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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix WR-001-OR003

Water resources and flood risk

Off-route works: Annandale depot

Water Framework Directive preliminary compliance assessment

M302

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Department for Transport

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1 Introduction

1.1.1 This report is an appendix to the water resources and flood risk assessment for the off-route works at Annandale depot, it reports on the interaction of the Proposed Scheme with the objectives of the Water Framework Directive (WFD)[1].

1.1.2 This appendix should be read in conjunction with Volume 4, Off-route effects and Volume 5 Appendices.

1.1.3 The following related reports should also be referred to:

- a Water resources assessment for the off-route works (Volume 5: Appendix WR-003-OR003); and
- a Draft water resources and flood risk operation and maintenance plan (Volume 5: Appendix WR-007-00000).

1.1.4 Additional information relevant to this assessment is set out in Background Information and Data (BID):

- Water Framework Directive preliminary compliance assessment baseline data (BID WR-002-OR003)[2]; and
- Water resources assessment baseline data (BID WR-004-OR003)[3].

1.1.5 The WFD compliance assessment for the main works is summarised in Volume 3, Route-wide effects, Section 16 and detailed in the WFD compliance assessment Volume 5: Appendix WR-001-00000.

1.1.6 Maps referred to within this assessment are contained in the Volume 5, Water resources and flood risk Map Book: Map Series WR-03.

1.2 Purpose of this appendix

1.2.1 The WFD aims to protect and enhance the quality of the water environment. It takes a holistic approach to the sustainable management of water by considering the interactions between surface water, groundwater and water-dependent ecosystems. Under the WFD,

[1] Water Environment and Water Services (Scotland) Act 2003 (WEWS Action) and supporting Regulations. Available online at: https://www.legislation.gov.uk/asp/2003/3/contents.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Water Framework Directive preliminary compliance assessment baseline data,* BID WR-002-OR003. Available online at: http://www.gov.uk/government/collections/hs2–phase–2b–crewe–manchester–environmental–statement.

[3] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background Information and Data, Water resources assessment baseline data,* BID WR-004-OR003. Available online at: http://www.gov.uk/government/collections/hs2–phase–2b–crewe–manchester–environmental–statement.

'water bodies' are the basic management units and are defined as all or part of a river system or aquifer. These water bodies form part of a larger 'river basin district' (RBD), for which 'river basin management plans' (RBMP) are developed and environmental objectives are set for all water bodies. These RBMP are produced every six years by the Environment Agency in England and by the Scottish Environment Protection Agency (SEPA) in Scotland, in accordance with the river basin management planning cycle.

1.2.2 The Proposed Scheme off-route works have the potential to affect surface water and groundwater bodies within the Gretna Coastal catchment of the Solway-Tweed RBD. A preliminary assessment of the Proposed Scheme's compliance against the WFD objectives for each of these water bodies is required. For works in Scotland, Scottish Environment Protection Agency's undertakes WFD compliance assessments as part of a determination under Controlled Activity Regulations (CAR) licensing. This report aims to provide information needed for preliminary discussions with SEPA relating to expectations for the licensing of works affecting WFD surface and groundwater bodies, and identify any required mitigation. Licensing of the works would be needed at a later stage of the project.

1.2.3 The assessment is based on consideration of the Proposed Scheme design (as shown in the Volume 4, Off-route effects Map Books: Map Series CT-05 and CT-06), which includes a range of avoidance and mitigation measures in the design.

1.2.4 This report summarises the preliminary WFD screening and scoping assessment process, its results and the additional mitigation required to achieve compliance with WFD legislation.

1.3 Scope of the WFD compliance assessment

1.3.1 A detailed description of the WFD Compliance assessment scope and methodology is provided in the Environmental Impact Assessment Scope and Methodology Report (SMR), WFD Compliance assessment process Technical note (Volume 5: Appendix CT-001-00001). This assessment has followed the principles of this approach, with some minor variations related to the different approach to WFD compliance in Scotland.

1.3.2 The spatial scope of the assessment includes all WFD designated surface water and groundwater bodies with potential to be affected by the Proposed Scheme off-route works - Annandale depot.

1.3.3 The assessment has been undertaken at the water body scale. For surface water bodies, the assessment considers all tributary watercourses that are potentially affected by the Proposed Scheme. It considers the potential impacts on all of the quality elements associated with these surface water bodies and also groundwater bodies.

1.3.4 Temporary adverse impacts are reviewed on a case-by-case basis and not considered to result in a deterioration of status if the water body:

- is only impacted for a short time period (less than three years);
- is likely to recover within a short time period (less than three years); and/or

- is likely to recover without the need for any restoration measures.

1.4 Assumptions and limitations

1.4.1 The WFD water body classification data presented in Volume 4, Off-route effects and Volume 5, Appendices are taken from the Solway Tweed 2015 Cycle 2 RBMP[4], and from Scottish Environment Protection Agency's Water Framework Directive Classification Hub[5]. These classifications are considered to provide the current best estimate of status and are the formal baseline against which Scottish Environment Protection Agency's will assess compliance with the 'no deterioration' objective.

1.4.2 Where baseline data is limited, professional judgement has been used in the assessment and a precautionary approach has been adopted.

1.4.3 The WFD assessment takes into account the avoidance and mitigation measures included in the design and the draft Code of Construction Practice (CoCP) (Volume 5: Appendix CT-002-00000). These measures are described further in the WFD Compliance assessment process Technical note.

1.4.4 The assumptions presented in Volume 1, Introduction and methodology, Section 8.16 also apply to this assessment.

1.4.5 Impacts on ecological receptors including protected species and designated sites, are described in the Volume 4, Off-route effects, Section 7, Ecology and biodiversity, where resulting in significant effects.

1.4.6 Impacts to groundwater quality from existing land contamination are presented in the Volume 4, Off-route effects, Section 10, Land quality, where resulting in significant effects. Based on land quality measures of removal or remediation of contaminated land, this report assumes that all potential impacts from land contamination will be mitigated during the construction phase.

[4] Natural Scotland (2015), *The river basin management plan for the Solway Tweed river basin district: 2015 update*. Available online at: https://www.sepa.org.uk/media/218890/rbmp_solway_tweed_2015.pdf.

[5] Scottish Environment Protection Agency (2015), *Water Classification Hub*. Available online at: https://www.sepa.org.uk/data-visualisation/water-classification-hub/.

2 Baseline assessment (screening)

2.1 Surface water baseline

2.1.1 One surface water body (Kirtle Water d/s Waterbeck 10666) has been identified as having potential to be affected by the Proposed Scheme off-route works. This is a river water body. No canal or lake water bodies are in the area potentially affected by the Proposed Scheme off-route works.

2.1.2 A breakdown of the current 2015 Cycle 2 status, interim Cycle 3 status (2018) and status objectives data for this water body, together with figures showing the catchment extent relative to the Proposed Scheme, is provided in the WFD BID report (BID WR-002-OR003). A summary is provided in Annex A, Table A1.

2.1.3 Following desk study, six individual watercourses within this water body catchment were screened in for preliminary WFD assessment; Kirtle Water, Stand Burn, Tributary of Stand Burn 1, Ewes Burn, Tributary of Ewes Burn 1 and Tributary of Ewes Burn 2. These are summarised in Annex A, Table A2.

2.2 Groundwater baseline

2.2.1 One groundwater body (Annan groundwater 150623) has been identified as having potential to be affected by the Proposed Scheme off-route works. This water body is summarised in Annex A, Table A4.

2.2.2 A breakdown of the current 2015 Cycle 2 RBMP status, interim Cycle 3 status (2018) and status objectives data for this groundwater body, together with figures showing the water body extent relative to the route of the Proposed Scheme, is provided in the WFD BID report. A summary is provided in Annex A, Table A3.

2.2.3 Following desk study a total of 37 groundwater features (10 springs, 15 groundwater dependent habitats, three abstractions and one monitoring borehole) were screened in for preliminary impact assessment within this groundwater body. These are summarised in Annex A, Table A4.

2.3 Scheme baseline

Scheme components

2.3.1 The key construction and operation maps located in the Volume 4, Off-route effects, Map Books: Map Series CT-05 and CT-06 are the primary source of Proposed Scheme design information.

2.3.2 The assessment has considered all scheme components that have the potential to permanently affect surface water and groundwater bodies, and therefore have the potential to impact upon WFD status. All scheme components have been assessed individually, before the combined effect on quality element status is considered.

