Sizewell C Project

Appendix D: MDS/CWDA/13 Package to Inform Countryside Rights of Way (CRoW) Act Assessment and Habitats Regulations Assessment

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1 INTRODUCTION

1.1 Overview

The Sizewell C Project ('SZC Project') is a consented nuclear power station [1], comprising two UK European Pressurised Reactors™ located north of the existing Sizewell B power station in Suffolk. The Development Consent Order (DCO) for the SZC Project was granted in 2022 [2]. The DCO was granted based on assessment work (underpinned by extensive baseline surveys and studies) and submitted to the Secretary of State. The Secretary of State's (SoS) Habitats Regulations Assessment (HRA) [3] (hereafter referred to as the 'SoS HRA') records his decision on the potential for adverse effects on the integrity of European and Ramsar sites as a result of the SZC Project.

The SZC Project is currently preparing construction-related environmental permit applications, including construction water discharge activity (CWDA) permits. These permits are required for several of the works and construction activities. Construction permits are required for a number of project-related activities (including, for example, water discharges and realignment of channels), several of which require HRA or have Countryside Rights of Way 2000 (CRoW) Act considerations.

The Competent Authority (Environment Agency, EA) has screened each permit to determine a potential zone of influence (ZoI) of the activities covered by the permit on both European sites and Sites of Special Scientific Interest (SSSI). Through the EA Screening Tool, risks have been identified to the Outer Thames Estuary Special Protection Area (SPA) and the Southern North Sea Special Area of Conservation (SAC) from a permit application (reference MDS/CWDA/13). This application relates to the proposed discharges from a combined drainage outfall (CDO) which is required during the construction phase on site. Therefore, this package has been put together to aid the EA in completing their HRA and CRoW assessment for this permit application.

1.2 Key Definitions

Term / Abbreviation	Definition
AEVF	Allowable Effective Volume Flux
BEEMS	British Energy Estuarine and Marine Studies
BOD	Biochemical Oxygen Demand
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CDO	Combined Drainage Outfall
CRoW	Countryside Rights of Way
CUF	Common User Facility
CWDA	Construction Water Discharge Activity
DCO	Development Consent Order
DIN	Dissolved Inorganic Nitrogen
EA	Environment Agency
EQS	Environmental Quality Standards
ES	Environmental Statement
GETM	General Estuarine Transport Model
HRA	Habitats Regulations Assessment

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Term / Abbreviation	Definition
MBBR	Moving Bed Biofilm Reactor
MCA	Main Construction Area
PAH	Polycyclic Aromatic Hydrocarbons
PTP	Package Treatment Plant (domestic foul water)
SAC	Special Area of Conservation
SID	Supporting Information Document
SoS	Secretary of State
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
SZC Project	The Sizewell C Project
TCA	Temporary Construction Area
TMO	Temporary Marine Outfall
TraC	Transitional and Coastal
TSS	Total Suspended Solids
WFD	Water Framework Directive
ZoI	Zone of Influence

1.3 References

Ref	Title	Location	Document No. / Link
1	The Sizewell C (Nuclear Generating Station) Order 2022	Online	https://www.legislation.gov.uk/uksi/2022/853/contents/made
2	The Sizewell C (Nuclear Generating Station) Order 2022. Made 20th July 2022, Coming into force 11th August 2022	Online	https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-011165-SZC-DCO.pdf
3	Secretary of State (Department for Business, Energy and Industrial Strategy) (2022). Habitats Regulations Assessment for an Application Under the Planning Act 2008: Sizewell C New Nuclear Power Station	Online	https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-011167-SZC-HRA.pdf
4	BEEMS Technical Report TR588 Sizewell C Construction water discharge assessment: Groundwater	Unpublished	Part of permit application package
5	Sizewell C project environmental statement section 21.4 baseline environment	Online	EN010012-001931-SZC_Bk6_ES_V2_Ch21_Marine_Water_Quality_and_Sediments.pdf (planninginspectorate.gov.uk)
6	The Sizewell C Project 6.3 Main Development Site Chapter 20 Coastal Geomorphology and Hydrodynamics Appendix 20A Coastal Geomorphology and Hydrodynamics: Synthesis for Environmental Impact Assessment	Online	EN010012-001928-SZC_Bk6_ES_V2_Ch20_Coastal Geomorphology and Hydrodynamics.pdf

Ref	Title	Location	Document No. / Link
7	The Sizewell C Project 6.3 Main Development Site Chapter 21 Marine Water Quality and Sediments	Online	EN010012-001931-SZC_Bk6_ES_V2_Ch21_Marine_Water_Quality_and_Sediments.pdf

1.4 Protected SSSI and Habitats Sites

Several SSSIs, SACs, SPAs and Ramsar sites are located within 1km of the anticipated CDO location including Sizewell Marshes SSSI, Minsmere to Walberswick Heaths & Marshes SSSI and SAC and Minsmere-Walberswick SPA and Ramsar site. However, Sizewell Marshes SSSI is a terrestrial designation not connected with the discharge of the CDO which is direct to the sea. As a result, the Outer Thames Estuary SPA, Southern North Sea SAC, Minsmere to Walberswick Heaths & Marshes SSSI and SAC and Minsmere-Walberswick SPA and Ramsar site are sites further considered within this document.

Table 1 - Sensitive Receptor Sites

Sensitive Receptor Site	Distance from Permit location
Southern North Sea SAC	The discharge from the CDO will be input directly to the SAC.
Outer Thames Estuary SPA	The discharge from the CDO will be input directly to the SPA.
Minsmere to Walberswick Heaths & Marshes SSSI	Within 1km
Minsmere to Walberswick Heaths & Marshes SAC	Within 1km
Minsmere-Walberswick SPA	Within 1km
Minsmere-Walberswick Ramsar	Within 1km

1.5 Environment Agency Risks

When considering the potential for an activity to impact upon a protected site the focus of the EA's assessment is risk-based. There are specific risks for specific types of permits, and these are the focus of the EA assessment. For the permit in question, which is associated with a water discharge activity, the risks to be considered are as follows:

- turbidity;
- toxic contamination;
- siltation;
- physical damage;
- changes in pH;
- nutrient enrichment;
- changes in thermal regime; and
- changes in salinity regime.

In order to inform the EA's assessment, **Appendix A** of this report provides the applicant's view on each of these risks as they apply to each feature of each designated site.

1.6 Permit Details

This report provides technical detail specifically regarding impacts on the aforementioned designated sites, for the EA to undertake its duties in relation to the CRoW Act and The Conservation of Habitats and Species Regulations 2017 (as amended). The following section provides a brief summary of the permitted activities for the permit application, by way of introduction.

