

APPENDIX 1
EXTRACT FROM ENVIRONMENT STATEMENT – NON-TECHNICAL SUMMARY

4. Air Quality

4.1 Scope of Assessment

4.1.1 This factor assesses the potential effects of construction and operation of the Proposed Scheme on air quality at sensitive human health and ecological receptors, as well as on the UK's reported ability to meet air quality European Union Limit Values in the shortest possible time.

4.1.2 The elements scoped into the air quality assessment include:

- Construction dust
- Operational traffic emissions – effects on human health, designated habitats and compliance limit values

4.1.3 The elements scoped out of the air quality assessment include:

- Construction plant emissions – as deemed unlikely to be significant
- Construction traffic exhaust emissions – in accordance with the *Design Manual for Roads and Bridges LA 105 Air Quality* – as construction is not expected to exceed two years' duration.
- Air Quality Management Areas in Colchester – as traffic modelling did not indicate significant changes in traffic in these areas

4.2 Baseline Environment

4.2.1 Currently, no Air Quality Management Areas have been declared by Tendring District Council. Colchester Borough Council, however, has three Air Quality Management Areas, all declared due to exceedances of annual mean nitrogen dioxide.

4.2.2 A number of human receptors (primarily residences) have been identified within 20 m – 350 m of the Proposed Scheme.

4.2.3 A number of designated ecological receptors have been identified within the air quality study area (350 m from the boundary of the site and 50 m of the routes likely to be used by construction vehicles on the public highway, up to 500 m from the site entrance). The baseline rates of nitrogen deposition have been obtained for these ecological sites for the assessment on air quality on ecological receptors. This has been assessed within the Biodiversity assessment.

4.3 Method of Assessment

4.3.1 The air quality assessment has been completed using the following standards and guidance:

- *Design Manual for Roads and Bridges LA 105 Air quality*
- Institute of Air Quality Management, *Guidance on the Assessment of Dust from Demolition and Construction*
- Department for Environment, Food and Rural Affairs, *Local Air Quality Management Technical Guidance, LAQM.TG (16)*

4.3.2 Information for the air quality assessment has been collected from:

- Local Air Quality Management review and assessments and air quality monitoring undertaken by Tendring District Council and Colchester Borough Council
- A site-specific air quality survey undertaken by Jacobs
- Department for Environment, Food and Rural Affairs background maps, for a 2018 reference year

- Projected roadside nitrogen dioxide concentrations data, for a 2018 reference year, from the Department for Environment, Food and Rural Affairs' Pollution Climate Mapping model
- Observed meteorological data from Wattisham Airport in 2019
- The Air Dispersion Model Software-Roads air dispersion model, which was used to estimate annual mean pollutant concentrations at sensitive receptors
- Vissim and EMME traffic models, which provided data on traffic flow, composition and speed on the local road network
- Ordnance Survey datasets, including AddressBase Plus (to identify sensitive human receptors), MasterMap and Highway Network
- Defra's MAGIC Map website and local ecological datasets to identify designated ecological habitat locations

4.4 Results

4.4.1 No significant effects were identified for the following:

- Construction dust: – due to a Low to Medium-level risk of dust soiling impacts at sensitive receptors, and a Negligible to Low risk of human health impacts, and a Negligible to Low risk of ecological impacts
- Operation – human health receptors: as the opening year and cumulative assessments indicate that all of the human health receptors considered are modelled to experience pollutant concentrations within the relevant Air Quality Objectives for all pollutants
- Operation – designated habitats: see paragraph 6.4.2 (significance has been assigned in the biodiversity assessment)
- Operation – compliance with Limit Values: annual mean nitrogen dioxide concentrations are modelled to be within the EU Limit Value adjacent to all links. As such, it is considered that there is no risk of the Proposed Scheme affecting the UK's reported ability to comply with the Air Quality Directive in the shortest timescale possible

4.5 Mitigation

4.5.1 No mitigation other than construction good practice has been considered as no significant effects have been identified.

4.6 Residual Effects

4.6.1 No residual effects have been identified.

4.7 Conclusion

4.7.1 The Proposed Scheme is predicted to have no significant effects on air quality.

5. Cultural Heritage

5.1 Scope of Assessment

- 5.1.1 This factor assesses potential effects of the construction and operation of the Proposed Scheme on archaeological remains, historic buildings and historic landscapes.
- 5.1.2 The elements scoped into the cultural heritage assessment include:
- Archaeology
 - Historic buildings
 - Historic landscapes
 - Historic hedgerows
- 5.1.3 During construction the following potential effects were considered:
- Partial or total removal/damage of cultural heritage features
 - Compaction of archaeological deposits
 - Changes in groundwater levels leading to the desiccation of waterlogged archaeological deposits and/or subsidence of historic buildings
 - Effects on setting from visual and noise intrusion, severance and adverse impacts on amenity
- 5.1.4 During operation only setting effects were considered relevant.
- 5.1.5 No elements were scoped out.

5.2 Baseline Environment

- 5.2.1 A summary of the cultural heritage assets in the vicinity of the Proposed Scheme is presented in Table 5.1.

Table 5.1: Cultural Heritage elements within the study area

Cultural Heritage Element	Within Planning Application Boundary	300 m Study Area	1 km Study Area	Total
Archaeological remains	22	34	Not included	56
Historic buildings	1*	2	14	17
Historic landscapes	8	3	1	12
Historic hedgerows	37 39	2	Not included	39 41
Total	68 70	41	15	124 126

* A non-designated cast iron milepost, not a designated Listed Building

5.3 Method of Assessment

- 5.3.1 The cultural heritage assessment has been completed using the following standards and guidance:
- *Design Manual for Roads and Bridges LA 104 Environmental assessment and monitoring*
 - *Design Manual for Roads and Bridges LA 106 Cultural heritage assessment*
 - English Heritage (now Historic England) *Conservation Principles, Policies and Guidance*

- Historic England's *Statement of Heritage Significance: Analysing Significance in Heritage Assets Historic England Advice Note 12*
- Historic England's *The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3*
- Historic England's *Managing Significance in Decision-Taking in the Historic Environment: Historic Environment Good Practice Advice in Planning: 2*
- The Chartered Institute for Archaeologists' *Code of Conduct*
- The Chartered Institute for Archaeologists' *Standard and guidance for historic environment desk-based assessment*

5.3.2 Information for the cultural heritage assessment has been collected from:

- Essex County Council Historic Environment Record data
- Results of a hedgerow assessment and aerial investigation mapping
- Results of a cultural heritage site visit of certain assets in December 2020
- Consideration of other factor assessments including:
 - Landscape and Visual - to assist determining potential visual impacts on the setting of cultural heritage assets
 - Geology and Soils - to understand the geology of the study area and assist in understanding the potential for the presence of prehistoric archaeological remains
 - Noise and Vibration - to assist in determining potential noise impacts on the settings of cultural heritage assets
 - Road Drainage and Water Environment - to understand the potential impacts from flooding and dewatering on cultural heritage assets

5.3.3 Due to access constraints, intrusive investigation has not occurred to inform the assessment of archaeological remains and there is the potential for unknown archaeological remains to be present. It is assumed that archaeological investigations are to be undertaken under the terms of a planning condition.

5.4 Results

5.4.1 Potential effects that have been identified as significant during construction and operation are summarised in Table 5.2.

5.4.2 Construction of the Proposed Scheme would have the potential to impact heritage assets through partial/total removal, compaction, changes in groundwater levels, or effects on setting. The main impacts during operation are expected to be effects on setting.

Table 5.2: Cultural Heritage potential effects identified as significant

Stage	Significance of Effect	Cultural Heritage Element								Total
		Archaeological remains		Historic buildings		Historic landscapes		Historic hedgerows		
		A ¹	B	A	B	A	B	A	B	
Construction (physical and setting impacts)	Moderate adverse	6			1			14		21
	Large adverse	3				1		14		18

Stage	Significance of Effect	Cultural Heritage Element								Total
		Archaeological remains		Historic buildings		Historic landscapes		Historic hedgerows		
		A ¹	B	A	B	A	B	A	B	
Operation (setting impacts only)	Moderate adverse				1					1
	Large adverse					1				1
Note 1: where A = within the Planning Application Boundary and B = within 300 m of the Planning Application Boundary										

5.4.3 No potential effects on cultural heritage assets within 300 m - 1 km of the Planning Application Boundary have been identified as significant.

5.5 Mitigation

5.5.1 During construction, proposed essential mitigation includes:

- Archaeological investigations to confirm the presence or absence of unknown archaeological remains. The results would inform the design of site-specific mitigation measures
- Creation of barriers around borrow pits, limiting their radius of influence to prevent dewatering of waterlogged deposits and subsidence to historic buildings
- Creation of new hedgerows, and hedgerows with trees
- Should Milepost at Elmstead (site of) (a historic building within the Planning Application Boundary) still be present, reinstatement or relocation will be considered

5.5.2 During operation, no mitigation has been proposed other than that associated with landscape designs which will afford some long-term screening to heritage assets.

5.6 Residual Effects

5.6.1 One historic building (Allen's Farmhouse - Grade II listed building) is predicted to experience a moderate adverse significant effect during both construction and operation. The mitigation measures proposed will not decrease the significance of effect to below moderate.