Surface water

2.3.3 The following scheme component types have been identified as having the potential to directly or indirectly affect the surface water bodies/watercourses along the route of the Proposed Scheme off-route works:

- culverts (box shaped structure that carries a watercourse under a road or railway crossing);
- realignments (permanent, localised realignment of a watercourse involving the creation of a new section of river channel tying back into the existing watercourse downstream);
- diversions (permanent, localised diversion of a watercourse involving the creation of a new section of river channel whereby the location of the watercourse's confluence with the downstream watercourse is changed);
- cutting (excavation in areas where the local topography is at a higher level than the desired route alignment); and
- discharge from proposed wastewater treatment plant, which is to be located to the south of the stabling facility.

2.3.4 Individual scheme components with the potential to affect the surface water bodies/watercourses screened in for WFD preliminary impact assessment have been identified and catalogued. These scheme components are summarised in relation to the relevant surface water body catchment and watercourses in Annex A, Table A5. The crossing type (i.e. track, access road or highway realignment), scheme component type and name and a unique reference ID is provided for each scheme component.

Groundwater

2.3.5 The following scheme component types have been identified as having the potential to directly or indirectly affect groundwater bodies along the route of the Proposed Scheme off-route works:

- overbridge foundations;
- cuttings; and
- embankments.

2.3.6 Individual scheme components with the potential to affect the groundwater body screened in for WFD preliminary impact assessment have been identified and catalogued. These scheme components are summarised in relation to the relevant groundwater body in Annex A, Table A6. The scheme component type and name, and a unique reference ID is provided for each scheme component.

Avoidance and mitigation included within the design

2.3.7 The hybrid Bill designs have been developed iteratively in close consultation with fluvial geomorphologists, hydrologists, hydrogeologists, ecologists and water quality scientists. The WFD Compliance assessment process Technical note in the SMR describes the generic approach to developing designs that are compliant with WFD legislation.

2.3.8 In addition, a range of wider environmental mitigation has been included within the design of the Proposed Scheme in order to avoid, prevent or reduce the likely significant adverse effects on the environment. This includes mitigation measures such as tree planting, wet grassland creation and flood storage areas, which may provide additional localised ecological, hydromorphological and water quality benefits within the relevant water body catchments. The approach to mitigation is described in Volume 1, Introduction and methodology, Section 9.

3 Preliminary assessment (scoping)

3.1 Likely effects on current status

3.1.1 A preliminary assessment of the likely effects of each of the scheme components on the various WFD status elements of the surface water and groundwater bodies concerned is summarised in the following sections.

Surface water

3.1.2 The results of the preliminary assessment of the likely effects of the relevant scheme components on the WFD status elements of surface water bodies are summarised in Annex B, Table B1. The general impacts and likely effects on surface water WFD elements for each scheme component type are discussed in the following sections.

3.1.3 All culverts have been assessed on a case-by-case basis, taking into consideration the length of the culvert and the baseline aquatic habitat potential of the section of channel to be culverted, as well as those reaches upstream and downstream. All culverts comprise standard box culvert structures. No drop inlet culverts are proposed on the watercourses screened in for WFD preliminary assessment.

3.1.4 All realignments/diversions have been assessed on a case-by-case basis, taking into consideration the baseline condition (including aquatic habitat potential and hydromorphological condition) of the reaches of existing channel to be lost and the total net gain/loss of river channel following realignment/diversion.

3.1.5 All cuttings have been assessed on a case-by-case basis, based on the location, size and depth of the proposed excavation area and the anticipated level of groundwater connectivity between the excavation site and nearby watercourses and degree of catchment area affected.

3.1.6 The wastewater treatment plant discharge has been assessed based on its location and taking into consideration the baseline aquatic habitat potential and hydromorphological condition of the reaches where the discharge is located, as well as conditions downstream.

Access for fish migration

3.1.7 Effects on fish migration are considered in terms of likely change in access for fish to upper reaches of the watercourse.

3.1.8 The likely effects of the relevant scheme component types scoped in for assessment on access for fish migration are summarised in Table 1.

Table 1: Likely access for fish migration effects of scheme component types on surface water bodies (after consideration of mitigation included within the design)

Scheme component type	Impact type	Impact description
Culvert	Footprint and shading	Culverts will cause a localised but permanent loss of a section of open river channel including permanent shading of the watercourse (see Physical condition in Table 3), within the footprint of the culvert. The magnitude of effect on fish migration will be dependent on the length of culvert and the baseline condition of the reach of watercourse affected. The lengths of all proposed culverts are >30m each, which may have an adverse effect on access for fish to upstream reaches.
	Changes to hydromorphology leading to changes in process upstream and/or downstream	Culverts will also cause a localised but permanent change to the hydromorphological regime, which may lead to changes in river processes and habitat upstream and downstream. However, due to the mitigation included within the design, this is anticipated to have a negligible effect on fish migration.

Water flows and levels

3.1.9 Effects on water flows and levels are considered in relation to quantity and dynamics of flow, river depth and width variation.

3.1.10 The likely effects of the relevant scheme component types scoped in for assessment on water flows and levels are summarised in Table 2.

Table 2: Likely water flow and level effects of scheme component types on surface water bodies (after consideration of mitigation included within the design)

Scheme component type	Impact type	Impact description
Culvert	Changes to hydromorphology leading to changes in process upstream and/or downstream	Culverts will cause a localised but permanent change in flow regime, which may lead to changes in river processes and habitat upstream and downstream. Given mitigation included within the design of the culverts to minimise impacts on sediment transfer and flow continuity, this is anticipated to have a negligible effect on water flow and level elements.
Realignment / diversion	Changes to hydromorphology leading to changes in process upstream and/or downstream	Realignments/diversions will result in a localised but permanent change in flow, which may in turn lead to changes in river processes and habitat upstream and/or downstream. Given appropriate design of the realigned/diverted channel, this is anticipated to have a negligible effect on water flow and level elements.
Cutting	Changes in flow velocity and volume due to dewatering Changes to hydromorphology	Cuttings may cause a change in the flow regime of nearby watercourses due to a reduction in the groundwater table resulting from dewatering activities. Baseflow reduction will cause a localised but permanent change to the hydromorphological regime. The magnitude of effect will be dependent on the degree of groundwater drawdown and baseflow reduction. In most cases, this is anticipated to have either a negligible effect or a minor, localised adverse effect on water flow and level elements.

Scheme component type	Impact type	Impact description
	leading to changes in process and habitat upstream or downstream	
Discharge from wastewater treatment plant	Changes in flow velocity and volume due to discharge	The wastewater treatment plant discharge may cause flow levels to increase in the receiving watercourses, and any watercourses downstream, due to the addition of discharge inputs. The magnitude of impact will be dependent on the rate of discharge from the treatment plant and therefore the relative changes in flow and level. This is anticipated to have a minor, localised adverse effect on water flow and levels.

Physical condition

3.1.11 Effects on physical condition are considered in relation to quantity and dynamics of flow, river continuity (including existing restrictions such as sluices), river depth and width variation, structure and substrate and structure of the riparian zone.

3.1.12 The likely effects on physical condition of the relevant scheme component types scoped in for assessment are summarised in Table 3.

Table 3: Likely physical condition effects of scheme component types on surface water bodies (after consideration of mitigation included within the design)

Scheme component type	Impact type	Impact description
Culvert	Footprint and shading	Culverts will cause a localised but permanent loss of a section of open river channel and riparian habitat, including permanent shading of the watercourse, within the footprint of the culvert. The magnitude of effect will be dependent on the length of culvert and baseline condition of the reach of watercourse affected. In most cases, this is anticipated to have a minor, localised adverse effect on the physical condition in the watercourse. However, where the length of proposed culverts is significant, this may have a more widespread adverse effect.
	Changes to hydromorphology leading to changes in process upstream and/or downstream	Culverts will also cause a localised but permanent change in hydromorphological regime, which may lead to changes in river processes and habitat upstream and downstream. Given mitigation included within the design of the culverts to minimise impacts on sediment transfer and flow continuity, this is anticipated to have a negligible effect on watercourse physical condition.
Realignment / diversion	Footprint	Realignments/diversions will result in the permanent loss of a section of existing river channel. However, realigned/diverted channels will provide features equivalent to those lost in the existing channel and, where reasonably practicable, will aim to provide improvements over the existing physical condition. In addition, all realignments and diversions will incorporate an appropriately sized buffer strip for marginal and riparian habitat creation/improvements. Where the existing hydromorphological value of the watercourse is limited or degraded, this is anticipated to have a negligible or minor, localised beneficial effect on physical condition.

