



South East Strategic Reservoir Option
Preliminary Environmental Information Report

Appendix 19.2 - Stage 2: Preliminary risk assessment

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1 **Stage 2: Preliminary Risk Assessment**

1.1 Introduction

1.1.1 This Appendix sets out the preliminary assessment of risks for Major Accidents and Disasters for the construction and operation stages respectively. The judgement of significance has been made assuming that embedded design mitigation and standard good practice mitigation relevant to Major Accidents and Disasters is applied (these are summarised in this Appendix with further detail provided in the Draft commitments register in Appendix 2.2). Each risk assessed has been assigned a unique identifier, the Effect ID.

1.1.2 The tables identify the following for each effect:

- Risk category, Effect ID and risk name and consequence
- Potential receptors
- Project components and activities giving rise to the effect
- Relevant embedded design mitigation and standard good practice measures (with unique Commitment ID, which relates to Appendix 2.2: Draft commitments register)
- Description of the risk
- Risk rating (tolerability) and significance

1.2 Preliminary Risk Assessment for construction stage risks / consequences

Table 1.1 Summary of construction effects that are not expected or likely (with embedded and standard good practice mitigation)

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
Sinkholes [MAD-24]	Sinkholes cause damage and/ or injury, change in land levels can also result in flooding	Human and environmental receptors, infrastructure	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base) River tunnel and shafts Reservoir tunnel	General construction activities	(ED-17) Measures for safe reservoir operation.	Rainfall and changes to groundwater can lead to erosion of surface rock, eventually leading to collapse and a sinkhole. The site is underlain by two thick clay to mudstone strata, namely Kimmeridge Clay and Gault Clay. The clay is low permeability which reduces water flow and thus the potential for sinkhole features. Due to the underlying geology, the source of the risk is removed.	Broadly acceptable	Not Significant
Landslides/mass movements [MAD-7]	Earthworks result in landslips/ mass movements, causing damage and/or injury, also resulting in flooding	Human and environmental receptors, infrastructure	Reservoir embankment	Material excavation and handling Material stockpiling	(ED-03) Construction sequencing to mitigate flood risk. (SGP-05) Managing construction works within flood zones.	During construction of the embankments, mass movement of earthworks could cause injury to construction workers and direct damage to adjacent works, including machinery and materials. Landslips can adversely affect flood storage and flood flow routes, increasing flood risk. Given the flat topography, the area affected by the slipped embankment material would be confined to the immediate environs of the landslide and limited in length. The risk would be managed through design and construction methods. The risk will be mitigated to ALARP during construction.	Tolerable	Not Significant
Ground instability [MAD-22]	Earthworks result in ground instability, causing damage and/or injury, also resulting in flooding	Human and environmental receptors, infrastructure	Reservoir embankment	Material excavation and handling Material stockpiling	(ED-03) Construction sequencing to mitigate flood risk. (SGP-05) Managing construction works within flood zones.	During construction of the embankments, mass movement of earthworks could cause injury to construction workers and direct damage to adjacent works, including machinery and materials. Landslips can adversely affect flood storage and flood flow routes, increasing flood risk. Given the flat topography, the area affected by the slipped embankment material would be confined to the immediate environs of the landslide and limited in length. The risk would be managed through design and construction methods. The risk will be mitigated to ALARP during construction.	Tolerable	Not Significant
Reservoir / embankment collapse [MAD-23]	Embankment failure during construction period, causing damage and/or injury, also resulting in flooding	Human and environmental receptors, infrastructure	Reservoir embankment	Commissioning and filling	(ED-17) Measures for safe reservoir operation. (SGP-37) Provision of information for	The risk to structural integrity is managed through the application of legislative requirements and international standards for the design and construction, including oversight from an independently appointed construction engineer, means that risks are	Tolerable	Not Significant