5.6.2 One historic landscape (Turnip Lodge Lane - Protected Lane) is predicted to experience a large adverse significant effect during both construction and operation. As there is no specific noise mitigation proposed, and the operational Proposed Scheme will be directly abutting this lane, the residual significance of effect of large adverse will remain.

5.6.3 Construction will involve partial or complete removal of 25 23 historic hedgerows and the Proposed Scheme will have moderate to large adverse significant effects on these assets. The removal of the historic fabric from these hedgerows is not mitigable, resulting in moderate or large adverse residual significant effects for all 25 23 hedgerows.

5.6.4 No archaeological remains are predicted to experience significant residual effects.

5.7 Conclusion

- 5.7.1 The Proposed Scheme is predicted to have significant adverse effects on 27 25 cultural heritage assets (primarily historic hedgerows) that cannot be sufficiently mitigated. Overall, the Proposed Scheme is predicted to result in a moderate adverse effect on cultural heritage receptors which is considered significant under the *Design Manual for Roads and Bridges*.

6. Biodiversity

6.1 Scope of Assessment

6.1.1 This factor assesses the potential effects of construction and operation of the Proposed Scheme on ecological receptors, which are considered to be those species and habitats protected by legislation or those otherwise recognised to be of importance in the maintenance of biodiversity within proximity to the Proposed Scheme.

6.1.2 The elements scoped into the biodiversity assessment include:

- Habitats
- Protected species including:
 - Bats
 - Dormouse
 - Water vole
 - Breeding birds
 - Reptiles
 - Badger
 - Invertebrates (stag beetle)
 - Invasive species
 - Other priority species (e.g. brown hare)

6.1.3 Following desk study and survey the following were scoped out of the biodiversity assessment:

- Ecologically designated sites - as none are considered to be ecologically connected to the study area
- Over-wintering birds - as no significant populations of species of nature conservation significance were identified during survey work
- Great crested newts - as no likely breeding ponds were identified within 500 m of the Proposed Scheme
- White-clawed crayfish - as no suitable habitat is present and the species is known to be absent from the catchment

6.2 Baseline Environment

6.2.1 Two Sites of Special Scientific Interest and one Local Nature Reserve are located within approximately 1 km of the Proposed Scheme.

6.2.2 Colne Estuary is designated as a Sites of Special Scientific Interest, Special Protection Area, Special Area of Conservation and Ramsar, and is located 3.5 km to the south of the Planning Application Boundary. Despite the distance of this site from the Proposed Scheme, there is a connection between the Proposed Scheme and the Colne Estuary as its drainage output will ultimately flow into the estuary. However the impact assessment concluded that there will be no direct physical impacts or disturbance of Colne Estuary or the habitats that are derived from it, due to the distance from the Proposed Scheme, and any potential effects on drainage are mitigated through measures embedded into the drainage design.

6.2.3 Eighteen Local Wildlife Sites are located within 2 km of the Planning Application Boundary, the closest being approximately 400 m to the west.

- 6.2.4 One Site of Special Scientific Interest, three Local Nature Reserves, 20 Local Wildlife Sites, **Strawberry Grove and Broom Grove**, and the Ancient Woodland at Friars Grove and Boudge Hill Wood are located within 200 m of the roads potentially affected by traffic from the Proposed Scheme.
- 6.2.5 Five habitat units within the study area (Planning Application Boundary and a 250 m buffer) have been identified as Priority Habitat, all Lowland Mixed Deciduous Woodland, two of them being Strawberry Grove and Broom Grove, considered to be surviving fragments of Ancient Woodland and of national value.
- 6.2.6 The field boundaries within the study area include a significant number of large pedunculate oak trees. Hedgerows to be crossed by the Proposed Scheme, that should be considered as Priority Habitat with national value, have been identified.
- 6.2.7 Following further assessment of the presence of protected species, it has been concluded that water voles and invasive species are likely absent from the study area and so will not be impacted by the Proposed Scheme.
- 6.2.8 The following species have been identified as present within the study area:
- Bats: at least seven bat species present and two roosts identified within trees affected by the construction of the Proposed Scheme. Commuting routes have also been identified that cross the Proposed Scheme.
 - Dormouse: present in two locations
 - 38 breeding bird species
 - Reptiles: low numbers of common lizard and slow worm present in two areas of suitable habitat intersected by the Proposed Scheme
 - Badger: the Proposed Scheme includes parts of active badger territories
 - Brown hare: identified across the survey area, including young animals that indicate a breeding population
 - Stag beetle: presence considered likely

6.3 Method of Assessment

- 6.3.1 The biodiversity assessment has been completed using the following standards and guidance:
- *Design Manual for Roads and Bridges LA 104 Environmental assessment and monitoring*
 - *Design Manual for Roads and Bridges LA 108 Biodiversity*
 - Chartered Institute of Ecology and Environmental Management *Guidelines for Ecological Impact Assessment in the UK and Ireland*
- 6.3.2 Information for the biodiversity assessment has been collected through the use of:
- A desk study including requests for existing biological records from Essex Field Club and from the Essex Wildlife Trust Records Centre
 - Defra's MAGIC Map website was used to obtain information about statutory designated sites, and Tendring District Council's and Colchester Borough Council's Local Plan web pages were used to identify Local Wildlife Site data
 - Field surveys carried out for all relevant species and habitats using appropriate methodologies as set out in current published guidance and best practice documents

6.4 Results

- 6.4.1 Significant effects were identified for the following during construction:

- Habitats - Hedgerows (moderate adverse) - Loss of 940 m of Priority Habitat and 2,836 m of other hedgerows
- Habitats - Ancient Woodland - Strawberry Grove (large adverse) - due to the loss of approximately 0.05 ha on the northern edge of Strawberry Grove
- **Bats (moderate adverse) - due to the loss of foraging habitat and interruption of commuting routes**
- Dormouse (moderate adverse) - due to the removal of approximately 0.8 ha of dormouse habitat which could lead to harm to individual dormice, if present

6.4.2 No significant effects have been identified in the air quality assessment of designated habitats as the modelled changes in air quality will not result in the loss of one species, which is the threshold for significance.

6.4.3 **The only significant effect identified during operation is the barrier effect of the new road and lighting on bats, considered to be moderate adverse.**

6.5 Mitigation

6.5.1 Mitigation proposed includes:

- Hedgerow removal will be minimised as far as is possible
- ~~6,348~~ **6,987** m of new hedgerow and linear woodland planting
- Creation of 1.5 ha of new woodland adjacent to Strawberry Grove by natural regeneration
- The south-western edge of Strawberry Grove will be restored following fire damage in 2019, with replacement of lost understorey species and restocking of standard trees
- Mitigation for impacts to dormouse will **be addressed through an application for a European Protected Species licence from Natural England. The method statement to accompany the licence application will involve displacing them from the habitat to be lost, by phased removal of vegetation over the winter of 2021/22 and the spring of 2022, combined with enhancement of remaining habitat and the creation of new habitat in compensation.** ~~including:~~ **All vegetation removal will be supervised by a suitably qualified ecologist, with pre-works searches to prevent individuals being harmed.**
- **Enhancement works will be carried out in advance of construction, during autumn 2021, including:**
 - Provision of 2 ha of new or enhanced habitat adjacent to, or connected with, Strawberry Grove
 - Other landscape planting will be designed to provide habitat suitable for dormouse to facilitate their dispersal and establishment in the wider landscape
 - Over winter 2021/22 vegetation will be cleared to just above ground level along the verge between the service station and the eastern end of the Planning Application Boundary to prevent harm to over-wintering dormice and encourage them to disperse when they emerge from hibernation in the following spring
 - In spring 2022 the remaining vegetation in areas of dormouse habitat will be removed under ecological supervision, searching for any established nests
- **A farmland bird mitigation strategy will be developed for the non-significant effect on breeding species, principally Skylark. This will take the form of a partnership with a local farm business to provide four Skylark nest plots in nearby arable fields for ten years after construction.**
- The pedestrian underpass at the northern end of the Link Road will be designed to encourage low-flying bats to pass beneath the road in order to reduce the barrier effect caused by its operation.

- Hop-over points will be incorporated into the landscape planting at five other locations along the road (and one on the A120) where there is evidence of regularly used bat commuting routes

6.6 Residual Effects

- 6.6.1 With the passage of time, the loss of hedgerows will be amply compensated by the planting and maturity of new hedgerows, particularly considering the variable quality of the hedgerows to be lost. This amounts to a slight beneficial effect.
- 6.6.2 The loss of Ancient Woodland habitat in Strawberry Grove will be addressed by the creation of new woodland habitat, but as an irreplaceable habitat, this is insufficient to counteract the adverse effect. However, the loss is very small and with the new planting proposed, it is only considered to be a slight adverse effect.
- 6.6.3 Some consequences of the road's presence on the movement of bats through the landscape will remain despite the measures that will be put in place. However, given the generally low levels of bat activity, the lack of direct impacts on any species of raised nature conservation value and the beneficial effects of landscaping on habitat quality and connectivity, the residual effect is considered to be neutral.
- 6.6.4 In the longer term, the effect of the Proposed Scheme on the local Dormouse population is considered to be positive, with a more extensive area of suitable habitat available and improved quality of existing habitats. As such, the residual effect is considered to be slight beneficial.