Permit MDS/CWDA/13 is for the water discharge associated with the combined drainage outflow. This includes several proposed water discharge activities and subsequent effluent streams which are listed below:

1. discharge of treated surface water run-off from the Main Construction Area (MCA);
2. discharge of groundwater from the MCA, including water produced by the installation and development of wells;
3. discharge of treated foul water from the MCA;
4. discharge of treated foul water from the Eastern Temporary Construction Area (TCA);
5. discharge of treated foul water from the Western TCA;
6. discharge of treated water from the sweeper tip facility; and
7. discharge of treated water from the bentonite plant

Based on the current schedule programme it is anticipated the earliest discharge activity is anticipated to commence from October 2026, once the CDO is constructed. Discharge activities are anticipated to have differing durations, depending upon the activity to which the discharge relates. Some will therefore start and finish earlier than others in line with the current construction programme.

2 TECHNICAL INFORMATION

2.1 Permit MDS/CWDA/13

The CDO is required to discharge wastewater, surface runoff and groundwater during the construction period of the Sizewell C Project. Due to the volume and nature of the discharge effluent streams, and the location of the site, these cannot be discharged to foul wastewater treatment works or inland freshwaters. Therefore, it was determined as part of the DCO stage of the project that an outfall would be constructed to carry certain discharge effluent streams into the North Sea, following suitable treatment so as not to adversely impact receiving marine water quality.

The CDO is anticipated to be operational from October 2026 and is expected to replace the Temporary Marine Outfall (TMO) that is anticipated to be constructed first for the initial discharge of surface water run-off and limited groundwater during early construction phases. The TMO has been subject to a separate permit application (MDS/CWDA/18) and is therefore not relevant to this application. The CDO will replace the TMO and will therefore follow sequentially in time, and as such there will be no ‘in combination’ effect.

2.1.1 Details of discharges; how many, where they are being discharged to, quantity of discharges, volume of discharges and how often the discharge will occur

This permit application covers the following discharge activities and subsequent effluent streams only (note that HAJ is not an acronym, it is purely an internal project reference for each treatment plant):

- discharge of treated surface water run-off from the MCA;
- discharge of groundwater from the MCA, including water produced by the installation and development of wells;
- discharge of treated foul water from the MCA (HAJ 1.1 treatment plant);
- discharge of treated foul water from the TCA (HAJ 1.2 treatment plant);
- discharge of treated foul water from the TCA (HAJ 1.3 treatment plant);
- discharge of treated water from the sweeper tip facility; and
- discharge of treated water from the bentonite plant.

These effluent streams will be combined in an onshore CDO collection chamber within the MCA. The effluent streams will typically be pumped directly, via a series of pipelines, into the collection chamber. The combined effluent will then be released from the collection chamber into the North Sea via the outfall pipeline, where it will be diffused from the marine dispersion head.

Flows of groundwater from the dewatering are currently anticipated to be up to 250 l/s for an initial 5 months (approximately), before reducing to an estimated maximum of 50 l/s throughout the maintenance phase. The 250 l/s is anticipated to be derived from 10 dewatering wells each operating at 25 l/s. The dewatering is currently anticipated to begin at the earliest by March 2027. The flow is then anticipated to reduce to ~25-50l/s during the maintenance phase, subject to the construction programme. The maximum flow rate will be limited by pump capacity. The maintenance phase is expected to last ~10 years (subject to project delivery requirements).

Treated domestic foul water from the MCA will be discharged to the CDO collection chamber for discharge to North Sea. The current expected maximum discharge rate for the sewage treatment plant HAJ1.1 is 24.8 l/s. Discharge of the above-described effluent stream is anticipated to commence in October 2026 and is currently anticipated to last until ~2040 (subject to project delivery requirements).

The maximum effluent discharge rate for the HAJ 1.2 sewage treatment plant is currently expected to be 4.5 l/s. The maximum effluent discharge rate for the HAJ 1.3 sewage treatment plant is currently expected to be 20.7 l/s. Discharges of the above-described effluent streams are anticipated to commence in October 2026.

The Sweeper Tip Facility is currently expected to be constructed within the TCA, and the effluent produced by the facility is anticipated to be waste potable/non-potable/surface water from activities including road sweeping and wheel washing. The maximum effluent discharge rate is anticipated to be 3 l/s from this facility. Discharge of the above-described effluent stream is anticipated to commence in October 2026.

The maximum effluent discharge rate for the bentonite plant is currently expected to be a maximum of 4.7 l/s, with a maximum discharge volume of 400m^3/day. Discharges of the above-described effluent streams are anticipated to commence in October 2026.

These effluent streams will be combined within an onshore CDO collection chamber and then released under gravity from the collection chamber into the North Sea via the outfall pipeline, where it will be diffused from the marine dispersion head, located at E 647980 N 264343. Every discharge activity addressed in the table below are to be discharged via this marine dispersion head.

Table 2 - Discharge activities – Summary Information

Discharge Activity	Maximum Discharge Rate	Maximum Discharge Volume	Duration
Discharge of treated surface water run-off from the MCA	400 l/s	34, 560 m^3/day	October 2026 – ~2040
Discharge of groundwater from the MCA, including water produced by the installation and development of wells	Drawndown Phase: 250 l/s Maintenance phase: 50 l/s	Drawndown Phase: 21,600 m^3/day Maintenance phase: 4,320 m^3/day	2027 – ~2040 Drawndown Phase: ~5 months Maintenance Phase: ~10 years
Discharge of treated foul water from the MCA (HAJ 1.1 treatment plant)	24.8 l/s	2,143 m^3/day	October 2026 – ~2040
Discharge of treated foul water from the TCA (HAJ 1.2 treatment plant)	4.5 l/s	389 m^3/day	October 2026 – ~2040
Discharge of treated foul water from the TCA (HAJ 1.3 treatment plant)	20.7 l/s	1,789 m^3/day	October 2026 – ~2040
Discharge of treated water from the sweeper tip facility.	3 l/s	97 m^3/day	October 2026 – ~2040
Discharge of treated water from the bentonite plant.	4.7 l/s	400 m^3/day	October 2026 – 2036

2.1.2 Location details including maps and national grid references

The exact location for the marine dispersion head is E 647980 N 264343. This is approximately 300m from the shoreline.

