much less than other values. 5.58x10-6 m/s is 20.1 mm/hr and therefore is slightly more than the SCC low figure. All 2021 figures are higher.

ACA: No Infiltration used in design. 8.68x10-6 m/s lowest, 3.02x10-5 to 3.56x10-6 m/s not confirmed 2021 results.

Green Railway: 1.06x10-4 m/s (2014 Structural Soils Limited, Test GR11A). Abbey Road – The value chosen is the lowest value amongst the satisfactory tests carried out. Although higher than the SCC low value it is a reasonable value to use in the zone.

Campus: 3.70x10-6 m/s (2014 Structural Soils Limited, Test SA3)

2021 Results:

No 2021 results were included within the analysis for 2 reasons:

- Results were not confirmed at the time of writing.
- Results are less conservative in all relevant WMZs.

Results from 2021 campaign have not been issued formally, however draft data has been provided for some areas and the results, although to be confirmed, gave values that are less conservative than the figures chosen. The method used in the 2021 campaign comply with BRE 365.

To aid with the positioning and identification of the 2021 infiltration testing completed to date, the draft site location plans are shown in Appendix A.

3. Treatment Indices

3.1. ACA Treatment

The Simple Index Approach (SIA) was used to assess water quality management for the ACA. It was recognised that the ACA presented the largest difficulties and was the reason this assessment was carried out first. The treatment index for the SuDS features in the ACA have been reviewed and altered to Basin from Pond. The Basin index is for total suspended solids (0.5), metals (0.5) and hydrocarbons (0.6), is generally less than that of a pond (0.7, 0.7, 0.5) respectively. A summary of each area is shown below in the Table 3-1. Note that where the total mitigation index values were greater than 1, these are limited to state '>0.95' as advised by the SIA tool.

As shown, some areas within the ACA are shown to not have sufficient mitigation methods for each contaminant type. Currently the flows in some areas flow directly into the basin without upstream pre-treatment.

It is anticipated that a mixture of SuDS features and proprietary methods will be introduced during Detailed Design in the appropriate areas to address these shortfalls as noted in the ACA Drainage Strategy Technical Note DCO Task D4 (SZC-EW0320-ATK-XX-000-XXXXXX-NOT-CIV-000003).

Table 3-1 - ACA SuDS mitigation indices for discharges to surface waters

ACA area	Assigned Pollution hazard levels	SuDS features proposed	Total SuDS mitigation Index		
			TSS	Metals	Hydrocarbons
Park and Ride area	Medium	- Permeable pavement - Basin	0.95 (>0.7)	0.85 (>0.6)	>0.95 (>0.7)
Logistics compound	Medium	- Permeable Pavement - Basin	0.95 (>0.7)	0.85 (>0.6)	>0.95 (>0.7)
Railway	Medium	- Filter drains - Basin	0.65 (<0.7)*	0.65 (>0.6)*	0.7 (=0.7)*
Material Transfer Laydown	High	- Permeable Pavement - Basin	0.95 (>0.8)	0.85 (>0.8)	>0.95 (>0.9)
Sand & Aggregate Stockpile	High	- Basin	0.5 (<0.8)**	NA	NA
Topsoil compound	High	- Swale - Basin	0.75 (<0.8)	0.85 (>0.8)	0.9 (=0.9)
HGV parking	High	- Basin	0.5 (<0.8)*	0.5 (<0.8)*	0.6 (<0.9)*
Caravan Pitches	Medium	- Permeable Pavement - Basin	0.95 (>0.7)	0.85 (>0.6)	>0.95 (>0.7)

** Drainage treatment to be supplemented by proprietary non-SuDS treatment, to be discussed and agreed with LLFA.*

*** Sand & Aggregate stockpile compound to be reviewed in next design phase to investigate the use of swales or filter drains around the perimeter of this compound.*

3.2. Simplified Treatment Indices Approach

To demonstrate water quality risk management, the Simple Index Approach (SIA) outlined in Section 26.7 of CIRIA C753 The SuDS Manual can be used to characterise hazards and SuDS performance capacities by assigning simple qualitative indices. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant) type that equals or exceeds the pollution hazard index (for each contaminant type). From Table 26.2 of CIRIA C753 The SuDS Manual, the pollution hazard index for the SZC development can be assigned for different land use classifications. In general, the Main Development Site can be categorised into either 'High' or 'Medium' hazard levels as shown in the table below.

Table 3-2 - Pollution hazard indices for different land use classifications

Land use	Risk Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, home zones and general access	Low	0.5	0.4	0.4

roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements/day				
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospital, retail), all roads except low traffic roads and trunk roads/motorways.	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approached to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways.	High	0.8	0.8	0.9

An assessment was conducted for the ACA and is presented in the ACA Drainage Strategy Technical Note DCO Task D4 (SZC-EW0320-ATK-XX-000-XXXXXX-NOT-CIV-000003). The ACA is not presented in this section.

3.2.1. Temporary Construction Area

In general, surface water runoff in the TCA will be collected and/or directed towards one or more SuDS features as shown in the table below. As outlined in the WMZ1 Surface Water Treatment Assessment Technical Note (ref. SZC-EW0320-ATK-XX-000-XXXXXX-NOT-CCD-000006), three discharge pathways are considered and are all shown to demonstrate sufficient water quality management. This approach applies to other WMZ's within the TCA.

- Pathway 1 – Filter Strip and Swale to Groundwater via infiltration trench.
- Pathway 2 – Filter Strip and Swale and Basin to Groundwater.
- Pathway 3 – Filter Strip and Swale and Basin to Watercourse.

Table 3-3 - SuDS Mitigation Indices (includes mitigation indices for discharge to ground water Table 26.4 of CIRIA C753 The SuDS Manual)

Pathway	TSS	Metals	Hydrocarbons
Filter Strip + Swale (with infiltration trench)	0.85	0.9	>0.95
Filter Strip + Swale + Basin (infiltration at basin)	>0.95	>0.95	>0.95
Filter Strip + Swale + Basin (discharge to watercourse only)	0.9	0.95	>0.95

Whilst catchments differ in their proposed land use, and therefore associated risk level, a 'high' risk level has been used to demonstrate a worst-case scenario. A detailed assessment of each catchment, and their proposed land-uses (e.g. contractor compound, stockpile etc.) will be carried out at the next design stage. During Detailed Design, optimisation of proposed features will be undertaken, and additional water management features will be considered and introduced on a risk management basis where necessary.

At this stage, the WMZ 10 (Accommodation Campus area) has conservatively been assigned a 'medium' hazard risk level, however this will be reviewed during Detailed Design as this area can also be described as a 'low' risk level. Surface water runoff in WMZ 10 will generally be treated and attenuated using a porous pavement build-up. Where good infiltration potential is identified, these will be explored further at detailed design to maximise infiltration to ground. The runoff may be conveyed towards an outfall, that is consistent with the existing (non-developed) runoff, should infiltration be too low to provide an adequate solution. This runoff can be conveyed via swales to provide additional water treatment. See Section 9.1 for further information on the Campus drainage strategy.

Table 3-4 - TCA SuDS mitigation indices

Water Management Zone	Highest Hazard in Zone	Hazard Risk	Risk Indices (TSS/ Metals/ Hydrocarbons)	Discharge pathway with least treatment	Treatment Index (TSS/ Metals/ Hydrocarbons)
WMZ 1	Haul Road	High	0.8, 0.8, 0.9	1	0.85, 0.9, >0.95
WMZ 2	Haul Road	High	0.8, 0.8, 0.9	1	0.85, 0.9, >0.95
WMZ 3	Haul Road	High	0.8, 0.8, 0.9	1	0.85, 0.9, >0.95
WMZ 4	Haul Road	High	0.8, 0.8, 0.9	1	0.85, 0.9, >0.95
WMZ 5	Haul Road	High	0.8, 0.8, 0.9	1	0.85, 0.9, >0.95
WMZ 6	Haul Road	High	0.8, 0.8, 0.9	1	0.85, 0.9, >0.95
WMZ 10 – Campus	Access Road	Medium	0.7, 0.6, 0.7	Pervious Pavement only	0.7, 0.6, 0.7

3.2.2. Main Construction Area (WMZs 7, 8 and 9)

The collection of surface water across WMZs 7, 8 and 9 will be designed to suit the sequence of construction events. In the early phases, prior to the completion of the cut-off wall, surface water will be collected and held in temporary ditches/bund and sediment ponds within the MCA area, before being treated using proprietary devices, such as Siltbuster packaged treatment plant (60 mg/l suspended solids), if required. Where necessary, the packaged treatment plant will be operated to perform in line with the water quality and discharge requirements set out in the water discharge permit. The captured runoff will be discharged to the diverted Sizewell Drain, or in extreme circumstances, to the sea via the temporary marine outfall.

Upon completion of the cut-off wall, surface water within WMZ9 will be managed by constructing multiple sediment ponds at low points within the excavation, constantly evolving ahead of the main excavation areas. Water from within the ponds will infiltrate into the ground and be captured within the dewatering process and directed to the Groundwater Treatment Plant, before discharging to the sea via the Combined Drainage Outfall (CDO).

Discharge from WMZ 7 and 9 will be directly to the sea via the Combined Drainage Outfall (CDO) during construction phase, and the discharge from the plant when it becomes operational will be via the cooling water tunnel.