6.7 Conclusion

- 6.7.1 The Proposed Scheme is predicted to have both beneficial and adverse effects on biodiversity. Overall, the Proposed Scheme has a neutral or slight beneficial effect on ecological receptors which are deemed to be not significant for the purposes of this impact assessment.

7. Landscape and Visual

7.1 Scope of Assessment

7.1.1 This factor assesses the potential effects of construction and operation of the Proposed Scheme on landscape as a resource and people's views and visual amenity.

7.1.2 The receptors scoped into the landscape and visual assessment include:

- Local Landscape Character Areas
- Visual receptors

7.1.3 Several potential visual receptors have been scoped out of the landscape and visual assessment as potential views would likely be filtered by intervening vegetation, topography or buildings.

7.2 Baseline Environment

7.2.1 There are no National Parks, **heritage coasts**, Areas of Outstanding Natural Beauty or Special Landscape Areas located within 1 km of the Proposed Scheme.

7.2.2 There are five Ancient Woodland blocks identified on the Ancient Woodland Inventory within approximately 1 km of the **proposed route Proposed Scheme**. In addition, Broom Grove, adjacent to the Planning Application Boundary; and Strawberry Grove, within the Planning Application Boundary, are woodland blocks that are considered likely to be Ancient Woodland.

7.2.3 There are a large number of veteran and ancient trees approximately 650 m to the south-west of the Proposed Scheme. No other veteran or ancient trees are recorded within the Proposed Scheme extents or a 15 m offset. Tree Protection Orders are present at seven locations within 1 km of the **proposed route Proposed Scheme**. These veteran trees, ancient tree and Tree Protection Orders are too far away to be affected by the Proposed Scheme.

7.2.4 The landscape setting of heritage features is relevant to the landscape assessment. One Registered Park and Garden, several listed buildings and a protected lane are located within 1 km of the Proposed Scheme, as set out in further detail in Chapter 5 – Cultural Heritage.

7.2.5 Settlement is sparse within 1 km of the **proposed route Proposed Scheme** with the largest settlements located approximately 1 km away. A number of existing and proposed open spaces and private open spaces are located within the vicinity of the Proposed Scheme.

7.2.6 The land use is predominantly arable agriculture, but sand and gravel extraction activities also take place due to the underlying geology. The busy A120 and A133 are key infrastructure routes crossing from east to west through the landscape. There are some recreational routes connecting Colchester, Wivenhoe, Elmstead Market and Bromley Cross within the wider countryside, which pass within the Planning Application Boundary.

7.2.7 The topography comprises a flat plateau, bisected by valleys associated with watercourses. The primary land cover is large-scale arable fields divided by managed hedgerows with intermittent hedgerow trees. Occasional woodland blocks punctuate the farmland. Intensification of agriculture has resulted in the gradual loss of areas of natural woodland and heathland, the amalgamation of fields and associated loss of hedgerow field boundaries, and remnant orchards. In addition, remaining hedgerow field boundaries have become gappy.

7.2.8 In the vicinity of the Proposed Scheme, the urban edges of Colchester and Wivenhoe, Elmstead Market and the area south of Ardleigh are most affected by light pollution, while the farmland areas furthest from these light sources are generally less affected by light pollution.

- 7.2.9 At a local scale, the area within 1 km of the **proposed route** ~~Proposed Scheme~~ is covered by both the Tendring and Colchester Landscape Character Assessments, which identify Landscape Character Areas within the study area. The majority of the study area is covered by Landscape Character Area 7A Bromley Heaths within the Tendring Landscape Character Assessment. Other Landscape Character Areas within the study area include Landscape Character Areas: LCA B8 Wivenhoe Farmland Plateau of the Colchester Landscape Character Assessment; as well as 6B Ardleigh Valley System and 6C Alresford Valley System, of the Tendring Landscape Character Assessment, and A6 Ardleigh River Valley, of the Colchester Landscape Character Assessment, which include the valleys of Salary, Bromley and Sixpenny Brooks.
- 7.2.10 While there are open views locally across agricultural fields, hedgerows, tree belts and woodlands tend to curtail more distant views. As such, views are generally close-range or middle-distance. There is potential for the following visual receptor groups to experience significant effects as a result of the Proposed Scheme:
- Users of Public Right of Ways
 - Residents of nearby dwellings
- 7.2.11 A selection of viewpoints that are representative of these visual receptor groups has been assessed. The final selection of representative viewpoints has been agreed with the local planning authorities.

7.3 Method of Assessment

- 7.3.1 The landscape and visual assessment has been undertaken using the following guidance:
- *Design Manual for Roads and Bridges LA 107 Landscape and visual effects (Rev. 2)*
 - *Design Manual for Roads and Bridges LA 104 Environmental assessment and monitoring*
 - The Landscape Institute and Institute of Environmental Management and Assessment *Guidelines for Landscape and Visual Impact Assessment, Third Edition GLVIA3*
 - The Landscape Institute's *Visual Representation of Development Proposals Technical Guidance Note 06/19*
- 7.3.2 Information for the landscape and visual assessment has been informed by the use of:
- Development of a Zone of Theoretical Visibility, i.e. determining from where the Proposed Scheme can be seen, taking account of topography and screening elements. **The Zone of Theoretical Visibility modelling produced are based upon the proposed route design for the Proposed Scheme submitted for planning in April 2021. The changes to the design for the Planning Application addendum submission are not considered likely to result in a materially different Zone of Theoretical Visibility, as the changes to the horizontal alignment of the proposed route are minor, the vertical alignment of the proposed route has not increased and the extent of any areas to be lit are similar to the April 2021 design** Desk-based study
 - Site visits (carried out in July 2019, March 2020, September 2020, October 2020 and December 2020)

7.4 Results

- 7.4.1 The potential effects of the Proposed Scheme on Landscape Character Areas and visual receptors are summarised in Table 7.1 (construction) and Table 7.2 (operation). Note that significance is not assessed in the landscape and visual assessment until after essential mitigation has been considered (see Section 7.6: Residual Effects, for the significant residual effects identified).

Table 7.1: Summary of potential landscape and visual construction effects

Adverse Short-term Construction Effects (Approximately Two Years)	
Effects on landscape character	<ul style="list-style-type: none"> • Removal of vegetation to facilitate construction of the Proposed Scheme, including some trees along the edge of Strawberry Grove, which is a likely Ancient Woodland • Changes to landform arising from earthworks to create embankments and excavation of attenuation ponds and borrow pits • Disruption to land use, landscape pattern and landscape character as a result of major earthworks and construction activity and the presence of construction plant and materials, temporary soil storage, construction compounds and haul routes • Reduced tranquillity
Effects on visual receptors	<ul style="list-style-type: none"> • Removal of vegetation would make the presence of traffic on the existing A120 more noticeable and open up views of construction activities • Views of construction compounds with temporary site offices, parking areas for plant and construction staff, and material storage • Views of construction plant and earthworks, including temporary soil storage • Views of temporary tall crane movements associated with construction of the proposed bridge across the A120 • Views of construction plant and vehicles on haul routes • Views of temporary signage, roadworks and congested traffic flow on roads locally due to traffic management • Views of lighting equipment during the day and lighting at night, associated with construction works to be undertaken during the hours of darkness

Table 7.2: Summary of potential landscape and visual operational effects

Adverse Long-term Operational Effects	
Effects on landscape character	<ul style="list-style-type: none"> • Absence of vegetation removed to facilitate the Proposed Scheme • Permanent changes to the landform due to embankments, attenuation ponds and borrow pits • Severance of the landscape by the proposed Link Road • Increased presence of traffic and highway infrastructure in the rural landscape, including signage and lighting columns, associated with the Link Road, roundabouts, A120 junction and A120 overbridge, which would reduce tranquillity locally • Increased lighting in the landscape in areas associated with roundabouts and the A120 junction
Effects on visual receptors	<ul style="list-style-type: none"> • Views of traffic and highway infrastructure, including signage, lighting columns, anti-glare barriers and vehicle restraint systems, associated with the Link Road, roundabouts, the A120 junction and A120 overbridge • Views of traffic on the A120 would be more noticeable due to the absence of vegetation along the road • Views of attenuation ponds and borrow pits • Night-time views of lighting associated with roundabouts and the A120 junction

Adverse Long-term Operational Effects	
	<ul style="list-style-type: none"> Night-time views of lighting associated with the shared use Public Right of Way diversion and segregated footway/cycleway routes to the west of the Link Road

7.5 Mitigation

7.5.1 It is not considered necessary to propose further essential mitigation for landscape and visual receptors during construction, as comprehensive mitigation is proposed as part of the embedded and good practice mitigation. However, where practicable, stripped soil shall be stored in windrows (a row of placed material, such as soil) around the perimeter of the temporary works and construction areas to provide temporary screening.

