SILVERTOWN TUNNEL

Environmental Statement Appendix 10.A (6.3.10.1)

Water Framework Directive (WFD) Compliance Assessment

April 2016

MAYOR OF LONDON

TRANSPORT FOR LONDON

EVERY JOURNEY MATTERS

THIS PAGE HAS INTENTIONALLY BEEN LEFT BLANK

Contents

List of Tables

List of Abbreviations

AWB	Artificial Water Body
BWD	Bathing Water Directive
DCO	Development Consent Order
EQS	Environmental Quality Standard
GES	Good Ecological Status
GEP	Good Ecological Potential
HMWB	Heavily Modified Water Body
NVZ	Nitrate Vulnerable Zone
PSD	Priority Substances Directive
RBMP	River Basin Management Plan
rBWD	Revised Bathing Water Directive
RTD	River Terrace Deposit
SAC	Special Area of Conservation
SPA	Special Protection Area
TBT	Tributyltin Compounds
UWWTD	Urban Waste Water Treatment Directive

WFD	Water Framework Directive

Glossary of Terms

Artificial Water Body (AWB)	A body of surface water created by human activity.
Biological Quality Element	A characteristic or property of a biological element that is specifically listed in Annex V of the Water Framework Directive for the definition of the ecological status of a water body (for example composition of invertebrates; abundance of angiosperms; age structure of fish).
Chemical Status	An expression of the pollutants within the water. Waters with good chemical status are those with concentrations of pollutants that do not exceed the environmental limit values specified in the Water Framework Directive.
Code of Construction Practice	Contains a series of measures and standards of work to be applied by contractors throughout the construction period of the Scheme. It provides a consistent approach to the management of construction activities across local authority boundaries.
Cycle	A description of a time period, usually six years, that has associated methods of classifying the ecological status of water bodies, water body boundaries and their association with catchments.
Development Consent Order	This is a statutory order which provides consent for the project and means that a range of other consents, such as planning permission and listed building consent, will not be required. A DCO can also include provisions authorising the compulsory acquisition of land or of interests in or rights over land which is the subject of an application.
Disproportionate Cost	The determination of disproportionate cost requires a decision making procedure that assesses whether the benefits of meeting good status in a water body are outweighed by the costs.
Ecological Potential	The status of a heavily modified or artificial water body measured against the maximum ecological quality it could achieve given the constraints imposed upon it by those heavily modified or artificial characteristics necessary for its use.
Ecological Status	An expression of the structure and functioning of aquatic ecosystems associated with surface waters. Such waters are classified as being of good ecological status when they meet the requirements of the Water Framework Directive.
Environmental Quality Standard	The concentration of a particular pollutant or group of pollutants in water, sediment or in aquatic life which should not be exceeded in order to protect human health and the environment, as defined under the

	Priority Substances Directive.
Good Ecological Potential	Those surface waters which are identified as Heavily Modified Water Bodies and Artificial Water Bodies must achieve 'good ecological potential' (good potential is a recognition that changes to morphology may make good ecological status very difficult to meet). In the first cycle of river basin planning good potential may be defined in relation to the mitigation measures required to achieve it.
Good Ecological Status	The objective for a surface water body to have biological, structural and chemical characteristics similar to those expected under nearly undisturbed conditions
Good Status	A general term meaning the status achieved by a surface water body when both the ecological status and its chemical status are at least good or, for groundwater, and when both its quantitative status and chemical status are at least good.
Groundwater	All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. This zone is commonly referred to as an aquifer which is a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow a significant flow of groundwater or the abstraction of significant quantities of groundwater.
Groundwater Source Protection Zone	Groundwater sources such as wells, boreholes and springs that are used for public drinking water supply. The zones show the risk of contamination from activities that might cause groundwater pollution in the area.
Guidance Action Level	Guideline Action Levels for the disposal of dredged material are not statutory contaminant concentrations for dredged material but are used as part of a weight of evidence approach to decision-making on the disposal of dredged material to sea.
Heavily Modified Water Body (HMWB)	As a result of physical alterations by human activity, a water body which has changed substantially in character as designated by an individual Member State and in accordance with the provisions of Annex II of the Water Framework Directive.
Hydromorphological Designation	The characterisation of a water body regarding whether it is considered artificial, heavily modified or natural.
Nitrate Vulnerable Zone	Area designated as being at risk from agricultural nitrate pollution.
Priority (Hazardous) Substance	A specific list of substances under the Water Framework Directive (Priority Substances Directive) which present a

	significant risk to the aquatic environment and water used for the production of drink water.
Priority substance	A pollutant, or group of pollutants, presenting a significant risk to or via the aquatic (surface water) environment that has been identified at Community level under Article 16 of the Water Framework Directive. They include 'priority hazardous substances'.
Quantitative Status	An expression of the degree to which a body of groundwater is affected by direct and indirect abstractions. If this complies with Water Framework Directive requirements the status is good.
River Basin District	A river basin or several river basins, together with associated coastal waters. A river basin district is the main unit for management of river basins under the WFD.
River Basin Management Plan	A detailed document describing the characteristics of the basin, the environmental objectives that need to be achieved and the pollution control measures required to achieve these objectives through a specified work programme.
River Basin Management Plan (RBMP)	A detailed document describing the characteristics of the basin, the environmental objectives that need to be achieved and the pollution control measures required to achieve these objectives through a specified work programme.
Silvertown Tunnel	Proposed new twin-bore pair of road tunnels under the Thames from Silvertown to the Greenwich Peninsula in East London
Site Waste Management Plan	A document that outlines how the Scheme will reduce, manage, and dispose of its solid waste.
Specific Pollutant	A substance considered as being discharged to the aquatic environment in significant quantities at the national level and for which Environmental Quality Standards have been established. As part of the ecological classification criteria, and in places where these pollutants are monitored, these standards must be met, in order for a surface water body to be classified as good ecological status.
Transitional Waters	Bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their vicinity to coastal waters, but which are substantially influenced by freshwater flows.
Water Body	A discrete and significant element of surface water such as a river, lake or reservoir, or a distinct volume of groundwater within an aquifer.

Water Framework Directive	European Union legislation, Water Framework Directive (2000/60/EC) establishing a framework for European Community action in the field of water policy.

1. WATER FRAMEWORK DIRECTIVE (WFD) COMPLIANCE ASSESSMENT

1.1 Introduction

1.1.1 The marine works for the proposed Silvertown Tunnel Crossing Scheme, as outlined in Chapter 4 – Scheme Description (Document Reference: 6.1.4), include the construction, operation and decommissioning of a temporary jetty, along with an associated dredge and the disposal of the dredge arisings. The methods for disposal of dredge arisings will be determined as part of a Site Waste Management Plan (SWMP) and would not include disposal of material at sea (Document Reference: 6.10). In addition, while the tunnel excavation does not directly impact on the marine environment, it is necessary to consider the potential for effects on surrounding groundwaters.