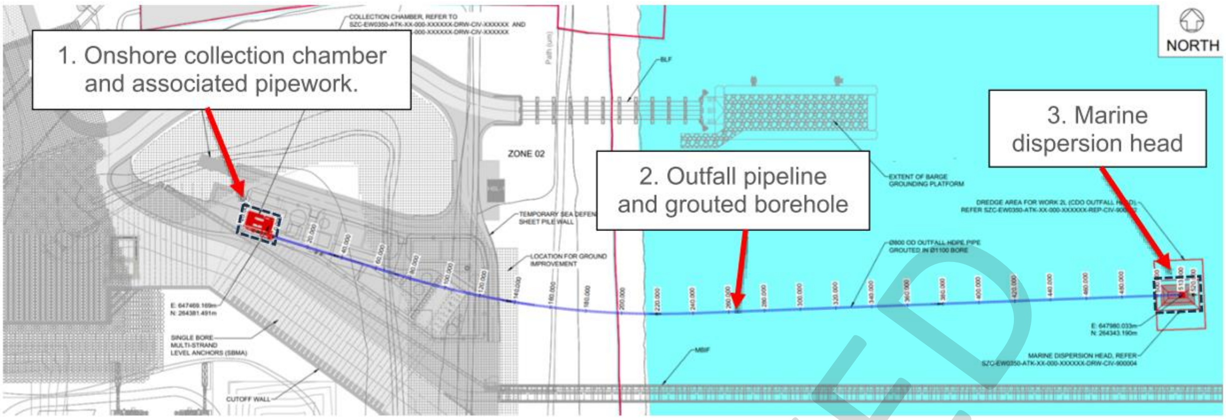

Figure 1 - Indicative Location Drawing of CDO infrastructure

2.1.3 Breakdown of nature of discharge: chemical makeup and concentration, pH details, full H1 risk assessment with relevant tests for either freshwater or marine discharge

The chemical makeup and concentration of the discharge is assessed in full in the British Energy Estuarine and Marine Studies (BEEMS) Technical Report TR588 Sizewell C Construction water discharge assessment: Groundwater which was undertaken by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) [4]. Table 4 of reference [4] identifies the maximum concentration of substances likely to be present in the discharge stream, based on assessments of the groundwater conducted in 2014 and 2020, including the concentration of each substance. The table is not reproduced here to avoid taking it out of context. This is because the presentation of the data inevitably requires discussion of the derivation of that data and its interpretation, and the table covers twelve chemicals. The data demonstrates that the CDO generates a wastewater effluent stream with elevated concentrations of trace metals. Each substance was subject to a transitional and coastal (TraC) test to compare the quality standard for each substance with the concentration in the discharge, a precautionary approach was taken at this stage. Chromium, copper, iron, lead and zinc were subject to further investigation as identified in Table 6 of the CEFAS BEEMS Technical Report [4].

A summary of ammoniacal nitrogen loads within the discharge is provided in Tables 11 and 12 of the CEFAS BEEMS Technical Report [4] which forms part of the permit package. This found that all un-ionised ammonia cases pass the screening and therefore do not require further assessment. The Test 5 results are considerably below the Allowable Effective Volume Flux (AEVF) of 3.5, even when applying immediate seawater conditions without accounting for dilution.

2.1.4 Details of any sampling done including sampling method, location, frequency and data acquired

No sampling has been done to inform this permit as the treatment processes are not yet in operation.

2.1.5 Details of any monitoring of background or baseline conditions undertaken including location of monitoring, frequency and results.

A useful overall summary of the existing marine baseline conditions, derived from the surveys and reports described in the above bullet points, is provided in Section 21.4 of Section 6.3 Volume 2 Main Development Site Chapter 21 of the Environmental Statement (ES) for the project [7]. That summarises the baseline environment with regards to physical environment, temperature, salinity, dissolved oxygen, suspended sediments concentration, nutrient status, unionised ammonia, sediment quality, trace metal concentrations in the water and sediment and polycyclic aromatic hydrocarbons (PAH) and contaminants. The information in that document concerning background conditions has been appended to the permit application as an extract.

The EA identifies the following risks associated with this type of permitted activity:

- turbidity;
- toxic contamination;
- siltation;
- physical damage;
- changes in pH;
- nutrient enrichment;
- changes in thermal regime; and
- changes in salinity regime.

Accounting for the EA identified risks, of relevance to this permit, the following baseline conditions are identified:

- seawater temperature minimum approximately 3°C;
- seawater temperature maximum approximately 20°C;
- seawater temperature average approximately 12°C;
- an annual trend in salinity with lowest values in winter months, mean annual salinity 33.3 with 5th percentile winter salinity 31.7;
- depth-dependent, seasonal suspended sediment concentration which varies throughout the tidal cycle; and,
- higher nutrient concentrations in the inner waters off Sizewell than waters offshore, the highest nitrate and silicate concentrations occur January-March (30µmol/l) and the lowest is July-August (5µmol/l).

For further details regarding the baseline monitoring and conditions, see the full Chapter of the ES [7].

2.1.6 Details of any modelling undertaken and the results/outcome of said modelling

The BEEMS Technical Report by CEFAS [4] screened suspended sediment in the discharge, against a threshold of 100 mg/L based on no change of the Water Framework Directive (WFD) turbidity class. It was noted that the natural background suspended sediment varies considerably at Sizewell and is often in excess of 250 mg/L meaning the discharge is within the natural background variance, although greater than the long-term background average. When considering a scenario including all effluent flows and long-term average background surface suspended sediment concentration, the discharge passed the screening test and therefore suspended sediment in the discharge is not considered to pose a risk to water quality. Given the background concentrations, modelling of the upper tier suspended solids in the receiving environment is not considered necessary.

Modelling included in the BEEMS Technical Report by CEFAS [4] identifies that total metals in the discharge are more concentrated than compared to the background. Concentrations of chromium, copper, iron, lead and zinc were the only metals to fail the initial screening for annual average environmental quality standards. Every metal passed the screening test for maximum allowable concentration. CORMIX modelling for metals that failed the initial screening test indicated that the discharge plumes where the concentration would exceed the relevant Environmental Quality Standards (EQS) for all of these metals, with the exceptions of chromium and zinc, have a maximum plume range of under 20m. For zinc and chromium, the predicted plume extents were modelled with the full hydrodynamic General Estuarine Transport Model (GETM) model. As the largest plumes from the discharge, the plume footprints for zinc and chromium have been mapped in figures 5 and 6 of the BEEMS Technical Report. These figures are reproduced below. It can be seen that the plumes extend only a small distance and do not reach any other designated sites beyond Southern North Sea SAC and Outer Thames Estuary SPA, within which the outfall is situated. The largest plume size (a plume of 0.221 km^2 for chromium) does not extend to the Minsmere Sluice. The total area of the largest plume is approximately 0.221 km^2. There is thus no impact pathway to other designated sites such as Sizewell Marshes SSSI or Minsmere-Walberswick Heaths and Marshes SSSI/SAC or Minsmere-Walberswick SPA/Ramsar site.