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
					off-site reservoir emergency plan.	effectively designed out and works regularly inspected. In the unlikely event that a risk, such as structural integrity, is identified, emergency drawdown would quickly lower water levels either as a precaution while the problem is investigated or as an emergency measure. This reduces the load on the embankments, enables remedial measures to be taken, or in a worst-case reduces wider flood risk in the event of failure. The design, construction and inspection requirements mean that the risk is ALARP.		
Rail accidents [MAD-13]	The use of temporary sidings for movement of freight during construction can cause risk of rail accidents, leading to injury or damage.	Passengers, construction workers, rail line.	Rail siding and material handling facility Modifications to mainline to allow exit west (switch and crossing)	General construction activities	(SGP-40) Management of risks of working near railways.	Risks include presence of Overhead Line Electrification (OLE) Railway and SSE overhead line which cause a hazard for cranes and other tall plant. There is a risk of collision, from a potential obstruction of operational line from freight movements and between freight movements and construction workers. Risks would be managed through Construction Design Management (CDM) and Health and Safety requirements. Application of CDM and Health and Safety requirements mitigates risk to ALARP	Tolerable	Not Significant
Aviation accidents [MAD-16]	Aircraft collision with tall structures resulting in severe injury or fatality, damage to infrastructure	RAF personnel, including those using RAF Benson; other aircraft pilots and passengers using private airstrips.	Most / all project components	General construction activities	No embedded design or standard good practice mitigation identified at this stage.	Temporary tall structures, such as cranes, could increase risk of collision with aircraft during construction. The northeast of the Project falls within the RAF Benson safeguarding zone and there are aircraft operating from private airstrips in the area. The Defence Infrastructure Organisation (DIO) will undertake a safeguarding assessment following submission of the DCO application and take standard measures to warn aircraft of any tall structures, such as changes to mapping. Private airstrip operators will need to take similar measures. The DIO will undertake a safeguarding assessment and take measures to warn aircraft of any tall structures.	Broadly acceptable	Not Significant

1.3 Preliminary Risk Assessment for operation stage risks / consequences

Table 1.2 Summary of operation effects that are not expected or likely (with embedded and standard good practice mitigation)

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
Animal strike (bird strike) [MAD-3]	Bird collision with aircraft resulting in severe injury or fatality	RAF personnel, including those using RAF Benson; other aircraft pilots and passengers using private airstrips.	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base) Lagoons Recreational lakes (east and west) Project Priority Areas for Biodiversity	Presence (of project components)	No embedded design or standard good practice mitigation identified at this stage.	SESRO will create new habitats which will attract birds. Safeguarding systems will apply to new or increased wildlife hazards up to 13km of an aerodrome and this also applies to private airstrips. SESRO habitats are outside the RAF Benson Safeguarding Zone, but the risk is being kept under review as design develops. Initial consultation with Defence Estates Safeguarding indicates SESRO is outside bird risk safeguarding area. This will be kept under review for the ES.	Broadly acceptable	Not Significant
Healthcare [MAD-20]	Health risks due to harmful algal blooms	Reservoir workers undertaking maintenance and operations or visitors undertaking watersports	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base)	Use of publicly accessible areas and recreation facilities Operation	(ED-28) Maintain water quality in the reservoir.	Toxins produced by blue-green algae could come into contact with skin or swallowed causing rashes, fever and muscle pain, vomiting and diarrhoea. To minimise occurrence of algal blooms, the reservoir includes a mixing system and the water will be aerated via pipes located on the reservoir bed. Design and operational management will minimise the risk of algal blooms to ALARP.	Tolerable	Not Significant
Water supply affected (various factors) [MAD-4]	Failure of water supply due to failure of infrastructure	Populations using water supply, surface water ecosystems.	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base) River tunnel and shafts Reservoir tunnel Pumping station	Operation	(ED-15) Security and emergency measures to prevent sabotage. (ED-17) Measures for safe reservoir operation.	The effects would be similar to the future baseline without the Project. Customers of Thames Water, Southern Water and Affinity Water would be affected. If the Project failed to release water into the River Thames for any reason, this could reduce flow and over-abstraction from other waterbodies could also lead to impacts on aquatic ecology. However, the design working life of the main reservoir embankment, tower, tunnels, water treatment works and other safety critical assets is 120 years. Security measures (covered under terrorist attacks) and	Tolerable	Not Significant