1.1.2 Consideration of the Water Framework Directive (WFD) (2000/60/EC) is required for Development Consent Order (DCO) applications which have the potential to cause deterioration in the ecological and chemical status of a water body or to compromise improvements which might otherwise lead to a water body meeting its WFD objectives. Therefore, it is necessary to consider the potential for the marine works, along with the wider proposed Scheme (i.e. tunnel excavation), to impact WFD water bodies.

1.1.3 The WFD aims to protect and enhance water bodies (i.e. inland water bodies, estuaries and coastal waters out to one nautical mile from low water mark) within Europe. This is to be accomplished by implementing the measures necessary to achieve the following objectives:

- prevent deterioration of the status of waters;
- protect, enhance and restore all bodies of surface waters and ground waters;
- promote sustainable water use (through effective pricing of water services);
- progressively reduce discharges of priority substances and cease or phase discharges of priority hazardous substances for surface waters;
- ensure progressive reduction of pollution of groundwater;
- mitigate the effects of floods and droughts;

- ensure sufficient supply of water; and
- protect the marine environment.

1.1.4 A WFD compliance assessment is undertaken in four stages as outlined in the Environment Agency's 'Clearing the Waters' guidance:

1. Screening – An initial exercise to determine the necessity for a WFD compliance assessment[1]
2. Scoping – The potential for the project to cause a 'deterioration' or failure of the water body to meet its WFD objectives is reviewed (scoped). This involves consideration of each parameter reported for the water body to identify if the development could be a potential cause of failure[2]
3. Assessment – Consideration of whether the activity will compromise the achievement of measures set out in the River Basin Management Plan (RBMP) programme of measures, and/or cumulative effects. For all projects where the water body is not at good status, there is a need to consider whether it is possible for the activity to contribute to the WFD 'protect, enhance and restore' objective[3]; and
4. Identification and evaluation of measures – The selection of mitigation and improvement measures required to support WFD objectives. This includes actions to remove or reduce the effect on status to an acceptable level and/or exploiting opportunities for environmental improvements[4]

[1] Environment Agency (EA) (2012); Clearing the waters. Marine dredging and the Water Framework Directive. Stage one: the screening stage.
[2] Environment Agency (EA) (2012); Clearing the waters. Marine dredging and the Water Framework Directive. Stage two: the scoping process.
[3] Environment Agency (EA) (2012); Clearing the waters. Marine dredging and the Water Framework Directive. Stage three: assessment.
[4] Environment Agency (EA) (2012); Clearing the waters. Marine dredging and the Water Framework Directive. Stage four: identification and evaluation of measures.

1.2 Screening

1.2.1 As the proposed dredging and associated disposal activity was not previously carried out during the period 2006–2008, it is considered as a "new project" and therefore requires scoping. While it can be confirmed that scoping the potential effects will be required, this screening exercise provides a useful precursor. This section identifies the water bodies potentially affected by the proposed dredging and disposal activities and the WFD parameters which need to be considered to inform scoping.

Dredging and Temporary Jetty

1.2.2 Information is presented in Table 1-1 about the dredge site, while Table 1-2 presents information regarding the temporary jetty. As previously mentioned, disposal of dredge arisings will not be to the marine environment.

Table 1-1: Dredge site information to inform screening

Location of dredge site	See Drawing 10.1 - *Sightings Compiled as Part of the Thames Marine Mammal Sightings Survey (2004 to 2015)* (Document Reference: 6.2)
Dredge footprint	27,200m^2 (0.027 km^2)
Dredge depth	3m (plus 0.5m over dredge)
Dredge timing and duration (proposed)	2 months (timing unknown, potential to be at any point year round)
Dredge methodology	Back hoe dredger
Dredge volume	54,700m^3 (up to 60,170 m^3 with over dredge)
Above information relating to any previous dredging and disposal activities at that location	No
Sediment quality data (available from MMO or Cefas if a marine licence application has previously been made)	Yes
Protected areas in or close (within 2km) to the activity	Yes – nitrate vulnerable zone (NVZ) within 2km to the north of the dredge site. The nearest sensitive area (eutrophication), nature conservation designation, shellfish water or coastal bathing water is more than 15km from the dredge site.
Was this dredging activity carried out during the period 2006–2008?	No

Table 1-2: Temporary jetty information to inform screening

Location of jetty	See Drawing 10.1 - *Sightings Compiled as Part of the Thames Marine Mammal Sightings Survey (2004 to 2015)* (Document Reference: 6.2)
Jetty length	72m
Jetty width	14m
Scour protection	No
Number of piles	25 (Hollow tubular steel piles, 17.5 mm thick)
Piling method	Vibro and percussive
Pile diameter	1.016 m
Pile length	35m
Duration of construction	2 months (piling), 1 month (jetty superstructure)
Duration of operation	4 years
Will the jetty be decommissioned?	Yes

Water Body Information

1.2.3 Under the WFD, coastal waters, estuaries, rivers, man-made docks and canals are divided up into a series of discrete water bodies. The WFD sets ecological as well as chemical targets (objectives) for each water body. However, as other factors can affect the ability of a water body to meet its ecological targets, objectives are also set under the WFD in respect of:

- changes in 'hydromorphological' parameters such as hydrology (tidal flows) and geomorphology (bed forms); and
- changes in 'physico-chemical' parameters such as dissolved oxygen, salinity and nutrients.

1.2.4 Each surface water body has a hydromorphological designation that describes how modified a water body is from its natural state. Water bodies are either undesignated, designated as a heavily modified water body (HMWB) or designated as an artificial water body (AWB). HMWBs are defined as bodies of water which, as a result of physical alteration by human activities (such as flood protection, port/harbour use, commercial fin-fish and shellfisheries and resource extraction), are substantially changed in

character and cannot therefore meet 'good ecological status' (GES), whereas AWBs are artificially created.

1.2.5 The default target for HMWBs and AWBs under the WFD is to achieve 'good ecological potential' (GEP). This status recognises the importance of their human use whilst ensuring ecology is protected as far as possible. Good surface water chemical status should also be achieved by 2015 (original objective), 2021 or 2027. Ecological potential and status are measured on a scale of high, good, moderate, poor and bad, while chemical status is measured as either good or fail. It should be noted that groundwater water bodies are assessed against qualitative status, based on the amount of groundwater present, and chemical (groundwater) status.