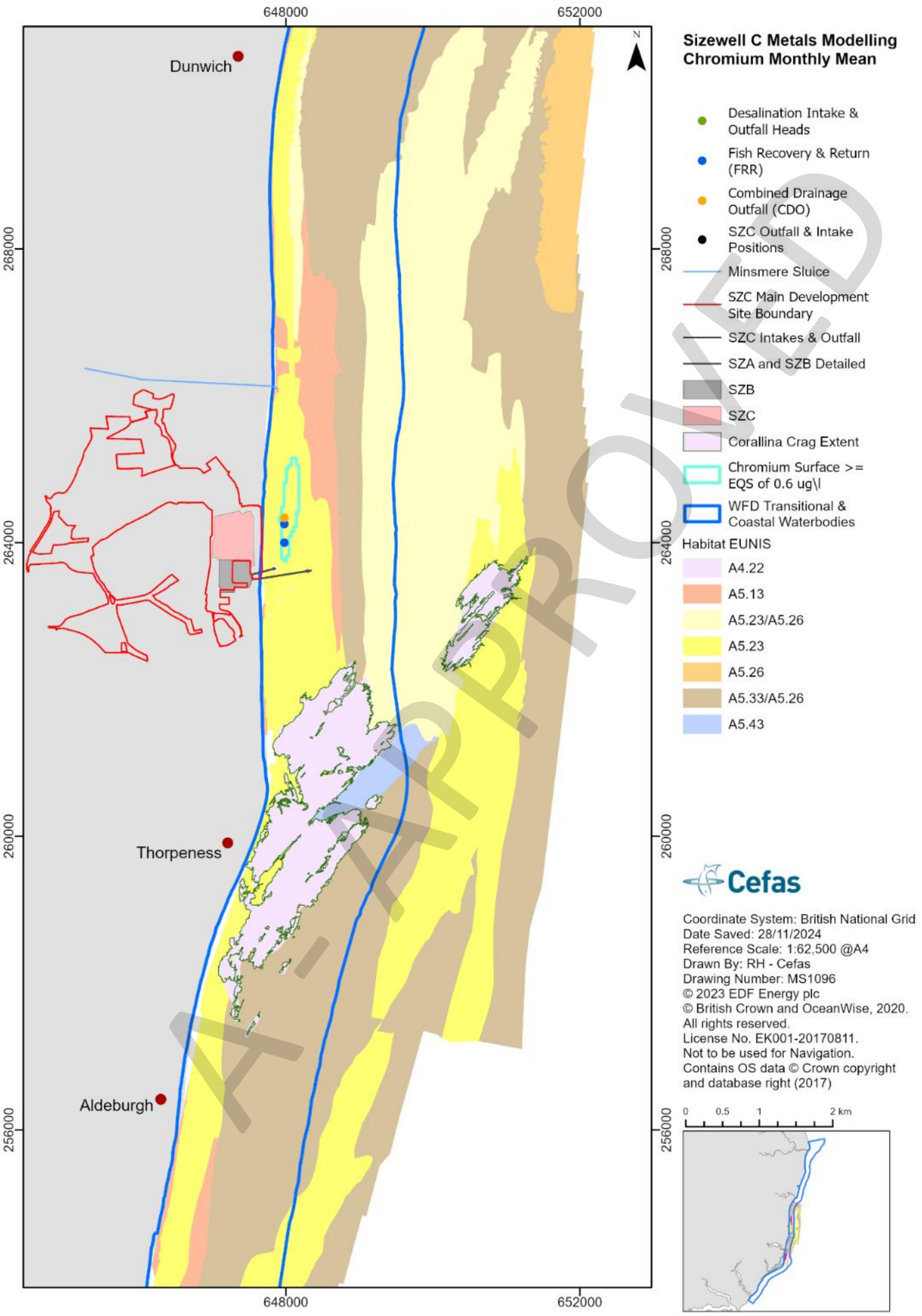

Figure 2 - GETM model results for chromium based on the mean mixing zone and AA EQS (surface) showing the CDO and the Desalination Intake & Outfall heads

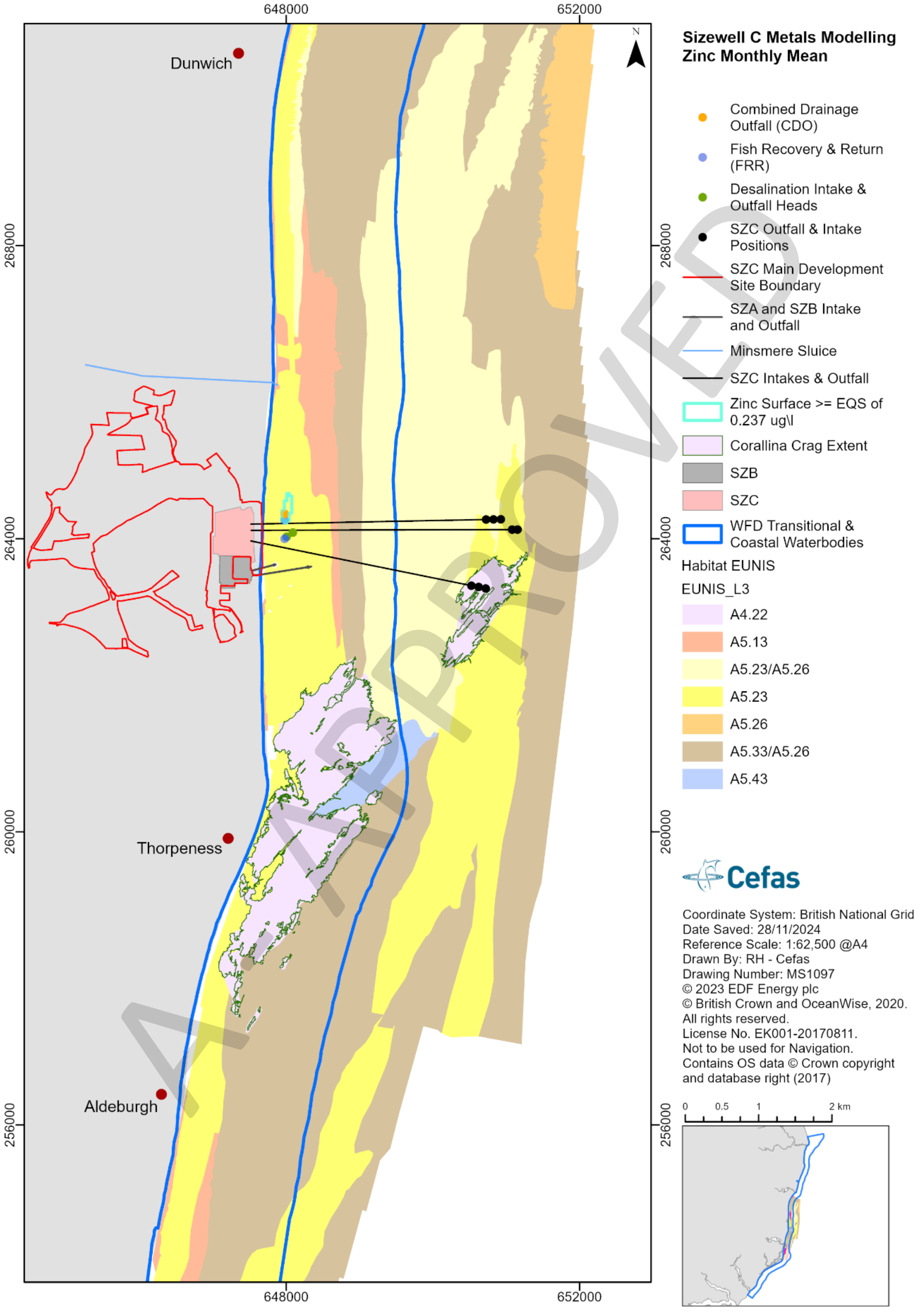

Figure 3 - GETM model results for zinc based on the mean mixing zone at 3% of the EQS above the baseline (surface) showing the CDO and the Desalination Intake & Outfall heads

2.1.7 Details of any treatment discharges will receive including explanation of whether the treatment is standard protocol or mitigation

Several of the effluent streams covered by this application will undergo treatment as standard protocol prior to discharge. These are:

- discharge of treated surface water run-off from the MCA;
- discharge of groundwater from the MCA, including water produced by the installation and development of wells;
- discharge of treated foul water from the MCA (HAJ 1.1 treatment plant);
- discharge of treated foul water from the TCA (HAJ 1.2 treatment plant);
- discharge of treated foul water from the TCA (HAJ 1.3 treatment plant);
- discharge of treated water from the sweeper tip facility; and
- discharge of treated water from the bentonite plant.

