

M2 Junction 5 Improvement Study Regional Investment Programme

PCF Stage 1 Report – Option Identification
Technical Appraisal Report

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Executive summary

At the end of PCF Stage 0 Strategy, Shaping and Prioritisation, three main options to improve the M2 Junction 5 were put forward for the optioneering processes in PCF Stage 1. All three options complied with the scheme objectives, which are described later in this summary and in more detail within this report.

Initial Stage 1 options:

- Option 4 – Two tier intersection - This option sees the existing roundabout replaced with a new grade-separated interchange, with free flowing movement provided on the A249 under the junction. Additional free-flow links are included for the A249 westbound to M2 northbound, A249 eastbound to M2 coast-bound, and M2 coast-bound to A249 eastbound movements. The M2 eastbound to A249 northbound free-flow link avoids the roundabout. Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided to the Stockbury interchange.
- Option 8 – Two Tier Dumbbell Intersection (at existing Stockbury Viaduct) - This option proposes that the existing Stockbury Roundabout be enlarged and linked with another smaller roundabout on the opposite side of the M2 Viaduct to form a dumbbell junction (north – south orientation). The existing A249 would fly under or over the proposed roundabouts with connector roads between the roundabouts and linking local roads and the M2.
- Option 10 – Three tier intersection - This option sees the existing roundabout replaced with a traditional three-tier grade separated interchange; removing the unusual geometry of the junction and slip road alignments. The A249 has a dedicated through link at the lower- level, with the interchange at the mid-level, and M2 as existing at the top-level. There are additional free-flow links serving the M2 coast-bound to A249 eastbound, M2 westbound to A249 westbound and A249 eastbound to M2 northbound movements. The interchange would be partially signalised. Local connections would be provided with a link between Oad Street, Maidstone Road and the interchange. The gyratory under the M2 viaduct would be provided with three lanes on both sides with the adjustment of entry, exit and free-flow lanes around the gyratory adjusted to suit.

Following the initial transition of options from Stage 0 to Stage 1, the scheme options were refined during the early stages of Stage 1 and submitted for cost estimation. Following the initial estimation exercise undertaken by Highways England's estimation specialists, Benchmark, it became apparent that all three options were likely to exceed the £100m budget. A detail Value Management exercise was therefore undertaken mid Stage 1 to further review and refine the options.

Following the Value Management exercise, two of the initial options (Option 4 and 10) were refined in order to ensure they could be delivered within the original £100m budget. It was agreed that the remaining option (Option 8) would not be taken further due to complexity and anticipated cost. A new option (Option 12) was therefore developed to replace Option 8 to meet the objective of being both within the RIS budget and the revised scheme budget of £70.8m.

Options considered for further development in Stage 1

- Options 4 and 10 from Stage 0 as refined and detailed above
- Option 12 – a new at grade (Low Cost) option - This option sees the existing roundabout on the A249 retained and no realignment of the A249. Existing slip roads will be retained but a two lane diverge from the M2 coast-bound and a free-flow lane from the M2 to A249 north-bound will be created. A free-flow lane from the A249 westbound to the M2 London-bound merge slip road will also be added. A link will be created between Maidstone Road and Oad Street. The connection of Maidstone road to the roundabout will be removed, and the existing access to the A249 from Oad Street west of junction retained.

All three options propose to maintain existing NMU provisions at Junction 5.

Structural impacts, operational, technology and maintenance assessments were also appraised for each option in their respective chapters of this report.

A qualitative Environmental Assessment was undertaken, which will be further development with more surveys and quantitative data becoming available in future PCF Stages. In conclusion, due to the numerous elements of the environmental assessment it is not possible to identify which option presents the least environmental impact.

As detailed above cost consultants Benchmark provided a detailed assessment of costs for each option in 2014 prices. The initial Stage 1 estimates were revised following the Value Management exercise undertaken for Option 4 and Option 10 along with a new estimate for Option 12. Based upon these costs (rebased to 2010 in line with WebTAG requirements), an economic appraisal was undertaken using TUBA and COBALT. The expected total scheme and the corresponding Benefit to Cost Ratio (BCR) for the three options are shown below.

Option	Expected Scheme Cost in 2014 prices (£)	BCR, with benefits from accident savings applied	VfM Category
Option 4 – Two tier intersection	80,735,518	14*	High
Option 10 – Three tier intersection	88,564,144	14*	High
Option 12 – At grade (Low Cost) option	46,308,222	24*	High

* Extreme caution should be applied when using the BCR and VfM values. As outlined below and in further detail within this report the value is likely to be an overestimation, especially Option 12, due to issues with latent demand.

Scheme Objectives

Scheme objectives		Compliance with objectives		
		Option 4	Option 10	Option 12
1	To enhance the capacity, connectivity (including all modes of transport) and the resilience provided by the M2 Junction 5 in order to contribute positively to strengthening the local and regional economic base, delivering housing allocations within the Swale Local Plan and promoting economic growth across the region.	High	High	Low
2	To improve safety and security offered by M2 Junction 5 to all road users. To reduce the number of KSI (Killed and Seriously Injured) collisions, and to reduce the number of slight collisions.	High	High	Low
3	To improve the journey quality, journey time and reliability for all routes through M2 Junction 5.	High	High	Low
4	To deliver a high standard of design for any M2 Junction 5 improvement that reflects the quality of the landscape and setting, and that minimises the adverse environmental impact of new construction and supports the following objectives: <ul style="list-style-type: none"> Plan for climate change; Work in harmony with the environment to conserve natural resources and encourage bio-diversity; and Protect and enhance countryside and historic and archaeological environments. 	Neutral	Neutral	Neutral

Fully compliant options

Option 4

Option 4 fully complies with the scheme objectives. It has:

- a large increase in highway capacity
- a high journey time reliability & journey time reduction
- the second highest estimated scheme cost (within allocated RIS budget, but over revised scheme budget)
- a high VfM *Subject to further assessment in a strategic transport model
- a high BCR (>2) *Subject to further assessment in a strategic transport model
- the second highest accident savings

It is therefore recommend that this option be taken forward to PCF Stage 2 for further consideration.

Option 10

Option 10 fully complies with the scheme objectives. It has:

- a large increase in highway capacity
- a high journey time reliability & journey time reduction
- the highest estimated scheme cost (within allocated RIS budget, but over revised scheme budget)
- a high VfM *Subject to further assessment in a strategic transport model

- a high BCR (>2) *Subject to further assessment in a strategic transport model
- a high standard of design (traditional DMRB design layout)
- the highest accident savings

It is therefore recommend that this option be taken forward to PCF Stage 2 for further consideration.

Partially compliant option

Option 12 was developed, to comply as fully as possible with the scheme objectives by increasing capacity, albeit to a limited amount. It could also provide a basis for an incremental delivery of the fully compliant Option 4. Option 12 has:

- the lowest increase in highway capacity
- the lowest journey time reliability & journey time reduction
- the current lowest estimated scheme cost (& only current option within the revised scheme budget)
- the joint highest VfM *Subject to further assessment in a strategic transport model
- a high BCR (>2) *Subject to further assessment in a strategic transport model
- the lowest accident savings

It is therefore recommend that this option be taken forward to PCF Stage 2 for further consideration.

Recommendations

Based on the combination of the individual assessments above, the BCR's and the various options compliance with the scheme objectives, it was concluded that all three options, (Option 4, Option 10 and Option 12) should be carried forward to PCF Stage 2 for further assessment and development.

This report will now form a key input source to the Scheme Appraisal Report (SAR), which will be produced during PCF Stage 2.

1 INTRODUCTION

1.1 General

1.1.1 WSP | Parsons Brinckerhoff have been commissioned by Highways England to develop scheme proposals for the M2 Junction 5 Improvement.

1.1.2 M2 Junction 5 forms part of the strategically important corridor linking Dover with London. The Junction 5 / A249 Stockbury Roundabout has been identified to have capacity and network performance issues, in terms of both M2 east-west movements on and off the mainline and A249 north-south Sittingbourne / Maidstone movements.

1.1.3 The broad scheme study area is shown in Figure 1.1.

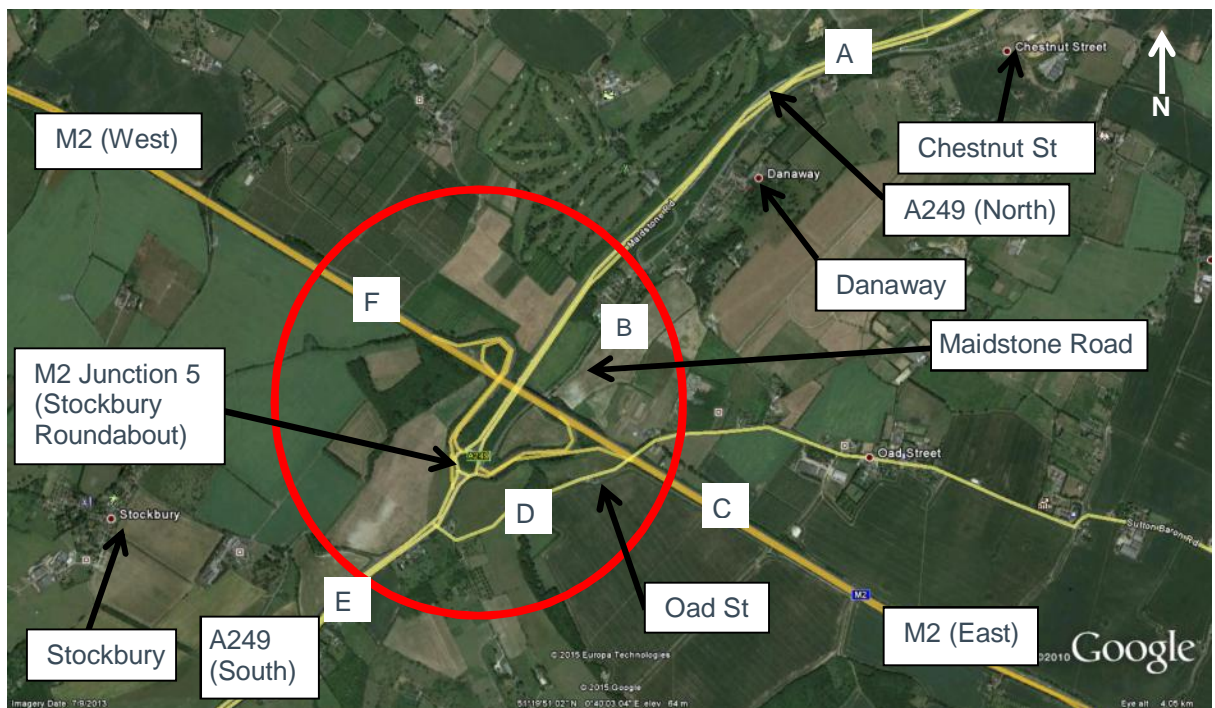


Figure 1.1: M2 Junction 5 Stockbury Roundabout

1.1.4 Further details on the studies background, objectives and desired outcomes can be found in the Appraisal Specification Report (ASR) and Route Strategy documents; the Option Assessment Report and Strategic Outline Business Case, completed during PCF Stage 0.

1.1.5 Details of the base year (2015) micro simulation (VISSIM) model are within the Local Model Validation Report (LMVR), dated June 2015. The letters (A – F) in the figure above correspond to the count data and identification of each approach).

1.2 Scheme Background

1.2.1 The performance of the M2 was considered in the Kent Corridors to M25 Route Strategy, in addition to existing capacity constraints at the junction. It was also identified as being joint 10th out of the top 250 collision locations nationally for the total number of casualties per billion vehicle miles for the period 2009-2011.

- 1.2.2 Previous study work was undertaken by Jacobs in July 2009. This work identified capacity issues at the M2 J5 and set out short term solutions (up to 2016). The need for longer term solutions to accommodate future planned development was also identified. Further work was undertaken by WSP | Parsons Brinckerhoff (formerly Parsons Brinckerhoff) in September 2012, which considered further options for improvements and looked at fundable capacity enhancements for M2 J5.
- 1.2.3 The need for this Regional Investment Programme (RIP) study was identified during the Route Strategies work stream in 2014. A commitment to undertake a detailed improvement study at M2 J5 was made as part of the 2014 Autumn Statement, and subsequently detailed in the DfT's Road Investment Strategy (RIS). The RIS (December 2014) included an investment of between £50 - 100m for improvements to M2 J5.
- 1.2.4 In March 2015, Highways England established their investment priorities for the Kent Corridor. It was identified that the M2 at junction 5 would benefit from improvements to increase capacity to assist the delivery of residential and employment growth.

1.3 Report Objectives

- 1.3.1 This report summarises the technical aspects of the existing highway problems and describes how a suitable scheme could solve them.
- 1.3.2 It describes the existing highway network in the study area, existing traffic conditions, and the condition of the surrounding environment and landscape, along with a summary of the planning factors affecting the Scheme.
- 1.3.3 The report describes the current preferred options, including assessments of how they support local Planning Policies. Further assessments of environmental impact, traffic and economics factors are also provided. A description of other rejected options is also given, together with the reasons for their rejection. The report includes an outline proposed programme to achieve the scheme objectives.
- 1.3.4 This report provides evidence to support the choice of the preferred options, to be taken forward to Option Selection and ultimately a Preferred Route Announcement (PRA) during PCF Stage 2.

2 PLANNING BRIEF

2.1 Introduction

2.1.1 The Planning Brief for the M2 Junction 5 improvement scheme is described in the Client Scheme Requirements (CSR).

2.1.2 The Brief determines that the Consultants shall 'identify and evaluate all suitable alternatives in terms of engineering, traffic, safety, economics and environmental impact'.

2.2 Scheme Objectives

2.2.1 In line with the National Policy Statement for National Networks, the high-level objectives are:

- To enhance capacity, connectivity, and resilience to support national and local economic activity and facilitate growth and create jobs;
- To support and improve journey quality, reliability and safety;
- To join communities and link them effectively to each other;
- To support the delivery of environmental goals and move to a low carbon economy; and
- To improve road safety with a reduction in the number of collisions

2.2.2 The specific objectives identified for the scheme at M2 J5 are given below.

2.2.3 **Objective 1:** To enhance the capacity, connectivity (including all modes of transport) and the resilience provided by the M2 J5 in order to contribute positively to strengthening the local and regional economic base, delivering housing allocations within the Swale Local Plan and promoting economic growth across the region.

2.2.4 **Objective 2:** To improve the safety and security offered by M2 J5 to all road users. To reduce the number of KSI collisions, and to reduce the number of slight collisions.

2.2.5 **Objective 3:** To improve the journey quality, journey time and reliability for all routes through M2 J5.

2.2.6 **Objective 4:** To deliver a high standard of design for any M2 J5 improvement that reflects the quality of the landscape and setting, and that minimises the adverse environmental impact of new construction and supports the following objectives:

- Plan for climate change;
- Work in harmony with the environment to conserve natural resources and encourage biodiversity; and
- Protect and enhance countryside and historic and archaeological environments.

3 Existing Conditions

3.1 Description of the Locality

3.1.1 M2 Junction 5 forms the intersection between the strategically important M2 corridor linking Dover with London and the A249. It provides a strategic connecting route between Maidstone and Sittingbourne, also serving as the principal route to and from the Isle of Sheppey. A location plan is shown in Figure 3.1.

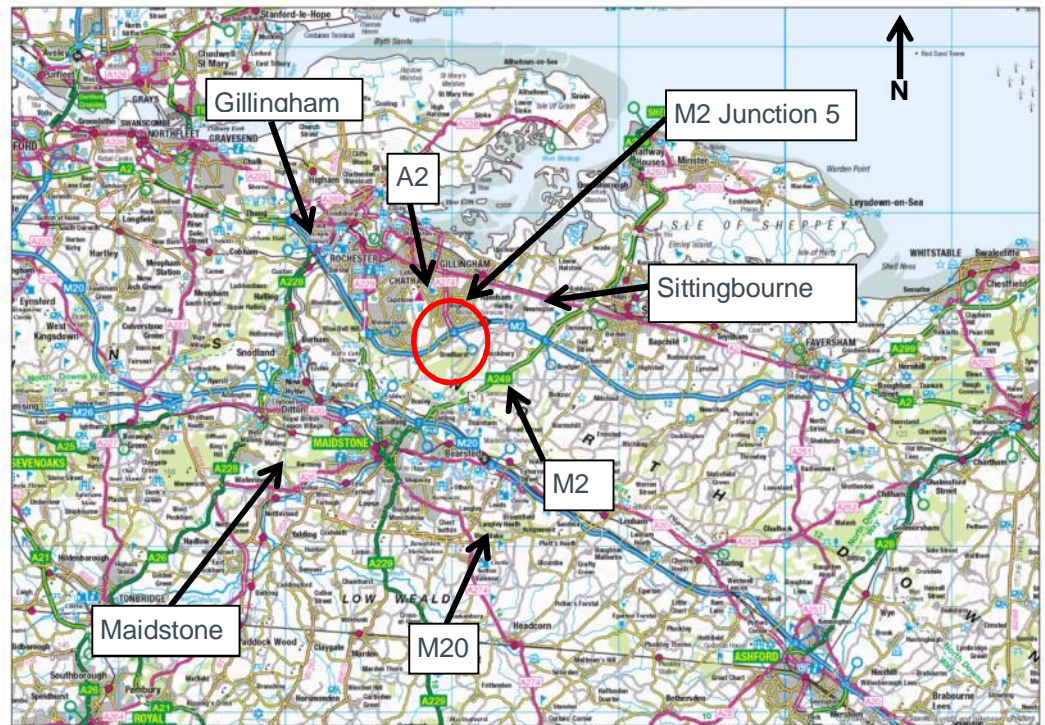


Figure 3.1: Location of M2 Junction 5

3.1.2 M2 J5 is approximately 58km from the centre of London, with the built up area of Sittingbourne approximately 5km north west of M2 J5.

3.1.3 The area is largely open countryside, with areas of woodland close to the motorway slip roads. The open countryside areas are given over to grassland and arable farmland. There are a line of properties located to the north of the M2 (Danaway), adjacent to the A249 boundary. There are also several isolated properties to the south of the roundabout, around the Oad Street junction.

3.1.4 The M2 crosses the study area, generally in an east to west direction on a viaduct, high above the A249, which is located on a valley floor between two adjacent ridge lines. The A249 generally crosses the study area in a north east to south west direction. The existing A249 Stockbury Roundabout is located on the valley floor to the south the M2 and connects with the M2 J5 sliproads. The M2 slip roads traverse the valley sides to join the M2 mainline carriageway.

3.2 Existing Highway Network

- 3.2.1 Figure 1.1 and Figure 3.1 show the existing highway network around M2 J5, the connections to Sittingbourne, Sheppey and beyond.
- 3.2.2 The M2 is part of the Strategic Road Network (SRN) serving east-west movements between the Port of Dover and London and also serving major urban areas around Canterbury, Medway, Gravesham and Dartford. The A2/M2 corridor ranges from being dual 3 lane (D3) and dual 4 lane (D4) carriageway standard in the west to predominantly dual 2 lane (D2) carriageway standard in the east. The M2 through the study area is currently dual 2 lane motorway standard (D2M).
- 3.2.3 The A249 provides a local and strategic route between Maidstone and the Isle of Sheppey, serving a number of smaller villages and Sittingbourne along the way. The A249 crosses the M20 and M2 routes. The A249 is generally to dual 2 lane all purpose (D2AP) carriageway standard except for single carriageway (S2) sections in Maidstone and on the Isle of Sheppey.
- 3.2.4 The A249 sits within a valley with ground elevations typically increasing relatively steeply on either side of the road. Access to the eastbound M2 is west off Stockbury Roundabout and access to the westbound carriageway is east off Stockbury Roundabout.
- 3.2.5 There are four other local access roads within the site area. Maidstone Road is accessible from Stockbury Roundabout and runs sub-parallel with the A249 towards Sittingbourne. The other access routes are situated in the south eastern extent of the site area, providing access to occasional farm houses / residential properties..
- 3.2.6 Maidstone Road runs parallel to the A249 north of the roundabout and serves villages such as Danaway and Chestnut Street. It also provides a potential alternative route for traffic from the A2 and Sittingbourne during the peak periods. Maidstone Road is subject to a 50 mph restriction through Danaway and a 30 mph restriction through Chestnut St. There is also a 6'6" width restriction through Chestnut Street due to the narrow lanes.
- 3.2.7 Oad Street joins the A249 approximately 250m south of the roundabout, having served a number of small settlements and rural properties. Vehicles are currently allowed to turn both left and right out of Oad St, whilst only left turns in are enabled. The right out of Oad St involves a manoeuvre crossing the southbound dual carriageway, through the central reserve and joining the A249 north bound carriageway, which is a potential safety risk. Oad St provides an alternative route into the southern side of Sittingbourne and therefore has traffic calming measures installed in the hamlet of Oad Street (parish of Borden).

3.3 Existing Traffic Conditions

3.3.1 This section summarises the existing traffic conditions around the M2 J5. Manual turning counts were conducted on Wednesday 11 March 2015, Wednesday 18 March 2015 and Thursday 19 March 2015.

3.3.2 A summary of the turning counts during the study period (07.00 – 19.00) on Wednesday 11 March 2015 is shown in Figure 3.2. Full details of the existing traffic conditions are documented in the Data Collection Report.

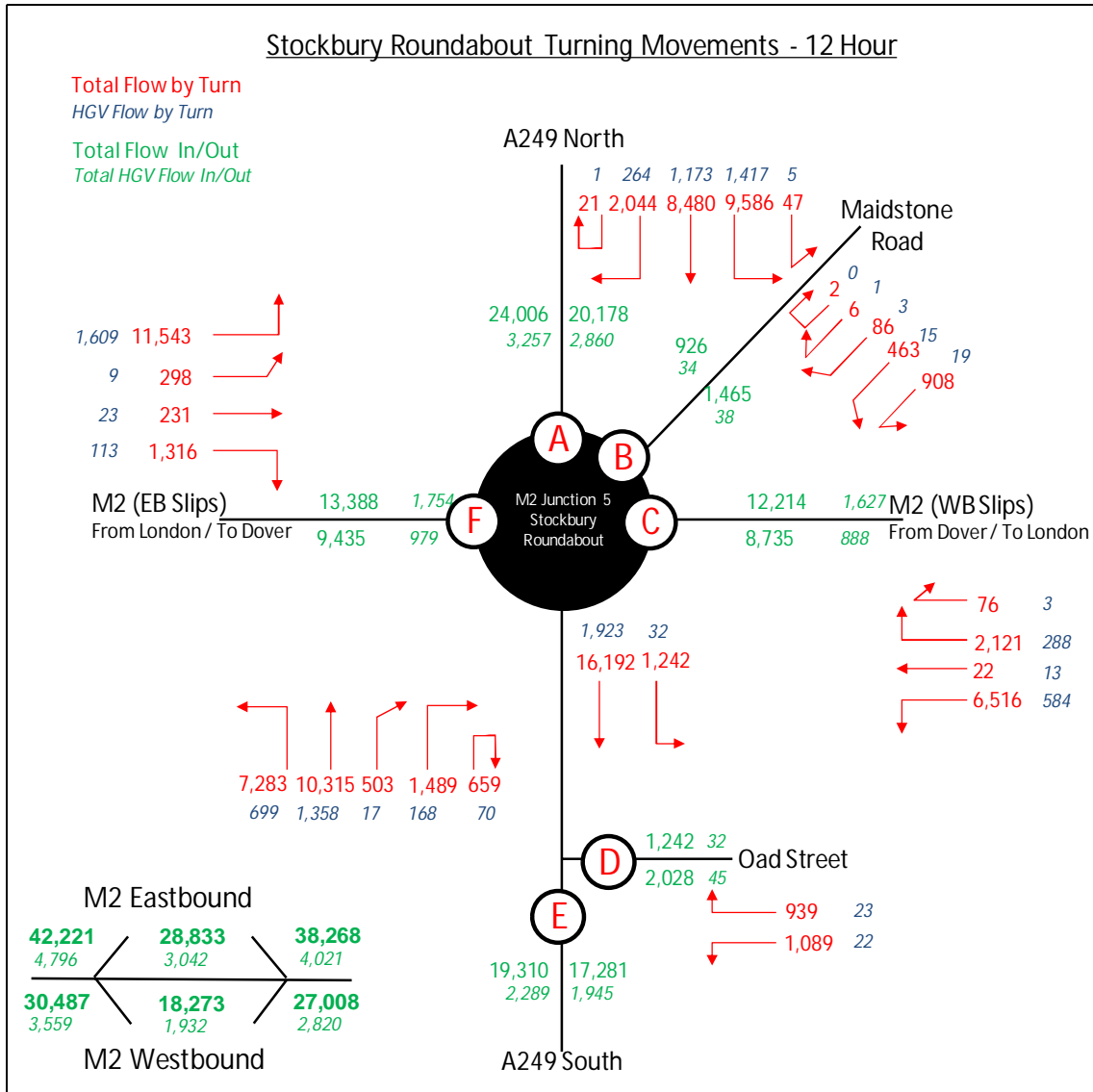


Figure 3.2: 12 Hour (07.00 – 19.00) Turning Movements

3.3.3 The diagram also shows the Heavy Goods Vehicle (HGV) flows in actual numbers (blue text), as well as the total all vehicle flows (red text).

3.3.4 It can be seen that the highest link flows (green text), excluding the M2 mainline, occur on the A249 north (24,006 n/b plus 20,178 s/b = 44,184 2-way flow), followed by the A249 south. (19,310 n/b plus 17,281 s/b = 36,591 2-way flow) It can also be seen that the highest movements at the Stockbury Roundabout are as follows:

- M2 eastbound (from London) to A249 northbound – 11,543

- A249 through route northbound – 24,006
- A249 southbound to M2 westbound (to London) – 9,586
- A249 through route southbound – 20,178

- 3.3.5 To facilitate the M2 eastbound (from London) to A249 northbound traffic and the A249 northbound to M2 eastbound (to Dover), there are existing free-flow links to remove the need for vehicles to enter the roundabout. All other traffic movements are via the circulatory carriageway of the Stockbury Roundabout.
- 3.3.6 The major minor junction between the A249 and Oad Street allows for traffic to leave Oad Street and join the A249 in a northbound or southbound direction. Traffic seeking to enter Oad Street from the A249 has to approach Oad Street from the Stockbury roundabout as a right turning movement from the A249 into Oad Street is not provided for.
- 3.3.7 The largest junction movement observed between Oad Street and the A249 was that from the A249 southbound into Oad Street, (as above this movement includes all A249 to Oad Street movements). Traffic movements from Oad Street to A249 were split 46% to the south and 54% to the north. Overall, there was a higher number of vehicles exiting Oad Street than entering throughout the day.
- 3.3.8 Given that there are a greater number of turns out of Oad Street than in, it is clear that this provides an alternative route to the A249 from the north of the study area. If these movements were attributable to local traffic only, a tidal pattern would be expected with entry and exit turns being similar.
- 3.3.9 The following figures show the breakdown of total traffic flow over the AM, Inter and PM peak hour flows with the corresponding HGV flows shown separately.

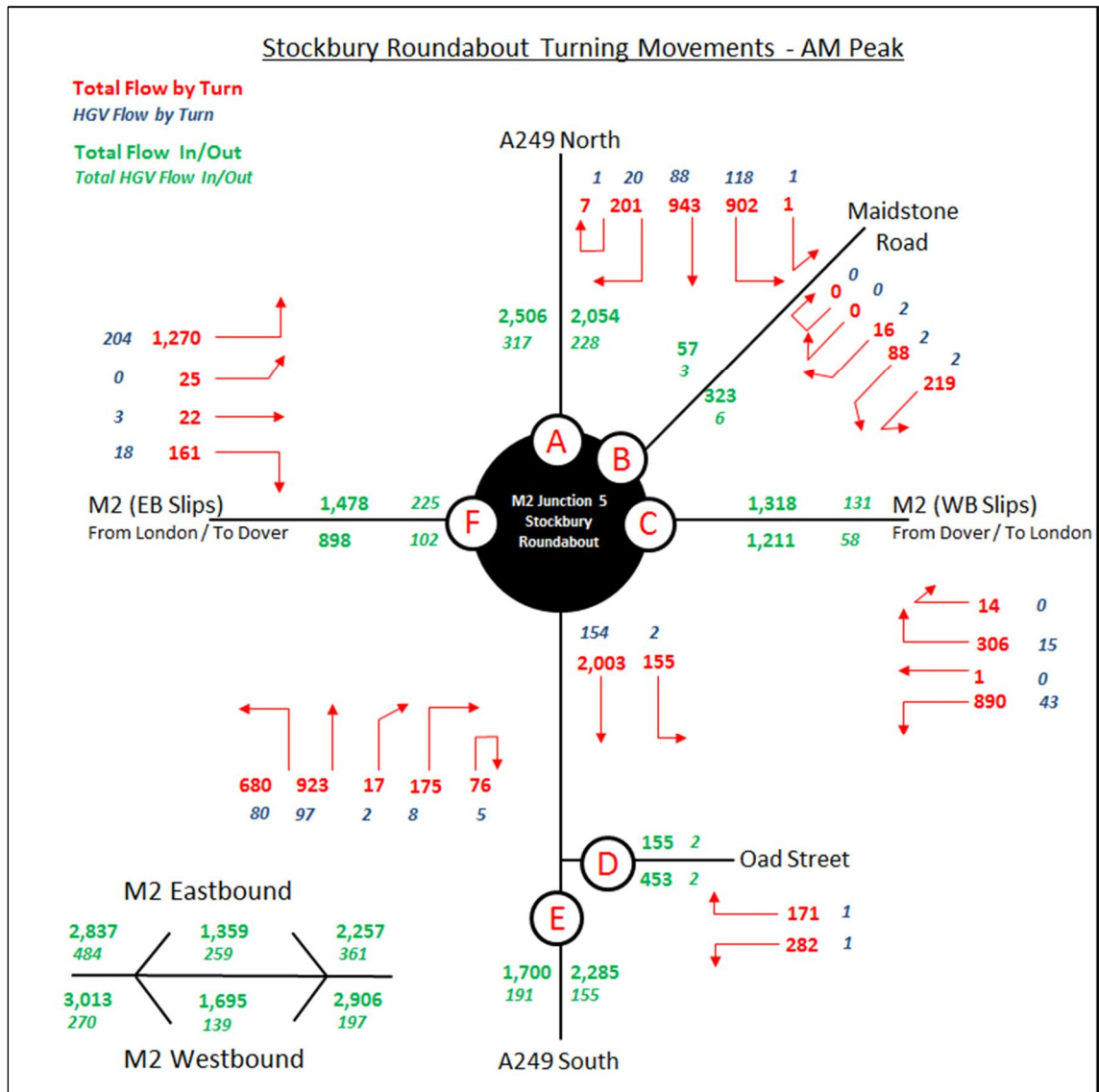


Figure 3.3: AM Peak Hour (07.15 – 08.15) Turning Movements

- 3.3.10 The AM peak hour counts, in Figure 3.3, show that the highest flows are the M2 eastbound (from London) to the A249 northbound (1,270) and from the A249 southbound to the M2 westbound (from Dover) (902) and on the A249 through route (943 s/b and 923 n/b). The flow out of Oad Street is greater than the flow in. The highest HGV movements are from the A249 southbound to the M2 westbound (118) and from the M2 eastbound (from London) to the A249 northbound (204).
- 3.3.11 The Inter-peak hour counts, in Figure 3.4, show that the highest flows during the Inter-peak hour (14.00 – 15.00) are from the M2 eastbound (from London) to the A249 northbound (966), from the A249 southbound to the M2 westbound (773) and on the A249 through route in both directions (668 s/b and 824 n/b). The highest HGV flows are on the M2 eastbound to A249 northbound (230) and A249 southbound to M2 westbound (154) and the A249 through route (125 s/b and 151 n/b).

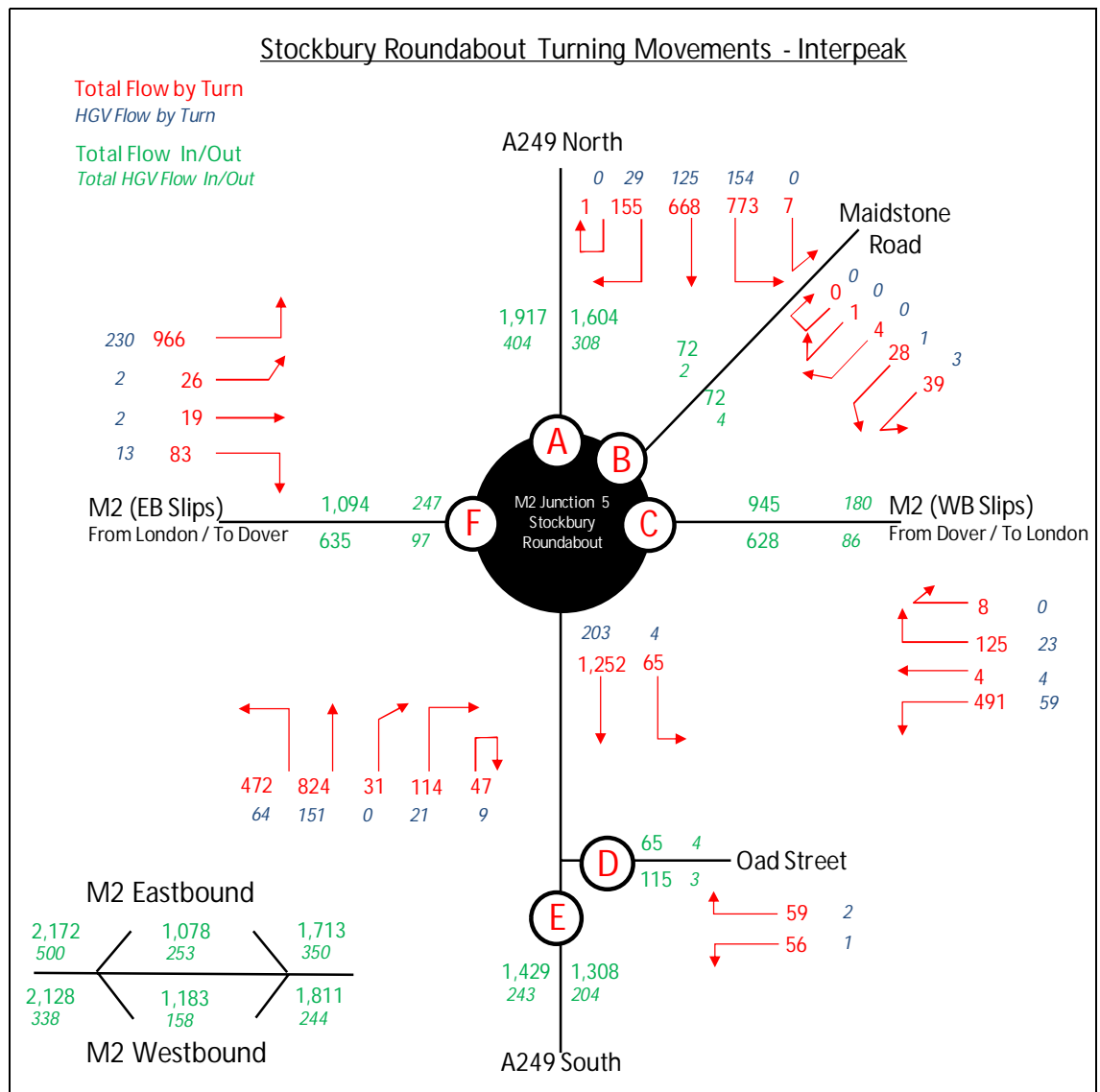


Figure 3.4: Inter-Peak Hour (14.00 – 15.00) Turning Movements

3.3.12

The PM peak hour counts, in Figure 3.5, show that the highest vehicle flows are on the M2 eastbound to A249 northbound (1,544) and A249 southbound to M2 westbound (1,051) and on the A249 through route (806 s/b and 1,497 n/b). The flow out of Oad Street is significantly higher (109, 80%) than the flow into Oad Street. The highest HGV flows are on the M2 eastbound to A249 northbound (115) and A249 southbound to M2 westbound (87) and on the A249 through route (59 s/b and 82 n/b).