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
						regular inspections and maintenance will ensure risk is ALARP. Security measures and regular inspections and maintenance will ensure risk is ALARP.		
Severe weather events (heatwaves, drought) [MAD-5]	Extended periods of drought or heatwaves could lead to the reservoir embankments drying out. This could lead to cracks leading to leakage or resulting in catastrophic landslide and flooding.	Human and environmental receptors, infrastructure.	Reservoir embankment	Presence (of project components)	(ED-12) Measures to address the risks of increased temperatures, including prolonged periods of hot weather and drought. (ED-17) Measures for safe reservoir operation.	The design includes an embankment core sized and designed to prevent internal cracking. Internal drainage has also been designed to prevent internal erosion. Earthworks and landscape design of outer banks avoids steep slope gradients and uses additional landscaping materials to reduce the risk from surface water erosion. Given design standards and requirements under the Reservoirs Act, the risk is ALARP.	Tolerable	Not Significant
Severe weather events (rain, high winds) [MAD-6]	Flood from overtopping due to severe weather events (high winds, rain).	Human and environmental receptors, infrastructure.	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base)	Operation	(ED-13) Measures to address the risks of increased precipitation, intense periods of rainfall and frequency and intensity of flooding. (ED-17) Measures for safe reservoir operation.	There is a risk that heavy rainfall could reduce capacity in reservoir, eventually leading to overtopping of embankments. The reservoir has been sized to accommodate the design rainfall landing within it (probably Maximum Pluvial event, the theoretical worst-case storm that can occur within the area). High winds could lead to leading to wave action which could also result in a risk of over-topping and/or erosion of the crest. Over-topping can lead to erosion of downstream face, in addition to flooding. The design follows guidance and standards to limit wave overtopping to safe amounts (essentially spray). To prevent erosion the inner face of the dam is lined with wave protection measures such as riprap (rock armour) and considers wave loading on waterside structures. In addition, the downstream face of the reservoir is covered in extensive landscaping fill, which acts as a protective buffer to the structural fill beneath. The risk is mitigated to ALARP.	Tolerable	Not Significant

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
Sinkholes [MAD-9]	Sinkholes cause damage and/or injury, change in land levels can also result in flooding	Human and environmental receptors, infrastructure	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base) River tunnel and shafts Reservoir tunnel	Presence (of project components)	(ED-17) Measures for safe reservoir operation.	Rainfall and changes to groundwater can lead to erosion of surface rock, eventually leading to collapse and a sinkhole. The site is underlain by two thick clay to mudstone strata, namely Kimmeridge Clay and Gault Clay. The clay is low permeability which reduces water flow and thus the potential for sinkhole features. Due to the underlying geology, the source of the risk is removed.	Broadly acceptable	Not Significant
Emergency drawdown to the River Thames [MAD-12]	Emergency drawdown to the River Thames could result in flooding	Environmental and human receptors	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base)	Operation	(ED-17) Measures for safe reservoir operation. (SGP-37) Provision of information for off-site reservoir emergency plan.	Emergency drawdown would only occur if needed to reduce the load on the dam structure to reduce the risk of failure. In the very unlikely event emergency drawdown is required, then the reservoir would discharge up to 1m of reservoir depth per day into the River Thames, which has potential to cause flooding, if flows in the river are already high. With normal or low flows in the River Thames, the emergency drawdown flow would be fully contained in the river without flooding by opening the Thames weir gates. The design of the reservoir means that the risk is ALARP.	Tolerable	Not Significant
Reservoir / embankment collapse [MAD-11]	Damage to embankments results in embankment failure, causing damage and/or injury, also resulting in flooding	Human and environmental receptors, infrastructure	Reservoir embankment	Operation	(ED-17) Measures for safe reservoir operation. (SGP-37) Provision of information for off-site reservoir emergency plan.	Risks of damage leading to leaks and flooding could arise from surface run-off, cracking and settlement, deliberate or accidental damage (also covered separately) or other risks. The application of legislative requirements and international standards for the design, construction, operation, maintenance and inspection of the reservoir, means that risks are effectively designed out, mitigated or managed throughout the Project lifetime. In the unlikely event that a risk, such as structural integrity, is identified during the lifetime of the Project, emergency drawdown would quickly lower water levels either as a precaution while the problem is investigated or as an emergency measure. This reduces	Tolerable	Not Significant