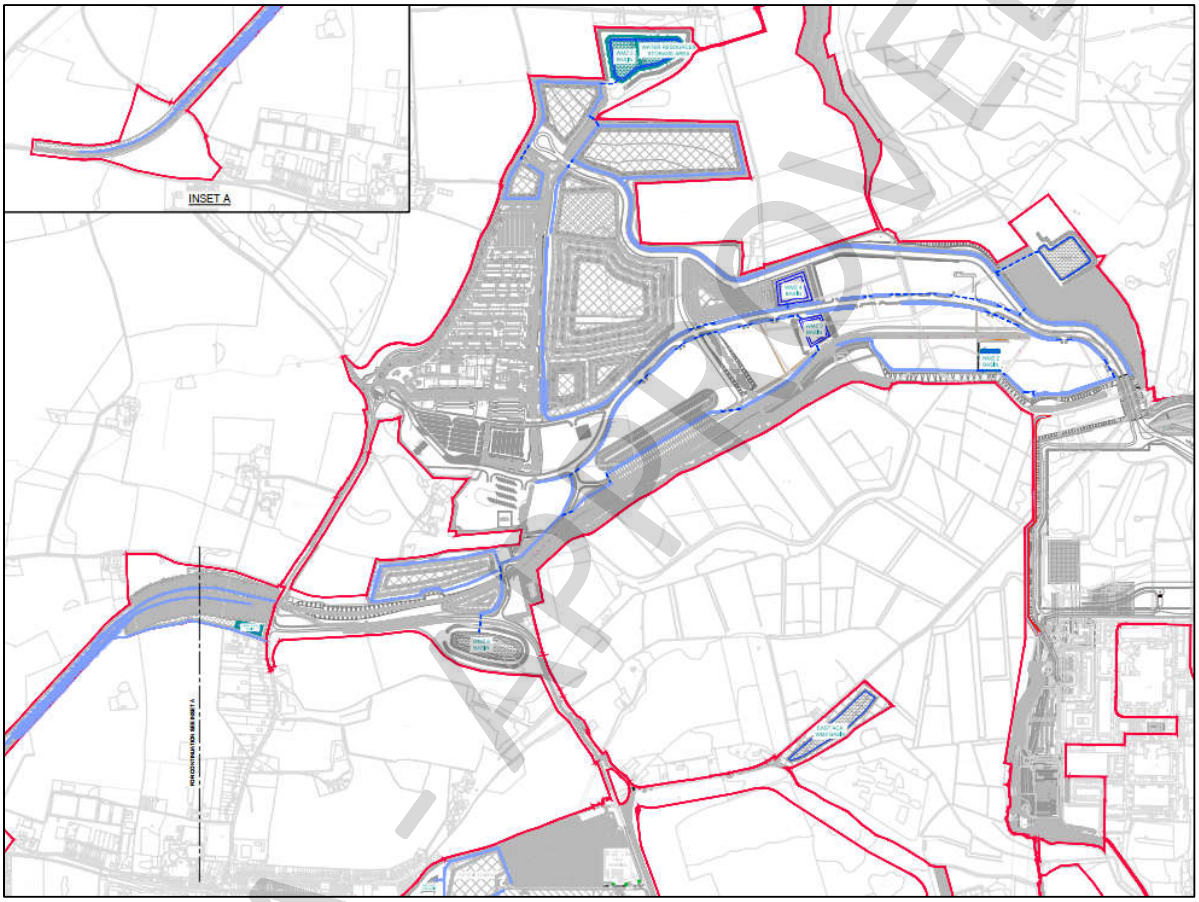
WMZ 8 is currently proposed to drain using filter drains along the verge and attenuated sub surface to restrict it to greenfield runoff rates. From the SIA, filter drains alone do not provide sufficient mitigation (0.4, 0.4, 0.4) and further work will be undertaken at the next design stage to ensure adequate water treatment is proposed. The proposals are to be developed and agreed with SCC.

Further to the above, it is proposed to remove as much sediment as possible as close to source as possible and this can be done by installing wheel washes at the MCA when trucks exit the excavation, as well as wheel washes positioned at stockpile/borrow put areas. Secondly, road sweeper operation along the access roads and haul roads is proposed, reducing the need to remove silt from the swales and filter drains. All surface water drainage proposals will be reviewed and refined in Detailed Design to ensure sufficient water treatment is provided prior to discharge to surface waters.

4. Perimeter Swale

An overview of the swale network is provided indicatively in Figure 4-1 below and in Appendix C. The swales shown on the drawing are between 4 and 6 m wide across the site. The final position and geometry of the swale network will be progressed during the next design stage and will ensure water quantity and quality benefits are realised in accordance with CIRIA C753 The SuDS Manual. This may entail dedicating a larger area for this purpose, and the provision of additional swale features across the development site.

Figure 4-1 – Indicative Swale Network Overview (ref. SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CCD-000038)



5. Basin Design for Treatment

The general guidance provided in the CIRIA C753 SuDS manual will be used assist in the design of attenuation basins for treatment. A range of these factors have been used in Hinkley Power Station, which are intended to be replicated at SZC.

The attenuation basins are to have sediment forebays upstream by dividing off areas of the basin using permeable berms. This reduces velocity of flows entering and allows sediment to build locally. These areas require regular desilting to ensure continued operation.

The quality of the water can be further improved by additional use of permeable berms that encourage a serpentine flow of water. This maximises the flow path length thereby allowing more time for sedimentation. There is an opportunity to have vegetated sides and a small permanent pool near the outlet. This option will be considered during detailed design.

The sizes of the proposed basins are large and there is an expectation that they are very unlikely to overflow to a watercourse. During normal storm events there is every reason to expect these basins to operate well, delivering the water quality required. For basins located in WMZs 1, 2, 3 & 4 there is a proposed connection to the spine network, which discharges to the CDO. This is expected to be required only in the rarest of times and allow drawdown of the basin water level.

The addition of proprietary devices, such as a Siltbuster packaged treatment plant, may be considered at detailed design to ensure the water quality requirements (60 mg/l suspended solids etc.) are adhered to.

6. Calculation of impermeable / permeable areas

The table below shows the breakdown of the type of area (roofed, paved, unpaved and soft) within each catchment and the assigned percentage impervious (PIMP) value, used to determine an overall PIMP for the catchment. The ‘Design PIMP’ is the value taken forward in the calculation of the required storage (Water Management Zone Summary Technical Note DCO Task D2) and is more conservative than the calculated PIMP.

WMZ	Total Catchment Area (ha)	Total Catchment Area (m^2)	Area type (m^2) and associated PIMP (%)				Overall Catchment PIMP (%)	Design PIMP (%)
			Roofing	Paved	Unpaved[1]	Soft[2]		
			100%	90%	50%	30%		
WMZ1	19.43	194300	34070	87778	72452	0	77%	90%
WMZ2	17.37	173700	61410	94247	18043	0	89%	90%
WMZ3	20.96	209600	5149	148757	55694	0	80%	90%
WMZ4	33.32	333200	0	29572	85303	205441	39%	50%
WMZ5	31.20	311952	0	11512	253282	47159	48%	50%
WMZ6	47.77	477700	17345	99984	319495	40876	58%	58%
ACA East	26.84	268410	100% PIMP Considered				100%	100%
ACA West	4.438	44380	100% PIMP Considered				100%	100%
Abbey Road	6.478	64780	50	300	64780	0	50%	50%
Campus	20.48	204800	33541	97004	74255	0	77%	80%

1. Unpaved areas including grassed verges and landscaping to provide worst case scenario

2. Soft areas comprise of stockpile areas only

Catchment areas, type of area and associated PIMP values may be subject to change and to be reviewed in Detailed Design.

The Design PIMP was used to calculate the Percentage Runoff (PR) and Volumetric Runoff Coefficient (Cv) for each catchment using equations 7.1 and 7.3 of Design and Analysis of Urban Storm Drainage - The Wallingford Procedure, Volume 1, September 1981.

7. Hydrological Catchment

The existing ground (surface) contours can be seen in the drawing 'Existing Ground Surface ref. SZC-EW0000-XX-000-DRW-400008' (Appendix B). The contours defined are at 1m (minor - yellow line) and 5m (major – cyan line) intervals. Early catchment areas were defined based on the existing levels and contour information. These catchments are approximations of where surface water would generally flow with some consideration of where runoff may be diverted/captured as a result of the initial earthworks. In places, land external to the red line boundary was included as part of the early catchment areas, as it is shown to contribute to surface water runoff within the SZC site.

The early catchments, along with early outfalls (presented in Section 8) is shown in drawing SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000052. As works progress within the ACA, MCA, TCA and Railway areas, these early catchments will evolve in shape and size and become definitive catchments which have been designed in the Enabling Works Surface Water Drainage Basic Design. These catchments (late or Enabling Works) are shown in SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000053.

Drawings SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000052 and SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000053 are shown in Appendix D.1 and D.2 respectively.

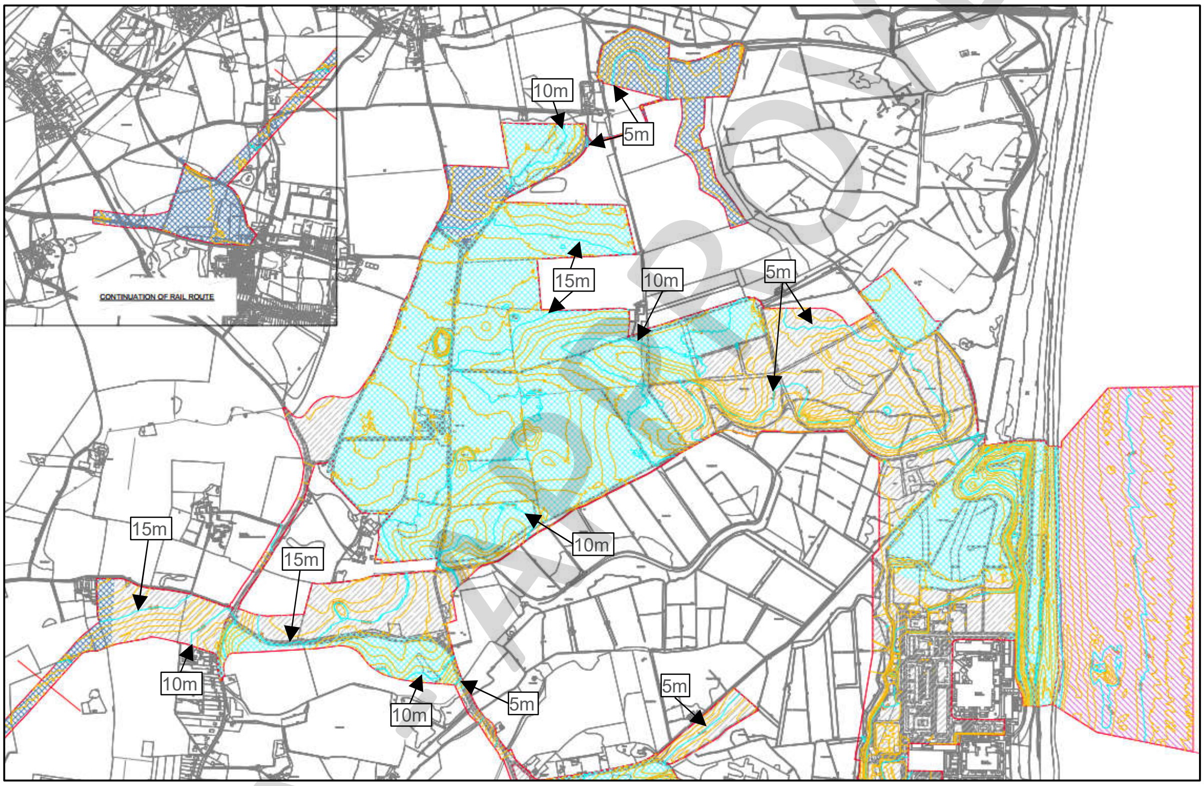


Figure 7-1 - Existing Ground Contours (SZC-EW0000-XX-000-DRW-400008)

8. Basin Design (Size)

8.1. WMZ Basin Parameters

Table 8-1 below presents the current WMZ basin dimensions and sizes that are proposed in the Main Development Site. All basins have a 1 in 3 side slope, except WMZ6 basin which has a 1 in 4 side slope. The side slopes will be no steeper than 1 in 3.

