JACOBS ARUP

A report on behalf of Transport Scotland and in association with Natural Capital

Forth Replacement Crossing

Sustainability Appraisal and Carbon Management Report

Appendix 3:

Indicator Results Table

November 2009

TRANSPORT SCOTLAND

natural CAPITAL

Appendix 3: Indicator Results Table

Reference		Indicator	Quantitative	Qualitative	Outcome	Comment
Objective	Target					
Economic						
1	1	Predicted number of planned closures	✓		123 lane-hours/year[1]	This figures refers to the overall mean proportion of lane closures on existing FRB for planned inspection and maintenance activities between 0600 and 2000 hrs daily compared to full carriageway availability (years 2004 to 2008). This figure can be used to compare future performance on the FRC scheme
		Actual number of planned closures	✓		To be monitored during operation	The Stage 3 design of the proposed scheme should facilitate an improvement on this baseline figure. For example, provision of hard shoulders and the central margin between the carriageways on the Main Crossing should reduce the impact of planned maintenance activities on traffic flow. It is also assumed that maintenance activities on the Main Crossing will be less than currently experienced on the Forth Road Bridge, which is requiring ongoing monitoring and maintenance of the cables
	2	Predicted number of unplanned (non-weather) closures	✓		80 lane-hours/year[2]	This figure refers to the mean number of breakdowns and accidents per year experienced on the FRB is 183.1 and the mean time taken to clear these incidents is 21 minutes. For the purposes of determining this Indicator it is assumed that 75% of incidents will affect one lane only of the carriageway concerned and that 25% will affect two lanes. On this basis, the actual number of unplanned closures experienced by FRB is 80 lane-hrs/year. This figure can be used to compare future performance on the FRC scheme
		Actual number of unplanned (non-weather) closures	✓		To be monitored during operation	A number of features have been incorporated into the design that will deliver an improvement on the baseline figure, these include: provision of hard shoulders; special windshielding at the towers (if necessary) will reduce accidents due to the "wind shadow" effect; use of an integrated traffic management system (ITS) will allow incidents to be managed to minimise disruption to traffic

[1] 1 la-hr represents one lane open to traffic for one hour [(0.8% + 0.6%) / 2 =0.7% full availability = 0.007 X 17520 = 123] Where 0.8% is the northbound carriageway availability; 0.6 % is the southbound carriageway availability and 17250 is based on each carriageway of the FRB having two traffic lanes and so the maximum lane availability in each direction crossing the Forth is 2 x 8760hours per year = 17520 la-hrs.

[2] (0.75 x 183.1) x 1 x (21/60) + (0.25 x 183.1) x 2 x (21/60) = 48.1 + 32.0 = 80.1 lane-hours/year (round up to 80 lane-hours/year.)

