highways england

A27 Chichester Bypass

Environmental Study Report Summary

Options 1, 1A, 2, 3 and 3A

(updated 28 July 2016)

July 2016

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1 Introduction

The primary aim of the A27 Chichester Bypass Scheme (the Scheme) is to increase capacity on the existing Chichester Bypass between Fishbourne and Portfield roundabouts, while facilitating new housing developments being considered in the area in line with the Chichester Local Plan 2014-2029 and forecast traffic volumes up to 2035.

The Scheme has been assessed in accordance with Highways England's Interim Advice Note 125/15 'Environmental Assessment' (IAN 125/15) which supplements the guidelines provided in Volume 11 of the Design Manual for Roads and Bridges (DMRB). The results of the Environmental Assessment are presented within two Environmental Study Reports (ESR) (Options Selection Stage), one for the discounted northern offline options and one for the online options, which also includes a discounted offline option. The conclusions of the ESR for Options 1, 1A, 2, 3 and 3A are summarised below.

The objective of the ESRs is to ensure that significant adverse and/or beneficial effects of the Scheme proposals on the environment are identified and assessed accordingly and that adverse effects are minimised or mitigated where possible. Significant effects are those that are considered to be moderate (adverse or beneficial) or above, which is determined by a combination of the magnitude of an impact and the sensitivity of a receptor. Assessment has been carried out for both the construction and operation phases of the Scheme.

The ESRs have assessed significance and impact based on the level of design and information currently available, which is considered to be appropriate for this stage in the Scheme's development. The levels of assessment presented within the ESRs enables the differences between options to be identified, to inform the selection of the preferred option. The assessment will be refined with the production of an Environmental Impact Assessment Report (EIAR) for the preferred option that will be selected at the end of the current Stage 2.

Sections 1.2 to 1.11 below summarise the results of the assessments for the ten topics laid out within IAN125/15[1]. In addition, Section 1.12 below provides a summary of the assessment of combined and cumulative effects. However, for completion the summary of the results presented herein should be read in conjunction with the main ESR documents where reference to the methodology used is made and detailed technical background is given to the full assessment carried out.

[1] Note that the topic 'People and Communities' set out in IAN 125/15 has been assessed as two separate topics 'Communities and Private Assets' and 'Effects on All Travellers', in accordance with the previous version of IAN125/08, which was the latest supplementary guidance available when this assessment process started.

2 The proposed options

The existing Chichester Bypass is approximately 5.0km of dual carriageway located to the south of Chichester in West Sussex, with six at-grade junctions: Fishbourne, Stockbridge, Whyke, Bognor, Oving and Portfield distributed along the road from west to east.

The primary aim of the A27 Chichester Bypass Scheme is to increase capacity on the existing Chichester Bypass between Fishbourne and Portfield roundabouts, while facilitating new housing developments being considered in the area in line with the Chichester Local Plan 2014-2029 and seeking to accommodate forecast traffic volumes up to 2035 (the Design year).

During project development Stage 1, a total of 20 options were reviewed, seventeen road-based solutions and three alternative solutions. The three alternative solutions were discounted early in the process. The road-based options were then sifted using Department for Transport (DfT) guidance tools to determine those that had the most potential to be successful in addressing the needs of the Scheme. Following the sifting and a review of the Scheme budget and the Government's Roads Investment Strategy 2015-2020, five options were shortlisted in Stage 2 for public consultation, as follows:

2.1 Option 1

Fishbourne Roundabout would be grade-separated with the A27 flying over the local roads. To improve junction capacity, Terminus Road would be diverted on to Cathedral Way.

At Stockbridge and Whyke Junctions the existing roundabouts would be replaced with signalised junctions. Right turns from all arms would be banned and dedicated lanes would be provided for left turning traffic.

Bognor Road Roundabout would be grade-separated with the A27 flying over the local roads. The flyover construction would incorporate a new railway bridge north of the junction. Vinnetrow Road would be diverted to join the A259 east of the existing roundabout via a new at-grade roundabout.

