Qualitative Environmental Risk Assessment - Combined Drainage Outfall (CDO) Discharge											
Hazard	**Receptor**	**Pathway**	**Potential Harm**	**Probability of exposure**	**Consequence**	**Magnitude of risk**	**Justification for Magnitude**	**Risk management**	**Probability of exposure**	**Consequence**	**Magnitude of Residual Risk**
What is the agent or process with potential to cause harm?	**What is at risk? What do I wish to protect?**	**How might the receptor come into contact with the hazard?**	**What are the harmful consequences if things go wrong?**	**How likely is this contact? (with no mitigation measures)**	**How severe will the consequences be if this occurs? (no mitigation)**	**What is the overall magnitude of the risk? (no mitigation)**	**On what did I base my judgement?**	**How can I best manage the risk to reduce the magnitude?**	**How likely is this contact? (with mitigation measures implemented)**	**How severe will the consequences be if this occurs?**	**What is the magnitude of the risk after management?**
Discharge of effluent from combined drainage outfall (CDO)	North Sea	Direct discharge pathway for effluent from CDO	Potential adverse impacts on receiving water quality and any aquatic species that may be present in the immediate vicinity of the discharge plume.	High	Medium	High	The CDO will discharge to the North Sea. The discharge will contain treated trade effluent, foul wastewater, surface water and groundwater.	Risks specifically associated with the composition of the discharge and it's impact on the receiving marine water quality have been considered in the Surface Water Pollution Risk Assessment and Water Framework Directive Assessment, which accompany the permit application. In summary however, the marine dispersion head, which will be located above the seabed, will be fitted with 4 duckbill valves arranged in a horizontal cross at the end of the pipe to aid mixing and dispersion of the discharge in the marine environment. For effluent streams where dosing chemicals are used, there is not anticipated to be carry over of these within the final effluent. Spot sampling and continuous monitoring, where appropriate, will be undertaken as per the permit application supporting information document, or as per permit conditions if these differ. Testing of samples of the effluent will be undertaken at a UKAS accredited facility, where required. Please refer to Section 6 of the permit application supporting information document for further detail on proposed monitoring and sampling arrangements for individual effluent streams. Ultimately, all monitoring and sampling arrangements will be designed to adhere to conditions set out in the permit. Regarding the control of the flow of the final combined effluent into the sea, the CDO collection chamber flushing cells shall operate as a storage-release system controlled by an automated OPEN / CLOSE penstock. The collection chamber shall have a dedicated ultrasonic level instrument for the level measurement and control of the penstock, providing control over discharge timings and volumes. A high-level and low-level float switch is provided in the collection chamber for backup control in the event of failure of this ultrasonic level instrument. Manual operation will also be available as a backup in the event of failure of the automated penstock. If the penstock was to completely fail, the water will eventually overflow to the outfall chamber such that the discharge would continue. An alarm signal will be raised in the event of an overflow condition due to high water level or failure of an instrument. The status and alarm signals associated with the CDO chamber shall be transmitted via the remote telemetry unit and made available to the Site Operations central management system.	High	Very Low	Low
The discharge of treated surface water run-off from the MCA	North Sea	The effluent stream will be combined with other effluents before being discharged directly to the North Sea from the CDO pipeline.	Untreated surface water from the MCA may have a high TSS content, high pH and/or a visible oil sheen. This could have adverse impacts on receiving water quality and any aquatic species that may be present in the immediate vicinity of the discharge plume when discharged.	High	Medium	High	Surface water from the MCA will be discharged to the North Sea.	Surface water from the MCA will be directed towards attenuation features prior to being sent to the surface water treatment plant for treatment. As part of the surface water treatment plant, dosing of chemicals might be used to treat TSS / pH. As described in the permit application technical supporting document, there is not anticipated to be carry over of dosing chemicals in the final effluent stream. This is because any residue from the dosing chemicals will be bound (by the flocculant) and subsequently removed from the effluent stream along with the settled solids from the treatment plant, prior to the treated effluent entering the CDO collection chamber. Sampling is proposed to be undertaken on a periodic basis that is proportionate to the risks posed by the effluent stream. Instantaneous spot measurements are proposed over continuous monitoring, as the surface water effluent is mainly rainfall dependent and intermittent, and should not contain any hazardous substances. The surface water network will also be visually inspected for the presence of visible hydrocarbon sheens (oil / fuel). See Section 6.2.1 of the Technical Supporting Document for further details.	High	Very Low	Low