Scheme component type	Impact type	Impact description
		However, the realignment/diversion of reaches with well-developed riparian habitats may have a minor, localised adverse effect until riparian vegetation fully re-establishes.
	Changes to hydromorphology leading to changes in process upstream and/or downstream	Realignments/diversions will also result in a localised but permanent change in hydromorphological regime, which may in turn lead to changes in river processes and habitat upstream and/or downstream. Given appropriate design of the realigned/diverted channel, this is anticipated to have a negligible effect on watercourse physical condition.
Cutting	Changes in flow velocity and volume due to dewatering Changes to hydromorphology leading to changes in process upstream and/or downstream	Cuttings may cause a change in the flow regime of nearby watercourses due to a reduction in the groundwater table resulting from dewatering activities. Baseflow reduction will cause a localised but permanent change to the hydromorphological regime. The magnitude of effect will be dependent on the degree of groundwater drawdown and baseflow reduction. This is anticipated to have a negligible or a minor, localised adverse effect on watercourse physical condition.
Discharge from wastewater treatment plant	Changes in flow velocity and volume due to discharge	The additional wastewater treatment plant flow discharge may cause a minor localised effect on the watercourse physical condition of the receiving watercourse as well as the downstream watercourses.

Freedom from invasive species

3.1.13 Effects on freedom from invasive species are not considered to be relevant to the Proposed Scheme. Best practice guidance on working with invasive species will be followed if invasive species are found within the working area, such that invasive species are not transferred to or from the site.

Ecological condition

3.1.14 Effects on ecological condition are considered in terms of likely change in composition and abundance of phytobenthos, macrophytes, macroinvertebrate and invertebrate communities and in composition, abundance and age structure of fish populations.

3.1.15 The likely effects of the relevant scheme component types scoped in for assessment on ecological condition are summarised in Table 4.

Table 4: Likely ecological condition effects of scheme component types on surface water bodies (after consideration of mitigation included within the design)

Scheme component type	Impact type	Impact description
Culvert	Footprint and shading	Culverts will cause a localised but permanent loss of a section of existing river channel and localised but permanent shading of the river channel within the footprint of the culvert. This is anticipated to have a minor, localised adverse effect on macrophytes and phytobenthos, macroinvertebrates and fish. Where the length of proposed culverts is significant, however, this may have a more widespread, adverse effect on fish due to impacts on fish passage and spawning migration.
	Changes to hydromorphology leading to changes in process upstream / downstream	Culverts will also cause a localised but permanent change to the hydromorphological regime, which may in turn lead to changes in river processes and habitat upstream and/or downstream. Given mitigation included within the design, this is anticipated to have a negligible effect on macrophytes and phytobenthos, macroinvertebrates and fish.
Realignment / diversion	Footprint	Realignments/diversions will result in the permanent loss of existing sections of river channel and riparian habitat. However, the newly created realigned/diverted channel will provide features equivalent to those lost in the existing channel and, where reasonably practicable, will aim to provide hydromorphological improvements over the existing condition. In addition, all realigned/diverted channels will incorporate an appropriately sized buffer strip to allow for marginal and riparian habitat creation/improvements. Where the existing aquatic habitat potential of the watercourse is limited or degraded, this is anticipated to have a negligible or minor, localised beneficial effect on macrophytes, phytobenthos, macroinvertebrates and fish. However, the realignment/diversion of reaches with existing aquatic and riparian habitat that is well-developed and of high value may have a minor, localised adverse effect or a more widespread adverse effect on macrophytes, phytobenthos, macroinvertebrates and fish (until new habitats along the realigned/diverted channel are established and re-colonised).
	Changes to hydromorphology leading to changes in process upstream / downstream	Realignments/diversions will also result in a localised but permanent change in hydromorphological regime, with potential resultant changes to river processes and habitat upstream and downstream. In most cases, given appropriate design of the realigned/diverted channel, this is anticipated to have a negligible effect on macrophytes, phytobenthos, macroinvertebrates and fish.
Cutting	Changes in flow velocity and volume due to dewatering Changes to hydromorphology leading to changes in process and habitat upstream and/or downstream	Cuttings may cause a localised change in the flow regime of nearby watercourses due to a reduction in the groundwater table resulting from dewatering activities. Baseflow reduction will cause a localised but permanent change to the hydromorphological regime, which may in turn lead to changes in river processes and habitat downstream. The magnitude of effect will be dependent on the degree of groundwater drawdown and baseflow reduction. In most cases, this is anticipated to have either a negligible effect or a minor, localised adverse effect on macrophytes, phytobenthos, macroinvertebrates and fish.

Scheme component type	Impact type	Impact description
	Changes in water quality due to discharge of groundwater to surface water	Groundwater intercepted in cuttings will be collected and discharged to surface water. All drainage networks are designed on a case by case basis so that collected groundwater is discharged to the receiving water that it naturally would drain to. Changes to the groundwater flow regime may lead to changes in water quality. The magnitude of the effect will be dependent on the degree of change in the flow regime and quality groundwater of adjacent groundwater bodies. This is anticipated to have either a minor, localised adverse effect or an adverse effect on macrophytes, phytobenthos, macroinvertebrates and fish. Potential impacts to groundwater quality from existing land contamination are presented in Volume 4 Section 6.7, Land quality, which provides mitigation by way of removal or remediation. On the basis that existing contamination will be mitigated against, this is anticipated to have a negligible effect on macrophytes, phytobenthos, macroinvertebrates and fish.
Discharge from wastewater treatment plant	Changes in flow velocity and level due to discharge	Wastewater treatment works discharge may cause flow levels to increase in the receiving watercourse, and any watercourses downstream. The discharge may also have a localised impact on the channel morphology of the receiving watercourse as well as the downstream watercourses through changing the flow volume. This is anticipated to have a minor, localised adverse effect on macrophytes, phytobenthos, macroinvertebrates and fish.
	Changes in water quality due to discharge	Wastewater treatment works discharge may result in the deterioration of water quality and alteration of natural water chemistry in the receiving watercourse. The impact to water quality is likely to be localised, but downstream watercourses may also be impacted. The magnitude of impact will be dependent on the degree of dilution which occurs and is anticipated to have either a minor, localised adverse effect or an adverse effect on macrophytes, phytobenthos, macroinvertebrates and fish.

Water quality effects

3.1.16 Effects on water quality are considered in relation to likely changes in the chemical composition of phosphate and ammonia and for physical changes which cause variations in dissolved oxygen and temperature within a water body, along with changes in specific pollutants.

3.1.17 The likely effects of the relevant scheme component types scoped in for assessment on water quality status are summarised in Table 5.

Table 5: Likely water quality effects of scheme component types on surface water bodies (after consideration of mitigation included within the design)

Scheme component type	Impact type	Impact description
Culvert	Shading	Culverts will cause localised but permanent shading of the watercourse. The magnitude of effect will be dependent on the length of culvert and baseline condition of the reach of watercourse affected. This is anticipated

Scheme component type	Impact type	Impact description
		to have a negligible effect on water temperature and dissolved oxygen levels (due to potentially reduced photosynthetic activity by aquatic flora).
	Changes to hydromorphology leading to changes in process upstream and/or downstream	Culverts will also cause a localised but permanent change in hydromorphological regime, which may in turn lead to changes in river processes and habitat upstream and downstream. Given mitigation included within the design of the culverts to minimise impacts on sediment transfer and flow continuity, in most cases this is anticipated to have a negligible effect on dissolved oxygen.
Realignment / diversion	Footprint	Realignments/diversions will result in the permanent loss of existing river channel and riparian habitat. However, the newly created realigned/diverted channel will provide features equivalent to those lost in the existing channel and, where reasonably practicable, will aim to provide hydromorphological improvements over the existing condition. In addition, all realigned/diverted channels will incorporate an appropriately sized buffer strip to allow for marginal and riparian habitat creation/improvements where practicable. This, in turn, may reduce bank erosion (e.g. via poaching by livestock) and sediment runoff and nutrient loading from adjacent land. In most case, this is anticipated to have a negligible effect on dissolved oxygen, phosphate and ammonia concentrations.
	Changes to hydromorphology leading to changes in process upstream and/or downstream	Realignments/diversions will also result in a localised and permanent change in hydromorphological regime, which may in turn lead to changes in river processes and habitat upstream and downstream. In most cases, given appropriate design of the realigned/diverted channel, this is anticipated to have a negligible effect on dissolved oxygen.
Cutting	Changes in flow velocity and volume Changes to hydromorphology leading to changes in process upstream and/or downstream	During the construction phase, cuttings may cause a change in the flow regime of nearby watercourses due to a reduction in the groundwater table resulting from dewatering activities. The magnitude of effect will be dependent on the degree of groundwater drawdown and baseflow reduction. This is anticipated to have a negligible or minor, localised adverse effect on dissolved oxygen.
	Changes in water quality due to discharge of groundwater to surface water	Groundwater intercepted in cuttings will be collected and discharged to surface water. All drainage networks are designed on a case by case basis so that collected groundwater is discharged to the receiving water that it naturally would drain to. The magnitude of the effect will be dependent on the degree of change in the groundwater flow regime and quality groundwater of adjacent groundwater bodies. In most cases, this is anticipated to have either a negligible or minor, localised adverse effect on dissolved oxygen, phosphate and ammonia concentrations.
Discharge from wastewater treatment plant	Changes in water quality due to discharge	Discharge from the wastewater treatment plant will be to surface water. This discharge may lead to changes in water quality. The magnitude of the effect will be dependent on the degree of change in the flow regime and quality of discharge compared to natural surface water quality. This is anticipated to have a potential adverse effect on nutrient concentrations.