7.5.2 Mitigation proposed during operation includes:

- Native planting, including hedgerows, hedgerows with trees, shrubs and trees, and woodland, to integrate the Proposed Scheme into the landscape and screen views, whilst allowing some views to the surrounding landscape from the proposed Link Road and shared-use Public Right of Way diversion and segregated footway/cycleway routes. The indicative species, pattern and distribution of proposed hedgerows, shrubs and trees along the Proposed Scheme have been selected to reflect the distinctive local character of vegetation within the landscape and to provide screening
- Use of hedgerows on the highway boundary, including hedgerows with trees, to link into existing field boundaries, and provide screening and integration of the Proposed Scheme with the local landscape pattern
- Gapping up of poor-quality hedgerows to be retained, for landscape integration and to enhance the local landscape character
- Native planting and natural regeneration to expand woodland cover to integrate the Proposed Scheme into the landscape and enhance the local landscape character
- The sensitive design of attenuation ponds to integrate these into the landscape **and be sympathetic to their landscape surroundings**, reduce visual intrusion and enhance visual amenity value
- Specification of root barriers where necessary during detailed design to reduce effects on the proposed planting as a result of any refinements to the drainage design**
- Sensitive restoration of borrow pits to integrate these into the landscape, such as, where practicable, slackening earthworks, designing natural contours and allowing water to fill the pits, and to enhance visual amenity
- Creation of species-rich grassland, including naturally regenerated grassland, at locations where conditions are suitable for their establishment, to provide seasonal interest for visual amenity
- Explore feathering of earthwork slopes and rounding the crests and toes of embankments during detailed design to improve integration with the surrounding landform, where space and materials are available
- Integration of fences, **environmental barriers** and retaining walls within the landscape during detailed design
- Sensitive positioning and specification of signage during detailed design to help to integrate these features into the landscape**
- All lighting of the shared use Public Right of Way diversion and segregated footway/cycleway routes to the west of the Link Road will be sensitively designed and integrated into the path surface as solar studs in order to reduce visual intrusion

7.6 Residual Effects

- 7.6.1 Significant landscape residual effects have been identified for Bromley Heaths Landscape Character Area. Changes to the generally flat landform, removal of vegetation, including a narrow strip of likely Ancient Woodland, and the presence of construction activities and major earthworks in the landscape would affect the rural character, resulting in a moderate adverse and therefore significant effect locally. The significance of effect would remain moderate adverse and therefore significant locally during winter year 1 of operation due to the permanent change to the landform, absence of woody vegetation and presence of traffic and highway infrastructure (including lighting) in the landscape, which would erode the generally rural landscape character. The establishment of mitigation planting would help to integrate the Proposed Scheme into the surrounding landscape by summer year 15 of operation, but the significance of the effect would not change locally. However, the overall effect on the wider Bromley Heaths Landscape Character Area during construction and winter year 1 of operation, and summer year 15 of operation would not be significant due to distance.
- 7.6.2 Significant visual residual effects have been identified for users of Public Right of Ways and residents. There would be significant adverse effects on users of Public Right of Ways (moderate to very large adverse) and residents (moderate to large adverse) during construction, due to views of construction activities. There would also be significant effects on users of Public Right of Ways and residents (both moderate to very large adverse) during the winter year 1 of operation, due to views of traffic and highway infrastructure, which would be noticeable in most views and dominant in some. The established mitigation planting would generally screen traffic and highway infrastructure associated with the Proposed Scheme from Public Right of Ways and residential properties by the summer year 15 of operation. However, the tops of lighting columns associated with the roundabouts and A120 junction would remain visible above the planting, along with the tops of high-sided vehicles from some viewpoints. Lighting would also be visible during the hours of darkness. As such, adverse visual effects would have reduced notably and there would not be significant adverse effects on most visual receptors. However, a moderate adverse significant effect would remain at three representative viewpoints located in the vicinity of the Allens Farm.

7.7 Conclusion

- 7.7.1 The overall long-term residual significance of effect on the wider landscape character and visual amenity would not be significant. However, there would be moderate adverse and, therefore, significant adverse residual effects on local landscape character and three close-range views from footpaths and residential properties.

8. Geology and Soils

8.1 Scope of Assessment

8.1.1 This factor covers the potential effects of the construction and operation of the Proposed Scheme on soil resources, and from land contamination on human health and the water environment.

8.1.2 The elements scoped into the geology and soils assessment include:

- Soil resources
- Contamination effects on human health
- Contamination effects on groundwater and surface water

8.1.3 There are two geologically important sites within the study area, however they are approximately 1 km away from the Proposed Scheme, and therefore, outside the zone of influence. Based on this, and as there are no other geologically important sites within the study area, geologically important sites have been scoped out of further assessment.

8.2 Baseline Environment

8.2.1 The Proposed Scheme predominantly crosses grade 1 (excellent quality) and some grade 2 (very good quality) Best and Most Versatile agricultural land.

8.2.2 Residential properties are located over 100 m from the Proposed Scheme and are limited in number. There is a possibility of encountering potentially contaminated material from around commercial properties including Colchester Waste Transfer Station, Ardleigh South Services, and Allens Farm. Construction workers, and maintenance/ground workers during the operational phase, will likely have contact with soils.

8.2.3 The geology and aquifer designations for the study area are summarised in Table 8.1.

Table 8.1: Geology and aquifer designations within the study area

Geology	Aquifer Designation	Depth (Metres Below Ground Level)
Coversands	Secondary B Aquifer	Top depth: 0.0 to 0.9 Base depth: 0.9 to 3.4
Kesgrave Catchment Subgroup	Secondary A Aquifer	Top depth: 0.9 to 3.4 Base depth: 5.8 to 11.2
London Clay Formation	Unproductive Strata	Top depth: 5.8 to 11.2 Base depth: 42.6*

8.2.4 The study area falls within a groundwater source protection zone likely to be associated with abstractions from the Chalk Principal aquifer to the north of the Proposed Scheme. A groundwater source protection zone is a zone around groundwater sources used for potable supply or food processing, including wells, boreholes and springs. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk.

8.2.5 The main surface water body in the study area is the Sixpenny Brook, which has several tributaries running through the study area. The southern part of the Proposed Scheme crosses one of the tributaries.

- 8.2.6 There are no surface water abstraction licences or recorded licensed active or closed landfills within 250 m of the Proposed Scheme.
- 8.2.7 The potential risk of pollutant linkages for the Proposed Scheme can be summarised as low to moderate/low with the risk drivers summarised as follows:
- Potential for made ground and soil contamination from existing road construction and local small-scale industries
 - Potential for made ground and contaminated soil from areas of potentially infilled land across the study area
 - Potential for contaminated soil from Colchester Waste Transfer Station
 - Potential for contaminated soil from Ardleigh South Services
 - Potential for contaminated soil from local active and historical farms
 - Potential for soil contamination within the Proposed Scheme footprint to have an impact upon human health (particularly construction workers during the construction phase)
 - Potential for pathways to develop during and following construction for soil contamination within the Proposed Scheme footprint to impact groundwater aquifers in the superficial geology
 - Potential for pathways to develop during and following construction for soil contamination within the Proposed Scheme footprint to impact surface watercourses on and near the Proposed Scheme
- 8.2.8 A number of uncertainties were identified, to be addressed by intrusive ground investigation and appropriate risk assessment, summarised as:
- The presence, extent, thickness, nature, variability and contaminative status of areas of Made Ground within the Proposed Scheme footprint, in particular the area of the A120 embankments and areas of potentially infilled land identified in the walkover
 - The presence and nature of any contamination associated with the local industrial areas, including the Colchester Waste Transfer Station, Ardleigh South Services and Allens Farm

8.3 Method of Assessment

- 8.3.1 The geology and soils assessment has been completed using the following standards and guidance:
- *Design Manual for Roads and Bridges LA 104 – Environmental assessment and monitoring*
 - *Design Manual for Roads and Bridges LA 109 – Geology and soils*
 - *Design Manual for Roads and Bridges LA 110 – Material assets and waste*
 - *Design Manual for Roads and Bridges LA 113 – Road drainage and the water environment*
 - *Environment Agency Land Contamination Risk Management*
 - *CIRIA C552: Contaminated Land Risk Assessment: A guide to good practice*

- 8.3.2 A site walkover was conducted in June 2019 as part of the desktop study. The site walkover provided information on the condition of the study area and any potential sources of contamination were noted.

8.4 Results

- 8.4.1 Significant effects have been identified during construction and outlined in Table 8.2. No significant effects have been identified during operation.