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	3	Predicted number of closures to any class of vehicle due to adverse weather conditions	✓		843 hour/year (taken as an average from FETA logbooks 2002-2008)	The annual mean number of hours when restrictions are in place on the FRB because of wind is 843 hours. The emergency sign data gives the recorded usage of the emergency signs for strong winds. This data provides a good indicator of the annual cumulative duration of vehicle restrictions on the bridge due to adverse weather conditions. This figure can be used to compare future performance on the FRC scheme.
		Actual number of closures to any class of vehicle due to adverse weather conditions	✓		Can be monitored during operation	Windshielding on the FRC will allow traffic to cross the Forth at wind speeds where restrictions would be in place on the FRB. This will have a major positive impact on the reliability of the crossing.
2	1	Percentage of road journeys that do not take longer than 115% of the average journey time (Traffic Scotland Local Trunk Road Congestion Indicator 4)	✓		Forth Road approach from the north – 98.4% of northbound and 96.7% of southbound journeys do not take longer than 115% of the average journey time M8 Junction 2 to M9 spur – 89.3% of northbound and 94.8% of southbound journeys do not take longer than 115% of the average journey time	These figures are taken from Traffic Scotland's 2006 journey reliability indicators for the existing monitored routes likely to be directly affected by the Managed Crossing Strategy.
	2	An indicator for monitoring this target has not been identified			It is considered that the proposed scheme could contribute to this target by providing the dedicated public transport crossing and access routes.	The structure of public transport service delivery in Scotland is such that much of it is delivered from other private and public sector agencies. The proposed scheme is designed to not preclude any future improvements in public transport, and Transport Scotland is currently investigating possibilities for improvements with partner delivery organisations (see below). It should be noted however that Transport Scotland cannot be fully responsible for their delivery (and therefore monitoring).
	3	Average time lost per vehicle kilometre (veh-km)	✓		Forth Road approach from the north – 3.35 seconds per veh-km northbound, and 7.07 seconds per veh-km southbound M8 Junction 2 to M9 spur – 9.48 seconds per veh-km northbound and 5.98 seconds per vehicle-kilometre southbound.	Traffic Scotland's 2006 "lost time to congestion" indicators for the existing monitored routes likely to be directly affected by the Managed Crossing Strategy.
3	1	Provision of cross-Forth infrastructure to facilitate multi-modal transport		✓	Facilitation of new & improved car/bus interchanges Improved reliability for bus services, evidenced by the provision of a dedicated public transport crossing Scope for additional services and routes The scheme also retains existing cross-Forth walking and cycling infrastructure.	
4	1	Absolute area of agricultural land lost by land type	✓		100 ha agricultural land lost to the scheme includes: • 74 ha prime land • 6.2 ha non-prime land • 12.7 ha woodland • 7.1 ha scrub	Reference: Environmental Statement Chapter 7: Land Use
		Proportion (%) of land returned to agricultural use	✓		11% land returned to agricultural use (12.5 ha of 112.5 ha = estimated permanent land loss reduced to 100ha)	Reference: Environmental Statement Chapter 7: Land Use

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		Proportion (%) of landholdings, businesses, residential properties and areas of community land significantly affected as a result of land-take	✓		Agriculture	3 agricultural interests (43%) significantly impacted.	Reference: Environmental Statement Chapter 7: Land Use
					Commercial	5 properties (45%) significantly impacted.	
					Residential	1 property (50%) significantly impacted.	
					Community Land	1 land interest (14%) significantly impacted due to high sensitivity.	
					Development Land	1 land interest (13%) significantly impacted where land-take is over 5 ha.	
	2	Proportion (%) of affected agricultural land holdings where the degree of severance less than 10% of the total land holding	✓		86%: 6 out of the 7 land holdings affected by severance would be affected by less than 10%		Reference: Environmental Statement Chapter 7: Land Use
		Proportion (%) of land holdings affected by severance where access will be maintained through the provision of new or upgraded overbridges/underpasses as part of the scheme or through accommodation works	✓		100%: Alternative access will be provided for all agricultural land holdings, residential and commercial properties where existing access arrangements would be affected		Reference: Environmental Statement Chapter 7: Land Use
5	1	A sustainable resource management framework in place and in use		✓	A Sustainable Resource Management Framework has been produced and is provided in Appendix 5		Reference: Sustainable Resource Management Framework
	2	Development of a specific materials plan		✓	A Materials Plan is included in the Sustainable Resource Management Framework		Targets have been developed based on the Stage 3 design, including materials recovery, re-use and recycling, and the use of locally sourced materials. These targets have also been set as aspirations for the Final Design
		Percentage reduction in specific materials as compared with Stage 3 design	✓		To be assessed at Tender Design Stage against Stage 3 baseline		
Social							
6	1	Demonstrate a thorough and inclusive stakeholder identification process		✓	160 consultees (including Historic Scotland, SEPA, SNH, local authorities, and community councils) Over 100 landowners and tenants consulted		The process undertaken in identifying relevant consultees for the proposed scheme aimed to ensure that all relevant consultees were included. Reference: Consultation and Engagement Report Environmental Statement Chapter 6: Consultation and Scoping