The last two junctions, namely Oving and Portfield, will be modified in due course from their current arrangement in conjunction with plans for Shopwhyke Lakes housing development, as detailed in the Chichester Local Plan. The Scheme however introduces alterations to the developer’s proposals for these two junctions as below:

- the traffic signals and pedestrian crossing at Oving Crossroads would be removed;
- the left-in left-out junction present on the bypass eastbound carriageway only would be retained and improved;
- the access to Oving Road East would be removed for all traffic; and,
- Portfield roundabout would be remarked on the circulatory carriageway to increase capacity.

2.2 Option 1A

Option 1A is as Option 1 above, but with no changes proposed at Stockbridge and Whyke junctions.

2.3 Option 2

Fishbourne and Bognor Road roundabouts would be grade-separated, with Terminus Road diverted onto Cathedral Way at Fishbourne, and Vinnetrow Road diverted onto the A259 at Bognor Road, in a similar manner as in Option 1. The flyover construction at Bognor would incorporate a new railway bridge north of the junction.

Stockbridge and Whyke Junctions would be closed in this Option, with the side roads passing over the A27 on new bridges with no connection between the main lien and these side roads.

The last two junctions, namely Oving and Portfield, will be modified in due course in conjunction with plans for Shopwhyke Lakes housing development, as detailed in the Chichester Local Plan. The Scheme however introduces alterations to the developer's proposals for these two junctions, as follows:

- the traffic signals and pedestrian crossing at Oving Crossroads would be removed;
- the left-in left-out junction present on the bypass eastbound carriageway only would be retained and improved;
- the access to Oving Road East would be removed for all traffic; and,
- Portfield roundabout would be remarked on the circulatory carriageway to increase capacity.

To compensate for the loss of connection with the A27 at Stockbridge and Whyke junctions, a single carriageway link road is proposed from Fishbourne Junction down to join to the B2145 (the Stockbridge Link Road).

2.4 Option 3

Option 3 would convert Fishbourne Roundabout to a 'hamburger' type layout with two lanes through the signalised roundabout. At Stockbridge and Whyke Junctions the existing roundabouts would be replaced with signalised junctions. Right turns from all arms would be banned and dedicated lanes would be provided for left turning traffic. Bognor Road Junction would be increased in size and signalised, with three lanes provided on the circulatory carriageway.

At Oving and Portfield, the proposals from the Shopwhyke Lake housing development would be retained and implemented separately from the Scheme. Oving crossroads would remain as a traffic signalised junction with all right turns banned, except from Oving Road East. All straight across movements on the side roads would also be banned. Oving Road East would be closed to all traffic except buses. At Portfield roundabout, the circulatory carriageway would be remarked to provide three lanes from the A27 southern arm round to the Chichester bypass.

Two straight ahead lanes would be provided at Oving Road, but right turns from the A27 would be prohibited. Left-in, left-out would be provided from Oving Road West with only Bus egress provided from Oving Road East, while the traffic signals would be retained. The westbound approach of Portfield Roundabout would be widened and a dedicated left turn lane from the eastern arm to the southern arm added.

2.5 Option 3A

Option 3A would convert Fishbourne Roundabout to a 'hamburger' type layout with two lanes through the signalised roundabout. At Stockbridge and Whyke Junctions the existing roundabouts would be replaced with signalised junctions. Right turns from all arms would be banned and dedicated lanes would be provided for left turning traffic. Bognor Roundabout would be grade separated, with the A27 constructed over the existing roundabout. The flyover construction would incorporate a widened railway bridge, Vinnetrow Road would be diverted on to the A259.

This Option would add a third lane on the mainline from Fishbourne junction to Bognor junction in each direction, to increase capacity and assist with local traffic movements.

At Oving and Portfield, the proposals from the Shopwhyke Lake housing development would be retained and implemented separately from the Scheme. Oving crossroads would remain as a traffic signalised junction with all right turns banned, except from Oving Road East. All straight across movements on the side roads would also be banned. Oving Road East would be closed to all traffic except buses. At Portfield roundabout, the circulatory carriageway would be remarked to provide three lanes from the A27 southern arm round to the Chichester bypass.

3 Air Quality

There are three Air Quality Management Areas (AQMA) within the study area:

- Stockbridge Roundabout AQMA - an area encompassing the Stockbridge Roundabout at the junction of the A27 and Stockbridge Road;
- St Pancras AQMA - an area along St Pancras Road, between Eastgate Square and New Park Road; and,
- Orchard Street AQMA - an area along Orchard Street, at the eastern end of the street where it meets Northgate.