Specific treatment measures to be incorporated into the management of the proposed discharge streams have been based upon the water quality parameters considered appropriate and achievable for each effluent stream to be discharged and the overall combined effluent stream which will be entering the North Sea from the CDO. These measures are implemented as part of standard protocol to protect water quality and are not specific mitigation to protect the European sites.

Surface water run-off from the MCA

Surface water run-off from the MCA will drain via gravity to a series of attenuation ponds / features, from where it will be pumped to the relevant pumping station, and then onwards to the feed chamber of a surface water treatment plant (referred to as 'HSV').

With regards to treatment of the surface water, it is envisaged that the attenuation ponds / features will provide an initial level of settlement, prior to the water being pumped to a dedicated treatment plant.

Treatment plant designs and substances are not yet confirmed; however, the MCA surface water treatment plant is anticipated to include (but not be limited to):

- an inlet pumping station to deliver all flows captured in the surface water drainage network in the MCA up to a feed chamber;
- feed chamber for flow balancing between mixing chambers;
- mixing tanks (for pH correction, coagulant dosing and flocculation, if required);
- lamella settlement tanks for clarification and associated desludging facilities;
- sludge holding tanks;
- centrifuge for sludge dewatering;
- supernatant collection chamber, pumping station wet well and pumping system;
- coagulant dosing system;
- pH correction dosing system;
- dewatering polymer dosing system; and
- wash water break tank and booster pumping station (for supplying potable water to chemical dosing areas, emergency showers etc.).

Provision will be made for a downstream sampling point which will enable a representative sample to be taken of the treated surface water run-off prior to this combining with other influent streams in the combined pumping station and eventually the CDO collection chamber. The current HSV performance specification sets out that provision should be made for draining the plant to tankers and / or recycling water into the treatment plant if water quality limits are not met. This therefore sets out the fallback position in the absence of current detailed design information on (for example) pH correction, coagulant dosing and flocculation, to ensure SSSIs and European sites are protected. The current design performance specification for the HSV treatment plant sets out the proposed final effluent quality of the treated surface water, as shown in **Table 3**.

Table 3 – Treated Surface Water Run-Off Effluent Quality

Parameter	Upper Tier
Total suspended solids	250 mg/l
pH	6-9
No visible or grease	No significant trace

Groundwater

The optimised strategic approach for MCA groundwater management is considered to be to implement a monitoring protocol such that groundwater flows are monitored for total suspended solids (TSS), perhaps using an in-line TSS probe at an appropriate location of pipework, prior to discharge. Provided the TSS is below a proposed threshold of 250mg/l, the groundwater will be discharged to the pumping station before feeding into the CDO collection chamber and then discharged without treatment. The methods that will be used should the TSS rise above 250mg/l, the groundwater will be diverted, perhaps using a diversion valve linked to the monitoring system, to a suitable groundwater treatment facility for treatment. This strategy will ensure that no groundwater will be discharged from site with TSS concentrations higher than what could be achieved through the groundwater treatment facility, while minimising any unnecessary and costly treatment of large volumes of groundwater.

Using this approach, under normal operating conditions, it is not anticipated that groundwater will require treatment. It is anticipated that groundwater produced very early in a well's construction is more likely to require treatment due to higher TSS; however, no metal treatment is proposed for the groundwater. The water quality parameters for treated groundwater are the same as those for surface water and can be seen in **Table 2** above.

Domestic Foul Water from the MCA

HAJ 1.1 is expected to comprise a modular above-ground Package Treatment Plant (PTP) that can be easily decommissioned and removed from the site at the end of the construction phase of the project. The overall treatment process is based on Moving Bed Biofilm Reactor (MBBR). Treatment plant designs and substances are not yet confirmed; however, the PTP is expected to include, but not limited to, the following process elements:

- a terminal (or inlet) pumping station with 2no. submersible pumps (duty / standby);
- inlet screening where incoming foul water will enter the screen for removal of solids and fibrous materials;
- MBBR tanks along with MBBR blowers for aeration. The MBBR provides biological treatment and removes / reduces Biochemical Oxygen Demand (BOD) and ammonia;
- lamella clarifier with desludging pumps for settlement of fully aerated effluent from the MBBR tanks. Settled sludge at the bottom of the clarifier is to be discharged to a sludge holding tank (for removal offsite). Dissolved air flotation may also be considered as an option for post-MBBR settlement;
- return liquor pumping station; and
- a flocculation stage may be required before final clarification (lamellas). Chemical dosing may be required but this is dependent upon MBBR package technology supplier's design.

Table 4 - HAJ 1.1 Final Effluent Water Quality

Parameter	Upper Tier	Unit
BOD after secondary treatment	40	mg/l
TSS after secondary treatment	250	mg/l
Ammonia as N (NH3-N)	60	mg/l

Western TCA Domestic Foul Water Treatment - HAJ 1.3:

A PTP will be implemented to treat domestic foul water originating from facilities and buildings in the western TCA, including the accommodation campus. HAJ 1.3 will also treat septic flows (cess) from domestic welfare facilities.

The treatment plant and the treated final effluent quality shall be suitable for non-potable reuse and shall not pose risks to the environment, human and animal health. The treatment plant is anticipated to comprise a modular above-ground PTP that can be easily dismantled and removed from site at the end of the project construction phase.

The final design of the treatment plant is yet to be confirmed with suppliers; however, a performance specification has been developed by the SZC project team to inform procurement requirements, alongside a technical note outlining the treatment process for non-potable water re-use, details of which are in Section 4.4.1 of the Supporting Information Document (SID) included as part of this permit application.