Table 8.2: Significant effects identified for geology and soils elements during construction

Elements	Description of Effect	Significance
Human health: land users, residents, and construction workers	Made ground/infill materials and natural soils may potentially be contaminated by existing or historical land uses.	Moderate adverse
	Disturbance of potentially contaminated soils may cause mobilisation of contaminants along new or existing pollution pathways to current and future land users including short-term, acute risks to the health of construction workers and those involved in underground works in the operational phase.	Moderate adverse
Soil resources	<p>Loss of agricultural land (Grades 1 and 2 – Best and Most Versatile).</p> <p>It will not be possible to avoid disturbing these soils during construction.</p> <p>Impacts may include temporary loss of access to soils from borrow pits, attenuation ponds, access road to Allens Farm, temporary land take areas, such as those for site compounds and haulage routes, and damage to soils during construction including physical, biological and chemical damage. During operation, soil may be impacted by runoff from the carriageway.</p>	Very large adverse

8.1 Mitigation

8.1.1 Mitigation proposed regarding construction, includes:

- Prior to construction, geoenvironmental ground investigation sufficient to determine the extent and type of contaminants present will be undertaken to inform land contamination risk assessments. This may require ground investigation in addition to that which was undertaken at the time of writing the **first issue of the** Environmental Statement
- Where a risk assessment identifies the need for remediation measures, an appropriate Remediation Options Appraisal and Remediation Strategy will be produced. Implementation of the recommendations made in the Remediation Options Appraisal and Remediation Strategy, if required, will break contamination source-pathway-receptor linkages and/or reduce the overall risk of harm

8.2 Residual Effects

- 8.2.1 The implementation of mitigation measures in relation to land contamination issues and direct/indirect impacts is expected to reduce potential impacts to a level which is not considered significant.
- 8.2.2 It is unlikely that the disturbance of agricultural soils resulting from the construction of the Proposed Scheme could be fully mitigated within the Planning Application Boundary and there will likely be a significant residual very large adverse impact on soils.

8.3 Conclusion

- 8.3.1 With the implementation of all the mitigation measures, the Proposed Scheme is unlikely to have significant adverse effects in relation to contamination, on human health, surface water and groundwater. However, a **very** large adverse effect on soil resources is predicted.

9. Noise and Vibration

9.1 Scope of Assessment

9.1.1 This factor assesses the potential effects of the construction and operation of the Proposed Scheme on noise and vibration sensitive receptors.

9.1.2 The elements scoped into the noise and vibration assessment include:

- Construction noise
- Construction vibration
- Operational road traffic noise
- Operational road traffic vibration

9.1.3 The elements scoped out of the noise and vibration assessment include:

- Construction traffic noise and vibration – to experience an increase in noise level sufficient to result in a significant effect, the road traffic flow on the A120 or A133 would need to approximately double. However, it is expected that additional road traffic from construction vehicles would only increase traffic flows on the A120/A133 by a small fraction. Therefore, the additional vehicles expected to use these roads are likely to have a negligible impact in terms of increases in noise levels
- Operational vibration – as the new maintained road surface will be free of irregularities, it will not have the potential to lead to significant adverse vibration effects

9.2 Baseline Environment

9.2.1 The baseline noise environment is likely to be dominated by road traffic noise from the A120 and A133. Within the study area there are 1,376 noise-sensitive receptors. These receptors are largely rural, including farms, smallholdings, villages and businesses.

9.2.2 Defra has undertaken noise-mapping exercises, the latest of which was published in late 2019. Defra has produced a list of Noise Important Areas (areas identified as requiring action to reduce noise levels). The Noise Important Areas identified within the study area are listed below, with a sample receptor chosen inside each Noise Important Area:

- The A120 westbound carriageway north of Bromley Road, responsibility of Highways England
- The A120 eastbound carriageway by the Bromley Road overbridge, responsibility of Highways England
- The A133 by Crabtree Farm, responsibility of Essex County Council
- The A133 in Frating, responsibility of Essex County Council

9.3 Method of Assessment

9.3.1 The noise and vibration assessment has been completed using the following standards and guidance:

- Construction noise:
 - *Design Manual for Roads and Bridges LA 111 Noise and vibration*
 - *BS 5228-1: 2009 + A1: 2014 – Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (BS 5228-1)*
- Construction vibration:
 - *Design Manual for Roads and Bridges LA 111 Noise and vibration*

- *BS 5228-2: 2009 + A1: 2014 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BS 5228-2)*
- Operational road traffic noise:
 - *Design Manual for Roads and Bridges LA 111 Noise and vibration*
 - *Calculation of Road Traffic Noise*

9.3.2 Information for the noise and vibration assessment has been collected from:

- Defra's Noise Action Plan: Roads (Including Major Roads) – to identify any Noise Important Area within the study area
- Noise modelling – the Do-Minimum 2026 noise model has been used to represent the baseline in both the construction and operational assessments
- Ordnance Survey MasterMap data to identify existing building locations, existing road alignments and areas of acoustically hard (reflective) or soft (absorbent) ground
- Ordnance Survey AddressBase Plus to identify noise- and vibration-sensitive receptors
- Defra's MAGIC mapping database to identify any designated sites
- Highways England's Pavement Management System for information on existing road surfacing type on Highways England's roads (e.g. the A120)
- Defra National LIDAR Project Digital Terrain Model, 1 m contours to create the existing Digital Terrain Model for the noise model. LIDAR is a surveying method that measures distance to a target by illuminating that target with a laser light.
- Proposed Scheme 3D alignment, to create the proposed Digital Terrain Model for the noise model
- Indicative construction methods and plant/equipment lists provided by the Jacobs constructability team

9.3.3 For the noise and vibration assessment, an impact of moderate magnitude or above is considered potentially significant, dependent upon further contextual factors such as duration of the activity.

9.4 Results

9.4.1 During construction, Mount Pleasant Cottages, Turnip Lodge Cottages and Allens Farm are likely to experience an impact for more than 40 days in a six-month period for the site clearance, earthworks and capping-layer activities with a moderate impact magnitude considered to be significant.

9.4.2 There is the potential for significant vibration effects from compaction on a minimum of four sensitive receptors.

9.4.3 During operation the following potential significant effects have been identified:

- Significant adverse effects on 11 dwellings and one Protected Lane, due to increases in traffic noise levels
- Significant beneficial effects on 239 dwellings and five other noise-sensitive receptors (for example schools, hospitals, places of worship and outdoor spaces), due to reductions in traffic noise levels

9.5 Mitigation

9.5.1 Mitigation proposed during construction, includes:

- Engagement with the local community and anyone living or working with 100 m of vibratory works to pre-warn them, provide timings, and advise of what is being done to control vibration

- The 18-tonne Bomag BW 216 single drum vibratory roller should not be used within 100 m of a vibration-sensitive receptor when the highest vibration setting is selected. When the lowest vibration setting is selected, it can be used within 48 m of a vibration-sensitive receptor
- Selection of low-vibration or non-vibratory plant when working within 100 m of a vibration-sensitive receptor, should be considered
- Starting up and turning off vibratory equipment as far away from sensitive receptors as possible, should be considered

9.5.2 Implementing noise barriers for the operation of the Proposed Scheme is not considered proportionate from either a monetary or practical perspective, and therefore no permanent noise barriers are proposed.

9.6 Residual Effects

9.6.1 Mount Pleasant Cottages, Turnip Lodge Cottages and Allens Farm are likely to experience a significant adverse residual effect as a result of noise from daytime construction activities including construction of haul roads, earthworks, capping layer activities and site clearance.

9.6.2 Mount Pleasant Cottages are also likely to experience a significant adverse residual effect as a result of construction vibration due to the likely duration of the impact.

9.6.3 During operation, 256 receptors are likely to experience a significant residual effect as a result of operational noise. Of these, 244 receptors are likely to experience a significant residual beneficial effect as a result of reduction in noise levels. The remaining 12 receptors are likely to experience a significant residual adverse effect as a result of increases in noise levels.

9.7 Conclusion

9.7.1 During construction, whilst the application of best practicable means for controlling construction noise and vibration would provide a reasonable level of mitigation, it cannot be guaranteed that all adverse impacts would be reduced to a level resulting in no significant effects at the nearest noise-sensitive receptors. As such, it is likely, even with the inclusion of noise and vibration mitigation measures, that some residual significant adverse effects would remain. These effects, however, would only affect a limited number of receptors and would be transient in nature (when plant is operating in close proximity).

9.7.2 The Proposed Scheme is predicted to result in substantially more significant beneficial effects than adverse, during operation. However, given the context of the adverse effects (the short distance of some receptors from the Proposed Scheme and the existing quiet rural environment) these significant adverse effects are likely to outweigh the significant beneficial effects afforded by the reduction in flow on the bypassed routes.

10. Road Drainage and the Water Environment

10.1 Scope of Assessment

10.1.1 This factor assesses the potential effects of the construction and operation of the Proposed Scheme on surface water and water quality, hydromorphology (the scientific study of the physical characteristics of a water body including the shape and its content), groundwater flows and quality (including groundwater dependent terrestrial ecosystems) and flood risk.