Table 8-1 - Allocated WMZ Basin Sizes

WMZ	Area at base (m^2)	Base level of Basin (mAOD)	Area at freeboard level (m^2)	Depth to freeboard level (m)	WMZ Basin Volume (m^3) Base to Freeboard Level	Area at top of basin (m^2) 300mm Freeboard	WMZ Basin Volume (m^3) including freeboard
WMZ1	10579.2	1.200	12618.8	1.500	17398.5	13786.5	**21929.1**
WMZ2	3290.1	3.200	6274.5	3.700	17694.5	6554.8	**19689.8**
WMZ3	3224.3	5.000	6082.1	3.500	16286.2	6368.6	**18226.5**
WMZ4	5357	5.200	8931.8	3.500	25005.4	9279.1	**27808.6**
WMZ5	7051.6	6.000	9193.6	2.000	16245.2	9533.5	**19072.9**
WMZ6	7165.8	8.000	11287.5	2.100	19376.0	11911.5	**22892.8**
ACA East	12968.8	1.600	15431.6	1.100	15620.2	16117.6	**20360.5**
ACA West	659.6	5.700	1510.9	2.000	2170.5	1667.8	**2676.5**
Abbey Road	1268.6	6.742	1964.5	1.158	1872.0	2161	**2500.2**

8.2. Half Drain Times and Follow-on Storms

Table 8-2 below presents the input parameters, along with the basin sizes stated in Table 8-1 used in Innoyvze Source Control to determine the maximum volume and critical storm event at which this occurs for each WMZ basin for a 100-year return period (RP), and a 10-year RP. The basins have been designed with a factor of safety of 1.5 applied to the infiltration rate. This represents the recognised lower risk associated with basins used for construction purposes that are of a temporary nature. The infiltration rate is applied to side walls of the structure only and no infiltration has been applied to the base area.

Table 8-2 - Source Control Basin Design Inputs

WMZ	Basin Side Slope	WMZ catchment area (ha)	Outflow (l/s)	Water Course Outlet	Infiltration rate (m/s)	Infiltration Testing Data Set
WMZ1	1/3	19.43	19.43	Y	0	N/A
WMZ2	1/3	17.37	17.37	Y	7.55E-06	TP-WMZ-23 (2017 SSL - Test 1)
WMZ3	1/3	20.96	20.96	Y	1.34E-06	WMZ3_2020-3-TP-A (2020 Fugro – Test 1)
WMZ4	1/3	33.32	33.32	Y	7.76E-06	TP-WMZ-21 (2017 SSL Test - 2)
WMZ5	1/3	31.20	31.20	Y	1.24E-06	TP-BP-4 (2017 SSL – Test 1)
WMZ6	1/4	47.77	47.77	Y	5.58E-06	WMZ6_2020-2-PIT (2020 Fugro – Test 3)
ACA East	1/3	26.84	62.00	Y	0	N/A
ACA West	1/3	4.44	10.25	Y	0	N/A
Abbey Road	1/3	6.48	6.50	Y	1.06E-04	GR11A (Structural Soils 2014 - Test 3)

Table 8-3 below shows the maximum volume of water for a 100yr RP plus 20% climate change allowance from Source Control. The Flood Studies Report (FSR), Flood Estimation Handbook (FEH) 1999 and FEH 2013 rainfall-runoff methods were checked and for the 100yr RP, the FEH 2013 was most onerous.

Also stated in the table below is a comparison between the basin volume provided (Table 8-1) and the maximum water volume. Values for the volume drained in a 24-hour period from each WMZ basin are also provided, and are based on the proposed outflow, without infiltration. The table shows that basin volumes are adequate (except ACA East and West) to contain the 1:100+CC critical storm.

ACA East and West figures in Table 8-3 show a shortfall of approximately 900 m^3 and 2000 m^3 respectively, to contain the 1:100+CC storm represents the Source Control volume and not the detailed hydraulic model (MicroDrainage) results therefore no network volumes have been taken into consideration. This additional volume will be provided within the pipe network, swales and sub-surface attenuation that are proposed across various sub-catchments within the ACA and is further detailed in the ACA Drainage Strategy Technical Note (DCO Task D4) (ref. SZC-EW0320-ATK-XX-000-XXXXXX-NOT-CIV-000003).

Table 8-3 - Maximum Water Volume - 100yr RP +20% CC critical storm event

WMZ	Critical Storm Event	Max Storm Volume (m^3)	Max Water Depth (m)	Half Drain Time (mins)	Half Drain Time (days)	Spare Volume in basin (m^3)	Volume drained in 24hr (m^3)	Spare Volume after 24hrs (m^3)
WMZ1	2160 min Winter	15116.6	1.319	6639	4.61	6812.5	1678.8	8491.3
WMZ2	2160 min Winter	12761.1	2.916	4684	3.25	6928.7	1500.8	8429.5
WMZ3	2160 min Winter	16051.7	3.505	6796	4.72	2174.8	1810.9	3985.8
WMZ4	1440 min Winter	11433.3	1.839	2589	1.80	16375.3	2878.8	19254.1
WMZ5	1440 min Winter	11030.5	1.417	2932	2.04	8042.4	2695.7	10738.0
WMZ6	1440 min Winter	19745.4	2.147	2836	1.97	3147.4	4127.3	7274.7
ACA East	1440 min Winter	22,592.2	1.540	2906	2.02	-2,231.7	5356.8	3125.1
ACA West	1440 min Winter	3581.3	2.895	2934	2.04	-904.8	885.6	-19.2
Abbey Road	240 min Winter	1432	0.933	346	0.24	1068.2	561.6	1629.8

The SuDS manual does not require that attenuation basins should be able to receive a follow-on storm but rather that they are able to deal with a rare event such as a 1:100+CC. This has always been the basis of design.

At this stage, a simplified analysis of a subsequent storm (10yr RP) was undertaken and show a number of the basins do have additional volume to contain a follow-on storm and this volume varies from basin to basin reflecting available space on site. Table 8-4 below shows the maximum volume of water for a 10yr RP plus 20% climate change allowance from Source Control. Critical storm events for a 10yr RP varied between FEH 1999 and FEH 2013 rainfall-runoff methods as stated in the table. The purpose of this table is to approximate how each WMZ basin will manage a 100yr critical storm event, followed by a 10yr critical storm event, after 24 hours. This additional volume cannot, in all cases, contain a critical 10yr RP storm event. This is a highly improbable scenario and to achieve the volumes states would lead to an extremely conservative design. The right-hand side column shows the available volume within each basin using the peak (discrete) values only. It must be noted that, whilst it is a conservative representation, it also does not accurately represent a continuous rainfall profile. The scope of this subsequent storm analysis will be agreed with SCC and will be completed during the design development to consider continuous rainfall profiles.

Table 8-4 - Maximum Water Volume - 10yr RP +20% CC critical storm event

WMZ	Critical Storm Event	Max Storm Volume (m^3)	Spare Volume in Basin after 24hrs of 100yr RP event (m^3)	Spare Volume - 10RP Volume (m^3)
WMZ1	FEH 1999 2880 min Winter	7682	8491.3	809.3
WMZ2	FEH 1999 2160 min Winter	6577.3	8429.5	1,852.2
WMZ3	FEH 1999 2880 min Winter	8242.7	3985.8	-4,256.9
WMZ4	FEH 2013 960 min Winter	5362.5	19254.1	13,891.6
WMZ5	FEH 1999 1440 min Winter	5127.6	10738.0	5,610.4
WMZ6	FEH 1999 1440 min Winter	9432.4	7274.7	-2,157.7

ACA East	FEH 1999 1440 min Winter	10988.2	3125.1	-7863.1
ACA West	FEH 2013 720 min Winter	1630.6	-19.2	-1,649.8
Abbey Road	FEH 2013 360 min Winter	730.4	1629.8	899.4

The additional volume from WMZ3 may be interconnected with WMZ4 to alleviate any flood risk and will be considered during design development. The shortfall in WMZ6 will also be accommodated through upstream storage within the drainage network.

It must be recognised that these are extreme events and much of the surrounding area will be under water. There is no risk to habitation present next to the construction site basins as they are surrounded by open areas. In addition, there would be no risk for water quality as there are large dilution effects.

8.3. ACA West Basin Half Drain Time

The proximity of this basin means that the flood risk should be minimised, and it is therefore appropriate that the half drain time should meet the 24 hour requirement.

The source control volume for a 1:100 + 20% CC in the ACA West would require a basin volume of 3,581 m^3. For a 24-hour half drain time this equates to 4.71 l/s/ha (1,790.5 x 1000 / 24 x 3600 = 20.7 l/s for 4.44 Ha). It is anticipated that the source control volume is the worst case and that the detailed design figure, which takes into consideration other storage volumes, upstream of the basin, will reduce this pumped value. To achieve the 24-hour half drain time a pumped discharged is proposed to be set to approximately 4.71 l/s/ha, giving a maximum flow of 20.9 l/s (based upon Source Control data). This flow would discharge to Outfall O6, subject to agreement from SCC, the Internal Drainage Board and the Environment Agency. Alternatively, this additional volume can be pumped to the ACA East basin and will be considered during design development in coordination with SCC.