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
						the load on the embankments, enables remedial measures to be taken, or in a worst-case reduces wider flood risk in the event of failure. The design, construction, maintenance and inspection requirements mean that the risk is ALARP.		
Battery storage fire [MAD-18]	Fire in the battery energy storage system causes harm to people and the environment.	Staff and possibly visitors, water environment and aquatic ecology.	Site-wide utilities diversions and new supplies	Presence (of project components)	(ED-46) Emergency fire management system for Battery Energy Storage System (BESS).	While small or isolated battery fires would have limited potential for injury or contamination, for larger-scale fires from battery storage systems, there is greater potential for harm, including contaminants in the firewater used to suppress fire or entering the environment in the event of a flood. Battery energy storage systems contain lithium ion and other components (metals, oxides, solvents). Design measures, including location adjacent to foul water pumping station (to offsite sewage treatment facility) and adequate containment of firewater (connected to foul pumping station), in addition to compliance with design safety standards is anticipated to manage this risk. Through design and compliance with fire safety standards, including response planning the risk is reduced to ALARP.	Tolerable	Not Significant
Chemical Accidents [MAD-19]	Large volumes of chemicals stored at the WTW could lead to accidents	Workers at the WTW, Water environment, aquatic ecology.	Thames to Southern Water Transfer (T2ST) Water Treatment Works (WTW) and pipelines	Operation	(SGP-36) Operational management of surface and groundwater quality and quantity at the Water Treatment Works.	Spillage of chemicals such as sodium hypochlorite could cause injury to workers, either through burns from direct contact with skin or respiratory issues from inhalation. A spillage could also be toxic to aquatic organisms. At this stage in the design, it is anticipated that chemical storage volumes on T2ST will be below the lower tier threshold levels for COMAH. Chemical storage and incident planning would be required to comply with the COSHH Regulations to prevent harm. Pollution control measures mean the risk is ALARP	Tolerable	Not Significant

Accident/Disaster Risk Category [Effect ID]	Risk/consequence	Potential receptors	Project component(s)	Project activity(ies)	Embedded design / standard good practice mitigation applied	Description of risk	Risk Rating (tolerability)	Initial Significance of Risk/Consequence
Water sports accidents/drowning [MAD-14]	Use of the reservoir and lakes for recreation and watersports results in accidents and drowning	Users of SESRO for sailing, swimming, paddleboarding and other watersports	Reservoir (including embankment and directly associated infrastructure, such as pipes in the base) Recreational lakes (east and west)	Use of publicly accessible areas and recreation facilities	(SGP-41) Watersports safety measures.	The risk of drowning is possible given that the SESRO Project comprises the creation of a large expanse of water and is likely to be a visitor attraction for watersports. Watersports safety measures will be taken to promote safe recreational use. Standard Health and Safety legislation and operational measures will reduce the risk to ALARP	Tolerable	Not Significant
Aviation accidents [MAD-17]	Aircraft collision with tall structures resulting in severe injury or fatality, damage to infrastructure	RAF personnel, including those using RAF Benson; other aircraft pilots and passengers using private airstrips; infrastructure.	Reservoir embankment Existing 132kV overhead line diversion	Presence (of project components)	No embedded design or standard good practice mitigation identified at this stage.	New tall structures could increase risk of collision with aircraft. The northeast of the Project falls within the RAF Benson safeguarding zone and there are aircraft operating from private airstrips in the area. The DIO will undertake a safeguarding assessment following submission of the DCO application and take standard measures to warn aircraft of any tall structures, such as changes to mapping. Private airstrip operators will need to take similar measures. The DIO will undertake a safeguarding assessment and take measures to warn aircraft of any tall structures.	Broadly acceptable	Not Significant
Terrorist attack on people or the reservoir and WTW (bomb, chemical, vehicle, malicious drone incident) [MAD-15]	Terrorist attack results in damage and/ or injury	Human receptors and infrastructure	Most / all project components	Operation	(ED-15) Security and emergency measures to prevent sabotage.	The risk of a terrorist attack could be aimed at members of the public visiting the reservoir or infrastructure such as the reservoir or water treatment works. The nature of the attack could range from direct injury or physical damage to malicious disruption of water provision. Security measures would be in place to manage the risk. Implementation of security measures mean the risk is ALARP.	Tolerable	Not Significant



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