1.2.6 Compliance with chemical status objectives is assessed in relation to environmental quality standards (EQSs) for a specified list of 'priority' and 'priority hazardous' substances. These priority (hazardous) substances were first established by the Priority Substances Directive (PSD) (2008/105/EC) which entered into force in early 2009. The PSD set objectives, amongst other things, for the reduction of these substances through the cessation of discharges or emissions. As required by the WFD and PSD, a proposal to revise the list of priority (hazardous) substances was submitted in 2012. Subsequently, an updated PSD (2013/39/EU) was published in 2013, identifying new priority substances, setting EQSs for those newly identified substances, revising the EQS for some existing substances in line with scientific progress and setting biota EQS for some existing and newly identified priority substances.

1.2.7 In September 2015, the updated PSD was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015 and revised directions for the implementation of the updated PSD were published.

1.2.8 RBMPs are a requirement of the WFD, setting out measures for each river basin district to improve water quality in rivers, lakes, estuaries, coasts and in groundwater. In 2009, the Environment Agency published the first cycle (2009 to 2015) of RBMPs for England and Wales, reporting the status and

objectives of each individual water body. The proposed works at Silvertown are located within the catchment of the Thames RBMP[5] .

1.2.9 As stipulated under the WFD, RBMPs must be reviewed and updated every six years. The Environment Agency recently submitted updated versions of the RBMPs for ministerial approval in preparation of the second cycle (2015 to 2021). The approved updated RBMPs are anticipated to be published in early 2016, although revised water body classifications used to inform the updates have already been made available by the Environment Agency.

Potentially Affected Water Bodies

1.2.10 Water bodies to be considered in the WFD compliance assessment have been selected on the basis of the following criteria:

- all surface water bodies that could potentially be directly impacted by the proposal (i.e. those within the direct footprint of the proposed works);
- any surface water bodies that have direct connectivity and could potentially be indirectly affected by the proposed works (within 5 km of the proposed activity); and
- any groundwater water bodies that have direct or indirect connectivity to the proposed works.

1.2.11 The proposed works are to be located wholly within the Thames Middle transitional water body and, therefore, this surface water body could be affected by the proposed works. Table 1-3 provides a summary of the Thames Middle transitional water body based on the 2015 classifications; it should be note that reasons for hydromorphological designation are from the 2009 (Cycle 1) RBMPs as the updated information is currently unavailable (although unlikely to have changed significantly).

Table 1-3: Thames Middle transitional water body summary table

Water Body Name	Thames Middle
Water Body Type	Transitional
River Basin District	Thames
Water Body ID	GB530603911402

[5] Environment Agency (2009); Thames River Basin Management Plan (RBMP): Thames River Basin District.

Water Body Size	44.21km^2
Hydromorphological Designation	HMWB
Reason For Hydromorphological Designation (2009)	Coastal Protection, Flood Protection, Navigation
Protected Area Designation	Natura 2000 (Habitats and/or Birds Directive), Nitrates Directive, Urban Waste Water Treatment Directive
Overall Status	Moderate
Ecological Status/Potential	Moderate
Chemical Status	Good
Parameters Currently Not Good	Supporting elements (Surface Water), Angiosperms (Saltmarsh), Dissolved Inorganic Nitrogen, Dissolved Oxygen, Zinc, Mitigation Measures Assessment

1.2.12 The Thames Middle transitional water body currently has an overall moderate potential, based on moderate ecological potential and good chemical status. The overall, ecological and chemical status/potential is determined by the "one-out, all-out" principle, whereby the poorest individual parameter classification defines the assessment level. Therefore, if any ecological parameter is assessed as less than good (e.g. moderate), then the ecological status/potential for that water body is reported at that level.

1.2.13 Moderate ecological potential, based on the assessment of three WFD quality elements (biological, physico-chemical and hydromorphological), is due to the parameters 'supporting elements (surface water)', 'angiosperms', 'dissolved inorganic nitrogen' and 'dissolved oxygen' being assessed as moderate, along with the specific pollutant 'zinc'. In addition, the 'mitigation measures assessment' identified measures which are not in place (disproportionately expensive), thus also contributing to moderate ecological potential.

1.2.14 Comparison of the Cycle 1 (2009) classifications with the Cycle 2 (2015) classifications for the Thames Middle transitional water body shows that, while the overall water body status has remained moderate, chemical status has improved from moderate to good. However, in terms of ecological potential, the biological quality element 'angiosperms' has also been assessed as moderate (not assessed in 2009), the biological quality element 'macroalgae' has been downgraded from high to good and the specific pollutant 'zinc' has been downgraded from high to moderate.

1.2.15 It should be noted that improvements in the biological quality elements 'invertebrates (moderate to good)', 'fish' and 'phytoplankton blooms' (both

not previously assessed) have been reported between 2009 and 2015. With regard to chemical status, 'benzo (ghi) perelyene and indeno (123-cd) pyrene', 'diuron' and 'tributyltin compounds' (TBT) were assessed as failing to achieve good in 2009, but have not been classified in 2015.

1.2.16 Numerous surface water bodies are located upstream and downstream of the Thames Middle transitional water body. These more distant surface water bodies are all more than 5 km from Silvertown and, therefore, not considered to be affected by the proposed works as there will be no physical or environmental effects. Equally, these upstream and downstream water bodies will not be benefited by the project. Therefore, upstream and downstream water bodies have been scoped out of the assessment.

1.2.17 The Greenwich Tertiaries and Chalk groundwater water body, for which the proposed scheme at Silvertown partially overlaps, could be affected by the proposed Scheme (Table 1-4). While the construction methods to excavate the material during tunnel boring are anticipated to restrict the leaching of contaminants (e.g. drill head lubricants) into the surrounding sediments, it is not possible to scope out the possibility of a significant effect on the groundwater such as the following (see Chapter 12 - Geology, Soils and Hydrogeology (Document Reference: 6.1.12)):

- disturbance of current contaminated soils, creating new contamination pathways into underlying soils and groundwater;
- migration of contaminated groundwater during dewatering activities; and
- contaminating controlled waters from removal of topsoil, transportation of waste materials and contamination associated with the construction of the Scheme and mobilisation of existing contaminated groundwater into unaffected areas.

Table 1-4: Greenwich Tertiaries and Chalk water body summary table

Water Body Name	Greenwich Tertiaries and Chalk
Water Body Type	Groundwater
River Basin District	Thames
Water Body ID	GB40602G602500
Water Body Size	81.5 km^2
Protected Area Designation	Drinking Water Protected Area
Overall Status	Poor
Quantitative Status	Poor
Chemical (Groundwater) Status	Poor

Parameters Currently Not Good	Quantitative Water Balance, Quantitative Saline Intrusion, Chemical Saline Intrusion,

1.2.18 Therefore, the water bodies potentially affected and therefore scoped in to the assessment are the Thames Middle transitional water body and the Greenwich Tertiaries and Chalk groundwater water body.

