22 Summary of Potential Impacts

22.1 Introduction

Tables 22.1 to 22.14 summarise the potential impacts of the proposed scheme, as identified and assessed in this ES. A mitigation item number is assigned as appropriate (Chapter 23 provides a summary of each Mitigation Item).

Table 22.1: Potential Land Use Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Residential and Commercial Land	
Catering Van (mobile snack bar) loss of commercial land.	n/a
Deep Sea World overspill car park loss of commercial land.	n/a
Kapital Corporation, Admiralty House (St. Margaret's Lodge) loss of commercial land and disruption to access during operation.	n/a
Queensferry Hotel loss of commercial land.	n/a
Scottish Water - Dunfermline WWTW loss of commercial land and change to access during operation.	n/a
Stagecoach (Ferrytoll Park and Ride) loss of commercial land and change to access during operation.	n/a
Inchgarvie House (includes 10 flats) loss of residential land and potential alteration or loss of access during operation.	n/a
Inchgarvie Lodge temporary loss of residential and commercial land to allow access during construction.	n/a
Dundas Castle loss of commercial land.	n/a
Ove Arup and Partners Scotland Ltd loss of commercial land and change to access during operation.	n/a
Scottish Museum – Port Edgar Barracks temporary loss of commercial land to allow access during construction.	n/a
Scottish Water South Queensferry WWTW loss of commercial land and change to access during operation.	n/a
Community Land	
St. Margaret's Marsh SSSI loss of land.	n/a
Hope Street Cemetery, Inverkeithing loss of land.	n/a
Local recreational greenspace - fields west of South Queensferry loss of land.	P4
Open Space - fields west of South Queensferry and east of the proposed scheme loss of land.	P4
Open Space - Kirkliston Leisure Centre loss of land.	n/a
Open Space - to south west of Kirkliston loss of land.	n/a
Open Space – to east of Standingstane Road loss of land.	n/a
Development Land	
HSG2 - Springfield Rd, South Queensferry, housing development for 150 houses: direct land-take and changes in amenity.	N1-N4
ENV6 - Springfield Rd, South Queensferry, site for environmental improvement associated with HSG2: direct land-take and changes in amenity.	N1-N4
HSP1 - Kirkliston North, strategic housing allocation, with estimated capacity of 610 units: direct land-take only, no adverse changes in amenity.	n/a
HSP2 - Main Street West Kirkliston, strategic housing allocation, with estimated capacity of 90 Units: direct land-take only, no adverse changes in amenity.	n/a
ECON2 - Ferry Muir South Queensferry, allocation for business development: direct land-take only, no adverse changes in amenity.	n/a

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
ECON7 - Newbridge North, allocation for business development: direct land-take only, no adverse changes in amenity.	n/a
CDA8 - Winchburgh core development area, mixed use development: direct land-take only, no adverse changes in amenity.	n/a
HSG7 - Society Road South Queensferry, housing land allocation: no permanent land-take although changes in amenity.	n/a
HSG 6/ECON 10 - Port Edgar, allocation for a mixed use development: no permanent land-take although changes in amenity.	n/a
Planning Applications	
06/05149/OUT - Queensferry Road Kirkliston, mixed use development: direct land-take, no adverse changes in amenity.	n/a
08/00529/REM - 2A Kirkliston Road Newbridge, proposed hotel development: direct land-take, no adverse changes in amenity.	n/a
08/00031/FUL - Queensferry Road, Kirkliston, residential development: direct land-take, no adverse changes in amenity.	n/a
8/02002/REM - 2A Kirkliston Road, Newbridge, proposed road layout: direct land-take, no adverse changes in amenity.	n/a
07/04961/REM - 2A Kirkliston Road, Newbridge, proposed office development: direct land-take, no adverse changes in amenity.	n/a
07/04254/FUL - Queensferry Road, Kirkliston, infrastructure works for future development: direct land-take, no adverse changes in amenity.	n/a
08/00435/REM - 2A Kirkliston Road Newbridge, hotel and restaurant/public house: direct land-take, no adverse changes in amenity.	n/a
07/04960/REM - Kirkliston Road, Newbridge, proposed office development: direct land-take, no adverse changes in amenity.	n/a
07/01358/REM - 9 Edinburgh Road, Newbridge, proposed road layout for Phase 1 of site: direct land-take, no adverse changes in amenity.	n/a
1012/P/05 - land around Winchburgh, outline planning for mixed used development: direct land-take, no adverse changes in amenity.	n/a
09/00490/OUT - Ferrymuir South Queensferry, proposed mixed use development: direct land-take, no adverse changes in amenity.	n/a
HSG2/ ENV6 - Springfield Road, South Queensferry, detailed consent for residential development: direct land-take and changes in amenity.	N1-N4
Agricultural, Sporting and Forestry Interests	
Castlandhill Farm and Broomhall Estate, Land Ref 30 and 42: loss of arable land (LCA classes 2, 3.1, 3.2, 5.2) scrub and woodland. Land lost equates to 1% of total farmed area. Loss of boundary features, field access and disruption to field drainage system.	LU2-LU12
Dundas Estate, Land Refs 1, 6, 9 and 23: loss of arable land (LCA Classes 2, 3.1) and woodland. Land-take equates to 9% of the farm area. Disturbance to access, field boundaries and field drainage. Land severed by road infrastructure from the main steading.	LU1-LU12
Dundas Mains, Land Ref 3: loss of arable land (LCA Classes 3.1, 3.2) and woodland. Land-take equates to 33% of the farm area. Severance, disturbance to access, field boundaries and field drainage.	LU2-LU12
Humbie Farm, Land Ref 7: loss of arable land (LCA Class 3.1). Land lost equates to 5% of total farmed area. Loss of boundary features, field access and disruption to field drainage system.	LU1-LU10
Newliston Estate, Land Ref 16 & 11: loss of arable land (LCA Classes 2, 3.1, 3.2) and woodland. Land lost equates to 3% of total farmed area. Loss of boundary features, field access and disruption to field drainage system.	LU1-LU12
Overton Grazing, Land Ref 15: loss of arable land (LCA Class 3.1). Land lost equates to 35% of total farmed area. Loss of boundary features and disruption to field drainage system.	LU1-LU10

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Rosebery Estate, Land Ref 44: loss of arable land (LCA Classes 3.1 and 2) and woodland. Land lost equates to less than 1% of total farmed area. Loss of boundary features, field access and disruption to field drainage system.	LU2-LU11
Land Not Actively Managed for Agricultural, Sporting or Forestry Purposes	
Broomhall Estate (McMenamin Grazings), Land Ref 42 loss of land.	n/a
Castlandhill Wood, Land Ref 27 loss of land.	n/a
Ferrytoll Grazing, Land Ref 41loss of land.	n/a
St. Margaret's Marsh, Land Ref 36 loss of land.	n/a
Queensferry Hotel, Land Ref 34 loss of land.	n/a
St. Margaret's Hope, Land Ref 33 loss of land.	n/a
Land south of South Queensferry, Land Ref 17 loss of land.	n/a
Wimpey Homes Holding Ltd, Land Ref 18 loss of land.	n/a