The pumping station arrangement would be as per Sewers for Adoption in regard to pump provision. A twin pump arrangement (duty standby) would be in place with alarms (level and failed to start). In addition to alarms the arrangement of the basin allows the water level to be easily viewed from outside and has the benefit of the proximity of staff to speedily react to them.

In the unlikely event that failure of the pumped outflow from the ACA West basin coincides with a 100yr RP storm event, a simple volume estimation is shown below. The duration of the 100yr RP storm event has been limited to 24 hours to acknowledge that a temporary solution or repair of the pumped network can be completed with 24 hours. Nonetheless, this consideration will be reviewed during the design stage and with acceptance from SCC.

WMZ	Catchment Area (ha)	PIMP (%)	Infiltration rate (m/hr)	Outflow (l/s)	Max Volume (m^3) (15-1440 min)			Storm Event (100RP + 20%CC)		
					FSR	FEH 1999	FEH 2013	FSR	FEH 1999	FEH 2013
ACA West	4.438	100	0	0	3340.5	4258	4445.4	1440 min Winter	1440 min Winter	1440 min Winter

8.4. Surface Water Outfalls – Early and Late

Greenfield runoff estimates for all areas have been calculated using the IH124 method following the online 'greenfield runoff rate estimation' tool hosted by HR Wallingford. The greenfield runoff rates are relatively small considering the size of the catchment areas with Q_{BAR} (peak rate of flow from a catchment for the mean annual flood - return period of approximately 1:2.3 years) generally less than 5 l/s. The Environment Agency (EA) guidance states that the limiting discharge rates for sites should be set to Q_{BAR} or 1 l/s/ha, whichever is greater, as this is an unreasonable requirement for permeable sites which results in large storage volumes (Environment Agency - Rainfall runoff management for developments ref. SC030219). This advice has been followed for each catchment.

Table 8-5 and Table 8-6 state the determined greenfield runoff rates for the early and late catchments respectively in the current design.

Table 8-5 - Greenfield Runoff Rates vs 1 l/s/ha Summary for Early Catchments

			Discharge Rate (l/s)					
Site	Catchment Name	Total Area (ha)	1 in 1 yr	1 in 30 yr	1 in 100 yr	Qbar	1 l/s/ha *	Proposed
TCA	Early Catchment 1	26.221	3.07	8.66	12.59	3.53	26.22	26.22
TCA	Early Catchment 2	19.355	2.27	6.39	9.29	2.61	19.36	19.36
TCA	Early Catchment 3a	54.478	6.34	17.86	25.95	7.29	54.48	54.48
TCA	Early Catchment 3b	29.658	3.49	9.82	14.27	4.00	29.66	29.66
TCA	Early Catchment 4	38.191	4.49	12.64	18.37	5.16	38.19	38.19
TCA	Early Catchment 5	35.216	4.14	11.66	16.94	4.75	35.22	35.22
TCA	Early Catchment 6	19.117	2.25	6.33	9.20	2.58	19.12	19.12
Rail	Early Catchment 8	14.703	1.73	4.88	7.08	1.99	14.70	14.70
Rail	Early Catchment 9	3.027	6.11	17.20	24.99	7.02	3.03	7.02
Rail	Early Catchment 10	8.163	16.47	46.39	67.40	18.93	8.16	18.93
MCA	Early MCA	38.614	4.51	12.07	18.46	5.18	38.61	38.61
ACA	Early ACA	31.278	62.86	177.03	257.23	72.25	31.28	72.25

* Rate of discharge set to 1 l/s/ha for permeable sites where the Qbar is seen to be less than 1 l/s/ha - Chapter 3.3 of EA guidance Rainfall Runoff Management for Developments.

Table 8-6 - Greenfield Runoff Rates vs 1 l/s/ha Summary for Late TCA and ACA Catchments

Site	Catchment Name	Outfall	Catchment Area (ha)	Discharge Rate (l/s)					
				1 in 1 yr	1 in 30 yr	1 in 100 yr	Qbar	1l/s/ha *	Proposed
TCA	WMZ1	O1	19.430	2.27	6.39	9.29	2.61	19.43	19.43
TCA	WMZ2	O2	17.370	2.04	5.74	8.34	2.34	17.37	17.37
TCA	WMZ3	O3	20.960	2.46	6.94	10.08	2.83	20.96	20.96
TCA	WMZ4	N/A	33.320	3.92	11.03	16.03	4.5	33.32	N/A
TCA	WMZ5	O5	31.195	3.67	10.33	15.00	4.21	31.20	31.20
TCA	WMZ6	O6	47.770	5.62	15.81	22.98	6.45	47.77	47.77
Rail	GRR West 3	O8	6.478	0.77	2.16	3.13	0.88	6.48	6.48
Rail	GRR West 2	O9	1.377	2.82	7.96	11.56	3.25	1.38	3.25
Rail	GRR West 1	O10	0.706	1.41	3.98	5.78	1.62	0.71	1.62
ACA	West ACA WMZ	O6	4.438	8.92	25.12	36.5	10.25	4.44	10.25
ACA	East ACA WMZ	O7	26.841	53.95	151.91	220.74	62.00	26.84	62.00

* Rate of discharge set to 1 l/s/ha for permeable sites where the Qbar is seen to be less than 1 l/s/ha - Chapter 3.3 of EA guidance Rainfall Runoff Management for Developments.

The outfall locations are indicative and will be progressed at the next design stage. The greenfield runoff rates and proposed discharge rates may change should catchment extents develop and are subject to agreement from SCC, the Internal Drainage Board and the Environment Agency. A summary of this information is shown in Table 8-7.

Table 8-7 - Summary of Early and Late discharges

Area	Outfall	National Grid Reference	Indicative Invert Level (mAOD)	Early		Late	
				Discharge (l/s)	Method	Discharge (l/s)	Method
MCA	EO1	TM 47659 64054	1.550	200.00	None	0.00	None
WMZ1	O1	TM 47238 64963	0.500	26.22	l/s/ha	19.43	l/s/ha
WMZ2	O2	TM 46873 64545	0.500	19.36	l/s/ha	17.37	l/s/ha
WMZ3	EO3	TM 46573 64545	0.500	54.48	l/s/ha	0.00	None
WMZ3	O3	TM46354 64123	3.300	29.66	l/s/ha	20.96	l/s/ha
WMZ4	EO4	TM 45699 63890	2.500	38.19	l/s/ha	0.00	None
WMZ5	O5	TM 46443 65809	0.764	35.22	l/s/ha	31.20	l/s/ha
WMZ6	O6	TM 45473 63483	1.422	29.96	l/s/ha	47.77	l/s/ha
ACA West	O6	TM45473 63483	1.422	10.25	QBAR	10.25	QBAR
ACA East	O7	TM46523 63487	0.450	62.00	QBAR	62.00	QBAR
Railway	O8	TM 44477 63720	6.527	14.70	l/s/ha	5.00	Proposed
Railway	O9	TM43961 63705	12.500	7.02	QBAR	5.00	Proposed
Railway	O10	TM43525 63229	20.400	18.93	QBAR	5.00	Proposed
MCA	O11	TM 47980 64340	-3.250	0.00	None	2000.00	Max Flow
MCA	O12	TM 47005 64352	0.263	6.44	Averaged l/s/ha	17.08	Proportioned l/s/ha
MCA	O13	TM 47004 64182	0.251	6.44	Averaged l/s/ha	2.03	Proportioned l/s/ha
MCA	O14	TM 47000 64094	0.292	6.44	Averaged l/s/ha	3.88	Proportioned l/s/ha
MCA	O15	TM 46979 63984	0.308	6.44	Averaged l/s/ha	2.35	Proportioned l/s/ha
MCA	O16	TM 46979 63873	0.325	6.44	Averaged l/s/ha	11.42	Proportioned l/s/ha
MCA	O17	TM 46978 63790	0.344	6.44	Averaged l/s/ha	1.85	Proportioned l/s/ha

9. Operational Infrastructure

9.1. Campus

The surface water drainage strategy for the Campus (WMZ10) relies on discharging runoff to the ground at source through infiltration, without the need to discharge to a watercourse or surface water drainage network. Rainfall runoff is proposed to be stored below ground in areas such as car parks and other paved areas located within the catchment, using pervious pavement which allow gradual infiltration.

Infiltration to the ground will occur at different rates across the site depending on the characteristics of the underlying soil. Ground investigation campaigns from 2014 to 2020 show that the rates vary with lowest recording of 3.70x10-6 m/s (2014). This worst-case rate is considered too low to provide adequate infiltration, though further investigation will be carried out to determine areas of good infiltration and these will be explored further at detailed design to maximise infiltration to ground. No runoff is proposed to be conveyed to an attenuation basin.

The existing (undeveloped) site is at a high level in comparison to adjacent TCA areas, and the ground levels fall from west to east, towards WMZ4. Should infiltration rates be too low to provide an adequate solution, the runoff may be discharged at greenfield rates to an outfall along the Leiston Drain, south-east of the WMZ10. The final outfall position will consider the existing runoff conditions and flow paths within the catchment, as well as adjacent areas. The proposed rate will be limited to the greater of 1 l/s/ha or Q_{BAR} as per the strategy proposed for other TCA areas. This will be agreed in consultation with SCC during design development.

To provide an initial estimate on the required area needed to contain sub-surface storage within pervious pavement, an attenuation structure of 500mm depth was modelled in Innovyze Source Control as an infiltration basin with a porosity of 40% to symbolise a graded granular fill. The worst-case infiltrate rate of 3.70x10-6 m/s was applied to the base area only. A permitted outflow of 20.48 l/s (equivalent 1 l/s/ha) was included in the assessment. The output shows that a 11600 m^3 of storage is sufficient to store a 100yr +20% CC storm event, which is equivalent to a footprint of 58000 m^2, which is significantly less than the available paved area within the catchment - 97004 m^2. The half drain times is approximately 744 minutes, much lower than the 24-hour requirement, therefore a subsequent storm analysis is considered necessary.