10.1.2 The elements scoped into the assessment of road drainage and the water environment include:

- Hydromorphology of Sixpenny Brook
- Groundwater flows
- Operational surface water and water quality
- Operational groundwater quality
- Fluvial (relating to a river) flood risk
- Surface water flood risk
- Groundwater flood risk
- Flood risk associated with other artificial water-retaining infrastructure

10.1.3 The elements scoped out of the road drainage and the water environment assessment include:

- Construction surface water and water quality - as any impact would be mitigated by adhering to good practice embedded mitigation
- Hydromorphology of watercourses other than Sixpenny Brook - as any impact would be mitigated by adhering to good practice embedded mitigation
- Construction groundwater quality - as any impact would be mitigated by adhering to good practice embedded mitigation
- The following, associated with flood risk:
 - Tidal - as the study area is not influenced by tidal flooding
 - Reservoir failure - as there are no areas of risk within the study area
 - Sewers - as there are no records of sewer flooding within the study area
 - Flood defences - as no flood defences or areas benefiting from flood defences occur in the study area

10.2 Baseline Environment

10.2.1 The Proposed Scheme crosses six ordinary watercourses in ~~six seven~~ locations:

- Unnamed Tributary to Bromley Brook
- Ward Boundary Drain
- Strawberry Grove Ditch
- ~~An~~ Unnamed watercourse 5
- ~~Unnamed~~ Tye Road Drain (crossed at two locations)
- Sixpenny Brook - the only Water Environment Regulations Framework Directive watercourse in the study area (a waterbody classified under the Water Environment Regulations Framework Directive that requires an assessment to demonstrate compliance if a development is expected to cause

deterioration or contribute to a failure of the waterbody to meet the Good Status/Potential under the Directive)

- ~~Unnamed~~ Tributary of the Sixpenny Brook

10.2.2 There are also several ordinary watercourses within the study area (all watercourses not designated as Main River watercourses on maps approved by Defra in England):

- Salary Brook and its tributaries
- Tributaries of the Sixpenny Brook
- Small land drains

10.2.3 The A120 is currently served by filter drains and drainage gullies within the carriageway. It is currently assumed that the A133 drainage features are similar to the A120 with the road draining to the nearest watercourse.

10.2.4 The entire study area lies within a source protection zone (safeguarding area defined around large and public potable groundwater abstraction sites), likely to be associated with abstractions from the Chalk Principal aquifer.

10.2.5 Three licensed groundwater abstractions are located within the study area. One of these abstractions is located within the footprint of the Proposed Scheme at Collierswood Farm.

10.2.6 There is one active licensed discharge consent to groundwater within the study area and four unlicensed abstractions; and private water supplies lie within the 500 m buffer of the Proposed Scheme.

10.2.7 A number of potential springs are located in the south and east of the study area. The closest of these is approximately 50 m from the Proposed Scheme footprint, located within an area with potential for groundwater flooding at the surface. An area of the Proposed Scheme, where it crosses Tye Road, is also classed as having the potential for groundwater flooding at the surface.

10.2.8 There are areas of Flood Zone 3 (greater than 1 % Annual Exceedance Probability risk of fluvial flooding) and Flood Zone 2 (between 0.1 % and 1 % Annual Exceedance Probability risk of fluvial flooding) throughout the study area.

10.2.9 The study area lies predominantly within an area at very low risk of flooding from surface water and with <25 % susceptibility to groundwater flooding.

10.2.10 An artificial lake has been identified close to Allens Farm that is retained by an earth embankment. Therefore, the study area is considered at risk of flooding from the artificial water-retaining infrastructure.

10.2.11 The presence of irrigation pipes in the vicinity of the Proposed Scheme indicates a potential flood risk due to burst pipes.

10.2.12 There are no recorded historic flood events within the study area.

10.3 Method of Assessment

10.3.1 The assessment has been completed using the following standards and guidance:

- *Design Manual for Roads and Bridges LA 104 Environmental Assessment Methodology*
- *Design Manual for Roads and Bridges LA 113 Road drainage and the water environment*
- *CIRIA: Groundwater control: design and practice, second edition*

10.3.2 Information for the assessment of road drainage and the water environment has been collected from:

- Existing reports prepared for the Proposed Scheme as part of the Stage 2 Desktop Study

- Desk-based study of readily available information
- Site walkover survey undertaken prior to COVID-19 restrictions as part of the Stage 2 desktop study
- Data received from the Lead Local Flood Authority, Environment Agency, Tendring District Council and Essex Highways
- Groundsure reports
- Consultation with the engineering team and review of their outputs including the proposed drainage design and culvert-sizing assessment

10.4 Results

10.4.1 During construction, the following potential effects have been identified as significant:

- Borrow pit dewatering, impacting groundwater flows and quality of groundwater within the Coversands aquifer (moderate adverse)
- Borrow pit dewatering impacting groundwater flows and quality of groundwater within the Kesgrave Catchment Subgroup aquifer (large adverse)
- Reduction in groundwater flow/baseflow due to dewatering of Borrow Pit 3, on a potential spring, private water supply at Balls Farm and Sixpenny Brook (moderate adverse)
- Subsidence due to dewatering of Borrow Pit 3, on minor roads including Tye Road and Turnip Lodge Lane Protected Lane (moderate adverse)
- Reduction in groundwater flow/baseflow due to dewatering of Borrow Pit 4 on Sixpenny Brook (moderate adverse)
- Subsidence due to dewatering of Borrow Pit 4 on domestic properties and the A133 (moderate adverse)
- Reduction in groundwater flow/baseflow due to dewatering of Borrow Pit 5 on a licensed groundwater abstraction at Collierswood Farm (large adverse)
- Subsidence due to dewatering of Borrow Pit 5 on the A120 (moderate adverse)
- Direct impact as a result of the embankment on licensed groundwater abstraction at Collierswood Farm (very large adverse)
- Direct impact as a result of earthworks on a licensed discharge consent at Colchester Waste Transfer Station (moderate adverse)

10.4.2 There are no moderate or greater significance adverse effects on the water environment receptors during operation. ~~The proposed re-profiling of the Ward Boundary Drain is assumed to have a moderate beneficial effect on the local access road, which is a flood-risk receptor.~~

10.5 Mitigation

10.5.1 Mitigation proposed for construction includes:

- The installation of interception drains for the borrow pits to prevent excessive ingress of surface water into the workings
- Dewatering of the borrow pits will take place followed by controlled discharge into ordinary watercourses
- Where buildings or infrastructure may be impacted by settlement due to dewatering, a geotechnical dewatering settlement assessment will be carried out to determine the actual level of risk. Any required mitigation measures, either standalone or in combination, would be determined following full geotechnical assessment

- Where required, mitigation measures such as cut-off walls and/or recharge to groundwater and surface water would be used to mitigate the potential impacts of borrow pit dewatering on groundwater and associated receptors. At present these measures are not committed to as they would be contingent on the settlement assessment
- Relocation of the spray irrigation abstraction well at Collierswood Farm and the licensed discharge to ground consent will be needed if their loss is confirmed during construction

10.6 Residual Effects

- 10.6.1 As effects on surface water and water quality are predicted to be of neutral significance prior to mitigation, any residual effects are considered to be slight beneficial (not significant) on the basis that the embedded mitigation proposed would capture and treat existing highways drainage from the A120 and A133.
- 10.6.2 Effects on the hydromorphology of Sixpenny Brook and Salary Brook are predicted to be neutral or slight adverse (not significant).
- 10.6.3 Effects on groundwater flows and quality are predicted to be slight adverse (not significant) due to borrow pit dewatering. Neutral residual effects (not significant) are predicted for Collierswood Farm provided the abstraction is not located within the Proposed Scheme footprint, and for Colchester Waste Transfer Station provided the consented discharge is relocated to a suitable location.
- ~~10.6.4 Following the implementation of the embedded mitigation and good practice, residual effects on most flood risk receptors are expected to be neutral or slight adverse. However, there would be a slight beneficial effect (not significant) on agricultural land as a result of the construction of Ward Boundary Drain bypass ditch.~~

10.7 Conclusion

- 10.7.1 Overall, with the implementation of embedded, good practice and essential mitigation, the Proposed Scheme is not predicted to have any significant adverse effects on the receptors, as defined under the *Design Manual for Roads and Bridges*.

11. Population and Human Health

11.1 Scope of Assessment

11.1.1 This factor assesses the potential effects of construction and operation of the Proposed Scheme on population and human health.

11.1.2 The elements scoped into the population and human health assessment include:

- Effects on agricultural land holdings
- Effects on walking, cycling and horse riding
- Effects on human health associated with physical activity
- Effects on human health associated with access to green space and the countryside
- Effects on human health associated with air pollution
- Effects on human health associated with noise
- Effects on health inequalities

11.1.3 The elements scoped out of the population and human health assessment include:

- Effects on private property and housing - as it is not envisaged that any buildings would be lost to the Proposed Scheme
- Effects on community land and assets - as no community land has been identified that would be directly physically affected
- Effects on development land and businesses - as the Proposed Scheme has been identified and designed to facilitate proposals for growth within Colchester and, as such, is part of the strategic development and economic proposals for the area

11.2 Baseline Environment

11.2.1 There are currently no settlements within the footprint of the Proposed Scheme. The village of Elmstead Market is approximately 350 m east of the study area (footprint of the Proposed Scheme plus a 500 m buffer), situated either side of the A133, while the eastern outskirts of Colchester are some 800 m west of the study area.

11.2.2 The Link Road section of the Proposed Scheme, and connections to the A120 to the north, fall within land owned by five different landowners. Four of these own large areas of arable land, the fifth owning a small parcel of land near Allens Farm.

11.2.3 The Public Right of Way network provides access to green space for local communities, particularly from Elmstead Market and the eastern parts of Colchester:

- A footpath runs from Wivenhoe Road in a south-easterly direction, becoming a restricted byway until it reaches Allens Farm where it joins a footpath and continues east to Elmstead. At Elmstead it terminates where it meets a further public footpath which extends northwards, crossing the A120
- A public footpath runs north-south between Brightlingsea Road and the A133
- Two footpaths connect Bromley Road to Wivenhoe Road via Broomhangings Farm, and head north from Bromley Road towards Fox Street

11.2.4 Turnip Lodge Lane Protected Lane runs from Slough Lane in an easterly direction for approximately 900 m where it intersects with Wivenhoe Road and Tye Road.