Groundwater

3.1.18 The results of the preliminary assessment of the likely effects of relevant scheme components on the WFD status elements of groundwater bodies are summarised in Annex B, Table B2. The impacts and likely effects on groundwater WFD status for each scheme component type are discussed in the following sections.

3.1.19 The majority of the Proposed Scheme is predicted to result in local and/or temporary impacts that are considered unlikely to affect WFD status at the groundwater body scale. However, potential risks to WFD quantitative status and chemical status elements have been identified for the relevant groundwater body.

3.1.20 Where groundwater impacts have the potential to impact on surface water then these 'knock on' impacts are considered in the surface water assessment.

Water flows and levels effects

3.1.21 Likely effects on water flows and levels are considered in terms of the following two key impact types:

- lowering of groundwater levels and reduction in groundwater or baseflow contributions by temporary dewatering or permanent groundwater control; and
- 'damming' of groundwater flow and reduction in groundwater or baseflow contributions by physical obstruction of pathways.

3.1.22 The likely effects arising from the groundwater impacts at each of the relevant scheme component types are described in terms of changes in groundwater contributions to receptors (surface waters, Groundwater Dependent Terrestrial Ecosystems (GWDTE), groundwater abstractions and drinking water) and intrusions (saline or other) in Table 6.

Table 6: Water flows and levels effects of scheme component types on groundwater bodies (after consideration of mitigation included within the design)

Scheme component type	Impact type	Impact description
Overbridge foundations	'Damming' of groundwater flow and reduction in groundwater contributions	Foundations that extend below the water table have the potential to reduce transmissivity and lead to groundwater damming upgradient and groundwater lowering downgradient. If foundations facilitate connectivity between two isolated aquifers, then groundwater levels may interact and either rise or fall depending on the relative groundwater heads.
Embankment with sub-surface reinforcement	Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	Embankments of the proposed scheme may include sub-surface reinforcement (such as linear closely spaced piles or retaining structures). Potential quantitative effects are considered on a site by site basis.

Scheme component type	Impact type	Impact description
	'Damming' of groundwater flow and reduction in groundwater contributions	Embankment of the proposed with sub-surface reinforcement (such as linear closely spaced piles or retaining structures) will have no anticipated effects where they do not extend down to the water table. Refer to viaduct foundations/ overbridge foundations for effects from deep foundations that extend below the water table.
Cutting	Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	Drawdown of groundwater levels will occur along the cutting where the cutting invert (including drainage elements) lies below the water table. The extent of drawdown is a function of the cutting length, the range of cutting depth and the properties of the aquifer where the cut occurs. Likely quantitative effects are considered on a site by site basis.

Water quality effects

3.1.23 Likely effects on water quality elements are considered in terms of the likely changes in water quality. This is related to the following two key impact types:

- disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control; and
- creating or altering pathways along which existing poor quality groundwater can migrate.

3.1.24 The likely effects arising from groundwater impacts at each of the relevant scheme component types are described in terms of changes in groundwater contributions to receptors (surface waters, GWDTE, groundwater abstractions and drinking water) and intrusions (saline or other intrusions) in Table 7.

Table 7: Likely water quality effects of scheme component types on groundwater bodies (after consideration of mitigation included in the design)

Scheme component type	Impact type	Impact description
Overbridge foundations	Creating or altering of pathways along which existing poor quality groundwater can migrate	Foundations of the Proposed Scheme will have no anticipated effects where they do not extend down to the water table. Foundations that extend below the water table may create pathways between aquifers and potentially cause change in groundwater quality.
Embankment with sub-surface reinforcement	Creating or altering of pathways along which existing poor quality groundwater can migrate	Embankments with sub-surface reinforcement of the Proposed Scheme will have no anticipated effects where they do not extend down to the water table. Embankments with sub-surface reinforcement that extend below the water table may create pathways between aquifers and potential for change in chemical status. If damming of the water table occurs from embankments with sub-surface reinforcement then there is potential for change in

Scheme component type	Impact type	Impact description
		groundwater quality from modifications to the groundwater flow regime.
Cutting	Disturbing or mobilising existing poor quality groundwater by temporary dewatering or depressurisation and permanent groundwater control	If drawdown of the water table occurs, then there is potential for change in groundwater quality from modifications to the groundwater flow regime.

3.2 Likely effects on achievement of status objectives

3.2.1 WFD legislation requires consideration of whether new developments have the potential to prevent the future attainment of good status or potential objectives for water bodies (where not already achieved).

3.2.2 As part of the preliminary assessment, a scoping exercise has therefore been carried out to ensure that the construction and operation of the Proposed Scheme will not prevent any of the relevant water bodies from achieving their status objectives in the future.

3.2.3 The assessment has included only those water bodies affected by the Proposed Scheme that are currently failing to meet their good ecological status/potential or good quantitative status (with regards to surface water and groundwater bodies, respectively).

Pressures

3.2.4 Scottish Environment Protection Agency have identified 'pressures' for water body quality elements that are not currently at good status/potential. They identify relevant sectors and activities that are currently impacting upon the status classification of a water body and therefore provide an indication of the high-level causes of status objective failure.

3.2.5 Scottish Environment Protection Agency's have identified six main pressures on water bodies: point source pollution; diffuse source pollution; abstraction (changing the amount of water in the water body e.g. by use for irrigation); flow regulation (changing the flow of a water body e.g. by installing a dam); morphological (changing the physical structure of a water body e.g. by building flood walls), and invasive non-native species.

3.2.6 The available pressures information for the one surface water body affected by the Proposed Scheme off-route works is provided in Annex B, Table B3. The groundwater body is already at good status and therefore does not have identified pressures.

3.2.7 The assessment has identified whether the existing pressure is likely to be adversely or beneficially effected by the relevant scheme components, following consideration of

mitigation included in the design. A precautionary approach has been taken, whereby any identification of a potential adverse effect on the 'reason for not meeting good' is used to highlight the potential for the Proposed Scheme to prevent or inhibit the attainment of the status objective of the relevant quality element.

4 Conclusions

4.1 Overview

4.1.1 The Proposed Scheme will cross one surface water body and one groundwater body. This appendix reports the assessment of the Proposed Scheme's compliance against the WFD objectives of those water bodies potentially affected.

4.1.2 The WFD assessment methodology has been developed in accordance with the WFT Compliance assessment process Technical note in the SMR and in consultation with Scottish Environment Protection Agency's. It has also been developed to retain consistency with the approaches adopted at Phase One, Phase 2a and the 2b route in England.

4.1.3 The assessment is based on the Proposed Scheme design, current Scottish Environment Protection Agency's WFD baseline data, and baseline hydromorphological, ecological and hydrogeological data derived via desk study. The assessment has taken into account the mitigation included within the design and construction methodology of the Proposed Scheme. The assessment will be updated during the detailed design stage of the Proposed Scheme, in order to reflect the latest iteration of the design and assessment process.

4.1.4 The statutory objectives of relevance to all surface water and groundwater bodies potentially affected by the Proposed Scheme are recorded within the 2015 Cycle 2 RBMP.

4.1.5 SEPA 2015 Cycle 2 WFD water body classification data have been used within this assessment, obtained from Scottish Environment Protection Agency's Water Classification Environment Hub. These data are considered to provide the current best estimate of status and are the formal baseline against which Scottish Environment Protection Agency's will assess compliance with WFD objectives.

4.2 No deterioration of current status

4.2.1 A preliminary impact assessment has been undertaken of all components of the Proposed Scheme identified as having the potential to have an effect on the status elements of the relevant WFD water bodies.