Water Quality and Protected Areas

Bathing Water Directive

1.2.19 The revised Bathing Water Directive (rBWD) (2006/7/EC) was adopted in 2006, updating the microbiological and physico-chemical standards set by the original Bathing Waters Directive (BWD) (76/160/EEC) and the process used to measure/monitor water quality at identified bathing waters. The rBWD focuses on fewer microbiological indicators, whilst setting higher standards, compared to those of the BWD. Bathing waters under the rBWD are classified as excellent, good, sufficient or poor according to the levels of certain types of bacteria (intestinal enterococci and *Escherichia coli*) in samples obtained during the bathing season (May to September).

1.2.20 The BWD was repealed at the end of 2014 and monitoring of bathing water quality has been reported against rBWD indicators since 2015. The new classification system considers all samples obtained during the previous four years and, therefore, data has been collected for rBWD indicators since 2012. The UK Government's target under the rBWD is to achieve 'sufficient' for all bathing waters by 2015, as described under the Bathing Water Regulations 2013 which transposes the rBWD into UK law.

1.2.21 There are no coastal bathing waters situated within 2km of the proposed works, with Leigh Bell Wharf (assessed as good in 2015) being the closest at approximately 45km to the east.

Shellfish Waters Directive

1.2.22 The Shellfish Waters Directive was originally adopted on 30 October 1979 (79/923/EEC) and replaced on 12 December 2006 (2006/113/EC). It was developed in order to protect designated shellfish waters, thereby maintaining the high water quality necessary for producing edible shellfish (bivalve and gastropod molluscs, including oysters, mussels, cockles and clams). It set physical, chemical and microbiological water quality requirements that designated shellfish waters must either comply with

('mandatory' standards) or endeavour to meet ('guideline' standards), including:

- Dissolved oxygen – Measured as percentage saturation, should exceed 70% (as a mean), and individual measurements may not be less than 60% unless there are no harmful consequences on the development of shellfish colonies; and
- Suspended solids – A discharge affecting shellfish waters must not cause the suspended solid content of the water to exceed by more than 30% the content of waters not so affected.

1.2.23 The Shellfish Waters Directive was subsumed (repealed) by the WFD at the end of 2013, which must provide an equivalent level of protection for shellfish waters.

1.2.24 There are no shellfish waters situated within 2 km of the proposed works, with Southend shellfish water being the closest at approximately 40 km to the east.

Urban Wastewater Treatment Directive

1.2.25 The Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC) aims to protect the environment from the adverse effects of the collection, treatment and discharge of urban waste water. It sets treatment levels on the basis of sizes of sewage discharges and the sensitivity of waters receiving the discharges. In general, the UWWTD requires that collected waste water is treated to at least secondary treatment standards for significant discharges. Secondary treatment is a biological treatment process where bacteria are used to break down the biodegradable matter (already much reduced by primary treatment) in waste water.

1.2.26 Under the UWWTD, the UK is required to review environmental waters at four-yearly intervals to determine whether they are sensitive to the effects of sewage discharges. Sensitive areas under the UWWTD are water bodies affected by eutrophication due to elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

1.2.27 There are no designations under the UWWTD located within 2km of the proposed works; the closest sensitive area (eutrophication) is the River Wandle which is approximately 15 km to the west (upstream) of the dredge site.

Nitrates Directive

1.2.28 The Nitrates Directive (91/676/EEC) aims to reduce water pollution from agricultural sources and to prevent such pollution occurring in the future (nitrogen is one of the nutrients that can affect plant growth). Surface waters have to be identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water body.

1.2.29 The Thames Middle transitional water body is designated under the Nitrates Directive and coastal areas <2km to the north of the proposed works are designated as Nitrate Vulnerable Zones (NVZs).

Natura 2000 Protected Areas

1.2.30 Article 3 of the Habitats Directive (92/43/EEC, as amended) requires the establishment of a European network of important high-quality conservation sites known as Special Areas of Conservation (SACs) that will contribute to conserving habitats and species identified in Annexes I and II of the Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). In accordance with Article 4 of the EC Birds Directive (2009/147/EC), Special Protection Areas (SPAs) are strictly protected sites classified for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory species. Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

1.2.31 There are no international nature conservation protected areas located within 2 km of the proposed works; the Essex Estuaries SAC, Thames Estuary and Marshes SPA and Thames Estuary and Marshes Ramsar are located approximately 30km (or more) to the east of the site.

Groundwater Protection Zones

1.2.32 Groundwater Source Protection Zones are designated by the Environment Agency to protect groundwaters around registered abstraction points from contamination. The Silvertown Tunnel Crossing Scheme is not located within a Groundwater Source Protection Zone; however, the area is situated within a Groundwater Vulnerable Zone (minor aquifer high). The site overlays ‘Secondary (undifferentiated)’ superficial deposits and ‘Secondary A’ bedrock, suggesting minor and non-aquifer characteristics in rock type.

Sediment Quality

1.2.33 Unlike water quality, there are no formal quantitative environmental quality standards (EQS) for sediments. Therefore, in the absence of any quantified UK standards, common practice for characterising baseline sediment quality conditions is to compare against the Centre for Environment, Fisheries and Aquaculture Science (Cefas) Guideline Action Levels for the disposal of dredged material (Table 1-5).

Table 1-5: Cefas Action Levels

Contaminant	Cefas Action Levels (mg/kg dry weight)	
	AL1	AL2
Arsenic	20	100
Cadmium	0.4	5
Chromium	40	400
Copper	40	400
Lead	50	500
Mercury	0.3	3
Nickel	20	200
Zinc	130	800
Organotins (Tributyltin, Dibutyltin, Monobutyltin)	0.1	1
Polychlorinated biphenyls (sum of ICES 7)	0.01	-
Polychlorinated biphenyls (sum of 25 congeners)	0.02	0.2

1.2.34 Cefas Guideline Action Levels are used as part of a 'weight of evidence' approach to assessing material suitability for disposal at sea. Cefas guidance indicates that, in general, contaminant levels below Action Level 1 (AL1) are of no concern and are unlikely to influence the licensing decision. However, material with contaminant levels above Action Level 2 (AL2) is generally considered unsuitable for disposal at sea. Dredged material with contaminant levels between AL1 and AL2 requires further consideration and testing before a decision can be made. However, the action levels should not be viewed as pass/fail thresholds and it should be acknowledged that these guidelines are not statutory requirements.

1.2.35 Sediment samples were collected in the vicinity of the proposed temporary jetty and dredge area. Five near surface sediment samples were collected from the intertidal area adjacent to the site in December 2015, while seven subtidal vibracore samples from depths of between 0.5 m and 1.9 m were collected in January 2016 from within the proposed dredge area (Table 1-6).