The discharge of groundwater from the MCA	North Sea	The effluent stream will be combined with other effluents before being discharged directly to the North Sea from the CDO pipeline.	Untreated groundwater from the MCA may have a high TSS content, high pH and/or a visible oil sheen. This could have adverse impacts on receiving water quality and any aquatic species that may be present in the immediate vicinity of the discharge plume when discharged.	High	Medium	High	Groundwater from the MCA will be discharged to the North Sea.	The effluent quality will be ensured through agreed monitoring and sampling arrangements. Sampling will be undertaken on a periodic basis that is proportionate to the risks posed by the effluent stream. Monitoring is also proposed for TSS, and it is envisaged that a suitable flowmeter will be installed at a suitable location. See Sections 4.2 and 6.2.2 of the Technical Supporting Document for further details. It is proposed that groundwater shall be monitored for relevant determinands e.g. TSS prior to entry to any suitable groundwater treatment facility (if this facility is required) and prior to discharge to the CDO collection chamber. This strategy is based on the conclusions of the Surface Water Pollution Risk Assessment and marine modelling and the results of the groundwater analysis completed to inform the assessment. This evidence-based approach will ensure that any treatment is proportionate to the conditions encountered. Elevated TSS values are only expected for a short duration when a well is first installed. Therefore, temporary treatment for TSS (during this well installation period) may be employed to enable the effluent to discharge via the CDO, or the effluent can be disposed of via an alternative suitable route e.g., collected and tankered to suitable off-Site facility.	High	Very Low	Low
The discharge of treated domestic foul water from the MCA, the Eastern TCA and Western TCA	North Sea	The effluent streams will be combined with other effluents before being discharged directly to the North Sea from the CDO pipeline.	If the domestic foul water package treatment plants were to fail / malfunction, the discharge of untreated domestic foul water would adversely impact receiving water quality and could spread bacteria and disease among aquatic species that may be present in the immediate vicinity of the discharge plume.	High	High	High	Raw sewage can carry bacteria and disease which are harmful to species health in the vicinity of the North Sea discharge location.	There will be three foul water treatment plants implemented on site during construction, referred too as HAJ 1.1, 1.2 and 1.3. All treatment plants will be package treatment plants (PTPs) based on established technologies. Each will have a downstream sampling point following treatment and prior to discharge to the CDO collection chamber. HAJ 1.1 and HAJ 1.2 are expected to employ MBBR treatment (moving bed biofilm reactor) and shall treat effluent to a quality suitable for discharge via the CDO. HAJ 1.3 shall treat effluent to a quality suitable for non-potable reuse and shall not pose risk to the environment, human and animal health. HAJ 1.3 is expected to treat water using submerged aerated filters (SAF) and also employ UV treatment. See sections 4.3 and 4.4 of the Technical Supporting Document for further details on foul water treatment. The PTPs will incorporate telemetry monitoring for all required effluent quality parameters (expected to be set out in the permit), and the plants are anticipated to operate automatically, with suitable standby equipment as required that can also operate automatically. The plants will also incorporate a re-circulation function such that in the event of treated effluent requiring further treatment, this can be easily achieved. The plants shall also have a draining facility such that, in the unlikely event of treatment failure, effluent can be removed from site via tanker to a suitably licensed facility and not discharged via the CDO outfall.	High	Very Low	Low
The discharge of treated effluent from a sweeper tip facility	North Sea	The effluent stream will be combined with other effluents before being discharged directly to the North Sea from the CDO pipeline.	Untreated effluent from the sweeper tip facility may have a high TSS content, high pH and/or a visible oil sheen. This could have adverse impacts on receiving water quality and any aquatic species that may be present in the immediate vicinity of the discharge plume when discharged.	High	Medium	High	The effluent produced by the Sweeper Tip Facility is anticipated to comprise waste potable/surface water from activities including road sweeping and wheel washing, which shall not contain hazardous substances.	Silt prevention measures will be put in place to reduce the TSS content in the effluent from the Sweeper Tip Facility. Porous blocks will filter solids from the effluent at the facility, which will then flow to the treated foul water network. See Section 4.3.3 of the Technical Supporting Document for treatment details, which may involve the use of dosing chemicals (such as coagulants / flocculants) and pH correction. Carry over from any dosing chemicals is not anticipated as any residue from the chemicals would be bound (by the flocculant) and subsequently removed from the effluent stream along with the settled solids as sludge, prior to the discharge stream entering the CDO collection chamber. Sampling will be undertaken on a periodic basis that is proportionate to the risks posed by the effluent stream. It is anticipated that pH and TSS content will be continuously monitored by e.g. suitable TSS/pH monitoring probe, to inform the potential need for dosing, and in addition spot sampling will be undertaken for pH, TSS and visible oil and grease. The surface water network will also be visually inspected for the presence of visible hydrocarbon sheens (oil / fuel). See Section 6.2.4 of the SID for further information.	High	Very Low	Low