Surface water

4.2.2 One surface water body (Kirtle Water d/s Waterbeck 10666) has been assessed to be impacted by the Proposed Scheme. Three watercourses within the catchment of Kirtle Water have the potential to be adversely impacted by the proposed works. One committed development GSTF/010 (an allocation for business and industry) is located in the area of Ewes Burn. Any development impacting surface water would be subject to consent and therefore no cumulative effects on WFD status are anticipated.

4.2.3 A preliminary WFD assessment has been carried out for Kirtle Water surface water body (see Annex B). Within this water body, Ewes Burn and its tributaries will be affected by a series of watercourse diversions and realignments as well as culverts for track sidings and access roads. The watercourses affected comprise small, agricultural drainage channels which are unlikely to be sensitive to changes in physical conditions and/or support significant populations of migratory fish species. The effects of each scheme component on the WFD status elements of this water body are summarised in Annex B, Table B3. The watercourse realignments and diversions are anticipated to provide minor improvements (factoring in mitigation included within the design), whilst the culverts are expected to have minor, localised adverse effects. The WFD impacts at the water body scale are therefore deemed to be minor and will be minimised by mitigation included in the scheme design.

4.2.4 A wastewater treatment works will discharge treated effluent to Tributary of Ewes Burn 1 and then to Ewes Burn downstream, and as a result could have an adverse impact on surface water quality through the release of flows that contain elevated levels of nutrients (e.g. phosphate). Ewes Burn joins with Stand Burn downstream of the A74(M). Depending on dilution in Tributary of Ewes Burn 1 and Ewes Burn, the effluent might also affect the water quality of Stand Burn, although the impact is expected to lessen downstream with increased dilution.

4.2.5 The Headshunt cutting, Reception Track cutting, Southern Reception Track cutting and Traction Substation cutting have been identified to have potential to alter groundwater flows and interaction with Ewes Burn and Tributary of Ewes Burn 1 and 2, through changes to baseflow. Further detail is discussed in the section below and Annex B.

4.2.6 Mitigation measures in relation to the discharge of the treated effluent will be designed in detail following ground investigation and monitoring of surface water flows and quality. Mitigation could take the form of discharge of groundwater, intercepted by drainage in the southern reception tracks or Headshunt cuttings, to Ewes Burn and tributaries. The discharge of groundwater drainage would be at an appropriate rate to provide dilution of the treated effluent discharge either at the same discharge location or further downstream.

Groundwater

4.2.7 One groundwater body (Annan – 150623) is anticipated to be impacted by the Proposed Scheme.

4.2.8 A preliminary WFD assessment has been carried out and several scheme components have been identified as having the potential to cause adverse effects to Annan groundwater water body. This assessment is set out in Annex B. A summary of the main effects is set out below.

4.2.9 The below ground elements of the proposed Headshunt cutting, Southern reception track cutting, Northern reception track cutting and Traction substation cutting are anticipated to have minor, localised adverse effects on three watercourses, potentially in hydraulic connection with Annan groundwater body.

4.2.10 Drainage to the cuttings and lowering of groundwater levels in the Gretna Till as a result of the drainage, have the potential to reduce the yield in any unregistered abstraction sources located within the zone of influence of the cuttings. As a result, there could be a localised impact on the quantitative status of the groundwater body.

4.2.11 If, following discussion with Scottish Environment Protection Agency's and site surveys, it is confirmed that any groundwater abstractions are present in or close to the zone of influence, mitigation options for the impact on groundwater flow and groundwater levels will be discussed with the abstraction owners and Scottish Environment Protection Agency's. Mitigation options will be considered with a view to ensuring a continuous, reliable water supply at abstraction sources from either the superficial deposits or the bedrock. Such mitigation options might include the lowering of pumps, deepening of abstraction sources or provision of alternative boreholes.

4.2.12 No cumulative effects associated with the impacts of scheme components located within other, adjacent water bodies have been identified for the groundwater body affected by the Proposed Scheme.

WFD monitoring of effects on surface water and groundwater status

4.2.13 The WFD monitoring strategy will be developed in consultation with SEPA and tailored around the relevant quality elements anticipated to be affected. If required, targeted and proportional WFD monitoring will be implemented prior to, during and following construction at all sites where a potential effect has been identified on a water body quality element.

4.2.14 Monitoring outcomes will be utilised to assess the suitability and effectiveness of the mitigation included in the design applied to the relevant scheme components and, where deemed necessary by Scottish Environment Protection Agency's, inform the development of any required corrective measures and/or further mitigation measures.

4.3 No prevention of status objectives

4.3.1 The Proposed Scheme has been screened against the reported pressures for the relevant water bodies.

Surface water

4.3.2 The Proposed Scheme is considered unlikely to pose a significant risk to the status objectives of Kirtle Water. According to Scottish Environment Protection Agency's investigations, the cause reported as a 'reason for not meeting good' for fish populations is not yet known. Therefore, it is not possible to know whether this is relevant to the proposed scheme. However, the watercourses affected comprise small, agricultural drainage channels which

are unlikely to support significant populations of migratory fish species. It is planned to verify this assumption by undertaking baseline watercourse surveys.

Groundwater

4.3.3 There is no potential risk to preventing groundwater achieving good status, as it is already at good status.

4.4 Summary of conclusions

4.4.1 The assessment has identified one WFD surface water body (a river water body, Kirtle Water d/s Waterbeck), and one WFD groundwater body, Annan that are potentially affected by the Proposed Scheme.

4.4.2 Neither water body is anticipated to experience adverse overall effects of sufficient scale to cause a deterioration in WFD status or prevent achieving future objectives. This conclusion should be verified by completion of field surveys to confirm the baseline condition, and through ongoing consultation with Scottish Environment Protection Agency's to confirm the mitigation strategy for:

- the predicted localised effects of culverts and realignments on Ewes Burn and tributaries on physical condition and access for fish migration;
- the potential water quality effects of the effluent from the wastewater treatment works discharge on Ewes Burn and downstream watercourses; and
- the potential effects on groundwater and associated features from cuttings.

4.4.3 This will be informed by surveys, ground investigation, and further assessment. The implementation of these measures will ensure that there are no residual adverse overall effects that pose a risk of deterioration in status within these water bodies.

Annex A: Baseline assessment (screening)

1 Surface water baseline

1.1 WFD surface water bodies

The surface water bodies screened in as being affected by the Proposed Scheme off-route works are summarised in Table A1.

Baseline details for all the surface water bodies within the study area are summarised in the Water Framework Directive compliance assessment baseline data (BID WR-002-OR003).

Table A1: Summary of WFD surface water bodies screened in as being affected by the Proposed Scheme off-route works and their 2015 Cycle 2 and 2018 interim Cycle 3 status classifications

WFD water body	Water body ID	River Basin District/ Management Plan	SEPA management catchment	Water body type (designation)	Overall status 2015/ 2018	Overall ecology 2015/ 2018	Overall chemistry 2015/ 2018
Kirtle Water d/s Waterbeck	10666	Solway and Tweed	Gretna Coastal	River	Poor / Poor	Poor / Poor	N/A / N/A

1.2 Watercourses

The watercourses that have been screened in for detailed impact and mitigation assessment are summarised in Table A2. Watercourses have been grouped according to the relevant WFD surface water body catchment.

Baseline details of all watercourses affected by the Proposed Scheme are summarised in the Water resources assessment baseline data (BID WR-004-OR003).

Table A2: Summary of watercourses affected by Proposed Scheme screened in for preliminary assessment

WFD water body	Watercourse name	Watercourse designation	Upstream (US)/ downstream (DS) National Grid Reference (NGR)	Approx. watercourse length (km)	Estimated Q95 (m^3/s) at Proposed Scheme location	Watercourse receptor value at Proposed Scheme location (to be confirmed by field survey)
Kirtle Water d/s Waterbeck	Ewes Burn	Minor watercourse	US: NY 30715 70040 DS: NY 29676 68725	2.3	0.004	Moderate
	Tributary of Ewes Burn 1	Minor ditch	US: NY 29177 69902 DS: NY 29542 69672	0.475	<0.002	Moderate
	Tributary of Ewes Burn 2	Minor ditch	US: NY 30702 70034 DS: NY 29966 69749	1.0	<0.002	Moderate
	Stand Burn	Minor watercourse	US: NY 30144 68964 DS: NY 29549 68272	1.5	0.005	Moderate
	Tributary of Stand Burn	Minor watercourse	US: NY 30656 68229 DS: NY 29544 68394	1.2	<0.002	Moderate
	Kirtle Water	River	US: NY 28003 84773 DS: NY 31355 65704	19.2	0.14	High

2 Groundwater baseline

The groundwater bodies screened in as being affected by the Proposed Scheme off-route works are summarised in Table A3. Baseline details of all the groundwater bodies within the study area are summarised in the Water resources assessment baseline data (BID WR-004-OR003).