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	2	Range of methods of engagement and communication channels		✓	Engagement took place on an ongoing basis but meetings were specifically set up with stakeholders at key junctures in the project as follows: Spring 2008 to outline details of the selected crossing, introduce project team members, outline the programme of works and establish working relationships with stakeholder groups Early 2009 (to outline details of the revised crossing strategy and road corridor selection and gain feedback on the developing proposals) Spring 2009 to consult on proposed amendments to the road layout and junctions Public exhibitions in January 2009, with a further round to be held in November 2009. Summer 2009 to consult on landscaping and mitigation, construction approach and construction compounds	A portfolio of methods was used to target as wide an audience as possible (e.g. printed newsletters, ezines, press releases) Reference: Engaging with Communities Stakeholder contact reports: Public Information Exhibitions – Feedback & Outcomes Report
		Delivery of consultation commitments in 'Engaging with Communities'		✓		
	3	Facilities for stakeholders to feed into the project development		✓	Opportunities for two-way dialogue included: • Stakeholder meeting (including community councils, resident associations, public meetings) • FRC email enquiry line • FRC enquiry telephone line • via letter, address details on website The public exhibitions in January 2009 and ongoing community liaison provided further opportunity for stakeholders to feedback their views and contribute to the design stage.	Contact details were on the website and printed on letters/ leaflets that were issued. These services were ongoing throughout the design. Reference: Project website: www.forthreplacementcrossing.info Feedback and Outcomes Report and supporting database Stakeholder contact reports Consultation and Engagement Report
		Demonstrate stakeholder comment has been taken into consideration during the project development		✓		
7	1	Number of pedestrian/cycle paths which would experience a reduction in traffic flows at non-signalised road crossing points	✓		Relief from existing severance would occur at one location, south of South Queensferry, east of the proposed Queensferry Junction, where an approximate 70% decrease in traffic flow is predicted	Whilst reductions are noted at five other crossing points, traffic flows on these local roads are less than 8,000 AADT, which is considered to be unlikely to provide any significant severance relief in terms of DMRB criteria. Some minor local benefits could however be experienced. Reference: Chapter 17 of the ES: Pedestrians, Cyclists, Equestrians and Community Effects
	2	Number of paths/cycleways improved/created/disrupted	✓		Improved 28 existing paths/ cycleways would be improved Created 5 footpaths 3 combined footpath/ cycleways (1 part of NCR1, 1 part of NCR76) 1 new cycle path (part of NCR1) Disrupted	Improved The majority of these improvements would be due to slight changes in amenity value Created Realignment of the B981 would include a replacement footpath and a new cycle path (part of NCR 1) to maintain safe access along it. Access from St Margaret's Marsh would also be maintained.

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					9 existing paths and cycleways (including parts of NCR1 and NCR76) would be disrupted	Realignment of the A90 from Ferrytoll to the Forth Road Bridge would include realignment of the combined footpath/ cycleway (part of NCR1). At Ferrytoll and Queensferry Junctions access would be maintained across the proposed scheme by footpaths and cycleways (parts of NCR76 at Ferrytoll) with improved crossing provisions. New footpaths at Castlandhill Road and from the A8000 overbridge would improve accessibility by increasing the links between paths. Disrupted The proposed scheme would directly sever and affect access along some existing paths and cycleways. Access would be maintained via replacement paths, new paths and diversions Reference: Chapter 17 of the ES: Pedestrians, Cyclists, Equestrians and Community Effects
	3	Percentage increase in the number of households within 400m of a high frequency bus service	✓		Based on data for 2007, approximately 29% of dwellings in the SESTran area are within 400m of a high frequency bus service.	It is currently unknown how access to high frequency buses might change in the future as a result of the FRC scheme. Responsibility for delivery (and therefore monitoring) of public transport services is largely a matter for other private and public sector agencies, outwith the scope of the FRC scheme.
8	1	The number of pedestrian or cyclist networks retained or amended on their current alignment, or aligned in accordance with Transport Scotland's "Disability Discrimination Act Good Practice Guide for Roads"	✓		All existing pedestrian and cyclist routes will be maintained with the proposed scheme. Where practicable, they will also be improved in accordance with Transport Scotland's "Disability Discrimination Act Good Practice Guide for Roads". Some routes will retain their current alignment while others will be realigned, however, all will benefit from design measures such as minimum footway widths, tactile paving and best practice at pedestrian crossings while shared routes will be designed in accordance with the Scottish Executive's "Cycling by Design." A new access ramp linking the B981 and the west side of the Forth Road Bridge has also been designed in accordance with Transport Scotland Guidance and will be DDA complaint. This will maintain and improve on the existing access for disabled users to the Forth Road Bridge. Longitudinal gradients is the one area of the Guide where the standard will not be achieved. Pedestrian routes in the vicinity of Ferrytoll Junction are currently in excess of the minimum 5% specified in the Guide. Due to the constraints created by topography and the land available to make improvements, the existing gradients will be retained.	All proposals will be presented to local disabled people, a key process of DDA 2005. This will allow the opportunity for feedback and suggestions, which will be considered in further optimisations of the design. Reference: Transport Scotland (2009) Disability Discrimination Act Good Practice Guide for Roads