The discharge of treated water from the bentonite plant	North Sea	The effluent stream will be combined with other effluents before being discharged directly to the North Sea from the CDO pipeline.	Untreated waste water from bentonite slurry will contain a high TSS content and potentially an elevated pH. This could have adverse impacts on receiving water quality and any aquatic species that may be present in the immediate vicinity of the discharge plume when discharged.	High	Medium	High	Untreated effluent from a bentonite treatment plant will contain a high TSS content and potentially an elevated pH. This could have adverse impacts on the receiving water quality if discharged without treatment.	The bentonite waste water will be treated for TSS using de-sanding and de-silting units, centrifugation and flocculation (the specific flocculant to be used will not be identified until nearer to plant commissioning following contractor input). Safety data sheets will be obtained for the flocculant and it is acknowledged that this information may need to be provided to the Environment Agency to inform suitable permit limits. The effluent quality will be ensured through monitoring and sampling arrangements. It is anticipated that a sampling point will be installed at the outlet point of the bentonite plant to enable spot samples to be taken, alongside an appropriate flowmeter. Visual inspections of the effluent derived from the bentonite plant (where accessible) will also take place, in particular to identify any issues associated with hydrocarbons (oil / fuel) which may leave visible sheens for example. See Section 6.2.5 of the Technical Supporting Document for further information.	High	Very Low	Low
Storage and use of chemicals in treatment plants prior to discharge (e.g., package treatment plants, surface water treatment)	North Sea Soil / ground on site (where exposed) On-site infrastructure Nearby sensitive receptors (e.g., flora / fauna) Human receptors	Overuse / overdosing of chemicals in treatment processes could lead to increases of certain substances in above-described discharge streams. Accidental leaks / spills during delivery, use and storage of chemicals on site Wind-borne if using powdered chemicals	Where chemicals are used for any discharge stream treatment processes, if there are issues with dosing equipment, this could result in discharges being made to the North Sea that do not meet limits set in the permit. This could impact receiving marine water quality and any aquatic species that may be present in the vicinity of the discharge plume.	Low	High	Medium	Chemicals (e.g., flocculants) may be used to treat certain discharge streams that go into the CDO collection chamber. These substances have the potential to cause pollution if not suitably managed.	Chemical use in treatment processes / discharge activities will be kept to a minimum where possible. Any chemicals will be managed in line with the SZC Code of Construction Practice requirements. Appropriate storage and containment features will be incorporated, with bunding as appropriate, and these will be subject to regular checks. Any issues identified will be escalated as per the relevant site management procedures. Safety data sheets will be held on site and risk assessments completed as per COSHH requirements where applicable. All deliveries of liquid chemicals will take place in bunded areas. Suitable spill equipment will be in place on site. Oil and chemical spill kits will be provided in strategic locations and operatives will be trained in their use. Contents will be replaced following any use. A site spill response procedure, or similar, will be implemented as part of the SZC / contractor-specific environmental management system requirements. Any used spill equipment will be tested and classified before being disposed of as hazardous or non-hazardous waste.	Very Low	Medium	Low
Failure of equipment (e.g., pumps, monitoring / sampling equipment, flow meters) leading to potential exceedances in permitted flow rate / volume / effluent quality not being identified	North Sea	Direct discharge pathway for effluent from CDO	Equipment failure could lead to several undesirable scenarios including for example: - Over-dosing of treatment chemicals in relevant treatment plants - Blocked pipelines for movement of effluent to CDO collection chamber (where pumped for example) - Failure to identify out-of-specification effluent if monitoring equipment were to malfunction The above scenarios could impact on-site management of the effluent streams entering the CDO collection chamber and / or the receiving marine environment if discharge is not being properly monitored.	Low	Medium	Medium	All equipment implemented as part of the discharge activities will be required to be of tried-and-tested methods and will be required to meet design performance specifications, where applicable. However, equipment failure can never be fully ruled out. Severity may be higher if effluent is discharged that is out-of-specification.	All equipment which relates to the management and / or treatment of the proposed discharge streams will be subject to routine inspection and planned preventative maintenance, which will be in accordance with the manufacturers / suppliers recommendations and any other applicable SZC maintenance and inspection / quality requirements. Any defected / malfunctioning equipment will be reported to the relevant person and replaced / repaired as necessary. Emergency response procedures will be in place which will be followed if required. Appropriate stand-by equipment may also be available for use in the event of relevant equipment failure, allowing for the prompt mitigation of such an event. There is additional robustness of monitoring / sampling arrangements due to the expected availability of sampling points on both the inlets and outlet of the CDO collection chamber, alongside the required monitoring/sampling points for each water discharge activity (prior to CDO collection chamber). These robust arrangements will help to minimise the likelihood of any non-compliant effluent being discharged to the environment. Treatment plant design is anticipated to ensure that the failure of any single item of equipment does not cause a loss of supply or reduction in the ability to achieve Peak Maximum Capacity or put compliance at risk. All major and compliance critical equipment is to be installed with fully operational standby equipment.	Very Low	Low	Low