Table A3: Summary of all WFD groundwater bodies screened in as being affected by the Proposed Scheme off-route works and their 2015 Cycle 2 and 2018 interim Cycle 3 status classifications

WFD water body	Water body ID	River Basin District/ Management Plan	Overall status 2015/2018	Quantitative status 2015/2018	Chemical status 2015/2018
Annan	150623	Solway and Tweed	Good / Good	Good / Good	Good / Good

2.1 Groundwater features

A range of features, such as groundwater abstraction boreholes, springs, or GWDTE that receive groundwater baseflow, can be used to characterise the groundwater body and are also receptors to potential Proposed Scheme impacts. These have been assessed in the Water resources assessment (Volume 5, Appendix WR-003-OR003), and are considered, where relevant, in this assessment.

Features which have potential to be springs have been identified from Ordnance Survey maps. Surveys have not been completed at this stage due to access limitations, and therefore the potential springs have been screened in as potentially being affected by the Proposed Scheme and for future groundwater characterisation and monitoring. This may not be relevant in the future if surveys prove otherwise.

The groundwater features screened in as being affected by the Proposed Scheme are summarised in Table A4. Features are shown in relation to the relevant WFD groundwater body.

Baseline details of all groundwater features affected by the Proposed Scheme are summarised in the Water resources assessment baseline data (BID WR-004-OR003).

Table A4: Summary of groundwater body features/receptors screened in as being potentially affected by Proposed Scheme off-route works

WFD groundwater waterbody (ID)	Feature type	NGR	WFD assessment unique reference ID	Feature name	Feature description
Annan (150623)	Public water supply (PWS) abstraction	Unknown	Ab_01	Potential PWS abstraction	Potential public water supply[6]
	Potential spring	NY308685	S_02	Potential spring in south of Gretna service area	Potential spring
	Potential spring	NY308685	S_03	Potential spring in south of Gretna service area	Potential spring
	Potential non-licensed abstraction	NY329686	UAb_04	Potential abstraction at Watchhill Well	Potential non-licensed abstraction
	Potential spring	NY309687	S_05	Potential spring in east of Gretna service area	Potential spring
	Potential spring	NY301689	S_06	Potential spring at Stand Burn ponds	Potential spring
	SEPA groundwater level monitoring borehole	NY310692	SAL_09	SEPA groundwater level monitoring borehole	SEPA groundwater level monitoring borehole
	Potential GWDTE	NY317692	G_10	Bensmoor Wood	Woodland
	Potential spring	NY318694	S_11	Potential spring 170m north east of Bensmoor Wood	Potential spring
	Potential spring	NY287694	S_12	Potential spring 220m west of Redhall Castle	Potential spring
	Potential GWDTE	NY296695	G_14	Plantation east of Nook Cottage	Woodland
	Potential spring	NY286695	S_17	Potential spring 300m north west of Redhall Castle	Potential spring

[6] The proposed Annandale depot is located within a drinking water protection area. Therefore, there is the potential that a drinking water supply could be located close to the Proposed Scheme, albeit outside of the 1km study area.

WFD groundwater waterbody (ID)	Feature type	NGR	WFD assessment unique reference ID	Feature name	Feature description
	Potential GWDTE	NY314696	G_18	Blacksike Wood	Woodland
	Potential spring	NY306696	S_19	Potential spring 100m south of Cranberry Bridge	Potential spring
	Potential spring	NY307700	S_22	Potential spring 90m north of Cranberry Farm	Potential spring
	Potential non-licensed abstraction	NY278701	UAb_24	Potential abstraction at Well south of North Lodge	Potential non-licensed abstraction
	Potential GWDTE	NY287701	G_25	Woodland south of Railway Cottage	Woodland
	Potential GWDTE	NY291701	G_27	Woodland east of Grahamshill Railway Cottages	Woodland
	Potential GWDTE	NY285704	G_34	Billy's Wood North	Woodland
	Potential spring	NY277705	S_35	Potential spring at Kirkpatrick Fleming	Potential spring

3 Scheme baseline

3.1 Surface water scheme components

All scheme components affecting the surface water bodies and watercourses screened in are summarised in Table A5. The scheme component type, name and design parameters are provided, and a unique reference ID has been applied for each scheme component. Cuttings are included in Section 3.2.

Table A5: Summary of Proposed Scheme components located on surface water bodies/watercourses screened in for preliminary assessment

WFD water body (ID)	Watercourse	Scheme component type	Scheme component name	Unique ID	Scheme component details	Off-route effects, CT-05 or CT-06 maps
Kirtle Water d/s Waterbeck (10666)	Ewes Burn	Watercourse realignment	Ewes Burn realignment	10666-T-01-RE-01	Ewes Burn is to be realigned to the south of the stabling facility in an open channel for approximately 1km.	CT-06-805 and CT-06-806
	Tributary of Ewes Burn 1	Wastewater treatment plant	Wastewater treatment plant discharge outfall	10666-T-02-WT-01	New wastewater treatment plant required to manage wastewater from the proposed stabling facility site, with effluent discharging into Tributary of Ewes Burn 1.	CT-06-805 and CT-06-806
	Tributary of Ewes Burn 1	Diversion	Tributary of Ewes Burn 1 diversion	10666-T-02-DV-01	Diversion of tributary to south of stabling facility for approximately 350m to accommodate access road and embankment.	CT-06-805 and CT-06-806
	Tributary of Ewes Burn 1	Culvert	Access road culvert	10666-T-02-CVA-01	Culvert approximately 35m long at upstream end of Tributary of Ewes Burn 1, to accommodate stabling facility access road.	CT-06-805 and CT-06-806
	Tributary of Ewes Burn 2	Diversion	Tributary of Ewes Burn 2 diversion	10666-T-03-DV-02	Diversion of tributary to the east of stabling facility for approximately 200m, beneath the reception track and sidings.	CT-06-805 and CT-06-806
	Tributary of Ewes Burn 2	Culvert	Northern Reception Track culvert	10666-T-03-CVA-01	Culvert approximately 30m long on Tributary of Ewes Burn 2, beneath reception track.	CT-06-805 and CT-06-806
	Tributary of Ewes Burn 2	Culvert	Depot sidings culvert	10666-T-03-CVA-02	Culvert approximately 50m long on Tributary of Ewes Burn 2, beneath sidings.	CT-06-805 and CT-06-806

3.2 Groundwater scheme components

All scheme components affecting the groundwater bodies screened in are summarised in Table A6. The scheme component type, name and design parameters are provided, and a unique reference ID has been applied to each scheme component.

Table A6: Summary of proposed scheme components within groundwater bodies screened in for preliminary assessment

WFD groundwater water body (ID)	Scheme component type	Scheme component name	Unique ID	Scheme components location	Off-route effects, CT-05 or CT-06 maps
Annan (150623)	Cutting	Headshunt cutting	150623-C-01	Cutting located to the west of the Annandale depot to accommodate the headshunt	CT-06-806
	Embankment	Depot sidings embankment	150623-EM-01	Embankment located around the Annandale depot	CT-06-805 and CT-06-806
	Embankment	Reception track embankment	150623-EM-02	Embankment located on the reception track	CT-06-805 and CT-06-806
	Cutting	Reception track cutting	150623-C-02	Located to the north / north-east of the Annandale depot	CT-06-805 and CT-06-806
	Cutting	Southern reception tracks cutting	150623-C-03	Located to the east of the Annandale depot	CT-06-805
	Embankment	Cranberry farm accommodation overbridge embankment	150623-EM-03	Embankment located to the east of the Annandale depot	CT-06-805
	Cutting	Traction substation cutting	150623-C-04	Cutting located to the east of the Annandale depot	CT-06-805

Annex B: Preliminary assessment (scoping)

1 Likely effects on current status

1.1 Surface water

The results of the preliminary assessment (scoping) of the likely effects of the relevant scheme components on the WFD status elements of surface water bodies are summarised in Table B1.

The assessment has identified the relevant impact types of each scheme component (following consideration of mitigation included within the design) and which WFD status elements are likely to be affected.