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	2	Consideration of disabled access in the development of the design		✓	The Main Crossing Bridge Deck Configuration and Incident Management Report takes account of the needs of disabled people. In the event of a major incident on the bridge traffic would be stopped and it would be possible to escort all people back along the carriageway to a muster point.	The Intelligent Transport System would be used in such a situation to close the road downstream.
		Emergency telephones accessible to disabled people			Emergency telephones, accessible to disabled people, will be provided. Attempts will be made to co-locate emergency telephones with signalised gantry hard standing areas and where this is not possible, stand alone sites will be adopted.	
		Temporary footpaths/ cycleway diversions during construction in accordance with Transport Scotland's "Disability Discrimination Act Good Practice Guide for Roads"		✓	Construction work will not act as a barrier to disabled people. The contract will specify that any temporary NMU routes be designed in accordance with the Guide.	
9	1	The number of open/green spaces in the vicinity of the scheme experiencing significant positive/negative effects, measured according to direct loss, effects on amenity, views and accessibility	✓		Significant adverse affects on Echline fields, west of South Queensferry - loss of local paths, approximate 57% loss of land. Reduced access from South Queensferry to the west of the proposed scheme would result in residual impacts of moderate significance. Access maintained east to west via paths and cycleways on the Queensferry Junction and routes via Society Road. Residual beneficial impacts for the Echline and Ferry Glen community woodlands, associated local paths and Inchcolm Park in South Queensferry.	Reference: Environmental Statement Chapter 7: Land Use Environmental Statement Chapter 17: Pedestrians, Cyclists, Equestrians and Community Effects
	2	Training places provided that are recognised and accredited by the CITB-Construction Skills and which lead to a qualification of at least Scottish Vocational Qualification (SVQ) Level 2 or higher.	✓		This set of indicators is to be monitored and reported by Transport Scotland during construction stage.	
		Training places provided that are recognised and accredited by Professional Bodies (such as the Institution of Civil Engineers) leading to membership of the Professional Body.				
		The number of employment opportunities for those who are currently long-term unemployed.				
		Proportion of training and employment opportunities taken by local people, and for residents of deprived areas.				

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Reference		Indicator	Quantitative	Qualitative	Outcome	Comment
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	3	Public Transport journey times to key economic centres in the region for communities where geographic access is a factor in high levels of deprivation			Quantitative journey time information is not available at this stage to enable this indicator to be monitored.	
	4	Proportion of the population in deprived communities predicted to be directly affected by construction impacts Proportion of the population in non-deprived communities predicted to be directly affected by construction impacts	✓		Areas directly affected by the proposed scheme are all within SIMD percentile groups 5 to 10, or the 60% least deprived areas within Scotland. The most deprived areas located along the proposed scheme route are in SIMD percentile 5, and these comprise 11% of the total area. There therefore does not appear to be a tendency for locating the proposed scheme in any of the most deprived areas in Scotland.	The Scottish Index of Multiple Deprivation (SIMD) ranks 6,505 data zones across Scotland according to deprivation indicators, 1 being the most deprived and 6,505 the least deprived. The overall SIMD rankings provide a picture of relative deprivation, and areas can be divided into 10-percentile brackets, with the areas ranked 0 to 646 identified as the most deprived 10% (1) and the areas ranked 5855 to 6505 identified as the least deprived 10% (10).
10	1	Predicted accident rates	✓		Data for predicted accident rates will be contained in the Accident Review Report currently being drafted by the traffic team	Reference: Cross section plans of the main crossing Scheme layout plans Kerbs, Footways and Paved area plans
		Actual accident rates	✓		To be monitored during operation	The scheme complies with the Design Manual for Roads and Bridges (DMRB) with appropriate departures from standard identified at a number of locations where environmental or cost constraints have merited their inclusion. Various other safety-related improvements are included such as wind shielding, widened hard shoulders and the introduction of controlled crossing points for pedestrians and others. The ITS system will also assist in managing safety on the road network through lane signalling, mandatory variable speed signalling, variable message signs, incident management and information on adverse weather conditions
Environmental						
11	1	Predicted cut and fill design volumes (Stage 3)	✓		Assessment of cut and fill volumes (1000m3): • North Cut / Fill: 295 / 340(45 deficit) • South Cut / Fill: 535 / 585 (50 deficit) • Jct 1A: Cut / Fill: 165 / 300 (135 deficit)	Vertical and horizontal alignment requirements to be considered in appraisal Reference: Stage 3 Scheme Assessment Report
		Predicted cut and fill design volumes (tender design)	✓		To be assessed at Tender Design Stage	
		Actual cut and fill volumes achieved (as built)	✓		To be assessed at Final Design and Construction Stage	