At this stage, where there are large car parking areas proposed, it is proposed that these areas use permeable surfacing. The surfacing will be robustly constructed, emulating the current drainage characteristics, whilst providing suitable treatment of an incidental oil spills. In addition, the access ways between buildings and non-heavily tracked areas with the Campus will also employ permeable surface to allow infiltration at source. Runoff from roofed areas may also conveyed to the subsurface storage where practicable, as well as storage provided in tree pits, where trees are proposed. Opportunities to provide further infiltration at source, using features such as infiltration trenches, will be explored during Detailed Design.

Following the Simple Index Approach (SIA) guidance in CIRIA C753 The SuDS Manual on water quality management, the Campus area largely falls into a low-risk hazard level. The use of porous paving alone can provide sufficient treatment and the SIA criteria will be satisfied. As the design develops and should parts of the Campus area align to a medium-risk hazard level, porous paving will still satisfy the SIA criteria. A review will be undertaken in the next design stage considering the inclusion of further SuDS features and the proposals will be discussed with SCC.

9.2. Nuclear Island

The MCA has 3 stages: Early, Construction and Operation. Each stage has a different mode of operation for the surface water.

9.2.1. Early

Upon site establishment, and as topsoil stripping and earthworks are undertaken, the early construction site will potentially run the risk of being flooded. Surface water runoff will be retained on site by constructing temporary ditches/bunds and sediment ponds. Runoff that does not infiltrate will undergo treatment using packaged treatment plant (e.g. Siltbuster – 60 mg SS/l) if required prior to discharge to the realigned Sizewell Drain, or to the sea. Where necessary, the packaged treatment plant will be operated to perform in line with the water quality and discharge requirements set out in the water discharge permit. During this phase it is proposed to construct six outfalls along the realigned Sizewell Drain to prevent starving the Sizewell Marshes and to maintain the existing hydrological conditions. Further to this, a temporary marine outfall EO1 is available to discharge directly to sea. This runs across the beach with pedestrian protection and is proposed to allow excess surface water runoff to be discharged to the sea during construction options prior to completion of the Combined Drainage Outfall (CDO). The outfalls will be controlled through conditions set by the Environment Agency through discharge permit applications. Infiltration would still play a major role in surface water control at this stage.

9.2.2. Construction

As the site develops and on completion of the CDO, the temporary marine outfall (EO1) would no longer be required and will be removed. For the construction phase there is a series of 6 outfalls along the western edge of the MCA and when commissioned, the Combined Discharge Outfall (CDO) which outfalls to the sea.

The construction area is divided into 3 catchments, which become defined as the cut off wall is constructed:

- WMZ 7, which controls the water to the east of the main excavation. WMZ 7 is pumped to the CDO.
- WMZ 8, which includes the 6 outfalls to the west. WMZ 8 drains into the 6 outfalls to the west.
- WMZ 9, which is the main excavated area within the cut off wall (COW). WMZ 9 is pumped to the CDO.

9.2.3. Operation

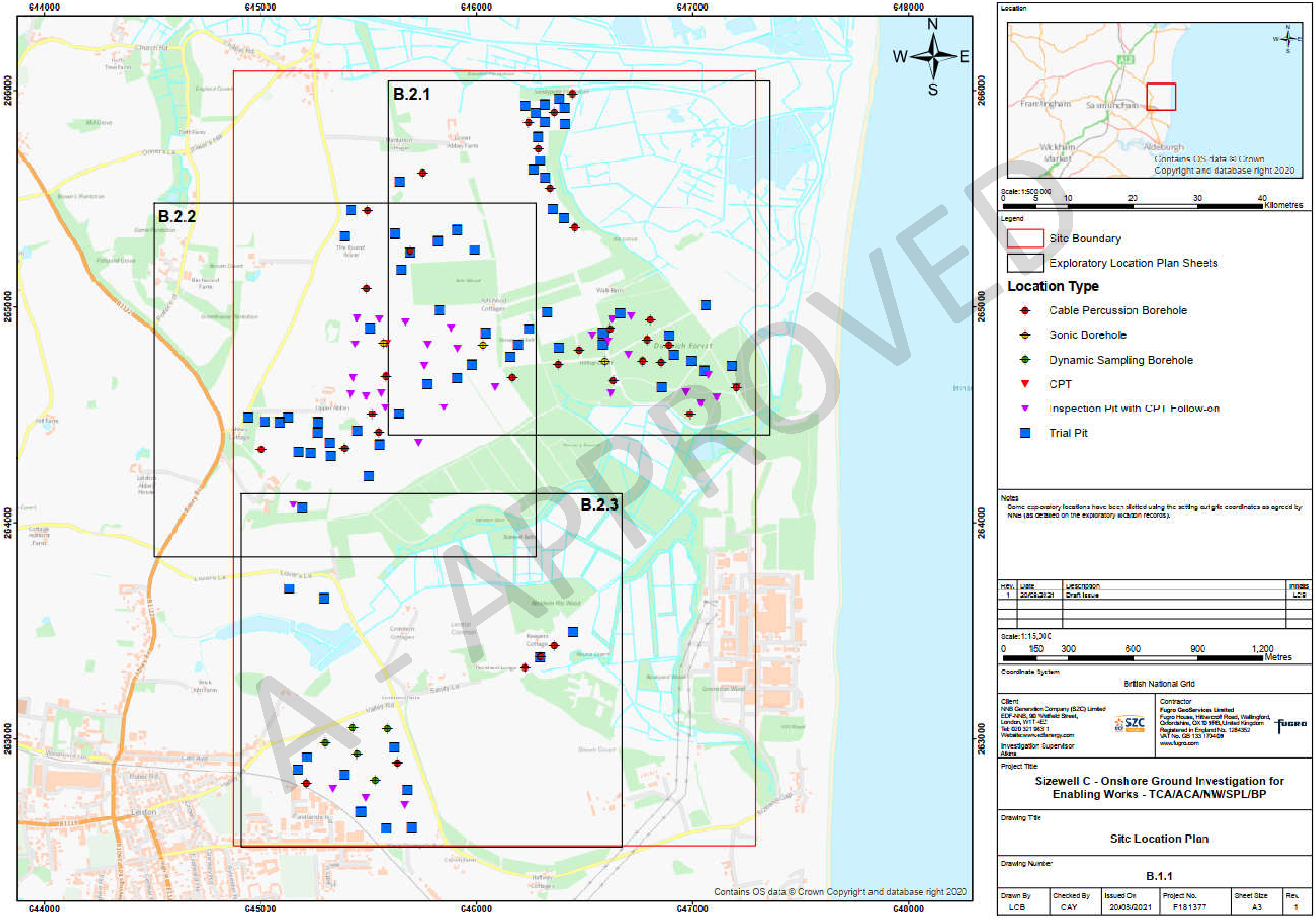
During the Operational stage the surface water is controlled in 2 ways. The western WMZ 7 is still to discharge through the 6 outfalls, whilst the remainder of the main site is to discharge to the cooling seawater outfall. The CDO would not be used.

9.2.3.1. Permanent Car Park

A permanent car park is planned within the area designated as the Temporary Construction Area. This has not been designed in detail but will comply with SuDS design philosophy and any future amendments to that design code. The design will be developed in coordination and agreement with SCC.

10. Appendices

Appendix A. 2021 GI Site Location Plan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Saxmundham
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Exploratory Location Plan Sheets
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Sonic Borehole
Dynamic Sampling Borehole
CPT
Inspection Pit with CPT Follow-on
Trial Pit
Notes
Some exploratory locations have been plotted using the setting out grid coordinates as agreed by NNB (as detailed on the exploratory location records).
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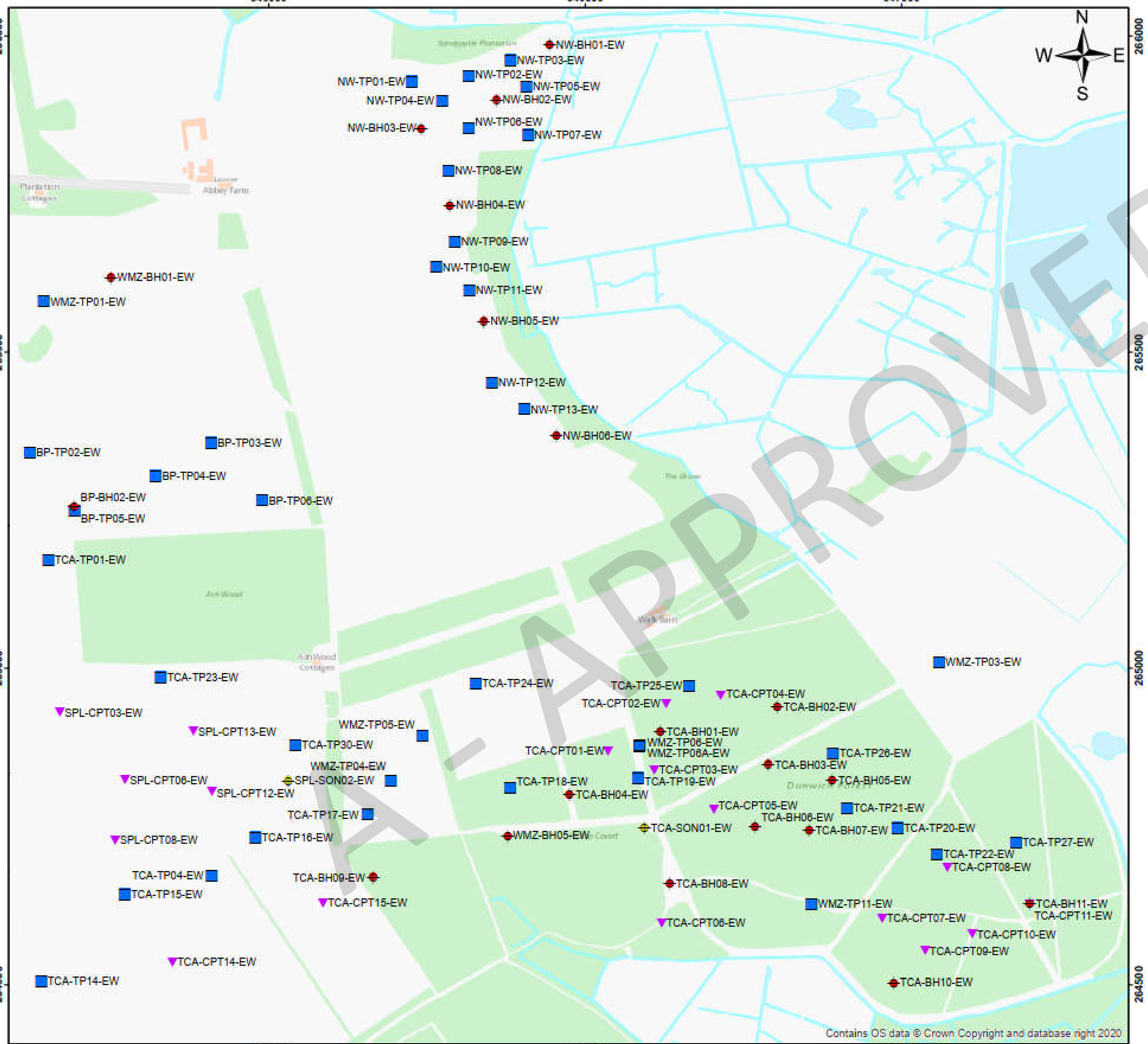
Client
Investigation Supervisor
Atkins
Contractor
Fugro GeoServices Limited
www.fugro.com
Project Title
Sizewell C - Onshore Ground Investigation for Enabling Works - TCA/ACA/NW/SPL/BP
Drawing Title
Site Location Plan
Drawing Number
B.1.1
Drawn By LCB
Checked By CAY
Issued On 20/08/2021
Project No. F181377
Sheet Size A3
Rev. 1