Table 22.2: Potential Geology, Contaminated Land and Groundwater Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Solid Geology	
Beamer Rock: blasting and excavation impacts.	n/a
Firth of Forth bedrock: impacts from the installation of rock sockets and pre-cast pile caps.	n/a
Northern construction access road, area and platform: impacts from bedrock excavation.	n/a
Cuttings throughout the study area: impacts from bedrock excavation.	n/a
Ferry Hills SSSI: impacts from rock cut, with blasting potentially destabilising blocks of rock over the railway line that runs parallel to the proposed scheme to west of Ferry Hills.	G1
Where cuttings/excavations/reprofiling extends into bedrock, blasting may be required which would generate new fractures, dilate existing joints and discontinuities by the action of high pressure explosive gases, promote slip along joints and fracture surfaces and change groundwater pathways.	G1
Drift Geology	
Firth of Forth: disturbance of marine sediments from the construction of marine foundations and dredging.	n/a
Cuttings throughout the study area: impacts from partial or total removal of drift deposits.	n/a
Firth of Forth SSSI: impacts on mud deposits from construction of temporary bund.	n/a
Mineral Extraction	
Oil-shale and/or limestone areas in southern study area: risk of ground instability during both construction and operation.	G2
Contaminated Land	
Construction workers: risk of ingestion, inhalation and dermal contact with soils, soil dust, marine sediments, groundwater in the short term during construction (incl. at St. Margaret's Marsh, B981 realignment) and maintenance activities, risk of asphyxiation/explosion through migration of ground gases into confined spaces and/or cutting areas during construction.	G3, G4, G6-G19
Off-site receptors: risk of ingestion, inhalation and dermal contact with wind blown dust created during excavation works, risk of asphyxiation/explosion risk through migration of ground gases into homes/workplaces through preferential pathways created during construction.	G3, G6-G19
End users during operation: risk of ingestion, inhalation and dermal contact with wind blown dust from contaminated soils reused within road features such as embankments and landscaped areas.	G3, G6-G19
Shallow groundwater: risk of leaching and migration of contaminants (Iron, selenium, chloride and ammoniacal nitrogen) from soils excavated during construction and reused / stored on site and used in embankments (incl. at St. Margaret's Marsh, B981 realignment).	G4, G6-G19
Deep groundwater (potential drinking water source): risk of vertical migration of contaminated (Iron, selenium, chloride and ammoniacal nitrogen) shallow groundwater into the deeper rock aquifer through artificial channels created during the construction of engineering structures e.g. during piling or through leaching of contaminants from soils reused/stored on site through the shallow cohesive drift deposits.	G4, G6-G19
Surface water: risk of contaminated shallow and deep groundwater entering cuttings during blasting and construction and drainage channels during operation.	G4, G6-G21
Marine study area: contaminated sediments disturbed during the construction of the bridge piers.	G5, G10
Ecological receptors (incl. St. Margaret's Marsh SSSI): risk of inhalation, ingestion and direct contact with contaminated soils/sediments excavated and stored/reused on site	G4

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
during construction, plant uptake from contaminated soils excavated and stored/reused on site during construction and used in embankments and landscaped areas.	
Buildings and Structures: risk of direct contact with contaminated soils and groundwater resulting in chemical attack from sulphates.	G6
Groundwater and Private Water Supplies	
Risk of affecting groundwater flow from localised compaction of superficial deposits in embankments.	G22
Lowering of the groundwater table (temporal dewatering during construction or long term effect during operation) may locally impact on groundwater flow, private water supplies, or ecologically sensitive areas supported by groundwater and urban settlement.	G22
Where cuttings are likely to intercept groundwater, accidental spillages have the potential to contaminate the groundwater. Areas at risk are: Mainline (ch7900-8430); B981 realignment (ch110-935); southbound slip road from Ferrytoll Junction (ch180); Castlandhill Road (ch210-220); north haul road (temporary access roads/platform excavations); mainline and associated side roads (ch3200-4150). Area at risk is: a small area draining into the River Almond (ch800-1120) located below a proposed embankment. Areas at risk: Mainline and associated slip roads and B981 realignment (ch6800-7650); Mainline (ch7650-7900); FRC southbound slip road to Ferrytoll Junction (ch0-280); FRC southbound slip road from Ferrytoll Junction (ch0-190); Ferrytoll Junction (ch0-420); Ferrytoll Road (ch0-60); Castlandhill Road (ch55-310); temporary access roads/ platform excavations (ch0-200), M9 Junction 1A, Queensferry Junction (ch2000-2500), mainline and associated side roads (ch4150-4600), temporary access road (ch0-1050).	W1-W20, W28
During operation, contaminants from storm water ponds and treatment facilities may percolate down and contaminate underlying groundwater.	W1-W20, W28
Risk of contamination of bedrock aquifer from blasting.	G24
Risk of contamination of water environment (incl. Forth of Forth and local burns) from the discharge of dewatered groundwater during construction at cuttings.	G22, G23, W1-W20, W28
Potential risk of impact to quality of private water supplies at: • N03: A90 northbound slip road to Ferrytoll Junction (ch185-235) • N04: Castlandhill Road (ch55-310) • N23: FRC southbound slip road to Ferrytoll Junction (ch8600)	G22
Potential risk of impact to yield of private water supply at N04: Castlandhill Road (ch55-310) as a result of blasting activities or cuttings intercepting groundwater.	G24
Potential risk of impact to quality and yield of private water supplies at: • N01: A90 northbound slip road to Ferrytoll Junction (ch0-100) • N02: A90 northbound slip road to Ferrytoll Junction (ch0-100) • N07: Mainline (ch8750) • N12: Mainline (ch9150) • S06: Mainline (ch2900)	n/a
Potential reduction of St Margaret's Marsh catchment area (by up to approximately 25%) impacting water level and quality as a result of construction of an access road which may act as a barrier to shallow groundwater flow.	G26, G27
Dewatering between the cutting at ch3200-4250 could potentially result in differential settlement beneath loaded areas (e.g. buildings) and put adjacent properties at risk.	G26, G27

Table 22.3: Potential Water Environment Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Generic Construction Impacts	
Impacts on hydrology and increased flood risk from: • soil compaction from works traffic; • alteration of runoff pathways; • erosion and sedimentation of watercourses; • dewatering of watercourses; • increase in runoff from temporary haul roads; • changes to hydrological and flood regimes of receiving watercourses; • changes to sediment regime from temporary discharge of working area; • watercourse diversions to facilitate culvert and bridge construction; • temporary runoff control measures (swales and geotextile-wrapped straw bale barriers); and • construction works materials and plant placed within the floodplain.	W1-W20, W28
Impacts on fluvial geomorphology from: • increase in suspended solids supply to watercourses which may increase turbidity and siltation, reduce channel diversity and lose dynamic activity; • vegetation clearance which may reduce the stability of the river channels, increase sediment supply, reduce channel diversity and increase bank erosion; • culvert installation which would increase sediment release and turbidity, disturb the channel bed and cause localised erosion and deposition constraining planform change; • channel realignment which would increase sediment supply and channel erosion, disturb established bedforms and reduce morphological diversity, and exacerbate fluvial processes; and • outfalls which would increase sediment release and turbidity, modifications to channel morphology, and reduce stability of the banks and increase erosion rates.	W1-W20, W28
Impacts on water quality from: • pollution from mobilised suspended solids, accidental spillage or leakage of fuels, lubricants and hydraulic fluids from construction plant; • pollution from spillage or leakage of oil, fuels and chemicals from storage tanks; • accidental release of concrete, cement and admixtures from the washings of plant and machinery or spillage during concrete pouring; • accidental or uncontrolled release of sewage from sewers through damage to pipelines during service diversion; and • disturbance of contaminated materials leading to pollution of ground and surface waters.	W1-W20, W28
Generic Operational Impacts	
Impacts on hydrology and increased flood risk from: • increased impermeable areas resulting in increased overall volume of water reaching the watercourse, run-off may also reach receiving watercourse earlier than pre-scheme conditions which may result in increased flood risk and stream power downstream; • discharge of road drainage resulting in changes to hydrological and flood regimes, sediment regime and water quality of the receiving watercourse; • increased or reduced catchment requiring diversion of watercourses or introduction of outfalls;	W1, W28, W31, W45, W46

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
• pre-earthworks drainage installation; • watercourse crossings potentially affecting flow regimes, channel dimensions, roughness and gradient; • blockages caused by new structures; and • watercourse realignments resulting in a different sized channel and potential changes to the floodplain storage capacity.	
Impacts on fluvial geomorphology from: • increase in road drainage leading to an increase in fine sediment supply, increase in turbidity and sediment deposition, reduction of morphological and ecological diversity and a reduction in dynamic processes; • scour around outfalls leading to local increases in sediment supply to the watercourse, localised changes in channel morphology, alteration of fluvial processes, changes in rates of bank erosion, localised alterations to flow and patterns of sediment deposition; • increase in discharge during rainfall events leading to an increase in turbidity, increase in erosion of the channel bed and banks, reduction or improvement in morphological diversity and natural fluvial processes; • culverting resulting in changes to sediment regime, reduction in morphological diversity and constraining the channel preventing lateral and vertical adjustment; and • watercourse realignments resulting in potential major changes to sediment regime and nature of fluvial processes, improvement in channel morphology, with opportunities to restore/rehabilitate the watercourse in poor quality watercourses.	W1, W28, W45, W46
Impacts on water quality from: • pollution in run-off from metals, suspended solids and contaminants bound to them, organic compounds, biodegradable organic material, rock salt and alternative de-icing agents; and • culverting resulting in release of previously 'locked' contaminants into the water column and oxygen sags caused by the lack of light and rapid microbiological degradation of biodegradable matter.	G19, W1,W28
Specific Construction Impacts	
St. Margaret's Marsh • temporary alteration of the hydrological regime; • potential release of suspended solids and risk of accidental spillage of pollutants due to construction works; and • potential mobilisation and release of potential contaminants from St. Margaret's Marsh landfill during construction.	W1-W20, W21, W22, W29
Linn Mill Burn • temporary increases in runoff rates from increase in hardstanding areas; and • potential sediment release and risk of accidental spillage of pollutants into Linn Mill Burn during construction works in catchment.	W1-W20, W30
Swine Burn • localised increases in flood risk can be expected if plant/materials are placed within the floodplain; • potential increased sediment supply downstream from in-channel works which may lead to smothering of the channel bed and a reduction in channel morphology; and • potential sediment release and risk of accidental spillage of pollutants due to construction works in or adjacent to the burn and close proximity of site compound to Swine Burn.	W1-W20, W31-W34

