Report

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Deal Transport and Flood Alleviation Model Study

Stage 2 Report

October 2012

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For and on behalf of GVA Grimley Ltd

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1. Introduction

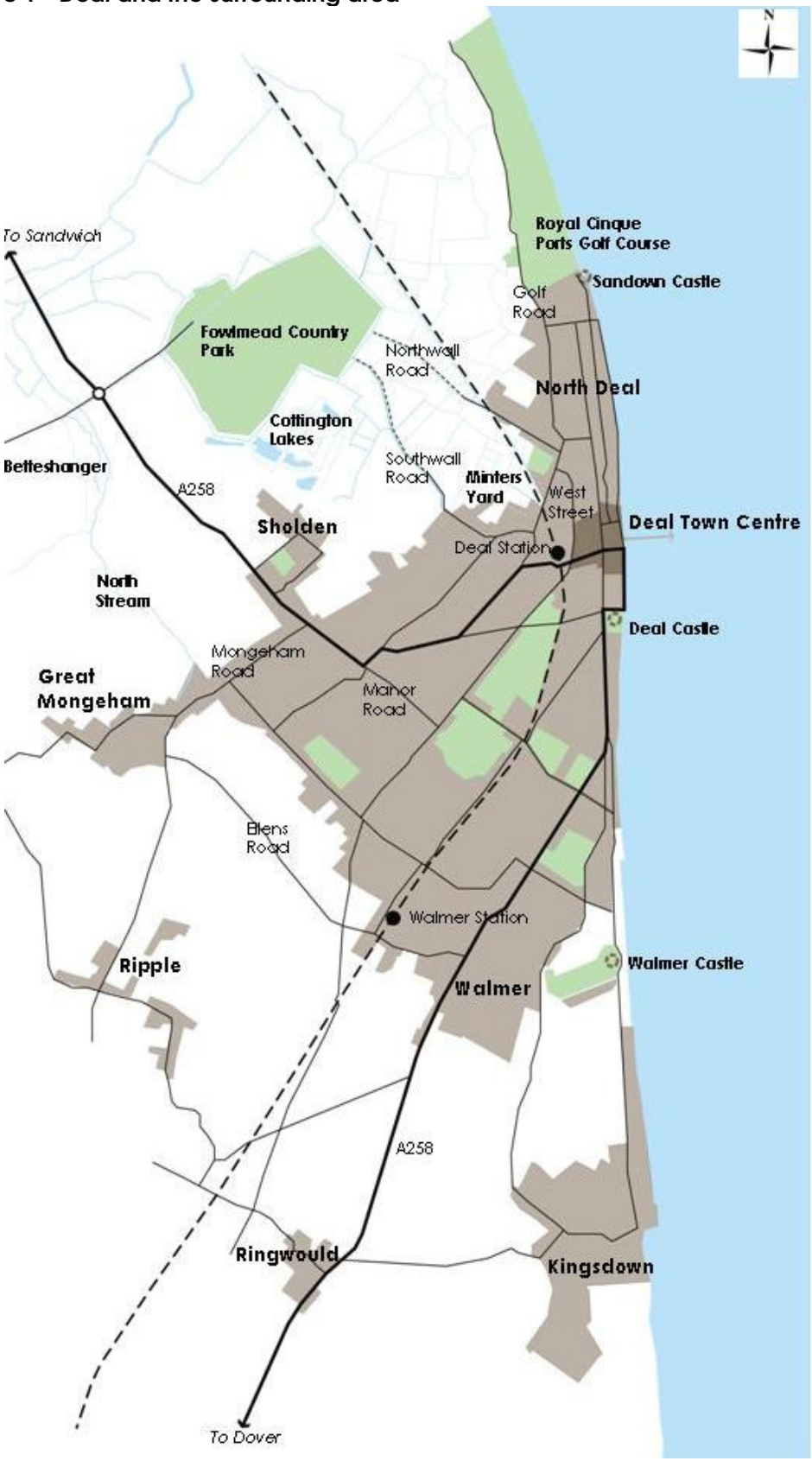
Purpose of this Study

1.1 The Dover District Local Development Framework (LDF) Core Strategy sets out the growth aspirations for Dover District for the period 2006 to 2026. Adopted in 2010 the Core Strategy provides the statutory basis for the growth of Deal and its constituent communities, identifying a housing delivery target of 1,600 additional homes and also employment growth. The Core Strategy identifies the potential for further development to be accommodated within Deal. However, this is required to be subject to detailed testing of the feasibility of overcoming constraints evident in the area.

1.2 The purpose of this Study is to understand the existing issues faced by the Deal community. Transport, flooding, ecology, landscape, town character and the town centre have been investigated. There are future challenges in these domains that the Deal community will face which will need to be addressed, such as flood risk and also how this will be addressed by flood defence improvements. These current issues and future challenges present constraints on growth. Dover District Council embarked on this study to avoid uncoordinated and ad-hoc public and private investments in single issues or constraints without a net benefit to the Deal as a whole.

1.3 This study investigates Deal to identify existing conditions, issues, challenges and constraints in detail. It investigates interventions the Deal community requires, as well as the relationship between this local mitigation and future growth. The goal is to understand what Deal needs today and in the future, and also whether new development can be accommodated in a manner which provides a net benefit to residents of Deal as a whole. It also establishes the basic feasibility and deliverability of proposals, given regulatory and funding regimes.

Figure 1 - Deal and the surrounding area



Stage I of the Study

1.4 The first stage of the Study created a robust baseline to identify existing conditions, issues and challenges, as well as the relationship between local mitigation and future growth. In particular, Stage 1:

- Clarified existing conditions;
- Identified future challenges that will be faced in Deal;
- Established appropriate measures to tackle existing issues and future challenges – providing net benefits to residents;
- Identified broad opportunities for future growth;
- Tested scenarios for growth to explore the range of interventions, investments and mitigations that could be delivered.

1.5 The Stage 1 baseline did not identify any fundamental barriers to future growth beyond the Core Strategy level in the domains that UK planning decisions are made within. Reference to this national basis for making local decisions has been reinforced by the National Planning Policy Framework.

1.6 It was concluded that there are localised and typical development impacts that can be addressed as part of project delivery. The delivery of infrastructure improvements, such as flood defence improvements, will create new development opportunities as well as alleviating current issues and future threats. However, strategic infrastructure will require capital funding beyond committed management and maintenance revenue budgets. Contributions from the private sector will become increasingly important to deliver infrastructure improvements. However, a planned, coordinated and managed approach would be required to ensure further growth addresses existing issues, mitigates inevitable future threats and mitigates constraints on further expansion.

1.7 The Stage 1 report can be viewed online at: *http://www.dover.gov.uk/regeneration_delivery/local_development_framework/deal_transport_and_flood_model.aspx*

Public Consultation Feedback

1.8 A series of public consultation events during and following Stage 1 identified a set of local concerns and objectives for, and future change or growth at, Deal.

- There is a key concern over transport capacity and highway and junction performance. This is the dominant issue raised by local residents;
- Respecting the character of the existing town, and ensuring the best qualities of its built fabric, density and scale are maintained;
- Strengthening the existing town centre, by retaining more local spending and growing the catchment;
- Consider the cumulative impact on infrastructure requirements of any growth, rather than the effect of individual developments; and
- Address existing issues not make them worse, to create a net benefit to Deal.

Stage 2 of the Study

1.9 The purpose of Stage 2 of the study is to investigate a range of options to establish the broad extent and general location of future growth in North and Middle Deal. This has entailed further investigation of a range of transport, flood, environment and heritage constraints and opportunities. Detailed investigations have identified improvements that can be made to Deal to address current issues, how future threats can be mitigated against and also the relationship between mitigation and any future growth.

1.10 Given strong local concerns, investigations in Stage 2 have considered a range of strategic transport options as a means of defining the parameters of a feasible growth direction. Critically, potential road alignments help identify where they would conflict with environmental, heritage or flood risk constraints. This approach helps identify locations where new residential or commercial development would be constrained by the same constraints. The highway capacities associated with each option have a direct relationship to the scale or quantum of growth that could be accommodated by highway solutions.

1.11 As a result of the more detailed testing carried out Stage 2, a broad quantum of development and how it may relate to the existing Deal settlement geographically has been identified.

1.12 This report is organised to address and provide:

- Key investigations and constraints revealed for flood risk after defence improvements; environment and ecology; heritage and conservation; existing built fabric; transportation and traffic conditions;
- a Strategic Options Investigation approach using transport access routes and capacity as a means to identify constraints and opportunities;
- An assessment of options and the parameters these set for future growth directions beyond the Core Strategy;
- A more detailed investigation of a Mitigation Strategy for growth potential in the North and Middle Deal Areas; and
- A conclusion and recommendations on the scale and location of feasible future growth as a basis for conceptual masterplanning to be carried forward in Stage 3 and 4 of the study

1.13 Individual technical reports are provided as Appendices to this document. These include:

- North Deal Flood Risk and Drainage Assessment
- Flood Modelling and Hazard Mapping
- Road Link Options Appraisal & Initial Transport Model Results
- Phase 2 Traffic Assessment
- Utilities Report

2. Key Investigations and the Constraints Identified

Contextual Conditions

2.1 This Stage of work has entailed further investigation of key contextual conditions, constraints and opportunities. The purpose has been to provide a clear summary of the factors that future planning decisions are likely to be based on and therefore provide a robust basis for the future development of Deal.

2.2 It is important that the factors that Local Planning Authorities must consider in determining planning applications against, and those which land/property owners and developers will base development decisions on, are made clear for North and Middle Deal. Conditions are set out for:

- The area at risk from flooding after defence improvements;
- Environment and ecology;
- Heritage and conservation;
- Existing built fabric; and
- Transportation and traffic.

2.3 The purpose is to identify constraining factors and locations to inform the broad extent and form of any future development that could be justified in town planning and statutory terms.

Tidal Flooding

Stage 1 Findings: Tidal Flooding

Under the Present-Day scenario, with the existing present flood defences, most parts of the town centre, and north and north west of Deal are at risk of tidal flooding from a 1 in 200 year flood event with a breach and overtopping scenario taken into consideration. Due to the climate change factors the risk of flooding will increase significantly in the future unless the standard of flood defences is raised. However, the proposed coastal defence scheme, if implemented, will reduce the risk of flooding to people, properties, infrastructure and the environment.

Flood Conditions Following Installation of new Defences

2.4 The basis for Stage 2 investigations has been a flood modelling exercise in collaboration with the Environment Agency and Dover District Council officers.

2.5 To protect Deal from tidal flooding, the EA has prepared a flood defence scheme intended to reduce the risk of flooding. The scheme is funded and construction work will commence in 2012. The proposed flood defences at Deal will reduce the risk of coastal flooding to the town, and include:

- Construction of a new wave wall along the promenade between the Royal Hotel and Deal Castle;
- Provision of 250m of improved rock protection along the existing embankment, to strengthen the beach just north of Sandown Castle; and
- Raising and widening of the shingle beach from the northern part of the extended rock revetment to Deal Castle, and maintaining the beach profile with annual recycling of shingle (periodic re-shaping of the beach using bulldozers, diggers and trucks as required following storm events).

2.6 Further north, parts of Sandwich are currently at risk of tidal flooding. Defences for this area are also planned to commence in the financial year 2012 / 2013.

Stage 2 Findings

2.7 The area to the North and North West of Deal currently lies mostly within Flood Zone 2 and 3. The proposed defence will significantly improve the level of protection against tidal flooding (to a 1 in 300 year storm event). The extent of flooding (of a 1 in 200 year storm event) will be eliminated.

2.8 The risk of breach is considered to be extremely low. In the event of a breach at a location to the north of Sandown Castle flood waters would eventually flow to approximately the same area as the current flood zones. However, for the purposes of development planning a Rapid Inundation Zone (RIZ) has been used to determine those areas which could be flooded to a depth (200 millimetres) within a given time of a breach (30 minutes). See *Appendix A: North Deal Flood Risk and Drainage Assessment (Section 2)*.

2.9 The primary basis upon which planning and development control decisions will be made in this area will be related to the vulnerability to the proposed development to coastal flooding. The flood defence scheme will reduce the risk of flooding across an area extending from the defence scheme through North Deal and to the west to the railway line. A small area to the east of the railway line that has been at flood risk, will have that risk reduced by the defence works. Development proposals across this area will be subject to 'sequential' and 'exception' tests (as defined in NPPF) which will make choices between development locations, identifying those with the lowest risk and ensure that any proposals are sustainable and safe.

2.10 Given the current extent of flood zones, the nature and effect of the flood defence scheme and the resulting minimal flood risk, any proposed 'vulnerable' development ito the east of the rail line (and in certain land parcels to the west) will need to meet the Sequential and Exception Tests. Given much of the area is at low risk there is a strong probability of housing development being considered suitable to the west of the rail line provided mechanisms for adequate warning of storm and tidal events, and safe access paths to exit the area are provided. There is also a strong probability of commercial development meeting these requirements to the east of the railway line. Both uses and locations would be subject to other planning and transport considerations.

2.11 In the event that the sequential test shows that development in these areas is appropriate - that there are no other reasonably available sites at lower risk of flooding – more

vulnerable types of development should be located in areas of least risk. It is likely that any living accommodation would have to be raised above the flood level predicted in the breach modelling. All proposals would require a site specific Flood Risk Assessment to demonstrate the exception test has been met.

2.12 Further details can be found in Appendix A: North Deal Flood Risk and Drainage Assessment (Section 7 and Appendix 1). As part of this assessment an updated hazard map has been produced and is contained in Appendix E.

Surface Water

Stage 1 Findings: Surface and Ground Water

Surface and ground water are not considered absolute constraints to development in North/Middle Deal. Appropriate deployment of Sustainable Urban Drainage Systems can actually be used to enhance wetland areas to the north of the town.

2.13 The Environment Agency's Surface Water Flood Map indicates that some areas north of Deal are at risk of surface water flooding. Surface water flooding should not act as a significant constraint for future growth within North and Middle Deal providing consideration is given to drainage infrastructure during the planning and design stage.

Stage 2 Findings

2.14 Following the consultation process for the Stage 1 Report Kent County Council provided additional information relating to surface water flood risk and historic events within Deal. The focus of the areas most 'at risk' from surface water flooding was within the town centre and further south than the study area for this work extends. As such these revealed no further constraints on growth or development to those established within Stage 1.

2.15 It was however reinforced by both KCC and the Stour IDB that surface water run off rates within the Study area will need to be carefully controlled to maintain rates consistent with the current Greenfield rates, as such storage and drainage for surface water need to be integral to future plans.

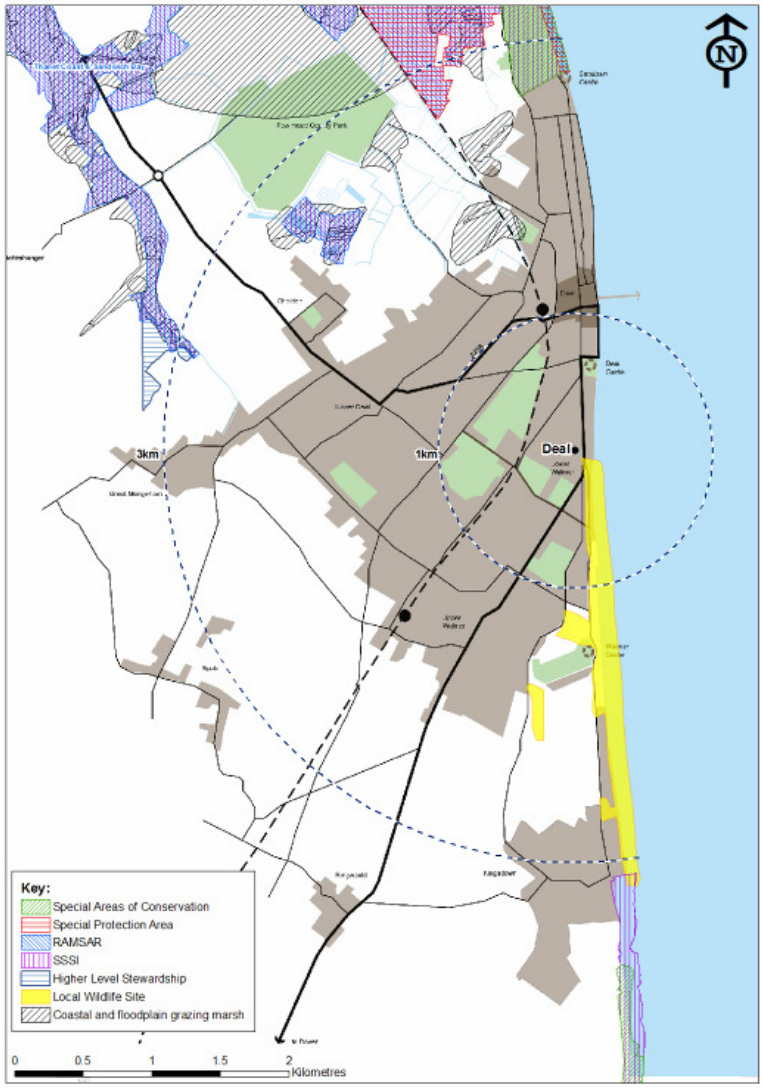
2.16 Stage 2 Investigations have addressed the most appropriate SuDs approaches for North and Middle Deal, which would need to be applied as part of any mitigation strategy. Details can be found in Section 5 of Appendix A: North Deal Flood Risk and Drainage Assessment. Sustainable Drainage Systems (SuDS) are the primary means by which this increase in run-off due to development should be mitigated. It is also a possibility to convey the additional runoff water northwards through the existing drainage ditches to the Hacklinge Marshes.

Habitat and Ecological Considerations

Stage 1 Findings: Habitat and Ecology

Data review indicated clear patterns of species richness especially to the south of Deal within chalk habitats. Otherwise the data suggest that the areas to the west and north of Deal are predominantly species-poor and present few constraints within habitats that may be identified for development. A range of Natura 2000 habitat sites and environmental designations were found north of Deal. These sites present significant constraints to new construction to the North, East and South of the Fowlmead Country Park. This area also includes UK Biodiversity Action Plan Sites in the form of Coastal and Flood Plain Grazing Marshes.

Figure 2: Environmental and Habitat Designations



Stage 2 Findings

2.17 There is a cluster of other Environmental and Habitat Designations lying on the east and west sides of the railway line north of Deal. There are also clusters to the north and south of Fowlmead Country Park. In some cases there is overlap with Natura 2000 sites. The area includes Higher and Entry Level Stewardship Sites. These are not protected in legislation, and not an absolute constraint on development. The number and extent of these designations is limited to the north of Deal.

Heritage Considerations

2.18 Stage 1 provided a broad overview of conservation areas and specific locations at a town wide scale. Stage 2 has investigated specific locations and buildings that present constraints to either infrastructure expansion of new development.

2.19 Heritage assets cluster to the west of the study area, close to the London Road and Manor Road junction and further north around Sholden. Key heritage designations are:

- Buildings at the South East Corner of the London Road and Manor Road Junction;
- St Nicholas' Church – Grade II Listed* church on the east side of London Road;
- St Nicholas' Church Graveyard – Grade II Listed* on the east side of London Road;
- Sholden Hall – Grade II Listed within Sholden Village;
- Hull Place – Grade II Listed to the north of Sholden Village; and
- Roman Villa remains – identified north east of Sholden.

2.20 Within Sholden the listed properties have two key influences on the potential in the village:

- The character of the village itself, reducing suitability of increasing traffic
- Potential to increase capacity or introduce new access onto London Road close to Mongeham Road

2.21 The conservation area at the Manor Road London Road junction (as shown in the lower part of Figure 3) contains a number of listed buildings and structures which provide particular restrictions on the ability to increase the capacity and performance of this key junction. In particular the key properties are:

- Jenkin's Well, 288 London Road
- 92-98 Manor Road
- St Leonard's Church

2.22 When considering the opportunities at this junction it is particularly important to consider the details of individual building listings. Individually these buildings have architectural and heritage interest and merit however there is also "group value" in the collection of properties on the character at the junction.

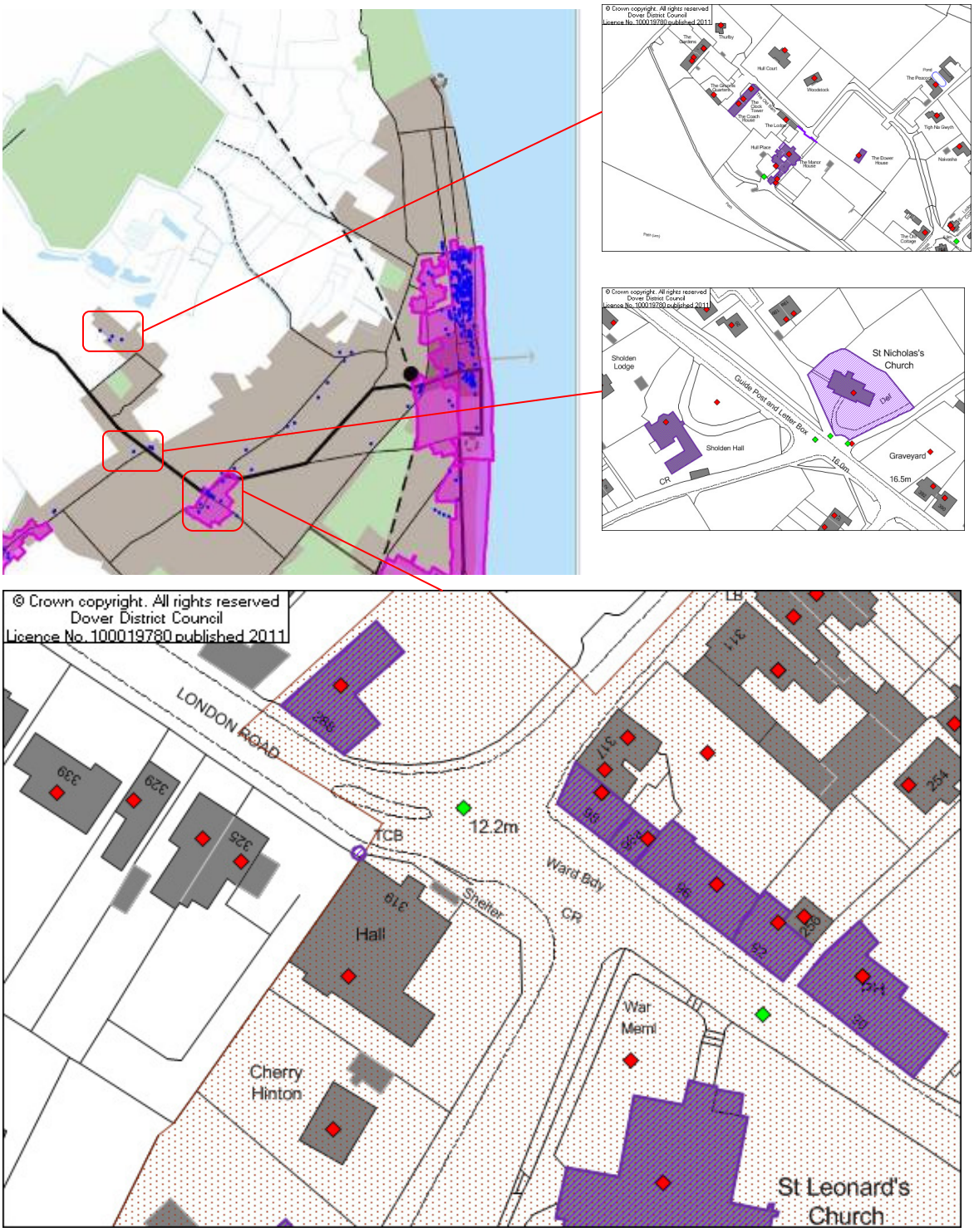


Figure 3 – Heritage Assets

2.23 For this reason not only do the buildings need to be considered on their own merits but also how the relate to each other and the road, it is a key reason for the listing of the K6

Telephone Kiosk to the west of London Road which details how it visually links to the the Church and the (unlisted) Hall building.

2.24 This consideration of the "group value" and setting is highlighted as an important consideration for the treatment of heritage assets within *"The Setting of Heritage Assets: English Heritage Guidance, 2011"* which sets the framework for assessing the impact on existing heritage assets. This includes assessment of:

- Impacts on the Listed Buildings; and
- Impacts on their settings.

2.25 As such these designations and their setting present a constraint to new development and new infrastructure construction on these sites and in their immediate areas. The National Planning Policy Framework maintains an emphasis on the role that heritage assets play in assessing future proposals (NPPF Para 1.29). The impacts of the heritage considerations are investigated in light of potential access strategies in more detail in Section 3 of this report.

Utilities Considerations

2.26 Investigations carried out as part of Stage 2 have allowed utility providers to respond to the broad location and potential scale of growth in the North and Middle Deal area. Responses are indicated in Appendix D: *Utilities Summary.*

2.27 The existing utility infrastructure provides adequate service to the existing urban area however, particularly for surface water drainage, at times of high stress the current system operates at or close to capacity. As such there is the potential for the capacity of utilities infrastructure to act as a constraint on the future development capacity of North and Middle Deal, particularly as the capacity of existing networks is finite. Whilst utility capacity assessments were undertaken as part of the LDF process it is unclear whether any growth beyond the Core Strategy level can be accommodated, particularly given the time elapsed since these assessments were undertaken and the issues identified at the time.

2.28 In consultation with utility infrastructure providers we have investigated at a strategic level the future provision of:

- Water Supply

- Waste Water & Drainage
- Electricity
- Gas

2.29 It should be noted that given the nature of the Study, and the stage at which consultation with utilities providers was undertaken, all consultees highlighted their ability to only consider potential issues at a strategic level. They advised further consultation once specific development proposals and site plans had been developed, which extends beyond the scope of this Study. In order to identify any site specific constraints and considerations more detailed discussions would need to be undertaken with the utility providers.

2.30 A summary of the key findings are presented in the table overleaf:

Utility	Existing Constraints	Planned Upgrades	Planned Period	Additional Requirements
Water Supply	None	Continued bulk transfer to Deal reservoir. Universal metering.	2014	Potential new connections to supply network if capacity limited.
Waste Water	Capacity of combined sewers and surface water drainage network.	Maintenance and clearance of ditch network – Stour IDB.	2014	Alternative surface water discharge methods. Potential new sewer/pumping capacity. Potential treatment facilities upgrade.
Electricity Supply	None	None	To 2021/22	Potential need to upgrade circuits and extend switchboard provision at Deal substation
Gas Supply	None	None	2026	Potential reinforcement main connection.