At this stage, but subject to understanding wider permitting requirements beyond the scope of this application, it is anticipated that most of the treated foul water from HAJ 1.3 will be directed to a suitable storage area on site, via a final effluent storage tank, where the water can be re-used for activities like dust suppression. This is being proposed to reduce dependency on desalinated / abstracted water use during construction. There will however be a high-level overflow pipe from the PTP which will enable the transfer of treated effluent to the CDO collection chamber when the storage area has reached full capacity. The overflow effluent will be pumped to the HAJ 1.2 (see below) treated effluent pumping station, which then discharges to the CDO collection chamber. HAJ 1.2 is a separate treatment plant being utilised for treatment of domestic flow from the rest of the TCA. Modelling to inform this permit application and assessment of risks included in this document have been completed assuming a worst case where all HAJ 1.3 treated wastewater is discharged via the CDO.

The table below sets out the proposed final effluent water quality that would be discharged to the CDO collection chamber (via the overflow system when the water storage area is at full capacity) from HAJ 1.3.

Table 5 - HAJ 1.3 Final Effluent Water Quality

Parameter	Upper Tier	Unit
BOD after secondary treatment	40	mg/l
TSS after secondary treatment	250	mg/l
Ammonia as N (NH3-N)	60	mg/l

It is acknowledged that any final discharge water quality parameters will need to be in accordance with limits set out in the environmental permit. Suppliers of the proposed treatment plants will be made aware of these.

Eastern TCA Domestic Foul Water Treatment - HAJ 1.2

There is proposed to be a second PTP (referred to as 'HAJ 1.2') located in the eastern part of the TCA to treat domestic foul water from other buildings and welfare facilities, including the Common User Facility (CUF) buildings and contractors' compounds (essentially any aspects not covered by HAJ 1.3 described above). The effluent from the PTP will flow to a final treated effluent pumping station, which will also receive overflow effluent from HAJ 1.3 as described above when the WRSA is at full capacity. It is then fed to the CDO collection

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chamber where it combines with the other flows incoming into the chamber prior to discharge into the North Sea.

The table below sets out the proposed final effluent quality for HAJ 1.2 (and also HAJ 1.1 which is described above).

Table 6 - HAJ 1.2 Final Effluent Water Quality

Parameter	Upper Tier	Unit
BOD after secondary treatment	40	mg/l
TSS after secondary treatment	250	mg/l
Ammonia as N (NH3-N)	60	mg/l

Sweeper Tip Facility effluent

The Sweeper Tip Facility is currently expected to be constructed within the TCA, and the effluent produced by the facility is anticipated to be treated waste potable/non-potable/surface water from activities including road sweeping and wheel washing. The final design of this facility is on-going and subject to contractor input but will be an industry standard design.

The facility is currently expected to comprise of a compartmentalised concrete structure, with compartments separated by porous blocks. The effluent is to be collected in the initial compartment and then move via gravity through the facility with the concrete blocks providing a filtration function. It is likely the filtered solids would be disposed of as waste; being transported offsite for disposal by registered waste carriers to a suitably licensed facility. There may be scope in future to treat the filtered solids for re-use on site under the appropriate regulatory arrangements, however this is not in the scope of this application.

Following appropriate treatment for suspended solids, the effluent would then flow to the treated foul water network (outlined above). It is expected that the effluent will be sent for further settlement including oil/water separation. Within this system it is considered likely there will be a facility to enable the addition of coagulants/flocculants if required, alongside pH dosing if required. It is expected the pH dosing may be carried out using carbon dioxide. The specific coagulants/flocculants are to be confirmed at the final design stage, with input from the construction contractor. Provision will be made for spot sampling of the effluent for pH, total suspended solids and visible oil and grease, prior to discharge to the CDO collection chamber. In the event that sampling or visual monitoring identifies unsuitable effluent for discharge, provision will be made for the effluent to be re-treated through the system or disposed of elsewhere e.g. via tanker to an off-site facility.

Following treatment, the effluent will be pumped to a pumping station, from where it will be pumped to the CDO collection chamber, prior to discharge to the North Sea.

The table below sets out the proposed final effluent quality for the sweeper tip facility.

Table 7 - Sweeper Tip Facility Effluent Water Quality

Parameter	Upper Tier
Total suspended solids	250 mg/l
pH	6-9
No visible or grease	No significant trace

Bentonite Plant effluent

The bentonite plant is expected to consist of a de-sanding and de-silting unit, alongside a centrifuge. In the de-sanding/de-silting unit coarse solids will be removed. The larger particles are removed then the bentonite slurry is passed through a decanter system, which uses a centrifuge to separate the finer solids. It's expected that a flocculant will be added in the decanter system. The specific flocculant chemical will be identified closer to the start of commissioning the plant, following final design and with supplier input. The separated particles are then removed directly to a suitable container. The separated solids will then be transported for disposal at a suitably licensed facility, or there may be some potential for re-use in the future. The potential disposal/re-use of these solids is not in the scope of this permit application.

Following treatment, the treated water can either be re-cycled if suitable (and used again as bentonite slurry), or will be pumped to the CDO collection chamber, prior to discharge. Provision will be made for spot sampling of the treated water for pH, total suspended solids and visible oil and grease, prior to discharge to the CDO collection chamber.

The table below sets out the proposed final effluent quality for the treated water from the Bentonite Plant.

Table 8 - Treated water quality from the Bentonite Plant

Parameter	Upper Tier
Total suspended solids	250 mg/l
pH	6-9
No visible or grease	No significant trace

2.1.8 Details of any mitigation

No specific mitigation measures are required as part of this permit to protect designated habitat sites beyond those which would be required as part of general environmental protection measures (e.g. measures to protect water quality in line with other legislation).

3 INFORMATION TO INFORM THE IN-COMBINATION ASSESSMENT

Sizewell B forms part of the baseline for the combined drainage outfall rather than an ‘other plan or project’ for in combination assessment and thus is factored into the baseline condition information included in Section 2.1.6 of this package. No other discharges unrelated to Sizewell C have been identified that would operate in combination with the CDO.

The majority of other discharge permits associated with this project are inland and the plume analysis for the permit indicates that the maximum plume (for chromium) will be approximately 0.22km^2 in area and not reach the Minsmere Sluice, thus providing no direct connection to inland designated sites.

The CDO is anticipated to be operational from October 2026 and is expected to replace the TMO that is anticipated to be constructed first for the initial discharge of surface water run-off and limited groundwater during early construction phases. The TMO has been subject to a separate permit application (MDS/CWDA/18) and is therefore not relevant to this application. The CDO will replace the TMO and will therefore follow sequentially in time, and as such there will be no ‘in combination’ effect.

The discharges from the CDO and desalination outfall (permit MCA/CWDA/78) may occur simultaneously. Notably the CDO discharge is buoyant and creates a surface plume whereas the desalination plume is dense and results in a plume at the bed, therefore there is a vertical offset. The maximum surface plume from the CDO extends close to, but not quite overlapping the desalination plant outfall. As a worst-case it is possible that the plumes from the two discharges may occur simultaneously without any overlap, and therefore the combined area in excess of the relevant EQS would be the sum of the two areas (noting the vertical offset described above). Overlapping plume areas may marginally increase the concentration but the total area in excess of the EQS could not be larger than the total of the two separate plumes combined.