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Tributary of Swine Burn • temporary increases in runoff rates due to construction of new SUDS features and outfalls; • sediment release and deposition downstream from outfall construction which may cause a reduction in morphological diversity; and • potential sediment release and risk of accidental spillage of pollutants due to works in or adjacent to watercourse.	W1-W20, W35
Niddry Burn • temporary increases in runoff rates and localised increases in flood risk if plant/materials are placed within the floodplain; • increase sediment supply downstream which may lead to smothering of the channel bed and a reduction in channel morphology; and • potential sediment release and risk of accidental spillage of pollutants due to works in or adjacent to watercourse.	W1-W20, W31, W36, W37
Tributary of Niddry Burn • increased flood risk upstream from culvert extension and embankment widening; • temporary increases in runoff rates and localised increases in flood risk if plant/materials are placed within the floodplain; • increase sediment supply downstream which may lead to smothering of the channel bed and a reduction in channel morphology; and • potential sediment release and risk of accidental spillage of pollutants due to works in or adjacent to watercourse.	W1-W20, W31, W38
River Almond • temporary increases in run-off rates from increase in hardstanding areas; • temporary displacement of flood waters due to works placed within the River Almond floodplain; • sediment release and deposition downstream from outfall construction which may cause a reduction in morphological diversity; and • potential sediment release and risk of accidental spillage of pollutants due to works in or adjacent to watercourse.	W1-W20, W31, W39
Ferry Burn • temporary increases in run-off rates from increase in hardstanding areas; • sediment release and deposition downstream from outfall construction which may cause a reduction in morphological diversity; and • potential sediment release and risk of accidental spillage of pollutants due to works in or adjacent to watercourse.	W1-W20, W40
Dolphington Burn • impacts on peak flow rates into the watercourse due temporary works within catchment (assessed as negligible); • impact of road drainage on fluvial geomorphology (negligible as it would be routed to the existing drainage system and utilise existing treatment systems (SUDS)); and • potential sediment release and risk of accidental spillage of pollutants due to works adjacent to watercourse.	W1-W20, W41
Firth of Forth • temporary increase in runoff to receiving waterbodies which discharge into Firth of Forth and temporary displacement of floodwaters due to construction works within Forth; • temporary and localised morphological change including scour and erosion of subtidal bed and shoreline, and transport and deposition of suspended sediment, due to construction activities within the Firth of Forth but of limited spatial and temporal extent; • release of suspended solids and other pollutants and risk of accidental spillage pollutants; and • spatial and temporal increase in turbidity and pollutants in water column (limited as high dilution and dispersal capacity of Firth of Forth).	W1-W20, W23-W27, W42

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Specific Operational Impacts	
St. Margaret's Marsh • changes in hydrological regime into the marsh from realignment of the B981 through the SSSI (no road drainage impacts on water quality as it would be discharged to Firth of Forth).	W29
Linn Mill Burn • increases in runoff from increase in hardstanding areas; and • substantial flow directly north of the viaduct abutment and south of Society Road south of the proposed crossing during the 1% AEP (1 in 100-year return period) +20% flood event from the carriageway.	W30
Swine Burn • increase flood risk locally upstream of M9 Spur crossing due to installation of new crossing; • increase flood risk upstream due to culvert extension and embankment widening as it would encroach onto floodplain; • increase peak flows and change the spatial distribution of flows along reach of Swine Burn due to increases in permanent hardstanding area and new outfall location; • erosion, deposition and a reduction in morphological diversity from channel realignment; • interruptions to sediment transport and sediment supply due to culvert works which could lead to some limited smothering of the channel bed; • scour due to new outfalls; • impact upon water quality due to lack of light at new culvert and culvert extension (negligible impact due to lengths required); and • exceedance of annual average EQS for copper and zinc concentrations.	W32-W34
Tributary of Swine Burn • increase peak flows and change spatial distribution of flows within reach near outfall location due to construction of SUDS feature and new outfall; • increases in runoff from increase in hardstanding areas; • sediment supplied from untreated road drainage which could lead to some limited smothering of the channel bed; • scour due to new outfall which could encourage channel erosion or deposition; and • exceedance of annual average EQS for copper concentrations.	W35
Niddry Burn • increase flood risk upstream due to floodplain encroachment from culvert extension and embankment widening; • increase peak flows and change the spatial distribution of flows along reach of Niddry Burn due to increase of hardstanding area and new outfall location; • increases in runoff from increase in hardstanding areas; • erosion, deposition and localised reduction in morphological diversity; • sediment supplied from untreated road drainage could lead to some limited smothering of the channel bed; • scour due to new outfall; • reduced water quality due to lack of light at culvert extension on (negligible impact due to limited length of extension); and • exceedance of annual average EQS for copper concentrations.	W31, W36, W37

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Tributary of Niddry Burn • increase local flood risk due to widening of roadway at crossing location; • increases in runoff from increase in hardstanding areas; • localised reduction in morphological diversity due to culvert extension; and • reduced water quality due to lack of light at culvert extension on (negligible impact due to limited length of extension).	W31
River Almond • changes to peak flows and hydrological regimes of waterbodies with discharge into River Almond are not expected to impact on the River Almond as these are considered local disturbances; • slight changes to spatial distribution of flows due to new outfall; • slightly impact on local flood risk due to roadway widening within the River Almond floodplain; • sediment supplied from untreated road drainage may lead to some limited smothering of the channel bed; • scour due to new outfall and may encourage channel erosion or deposition; and • marginal increase over baseline for copper and zinc concentrations, although no exceedance of average annual EQS for both pollutants.	W31, W39
Ferry Burn • increases in runoff from increase in hardstanding areas; • sediment supplied from untreated road drainage may lead to some limited smothering of the channel bed. • scour due to new outfall and may encourage channel erosion or deposition; and • exceedance of annual average EQS for copper and zinc concentrations.	W40
Dolphington Burn • increases in runoff from increase in hardstanding areas for high return period events; and • changes to geomorphology and water quality (negligible impacts as road drainage would be routed into the existing drainage system and utilise existing treatment systems (SUDS)).	W41
Firth of Forth • flood risk from potential spillage from viaduct onto properties located under viaduct for high return period events (greater than the drainage capacity of the drainage system); • localised morphological change including scour and erosion of subtidal bed and shoreline due to new runoff outfalls and relocation of Scottish Water treated sewage outfall; and • impacts from routine runoff and accidental spillage from Main Crossing and approach road runoff. High dilution and dispersal capacity of Firth of Forth would reduce any increase in pollutants in water column.	W42, W43

Table 22.4: Potential Terrestrial and Freshwater Ecology Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Terrestrial Habitats – Construction Impacts	
Habitat loss and fragmentation of woodland.	TE1-TE5, TE11, TE18, TE19, TE22, TE24, TE25, TE26, TE34
Disturbance of waterbodies and species rich grassland.	TE1-TE5, TE7, TE8, TE11, TE12, TE17-TE20, TE23, TE29, TE32, TE48, TE49
Risk of pollution of St. Margaret's Marsh SSSI.	TE1- TE5, TE23, TE29, TE51
Risk of alien species transfer at St. Margaret's Marsh SSSI, St. Margaret's Hope; Port Edgar; Lindsay's Craigs; and species rich grassland near to Castlandhill Wood.	TE13
Badger – Construction Impacts	
Risk of direct mortality to 4 badger social groups (A, B, D and F) and one population group (C).	TE1-TE6, TE10, TE15, TE16, TE27, TE41, TE44
Disturbance to one badger social group (A) and one population group (C).	TE1-TE6, TE15, TE16, TE18, TE19, TE27
Risk of pollution impact for 3 badger social groups (A, D and F) and one population group (C).	TE1, TE2, TE5, TE23, TE29
Bats – Construction Impacts	
Risk of direct mortality impact for bats at Castlandhill Woods; St. Margaret's Hope; Port Edgar and west of South Queensferry; Dundas (North); Milton and Dolphington; Kirkliston; Ross's Plantation and Lindsay's Craigs.	TE1-TE4, TE6,TE17-TE19,TE25,TE39
Habitat loss for foraging and roosting bats at Port Edgar and west of South Queensferry; Milton and Dolphington; and Kirkliston.	TE4,TE6, TE17-TE19, TE25, TE39,TE45
Habitat fragmentation for bats at Rosyth; Castlandhill Woods; North Queensferry; North Cliff Wood; St. Margaret's Hope; South Queensferry; Port Edgar and west of South Queensferry; Dundas (North); Milton and Dolphington; Humbie; Kirkliston; Carmelhill and Muriehall; Swineburn; Ross's Plantation and Lindsay's Craigs.	TE4, TE6, TE17, TE21, TE22, TE24, TE25
Disturbance to bats from noise, vibration and light at Rosyth; Castlandhill Woods; St. Margaret's Hope; Port Edgar and west of South Queensferry; Dundas (North); Kirkliston; Ross's Plantation and Lindsay's Craigs.	TE1-TE6, TE15, TE16, TE18, TE19
Risk of pollution from accidental spills may reduce food supply for bats at St. Margaret's Hope; Kirkliston; Niddry Burn; River Almond; Ross's Plantation and Lindsay's Craigs.	TE1-TE2, TE5, TE23, TE29