Risk of physical damage to infrastructure associated with proposed discharge activities (e.g., CDO collection chamber, connecting pipework, treatment plants / systems). This could occur due to physical impacts e.g., from plant movements, vehicle movements on site, vandalism, accidental damage, fire, corrosion of materials. It may lead to release of effluent(s) on site. The outfall pipeline is located offshore, therefore there is a risk this could be impacted from underwater vessels / apparatus.	North Sea Soil / ground on site (where exposed) On-site infrastructure Nearby sensitive receptors (e.g., flora / fauna) Human receptors	Through direct physical damage to infrastructure leading to release of effluent(s)	The potential harmful consequences would be dependent upon the receptor and the nature of the effluent stream released. Effluent release(s) could result in direct and / or indirect pollution / contamination of / to environmental receptors, such as surface watercourses, exposed soil or ground, nearby flora and fauna. Potential impacts also possible to human health, e.g., from domestic foul wastewater (sewage).	Medium	High	High	The effluent will be transferred to the collection chamber via several pipelines across the site. These, alongside other associated infrastructure such as treatment plants, are all at risk of physical damage due to being located upon a large and live construction site. Depending on the extent of the physical damage to the infrastructure and the resultant type and volume of the effluent release, the severity of the impact could vary considerably.	There will be site-wide traffic control measures implemented to reduce the risks of collisions between plant, machinery and infrastructure. Pipework will be visible on site and all personnel working in the immediate area made aware of it's location. Additional protection measures such as racking and barriers will be installed as considered necessary once the discharge stream routes have been established. There will be measures in place to ensure that any required movement of the transfer pipelines (between treatment plants and the CDO chamber) is undertaken in accordance with relevant environmental and safety considerations, to avoid any damage to the infrastructure. All treatment plants and supporting infrastructure will be positioned carefully on site with due consideration to surrounding features and other nearby infrastructure, traffic routes, plant crossings etc. All infrastructure relating to the management of the proposed discharge activities, including treatment systems, will be subject to regular visual checks and maintenance. Monitoring programmes will be in place and any issues identified will be escalated as per relevant on-site procedures. All infrastructure will be suitably designed and made from appropriate materials. The CDO collection chamber will be constructed from reinforced concrete. The outfall pipeline will also be composed of durable material and minimum wall thicknesses have been stated as part of design requirements. Spill emergency response training and procedures will be implemented on site and communicated to all relevant personnel, including contractors. Measures will be implemented on site to reduce the risk of fire and security measures are detailed to prevent unauthorised access.	Very Low	Medium	Low

Disruption to power supply affecting operation of treatment facilities / plants	North Sea	Direct discharge pathway for process effluent. If upstream flow management is impacted, potential for un-planned releases to land	Power is required to operate the treatment plants. If the power supply is interrupted, all plants could stop and all flows could cease, causing upstream flow management issues	Low	Medium	Medium	Power cuts are not planned events so considered unlikely even without mitigation for power failure.	There will be arrangements in place to ensure that, in the event of a mains power failure, all treatment plants and CDO infrastructure can continue to operate as required. All three sewage treatment plants (HAJ1.1, HAJ 1.2, HAJ1.3) and the surface water treatment plant (HSV) will be serviced by an incoming power supply from the relevant upstream package substation and shall each have back-up power supply from a dedicated stage V local generator. In the event of any interruption to normal power supply, the dedicated generators will switch on automatically within 2-3 minutes to ensure the continuation of treatment plant operation. The Bentonite plants and suitable groundwater treatment facility (if required) shall also have suitable arrangements in place to minimise the impacts of any power interruption. Inputs to the sweeper tip facility are expected to be manual i.e. from road sweeper vehicles, and therefore would be expected to cease in the event of a power interruption. Furthermore, the facility is designed such that water will flow through under gravity, without the need for a pumped flow, minimising the impacts of any power interruption. Power supply to pumping stations is also anticipated to be supported by back-up portable generators as required, enabling the pumping of input effluent and treated effluent to relevant destinations as required. The CDO collection chamber is anticipated to be supported by a back-up battery system to provide power to key units such as ultrasonic level controllers, remote telemetry units and flowmeters, in the event of a power interruption. However it is worth noting that in the unlikely event of total power failure to the CDO Collection chamber, the risk of overflow from the chamber to the local land-based environment is considered negligible due to the design of the chamber - enabling a discharge to continue even when there is no power.	Low	Very Low	Low