Sediments collected from the intertidal zone comprised coarser material compared to the subtidal dredge site (e.g. >70% silt/clay material). In general, contaminant concentrations were higher in subtidal sediments, potentially due to the increased proportion of fine material. Contaminant concentrations were typically below AL1 or between AL1 and AL2, with one exceedance of AL2 for cadmium (9.0 mg/kg), lead (549 mg/kg), mercury (7.4 mg/kg) and the sum of 25 polychlorinated biphenyl (PCB) congeners (0.344 mg/kg). These exceedances were approximately two times greater than AL2 for cadmium, mercury and the sum of 25 PCB congeners.

Table 1-6: Summary of Sediment Quality

Contaminant	**Sediment Quality (mg/kg dry weight)**					
	Intertidal (n = 5)			**Subtidal (n = 7)**		
	Min	**Max**	**Mean**	**Min**	**Max**	**Mean**
Arsenic	9.6	23	15	4.1	28	13
Cadmium	0.3	0.7	0.5	0.1	9.0	1.6
Chromium	17	89	46	40	184	79
Copper	31	106	71	30	203	61
Lead	65	549	238	12	248	51
Mercury	0.4	2.0	1.1	0.05	7.4	2.5
Nickel	14	41	24	31	73	53
Zinc	104	309	209	85	679	181
Dibutyltin (BDT)	<0.001	0.034	0.018	<0.001	0.145	0.145*
Tributyltin (TBT)	0.012	0.101	0.034	<0.001	0.705	0.705*
Polychlorinated biphenyls (sum of ICES 7)	0.005	0.028	0.016	<0.01	0.144	0.144*
Polychlorinated biphenyls (sum of 25 congeners)	0.009	0.058	0.033	<0.02	0.344	0.344*
Key						
Below Action Level 1						
Between Cefas Action Level 1 and Action Level 2						
Above Action Level 2						

* Based on one sample only.

1.3 Scoping

1.3.1 A scoping table, based on Environment Agency's 'Clearing the Waters' guidance, is presented below for the Thames Middle transitional water body (Table 1-7).

1.3.2 Step 1 for each parameter uses a series of 'triggers' to determine whether the dredging activity (and new temporary jetty) will have a significant non-temporary effect at the water body level. The potential for chemical contamination (re-distribution) is considered based on sediment samples from the dredge site which are compared to Cefas Action Levels[6].

1.3.3 Step 2 presents current water body classifications and objectives from the latest RBMP update (December 2015) where available. Cells highlighted in green are scoped in to the assessment and cells highlighted in red are scoped out.

[6] http://www.cefas.defra.gov.uk/media/562541/cefas%20action%20levels.pdf (Accessed February 2016).

Table 1-7: Scoping the potential on the Thames Middle transitional water body

Step	1	2		
	Identify Issues	Record Current Status and Objectives		
	Note all potentially affected quality elements	Record 2015 status of quality element	Record 2021 objective	Record 2027 objective
	1	2a	2b	2c
WFD Parameter (Quality elements, specific pollutant priority substance, Protected Area)	**Referring to trigger tables, note quality elements where potential causal link exists**	**High/Good/Moderate/Poor/Bad for Ecological Elements or High/Fail for Chemical Elements or Protects Area status or Not Assessed**		
Biological elements				
Phytoplankton	Screened out as the Environment Agency's 'Clearing the Waters' guidance suggests there is "no obvious mechanism by which dredging or disposal activities could affect phytoplankton at water body level".			
Other aquatic flora (e.g. saltmarsh and seaweed)	Scoped in to the assessment as the dredge site is located within 10m of MLWS (no direct removal of intertidal area). The proportion of water body impacted by dredging activity does not exceed 5% (<0.1%). A high level risk assessment score of 2 based on dispersive dredging methodology and timing (March to October). Scores of 1.5 or more are scoped in. Current status and objectives not available for these parameters.	Angiosperms (saltmarsh) – Moderate; Macroalgae (opportunistic macroalgae/fucoid extent) – High/Good	Angiosperms – Moderate; Macroalgae – Good	Angiosperms – Moderate; Macroalgae – Good
Benthic invertebrate fauna		Invertebrates (Infaunal Quality Index) – Good	Invertebrates – Good	Invertebrates – Good
Fish fauna (transitional water bodies only)		Fish – Good	Fish – Good	Fish – Good
Hydromorphological elements supporting biological elements				
Morphological conditions				
Depth variation	Scoped out as proportion of water body impacted by dredging activity does not exceed 5% (<0.1%).			
Bed				
Intertidal zone structure	Scoped in to the assessment as the dredge site is located within 10m of MLWS (no direct removal of intertidal area). Current status and objectives not available for this parameter. Current status and objectives not available for this parameter.			
Tidal regime				

Step	1	2		
	Identify Issues	Record Current Status and Objectives		
	Note all potentially affected quality elements	Record 2015 status of quality element	Record 2021 objective	Record 2027 objective
	1	2a	2b	2c
WFD Parameter (Quality elements, specific pollutant priority substance, Protected Area)	**Referring to trigger tables, note quality elements where potential causal link exists**	**High/Good/Moderate/Poor/Bad for Ecological Elements or High/Fail for Chemical Elements or Protects Area status or Not Assessed**		
Dominant currents (coastal water bodies only)	Scoped out as transitional water body.			
Freshwater flow (transitional water bodies only)	Screened out as the Environment Agency's 'Clearing the Waters' guidance suggests there is "no obvious mechanism by which dredging or disposal activities could affect freshwater flow at water body level".			
Wave exposure	Scoped in to the assessment as the dredging activity represents a new project (capital dredge) in a relatively shallow water body. Current status and objectives not available for this parameter.			
Chemical and physico-chemical elements supporting biological elements				
Transparency	Scoped in to the assessment as high level risk assessment score of 2 based on dispersive dredging methodology and timing (March to October). Scores of 1.5 or more are scoped in. Current status and objectives not available for this parameter.			
Thermal conditions	Screened out as the Environment Agency's 'Clearing the Waters' guidance suggests there is "no obvious mechanism by which dredging and disposal activities could affect thermal conditions".			
Oxygenation conditions	High level risk assessment score of 2 based on dispersive dredging methodology and timing (March to October). Scores of 4 or more are scoped in. However, water body currently at moderate status for dissolved oxygen and therefore has been scoped in on a precautionary basis.	Dissolved Oxygen – Moderate	Dissolved Oxygen – Moderate	Dissolved Oxygen – Good
Salinity	Screened out as the Environment Agency's 'Clearing the Waters' guidance suggests "salinity is not usually an issue for dredging activities and this element does not require assessment with the exception of certain tidal rivers where there may be issues relating to the migration of the salt water wedge".			