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Terrestrial Breeding Birds – Construction Impacts	
Risk of direct mortality, habitat loss, disturbance and pollution for terrestrial breeding birds at St. Margaret's Marsh SSSI and in the footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas.	TE1-TE6, TE15-TE19, TE22-TE25, TE29
Terrestrial Wintering Birds – Construction Impacts	
Risk of direct mortality, habitat loss, disturbance and pollution for terrestrial wintering birds in the footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas.	TE1-TE6, TE15-TE19, TE22-TE25, TE29
Otter – Construction Impacts	
Risk of direct mortality, habitat loss, disturbance and pollution impacts on otters along coastline from Rosyth Europarc to North Queensferry including St Margaret's Marsh; along coastline from Abercorn Point to Long Craig Pier; and Swine Burn, Niddry Burn and River Almond.	TE1-TE6, TE10, TE14-TE20, TE30-TE32, TE40, TE42, TE43
Habitat fragmentation for otters along coastline from Abercorn Point to Long Craig Pier; and Swine Burn, Niddry Burn and River Almond.	TE1-TE6, TE20, TE37, TE38, TE42
Amphibians – Construction Impacts	
Risk of direct mortality, habitat loss, disturbance of amphibians to the west of Ferry Loch; and other suitable terrestrial habitats throughout the remainder of the proposed scheme.	TE1-TE5, TE33
Terrestrial Invertebrates – Construction Impacts	
Risk of direct mortality and disturbance to terrestrial invertebrates at St. Margaret's Hope Wood, St. Margaret's Marsh SSSI, Ferry Hills SSSI, Dundas Wood North, Dolphington Burn Wood, Ross's Plantation, parkland west of Kirkliston and Lindsay's Craigs.	TE1-TE5
Habitat fragmentation for terrestrial invertebrates at Ferry Hills SSSI, Dundas Wood North and Dolphington Burn Wood.	TE1-TE5
Changes to the hydrology at St. Margaret's Marsh SSSI, St. Margaret's Hope Wood and Dolphington Burn Wood.	TE1-TE5, TE50, TE51
River Habitats – Construction Impacts	
Habitat loss, habitat fragmentation, pollution impacts and changes in hydrology at Swine Burn and Niddry Burn.	TE1-TE5, TE29-TE32, TE35-TE38,
Aquatic Macroinvertebrates – Construction Impacts	
Risk of direct mortality, habitat fragmentation, pollution impacts and changes in hydrology for aquatic macroinvertebrates in Swine Burn and Niddry Burn.	TE1-TE5, TE30-TE38
Pollution impacts for aquatic macroinvertebrates in River Almond.	TE1, TE2, TE5, TE23, TE29
Freshwater Macrophytes – Construction Impacts	
Habitat fragmentation, pollution impacts and changes in hydrology for freshwater macrophytes in Swine Burn.	TE1-TE5, TE30-TE38

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Pollution impacts and changes in hydrology for freshwater macrophytes in Niddry Burn.	TE1, TE2, TE5, TE23, TE29
Pollution impacts for freshwater macrophytes in River Almond.	TE1, TE2, TE5, TE23, TE29
Freshwater Fish – Construction Impacts	
Risk of direct mortality, habitat loss, habitat fragmentation, disturbance and pollution impacts for freshwater fish in Swine Burn and Niddry Burn.	TE1-TE5, TE30-TE32, TE34-TE38
Pollution impacts for freshwater fish in River Almond.	TE1, TE2, TE5, TE23, TE29
Terrestrial Habitats – Operational Impacts	
Habitat loss at St. Margaret's Marsh SSSI; waterbodies and species rich grassland; and habitat loss and fragmentation of woodland at St. Margaret's Hope Wood, south of Port Edgar barracks, within the grounds of Inchgarvie House, the Echline Strip (Dundas Estate), along the northern side of the M9 at Junction 1A. Small loss of woodland at Castlandhill and Lindsay's Craigs.	TE2, TE22, TE24-TE26, TE34
Risk of pollution of woodland and waterbodies.	TE2, TE23
Changes in hydrology at St. Margaret's Marsh SSSI and Ferry Hills SSSI.	TE2, TE23, TE51
Badger – Operational Impacts	
Risk of direct mortality to 4 badger social groups (A, B, D and F) and one population group (C).	TE2, TE27, TE40, TE41, TE44
Habitat loss to one badger social group (A) and one population group (C).	TE24, TE25, TE27
Habitat fragmentation to one badger social group (A) and one population group (C).	TE2, TE24, TE25, TE44
Disturbance to one badger population group (C).	TE2, TE24, TE25, TE44
Risk of pollution impact for 4 badger social groups (A, B, D and F) and one population group (C).	TE2, TE23
Bats – Operational Impacts	
Risk of direct mortality impact for bats at St. Margaret's Hope, Port Edgar and west of South Queensferry, Dundas (North), Dundas (Central), Dundas (South), Milton and Dolphington, Humbie, Kirkliston, Carmelhill and Muriehall, Swineburn, Ross's Plantation and Lindsay's Craigs.	TE2, TE45
Habitat loss for foraging and roosting bats at Castlandhill Woods, St. Margaret's Hope, Port Edgar and west of South Queensferry, Dundas (North), Milton and Dolphington, Humbie, Kirkliston, Carmelhill and Muriehall, and Swineburn.	TE2, TE24, TE25, TE45
Habitat fragmentation for bats at St. Margaret's Hope, South Queensferry, Port Edgar and west of South Queensferry, Dundas (North), Dundas (Central) and Dundas (South), Ross's Plantation and Lindsay's Craigs.	TE2, TE24, TE25, TE45
Disturbance to bats from noise, vibration and light at St. Margaret's Hope, South Queensferry, Port Edgar and west of South Queensferry, Dundas (North), Milton and	TE2, TE18