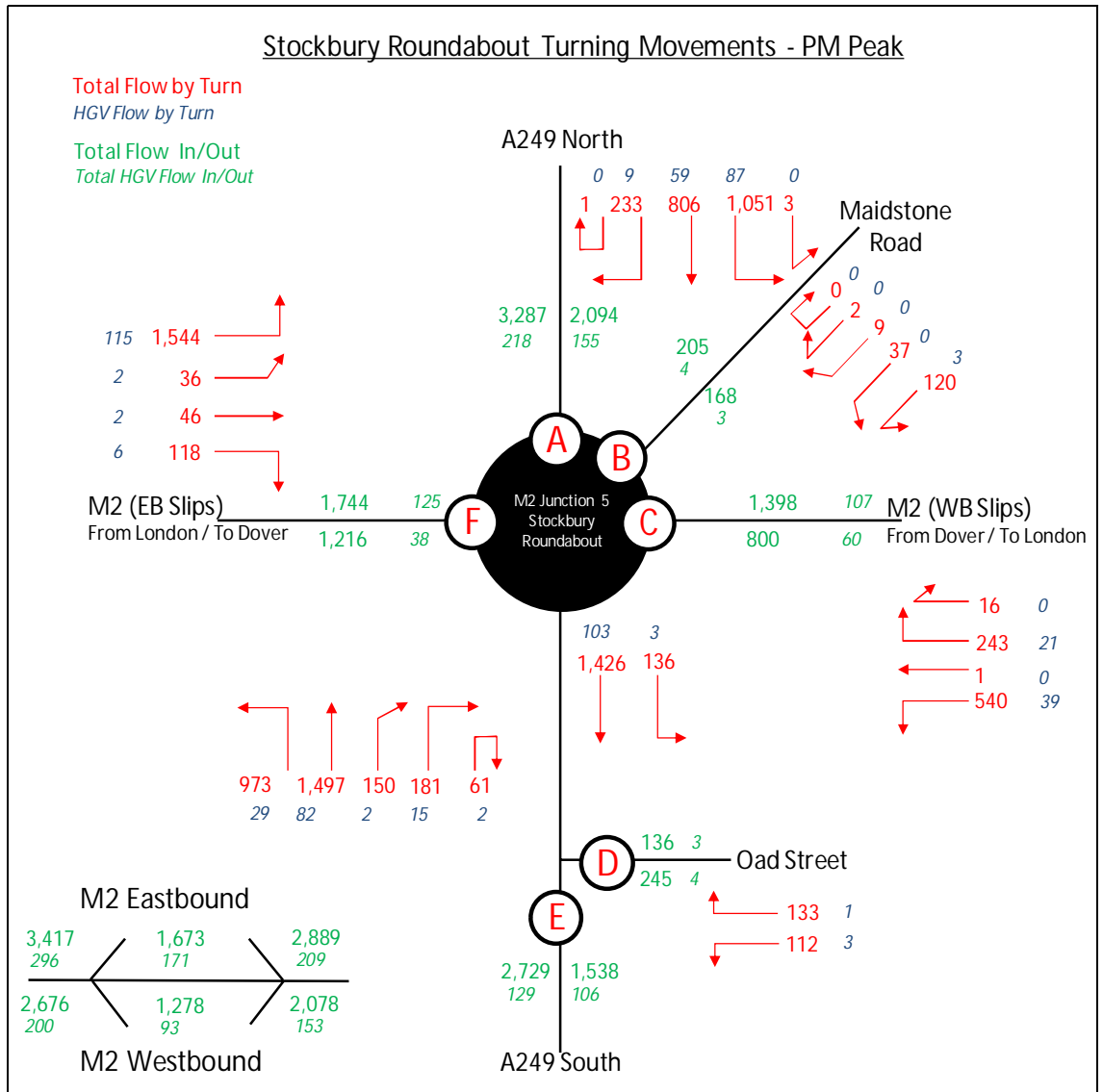


Figure 3.5: PM Peak Hour (17.00 – 18.00) Turning Movements

3.3.13

In summary the peak hour turning count data shows that the highest flows are on the M2 eastbound to A249 northbound and A249 southbound to M2 westbound routes and on the A249 through route, with similar patterns observed for HGV's. Throughout all peak hours shown above, the flow out of Oad Street is greater than the flow in, indicating its use as an alternative route to the A249 out of Sittingbourne but not as popular as a route into Sittingbourne.

3.4 Accidents

3.4.1 Collision data was obtained from Kent County Council for the five-year period from 1 October 2009 to 31 September 2014. In the area immediately around the Stockbury Roundabout, there were 92 collisions reported, 88 were slight collisions and four were serious. There were no fatal collisions reported within the study area.

3.4.2 The location of the reported collisions within the study area is shown in Figure 3.6.



Figure 3.6: Location of Road Traffic Collisions

3.4.3 The classification of the incident severity is normally recorded by the police immediately after the incident occurs, but can be updated if additional information becomes available (for example if a casualty dies of their injuries within 30 days of the incident occurring). The following guidance is used in determining severity:

- When a collision causes one or more deaths within 30 days of the incident it is recorded as fatal.
- When a collision does not cause a death within 30 days but results in one or more individuals sustaining fractures, concussion, internal injuries, crushing, severe cuts, lacerations, severe general shock or where they are detained in hospital as an in-patient it is classed as a serious.
- A slight collision is an incident where no fatal or serious injuries are sustained, but one or more casualties sustain injuries such as

sprains, bruising, cuts or shock that can be treated at the roadside.

- 3.4.4 Fourteen collisions were reported as occurring in the AM peak period (07.00-10.00) of which two were serious. Thirty collisions occurred during the PM peak period (16.00-19.00) of which one was serious.
- 3.4.5 Given the high traffic flows and queuing observed on the A249 during the peak periods, a high proportion of rear shunt collisions might be expected, where vehicles have failed to react to slow or stationary traffic. Additionally due to the roundabout location, a number of poor observation or manoeuvre collisions would be expected due to the lane changing on approach to the roundabout and driver judgement errors in pulling out onto the roundabout.
- 3.4.6 Data indicates that 47% of all collisions occurred during the peak period when congestion and queuing is known to be at its highest. This ties in with standard trends. Data also shows a significant number of collisions on the roundabout its self, again fitting the anticipated pattern.
- 3.4.7 Figure 3.7 is taken from the Kent Corridors to M25 Route Strategy Evidence Report (April 2014), indicating the total number of casualties per billion vehicle miles. It identifies the M2 J5 / Stockbury Roundabout as being joint 10th out of the top 250 collision locations nationally for the total number of casualties per billion vehicle miles for the period 2009-2011.

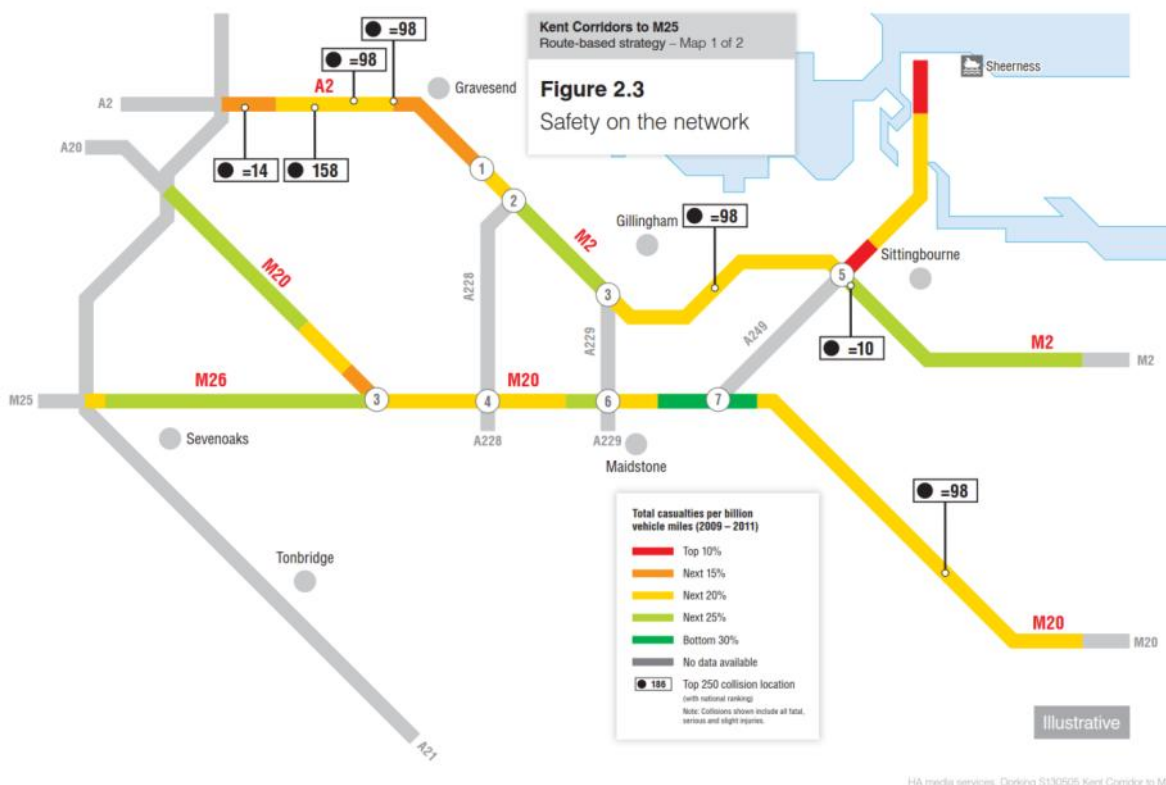


Figure 3.7: Kent Corridors to M25 Safety on the Network

- 3.4.10 The junction suffers from severe delays, particularly on the A249 approaches during the peak periods. Without intervention congestion at the junction is anticipated to continue, causing delays to drivers and safety risks through

queuing traffic on all approaches. If traffic increases, as forecast by the DfT and associated with additional growth in the local area, it will exacerbate the problems.

3.5 Journey Time Reliability

3.5.1 The Highways England Journey Time database has been reviewed for the section of the M2 between Junction 4 and 6 and for the A249 section between the M2 and the A2 in order to identify the variability of journeys over different days of the week. No data was available for the A249 Section between the M2 and M20 as this is a local authority road.

3.5.2 Data was extracted for the period 1 March 2015 to the 31 March 2015. This period was chosen as the moving observer journey time surveys and turning count surveys were conducted during this same period.

Journey Time Variability through the Day

3.5.3 The journey times reported for working weekdays in the Highways England Journey Time database are shown in Table 3.1 for each peak hour. A comparison to the Inter-peak hour is also shown, assuming that during the Inter-peak hour, journeys are most reliable.

3.5.4 In line with the count data survey periods, the AM peak hour refers to the period 07.15-08.15, the Inter-peak hour period 14.00-15.00 and the PM peak hour period 17.00-18.00.

Table 3.1: Journey Times by Route and Peak Period (Journey Time Database)

Route	Journey Time (sec)			Journey Time (min)			% IP Change to AM	% IP Change to PM	Length (km)
	AM	IP	PM	AM	IP	PM			
A249 (M2-A2)	116.5	113.1	115.3	2	2	2	3%	2%	3.20
A249 (A2-M2)	440.0	122.6	242.4	7	2	4	259%	98%	3.24
M2 (J4-5)	187.5	179.3	207.7	3	3	3	5%	16%	5.84
M2 (J5-4)	212.0	208.4	207.7	4	3	3	2%	0%	5.76
M2 (J5-6)	581.6	557.6	601.2	10	9	10	4%	8%	17.09
M2 (J6-5)	614.8	564.3	651.9	10	9	11	9%	16%	17.24

3.5.1 Table 3.1 indicates that the main routes where there are journey time reliability issues are on the A249 between the A2 and the M2 for both the AM and PM peaks (this is the section of road north of the junction), M2 J6-5 and M2 J4-5 during the PM peak, on the A249 between the A2 and M2, the AM journey time shows a significant increase of 5 minutes compared to the Inter-peak period. The PM peak shows the journey time has increased by 2 minutes from the Inter-peak period. The M2 J6-5 shows an increase in journey time of 1.5 minutes during the PM peak.

Journey Time Variability through the Week

3.5.2 The average journey times by route and day of the week, for the each peak period are shown in Table 3.2 to Table 3.4.

Table 3.2: Journey Time (in seconds) by Weekday and Route (AM Peak Hour)

Route	Normal Working Monday	Normal Working Tuesday	Normal Working Wednesday	Normal Working Thursday	Normal Working Friday	Minimum	Maximum	Range	Range/Min %
A249 (M2-A2)	116.3	116.7	116.9	118.2	114.5	114.5	118.2	3.7	3%
A249 (A2-M2)	451.9	580.5	461.7	423.8	282.2	282.2	580.5	298.3	106%
M2 (J4-5)	187.3	189.0	187.2	189.1	184.8	184.8	189.1	4.3	2%
M2 (J5-4)	200.0	200.7	200.2	200.7	197.2	197.2	200.7	3.5	2%
M2 (J5-6)	571.3	592.1	582.8	591.9	569.9	569.9	592.1	22.2	4%
M2 (J6-5)	595.3	603.4	593.6	602.0	576.1	576.1	603.4	27.3	5%

Table 3.3: Journey Time (in seconds) by Weekday and Route (Inter-Peak Hour)

Route	Normal Working Monday	Normal Working Tuesday	Normal Working Wednesday	Normal Working Thursday	Normal Working Friday	Minimum	Maximum	Range	Range/Min %
A249 (M2-A2)	113.3	111.3	113.6	115.0	112.2	111.3	115.0	3.7	3%
A249 (A2-M2)	124.0	112.6	123.7	122.0	120.6	112.6	124.0	11.4	10%
M2 (J4-5)	176.7	180.4	179.1	178.6	181.8	176.7	181.8	5.1	3%
M2 (J5-4)	192.2	194.5	194.1	193.7	194.8	192.2	194.8	2.6	1%
M2 (J5-6)	555.1	557.3	555.6	558.8	561.2	555.1	561.2	6.1	1%
M2 (J6-5)	558.7	562.8	559.2	563.7	560.5	558.7	563.7	5.0	1%

Table 3.4: Journey Time (in seconds) by Weekday and Route (PM Peak Hour)

Route	Normal Working Monday	Normal Working Tuesday	Normal Working Wednesday	Normal Working Thursday	Normal Working Friday	Minimum	Maximum	Range	Range/Min %
A249 (M2-A2)	118.3	116.6	117.3	115.1	114.4	114.4	118.3	3.9	3%
A249 (A2-M2)	135.9	160.6	227.7	172.0	127.5	127.5	227.7	100.2	79%
M2 (J4-5)	201.0	196.3	192.5	195.7	204.1	192.5	204.1	11.6	6%
M2 (J5-4)	203.8	202.6	200.4	202.3	205.0	200.4	205.0	4.6	2%
M2 (J5-6)	599.9	608.7	595.3	592.7	609.5	592.7	609.5	16.8	3%
M2 (J6-5)	579.6	585.6	582.5	578.1	595.3	578.1	595.3	17.2	3%

- 3.5.3 On examination of the data, there were three instances where the journey times were significantly higher than the average for that particular day. These were Tuesday 3rd March 2015 (AM and PM) on the M2 J6-5 route, and on Friday 27th March 2016 (PM) on the M2 J4-5 route. On these routes, the monthly average for that day, time period and route was calculated and used.
- 3.5.4 Journey time by weekday results, presented in detail within the Data Collection Report, indicate that there is limited variability in journey time on all routes except for the A249 (A2-M2) route. This route shows significant variation between weekdays during the AM and PM peak periods.
- 3.5.5 These observations accord with those observed in the link counts, moving observer journey time surveys and general observations as reported in the Data Collection Report.

3.6 Topography, Land Use, Property and Industry

Topography

- 3.6.1 The topography of any landscape is influenced by the underlying geology, which along with the actions of weathering and erosion create the soilscape, drainage patterns, vegetation and its historic and current land-use.
- 3.6.1 The A249 runs north to south along the floor of the steep sided, well wooded Stockbury Valley. The M2 runs broadly east to west. The M2 motorway and A249 are both two lane dual carriageways at Junction 5; the A249 is in cutting and the M2 crosses over it on embankments and a viaduct.

Land Use and Industry

- 3.6.2 The majority of the immediate surroundings of the junction comprises agricultural (arable) land with the isolated areas between highways or bounding fields largely forested and unused.
- 3.6.3 There are also a number of private properties close to the scheme. These comprise those directly alongside the A249 near the Oad Street junction to the south of the Stockbury roundabout, which have access directly on to the A249, and a number of properties which form the Danaway hamlet to the north of the Stockbury roundabout and which access Maidstone Road.
- 3.6.4 The Envirocheck Report (March 2015) indicates that there are no designations or licenses associated with industrial land use within 500m of the maximum physical extent of the junction options. This supports the previous finding that agriculture is the predominant land use in the immediate surroundings of the scheme.

Private Property

- 3.6.5 It is considered unlikely that there will be a need to acquire any non-agricultural private property. However, this will need to be considered further once the land ownership information is made available, and the alignments of the junction options are confirmed in greater detail during PCF Stage 2.

Community Land

- 3.6.6 No land uses which can be considered valuable for community purposes have been identified in the immediate vicinity of the scheme.

Development Land

- 3.6.7 There are no development plan allocations, or extant planning applications for development within the immediate vicinity of the junction options. Policy E7 of the Swale Borough Council Local Plan designates land south west of the M2, and A249 as a Strategic Gap. This is designated to retain the individual character of settlements in this area. Extant planning applications will be reviewed as the design progresses.

Agricultural Land

3.6.8 The Agricultural Land Classification (ALC) maps were created from surveys undertaken by Defra between 1989 and 1999, and should be treated with some caution in the absence of detailed site investigation survey results. The maps indicate that the junction options are located in an area which is a mixture of Grade 1, 2 and 3 agricultural land. The areas of land immediately adjacent to the junction are classified as Grade 3 (Good to Moderate). Approximately 40m northwest of the M2 eastbound slip road and 40m north-east of Maidstone Road the classification changes to Grade 2 (Very Good). Approximately 410m north-west of the M2 eastbound slip road and 1.9km east of Maidstone Road the land is classified as Grade 1 (Excellent). All these grades are considered the Best and Most Versatile (BMV) agricultural land.

Community Severance

3.6.9 Community severance is defined as the separation of residents from facilities and services that they use within their community. In this case, severance could occur if Non-Motorised Users (NMU) or Motorised Traveller (MT) routes are severed by the design of the junction option.

3.6.10 The scheme is located between the villages of Danaway and Stockbury. These villages are connected by a Public Right of Way (PRoW) as shown in Figure 3.8. It shows the public footpath running along the western side of the A249 (purple line), and over the M2 via a pedestrian overbridge, before proceeding through Church Wood and back toward the A249 south of the roundabout.

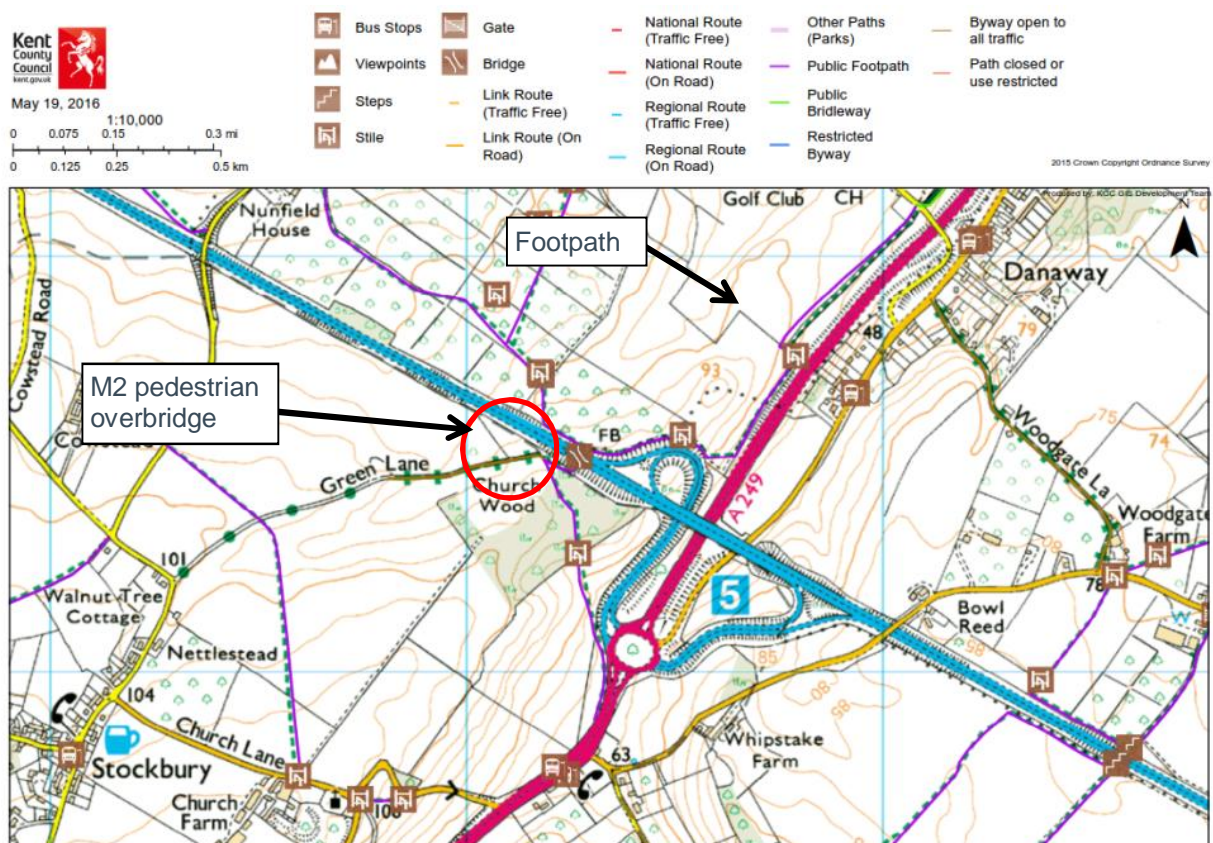


Figure 3.8: Rights of Way

3.6.11 No essential services or facilities have been identified in Danaway or Stockbury. Although Stockbury contains a public house, and a church, it is considered unlikely that the residents of Danaway and Borden rely exclusively on these services or facilities, as similar services are available in other nearby villages and towns, the nearest town to the roundabout being Sittingbourne.

Industry

3.6.12 There are no known industrial activities within the study area.

3.7 Climate

3.7.1 The study area in terms of rainfall, sunshine and temperatures, is shown to be fairly close to the all-England statistical norm.

3.7.2 The following climate figures were obtained from the Meteorological Office website for the nearest weather station to the junction options, approximately 9.2km to the northwest at Gillingham Football Club. The figures are averaged over the years 1981-2010, and are, as follows:

- Average mean daily maximum temperature: 15.1°C
- Average mean daily minimum temperature: 7.4°C
- Annual average number of days with an air frost: 38.6 days
- Annual average number of hours with sunshine: 1549.2 hours
- Average annual rainfall: 594.2 mm
- Annual average number of rainy days (≥ 1 mm): 109 days

3.8 Flood Risk

3.8.1 The Environment Agency (EA) Flood Map for Planning (Rivers and Sea), Figure 3.9, indicates that the A249 Sittingbourne Road, the M2/A249 roundabout junction, and Maidstone Road are located within Flood Zone 3 (medium risk), which is defined as an area with a 1% (1 in 100) or greater annual probability of flooding from fluvial sources in any year.

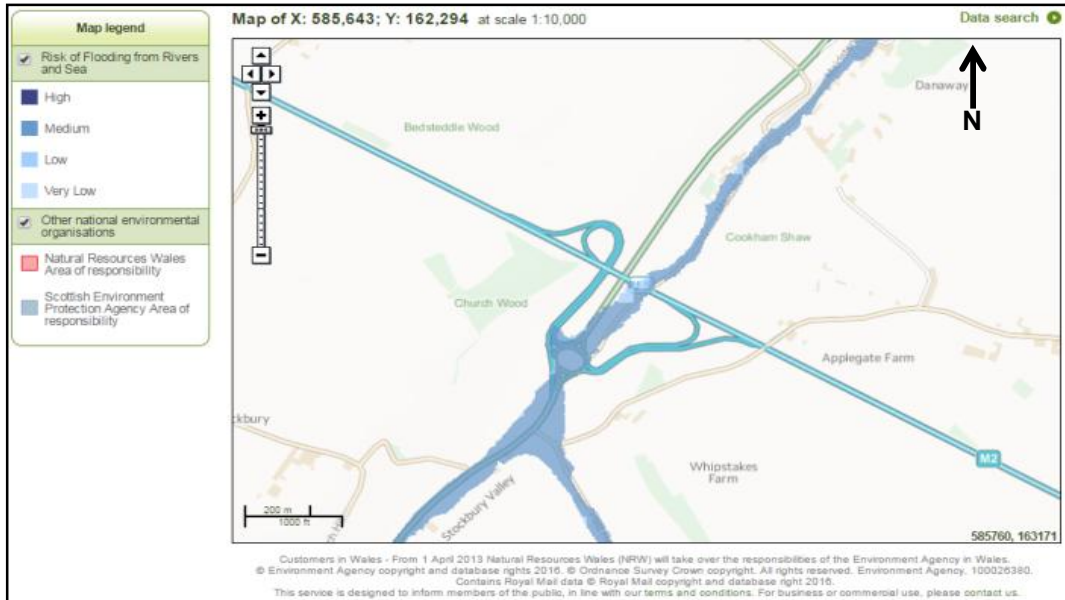


Figure 3.9: EA Map Risk of Flooding from Rivers and Sea

3.8.2

The EA Surface Water Flood Risk map, Figure 3.10, indicates that the same area is located within a zone at high risk from surface water flooding, particularly south of the existing A249/Junction 5 roundabout. Land at high risk of surface water flooding is described as having a 3.33% (1 in 30) or greater annual probability of flooding in any year. The direction of surface water flow is from south to north. There are also some isolated areas of high risk flooding on the northern and southern link roads. There is no risk of flooding to the M2 mainline carriageway.

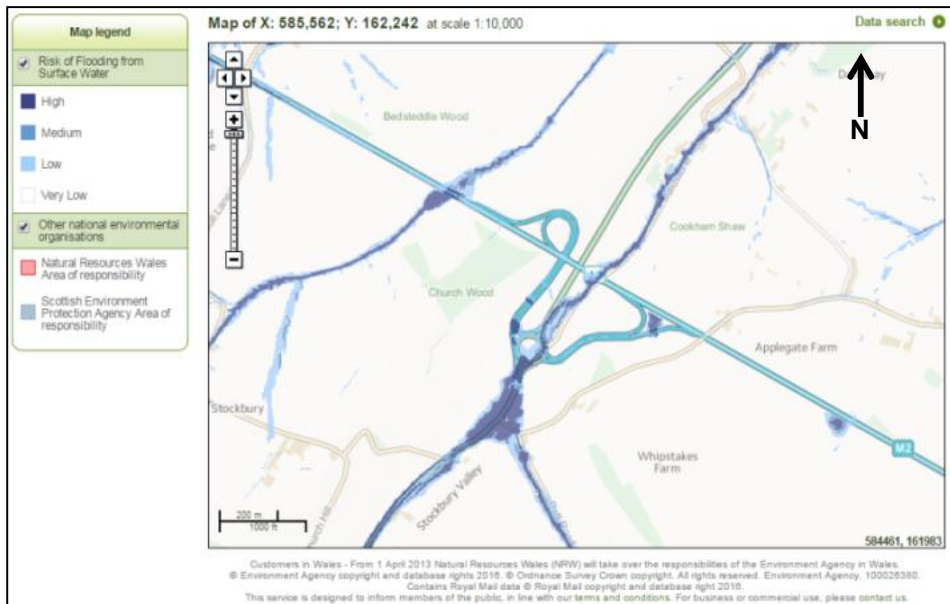


Figure 3.10: EA Map Risk of Flooding from Surface Water

3.8.3

The EA Risk of Flooding from Reservoirs map does not identify the area of the junction options to be at risk of flooding from reservoirs.

Historical Flood Events

3.8.4

HADDMS (Highway Agency Drainage Data Management System) has records of eight flood events occurring in the area of the M2 J5 since 2011.

These flood events typically occur in autumn/winter (August to November), and vary in severity from 0 to 7 (where 10 is the maximum flood severity). The flood events are shown in Figure 3.11. The A249 within the study area has been classified with a 'very high' flood hotspot status.

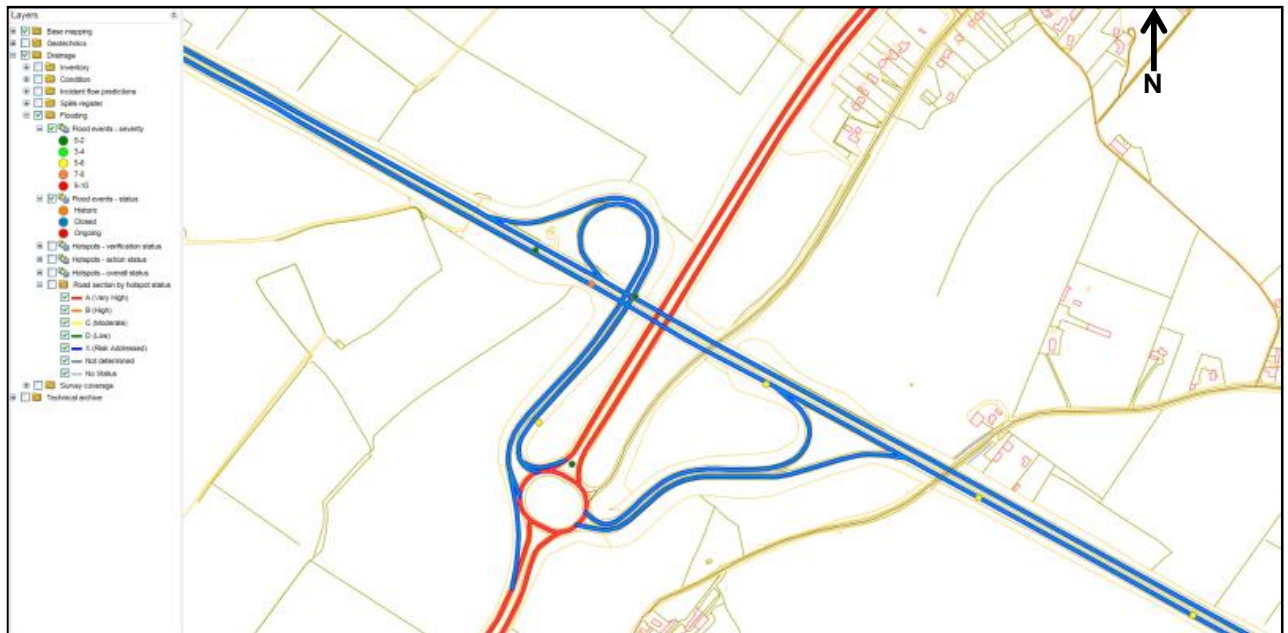


Figure 3.11: HADDMS Flood Events

3.8.5 The historical flood events are likely due to an inadequate existing drainage system, or poor asset condition and maintenance resulting in reduced capacity.

3.9 Existing Road Drainage

M2 and Junction 5 Links

3.9.1 Information on the existing drainage system of the M2 was gathered from asset records from HADDMS. Surface water on the M2 mainline carriageway and Junction 5 links is collected by gullies and catchpits which feed into a positive drainage system comprised of a mix of pipes, filter drains, ditches and soakaways. There is one pond located within the island formed by the motorway on-and-off-slips. This could be detention, soakaway, or treatment ponds. The motorway drainage network is owned by Highways England.

3.9.2 The four soakaways on the M2 J5 have been classed as low risk in HADDMS. There do not appear to be any culverts or outfalls in this drainage system.

A249 and Stockbury Roundabout

3.9.3 The Statutory Undertakers plans (C2) provided by Southern Water and South East Water show potable water mains only. Southern Water has confirmed that although they are responsible for surface and highway drainage in the area, they have no sewer apparatus in the area. The A249 to the north of Stockbury Roundabout is part of the Highways England, Design, Build, Finance, Operate (DBFO) Area 34 managed by Carillion Highway

Maintenance. Carillion confirmed that they clear the gullies on the A249 but do not have plans of the drainage system.

- 3.9.4 During the site visit it was observed the Stockbury Roundabout central island is formed of a combined kerb and drainage system. Gully gratings are observed at regular intervals along the length of the A249. As on the M2, there are likely to also be soakaways along the A249.

Maidstone Road and Other Minor Roads

- 3.9.5 No drainage plans are available for Maidstone Road, Oad Street, or other affected minor roads. The drainage system on these roads is likely to be owned by Kent County Council. During the site visit, gully gratings were observed along Maidstone Road to the south of the M2 flyover and through Danaway village. A ditch is present to the north of the M2 flyover. Gully gratings were also observed along Oad Street, in the vicinity of the M2 flyover, and a ditch on the north side of the bridge.
- 3.9.6 In the absence of as-built drainage plans for the area, except for the M2, it is recommended a CCTV and drainage survey is undertaken during PCF Stage 2 / 3. This is required to support the current assumptions about the existing drainage network.
- 3.9.7 In addition, it is recommended borehole investigations are carried out to determine the soil infiltration rates during PCF Stage 2 or 3.

3.10 Geology

- 3.10.1 The baseline conditions of this site have been assessed with reference to the following sources of information:
- British Geological Survey. (2016). GeoIndex. Retrieved 3 28, 2016, from <http://www.bgs.ac.uk/geoindex/>
 - British Geological Survey. (n.d.). British Geological Survey. Retrieved June 2016, from <http://www.bgs.ac.uk/>
 - Highways England. (2015). HD41/15 Maintenance of Highway Geotechnical Assets. Stationary Office.
 - Highways England. (2016). Retrieved Mar 20, 2016, from <http://www.haddms.co.uk/>
 - Landmark. (2016). Envirocheck Report M2 J5.
 - Met Office. (2016). Retrieved April 2016, from <http://www.metoffice.gov.uk/public/weather/climate/gcpvj0v07>
 - Smith, J. (1998). Study on Animal Behavior. Sydney: World Press.
 - Streetmap EU Ltd. (2016, June). Streetmap . Retrieved from <http://streetmap.co.uk/>
 - The Highways Agency. (2008, March). HD 22/08 Managing Geotechnical Risk. Design Manual for Roads and Bridges.
 - WSP | Parsons Brinckerhoff Atkins. (2015). M2 Junction 5 Improvements Road Investment Strategy PCF Stage 0 Report.

- Zetica. (2009). Zetica. Retrieved June 2016, from <http://www.zetica.com/>

3.10.2 Further geological information can be found in the PSSR report (October 2016).

General ground conditions

3.10.3 The geological and hydrogeological maps to which the site relates have been obtained from the Envirocheck Report.

Made Ground/Artificial

3.10.4 Although Made Ground has not been recorded at the maps provided by the Envirocheck Report, It is anticipated to be present at the site due to the historic highway works.

Superficial deposits

Head Deposits

3.10.5 Head Deposits comprise sand and gravel, locally with lenses of silt, clay or peat and organic material. They can be red or brown silt and stony clay with cobbles of hard rock. Head Deposits may also contain argillaceous frost-shattered rock debris either in-situ or soliflucted. Soliflucted deposits may have variable sand/clay content.

Clay with Flints

3.10.6 The Clay-with-Flints Formation, underlying the Head Deposits, is a residual deposit, which is formed from the dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group and in the extreme west of the outcrop, the Upper Greensand Formation. It is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint.

Solid geology

Thanet Formation

3.10.7 The Thanet formation forms the uppermost solid geology in the study area and consists of glauconite-coated, nodular flint underline at base by pale yellow-brown and green glauconitic fine-grained sand that can be clayey with rare calcareous or siliceous sandstones.

Seaford Chalk Formation (White Chalk)

3.10.8 Firm white Chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known to be present in the lowest beds. Some flint nodules are large to very large.

Lewes Nodular Chalk Formation (White Chalk)

3.10.9 Composed of hard to very hard nodular chalks and hardgrounds with interbedded soft to medium hard chalks (some grainy) and marls; some griotte chalks. The softer chalks become less abundant towards the bottom. Nodular chalks are typically lumpy and iron-stained (usually marking

sponges). Brush is rough and flaggy or rubbly, and tends to be dirty. First regular seams of nodular flint, some large, commence near the base and continue throughout.