- 11.2.5 The A133 offers a potential cycle commuting route between southern Colchester and smaller settlements to the east. There is a footway alongside the eastbound carriageway of the A133. National Cycle Network Route 51 passes north-south, crossing the A133.
- 11.2.6 There is a horse riding stable, Crockleford Stud, on Bromley Road in Crockleford Heath approximately 1 km from the Proposed Scheme.
- 11.2.7 The health profiles of the communities in each ward compared to the average for England have been considered and the following have been identified:
- The Thorrington, Frating, Elmstead and Great Bromley ward (within which the majority of the Proposed Scheme falls, including the entire new Link Road section) has a larger proportion of older residents (65+ years) than the Ardleigh and Little Bromley ward, and the average for England as a whole. Levels of income deprivation are significantly lower than average for England
 - In the Ardleigh and Little Bromley ward (within which only the western connections to the A12 and services fall) the life expectancy at birth for males is significantly better than the England average and, unusually, male life expectancy is slightly longer than for females within the ward (though not significantly different)
 - The health of communities within the study area is generally comparable to the average for England, however the Thorrington, Frating, Elmstead and Great Bromley ward has significantly more of the population with a long-term illness or disability compared to the average for England, which is likely linked to the generally older population
- 11.2.8 According to the World Health Organization, noise from road traffic alone is the second most-harmful environmental stressor in Europe. The baseline noise environment is likely to be dominated by road traffic noise from the A120 and A133.
- 11.2.9 The percentage of adults walking or cycling for at least three days per week in 2017/18 in Colchester and Tendring was lower than the England averages.
- 11.2.10 Collision data during 2014-2019 were reviewed and no collisions involving pedestrians, cyclists or horse riders occurred on the A120, A133 or roads within the study area linking the A120 and A133 within this five-year period.

11.3 Method of Assessment

- 11.3.1 The population and human health assessment has been completed using the following standards and guidance:
- *Design Manual for Roads and Bridges LA 112 Population and human health*
 - The Institute for Environmental Management and Assessment's *Health in Environmental Assessment – A Primer for a Proportionate Approach*
 - The International Association for Impact Assessment's *Addressing Human Health in Environmental Impact Assessment, Consultation Draft*
- 11.3.2 Information for the population and human health assessment has been collected from:
- Desk-based review of:
 - Essex Highways Public Rights of Way web mapping application: <https://www.essexhighways.org/getting-around/public-rights-of-way/prow-interactive-map.aspx>
 - Public England's Local Health tool: <https://www.localhealth.org.uk/>
 - Ordnance Survey 1:25,000 mapping

- Shared information from other factors

11.4 Results

11.4.1 During construction, potential effects on agricultural holdings have been identified as significant (moderate adverse) due to the loss of land affecting operating conditions for individual farmers, representing 0.8 % of the arable farm holding community in the county. It is not anticipated that any agricultural lang holdings would become non-viable.

11.4.2 No potential effects during operation have been identified as significant.

11.5 Mitigation

11.5.1 There is no specific mitigation proposed for population impacts during construction or operation in addition to mitigation proposed for other factors. This includes minimising impacts on health and amenity arising from construction dust, noise, and views of the construction works. The embedded mitigation proposals mitigate the temporary significant effect on agricultural land holdings as far as practicable given the scale and location of the Proposed Scheme which necessarily requires a degree of temporary and permanent land take and disruption in access to affected landowners.

11.6 Residual Effects

11.6.1 In the absence of essential mitigation in addition to the proposed embedded mitigation, the residual effects are unchanged from those reported in Section 11.4, a moderate adverse significant effect on agricultural holdings due to loss of land.

11.7 Conclusion

11.7.1 The overall effects of the Proposed Scheme are deemed to be not significant under the *Design Manual for Roads and Bridges*.

12. Climate

12.1 Scope of Assessment

- 12.1.1 This factor assesses both the potential effects of construction and operation of the Proposed Scheme on climate, and potential effects of climate change on the Proposed Scheme.
- 12.1.2 The elements scoped into the climate assessment include:
- Greenhouse gas emissions resulting from construction
 - Greenhouse gas emissions associated with the change in land use
 - Vulnerability of the Proposed Scheme to changes in climate during construction and operation
 - Greenhouse gas emissions resulting from operation
 - Change in greenhouse gas emissions due to changes in end-user road traffic resulting from operation
- 12.1.3 No potential impacts required to be assessed by the *Design Manual for Roads and Bridges LA 114 Climate* have been scoped out.

12.2 Baseline Environment

- 12.2.1 Carbon dioxide emissions for Essex County in 2018 represented approximately 2 % of total carbon dioxide emissions for the UK, and 1.6 % of total UK greenhouse gas emissions. Tendring District Council area carbon dioxide emissions were approximately 0.2 % of the UK carbon dioxide emissions.
- 12.2.2 Road transport carbon dioxide emissions are estimated to comprise 49 % of the total carbon dioxide emissions within Essex County (2.8 % of the total in the UK), with A-roads estimated to generate approximately 20 % of the total carbon dioxide emissions in Essex.
- 12.2.3 The greenhouse gas emissions from operational road users for the Do-Minimum scenario (without the Proposed Scheme) against which the Proposed Scheme has been compared, are presented in Table 12.1.

Table 12.1: Operational road users' greenhouse gas emissions (total carbon dioxide equivalent) for the Do-Minimum scenario

Year/Period	Operational Road User Greenhouse Gas Emissions (Total Carbon Dioxide Equivalent)
Opening Year (2026)	224,016
Design Year (2041)	198,251
60-year appraisal period (i.e. 2026-2085)	12,101,180

- 12.2.4 The receptor for greenhouse gas emissions is the global climate and, indirectly, the UK carbon budgets which act as its proxy.
- 12.2.5 Under the climate scenarios considered, annual accumulated precipitation at the location of the Proposed Scheme is projected to slightly decrease over time. All of the temperature-related metrics considered, indicate that a steady increase in temperature has the potential to occur.
- 12.2.6 Climate variables selected to represent more extreme conditions indicate the following may occur between 2061-2080 compared to the baseline of 1981-2000:
- More extreme precipitation events to be of slightly greater intensity

- Very extreme precipitation events, which would occur very infrequently, would be more severe
 - Fewer days with very low temperatures
 - Days with more extreme temperatures will potentially be substantially warmer and more frequent
 - Wind speeds on days experiencing higher winds will potentially be marginally reduced
 - Annual number of air frost days is projected to be considerably lower
 - Extremely hot days are projected to be more frequent
 - Annual drought events and dry spells are projected to increase
 - Days with wind gust events exceeding 45 miles per hour are projected to be less frequent
- 12.2.7 The Essex Local Climate Impact Profile, summarised in Essex County Council's *Adapting to Climate Change Action Plan*, reviewed 160 weather-related incidents throughout Essex during the period 2004 – 2009 and identified that heavy rain and flooding, strong winds, extreme winter temperatures and extreme summer temperatures are the relevant climate-related hazards for the county.
- 12.2.8 Based on Highways England Data Management System, there were two historical flood records along the A120 in 2014 and 2016. The footprint of the Proposed Scheme is located predominantly within an area at very low risk of surface water flooding. The Tendring District Council Strategic Flood Risk Assessment indicates that the Proposed Scheme lies within 1 km grid squares defined as having less than 25 % susceptibility to groundwater flooding. However, according to the British Geological Survey susceptibility to groundwater mapping, the Proposed Scheme near to Tye Road is shown to be located within an area that has the potential for groundwater flooding to occur at the surface.
- 12.2.9 Following the identification of climate trends, and the past and potentially existing vulnerabilities within the Proposed Scheme's footprint, the identified receptors during each phase are as follows:
- Construction:
- Machinery and plant
 - Construction areas including compounds, material stockpiles and adjacent watercourses or land
 - The contractor and the construction workforce
- Operation:
- Drainage infrastructure
 - Pavements
 - Structures
 - Earthworks
 - Members of the public and commercial operators
- Maintenance
- Machinery and plant
 - Scheme operator
 - Maintenance workforce

12.3 Method of Assessment

- 12.3.1 The climate assessment has been completed using the following standards and guidance:
- *Design Manual for Roads and Bridges LA 114 Climate*
 - Highways England *Carbon Tool Guidance*
 - *Transport Analysis Guidance Unit A3 Environmental Impact Appraisal Data Book*

12.3.2 Information for the climate assessment has been collected from:

- Design and construction information for the Proposed Scheme
- Climate observations – Met Office HadUK-Grid regional observations dataset
- Climate projections – Met Office UK Climate Projections 2018 data collection
- Geological hazards – British Geological Survey
- Highways England carbon tool emission factors
- Traffic data for the reliable extent of the Vissim and EMME traffic models (total traffic flows, vehicle speed and percentage of heavy duty vehicles on an Annual Average Daily Traffic flow basis) for the opening year and the design year scenarios without (i.e. Do-Minimum) and with (i.e. Do-Something) the Proposed Scheme
- Transport Analysis Guidance Unit A3 Environmental Impact Appraisal Data Book emission factors and National Atmospheric Emissions Inventory vehicle fleet projections
- UK local authority and regional carbon dioxide emissions, Department of Business, Energy and Industrial Strategy
- Land use data statistics, Ministry of Housing, Communities and Local Government
- Natural England average estimated carbon stock values
- Other environmental factor assessments (Biodiversity, Landscape and Visual, Road Drainage and the Water Environment)

12.4 Results

12.4.1 No potential effects during construction or operation have been identified as significant, as any effects associated with greenhouse gas emissions or vulnerability would be mitigated through embedded mitigation measures.