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Dolphington, Kirkliston, and Swine Burn.	
Risk of pollution from accidental spills may reduce food supply for bats at St. Margaret's Hope, Swine Burn, Ross's Plantation and Lindsay's Craigs.	TE2, TE18
Terrestrial Breeding Birds – Operational Impacts	
Risk of direct mortality, habitat loss, disturbance and pollution for terrestrial breeding birds at St. Margaret's Marsh SSSI and in the footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas.	TE2, TE21, TE22, TE24, TE25
Habitat fragmentation for terrestrial breeding birds in the footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas.	TE2, TE21, TE22
Terrestrial Wintering Birds – Operational Impacts	
Risk of direct mortality, habitat loss, disturbance and pollution for terrestrial wintering birds at St. Margaret's Marsh SSSI and in the footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas.	TE2, TE21, TE22-TE25
Habitat fragmentation for terrestrial wintering birds in the footprint of the proposed scheme including temporary locations for site compounds, access roads, easements and working areas.	TE2, TE21, TE22
Otter – Operational Impacts	
Risk of direct mortality of otters along coastline from Rosyth Europarc to North Queensferry including St Margaret's Marsh.	TE2, TE32
Risk of direct mortality, habitat loss, habitat fragmentation and pollution impacts on otters in Swine Burn, Niddry Burn and River Almond.	TE2, TE23, TE24, TE31, TE32, TE37, TE43
Amphibians – Operational Impacts	
Risk of direct mortality, habitat loss, and habitat fragmentation for amphibians in other suitable terrestrial habitats throughout the proposed scheme.	TE2, TE33
Terrestrial Invertebrates – Operational Impacts	
Risk of direct mortality, habitat loss, disturbance and pollution impacts to terrestrial invertebrates at St. Margaret's Hope Wood, St. Margaret's Marsh SSSI, Ferry Hills SSSI, Dundas Wood North and Dolphington Burn Wood, Ross's Plantation and parkland west of Kirkliston.	TE2, TE24, TE25
Habitat fragmentation for terrestrial invertebrates at Ferry Hills SSSI, Dundas Wood North and Dolphington Burn Wood.	TE2, TE24, TE25
Risk of direct mortality, habitat loss and pollution impacts to terrestrial invertebrates at Lindsay's Craigs.	TE2, TE24, TE25
Risk of pollution impacts on terrestrial invertebrates in River Almond.	TE2, TE23
River Habitat – Operational Impacts	
Habitat loss, habitat fragmentation, pollution impacts and changes in hydrology at Swine Burn and Niddry Burn.	TE2, TE20, TE23, TE38
Aquatic Macroinvertebrates – Operational Impacts	
Habitat loss, habitat fragmentation, pollution impacts and changes in hydrology for aquatic macroinvertebrates in Swine Burn and Niddry Burn.	TE2, TE35
Pollution impacts for aquatic macroinvertebrates in River Almond.	TE2, TE23

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Freshwater Macrophytes – Operational Impacts	
Habitat loss, pollution impacts and changes in hydrology for freshwater macrophytes in Swine Burn and Niddry Burn.	TE2, TE23
Pollution impacts for freshwater macrophytes in River Almond.	TE2, TE23
Freshwater Fish – Operational Impacts	
Habitat loss, habitat fragmentation, disturbance and pollution impacts for freshwater fish in Swine Burn.	TE2, TE18, TE20, TE36
Habitat loss, habitat fragmentation and pollution impacts for freshwater fish in Niddry Burn.	TE2, TE18, TE20, TE36
Pollution impacts for freshwater fish in River Almond.	TE2, TE23

Table 22.5: Potential Estuarine Ecology Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Construction Impacts	
Noise/vibration disturbance impacts on fish, marine mammals & estuarine birds Beamer Rock excavation, piling, dredging, construction of temporary causeway and earth bunds.	EE1-EE18
Loss of intertidal and subtidal benthic habitat from construction of piers and towers.	EE1-EE5
Loss of habitat for migratory and non-migratory fish, pinnipeds, cetaceans and estuarine birds.	EE1-EE5
Increased vessel movements from Beamer Rock excavation, piling, dredging & construction of a temporary causeway may crease risk of mammal strike or disturb benthic fauna.	EE1-EE5, EE15
Release of pollutants from re-suspension of contaminated sediments or as a result of accidental spills from construction works and vessels may bio-accumulate within the food chain and impact on the estuarine bird species.	EE1-EE6
Chemical spills or leaks from construction activities may impact on the intertidal and subtidal benthic habitats, result in fish kills, and potentially affect marine mammals.	EE1-EE6
Impacts on the estuarine environment from sediment loading and changes in sedimentation from excavation of Beamer Rock, piling, dredging and construction of a temporary causeway and earth bunds.	EE1-EE6, EE16
Disturbance of habitat from excavation of Beamer Rock, dredging and construction of a temporary causeway.	EE1-EE6, EE16
Severance to migration of fish (including Atlantic salmon and sea trout) from piling and construction of a temporary causeway and earth bunds.	EE4-EE8
Disturbance of foraging or to roosting sites may occur as a result of increased light pollution.	EE1-EE4, EE17
Operational Impacts	
Risk of accident on the Main Crossing resulting in spillage to the Firth of Forth and impacts on benthic habitats, fish and marine mammals and estuarine birds.	EE6

Table 22.6: Potential Landscape Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Alteration of the regional and local character of the landscape, or the special qualities of designated areas, due to loss of landscape elements and the addition of the Main Crossing to the landscape setting of the Forth Road Bridge and Forth Rail Bridge.	L1-L70
Introduction of infrastructure elements associated with the proposed scheme, including road surface, noise barriers and false cuttings, SUDS detention ponds, bridges, underpass, culverts, ITS gantries, signage and lighting.	L1-L70
Alterations to landform, land use, pattern, boundaries, vegetation and watercourses.	L1-L70

Table 22.7: Potential Visual Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Alteration to the character of views from the addition of the Main Crossing to the visual setting of the Forth Road Bridge and Forth Rail Bridge.	V1, V2
Alteration to the character of views by the introduction of infrastructure elements associated with the proposed scheme, including road surface, noise barriers and bunds, SUDS detention basins, bridges, underpass, culverts, ITS gantries, signage and lighting into rural areas and in close proximity to settlement.	
Introduction of changed appearance of landform due to new rock cuttings to the north of the Main Crossing.	
Alteration and obstruction of views by the introduction of significant cuttings or embankments into the landform and reduced screening where woodland is lost.	
Potential impacts from the introduction of ITS, and ADS gantries and lighting to the existing road network, outwith the extent of the proposed scheme at the following locations: • M90 north of Admiralty junction to Halbeath: refer to Chapter 13 (Visual) paragraph 13.6.57 and Appendix A 13.3; and • M9 Spur: refer to Chapter 13 (Visual) paragraph 13.6.88 and Appendix A13.5.	None

Table 22.8: Potential Cultural Heritage Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Direct physical impact from the proposed scheme on: • St. Margaret's Hope Rosyth, Wharf; • Dundas Castle Designed Landscape (Inventory of Gardens and Designed Landscapes); • Newliston Designed Landscape (Inventory of Gardens and Designed Landscapes); • Newbigging Cobbled Surface; • Echline Strip Clearance Cairns; and • Newbigging Tank/Spring.	CH1, CH5, CH9
Change to setting of: • Jamestown Viaduct Inverkeithing (Category B Listed Building); • St. Margaret's Hope, Including Boundary Walls, Walled Garden To South And Archway On Drive To North (Category B Listed Building); • Ferry Craig, North Queensferry (Category C Listed Building); • Hopetoun House/Viewing platform (Category A Listed Building); • Port Edgar West Pier (Category C Listed Building); • Port Edgar Harbour Barracks Complex (Category B Listed Building); • Inchgarvie House (Category C Listed Building); • Inchgarvie House Lodge (not designated); • St. Margaret's Hope Relict Country Estate (not designated); • Hopetoun House Designed Landscape (Inventory of Gardens and Designed Landscapes); • Blackness Castle (Category A, B & C Listed Buildings, SAM); • Dundas Mains, Rose Acre, Brown Acre and Lilac Cottage (Category B Listed Buildings); • Dundas Castle and Designed Landscape (Category A Listed Building (part of Category A group) Inventory of Designed Landscapes, SAM (Castle)); • North Queensferry Conservation Area (Numerous Category A, B & C Listed Buildings); • North Queensferry, Craigdhu (Category B Listed Building); • North Queensferry, Northcliff House, Gate piers, Gates and Railings (Category B Listed Building); • Forth Road Bridge (Category A Listed Building); • Newliston Designed Landscape (Inventory of Gardens and Designed Landscapes); • Dalmeny Conservation Area (Category A, B & C Listed Buildings); • Dalmeny Church (Category A Listed Building); • Echline Farmhouse (Category B Listed Building); • Echline Cottages (Category C (s) Listed Buildings (group)); • Dundas Mains Home Farm 6-18 (Category B Listed Building (grouping));	CH10

Description of Potential Impact	Mitigation Item
• Newbigging Farmhouse (Category C (s) Listed Building); • Dundas Castle North Gate Lodge (Category B Listed Building); • Humbie Cottages and Farmhouse (Category C Listed Building); • 79 Hope Street, Viewforth House Inverkeithing (Category B Listed Building); • Hope Street, Bowed Truss Railway Bridge Inverkeithing (Category B Listed Building); • Hope Street, K6 Telephone Kiosk Inverkeithing (Category B Listed Building); • Jamestown Naval Base Mansions (Category B Listed Building); • 54 Hope Street, Ardlea (Category C (s) Listed Building); • Hope street, Episcopal Church of St Peter Inverkeithing (Category C (s) Listed Building); and • Roman Road, Town Wall (Category C (s) Listed Building).	
Direct physical impacts from the Main Crossing: • Beamar Rock Beacon (site 426); • St. Margaret's Hope Relict Country estate (site 1102); • Port Edgar Barracks complex (site 484); • Inchgarvie House (site 532); • St. Margaret's Hope Arch (site 300); • St. Margaret's Hope (former Admiralty House) (site 300); • Inchgarvie House, Roman finds (site 534); • Inchgarvie House, Springfield House, graves (site 543); • Inchgarvie House, Linear cropmarks (site 811); • South Queensferry Linear Cropmark (site 1118); and • Beamer Rock – shipwrecks (sites 410-417, 419-20, 424).	CH2, CH3, CH4, CH6, CH7, CH8, CH9