To assess the potential effects on air quality, a selection of 22 sensitive receptors were identified within 200m of the affected roads in the study area (across all options); these represented worst case locations. Receptors were selected using professional judgement to determine where the highest pollution concentrations would be likely to arise and where the greatest effects would be expected to occur due to the proposed Scheme options.

During construction, there would be the potential for some construction activities to generate dust which may result in nuisance, such as discolouration of surfaces, at nearby properties, if uncontrolled. These effects would be mitigated through the implementation of best practicable means, such as wetting down. Measures would be detailed within a Construction Environmental Management Plan (CEMP) for the Scheme, to be prepared in advance of the works and implemented by the contractor. These measures would ensure no significant adverse effects during construction for any of the options.

During operation for Option 1, Option 3 and Option 3A, there would be only one receptor where the annual NO_2 objective is currently exceeded which would experience a deterioration in air quality, although there would be other properties which currently exceed the NO_2 objective where there would be an improvement in air quality. There would be several receptors in St Pancras AQMA which would experience an improvement in air quality, although Options 1, 3 and 3A would not bring the St Pancras AQMA within the air quality objective limits.

During operation for Option 1A, there would be several receptors in the Stockbridge AQMA which would experience a deterioration in air quality as a result of this option, and where the annual NO_2 objective would be exceeded. However, this would be limited to receptors adjacent to Stockbridge Roundabout, and a single receptor immediately adjacent to the A27. There would be several receptors in St Pancras AQMA which would experience a benefit in air quality although Option 1A would not bring the St Pancras AQMA within the air quality objective limits.

During operation for Option 2, air quality effects would be beneficial overall. There would be no receptors which experience a deterioration in air quality where the annual NO_2 objective is exceeded, and there would be one receptor within the Stockbridge AQMA that currently exceeds the annual NO_2 objective, that would be brought within the NO_2 objective. There are likely to be several receptors in St Pancras AQMA which would experience an improvement in air quality where the annual NO_2 objective is exceeded, although Option 2 would not bring the St Pancras AQMA within the air quality objective limits.

Air quality effects would therefore be beneficial overall for all but Option 1A, which would have an overall adverse effect, but all effects are unlikely to be considered significant due to the small numbers of receptors affected. Air quality effects would be beneficial overall for all options at St Pancras AQMA. Further assessment will be carried out for the preferred option during Stage 3.

4 Cultural Heritage

There is one scheduled monument located within the study area; the remains of Fishbourne Roman Palace are located 85m to the west of Fishbourne Junction. There is one Grade II* Registered Park and Garden within the study area, which is the gardens associated with the Fishbourne Roman Palace. There are also two Conservation Areas (Fishbourne Conservation Area and Chichester Conservation Area) and numerous Grade II Listed Buildings within the vicinity of the Scheme options.

All of the Scheme options, with the exception of Option 3, have the potential to result in significant adverse effects upon historic environment receptors during construction, with adverse effects anticipated on the setting of designated assets, buried archaeological remains within the construction area, and the historic setting of the local area.

During operation for Option 1, there would be a moderate adverse effect on Fishbourne and Chichester Conservation Areas, and the setting of five Grade II Listed buildings. For Option 1A, there would be a moderate adverse effect on Fishbourne and Chichester Conservation Areas, and the setting of four Grade II Listed buildings during operation. For Option 2, there would be a major adverse effect on a Grade II Listed building, as the realignment of Stockbridge Road under Option 2 would require the demolition of this designated asset. There would also be a moderate adverse effect on Fishbourne and Chichester Conservation Areas, and the setting of five Grade II Listed buildings during operation of Option 2. For Option 3, there would be no significant effects on cultural heritage assets during operation, due to the scale of the works proposed. For 3A, there would be a moderate adverse effect on Chichester Conservation Area during operation.

Since there is the potential for significant adverse effects for the majority of Scheme options, further detailed assessment will be required for the preferred option, once confirmed. The assessments given are based on current knowledge of the study area, but there is the potential for hidden / unknown archaeology or for effects to change as the design develops. Archaeological investigations will therefore be carried out during subsequent phases of the scheme based on best practice, which may comprise a combination of archaeological fieldwalking, archaeological metal detector survey, geophysical survey and trial trench evaluation.