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Reference		Indicator	Quantitative	Qualitative	Outcome	Comment
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		Predicted and actual proportions by volume of cut material that is used on site as part of the works	✓		Assessment of cut and fill volumes (1000m3). Maximising use of site won materials (minimising export): • North Cut used / Total Cut: 255 / 295 (86%) (40,000m3 exported) • South Cut used / Total Cut: 480 / 535 (89%) (55,000m3 exported) • Jct 1A: Cut used / Total Cut: 145 / 165 (87%) (20,000m^3 exported)	Consideration of north, south and Junction 1A as individual entities reduces possible economies of scale (especially Junction 1A and South areas). The assessment assumes the following volumes of unsuitable material have been processed to allow incorporation in the works thereby reducing import (and export) volumes: North 38,000m^3, South 167,000m^3 and Junction 1A 66,000m^3. Reference: Stage 3 Scheme Assessment Report
		Predicted and actual proportions by volume of fill material that is site won (including modified material)	✓		Assessment of cut and fill volumes (1000m3). Minimising imported volumes: • North: Imported fill / Fill used: 85 / 340 (25%) South: Imported fill / Fill used: 105 / 585 (18%) Jct 1A: Imported fill / Fill used: 155 / 300 (51%)	Consideration of north, south and Junction 1A as individual entities reduces possible economies of scale (especially Junction 1A and South areas). The assessment assumes the following volumes of unsuitable material have been processed to allow incorporation in the works thereby reducing import (and export) volumes: North 38,000m^3, South 167,000m^3 and Junction 1A 66,000m^3. Reference: Stage 3 Scheme Assessment Report
		Actual quantities of recycled materials used during construction	✓		To be assessed at Final Design and Construction Stage	Inclusion of recycled aggregates in scheme (link to Target 2 below for transport distance).
	2	Predicted % materials by type sourced locally – within 10km	✓		Assessment of local sourcing of earthworks materials (%): • North distance travelled: <10km: 0%; >10, <80km: 100%; >80km: 0% • South distance travelled: <10km: 100%; >10, <80km: 0%; >80km: 0% • Jct 1A distance travelled: <10km: 100%; >10, <80km: 0%; >80km: 0%	Consideration of north, south and junction 1A as individual entities reduces possible economies of scale.
		Predicted % materials by type sourced locally – within 80km	✓		Assessment of local landfill or excess earthworks materials (%): • North distance travelled: <10km: 0%; >10, <80km: 100%; >80km: 0% • South distance travelled: <10km: 0%; >10, <80km: 100%; >80km: 0% • Jct 1A distance travelled: <10km: 0%; >10, <80km: 100%; >80km: 0%	Split landfill sites between area North and areas South and Jct 1A thereby changing haulage distances for South and Jct 1A compared to those shown.
		Actual % materials by type sourced locally– within 10km	✓		To be monitored during final design and construction stage	
		Actual % materials by type sourced locally – within 80km	✓			