Historic borehole information

- 3.10.10 The relevant borehole information is summarised in Table 3.5. It should be noted that the maximum depth, for the boreholes identified is 13.41 meters below ground level (mbgl) with no water strikes encountered.
- 3.10.11 The majority of the boreholes consisted of three distinctive layers comprising Made Ground and/or Topsoil, Head Deposits (either granular or cohesive) and Upper Chalk which appeared to be weathered and structureless at shallow depth turning into weak at depth of about 10m bgl. Additionally, in boreholes TQ865E239 and TQ86SE1 Thanet Sands appear to have been encountered overlying the Chalk with no discovered Made Ground.

Table 3.5: Historic borehole information BGS Geoindex, Envirocheck Report

Borehole Reference	Length (m)	Date	Easting	Northing	Strata Summary (mbgl)
TQ86SE116	8	1990	585599	162390	0-0.7 TOPSOIL 0.7-1.9 MADE GROUND 1.9-8 UPPER CHALK*
TQ86SE125	8	1990	585814	162721	0-0.2 TOPSOIL 0.2-0.6 HEAD DEPOSITS (CLAY) 0.6-8 UPPER CHALK*
TQ86SE126	8.5	1990	585795	162670	0-0.6 TOPSOIL 0.6-0.9 HEAD DEPOSITS (CLAY) 0.9-8.5 UPPER CHALK*
TQ86SE127	8	1990	585636	162475	0-0.3 TOPSOIL 0.3-1.45 HEAD DEPOSITS (CLAY) 1.45-8 UPPER CHALK*
TQ86SE128	10	1990	585482	162202	0-0.2 TOPSOIL 0.2-2.3 MADE GROUND 2.3-4.5 HEAD DEPOSITS (CLAY) 4.5-5.6 HEAD DEPOSITS (GRAVEL) 5.6-10 UPPER CHALK*
TQ86SE134	8.5	1990	585700	162600	0-0.6 TOPSOIL 0.6-8.5 UPPER CHALK*
TQ86SE238	9.5	1990	585375	162008	0-2.3 MADE GROUND 2.3-2.3-4.95 HEAD DEPOSIT (CLAY) 4.95-7.2 HEAD DEPOSIT (GRAVEL) 7.2-9.5 UPPER CHALK*
TQ86SE239	10.2	1958	585700	162100	0-0.3 TOPSOIL 0.3-2.29 Soft fine SAND 2.29-7.16 Dense fine SAND 7.16-10.2 UPPER CHALK*
TQ86SE1	15.2	N/A	585350	162530	0-0.15 TOPSOIL 0.15-1.52 Soft CLAY 1.52-5.18 Soft SILT 5.18-11.89 Dense SAND 11.89-13.41 Soft CHALK 13.41-15.2 UPPER CHALK*

HAGDMS

- 3.10.12 The Table 3.6 summaries the details of the historical reporting writing associated with the study area obtained from HAGDMS.

Table 3.6: Historic report summary

HAGDMS Reference	Name	Comment
16742	Proposed Medway Towns Motor Road Sections, George Wimpey & Co Ltd	Section 11b shows Borehole and cross section of the M2 J5.
4108	Report on Site Investigation for Proposed Medway Towns Motor Road Kent, George Wimpey & Co Ltd, November 1958	Section 11b shows Borehole and cross section of the M2 J5 including lab/in-situ testing.
2761	Report on Site Investigation for Proposed Medway Towns Motor Road, George Wimpey & Co Ltd	Section 11b shows Borehole and cross section of the M2 J5 including lab/in-situ testing.
2049	A249 Improvement M2 to Bobbing Railway Bridge, Soil Survey Report, Kent County Council, November 1973	A249 widening North of the M2 Junction 5.
2050	Site Investigation for the A249 Improvement at Cheshunt Street, Kent County Council, November 1975	North of M2 J5 along the A249.
2051	A249 Chushunt Street – Bobbing Railway Advance Works, Kent County Council, November 1979	A249 widening North of the Junction 5.
2052	A249 Chesnut Street To Bobbing Railway Site Investigation, Kent County Council, April 1980	A249 widening North of the Junction 5.
2054	Proposed Dualling of the A249 Between the A2 and M2 Kent, Factual Report On Site Investigation, Ground Engineering Laing Technology Group Ltd, March 1990	A249 widening North of the Junction 5.
2055	A249 Trunk Road M2 to Bobbing Improvement, Geotechnical Interpretative Report, October 1990, LG Mouchel & Partners Ltd	Includes a cavities database search.
23745	A249 Trunk Road M2 to Bobbing Improvement, Environmental Statement, October 1990, LG Mouchel & Partners Ltd	Useful background info – historic activities / environmental consideration.
2058	Factual Report on a Site Investigation for A249: M2 to Bobbing Improvement, L G Mouchel & Ptns Ltd	A249 widening North of the M2 Junction 5.
26000	A249 M2 to Bobbing Improvement Geotechnical Interpretative Report, L GMouchel & Partners Ltd, August 1992	A249 widening North of the M2 Junction 5.
26001	A249 M2 to Bobbing Improvement Geotechnical Addendum Report, L G Mouchel & Partners Ltd, April 1993	A249 widening North of the M2 Junction 5 cross section Along A249.
2061	A249 M2-lwade Improvement Earthworks Design Report, May 1993	A249 widening North of the M2 Junction 5 cross section Along A249.
12439	Motorways and All-Purpose Trunk Roads RMMS Detailed Inspection of Embankments and Cuttings, Geotechnical Factual Report, Kent County Council, April 1995	Earthwork Inspections across the M2.
2064	A249 M2-lwade Improvement, A Review of the Testing of Earthworks Materials, Contest Melbourne Weeks, November 1995	A249 M2 improvements but no plan.
2066	A249 M2 lwade Improvement Contract, Report on the Specification for Geotechnical Testing, Dr JW Walsh, July 1996	Report about a dispute regarding shearbox and moisture content testing of fill North of M2 Junction 5.
12480	A249 M2 lwade Improvements, Earthworks, Deposition of Grades v/vi Structureless Chalk in Chestnut Street Embankment, Amex Civil Engineering, September 1997	Includes some information about the fill available in Chestnut area.
12652	Area 4 Term Maintenance M2 Junction 5 Investigation and Repair Geotechnical Report, WS Atkins Consultants Ltd, March 1999	Subsidence on Junction 5 slip road.
27765	A249 M2 to Bobbing Improvement Geotechnical Feedback Report, August 1999	Report about a dispute regarding moisture content testing of fill North of M2 Junction 5.
17249	M2 Drainage Renewal Junctions 4 to 7 Geotechnical Hazard Report, WS Atkins Consultants	Drainage leaks in relation to the destabilisation of solution features.

	Ltd, September 2000	
17266	A249 DBFO Operation and Maintenance Geotechnical Assessment, Atkins, October 2002	PSSR and basic risk register.
20131	M2 Junctions 4-7 Geotechnical Interpretative Report and Hazard Assessment, Atkins, May 2003	Includes full assessment of solution features, geological plans and cross-sections.
20275	Geotechnical Principal Inspection Report A2, M2 and A20, InterRoute, July 2005	Moderate and severe risks identified at M2J5. Mark up: geo_05_04_761_a2w_006
20279	M2 Junction 5 Solution Feature Geotechnical Report, InterRoute, September 2005	Includes location of solution features and mini risk register.
20489	M2 Junction 5 Geotechnical Report, InterRoute, September 2005	Dissolution feature at South West of the Junction (North bound access road of Junction 5 on M2).
20283 & 20499	M2 Junction 5 Eastbound on-slip Preliminary Sources Study Report, InterRoute, March 2006	M2 Junction 5 high risk features have been remediated.
22622	M2 Junction 5 London Bound Ground Investigation Static Cone Penetration Tests Factual Report, InterRoute, October 2006	M2 Junction 5 high risk features have been remediated.
22624	M2 Junction 5 Eastbound on-slip Highway Improvement, Geotechnical Engineering Ltd, November 2006	Tension cracking on a slope at the East-bound on Slip (west side of J5).
21190	M2 Junction 5 Phase II Geotechnical Report, InterRoute, December 2006	Dissolution feature at South West of the Junction (North bound access road of Junction 5 on M2).
21181	M2 Junction 5 Dissolution Feature Geotechnical Feedback Report, InterRoute, May 2007	Report on compaction / grout works to remediate a dissolution feature along the M2 London bound on-slip.
22157	M2 Junction 5 East Bound on Slip Geotechnical Report, InterRoute, July 2007	Tension cracking on a slope at the East Bound on Slip (west side of J5) reduced to low risk no remediation.
21892	Area 4 MAC Geotechnical Asset Management Plan, InterRoute, August 2008	M2 Junction 5 high risk features have been remediated.

Existing earthworks

3.10.13 HAGDMS was assessed in order to obtain existing earthwork information for assets relevant to the scheme area. The derived information is summarised in Table 3.7 below.

Table 3.7: Existing earthwork information summary

EARTHWORK REFERENCE	EARTH WORK TYPE*	C/W DIRECTION	SIDE	EARTH WORK LENGTH (m)	MAXIMUM RECORDED ANGLE (°)	START POINT Coordinates		END POINT Coordinates	
4_A249_63198	AG	S/B	Left	55	0	585457	162130	585443	162081
4_A249_63199	C	N/B	Left	32	10	585419	162120	585436	162146
4_M2_11834	C	W/B	Left	119	27	586000	162096	585892	162096
4_M2_11836	E	W/B	Left	72	0	585889	162125	585819	162108
4_M2_11838	C	W/B	Left	409	25	585819	162108	585439	162014
4_M2_11840	C	W/B	Left	456	21	585453	162035	585787	162196
4_M2_11845	E	W/B	Left	90	23	585787	162196	585719	162251
4_M2_11966	C	E/B	Left	119	26	585190	162580	585295	162522
4_M2_11968	C	E/B	Left	295	26	585292	162512	585568	162497
4_M2_11969	E	E/B	Left	100	23	585568	162486	585538	162389
4_M2_11970	E	E/B	Left	147	23	585519	162354	585428	162237
4_M2_11971	AG	E/B	Left	222	0	585424	162239	585412	162119
4_M2_11974	C	E/B	Left	311	20	585319	162106	585496	162361
4_M2_11983	C	E/B	Left	312	20	585516	162395	585473	162427
4_M2_11984	AG	E/B	Left	31	0	585473	162427	585493	162411
4_M2_14513	E	E/B	Left	159	0	585050	162651	585192	162580
4_M2_14516	AG	E/B	Left	126	0	585339	162488	585449	162426
4_M2_14519	E	E/B	Left	219	30	585737	162278	585927	162168
4_M2_14520	C	E/B	Left	113	25	585928	162164	586024	162104
4_M2_14522	C	E/B	Left	407	25	586033	162101	586393	161912
4_M2_14664	C	W/B	Left	362	27	586422	161864	586016	162087
4_M2_14669	E	W/B	Left	126	0	585909	162142	585799	162203
4_M2_14671	AG	W/B	Left	27	0	585469	162384	585449	162402
4_M2_14672	C	W/B	Left	203	25	585446	162398	585270	162500
4_M2_14674	C	W/B	Left	131	25	585263	162499	585149	162562
4_M2_14676	E	W/B	Left	126	0	585146	162564	585038	162630

*E=Embankment, C=Cuting and AG=At Grade.

Ground stability and Mining

- 3.10.14 There is a known presence of dissolution features and deneholes in the area. According to previous work done by InterRoute (HAGDMS Report Ref. 21190), seven cavities have been recorded in the surrounding area, three of which are outside the Highway England network boundary. There is a high possibility for many more unrecorded cavities to exist in the area, especially those occurring naturally. The northeast part of the Junction 5 was also characterised as High Subsidence Hazard by information obtained from the Envirocheck Report which is summarised in Table 3.8. These cavities can prove to be a high risk, causing extensive damage to the carriageways and are very difficult to predict with accuracy and certainty.

Table 3.8: Ground stability information

Ground Stability	Risk
Potential for compressible Ground Stability Hazard	Very low
Potential for collapsible Ground Stability Hazard	Very low
Potential for Landslide Ground Stability Hazard	Very low
Potential for Landslide Ground Stability Hazard	Very low to high
Potential for Running Sand Ground Stability Hazard	Very low to moderate
Potential for shrinking/swelling clay ground stability hazard	Low

- 3.10.15 The area is also characterised as Conclusive Rock Mining region as it appears in the Envirocheck Report. Furthermore, evidence from historic maps was found, incorporating historic open cast mining and excavation pits for chalk extraction. These historic activities were located south west of the site and appear to have been backfield at present.

Hydrogeology and Hydrology

- 3.10.16 The hydrogeological information derived from the Envirocheck Report is listed below:
- The superficial deposits are classified as Secondary Undifferentiated Aquifer;
 - Chalk is classified as a Principal Aquifer and Thanet Sands as a Secondary A Aquifer;
 - Several water protection zones present within and in close proximity to the site ranging between inner protection zone one and total catchment zone three; and
 - The majority of the site is prone to extreme flooding with high risk of flooding from surface water.

3.11 Ground water

3.11.1 EA mapping in Figure 3.13 shows the area around Danaway is classed as a groundwater source protection zone (SPZ) 1. The northern and eastern extents of the study area fall within SPZ2, and a small area around Stockbury Roundabout falls within SPZ3.

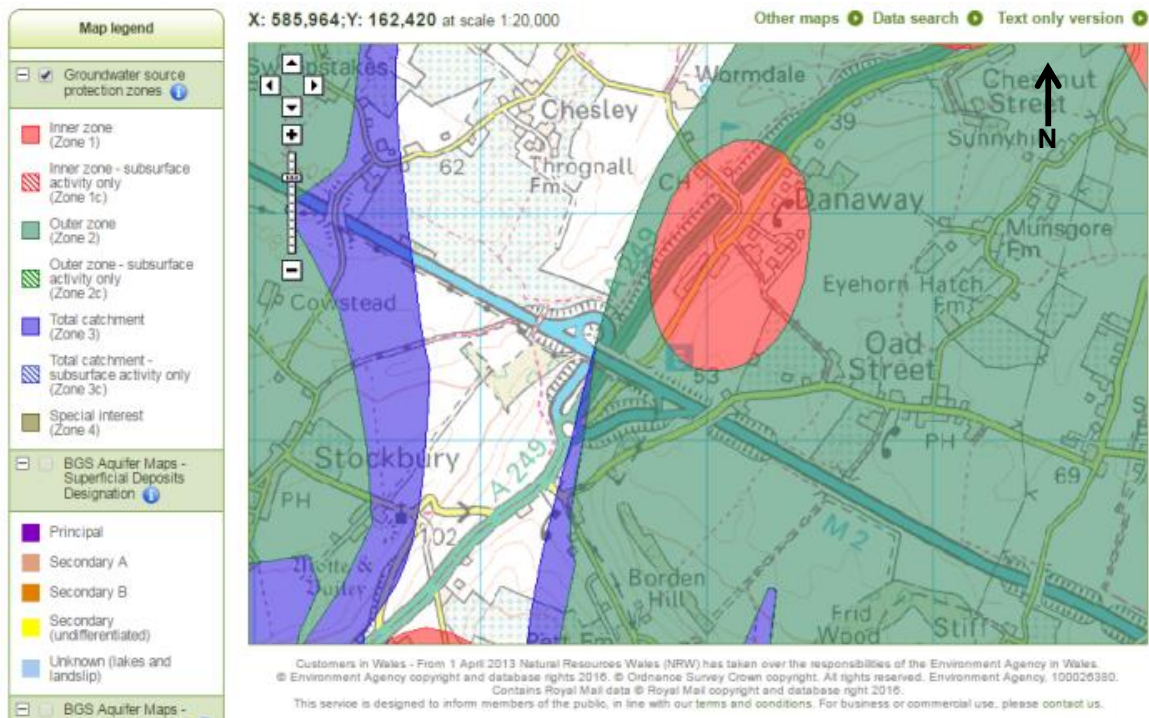


Figure 3.12: EA Groundwater Map

3.11.2 The EA's position on groundwater protection from transport developments is they require that:

- drainage is via sustainable drainage systems (SuDS) designed and maintained to current good practice standards, including the provision of suitable treatment or pollution prevention measures. The point of discharge should normally be outside SPZ1 and, ideally outside SPZ2;
- where there is an existing or unavoidable need to discharge in SPZ1, a risk assessment is required to demonstrate that pollution of groundwater will not occur. (Position C4, GP3, 2013).

3.11.3 The existence of an SPZ places constraints on the design through a requirement for pollution prevention measures in areas which are higher risk.

3.12 Contaminated Land

3.12.1 Potential contamination sources associated with the study area's historic and current usage comprise the use of the central and northern areas as public highway. BGS logs indicate approximately 4.5m depth of Made Ground within the physical extent of the junction options; the provenance and quality of which is unknown.

3.12.2 There is also the potential for spills and releases from vehicles, which would likely be hydrocarbon based, such as diesel fuels, lubricants, etc. No

evidence of significant hydrocarbon spills was observed during the site walkover; however, such events may have impacted upon drainage routes.

- 3.12.3 A disused petrol station is located approximately 335m north of the study area. As regional groundwater flow is likely to be to the north, it is considered unlikely that there is a viable pathway between the petrol station and the location of the junction options, so this is unlikely to be a potential source of contamination.
- 3.12.4 No landfills, animal burial sites, tanneries, knacker's yards or other notable source of contamination have been identified within 250m of the maximum anticipated physical extent of the options. Guidance contained within Research and Development Publication 66: Guidance for the Safe Development of Housing on Land Affected by Contamination (EA/NHBC, 2008) states that off-site features within an area up to 250m from the site boundary should typically be considered within the hazard identification stage of site assessment.
- 3.12.5 The study area is in a lower probability radon area, as less than 1% of homes are above the action level. No radon protective measures are therefore considered necessary.
- 3.12.6 No further potentially contaminative current land uses have been identified within the study area.

3.13 Public Utilities

C2 Preliminary Inquiries

- 3.13.1 In order to fully understand the extent to which Statutory Undertakers' apparatus is affected by the proposed scheme, preliminary (C2) enquiries were sent out to all Statutory Undertakers in the region in accordance with the New Roads and Streetworks Act 1991 (NRSWA 1991). The preliminary enquiry process requests the Statutory Undertaker's to provide any information they have available that may impact on the scheme. Table 3.9 identifies the Statutory Undertakers that were consulted during the C2 Preliminary Enquiry stage.

Table 3.9: List of Statutory Undertakers Consultees

Statutory Undertaker	Date Issued	Date Received	Apparatus Present	Apparatus Affected
BT	13/07/2015	17/07/2015	Yes	Yes
Carillion DBFO (Northern A249)	18/03/2016	23/03/2016	Yes – No drawings available	Yes
Cityfibre	13/07/2015	29/07/2015	No	No
Colt	13/07/2015	20/07/2015	No	No
Energetics	13/07/2015	22/07/2015	No	No
Environment Agency	13/07/2015	16/07/2015	No	No
GeneSYS	13/07/2015	24/07/2015	Yes	Yes
GTC	13/07/2015	15/07/2015	No	No
Highways England	13/07/2015	23/07/2015	Yes	Yes
Highways England (M2)	13/07/2015	23/07/2015	Yes	Yes
Instalcom	13/07/2015	31/07/2015	No	No
KCOM	13/07/2015	13/07/2015	No	No
Kent County Council	13/07/2015	07/08/2015	Yes	Yes
Kent County Council (Southern A249)	18/03/2016	18/03/2016	Yes – No drawings available	Yes
KPN	13/07/2015	30/07/2015	No	No
Network Rail	13/07/2015	15/07/2015	No	No
Plancast	13/07/2015	16/07/2015	No	No
SSE	13/07/2015	13/07/2018	No	No
Sky	13/07/2015	15/07/2015	No	No
South East Water	13/07/2015	21/07/2015	Yes	Yes
Southern Water	13/07/2015	23/07/2015	Yes	Yes
Tata	13/07/2015	30/07/2015	No	No
Telent	13/07/2015	16/07/2015	No	No
Traffic Master	13/07/2015	16/07/2015	No	No
UK Power Networks	13/07/2015	24/08/2015	Yes	Yes
Verizon	13/07/2015	15/07/2015	No	No
Virgin Media	13/07/2015	13/07/2015	No	No
Vodafone	13/07/2015	23/07/2015	No	No

C3 Preliminary Inquiries

- 3.13.2 The Statutory Undertakers apparatus details received from the C2 enquiries were reviewed in order to establish which Statutory Undertakers may be affected by the proposed works. Requests for budget C3 estimates have not been sent at this stage to the Statutory Undertakers identified as possibly affected by the proposed works. C3 requests will be issued once route options for on-going consideration are identified during PCF Stage 2.

3.14 Operational/Maintenance Regime

Current Operating Regime

- 3.14.1 The A249 between the M20 Junction 7 Maidstone and the A2 Sittingbourne is a dual two-lane all-purpose carriageway with hard strips on either side. The

A249 immediately north-east of the existing Stockbury Roundabout forms part of the A249 DBFO, currently operated by Carillion. The A249 immediately south-west of the existing Stockbury Roundabout is maintained by Kent County Council as the Highway Authority.

- 3.14.2 The M2 is a dual two lane motorway with hardshoulder on the nearside and hard strip against the central reserve. Over the Stockbury viaduct, the carriageway is widened to three lanes to provide slip roads from the Stockbury Roundabout. The M2, slip roads and Stockbury Roundabout are part of Highways England Area 4. Area 4 is currently maintained by AOne+ as an Asset Support Contract. Prior to July 2016 a similar role was undertaken by Balfour Beatty Mott Macdonald as the Managing Agent Contractor.
- 3.14.3 In addition to the M2, the A249 north of the M2 J5 roundabout also forms part of the Highway England network as a DBFO contract. This is held by Sheppey Route Limited and the O&M Contractor, Carillion Highway Maintenance.
- 3.14.4 The routine maintenance requirements for this section of the A249 are typical of other busy D2AP trunk roads. Access to undertake routine maintenance in the verge and central reserve requires the closure of live traffic lanes using Temporary Traffic Management (TTM). A single lane 1 closure is usually required to enable maintenance to be undertaken in the verge whilst lane 2 closures on both carriageways are required to enable routine maintenance works to be undertaken in the central reserve.
- 3.14.5 The operation of temporary traffic management is influenced by the following factors:
- Working Window: The high traffic volumes on the A249 of 45,000 vehicles per day means that TTM is usually only implemented during night time off peak traffic periods when the traffic demand can be accommodated within a single running lane. Time period of operation is usually 20.00 to 06.00 dependent on the actual traffic volume experienced. Implementation of lane closures during the day, that is 06.00 to 20.00, would normally result in unacceptable congestion at peak periods.
 - Junction arrangements: The existing slip roads are largely single lane with short two lane sections approaching and leaving Stockbury Roundabout. Hardshoulders are provided on the slip roads in the vicinity of the M2, whilst a combination of hard strips or hatched margins of the offside are provided elsewhere. The single lane slip roads are of insufficient width to enable TTM to be implemented with adequate safe working areas and safety zones and so these will need to be closed to provide a safe working environment.
 - Closures of slip roads necessitate the use of the established diversion routes (tactical diversion routes) developed by the Area 4 Service Provider re-routing traffic via the A228 between the M2 J2 and M20 J4. The high traffic volumes using these slip roads mean that TTM is usually only implemented during night time off peak traffic periods similar to the A249 above.

3.14.6 Typical access arrangements to undertake maintenance activities include:

- Repair and replacement of steel Vehicle Restraint Systems (VRS)
 - The maintenance of steel VRS in the central reserve normally requires the closure of the offside lanes both sides of the central reserve to undertake inspections, routine maintenance and repair. The maintenance of steel VRS in the verge requires closure of the nearside lane to undertake inspections, routine maintenance and repair. However, maintenance of steel VRS in the slip roads will require closure of the slip road as a consequence of the current provisions of single lane slip roads.
- M2 Stockbury Viaduct – Access to the substructure and piers to undertake inspections and routine bridge maintenance can be obtained from adjacent land and the central reserve on the A249 and by application of TTM on the carriageway.
- M2 Stockbury pedestrian overbridge– Access to the substructure and piers to undertake inspections and routine bridge maintenance can be obtained from the central reserve and verge with and by application of appropriate TTM on the main carriageway.
- Verge and pavement maintenance – access to the verges, central reserve and the carriageway all require lane closures. Such operations would also include detailed inspections, routine maintenance of drainage, lighting, existing technology, signs, grass cutting and litter picking. Access to the verges, central reserve and the carriageway of the slip roads will require closure of the slip road.

4 Environmental Status

4.1 Designations

- 4.1.1 The scheme lies adjacent to, and partially within, the Kent Downs Area of Outstanding Natural Beauty (AONB) (as shown in Figure 7.2 of the Environmental Study Report).
- 4.1.2 The designated heritage assets identified within 1km of the junction options include one scheduled monument, 22 Listed Buildings and two World War Two (WWII) crash sites. In addition, the Chatham Front World War One (WWI) defences are present within the study area. Although they are undesignated, if they are found to be affected by the junction options, and are in a good state of preservation, they may be considered of national importance, and require preservation in situ.
- 4.1.3 There are four statutory designated sites of international importance for nature conservation within 10km of the junction options, the closest being the Queendown Warren Special Area of Conservation (SAC), which is located approximately 1.9km to the west of the junction options.
- 4.1.4 There are three Air Quality Management Areas (AQMA) located within 6km of the junction options, with the nearest being located in Newington, approximately 2.25km to the north.
- 4.1.5 There are four Noise Important Areas (NIA) in close proximity of the junction options as follows:
- NIA 4575 is located approximately 189m south of the Stockbury roundabout along the A249;
 - NIA 4576 is located in Danaway, approximately 1,450m north east of the Stockbury roundabout;
 - NIA 4574 is located approximately 674m to the south of the Stockbury roundabout;
 - NIA 12242 is located approximately 1,123m to the south of the Stockbury roundabout.

5 Existing Environmental Conditions

5.1 Noise

- 5.1.1 Baseline noise monitoring was undertaken on 10th March and 11th March 2016 to support the preparation of the noise model. Observations during the survey confirmed that the noise climate is dominated by the road traffic on the M2 and A249.
- 5.1.2 Based on the maximum potential physical extent of the scheme, there are 46 residential receptors within 300m of the junction options and 168 within 600m of the junction options.

5.2 Local Air Quality

- 5.2.1 The three AQMAs within 6km of the study area have been declared for exceedances of the UK's objective for annual mean nitrogen dioxide (NO₂), due to high volumes of traffic on major roads and their associated exhaust emissions.
- 5.2.2 Swale Borough Council (SBC) monitors pollutant concentrations using a network of automatic and manual NO₂ diffusion tubes and automatic monitoring of particulate matter (PM₁₀). No SBC monitoring areas are located within the vicinity of the study area, with the nearest monitoring station located in Newington, over 2km north of the junction options.
- 5.2.3 Within the AQMAs, annual mean NO₂ concentrations exceed the air quality objective of 40µg/m⁻³ at some roadside sites, however rural and urban background concentrations are below the UK objective. Maidstone Borough Council (MBC) also monitors NO₂ and data suggests concentrations exceed the UK air quality objective at roadside sites, but rural concentrations are well within the objective.
- 5.2.4 PM₁₀ monitoring is conducted in Faversham, approximately 10km to the east of the junction options and in 2013 there were 21 exceedances of the daily mean PM₁₀ objective of 50 µg/m³. It is suggested that PM₁₀ is elevated in the area due to the influence of significant sources of particulate matter including London and continental Europe.
- 5.2.5 Highways England has undertaken a six month monitoring regime in the vicinity of the junction options. This data will be supplemented by a further six months of data during future stages of assessment. The monitoring shows that NO₂ concentrations are generally slightly elevated near to the A249, A2, and the M2 in particular, and reduce with increased distance from the roadside.
- 5.2.6 Whilst the monitoring shows an exceedance (41.7µg/m⁻³) of the annual mean standard within the assessment area, at one location to the south of the junction, the exceedance occurs close to the roadside of the A249, away from the façade of the nearest buildings. Rural and Background locations show relatively low concentrations (all <20µg/m⁻³) away from the sides of major roads.

5.3 Greenhouse Gases

- 5.3.1 Greenhouse gases (GHGs) are atmospheric gases that absorb and emit radiation within the thermal infrared range; this process is the fundamental cause of the greenhouse effect. For the purposes of the assessment of the potential impact of the scheme on climate change, the gas of interest is carbon dioxide (CO₂).
- 5.3.2 Consideration will be given at a later stage to possible approaches to minimise the effect of GHGs.

5.4 Landscape

Landscape Character and Designations

- 5.4.1 The scheme lies partially within the Kent Downs Area of Outstanding Natural Beauty (AONB), an area of open, rolling hills which gradually decline in elevation to the north, with ancient woodlands in dry valleys. There is also a locally designated Area of High Landscape Value at Lower Harlip, on the western edge of the study area (as shown in Figure 7.2 of the Environmental Study Report).
- 5.4.2 The southern half of the study area lies within National Character Area (NCA) 119 – North Downs, and the northern half falls within NCA 113 – North Kent Plain.
- 5.4.3 The scheme also lies within three local landscape character areas (LCA) which are separated by the M2 and A249. These include Chatham Outskirts: Mid Kent Downs LCA, Bicknor: Mid Kent Downs LCA; and the Fruit Belt LCA (Landscape Assessment of Kent, 2004).

Visual Baseline

- 5.4.4 The landscape site walkover survey indicated that the woodland, shelterbelts and tall hedges in the study area provide effective visual screening to views of the M2, A249 and Stockbury Roundabout, even during winter months. The elevated M2 viaduct is largely inconspicuous within the surrounding landscape and only becomes noticeable due to moving and high sided vehicles and their associated headlights. Road lighting on the A249 at Stockbury Roundabout is contained by the Stockbury Valley, and the M2 and A249 are not lit.
- 5.4.5 A number of sensitive visual residential receptors have been identified within 1km of the junction, including Whipstakes Farm and residential properties near the A249 to the north of Borden village, Church Farm on the south western edge of Oad Street, and residential properties in Danaway village along Old Maidstone Road south of the junction options.
- 5.4.6 The viewpoints from local roads in the area are relatively restricted because of narrow, single track winding roads enclosed by tall hedges, which screen views of the scheme. Where local roads cross the M2 and A249, panoramic views are available. The potential physical extent of the junction options is

not visible from accessible land (e.g. Public Rights of Way (PRoW)) or the Area of High Landscape Value within the study area.

5.5 Heritage and Historic Resources

Archaeological Remains

- 5.5.1 Two protected World War Two military remains have been found within the 1km study area. No known archaeological remains from the Prehistoric, Romano-British, Early, Late and Post medieval periods have been found in the study area, but there is the potential to uncover such remains in previously undisturbed ground. For figures showing the location of the aforementioned assets, please refer to the Environmental Study Report (ESR).

Historic Buildings and Assets

- 5.5.2 There is one scheduled monument, Stockbury Castle, located within the study area. There are no listed buildings located within the physical extent of the junction options. There is one Grade I Listed building, one Grade II* Listed building and twenty Grade II Listed buildings within the 1km study area.
- 5.5.3 There are eighteen non-designated historic assets within the 1km study area including a First World War Pill (WWI) Box located within the scheme extent.
- 5.5.4 For figures showing the location of the aforementioned assets, please refer to the ESR.

Historic Landscape

- 5.5.5 There is a non-statutory designated historical landscape within the study area, Chatham Land Front, which comprises WWI land defences. (see Section 4.1.2 for further details).

5.6 Biodiversity

- 5.6.1 For details of the designated nature conservation sites, please refer to Section 4, Environmental Status. For figures showing the location of these designated nature conservation sites, please refer to the ESR.
- 5.6.2 Five non-statutory designated sites were identified within 2km of the junction, namely Queendown Warren Local Nature Reserve, Stockbury Wood Local Wildlife Site (LWS), Squirrel Wood LWS and two roadside nature reserves.
- 5.6.3 The dominant habitats identified during the Extended Phase 1 Habitat Surveys, undertaken in March 2015 and May 2016, were semi-natural broad-leaved woodland including ancient woodland, broad-leaved plantation woodland, dense/continuous scrub, semi-improved grassland, arable land, ephemeral/short perennial, hard standing, introduced shrub and standing water.
- 5.6.4 Habitats within the study area have the potential to support bats, breeding birds, reptiles, invertebrates, and dormice.

5.7 Water Environment

Water Quality of Surface Watercourses

- 5.7.1 Review of Environment Agency indicative flood mapping (see Section 3.8) suggests that a minor watercourse flows parallel to the A249 and, further north, to Maidstone Road and Chestnut Street. The project ecologist undertook a visual inspection of the watercourse and confirmed that the watercourse, which was dry at the time of inspection, comprises a shallow and narrow ditch that is heavily vegetated with scrub.
- 5.7.2 An attenuation pond has been identified adjacent to the eastern slip road (from the A249 to join the westbound M2 carriageway) and is understood to form part of the surface water management system for the highway network. The project ecologist undertook a visual inspection of the pond and reported that it appeared to be artificial and deep with steep sided banks, and was dry at the time of survey with very little marginal or aquatic vegetation.
- 5.7.3 There are no other known standing-water features (ponds, pools, reservoirs, lakes) within the maximum physical extent of the junction options or the study area that may constitute potential receptors.

Water Quality of Groundwater

- 5.7.4 The EA has assessed the groundwater in the area against the objectives of the Water Framework Directive (WFD), and has classified overall quality as poor, but chemical quality as good.
- 5.7.5 The EA Groundwater Vulnerability Zones maps indicate the majority of the area beneath the junction options is underlain by a Principal Aquifer with soils of high leaching potential.

Flood Risk

- 5.7.6 The potential flood risk of the site is described in Section 3.8 of this report.

5.8 People and Communities

- 5.8.1 There are several PRoW adjacent to or intersecting sections of the road as detailed in Section 3.6.11.
- 5.8.2 In terms of views from the road for motorised travellers, the eastern approach to Junction 5 provides restricted and intermittent views of arable land within the Kent Downs AONB. Towards the eastern side of the junction, views become increasingly restricted by trees, verges and other screening features.
- 5.8.3 Where the M2 crosses the A249, open views are available on the southern and northern side of the road that extend for a considerable distance and contain areas of arable land, woodland and the Kent Downs. After the crossing of the A249, views become restricted by wooded areas adjacent to the highway.
- 5.8.4 The majority of link roads connecting the M2 to the A249 have restricted views due to roadside vegetation although there are intermittent views of surrounding arable land and wooded areas.

- 5.8.5 Generally, the views from the road for motorised travellers provide a positive experience.
- 5.8.6 Driver stress is considered to be the adverse mental and physiological effects experienced by a driver traversing a road network. Driver stress has three main components: frustration, fear of potential accidents and uncertainty relating to the route being followed.
- 5.8.1 Driver stress is likely to be high at M2 Junction 5. Congestion affects the A249 southbound between Sittingbourne and M2 Junction 5 where average peak hour speeds are significantly below the national speed limit due to congestion. This is likely to cause frustration due to the driver's inability to drive at a speed consistent with his or her own wishes in relation to the general standard of the road.
- 5.8.2 In addition, the junction was identified as being in the top 50 national casualty locations as well as being one of the main areas within the Kent Corridors to the M25 study route, which interacts with vulnerable road users. 33 collisions occurred from 2009 to 2011, and overall these collisions were considered to have the highest severity rating. This indicates that the fear of potential accidents at this location may be high.

6 Accessibility

6.1 Option Values

6.1.1 The immediate local area has limited options in terms of alternative transport modes, with private car use dominant. Public transport options are limited to five bus services through the junction from or to the north: four use the A249 south of the roundabout and one onto the M2 west of the roundabout. The routes and frequencies are summarised below:

- Oare – Faversham – Sittingbourne – Maidstone (Hourly, Monday-Saturday)
- Sheerness – Sittingbourne – Maidstone (Hourly, Monday-Saturday)
- Faversham – Oare – Sittingbourne – Maidstone (2 Hourly, Sunday)
- Leysdown – Minster – Maidstone (1 Journey, Tuesday and Thursday only)
- Sheerness – Sittingbourne – Hempstead Valley Shops (1 Journey, Thursday)

6.1.2 Within the study area there are bus stops located on Maidstone Road in Danaway and the A249 south of the Oad Street junction in dedicated bus laybys (northbound and southbound).