5 Landscape

The study area is characterised by the historic city of Chichester and the South Downs National Park to the north. Chichester Harbour Area of Outstanding Natural Beauty (AONB) is located to the south west of Chichester, extending landwards to within 150m of the A27. The A259, which would be altered as part of Options 1, 1A and 2, forms the boundary of the AONB. The South Downs National Park lies to the north of the city. The existing A27 forms a delineating feature between the conurbation of Chichester to the north and more rural agricultural landscape to the south. The relatively open character of the coastal plain to the south of Chichester allows long views to Harbour area and occasional views to Chichester Cathedral spire, with the southern extent of Chichester forming a more commercial and light industrial land use, interspersed with areas of residential housing.

Construction of all options would see new elements within the landscape/townscape. The presence of machinery, plant, earthworks and general construction activity would be at odds with the existing environment to varying degrees, however intervening vegetation may help to enclose areas of the work from the wider area. This would be more notable within the more rural agricultural scene to the south of the A27 where the Stockbridge Link Road (a component of Option 2) would be located, as this landscape has little development in comparison with the urban fringe of Chichester. Construction within, and immediately adjacent to, the existing A27 corridor would bring new elements to the townscape, including areas in close proximity to Fishbourne and Chichester Conservation Areas and Chichester Harbour AONB. The change would be set within the context of the heavily trafficked A27 and associated highway infrastructure, but there would still be temporary significant adverse effects during construction for all options.

During the operational phase of the Scheme, effects where at-grade junctions are proposed would be minimal during operation, so for Option 3 the landscape/townscape would essentially remain unchanged and a neutral effect is anticipated. However all other options would have potentially significant effects, from grade separated junctions at Bognor and particularly at Fishbourne Junction, due to the proximity of the grade-separated junction as part of Options 1, 1A and 2 to the Fishbourne Conservation Area and Chichester Harbour AONB. There would also be potentially significant effects from the widening of the existing A27 to three lanes between Fishbourne and Bognor proposed for Option 3A.

Landscaping planting is proposed as part of the design of all options, which would help to reduce adverse effects over time, as the planting matures to form an effective screen. Further assessment will be carried out for the preferred option in Stage 3, which will be informed by the additional landscape design available at that stage.

6 Nature Conservation

Chichester Harbour lies approximately 500m to the southeast of Fishbourne junction, and is designated as a Special Area of Conservation (SAC) under the EU Habitats Directive, a Special Protection Area (SPA) under the EU Birds Directive, a Ramsar site, a Site of Special Scientific Interest (SSSI) under the Countryside and Rights of Way Act, and a Site of Nature Conservation Importance (SNCI). Chichester and Langstone Harbours SPA and Ramsar qualifies as a wetland of international importance by regularly supporting at least 20,000 waterfowl and is of particular significance especially during migration periods and in winter. Chichester Harbour SSSI is designated for its wide range of habitats, important plant communities including unimproved pasture, sand dunes and salt marsh and is of particular significance for wintering wildfowl and waders and breeding birds.

Singleton and Cocking Tunnels SAC (designated for bats) is located approximately 6km north and constitutes one of the most important sites for hibernating bats in the region, in particular Barbastelle and Bechstein's. It is also the only known location in Britain for the greater mouse-eared bat *Myotis myotis*. Ebernoe Common SAC is located approximately 20km north east, and records of both Barbastelle and Bechstein's maternity roosts in this area are the primary reasons for its designation. The Mens SAC, located approximately 19km north east, supports an important population of Barbastelle.

It is anticipated that following the implementation of recommended mitigation measures, there would not be a direct or indirect effect during construction or operation on the majority of designated sites within the study area, namely Solent Maritime SAC, Chichester and Langstone Harbours SPA and Ramsar, Chichester Harbour SSSI, River Lavant SNCI, River Lavant Marsh SNCI, River Lavant SNCI, Chichester Canal SNCI, Hunston Copse SNCI or Fishbourne Conservation Area. However, Options 1 and 2 are anticipated to have a slight adverse effect on Chichester Gravel Pits and Leythorne Meadow SNCI due to the effect on potential protected species associated with the designation. Options 1, 1A and 2 would also have a slight adverse effect on the Fishbourne Meadows SNCI, as the relocation of the A259 at Fishbourne junction would slightly encroach into the designated site.