Table 22.9: Potential Air Quality Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
NO_2 concentrations: 2017 – small increases for St. Margaret's Hope Gatelodge (R12), St. Margaret's Hope (R25) and Inchgarvie House (R51). Small decrease for 45 Stoneyflats Cresecent, South Queensferry (R28). 2032 – small increases for St. Margaret's Hope (R25) and Inchgarvie House (R51). Large increase for St. Margaret's Hope Gatelodge (R12). Small decreases for Stoneyflats Cresecent, South Queensferry (R28) and 21 Echline, South Queensferry (R47).	n/a
$PM_{2.5}$ and PM_{10} concentrations: More properties are predicted to experience a worsening than benefiting from the proposed scheme but the numbers of properties affected by changes in PM_{10} and $PM_{2.5}$ concentrations (positively or negatively) is extremely small.	n/a
Improvements to local air quality around the Forth Road Bridge and deteriorations around areas of the Main Crossing.	n/a
Firth of Forth SSSI Nitrogen deposition rates: • For the 2017 scenarios, dry deposition and total deposition rates decrease between the Do-Minimum scenario and the Do-Something scenario. • In 2032 total deposition rates are below the critical load range (10kg N/ha/yr) for both the Do-Minimum and Do-Something scenario.	n/a
Ferry Hills SSSI Nitrogen deposition rates: • The total deposition rate in 2017 and 2032 are below the upper band of the critical load range for both the Do-Minimum scenario and the Do-Something scenario but slightly exceed the lower band of the range in 2017.	n/a
St Margaret's Marsh SSSI Nitrogen deposition rates: • Total deposition rates in 2017 and 2032 are below the critical load range for both the Do-Minimum scenario and the Do-Something scenario.	n/a

Table 22.10: Potential Noise and Vibration Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Direct Impacts on Residential Receptors (North of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • Mucklehill Park, Inverkeithing overlooking the A90; • Whinny Hill Crescent, Inverkeithing; • Ferry Barns Court, Brock Street and Inchcolm Drive in North Queensferry; and • St.Margaret's Hope Gatelodge.	n/a
Indirect Impacts on Residential Receptors (North of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • Dales Steading; • Dales Farm Cottages; • majority of Inverkeithing and in particular, Spittalfield Crescent, King Street, Alma Street and dwellings facing onto Dunfermline Wynd/Hill Street; • majority of Rosyth and in particular, Queensferry Road to the northwest of its junction with Admiralty House; and • southwest area of North Queensferry.	n/a
Direct Impacts on Non-residential Receptors (North of Firth of Forth)	
Changes to noise levels at the following non-residential receptors (scheme opening and future assessment year unless otherwise stated): • Queensferry Hotel; • St. Margaret's Hope; • Park Road Primary School, Rosyth; • Camdean School, Rosyth; • Kings Road Primary School, Rosyth; • St John's Primary School, Rosyth; • Hilton Court Care Home, Rosyth; • North Queensferry Primary School; and • North Queensferry Community Centre (scheme opening).	n/a
Indirect Impacts Outside Noise Study but within 2km of Proposed Scheme on Residential and Non-residential Receptors (North of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • the area surrounding the junction of the A823(M), A823 and B980 to the northwest of Rosyth; • properties in the northeast of North Queensferry (near Scaur Hill); • a small stretch of the bank of the Firth of Forth to the west of St Margaret's Marsh, including the Port of Rosyth. However, there are no noise-sensitive receptors in this area; • the Careshare Nursery, Dunfermline on scheme opening and future assessment year; and	n/a

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
• Inverkeithing High School, Inverkeithing Primary School and Inverkeithing Nursery.	
Direct Impacts on Residential Receptors (South of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • Inchgarvie House, Linn Mill, Butlaw Fisheries, The Weddles, The Square, The Rowans and Butlaw Cottages Society Road, Clufflat Brae, Springfield Place and Springfield Lea in South Queensferry; • properties in South Queensferry within 600m east of the proposed route and to the north of Bo'ness Road; • the western half of Echline estate in the southwest of South Queensferry; • Green Acre, Blue Acre and Clock House around Dundas Castle; • Dundas Mains and White Lodge, south of South Queensferry; • Dundas Home Farm; • areas of Kirkliston whose noise climate is dominated by the M9 or the M9 Spur; and • small cluster of dwellings to the southwest of M9 J1A including Overton Cottages.	N1-N10, L4
Direct Impacts on Non-residential Receptors(South of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • Leonard Cheshire Home in Kirkliston; • Kirkliston Primary School; • Echline Primary School in South Queensferry; • Queensferry Primary School in South Queensferry; • Queensferry Churches Care in the Community Project; • St Margaret's RC Primary School; • Dalmeny Primary School; • Port Edgar; and • Port Edgar Barracks.	n/a
Indirect Impacts on Residential and Non-residential Receptors (South of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • houses along the southern edge of the Echline Estate in South Queensferry which face directly onto the A904; • the houses to the west of the approach road to the existing bridge within approximately 300m of the scheme including the eastern half of Echline Estate; • the area of South Queensferry to the east of the existing bridge approach road, bounded by the B924, the B907 and the A8000; • the area to the east of the B907, east of South Queensferry; • the junction of the existing A90 and A8000 down to the northern outskirts of Kirkliston; • dwellings in Kirkliston which face directly onto the B9080; • dwellings in Newbridge;	N1-N10, L4

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
• dwellings in Winchburgh; and • dwellings facing onto the B8020 between the B9080 and the A904, north of Winchburgh.	
Direct Impacts Outside Noise Study Area but within 2km of Proposed Scheme on Residential and Non-residential Receptors (South of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • the southern bank of the Firth of Forth to the west of the Main Crossing; • the area to the northwest of Dundas Estate, including Duddingston Wood; and • the majority of Dundas Estate, south of Dundas Castle.	n/a
Indirect Impacts Outside Noise Study Area but within 2km of Proposed Scheme on Residential and Non-residential Receptors (South of Firth of Forth)	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • the western half of Winchburgh; • east of South Queensferry; • South Queensferry High School; and • the majority of the remaining areas between 600m and 2km from the proposed scheme in the south of the study area.	n/a
Firth of Forth	
Changes to noise levels at the following locations (scheme opening and future assessment year unless otherwise stated): • the area between the Main Crossing and the Forth Road Bridge; • the area to the east of the Forth Road Bridge; and • the area to the west of the Main Crossing.	n/a