6.1.3 No other proposed public transport improvements or park and ride provision are known about at this stage.

6.2 Severance

6.2.1 The A249 route through the valley has been in place since before the 1940s, with the M2 motorway and Junction 5 constructed in 1963. The A249 to the north of the junction remained a single carriageway road until the mid-1990's when the dual carriageway section was constructed. The surrounding study area is principally rural farm land, with a small number of dwellings.

6.2.2 Given that M2 J5 has been in existence for over 50 years and the dual carriageway section for 20 years, and that the principle surrounding land use is agricultural, the initial severance effects of the A249 and M2 will have been adapted over time by the local population. Improvements to M2 J5 are not expected to detrimentally affect the levels of physical severance created by the existing road network.

6.2.3 PRoW will be impacted by the proposed improvements at Junction 5, however severance is not anticipated to be a significant issue as rights of way will be maintained. The existing public rights of way are shown in Figure 3.8.

6.3 Access to Transport System

6.3.1 The local area currently has good access to the local and national strategic road network, although congestion is a constraint at busy times. Access to

public transport via the local and national rail network is not available in the immediate locality, although the A249 can be used for access to national rail services from Sittingbourne.

- 6.3.2 The proposed scheme is unlikely to create conditions which would influence access to the public transport system.

7 Integration

7.1 Transport Interchange

7.1.1 There are no significant public transport interchanges in close proximity to the scheme location, although some journeys to access the national rail network may make use of the A249 or M2.

7.1.2 The proposed scheme is unlikely to have an impact on transport interchanges and existing public transport networks mainly run out to the East, West and North of Sittingbourne and therefore there is limited potential for modal shift given M2 J5 is located to the South of Sittingbourne.

Land Use Policy

7.2.1 National Policy Guidance is provided through the National Policy Guidance – National Networks, <https://www.gov.uk/government/collections/national-networks-national-policy-statement>.

7.2.2 The following documents have been identified as having relevance to M2 J5 and the policy context in addition to the Highways England Business Plan:

- Swale Transportation Strategy Draft, 2014 – 2031 (Consultation Draft, Dec 2014)
- South East LEP Growth Deal and Strategic Economic Plan 2014.
- Unlocking Kent's Potential / Growth without Gridlock, 2010.

Swale Transportation Strategy

7.2.3 The Swale Transportation Strategy Draft 2014 – 2031, Consultation Draft, was published December 2014 as part of a large package of documents submitted for the examination as part of the emerging Swale Local Plan. Key elements relating to this study have been extracted and included in the sections below.

Unlocking Kent's Potential / Growth without Gridlock

7.2.4 Unlocking Kent's Potential: opportunities and challenges is Kent County Council's (KCC) framework for regeneration, identifying the key opportunities and challenges facing Kent over the next 20 years.

7.2.5 Growth without Gridlock is KCC's transport delivery plan, identifying the necessary transport infrastructure needed to accommodate the level of economic growth and regeneration planned for Kent.

Local Enterprise Partnership (LEP)

7.2.6 The South East LEP Growth Deal and Strategic Economic Plan 2014 and accompanying appendices highlights a package of M2/A2 corridor improvements, which include the M2 J5 capacity improvements, stating that it "will unlock growth in Sittingbourne and Maidstone". It goes on to state that:

7.2.7 "At present the Highways Agency [England] are minded to implement any improvement to M2 J5 post 2021. SE LEP intends to work with the Highways

Agency to make a case for earlier delivery. SE LEP is willing to put £15m of LGF towards a scheme if Highways England funding is not forthcoming in order to bring a scheme forward” and proposes a desired date of commencement of 2019/20. (Appendix A – Trunk Road Network – Highways Agency Schemes).

7.2.8 It should be noted that this document was published prior to the publication of the RIS and confirmation of delivery of an M2 J5 scheme or the creation of Highways England (formally known as the Highways Agency).

7.2.9 The above documents and their relationships to the M2 J5 are summarised in the respective sections below.

Swale Transportation Strategy Draft, 2014 – 2031 (Consultation Draft, Dec 2014)

7.2.10 The Transportation Strategy (TS) for Swale is a comprehensive document looking at the issues regarding transport in Swale and potential solutions, which it does in line with national and local policies, as set out in the document.

7.2.11 It is noted that the transportation action plan is structured into four main sections, linked to the Borough’s ambitions:

- Encouraging sustainable travel
- Improvements to transport infrastructure
- Alternative access to services
- Road Safety

7.2.12 Section three of the document covers the Policy Context, and of specific relevance is Kent County Council Policy Vision for Kent 2012 – 20223, which states in section 3.11 that the “A249 between the A2 and M2 carries the lightest traffic flow of the strategic road network, but has a low rate of journey time reliability” and that there is “consistently significant delay on the M2 between junctions 6 (Faversham) and 5 (Sittingbourne)”.

Previous Transport Strategy (2006 – 2011)

7.2.13 The Swale Borough Council’s previous Transport Strategy (2006-2011) contained three main objectives, which were:

- To provide infrastructure that enables regeneration in a sustainable manner;
- To increase use of sustainable modes of transport;
- To increase accessibility by all sectors of the community

7.2.14 The current TS considers that these objectives are still appropriate and states that they are encompassed within the new strategy, which also considers how the projects will be delivered and how they will link to the developments and policies within the Local Plan.

7.2.15 The table below, extracted from the previous TS, outlines the key successes of the strategy that includes the provision of a small-scale improvement scheme at Junction 5.

Table 7.1: Extract of Table 2: Successes of the previous transportation strategy

Aim	Progress
Undertake design and feasibility work on Sittingbourne Town Centre Regeneration Project.	This design work is now underway, and the scheme has received a significant grant from the LEP fund.
A251 Faversham to Ashford Study to consider safety improvements	Safety improvements have been implemented, and a further study into a junction improvement at the junction of A251 / A2 has recommended that traffic signals should be provided to increase capacity and safety at the junction.
M2 Junction 5 Undertake appraisal of options to improve safety and capacity KCC/SBC to engage the Highways Agency to commence analysis of options	A scheme was identified to provide short term capacity improvements from the north. This is linked to the Watermark development and is awaiting implementation.
B2231 Lower Road Safety Improvements	A programme of safety improvements was identified and the top priorities of these were implemented in 2008.

Key Transport Challenges

7.2.16 The key transport issues in Swale are set out below:

- Congestion at M2 J5 acts as a barrier to further development in Swale
- Capacity improvements required at A249 Key Street and Grovehurst interchanges
- Rural areas of the borough are remote from main centres and less well served by public transport
- Public transport tends to be inaccessible to the mobility impaired
- Traffic congestion with school/ employment commuting into Sittingbourne, causing rural rat-runs in the south of town and air quality issues.
- Transport interchange between cycle routes, bus services, and train services is poor, therefore encouraging the use of cars to rail stations, which add to problems with parking and congestion
- Not enough uptake of sustainable transport
- No current parking strategy
- Constrained viability of new developments to provide significant infrastructure contributions.

7.2.17 The current Transport Strategy proposes a balance of development linked highway improvement schemes and sustainable transport measures across Swale.

7.2.18 The majority of complaints received about transportation are that roads are congested and need to be widened to cope with the additional traffic. This is not sustainable, not affordable, and often not practical. Therefore other means of moving traffic around the network efficiently have to be found and

other modes of transport to reduce reliance on the private car have to be made more attractive.

7.2.19 The table below outlines the Swale strategic site locations 2014 - 2031. Given the overall scale of development, highway infrastructure improvements and sustainable transport improvements are deliverable. All new developments are required to have a travel plan in place with robust modal shift targets and specific measures to bring this about.

7.2.20 The current Transport Strategy says that VISUM modelling of the developments was carried out in 2010, and subsequently updated to include the northern relief road and recent development completions.

7.2.21 The Transport Strategy concludes that with the forecasted growth, the M2 junction 5 will come under greater pressure from the increase in traffic associated with the housing growth for Swale. The junction is currently perceived to be operating over capacity, with some form of mitigation required in the future. Short term, the provision of an additional lane on the A249 southbound approach to Stockbury roundabout would solve the capacity issue but in the longer term, a more comprehensive redesign of the junction will be required.

Improvements to Transport Infrastructure

7.2.22 Investment in major transport infrastructure can remove pinch points and make the network perform more efficiently. It can also be used to direct traffic onto the most suitable routes or make safety improvements at key locations. Previous experience has demonstrated that additional road capacity encourages more people to drive and the capacity is soon backfilled.

7.2.23 Table 1.4 is an extract taken from the current Swale Transport Strategy outlining the actions and outcomes of any potential improvements to the M2 junction 5. Capacity and safety improvements will be required in areas of queuing traffic. Linking sets of traffic signals together to give priority to a tidal flow would also improve network performance. Variable message signs could also be used to warn motorists of hazards or unexpected queues ahead.

Table 7.2: Extract of Table 8: Network Improvement Actions and Outcomes

Location	Action	Outcomes
Junction 5 M2/A249	1 Improve capacity at this junction as congestion at peak times is severe, which is limiting development opportunities within the borough. A short term improvement has been identified, but a more comprehensive solution will be needed in the longer term.	Reduce the peak hour queue on the southbound approach to this junction.
A249 – Grovehurst Interchange	2 Capacity and safety improvements at A249/Grovehurst junction .	To plan for growth in northern Sittingbourne. Increase walking/ cycling links between Iwade and Sittingbourne.

7.2.24 The following table is an extract taken from the Swale Transport Strategy of the Infrastructure Delivery Plan outlining the improvements and interventions that are required to support the proposed level of development. The estimated cost and funding source are also included. The extract taken relates to improvements at M2 J5.

Table 7.3: Extract of Table 12: Improvements to Transport Infrastructure

Ref	Location	Description	Estimated cost	Potential Funding Source
E1	M2/A249 J5	Short term capacity improvements	£1M	S106
E2	M2/A249 J5	Long term capacity improvements	£100M	DfT

Unlocking Kent's Potential / Growth without Gridlock – the Regeneration Framework for Kent

7.2.25 Unlocking Kent's Potential is KCC's 20-year framework for regeneration, published in 2010. This framework identified five key challenges – new business relationships, unlocking talent within Kent, embracing a growing and changing population, building homes and communities and delivering growth without transport gridlock.

7.2.26 The framework identifies the expansion of Junction 5 of the M2 at Stockbury and associated road infrastructure to support the development of Sittingbourne, including the completion of Sittingbourne Northern Relief Road. This is one of a number of improvements identified in the A2/M2 corridor that are vital to cater for the increased volumes of traffic flowing through Dover, East Kent and the Thames Gateway.

Growth without Gridlock – A transport deliver plan for Kent

7.2.27 Growth without Gridlock is KCC's transport delivery plan, identifying the necessary transport infrastructure needed to accommodate the level of economic growth and regeneration planned for Kent.

7.2.28 The plan states that in the Thames Gateway, the delivery of 53,000 new homes and 58,000 jobs form part of Europe's largest regeneration programme. If Kent is to accommodate this growth, the transport network must have sufficient capacity and resilience to provide efficient and reliable journeys. However, Kent's highway network is already overloaded.

7.2.29 The key transport challenges in Swale identified by the transport plan are:

- Securing the necessary infrastructure to open up key development areas for housing and employment
- Delivering capacity improvements on the strategic road network
- Regeneration of Sittingbourne town centre.

7.2.30 The identified major road infrastructure project proposals include the Sittingbourne Northern Relief Road and extension to the A2, M2 J5 capacity improvements, A249 Grovehurst Interchange and Rushenden Relief Road. The expansion of Kent Science Park with possible new links to the M2 and A2 were also proposed.

South East LEP Growth Deal and Strategic Economic Plan 2014

7.2.31 The South East LEP Growth Deal and Strategic Economic Plan (SEP) seek to set out the opportunities and challenges across the LEP area. It outlines

the approach and context to creating the conditions needed to facilitate growth in the area.

7.2.32 The SEP focuses on building on existing economic strengths, boosting productivity, improving skills and investing in transport corridors in order to meet the growth ambitions – 200,000 private sector jobs, 100,000 new homes and £10 billion investment to accelerate the growth.

LEP Growth Corridors

7.2.33 The South East LEP SEP has identified 12 growth corridors as key drivers for economic growth. One of these is the A2/M2 Thames Gateway corridor, stretching from Dartford in the West to Sittingbourne in the East.

7.2.34 Capacity for an additional 18,000 jobs and 24,000 homes is identified in the Thames Gateway area, with growth focussed in the Ebbsfleet, Swanscombe Peninsula and Medway/A249 areas.

7.2.35 The Medway and A249 areas were identified as having a major concentration of manufacturing employment, with strength in defence, automotive, environmental and more recently renewables. The Kent Science Park near Sittingbourne was also identified as a growing centre for life science and environmental research and development.

Transport Infrastructure Investment

7.2.36 To facilitate growth in this area, transport infrastructure improvements identified were M2 J5 capacity improvements, Sittingbourne Northern Relief Road and development of a limited access junction from the M2 to Kent Science Park (Junction 5a).

7.2.37 The LEP Growth Deal and Strategic Economic Plan Appendix A identifies trunk road network schemes that would be needed to enable growth within the LEP area. Desired date of commencement and funding sources are also identified.

7.2.38 Within our study area, M2 junction 5 capacity improvements and A249 corridor improvements are included. The table below is an extract from the aforementioned Appendix A.

Table 7.4: Appendix A - Trunk Road Network Schemes (Extract of)

Current activity		Details of discussions with NR/HA	Desired date of commencement	Funding Sources
M2/A2 Corridor Improvements	<p>This package involves improvements along the length of the M2/A2 through Kent that will not only unlock significant local development where strategic network junctions are restricting growth, but will also help create a new high quality national corridor from Dover to the Midlands and North in conjunction with a new Lower Thames Crossings. The components of this package are:</p> <ul style="list-style-type: none"> A2 Bean and A2 Ebbsfleet Junction Improvements – increasing capacity of these junctions to support planned growth in Thames Gateway North, Kent at Eastern Quay, Northfleet Embankment, Bluewater and Paramount Park. Highways Agency assessments indicate post-2021 implementation, but SE LEP intend to work to bring this forward in order to unlock growth in the SE LEP area particularly given recent Government announcements of the Ebbsfleet Garden City M2 Junction 3 capacity improvements - increasing capacity to support growth in Rochester and Chatham and in particular on the Rochester Airport site where 1,000 new jobs are planned. The junction is situated in Kent County Council area M2 Junction 5 capacity improvement – will unlock growth in Sittingbourne and Maidstone M2 Junction 7 Brenley Corner – realignment to enable straight through movement from M2 to A2 significantly improving access to Dover, supporting significant port expansion as well as growth in Canterbury and East Kent A2 Dualling Lydden to Dover – dualling the few remaining single carriageway stretches of the A2 to Dover as part of the creation of a new national corridor and supporting significant port expansion in Dover. 	<ul style="list-style-type: none"> HA currently progressing business cases for both these junction improvements. Not scheduled for construction until post 2021. SE LEP willing to put LGF towards schemes if HA will not fund in order to bring schemes forward All present the Highways Agency are minded to implement any improvement to M2 Junction 5 post 2021. SE LEP intend to work with the Highways Agency to make a case for earlier delivery. SE LEP willing to put £15m of LGF towards scheme if HA will not fund in order to bring scheme forward HA aware of issues caused by M2 J7 and A2 single carriageway sections in terms of congestion and level of service on national corridor but have no plans to bring forward these schemes in short to medium term Provisional discussions between HA, Medway Council and KCC regarding the existing operational problems of junction 3 causing significant delays during peak periods, and the potential for planned development to further exacerbate the situation. Scale of improvements not identified at this stage. 	<p>A2 Bean/ Ebbsfleet 2017/18; Junc 5 2019/20 Junc 3 2018 Junc 7 & Dualling 2020/21</p>	<p>£10m LGF for A2 Bean; £6m LGF for A2 Ebbsfleet; Junc 5 £15.0m LGF; Junc 3 – not identified</p>
A249 Improvements including the widening and realignment of Detling Hill and M20 Junction 7	<p>This scheme will provide an alternative to the congested A229 Bluebell Hill link between the M2 and M20. The scheme will support growth across Swale and improve access between the Port of Sheerness and the M20. The package will be a key element in supporting the development of a new national strategic route from Dover to the Midlands and North via a new Lower Thames Crossing.</p>	<ul style="list-style-type: none"> HA are aware. 	<p>2020/21</p>	

- 7.2.39 The M2 J5 capacity improvements in Appendix A, state that it is expected to unlock growth in Sittingbourne and Maidstone and are likely to be implemented from 2021. The LEP makes the case for an earlier delivery, with £15m of Local Growth Fund funding available should if the Highways Agency not fund to bring it forward.
- 7.2.40 The A249 improvements listed in Appendix A of the SEP include the widening and realignment of Detling Hill and M20 Junction 7. This scheme would provide an alternative to the congested A229 link between the M2 and M20, as well as supporting growth in Swale and improving access between the Port of Sheerness and the M20. There would also be the possibility of linking in to the new Lower Thames Crossing depending on the route chosen. The LEP identified desired date of commencement is 2020/21.
- 7.2.41 No major rail or integrated transport solutions or improvements were identified in Appendix A that would have an impact on the M2 J5 area.

7.3 Other Government Policies

- 7.4.1 The Highways England Delivery Plan (2015-2020), forms the strategic document which outlines the need for improvements to the M2 J5 in this area. The strategic outcomes are as follows:
- Supporting Economic Growth
 - A Safe and Serviceable Network
 - A More Free-Flowing Network
 - Improved Environment
 - An Accessible and Integrated Network
- 7.4.2 In line with the Highways England Business Plan, eight Key Performance Indicators (KPIs) have been identified to which the Government and Strategic Roads Network Monitor can measure network and company performance. These KPIs will be scored against a number of targets.
- 7.4.3 The key performance indicators are outlined below:
- Making the network safer
 - Improving user satisfaction
 - Supporting the smooth flow of traffic
 - Encouraging economic growth
 - Delivering better environmental outcomes
 - Helping cyclists, walkers and vulnerable road users
 - Achieving real efficiency
 - Keeping the network in good condition

7.4.4

The high-level scheme objectives have been set in accordance with Highways England KPIs, measurable by the meeting of specific targets for most KPIs. The objectives, KPIs and targets are shown in Table 1.7, with an indication given whether they are applicable to the scheme. The M2 forms the Boundary of the Kent Downs AONB and all land to the west of the M2 including the Stockbury Roundabout is within the AONB. Any significant expansion of the junction needs to ensure there is no environmental disbenefit to the setting of the AONB and adjacent habitats.

Table 7.5: Highways England KPI Objectives

KPI Objective	KPI	Announced Target	Scheme Benefit	Scheme Dis-Benefit	N/A
Making the network safer	The number of KSIs on the SRN	On-going reduction in network KSIs to support a decrease of at least 40% by the end of 2020 against 2005-09 baseline	✓		
Delivering better environmental outcomes	Number of noise important area mitigated	Mitigate at least 1,150 Noise Important Areas over Road Period 1.			✓
	Delivery of improved biodiversity, as set out in the Company's Biodiversity Action Plan	The company should publish its Biodiversity Action Plan by 30 June 2015, and report annually on how it has delivered against the Plan to reduce net biodiversity loss on an annual basis.		✓	
Helping cyclists, walkers and other vulnerable users	The number of new or upgraded crossings	None announced			✓
Encouraging Economic Growth	Average delay (time lost per vehicle per mile)	None announced	✓		
Keeping the network in good condition	The percentage of pavement asset that does not require further investigation for possible maintenance	Percentage to be maintained at 95% or above	✓		
Supporting the smooth flow of traffic	Network Availability: the percentage of the SRN available to traffic	Maximise lane availability so that it does not fall below 97% in any one rolling year.	✓		
	Incident Management: percentage of motorway incidents cleared within one hour	At least 85% of all motorway incidents should be cleared within one hour	✓		
Achieving real efficiency	Cost savings: savings on capital expenditure	Total savings of at least £1,212bn over Road Period 1 on capital expenditure			✓
	Delivery Plan Progress: progress of work, relative to forecast set out in the Delivery Plan, and annual updates to that Plan, and expectations at the start of Road Period 1	Meet or exceed forecasts			✓
Improving user satisfaction	The percentage of National Road Users' Satisfaction Survey respondents who are Very or Fairly Satisfied	Achieve a score of 90% by March 2017 and then maintain or improve it	✓		

8 Maintenance and Repair Statement

8.1 Introduction

- 8.1.1 The Maintenance and Repair Strategy (MRSS) is the PCF Product that outlines key strategic design assumptions and decisions taken during the design and construction of the scheme. These relate to how the maintenance of assets within the scheme limits can be carried out efficiently during its lifetime, and how risks to road workers are kept as low as reasonably practicable. It should detail the likely impact on network availability, identify any specific resource requirements and highlight any safety issues for road users and operatives.
- 8.1.2 The aim is to provide a high level strategic document that demonstrates that a design for maintenance approach has been taken during the design and construction of roads, roadside assets, and associated technology. This is to enable maintenance to be carried out safely and cost effectively while ensuring that any future maintenance interventions which expose road workers to risk are minimised.
- 8.1.3 The MRSS is not intended to provide a detailed statement describing how the maintenance is to be undertaken. It is the responsibility of the Maintenance Service Provider (MSP) to identify and implement appropriate methods of work for the required maintenance activities.

8.2 Maintenance requirements

- 8.3.1 The existing maintenance access provision has been described in Section 3.14 above. The following maintenance requirements will need to be considered in the development of scheme MRSS documents:
- All maintenance vehicle stops will require the implementation of closures of live lanes requiring placing of TTM;
 - Group any infrastructure and equipment provided as part of any future technology upgrade reducing maintenance access points;
 - Consider provision of additional off network access with footway provision for maintenance access on foot;
 - Ensure equipment placed in the verge is placed as far from the traffic lanes as possible to reduce risk from errant vehicles and to reduce risk and avoiding need for TTM if possible;
 - Provide low maintenance verge with reduced landscape maintenance requirements using low growth grass and planting. Avoid planting close to visibility splays and the like reduces the need for annual cutting back thus reducing maintenance worker risk exposure;
 - Ensure any drainage channels and gulleys can be mechanically swept removing the need for manual clearance of detritus;
 - Provide paint systems with extended maintenance periods so as to achieve a 30 year design life with minimal maintenance treatments;

- Provide low maintenance central reserves in conjunction with rigid concrete barriers (RCB) in place of steel VRS, provide channels that can be mechanically swept; and
- Use of self-cleansing facings to traffic signs to reduce cleaning requirements.

8.3.2 Combined cyclic maintenance activities within TTM are suggested so as to minimise the amount of traffic management implemented reducing risk exposure of the traffic management operatives.

9 Other Relevant Factors

9.1 Impact of Options on Existing Structures

- 9.1.1 M2 Stockbury Viaduct, carrying both carriageways of the M2 including additional lanes for the slip road approaches, will not be affected by any of the proposals. The existing structure has sufficient headroom beneath it to cater for all options, including a three-tier option at this location. There is also sufficient clearance between piers and foundations to comply with design standard requirements.
- 9.1.2 M2 Stockbury Footbridge – The existing footbridge immediately north of M2 Stockbury Viaduct (referred to as M2 Stockbury Footbridge) will need to be replaced with a longer structure spanning the improved slip roads as well as the existing main carriageway. This will probably include replacement of the piers in the central reserve and verges as well as the existing abutments. Removal of the existing footbridge will be critical to completing the construction of the widened slip roads north-east of the viaduct.

10 Planning Factors

10.1 Introduction

10.1.1 The planning factors considered in this section of the report include local, strategic and national plans. A planning context is established for the scheme by summarising the factors in a number of areas, including;

- Housing
- Employment areas
- Transport and Connectivity
- Transport Technology
- Programming
- Environmental
- Statutory Process

10.2 Housing

10.2.1 For the Swale area, the Swale Local Plan identifies development targets of 10,800 dwellings (540 per annum) and an Objectively Assessed Need (OAN) figure significantly higher at 13,192 dwellings (776 per annum).

10.2.2 The location of the sites to meet the requirements has not been fully identified, except to say that the focus of the development strategy is at the Western end of the borough.

10.2.3 There are no planned housing developments in the vicinity of the scheme.

10.3 Employment Areas

10.3.1 For the Swale area, the Swale Local Plan identifies development targets of 7,053 jobs (353 per annum); however a revised figure of 6,104 jobs was provided by SBC in February 2016.

10.3.2 The location of the sites to meet the requirements has not been fully identified, except to say that the focus of the development strategy is at the Western end of the borough.

10.3.3 There are no planned employment land developments in the vicinity of the scheme.

10.4 Transport and Connectivity

10.4.1 There are no other known junction improvement schemes or proposed transport initiatives for the study area around M2 J5.

10.5 Transport Technology

10.5.1 There are no known technological improvements proposed in the study area.

10.6 Programming

- 10.6.1 A key constraint will be the construction phasing and resourcing in Highways England's supply chain as current delivery is expected to be at the same time as a large number of national schemes in line with the current Delivery Plan.
- 10.6.2 There are no known local network schemes in the area that would be delivered alongside the proposed improvements at Junction 5 that would cause additional disruption to traffic using M2 J5.

10.7 Environmental

- 10.7.1 The scheme is located partially within the Kent Downs Area of Outstanding Natural Beauty and therefore landscape impacts are a key consideration.
- 10.7.2 There is one Special Area for Conservation (SAC) (internationally important site for Nature Conservation) within 1.9km, and three other internationally designated sites (two Ramsar and Special Protection Areas (SPA) and another SAC) located within 10km of the junction options. There is ancient woodland immediately adjacent to the existing junction. An Assessment of Implications on European Sites screening exercise has been undertaken which will need to be updated when more information is available in order to establish the potential for impacts on the internationally designated sites.
- 10.7.3 There are heritage assets (a Scheduled Monument and a Grade 1 Listed Building) nearby for which setting may be a key constraint and there is the potential for First World War (WWI) defences to be present. If they are present, and are in a good state of preservation, the WWI defences could be of national importance and require preservation in situ.

10.8 Statutory Process

- 10.8.1 It has not been established yet whether this scheme would require either an Environmental Statement (ES) or a Development Consent Order (DCO), although currently a DCO is considered highly likely due to the land take involved.

11 Description of Route Options

11.1 Scheme History

- 11.1.1 The M2 was considered in the Kent Corridors to M25 Route Strategy. As noted in addition to existing capacity constraints at the junction it was also identified in the top 50 national casualty locations.
- 11.1.2 Previous study work was undertaken by Jacobs in July 2009 set out short term solutions (up to 2016) for M2 J5 identifying capacity issues at the junction and improvements required to mitigate the problems in the short term, however the need for longer term solutions, in line with planned development was identified as being required. Further work was undertaken by PB in September 2012, which considered further options for improvements, and looking at fundable capacity enhancements for M2 J5.
- 11.1.3 The need for further study was identified during the Route Strategies work stream in 2014, whilst the commitment to undertake a detailed improvement study at M2 J5 was made as part of the 2014 Autumn Statement, and subsequently detailed in the DfT's Road Investment Strategy (RIS). The Road Investment Strategy (December 2014) included an investment of between £50 - 100m for improvements M2 J5.
- 11.1.4 In March 2015, Highways England established their investment priorities for the Kent Corridor. It was identified that the M2 at junction 5 would benefit from improvements to increase capacity to assist the delivery of residential and employment growth.

11.2 Options Identified at Stage 0

- 11.2.1 During PCF Stage 0 a number of options were developed; the main options identified are listed below:
- Option 4 – A249 Fly-over / Fly-under
 - Option 6 – A249 Through-about (Hamburger)
 - Option 7 – Two-tier Dumbbell (east-west)
 - Option 8 - Two-tier Dumbbell (north-south)
 - Option 10 – Three-tier Intersection
- 11.2.2 It is noted that as no formal EAST assessment has been carried out on the options identified, four options have been taken forward for the purposes of PCF Stage 1. These options have been chosen as they cover the range of options, both in terms of size, scale and operation.

Option 4 - A249 Flyover / Fly under

- 11.2.3 This option proposes that the A249 southbound and northbound carriageways are either carried over or under the existing Stockbury Roundabout. This would see two 3.65m lanes maintained in each direction on the A249.

11.2.4 A viaduct or underpass would be provided at Stockbury Roundabout, with the existing roundabout remaining in its current location. Access to the A249 would be provided by a 3.65m lane slip road with a hardshoulder for entry and exit.

11.2.5 A single 3.65m with a hard shoulder will be provided for the free-flow link between the A249 northbound and the M2 eastbound.

Option 6 - Through-about (Hamburger) junction (conversion of existing junction)

11.2.6 This option proposes an at-grade through access for A249 southbound and northbound traffic with traffic signals on all approaches and within the roundabout, creating a through-about or hamburger layout.

11.2.7 To match the existing, two 3.65m lanes provided in each direction through the roundabout. A single 3.65m lane would be provided for all left turn movements at the roundabout.

Option 7 - Two Tier Dumbbell Intersection (at existing Stockbury Roundabout)

11.2.8 This option proposes that the existing Stockbury Roundabout be replaced with a dumbbell junction to permit A249 southbound and northbound carriageways to be carried over the connecting road by viaduct or underpass, comprising of two 3.65m lanes in each direction.

11.2.9 Slip roads would be provided to link to the A249 route, comprising of a single 3.65m lane and a hardshoulder.

11.2.10 The western dumbbell roundabout would be a three lane circulatory carriageway (3.65m lane width) with an ICD of 50m. The eastern dumbbell roundabout would have two 3.65m lanes and an ICD of 50m. The roundabout connector would have two 3.65m lanes in each direction.

11.2.11 Maidstone Road would be closed from before the M2 viaduct, with a 7.3m wide single carriageway link constructed linking to Oad Street. Oad Street would be widened to two 3.65m lanes from the M2 to the new junction.

Option 8 - Two Tier Dumbbell Intersection (at existing Stockbury Viaduct)

11.2.12 This option proposes that the existing Stockbury Roundabout be enlarged and linked with another smaller roundabout on the opposite side of the M2 Viaduct to form a dumbbell junction. The existing A249 would fly under or over the proposed roundabouts with connector roads between the roundabouts and linking local roads and the M2.

11.2.13 Slip roads would be provided to link to the A249 route, comprising of a single 3.65m lane and a hardshoulder.

11.2.14 Slip roads would be provided to link to the M2 route, comprising of two 3.65m lanes and a hardshoulder.

11.2.15 Connector roads between the roundabouts comprising of two 3.65m lanes and hardshoulder.

Option 10 - Three Tier Intersection (at M2 viaduct location)

11.2.16 This option proposes that the existing Stockbury Roundabout be replaced with large gyratory at M2 intersection with A249. The new gyratory would be a two 3.65m lane carriageway, with a 110m ICD.

11.2.17 The A249 would be retained in its existing position albeit at a slightly lower level as the bottom level of the three tier intersection.

11.2.18 The M2 slip roads would be realigned, and comprise of two 3.65m lanes and a hardshoulder, the A249 slip roads would be two 3.65m lanes and a margin.

11.2.19 This option would see the Oad Street / A249 junction closed, and a new 6m wide link to Maidstone Road and the gyratory constructed to the north of the viaduct.

11.3 Stage 1 Modelling and Option Testing

11.3.1 Based on the Stage 0 options identified and presented in Section 11.2, a number of variants and layouts based around Options 4, 6, 7, 8 and 10 were drawn up and tested during PCF Stage 1. However Options 4, 8 and 10 formed the core options taken forward.

11.3.2 During the early Stage 1 development, two additional options were considered; one was a fully free-flowing interchange between the A249 and the M2; this is referred to as Option 11 and a Low Cost option consisting largely of elements of Option 4; this is referred to as Option 12.

11.3.3 Based on the forecasted flows, a number of major movements were identified as being critical to the operation of any option identified. These are outlined below:

- M2 EB to A249 NB
- A249 NB to M2 WB
- A249 N-S and S-N movements

11.3.4 The option identification and testing process considered different permutations around lane drops and gains, merge and diverge layouts, free-flow slip roads and roundabouts.

11.3.5 Four options were identified as being the most likely to provide a suitable solution to the growth problem identified. These were Options 4F, 4G, 8C and 10A.

11.3.6 Option 11 would have been considered as the top-end design in terms of cost and successfulness but local connectivity is not taken into account in this option, and with substantial land take requirements it was seen as unsuitable. However, if a purely strategic solution is required it could be considered.

- 11.3.7 The initial estimates received for the options submitted for estimation by Benchmark (Options 4G, 8C, 10A) were found to be significantly over both the original RIS scheme budget of £100m and the revised scheme budget of £70.8m.
- 11.3.8 An extensive value management exercise was undertaken, which saw two of the initial options (Option 4 and 10) refined in order to ensure they could be delivered under the original RIS budget of £100m. A new option (Option 12) was developed to meet the objective of being both within the RIS budget and the revised scheme budget of £70.8m. Option 8 was removed completely due to its complexity and likelihood that even following a value management exercises it would remain over the original RIS budget.
- 11.3.9 Option 12 was developed and taken forward following the initial estimation exercise in order to ensure at least one option was wholly within the revised scheme budget. The value managed versions of Options 4 and 10 were taken forward on the basis that they would be within the original RIS scheme budget, whilst also fully meeting the scheme objectives.
- 11.3.10 Layout drawings of the original Options 4, 8, and 10 are included in **Appendix A**, a brief description of each option is included below.
- Option 4F – Flyover / flyunder – Variant 1**
- 11.3.11 Option 4F retains a roundabout in the existing location, with a free flowing movement provided on the A249 over or under the junction. Additional free-flow links are included for the A249 SB – M2 WB, A249 NB – M2 EB, M2 WB – A249 SB and M2 EB – A249 NB movements. The M2 EB – A249 NB free-flow link is located adjacent to the roundabout as per the existing link.
- 11.3.12 Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided between Oad Street and the roundabout.
- Option 4G – Flyover / flyunder – Variant 2**
- 11.3.13 Option 4G retains a roundabout in the existing location, with a free flowing movement provided on the A249 over or under the junction. Additional free-flow links are included for the A249 SB – M2 WB, A249 NB – M2 EB, M2 WB – A249 SB and M2 EB – A249 NB movements. The M2 EB – A249 NB free-flow link avoids the roundabout.
- 11.3.14 Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided between Oad Street and the roundabout.
- Option 8C – North – South Dumbbell**
- 11.3.15 Option 8 sees two new roundabouts, orientated north-south. Free-flow links are provided for the movements outlined in Option 4G. The A249 has a free-flowing through link passing over or under both roundabouts.
- 11.3.16 A local connection between Oad Street, Maidstone Road and the northern roundabout is provided.

Option 10A – Three-tier roundabout

- 11.3.17 In Option 10, a traditional three-tier grade separated roundabout is provided, removing the unusual geometry of the slips. The A249 has a dedicated through link, with additional free-flow links serving the M2 EB – A249 NB, M2 WB – A249 SB and A249 NB – M2 WB movements. The roundabout would be partially signalised.
- 11.3.18 Local connections would be provided with a link between Oad Street, Maidstone Road and the roundabout.
- 11.3.19 Layout drawings of the three options following initial Benchmark estimation and the value management exercise are included in **Appendix C**. A brief summary of the options is included below.

Option 4 – Two tier intersection

- 11.3.20 This option sees the existing roundabout replaced with a new grade-separated interchange, with free flowing movement provided on the A249 under the junction. Additional free-flow links are included for the A249 westbound to M2 northbound, A249 eastbound to M2 coast-bound, and M2 coast-bound to A249 eastbound movements. The M2 eastbound to A249 northbound free-flow link avoids the roundabout. Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided to the Stockbury interchange.

Option 10 – Three tier intersection

- 11.3.21 This option sees the existing roundabout replaced with a traditional three-tier grade separated interchange; removing the unusual geometry of the junction and slip road alignments. The A249 has a dedicated through link at the lower-level, with the interchange at the mid-level, and M2 as existing at the top-level. There are additional free-flow links serving the M2 coast-bound to A249 eastbound, M2 westbound to A249 westbound and A249 eastbound to M2 northbound movements. The interchange would be partially signalised. Local connections would be provided with a link between Oad Street, Maidstone Road and the interchange. The gyratory under the M2 viaduct would be provided with three lanes on both sides with the adjustment of entry, exit and free-flow lanes around the gyratory adjusted to suit.