Transport Considerations

2.31 The A258 acts as the only primary road access for Deal and connects the town with Dover in the South and Sandwich to the North. The B2056 Manor Road acts as a secondary route within Deal and provides a diversion for traffic on the A258 wishing to by-pass the town centre. The A256 is the primary north/south route to the west of Deal. The road provides a connection between Dover with Sandwich and the wider North Kent region. Deal's street network includes a historic grid at the historic centre and north and south along the coast, and a broader grid to west of the railway line.

Stage 1 Findings: Transport

Deal experiences problems with traffic congestion most notably during peak periods. On a daily basis local residents contribute to, and experience traffic queues as they attempt to make their journeys to and from work or school. Most congestion is linked to the level of out-commuting which is significant; in-commuting and through traffic are much lesser issues. Congestion in Deal also tends to be focussed around a series of bottleneck junctions.

A unique feature of the highway network in Deal is the fact that most of the development in the town is accessed off the A258 which provides the main route into and out of town. Much of the congestion arises as a result of traffic trying to filter through the local network of generally narrow residential streets to gain access to the A258. In many places the road layout is highly constrained by the frontage development or roadside parking.

If compared to some of the busier towns in the country, delays in Deal would not be classified as severe by standard transport industry and governmental measures.

Stage 2 Investigations

2.32 Based on information identified from a review of transport baseline conditions and our forecasts for traffic growth, the following junctions have been identified as potential constraints on development that could be implemented in the areas of search identified in Stage 1.

- A258 London Road / B2056 Manor Road;
- A258 London Road / Mongeham Road;
- A258 London Road / Albert Road;
- A258 London Road /Queens Street / West Street; and
- A258 Dover Road / Cornwall Road.

2.33 In response, a series of strategic transport options were considered that would have the potential to address these constraints, and which would also respond to stakeholder suggestions for strategic access routes.

2.34 The next chapter uses transport considerations as a mechanism to identify constraints and opportunities across a range of factors including: transport itself; environment, heritage and flooding. A series of highway access scenarios are used to investigate potential growth locations and quantities. This also entails further assessment of the opportunities to improve existing conditions within the town of Deal.

3. Strategic Options Approach

Using Access as a Way to Confirm Constraints

3.1 Stakeholder and public consultation revealed a significant local concern with traffic and transport issues. At the same time, specific proposals were put forward by the public and stakeholders for a link road to the north of Deal. It was proposed this could act as a relief road for traffic travelling north from Deal, relieving demand in the town. It was also suggested this could mitigate the impact of any future growth at north or middle Deal.

3.2 As a key dependency for development, it was concluded that investigation of highways options was important at a strategic level, and that the physical construction requirements of routes and alignments for this infrastructure would reveal the level of flood, environmental and heritage constraints in the area and how far these could be addressed.

The Type of Highway Investigated

3.3 The type of highway considered for North Deal is based on the assumption that a new road and any new junctions will need to have sufficient capacity to accommodate:

- Traffic from the existing urban area;
- Additional trips generated by planned growth;
- Future trips by development over and above Core Strategy levels.

3.4 Given the need to accommodate the full range of vehicle movements, the strategic route assessments are based on the following road specification:

- 7.3 metre carriageway (for strategic route options 1 and 2 only);
- Associated pedestrian and cycleways;
- Street lighting within the built up area and at key junctions in accordance with Kent County Council standards;
- Appropriate landscaping; and

- Suitable junctions

3.5 Each of the options considered has to demonstrate the key transport requirements of a rational route connecting origins and destinations together with an appropriate relationship between costs and the level of usage.

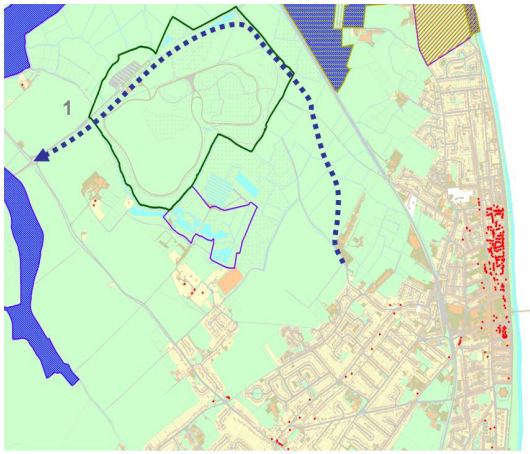
3.6 An indicative cost range was also identified to give an illustration of scale and highlight the relative costs between options. It is stressed that the estimates are PRELIMINARY and based on composite rates for infrastructure items drawn from published information and records of out-turn construction costs. The cost estimates should be viewed with caution and not used for any purposes other than those outlined above. In accordance with HM Treasury Guidance we have applied an optimism bias (contingency allowance) of either 44% or 66% within the cost estimate. The higher contingency is applied to proposals where the expected engineering works are more complex.

Introduction to the Options

3.7 The following route options were considered.

Access Option 1: A258 Betteshanger Roundabout to North Deal

3.8 At a concept level Option 1 would involve a purpose-built access road from the Betteshanger Roundabout on the A258 skirting the northern boundary of Fowlmead Country Park. Whilst it may be possible to utilise or upgrade the existing park access to create the western section of the route, the majority of the link would require new construction in an alignment to the west of the railway lines. The overall length of new road required to access development north of Deal would be approximately 2.5km running through the existing countryside and Country Park. Significant reconfiguration of the Park access and parking arrangements would be required. This option could be linked to a new connection to North Deal via a new connection over the railway line that links into Golf Road at a new junction north of Ethelbert Road. This could provide wider accessibility benefits in conjunction with a link road solution, by providing access to and from North Deal. A bridge and new additional grade crossings have been investigated.

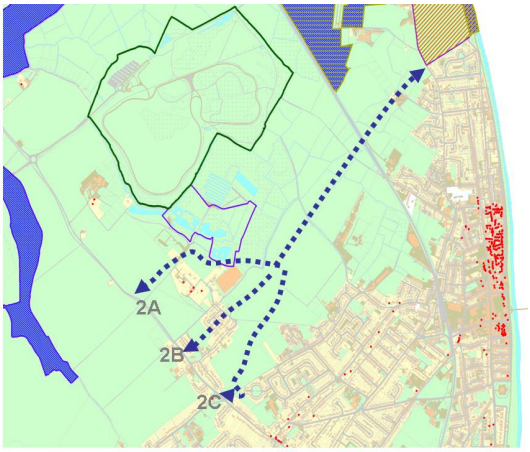


Access Option 2 – Link West to A258

3.9 Option 2 is a link to the A258 London Road to the west between North and Middle Deal and Fowlmead Country Park. Three options for how this could connect were tested:

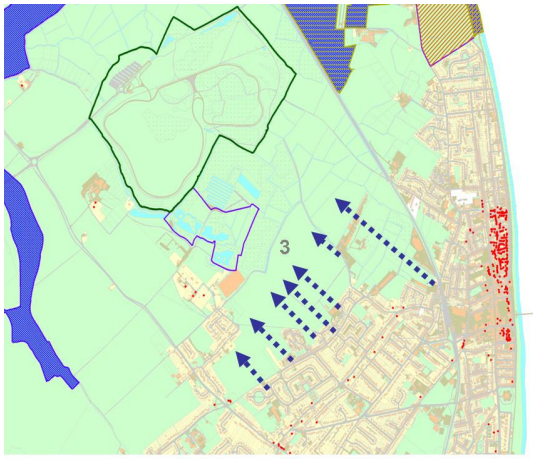
- 2A - to the north of The Wards site in Sholden;
- 2B - through the Village of Sholden, using existing roads;
- 2C - south of Sholden close to the Mongeham Road junction.

3.10 This option could also be linked to a a new connection to North Deal via a new connection over the railway line that links into Golf Road at a new junction north of Ethelbert Road. This could provide wider accessibility benefits in conjunction with a link road solution, by providing access to and from North Deal.



Access Option 3 – Extended Framework

3.11 Option 3 is based on extending the existing street framework to the north and a series of improvements to the existing network across Deal. From a movement perspective, this enables traffic to be flexibly dispersed across multiple routes and through multiple junctions.



Strategic Access Options Evaluation

3.12 Each of the three options and sub components were evaluated for basic feasibility. The transport case of each was considered. This entailed assessment against standard criteria for funding and planning approval by highways authorities at local, county and national level. This was also an opportunity to test routes and alignments for their relationship to environmental, heritage and property impact as well as likely costs. The following table summarises this assessment.

Considerations						Conclusion
Strategy	**Transport Viability**	**Environmental Constraint**	**Heritage Impact**	**Property Impact**	**Infrastructure Cost (excludes land assembly etc)**	
1 – Access from Betteshanger Roundabout via Fowlmead	Indirect route, Capacity in excess of need, Unproven in transport terms	Within 200 metres of: RAMSAR, SAC, Grazing Marsh, Impact on setting of Fowlmead Country Park	N/A	N/A	£4.4mn to £7.3mn	Neither feasible nor recommended.
2a – Access from new A258 junction north of Wards	Suitable level of capacity would be provided	Within 200 metres of: RAMSAR, SAC, Grazing Marsh, Impact on setting of Cottington Lakes Railway crossing could increase recreation al pressure on SAC and SPA	Listed properties at Hull Place, Remains of Roman Villa	Requires land acquisition including operational nursery land	£8.2mn to £13.2mn	Significant environmental and property constraints. Not recommended.
2b – Access via existing Sholden New Road and The Street	Constrained current traffic capacity in Sholden Village and A258 junctions. Lack of footpaths on The Street	Within 200 metres of: RAMSAR, SAC Railway crossing could increase recreation al pressure on SAC and SPA	Listed properties at Hull Place, Listed properties on The Street	Requires land acquisition to increase traffic capacity through the village	£8.3mn to £13.3mn	Significant heritage, environmental and property constraints. Not recommended.
2c – Access from new A258 junction opposite Mongeham Road	New junction capacity limited by listed St Nicholas Church	Within 200 metres of: SAC, Grazing Marsh Railway crossing could increase recreation al pressure on SAC and SPA	Listed St Nicholas Church and graveyard and Sholden Hall	Requires acquisition of land and residential property	£7.4mn to £12mn	Neither feasible nor recommended.
3 - Extending existing framework and junction improvements	Enables dispersed approach across improved framework within existing urban area	Avoids environmental designations	N/A	Requires additional connections within extension area.	£2.4mn to £3.75mn	Feasible subject to development quantum and traffic capacity determination.

Access Option 1: A258 Betteshanger Roundabout to North Deal

3.13 The northern route from the A258 around Fowlmead Country Park and south to North Deal does not meet fundamental transportation requirements.

3.14 Given the balance of traffic that travels south from Deal, this would be a lengthy and circuitous route and would represent an excessive distance between North Deal points of origin and destinations. This route does not relate to the prevailing pattern of traffic movement in the Deal area. The northern highway route directs traffic north, while the balance of traffic movement generated in Deal is towards the south of the town. This route would produce a low Benefit Cost Ratio (BCR) as measured by the Department for Transport's highway proposal appraisal process.

3.15 This alignment is significantly constrained by environmental designations, including SACs and SPAs. As routes would directly impact RAMSAR buffer zones, and other environmental designations, there would be very significant and potentially insurmountable regulatory opposition to construction of infrastructure of this nature in this location. Precedent suggests considerable Environment Agency resistance to such a direction, with limited prospects for approval as it is not expected that it could be demonstrated that a successful Overriding Public Interest (IROPI) case could be mounted. IROPI can only be established where it can proven that no alternative solution exists and the project:

- Addresses serious public health and safety risks;
- Is in the interests of national security and defence;
- Has a clear and demonstrable environmental benefit at a national scale;
- Makes a vital contribution to strategic economic development; and
- Not proceeding would have unacceptable social and/or economic impacts.

3.16 Town Planning criteria and processes also severely constrain such prospects. Significant costs would also be entailed in such an application, with very high risk of refusal. There would also be impacts on the setting of the Fowlmead Country Park.

3.17 At this stage, costs for road construction could be between £4.4mn and £7.3mn. This is a broad range of costs for construction and would depend on how far the exiting roads could be used. This does not include costs for third party land acquistion. It also does not

include costs for mitigation of impacts on RAMSAR and other sites. Significant planning, environmental and legal costs could be anticipated as noted above. It is very unlikely that funding would be available from Kent County Council, Dover District Council or central government funding. There is no expectation that the public sector would fund land acquisition, design and engineering or construction of a project of this scale along this route. Given potential costs, private sector construction of this route is unlikely.

3.18 In the professional opinion of the consultant team, this is not considered to be a feasible option for further investigation given the multiple constraints on delivery.

Access Option 2 – Link West to A258

3.19 This option is has a primary east west route to the north of Deal, with three sub-options for connecting to the A258 London Road. This route was established and tested in order to investigate the widest range of alternatives and to clarify the range of constraints faced.

3.20 While the challenges of certain options may have already been known to some, this exercise is also intended to broaden knowledge across the community and clarify the basis upon which decisions are taken. We note that a number of highway, environmental and heritage constraints were identified through this process, in addition to the impact of recent planning decisions.

3.21 Access to a **new junction at the A258 north of Sholden** and the recently consented Wards development site could provide a suitable level of traffic capacity and could be transport requirements. However, the route would pass within 200 metres of a RAMSAR site and impact a Special Area of Conservation and Grazing Marshes. There would also be impacts on the setting of Cottington Lakes.

3.22 From a heritage perspective there would also be impacts on the setting of listed properties at Hull Place. The remains of a Roman Villa would also need to be addressed.

3.23 Potential costs are estimated at £8.2mn to £13.2mn, excluding land acquisition, which would include parts of operational nursery land. This route would also face the significant planning, environmental mitigation and legal costs, all at risk.

3.24 In the professional opinion of the consultant team, this is not considered to be a viable option for further investigation given the multiple constraints on delivery.

3.25 A second sub-option in this area investigated **access to the A358 via the existing Sholden New Road and The Street**.

3.26 This option is constrained by current traffic capacity in Sholden Village. There is a lack of footpaths and narrow carriageways and street widths at a number of locations on the Street. An upgraded junction would be required at the A258 to address the grade shift up to the London Road and the lack of visibility because of buildings close to carriageways at the existing junction.

3.27 This route would come within 200 metres of a RAMSAR site and a Special Area of Conservation, with the significant regulatory constraints set out above.

3.28 Impacts on the heritage setting of listed properties at Hull Place and Sholden Village Hall, as well as the overall fabric of Sholden would be expected if the route were to use Sholden New Road. A route using The Street would be constrained by and alter the setting of the St Nicholas' Church and Graveyard.

3.29 Potential costs are estimated at £8.3mn to £13.2mn, excluding land acquistion, which would include residential properties at the east part of Sholden. This route would also face significant planning, environmental mitigation, heritage mitigation and legal costs. Individually and in combination these present the Council with a significant risk of failure to deliver the scheme.

3.30 In the professional opinion of the consultant team, this is not considered to be a viable option for further investigation given the multiple constraints on delivery.

3.31 A further sub option investigated access via a **new A258 junction opposite Mongeham Road** to the south of Sholden.

3.32 From a transport perspective a new junction would be constrained by its proximity to the Mongeham Road junction. Highway standards require minimum distances between junctions on to A roads. The capacity of the junction would also be limited by the impact on the listed St Nicholas Church and graveyard.

3.33 This route would come within 200 metres of a RAMSAR site and a Special Area of Conservation, with the significant regulatory constraints set out above.

3.34 Potential costs are estimated at £7.4mn to £12mn, excluding land acquistion, which would include residential properties at the east part of Sholden. This route would also face the significant planning, environmental mitigation, heritage mitigation and legal costs. Individually and in combination these present the Council with a significant risk of failure to deliver the scheme.

3.35 In the professional opinion of the consultant team, this is not considered to be a feasible option for further investigation given the multiple constraints on delivery.

Access Option 3 – Extended Framework

3.36 This option extends the existing highway framework from Deal at multiple points. An essential component of this approach is improvement to streets and junctions in the North and Middle Deal areas. Under this option a selection of streets could be extended north of Middle Deal Road and Albert Road, between London Road and the railway line.

3.37 From a transport perspective, this approach provides a rational solution. It enables any increase in traffic demand to be dispersed flexibly across multiple routes and alterntiaves.

3.38 This option would require: upgrade to new access points in North Deal; upgrade to existing highways in North and Middle Deal and upgrade to existing junctions in North and Middle Deal.

3.39 Upgrade of the Albert Road junction would be required. This could provide potential new access to Minters Yard and Southwall industrial estate, alleviating pressure on Southwall Road. Junction improvements would also be required along London Road at Great Mongeham Road, Manor Road, Park Avenue and Queen St / West St.

3.40 A series of system improvements would also be required to improve operational performance. This would include: peak hour parking management around junctions, timing of refuse collection to avoid peak hour impacts, school bus standing and drop off close to junctions; staggering bus stop locations to ease passing, relocation of pedestrian crossings away from junctions to reduce stacking through them, selective right turn management and passing lanes at junctions.

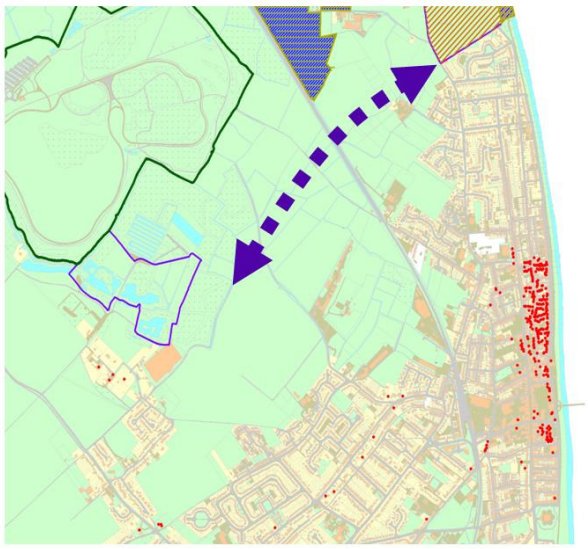
3.41 Given the use of existing infrastructure, these routes would not impact or be constrained by environmental designations. This option does not directly impact listed buildings, their settings or conservation areas.

3.42 Potential costs are estimated at £2.4mn to £3.75mn. Land acquisition is not anticipated, expected beyond any minor requirements for existing junction expansion. Specific junction improvements are identified in the next chapter.

3.43 In the professional opinion of the consultant team this option is the most feasible and is recommended for further definition and investigation to determine its traffic capacity and associated development quantum.

Connections Across the Railway

3.44 A new highway connection across the railway north of Deal has been proposed in public and stakeholder consultations. The link could be coordinated with and linked to any of the three strategic options set out above.



3.45 This connection could provide a number of benefits by providing another alternative route for traffic originating north of the town centre wishing to travel north from Deal, or traffic originating north of Middle Deal seeking a route to the south by travelling along the seafront. A new road bridge and new at grade crossings have been investigated. The latter would also be an opportunity to replace the hand cranked crossing at North wall Road.

3.46 The benefits of such a connection would be to provide additional routes for distribution and dispersal of traffic, a new public transport link, a new pedestrian and cycle link and improved connections to the golf course to the north.

3.47 This component faces a number of constraints that would need to be addressed, including;

- Network Rail prefers not to install new grade crossings on its network due to health and safety and operational concerns;
- Further reticence due to proximity of any grade crossing to the existing crossing at Albert Road to the south;
- Concerns regarding the use of this rail route by High Speed trains, although current services accelerate and decelerate in relation to stopping at Deal railway station;
- The potential cost of a bridge structure;
- Planning concerns given the visual impact of a bridge that would need to be high enough to clear the rail line, taking into account the different dimension of High Speed rolling stock, which is currently raised above the grade level of surrounding fields; and
- Depending on location, there is potential impact on a Special Area of Conservation. The potential land take required to bring such a bridge crossing down to ground could have wider impacts on SAC, SPA and grazing marsh re-establishment areas. A new crossing could also increase recreational accessibility to areas already known to be under significant recreational pressures.

3.48 Potential costs are £4.0 to £6.6mn for a bridge. Potential costs for a controlled grade crossing are £1m. Associated road costs to access the crossing at of 1.3km would be £1.9mn to £3.2mn.

3.49 Total costs could range from approximately £5.9mn to £6.7m for a bridge crossing. Total costs could range from approximately £2.9mn to £3.3mn for a grade crossing.

3.50 This component of any transport solution would have a long lead in time, has considerable regulatory uncertainty relating to railway operations and has potentially significant costs.

3.51 It is the professional opinion of the consultant team that concepts for the future growth of North and Middle Deal should not be dependent on a new crossing across the railway given these risks.

Conclusion

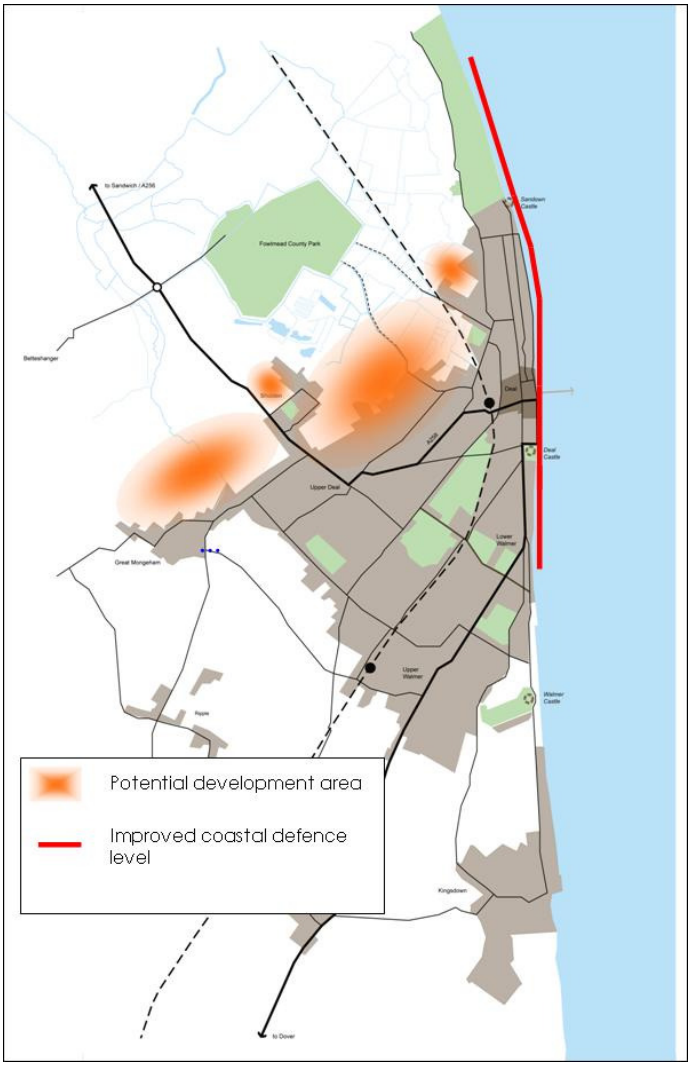
3.52 On the basis of this analysis it is concluded that Access Option C – Extended Framework is the most feasible of the transport options available on the basis of transport, environmental, heritage and cost considerations. As such, more detailed investigations for the growth of Deal beyond Core Strategy levels should focus on the development potential that could be served by an extended and improved highway framework in North and Middle Deal. This may evolve to include a new railway crossing, but should not be dependent on it for delivery in the first instance.

4. Growth Directions Beyond the Core Strategy

4.1 This section investigates the potential location and scale of growth beyond Core Strategy levels. In the first instance, the scale of growth is linked to the feasibility of increasing the capacity of the local highway network. In the second instance, the location of this potential growth is considered in terms of where it is most feasibly located in access, environmental and townscape terms.

Area of Search and Potential Development Locations

4.2 Stage 1 identified a broad area of search which would be broadly acceptable in planning terms based on the baseline understanding of environmental, habitat, flood, landscape and design constraints and opportunities. This area focussed to the north of the existing urban area and lying between the A258 and Northwall road and the railway line. A further potential development area was identified to the east of the railway. However, the acceptability of this area was noted as subject to further flood defence breach analysis.



4.3 It is clear that, even allowing for protected habitats and suitable 'buffer zones' there is significant development (land) capacity within the area of search. However, the scale and quantum of any development potential is very likely to be determined by the capacity of the road network and the opportunities to improve and expand existing junctions to accommodate additional traffic.

4.4 To understand where the transport capacity reaches a 'tipping point' and therefore acts as a constraint on development levels, the future functioning of the key junctions within the town have been modelled both in their current state and once they have been 'improved' through potential upgrades and expansions.

4.5 This analysis has been set out in the Section 5 and it is this constraint that will ultimately set the maximum level of development that North and Middle Deal could accommodate without having a detrimental effect on the efficiency of the road network.

4.6 Once this quantum has been established a refined development area can be identified taking into account the aspiration to ensure any future growth provides net benefit to the town, and respects and enhances the ecological and habitat assets to the north.

4.7 Our analysis now considers how an extended framework transport solution best relates to the area of search identified in the Stage 1 report in development quantum terms.

Potential Capacity increases Through Junction Upgrade

4.8 The potential traffic impact of varying levels of future development in the North/Middle Deal area have been investigated to identify the:

- quantity of development that could be supported within existing highway capacity;
- the quantity that could be supported with feasible highway improvement measures.

4.9 The period up to 2031 is assessed. This is five years beyond the adopted LDF Core Strategy period. As such it allows for the effects of traffic associated with consented development in Deal *and* general traffic growth between now and 2031 to be factored in.

4.10 The Extended Framework Strategy identified seeks to link the development area into the existing road network via a number of connection points thereby creating multiple routeing options for traffic, dispersing the load and reducing impacts at individual junctions. It also recognises the need for co-ordinated upgrades junctions and the local highway network to mitigate both the impact of development traffic and general traffic growth between the present day and 2031, the envisaged year of completion.