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	3	Predicted % of materials used that are from recycled sources	✓		There are a number of products used in the construction of a road that could be derived from recycled materials such as kerbing, fencing and plastic pipes. The use of any recycled materials should comply with the Manual of Contract Documents for Highway Works (MCHW) (Highways Agency 1992) and British Standards.	
		Actual % of materials used that are from recycled sources	✓		To be monitored during Final Design and Construction Stage	
	4	Area of brownfield/contaminated land brought back into beneficial use, according to environmental risk	✓		The proposed scheme passes through and adjacent to areas of development land, some of which are allocated for residential use in the future. The scheme would therefore improve accessibility to these development sites providing benefit to the area.	
12	1	Estimated embodied energy and carbon	✓		The total embodied energy for the scheme is estimated to be 3,129,574 GJ and the total embodied carbon would be 232,074 tCO_2	The figure provided here is based on the assumption that the orthotropic single deck box girder is selected for the cable-stay bridge and twin composite box girder for the approach viaduct. Details of estimated embodied energy and carbon for other option are included within the main Energy and Carbon Report (Appendix 6) Reference: Appendix 6 Energy and Carbon Report
		Actual embodied energy and carbon in materials, transportation and waste	✓		To be monitored during Final Design and Construction	
	2	Predicted energy requirement and CO_2 emissions	✓		Not estimated for Stage 3 design, since detailed methods of construction are not known at this stage. Once the Contractor develops the detailed design and construction methodology, meaningful figures can be calculated.	
		Actual energy used and CO_2 emissions	✓		To be monitored during Final Design and Construction.	
13	1	Predicted CO_2 emissions per veh-km	✓		Comparing the 2017 Do-Minimum and 2017 Do-Something scenarios, there is predicted to be an increase in emissions of 14,952 tCO_2 per annum Comparing the 2032 Do-Minimum and 2032 Do-Something scenarios, there is predicted to be an increase in emissions of 20,317 tCO_2 per annum The increase in emissions between the Do-Minimum and Do-Something scenarios is consistent with the increase in vehicle kilometres travelled along the traffic links selected for the regional air quality assessment. In 2017, Do-Something, 8,519,626 tonnes of CO_2 are estimated to be produced with 104,194,154 vehicle km travelled, equating to 0.08 tonnes of CO_2 per vehicle km travelled.	The assessment of air quality is made in terms of the difference between the air quality that would be likely with the proposed scheme (the 'Do-Something' scenario) and without the proposed scheme (the 'Do-Minimum' scenario) for both the anticipated year of opening (2017) and the design year 15 years after opening (2032). The future Do-Minimum scenario assumes that the Forth Road Bridge is still in operation Findings from the PHEM model indicate that during the congested morning peak period, CO_2 emissions from the additional distance travelled may be offset to a significant degree by a reduction in emissions arising from the decreased congestion that the proposed scheme as a result of the improved network efficiency and by the use of Intelligent Transport

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							Systems (ITS). There is less congestion relief in the evening peak and therefore a lower offsetting effect during this period. Reference: Environmental Statement Chapter 15: Air Quality
	2	Predicted energy requirements	✓		The predicted operational energy use for the following scheme components in the Stage 3 design is: • Main Crossing dehumidification system (deck cells, southern approach viaduct and towers): 1,067,625 kWh per year. • Lighting (for Main Crossing and road infrastructure): 1,000,196 kWh per year. • ITS (based on 65 gantries): 1,959,922 kWh per year.		A number of design measures aimed at reducing energy use have been discussed within the project team. These included the use of energy efficient lighting and ITS equipment.
		Actual energy requirement	✓		To be monitored during Final Design and Construction Stage		
	3	Predicted energy sources		✓	No data available at this stage. To be assessed at the Tender Design Stage		
		Actual energy sources		✓	To be monitored during Final Design and Construction Stage		
14	1	Number and type of sites (e.g. international and local) and protected species impacted and significance of predicted impacts	✓	✓	Terrestrial Habitats	Significant positive residual impact at Swine Burn. Significant positive residual impact at St. Margaret's Marsh (pending further consultation and agreement).	Reference: Environmental Statement Chapter 10: Terrestrial and Freshwater Ecology; & Chapter 11: Estuarine Ecology
					Bats	During construction some significant negative residual impacts at Port Edgar Barracks and West of South Queensferry. Significant positive residual impacts of high magnitude are predicted at North and South Queensferry during operation, due to the provision of a third crossing over the Firth of Forth which would facilitate further bat movements between Fife and the Lothians.	
					Otters	During construction, there would be some significant negative residual impacts at the Swine Burn, Niddry Burn and River Almond. In the long- term these impacts are not considered to be significant.	
					Freshwater Ecology	Significant positive residual impacts of medium magnitude during operation for all receptors through the inclusion of meanders and bends as part of the Swine Burn realignment, in addition to the provision of riparian planting Significant positive impact of low	