Table B1: Summary of preliminary assessment (scoping) of the likely effects of the Proposed Scheme on the WFD status elements of surface water bodies

WFD water body (ID)	Watercourse	Scheme component name	Access for fish migration	Water flows and levels	Physical condition	Freedom from invasive species	Water quality
Kirtle Water d/s Waterbeck (10666)	Ewes Burn	Ewes Burn realignment	There is potential to improve access for fish migration, if there are improvements to hydromorphological condition which reduce existing barriers to migration, as part of the realignment. However, fish populations are unlikely to be present within the watercourse, as it comprises a straightened drainage ditch network.	There is potential for the realignment to result in changes to flow velocity and/or flow depth depending on how the channel is redesigned / regraded.	There is potential to improve the physical condition of the channel, if there are improvements to hydromorphological condition as part of the realignment.	N/A (best practice guidance on working with invasive species to be followed, if invasive species are found within the working area).	Realigned/diverted channels would, if practicable, incorporate a buffer strip to allow for the inclusion of marginal and riparian habitat. Inclusion of these habitats will help to reduce the sediment load in runoff and nutrient loading from adjacent land. There is potential, therefore, for minor, localised improvements to water quality.
		Headshunt cutting Southern reception track cutting Traction substation cutting	There is potential for cuttings to result in changes to baseflow in watercourses, which could affect fish migration. However, fish populations are unlikely to be present within the watercourse, as it comprises a straightened drainage ditch network.	There is potential for cuttings to result in changes to baseflow in watercourses.	N/A	N/A	There is potential to disturb or mobilise existing poor quality water into surface watercourses by temporary or permanent groundwater control, but no poor quality groundwater has been identified in the area.

WFD water body (ID)	Watercourse	Scheme component name	Access for fish migration	Water flows and levels	Physical condition	Freedom from invasive species	Water quality
		Wastewater treatment plant discharge outfall (Tributary of Ewes Burn 1)	N/A	There is potential for flow to increase because of additional discharge into the upstream Tributary of Ewes Burn 1 from the proposed wastewater treatment plant. This may have a localised impact on the channel, as well as on the downstream watercourses (Stand Burn).	N/A	N/A	Discharge from the proposed wastewater treatment plant into Tributary of Ewes Burn 1 has potential to impact on water quality of Ewes Burn downstream of the confluence with Tributary of Ewes Burn 1, as flows in the tributary will contain elevated levels of nutrients (e.g. phosphate). Some dilution of nutrients should occur in Ewes Burn.
	Tributary of Ewes Burn 1	Wastewater treatment plant discharge outfall	N/A	There is potential for flow to increase because of additional discharge from the proposed wastewater treatment plant. This may have a localised impact on the channel.	N/A	N/A	Discharge from the proposed wastewater treatment plant has potential to impact on water quality in the watercourse, through the release of flows that contains elevated levels of nutrients (e.g. phosphate). There is expected to be a localised impact on water quality in the Tributary of Ewes Burn 1.
		Tributary of Ewes Burn 1 diversion	There is potential for the watercourse diversion to improve access for fish	There is potential for the diversion to result in changes to flow velocity and/or flow	There is potential to improve the physical condition of the channel, if there are	N/A (best practice guidance on working with invasive species to be followed if	Diverted channels will aim to incorporate a buffer strip to allow for the implementation of

WFD water body (ID)	Watercourse	Scheme component name	Access for fish migration	Water flows and levels	Physical condition	Freedom from invasive species	Water quality
			migration. However, fish populations are very unlikely to be present within the watercourse, as it is a small, straightened drainage ditch.	depth depending on how the channel is redesigned / regraded.	improvements to hydromorphological condition as part of the diversion. However, there may be limited scope to enhance the physical condition of this watercourse as it is a small drainage ditch.	invasive species are found within the working area).	marginal and riparian habitat, which in turn will help reduce sediment runoff and nutrient loading from adjacent land – therefore there is potential for minor, localised improvements to water quality.
		Headshunt cutting	There is potential for cuttings to result in changes to baseflow in watercourses, which could affect fish migration. However, fish populations are unlikely to be present within the watercourse, as it comprises a straightened drainage ditch network.	There is potential for cuttings to result in changes to baseflow in watercourses.	N/A	N/A	There is potential to disturb or mobilise existing poor quality water into surface watercourses by temporary or permanent groundwater control, but no poor quality groundwater has been identified in the area.
		Access road culvert	There is potential for the culvert to affect fish migration within the channel by adversely affecting fish passage. However, fish populations are very unlikely to be present within the watercourse,	There is potential for the culvert to have minor, localised impacts on local flow dynamics and flow continuity in the watercourse. However, the culvert will be short in length,	The culvert will have a localised, but permanent, impact on the hydromorphological regime of the watercourse, which may, in turn, lead to minor changes in	N/A (best practice guidance on working with invasive species to be followed if invasive species are found within the working area).	N/A

WFD water body (ID)	Watercourse	Scheme component name	Access for fish migration	Water flows and levels	Physical condition	Freedom from invasive species	Water quality
			as it is a small, straightened drainage ditch.	and will be designed to minimise impacts on sediment transfer and flow continuity.	flow processes and habitat upstream and downstream. However, these changes will be very limited given the short length of the culvert.		
	Tributary of Ewes Burn 2	Tributary of Ewes Burn 2 diversion	There is potential for the watercourse diversion to improve access for fish migration. However, fish populations are very unlikely to be present within the watercourse, as it is a small, straightened drainage ditch.	There is potential for the diversion to result in changes to flow velocity and/or flow depth depending on how the channel is redesigned / regraded.	There is potential to improve the physical condition of the channel, if there are improvements to hydromorphological condition as part of the diversion. However, there may be limited scope to enhance the physical condition of this watercourse as it is a small drainage ditch.	N/A (best practice guidance on working with invasive species to be followed if invasive species are found within the working area).	Diverted channels will aim to incorporate a buffer strip to allow for the implementation of marginal and riparian habitat, which in turn will help reduce sediment runoff and nutrient loading from adjacent land – therefore there is potential for minor, localised improvements to water quality.
		Reception track cutting Southern reception track cutting	There is potential for cuttings to result in changes to baseflow in watercourses, which could affect fish migration. However, fish populations are unlikely to be present within the watercourse, as it	There is potential for cuttings to result in changes to baseflow in watercourses.	N/A	N/A	There is potential to disturb or mobilise existing poor quality water into surface watercourses by temporary or permanent groundwater control, but no poor quality groundwater has been identified in the area.

WFD water body (ID)	Watercourse	Scheme component name	Access for fish migration	Water flows and levels	Physical condition	Freedom from invasive species	Water quality
		Traction substation cutting	comprises a straightened drainage ditch network.				
		Northern Reception Track culvert Depot sidings culvert	There is potential for these culverts to affect fish migration within the channel by adversely affecting fish passage. However, fish populations are very unlikely to be present within the watercourse, as it is a small, straightened drainage ditch.	There is potential for the culverts to have minor, localised impacts on local flow dynamics and flow continuity in the watercourse. However, the culverts will both be relatively short in length, and will be designed to minimise impacts on sediment transfer and flow continuity.	The culverts will have a localised, but permanent impact on the hydromorphological regime of the watercourse, which may, in turn, lead to minor changes in flow processes and habitat upstream and downstream. These changes will, however, be limited given the short (combined) length of the culverts.	N/A (best practice guidance on working with invasive species to be followed if invasive species are found within the working area).	N/A
	Stand Burn	Wastewater treatment plant discharge outfall (Tributary of Ewes Burn 1)	N/A	There is potential for flow to increase because of the discharge from the proposed wastewater treatment plant into Tributary of Ewes Burn 1 upstream of Stand Burn. This may have an impact on downstream	N/A	N/A	Discharge from the proposed wastewater treatment plant into Tributary of Ewes Burn 1 has potential to impact on water quality of Ewes Burn and subsequently Stand Burn further downstream, through the release of flows that contains elevated levels of nutrients

WFD water body (ID)	Watercourse	Scheme component name	Access for fish migration	Water flows and levels	Physical condition	Freedom from invasive species	Water quality
				watercourses. including Stand Burn.			(e.g. phosphate). A degree of dilution will have occurred due to the confluence of the watercourses and additional flow from Stand Burn.
	Kirtle Water	Wastewater treatment plant discharge outfall (Tributary of Ewes Burn 1)	N/A	There is potential for flow to increase because of additional discharge inputs from the proposed wastewater treatment plant. This may have a localised impact however it is likely to be negligible compared to the flow volume of the much larger watercourse.	N/A	N/A	Discharge from the proposed wastewater treatment plant has potential to impact on water quality in the watercourse, through the release of flows that contains elevated levels of nutrients (e.g. phosphate). There is expected to be a localised impact on water quality in Kirtle Water although the effect of increased dilution may make it negligible.

1.2 Groundwater

The results of the preliminary assessment (scoping) of the likely effects of relevant scheme components on the WFD status elements of groundwater bodies are summarised in Table B2. The assessment has identified which WFD status elements have potential to be affected by each of the scheme components, in relation to the relevant WFD groundwater body.