12.4.2 It is noted (at the time of writing), that the Committee on Climate Change very recently published its recommendation on the level of the Sixth Carbon Budget in December 2020. The Sixth Carbon Budget recommendation is substantially lower than the third, fourth and fifth carbon budgets, used for this assessment. However, the Proposed Scheme is predicted to lead to a reduction in greenhouse gas emissions so it is concluded that the Proposed Scheme would not hinder the UK Government in meeting the Sixth Carbon Budget once it is formally legislated.

12.5 Mitigation

12.5.1 No mitigation has been proposed during construction or operation as no significant effects have been identified.

12.6 Residual Effects

12.6.1 No significant residual effects have been identified.

12.7 Conclusion

12.7.1 While the Proposed Scheme will result in greenhouse gas emissions, their magnitude is predicted to be negligible when compared with the UK carbon budgets. Therefore, it is not expected that the Proposed Scheme will materially hinder the UK Government from meeting its legislative carbon reduction targets. As such, no significant residual effects are identified.

12.7.2 Climate change is likely to have an adverse impact on certain parts of the Proposed Scheme during both the construction and operation stages. However, given the embedded mitigation and good practice measures to be applied, no significant residual impacts are identified.

13. Cumulative Effects

13.1 Scope of Assessment

13.1.1 This factor assesses the likely significant cumulative effects associated with the Proposed Scheme. Cumulative effects occur when impacts caused by past, present and reasonably foreseeable activities combine to create an increased level of effect. They can occur during both the construction and operational phases of a project.

13.1.2 Both intra-project and inter-project effects have been scoped into the assessment:

- Intra-project effects are the interrelationship between different environmental factors for the Proposed Scheme
- Inter-project effects are cumulative effects from different projects in the vicinity of the Proposed Scheme, as well as the Proposed Scheme itself

13.2 Baseline Environment

13.2.1 The baseline environment is the same baseline environment reported by each specialist factor assessment.

13.3 Method of Assessment

13.3.1 The methodology for this assessment draws on The Planning Inspectorate's *Advice Note 17 Cumulative Effects Assessment* and the *Design Manual for Roads and Bridges LA 104 Environmental assessment and monitoring*.

13.3.2 The main data sources for the cumulative effects assessment have been the other environmental factor assessments, and a shortlist of other proposed developments selected through professional judgement and consultation with Essex County Council.

13.3.3 The intra-project effects assessment only considered adverse effects and those assigned as slight adverse or greater.

13.3.4 For the inter-project effects assessment, a Zone of Influence was used in order to identify the different projects in the vicinity of the Proposed Scheme to include the assessment. The Zone of Influence is a distance from the Proposed Scheme determined based on the individual environmental factor study areas, professional judgement and experience from similar schemes.

13.4 Results

13.4.1 Intra-project and inter-project effects that have been identified as significant have been summarised in Table 13.1. The majority of cumulative effects identified are a result of noise, vibration and visual impacts on receptors.

Table 13.1: Potential significant intra-project and inter-project effects

Receptor	Description of Effect	Potential Cumulative Effect
Intra-project – construction		
Residents at Allens Farm	A temporary large adverse combined effect on receptors of high value as a result of noise, vibration and visual impacts.	Large adverse
Residents at Turnip Lodge Cottages		

Receptor	Description of Effect	Potential Cumulative Effect
Residents at Mount Pleasant Cottages	A temporary very large adverse combined effect on receptors of high value as a result of noise, vibration and visual impacts.	Very large adverse
Turnip Lodge Lane	A combined permanent large adverse effect on Turnip Lodge Lane as a Protected asset, from partial removal and dewatering-related subsidence.	Large adverse
Intra-project – operation		
Residents at Allens Farm House	A short-term very large adverse combined effect on receptors of high value as a result of noise and visual impacts.	Very large adverse
	The longer-term combined effect is considered to be of moderate adverse significance.	Moderate adverse
Residents at Mount Pleasant Cottages	A short-term very large adverse combined effect on receptors of high value as a result of noise and visual impacts.	Very large adverse
	The longer-term combined effect is considered to be of large adverse significance.	Large adverse
Residents at Balls Farm	A short-term moderate adverse combined effect on receptors of high value as a result of noise and visual impacts.	Moderate adverse
Residents at Turnip Lodge Cottages	A short-term large adverse combined effect (Significant) on receptors of high value as a result of noise and visual impacts.	Large adverse
	The longer-term, combined effect is considered to be of moderate adverse significance on receptors of high value as a result of noise and visual impacts.	Moderate adverse
Residents at Park Farm Cottages and Park Farmhouse	A medium-term large adverse combined effect (Significant) on receptors of high value as a result of noise and visual impacts.	Large adverse
Inter-project cumulative effects		
Landscape character	<p>A number of developments and mineral sites have been identified to have adverse cumulative impacts on landscape character along with the Proposed Scheme if the construction phases overlap, and also during operation.</p> <p>There would be a direct adverse cumulative impact on the Bromley Heaths Landscape Character Area having an urbanising effect</p>	Significant adverse

Receptor	Description of Effect	Potential Cumulative Effect
	on the rural landscape. Proposed Scheme construction lighting, street lighting and lighting from other developments during operation, would also affect the night-time character. The cumulative effect of this would be significant during construction and operation.	
Views from Public Right of Ways and residential properties	<p>Only five of the other developments have been identified to have adverse cumulative visual impact with the Proposed Scheme. These include:</p> <ul style="list-style-type: none"> • Bio-gas plant at Allens Farm • Agricultural building at Allens Farm • Mixed use development west of Church Road, Elmstead Market • Irrigation reservoir near Elmstead Hall • Extension of Martells Quarry <p>There could be inter-project cumulative adverse effects during construction, if the construction phases overlap, and during operation, on views from Public Right of Ways and residential properties in the vicinity of the Proposed Scheme as well as other developments. The effects are considered significant during construction and operation of the Proposed Scheme.</p>	Significant adverse

13.5 Mitigation

13.5.1 No additional mitigation has been identified beyond the measures proposed within each environmental factor assessment.

13.6 Residual Effects

13.6.1 As no additional mitigation has been proposed, the residual effects are the same as those identified in Section 13.4.

13.6.2 Further significant intra-project effects have been captured in the following environmental factor assessments and have not been reported here to avoid double counting:

- Cultural Heritage
- Population and Human Health

13.7 Conclusion

13.7.1 Both intra-project and inter-project significant adverse residual effects have been identified. Intra-project significant residual effects have resulted from a combination of potential noise, vibration (construction only) and visual impacts and are limited to receptors in close proximity to the Proposed Scheme. Inter-project significant residual effects with other developments were only identified for receptors associated with the landscape and visual assessment.

14. Overall Summary

14.1.1 The environmental factor assessments have demonstrated that the Proposed Scheme would only result in significant (i.e. moderate or above) residual adverse effects relating to the following issues:

- Cultural Heritage – physical effects on historic landscape and removal of historic hedgerows during construction, and visual and noise intrusion on setting during construction and operation
- Biodiversity – loss of Ancient Woodland
- Landscape – landscape and visual effects during both construction and operation on landscape character, users of Public Right of Ways and residents
- Geology and Soils – disturbance of soil resources resulting in loss and damage
- Noise and Vibration – noise and vibration effects on dwellings during construction, and noise effects on dwellings during operation
- Cumulative Effects:
 - Intra-project effects – construction and operation noise and visual impacts on residents, and partial removal and dewatering-related subsidence of Turnip Lodge Lane
 - Inter-project effects – combined noise impacts on residents and impacts on landscape character

14.1.2 Overall, significant adverse residual effects have been identified on 105 sensitive receptors, and significant beneficial residual effects have been identified on 244 receptors. These significant residual effects can be summarised as follows:

- Construction
 - Very large adverse: 2
 - Large adverse: 12
 - Moderate adverse: 17
 - Moderate to very large adverse: 10
 - Moderate to large adverse: 10
 - Significant adverse (noise and vibration and inter-project cumulative effects): 6
- Operation
 - Very large adverse: 2
 - Large adverse: 4
 - Moderate adverse: 9
 - Moderate to very large adverse: 19
 - Significant adverse (noise and vibration and inter-project cumulative effects): 14
 - Significant beneficial (noise and vibration): 244

14.1.3 No significant residual effects have been identified for the following environmental factors:

- Air Quality
- Biodiversity
- Road Drainage and the Water Environment
- Climate