All Scheme options would result in temporary and permanent loss and severance of Priority Habitats, including hedgerows, lowland mixed deciduous woodland and ponds. Furthermore, there would be temporary habitat loss in order to facilitate works, although mitigation in the form of replacement planting would be undertaken in accordance with the National Planning Policy Statement (NPPF) to compensate for the loss of priority habitat.

Although habitat loss accounts for a small proportion of each designation within Chichester Gravel Pits and Leythorne Meadow SNCI, Fishbourne SNCI and Fishbourne Conservation Area, the presence and density of potential protected species associated with the designations is unknown. On completion of protected species surveys, the significance of effect of works on these designations would be revised.

Further protected species surveys will be carried out across the route of the preferred option, once selected, to assess the presence/absence and population size of protected species. Further assessment for the preferred option would also be required to assess the species composition and Zone of Influence (ZoI). This will help inform appropriate mitigation and compensation design.

7 Geology and Soils

The topography and geology of the Chichester area has been governed by the erosion of the coastal plain during glacial and interglacial periods, which resulted in the flat gently undulating topography and the formation of a cliff line approximately 6km to the north of Chichester. Originally, the River Lavant cut across the ancient cliff line, in a narrow channel, beyond which it broadened out on the coastal plain, resulting in the deposition of gravels followed by sands as an alluvial fan. The alluvium and gravels are designated as a secondary A aquifer, which are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The chalk bedrock underlying the area is also classified as an aquifer, with areas of both secondary A aquifer and principal aquifer, the latter being layers of rock or drift deposits that have high intergranular and/or fracture permeability, which usually provide a high level of water storage. Several potential sources of contamination have been identified, including historic landfills, artificial ground, trade and industrial development, waste licenced facilities, and fuel stations. Pollution incidents, such as spillages on the road network, may also form potential sources of contamination.

During construction, all options have the potential to result in significant adverse effects upon geology and soils, resulting from potentially contaminated land and construction processes. There could be large adverse effects on groundwater from the mobilisation of previously unidentified contaminated material, and moderate adverse effects could result from physical removal and degradation of soils. However, the operational Scheme is not expected to result in any adverse effects for geology and soils, as the drainage design for the preferred option would keep all surface water runoff, and therefore potential sources of pollution, away from the groundwater and soils.

Further assessment of effects on geology and soils will be carried out for the preferred option. The assessment will require the preparation of a Phase 1 and Phase 2 Contaminated Land Risk Assessment (CLRA) report, following the completion of an appropriate ground investigation.

8 Materials

The potential effects associated with the transportation of materials and imports of primary aggregates and/or fill material, and exports of surplus waste material where it cannot be reused on site have been identified for all options. During the construction phase, slight to moderate adverse effects could result from the demolition of existing structures and effects associated with the transportation of construction material and the disposal of waste associated with the removal of existing material. In addition, to realign the carriageway there may be waste arising from activities such as carriageway planings from re-surfacing of the existing carriageway, replacement of trenched cables with ducting and bridge replacement and tying-in at junctions.

Effects are also anticipated for all options due to waste arisings, such as quantities of spoil from piling, timber shuttering, and removal of existing steel safety barriers. Cut and fill material may also result in a significant effect for all options. There are not anticipated to be any effects associated with materials during the operation of any of the proposed options.

All the Scheme options have the potential to require significant quantities of materials for use, as well as the potential to generate significant quantities of waste, although given the level of design and information available it is not possible to differentiate between the options at this stage. Once the preferred option has been confirmed, a more comprehensive assessment will be undertaken with the benefit of additional design and construction information. In addition, a Site Waste Management Plan (SWMP) will be produced to ensure that unavoidable construction waste is managed in accordance with relevant legislative requirements.

Materials, waste arisings and transportation during construction all produce carbon dioxide either directly, as in the case of transportation, or indirectly as embodied carbon of the materials used. A carbon assessment will therefore be undertaken for the preferred option, using Highways England's Carbon Tool (February 2016), to identify opportunities to reduce embodied carbon.