Option 12 – At grade (Low cost) option

- 11.3.22 Option 12 consists of specific elements included within Option 4, such as the free flow lanes, however it remains at grade. Option 12 sees the existing roundabout on the A249 retained and no realignment of the A249. Existing slip roads will be retained but a two lane diverge from the M2 coast-bound and a free-flow lane from the M2 to A249 north-bound will be created. A free-flow lane from the A249 westbound to the M2 London-bound merge slip road will also be added. A link will be created between Maidstone Road and Oad Street. The connection of Maidstone road to roundabout will be removed, and the existing access to the A249 from Oad Street west of junction retained.

12 Traffic Analysis

12.1 Traffic Data Collection

12.1.1 To assist with model development and forecasting, all available data was obtained and where necessary additional data collection exercises were undertaken to collect the additional network and traffic flow information.

12.1.2 The principle sources of information used to date are shown below:

- Junction Turning Count Surveys
- Automatic Count Surveys
- Journey Time Surveys
- Collision Investigation
- Census Journey to Work Data
- Traffic Master Data
- Traffic Signal Timings
- Link Count Surveys

12.1.3 The sources of data identified above were used to underpin and validate a VISSIM model of the junction. Other existing models including the Swale Local Plan VISUM model and the Lower Thames Crossing (LTC1) SATURN model. However it became evident that these models did not provide sufficient coverage of the study area to be suitable as a base for option testing.

12.1.4 Further details of the traffic data used in modelling and the validation process can be found in the Traffic Data Collection Report and Local Model Validation Report.

12.2 Model Development

12.2.1 A full description of the model development work carried out is available in the Local Model Validation Report.

12.2.2 A number of existing highway models were identified as covering the M2 J5 area during Stage 0, however all models are considered not to be suitable as they are largely based upon 2001 LATS RSI data with minimal additional surveys conducted during the preceding years. It is also noted that none of the models provide coverage of M2 J5 in sufficient (simulation level) detail meaning that if any model was to be used a significant update exercise would be required.

12.2.3 Further examination of these models also showed that neither model provided suitability robust distribution information for the M2 J5 scheme.

12.2.4 As no suitable strategic model existed to support the development of a major junction improvement scheme at M2 J5, a micro simulation model of the junction and surrounding network was created to assess improvement options, network performance and economic benefit.

12.3 Model Forecasting

- 12.3.1 A full description of the traffic forecasting assessment work carried out for M2 J5 is available in the Traffic Forecasting Report.
- 12.3.2 Using the validated base model as a starting point, traffic forecasts have been produced in order to assess the operational, economic and environmental impacts of the scheme options.
- 12.3.3 The years of assessment for the model networks are 2021 and 2031. This provides a consistent approach to economic assessment for all options and the future year (10 years post opening - 2031) is modelled in line with TAG guidance to capture most benefit. This also coincides with the end of the Swale Local Plan.
- 12.3.4 WebTAG unit M4, forecasting and uncertainty, recommends that a core forecast scenario should be developed to include local development and a core forecast scenario based purely on TEMPro and NTM.
- 12.3.5 Three forecast scenarios have been created; Low, Central and High. These are outlined below:
- Low - TEMPro + NTM (excludes specific Local Plan growth)
 - Central - Local Plan + TEMPro + NTM (Constrained)
 - High – Local Plan + TEMPro + NTM (Unconstrained)
- 12.3.6 The Central growth scenario is based on the High growth scenario, except that the number of vehicles on each link have been limited to an assumed network capacity (2000 vehicles per lane) as the High, unconstrained scenario, forecasts demand greater than the wider network is understood to enable without significant improvements. Therefore the Central, constrained, scenario is considered to be robust and present the most likely forecast scenario currently.
- 12.3.7 It should be noted that the pure TEMPro and NTM scenario applies growth uniformly to the base year demand.
- 12.3.8 In accordance with WebTAG Unit M4, appropriate growth factors from TEMPro were adjusted, extracted and applied to all movements to account for forecasted growth in the area (background growth only for Central / High Scenarios). Adjustments to the growth forecasts were made by applying fuel and income factors as calculated per TAG guidance.
- 12.3.9 Local development information provided by Swale County Council was used as the basis for the Central and high growth scenarios.
- 12.3.10 The level of growth compared to the base year 2015 for each scenario and peak period are shown in Table 12.1 - Table 12.3.

Table 12.1: AM Peak Flows and Growth by Scenario

	Low		Central		High	
	Peak Hour Flow	% Growth	Peak Hour Flow	% Growth	Peak Hour Flow	% Growth
Base Year	-	-	10,273	-	-	-
Opening Year 2021	12,465	21%	13,211	29%	13,211	29%
Forecast Year 2031	12,465	21%	14,330	39%	14,458	41%

Table 12.2: Inter-Peak Flows and Growth by Scenario

	Low		Central		High	
	Peak Hour Flow	% Growth	Peak Hour Flow	% Growth	Peak Hour Flow	% Growth
Base Year	-	-	7,203	-	-	-
Opening Year 2021	9,096	26%	11,914	65%	10,206	42%
Forecast Year 2031	9,096	26%	11,914	65%	11,914	65%

Table 12.3: PM Peak Flows and Growth by Scenario

	Low		Central		High	
	Peak Hour Flow	% Growth	Peak Hour Flow	% Growth	Peak Hour Flow	% Growth
Base Year	-	-	10,732	-	-	-
Opening Year 2021	13,108	22%	13,459	25%	14,447	35%
Forecast Year 2031	13,108	22%	14,316	33%	16,617	55%

12.3.11 The central growth scenario provides a more realistic scenario based on the number of vehicles that the existing network could supply. The link capacity was constrained to 2,000 vehicles per lane, based on DMRB Volume 5 Section 1 TA 79/99 Traffic Capacity of Urban Roads.

12.4 Road Layout and standards

12.4.1 As outlined above, three key options have been identified during PCF Stage 1 and assessed.

- Option 4 - A249 elevated to provide flyover above enlarged existing Stockbury roundabout.
- Option 10 - Three tier gyratory beneath the existing M2 Stockbury viaduct.
- Option 12 – At grade (Low Cost) improvement to increase the size of the existing roundabout and provide free flow movements

12.4.2 Current designs for all three options retain the existing design standards for the A249 (D2AP) and for the M2 (D2M). Hardshoulders and margins are also retained to the existing design standards.

12.4.3 The M2 Junction 5 and A249 Stockbury Roundabout have capacity constraints resulting in unsatisfactory network performance. This affects M2 east-west movements and A249 north-south Sittingbourne/Maidstone movements, with current traffic demands significantly exceeding capacity. The approach to the junction from the east experiences high levels of delay and the junction is identified in the list of the top 50 national casualty locations. It is also noted that growth plans, as set out in the Local Economic Partnerships' Strategic Economic Plan, are likely to be inhibited by a lack of capacity at this junction.

12.4.4 To address the capacity and performance deficiencies, the improvement to M2 junction 5 was included in the DfT's Road Investment Strategy (RIS). The improvement contributes to national transport objectives by:

- Providing additional capacity
- Enhancing journey time reliability, and
- Supporting the development of housing and creation of jobs

12.4.5 Following an extensive option development and sifting process three potential improvements for further consideration have been identified as follows:

Option 4: Stockbury Roundabout Flyover – Main Design Elements

- The existing Stockbury Roundabout is replaced with a new grade separated interchange with free flowing movement provided on the A249 under the junction.
- Additional free-flow links are included for the A249 southbound to M2 westbound, A249 northbound to M2 eastbound, M2 westbound to A249 southbound and M2 eastbound to A249 northbound movements.
- The M2 eastbound to A249 northbound free-flow link avoids the roundabout.
- Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided to the Stockbury interchange.

Option 10: Three Tier Gyratory – Main Design Elements

- This option sees the existing Junction 5 replaced with a traditional three-tier grade separated interchange; removing the unusual geometry of the junction and slip road alignments.
- The A249 has a dedicated through link at the lower- level, with the interchange at the mid-level, and M2 as existing at the top-level.
- There are additional free-flow links serving the M2 eastbound to A249 northbound, M2 westbound to A249 southbound and A249 northbound to M2 westbound movements.
- The interchange would be partially signalised.
- Local connections would be provided with a link between Oad Street, Maidstone Road and the interchange.

Option 12: Low Cost – Main Design Elements

- This option provides free flow links targeted at the predominant traffic flows: the A249 southbound to M2 London bound carriageway and the M2 coast bound (traffic returning from London) to the A249 northbound carriageway.
- The old Maidstone Road will be diverted to Oad Street similar to the other options and junction improvements provided at the Oad Street/A249 junction.

12.5 Other Options Considered

- 12.5.1 The PCF Stage 0 report features an alternative option (Option 8) that was similar to option 4 but included an additional two-tier intersection north of Stockbury Viaduct for improved connectivity to local roads. This was dropped mid-way through this design stage due to the high construction cost.

13 Economic Assessment

13.1 Application of Assessment Software

13.1.1 The economic appraisal of the scheme options for M2 Junction 5 were undertaken, using TUBA version 1.9.7. The default TUBA economics file (TUBA 1.9.7) was used. This was based on WebTAG December 2015 and Data Book July 2016. Cost estimation was undertaken by Benchmark, with costs re-based to 2010 levels.

13.1.2 An accident analysis assessment was undertaken using Cobalt, which provided additional information on benefits through potential accident savings. These were added to the final BCR figures for the three scheme options.

13.1.3 The modelled outputs were factored to represent the annual benefits as follows:

- AM peak (0700 to 1000) A = 3 hours x 253 days = 759
- Inter peak (1000 to 1600) A = 6 hours x 253 days = 1518
- PM peak (1600 to 1900) A = 3 hours x 253 days = 759

13.1.4 The economic assessment was based on model outputs representing 2021 and 2031, with only the central growth scenario assessed.

13.1.5 Further detail on the economic modelling is provided in the Economic Assessment Report

13.2 Individual Impacts

13.2.1 TUBA was used to assess the costs and benefits for travel time savings and vehicle operating costs. The trip length, trip volume and journey time information needed for this has been extracted from the VISSIM model.

13.2.2 TUBA also provided a forecast of the impacts on indirect tax revenues as a result of the scheme.

13.2.3 An accident assessment using Cobalt was undertaken. Overall the analysis showed a positive impact upon accidents for all three options as shown in Table 13.1. Further detail is included in the Economic Assessment Report.

Table 13.1: Cobalt Analysis Results, Fixed Assignment

Option	Collisions Saved	Casualties Saved			Economics		
		Fatal	Serious	Slight	Do Minimum	Do Something	Benefit
4	621	5.6	73.7	979.9	£83,284.90	£52,696.60	£30,588.30m
10	780	9.5	93.3	1,194.1	£83,284.90	£42,657.70	£40,627.70m
12	480	3.6	51.2	758.1	£83,284.90	£60,894.00	£22,390.90m

13.2.4 It should be noted that TUBA is unable to take into account the number of trips failing to load during the modelled peak hours. Where there are the greatest number of incomplete trips (e.g. Option 12), there will be a greater reduction in the overall level of benefit of the option. It was not possible to determine the level of benefit /disbenefit for the full demand in the current model, therefore the level of incomplete trips needs to be considered when evaluating the overall performance and benefit of each option. As a result the economics assessment currently presents higher BCR values than would be the case.

Table 13.2: Number of incomplete trips by option and time period

Time Period	Option 4	Option 10	Option 12	Ref. Case	Demand
Option 4	814 (6%)	245 (2%)	2,831 (20%)	3,079 (21%)	14,330
Option 10	1,054 (9%)	871 (7%)	1,260 (11%)	1,825 (15%)	11,914
Option 12	113 (1%)	550 (4%)	2,122 (15%)	3,091 (22%)	14,316

13.2.5 The approximate BCRs for all options, adjusted to include accident saving benefits, are shown in Table 13.3. However, it should be noted that these values are subject to change and need to be verified through the development of a strategic model during PCF Stage 2.

Table 13.3: Adjusted Benefits ('000s of pounds)

Type	Option 4	Option 10	Option 12
Present Value of Benefits (PVB) (TUBA)	£827,022	£874,064	£777,276
Accident Impacts (COBALT)	£30,588	£40,628	£22,391
Sub Total Value of Benefits (sum of above 2 rows)	£857,610	£914,692	£799,667
Present Value of Costs (PVC)	£58,024	£60,846	£32,355
Overall Impacts			
Net Present Value (NPV)	£799,586	£853,846	£767,312
Benefit to Cost Ratio (BCR)	14.780	15.033	24.715

- 13.2.6 In Option 12, the large benefit seen is derived from the small journey time improvements seen by the completed trips. Across all peak periods, 10-20% of all trips fail to complete, this is due to the network becoming severely congested. Trips failing to complete in Option 12 mean that the benefit identified using TUBA is unrealistically high and therefore cannot be seen as reliable.
- 13.2.7 Whilst Options 4 and 10 also show trips failing to complete, the level is lower and therefore the impact on the overall benefit is lower once the incomplete trips are considered.
- 13.2.8 More detailed analysis of the economic assessment is found in the Economics Assessment report.
- 13.2.9 In Options 2 and 3, it looks like much of the benefit is gained in 2019, and due to the problems at Millbrook described above, the benefits gained are gradually reduced in subsequent years and, by 2036, benefits are diluted for both options.

13.3 Discussion of Overall Results

- 13.3.1 The economic assessment results have shown that each option would provide significant benefits, with BCR's of 14.8 (Option 4), 15.0 (Option 10) and 24.7 (Option 12). As discussed previously, these should be seen as unrealistic and treated cautiously due to the significant number of incomplete trips observed and the limitations of the VISSIM model.

- 13.3.2 The level of incomplete trips due to the congested network seen in some options, the inability to determine benefit and the need to maintain delivery in accordance with the programme mean that realistic BCR's have not been obtained.
- 13.3.3 Limitations within the VISSIM mean that it is not possible to determine a journey time for incomplete trips or assign delay to those vehicles unable to load due to the congested network. Where a congested network is seen, a lower proportion of trips are complete and the journey time benefit seen is inflated due to later trips not completing. Running TUBA using the VISSIM journey times obtained means that the benefits and BCR's obtained are likely to be an overestimation, especially for Option 12 due to issues with latent demand.
- 13.3.4 Despite the issues identified, it is still considered that there continues to be a justification for the M2 Junction 5 scheme. Due to the high BCR's across all schemes, it is not possible to rule particular options out until additional economic assessment is carried out during PCF Stage 2. PCF Stage 2 sees the development of a strategic model, from which re-routing can be tested as well as the full benefits of each option determined prior to ruling out options.
- 13.3.5 Further detail on the traffic modelling, option testing and economic assessment can be found in the Traffic Forecasting and Economics Assessment Reports.

14 Safety Assessment

14.1 Impact on Road User – Strategic Safety Action Plan

14.1.1 The M2 Junction 5 improvement scheme will be deemed to have satisfied the road user safety objective if it is demonstrated for a period of three years after becoming fully operational that:

- The average number of Fatal Weighted Injury (FWI) casualties per year is no more than the 2005-2009 safety baseline stated in Highways England's 'Our Approach to Improving Road Safety' document.
- The rate of FWI's 1 per billion vehicle miles per annum is no more than the safety baseline.

14.1.2 These two key indicators are defined in the Information for Managing Safety on the Highways England Network, which is designed to help Highways England to monitor progress towards improving road safety. The two indicators will provide a measure of safety performance both in terms of actual numbers of casualties but also, by including a measure of exposure, the safety risk.

FWI is defined as: (Number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties)

14.1.3 This definition reflects the approximate ratios between the costs of fatal, serious, and slight casualties given in DfT's WebTAG (Unit A.4.1).

14.1.4 The use of FWI, rather than the numbers of killed and seriously injured, allows for the use of a larger data set, leading to more accurate and stable results. DfT's Strategic Framework for Road Safety acknowledges that at the local level the number of road deaths is small and subject to fluctuation. Therefore, in place of the key indicator of the number of road deaths (and the rate per billion vehicle miles), it proposes the following two key indicators for use at local level; the KSI's and the rate of KSI's per billion vehicle miles. Although all external reporting of safety performance of schemes and the programme will comply with the framework, FWI numbers and rates will be used for internal monitoring of safety performance.

14.1.5 For each trafficked route [link] of the scheme, no population (e.g. car drivers, pedestrians, HGV drivers and motorcyclists) is disproportionately adversely affected in terms of safety and risk to each population remains tolerable.

14.1.6 There is no numerical objective or target for road worker accidents for major schemes and the risk must be managed in accordance with the "So Far As Is Reasonably Practicable" principle which is a legal requirement. The Highways England's Health and Safety Plan sets out the requirement that no one should come to harm using or working on the Highways England network. This aim is furthered by Highways England Aiming for Zero strategy that must be applied for further positive actions to reduce the risk to road

workers during maintenance and operation. One part of the strategy aims to eliminate all fatalities and serious injuries to road workers maintaining the Highways England road network.

- 14.1.7 It is likely that the M2 Junction 5 Improvement scheme will be categorised under IAN139 Table 2-1, as a scheme requiring a Type A Safety Management System.
- 14.1.8 All of these elements form part of the Highways England's Safe Systems Approach which puts safety at the heart of planning, designing and engineering without sacrificing other operational requirements. This approach considers that no one should be harmed when travelling or working on the Strategic Road Network.
- 14.1.9 The proposed changes to the M2 Junction 5 will also assist Highways England in achieving one of its Key Performance Indicators of reducing KSI's on the Strategic Road Network by at least 40% by the end of 2020. It will also assist Highways England in achieving its aim of ensuring 90% of the Strategic Road Network is rated as 3* or above, equivalent to EuroRAP, by 2020.
- 14.1.10 The M2 Junction 5 currently experiences high traffic flows and congestion, particularly from the A249 south westbound approach and the M2 south eastbound approach. The junction is also currently identified as one of the top 50 national casualty locations on the Strategic Road Network. These factors combined often lead to lane closures and travel time reliability issues.
- 14.1.11 It is anticipated that these existing issues will be compounded with proposals to expand the Kent Science Park, build a new hotel and residential properties if improvements are not made to the junction.
- 14.1.12 The overarching aims of the proposals are to ease congestion, provide a greater free flow of traffic, unlock economic investment and provide a safer junction. Through increasing the capacity of the junction alone it is likely to naturally lead to a reduction in collisions which in itself will improve journey times and reliability. The provision of additional capacity will also improve the resilience of the network when incidents do occur. These factors combined will all assist in reducing driver frustration which will also reduce the likelihood of collisions.
- 14.1.13 Features that are similar across all options that are likely to improve the safety performance of the junction, compared to the existing layout include:
- Providing a segregated left turn lane from the M2 (south eastbound) onto the A249 (north eastbound). This will reduce the volume of vehicles at the A249 Stockbury roundabout and is anticipated to reduce congestion and the likelihood of rear shunt collisions.
 - Realigning Oad Street to join the A249 at Stockbury roundabout. This will remove a priority junction that currently requires right turning drivers to cross the two lane dual carriageway to enter and exit the A249.
- 14.1.14 Notable features of Option 4 that are likely to improve the safety performance of the proposed scheme, compared to the existing layout include:

- The closure of the existing priority junction from Honeycrook Hill onto the A249 will reduce the risk of side impact collisions as drivers enter/ exit the A249.
- Making the A249 into a continuous section of dual carriageway Grade separating the A249 from the Stockbury roundabout will improve traffic flow and reduce congestion on the A249 this in turn will reduce queuing and the frequency of rear shunt collisions on the approaches to the roundabout.
- A segregated left turn lane for traffic joining the M2 north westbound from the A249 south westbound will reduce congestion and queuing at the Stockbury roundabout and the likelihood of rear shunt collisions.

14.1.15 Notable features of Option 10 that are likely to improve the safety performance of the proposed scheme, compared to the existing layout include:

- The closure of the existing priority junction from Honeycrook Hill onto the A249 will reduce the risk of side impact collisions as drivers enter/ exit the A249.
- The replacement of Stockbury roundabout with a grade separated junction will provide greater capacity and reduce queuing.
- Segregated left turn lanes from the A249 north eastbound onto the M2 north westbound and from the M2 north westbound onto the A249 south westbound will provide free flowing traffic to and from the motorway and reduce congestion and queuing at the grade separated junction.
- Replacement of the merge loop onto the M2 south eastbound with a parallel merge with auxiliary lane will improve traffic flow and reduce the likelihood of rear shunt collisions as vehicles approach the motorway.

14.1.16 Notable feature of Option 12 that are likely to improve the safety performance of the proposed scheme, compared to the existing layout include:

- A segregated left turn lane from the south westbound A249 approach to Stockbury roundabout onto the M2 north westbound. This will reduce congestion at the roundabout and reduce the likelihood of rear shunt collisions.
- Realigning Maidstone Road to remove the minor arm of the roundabout located between the A249 and the M2 will reduce driver confusion and side impact collisions.
- Increasing the size of the Stockbury roundabout will increase the capacity on the circulatory and improve traffic flow and reduce the incidences of queuing.

14.1.17 Details of the safety performance of each option in terms of collision savings is provided in the Economic Assessment Report, dated October 2016, which reports on the COBALT assessment undertaken. A summary in terms of monetised savings is included in Section 13.2 above.

14.2 Impact during construction and operation – Construction (Design and Management) Regulations 2015

During Construction

- 14.2.1 The objective of the CDM 2015 regulations is to ensure the systematic management of projects from conception through to completion with hazards identified and eliminated where possible and where remaining, reduced and controlled.
- 14.2.2 The following measures will need to be considered to ensure a robust management of all hazards during construction including:
- Use of speed enforcement to protect the workforce and road user during periods of temporary traffic management.
 - Use of narrow lanes to ensure that sufficient working space is available to enable works to be constructed safely and to provide sufficient through traffic capacity (maintaining two lanes during peak traffic periods).
 - Use of temporary vehicle restraint systems to prevent incursions into the works area by errant vehicles providing protection to the construction work force.
 - Work to be undertaken at night when additional space is required and the A249 and M2 reduced to a single traffic lane or closed to generate adequate safe working areas.
- 14.2.3 Construction of major structures off line away from the existing road reduced the exposure to risk for both road users and road workers. There is significantly reduced impact on road users as the works can be undertaken without significant lane and road closures. The reduced traffic management reduces the risk exposure of both the construction worker and the traffic management operative.
- 14.2.4 Offline construction will enable greater working space to be provided significantly reducing the road worker risk of working in tightly constrained site where space is limited and haulage vehicle movements very restricted.

During Operations

- 14.2.5 The options being considered in this Technical Appraisal Report will have the same operations and maintenance requirements as would be expected by a 2 lane dual carriageway motorway or all-purpose trunk road and as currently experienced on the existing road layout. The provision of the following (in addition to the measures outlined in Section 8 Maintenance and Repair Statement) would enable the operations and maintenance requirements to be optimised:
- Existing formal access arrangements to the current roundabout to be replicated for the new roundabout, dependent on the option carried forward.
 - Existing access arrangements to the verges and central reservations are to be maintained or relocated dependent on the option carried forward.

- Existing access arrangements to the footways and bridlepaths are to be maintained or improved dependent on the option carried forward.
- New access arrangements will need to be developed for the new structures.

14.2.6 Off network access is to be considered to enable assets to be maintained reducing the need to implement TTM. The reduction in the amount of TTM required has a significant impact on reducing road worker risk exposure.

15 Operational Assessment

15.1 Road Characteristics and Option Design Implications

15.1.1 The Operational Assessment outlines the road characteristics and option design implications for the;

- Scheme's operating regime; and,
- Driver Compliance

15.2 Scheme's Operating Regime

15.2.1 The existing operational regime has been outlined in Section 8 Maintenance and Repair Statement. The proposed improvement will operate in a very similar manner to the existing regime.

15.2.2 All options propose an increased junction capacity with increased slip road width and enlarged circulatory areas. The provision of the additional traffic lanes and circulatory areas will result in less risk of flow breakdown due to congestion and vehicle stoppages (breakdowns and collisions) in live lanes. It will also reduce the impact of stoppages as the additional road capacity will usually enable two lanes of traffic to pass such vehicles.

15.2.3 The Traffic Officer Service does not operate along the A249 though does operate along the M2, slip roads and in this instance, Stockbury Roundabout. It is not currently envisaged that the scheme proposals will impact on the resource needs of the Traffic Officer Service or the Regional Control Centre as the service provided will continue as existing. The deployment of additional technology in the form of MIDAS and queue protection will be considered as part of the next design stage together with the impact on the Regional Control Centre resource requirements to operate the new systems.

15.2.4 The provision of additional carriageway and junction capacity will impact on winter maintenance services in that the increased road area will require additional quantities of salt for precautionary treatments. This will not require additional winter maintenance vehicles as a single gritter can adequately treat up to four lanes in a single pass though the amount of salt used will increase. This may impact on the winter maintenance depot's requirements to store the additional salt required. Additional depot requirements due to this improvement scheme have not yet been confirmed.

15.2.5 Methods of snow clearance will also be affected by the provision of the additional carriageway. Snow clearance currently involves moving snow both to the verge and to the central reserve. The provision of the additional traffic lane and possibly rigid concrete barrier in the central reserve will require changes to the method of clearance.

15.2.6 A possible modification might be to have snow ploughs operating in echelon with snow in lane 1 being moved to the verge and snow in lanes 2 and 3 being moved to the central reserve sacrificing lane 3 if necessary. This method accords with the MSP proposals for snow ploughing of 4 lane All Lanes Running Schemes (ALR) where there are similarity of features such as narrow hard strip and the provision of concrete barrier in the central reserve.

It is likely that additional snow ploughs will be required to enable this echelon ploughing as this is not normally undertaken on two lane carriageways, if conditions require additional resource then reserve equipment would be brought into operation.

15.3 Driver Compliance

- 15.3.1 The existing roads are operated at the national speed limit. It is proposed that the improvement scheme options would also operate with this speed limit. This speed limit is warranted by the alignment and slip road weaving lengths and the need to be compatible with the existing speed limits. It is recognised that the proposed options (as per the existing road) with a standard rural cross section and standard lane widths may create a tendency for increased vehicle speeds during low traffic periods. However, this situation would appear to be similar to the existing situation. It is not anticipated that any additional speed enforcement measures will be required.
- 15.3.2 All slip roads will be adequately signed to ensure appropriate driver behaviour at slip roads.

16 Technology Assessment

16.1 Existing ITS systems

16.1.1 The Technology Assessment outlines the option design implications for the utilisation of technology in terms of;

- ITS Systems
- RCC Systems and Sub-systems
- Communication Network

16.1.2 Section 17.2 describes the possible changes to the maintenance and repair strategy as a result of this scheme.

Option design Implications on Existing Technology

16.1.3 The ITS equipment currently identified at this location include the following:

- Traffic signal equipment
- Full PTZ high mast camera
- Communications equipment (including MIDAS loops)
- Communication station and weathering monitoring (on the M2)

16.1.4 The existing FPTZ camera and communications equipment will be retained within the scheme for continued traffic monitoring. The following equipment will be considered for inclusion in the next stage:

16.1.5 Signal Control - to operate safely and efficiently traffic signal controlled junctions should operate under Vehicle Actuated (VA) control to accommodate traffic and pedestrians / cyclists. This is considered the minimum ITS requirement, but Highways England guidance states that traffic signals should utilise either local MOVA control (Microprocessor Optimised Vehicle Actuation) or centralised SCOOT (Split Cycletime Offset Optimisation Technique) control on their network, in preference to vehicle actuated or fixed time signals.

16.1.6 Closed Circuit Television (CCTV) – the existing CCTV station should be retained, and if possible CCTV should be installed on the other parts of the junction, for example on the approaches to the junction from the M2, to allow a degree of operational monitoring. As a minimum, static fixed lens cameras could be used to monitor the main approaches. If the traffic signals are MOVA controlled, it will not be possible to adjust the traffic signal timings remotely. However, alternative data sets can be triggered to deal with specific traffic situations eg diversions such as Operation Stack. Ideally, full monitoring of all approaches would be required. CCTV communications in this situation should be via fibre-optic or ASDL fixed line. This will need to be reviewed during the later design stages.

- 16.1.7 Red Light Cameras – these should only be installed where there is a proven need on safety grounds. There are currently no red light cameras installed and this will need to be reviewed during the later design stages.
- 16.1.8 Communications – dial up communications (PSTN) are adequate for the VA or MOVA traffic signals. However as CCTV is already present either 3/4G mobile communications or an ADSL would be better.

17 Drainage Assessment

17.1 Proposed drainage strategy

- 17.1.1 The proposed junction upgrades represent an increase in the impermeable footprint of the existing highway, which will create greater amounts of surface water runoff compared to current situation. The proposed surface water drainage strategy will seek to replicate the site's existing hydrology through SUDS principles.
- 17.1.2 The drainage design will be undertaken in accordance with the following design standards and guidance:
- DMRB HD 33/06 – Surface and sub-surface drainage systems for highways
 - DMRB HD 45/09 – Road drainage and the water environment
 - DMRB HA 39/98 – Edge of pavement details
 - Ciria C753 SuDS Manual
 - BRE Digest 365 – Soakaway design
- 17.1.3 The following assumptions have been used in the development of the preliminary drainage design:
- Carriageway camber – the highway alignment is not yet fully developed to show the camber of the carriageway. It is assumed that the crossfall of carriageway is balanced except for at sharp radius bends where super elevation may be applied,
 - The design rainfall has been increased by a 20% allowance for climate change,
 - A 10 year return period has been used for soakaway design in accordance with BRE365,
 - A typical soil infiltration rate of 1×10^{-5} m/sec has been assumed for the local chalk ground conditions,
 - Soakaways are filled with granular material having 30% free volume.
- 17.1.4 The drainage strategy for catchments outside of SPZ1 is to collect the highway runoff through gullies which feed into a positive pipe network leading to by-pass oil separators. These will outfall to soakaway ponds and ditches. Calculations have been carried out for each option to estimate the size of interceptors and soakaway capacity required (Tables 17.1 – 17.3). These values are to be taken as guidelines only and will be further value-engineered during the progression of the design (for example oil separators may not be required outside of SPZ3).
- 17.1.5 Within SPZ1, the proposed strategy is to tie into the existing drainage systems of the A249 and Maidstone Road. It is recommended to discuss the concept proposal with the Environment Agency, demonstrating that although there is an increase in the impermeable area, there is existing highway land

use through this zone. A risk assessment may be undertaken to establish that this would represent no or minimal risk to the groundwater.

- 17.1.6 The drainage strategy for each option is illustrated in drawings HE551521-WSP-HGB-M2J5-DR-D-0302 to 0304, included in **Appendix D**.

Table 17.1 Drainage Strategy for Option 4

Catchment	A249 SW	A249 SE	A249 NW	A249 NE	M2 SW slip	Rbt NW slip	M2 SE slip + Rbt NE slip	M2 SE slip + Rbt island	Rbt SE slip	Maidstone Rd
Impervious Area (m2)	8,185	8,133	17,560	15,555	15,875	3,449	11,303	11,752	3,495	4,852
Outfall location	584955, 161532	584975, 161543	586036, 162997	586054, 162968	585321, 162134	585478, 162259	585609, 162292	585469, 162011	585394, 161979	585886, 162597
SPZ	None	None	SPZ1	SPZ1	None	SPZ2	SPZ2	SPZ2	SPZ3	SPZ1
Outfall	Soakaway	Soakaway	Existing A249 drainage network	Existing A249 drainage network	Soakaway	Soakaway	Soakaway	Soakaway	Soakaway	Existing drainage network
Inflow (Critical storm) (m3)	297	295	761	674	688	125	490	509	127	176
Oil interceptor min. nominal size (NSB)	14.7	14.6	31.6	28.0	28.6	6.2	20.3	21.2	6.3	8.7
Indicative dimensions (LxD) (m)	4.23 x 1.23	4.23 x 1.23	7.06 x 1.88	5.07 x 1.88	5.07 x 1.88	2.26 x 1.23	4.42 x 1.88	4.42 x 1.88	2.26 x 1.23	2.92 x 1.23
Indicative soakaway length (1m wide, 2m deep)	400	400	-	-	750	170	550	550	170	-

Table 17.2 Drainage Strategy for Option 8

Catchment	A249 SW	A249 SE	A249 NW	A249 NE	M2 SW slip	Rbts W link	Rbts E link	A249 SB to M2 WB	M2 WB on-slip	M2 WB off-slip
Impervious Area (m2)	13,974	12,893	14,098	10,501	11,178	2,544	2,487	3,807	5,319	6,505
Outfall location	585539, 162239	585579, 162316	586009, 162982	586033, 162956	585491, 162311	585525, 162321	585540, 162230	585633, 162306	585571, 162049	585569, 162014
SPZ	SPZ2	SPZ2	SPZ1	SPZ1	None	SPZ2	SPZ2	SPZ2	SPZ2	SPZ2
Outfall	Soakaway	Soakaway	Existing A249 drainage network	Existing A249 drainage network	Soakaway	Soakaway	Soakaway	Soakaway	Soakaway	Soakaway
Inflow (Critical storm) (m3)	606	559	611	455	484	92	90	138	193	236
Oil interceptor min. nominal size (NSB)	25.2	23.2	25.4	18.9	20.1	4.6	4.5	6.39	9.6	11.7
Indicative dim. (LxD) (m)	4.42 x 1.88	4.42 x 1.88	4.42 x 1.88	3.54 x 1.88	3.54 x 1.88	2.11 x 1.23	2.11 x 1.23	2.26 x 1.23	2.92 x 1.23	2.45 x 1.23
Indicative soakaway length (1m wide, 2m deep)	670	620	-	-	540	125	125	185	260	320

Table 17.3 Drainage Strategy for Option 8 (Continued)

Catchment	M2 WB to A249 SB	A249 NB to M2 EB	Stockbury rbt	Intermediate rbt	Maidstone Rd
Impervious Area (m2)	5,504	5,493	5302	4064	4,474
Outfall location	585122, 161689	585252, 161940	585391, 162024	585618, 162372	585832, 162498
SPZ	None	None	SPZ3	SPZ2	SPZ1
Outfall	Soakaway	Soakaway	Soakaway	Soakaway	Existing drainage network
Inflow (Critical storm) (m3)	200	199	193	148	194
Oil interceptor min. nominal size (NSB)	9.9	9.9	9.5	7.3	8.1
Indicative dim. (LxD) (m)	2.92 x 1.23	2.92 x 1.23	2.92 x 1.23	2.26 x 1.23	2.26 x 1.23
Indicative soakaway length (1m wide, 2m deep)	270	270	260	200	-

Table 17.4 Drainage Strategy for Option 10

Catchment	SE Slip	Maidstone Rd	A249 SB (N)	A249 NB (S)	A249 SB (S)	NW slip + A249 NB (N)	SW slip	Rbt + M2 EB on-slip
Impervious Area (m2)	14,787	6,040	11,951	13,482	13,887	21,856	14,006	16,251
Outfall location	585318, 161906	585791, 162444	586102, 163015	585527, 162301	585539, 162257	586074, 163038	585300, 161963	585552, 162252
SPZ	none	SPZ1	SPZ1	SPZ2	SPZ2	SPZ1	SPZ2	SPZ2
Outfall	Soakaway	Existing drainage network	Existing A249 drainage network	Soakaway	Soakaway	Existing A249 drainage network	Soakaway	Soakaway
Inflow (Critical storm) (m3)	641	262	518	584	602	947	607	704
Oil interceptor min. nominal size (NSB)	26.6	10.9	21.5	24.3	25.0	39.3	25.2	29.3
Indicative dim. (LxD) (m)	5.07 x 1.88	2.92 x 1.23	4.42 x 1.88	4.42 x 1.88	4.42 x 1.88	7.06 x 1.88	4.42 x 1.88	5.07 x 1.88
Indicative soakaway length (1m wide, 2m deep)	700	-	-	650	670	-	670	780

18 Maintenance Assessment

18.1 Maintenance Assessment

18.1.1 The Maintenance Assessment outlines the design implications for the maintenance and repair of;

- Civil infrastructure; and,
- Road side technology

18.1.2 The integrated design team have experience with the current operation and maintenance strategies and the implications at this location. The MSP for this area of Highways England is currently under change of management and a meeting will be arranged to confirm operation and maintenance strategies with the new MSP is in place as the scheme progresses through the PCF lifecycle.