Step	1	2		
	Identify Issues	Record Current Status and Objectives		
	Note all potentially affected quality elements	Record 2015 status of quality element	Record 2021 objective	Record 2027 objective
	1	2a	2b	2c
WFD Parameter (Quality elements, specific pollutant priority substance, Protected Area)	**Referring to trigger tables, note quality elements where potential causal link exists**	**High/Good/Moderate/Poor/Bad for Ecological Elements or High/Fail for Chemical Elements or Protects Area status or Not Assessed**		
Nutrient conditions (e.g. nitrogen)	Scoped in to the assessment as the dredging activity represents a new project.	Dissolved Inorganic Nitrogen - Moderate	Dissolved Inorganic Nitrogen - Moderate	Dissolved Inorganic Nitrogen - Moderate
Specific Pollutants				
Arsenic	Screened in to the assessment as concentrations present in sediments are above Cefas Action Level 1.	High	High	High
Chromium		Not Assessed	Not Assessed	Not Assessed
Copper		High	High	High
Zinc		Moderate	Moderate	High
Polychlorinated biphenyls (PCBs)		Not Assessed	Not Assessed	Not Assessed
Selected Priority Substances				
Anthracene	Screened in to the assessment as concentrations present in sediments are above Cefas Action Level 1.	Not Assessed	Not Assessed	Not Assessed
Hexachlorobenzene, Hexachlorobutadiene and Hexachlorocyclohexane		Hexachlorocyclo-hexane – Good	Hexachlorocyclo-hexane – Good	Hexachlorocyclo-hexane – Good
Penta bromodiphenyl ethers		Not Assessed	Not Assessed	Not Assessed
Cadmium and its compounds		Good	Good	Good
Fluoranthene		Not Assessed	Not Assessed	Not Assessed
Lead and its compounds		Good	Good	Good
Mercury and its compounds		Good	Good	Good
Napthalene		Good	Good	Good
Nickel and its compounds		Good	Good	Good

Step	1	2		
	Identify Issues	Record Current Status and Objectives		
	Note all potentially affected quality elements	Record 2015 status of quality element	Record 2021 objective	Record 2027 objective
	1	2a	2b	2c
WFD Parameter (Quality elements, specific pollutant priority substance, Protected Area)	**Referring to trigger tables, note quality elements where potential causal link exists**	**High/Good/Moderate/Poor/Bad for Ecological Elements or High/Fail for Chemical Elements or Protects Area status or Not Assessed**		
Polyaromatics hydrocarbons (PAHs) (Benzo(a)pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; and Indeno(1,2,3-cd)pyrene)		Not Assessed	Not Assessed	Not Assessed
Tributyltin compounds		Not Assessed	Not Assessed	Not Assessed
Protected Areas				
Areas designated for the protection of economically significant aquatic species (shellfish waters)	Scoped out as there are no designated shellfish waters located within 2 km of the dredge site.			
Bodies of water designated as recreational waters (bathing water)	Scoped out as there are no designated bathing waters located within 2 km of the dredge site.			
Nutrient-sensitive areas including Nitrate Vulnerable Zone, polluted Waters and Sensitive Areas	Scoped in to the assessment as the dredge site is located within 2 km of a designated nitrate vulnerable zone (NVZ) and the water body is designated under the Nitrates Directive.			
Areas designated for the protection of habitats or species where maintenance or improvement of the status of water is an important factor in their protection, including Natura 2000 sites (Special Areas of Conservation and Special protection Areas)	Scoped out as there are no international nature conservation designated sites located within 2 km of the dredge site.			

1.3.4 The Environment Agency's 'Clearing the Waters' guidance was developed to provide a structure for assessing the potential effects of dredging (and disposal) activities in the marine environment (e.g. coastal and transitional water bodies). However, there is currently no equivalent process to follow for assessing potential effects to groundwater water bodies for dredging or other activities. While the dredging activity and temporary jetty is not anticipated to result in significant effects to the surrounding groundwater, it is not possible to scope out the potential for significant impacts from the excavation of material during the construction of the tunnel. Therefore, further consideration of the Greenwich Tertiaries and Chalk groundwater water body is required.

1.4 Compliance Assessment

Thames Middle Transitional Water Body

1.4.1 Based upon the ecological, chemical and protected area information presented during screening and scoping, and consideration as to whether dredging may be a potential cause for a WFD failure using the trigger tables, the following WFD parameters have been identified as requiring further assessment for the Thames Middle transitional water body:

- Biological element (other aquatic flora);
- Biological element (benthic invertebrate fauna);
- Biological element (fish fauna);
- Hydromorphological (intertidal zone structure);
- Hydromorphological (wave exposure);
- Physico-chemical (transparency);
- Physico-chemical (oxygenation conditions);
- Physico-chemical (nutrient conditions);
- Specific pollutants;
- Selected priority substances; and
- Protected Areas (nutrient-sensitive areas).

1.4.2 The following sections assess each of these WFD parameters in order to determine whether the proposed dredging might cause deterioration in the status of the Thames Middle transitional water body (defined as a non-temporary effect on status at water body level), or an effect that prevents the water body from meeting its WFD objectives.

Biological Elements

1.4.3 Based on 2015 water body classifications, the biological quality elements 'angiosperms' (e.g. saltmarsh, seagrass) and 'macroalgae' have been assessed as moderate and good, respectively. There is no saltmarsh or macroalgae habitat in the vicinity of the dredge site or location of the temporary jetty. Instead, small areas of adjacent intertidal habitat are composed primarily by coarse sand and silt/mudflat and the surface subtidal sediments within the vicinity of the scheme consist predominantly of cobbles and gravels (Chapter 10 – Marine Ecology (Document Reference: 6.1.10)).

1.4.4 The biological quality element 'invertebrates' has been assessed as good in the 2015 classification for the Thames Middle transitional water body. Site specific data suggest that the benthic community within the study area is highly impoverished, supports low faunal abundances and is considered to be of limited ecological importance (Chapter 10 – Marine Ecology (Document Reference: 6.1.10)).

1.4.5 The 2015 classification of 'fish' for the Thames Middle transitional water body was good. A range of fish species are common in the area, including a number of commercially important and environmentally protected species (e.g. European smelt, River lamprey, Atlantic salmon). Potential impacts to fish include noise/light disturbance (e.g. piling, dredging, jetty operation) and water quality (e.g. elevated suspended sediments, release of contaminants, dissolved oxygen). However, the relevant impact assessments have been considered these pathways as minor adverse at worst (Chapter 10 – Marine Ecology (Document Reference: 6.1.10)).

1.4.6 Taking these points into consideration, it is concluded that the proposed works will not lead to a deterioration of the assessed biological elements within the Thames Middle transitional water body, nor prevent the water body from meeting its WFD objectives.

Hydromorphological

1.4.7 The triggers used to determine the potential for hydromorphological elements to be affected by an activity are primarily based on the triggers applicable to the biological elements. The dredging activity and construction, operation and decommissioning of a temporary jetty as part of the Silvertown Tunnel Crossing Scheme will not lead to a deterioration of the assessed biological elements (see above); therefore, it is also assumed that the supporting hydromorphological elements will not be deteriorated.