9 Noise and Vibration

Baseline noise surveys carried out in 2014 showed that measured noise levels were in proportion to proximity of the A27, with the highest value (66dB) being recorded at the closest receptor. There are numerous noise sensitive receptors close to the proposed Scheme options, including residential properties, farms and schools. Several Noise Important Areas (NIA) were designated along the existing A27 under the Environmental Noise (England) Regulations 2006, which transpose the Environmental Noise Directive (2002/49/EC). The largest of these are at Stockbridge, between Bognor and Portfield Junctions, and at Tangmere.

There is potential for construction activities to generate significant effects, and mitigation would be a necessity at some locations. With suitable mitigation, the likelihood of significant effects due to construction will be reduced, however this cannot be fully determined until a construction method statement becomes available once the preferred option is selected. Mitigation measures during construction may comprise shielding of noisy items of plant, appropriate siting of haul routes, enclosures, screening and monitoring.

During operation, the likelihood and occurrence of significant effects will depend on the balance between changing traffic flows on existing roads, new traffic noise sources on new or improved sections of road, and the level of mitigation designed into the preferred option. Based upon preliminary mitigation assumptions and comparing Do Minimum and Do Scheme traffic flows in the Year of Opening, there would be an overall reduction in significant effects with Options 1, 1A, 2, and 3A, and an overall negligible change in significant effects with Option 3, although improvements for all options may be possible as the design progresses through the implementation of mitigation measures such as noise barriers or thin course road surfacing.

The South Downs National Park would remain unaffected by all Scheme options. The nearest parts of the Chichester Harbour AONB would potentially be affected by small increases in noise by Option 2.

Further assessment of the potential noise effects of the preferred option will be carried out during Stage 3. This would inform any noise mitigation measures required, which would then be incorporated within the Scheme design.

10 Effects on All Travellers

Numerous non-motorised user (NMU) amenities are situated within 250m of Options 1, 1A, 2, 3 and 3A. Additional NMU surveys will be undertaken for the preferred option, to confirm NMU usage. During the construction period, adverse effects on NMUs are anticipated for all options, with temporary closures and diversions likely to be put in place. Effects on NMUs are anticipated, with beneficial and adverse effects predicted for all options, but with mitigation effects on NMUs are predicted to be not significant beneficial for all options. There is potential for changes to journey lengths, journey experience through alterations to NMU facilities and journey amenity with changes to NMU crossings. However, mitigation measures would be incorporated in the design of the preferred option where appropriate, such as new NMU crossing points and footpaths.

During construction, a high level of driver stress is anticipated for vehicle travellers throughout the duration of works, due to the presence of traffic management. However, this would be mitigated by measures such as appropriate phasing of works and the implementation of a CEMP and therefore construction effects on vehicle travellers are considered to be not significant adverse. During operation, effects on vehicle travellers are predicted to vary between the options, in accordance with predicted traffic flows. For all options, there would be a slight decrease in driver stress on the A27 with the Scheme in place, although traffic on roads within 250m of the A27 (e.g. A286, Selsey Road and the B2166) would experience a larger decrease in driver stress under Option 2, which would reduce from high to moderate.

During Stage 3, additional NMU surveys would be carried out for the preferred option, which would then inform the additional assessment to be carried out at that stage.

11 Community and Private Assets

The Chichester Local Plan identifies land adjacent to the east of Portfield and Oving junctions as the Shopwhyke Lakes housing development. Construction started in 2015 and is planned to conclude in 2024. The area adjacent to the A27 at Tangmere is identified as the Tangmere Strategic Development Location. Construction of 1,000 homes is planned to start in 2019 and conclude in 2029. In addition, Chichester District Council's Strategic Housing Land Availability Assessment (SHLAA) has identified the land immediately south of Fishbourne Junction as an area with the potential to be developed, however there are no further development plans detailed.

During construction, effects upon development land are anticipated as it is likely that there would be increased traffic during construction, particularly since the construction period for the A27 Chichester Bypass and the Shopwhyke and Tangmere developments overlap. This would be a slight adverse effect for all options. There would also be community severance effects due to temporary reduction in access to community facilities, although mitigation would be provided in the form of alternative access arrangements where appropriate. This would be a slight adverse effect for all options.