18.2 Maintenance and Repair of Civil Infrastructure

18.2.1 The existing maintenance and repair regime has been outlined in Section 8 Maintenance and Repair Statement above. All the options propose to provide facilities and assets that are normally associated with these classes of roads and which are found on this existing stretch of the A249 and M2. The maintenance and operation of all aspects of the infrastructure will be familiar to the MSP who already maintains similar facilities in this region.

18.2.2 The maintenance needs are not anticipated to change though the design of the options will take the opportunity of making maintenance access easier and hence reduce the need for implementing TTM wherever possible. This will reduce the risk exposure of traffic management operatives and other road workers.

19 Environmental Assessment

19.1 Noise and Vibration

All options

- 19.1.1 During the construction phase, there is potential for noise impacts at the nearest residential properties and it is expected that this will be medium to high but of a temporary nature.
- 19.1.2 During the operational phase, Option 10 has the potential to result in a significant impact on residential properties in the long term (i.e. increase in noise levels of 3dB or higher). With this option, it is predicted that properties at Oad Street, north of the M2 are likely to experience an increase in noise levels resulting in a minor adverse impact. However, this option would also result in minor to moderate beneficial impacts on dwellings immediately south of Sittingbourne Road. Under Options 4 and 12, most sensitive receptors would experience either a negligible adverse impact or a minor to moderate beneficial impact.

19.2 Air Quality

All options

- 19.2.1 The construction works will take place at a distance greater than 50m from any sensitive receptors for all junction options. In addition, the existing concentrations of Particulate Matter (PM₁₀) at the location of the scheme are low with background concentrations at <20µg/m³, which keeps sensitivity to health impacts in the area low. Therefore, with the application of mitigation measures, no significant air quality effects are anticipated from any of the junction options during the construction phase.
- 19.2.2 The assessment of operational impacts on air quality considered the change in total traffic emissions resulting from the junction options, and the proximity of sensitive receptors to each junction option. During operation, emission rates generally decrease with increased speed/reduced congestion, however, once the congestion on a road clears, emission rates begin to increase with speed (i.e. from free flow to high speed congestion bands). Variation in road layout can affect pollutant concentration at specific receptors significantly, particularly where the receptor is in close proximity to the roadside.
- 19.2.3 Overall, there is a large reduction (up to 44% for total emissions) in total emissions with each junction option when compared to the 'Do Nothing' scenario. Option 4 results in the largest overall decrease in emissions for all periods.
- 19.2.4 The benefit seen (reduction in total emissions when compared to the 'Do Nothing' scenario) is greatest with Option 10. The reduction in total emissions is the lowest with Option 12 when compared to the other junction options.
- 19.2.5 Options 4 and 12 both result in a reduction in the number of properties within 50m of the road (four and two properties respectively). For both of these junction options, the properties removed from this band are in an area of

relatively poor air quality. For Option 4, the properties are removed from this band due to the realignment of the A249, a relatively major road within the study area, resulting in a potential reduction in risk of exceedance of the air quality objectives. For Option 12, however, this is caused by the removal of a small portion of Oad Street, whilst the proximity of the properties to the A249 is unchanged.

- 19.2.6 Option 4 also results in an additional property within the 150-200m banded region, due to the realignment of Oad Street. Since this property is in a relatively rural location, and since the flow on Oad Street is likely to be relatively low, this is unlikely to have a significant effect on air quality at this property.
- 19.2.7 Option 10 results in little change to the number of properties within any banded distance from the roads. However, the distance between the properties in the southwest (region of relatively poor air quality) and the A249 increases, which results in a potential reduction in risk of exceedance of the air quality objectives.
- 19.2.8 All options result in an overall benefit to air quality during the operational phase. Of the assessed options, Option 4 results in the greatest benefit to air quality, with the greatest reduction in overall mass of generated emissions, and the proximity of human receptors to the scheme links as well as potentially reducing in the risk of exceeding the air quality objectives. Of the assessed junction options, Option 12 results in the smallest overall benefit to air quality.

19.3 Greenhouse gases

All options

- 19.3.1 Greenhouse gas (GHG) emissions are altered when the flow of traffic is changed in terms of speed and/or volume. Increased speeds and stop/start traffic would have an adverse effect on emissions due to vehicles operating at a lower fuel efficiency. Conversely, a reduction in queuing vehicles would have an overall beneficial impact on GHG emissions as vehicles are operating at higher levels of efficiency.
- 19.3.2 A primary objective of the scheme is to decrease the queuing at the junction which would increase the capacity of the road and improve traffic flow during busy periods. Reduced queuing would have an overall beneficial impact on GHG emissions.
- 19.3.3 The improvements to congestion are likely to attract additional vehicles to the network (induced traffic), which may increase emissions overall. However this will potentially provide benefits in other areas where traffic flows may reduce.
- 19.3.4 The overall impacts of all options will be dependent on the combination of changes to flow, vehicle speeds and impacts on surrounding links. To assess the potential impact on carbon, traffic data from a spatially detailed transport model will be required. This will be undertaken at the next PCF stage. Any long term carbon modelling will consider the potential benefits of improvements to vehicle efficiencies.

19.4 Landscape

Option 4

- 19.4.1 The new structures, which would be located in the Kent Downs Area of Outstanding Natural Beauty (AONB), would result in a noticeable change to the overall scale and character of the junction. The field patterns would be disrupted due to acquisition of agricultural land to construct new slip roads and links. This would result in small areas of severed land that may not be suitable for agricultural use. This option would not be in keeping with the existing character of the immediate landscape and would introduce new noticeable features.
- 19.4.2 Option 4 would involve the loss of grass verges, scrub, trees and shrubs but these could be replaced and additional woodland planted to screen and integrate the new features within the landscape. The overall impact of this option on the landscape resource is considered to be slight adverse and not be significant. The impact would reduce to neutral by year 15 when mitigation planting had matured.
- 19.4.3 In terms of visual effects, the removal of mature highway plantations to accommodate the realigned A249 and new A249/M2 link roads would open up views of the new junction and traffic to nearby residential properties and Public Rights of Ways (PRoWs).
- 19.4.4 There would be a noticeable deterioration in views from nearby residential receptors at Whipstakes Farm and residential properties near the A249 to the north of Borden Hill and Stockbury. The scheme would include new noticeable elements that would be readily apparent to the receptor. The visual effect either without landscape mitigation or at year 1 after planting is likely to be a moderate adverse effect and significant. With mitigation, visual effects would reduce to slight adverse and not significant at year 15 when the planting had achieved its design objectives.

Option 10

- 19.4.5 This option would have a smaller footprint than the existing junction, particularly on the southern side of the M2 where the Stockbury Roundabout would be removed from the Kent Downs AONB. Following the removal of slip roads and the Stockbury Roundabout from the Kent Downs AONB, areas of land may be released that could be used to plant vegetation to increase integration of the junction. The new retaining walls and gyratory would produce a network of new built features that could have an urbanising effect unless they are designed to integrate with the surrounding rural landscape.
- 19.4.6 The field pattern would be disrupted on the south eastern side of the junction where agricultural land would be required for the new Maidstone Road to Oad Street link. This would result in small areas of severed land that may not be suitable for agricultural use. The full magnitude of impact on the landscape resource would depend on how the existing Stockbury Roundabout was reinstated and the extent of highway vegetation retained. Assuming the land would remain within the highway estate and be reinstated for landscape and ecological enhancement, the overall landscape impact is expected to be a slight adverse effect.

19.4.7 This option would cause limited deterioration to views from nearby high sensitivity residential and recreational receptors. The junction would be a noticeable feature of the view that would be readily apparent to the receptor, although similar to existing elements. New planting adjacent to the proposed gyratory areas would reduce but not screen visual impacts by year 15. Landscape and visual integration could be achieved more effectively if the new structures reflected the design and construction of the adjacent Stockbury Viaduct. The visual effect is likely to be moderate adverse effect and significant at year 1, reducing to slight adverse and not significant at year 15 with mitigation, when the planting would have achieved its design objectives.

Option 12

19.4.8 Under Option 12, there would be a minor increase in the overall scale of the junction which would have a slight adverse impact on the Kent Downs AONB. The field pattern would be disrupted in areas where agricultural land would be required for the new M2/A249 northbound link, and Maidstone Road to Oad Street link. This would result in small areas of severed land that may not be suitable for agricultural use.

19.4.9 Grassland, scrub and woodland would be lost from the footprint of the new junction, which with time, could be replaced with new planting and seeding within the highway boundary.

19.4.10 This option would include noticeable new features, however, these would comprise elements very similar to those already present at the junction. At operation the overall significance of landscape effect on the landscape resource from Option 12 and the impact on high sensitivity landscape receptors either without landscape mitigation or immediately after planting would be a slight adverse localised effect reducing to neutral at year 15 when mitigation planting had matured.

19.4.11 Removal of mature highway plantations to accommodate the new A249/M2 link roads would open up views of the new junction and traffic to nearby residential properties and PRoWs.

19.4.12 There would be a slight deterioration in views from nearby residential receptors at Whipstakes Farm and residential properties near the A249 to the north of Borden Hill and Stockbury. This option would include new elements that would be apparent to the receptor. The visual effect either without landscape mitigation or at year 1 after planting is likely to be a slight adverse effect. With mitigation, visual effects would reduce to neutral at year 15 when the planting had achieved its design objectives.

19.5 Heritage and historic resources

All options

19.5.1 All the junction options would require land-take across areas of previously undisturbed ground. The geophysical and archaeological walkover surveys have confirmed the presence of archaeological remains of features associated with the Chatham Land Front First World War (WWI) defences. Any ground disturbance will adversely impact on these features. The junction

options extend through the site of crenelated fire trenches and associated gun emplacements. The degree of preservation and full extent of the defences is unknown and will require investigation. However, if any remains associated with this asset are identified through archaeological investigation it is likely that preservation in situ will be required. Therefore, all options are expected to have a large to very large adverse permanent effect on the Chatham Land Front WWI Defences, which could be reduced to neutral following avoidance and appropriate mitigation.

- 19.5.2 There is also the potential for the construction work to uncover hitherto unknown archaeological remains associated with historical periods ranging from Prehistoric to the Modern period. All options are expected to have a moderate to large adverse effect on other unknown buried archaeological remains. This would reduce to neutral following appropriate archaeological investigation.
- 19.5.3 All three options have the potential to have a slight adverse impact on the setting of Stockbury Castle, the Grade I Listed St. Mary Magdalene's Church, the Grade II Listed Church Farmhouse and Church Farm Cottage, three Grade II Listed headstones and one Grade II Listed tomb. Options 4 and 12 are considered likely to have a moderate to large adverse impact (significant) upon the WWI Chatham Land Front landscape due to the interruption of a key view southwards. Option 10 is considered to have slight to moderate impact upon the WWI landscape due to the increase in noise pollutants in the vicinity of the WWI pill box.

19.6 Biodiversity

Options 4 and 12

- 19.6.1 Options 4 and 12 may have some adverse effects on habitat and protected and notable species including the loss of species poor defunct hedgerow, and potential impacts on bats and dormice, although further species surveys will be required to determine the potential for significant effects.
- 19.6.2 Option 4 and Option 12 would not result in the direct loss of ancient woodland. However, construction works could potentially result in indirect adverse impacts on ancient woodland as a result of deterioration in air quality from dust deposition and root compaction. Option 4 and Option 12 both propose land take along Oad Street in close proximity (but not within) Chestnut Wood. The footprint of Option 4 is located approximately 20m from Chestnut Wood at its closest point, and for Option 12 is approximately 10m. The conservation status of ancient woodland is dependent on maintaining, amongst other things, its extent and species composition and connectivity to similar habitat. As ancient woodland cannot be fully recreated, the degradation of ancient woodland flora and trees as a result of deterioration in air quality (associated with Option 4 and 12), are likely to result in a permanent adverse effect that is significant at up to the County level.
- 19.6.3 There is the potential for changes in air quality to affect Queendown Warren Special Area of Conservation (SAC) during the operational phase, and this will be assessed further once appropriate traffic modelling is available. It should be noted, however, that significant effects on this designated site are considered unlikely.

Option 10

- 19.6.1 Option 10 may have some adverse effects on habitat and protected and notable species including the direct loss of semi-natural broad-leaved woodland, the loss of species poor defunct hedgerow, and potential impacts on invertebrates, bats and dormice, although further species surveys will be required to determine the potential for significant effects.
- 19.6.2 Option 10 would likely result in the permanent loss of ancient woodland in the northeast of Church Wood, immediately south of the M2 carriageway. The extent of loss cannot be precisely quantified until detailed scheme design information is available but it is likely to be approximately 0.3ha (just under 5% of Church Wood's area). In addition, construction works could potentially result in indirect adverse impacts on ancient woodland as a result of deterioration in air quality from dust deposition and root compaction. The footprint of Option 10 is located inside the north east part of Church Wood and thus will be directly adjacent to retained parts of Church Wood.
- 19.6.3 The conservation status of ancient woodland is dependent on maintaining, amongst other things, its extent and species composition and connectivity to similar habitat. As ancient woodland cannot be fully recreated, both the permanent loss of ancient woodland habitat from Church Wood, and degradation of ancient woodland flora and trees as a result of deterioration in air quality, are likely to result in a permanent adverse effect that is significant at up to the County level.
- 19.6.4 There is the potential for changes in air quality to affect Queendown Warren SAC during the operational phase, and this will be assessed further once appropriate traffic modelling is available. It should be noted, however, that significant effects on this designated site are considered unlikely.

19.7 Geology and Soils

All Options

- 19.7.1 With no geological Sites of Special Scientific Interest or Regionally Important Geological Sites within the study area, there will be no change to these geological and geomorphological attributes and therefore effects from all junction options are considered to be neutral during both construction and operation.
- 19.7.2 All options will require less than 20ha of land take from outside the existing highway. Therefore, the magnitude of impact to soils is expected to be negligible adverse during construction, with no change during operation. The significance of effect of all the junction option on soils is therefore expected to be slight adverse during the construction phase and neutral during the operational phase.
- 19.7.3 There is the potential for the creation of new migratory pathways for contaminants during construction. Although intrusive ground investigation works are yet to be undertaken, the Preliminary Risk Assessment (PRA) undertaken for the scheme indicates the study area is unlikely to contain significant sources of contaminative substances. Therefore the creation of migratory pathways is unlikely to lead to a viable pollutant linkage. Therefore,

no change to groundwater or surface water is expected and the effect of the junction options is considered to be neutral in both the construction and operational phases.

- 19.7.4 Chemicals that are destructive to concrete (e.g. sulphates and acids) have the potential to constrain the design of the junction options. However, it is assumed that laboratory data will be available at the detailed design stage to characterise the concentrations of these substances in soil and groundwater and that suitable construction materials resistant to any such substances will be used. In addition, the potential for the existence of cavities or dissolution features in the chalk bedrock may also constrain the junction options. A detailed ground investigation will be undertaken to confirm the absence of voids later in the design stages. On this basis, no change to the built environment is expected and therefore the effect of the junction options on the built environment will be neutral in both the construction and operational phases.
- 19.7.5 Potential impacts to human health during construction, arising from possible oral, inhalation, or dermal exposure to substances in shallow soils, will be mitigated by adherence to best practice and guidance.
- 19.7.6 The Preliminary Risk Assessment undertaken for the scheme indicates the study area is unlikely to contain significant contamination sources. Therefore, no exposure pathways relevant to end users in the operational phase are expected. No change to construction workers and end users is expected and therefore the effect of the junction options on construction workers and end users is considered to be neutral in both the construction and operational phases.

19.8 Water Environment

Option 4

- 19.8.1 Option 4 is likely to have a slight adverse impact on surface water quality during construction, due to the potential requirement to divert or realign a water course. In addition, this option may reduce the existing fluvial floodplain area and increase the risk of flooding in and surrounding the scheme area which will have a slight adverse impact on flood risk. A moderate adverse impact is considered likely on groundwater resources due to the deep excavations required under this junction option. Appropriate pollution prevention measures will therefore be required during the construction and operational phase.

Option 10

- 19.8.2 Option 10 has the potential to impact the quality of surface water and groundwater resources. The greatest risk to the quality of groundwater resources is in the area located close to Inner Zone of the groundwater Source Protection Zone (SPZ), and associated with deep excavations/foundations. The impact on groundwater is considered to be a moderate adverse impact. Appropriate pollution prevention measures will therefore be required during the construction and operational phase.

19.8.3 Option 10 is also likely to have a slight adverse impact on surface water quality during construction, due to the potential requirement to divert or realign a water course. In addition, the loss of fluvial floodplain may have a slight adverse impact on flood risk.

19.8.4 A large adverse impact is expected for road users due to the increased risk of surface water flooding for areas of new road that will be located in cutting.

Option 12

19.8.5 Option 12 is likely to have a slight adverse impact on surface water and ground water quality during construction, due to the potential requirement to divert or realign a water course and the location of works within the groundwater SPZ. In addition, the loss of fluvial floodplain may have a slight adverse impact on flood risk.

19.9 People and communities

All Options

Effects on All Travellers

19.9.1 All three options may temporarily increase driver stress as a result of construction works and associated construction traffic. Once operational, it is expected that traffic flows will be improved and congestion will be reduced locally, and may thereby decrease driver stress currently experienced by motorised travellers.

19.9.2 All of the options have the potential to impact views from the road through the removal of trees, verges and other screening as a result of the widening of existing highways and the creation of new carriageways. This is likely to result in the opening up of views, in turn having a beneficial impact on user's experience of the junction. However, mitigation screening planting is likely to result in a neutral impact on driver views once it becomes established. The overall impact on motorised travellers is expected to be of moderate beneficial magnitude and moderate significance for Option 10 and minor beneficial magnitude and slight beneficial significance for Options 4 and 12 during the operational phase.

19.9.3 Non-Motorised Users (NMU) amenity has the potential to be affected by disruptions to PRow within the study area. All of the junction options are likely to require the temporary closure and permanent diversion of a number of footpaths in the area which is likely to impact NMU amenity and journey time. For all junction options the PRow's likely to be impacted include the footpath adjacent to Stockbury roundabout, the footbridge crossing the M2 west of the junction, and the footpath that runs adjacent to the A249 north of the junction leading to Danaway. If these PRow's cannot be incorporated into, or improved through the option design, adequate mitigation measures will be required.

Effects on Communities

19.9.4 All three options have limited potential to sever communities. The junction is expected to provide a vital access route to larger settlements for a number of small towns and villages in the area. All the options introduce new local link

roads that are expected to increase local accessibility to the strategic road network. Any loss of access will be mitigated appropriately through effective diversions and construction regimes. It is anticipated that the level of severance experienced by communities for all options would be of neutral significance.

19.9.5 None of the options require the demolition of any private property and will not result in the loss of community assets or any land previously identified for future development.

19.9.6 All the options are likely to result in the loss of Grade 2 and Grade 3 Agricultural Land. However, the amount of land take from agricultural land is relatively small, not requiring formal consultation with Natural England (as the amount is under the 20ha threshold for all options). This is considered likely to result in a slight adverse effect.

Effects on People

19.9.7 All the options are expected to provide a beneficial impact on commuter journeys and access across Swale District through more reliable journey times. This increased level of access also has the potential to provide economic benefits in the district. Furthermore the junction options do not result in land take from any strategically allocated employment land. This is likely to result in a beneficial impact of moderate significance.

19.9.8 Previously, an Equality Impact Assessment screening activity was conducted for the scheme and determined that the construction and operational phases of the scheme have the potential to impact certain vulnerable groups, in particular the elderly, the young and the pregnant. The options have the potential to result in the temporary closure or relocation of bus stops south of Stockbury Roundabout to allow the construction works to be conducted, which may adversely impact the elderly and the young who use public transport regularly. Appropriate mitigation will be implemented in order to limit the negative impact on these vulnerable groups. With appropriate mitigation in place, the significance of this impact is considered likely to be neutral.

19.9.9 Increased traffic flows through the junction have the potential to have beneficial air quality impacts, which has the potential to provide related health benefits. Furthermore any improvements to existing, or addition of new, PRowS has the potential to have positive impacts on health through the improvement of walking and cycling infrastructure in the area. Overall, the impacts on health and well-being from Option 4 are considered to be neutral.

20 Assessment Summary

20.1 Appraisal Summary Tables (ASTs)

20.1.1 Please refer to **Appendix B**

21 Programme

21.1 Scheme Level Programme

21.1.1 The project programme shows key dates for the scheme as shown in Table 21.1 below.

Table 21.1 Key Programme Dates

Milestone	PCF ² Stage	Date
Recommendation of options to be taken forward to Public Consultation	1	Nov 2016
SGAR3 1	1	Nov 2016
Public Consultation Exhibition	2	Spring 2017
SGAR 2	2	Autumn/Winter 2017
Preferred Option Announcement	2	Winter 2017
SGAR 3	3	Winter 2017/18
SGAR 4	4	Autumn 2020
SGAR 5	5	Winter 2020/21
Commence Construction Phase	6	Winter 2020/21
Open for Traffic	7	Spring/Summer 2022

21.1.2 The anticipated construction period is 18 months for Option 4 and Option 10, whilst Option 12 is anticipated to be 12 months.

² PCF- Project Control Framework

³ SGAR - Stage Gate Assessment Review

22 Conclusion and Recommendations

22.1 Options for Public Consultation

22.1.1 The three PCF Stage 1 options (4, 10, 12) presented in this report have been assessed under the following headings:

- Brief summary description of each option
- Environmental Impact
- Buildability and Programme
- Compatibility with Key Design Considerations
- Option Cost
- BCR and VfM

Brief summary description of each option

22.1.2 Option 4 – Main design elements:

- Existing roundabout replaced with a new grade-separated interchange, with free flowing movement provided on the A249 under the junction. Additional free-flow links are included for the A249 westbound to M2 northbound, A249 eastbound to M2 coast-bound, and M2 coast-bound to A249 eastbound movements. The M2 eastbound to A249 northbound free-flow link avoids the roundabout. Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided to the Stockbury interchange.

22.1.3 Option 10 – Main design elements:

- Existing roundabout replaced with a traditional three-tier grade separated interchange. Partially signalised interchange
- Dedicated A249 through link at the lower- level, with the interchange at the mid-level, and M2 as existing at the top-level
- Additional free-flow links serving the M2 coast-bound to A249 eastbound, M2 westbound to A249 westbound and A249 eastbound to M2 northbound movements
- Link road created between Oad Street, Maidstone Road and the interchange. In enable local road access

22.1.4 Option 12 – Main design elements:

- Existing roundabout on the A249 retained; no realignment of the A249
- Existing slip roads retained but a two lane diverge from the M2 coast-bound and a free-flow lane from the M2 to A249 north-bound created

- Free-flow lane from the A249 westbound to the M2 London-bound merge slip road added
- Link road created between Maidstone Road and Oad Street. Connection of Maidstone road to roundabout removed, with access to A249 provided via link road and Oad Street.

Environmental Impact

- 22.1.5 Chapter 19 of this report summarises the finding of the Environmental Study Report, which considered the environmental effects of each scheme option. Please note that these findings are not definitive, and will be subject to review as more detailed, quantitative assessments are undertaken in future PCF stages. This may change the potential effects – and their significance – identified throughout this document.
- 22.1.6 Table 22.1 summarises the potential effects associated with each option during the operational phase. It uses the seven point scale from WebTAG and assumes normal mitigation measures. Where several different effects arise from a DMRB topic, or the receptors are affected to a differing degree, the score in Table 22.1 presents the most significant associated with that topic.

Table 22.1 Potential Environmental Effects

DMRB Topic	Option 4	Option 10	Option 12
Air Quality	Beneficial	Slight Beneficial	Slight Beneficial
Cultural Heritage	Adverse	Slight Adverse	Adverse
Landscape	Slight Adverse	Slight Adverse	Neutral
Nature Conservation	Adverse	Large Adverse	Adverse
Geology and Soils	Neutral	Neutral	Neutral
Materials	Adverse	Slight Adverse	Adverse
Noise and Vibration	Neutral	Slight Adverse	Neutral
People and Communities	Slight Adverse	Slight Adverse	Slight Adverse
Road Drainage and Water Environment	Slight Adverse	Large Adverse	Slight Adverse

- 22.1.7 The table shows that all three options are likely to have a positive impact on air quality, a neutral impact to geology and soil, and an negative impact on cultural heritage, materials, people and communities, and road drainage and water environment.

Buildability and Programme

- 22.1.8 It is currently anticipated that Options 4 and 10 could be constructed within an 18 month period, whilst Option 12 could be constructed within 12 months.
- 22.1.9 In terms of buildability, none of the scheme options considered would be expected to have any impact on the M2 viaduct. The structural elements of the viaduct, including its piers and foundations, will therefore remain intact.
- 22.1.10 The construction of the free-flow left turn lanes may require the construction of retaining features. This would require further detailed investigation in subsequent PCF Stages.
- 22.1.11 For all options the existing M2 pedestrian overbridge would need to be replaced in order to accommodate the revised slip road arrangements. Additionally, for Option 10 the existing Oad Street bridge over the M2 would need to be replaced, again in order to accommodate the revised slip road arrangements.
- 22.1.12 All options propose to maintain the NMU routes and facilities.
- 22.1.13 Additional land take will be required for all options to accommodate the revised junction and associated slip road layouts.

Compatibility with Key Design Considerations

- 22.1.14 Both Options 4 and 10 are considered to be compatible with the key design considerations set out within the Client Scheme Requirements. However, for Option 12, it fails to meet the full scheme objectives and is clear that it provides limited capacity increases, failing to cater for forecast demand.

Option Costs

Table 22.2 Expected Option Cost Expressed in 2014 Prices

Option	Total Scheme Cost (£)
Option 4	80,735,518
Option 10	88,564,144
Option 12	46,308,222

BCR and VfM

- 22.1.15 Table 22.3 summarises the BCR and the corresponding VfM category for each option. The stated VfM is based on definition set out within WebTAG guidance, as follows:
- Poor VfM if BCR is less than 1.0
 - Low VfM if BCR is between 1.0 and 1.5
 - Medium VfM if BCR is between 1.5 and 2.0
 - High VfM if BCR is between 2.0 and 4.0

- Very high VfM if BCR is greater than 4.0

Table 22.3 Summary Comparison of BCR and VfM Assessments

Option	BCR, with benefits from accident savings applied	VfM Category
Option 4	14*	Very high
Option 10	14*	Very high
Option 12	24*	Very high

22.1.16 Extreme caution should be applied when using the BCR value. As outlined below and in further detail within this report the value is likely to be an overestimation, especially Option 12, due to issues with latent demand.

22.2 Options to be taken forward

22.2.1 Whilst Option 8 has remained part of the assessment within the TAR for completeness and comparison with other options during PCF Stage 1, it has been concluded that this option should not be taken any further forward due to the aforementioned complexities and affordability issues.

22.2.2 It is recommended that Options 4, 10 and 12 are taken forward for further development within PCF Stage 2, having all achieved a “Very High” VfM category, albeit with the aforementioned caveats. The economic analysis supporting this outcome will be continuously refined during subsequent PCF Stages to give Highways England and stakeholders a continued confidence in the economic justification for the scheme, particularly following the development of a strategic transport model during PCF Stage 2.

22.3 Preferred solution

22.3.1 It is considered that Option 4 and Option 10 provide the greatest capacity improvements compared with Option 12, and therefore fully meet the scheme objectives. However, they both exceed the revised scheme budget, whilst Option 12 is within the scheme budget but fails to meet the full scheme objectives.

22.3.2 Due to the varying degrees the options address the scheme objectives and comply with the scheme the budget it is not possible to confirm a preferred solution at this stage. Therefore, it is proposed that all three options are taken forward in to PCF Stage 2 for further assessment.

23 Detailed Cost Estimate

23.1 Option Cost Comparison

23.1.1 Table 23.1 below provides a summary of the detailed cost estimate for each option. The option estimates are provided by cost estimates consultants on working on behalf of Highways England.

23.1.2 Cost estimates for the scheme will be subject to change in future PCF Stages, when more detailed assessments and design developments are undertaken.

Table 23.1 Summary of Detailed Cost Estimate for Each Option

OPTION	BASE ESTIMATE	UNSCHEDULED ITEMS	UNCERTAINTY	RISK	PORTFOLIO RISK	INFLATION	SCHEME TOTAL
Option 4							
Min	33,203,564	1,390,877	94,481	871,074	4,351,668	14,070,539	63,887,069
Expected	45,222,177	2,086,316	565,099	9,065,509	6,132,882	17,663,535	80,735,518
Max	70,527,631	2,781,754	18,856,441	18,856,441	7,508,313	25,277,612	113,159,091
Option 10							
Min	37,348,255	1,534,443	-	978,560	4,664,110	15,687,915	71,351,363
Expected	49,554,716	2,301,664	396,760	10,187,281	6,557,192	19,566,531	88,564,144
Max	84,944,269	3,068,886	3,167,280	21,196,226	8,081,442	29,740,873	132,345,902
Option 12							
Min	17,600,189	827,748	125,061	522,756	2,449,300	7,446,194	35,401,535
Expected	25,812,521	1,241,621	670,492	5,440,590	3,500,379	9,642,619	46,308,222
Max	41,408,521	1,655,495	2,395,601	11,316,725	4,330,042	14,303,026	66,479,336

23.1.3 All figures shown in pounds, in 2014 prices.

24 Bibliography

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- WSP | Parsons Brinckerhoff (2015) M2 Junction 5 PCF Stage 0 Local Model Validation Report (LMVR) [Unpublished]
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- WSP | Parsons Brinckerhoff (2015) M2 Junction 5 PCF Stage 1 Environmental Study Report [Unpublished]

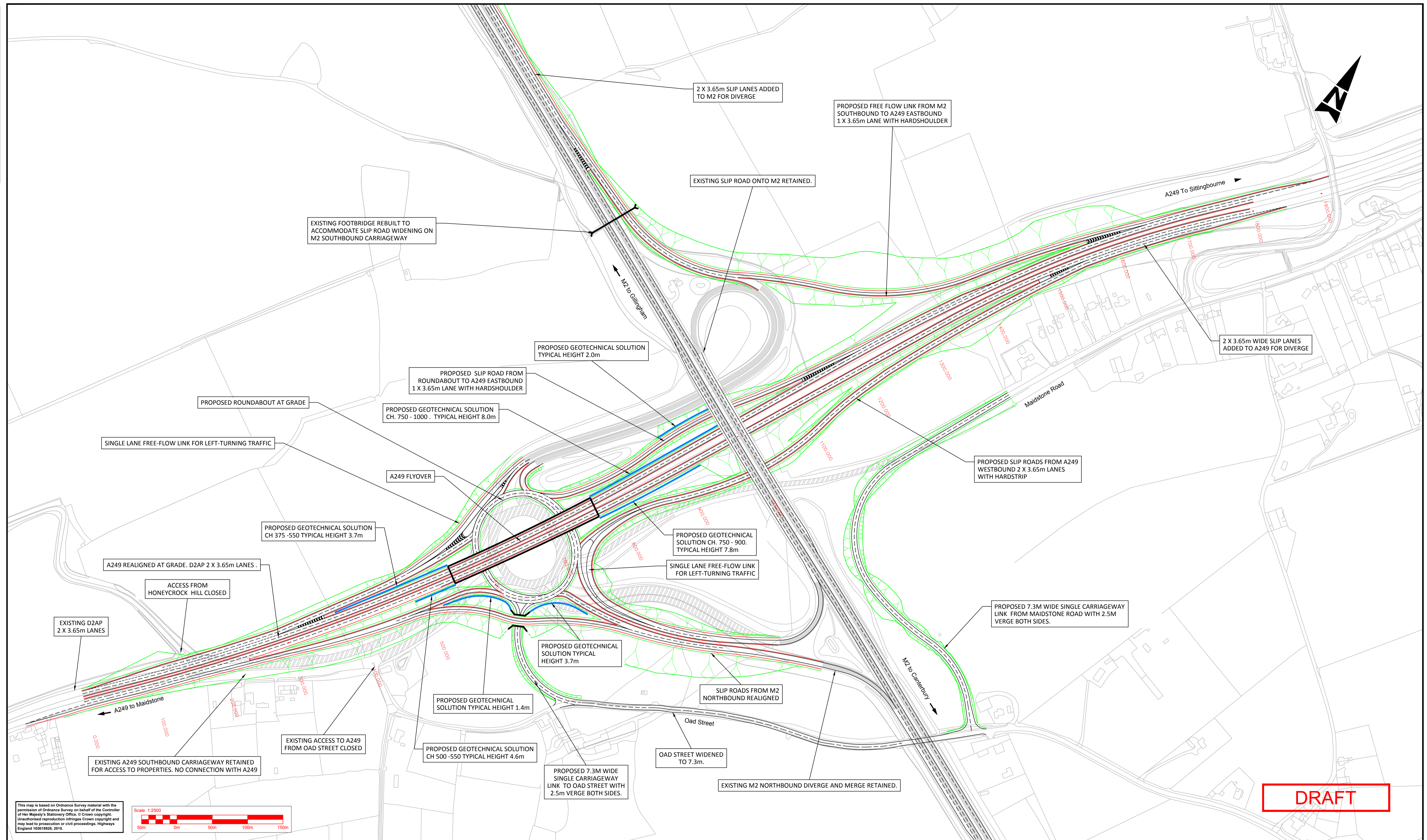
Abbreviation	Term
ALR	All Lane Running
AQMA	Air Quality Management Area
ASR	Appraisal Specification Report
AST	Appraisal Summary Tables
BGS	British Geological Survey
BMV	Best and Most Versatile
CCTV	
CDM	Construction (design and management)
CoMAH	Control of Major Accident Hazard
CSR	Client Scheme Requirements
DBFO	Design, Build, Finance, Operate
DCO	Development Consent Order
DfT	Department for Transport
EA	Environment Agency
ES	Environment Statement
ESR	Environment Study Report
GHG	Greenhouse Gases
HADDMS	Highways Agency Drainage Data Management System
HAPMS	Highways Agency Pavement Management System
ICD	Inscribed Circle Diameter
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention and Control
KSI	Kill, Seriously Injured
LAPPC	Local Authority Pollution Prevention and Control
LATS	London and South East Travel Survey
LCA	Landscape Character Area
LEP	Local Enterprise Partnership
LGF	Local Growth Fund
LMVR	Local Model Validation Report
LTC	Lower Thames Crossing
LWS	Local Wildlife Site
MAC	Managing Agent Contractor
MIDAS	Motorway Incident Detection and Automatic Signalling
MOVA	Microprocessor Optimised Vehicle Actuation
MRSS	Maintenance and Repair Strategy
MSP	Maintenance Service Provider
NCA	National Character Area
NRSAWA	New Roads and Streetworks Act
NTEM	National Trip End Model
NTM	National Transport Model
OAN	Objectively Assessed Need
PCF	Project Control Framework
PRA	Preferred Route Announcement
PRoW	Public Rights of Way
RCC	Regional Control Centre
RIP	Regional Investment Programme
RIS	Road Investment Strategy
SCOOT	Split Cycletime Offset Optimisation Technique
SGAR	Stage Gate Assessment Review
SPZ	Source Protection Zone
SRN	Strategic Road Network
SuDS	Sustainable Drainage Systems
TEMPro	Trip End Model Presentation Program
TS	Transport Statement
TTM	Temporary Traffic Management
WebTAG	WebTAG (DfT's on line) Transport analysis guidance
WFD	Water Framework Directive

Appendix A - Option Drawings

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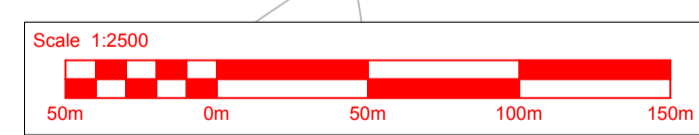
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- KEY:**
- Proposed hardshoulder / hardstrip
 - Proposed verge
 - Proposed geotechnical / retaining solution
 - Proposed bridge structure
 - Proposed A249 flyover structure
 - Existing carriageway to be made redundant
 - Existing carriageway to remain

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction (Enter "None" if applicable)	
Maintenance / Cleaning (Enter "None" if applicable)	
Use (Enter "None" if applicable)	
Decommissioning / Demolition (Enter "None" if applicable)	