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- Sonic Borehole
- Dynamic Sampling Borehole
- CPT
- Inspection Pit with CPT Follow-on
- Trial Pit

Notes

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Coordinate System

British National Grid

Client
NNB Generation Company (SZC) Limited
EDF-NNB, 90 Whitfield Street,
London, W1T 4EZ
Tel: 020 321 98311
Website:www.edfenergy.com

Investigation Supervisor
Atkins

Contractor
Fugro GeoServices Limited
Fugro House, Hithercroft Road, Wallingford,
Oxfordshire, OX10 9RB, United Kingdom
Registered in England No. 1284352
VAT No. GB 133 1704 09
www.fugro.com

Project Title

Sizewell C - Onshore Ground Investigation for Enabling Works - TCA/ACA/NW/SPL/BP

Drawing Title

Exploratory Location Plan

Drawing Number

B.2.1

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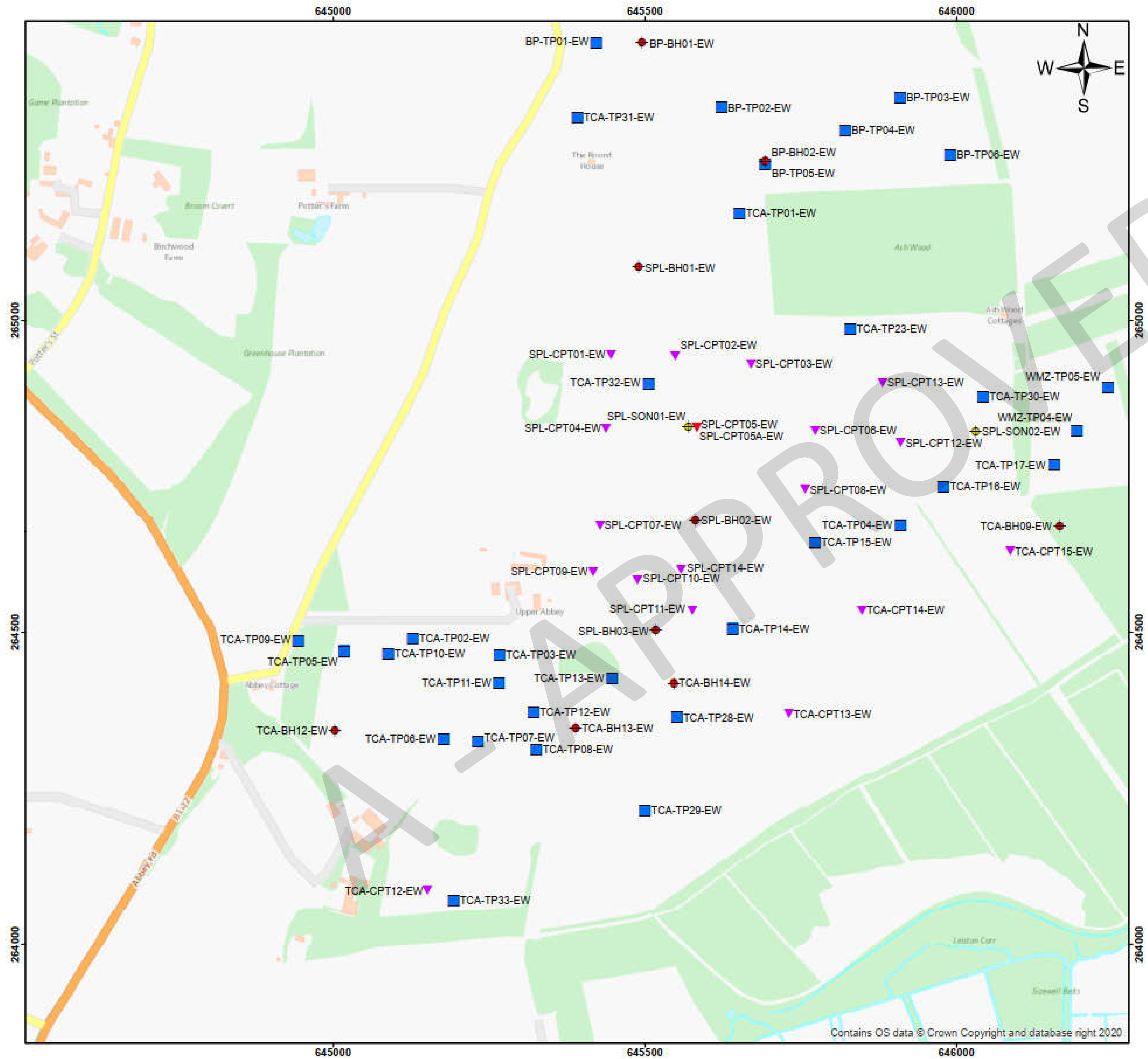

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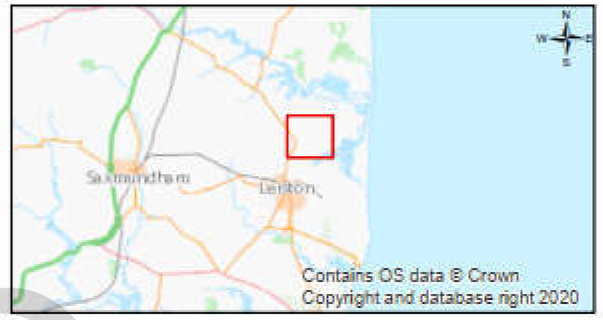

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- Sonic Borehole
- Dynamic Sampling Borehole
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- Inspection Pit with CPT Follow-on
- Trial Pit

Notes

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Rev.	Date	Description	Initials
1	12/07/2021	Draft Issue	LCB

Scale: 1:6,000
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Coordinate System

British National Grid

Client
NNB Generation Company (SZC) Limited
EDF-NNB, 90 Whitfield Street,
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VAT No. GB 133 1704 09
www.fugro.com

Project Title

Sizewell C - Onshore Ground Investigation for Enabling Works - TCA/ACA/NW/SPL/BP

Drawing Title

Exploratory Location Plan

Drawing Number

B.2.2

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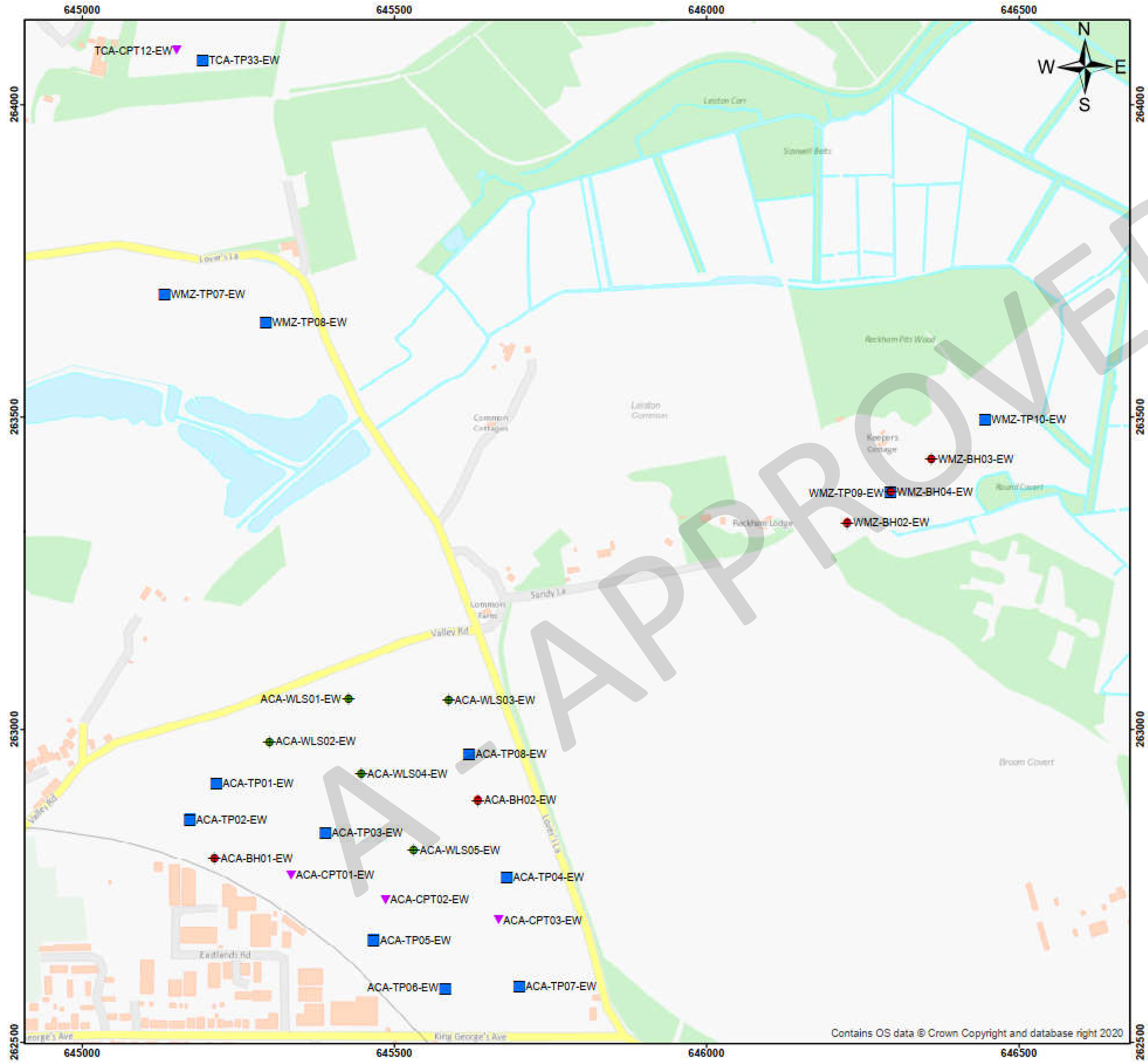