The Transport Assessment Model

4.11 The bespoke Transport Assessment Model (TAM) builds on the comprehensive baseline traffic data collected in February 2011 across the town and is consistent with analysis recently submitted in connection with the Ward Homes and Hillreed consented developments. The TAM assessment utilising existing trip patterns and allocates a proportionate increase to each to reflect future activity as a result of 'background

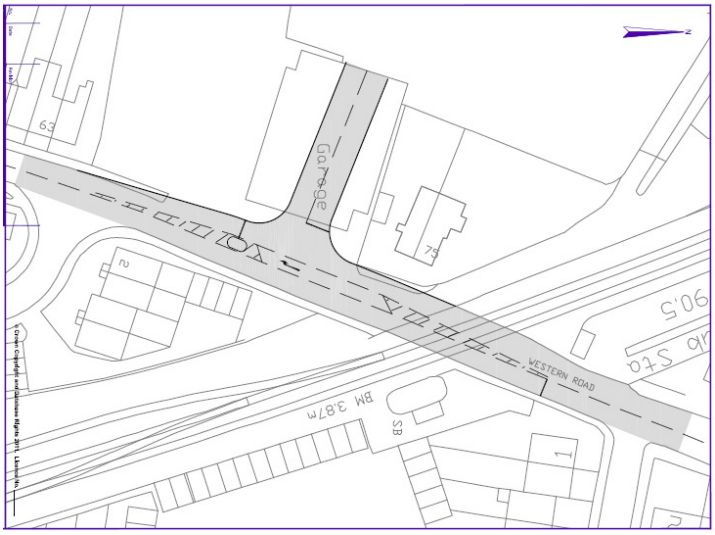
growth' (i.e. increases in car ownership and usage) and development. As such it is not necessary to input specific (uncommitted) sites in order to understand future behaviour and trends.

4.12 However, there are significant developments committed that directly impact on the key junctions (Minter's Yard and both the Ward and Hillreed Homes sites). These have been accounted for directly within TAM to ensure their impact is considered as accurately as possible.

4.13 A fuller description of the Model and its application to the Deal context is provided in Appendix B: Road Link Options Appraisal & Initial Transport Model Results. The methodology including assumptions about background traffic growth has been discussed and agreed with the Kent County Council as the Highways Authority.

4.14 In order to ensure a robust assessment, the future mode share for trips to/from and within Deal has been assumed to be the same as it is today. However, going forwards a key part of the transport strategy for the town should be the promotion of more sustainable modes of transport particularly walking, cycling and travel by public transport.

4.15 The Extended Framework Approach includes a new connection to the development area via Albert Road. Details of the Albert Road junction are provided in Appendix B. A summary diagram of the potential new junction is shown below. A technical note at the end of this report compares this junction proposal to the consented scheme and also demonstrates how standard traffic signals and level crossing warning lights and gates would operate together.



4.16 A new link across the railway (bridge or level crossing) to the north of the existing crossing at Northwall Road could be part of this overall scenario however the following results are not dependent upon this component.

Future Traffic Flows

4.17 Assessment of traffic flows includes: current traffic identified by survey; identified background growth from 2011 to 2031 including Core Strategy growth; allowance made for increases due to consented developments: Hillreed Homes, Ward Homes, Minters Yard and Bettshanger.

Development Traffic Flows

4.18 Census data has been used to assess the number of trips made by car. Census data produces a car mode share of 58%.

Summary of 2001 JtW Census Data (Mode Share)

JtW Mode	% share
Train	2%
Bus	3%
Taxi	2%

Car Driver	58%
Car Passenger	8%
Motorcycle	1%
Bicycle	4%
Foot	14%
Home Working	8%
Other	1%

4.19 The following table shows the forecast vehicle trip rates per residential unit within Deal.

Vehicle Trip Generation Rate (per residential unit)

Time Period	Arrivals	Departures	Total
AM Peak	0.109	0.346	0.455
PM Peak	0.163	0.100	0.263

4.20 These vehicle trips rates have then been applied to varying quanta of residential development. A range of scales of development between 100 and 1,000 residential units were tested to assess the ability of an extended and upgraded network to accommodate it.

4.21 Based on, the traffic distribution shown below has been applied to this assessment. These vehicle distribution figures correlate to the figures agreed by the Kent Highway Authority for the recent Ward Homes and Hillreed Homes development planning applications in Deal.

Development Traffic Distribution

Direction	Vehicle proportions

North (to/from Sandwich)	33%
West (to/from Mongeham Road)	5%
North Deal (including Town Centre)	12%
South (to/from Walmer and Dover)	50%

4.22 The figures below show a summary of the development flows across the highway network during the AM and PM peak periods respectively for a range of development quanta from 100 to 1,000 residential units.

Individual Junction Analysis

4.23 Based on this information certain junctions have been identified as potential constraints on the quantum of development that could come forward. Capacity assessments have been carried out at junctions using industry standards. Some options have been tested that would immediately be constrained by heritage or built form characteristics limiting practical delivery, but have been included here for completeness of the options investigation.

4.24 In terms of assessing junction performance, the Degree of Saturation (DoS) (for signal controlled junctions) and Ratio of Flow to Capacity (RFC) (for priority junctions and roundabouts) are used to identify its relative operational performance. Congestion will start to occur when the ratio exceeds 90%, although theoretically a junction reaches capacity when the DoS or RFC is at 100%. At high ratio levels the queues and delays are seen as 'unstable' with only slight changes to the traffic flow profiles or very minor incident on the ground creating a much greater queuing situation. As a consequence, queue forecasts at junctions over capacity need to be treated with caution as actual delay forecasts are difficult to predict. For the purpose of this assessment it has been assumed that the cut off point for junction operation acceptability is when the DoS (or RFC) reaches 100%.

4.25 It should be noted that a number of factors have not been taken into account within this assessment which might ultimately reduce the level of queues and delays predicted. Firstly, no mode shift from car to public transport has been assumed. The future transport

strategy for the town should include a package of measures which improve public transport, walking and cycling facilities. Such increase in non-car mode attractiveness together with increasing delay on the highway network is likely to encourage a certain amount of mode shift. Secondly in situations when significant highway delays are experienced, peak spreading is likely to occur, with some drivers delaying their journeys to avoid the main peak period. The effect of these changes would be to suppress the peak demand at each junction by perhaps 10%, allowing some flexibility around the maximum quanta of development indicated by the modelling.

4.26 The following results were identified.

Summary of Traffic Impact Assessment

4.27 The table below provides a junction by junction summary of the traffic assessment based around main junctions in the local network.

Junction	Junction Layout Arrangements – Existing and Proposed	Max level of dev (housing units above those identified in Core Strategy	Other Comments
A258 London Road / Mongeham Road	Existing Priority Junction	400 to 500	- Difficult for vehicles to turn right out of Mongeham Road
	Upgrade Option – All movement signal controlled junction	TBC	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land - Better control of traffic southbound along A258, thus assisting Manor Road junction operation.
A258 London Road / Manor Road	Existing Roundabout Junction	0	- Constrained by heritage designations of buildings around the junction
	Upgrade Option (1) – Signal controlled junction	0	- Potential to implement pedestrian and cycling crossing facilities.

Junction	Junction Layout Arrangements – Existing and Proposed	Max level of dev (housing units above those identified in Core Strategy	Other Comments
			- Junction within existing highway land
	Upgrade Option (2) – Signal controlled junction with right turn ban from northbound Manor Road east on to London Road	300 to 400	Same as option (1), plus: - right turn ban is likely to result in vehicles re-routing, turning right earlier, increasing traffic on some local roads.
	Upgrade Option (3) – Larger Signal Controlled junction	>1,000	- Potential to implement pedestrian and cycling crossing facilities - Significant third party land required.
	Upgrade Option (4) – Larger scale Roundabout	>1,000	- Poor option for Pedestrians and Cyclists. - Significant third party land required.
A258 London Road / Albert Road	Existing Priority Junction	400 to 500	
	Upgrade Option – All movement signal controlled junction	TBC	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land
Albert Road / New Development Access road	New Signal Controlled Junction	>1,000	- Proposed design minimises internal queuing within junction, reducing safety risks with railway level crossing
A258 London Road / Queen Street / West Street	Existing signal controlled junction	>1,000	
A258 Dover Road / Cornwall Road	Existing Priority Junction	0 to 100	- Difficult for traffic to turn right out of Cornwall Road.

Junction	Junction Layout Arrangements – Existing and Proposed	Max level of dev (housing units above those identified in Core Strategy	Other Comments
	Upgrade Option – Signal Controlled Junction	>1,000	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land

4.28 This table indicates the potential of each junction to accommodate development traffic either with the existing configuration or with improvements.

4.29 Junctions across the study area offer a range of potential capacity increases. However, overall network capacity increases are restricted by the results of capacity improvements at the lowest end of this range. In this case, feasible improvements to the A258 London Road / Manor Road junction set the scale of additional residential development at 300-400 units. Although capacity at other junctions can be improved, constraints at this junction limit capacities across the rest of the network given its key role as a gateway junction into and away from Deal.

Potential Capacity Increases Through Wider Network Improvements

4.30 The above analysis focuses on specific 'hotspot' junctions where there is known peak period traffic pressure today or envisaged pressure in the future. However, in a complex and constrained highway network such as Deal's, ease of movement from one point to another is affected by many factors. For example, at the micro-level, poorly located parking or out of date signal timings can have a significant bearing on the reliability of journey times. Some specific examples of constraints in Deal are listed below:

- On street parking is resulting in reduced highway capacity at certain points throughout the network, most notably during peak times. For example on the A258 in Sholden, opposite Sholden Primary School;

- A number of poorly located bus stops are resulting in reduced highway capacity. For example on the A258 north of Manor Road roundabout, where stopped buses lead to vehicles blocking back into junction;
- A number of directional signs are poorly positioned. For example London Road / Manor Road roundabout;
- Refuse and servicing vehicles operating during peak times can reduce highway network capacity;
- School drop off/pick up activities are resulting in localised congestion. For example along A258 outside Sholden Primary School.

4.31 A proven technique for improving the local highway network for all road users is to address specific problem areas in an holistic way using a corridor approach. This involves reviewing the use of the street by all road users and brings together principles of traffic management, urban design and street de-cluttering to create a more efficient space. Such an approach can be highly effective and helps create a better sense of place.

4.32 It is therefore recommended that alongside selective capacity enhancements at bottleneck junctions, the transport strategy for Deal includes a range of corridor treatments to address local constraints, provide positive measures for non car modes (see below) and enhance the quality of the public realm.

Encouraging Sustainable Travel

4.33 New development provides an opportunity to encourage behavioural change in the way people travel. At a strategic level the creation of mixed use development can help reduce commuting and place key services and facilities within a short distance of new homes thereby increasing opportunities for walking and cycling. With good IT infrastructure the opportunities for home working can be maximised; this, coupled with increasingly flexible working arrangements can reduce the traffic pressure during the traditional morning and evening rush hours.

4.34 Development in the Middle/North Deal area is within a 20 minute walk of the town centre. In order to capitalise on this position and encourage more trips to be made on foot, the routes into town should be audited to ensure that they are safe, direct well lit, legible and well maintained. Similarly, the town is highly accessible by bicycle and benefits from the presence of a number of local cycle routes together with National Cycle Route 1. This

provides a good basis upon which to build more positive cycle facilities into the fabric of the town, through for example, the creation of a wider network of signed routes, provision of more cycle lanes and the introduction of more secure cycle parking.

4.35 Good public transport services are also essential to encouraging more sustainable travel. Middle/North Deal is not currently well served by buses and the strategy should include steps to ensure regular, reliable bus connections to the town centre and surrounding area. There would appear to be an opportunity to serve the development area by diverting or enhancing the existing cross-town routes. This could provide a connection to the town centre and railway station as well as a link to towns such as Sandwich and Canterbury. Initial soundings with the local bus operator have indicated that this sort of arrangement could be self-sustaining and not require subsidy from the local authority.

4.36 Travel Demand Management (TDM) also has a modest but important role to play in the future transport strategy for Deal. TDM covers a wide range of measures that are designed to influence travel behaviour and ultimately reduce the pressure of traffic in towns. Of most relevance to Deal are likely to be residential travel plans, workplace travel plans, off peak servicing, school travel plans, home deliveries, and parking controls/management.

4.37 The overall effect of the measures discussed above could be a reduction in car use in the range of 5-15%

Future Transport Capacity Conclusions

4.38 This assessment has considered traffic conditions relating to varying levels of development beyond LDF Core Strategy commitments in the year 2031. The basis of the assessment is the emerging Extended Framework that seeks to link the development area into the existing road network via a number of connection points thereby creating multiple routeing options for traffic that spread the load and reduce impacts at individual junctions.

4.39 Predicting travel behaviour some 20 years into the future is not an exact science particularly given the rising cost of fossil fuels and the global drive towards carbon reduction. However, based on established good practice in Transport Assessment it has been possible to identify the quantity of development that could be supported within the capacity of the highway network as it stands or with selective local highway improvement measures.

4.40 The broad conclusions of the assessment are as follows:

- There will be significant growth of around 15% to 20% in traffic between the present day and 2031 due to the effects of general increases in background traffic, consented development and LDF Core Strategy commitments.
- With more significant improvements at traffic sensitive junctions, new development in excess of 1000 units could potentially be accommodated. However the delivery risk associated with these improvements is significantly higher, primarily because of requirements to acquire third party properties and, or, impact on designated heritage assets;
- Traffic sensitive junctions in the network such as the A258 London Road / Mongeham Road, and the London Road / Albert Road junction at the railway tracks have the capacity to accommodate the additional traffic demands of some 400 to 500 housing units in their current configuration or with minor modifications;
- However, this level of growth will push some other junctions within the network to or beyond capacity. Most notably this applies to the highly constrained A258 London Road/Manor Road which carries the vast majority of traffic movements to and from areas to the north of Deal. It also applies to the A258 Dover Road/Cornwall Road junction which forms part of an important movement corridor to the south;
- Based on this, it is the professional opinion of the consultant team that the extended framework approach would provide a feasible approach to providing the transport capacity necessary to accommodate demand from 300 to 400 new residential units, given the capacity and potential improvements to the critical A258 London Road/Manor Road junction;
- This level of development (and the subsequent traffic increase) could be alongside existing vehicle movements and forecast 'natural' growth in vehicle trips from both residential and commercial uses planned or existing within the area (including the extended Minter's Yard). A mixed use scheme would be a more sustainable form of development subject to detailed testing. The scale and scope of these would be the subject of a more detailed masterplanning exercise, needs test and detailed traffic modelling. At the time of Transport Modelling no requirement for large scale employment uses has been identified, as such the residential uses will generate more traffic at the peak times and hence the modelling is sufficient to estimate the 'worst case' scenario in terms of potential impacts. Future commercial floorspace

requirements incorporated within any development proposal will need to be aligned with the relevant evidence base documents prepared and updated separately by the Council;

- Accommodation of development amounts above this would require further capacity improvements at the London Road / Manor Road junction, including acquisition of third party properties and mitigation of impact on designated heritage assets. A larger, signalled junction would enable development of more than 1,000 new residential units in Deal.
- Increased quality of highways movement and net benefits can be further and independently achieved through:
    - A range of 'corridor style' treatments should be considered to address local constraints, provide positive measures for non-car modes and enhance the quality of the public realm;
    - The active promotion of non-car modes, specifically walking, cycling and bus use, coupled with the appropriate use of Travel Demand Measures will be important in checking the growth of traffic in the coming years;
    - Peak spreading, mode shift away from the private car and sensitivities within the analysis could potentially reduce the 2031 traffic demands tested in this assessment by up to 10%. This would give some headroom in the levels of development quoted above.

5. Future Directions

The Location of Feasible Development Levels

5.1 Given the feasibility of development capacities of 300 to 400 residential units, a further initial stage of investigation has assessed where it could be most feasibly located. An initial search of potential development locations has been carried out against the following criteria:

- An extended framework of streets;
- Improved Albert Road junction;
- Allows strong pedestrian and bicycle links to the Town Centre and Railway Station;
- Improves access for residents to open spaces to the north and Fowlmead Country Park;
- Capable of being integrated with existing neighbourhoods of Deal and Middle Deal;
- Avoids environmental designations requiring substantial mitigation;
- Avoids areas of Flood Risk and limits exposure to Rapid Inundation Areas;
- Avoids negative impacts on heritage assets;
- Responds to landforms and views.

5.2 Based on this, the following broad location for feasible development has been identified. This area is west of the railway line and east of South Wall Road.

Broad Location for Further Study

Potential Benefits of a Comprehensive Approach

5.3 A coordinated approach to planning for and delivering a strategic development in the area identified will provide a range of benefits both within the development location itself and more widely for the communities of North and Middle Deal. These potential benefits would accrue from growth which is brought forward in line with the Strategic Development and mitigation Strategy set out in this Report. Key benefits of a comprehensive planned approach would include the ability to provide:

- Homes for the residents and households of Deal to accommodate forecast 'natural' population growth;
- A location that allows a clear and coordinated approach to growth and infrastructure delivery, supported by appropriate evidence;
- Increased retail catchment for the town centre;
- Improved traffic flow through network and junction improvements;

- Opportunities to enhance existing and introduce new public transport services that can be fully integrated into the new community, encouraging increased patronage;
- Planned provision for future community facilities within new communities that are also accessible to existing residents;
- Enhanced links to existing green infrastructure assets; and
- On-site open spaces that can be used by existing residents.

5.4 It is also important to recognise that the UK National Planning Policy Framework places a strong emphasis on having an evidenced direction for growth in place. A coordinated approach for North Deal in line with the NPPF gives Dover District Council the evidence to direct and influence future development and avoid an ad hoc approach to development led by individual and un-coordinated proposals.

5.5 The location for further investigation will seek to avoid as much as possible those areas currently being targeted for restoration to grazing marsh by Stewardship, and for those areas that cannot be avoided, compensation greater than the area lost will be delivered

Mitigation Strategy

5.6 The recommended approach to the future growth of Deal to the north has been identified in a manner which seeks to avoid or minimise any potential impacts on the important heritage, landscape, ecological and transport conditions within the area.

5.7 However, no development can be completely impact free. Therefore to ensure any future growth provides a positive addition to the existing urban area there will be a need for a range of mitigation measures and development principles to be met. The following measures are within the normal range of activities associated with residential development of the scale suggested, and are not expected to present fundamental constraints to meeting standard planning requirements if delivered in an appropriate manner. These issues are not insurmountable

Coastal Flooding

5.8 The improved coastal flood defences remove the need for major mitigation within the area and, in the main, the identified potential development area avoids locating development within the Rapid Inundation Zone.

5.9 In addition to the flood modelling Flood Hazard Mapping provides additional guidance on the types of uses which may be permissible within the Study Area. Therefore, in general terms, it may be appropriate to consider the following mitigation measures:

- Any development that incurs into areas susceptible to rapid inundation or flood hazard areas as a result of a breach of the defences is designed to:
  - Not provide habitable rooms at ground floor level
  - Identify safe escape routes to areas where inundation is not expected, through the completion of a Flood Evacuation Plan.
- The location of 'non vulnerable' use such as industrial or commercial within locations which are more at risk from Coastal Flooding.

Fluvial Flooding

5.10 The risk of fluvial flooding within the area is minimal. Strategic mitigation is not required as a pre-requisite for development. However, development in low lying areas should be required to complete a site specific flood risk assessment to identify any issues and suitable localised mitigations.

Groundwater Flooding

5.11 The potential development area is located outside of the areas affected by groundwater flooding within Deal.

5.12 Infiltration sustainable drainage systems are therefore suitable for deployment to manage ground water however these should include measures to minimise ground water pollution from new development.

5.13 The deployment of these systems will be subject to detailed development design and form part of 'normal' development considerations. There are no strategic mitigations required.

Surface Water Flooding

5.14 Surface water flooding is a considerable concern for both the EA and Stour IDB within Deal given the reliance on drainage ditches and surface water pumping. Surface water

run off rates for any new development will need to be mitigated to ensure they do not exceed current green field run off rates.

5.15 In order to ensure there is no change in run off rates the following mitigations are recommended:

- Utilising additional surface water run off to replenish and enhance wetland habitats to the north of the development area, in particular at Hacklinge Marsh (if required) or, working with the RSPB, a new wetland area at Minnis Farm. Delivering this would involve:
  - Coordinated approach to ditch maintenance and enhancement across the area
  - Potential additional pumping capacity should gravitational forces not be sufficient
  - Achieving this would provide a significant benefit to Deal by providing a new recreational attraction and relieving visitor pressure on the NATURA 2000 sites. Using surface water run off would also potentially reduce the need to pump water to the area to sustain the wetland.
- Introduction of 'on-site' storage through sustainable drainage systems
- Minimising waste water run off through the deployment of:
  - Source control (green roof and rain/grey water harvesting)
  - Permeable and porous paving materials
  - Attenuation basins

5.16 The majority of these mitigation measures would reasonably form part of 'normal' development design and therefore could reasonably be expected to be funded by the developer.

5.17 The potential costs of utilising surface water to create new wetlands may be beyond what could be considered reasonable development costs and may require some public sector contribution. Given the wider benefits this would create for Deal this investment could be supported. Prior to development, a site specific FRA will be carried out to investigate risks from surface water flooding.

Ecology

5.18 The avoidance of direct impacts on NATURA 2000 sites has been a principal consideration through this Study. However, development has the potential to cause additional visitor pressure on these sites as well as have impacts on lower level ecological designations. To minimise and mitigate for these impacts we would recommend:

- Working with developers, IDB, EA and RSPB to restore and create new wetlands through the use of surface water;
- Provide new green open space within developments as an alternative to the NATURA 2000 sites for recreation. New green space will need to be of an appropriate size and location and appropriately designed to maximise the likelihood of its appeal to recreational users;
- Improve pedestrian and cycle connections between Deal, Sholden and Fowlmead Country Park to encourage greater usage as diversion away from the NATURA 2000 sites;
- Identify and provide replacement locations for Higher and Entry Level Stewardship activities where development directly incurs on existing designations;
- Continue to secure contributions to the EA management and enhancement strategy for the NATURA 2000 sites in line with those secured from Ward and Hillreed

5.19 These mitigations outline initial concepts that are emerging from the ongoing impact assessment/HRA work and will be further developed during the subsequent stages with input from stakeholders. This will be being complementary to additional access management targeted towards the Sandwich Bay SAC/Thanet Coast & Sandwich Bay SPA which could include the engaging of further wardens (separate and in addition to the existing Thanet Coast SPA Mitigation Strategy drawn up by Dover District Council)

Transport

5.20 The transport interventions and mitigations required have been discussed at length within this Report and the technical appendices, in summary the key mitigation measures are:

- Upgrading of the key junctions as set out in Section 3;

- Provision of a new, larger capacity, junction at Albert Road which provides coordinated traffic management between traffic signals and level crossing warnings;
- Development and implementation of a town wide road network management strategy;
- Review of bus service timetables and routes to serve new development and encourage patronage;
- Locate shops and community facilities within the development to encourage walking and cycling;
- Upgrading of cycleways and footpaths to encourage less car based access to:
  - The town centre;
  - Deal station; and
  - Fowlmead Country Park.

Design and Townscape

5.21 Achieving a high quality design will be vital in ensuring new development makes a positive contribution to the character and form of Deal. A number of development principles set through the Local Plan will be a pre-requisite of future development, however some locally important issues should also be addressed:

- Ensure permeability to encourage use of new access routes to the town centre and Fowlmead by existing and new residents;
- Investment in quality of the existing street fabric to link new and established areas;
- Provide new community facilities in locations which are accessible to existing and new residents;
- Development in a form which creates a high quality interface with the open space to the north

5.22 A high quality approach to useable public open spaces within development areas will also be required, subject to the emerging Land Allocations document.

Community Facilities

5.23 The scale of development recommended is unlikely to require investment in community facilities to service the population. As such mitigation of impacts would be delivered through the usual developer contribution processes.

5.24 Given the timescale of likely delivery, if a local need for community facilities is identified within the area in the future it may be appropriate to work closely with developers to secure space within any new development as a mechanism for integrating existing and new residents.

Site Mitigation

5.25 There is the potential to make improvements to sub surface and soil conditions where necessary, addressing the legacy of any previous uses where materials and structures have been left in the ground.

Next Steps

5.26 The Dover District Council adopted Core Strategy has identified the potential for further development to be accommodated within Deal. Based on a thorough review of transport, environment, flood and heritage factors, a feasible quantum of further development has been identified. This process has also revealed constraints on development locations to the North of Deal, and therefore the most feasible location for future development.

5.27 The approach identified minimises impact on environmental, heritage and built fabric assets and avoids the substantial costs, and planning risks associated with mitigating them. This approach also avoids transport approaches that could not be justified in standard transport industry and regulatory terms, and therefore would not attract public funding. Instead, a solution that builds from and improves the performance of existing transport assets is preferred.

5.28 It is recommended that a broad scale of development of 300 to 400 residential units which incorporates a mix of supporting activities at the general location identified be used as the basis for the next stage of the Deal Flood and Transport Alleviation Model Study. This next stage will set out a conceptual masterplan to define the character of future

development, how mitigation measures may be applied and to allow viability assessment. It is the professional opinion of the consultant team that the Study progress to the next stage on this basis.

5.29 These next stages are to:

- Establish a draft concept masterplan that:
  - Establishes development quantum and locations by use;
  - Tests and identifies the capacity of junction improvements through further detailed investigation and discussion with Kent Highways, Network Rail and other stakeholders;
- Refine the mitigation strategy in light of final development quantum and location;
- Prepare a development viability appraisal; and
- Identify delivery mechanisms.

Technical Note: Albert Road Junction

Development of a Fit for Purpose Access from Albert Road

5.30 Having undertaken a thorough assessment of the potential access strategies for north Deal (as set out in the main Stage 2 report and associated appendices) it was identified that the most achievable option was to create an access into the proposed development area from the south. This enabled the avoidance of incursion into the designated and protected habitat and conservation areas and also the potential negative impacts on the numerous listed buildings at Sholden.

5.31 The potential options for new access points from Middle Deal Road are limited by the extent and density of established development along the road and the permitted development to the north of the existing urban area.

5.32 However, an opportunity has been identified that would create an access at the location of the existing junction on Albert Road to the west of the railway line. In its present form the junction is unsuitable for any additional levels of traffic and would present considerable safety risks given its proximity to the level crossing.

5.33 An upgrade to the existing junction that takes the form of three-way junction has been granted planning permission following extensive negotiation with Network Rail and Kent Highways. It is designed to enable improved servicing of the existing activity of the site.