1.4.8 The proposed location of the dredge site and new temporary jetty are not within the intertidal zone and, therefore, the intertidal zone structure will not be directly impacted (e.g. habitat disturbance or loss). Minor changes to current velocities and increases in suspended sediments may arise as a result of dredging and the installation of the new temporary jetty (piling) (Appendix 16.B (Document Reference: 6.3.16.2)), thus potentially contributing to deposition in the adjacent intertidal area, but these impacts would be short-term and minimal given baseline conditions. Changes to the wave climate in the Thames Middle transitional water body are considered highly unlikely given the inshore location of the proposed works.

1.4.9 In conclusion, the proposed works at Silvertown are not expected to lead to a deterioration of the assessed hydromorphological elements within the Thames Middle transitional water body, nor prevent the water body from meeting its WFD objectives.

Physio-chemical

1.4.10 Hydrodynamic modelling has shown that the inclusion of the new temporary jetty structure will reduce current velocities around the jetty head due to the increased drag forces generated by the series of piles aligned with the direction of flow. In addition, sediment plume modelling indicates there will be negligible incremental impact due to the proposed dredging work as the current speed in the river is high (on the order of 1-1.5 m/s) and the proposed dredging rate is too low to have any significant increase in suspended sediment concentration or sedimentation (Appendix 16.B (Document Reference: 6.3.16.2)).

1.4.11 During dredging and piling activities, sediment disturbed into the water column can be dispersed in two different plume phases: dynamic and passive. The dynamic phase relates to the initial rapid descent of sediment

to the bed. In contrast, the passive phase is controlled by advection and the ambient hydrodynamic conditions (e.g. tidal flows), therefore allowing a less concentrated plume to extend further afield. The type of sediment also influences the extent of plumes. The sediment characteristics of the seabed at the proposed works site typically comprise coarse sands, with a low proportion of fine sediments.

1.4.12 Whilst increases in suspended sediment concentration can affect light penetration (transparency), any disturbance of sediment into the water column will typically be negligible when considered against background levels, the dispersive environment of the Thames and the low percentage of fine-grained size sediments. Therefore, variations due to the dredging and piling activities are likely to be indistinguishable from natural variability and any impact will be temporary, not leading to deterioration in the WFD parameter.

1.4.13 The physico-chemical quality element 'dissolved oxygen' has been assessed as moderate in the 2015 classification for the Thames Middle transitional water body. Increases in suspended sediment associated with dredging and piling activities could increase the ambient oxygen demand; however, given the increases in suspended sediments will be negligible compared to background levels, it is unlikely that dissolved oxygen concentrations will be significantly impacted, particularly given the short-term, temporary nature of the proposed works.

1.4.14 The Thames Middle transitional water body is failing its WFD objectives for 'dissolved inorganic nitrogen' in the 2015 classification, with a status of moderate. The Environment Agency acknowledged that it was disproportionately expensive to implement further measures to achieve good status at this time, and the objective for 2027 remains moderate. However, it should be noted that, according to the Environment Agency's 'Clearing the Waters' guidance, dredging activity does not generally affect nutrient behaviour. Therefore, it is considered that the proposed dredge will not lead to a deterioration of this WFD parameter, nor prevent the water body from meeting its WFD objectives with respect to dissolved inorganic nitrogen. Similarly, it is unlikely that piling during construction of the jetty will result in significantly adverse impacts to nutrient conditions at a water body level.

1.4.15 Overall, it is concluded that the proposed works at Silvertown will not lead to a deterioration of the assessed physico-chemical quality elements within the

Thames Middle transitional water body, nor prevent the water body from meeting its WFD objectives.

Contaminants

1.4.16 The specific pollutants 'arsenic' and 'copper' have been assessed as high in the 2015 classifications for the Thames Middle transitional water body, while 'zinc' has been assessed as moderate, contributing to the overall moderate ecological potential of the water body. In terms of chemical status, the Thames Middle transitional water body has been assessed as good in 2015, including consideration of priority (hazardous) substances such as cadmium, mercury, lead and nickel.

1.4.17 Dredging activity and the installation/removal of piles for the temporary jetty have the potential to disturb contaminated sediments. In the absence of formal EQS values for sediments, Table 1-6 presents a summary of sediment quality in the vicinity of the works compared to Cefas Guideline Action Levels. While the majority of sediment samples were below AL1 or between AL1 and AL2, one exceedance of AL2 was observed for cadmium, lead, mercury and the sum of 25 PCB congeners. However, it should be noted that the Cefas Action Levels were derived to consider the disposal of dredged material in the marine environment as opposed to the permanent extraction of material (i.e. any contaminants present are not introduced/re-distributed), thus providing a precautionary approach to acceptable concentrations for this project.

1.4.18 It is possible to estimate in-water pollutant concentrations as a result of the proposed works at Silvertown based on a number of basic assumptions. The maximum incremental suspended sediment concentration (SSC) in the dredge area for mean neap and mean river flow conditions (worst case scenario – lowest flow) is 8.01 mg/l (Appendix 16.B (Document Reference: 6.3.16.2)). Therefore, using the maximum concentration of pollutants in sediments (Table 1-6), it is possible to estimate the maximum concentration in suspension and compare these concentrations to relevant EQS values[7],

[7] As described under the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

as shown in Table 1-8. Although both freshwater and saltwater EQSs[8] are presented, the European Commission (EC) Technical Guidance for Deriving EQSs indicates that the freshwater EQS is most appropriate in considering transitional waters.

1.4.19 Due to the temporary nature of the proposed works at Silvertown, short term EQS values (referred to as the maximum allowable concentration (MAC)) are reported were possible. However, in cases where this information is not available, the annual average (AA) EQS is presented. With the exception of chromium and copper, the maximum total concentrations of all metal pollutants in suspension were below the freshwater and saltwater (marine) EQS (Table 1-8). It worth noting that these two exceedances are related to AA EQS values which represent a long term mean concentration, as opposed to a more realistic short term disturbance event as proposed at Silvertown. Therefore, comparison with the AA EQS is relatively conservative.

1.4.20 To determine the maximum dissolved fraction of metals released into the water column, it is necessary to consider the relative potential for each contaminant to change from one phase to another (i.e. adsorbed to sediment surfaces to dissolved in the water), referred to as the partition coefficient (Table 1-8). Due to the variability in environmental conditions, a wide range of partition coefficients are reported in the literature. The partition coefficient values used here have been taken from the US Environment Protection Agency (USEPA) document[9] and relate to suspended sediment load and the water in streams, rivers and lakes, specifically using the lower end of the range to provide a conservative approach. As shown in Table 1-8, the maximum possible dissolved phase concentrations for each metal are several orders of magnitude below the relevant EQS, suggesting that the potential for the works at Silvertown to impact water quality from metals in sediments is minimal.