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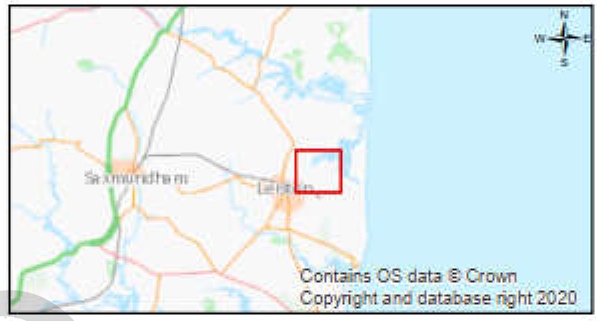

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- Sonic Borehole
- Dynamic Sampling Borehole
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- Inspection Pit with CPT Follow-on
- Trial Pit

Notes

Some exploratory locations have been plotted using the setting out grid coordinates as agreed by NNB (as detailed on the exploratory location records).

Rev.	Date	Description	Initials
1	12/07/2021	Draft Issue	LCB

Scale: 1:6,000
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Coordinate System

British National Grid

Client
NNB Generation Company (SZC) Limited
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Project Title

Sizewell C - Onshore Ground Investigation for Enabling Works - TCA/ACA/NW/SPL/BP

Drawing Title

Exploratory Location Plan

Drawing Number

B.2.3

Drawn By	Checked By	Issued On	Project No.	Sheet Size	Rev.
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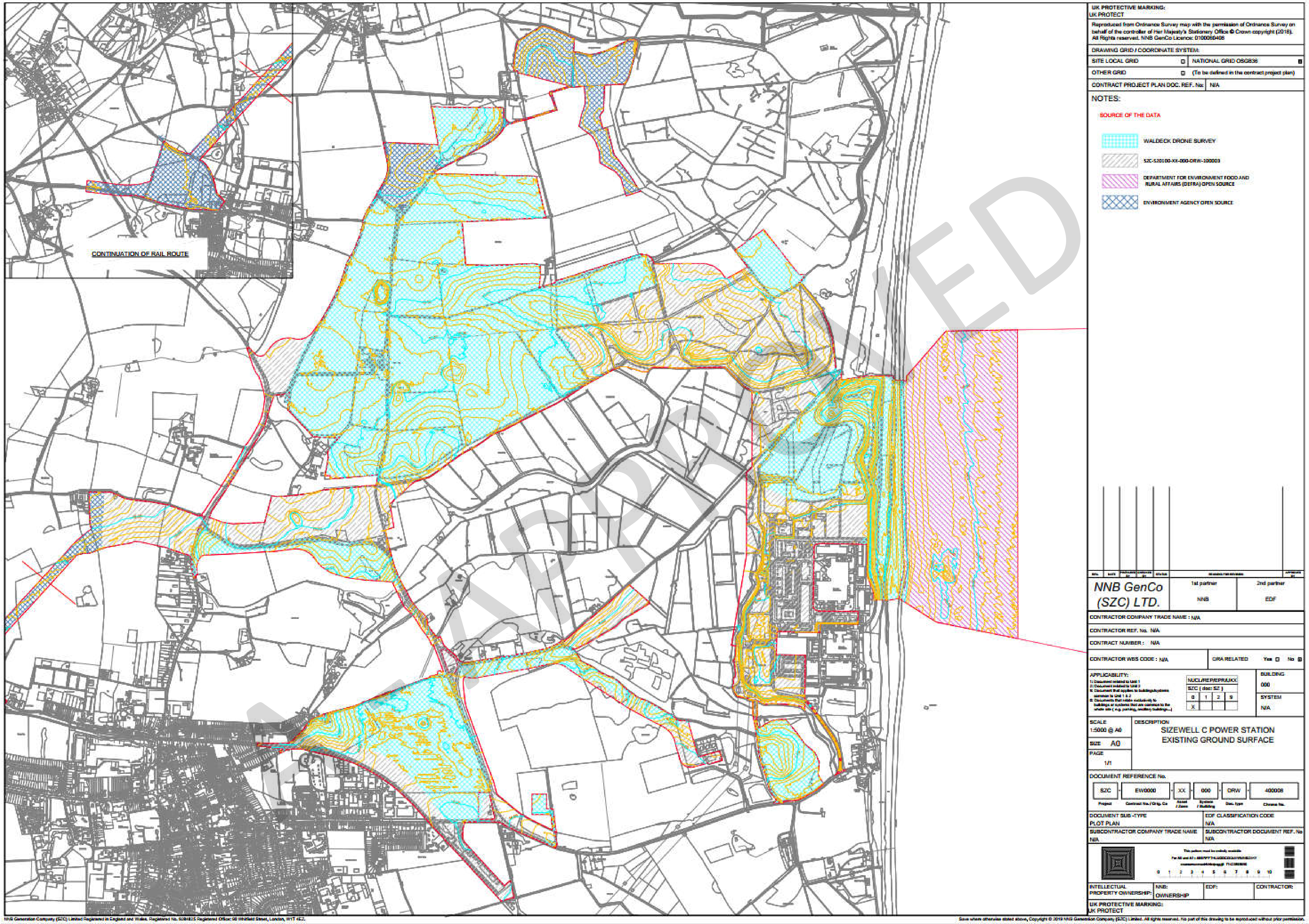
Appendix B. Existing Ground Surface