5.34 Having reviewed the permitted upgrade it is clear that it has been designed for this specific purpose and would not be appropriate to carry any significant volumes of traffic for reasons of road safety and junction capacity; for example the proximity of the new junction to the level crossing means that there is a potential risk of traffic queuing back over the railway line on the southbound approach. With modest side road flows this risk is minimal, but if there was a heavier right turn out of the side road in the morning peak period then it is likely that unacceptable queues would build up on the southbound approach- see below:

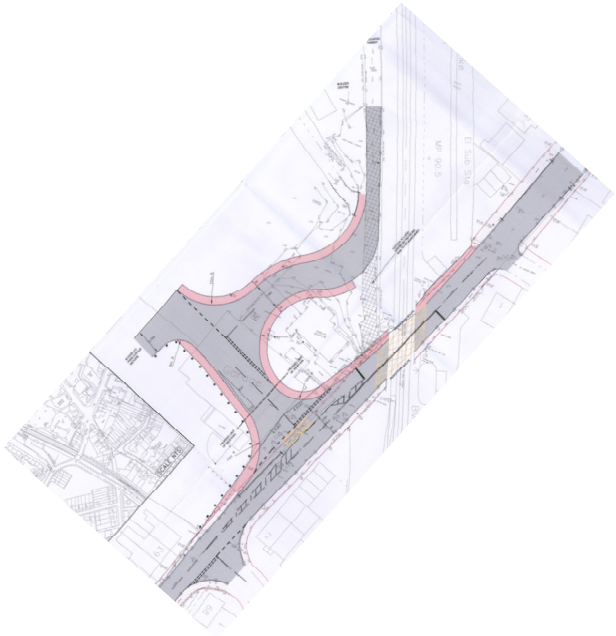


Fig 1 – Consented Scheme

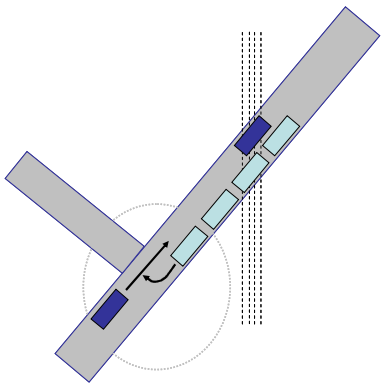


Fig 1- Current Proposal: Queuing Risk

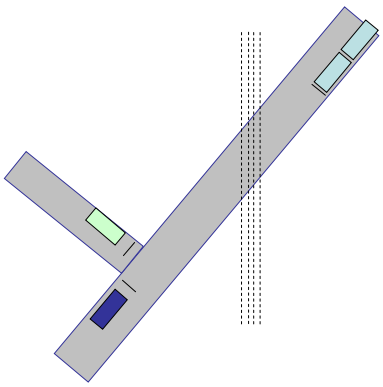


Fig 2 - Alternative: Queuing Management

5.35 Given the design of the junction it would not be appropriate to utilise the existing permitted design or simply 'tweak' aspects of it to address this safety concern or create greater capacity

5.36 As a result of the limitations of the existing and permitted junction it has been essential to identify a new junction layout that is designed from 'first principles' to cater specifically for the level and nature of growth proposed and to directly address safety concerns and issues related to the level crossing.

5.37 The alternative design introduces traffic signals to control traffic movement across the railway line and through the new junction. It is designed to minimise the risk of traffic on Albert Road/ Western Road queuing across or adversely affecting the operation of the level crossing - see below. Each arm of the junction would be separately signalled to ensure that right turners into the new access (from Western Road) do not get 'trapped' in the middle of the crossing and, or, junction, summarised in the phasing diagrams below.

5.38 Whilst it can be demonstrated that the proposed layout meets the basic design criteria for forward visibility to the signals there are no other specific guidelines that can be applied to the particular features of this non-standard arrangement. We have held informal discussions with our Safety Audit team which suggest the layout is likely to be feasible provided the traffic signals are linked to wig-wag lights at the crossing.

5.39 We therefore advise that the suitability of the layout is confirmed through an Independent Safety Audit and further dialogue with Network Rail and Kent County Council, as part of a more detailed design exercise at the appropriate stage in the Town Planning process.

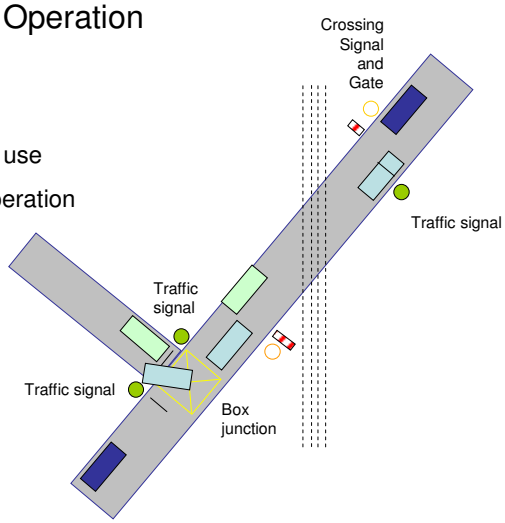
Phase: Normal Operation

Traffic signals green

Gates up

Crossing in highway use

Standard junction operation

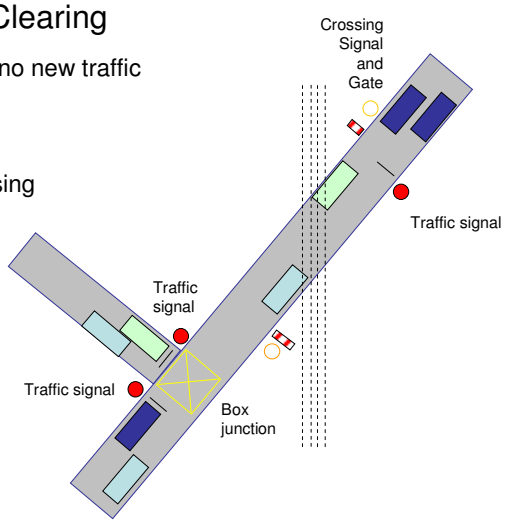


Phase: Traffic Clearing

Traffic signals red – no new traffic entering

Gates up

Traffic clearing crossing



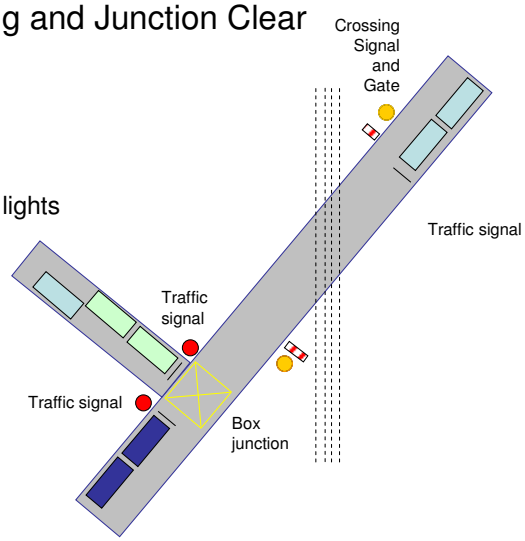
Phase: Crossing and Junction Clear

Traffic signals red

Gate warning lights

Crossing clear

Traffic held at traffic lights

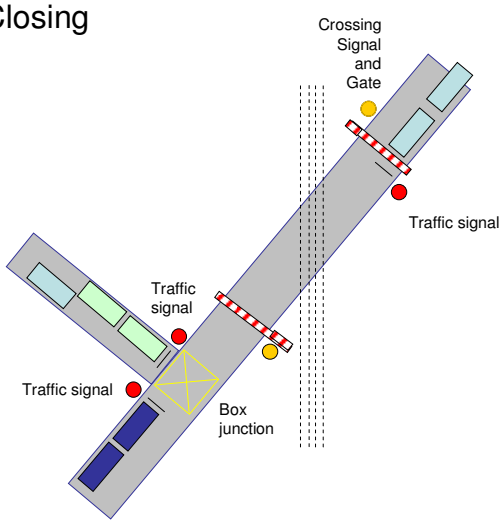


Phase: Gates Closing

Traffic signals red

Gates down

Crossing clear



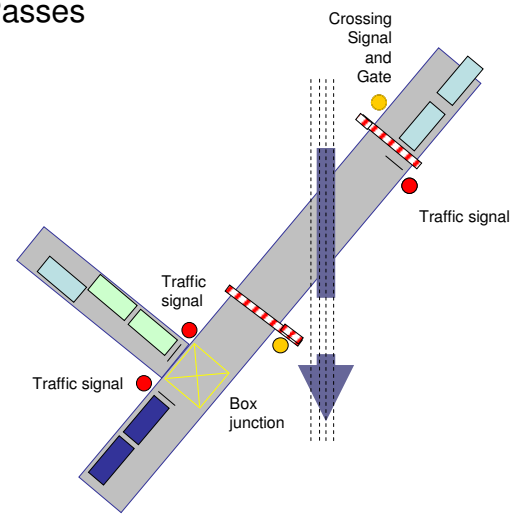
Phase: Train Passes

Traffic signals red

Gates down

Crossing clear

Train passes



URS

North Deal

FLOOD RISK AND DRAINAGE ASSESSMENT

March 2012

Prepared for:
GVA and Dover District Council

UNITED KINGDOM & IRELAND

REVISION SCHEDULE					
Rev	**Date**	**Details**	**Prepared by**	**Reviewed by**	**Approved by**
1	02/03/2012	Draft Report	Mazedur Rahman Senior Enginner and Sarah Littlewood Hydrological Engineer	Howard Waples and Kim Hearn Senior Consultant	Will Rogers Associate Director
2	31/03/2012	Draft Report	Mazedur Rahman Senior Enginner	Howard Waples Senior Consultant	Will Rogers Associate Director

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The methodology adopted and the sources of information used by URS in providing its services are outlined in this Report. The work described in this Report was undertaken between 10/01/2011 to 20/02/2012 and is based on the conditions encountered and the information available during the said period of time.

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EXECUTIVE SUMMARY

URS Infrastructure & Environment UK Limited (URS) has been commissioned to carry out the Flood Risk Study of the Deal Transport and Flood Alleviation Model Study (DTFAMS).

A hydraulic modelling exercise has been undertaken as part of this study in order to inform the preparation of the Deal Transport and Flood Alleviation Model Strategy' (DTFAMS) for Dover District Council (DDC). Mapping of the maximum flood extent and Rapid Inundation Zone (RIZ) arising from three discrete breach locations as well as overtopping of the local flood defences has been undertaken.

The base of the hydraulic model prepared for the assessment is taken from the Environment Agency linked 1D-2D ISIS-TUFLOW hydraulic model covering the tidal area between Pegwell Bay and Deal and including the tidally influenced part of the River Stour.

The outputs of the model simulations are included in the report. These consist of maps showing the maximum flood extent and RIZ to allow direct comparison with the 2007 Strategic Flood risk Assessment as well as mapping of the maximum hazard rating across the study area.

The results from these modelled scenarios demonstrate that the northern part of Deal town and the low lying area to the north of the town are at residual risk of flooding in the event of a breach in the flood defences during the 0.5% AEP event including climate change to 2112. The area to the east of the railway line and within the northern part of Deal town has been defined as lying within the RIZ and is therefore at particular risk.

In addition, the modelling shows that several areas along the coastline are at risk of flooding from overtopping during the 0.1% AEP event including climate change to 2112, including Canute Road, Godwyn Road, Hengist Road, Marine Road, and Wallington Parade (in Walmer).

The modelling includes the presence of the wave wall about to be constructed along the Deal frontage between Deal Pier and the Royal Hotel car park which has been designed to reduce the risk of wave overtopping in this area during the high order return period events. It also used data for the upgraded defences north of Sandown Castle, which are also about to be constructed

The study has also assessed the risk of flooding from fluvial, groundwater, surface water and wastewater sources. Deal predominately lies within a tidal flood risk area; fluvial flood risk is likely to be influenced by the tidal flooding. Most parts of Deal are outside of the fluvial flood risk areas.

The study area is generally located outside areas affected by groundwater flooding, which means that various infiltration SuDS (i.e. wetland, basins, swales, filter strips etc) are likely to be suitable based on the individual site conditions.

Surface water flooding has historically been an issue in parts of Deal. The existing drainage network has inadequate flow capacity resulting surface water flooding in the North and Middle Deal areas, which are partly a result of un-attenuated historical development and a lack of maintenance of the drainage system. Runoff from the north of Deal is collected by the existing surface water network and eventually discharged in the IDB/EA maintained watercourses.

Several mitigation measures, involving SuDS, for surface water flooding have been recommended for the North Deal area to incorporate with the future development plan. However, the surface water management scheme will largely depend on the location, hydrological and hydro-geological characteristics of development site. To achieve the most efficient and sustainable outcome, it is recommended to establish a strategic surface water

management scheme of the whole North deal development masterplan involving all the relevant regulatory bodies' co-operation. However, in the event developments are looked at piecemeal fashion, it is recommended to develop a site specific drainage scheme in consultation with the relevant regulatory bodies (i.e. EA, IDB, LPA, Water Company etc).

1 INTRODUCTION

This report describes the existing situation with respect to the various sources of flood risk (coastal, fluvial, ground water and surface water) to the northern part of Deal, Kent. It also describes the measures proposed for mitigating flood risk, and discusses the implications for potential development.

This report is part of the 'Deal Transport and Flood Alleviation Model Strategy' that is being prepared, see:
http://www.dover.gov.uk/regeneration_delivery/local_development_framework/deal_transport_and_flood_model.aspx

Part of the study comprises coastal flood modelling and breach assessment, the methodology and detailed results are included in Appendix A. A consideration of the existing water distribution and wastewater infrastructure is also considered, along with proposed mitigation to reduce adverse impacts.

2 COASTAL FLOODING

2.1 Existing Situation

The main source of flooding in the Deal area is the sea. A Strategic Flood Risk Assessment (SFRA) was completed by JBA Consulting in 2007 (Ref. 1). As stated in the SFRA, coastal defences in the Deal area currently consist of the following:

- Embankment along Royal Cinque Ports Golf Links constructed of earth/colliery shale which is re-profiled annually to offer protection up to the 1 in 200 year event. The section of the embankment near Sandown Castle (end of Sandown Road) however only offers protection to the 1 in 1 year tidal event;

- Sea wall south of Deal pier comprising a recurved concrete wall founded on steel sheet piles. Protection along this section is offered up to the 1 in 1 year tidal event; and

- Natural shingle ridge and embankment 200m south of Deal pier and extending to Kingsdown. This section requires continual maintenance. The level of protection offered by this length of defence is unconfirmed.

According to the SFRA the area at greatest risk of flooding is north Deal, where the coastal defence structure is at greatest risk of being breached. From the flood map (Figure 1) produced in the SFRA, it can be seen that north and north west of Deal lies mostly within Flood Zone 2 and 3, without considering the effect of the existing defence. According to Planning Policy Statement 25: Development and Flood Risk (PPS25) (Ref. 2), wherever possible development should be avoided within these flood zones where application of the Sequential Test shows there are reasonably available sites at lower flood risk. In the event that no such sites are available, PPS25 also states that 'more vulnerable' development is allowed in Flood Zone 2, whereas 'less vulnerable' development and essential infrastructure is allowed in Flood Zone 3.

Figure 1: Flood zone map without considering the existing flood defences (Source: SFRA 2007)

2.2 Flood Risk Modelling of Existing Flood Defences

A 2-Dimensional ISIS-Tuflow model was obtained from the EA (Ref. 3) to assess the level of protection from the existing flood defences. A description of this is provided in Appendix A.

The 2D ISIS-Tuflow model developed by Halcrow for the EA shows that, with the existing flood defences, most parts of the town centre, and north and north east of Deal are at risk of tidal flooding from a 1 in 200 year flood event with breach and overtopping scenarios taken into consideration (see Figure 2).

Due to the climate change factor, the risk of flooding would increase significantly in the future without the standard of flood defence being raised. Figure 3 shows the extent of a 1 in 200 year tidal flooding in the year 2107 if the existing flood defence had been maintained in their current form. It can be seen that the extent and magnitude of flooding would have increased significantly.

Figure 2: 1 in 200 year flood extent with existing flood defence and overtopping & breach scenarios for the year 2007 (Source: Pegwell Bay to Kingsdown Coastal Strategy Model)

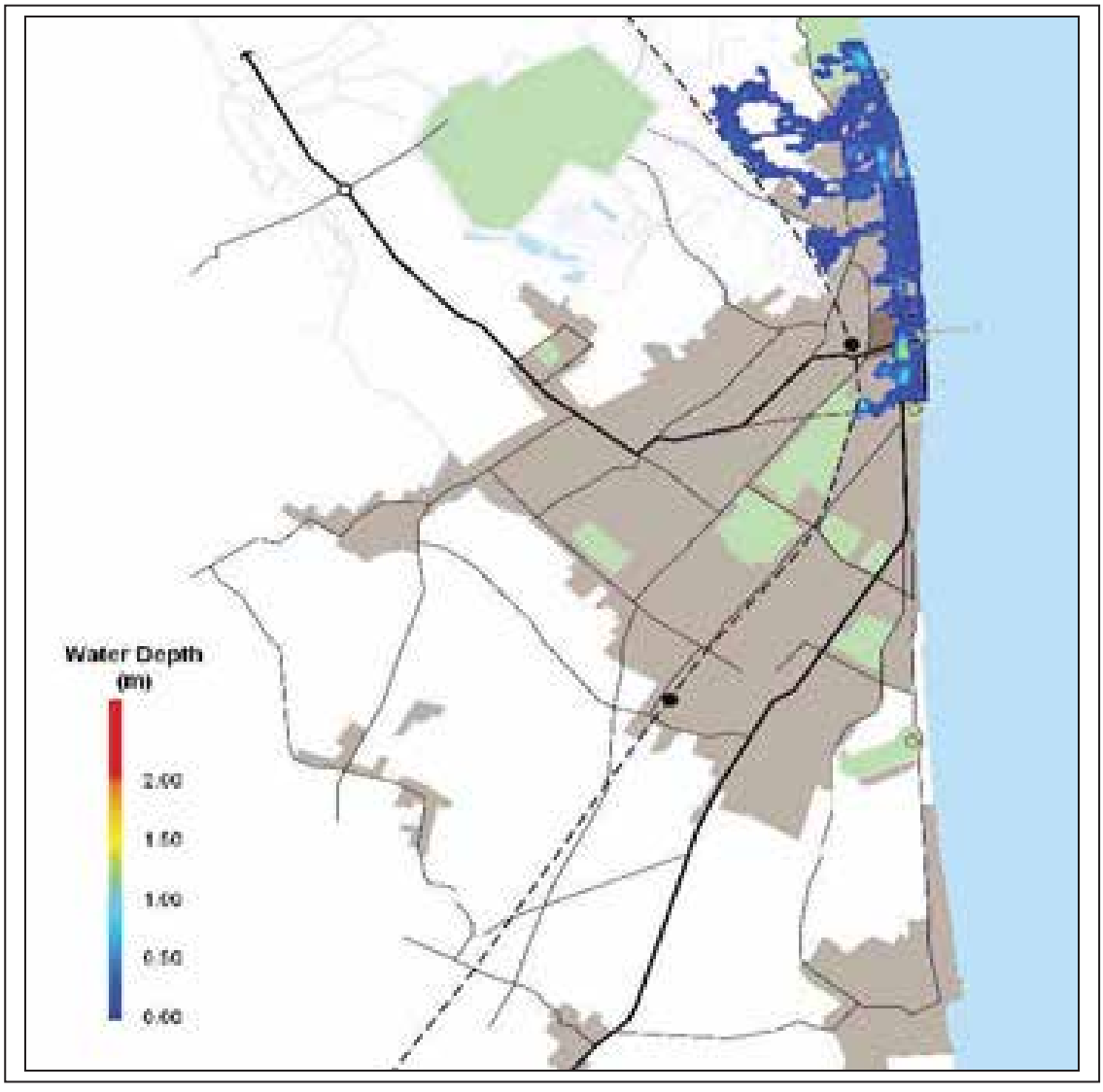


Figure 3: 1 in 200 year flood extent with existing flood defence for the year 2107 (Source: Pegwell Bay to Kingsdown Coastal Strategy Model)

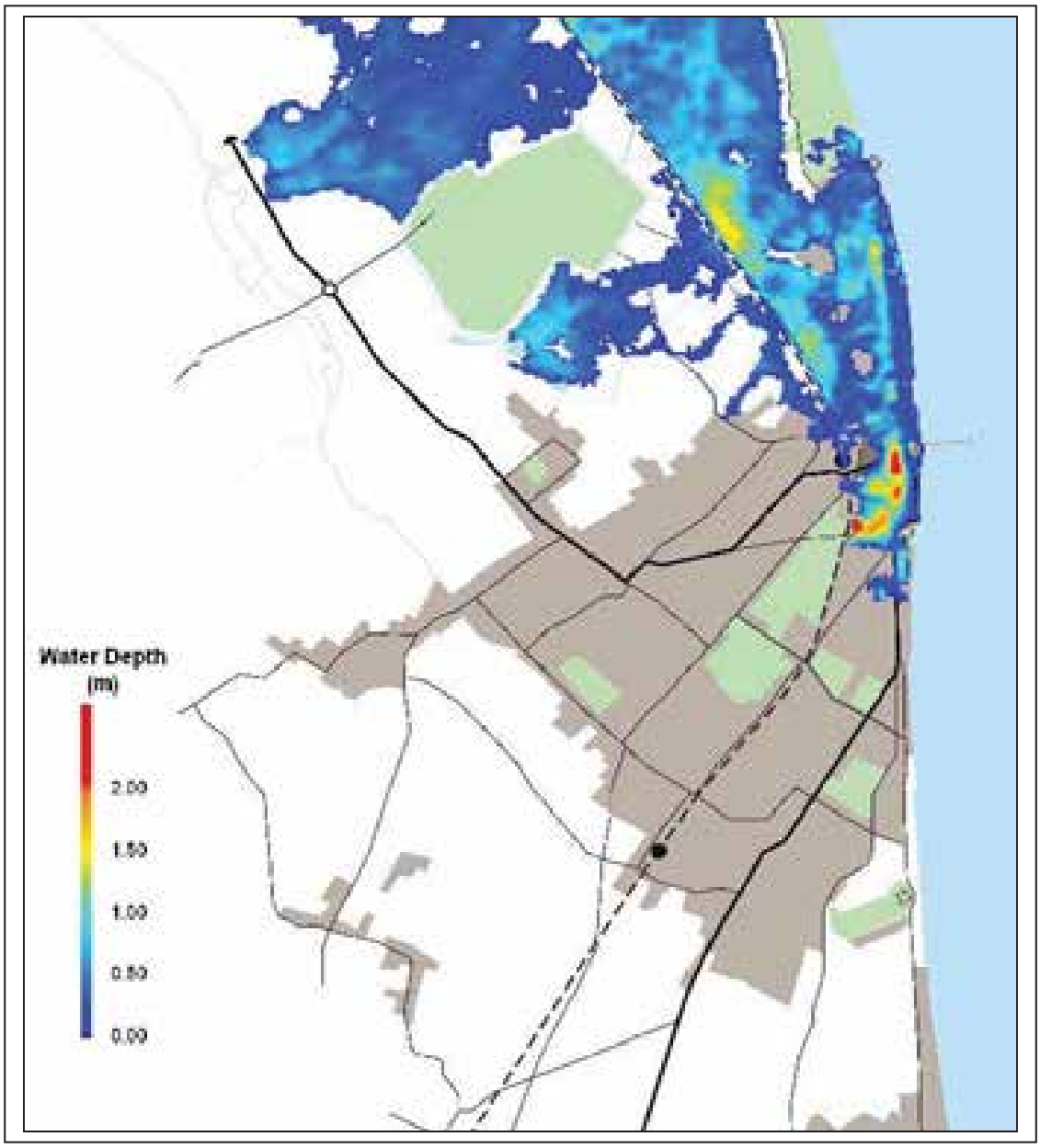
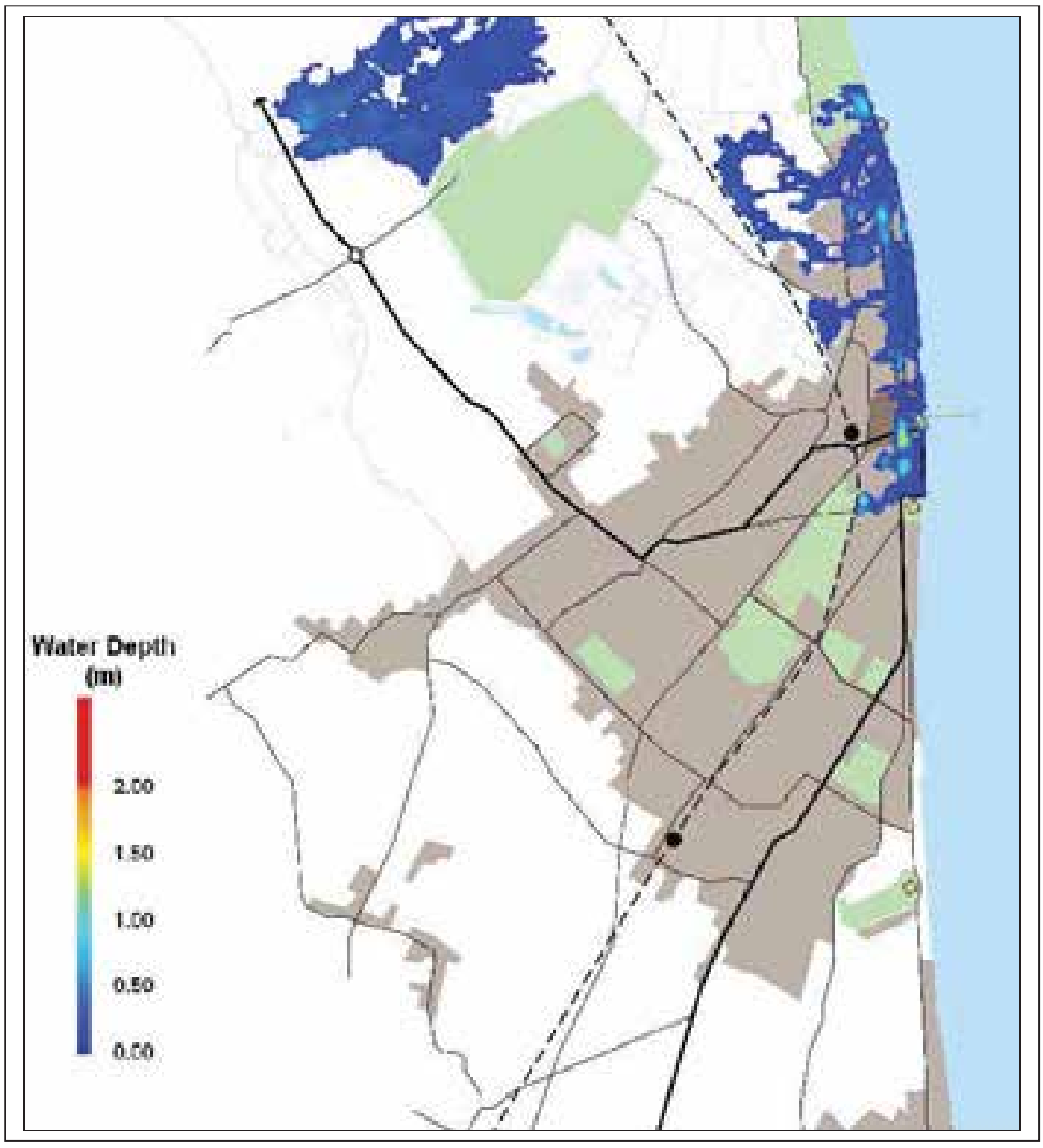


Figure 4: 1 in 200 year flood extent with increased flood defence at current standard for the year 2107 (Source: Pegwell Bay to Kingsdown Coastal Strategy Model)



2.3 Mitigation of Tidal Flood Risk Based on Improved Coastal Defence Standards

To protect Deal from tidal flooding, the EA has prepared a flood defence scheme. The scheme has already obtained government funding and construction work will commence in 2012. These flood defences at Deal will reduce the risk of coastal flooding to the town, and include:

- Construction of a new wave wall along the promenade between the Royal Hotel and Deal Castle;

- Provision of 250m of improved rock protection along the existing embankment, to strengthen the beach just north of Sandown Castle;

- Raising and widening of the shingle beach from the northern part of the extended rock revetment to Deal Castle, and maintaining the beach profile with annual recycling of shingle (periodic re-shaping of the beach using bulldozers, diggers and trucks as required following storm events).