During operation, there would be effects due to the demolition and land acquisition of residential and business properties. Option 1 and 1A would cause the loss of five properties (three greenhouses, one barn and a disused warehouse) and Option 2 the loss of twenty properties (thirteen residential, three greenhouses, one barn, a disused warehouse and a garage). No properties would be lost as a result of Option 3 or Option 3A. There would be additional effects due to demolition and land acquisition during construction, but as the exact extent of construction works and compounds is not known at this stage, it has not been possible to assess this.

There would be an overall slight beneficial effect on development land during operation for all options, as the Scheme has the potential to reduce journey times to the proposed strategic developments sites. The effect on agricultural land would be moderate adverse Options 1, 1A, 2 and 3A due to the classification and area of land that would be lost. Option 3 would be no change due to the much smaller agricultural land take required.

Once the preferred option is selected and the design progressed, further assessment of the effects on Communities and Private Assets will be carried out. This will incorporate details of the construction compounds and required site clearance, enabling a full assessment construction effects that has not been possible at this stage.

12 Road Drainage and the Water Environment

The River Lavant and the Chichester Canal are both crossed by the existing A27. In terms of hydrology on the river Lavant, flows become very low in Chichester most years for a period during the driest months. Chichester Canal is an artificial waterbody that stretches from Chichester Canal basin in the southwest of the city to Chichester Harbour, although flows are cut off by the B2145 at Hunston. The downstream waterbody of the Lavant and Chichester Canal is Chichester Harbour, which is heavily protected for its ecological value and is designated as an SAC, SPA, Ramsar site and SSSI. There are numerous lakes to the southeast of Chichester, which were formed when excavations from gravel extraction filled with groundwater. These are now popular coarse fishing and amenity areas. The Scheme lies over an area of bedrock classed as principal aquifer, with a secondary A aquifer present in the superficial geology.

With the inclusion of standard mitigation measures, through the CEMP, and the use of Sustainable Drainage Systems (SUDS) to attenuate surface water run-off and provide treatment, there are no significant effects anticipated on water quality as a result of the construction or operation of all the proposed options. However, the proposed grade-separation of Bognor junction as part of Options 1, 1A, 2 and 3A would result in the loss of an area of Leythorne Lake, which would be a moderate adverse effect.

An initial flood risk appraisal showed that fluvial and groundwater flooding are considered to be the greatest risks to the Chichester area. The majority of the options would maintain existing flood flow paths and therefore the risk of affecting flood risk would be low. However even minor changes to ground levels have the potential to affect flood risk, and therefore the preferred option would be investigated through detailed hydraulic modelling using final design dimensions. The Stockbridge Link Road proposed as part of Option 2 could affect the flood extent and flood levels, although this could be mitigated using an open span bridge for the main river channel, with additional culvert(s) to maintain the existing flood flow paths to ensure flood risk is not increased as a result of the preferred option.

The assessment of groundwater flood risk shows that Fishbourne and Stockbridge junctions are located in a Groundwater Emergence Zone and therefore are at risk of groundwater flooding. All options would require some degree of excavation and therefore there is potential to affect sub-surface flow paths, which could result in ground water emergence upstream of the carriageway. Surface flow paths would be maintained to minimise effects on ground water flows, should they emerge.

A preliminary Water Framework Directive (WFD) assessment concluded that there is the potential for all the options to affect the waterbody status, through the inclusion of culverts and potential channel realignment. In addition, the underlying Chichester Chalk groundwater could be affected by a number of the scheme elements, including dewatering, piling, and retaining walls. A detailed WFD assessment will therefore be carried out during Stage 3 to fully assess this potential. A full Flood Risk Assessment will also be carried out during Stage 3 for the preferred option, which will assess the flood risk to the Scheme and the potential for increased flood risk caused by the preferred option. The latter would be mitigated through the Scheme's drainage design.

13 Combined and Cumulative Effects

Combined and cumulative effects result from multiple actions on receptors over time and are generally additive or interactive (synergistic) in nature. They can also be considered as effects resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project, identified as:

- Combined effects from a single project (the interrelationship between different environmental factors); and,
- Cumulative effects from different projects (with the project being assessed).