Rev.	Date	Description	By	CHK'd	App'd
P01.1		First Issue			

Drawing Status: **WORK IN PROGRESS** Suitability: **S0**

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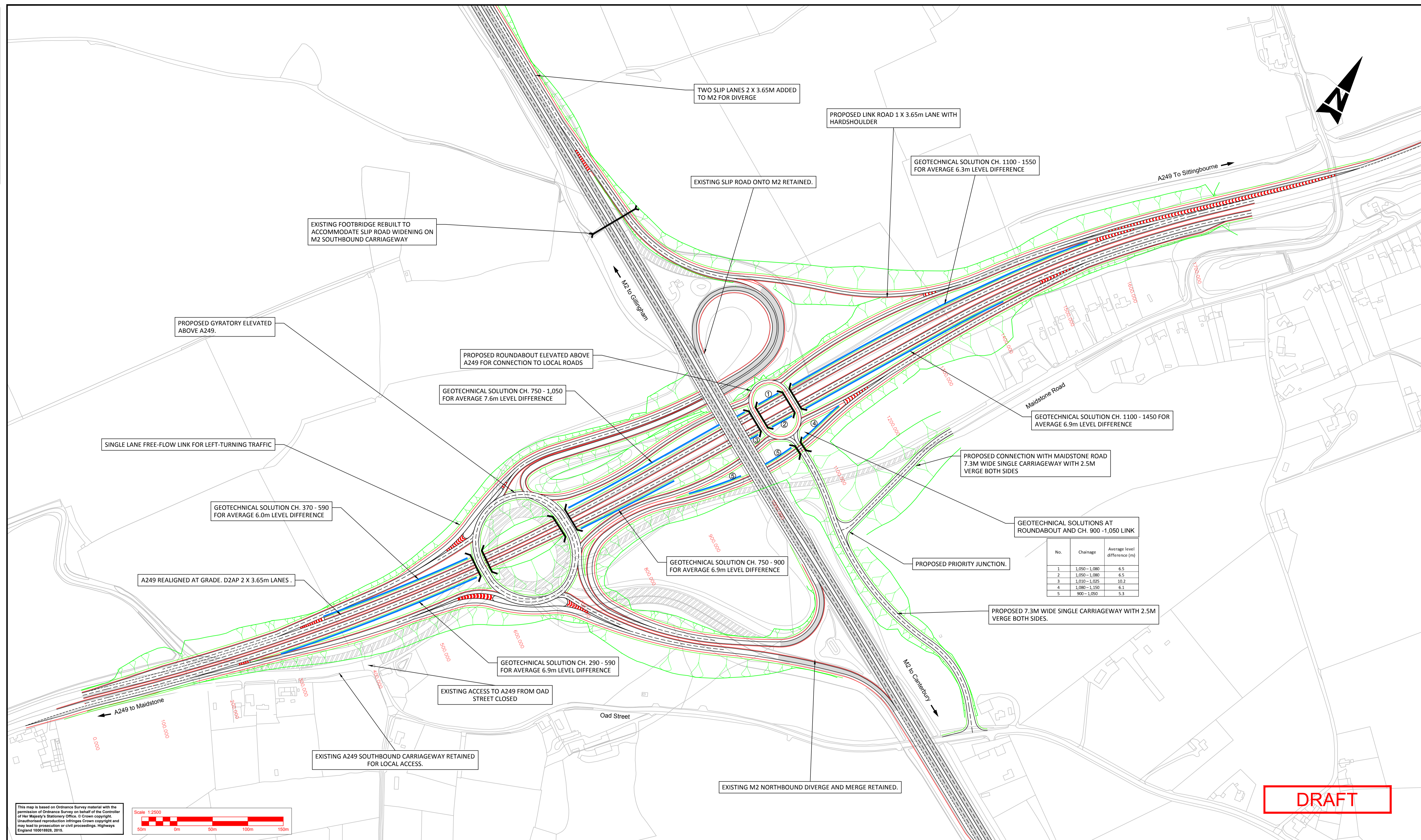
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Drawing Title: **HIGHWAYS DESIGN LAYOUT OPTION 4 JUNCTION AREA**

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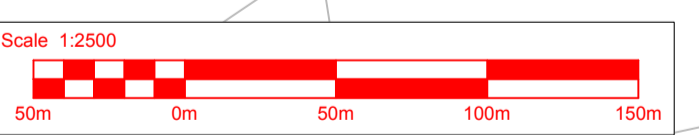
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- KEY:**
- Proposed hardshoulder / hardstrip
 - Proposed verge
 - Proposed geotechnical / retaining solution
 - Proposed bridge structure
 - Existing carriageway to be made redundant
 - Existing carriageway to remain

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

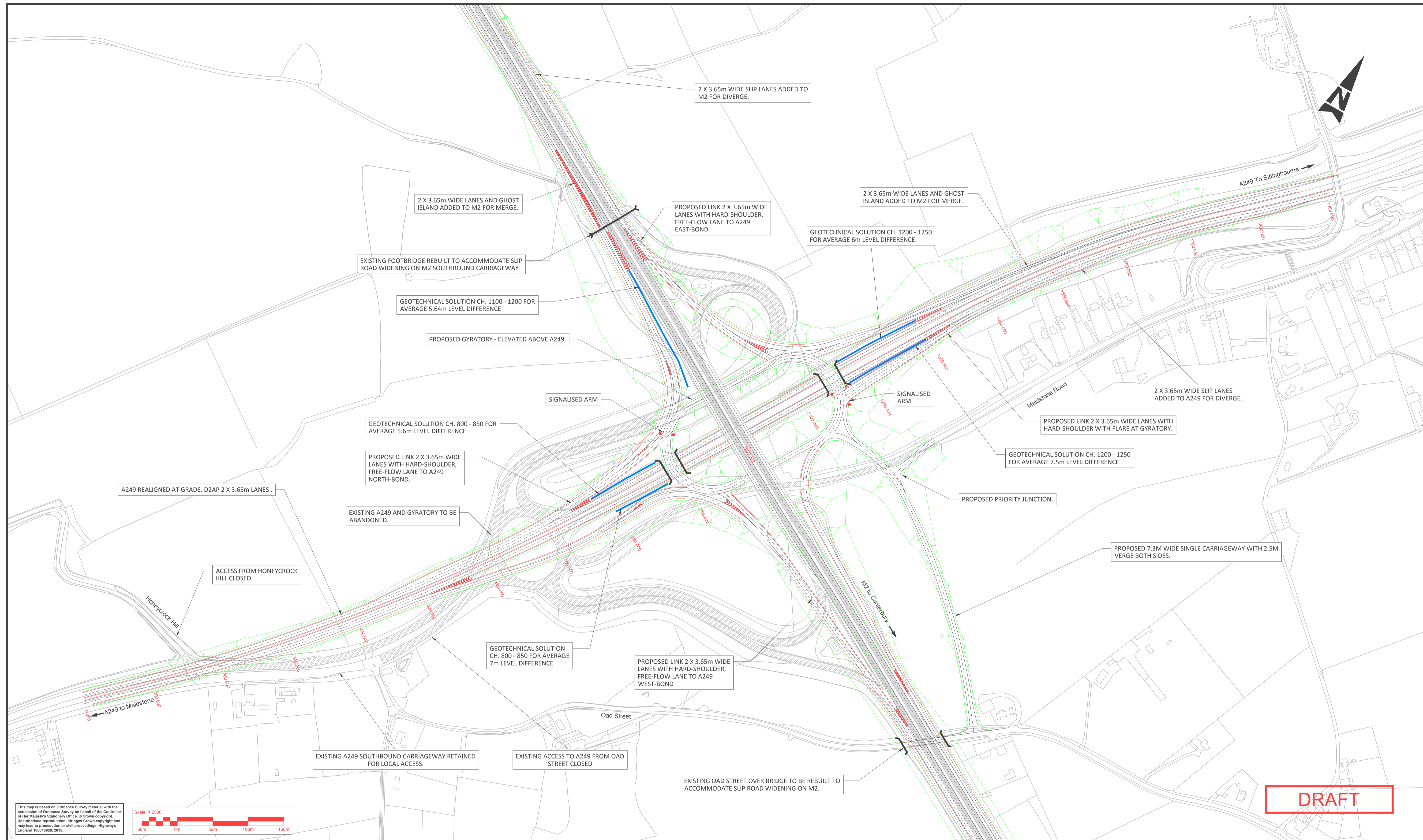
Decommissioning / Demolition
(Enter "None" if applicable)

Rev.	Date	Description	By	Chk'd	App'd
P01.1		First Issue			

Drawing Status	WORK IN PROGRESS	Subsidiary	S0	Project Title	REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS					
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Client	Working on behalf of				Scale	1:2500	Drawn	Checked	Approved	Authorised
		Original Size	A1	Date	---	Date	---	Date	---	Date
Drawing Number	HE551521 - WSP - HGN -	Project	M2J5 - DR - D - 0082	Originator	Volume	Project Ref. No.	5145771	Revision	P01.1	
Location		Type		Role		Number				

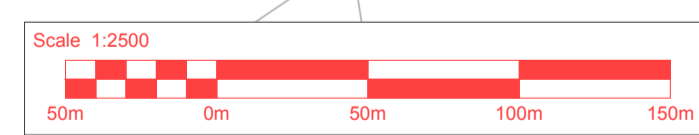
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- KEY:**
- Proposed hardshoulder / hardstrip
 - Proposed verge
 - Proposed geotechnical / retaining solution
 - Proposed bridge structure
 - Proposed traffic signals
 - Existing carriageway to be made redundant
 - Existing carriageway to remain

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction	
Maintenance / Cleaning	
Use	
Decommissioning / Demolition	

Rev.	Date	Description	By	Chkd	App'd
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Drawing Status: **WORK IN PROGRESS** Suitability: **S0**

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Project Title: **REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS**

Drawing Title: **HIGHWAYS DESIGN LAYOUT OPTION 10 JUNCTION AREA**

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Appendix B – Appraisal Summary Table (AST)

Appraisal Summary Table		Date produced:	27/10/2016		Contact:			
Name of scheme: M2 Junction 5 Improvement Study PCF Stage 1 Description of scheme: M2 Junction 5 (A249) Stockbury Roundabout Option 4 - Two tier intersection. This option sees the existing Stockbury Roundabout replaced with a new grade-separated interchange, with free flowing movement provided on the A249 under the junction. Additional free flow links are included for the A249 westbound to M2 northbound, A249 eastbound to M2 eastbound, and M2 eastbound to A249 eastbound movements. The M2 eastbound to A249 northbound free-flow link avoids the roundabout. Local road connectivity is provided via a connection between Maidstone Road and Oad Street, with a connection provided to the Stockbury interchange. Earthworks will be modified with 1:2 slopes. AST required to support SGAR 1. Price base is 2010. Constrained growth and fixed demand assumption.		Name: Ross Verhey Organisation: Highways England Role: Promoter/Official						
Impacts	Summary of key impacts	Assessment				Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp	
		Quantitative		Qualitative				
Economy	Business users & transport providers The scheme provides business user benefits, with the majority of benefits being from time savings of between 2 and 6 minutes. As expected, these are predominantly from cars and from the later years of the assessment period.	Value of journey time changes(£)		E222,736m *	N/A	£272,766m *		
		Net journey time changes (£)						
		0 to 2min	2 to 5min	> 5min				
		£25,312m *	£25,619m *	£182,125m *				
Reliability impact on Business users	A qualitative assessment is not required at PCF stage 1 so a MyRAD (or similar) analysis is not required. The journey time results from the modelling exercise indicate that there will be time savings and reduced congestion, especially for traffic travelling through from the east to north through the newly improved junction. There would therefore be a consequential increase in journey time reliability, especially at periods of peak traffic flow. Moderate to Large Beneficial expected, especially in peak periods of traffic flow.	N/A			Moderate to Large Beneficial	N/A		
Regeneration	The scheme supports the development aspirations of Swale Borough Council and Kent County Council local plans including a significant level of housing and employment growth. Swale Borough Council is planning for an additional 10,800 dwellings and 7,053 jobs up to 2031 (figures subject to review by Swale BC). Large beneficial impact is assumed.	N/A			Large Beneficial	N/A		
Wider Impacts	Wider economic impacts have not been assessed for this scheme.	N/A			Neutral	N/A		
Environmental	Noise	There is likely to be an overall improvement in noise conditions as a result of the scheme. This is due to sensitive receptors south of Sittingbourne Road experiencing a reduction in noise as a result of the removal of the existing Stockbury Roundabout. Most dwellings in other areas are likely to experience slight increases in noise, however this is assessed as being negligible in relation to existing noise levels. There will be no impact on noise sensitive non-residential receptors or significant changes in night-time noise.	There are 46 residential receptors within 300m and 168 within 600m of the scheme. There is likely to be a reduction in the overall number of people annoyed by the scheme after 15 years.			Minor Beneficial	To be assessed at PCF Stage 2.	No vulnerable groups are adversely affected.
	Air Quality	Construction: The sensitivity of the construction study area is assessed as being low as the works are greater than 30m from sensitive receptors. Option 10 has a smaller physical extent than Option 4 but involves a complete realignment of the junction, which will also require considerable earthworks to remove the existing junction layout. It is therefore considered likely to have construction air quality impacts of a Minor to Moderate Adverse magnitude. The significance of the effects of construction on human receptors is likely to be 'not significant' in relation to both dust soiling (nuisance) and human health as a result of increased PM10 concentrations. Operation: The reduction in total emissions from the operational phase of Option 10 are likely to be less than Option 4, although it will be a benefit in comparison to the 'without scheme' approach. Option 10 results in little change to the number of properties within any banded distance from the road. However, the distance between the properties in the south-east region of relatively poor air quality and the A249 increases, which results in a potential reduction in risk of exceedance of the Air Quality Objectives. The option is considered to have operational impacts of a Moderate Beneficial magnitude.	At this stage the number of properties with positive or negative air quality impacts, or predicted decreases or increases in NOx or PM10, has not been assessed. Further surveys at PCF Stage 2 will determine these effects.			Moderate Beneficial	To be assessed at PCF Stage 2	No vulnerable groups are adversely affected.
	Greenhouse gases	Changes in greenhouse gas emissions as a result of the scheme are likely to show an increase in greenhouse gas emissions as reported in AMCB is -£24,164m and is to be verified and reviewed in subsequent PCF Stages 2 - thus it is more prudent to assume an overall neutral impact at this stage.	Change in non-traded carbon over 60y (tonnes CO2e) 345,071* Change in traded carbon over 60y (tonnes CO2e) -242*			Neutral	PVB -£16,015*	
	Landscape	New elements introduced by Option 4 will be noticeable. However, these will be in keeping with the existing junction and highways. During the construction phase there will be locally significant impacts as a result of vegetation clearance and increases in construction related infrastructure. Long-term changes in pattern, landcover and character will be largely mitigated through landscaping and screen planting, resulting in impacts of a Neutral - Slight Adverse magnitude on these landscape features. Cultural landscape features, especially the WWI Chatham Land Defences historic landscape, have the potential to be adversely affected by this option. These impacts have the potential to be of Moderate - Large Adverse magnitude.	N/A			Moderate - Large Adverse	N/A	
	Townscape	N/A	N/A			N/A	N/A	
	Heritage of Historic Resources	There are a total 45 heritage assets within 1km of the scheme, of which 25 are designated. Designated heritage assets within close proximity of the scheme include: Ringwork and Balleys at Church Farm (Scheduled Monument); Church of St Mary Magdalene (Grade I Listed); Yew Tree Cottage (Grade II Listed); and several Grade II Listed Buildings, headstones and tombs. There is one non-designated heritage asset, the WWI Chatham Land Front Defences historical landscape, which the scheme is located within. Although the structural elements of the scheme will change the view, it is not anticipated that this will alter the contribution of the setting to any of the designated heritage assets. Land take as a result of the scheme will be considered harmful to the significance of the WWI landscape. It is likely that Option 4 will obscure one or more key views associated with the Stone Defence system. Disturbance of undecorated remains associated with the WWI landscape could have potentially irreversible negative impacts. This is likely to be able to be mitigated through appropriate archaeological investigation.	N/A			Large Adverse	N/A	
	Biodiversity	Option 4 does not result in direct land take from ancient woodland, however it is likely to have indirect impact on the ancient woodland at Chestnut Wood as a consequence of deteriorations in air quality during the construction phase. There will be direct loss of semi-natural broadleaved woodland and semi-natural mixed woodland, which is identified within the Kent BAP as having a target of no net loss. Sufficient mitigation, including replacement planting, will be incorporated into the design to provide the level of woodland that is currently present in the long term. Habitats have been identified within the scheme boundary which have the potential to support protected and notable species, including bats, dormice, and invertebrates. Option 4 has the potential to negatively affect these species, however at this early stage of the design process and without further protected species survey information, the exact levels of impacts and appropriate mitigation requirements are unknown.	N/A			Moderate Adverse	N/A	
Water Environment	Option 4 is expected to have significant impacts of a Moderate Adverse magnitude on the floodplain. Significant works are required to the A249 south of the M2 within areas located in the high risk Flood Zone 3. There is the potential to reduce the existing floodplain and increase the risk of flooding in the area or elsewhere, including several residential properties. Option 4 could affect the quality of surface water and groundwater resources. The greatest risk to the quality of groundwater resources is in the area located close to Inver Zone of the groundwater SPZ. This impact could be highly significant and of a Moderate Adverse magnitude. Appropriate pollution and flood prevention measures will be required during the construction and operational phase to reduce the scheme's adverse effects.	N/A			Moderate Adverse	N/A		
Social	Commuting and Other users	The scheme provides significant commuting and benefits for other trip purposes, with the majority of benefits being from time savings of over 6 minutes. As expected, these are predominantly from cars and from the later years of the assessment period.	Value of journey time changes(£)		E 100,915m *	N/A	£107,469m *	No vulnerable groups are adversely affected.
	Net journey time changes (£)							
	0 to 2min	2 to 5min	> 5min					
	£59,546m *	£61,422m *	£438,380m *					
	Reliability impact on Commuting and Other users	A qualitative assessment is not required at PCF stage 1 so a MyRAD (or similar) analysis is not required. The journey time results from the modelling exercise indicate that there will be time savings and reduced congestion, especially for traffic travelling through from the east to north through the newly improved junction. There would therefore be a consequential increase in journey time reliability, especially at periods of peak traffic flow. Moderate to Large Beneficial expected, especially in peak periods of traffic flow.	N/A			Some benefit expected in peak periods of traffic flow.	N/A	
	Physical activity	Due to the strategic nature of the scheme improvements, it is not expected that the level of walking or cycling will be affected.	N/A			Neutral	N/A	
	Journey quality	This option is expected to significantly improve journey times with reduced congestion and greater reliability and a decrease in driver frustration. Moderate to Large Beneficial expected, especially in peak periods of traffic flow.	N/A			Large Beneficial	N/A	
	Accidents	COBALT has been used to assess the impact of the scheme on accidents. Overall there is a reduction in accidents as a result of the scheme leading to an increase in benefits.	Total accidents saved: 621 Casualties saved: Fatal - 5.6 Serious - 73.2 Slight - 979.2			Moderate Beneficial	£30,588m	No vulnerable groups are adversely affected.
	Security	This option is not expected to change the level of security for general traffic, public transport passengers, and freight.	N/A			Neutral	N/A	No vulnerable groups are adversely affected.
	Access to services	This option is not expected to change provision, routing, frequencies or timings of current public transport services or walking facilities or any impacts on accessibility to services.	N/A			Neutral	N/A	No vulnerable groups are adversely affected.
Affordability	This option is not expected to lead to extra charges to users (parking charges, public transport fare changes etc). Some minor changes to fuel costs (due to reduced congestion and increased speeds) are expected.	N/A			Neutral	N/A	No vulnerable groups are adversely affected.	
Severance	This option is not expected to impact local severance.	N/A			Neutral	N/A	No vulnerable groups are adversely affected.	
Public Accounts	Option values	This scheme does not involve the loss or introduction of a new mode of transport	N/A			Neutral	N/A	
	Cost to Broad Transport Budget	The scheme will be funded through central government funds (RIS 1). Current (post April 2016) Central Government funds are £70.9m. Previously (up to April 2016) Central Government funds were up to £100.0m.	£58,024m			N/A	£58,024m	
	Indirect Tax Revenues	There would be a decrease in the tax being paid to the Exchequer from fuel taxes etc. due to a decreased use of fuel as congestion is eased.	£28,535m *			N/A	£28,535m *	
Notes:	* - All values should be treated with extreme caution. Current modelling is likely to be an overestimation of the BCR and VM values due to the level of uncompleted trips. For further details please refer to the Economic Assessment Report.							

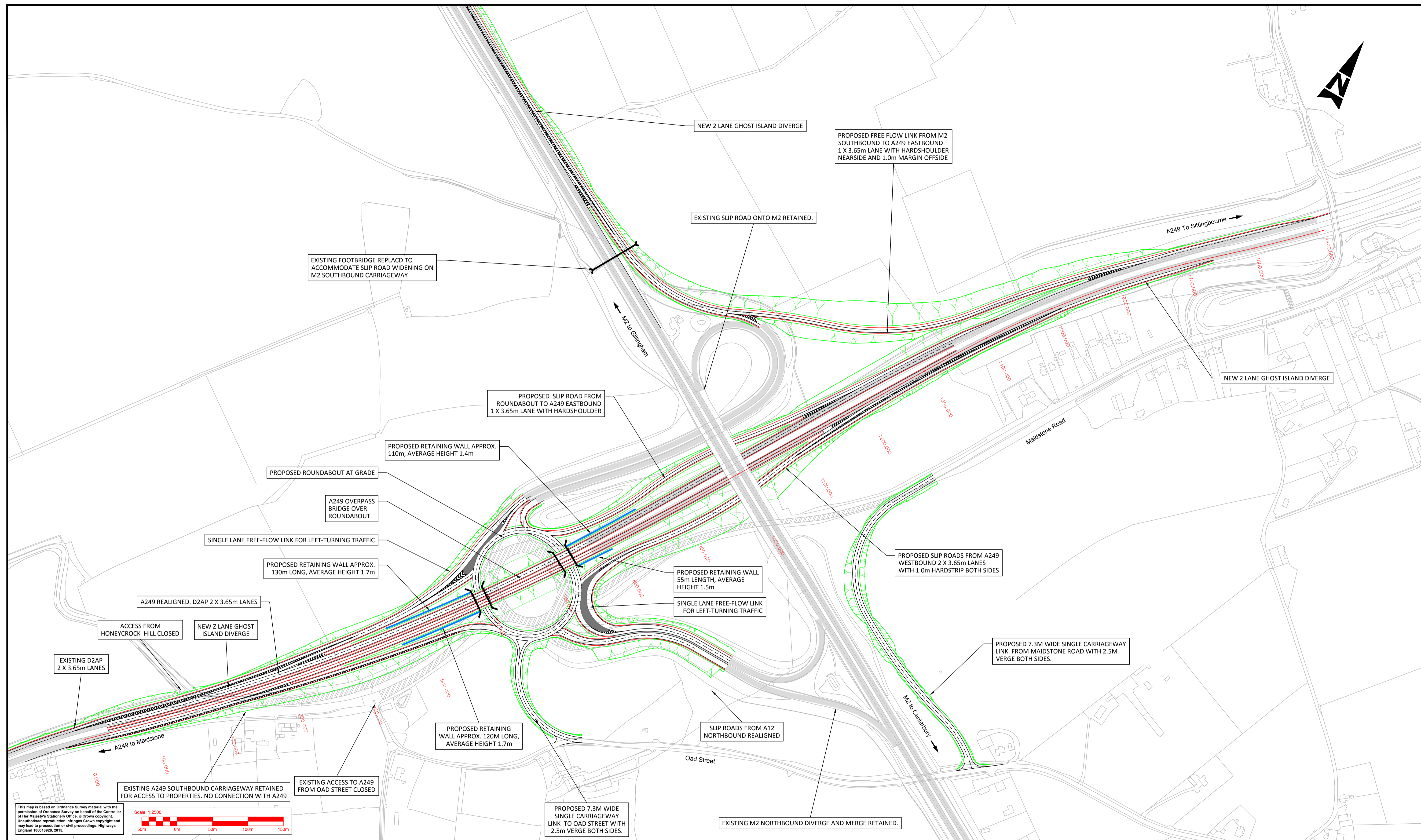
Appraisal Summary Table		Date produced:	27/10/2016		Contact:			
Name of scheme:		M2 Junction 5 Improvement Study PCF Stage 1			Name	Ross Verhey		
Description of scheme:		M2 Junction 5 (A249) Stockbury Roundabout, Option 10 - Three tier intersection This option sees the existing Junction 5 replaced with a traditional three-tier grade separated interchange, removing the unusual geometry of the junction and slip road alignments. The A249 has a dedicated through link at the lower level, with the interchange at the mid-level, and M2 as existing at the top-level. There are additional free-flow links serving the M2 coast-bound to A249 eastbound, M2 westbound to A249 westbound and A249 eastbound to M2 northbound movements. The interchange would be partially signalised. Local connections would be provided with a link between Oad Street, Maidstone Road and the interchange. The gyratory under the M2 viaduct would be provided with three lanes on both sides with the adjustment of entry, exit and free-flow lanes around the gyratory adjusted to suit. Earthworks will be modelled with 1:2 slopes. AST required to support SGAR 1. Price base is 2010. Constrained growth and fixed demand assumption.			Organisation	Highways England	Role	Promoter/Official
Impacts		Summary of key Impacts		Assessment				
		Quantitative		Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable GFP		
		Value of journey time changes(£)						
		Net journey time changes (£)						
		0 to 2min	2 to 5min	> 5min				
Economy	Business users & transport providers	The scheme provides business user benefits, with the majority of benefits being from time savings of between 2 and 6 minutes. As expected, these are predominantly from cars and from the later years of the assessment period.		£231.135m *	N/A	£296.181m *		
	Reliability impact on Business users	A qualitative assessment is not required at PCF stage 1 so a MyRIAD (or similar) analysis is not required. The journey time results from the modelling exercise indicate that there will be time savings and reduced congestion, especially for traffic travelling through from the east to north through the newly improved junction. There would therefore be a consequential increase in journey time reliability, especially at periods of peak traffic flow. Moderate to Large Beneficial expected, especially in peak periods of traffic flow.		N/A	Moderate to Large Beneficial	N/A		
	Regeneration	The scheme supports the development aspirations of Swale Borough Council and Kent County Council local plans including a significant level of housing and employment growth. Swale Borough Council is planning for an additional 10,800 dwellings and 7,053 jobs up to 2031 (figures subject to review by Swale BC). Large beneficial impact is assumed.		N/A	Large Beneficial	N/A		
	Wider Impacts	Wider economic impacts have not been assessed for this scheme.		N/A	Neutral	N/A		
Environmental	Noise	The scheme is likely to have beneficial and adverse noise impacts on residential receptors. Dwellings immediately south of Sittingbourne Road are likely to experience a reduction in noise levels resulting in a beneficial impact, whilst properties at Oad Street, north of the M2, are likely to experience an increase in noise levels resulting in a minor adverse impact. There will be no impact on noise sensitive non-residential receptors or significant changes in night-time noise.		There are 46 residential receptors within 300m and 168 within 600m of the scheme. The overall number of people annoyed by the scheme after 15 years is likely to be similar to present.		Neutral	To be assessed at PCF Stage 2.	No vulnerable groups are adversely affected.
	Air Quality	Construction: The sensitivity of the construction study area is assessed as being low as the works are greater than 30m from sensitive receptors. Option 10 has a smaller physical extent than Option 4 but involves a complete realignment of the junction, which will also require considerable earthworks to remove the existing junction layout. It is therefore considered likely to have construction air quality impacts of a Minor to Moderate Adverse magnitude. The significance of the effects of construction on human receptors is likely to be 'not significant' in relation to both dust soiling (nuisance) and human health as a result of increased PM10 concentrations. Operation: The reduction in total emissions from the operational phase of Option 10 are likely to be less than Option 4, although it will be a benefit in comparison to the 'without-scheme' approach. Option 10 results in little change to the number of properties within any banding distance from the roads. However, the distance between the properties in the south-west (region of relatively low quality) and the A249 increases, which results in a potential reduction in risk of exceedance of the Air Quality Objectives. The option is considered to have operational impacts of a Moderate Beneficial magnitude.		At this stage the number of properties with positive or negative air quality impacts, or predicted decreases or increases in NOx or PM10, has not been assessed. Further surveys at PCF Stage 2 will determine these effects.		Moderate Beneficial	To be assessed at PCF Stage 2.	No vulnerable groups are adversely affected.
	Greenhouse gases	Changes in greenhouse gas emissions as a result of the scheme are likely to show an increase in Greenhouse Gases (benefit as reported in AAD2) - £2,867m and is to be verified and reviewed in subsequent PCF Stages 2 - thus it is more prudent to assume an overall neutral impact at this stage. *		Change in non-traded carbon over 60y (tonnes CO2e)	189,421*	N/A	PVB -£8,887*	
				Change in traded carbon over 60y (tonnes CO2e)	-441*			
	Landscape	Option 10 requires the largest landscape of the three options. However, significant landscape from outside the highway boundary is not required. New elements of the scheme will be noticeable and these may be visually intrusive to sensitive receptors. During the construction phase there will be locally significant impacts as a result of vegetation clearance and increases in construction related infrastructure. Long-term changes in pattern and landscape will be largely mitigated through landscaping and screen planting, resulting in impacts of a Neutral - Slight Adverse magnitude on these landscape features. Option 10 has the least impact on cultural landscape features. The Stockbury Roundabout will be removed from the A249, resulting in an impact of a Minor Beneficial magnitude. Despite this improvement, the scheme is likely to have impacts of a Slight Adverse magnitude on landscape character.		N/A	Slight - Moderate Adverse	N/A		
	Townscape	N/A		N/A	N/A	N/A		
	Heritage of Historic resources	There are a total 45 heritage assets within 1km of the scheme, of which 25 are designated. Designated heritage assets within close proximity of the scheme include: Ringwood and Balleys at Church Farm (Scheduled Monument), Church of St Mary Magdalene (Grade I Listed), Yew Tree Cottage (Grade II Listed), and several Grade II Listed Buildings, headstones and tombs. There is one non-designated heritage asset, the WWI Chatham Land Front Defences historical landscape, which the scheme is located within. Although the structural elements of the scheme will change the view, it is not anticipated that this will alter the contribution of the setting to any of the designated heritage assets. No key views associated with the WWI landscape will be obstructed as a result of Option 10, however the realignment of the A259 closer to a WWI pillbox will result in a likely increase in noise pollution which is considered likely to have an adverse effect on the appreciation of this asset. Disturbance of undiscovered remains associated with the WWI landscape could have potentially irreversible negative impacts. This is likely to be able to be mitigated through appropriate archaeological investigation.		N/A	Moderate Adverse	N/A		
Biodiversity	Option 10 will require land take (approximately 0.3ha) from the ancient woodland at Church Wood. Ancient woodland is an irreplaceable resource, therefore the impact of the scheme on this habitat type is significant. There will be additional direct loss of semi-natural broadleaved woodland and semi-natural mixed woodland, both of which are identified within the Kent BAP as having a target of no net loss. Sufficient mitigation, including replacement planting, will be incorporated into the design to provide the level of woodland that is currently present in the long term. Habitats have been identified within the scheme boundary which have the potential to support protected and notable species, including bats, dormice and invertebrates. Option 10 has the potential to negatively affect these species, however, at this early stage of the design process and without further protected species survey information, the exact levels of impact and appropriate mitigation requirements are unknown.		N/A	Large Adverse	N/A			
Water Environment	Option 10 is expected to have significant impacts of a Moderate Adverse magnitude on the floodplain. The proposed works are located partially in the high risk Flood Zone 3, and therefore have the potential to reduce the existing floodplain and increase the risk of flooding in the area or elsewhere, including several residential properties. Option 10 has the potential to affect the quality of surface water and groundwater resources. The greatest risk to the quality of groundwater resources is in the area located close to Inner Zone of the groundwater SPZ. This impact could be highly significant and of a Moderate Adverse magnitude. Appropriate pollution and flood prevention measures will be required during the construction and operational phase to reduce the scheme's adverse effects.		N/A	Moderate Adverse	N/A			
Social	Commuting and Other users	The scheme provides significant commuting and benefits for other trip purposes, with the majority of benefits being from time savings of over 6 minutes. As expected, these are predominantly from cars and from the later years of the assessment period.		Value of journey time changes(£)	£548.152m *			
				Net journey time changes (£)				
				0 to 2min	2 to 5min	> 5min		
				£41.795m	£123.208m *	£383.149m *		
	Reliability impact on Commuting and Other users	A qualitative assessment is not required at PCF stage 1 so a MyRIAD (or similar) analysis is not required. The journey time results from the modelling exercise indicate that there will be time savings and reduced congestion, especially for traffic travelling through from the east to north through the newly improved junction. There would therefore be a consequential increase in journey time reliability, especially at periods of peak traffic flow. Moderate to Large Beneficial expected, especially in peak periods of traffic flow.		N/A	Some benefit expected in peak periods of traffic flow.	N/A		
	Physical activity	Due to the strategic nature of the scheme improvements, it is not expected that the level of walking or cycling will be affected.		N/A	Neutral	N/A		
	Journey quality	This option is expected to significantly improve journey times with reduced congestion and greater reliability and a decrease in driver frustration. Moderate to Large Beneficial expected, especially in peak periods of traffic flow.		N/A	Large Beneficial	N/A		
	Accidents	COBALT has been used to assess the impact of the scheme on accidents. Overall there is a reduction in accidents as a result of the scheme leading to an increase in benefits.		Total accidents saved: 779.2 Casualties saved: Fatal - 9.5 Serious - 93.2 Slight - 1,193.0		Moderate Beneficial	£40,582m	No vulnerable groups are adversely affected.
	Security	This option is not expected to change the level of security for general traffic, public transport passengers, and freight.		N/A	Neutral	N/A	No vulnerable groups are adversely affected.	
	Access to services	This option is not expected to change provision, routings, frequencies or timings of current public transport services or waiting facilities or any impacts on accessibility to services.		N/A	Neutral	N/A	No vulnerable groups are adversely affected.	
Affordability	This option is not expected to lead to extra charges to users (parking charges, public transport fare charges etc). Some minor changes to fuel costs (due to reduced congestion and increased speeds) are expected.		N/A	Neutral	N/A	No vulnerable groups are adversely affected.		
Severance	This option is not expected to impact local severance.		N/A	Neutral	N/A	No vulnerable groups are adversely affected.		
Option values	This scheme does not involve the loss or introduction of a new mode of transport		N/A	Neutral	N/A			
Public Accounts	Cost to Broad Transport Budget	The scheme will be funded through central government funds (RIS 1). Current (post April 2016) Central Government funds are £70.8m. Previously (up to April 2016) Central Government funds were up to £100.0m.		£60.846m	N/A	£60.846m		
	Indirect Tax Revenues	There would be a decrease in the tax being paid to the Exchequer from fuel taxes etc due to a decreased use of fuel as congestion is eased.		£13.401m *	N/A	£13.401m *		
Notes:	* - All values should be treated with extreme caution. Current modelling is likely to be an overestimation of the BCR and VM values due to the level of uncompleted trips. For further details please refer to the Economic Assessment Report.							