The construction of the proposed flood defence anticipated to start at Deal in 2012. To the north, parts of Sandwich are at risk of tidal flooding, and defences for this area are also planned to commence in the financial year 2012 / 2013.

The proposed defence will significantly improve the level of protection against tidal flooding (to a 1 in 300 year storm event). As a result, the extent of flooding (of a 1 in 200 year storm event) shown in Figures 2, 3 and 4 will be eliminated.

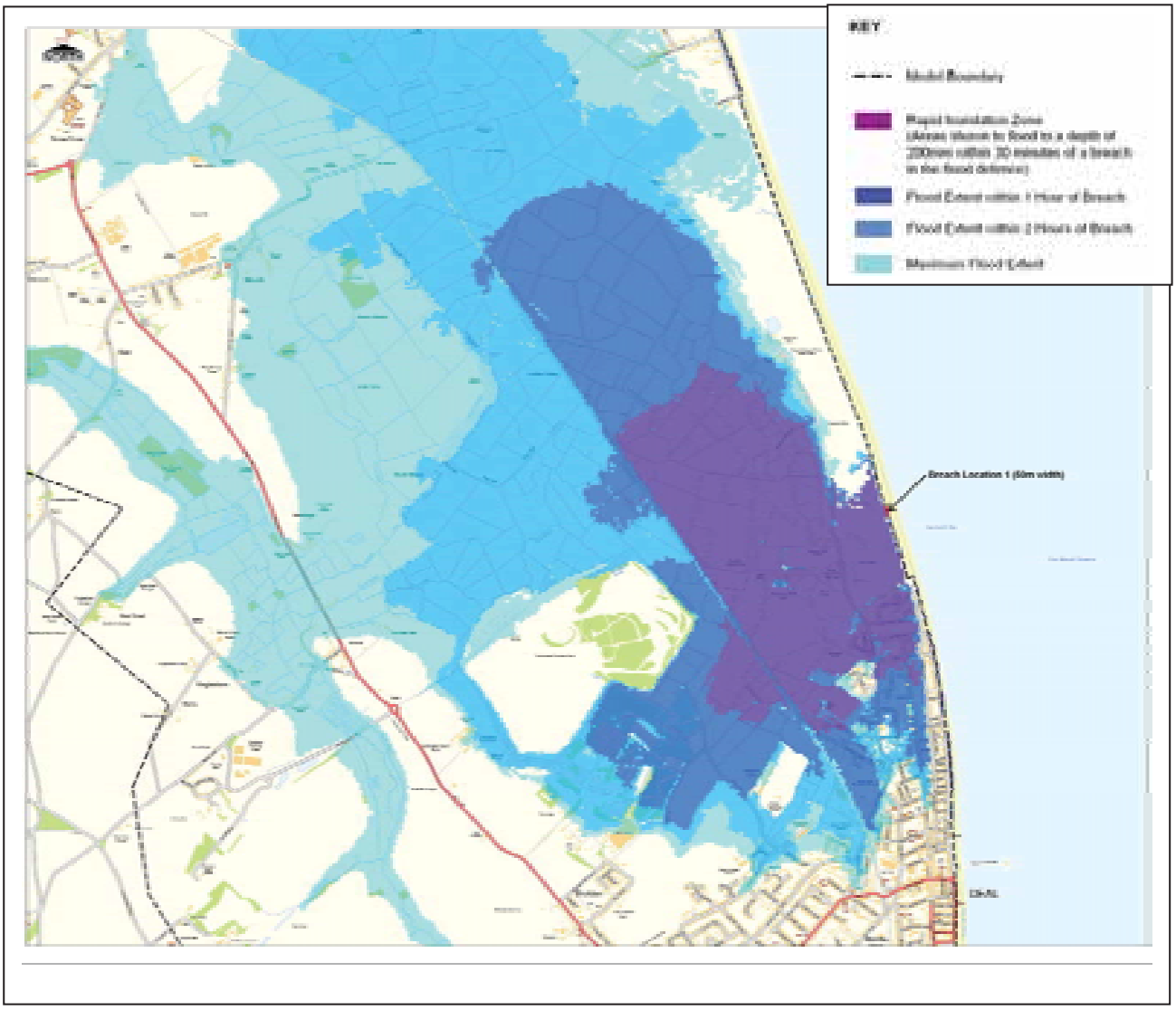
However, no coastal defence is impregnable, and given a storm of sufficient magnitude, significant overtopping and damage could occur which may lead to a breach, for both the sea wall within Deal and the proposed rock revetment/embankment north of Sandown Castle. The risk of breach is considered to be extremely low, and should the rock structure be destabilised, some level of 'protection' from the damaged structure would remain. The defence is designed to manage overtopping at 1 in 300 to the design parameter, with increasing overtopping beyond that.

However, for the purposes of identifying locations that could be used for development of 'more vulnerable' uses (such as housing), Dover District Council and the EA have instructed URS to utilise and adapt the 2-Dimensional ISIS-Tuflow model to undertake a series of modelling showing what would happen in the event of a breach and overtopping with the planned defences in place. The detailed methodology and outputs of this are provided in **Appendix A** of this report.

Figure 5 shows what would happen in the event of a breach at a location to the north of Sandown Castle. It shows that over time, the flood waters will reach the approximately same extent as that shown in Figure1 (flood zones in the absence of any defences). However, for the purposes of development planning, the key issue is human safety. As a result of this, the Rapid Inundation Zone (RIZ) has been used to determine those areas which are flooded to a given depth (200 millimetres) within a given time of a breach (30 minutes).

During the modelling work, the Environment Agency requested that in addition to showing the extent of the RIZ, Hazard Ratings should also be prepared. Since the 2007 SFRA was prepared, these Ratings are now used to assist in the allocation of development sites. These Ratings have therefore also been ascertained and are presented in **Annex C to Appendix A**.

Figure 5: Breach Analysis for 1 in 200 year flood (including predicted climate change effects up to 2112) showing the extent with proposed flood defence



3 FLUVIAL FLOODING

3.1 Current Situation

The main watercourses in the study area are the North Stream and South Stream. The drainage regime of the area is complex and relies on pumping stations to lift water from the central area to enable it to gravitate to the sea. This is shown in Figure 6. As assessed in the Sandwich Bay and Hacklinge Marshes Water Level Management Plan (WLMP) (Ref. 4), both North and South Stream deliver water to the Hacklinge Pumping Station, where flow is divided into two initially parallel watercourses, with approximately two thirds currently diverted into the North Stream which outfalls into the River Stour at Black Sluice, while one third flows into the Delf which outfalls into the River Stour in Sandwich town. The Worth Minnis Pumping Stations lifts water from the Internal Drainage Board (IDB) watercourses back into the North Stream.

Figure 5: Main watercourses, the direction of flow and the management responsibility (Source: WLMP)

Deal predominately lies within a tidal flood risk area; fluvial flood risk is likely to be influenced by the tidal flooding, for example when high tides prevent discharge to the sea. An earlier assessment carried out by JBA Consulting for the land between Deal and Sholden shows that the maximum flood water level of 1.99m AOD for a 1 in 100 year event including climate

change factor. Most parts of Deal are above the specified height and outside of the fluvial flood risk areas.

3.2 Mitigation

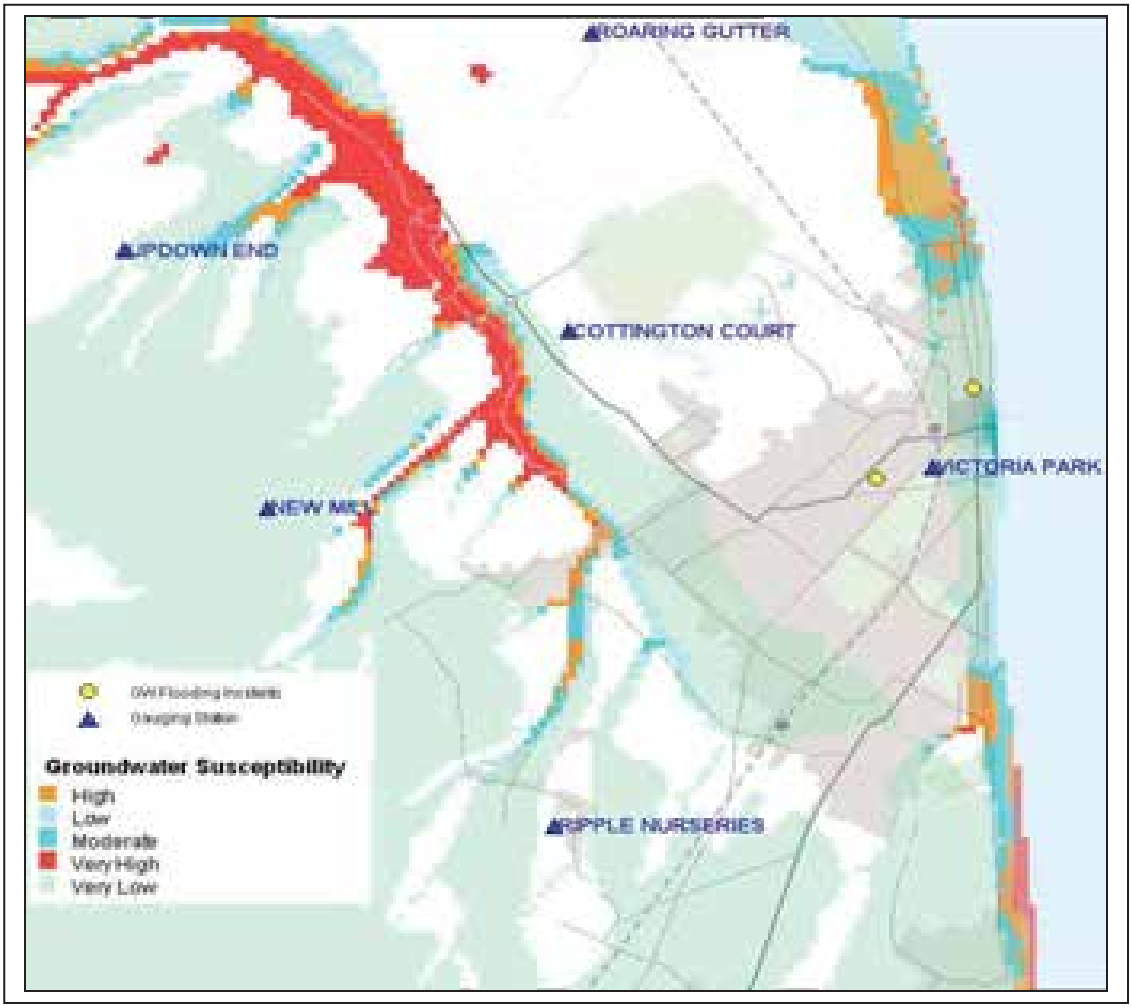
There is no recent record of fluvial flooding in Deal. However, for new development in the low lying areas within the proximity of main watercourses a detailed site specific flood risk assessment is recommended.

4 GROUNDWATER FLOODING

4.1 Current Situation

A qualitative assessment for groundwater flooding was carried out by considering the flood history, local geology, topography and the EA's Groundwater Map (see Figure 6). There is no record of groundwater flooding in the north and north west of Deal.

Figure 6: Groundwater Flood Susceptibility Map (Source: Environment Agency)



The geology of the study area comprises mainly alluvium and silty, sandy clay to a depth of approximately 5-6m below ground level underlain by a thick layer of chalk (Ref. 7). Groundwater levels in generally found within 5-6m below grounds; however at some locations,

near Southwall Road, groundwater was observed as close as 3m below ground level during a previous study (Ref. 7). Hence, it is considered to be **low risk** from groundwater flooding.

Three 'soakage tests' were undertaken during a previous study (Ref. 7) in the land between Sholden and Deal found that the rates of infiltration varied across the site between $5.0x10^{-6}$ metres per second (m/s) and $1.0x10^{-5}$ m/s. In terms for development implications, this means the area is typically good for an infiltration system but needs to be considered on a site by site basis by considering groundwater levels and the risk of pollution before any sustainable drainage system (SuDS) is designed that incorporates infiltration.

The integrity of the Southern Water sewerage system, primarily due to its age and original construction, leads to the sewer being considered a significant source of pollutants (nitrate, ammonia, pesticides, solvents, hydrocarbons, heavy metals and other pollutants) entering the Chalk aquifer.

The EA has found evidence of rising levels of nitrates, and solvents are detectable in the raw groundwater at the St Richards Road abstraction. If there is sewage discharging through the chalk, this is likely to be one of a few causes of this contamination. Other likely causes include agriculture and private sewage discharges.

4.2 Suggested Mitigation Measures

The study area is generally located outside areas affected by groundwater flooding, which means that various infiltration SuDS (i.e. wetland, basins, swales, filter strips etc) are likely to be suitable based on the individual site conditions. However, mitigation measures to prevent groundwater pollution will be considered during the detailed design of any future development.

To mitigate the impacts from deteriorating and unlined sewers, Southern Water is now working to improve the integrity of sewers in a phased improvement programme. The improvement works will at first involve an assessment of the integrity of the sewers in the Source Protection Zone (SPZ) for St Richards Road. This will lead onto an improvement programme and possibly assessment of sewers outside of the SPZ. The work is not yet programmed in, but will hopefully be started before 2015.

5 SURFACE WATER FLOODING & DRAINAGE

5.1 Current Situation

Surface water flooding has historically been an issue in parts of Deal. The existing drainage network was constructed to historic design standards which have been superseded and has inadequate flow capacity compared to the requirements of current standards. There are a number of surface water flooding records in the North and Middle Deal areas, which are partly a result of un-attenuated historical development and a lack of maintenance of the drainage system (piped network and open watercourses). The sewer record obtained from DDC (Appendix B- Confidential) shows that most parts of the Deal area are served by separate surface and foul water networks. However, it should be noted that the sewer record is incomplete and does not show all the existing networks.

Runoff from the north of Deal is collected by the existing surface water network and eventually discharged in the IDB/EA maintained watercourses.

5.2 Suggested Mitigation Measures

A recent record obtained from the Kent County Council (KCC) shows that KCC has been undertaking maintenance work to the drainage network which mainly involves cleaning the gullies and pipe network.

Considering the historical flooding records and un-attenuated existing drainage system, surface water management for any new development within the study area needs particular attention. In line with the national planning policy (PPS25) both the EA and Internal Drainage Board (IDB) seek to ensure that all developments aim to achieve at most greenfield runoff rates, or lower if possible. Therefore, any increase in building footprint due to new development on greenfield areas should aim to control the discharge rate at no more than Greenfield rate and retain and manage the additional runoff water on site for a 1 in 100 year event including the climate change factor by implementing Sustainable Drainage Systems (SuDS).

SuDS are the primary means by which this increase in run-off due to development should be mitigated. SuDS can also enhance water quality and provide a multi-functional use of land to deliver biodiversity, landscape and public amenity aspirations.

Providing large amounts of water attenuation onsite takes up land, and acts as a physical constraint to development. However, there is an opportunity to convey the additional runoff water northwards through the existing drainage ditches to the Hacklinge Marshes. This would have the additional benefit of enhancing wetland ecology by increasing the water level in the marshes, as recommended in the Sandwich Bay and Hacklinge Marshes Water Level Management Plan and the adopted Core Strategy. The Stour Internal Drainage Board (IDB) has recently confirmed (see Appendix C) the water level has already been restored in the Hacklinge Marshes area and any additional flow to the marshes will increase the need for mechanical pumping. Implementation of this option is largely dependent on the IDB and EA's assessment of the wetland areas at the time of implantation and co-ordination with the KCC, DDC, NE and the developers.

Alternatively, Natural England (NE) is currently working on a proposal to create a wetland area on land at Minnis Farm. The majority of this wetland is likely to be supplied from an elevated (pumped) channel, with the remainder from local runoff. In a discussion with the IDB and EA it was understood that there are opportunities to reduce the need for pumping by allowing the additional runoff from the new developments to the proposed wetland areas. The EA has stated (Barrie Neaves from the EA during a meeting at DDC offices on 4th November 2011) that the development and drainage should be considered strategically for the whole development area of Deal and instead of controlling the greenfield runoff rate onsite it can be controlled offsite in the proposed wetland areas. If appropriate plants are used, wetlands can also provide adequate treatment to the surface water to improve water quality. There are number of IDB and EA maintained watercourses running to the north and north east from the proposed development areas. At the appropriate time, the use of these watercourses to convey the flow will need to be investigated in detail (and in coordination with the IDB, EA, KCC, DDC and NE) by considering the development locations, topography and drainage route. If it is not feasible to drain the potential future development areas to the wetlands by gravity, then pumping options may also be looked at (although this would have a greater carbon footprint).

The EA and IDB are strongly opposed to unnecessary culverting of watercourses but accept that this is sometimes necessary for improving access. Should new access roads be constructed in this area for instance, further compensatory habitat will be created as part of the scheme.

The above stated options would only be feasible in the event of a co-ordinated development strategy or masterplan. However, should development only be possible on individual plots in a piecemeal fashion, only onsite surface water management (control discharge at greenfield or the EA specified rate from the site) is likely to be applicable and to be agreed with the EA and DDC before implementation.

The geological characteristics at the study area are suitable for SuDS infiltration system but the high groundwater level acts as a constraint against SuDS using infiltration. Based on the

groundwater level and geotechnical characteristics of each development area consideration should be given to the use of shallow soakaways, infiltration basin, trenches in the North & Middle Deal areas. This could help limit the amount of runoff entering the surface water network and therefore potentially reduce pumping requirements.

Table 1 assesses the potential suitability of each SuDS technique with regards to potential future development in the study area.

Table 1: SuDS Options for North Deal

Type of SuDS	Comments
Source Control (e.g. green roof and rainwater/greywater harvesting)	Green roofs should be used wherever suitable, water harvesting can be utilised for gardening/irrigation
Swales, Filter Strips and Soakaways	High groundwater table can act as a constraint for infiltration, especially for soakaways; however, site specific appropriate design consideration relate to North Deal study is recommended. Swales can also provide attenuation and enhance biodiversity
Permeable and Porous Pavements	Permeable and porous pavements can reduce and delay surface runoff
Attenuation Basins	Attenuation basins shall be designed to attenuate surface water runoff before discharging to the public sewer. Storage of the surface water runoff for the 1 in 100 year event can be provided by means of controlled site flooding (i.e landscaped area, car park etc).
Wetlands	The use of existing wetlands at the North of Deal or create a new wetland at Minnis Farm, in line with NE proposal. To implement this option the strategy needs to coordinated with all relevant body and to be included in the Deal Masterplan as a strategic option.

6 WATER SUPPLY AND WASTEWATER SERVICES

6.1 Current Situation

Southern Water is the main supplier of water and provides wastewater services to Deal.

Wastewater

Deal drains to Weatherlees Hill Wastewater Treatment Works (WWTW) via a number of collection and carrier drain networks. Southern Water has not identified any environmental

constraints against new development and are committed to meeting the demand from new development (see Appendix C).

Policy CP 5 of the DDC Adopted Core Strategy (Ref. 5), requires any new residential development to meet at least Code for Sustainable Homes (or any future national equivalent) level 4 from 1 April 2013, and level 5 from 1 April 2016. Therefore, the 1,600 new homes proposed for Deal in the Core Strategy will generate approximately 504m^3 of wastewater per day (assuming an average of 3 occupants per house each consuming 105 litres of water per day) which will add pressure to the wastewater infrastructure.

Water and wastewater infrastructure

Southern Water assessed the capacity of their sewerage network in 2008 as part of DDC's consultation during the preparation of their Development Plan Documents. The assessment shows that there is insufficient capacity in the north west of Deal, and for example, there is insufficient capacity to accommodate additional 200 dwellings at North West Sholden.

Most of Deal is served by separate surface water and foul water sewers, with some combined sewers to the north of the town.

The same principles apply to water distribution mains as to the sewerage system, i.e the availability of capacity will depend on the scale of development.

Water supply – water resources

Deal lies within the Kent Thanet Water Resources Zone. Southern Water have not identified any constraints to new development, but the development will need to be co-ordinated with provision of new and expanded capacity. Southern Water's Water Resources Management Plan (WRMP) (Ref. 6) outlines the schemes that are planned in this zone to meet the future demand for water.

6.2 Suggested Mitigation Measures

Wastewater Infrastructure

Additional treatment capacity is likely to be required to accommodate the additional flows, which will need to be planned and delivered through Southern Water's five yearly asset management plan process. Based on the Dover's adopted Core Strategy, Southern Water will submit an investment proposal for future development to Ofwat (the water industry's economic regulator) in 2014 as part of the five yearly periodic review of prices. Therefore, it is important that DDC inform Southern Water of any major development in the Deal area above the adopted Core Strategy, to allow Southern Water to obtain and adequately plan for future investment.

The availability of capacity in the sewers and associated pumping stations, and the water distribution mains will depend on the scale of development proposed. Where capacity is insufficient, the development must connect off-site to the nearest point of adequate capacity. Ofwat takes the view that enhancements required to the sewerage system and water distribution mains as a result of new development should be paid for by the developer. This ensures that the cost is passed to those who directly benefit from it, and protects existing customers who would otherwise have to pay through increases in general charges.

With the history of surface water flooding to Deal, Southern Water has stated that surface water from new development must not be discharged to existing foul or combined sewers, as this would increase the risk of the system becoming overloaded during periods of rainfall. Alternative means of surface water disposal must be explored, including sustainable drainage (subject to ground conditions and topography, and provision of long term maintenance), or a

separately piped system to an approved discharge point. If discharge is proposed to a surface water sewer owned by Southern Water, a capacity check would be required.

In line with Southern Water's statement details for the disposal methods of surface water runoff and SuDS has been discussed in Section 5: Surface Water Flooding and Drainage.

Water supply – water resources

To mitigate additional water demand, it is envisaged that new development should be required to meet strict targets for water usage, and measures such as:

- Rainwater recycling – collection of rainwater for irrigation of gardens and landscape areas;
- Greywater reuse – as above, but the water has already been used for showers, baths, washing up etc; and
- Water efficient and water saving fixtures and fittings in any development proposed.

7 OTHER FLOOD RISK AND DRAINAGE CONSIDERATIONS

7.1 Safe Access and Egress

Although in the future the study area will benefit from improved coastal defences, it is important that DDC consults their Emergency Planners and ensures that an appropriate Flood Warning and Emergency Plan is in place before approving new development within those areas that are subject to the greatest hazard in the event of a breach or overtopping of the coastal defence.

A Flood Evacuation Plan (FEP) is likely to be required as a condition of planning for any proposed development within the area identified as most hazardous.

Any proposed development situated within a flood risk area should also subscribe to the EA's automated telephone flood warning system to ensure that the evacuation plan can be implemented with as much forewarning as possible.

7.2 Flood Resilient Design

Any development within the existing flood risk area (Flood Zones 2 and 3), despite being defended, should consider flood resilient design techniques to mitigate the potential damage to property in case of flooding. In the event of a breach or overtopping of the flood defence during 1 in 1000 year event, it is not a question of trying to keep the water out of the buildings, but of trying to mitigate and limit the damage that would be caused in such an event.

The philosophy to be adopted in the design of the building when subject to breach water velocities is to consider the nature of the buildings' construction.

7.3 Water Framework Directive

The Water Framework Directive (WFD) requires that all European Member States (of which the UK is one) must aim to reach good chemical and ecological status in inland and coastal waters by 2015, subject to certain limited exceptions. It is designed to:

- Enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands which depend on the aquatic ecosystems;
- Promote the sustainable use of water;

- Reduce pollution of water, especially by 'priority' and 'priority hazardous' substances; and
- Ensure progressive reduction of groundwater pollution.

SuDS are typically aligned to serve the above stated purposes, however, site specific characteristics (i.e. hydrology, geology, topography etc.) will need to be considered in drainage management for any development within the study area.

7.4 Engineering Considerations for SuDS

Engineering considerations for SuDS are broad ranging, as for any drainage system. Conveyance and attenuation are primary considerations. To maximise the water quality treatment opportunities provided by SuDS, designers need to be cognisant of the characteristics of SuDS types and likely pollutant loads.

It is recommended that SuDS are designed in liaison with ecological specialists to ensure vegetation is consistent with roughness assumptions etc. and selection of fast growing vegetation to minimise erosion during and immediately following construction. Liaison with the Landscape Architects is also recommended to ensure the systems fit well within the area.

Designs should also focus on desired water quality improvements. For example, wet ponds should be designed to avoid short circuiting and to achieve required residence times for pollutants to settle out of the water.

Oil interceptors are likely to be required in commercial or industrial areas where runoff could be contaminated. Site specific guidance should be sought from Environment Agency.

Where cycle lanes and footpaths are proposed adjacent to or in linear SuDS features such as swales, they should be raised above these levels.

Regular and effective maintenance is essential to ensure that SuDS perform satisfactorily throughout their design life. For example, over time, available storage in retention ponds may decrease through vegetation growth and siltation.

8 REFERENCES

Ref. 1 JBA Consulting (August 2007): Dover District Council Strategic Flood Risk Assessment.

Ref. 2 Department for Communities and Local Government (2010): Planning Policy Statement 25: Development and flood Risk (PPS25)

Ref. 3 Environment Agency, Dover District Council and Halcrow Group Ltd. (March 2008): Pegwell Bay to Kingsdown Coastal Strategy Technical Appendix D Hydraulic Modelling Report.