Table 22.11: Potential Pedestrians, Cyclists, Equestrians and Community Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
North of Inverkeithing (paths 1-5): no changes in journey length; negligible changes in amenity value.	n/a
East of Inverkeithing (paths 7-9): no changes in journey length; improvements to amenity value due to views of the Main Crossing.	n/a
Rosyth (path 11-13): no changes to journey length; negligible changes in amenity value.	n/a
South of Rosyth (paths 24, 25): no changes to journey length; improvements to amenity value due to views of the Main Crossing.	n/a
North of Ferrytoll Junction (paths 14-16, 78, 79): no changes in journey length; slight reductions in amenity value due to views of the road.	P5, P9
South of Inverkeithing (paths 17, 30): no changes in journey length; negligible changes in amenity value.	n/a
Inverkeithing to Forth Road Bridge (path 6): NCR 1 slightly realigned with negligible increase in journey length; amenity value reduced.	P1, P6, P9
Ferrytoll Junction (paths 6a, 22, 80): community severance impacts would result between Inverkeithing and North Queensferry since NMUs travelling east (Forth Road Bridge/ North Queensferry to Inverkeithing) would experience increased journey length and reduced amenity; NMUs travelling west (Forth Road Bridge/ North Queensferry to Rosyth) would experience decreased journey length and reduced amenity.	P2, P3, P6, P7
Ferrytoll Junction (path 10): NCR 76 realigned with slight decrease in journey length; amenity value reduced.	P6, P7, P9
East and west of Ferrytoll Junction (paths 10a and 10b): no changes in journey length; amenity value of NCR 76 slightly improved due to views of the Main Crossing.	n/a
St. Margaret's Marsh (path 23): journey length reduced; amenity value reduced.	P8, P9
Ferryhills (paths 19-21): no changes in journey length; some slight improvements in amenity value due to views of the Main Crossing, although also some views of the proposed scheme and increases in noise levels would result in slight impacts on path network 21.	n/a
North Queensferry (path 18, 26-29, 69, 76, 77): no changes in journey length; some improvements in amenity value due to views of the Main Crossing from some of these paths.	n/a
Forth Road Bridge (path 31): no changes to journey length; improved amenity would result in significant beneficial impacts due to decreased traffic noise levels, improved local air quality and good views of the Main Crossing.	n/a
Port Edgar (path 81): no changes to journey length; slight reductions in amenity value.	n/a
Society Road (path 34): no changes to journey length; slight reductions in amenity value.	n/a
Echline fields (paths 46): severance of informal path routes would result in community severance impacts; increased journey lengths of the paths; reductions in amenity value due to views of proposed scheme and changes in air quality and noise levels would result in adverse impacts on access and recreational use of the fields.	P4, P7
West of Echline, Linn Mill (paths 47-50): no changes to journey length; reductions in amenity value due to increases in noise levels.	n/a
Queensferry Junction (path 45b, 75): increases in journey length; reductions in amenity value due to changes in views, air quality and noise levels at the junction. Community severance impacts would result between South Queensferry and Newton due to the required negotiation of this junction.	P7
A904, East of Queensferry Junction (path 45a): negligible change in journey length; slight improvement in amenity value. Decreased traffic flows on this section of the A904 would result in some relief in existing severance for the Echline community.	n/a
Swineburn area (paths 63-67, 73): no changes to journey length; some improvements in amenity value due to views of the Main Crossing from some of these paths.	n/a

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Newton (path 68): no changes to journey length; reduction in amenity value due to increased traffic flows on the A904.	n/a
South Queensferry (paths 32, 35, 36, 39-44, 51): no changes to journey length; some improvements in amenity value due to improvements in air quality and noise levels and views of the Main Crossing. Access and use of Echline and Ferry Glen Community Woodlands and Inchcolm Park would also be improved.	n/a
Dalmeny (path 33, 52-54): no changes to journey length; negligible changes in amenity value.	n/a
A8000 overbridge (path 74): realigned with negligible change in journey length; slight improvements to amenity value due to changes in air quality and noise and a new section path improving the connection to South Queensferry.	n/a
Queensferry to Kirkliston (path 37): no changes to journey length; negligible change in amenity value.	n/a
Kirkliston (paths 55-59): no changes to journey length; negligible change in amenity value.	n/a
River Almond (path 72): no changes to journey length; negligible change in amenity value.	n/a
A8 (path 70): no changes to journey length; negligible change in amenity value.	n/a
Kirkliston to Winchburgh (path 38): no changes to journey length; slight reduction in amenity value due to views of the proposed scheme.	P9
East of Winchburgh (paths 60-62, 71): no changes to journey length; negligible change in amenity value.	n/a

Table 22.12: Potential Vehicle Traveller Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Decreased extent to which vehicle travellers would be able to perceive the landscape because of deep cutting, adjacent structures, false cuttings and environmental barriers.	VT1
Increased extent to which vehicle travellers would be able to perceive the landscape because the road would generally be at grade or elevated on embankment and/or existing woodland or landform is removed.	VT1
Increased driver stress at locations where traffic flows are predicted to increase relative to the Do-Minimum 2032 forecast: • Admiralty – Ferrytoll, southbound; and • M9 Spur, southbound.	VT1

Table 22.13: Potential Disruption Due to Construction Impacts

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Land Use (during construction)	
Key land uses potentially affected by disruption due to construction works: • residential properties, particularly those near the construction compounds and Main Crossing works e.g. Inchgarvie House and residents to the west of North Queensferry, South Queensferry and Kirkliston; • agricultural uses, which includes high quality (prime) agricultural land to the north and south of the Firth of Forth; • businesses, which include premises located adjacent to construction works along the B981, A8000 and Society Road; • fields and woodland used for amenity, including areas at St. Margaret's Marsh, land to the west of South Queensferry and also playing fields at Kirkliston Leisure Centre adjacent to the M9 Spur; • marine uses (commercial and recreational), particularly activities associated with Port Edgar Marina and also creel fishery areas around Beamer Rock and the Forth Rail Bridge); and • educational facilities, including Dalmeny Primary School which is located approximately 200m of major works.	DC1-8
The key potential temporary disruption impacts on land use are those related to: • changes in access and journey length, including disruption to properties along Society Road; • loss of overspill parking facility for one commercial premises (Deep Sea World) (refer to Figure 7.2); • temporary loss of agricultural land (and also amenity areas at South Queensferry) for the construction compounds and works associated with the proposed scheme; • temporary loss of gardens; • disruption to cultivation and land management practices, including restrictions to the movement of livestock or machinery and also changes to existing drainage; • dust and emission impacts, including a reduction in arable crop productions; • disruption due to temporary noise, vibration and visual impacts; • disruption to marine activities during construction of the Main Crossing; and • short-term disruption of utility supplies during switchover to new infrastructure, particularly for local businesses.	DC1-8
Landscape and Visual (during construction)	
The construction activities associated with the proposed scheme are expected to cause temporary adverse landscape and visual impacts, typically resulting from: • machinery including drilling rigs, cranes, excavating equipment, dumper trucks, bulldozers; • transfer of machinery and materials to and from the construction compounds for road works, and to the Firth of Forth for construction of the Main Crossing (including the use of barges and cranes); • exposed bare earth over the extent of the proposed road construction works; • highways and structures construction operations; • site compounds (refer to Figure 19.1) and associated access, parking and office accommodation; • soil storage mounds and construction materials stockpiles; • lighting associated with night-time working and construction compounds;	DC9-12

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
• signs and safety barriers; • traffic congestion and queuing traffic at road works; and • temporary works associated with bridge construction operations.	
Potential impacts on Rosyth, Inverkeithing, Castlandhill, and South Inverkeithing Bay LLCA: • Views of major road and roundabout construction works at Ferrytoll Junction. • Views of Main Crossing construction. • Views of new rock cuttings. • Views of the construction compound at Ferrytoll Junction. • Views of major construction works for the northern viaduct and Main Crossing. • View of any grouting works that may be required adjacent to the northern route between Ferrytoll Junction and Ferry Hill, and adjacent to the southern route between the A8000 and M9 spur (refer to Chapter 8: Geology, Contaminated Land and Groundwater).	DC9-12
Potential impacts on Rosyth Industrial Area LLCA: • Temporary construction compound to east of LLCA area. • Views of major road and roundabout construction works at Ferrytoll Junction. • Views of Main Crossing construction. • Views of new rock cuttings. • Views of the construction compound at Ferrytoll Junction. • Views of major construction works for the northern viaduct and Main Crossing. • View of any grouting works that may be required adjacent to the northern route between Ferrytoll Junction and Ferry Hill, and adjacent to the southern route between the A8000 and M9 spur (refer to Chapter 8: Geology, Contaminated Land and Groundwater).	DC9-12
Potential impacts on North Queensferry Coastal Flat LLCA: • Temporary construction compound to north of LLCA area. • Major construction works for the main crossing northern approach viaduct. • Major construction works for the B981 realignment and new access road to the west of the Dunfermline WWTW. • Views of major road and roundabout construction works at Ferrytoll Junction. • Views of Main Crossing construction. • Views of new rock cuttings. • Views of the construction compound at Ferrytoll Junction. • Views of major construction works for the northern viaduct and Main Crossing. • View of any grouting works that may be required adjacent to the northern route between Ferrytoll Junction and Ferry Hill, and adjacent to the southern route between the A8000 and M9 spur (refer to Chapter 8: Geology, Contaminated Land and Groundwater).	DC9-12