Table B2: Summary of preliminary assessment (scoping) of the likely effects of the Proposed Scheme on the WFD status elements of groundwater bodies

WFD groundwater body (ID)	Scheme component name	Water flows and levels		Water quality	
		Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	'Damming' of groundwater flow and reduction in groundwater contributions	Disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control	Creating or altering of pathways along which existing poor quality groundwater can migrate
Annan (150623)	Headshunt cutting	Records for CAR licences indicate that no public water supply (PWS) boreholes are located within the study area, although PWS boreholes may be located in the region. BGS borehole logs suggest the cutting will only penetrate the Gretna Till Formation and this would significantly limit the potential impact on the Sherwood Sandstone groundwater levels. The Well south of North Lodge is located outside of the radius of influence of the cutting. Possible reductions in flow could occur to two potential groundwater features (potential springs 220m west of Redhall Castle and 300m north west of Redhall Castle). Surveys are required to assess the value of these potential features. If they are true expressions of groundwater, then monitoring and possible mitigation measures will be considered in detailed design. Ewes Burn and Tributary of Ewes Burn 1 may receive reduced baseflow. However, track	N/A	There is potential to disturb or mobilise existing poor quality water by temporary or permanent groundwater control, but no poor quality water has been identified in the area.	N/A

WFD groundwater body (ID)	Scheme component name	Water flows and levels		Water quality	
		Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	**'Damming' of groundwater flow and reduction in groundwater contributions**	**Disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control**	**Creating or altering of pathways along which existing poor quality groundwater can migrate**
		drainage and land drainage will be discharged back into these watercourses to help minimise the impact of the scheme on baseflow. There is the potential for reduced groundwater levels below three ancient woodlands (Billy's Wood North, Woodland east of Grahamshill Railway Cottages and Mossknowe Lodge Wood). It is currently unknown if these woodlands are dependent on groundwater. If surveys show they are dependent on groundwater, then monitoring and possible mitigation measures will be considered in detailed design.			
	Stabling sidings North reception track	N/A	Piling through the peat could cause damming of groundwater flow in the alluvium and Gretna Till between the existing West Coast Main Line (WCML) and Ewes Burn. This could lead to a localised change in the distribution of groundwater discharge and baseflow along Ewes Burn in the area. However, land drainage and track drainage will be	N/A	Potential to create surface water groundwater pathways from piling but industry best practice will be used to ensure no long-term effects. Acid sulphate conditions may occur in the deep peat deposits, if they become oxidised. Peat deposits are of limited

WFD groundwater body (ID)	Scheme component name	Water flows and levels		Water quality	
		Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	**'Damming' of groundwater flow and reduction in groundwater contributions**	**Disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control**	**Creating or altering of pathways along which existing poor quality groundwater can migrate**
			discharged into the watercourse, and any change in the total groundwater contribution to Ewes Burn should be negligible.		spatial extent and therefore no deep peat is anticipated. However, if acid sulphate conditions are identified in the peat then aquifer protection measures should be used to ensure no pathway created to cause oxidation.
	Reception track cutting	Records for CAR licences indicate that no public water supply (PWS) boreholes are located within the study area, although PWS boreholes may be located in the region. BGS borehole logs in this area suggest the cutting will only penetrate the Gretna Till Formation and this would significantly limit the potential impact on the Sherwood Sandstone groundwater levels. Lowering groundwater levels in the Gretna Till Formation due to the presence of cutting has the potential to reduce groundwater contributions to Tributary of Ewes Burn 2. However, track drainage and land drainage will be discharged back into this watercourse	N/A	There is potential to disturb or mobilise existing poor-quality water by temporary or permanent groundwater control.	N/A

WFD groundwater body (ID)	Scheme component name	Water flows and levels		Water quality	
		Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	**'Damming' of groundwater flow and reduction in groundwater contributions**	**Disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control**	**Creating or altering of pathways along which existing poor quality groundwater can migrate**
		to help minimise the impact of the scheme on baseflow.			
	Southern reception tracks cutting	Lowering groundwater levels in the Gretna Till Formation due to the presence of cutting has the potential to reduce groundwater contributions to Ewes Burn. However, track drainage and land drainage will be discharged back into this watercourse to help minimise the impact of the scheme on baseflow. The impact of drainage to the cutting on groundwater flow and groundwater levels in the Gretna Till Formation has the potential to reduce yield in any potential unregistered groundwater abstraction sources within the vicinity of the site. The potential spring 200m south of Cranberry Bridge is within the calculated zone of influence of the cutting and the spring discharge could be lost as a result. Surveys are required to assess the value of this potential feature. If it is a true expression of groundwater, then monitoring and possible mitigation measures, if practicable, will be considered in detailed design. Blacksike Wood, an ancient woodland, is located adjacent to the existing WCML and to	N/A	There is potential to disturb or mobilise existing poor-quality water by temporary or permanent groundwater control.	N/A

WFD groundwater body (ID)	Scheme component name	Water flows and levels		Water quality	
		Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	**'Damming' of groundwater flow and reduction in groundwater contributions**	**Disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control**	**Creating or altering of pathways along which existing poor quality groundwater can migrate**
		land required for the construction of the Proposed Scheme. It is currently unclear whether this woodland is dependent on groundwater and has therefore been included on a precautionary basis. The western section of Blacksike Wood, and the uppermost reach of a drain in the wood, are located within the calculated zone of influence of the southern reception tracks cutting. If the drain is fed by groundwater and supports an important habitat in Blacksike Wood, or if groundwater supports any other wetland habitats within the wood, these habitats could be impacted due to drainage in the cutting.			
	Cranberry farm accommodation overbridge embankment	N/A	Piling could cause localised damming of groundwater flow in the alluvium and Gretna Till Formation. This could lead to reduced baseflow in Ewes Burn. However, piling is not likely to be extensive and the impact is expected to be negligible.	N/A	Potential to create surface water groundwater pathways from piling but industry best practice will be used to ensure no long-term effects.

WFD groundwater body (ID)	Scheme component name	Water flows and levels		Water quality	
		Lowering of groundwater levels and reduction in groundwater contributions to surface water bodies, GWDTE or groundwater abstractions by temporary dewatering/ permanent groundwater control	**'Damming' of groundwater flow and reduction in groundwater contributions**	**Disturbing or mobilising existing poor-quality groundwater by temporary dewatering or depressurisation and permanent groundwater control**	**Creating or altering of pathways along which existing poor quality groundwater can migrate**
	Traction substation cutting	Lowering groundwater levels due to presence of cutting has the potential to reduce groundwater contributions to Ewes Burn due to interception of groundwater flow paths and disruption of spring discharges into Ewes Burn and its tributaries. Very shallow cutting, unlikely to impact on any abstractions in the area (licensed and non-licensed).	N/A	There is potential to disturb or mobilise existing poor-quality water by temporary or permanent groundwater control.	N/A

2 Likely effects on status objectives

2.1 Pressures

The identified 'pressures' for the quality elements of Kirtle Water affected by the Proposed Scheme have been considered against the relevant scheme components proposed within the water body catchment area. These together with the associated potential adverse and/or beneficial effects, are provided in Table B3.

A precautionary approach has been taken, whereby any identification of a potential adverse effect (following consideration of mitigation included in the design) is used to highlight the potential for the Proposed Scheme to prevent the status objective of the relevant quality element from being achieved. Accordingly, those pressures highlighted as potentially at risk from the Proposed Scheme have been taken forward for further assessment.

Table B3: Summary of preliminary assessment (scoping) of likely effects of Proposed Scheme off-route works on pressures for relevant WFD surface water bodies

WFD water body (ID)	Element not achieving good status	Pressure (tier)	Explanation	Relevant to Proposed Scheme?	Relevant scheme component (s)	Likely effect of Proposed Scheme when considered against mitigation included in the design
Kirtle Water d/s Waterbeck (10666)	Fish	Unknown	SEPA assessments indicate that fish populations in the water body may not be in a good condition, but no obvious cause has been identified. Therefore, the deadline for improving the condition of the water body's fish populations has been extended to 2027 (instead of 2021). During the period 2015 – 2021, Scottish Environment Protection Agency is undertaking further investigations to identify whether the assessment of the condition of the fish is reflective of adverse effects caused by humans or natural conditions.	Unlikely – if the cause for poor fish populations is not yet known, it is not possible to know whether it is relevant to the proposed scheme. Furthermore, fish populations in the affected waterbodies are likely to be limited due to the small, drainage ditch nature of the channels.	N/A	N/A

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