During construction, the combined effects would, on balance, be significant adverse for Options 2, and 3A, largely due to significant adverse effects predicted for landscape character and historic setting, cultural features, the water environment and ecological receptors. However, a combined non-significant adverse effect is anticipated for Options 1, 1A and 3. Once operational, Options 1, 1A and 3 would be on balance non-significant adverse effect. However, a significant adverse effect would be anticipated for Option 2, largely as a result of significant adverse effects predicted for landscape, cultural features and ecology.

During construction, the potential temporary cumulative effects with the additional proposed major developments would, on balance, be non-significant adverse for Options 1, 1A and 3, whilst an on balance cumulative significant adverse effect would be anticipated as a result of Options 2 and 3A. These cumulative adverse effects for Options 2 and 3A are largely as a result of the predicted adverse effects on ecology associated with these two options, caused by effects to the Fishbourne Meadows SNCI and the Chichester Gravel Pits and Leythorne Meadow SNCI.

Permanent cumulative effects once operational would, on balance, be neutral for Options 1, 1A and 3, as beneficial effects associated with some of the proposed options combine with any adverse effects and lead to an overall cumulative neutral effect. Options 2 and 3A would be anticipated to have an on balance cumulative non-significant adverse effect during operation, largely as a result of the more adverse effects anticipated for landscape and ecology.

14 Overall Conclusions

The overall significance of effect for each option during construction and operation is summarised in Table 1. This summary demonstrates that for all options, the majority of construction stage effects could be minimised and managed through the implementation of best practice measures, implemented through the CEMP. Appropriate design, including landscape and ecological design measures, and an appropriate drainage design (incorporating SuDS) would also ensure that potential operational effects for the preferred option would be minimised as far as possible

During the operational phase, there is the potential for significant adverse effects upon a number of features, which require further assessment during Stage 3. This includes potential effects upon protected species and priority habitats, heritage and archaeological features, key views, landscape character and local communities, during both construction and once the Scheme is operational.

Option 2 and Option 3A present the greatest likelihood of significant effects arising, largely as a result of the introduction of the new carriageway for the Stockbridge Link Road for Option 2 that would also result in the greatest area of habitat loss and potential effects on the flood plain of the River Lavant, or as a result of the additional lane between Stockbridge and Bognor Junctions in Option 3A. Option 3 presents the least potential for significant adverse effects, due to the minimal nature of the proposed works.

Further assessment will be carried out for the preferred option for both construction and operation, which will be presented within the Environmental Impact Assessment Report (EIAR) that will be prepared for the preferred option during Stage 3.

Table 1 Overall Conclusions – Significance of effects during construction and operation

	Option 1		Option 1A		Option 2		Option 3		Option 3A	
	Construction	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Quality	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant adverse	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant beneficial
Cultural Heritage	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Major adverse	Moderate adverse	Neutral	Neutral	Moderate adverse	Moderate adverse
Landscape	Significant adverse	Significant adverse	Significant adverse	Significant adverse	Significant adverse	Significant adverse	Significant adverse	Neutral	Significant adverse	Significant adverse
Nature Conservation	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate to large adverse	Moderate to large adverse	Slight adverse	Slight adverse	Moderate adverse	Moderate adverse
Geology and Soils	Large adverse	Neutral	Large adverse	Neutral	Large adverse	Neutral	Large adverse	Neutral	Large adverse	Neutral
Materials	Slight to moderate adverse	Neutral	Slight to moderate adverse	Neutral	Slight to moderate adverse	Neutral	Slight to moderate adverse	Neutral	Slight to moderate adverse	Neutral
Noise and Vibration	Not significant adverse	Beneficial	Not significant adverse	Beneficial	Not significant adverse	Beneficial	Not significant adverse	Neutral	Not significant adverse	Neutral
Effects on All Travellers	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant beneficial	Not significant adverse	Not significant beneficial
Communities and Private Assets	Slight adverse	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse	Moderate adverse
Road Drainage and Water Environment	Slight adverse	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse	Moderate adverse	Slight adverse	Slight adverse	Slight adverse	Moderate adverse
Combined and Cumulative	Not significant adverse	Not significant adverse	Not significant adverse	Not significant adverse	Significant adverse	Significant adverse	Not significant adverse	Not significant adverse	Significant adverse	Significant adverse

All effects are assessed on the basis of the precautionary principle and are therefore worst case. Shading indicates effects that are significant (moderate or above).