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						magnitude for freshwater fish would remain due to increased cover provided by the new culvert on the Swine Burn and extensions to existing culverts on Swine Burn and Niddry Burn.	
					Estuarine Ecology	During construction, residual impacts from noise and vibration on estuarine ecology have been assessed as extremely unlikely to occur. IN the event impacts do result they would be of low magnitude. During construction, residual impacts of temporary and permanent benthic habitat loss are certain to occur resulting in a residual impact of low magnitude. During construction, mitigation would reduce the likelihood of a chemical spill during the construction phase and an impact is extremely unlikely to occur. Should a spill occur it may result in a significant residual impact of low magnitude. During operation, the impact of a spillage from a road traffic accident on the Main Crossing on all receptors is extremely unlikely to occur. Should a spill occur it may result in a significant residual impact of low magnitude.	
		Actual impacts on sites and protected species during construction		✓	To be monitored during Final Design and Construction Stage		
	2	Number of watercourses impacted and significance of predicted impacts	✓	✓	There are 10 waterbodies within the study area that would be potentially impacted by the proposed scheme. With mitigation, during both construction and operation, residual impacts on all of these waterbodies would be reduced to Slight or Negligible significance. Impacts on water quality would be reduced to negligible for all 10 waterbodies.		Reference: Environmental Statement Chapter 9: Water Environment
		Actual number of watercourses impacted and significance of impacts	✓	✓			
		Actual impacts on water quality		✓			
		Number of reported roadkills of protected species	✓		To be monitored during operation		
		Percentage area of new habitats compared with areas lost	✓		Habitat Type	Habitat Change (inc. mitigation) (ha)	Reference: Environmental Statement Chapter 10: Terrestrial and Freshwater Ecology
					Dense/Continuous Scrub	+5.8	
					Plantation broadleaved woodland	-3.2	
					Plantation mixed woodland	+19.2	
					Poor semi-improved grassland	-4.9	
					Scattered scrub	-1.1	

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					Semi-improved neutral grassland	+35.0	
					Semi-natural broadleaved woodland	-1.2	
					Swamp	<1	
		Number of new records of species and habitats of nature conservation value	✓		To be monitored during operation		
15	1	Reported significance of residual landscape effects		✓	North of the Firth of Forth: the Main Crossing and northern route would have significant adverse impacts for the landscape of Ferry Hills and the area of reclaimed coastal flat, which features St. Margaret's Marsh, west of North Queensferry. South of the Firth of Forth: the landscapes of South Queensferry and the farmland of Duddingston, to the west of South Queensferry, would be adversely affected by the Main Crossing and southern connecting roads. Main Crossing impacts are considered adverse in this location owing to the presence of the bridge abutment and approach road structures. The designed wooded landscape of Dundas would also be adversely affected by significant impacts from the proposed scheme. Elsewhere, impacts upon the surrounding landscape would not be significant.		The most notable effects of the proposed scheme would occur at Ferry Hills, where proposed mitigation to reduce potential impacts includes naturalistic grading of the rock cutting, and planting along embankments and cuttings to replace lost vegetation. However, residual impacts of Substantial significance would remain from the north landing of the Main Crossing and the northern route, which would both cut into the west of this wooded coastal hill. This would affect the setting of Admiralty House and resulting in loss of woodland, altered landform, rock cutting and shading Reference: Environmental Statement Chapter 12: Landscape
		Number of and significance of direct and indirect residual effects on cultural heritage sites	✓	✓	There are two sites which are predicted to experience residual direct impacts of moderate significance: Beamer Rock Beacon and Dundas Castle Designed Landscape. Significant residual impacts on setting are predicted for five sites: substantial at St. Margaret's Hope, St. Margaret's Hope Relict Country Estate and Port Edgar Harbour Barrack Complex; and moderate at Ferry Craig, South Queensferry, Inchgarvie House and Inchgarvie House Lodge. All other residual impacts would be of slight or neutral significance, with slight positive impact on the setting of the Forth Road Bridge.		356 sites of cultural heritage importance were identified for the study area Reference: Environmental Statement Chapter 14: Cultural Heritage
		Actual number of and significance of direct and indirect residual effects on archaeological sites and monuments	✓	✓			
16	1	Noise level changes and associated changes in nuisance levels at quantified numbers of dwellings/groups of dwellings within 600m in accordance with DMRB methodology	✓		Construction noise may potentially create temporary adverse impacts in the vicinity of the compound. Mitigation will reduce these impacts and a Code of Construction Practice will assist the Contractor in ensuring that disruption is kept to a minimum. Mitigation has been proposed to reduce the significant adverse noise effects during operation. Noise nuisance analysis: noise level increases of less than 3dB(A) would affect 2180 fewer dwellings than without the proposed scheme and 990 more dwellings would be subject to increases of greater than 3dB (A). Noise level decreases of less than 3dB(A) would affect 560 more dwellings than without the proposed scheme and 630 more dwellings would be subject to decreases of greater than 3dB (A).		Reference: Environmental Statement Chapter 16: Noise and Vibration