Ref. 4 Sandwich Bay and Hacklinge Marshes Water Level Management Plan

Ref. 5 DDC (2010): Adopted Core Strategy

Ref. 6 Southern Water (2009): Water Resources Management Plan 2010-2035

Ref. 7 JBA Consulting (October 2010): Land between Deal & Sholden Church Lane FRA

APPENDIX A – HYDRAULIC MODELLING TECHNICAL NOTE

1 INTRODUCTION

1.1 Background

A hydraulic modelling exercise has been undertaken in order to inform the preparation of the Deal Transport and Flood Alleviation Model Strategy (DTFAMS) for Dover District Council (DDC). Mapping of the maximum flood extent and Rapid Inundation Zone (RIZ) arising from three discrete breach locations as well as overtopping of the local flood defences has been undertaken.

The following scenarios have been modelled:

- Breach location 1 (400m north of Sandown Castle) during the 0.5% Annual Exceedance Probability (AEP) event with climate change to 2112;
- Breach location 2 (70m north of Sandown Castle) during the 0.5% Annual Exceedance Probability (AEP) event with climate change to 2112;
- Breach location 3 (Harold Road) during the 0.5% Annual Exceedance Probability (AEP) event with climate change to 2112; and
- Overtopping only during the 0.1% Annual Exceedance Probability (AEP) event with climate change to 2112.

This technical note provides a record of the methodology and assumptions applied throughout the hydraulic modelling.

1.2 Previous Modelling

As part of the Strategic Flood Risk Assessment (SFRA) prepared for Dover District Council (Ref. 1), JFLOW software was used to model a series of breach events and overtopping along the coastline local to Deal. In addition, extensive modelling was undertaken as part of the Pegwell Bay to Kingsdown Coastal Strategy (Ref. 2) which included the modelling of potential flood defence and protection options for consideration.

Since the completion of this work, funding has been confirmed by Defra for a new wave wall along the frontage of the Deal coastline. Therefore, in order to inform the DTFMAS, revised modelling was required to include the representation of the new wave wall and to quantify the residual flood risk to the local area in the event of a breach and/or overtopping of the flood defences along the coast.

Furthermore, since the completion of previous modelling, more up to date information with respect to extreme sea levels (Ref. 3) and topographic information have been made available and have therefore afforded an opportunity to enable further refinement of the modelling for the study area.

1.3 Software Selection

TUFLOW software has been used to undertake the modelling assessment. TUFLOW is a modelling package for simulating depth averaged 2D free-surface flows, and is developed by BMT WBM, Australia. TUFLOW is in widespread use in the UK and elsewhere for 2D inundation modelling. The model simulations have been run using TUFLOW Build 2011-09-AD-iSP.

It is noted that as part of the SFRA, completed in 2007, breach modelling was undertaken using JFLOW generalised computer modelling. JFLOW is a coarse modelling approach and as noted within the SFRA, caution must be exercised in interpreting JFLOW derived flood outlines due to the large number of assumptions incorporated into the JFLOW model. The

selection of TUFLOW software for this modelling assessment provides more precise digital modelling.

1.4 Data Sources

The following information and data have been gathered and used to inform the construction and development of the hydraulic model:

- Environment Agency ISIS-TUFLOW Tidal and River Stour Hydraulic Model files from the Pegwell Bay to Kingsdown Coastal Strategy (Environment Agency and Dover District Council 2008).
- 2m resolution Light Detection and Ranging (LiDAR) topographic survey data provided by the Environment Agency, obtained between 1998 and 2011.
- Environment Agency Coastal Boundary Extreme Sea Levels (Base Year 2008).
- Base Astronomical Tide Curve for Dover for 15th – 19th October 2012 (Ref. 4)).
- Ordnance Survey Open Data 10K Mapping.
- Ordnance Survey MasterMap Data.
- Channel Coastal Observatory (CCO) topographic survey data for the coastline (June and July 2011) (Ref. 5).

1.5 Consultation

The Environment Agency was consulted throughout the modelling process regarding available datasets and appropriate breach parameters.

The modelling approach and assumptions were discussed and agreed with representatives from the Environment Agency and Dover District Council at a conference call on the 23rd January 2012 and at a meeting held on 25th January 2012. Correspondence and the agreed brief are included in Annex D.

2 MODEL CONSTRUCTION

2.1 Overview

The base of the hydraulic model prepared for the assessment is taken from the Environment Agency linked 1D-2D ISIS-TUFLOW hydraulic model covering the tidal area between Pegwell Bay and Deal and including the tidally influenced part of the River Stour.

This section provides a record of the changes made to the model as part of this project and details the construction of the hydraulic model used to inform the assessment of the study area. The main amendments are as follows:

- The extent of the Environment Agency ISIS-TUFLOW Model has been extended to the west and south;
- More recent LiDAR data has been used to represent the topography;
- The new wave wall along the Deal frontage has been included;
- Topographic survey from the Channel Coastal Observatory has been used to accurately represent the levels along the rest of the coastline;
- Extreme sea levels from the most recent Environment Agency sea level modelling (2008) have been used to calculate the tidal boundary conditions;
- The floodplain has been represented using a fix grid with a resolution of 15m (the previous modelling for the SFRA and Coastal Strategy used a 20m grid size).

2.2 Model Extent and Flood Cell Definition

The flood cell extent used for this modelling assessment is shown in Figure A-1 in Annex A.

The flood cell represents the extent of the model 'playing field' and is typically defined by prominent topographic features (relative to the flood source), which serve to constrain the movement of floodwater. Flood cells should incorporate every area likely to be inundated by incoming floodwaters, whether tidal or fluvial.

The existing Environment Agency model has been extended to the south to include the whole of Deal town centre to enable consideration of any potential overtopping in this area. In addition, the model has been extended to the west to include the complete extent of Flood Zone 2 and allow for propagation of floodwater to the west. The extent of Flood Zone 2 is shown in Figure A-2 in Annex A.

The hydraulic model developed for the Coastal Strategy included a 1D ISIS model of the tidal River Stour. Given that the River Stour is located approximately 5km to the north of the area of interest, it has not been considered necessary to include the ISIS model and therefore a solely 2d TUFLOW model has been used for the breach assessments.

2.3 Digital Terrain Model (DTM) Generation

A key component of the model is the representation of topography throughout flood prone areas within the study area. Various data sources were made available, including Photogrammetry data, LiDAR data and OS maps.

The platform used for the generation of the Digital Terrain Model (DTM) was the GIS package MapInfo Professional (version 9.0) with the addition of Vertical Mapper (version 3.1) to process raster data containing 3D information.

LiDAR

The topographical information for the modelling is primarily based on LiDAR data at a grid resolution of 2m. LiDAR data is an airborne survey technique that uses a laser to measure the distance between an aircraft and the ground surface. LiDAR data is provided in three formats:

- Digital Surface Model (DSM), which includes vegetation and buildings;
- Digital Terrain Model (DTM), which is filtered to remove the majority of buildings, structures and vegetation; and
- A Filter, which is the difference between the two models.

For the purpose of this study, the Digital Terrain Model (DTM) was used to represent the 'bare earth' elevation, with buildings, structures and vegetation removed. This is a conservative assumption as in reality these items would obstruct flood flows, thus potentially impacting on flood velocity and depth.

As part of this project, LiDAR data was provided by the Environment Agency for the modelled area. The data was supplied in 2011 and has a resolution of 2m.

A series of modifications have been made to the DTM in order to ensure accurate representation of the existing ground elevations.

New Wave Wall

Details of the new wave wall to be constructed between Deal Pier and the Royal Hotel car park have been used to update the defence levels in this location as set out in Table 2-1 and shown in Figure A3 in Annex A.

Table 2-1 Deal Wave Wall Dimensions

Location	Wall Height
Deal Pier	+0.67m
Queen Street	+0.91m
Stanley Road	+0.74m
Deal Castle Road	+0.40m

Survey Data

Topographic survey data for the coastline has been provided by the Channel Coastal Observatory and used to supplement the LiDAR data and update the coastal profile in the model. The survey data was obtained in June and July 2011 and is shown in the Figure A-3 in Annex A.

Key Features

The LiDAR data was interrogated to determine suitable crest levels for key linear features in the model floodplain such as embankments, railway lines, drainage ditches and prominent roads. This information has been used to ensure that key features within the model domain that could impact the propagation of floodwater across the flood cell are included in the model DTM.

2.4 1D Drainage Network

ESTRY has been used to enable the 1D representation of a number of large culverts within the 2D model domain. ESTRY, which is a part of the TUFLOW software, is a powerful 1D network dynamic flow software suitable for mathematically modelling floods and tides (and/or surges) in a virtually unlimited number of combinations.

2.5 Breach Locations and Parameters

Three breach locations have been selected and agreed with the Environment Agency and Dover District Council. These are; (1) 400m north of Sandown Castle; (2) 70m north of Sandown Castle; (3) Adjacent to Harold Road. These are considered to represent worst case breach locations for the area of interest.

In the Deal town centre, the land rises towards the sea to a level of approximately 6mAOD. This raised spit of land widens as is heads south into Deal town centre, and therefore in order to model a breach scenario that would result in water entering the flood cell, a breach would have to be modelled that is 50m width (i.e. parallel to the coastline), and approximately 30-50m (and in some cases up to 100m) depth (i.e. perpendicular to the coastline). Given the unlikely nature of such a breach event, it has not been considered necessary to consider additional breach locations further south of Harold Road.

Each breach has been modelled with a width of 50m and to occur instantly, 1 hour before the peak tide to assess the potential impact of rapid inundation of floodwater. The breaches are modelled to remain open for 36 hours. This was discussed with the Environment Agency (during the telephone conference on 23rd January 2012) and is considered to provide an adequate repair time.

The 'invert level' of the breach has been set to the lowest elevation of the land directly behind (landward) the flood defence. The elevation of land behind the flood defence wall was established by querying the LiDAR data information. Details of the breach characteristics are presented in Table 2-2.

Table 2-2 Breach Locations and Parameters

Breach No.	National Grid Reference	Description	Invert Level (mAOD)
1	637704 153892	400m north of Sandown Castle	2.6
2	637534 154398	70m north of Sandown Castle	2.6
3	637432 154705	Adjacent to Harold Road	4.4

2.6 Overtopping of Defences

An additional model run was undertaken to assess the impact of overtopping of the flood defences along the Deal coastline during the 0.1% AEP (1 in 1000 year) tidal flood event including allowances for climate change to 2112.

This scenario was modelled for 36 hours to include three tidal cycles. The peak tide is modelled to occur in the middle with two slightly smaller peaks on either side.

2.7 Design Event Tide Curve

The methodology set out in guidance provided by the Environment Agency (Coastal flood boundary conditions for UK mainland and islands, February 2011) (Ref. 6) has been used to generate a suitable tidal water level boundary for the modelling. In accordance with the guidance, the following three components are required to generate a design curve for any given site:

- Base astronomical tide curve;
- Surge component;

- Extreme sea level.

Base astronomical tide curve

A base astronomical tide curve has been provided by the Environment Agency for the standard port closest to the study area, which is Dover.

The selected base astronomical tide curve should be large enough to represent a larger than 'normal' event but also reach an appropriate level to reflect an event that occurs every year. A level has been selected that lies between the highest astronomical tide (HAT) and the mean high water spring (MHWS). This level is calculated to occur at Dover between 15th and 19th October 2012 and therefore this time series has been provided by the Environment Agency and used as the base astronomical tide for this study. The time series is shown in Figure 2-1.

Storm surge profile

The skew surge component is the difference between the observed high tide and the nearest predicted high tide, regardless of timing. The surge itself includes the rise in sea level caused by the pertaining low pressure weather system and its associated storm winds. It does not account for local wave set-up which can arise near the coastline.

In reality surge shapes are highly variable between different extreme events. However for practical purposes it is convenient to have a standard surge shape that can be used to generate total design event tide curves in a consistent manner for a particular length of the coastline. The Environment Agency have provided a series of surge shapes for specific lengths of the coastline along with their guidance documents. The surge shape for the length of coastline between Margate and Selsey is profile 12 which is shown as the red line in **Error! Reference source not found.**.

Environment Agency Extreme Sea Levels

The Environment Agency has undertaken sea level modelling for the coastline adjacent to the study area. The resulting water levels adjacent to the Deal coastline are included in Table 2-3. In order to ensure a conservative approach, the highest sea level along this stretch of coastline has been used in the generation of the design tide curve, these are the sea levels shown to occur at chainage 4390 in Table 2-3.

Table 2-3 Extreme Water Levels Base Year 2008 (Environment Agency)

Chainage	Extreme Sea Levels (mAOD)			
	0.5% AEP (2008)	0.1% AEP (2008)	0.5% AEP (2112)*	0.1% AEP (2112)*
4390	4.56	4.89	5.64	5.98
4392	4.56	4.87		
4394	4.55	4.86		
4396	4.55	4.84		
4398	4.55	4.84		

***** PPS25 Climate change allowances set out in Table 2-4 below have been used to calculate extreme water levels for 2112.

Climate Change

In the UK the effects of climate change over the next few decades is estimated to result in milder, wetter winters and hotter drier summers. An increased frequency of heavy, intense precipitation and storms will lead to different rainfall patterns resulting in changes in peak river

flows. The rise in sea levels will increase the duration and magnitude of tide locking affecting all tidal areas. Although the combined effect of climate change and sea level rise at the river catchment scale is uncertain, these factors are expected to have a major influence on the potential for future flooding. Consequently, PPS25 requires flood risk studies to consider the potential impacts of climate change on flood risk for the lifetime of proposed developments.

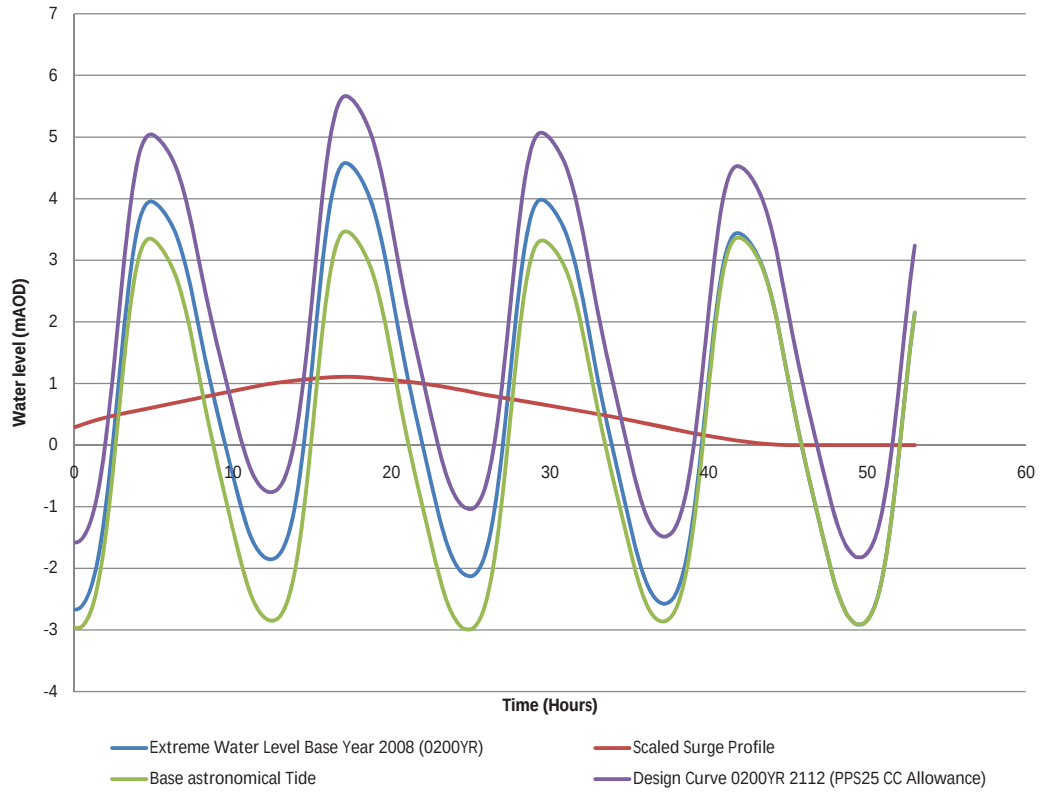
When considering flooding from the sea or tidal sources, allowances for regional rates of sea level rise should be taken into account. The recommended contingency allowances for net sea level rise, according to Table B.1 of PPS25, have been tabulated in Table 2-4.

Table 2-4: PPS25 Sea Level Rise Allowances (from PPS25, Table B.1)

Administrative Region	Net Sea Level Rise (mm/yr) Relative to 1990			
	1990 - 2025	2025 - 2055	2055 - 2085	2085 - 2115
London & SE England	4.0	8.5	12.0	15.0

The tidal curve resulting from this process, as shown in **Error! Reference source not found.Error! Reference source not found.**, is the design tidal curve used in the modelling. The peak water levels are shown in Table 2-3.

Figure 2-1 Design Tide Curve (0.5% AEP including climate change to 2112)



2.8 Hydraulic Roughness

Hydraulic roughness represents the conveyance capacity of the vegetative growth, bed and bank material, channel, sinuosity and structures of the floodplain. Within the TUFLOW model, hydraulic roughness is defined by the dimensionless Manning's 'n' roughness coefficient.

The Manning's 'n' roughness values throughout the model have been set according to the land-use based on OS Master Map data. Table 2-5 provides details of the values used within the model.

Table 2-5 Roughness Coefficients by Land use classification

TUFLOW Material Code	Manning's 'n' Value	Land-use type
1	0.04	Grass
2	0.06	Dense trees
3	0.05	Fence shrubs
4	0.035	Gravel Road
5	0.025	Footpaths and paved areas and roads
6	0.05	Hard surface, standing areas, work yards
7	0.04	Open car parks
8	0.20	Multi-storey car parks
9	0.05	Fields and natural land (Default value)
10	0.1	Buildings
11	0.05	Railway
12	0.03	Water
13	0.03	Structures
14	0.03	Water
98	0.04	Default Value
99	0.25	Stability

2.9 Grid Size

The Environment Agency Coastal strategy model and the JFLOW modelling undertaken as part of the SFRA both used a coarse grid size of 20m, which is appropriate for the strategic nature of the modelling being undertaken. During the development of this model, there was opportunity to refine the grid size and enable a slightly improved representation of the floodplain.

Following a series of initial runs, a 15m grid size was selected as it represented a good balance between the degree of accuracy (i.e. ability to model overland flow paths across the study area) whilst maintaining reasonable model run ("simulation") times.

2.10 Model Time-Step

The model time step interval is very important with respect to the numerical stability of the hydraulic model. As a general guide, the time step should be set at between ¼ and ½ of the cell size in seconds. In this case a 15m grid cell size has been selected which would therefore be expected to run on a time step of 3.75 to 7.5 seconds.

During initial model runs, it became clear that a lower time step would be required due to the rapid wetting of cells that occurs when a breach is modelled to occur instantaneously at the beginning of the model simulation. For the simulations that have been run to date, a time step

of 2 seconds has been therefore been used which is appropriate for modelling instantaneous breach events.

2.11 Model Simulations

The design model simulations listed below were run on a fixed 2 second time step using TUFLOW Build 2011-09-AD-iSP.

- 0.5% AEP (1 in 200 year) plus Climate Change (2112) Breach Location 1;
- 0.5% AEP (1 in 200 year) plus Climate Change (2112) Breach Location 2;
- 0.5% AEP (1 in 200 year) plus Climate Change (2112) Breach Location 3;
- 0.1% AEP (1 in 1000 year) plus Climate Change (2112) Overtopping.

3 MODELLING RESULTS AND CONCLUSIONS

3.1 Overview

The outputs of the model simulations are included in Annex B and C. These consist of maps showing the maximum flood extent and RIZ as well as mapping of the maximum hazard rating across the study area.

3.2 Maximum Flood Extent

The maximum flood extent is the entire area that is inundated by floodwater during the modelled simulation. The breaches are modelled to remain open for 36 hours, thereby allowing time for two additional tidal cycles following the peak tide. During the overtopping scenario, the model simulation is also run for 36 hours, with the peak tide occurring in the middle of the simulation, and two slightly lower peaks on either side.

3.3 Rapid Inundation Zone

In line with the methodology applied within the SFRA, RIZs have been defined for each of the breach locations. The RIZ is defined as the area inundated to a depth of 200mm within 30 minutes of a breach or overtopping of the flood defences.

3.4 Hazard Rating

Flood hazard is a function of both the flood depth and flow velocity. The model outputs of flood depth and flow velocity (for each element in the model) were therefore used to determine flood hazard categories within the flood cell. Each grid cell within the TUFLOW model domain has been assigned one of four hazard categories: 'Extreme Hazard', 'Significant Hazard', 'Moderate Hazard', and 'Low Hazard'.

The derivation of these categories is based on Flood Risks to People FD2321 (Defra & Environment Agency, 2005) (Ref. 7), using the following equation:

$$\textit{Flood Hazard Rating} = ((v+0.5)*D) + DF$$

(Where v = velocity (m/s), D = depth (m) and DF = debris factor)

The depth and velocity outputs from the 2D hydrodynamic modelling are used in this equation, along with a suitable debris factor. For this study, a precautionary approach has been adopted in line with FD2321; a debris factor of 0.5 has been used for depths less than and equal to 0.25m, and a debris factor of 1.0 has been used for depths greater than 0.25m.

Table 3-1: Hazard categories based on FD2320, Defra & Environment Agency 2005

Hazard Rating		Description
HR < 0.75	**Low**	**Caution** – Flood zone with shallow flowing water or deep standing water
0.75 ≥ HR ≤ 1.25	**Moderate**	**Dangerous for some** (i.e. children) – Danger: flood zone with deep or fast flowing water
1.25 > HR ≤ 2.0	**Significant**	**Dangerous for most people** – Danger: flood zone with deep fast flowing water
HR > 2.0	**Extreme**	**Dangerous for all** – Extreme danger: flood zone with deep fast flowing water

3.5 Mapping

The following maps have been prepared to present the findings of the hydraulic modelling and are including within Annex B and C:

- Figure B-1 Breach Location 1 0.5% AEP (2112) Flood Extent and RIZ
- Figure B-2 Breach Location 2 0.5% AEP (2112) Flood Extent and RIZ
- Figure B-3 Breach Location 3 0.5% AEP (2112) Flood Extent and RIZ
- Figure B-4 Overtopping 0.1% AEP (2112) Flood Extent and RIZ
- Figure C-1 Breach Location 1 0.5% AEP (2112) Maximum Hazard Rating
- Figure C-2 Breach Location 2 0.5% AEP (2112) Maximum Hazard Rating
- Figure C-3 Breach Location 3 0.5% AEP (2112) Maximum Hazard Rating
- Figure C-4 Overtopping 0.1% AEP (2112) Maximum Hazard Rating

3.6 Discussion

The results from this modelling demonstrate that in the event of a breach in the flood defences along the Deal coastline during an extreme sea level event, there is potential for widespread flooding. The area immediately to the north of the Deal town centre is flat and low lying, enabling rapid propagation of floodwaters in the westerly and northerly direction. This is classed as an 'extreme hazard' that covers the majority of the flood cell during modelled scenarios.

During the modelled scenarios at breach locations 1 and 2, floodwater spills through the breach, across the Golf Course and builds up against the embanked railway line. Water also spreads southwards into the northern part of Deal, extending as far as the North Deal Recreation Ground and along the High Street.

As the depths increase, water spills over the railway line at its lowest point and continues to spread westwards either side of the higher land of the Fowlmead Country Park and towards Sholden and Hacklinge and the A258. The maximum flood extent continues west of the A258, in accordance with the extent of Flood Zone 2 shown in Figure A-2 in Annex A.

During the modelled scenario at breach location 3, adjacent to Harold Hill, the maximum flood extent of flooding is very similar, however the area immediately impacted by floodwater is smaller and the flow route for floodwater through the northern part of Deal is more constrained due to the topography.

The maximum flood extents during these modelled breach scenarios are broadly similar to the extents shown in the SFRA prepared in 2007. However, where the model has been extended to the west to include the whole of Flood Zone 2, the maximum flood extent is larger than that shown in the SFRA.

The RIZs associated with the three breach locations that have been considered within this modelling exercise do not extend as far as the RIZ delineated in the SFRA modelling. This may be caused by a combination of effects including the use of a more refined modelling software package (TUFLOW) over the use of JFLOW within the SFRA, as well as the improved representation of the floodplain in this area (in particular the railway line which obstructs flow across the floodplain) through the use of more accurate LiDAR topographic survey and a finer grid size (15m). The probability of a breach is considered to be significantly lower once the planned flood defences are complete.

Within respect to overtopping, the modelling shows that, based upon the LiDAR data, the topographic survey from the Channel Coastal Observatory and the information about the new

wave wall provided by the Environment Agency, overtopping does occur during the 0.5% event including climate change to 2112. However the extent of overtopping during this return period event would be limited to a small area adjacent to Marine Road (just south of Middle Deal), an area further south in Walmer, and the larger area to the north of the Sandwich Bay Estate where the coastal levels are much lower. (It is noted that the peak water level for 0.5% AEP with climate change scenario is 5.64m AOD).

For the 0.1% event including climate change to 2112 (6mAOD), shown in Figure B-4, overtopping is shown to occur along the frontage including the areas adjacent to Canute Road, Godwyn Road, Hengist Road, Marine Road, and Wallington Parade (in Walmer).

3.7 Conclusions

A hydraulic modelling exercise has been undertaken in order to inform the preparation of the DTFAMS. Mapping of the maximum flood extent, RIZ and Hazard Ratings arising from three discrete breach locations as well as overtopping of the local flood defences has been undertaken.

The results from these modelled scenarios demonstrate that the northern part of Deal town and the low lying area to the north of the town are at residual risk of flooding in the event of a breach in the flood defences during the 0.5% AEP event including climate change to 2112. The area to the east of the railway line and within the northern part of Deal town has been defined as lying within the RIZ and is therefore at particular risk.

In addition, the modelling shows that several areas along the coastline are at risk of flooding from overtopping during the 0.1% AEP event including climate change to 2112, including Canute Road, Godwyn Road, Hengist Road, Marine Road, and Wallington Parade (in Walmer).

The modelling includes the presence of the new wave wall along the Deal frontage between Deal Pier and the Royal Hotel car park which has been designed to reduce the risk of wave overtopping in this area during the high order return period events.

4 REFERENCES

Ref. 1 JBA Consulting (August 2007): Dover District Council Strategic Flood Risk Assessment.