Commissioning of CDO infrastructure	North Sea	Discharge of commissioning effluent prior to operation	During individual plant commissioning periods, there is a risk that the proposed effluent quality parameters could be exceeded.	High	Medium	High	Commissioning is not anticipated to contain any additional substances not already considered in supporting risk assessments. However there is a risk that, during this period, parameter limits could be breached while treatment requirements are fine-tuned.	It is anticipated that for all treatment plants, commissioning flows may be recirculated through the system where possible until the water quality is demonstrably compliant. Where this is not possible, some commissioning flows may require removal via tanker for disposal off-site at a suitably licensed facility. A commissioning plan will be developed when the specific plant designs are finalised, and can be shared with the Environment Agency in advance of commissioning if required.	Very Low	Medium	Low
Climate change-related impacts including: - Increased frequency and duration of periods of heavy rainfall, potential for on-site flooding - Drought - Extreme temperatures (heat / cold) - Rising sea levels / tidal variations	North Sea	Direct discharge pathway for process effluent Exposure to external weather conditions	Climate change impacts listed may impact day-to-day operation of the CDO, for example interruptions to power supply from cables freezing / overheating. Extreme heat could increase the temperature of the discharge (for example by warming the CDO collection chamber). Changes in sea-level / tidal variations could impact the nature of the final discharge plume in the marine environment. Flooding (and other extreme weather) could impact operator ability to operate, maintain and obtain samples from the relevant infrastructure	Medium	Low	Medium	Impacts listed here may occur but are not currently experienced on a frequent basis. Weather events such as those listed may occur but are not predicted to occur frequently or throughout entire duration of operational lifetime of combined drainage outfall.	Contractors will be required to consider potential effects of climate change-induced impacts in their risk assessments / method statements and any other relevant corresponding management system information (e.g. CEMP), as appropriate to the proposed water discharge activities and as per the requirement set out in the SZC Code of Construction Practice (that CEMPs must consider measures to manage extreme weather events which may be derived from a changing climate). The design of the CDO and associated infrastructure has incorporated consideration of the effects of a changing climate where necessary too, for example through consideration of sea-level rises and potential impacts on tidal conditions that have input into the design of CDO infrastructure. Furthermore, the design tidal levels for the marine dispersion head incorporate sea level rise due to climate change up until 2040. Periods of prolonged or heavy rainfall may contribute to the mobilisation of silt / sediment on site; therefore weather conditions will be regularly monitored. Re-consideration of discharge arrangements due to changes in weather conditions will be instigated by site management if required. During such periods, the monitoring / sampling frequency can be revisited (as and when identified as being required by appointed contractors and / or Site Operations). Intensive in-situ monitoring may be required so that reactions to alter the management of the discharge activities are swift and effective In addition, the wider project has been subject to a climate change assessment as part of the DCO requirements.	Low	Low	Low

Noise	*While use of certain systems / equipment may increase noise emissions; the discharge activities themselves will not result in noticeable increases to noise emissions on site. Requirements relating to management of noise will be captured within relevant construction-related documentation. The Sizewell C Code of Construction Practice shall also be followed - which details various methods of noise control.*
Use of generators - use and storage of diesel	*The use of generators / combustion plant will be considered in separate permit applications (if required) and contractor risk assessments. The use of generators and diesel storage is not anticipated to impact upon the proposed water discharge activities contained within this permit application as this is a direct discharge from the combined drainage outfall pipeline to the North Sea. Diesel should not be able to enter the pipeline.*
Use of lighting	*N/A to the proposed discharge activities. Lighting will be used across site but this does not relate directly to the proposed discharge activities from a permitting perspective. The use of lighting will be covered as required in any relevant construction-related documentation.*
Odour	*N/A to the proposed discharge activities. There will not be any emissions to air associated with the proposed discharge activities specifically. Management of emissions to air will be covered as required in relevant construction-related documentation.*
Emissions to air	*N/A to the proposed discharge activities. There will not be any emissions to air associated with the proposed discharge activities specifically. Management of emissions to air will be covered as required in relevant construction-related documentation.*
Dust	*N/A to the proposed discharge activities. There will not be any emissions of dust associated with the proposed discharge activities specifically. Dust management will be covered as required in relevant construction-related documentation.*