Appendix 3: Indicator Results Table

Reference		Indicator	Quantitative	Qualitative	Outcome	Comment
Objective	Target					
		Number of legitimate complaints about noise nuisance	✓		To be monitored during construction and operation.	
	2	Absolute concentrations (µg/m^3) for NO_2 and PM_{10} at selected residential properties and other sensitive receptors	✓		The predicted concentrations of NO2 and PM10 at selected residential properties and sensitive receptors, as a result of the proposed scheme, do not exceed 40µg/m3 and 18µg/m3 respectively. The highest values predicted for the receptors assessed within the study area are 29µg/m3 for NO_2 and 14.4µg/m3 for PM_{10}. No mitigation measures are proposed with respect to operational traffic, but during construction the Contractor will implement a Dust and Air Quality Management Plan to limit air pollution.	Reference: Environmental Statement Chapter 15: Air Quality
	3	Dust deposition rates during construction that exceed 200mg/m^2/day	✓		The amount of dust generated from the construction of the proposed scheme is not predicted to exceed 200mg/m2/day at the construction sites or sensitive receptors. The contractor has an obligation under the Environmental Protection Act 1990 to use best practicable means to prevent or counteract the effects of any dust nuisance. The contractor will prepare and implement a Dust and Air Pollution Management Plan to set out the controls to be implemented to limit dust and air pollution due to the works. Dust mitigation measures as set out in the Code of Construction Practice, ES and Employers Requirements will aid the minimisation of dust nuisance at sensitive receptors, and this will reduce the risk to medium to low and would occur on a short to medium term basis only.	Reference: Environmental Statement Chapter 19: Disruption Due to Construction
		Dust deposition rates for biological SSSIs that exceed 1000mg/m^2/day				
17	1	Percentage of mainline drainage passing through SUDS	✓		Approximately 80-85% of drainage for trunk roads including motorways will pass through SUDs. Water quality at all watercourses affected by the proposed scheme is negligible.	The vast majority of surface runoff for the trunk roads, including motorways, passes through SUDs. The only exception to this is the main crossing over the Forth. The sections of the crossing that are over land and the intertidal zones will drain back to a SUDs basin on either side of the crossing. The centre section of the crossing will drain directly into the Forth. Reference: Environmental Statement Chapter 9: Water Environment
	2	Attainment of CAR Licence		✓	Consultations have been held with SEPA regarding the CAR licence and it is the intention to pursue a CAR licence from the agreement in principle. The licence will require a report to be submitted outlining in detailing the five watercourse crossings, realignments and culvert extensions that are being proposed. In addition plans showing the drainage outfall details will be prepared.	Reference: Environmental Statement Chapter 9: Water Environment Scheme layout plans CAR licence CAR Workshop minutes SEPA meeting minutes