The largest estimated plume footprint for metals (for zinc) discharged from the desalination plant is up to 0.630 ha (0.0063 km^2) at the bed; combined with the surface CDO plume (0.035 km^2) for zinc, a total area of the Greater Sizewell Bay of 0.041 km^2 may be exposed to average zinc levels above the EQS. This amounts to approximately 0.00105% of the Outer Thames Estuary SPA and 0.00011% of the Southern North Sea SAC.

The chromium plume was the largest plume from the CDO (up to 0.22 km^2), however chromium from the desalination plant discharge is expected to be very low, with a maximum footprint of 0.001 ha (0.00001 km2) and therefore combined effects would be negligibly larger.

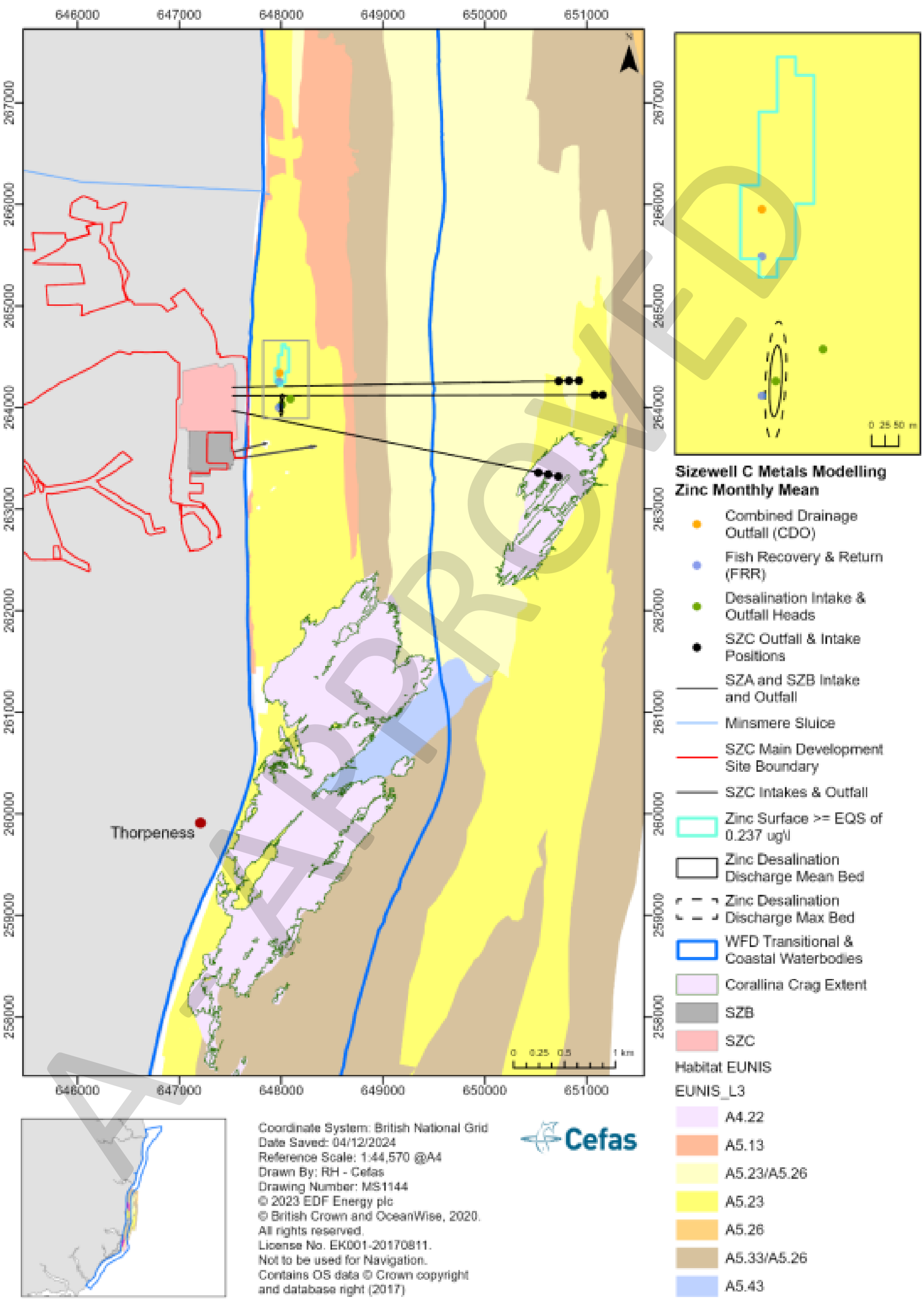

Figure 4 - In-combination CDO plume and desalination plume model results for zinc (refer to BEEMS TR552 for details desalination discharge assessment). Note CDO plume is modelled with GETM and is a buoyant surface plume, the desalination plume is modelled with CORMIX and is a dense bed plume, and therefore there is a vertical offset not illustrated on this map.

APPENDIX A: EA RISKS

A.1 EA Risks Relevant to Permit MCA/CWDA/13 on the Southern North Sea SAC and Outer Thames Estuary SPA