[8] European Commission (EC) (2011). Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 27. Technical Guidance for Deriving Environmental Quality Standards. Technical Report 2011-055.
[9] Allison, J.D. and Allison, T.L. (2005). Partition Coefficients for Metals in Surface Water, Soil, and Waste. United States Environment Protection Agency (USEPA). EPA/600/R-05/074, July 2005.

Table 1-8: Potential concentration of metal pollutants in the Thames Middle transitional water body

Contaminant	Maximum Total Sediment Concentration (mg/kg)	Maximum Suspended Concentration (µg/l)	Partition Coefficient		Maximum Dissolved Concentration (µg/l)	UK EQS (µg/l)	
			Log l/kg	l/kg		Freshwater	Saline
Arsenic	28	0.22	2.0	100	2.24×10^{-3}	50 (AA)	25 (AA)
Cadmium	9	0.07	2.8	631	1.14×10^{-4}	1.5 (MAC)	0.2 (AA)
Chromium	184	1.47	3.9	7,943	1.86×10^{-4}	3.4 (AA)	0.6 (AA)
Copper	203	1.63	3.1	1,259	1.29×10^{-3}	1.0 (AA)	3.76 (AA)
Lead	549	4.40	3.4	2,512	1.75×10^{-3}	14 (MAC)	14 (MAC)
Mercury	7.4	0.06	4.2	15,849	3.74×10^{-6}	0.07 (MAC)	0.07 (MAC)
Nickel	73	0.59	3.5	3,162	1.85×10^{-4}	34 (MAC)	34 (MAC)

Contaminant	Maximum Total Sediment Concentration (mg/kg)	Maximum Suspended Concentration (µg/l)	Partition Coefficient		Maximum Dissolved Concentration (µg/l)	UK EQS (µg/l)	
			Log l/kg	l/kg		Freshwater	Saline
Zinc	679	5.44	3.5	3,162	1.72×10^{-3}	12.9 (AA)	8.8 (AA)

The EQS for cadmium is based on the hardness of water. The water in the Thames is assumed to be Class 5 (>200 mg $CaCO_3$/l; see http://www.dwi.gov.uk/consumers/advice-leaflets/hardness_map.pdf).

The EQS for zinc is based on a baseline value (10.9 µg/l – freshwater; 6.8 µg/l – saltwater) plus background levels. The background concentration of zinc in the Thames is assumed to be 2.0 µg/l.

Maximum suspended concentrations have been based on the maximum incremental suspended sediment concentration in the dredge area (model output) of 8.01 mg/l.

Concentrations which exceed at least one EQS are presented in bold.

EQS – Environmental Quality Standard; AA – Annual Average; MAC – Maximum Allowable Concentration.

1.4.21 In conclusion, the proposed works at Silvertown are not expected to lead to a deterioration of the assessed contaminants (i.e. specific pollutants, priority substances or priority hazardous substances) within the Thames Middle transitional water body, nor prevent the water body from meeting its WFD objectives.

Protected Areas

1.4.22 The Thames Middle transitional water body is designated under the Nitrates Directive and coastal areas <2 km to the north of the proposed works are designated as Nitrate Vulnerable Zones (NVZs). The construction works will not introduce significant concentrations of nutrients (e.g. nitrates) into the water body and, thus, will not influence the surrounding NVZ or contribute to eutrophic conditions. In addition, while localised disturbance of sediments is anticipated due to dredging and piling activities, the proposed works will not result in the redistribution of nutrients at the water body level.

1.4.23 The proposed works at Silvertown are not expected to lead to a deterioration of the assessed protected area designations within the Thames Middle transitional water body, nor prevent the water body from meeting its WFD objectives.

Greenwich Tertiaries and Chalk Groundwater Water Body.

1.4.24 The 2015 classification indicates that the Greenwich Tertiaries and Chalk groundwater water body is currently failing to achieve good status due to the quantitative parameters ‘quantitative water balance’ and ‘quantitative saline intrusion, as well as the chemical (groundwater) status parameter ‘chemical saline intrusion’.

1.4.25 The potential effects of dewatering activities are, at this stage, not fully quantified and further assessment may be required following detailed design. A groundwater monitoring programme will be initiated ahead of construction to enable collection of shallow river terrace deposit (RTD) and lower aquifer baseline data (including that from the Lambeth, Thanet, Upnor and Chalk aquifer). The data obtained would then be used to quantify any potential impacts produced by the Scheme. Assuming mitigation is put in place where required, there is not predicted to be any residual impacts associated with the works on quantitative elements of the groundwater.

1.4.26 There is the potential risk of accidental spillages associated with the construction works, as well as accidents relating to construction materials. If leached into groundwater this could have detrimental effects. As the

proposed works are not located within a Groundwater Source Protection Zone, the sensitivity of the surrounding groundwaters are considered to be low; furthermore, embedded mitigation measures secured through the Code of Construction Practice (Document Reference: 6.10) such as the use of impermeable surfaces, bunding of fuel stores and following best practice handling of materials would render a negligible magnitude of impact.

1.4.27 Embedded mitigation measures ensure that no deterioration in status will occur in the Greenwich Tertiaries and Chalk groundwater water body and, therefore, impacts affecting future status objectives are not anticipated.

1.5 Identification and Evaluation of Measures

1.5.1 In addition to determining whether or not there will be an effect on status at water body level, it is also necessary to consider whether it is possible for a development (in this case dredging, the construction, operation and decommissioning of a jetty and tunnel excavation) to be carried-out in such a way as to contribute to improving the status of failing WFD parameters in a cost effective and not disproportionately costly manner. This requires consideration of the failing parameters and whether the proposed works might contribute to realising the wider WFD water body objectives.

1.5.2 With regard to the currently failing WFD parameters in the Thames Middle transitional water body (e.g. angiosperms, dissolved inorganic nitrogen, dissolved oxygen and zinc) and Greenwich Tertiaries and Chalk groundwater water body, it is considered there are no opportunities for improvement within the project, based on the scale and nature of the proposed works at Silvertown. It is also worth noting that the jetty is planned as a temporary structure and will be removed within four years of construction (linked to ‘remove obsolete structure’ mitigation measure).

1.6 Conclusion

1.6.1 Based upon the information presented within this WFD compliance assessment, and considering the impact assessment outcomes in the main report, it is concluded that the proposed works as part of the Silvertown Tunnel Crossing Scheme are not likely to have a permanent (i.e. non-temporary) effect on the status of WFD parameters that are significant at water body level. The proposed works are therefore not predicted to cause either deterioration to the current status of the Thames Middle transitional water body or Greenwich Tertiaries and Chalk Groundwater water body, nor prevent these water bodies from achieving future WFD status objectives.