Appraisal Summary Table		Date produced:	27/10/2016		Contact:			
Name of scheme: M2 Junction 5 Improvement Study PCF Stage 1 Description of scheme: M2 Junction 5 (A249) Stockbury Roundabout - Option 12 - At grade (Low Cost) option This option sees the existing roundabout on the A249 retained and no realignment of the A249. Existing slip roads will be retained but a two lane diverge from the M2 east-bound and a free-flow lane from the M2 to A249 north-bound will be created. A free-flow lane from the A249 westbound to the M2 London-bound merge slip road will also be added. A link will be created between Maidstone Road and Oad Street. The connection of Maidstone road to roundabout will be removed, and the existing access to the A249 from Oad Street west of junction retained. Earthworks will be modelled with 1:2 slopes. AST required to support SGAR 1. Price base is 2010. Constrained growth and fixed demand assumption.		Name: Ross Verhey Organisation: Highways England Role: Promoter/Official						
Impacts	Summary of key impacts	Assessment						
		Quantitative		Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp		
Economy	Business users & transport providers The scheme provides business user benefits, with the majority of benefits being from time savings up to 4 minutes. As expected, these are predominantly from cars and from the early years of the assessment period prior to the network becoming congested again in the later period.	Value of journey time changes(£)		E220.609m	N/A	£262.155m		
		Net journey time changes (£)						
		0 to 2min	2 to 5min	> 5min				
		£19.516m	£44.168m	£156.925m				
	Reliability impact on Business users	A qualitative assessment is not required at PCF stage 1 so a MyRIAD (or similar) analysis is not required. The journey time results from the modelling exercise indicate that there will be time savings and reduced congestion. There would therefore be a consequential increase in journey time reliability, especially at periods of peak traffic flow. Slight Beneficial expected in peak periods of traffic flow.		N/A	Slight Beneficial	N/A		
	Regeneration	The scheme supports the development aspirations of Swale Borough Council and Kent County Council local plans including a significant level of housing and employment growth. Swale Borough Council is planning for an additional 10,800 dwellings and 7,053 jobs up to 2031 (figures subject to review by Swale BC). Slight beneficial impact is assumed.		N/A	Slight Beneficial	N/A		
	Wider Impacts	Wider economic impacts have not been assessed for this scheme.		N/A	Neutral	N/A		
Environmental	Noise	Residential properties in close proximity to the scheme are likely to experience a slight increase in noise levels, however this is considered to be a negligible impact in comparison to current noise levels. The scheme may adversely impact nearby Noise Important Areas, although this is currently unknown. There will be no impact on noise sensitive non-residential receptors or significant changes in night-time noise.		There are 46 residential receptors within 300m and 168 within 600m of the scheme. The overall number of people annoyed by the scheme after 15 years is likely to be similar to present.		Neutral	To be assessed at PCF Stage 2.	No vulnerable groups are adversely affected.
	Air Quality	Construction: The sensitivity of the construction study area is assessed as being low as the works are greater than 30m from sensitive receptors. Option 12 has the smallest physical extent of the three options, and requires the least extensive earthworks, although the difference between Option 12 and the other options is not sufficient to reduce the magnitude of the construction impact. It is therefore considered likely to have construction air quality impacts of a Minor to Moderate Adverse magnitude. The significance of the effects of construction on human receptors is likely to be 'not significant' in relation to both dust soiling (nuisance) and human health as a result of increased PM10 concentrations. Operation: Option 12 is likely to result in the smallest decreases in operational emissions of the three options, although it will be a benefit in comparison to the 'without scheme' approach. There is a slight reduction in the number of properties within 50m of the scheme, caused by the removal of a small portion of Oad Street, whilst the proximity of the properties to the A249 is unchanged. This option is considered to have operational impacts of a Moderate Beneficial magnitude.		At this stage the number of properties with positive or negative air quality impacts, or predicted decreases or increases in NOx or PM10, has not been assessed. Further surveys at PCF Stage 2 will determine these effects.		Moderate Beneficial	To be assessed at PCF Stage 2.	No vulnerable groups are adversely affected.
	Greenhouse gases	Changes in greenhouse gas emissions as a result to the scheme are likely to show an increase Greenhouse Gases benefit as reported in AMCB is -£16.015m and is to be verified and reviewed in subsequent PCF Stages 2 - thus it is more prudent to assume an overall neutral impact at this stage.		Change in non-traded carbon over 60y (tonnes CO2e) 818,911* Change in traded carbon over 60y (tonnes CO2e) -70*		N/A	PVB -£24,164*	
	Landscape	Option 12 is the least intrusive junction option in terms of land take and therefore significant impacts on undeveloped land are minimal. New elements of the scheme will be noticeable. However, these will be in keeping with the existing junction and highways. During the construction phase there will be locally significant impacts as a result of vegetation clearance and increases in construction related infrastructure. Long-term changes in pattern, landscape and character will be largely mitigated through landscaping and screen planting, resulting in impacts of a Neutral - Slight Adverse magnitude on these landscape features. Cultural landscape features, especially the WWI Chatham Land Defence historic landscape, have the potential to be adversely affected by this option. These impacts may be significant and of a Moderate - Large Adverse magnitude.		N/A		Moderate - Large Adverse	N/A	
	Townscape	N/A		N/A		N/A	N/A	
	Heritage of Historic resources	There are a total 45 heritage assets within 1km of the scheme, of which 25 are designated. Designated heritage assets within close proximity of the scheme include: Ringwork and Bailiys at Church Farm (Scheduled Monument); Church of St Mary Magdalene (Grade I Listed); Yew Tree Cottage (Grade II Listed); and several Grade II Listed Buildings, headstones and tombs. There is one non-designated heritage asset, the WWI Chatham Land Front Defences historical landscape, which the scheme is located within. Although the structural elements of the scheme will change the view, it is not anticipated that this will alter the contribution of the setting to any of the designated heritage assets. Land take as a result of the scheme will be considered harmful to the significance of the WWI landscape. It is likely that Option 12 will obscure one or more key views associated with the Home Defence system. Disturbance of undiscovered remains associated with the WWI landscape could have potentially irreversible negative impacts. This is likely to be able to be mitigated through appropriate archaeological investigation.		N/A		Large Adverse	N/A	
	Biodiversity	Option 4 does not result in direct land take from ancient woodland, however it is likely to have indirect impact on the ancient woodland at Chestnut Wood as a consequence of deteriorations in air quality during the construction phase. There will be direct loss of semi-natural broadleaved woodland and semi-natural mixed woodland, which is identified within the Kent BAP as having a target of no net loss. Sufficient mitigation, including replacement planting, will be incorporated into the design to provide the level of woodland that is currently present in the long term. Habitats have been identified within the scheme boundary which have the potential to support protected and notable species, including bats, dormice, and invertebrates. Option 12 has the potential to negatively affect these species, however at this early stage of the design process and without further protected species survey information, the exact levels of impact and appropriate mitigation requirements are unknown.		N/A		Moderate Adverse	N/A	
	Water Environment	Although the works are predominantly within the existing alignment, Option 12 is expected to have significant impacts of a Moderate Adverse magnitude on the floodplain. The proposed works are located partially in the high risk Flood Zone 3, and therefore have the potential to reduce the existing floodplain and increase the risk of flooding in the area or elsewhere, including several residential properties. Option 12 has the potential to affect the quality of surface water and groundwater resources. The greatest risk to the quality of groundwater resources is in the area located close to Inner Zone of the groundwater SPZ. The works within the Inner Zone of the SPZ are less extensive than Options 4 and 10. However, the impact could be significant and of a Moderate Adverse magnitude. Appropriate pollution and flood prevention measures will be required during the construction and operational phase to reduce the scheme's adverse effects.		N/A		Moderate Adverse	N/A	
Social	Commuting and Other users	The scheme provides slight commuting and benefits for other trip purposes, with the majority of benefits being from time savings of up to 4 minutes. As expected, these are predominantly from cars in the early years prior to the network becoming congested around in the years of the assessment period.		Value of journey time changes(£) E511.366m Net journey time changes (£) 0 to 2min 2 to 5min > 5min £39.360m £108.485m £363.521m		N/A	£99.364m	No vulnerable groups are adversely affected.
	Reliability impact on Commuting and Other users	A qualitative assessment is not required at PCF stage 1 so a MyRIAD (or similar) analysis is not required. The journey time results from the modelling exercise indicate that there will be time savings and reduced congestion. There would therefore be a consequential increase in journey time reliability, especially at periods of peak traffic flow. Slight Beneficial expected in peak periods of traffic flow.		N/A		Slight benefit expected in peak periods of traffic flow.	N/A	
	Physical activity	Due to the strategic nature of the scheme improvements, it is not expected that the level of walking or cycling will be affected.		N/A		Neutral	N/A	
	Journey quality	This option is expected to improve journey times with reduced congestion and greater reliability and a decrease in driver frustration during early assessment years. Slight beneficial expected in early years.		N/A		Slight Beneficial	N/A	
	Accidents	COBAL has been used to assess the impact of the scheme on accidents. Overall there is a reduction in accidents as a result of the scheme leading to an increase in benefits.		Total accidents saved: 480.1 Casualties saved: Fatal - 3.6 Serious - 51.2 Slight - 758.1		Slight Beneficial	£22,390.9	No vulnerable groups are adversely affected.
	Security	This option is not expected to change the level of security for general traffic, public transport passengers, and freight.		N/A		Neutral	N/A	No vulnerable groups are adversely affected.
	Access to services	This option is not expected to change provision, routings, frequencies or timings of current public transport services or waiting facilities or any impacts on accessibility to services.		N/A		Neutral	N/A	No vulnerable groups are adversely affected.
	Affordability	This option is not expected to lead to extra charges to users (parking charges, public transport fare charges etc). Some minor changes to fuel costs (due to reduced congestion and increased speeds) are expected.		N/A		Neutral	N/A	No vulnerable groups are adversely affected.
	Severance	This option is not expected to impact local severance.		N/A		Neutral	N/A	No vulnerable groups are adversely affected.
	Option values	This scheme does not involve the loss or introduction of a new mode of transport		N/A		Neutral	N/A	
Public Accounts	Cost to Broad Transport Budget	The scheme will be funded through central government funds (RIS 1). Current (post April 2016) Central Government funds are £70.8m. Previously (up to April 2016) Central Government funds were up to £100.0m.		£32.355m		N/A	£32.355m	
	Indirect Tax Revenues	There would be a decrease in the tax being paid to the Exchequer from fuel taxes etc due to a decreased use of fuel as congestion is eased.		£42.616m		N/A	£42.616m	
Notes:	* All values should be treated with extreme caution. Current modelling is likely to be an overestimation of the BCR and VIM values due to the level of uncompleted trips. For further details please refer to the Economic Assessment Report.							

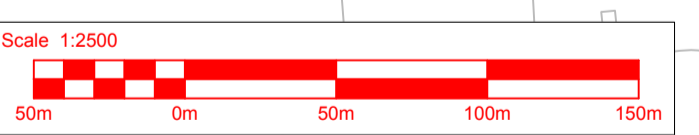
Appendix C – Revised Option Drawings

DO NOT SCALE

100
0 10
Millimetres



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- KEY:
- Proposed hardshoulder / hardstrip
 - Proposed verge
 - Proposed geotechnical / retaining solution
 - Proposed bridge structure
 - Proposed A249 flyover structure
 - Existing carriageway to be made redundant
 - Existing carriageway to remain

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

Decommissioning / Demolition
(Enter "None" if applicable)

Rev.	Date	Description	By	Chk'd	App'd
P01	13/05/16	First issue	WE	AS	GH
P02.1	26/07/16	Revised layout for cost estimate	TC	AS	GH

Drawing Status: **WORK IN PROGRESS**

Suitability: **S0**

Project Title: **REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS**

Drawing Title: **HIGHWAYS DESIGN LAYOUT OPTION 4 JUNCTION AREA**

Scale: 1:2500

Original Size: **A1**

Client: **Working on behalf of highways england**

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Scale	Drawn	Checked	Approved	Authorised
1:2500	TC	AS	GH	DH

Original Size	Date	Date	Date	Date
A1	26/07/16	26/07/16	26/07/16	26/07/16

Drawing Number	Project	Originator	Volume	Project Ref. No.
HE551521 - WSP - HGN - M2J5 - DR - D - 0042				5145771

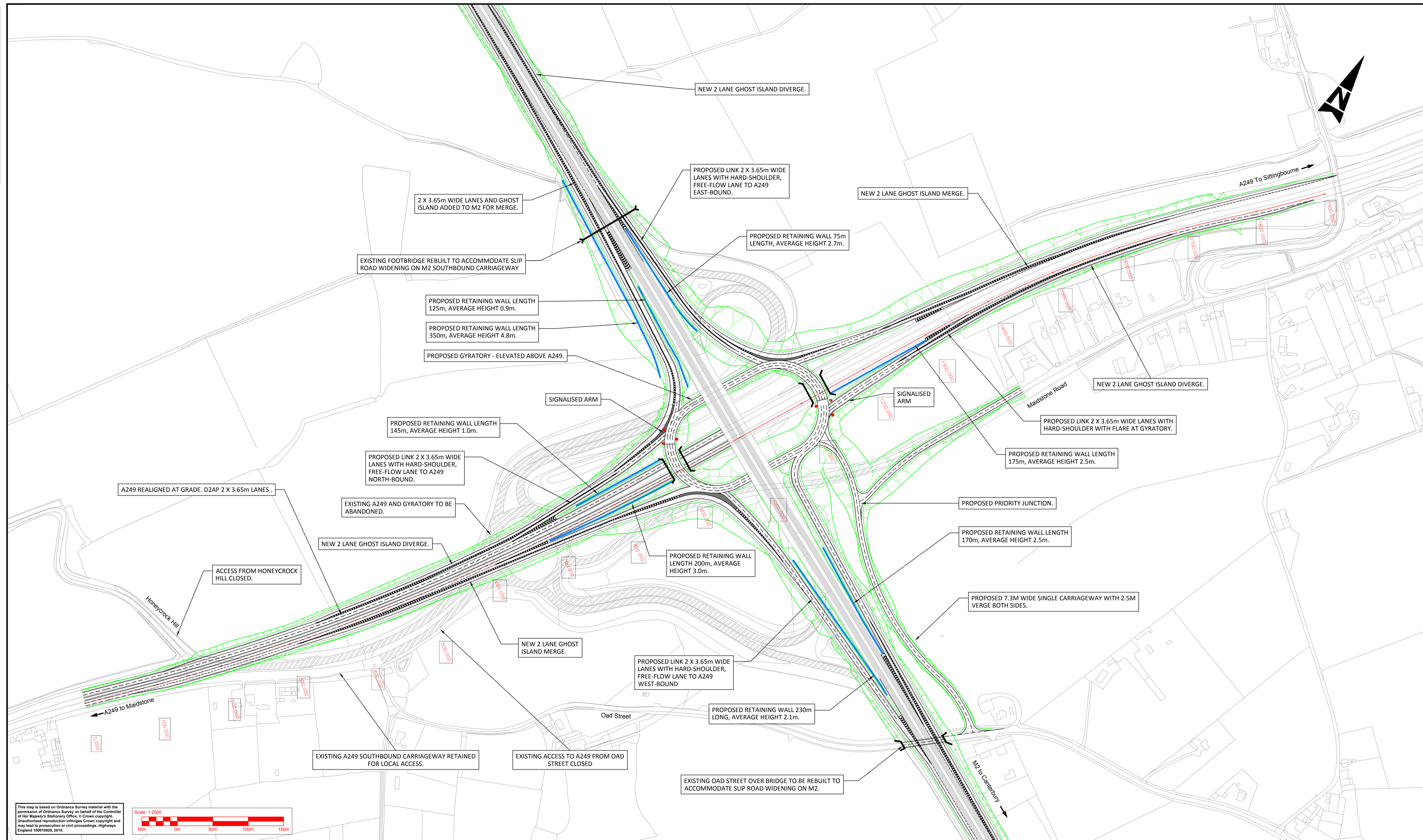
Revision	Number
	P02.1

DO NOT SCALE

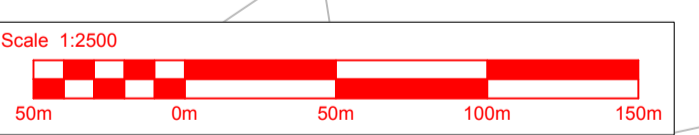
Millimetres

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- KEY:
- Proposed hardshoulder / hardstrip
 - Proposed verge
 - Proposed geotechnical / retaining solution
 - Proposed bridge structure
 - Proposed traffic signals
 - Existing carriageway to be made redundant
 - Existing carriageway to remain

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
(Enter "None" if applicable)

Maintenance / Cleaning
(Enter "None" if applicable)

Use
(Enter "None" if applicable)

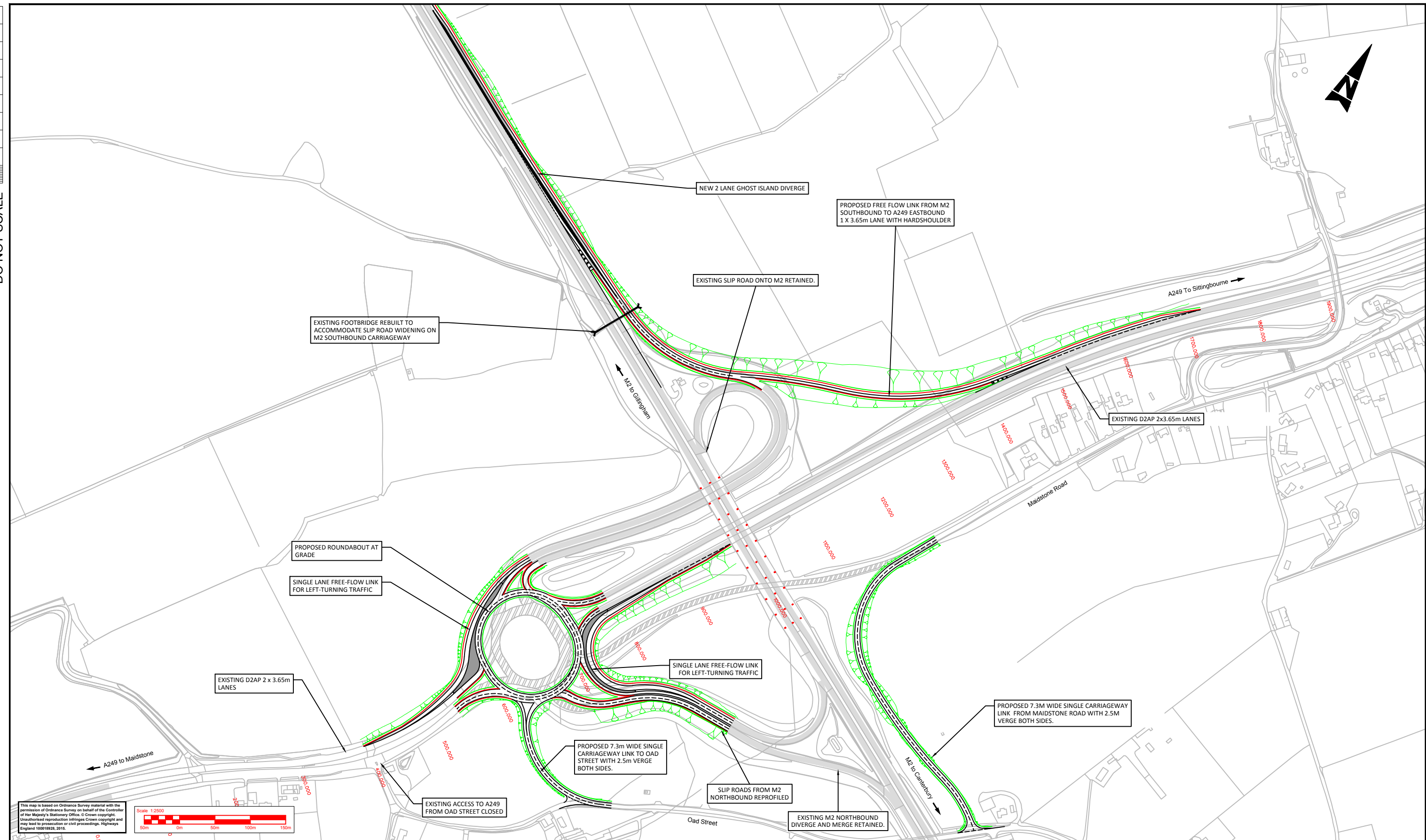
Decommissioning / Demolition
(Enter "None" if applicable)

Rev.	Date	Description	By	CHK'd	App'd
P01	13/05/16	First Issue	WE	AS	GH
P02	26/07/16	Revised layout for cost estimate	TC	AS	GH

Drawing Status WORK IN PROGRESS		Suitability S0	Project Title REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS			
		Westbrook Mills Borough Road Godalming Surrey GU17 2AZ Tel: +44 (0)1483 528400 Fax: +44 (0)1483 528989 www.wsp-pb.com		Drawing Title HIGHWAYS DESIGN LAYOUT OPTION 10 JUNCTION AREA		
Scale 1:2500	Drawn TC	Checked AS	Approved GH	Authorised RE		
Original Size A1	Date 26/07/16	Date 26/07/16	Date 26/07/16	Date 26/07/16		
Client 	Working on behalf of		Project Number HE551521 - WSP - HGN - M2J5 - DR - D - 0102		Project Ref. No. 5145771	
					Revision P02	

DO NOT SCALE

Millimetres
0 10 100



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- KEY:**
- Proposed hardshoulder / hardstrip
 - Proposed verge
 - Proposed structure
 - Proposed A249 flyover structure
 - Existing carriageway to be made redundant
 - Existing carriageway to remain

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction (Enter "None" if applicable)					
Maintenance / Cleaning (Enter "None" if applicable)					
Use (Enter "None" if applicable)					
Decommissioning / Demolition (Enter "None" if applicable)					

Rev.	Date	First Issue	Description	By	Chk'd	App'd
P01	04/08/16	First Issue		WE	AS	GH

WORK IN PROGRESS

WSP
PARSONS BRINCKERHOFF

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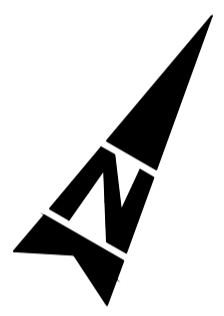
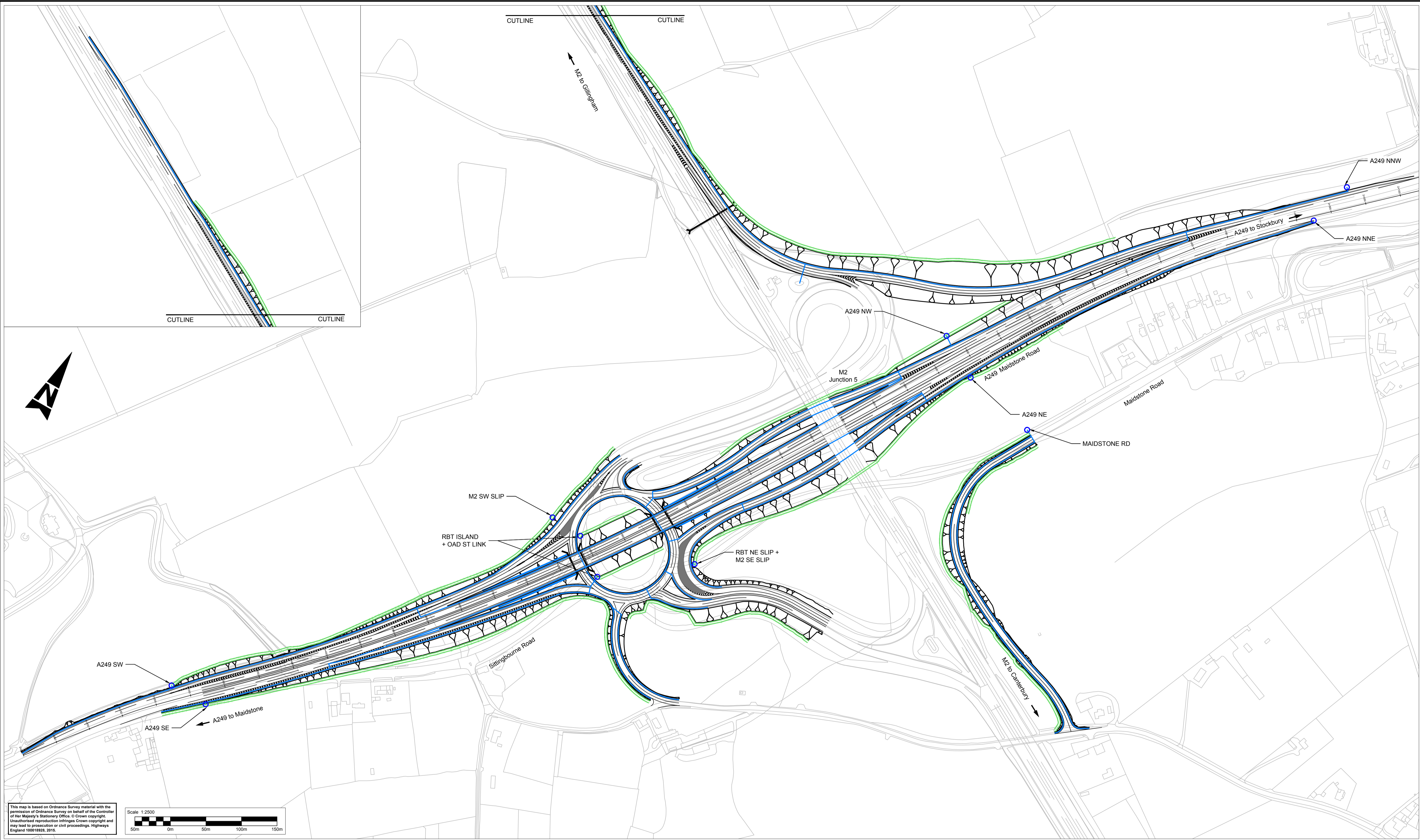
Working on behalf of
highways england

Subsidiary	S0	Project Title			
		REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS			
		Drawing Title			
		HIGHWAYS DESIGN LAYOUT OPTION 12			
Scale	1:2500	Drawn	WE	Checked	AS
Original Size	A1	Date	04/08/16	Date	04/08/16
Approved	GH	Date	04/08/16	Authorised	DH
Drawing Number	Project		Originator	Volume	Project Ref. No.
	HE551521 - WSP - HGN - M2J5 - DR - D - 0122				5145771
Location	Type	Role	Number	Revision	P01

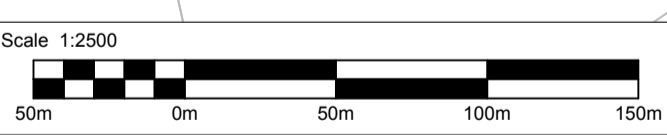
Appendix D – Revised Drainage Strategy Drawings

DO NOT SCALE

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Millimetres



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- KEY:**
- PROPOSED DRAINAGE CARRIER
 - PROPOSED SOAKAWAY OR CUTOFF DITCH
 - PROPOSED OIL INTERCEPTOR

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction (Enter "None" if applicable)	
Maintenance / Cleaning (Enter "None" if applicable)	
Use (Enter "None" if applicable)	
Decommissioning / Demolition (Enter "None" if applicable)	

Rev.	Date	Description	By	CHK'd	App'd
P01.1	---	First Issue	---	---	---

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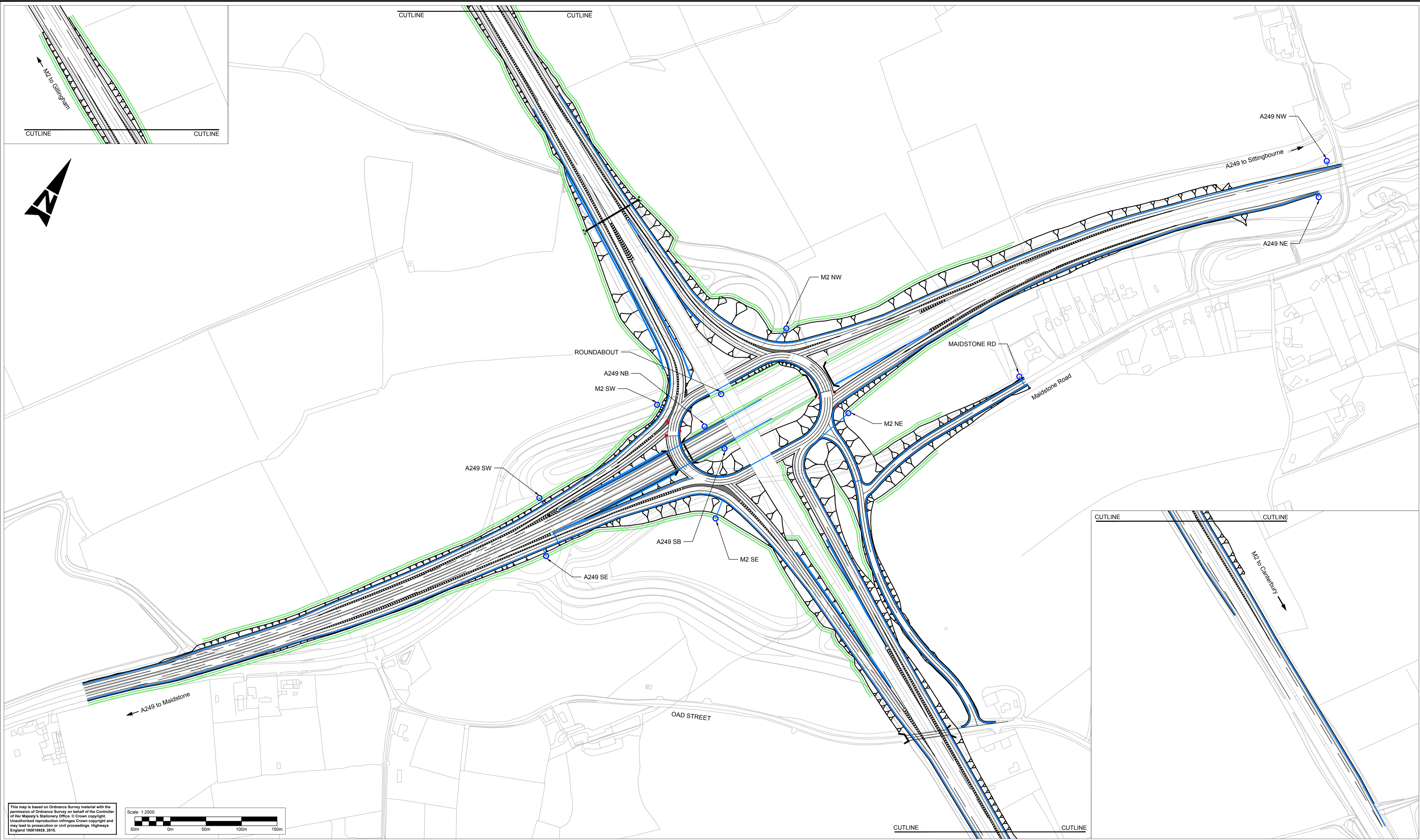
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Project Title: REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS				
Drawing Title: HIGHWAYS DESIGN LAYOUT OPTION 4 DRAINAGE STRATEGY				
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Original Size: A1	Date: ---	Date: ---	Date: ---	Date: ---
Drawing Number: HE551521 - WSP - HGN - M2J5 - DR - D - 0302	Project: ---	Volume: ---	Project Ref. No.: 5145771	Revision: P01.1
Location: ---	Type: ---	Role: ---	Number: ---	

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0 10
Millimetres



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- KEY:**
- PROPOSED DRAINAGE PIPE
 - PROPOSED SOAKAWAY OR CUT-OFF DITCH
 - PROPOSED OIL INTERCEPTOR

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction (Enter "None" if applicable)	
Maintenance / Cleaning (Enter "None" if applicable)	
Use (Enter "None" if applicable)	
Decommissioning / Demolition (Enter "None" if applicable)	

Rev.	Date	Description	By	Chk'd	App'd
P01.1		First Issue			

Drawing Status: **WORK IN PROGRESS**

Suitability: **S0**

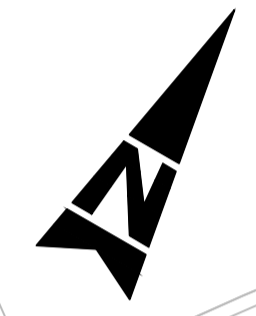
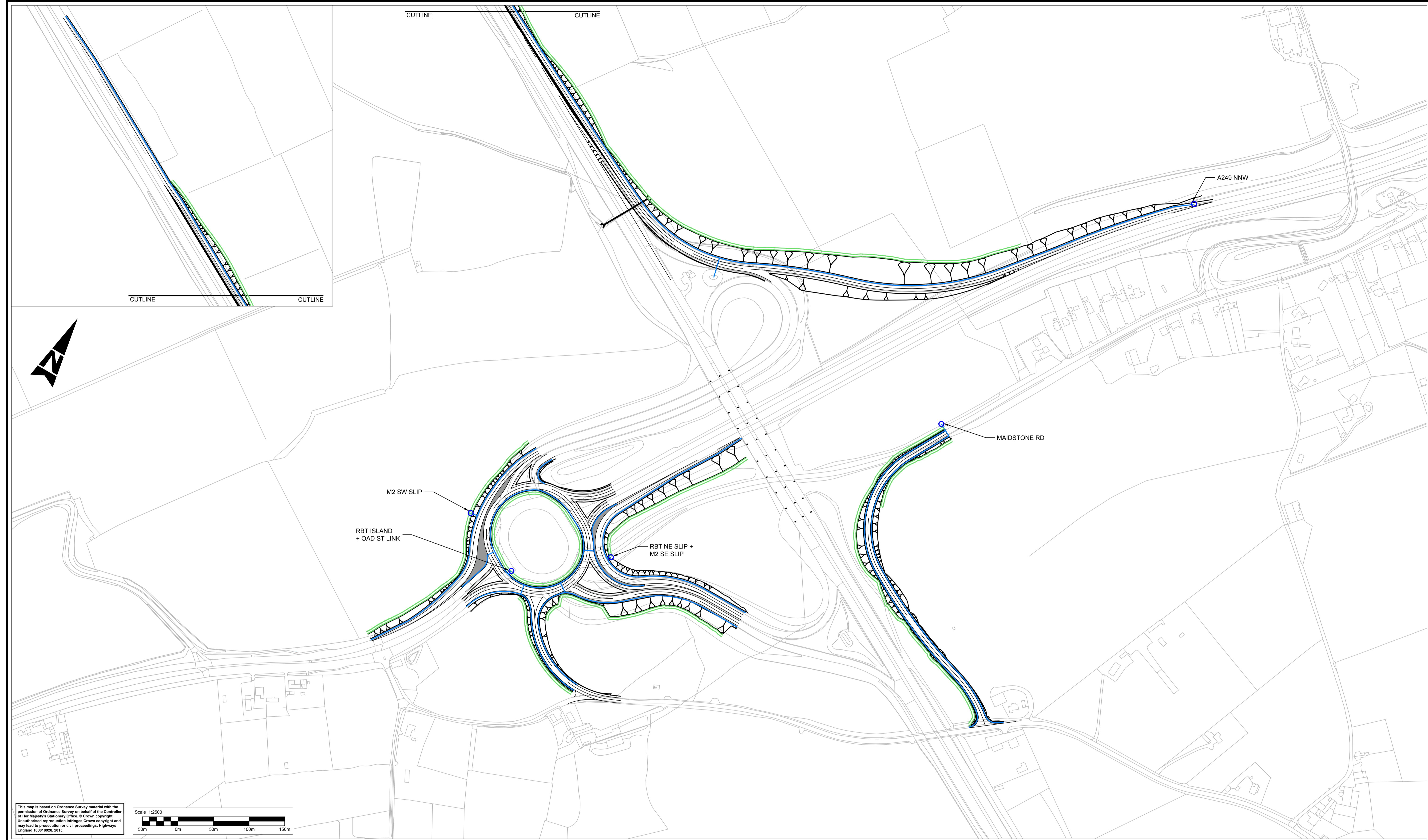
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Project Title: REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS				
Drawing Title: HIGHWAYS DESIGN LAYOUT OPTION 10 DRAINAGE STRATEGY				
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Original Size: A1	Date: ---	Date: ---	Date: ---	Date: ---
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Location: ---	Type: ---	Role: ---	Number: ---	Revision: P01.1

DO NOT SCALE
 0 10 100
 Millimetres



CUTLINE CUTLINE

CUTLINE CUTLINE

A249 NNW

MAIDSTONE RD

M2 SW SLIP

RBT ISLAND + OAD ST LINK

RBT NE SLIP + M2 SE SLIP

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- KEY:**
- PROPOSED DRAINAGE PIPE
 - PROPOSED SOAKAWAY OR CUT-OFF DITCH
 - PROPOSED OIL INTERCEPTOR

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction (Enter "None" if applicable)					
Maintenance / Cleaning (Enter "None" if applicable)					
Use (Enter "None" if applicable)					
Decommissioning / Demolition (Enter "None" if applicable)					

Rev.	Date	Description	By	Chk'd	App'd
P01.1		First Issue			

Drawing Status: **WORK IN PROGRESS** Subtality: **S0**

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Project Title: REGIONAL INVESTMENT PROGRAMME M2 J5 IMPROVEMENTS				
Drawing Title: HIGHWAYS DESIGN LAYOUT OPTION 12 DRAINAGE STRATEGY				
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Location: ---	Type: ---	Role: ---	Number: ---	Revision: P01.1

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