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Potential impacts on Ferry Hills LLCA: • Major construction works for the northern viaduct and Main Crossing. • New rock cuttings. • Major construction works for construction access roads. • Views of major road and roundabout construction works at Ferrytoll Junction. • Views of Main Crossing construction. • Views of new rock cuttings. • Views of the construction compound at Ferrytoll Junction. • Views of major construction works for the northern viaduct and Main Crossing. • View of any grouting works that may be required adjacent to the northern route between Ferrytoll Junction and Ferry Hill, and adjacent to the southern route between the A8000 and M9 spur (refer to Chapter 8: Geology, Contaminated Land and Groundwater).	DC9-12
Potential impacts on North Queensferry LLCA: • Views of major construction works for the Main Crossing.	DC9-12
Potential impacts on Firth of Forth LLCA: • Disturbance to calm and tranquil character from barges, cranes and major construction works for the Main Crossing and viaducts at the north and south shores. • Views of major construction works for the Main Crossing and viaducts at the north and south shores.	DC9-12
Potential impacts on South Queensferry LLCA: • Major construction works for the southern viaduct and Main Crossing. • Views of major road, roundabout and bridge construction at the Queensferry Junction • Views of construction compound and access road to the south abutment. • Views of major construction works for the southern viaduct and Main Crossing.	DC9-12
Potential impacts on Duddingston (north facing slopes) LLCA: • Temporary construction compound to northeast of LLCA area. • Major construction works for the Main Crossing, roads and roundabout at the Queensferry Junction. • Major construction works for the southern viaduct and Main Crossing. • Views of major road, roundabout and bridge construction at the Queensferry Junction • Views of construction compound and access road to the south abutment. • Views of major construction works for the southern viaduct and Main Crossing.	DC9-12
Potential impacts on Hopetoun LLCA: • Distant views of major construction works for the Main Crossing.	DC9-12

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
Potential impacts on Dundas LLCA: • Major construction works at the Queensferry Junction. • Views of the Main Crossing construction and also major road and roundabout works at the Queensferry Junction.	DC9-12
Potential impacts on Kirkliston LLCA: • Views of major road, junction and bridge construction at M9 Junction 1A.	DC9-12
Potential impacts on Overton LLCA: • Major construction works at Junction 1A. • Views of major road, junction and bridge construction at M9 Junction 1A.	DC9-12
Potential impacts on Duddingston (southern slopes)LLCA: • Temporary construction compound at Junction 1A. • Major construction works for road. • Major construction works for Swine Burn realignment. • Views of major road, junction and bridge construction at M9 Junction 1A.	DC9-12
Potential impacts on Newliston LLCA: • Construction works for detention ponds and access road at M9 Junction 1A. • Views of major road, junction and bridge construction at M9Junction 1A.	DC9-12
Air Quality (during construction)	
For the construction areas at Ferrytoll and South Queensferry, the magnitude of change for assessed receptors with regards to annual mean NO_2 concentrations varies from extremely small to small. The magnitude of change for PM_{10} concentrations ranges from extremely small to very small.	DC13-17
For the construction area at M9 Junction 1A, the magnitude of change for assessed receptors with regards to annual mean NO_2 concentrations varies from very small to medium. The magnitude of change for PM_{10} ranges from extremely small to small.	DC13-17
Key construction activities with the potential to create dust include top soil stripping, bulk excavation, drilling, grouting and import of materials, handling of soils, spoils and aggregates. In addition, at Ferrytoll potential dust raising activities such as blasting may be required for particular rock cuttings. Construction works at South Queensferry include demolition of the existing A8000 bridge and at the M9 Junction 1A, the partial demolition of the existing bridge over the B9080. The risk of dust nuisance experienced by all receptors within 50m (235 receptors) is considered High, whilst the dust nuisance potential for receptors within 100m (348 receptors) and within 200m (944) is considered to be of Medium and Low risk, respectively. There are 21 receptors within 50m at Ferrytoll, 152 at South Queensferry and 62 receptors at M9 Junction 1A. The risk of dust nuisance is higher at Inchgarvie House during certain activities, due to the close proximity of the construction works for the Main Crossing.	DC13-17
Noise and Vibration (during construction)	
A review of the construction activities for the proposed scheme indicates that the following may give rise to significant noise impacts: • removal of the 'cap' of Beamer Rock to form the foundations for the central tower of the Main Crossing; • top driven steel tubular piles to support the temporary jetties used to provide access to the pier locations for the north and south approach structures for the Main Crossing; • marine (bored) piling off the north and south shore of the Firth of Forth;	DC18-24

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
• mechanical rock breaking on the northern shore of the Firth of Forth for the construction of the north abutment; • sheet piling for the temporary bund off the south shore of the Firth of Forth; • construction of the south abutment; and • construction of the main highway works (a series of activities – drainage, earthworks, sub-grade pavement laying, highway furniture – that can be noisy in the immediate vicinity of the activity but do not occur at the same time in any one location and each is generally of a short duration at any one location).	
Construction noise impacts may occur at the following receptors: • St. Margaret's Hope (1 receptor); • Queensferry Hotel (1 receptor); • Tigh-na-grian (2 receptors); • St. Margaret's Hope Gatelodge; and • Inchgarvie House (1 receptor – 10 flats).	DC18-24
The following activities may give rise to vibration impacts: • removal of rock to create the access road to the north abutment; • compaction / vibro rolling of new road sub-grade and road surfacing: • impact driven piles (steel columns for temporary access trestle / jetty and sheet piles for coffer dams for main crossing piers S5 and S6); and • blasting (e.g. Beamer Rock and North of the Firth of Forth near Ferrytoll).	
Construction vibration impacts may occur at the following receptors: • Inchgarvie House (disturbance of occupants due to vibro-compaction of highway works and during the construction of the haul route); and • St Margaret's Hope Gatelodge (disturbance of occupants due to vibro-compaction of highway works).	DC18-24
Pedestrians, Cyclists, Equestrians, and Community Effects (during construction)	
During the construction period, pedestrians and other NMUs have the potential to be disrupted by: • temporary diversions of paths and cycleways e.g. along the B9080 where M9 Spur bridge widening may require diversion of the core path (refer to Figure 17.3); • creation of new paths and cycleways e.g. at Ferrytoll and along the B981 existing paths including a core path, NCR1, NCR76 would need to be temporarily diverted to maintain access; • construction traffic on local roads which may create busier crossing points e.g. for the core path and NCR 76 along Society Road, safe provision for pedestrians and cyclists would be required; • location of site compound on recreation areas which would reduce accessibility e.g. at Echline fields; • temporary community severance experienced by residents at Inchgarvie House resulting from the disruption to the access road to Society Road, and consequently potential for a reduction in access to community facilities in South Queensferry; and • effects on the amenity value of the path and cycleway network due to noise, dust, and also visual intrusion of the works.	DC25-30
Potential effects on the communities due to construction may include: • disruption of local bus services, for example, changes in journey times; • temporary diversions of paths, cycleways and minor roads which may increase journey time to community facilities; and	DC25-30

Description of Potential Impact	Mitigation Item (refer to Chapter 23)
• temporary severance where construction works disrupt or deter residents from accessing local facilities.	
Vehicle Travellers (during construction)	
It is anticipated that driver stress is likely to be increased during construction, particularly during peak time and for works that directly affect existing roads (primarily sections of the A90/M90, B981, M9, M9 Spur, A8000, A904 and B924). This would be caused as a result of, for example, increases in journeys times and delays due to temporary traffic lights, diversions and queuing traffic.	DC31-36
The proposed access to the construction compounds would avoid the need for construction traffic to travel through South Queensferry, however, some local disruption is anticipated along Society Road.	DC31-36
Negative impacts on drivers' view from the road are predicted due to the visual impact of construction works, including the works themselves and the associated temporary signage.	DC31-36
Other Environmental Parameters (during construction)	
• The proposed scheme has potentially significant impacts on geology, contaminated land and groundwater, through construction activities such as blasting, dredging of the Firth of Forth, and required earthworks. Dredging of the Firth of Forth, required in the construction of the southern approach viaduct to the Main Crossing, would potentially affect drift geology; however impacts are assessed as being negligible.	Refer to Table 22.2.
• The proposed earthworks in the southern study area have been identified as having potential contamination issues. These risks are considered moderate to low. In the northern study area, these impacts range from very low to very high. However, appropriate mitigation would be undertaken to avoid or reduce these impacts.	
• The construction of proposed scheme has potentially significant impacts on the water environment. These could include soil compaction from works traffic, alteration of run-off pathways, erosion and sedimentation of watercourses, dewatering of watercourses and increased flood risk.	Refer to Table 22.3.
• The construction phase has potential to impact on ecology and nature conservation interests. Potential impacts include the displacement of species due to noise or ground disturbance, severance of migratory or foraging routes, pollution and habitat loss. Appropriate mitigation will be required to avoid long-term or permanent ecological changes.	Refer to Table 22.4.
• Potential impacts on cultural heritage include changes to the setting of listed buildings, changes in access and also noise and vibration during construction of the proposed scheme. Some impacts, such as the removal and storage of the beacon light on Beamer Rock, occur during construction but would result in permanent changes to cultural heritage refer to Table 22.9.	Refer to Table 22.8.