EA Risk	Southern North Sea SAC qualifying features	Outer Thames Estuary SPA qualifying features			Justification
	Population of harbour porpoise	Red throated diver	Common tern	Little tern	
Turbidity	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. Accumulated flows will be released from the CDO collection chamber at a velocity sufficient to limit sediment deposition in the outfall pipeline. Sediment control measures will be implemented as part of construction best practice as detailed in the SID. Each of the effluent streams to be discharged will be adequately treated to ensure that suspended solids account for under 250mg/l
Toxic contamination	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. The CDO will discharge wastewater that has elevated concentrations of trace metals. Of the metals assessed during initial screening only chromium and zinc required additional analysis. This modelling indicates that, the plume area above the EQS was between 0.221 and 0.035km^2 respectively. Based on this assessment the discharge would be expected to have negligible effects on background water quality beyond the immediate small, localised area influenced by the discharge. The plume extends only a small distance and does not reach any other designated sites beyond Southern North Sea SAC and Outer Thames Estuary SPA, within which the outfall is situated. The largest plume size (a plume of 0.221 km^2 for chromium) does not extend to the Minsmere Sluice. Due to the scale of the Outer Thames Estuary SPA and the Southern North Sea SAC, this is therefore imperceptible in terms of a foraging area for SPA birds. A potential for the discharge to include un-ionised ammonia has been identified. An assessment was conducted in relation to this and has been considered in the CEFAS marine modelling in the BEEMS Technical Report [4]. This concluded that there is no significant potential for this to impact the marine environment.
Siltation	x	x	x	x	As the discharge is directly into open sea, it is not anticipated to cause any alteration to siltation and therefore will have no impact on the qualifying features of the Southern North Sea SAC or Outer Thames Estuary SPA.
Physical damage	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. Section 20.9.23 of [Sizewell C Project: Environmental Statement] states that the most conservative estimate of scour yields a 2.1m deep pit with a tidally aligned elliptical footprint 17.4 x 11.2m around the structure (i.e., scour extending 7.2m each side of the outfall along the tidal axis (N-S) and to 4.1m each side E-W). The associated changes in flow are not derived in scour assessments, but the scale of the outfall heads would be too small to interact significantly with flows so the overall magnitude of impact on hydrodynamics is assessed as low Physical damage has potential to occur through the installation of the pipeline and rock armour. This will be minimised through the use of horizontal directional drilling to install the pipeline where possible. Given the localised nature of this works, in the context of relatively large habitat availability elsewhere in the designations, the physical damage caused as a result of the installation of the pipeline is unlikely to cause a significant effect on the populations of protected species.
Changes in pH	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. It is anticipated that the pH of discharge will be comparable to that of the abstracted water, with a discharge pH of 6-9. In relative terms, the discharge of a small volume of water into open sea within large, designated sites is unlikely to cause significant effect given the likely rapid dilution of any pH differing to that of the baseline. As such, no impact to the protected species within the designated sites is anticipated as a result of changes in pH.
Nutrient enrichment	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. Since this is an open sea environment, it is likely that any additional nutrients discharged into the sea will be diluted and therefore not spread to habitats throughout the SAC and SPA. The Dissolved Inorganic Nitrogen (DIN) threshold for good status under the WFD is 70 µMol/L or 980 µg/L. If we use this as a proxy threshold and apply the same screening tests, the discharge of DIN would be 12,789 µg/L maximum. Background DIN is 425 µg/L winter max. Applying test 5 based on the max sewage case= (12,789*0.1)/(980-425) = 2.3 (less than the AEVF of 3.5. Therefore, DIN would pass Test 5 screening. Therefore, there are no nutrient enrichment impacts to the SAC and SPA anticipated as a result of the discharge from the CDO.
Changes in thermal regime					The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. None of the proposed treatment methods are anticipated to influence the temperature of the discharge or receiving marine environment as no thermal components are involved. Because of this the temperature of the discharge will reflect typical ambient temperatures (approximately between 9-15 degrees).
Changes in salinity regime	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. The effluent will be freshwater in nature and will not result in elevated salinity. As such, no impact to the salinity regime is anticipated as a result of the CDO discharge.

A.2 EA Risks Relevant to Permit MCA/CWDA/13 on the Minsmere to Walberswick Heaths & Marshes SAC and Minsmere-Walberswick SPA & Ramsar

EA Risks	Minsmere to Walberswick Heaths & Marshes SSSI	Minsmere-Walberswick SPA	Minsmere-Walberswick Ramsar	Minsmere to Walberswick Heaths & Marshes SAC	Justification
Turbidity	x	x	x		Accumulated flows will be released from the CDO collection chamber at a velocity sufficient to limit sediment deposition in the outfall pipeline. Sediment control measures will be implemented as part of construction best practice as detailed in the SID Each of the effluent streams to be discharged will be adequately treated to ensure that suspended solids account for under 250mg/l The qualifying features of Minsmere to Walberswick Heaths & Marshes SAC are not vulnerable to changes in turbidity.
Toxic contamination	x	x	x	x	The CDO will discharge wastewater that has elevated concentrations of trace metals. Of the metals assessed during initial screening only chromium and zinc required additional analysis. This modelling indicates that, the plume area above the EQS was between 0.221 and 0.035km2 respectively. Based on this assessment the discharge would be expected to have negligible effects on background water quality beyond the immediate small, localised area influenced by the discharge. The plume extends only a small distance and does not reach any other designated sites beyond Southern North Sea SAC and Outer Thames Estuary SPA, within which the outfall is situated. The maximum plume size (a plume of 750m maximum for chromium) does not extend to the Minsmere Sluice. The total area of the maximum plume is approximately 0.22km2. Due to the scale of the Outer Thames Estuary SPA and the Southern North Sea SAC, this is therefore imperceptible in terms of a foraging area for SPA birds. A potential for the discharge to include un-ionised ammonia has been identified. An assessment was conducted in relation to this and has been considered in the CEFAS marine modelling in the BEEMS Technical Report [4]. This concluded that there is no significant potential for this to impact the marine environment.
Siltation	x	x	x		As the discharge is directly into open sea, it is not anticipated to cause any alteration to siltation and therefore will have no impact on the qualifying features of the designated sites.
Physical damage	x	x	x		Section 20.9.23 of [Sizewell C Project: Environmental Statement] states that he most conservative estimate of scour yields a 2.1m deep pit with a tidally aligned elliptical footprint 17.4 x 11.2m around the structure (i.e., scour extending 7.2m each side of the outfall along the tidal axis (N-S) and to 4.1m each side E-W). The associated changes in flow are not derived in scour assessments, but the scale of the outfall heads would be too small to interact significantly with flows so the overall magnitude of impact on hydrodynamics is assessed as low Physical damage has potential to occur through the installation of the pipeline and rock armour. This will be minimised through the use of horizontal directional drilling to install the pipeline where possible. Given the localised nature of this works, in the context of relatively large habitat availability elsewhere in the designations, the physical damage caused as a result of the installation of the pipeline is unlikely to cause a significant effect on the populations of protected species. Given the distance from the designated sites, this physical damage will not occur to the designated sites themselves and are unlikely to impact the qualifying features of the designated sites.
Changes in pH	x	x	x	x	It is anticipated that the pH of discharge will be comparable to that of the abstracted water, with a discharge pH of 6-9. In relative terms, the discharge of a small volume of water into open sea within large, designated sites is unlikely to cause significant effect given the likely rapid dilution of any pH differing to that of the baseline. As such, no impact to the protected species and habitats within the designated sites is anticipated as a result of changes in pH.
Nutrient enrichment	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. Since this is an open sea environment, it is likely that any additional nutrients discharged into the sea will be diluted and therefore not spread to habitats throughout the SAC and SPA. The DIN threshold for good status under the WFD is 70 µMol/L or 980 µg/L. If we use this as a proxy threshold and apply the same screening tests, the discharge of DIN would be 12,789 µg/L maximum. Background DIN is 425 µg/L winter max. Applying test 5 based on the max sewage case= (12,789*0.1)/(980-425) = 2.3 (less than the AEVF of 3.5. Therefore, DIN would pass Test 5 screening. Therefore, there are no nutrient enrichment impacts to the designated sites anticipated as a result of the discharge from the CDO.
Changes in thermal regime					The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. None of the proposed treatment methods are anticipated to influence the temperature of the discharge or receiving marine environment as no thermal components are involved. Because of this the temperature of the discharge will reflect typical ambient temperatures (approximately between 9-15 degrees).
Changes in salinity regime	x	x	x	x	The effluent from the CDO will be directly input to the Southern North Sea SAC and Outer Thames Estuary SPA. The effluent will be freshwater in nature and will not result in elevated salinity. As such, no impact to the salinity regime is anticipated as a result of the CDO discharge.