Contours defined: 1m (minor - yellow line) and 5m (major – cyan line) intervals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UK PROTECT
Reproduced from Ordnance Survey map with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationery Office © Crown copyright (2018). All Rights reserved. NNB GenCo Licence: 0100060408
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ENVIRONMENT AGENCY OPEN SOURCE
NNB GenCo (SZC) LTD.
1st partner
NNB
2nd partner
EDF
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ORA RELATED Yes No
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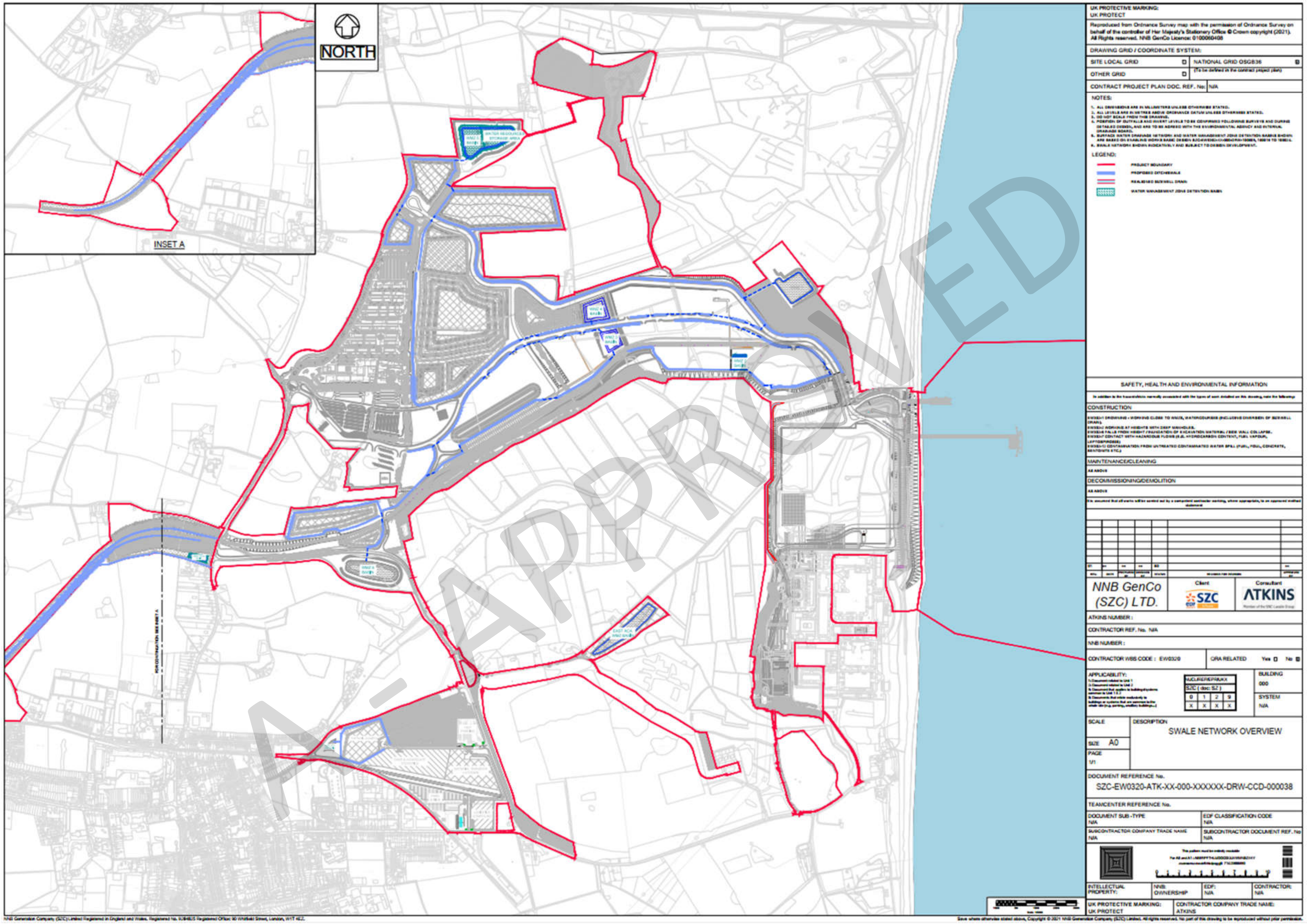
Appendix C. Swale Network Overview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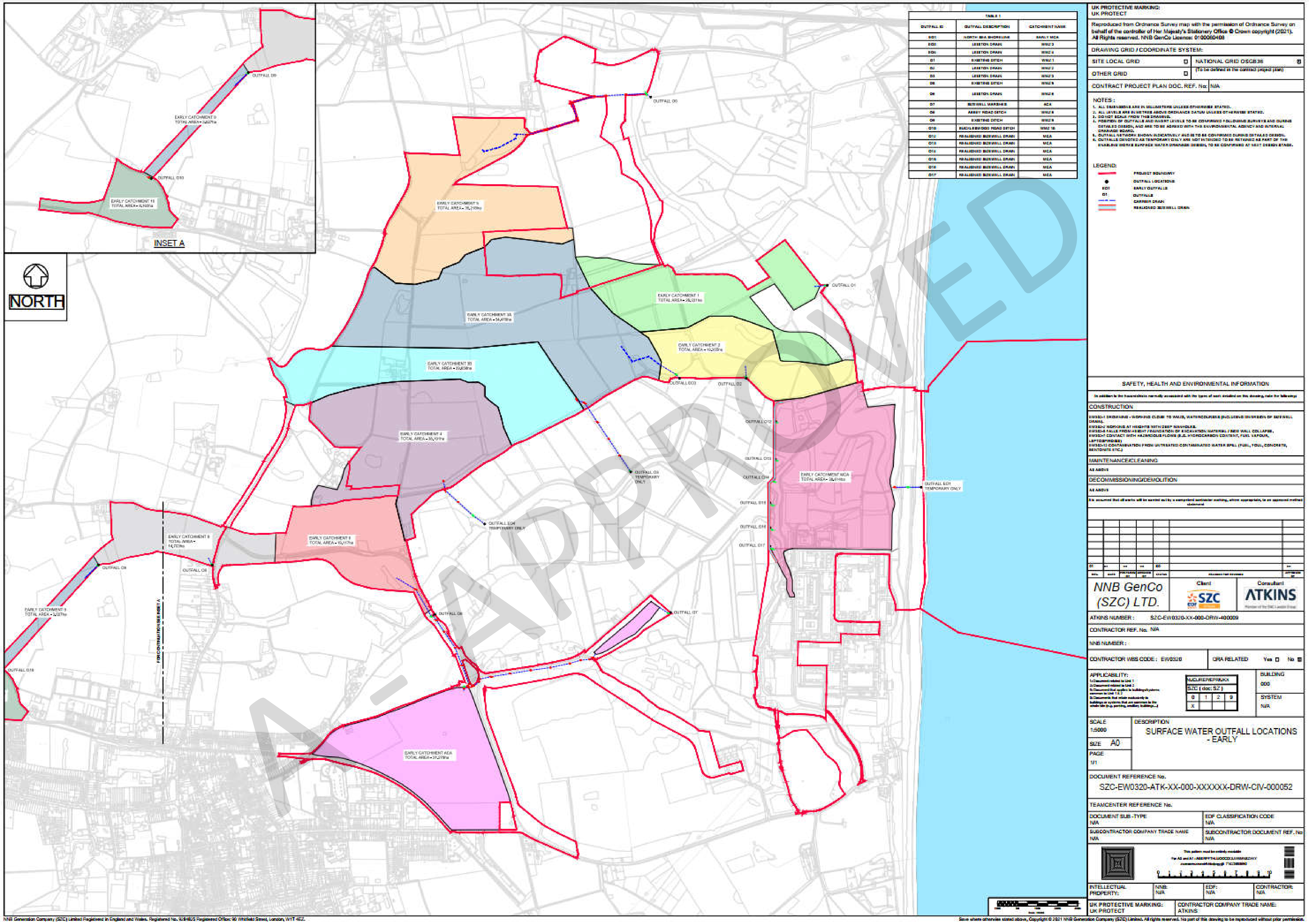
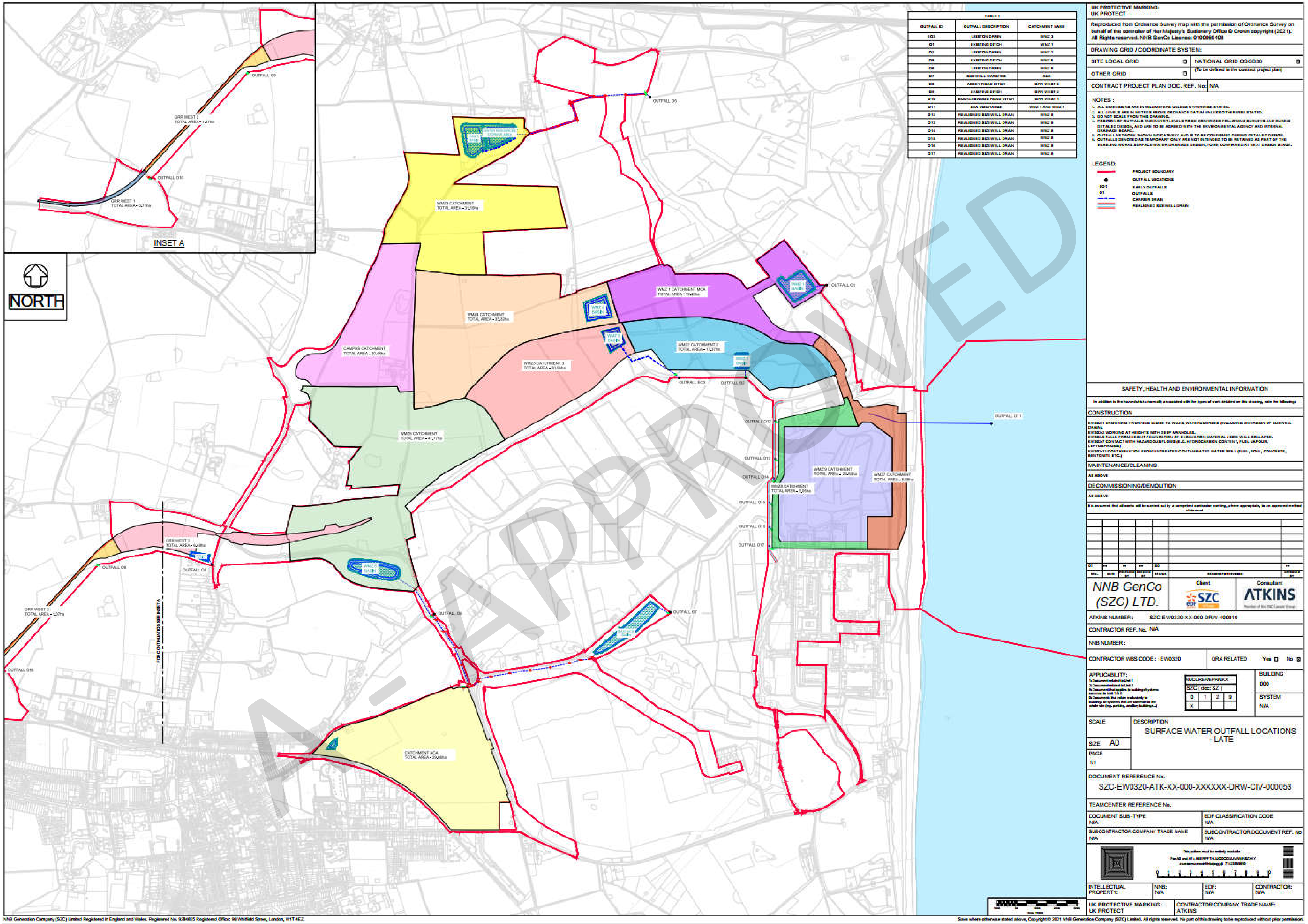
UK PROTECT
DRAWING GRID / COORDINATE SYSTEM:
SITE LOCAL GRID
NATIONAL GRID OSGB36
OTHER GRID
CONTRACT PROJECT PLAN DOC. REF. No: N/A
NOTES:
LEGEND:
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
CONSTRUCTION
MAINTENANCE/CLEANING
DECOMMISSIONING/DEMOLITION
NNB GenCo (SZC) LTD.
Client
SZC
Consultant
ATKINS
ATKINS NUMBER :
CONTRACTOR REF. No. N/A
NNB NUMBER :
CONTRACTOR WBS CODE : EW0320
CRA RELATED
APPLICABILITY:
BUILDING
000
SYSTEM
N/A
SCALE
DESCRIPTION
SWALE NETWORK OVERVIEW
SIZE A0
PAGE
1/1
DOCUMENT REFERENCE No.
SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CCD-000038
TEAMCENTER REFERENCE No.
DOCUMENT SUB -TYPE
N/A
EDF CLASSIFICATION CODE
N/A
SUBCONTRACTOR COMPANY TRADE NAME
N/A
SUBCONTRACTOR DOCUMENT REF. No
N/A
INTELLECTUAL PROPERTY:
NNB: OWNERSHIP
EDF: N/A
CONTRACTOR: N/A
UK PROTECTIVE MARKING:
UK PROTECT
CONTRACTOR COMPANY TRADE NAME:
ATKINS

Appendix D. Early & Late Catchments and Outfalls

D.1. Surface Water Outfall Locations – Early - SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000052


INSET A
NORTH
A - APPROVED
NNB GenCo (SZC) LTD.
SZC
ATKINS
SURFACE WATER OUTFALL LOCATIONS - EARLY
SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000052

D.2. Surface Water Outfall Locations – Late - SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000053


INSET A
NORTH
A - APPROVED
NNB GenCo (SZC) LTD.
SZC
ATKINS
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
SURFACE WATER OUTFALL LOCATIONS - LATE
SZC-EW0320-ATK-XX-000-XXXXXX-DRW-CIV-000053