Ref. 2 Environment Agency, Dover District Council and Halcrow Group Ltd. (March 2008): Pegwell Bay to Kingsdown Coastal Strategy Technical Appendix D Hydraulic Modelling Report.

Ref. 3 Environment Agency (2008): Coastal Boundary Extreme Sea Levels (Base Year 2008).

Ref. 4 Astronomical Tide Curve for Dover 15th – 19th October 2012 (Environment Agency).

Ref. 5 Channel Coastal Observatory Topographic Survey Data for the Deal Coastline (June and July 2011).

Ref. 6 Environment Agency (February 2011) Flood and Coastal Erosion Risk Management Research and Development Programme. Coastal flood boundary conditions for UK mainland and islands. Project SC060064/TR4: Practical guidance design sea levels.

Ref. 7 Defra, Environment Agency (2005) Flood Risks to People Phase Two FD2321/TR1 and TR2.

5 ANNEXES TO APPENDIX A

Annex A – Study Area Mapping

Figure A-1 Model Extent, Breach Locations & LiDAR Topographic Survey

Figure A-2 Environment Agency Flood Zones

Figure A-3 Coastal Topographic Levels

Annex B – Flood Extent Mapping

Figure B-1 Breach Location 1 0.5% AEP (2112) Flood Extent and RIZ

Figure B-2 Breach Location 2 0.5% AEP (2112) Flood Extent and RIZ

Figure B-3 Breach Location 3 0.5% AEP (2112) Flood Extent and RIZ

Figure B-4 Overtopping 0.1% AEP (2112) Flood Extent and RIZ

Annex C – Hazard Mapping

Figure C-1 Breach Location 1 0.5% AEP (2112) Maximum Hazard Rating

Figure C-2 Breach Location 2 0.5% AEP (2112) Maximum Hazard Rating

Figure C-3 Breach Location 3 0.5% AEP (2112) Maximum Hazard Rating

Figure C-4 Overtopping 0.1% AEP (2112) Maximum Hazard Rating

Annex D – Brief and Correspondence

D-1 Modelling Brief

D-2 DDC Confirmation of Brief

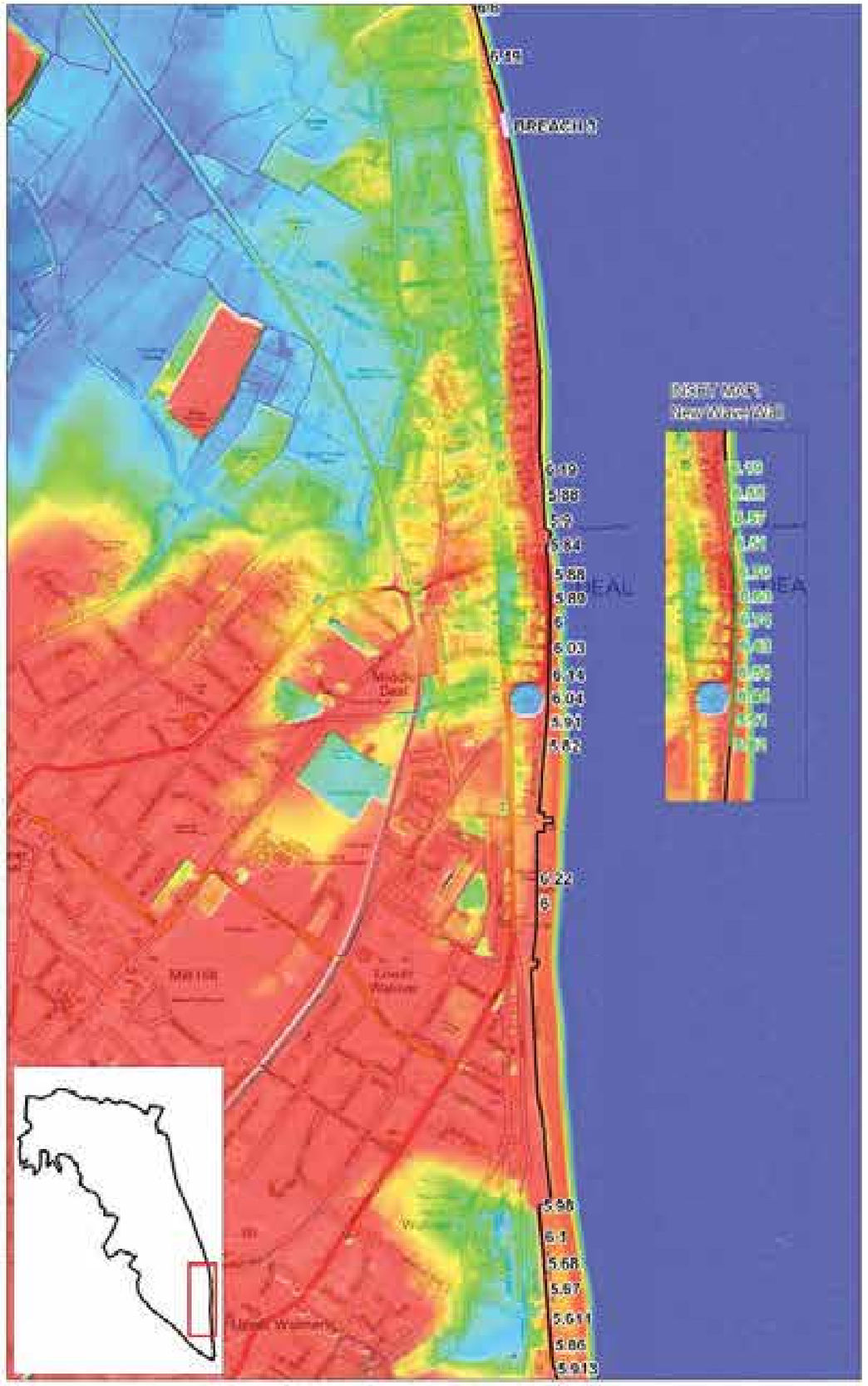
D-3 EA Confirmation of Brief

D-4 EA Confirmation of Approach

D-5 Southern Water Correspondence

D-6 Internal Drainage Board Correspondence

Annex A – Study Area Mapping



KEY

- Model Boundary
- Breach Location

LIDAR Topographic Survey (mAOD)

- 0.0m
- 2.0m
- 3.0m
- 4.0m
- 5.0m
- 5.0m and greater

TECHNICAL NOTE

Hydraulic modelling has been undertaken using JBA Hydraulic modelling software TuFlow (via FMFLOOD-2D/ESTRY-1D) to assess the effect of breaches at specified points and/or overtopping of defences.

This map shows the levels along the coastal frontage that have been applied within the modelling.
This is based upon Light Detection and Ranging (LIDAR) data provided by the Environment Agency (2011) and topographic survey data obtained from the Channel Coastal Observatory (2011). In addition, details of the sea wave wall at Walmer have been included in the model (inset map).

The Environment Agency's LIDAR data archive contains digital elevation data derived from surveys carried out since 1998. The data has a resolution of 2m.

A thorough description of the modelling methodology and assumptions is included in the accompanying Modelling Technical Note (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas vulnerable to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage (unless shown for specific structures). Areas flooded from alternative sources (residual risk) not included in this study.

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1 : 15,000	Landscape	

DEAL AAP MODELLING

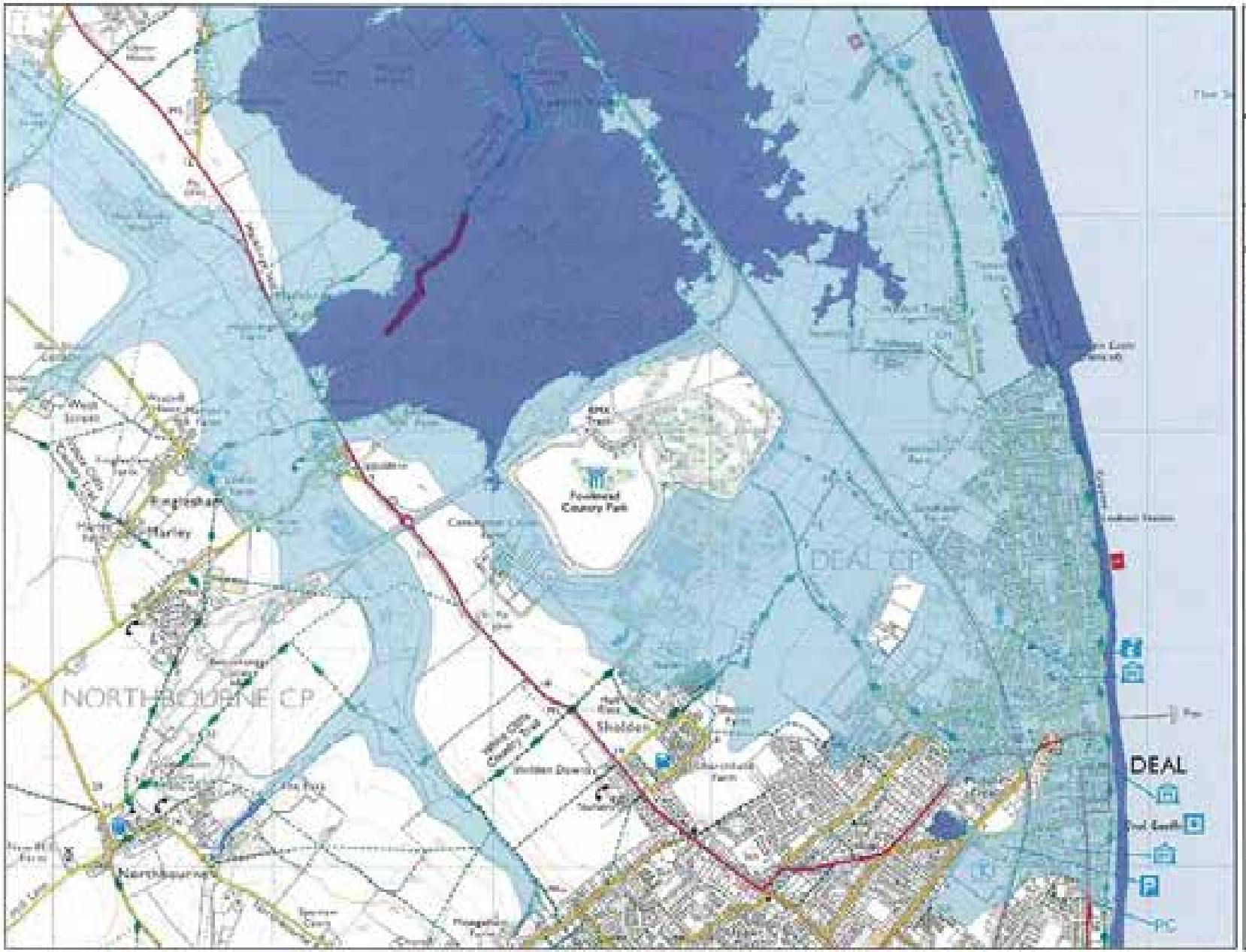
TOPOGRAPHY
LIDAR AND CHANNEL COASTAL OBSERVATORY DATA

Dover District Council
White Cliffs Business Park
Dover, Kent
CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE A-3

Flood Map 2 Centred On Deal
- Created 08 02 2011 Ref: ID2489



Environment Agency

Scale 1:25,000

N
W E
S

Legend

- Flood Defences
- Flood Storage Area
- Areas Benefiting From Flood Defence
- 1% Annual Probability of Flood & 0.5% Tidal Flooding
- 0.1% Annual Probability of Flooding

0 600 1,200
Meters

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

NORTH

RAMSGATE

MARGATE

BROADSTAIRS

RAMSGATE

MINSTER

THANET

SANDWICH

DOVER DISTRICT

DEAL

3

Tenants Hills

BREACH 1

CH

BREACH 2

S

Sandown Castle (remains)

C

BREACH 3

KEY

- Model Boundary
- Breach Location

LIDAR Topographic Survey (mAOD)

- 0.0m
- 2.0m
- 3.0m
- 4.0m
- 5.0m
- 5.0m and greater

TECHNICAL NOTE

Hydraulic modelling has been undertaken using ZB Hydraulic modelling software TuFlow (via FMFLOW-2013.ZB.AB-v1.0) to assess the effect of breaches at specified points and/or overtopping of defences.

Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to ensure the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 15 hours.

The Rapid Inundation Zone has been defined on the areas at risk of flooding to depths greater than 200mm within 15 minutes of the flood defence overtopping or breaching.

When using Mode stages 2 should be noted that they represent the flood extent and RIZ arising from one or more specified breach locations and the extent will almost certainly vary spatially if the breach locations are in different local areas. Changes in inundation extent or maximum depth are non-linear to changes in breach location.

It should be noted that the breach width and depth, though based on available guidance, are arbitrary and do not necessarily represent the actual dimensions of a potential breach at a given location.

A thorough description of the modelling methodology and assumptions is included in the accompanying Modelling Technical Note (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage (unless shown for specific structure). Areas flooded from alternative source locations not included in this study.

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DEAL AAP FLOOD RISK MODELLING

MODEL EXTENT, BREACH LOCATIONS & LIDAR TOPOGRAPHIC SURVEY

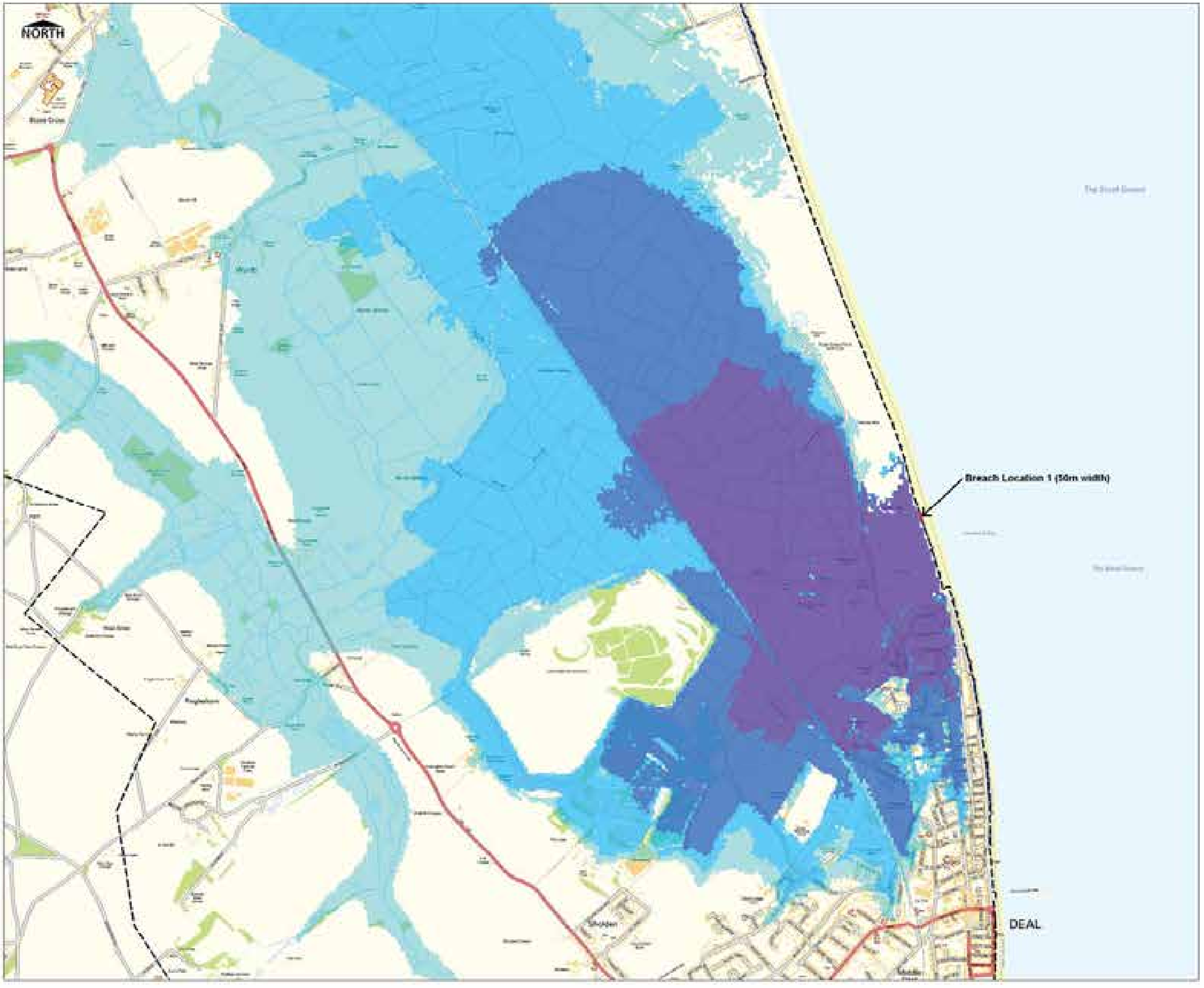
Dover District Council
White Cliffs Business Park
Dover, Kent
CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE A-1

I:\Client Projects\47xxx\47xxx1 Deal AAP Breach Inundation\GIS

Annex B – Flood Extent Mapping



KEY

- Model Boundary
- Rapid Inundation Zone (Areas shown to flood to a depth of 200mm within 30 minutes of a breach in the flood defence)
- Flood Extent within 1 Hour of Breach
- Flood Extent within 2 Hours of Breach
- Maximum Flood Extent

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2D hydraulic modelling software Tuflow (i.e. TUFLOW 2012-05-AD-x32) to assess the effect of breaches at specified points and/or overtopping of defences.
Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to assess the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 14 hours.
The Rapid Inundation Zone has been defined as the areas at risk of flooding to depths greater than 200mm within 30 minutes of the flood defence overtopping or breaching.
When using these maps it should be noted that they represent the flood extent and RIZ arising from one or more specified breach locations, and the extent will almost certainly vary spatially if the breach locations are in different local areas. Changes in inundation extent or maximum depth are non-linear to changes in breach location.
It should be noted that the breach width and depth, though based on available guidance, are arbitrary and do not necessarily represent the actual dimensions of a potential breach at a given location.
A thorough description of the modelling methodology and assumptions is included in the accompanying Modelling Technical Note (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage unless where the specific circumstance. Areas flooded from alternative breach locations not included in this study.

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DEAL AAP FLOOD RISK MODELLING

BREACH 1 FLOOD EXTENT AND R.I.Z.
1 in 200 YR + CLIMATE CHANGE (2112)
(0.5% AEP 2112)

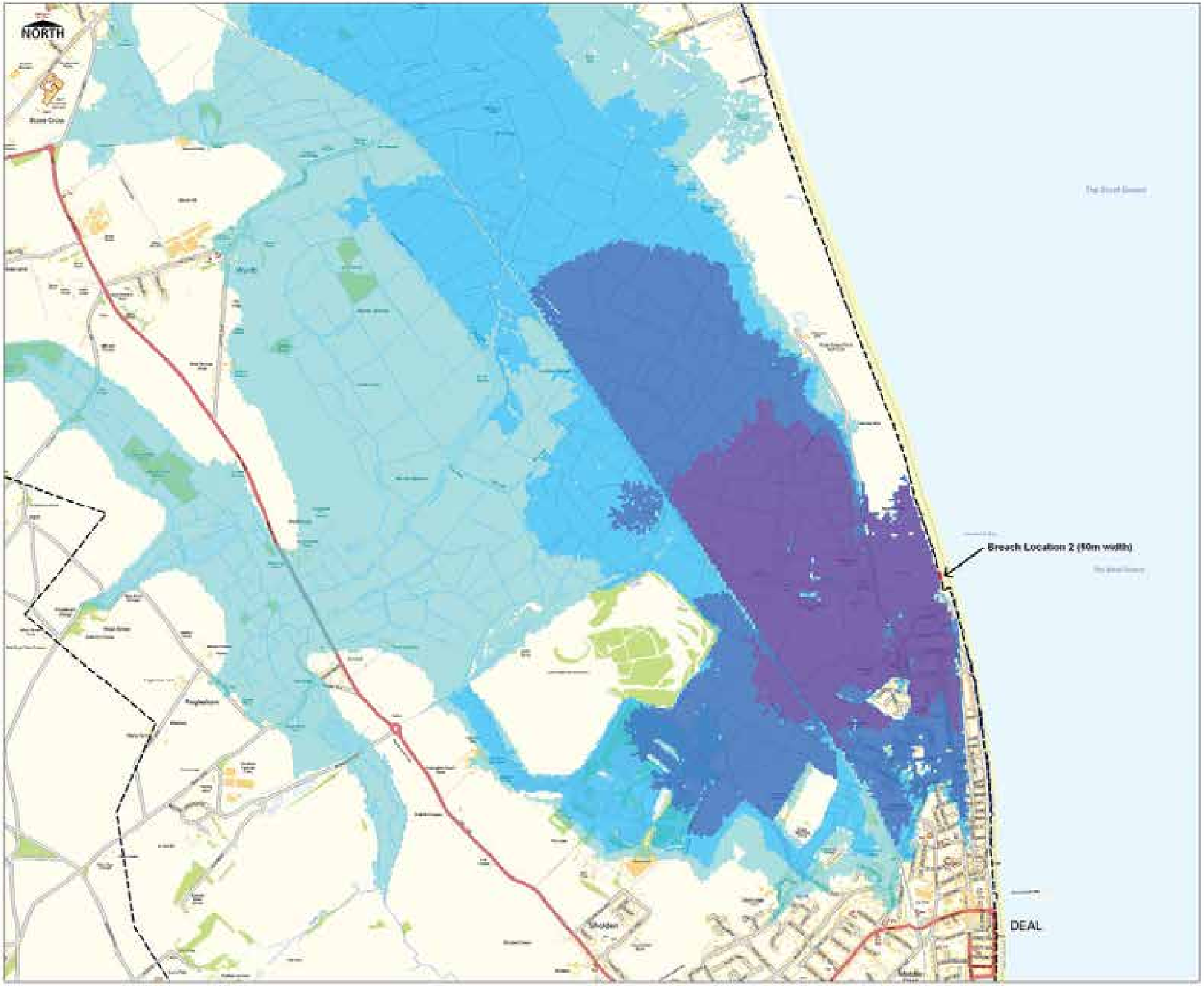
Dover District Council
White Cliffs Business Park
Dover, Kent
CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel. (020) 7798 5000

DRAWING NUMBER

FIGURE B-1

REV. 0



KEY

- Model Boundary
- Rapid Inundation Zone (Areas shown to flood to a depth of 200mm within 30 minutes of a breach in the flood defence)
- Flood Extent within 1 Hour of Breach
- Flood Extent within 2 Hours of Breach
- Maximum Flood Extent

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2D hydraulic modelling software TuFlow (i.e. TUFLOW 2012-05-AD-x32) to assess the effect of breaches at specified points and/or overtopping of defences.

Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to assess the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.

The Rapid Inundation Zone has been defined as the areas at risk of flooding to depths greater than 200mm within 30 minutes of the flood defence overtopping or breaching.

When using these maps it should be noted that they represent the flood extent and RIZ arising from one or more specified breach locations, and the extent will almost certainly vary spatially if the breach locations are in different local areas. Changes in inundation extent or maximum depth are non-linear to changes in breach location.

It should be noted that the breach width and depth, though based on available guidance, are arbitrary and do not necessarily represent the actual dimensions of a potential breach at a given location.

A thorough description of the modelling methodology and assumptions is included in the accompanying Modelling Technical Note (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage unless shown for specific structures. Areas flooded from alternative breach locations not included in this study.

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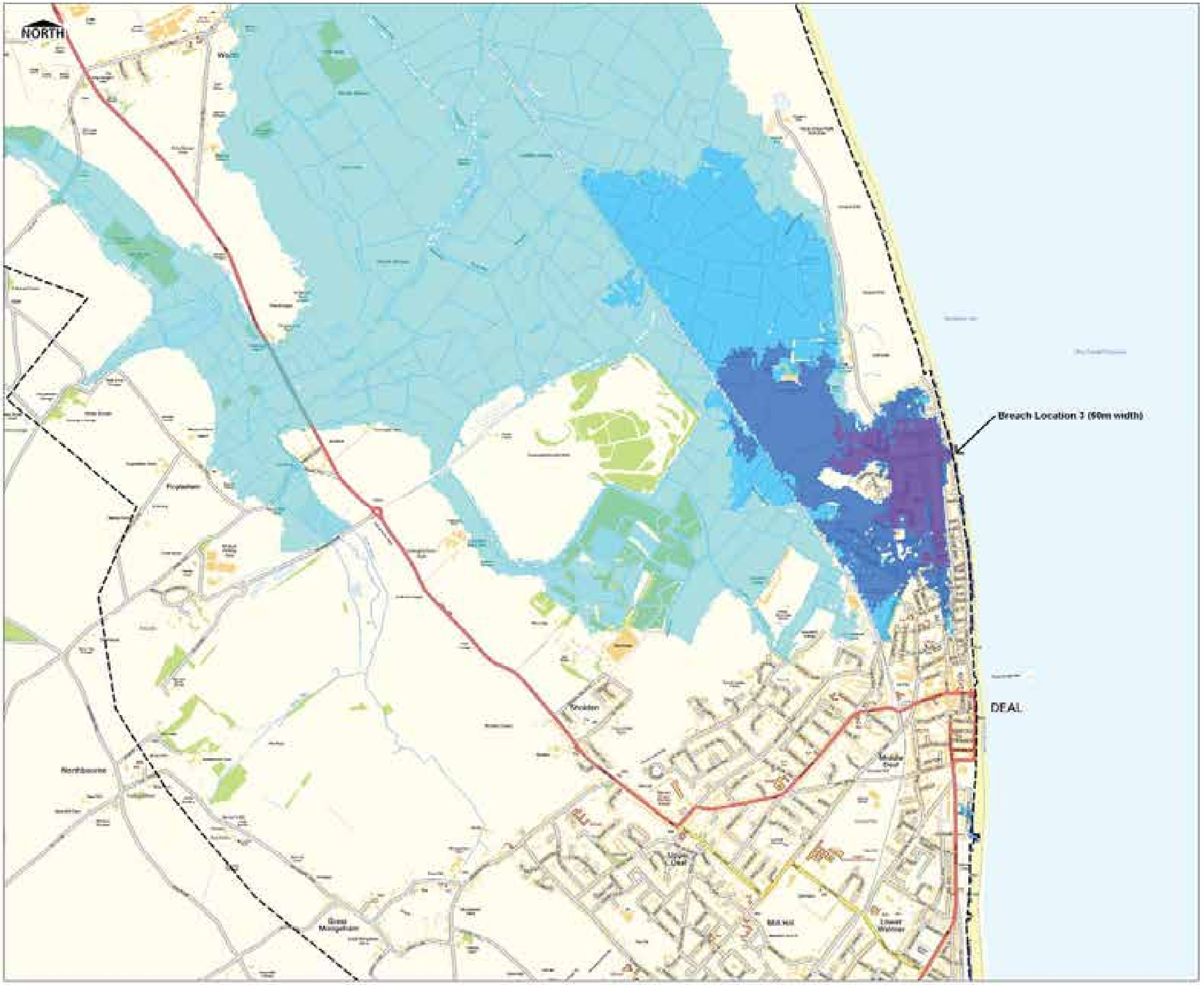
DEAL AAP FLOOD RISK MODELLING

BREACH 2 FLOOD EXTENT AND R.I.Z. 1 In 200 YR + CLIMATE CHANGE (2112) (0.5% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent
CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE B-2



KEY

- Model Boundary
- Rapid Inundation Zone (Areas shown to flood to a depth of 200mm within 30 minutes of a breach in the flood defence)
- Flood Extent within 1 Hour of Breach
- Flood Extent within 2 Hours of Breach
- Maximum Flood Extent

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2D hydraulic modelling software Tuflow (i.e. TUFLOW 2012-05-AD-x32) to assess the effect of breaches at specified points and/or overtopping of defences.

Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to assess the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.

The Rapid Inundation Zone has been defined as the areas at risk of flooding to depths greater than 200mm within 30 minutes of the flood defence overtopping or breaching.

Whilst using Mean Water Levels should be noted that they represent the flood extent and RIZ owing from one or more specified breach locations and the extent will almost certainly vary spatially if the breach locations are in different local areas. Changes in inundation extent or maximum depth are non-linear to changes in breach location.

It should be noted that the breach width and depth, though based on available guidance, are arbitrary and do not necessarily represent the actual dimensions of a potential breach at a given location.

A thorough description of the modelling methodology and assumptions is included in the accompanying Modelling Technical Note (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage unless shown for specific structures. Areas flooded from alternative breach locations not included in this study.

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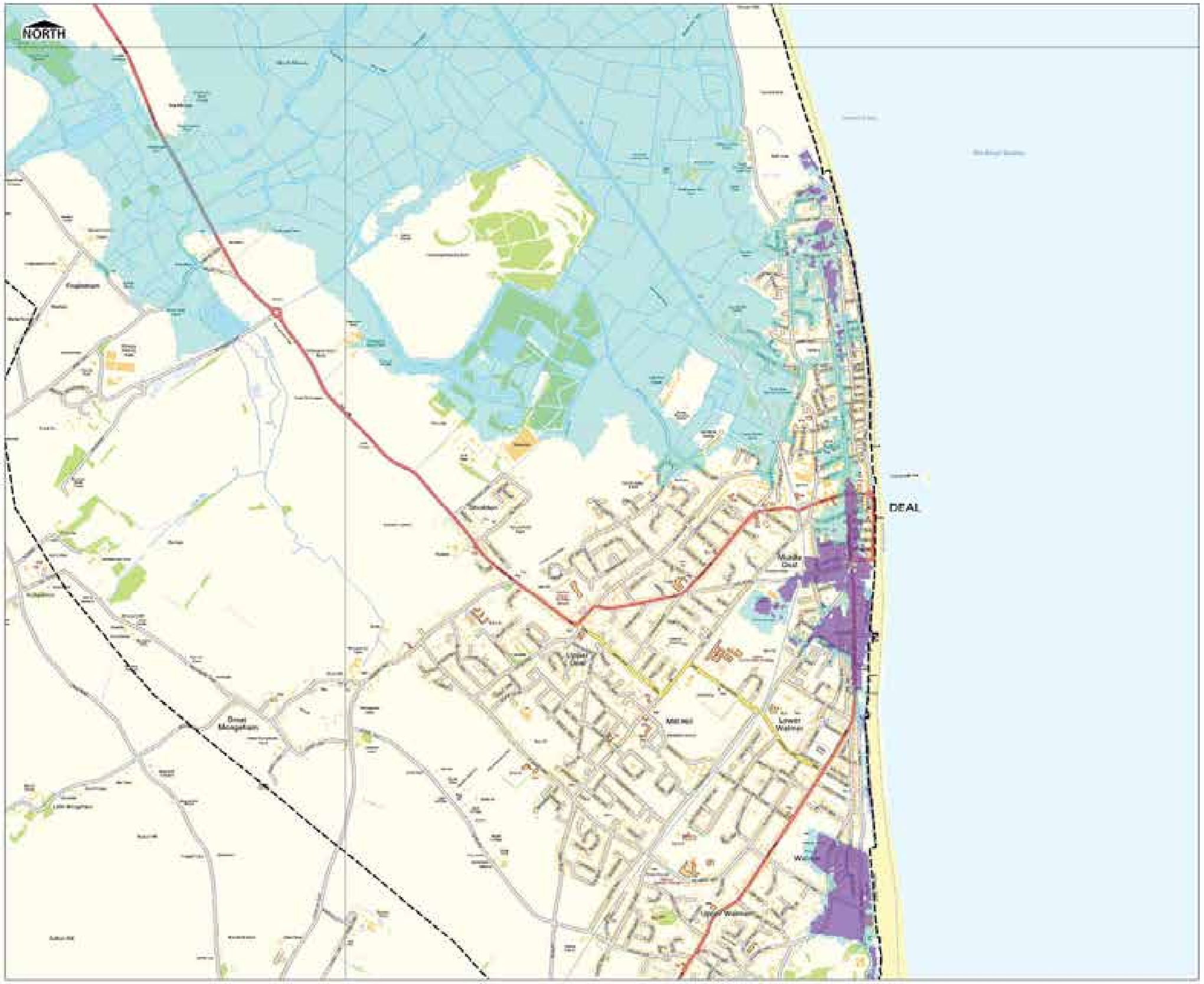
DEAL AAP FLOOD RISK MODELLING

BREACH 3 FLOOD EXTENT AND R.I.Z.
1 In 200 YR + CLIMATE CHANGE (2112)
(0.5% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent
CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE B-3



KEY

Model Boundary

Rapid Inundation Zone
(Areas shown to flood to a depth of 200mm within 30 minutes of a breach in the flood defence)

Maximum Flood Extent

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2D hydraulic modelling software TuFlow (i.e. TUFLOW 2012-05-AD-x32) to assess the effect of breaches at specified points and/or overtopping of defences.
Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to ensure the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.
The Rapid Inundation Zone has been defined on the areas at risk of flooding to depths greater than 200mm within 30 minutes of the flood defence overtopping or breaching.
Whilst using Mann maps it should be noted that they represent the flood extent and RIZ arising from one or more specified breach locations and the extent will almost certainly vary spatially if the breach locations are in different local areas. Changes in inundation extent or maximum depth are overthrow to changes in breach location.
It should be noted that the breach width and depth, though based on available guidance, are arbitrary and do not necessarily represent the actual dimensions of a potential breach at a given location.
A thorough description of the modelling methodology and assumptions is included in the accompanying Modelling Technical Note (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage unless shown for specific structures. Areas flooded from alternative breach locations not included in this study.

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1 : 20,000	Landline	

DEAL AAP FLOOD RISK MODELLING

OVERTOPPING FLOOD EXTENT AND R.I.Z.
1 in 1000 YR + CLIMATE CHANGE (2112)
(0.1% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent
CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE B-4

Annex C – Hazard Mapping

NORTH

Breach Location 1 (50m width)

DEAL

KEY

Model Boundary

Maximum Flood Hazard Rating (FD2320 EA & Defra 2005)

- Low
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2-dimensional hydraulic modelling software TuFlow (ref: RAFLWK/049-49-AR-v10) to assess the effect of breaches at specified points along/along all defences.

Breaches in the defences walls are modelled to occur 1 hour before the peak tidal level to ensure the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor and is based on the methodology from Flood Risks to People FD2320 (Defra & EA, 2005). These hazard classifications do not indicate a change in the flood probability shown using flood hazard maps, it should be noted that they represent the hazard arising from one or more specified breach locations, and that the rating will almost certainly vary spatially if the breach locations are in different local areas.

It should be noted that the breach width and depth, though based on EA guidance, are arbitrary and do not necessarily represent the worst dimensions of a potential breach at a given location.

A thorough description of methodology and assumptions is included within the Hydraulic Modelling Report (URS 2013).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system backup/surface or localised ponding. Areas flooded due to defect blockage/failure, closure for specific structures. Areas flooded from alternative breach locations not included in this study.

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SL	WR	15/02/2013
1 : 20,000	Landline	

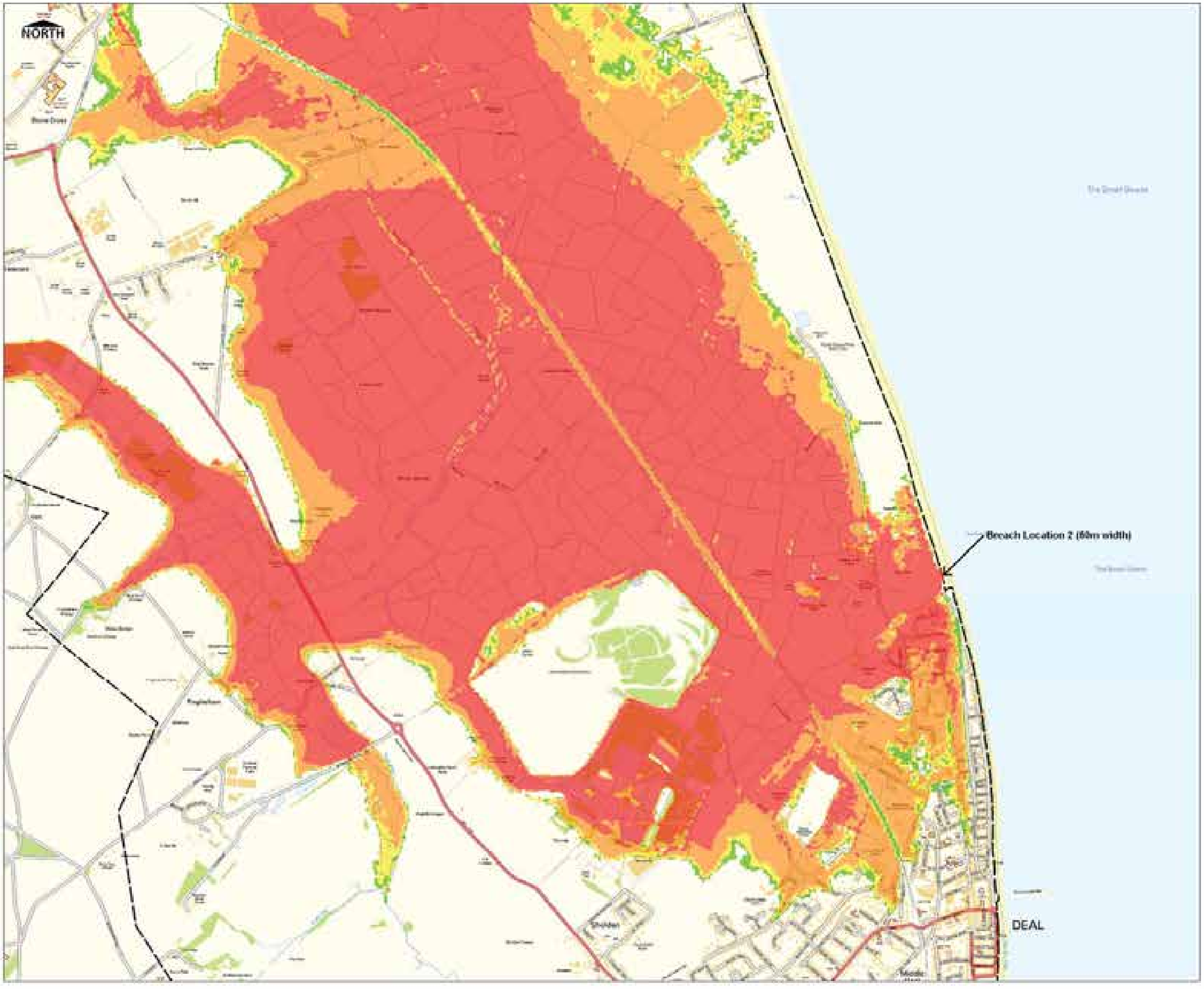
DEAL AAP FLOOD RISK MODELLING

BREACH 1 MAXIMUM FLOOD HAZARD
1 in 200 YR + CLIMATE CHANGE (2112)
(0.5% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE C-1



KEY

Model Boundary

Maximum Flood Hazard Rating (FD2320 EA & Defra 2005)

- Low
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2-dimensional hydraulic modelling software Tuflow (ref SMF/UNK/XXX-XX-XX-=-TN) to assess the effect of breaches at specified points along/adjacent to the defences.

Breaches in the defences were modelled to cover 1 hour 5 minutes this period being chosen to ensure the assumed inflow of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor and is based on the methodology from Flood Risks to People FD2320 (Defra & EA, 2005). These hazard classifications do not indicate a change in the flood probability shown using flood hazard maps, it should be noted that they represent the hazard arising from one or more specified breach locations, and that the rating will almost certainly vary spatially if the breach locations are in different flood areas.

It should be noted that the breach width and depth, though based on EA guidance, are arbitrary and do not necessarily represent the worst dimensions of a potential breach at a given location.

A thorough description of methodology and assumptions is included within the Hydraulic Modelling Report (URS 2013).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study, areas susceptible to drainage system backup/surface or localised ponding, areas flooded due to defect blockage/collapse, should the aquatic structures, areas flooded from alternative breach locations not included in this study.

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DRAWN BY	CHECKED BY	DATE
SL	WR	18/02/2013
SCALE @ A3	SOURCE DATA	
1 : 20,000	Lidar/dtm	

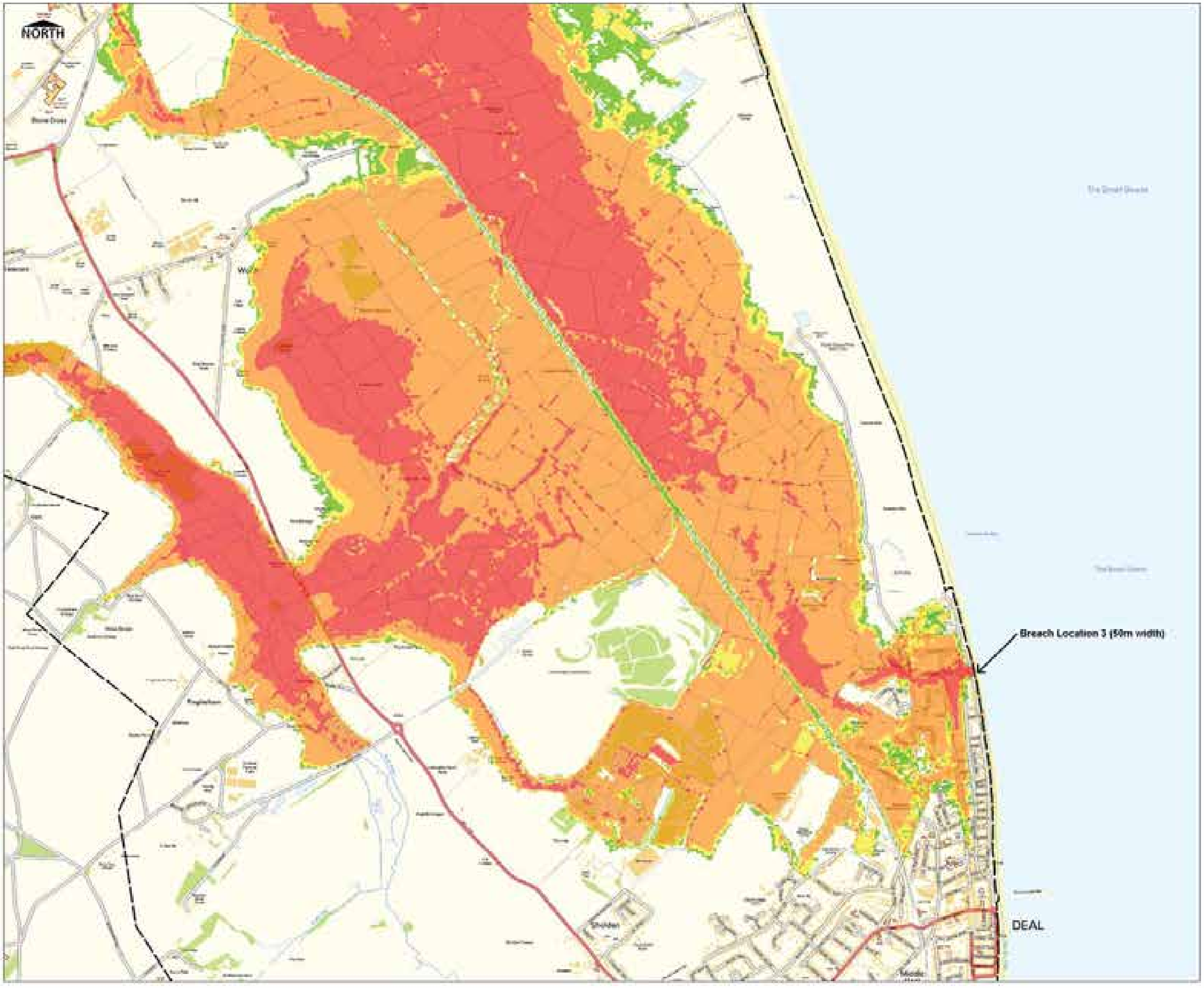
DEAL AAP FLOOD RISK MODELLING

BREACH 2 MAXIMUM FLOOD HAZARD
1 in 200 YR + CLIMATE CHANGE (2112)
(0.5% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE C-2



KEY

Model Boundary

Maximum Flood Hazard Rating (FD2320 EA & Defra 2005)

- Low
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2-dimensional hydraulic modelling software TuFlow (ref: RAFLWM-0001-00-A00-v1.0) to assess the effect of breaches at specified points and/or overtopping at defences.

Breaches in the defences walls are modelled to occur 1 hour before the peak tidal level to ensure the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor and is based on the methodology from Flood Risks to People FD2320 (Defra & EA, 2005). Flood hazard classifications do not indicate a change in the flood probability shown using flood hazard maps, it should be noted that they represent the hazard arising from one or more specified breach locations, and that the rating will almost certainly vary spatially if the breach locations are in different flood areas.

It should be noted that the breach width and depth, though based on EA guidance, are arbitrary and do not necessarily represent the worst dimensions of a potential breach at a given location.

A thorough description of methodology and assumptions is included within the Hydraulic Modelling Report (URS 2013).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system backup/surface or localised ponding. Areas flooded due to defect blockage/collapse, closure by sluice/flap structures. Areas flooded from alternative breach locations not considered in this study.

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SL	WR	15/02/2013
1 : 20,000	Location	

DEAL AAP FLOOD RISK MODELLING

BREACH 3 MAXIMUM FLOOD HAZARD
1 in 200 YR + CLIMATE CHANGE (2112)
(0.5% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE C-3

NORTH

DEAL

KEY

Model Boundary

Maximum Flood Hazard Rating (FD2320 EA & Defra 2005)

- Low
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2-D hydraulic modelling software Tuflow (ref SMF1.099.009.400.445.r.10) to assess the effect of breaches at specified points and/or overtopping at defences.

Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to ensure the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 24 hours.

Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a suitable debris factor, and is based on the methodology from Flood Risks to People FD2320 (Defra & EA, 2005). Flood hazard classifications do not indicate a change in the flood probability shown using flood hazard maps, it should be noted that they represent the hazard arising from one or more specified breach locations, and that the rating will almost certainly vary spatially if the breach locations are in different flood areas.

It should be noted that the breach width and depth, though based on EA guidance, are arbitrary and do not necessarily represent the worst dimensions of a potential breach at a given location.

A thorough description of methodology and assumptions is included within the Hydraulic Modelling Report (URS 2013).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system backupsflow or localised ponding. Areas flooded due to defect blockage/collapse, culvert inlet/outlet structures. Areas flooded from alternative breach locations not analysed in this study.

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DRAWN BY	CHECKED BY	DATE
SL	WR	15/02/2013
SCALE @ A3	SHEET SIZE	
1 : 20,000	Landscape	

DEAL AAP FLOOD RISK MODELLING

OVERTOPPING MAXIMUM FLOOD HAZARD
1 in 1000 YR + CLIMATE CHANGE (2112)
(0.1% AEP 2112)

Dover District Council
White Cliffs Business Park
Dover, Kent CT16 3PJ

URS Infrastructure & Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000

FIGURE C-4

Annex D - Correspondence

Annex D-1 Modelling Brief

Deal Transport and Flood Alleviation Model Study
Extent of hydraulic modelling in Stage 2

Introduction

This note describes why modelling work is proposed for Stage 2 of this study, the method proposed and the outputs.

Purpose

Modelling is required to improve the understanding of flood risks in areas of Deal and the surrounding countryside that will be defended by the improved flood defences to be constructed by the Environment Agency. Although the land will be protected by these defences, there will remain a risk of overtopping or breaching of the defences. This work should produce outputs that are consistent with and directly comparable with the Strategic Flood Risk Assessment (SFRA).

Nature of flood risks

Where land is protected by flood defences, PPS25 requires that those proposing development or allocating land for development demonstrate that the flood risks are appropriate for the type of development proposed, by carrying out an analysis of the risk that the defences will either be breached or overtopped by extreme events. The SFRA for this area includes such an analysis and a plan which shows the maximum possible extent of flooding from breach or overtopping. The plan also showed the area where such flooding could lead to conditions posing a hazard due to the combination of flood depth and speed of flood water. This area is known as the Rapid Inundation Zone (RIZ). Residential properties proposed within this zone would need further mitigation (such as raised floor levels) before such development could be considered acceptable – if indeed it could be accepted at all.

Method Proposed

The proposed modelling work will use the EA's hydraulic model and proposed flood defence design. At least two breaches will be modelled: one in the proposed hard defence south of Sandown Castle and one to the north. Details from the 1 in 200 flood (ie having a 0.5% probability in any one year) will be used plus an allowance for climate change. The exact location and size of the breaches will be agreed with EA and DDC officers and the reasons for these choices explained in the report. Depending on the results of these analyses, further locations may be selected. Overtopping of the flood defence will be modelled for the 1 in 1000 flood (ie having a 0.1% probability in any one year) plus an allowance for climate change.

Outputs

The output from the work will be a GIS layer showing a revised RIZ and maximum breach and overtopping flood outline (MBOFO), which can be compared to the RIZ and MBOFO shown in the SFRA. A report on the work will be prepared. This work should be consistent with and directly comparable with the SFRA. The outputs must be agreed with the EA. The report, amended model and GIS layer will become the property of Dover District Council.

Data Available

The modelling will use the same model and data that is being used by the EA in their design of the flood defences to create an amended model including the breaches.

Annex D-2 DDC Confirmation of Brief

Howard Waples

From: Will Rogers
Sent: 13 October 2011 12:20
To: Adrian Fox; Sarah Mason
Cc: Michael Timmins; Howard Waples; Maz Rahman; Michael Williams; barrie.neaves@environment-agency.gov.uk; Mike Ebbs; Saunders, Martyn; Hall, Christopher; Elizabeth Rix; Keith Watson
Subject: RE: Deal study - modelling of breach and overtopping of flood defences

Adrian

Confirmed. I had taken this as implied - DDC is the client and all such study outputs must be agreed with DDC officers. Thank you for providing Keith's contact email.

Regards

Will

From: Adrian Fox [mailto:Adrian.Fox@dover.gov.uk]
Sent: 13 October 2011 11:41
To: Will Rogers; Sarah Mason
Cc: Michael Timmins; Howard Waples; Maz Rahman; Michael Williams; barrie.neaves@environment-agency.gov.uk; Mike Ebbs; Saunders, Martyn; Hall, Christopher; Elizabeth Rix; Keith Watson
Subject: RE: Deal study - modelling of breach and overtopping of flood defences

Hi Will,

Many thanks sending through the revised brief - glad to hear that work can now progress without delay.

Just two minor points of clarification – we do want the exact location and size of the breaches to be agreed by EA Officers **and DDC (Keith Watson)** along with the reasons for these choices explained in the Report. Another minor point – the outputs should be agreed with the EA **and DDC**. Please can you confirm that the brief will be amended accordingly to pick up these two minor points?

With this in mind, it would be helpful if URS could indicate on a diagram where they suggest the exact location and size of breach analysis should be undertaken sooner rather than later? Keith Watson can be contacted on Keith.Watson@Dover.gov.uk Please can you ensure that Keith is kept fully in the loop with work along with Elizabeth Rix (who is managing the Project) to avoid any confusion.

Thank you

Adrian Fox
Principal Planner
Dover District Council
Council Offices, White Cliffs Business Park, Whitfield, Dover CT16 3PJ
Tel: 01304 872474
Mob: 07775 794983
Fax: 01304 872351
Email: adrianfox@dover.gov.uk
Web: www.dover.gov.uk

From: Will Rogers [mailto:Will.Rogers@urs.com]
Sent: 13 October 2011 10:45
To: Sarah Mason

Cc: Michael Timmins; Howard Waples; Maz Rahman; Michael Williams; Barrie Neaves (barrie.neaves@environment-agency.gov.uk); Adrian Fox; Mike Ebbs; Saunders, Martyn; Hall, Christopher
Subject: Deal study - modelling of breach and overtopping of flood defences

Sarah

We spoke last week about this modelling work which is needed as part of the above study. It attach the scope which has now been agreed with both Mike Ebbs and Adrian Fox from Dover District Council and Barrie Neaves from the Environment Agency.

Please could you discuss this with Michael Timmins and let me know who will be able to do this work. Maz will show you where the files are on our network and the job number / cost code.

We have been given permission to contact Halcrow who are EA's consultants for the flood defence scheme, and Maz has their contact details. Halcrow will advise whether the 2008 model we have is still current and will also supply details of the planned defences.

We will have to go through the usual EA process to discuss the breach locations, but Barrie has promised to contact his colleagues, so mentioning his name should speed up the process. He indicated that the breach in the hard defence would be 20m wide and in the soft defence 50m.

I hope this is clear, but if you have any questions let me know.

Regards

Will Rogers MA CEng MICE
Associate Director, Water Services
Transportation | Bedford
URS Scott Wilson
URS House, Horne Lane, Bedford, MK40 1TS, UK

Direct +44 (0) 1234 373663
Fax +44 (0) 1234 216268
Mobile +44 (0) 7767 346019

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Annex D-3 EA Confirmation of Brief

Howard Waples

From: KSL Enquiries [KSLE@environment-agency.gov.uk]
Sent: 04 January 2012 15:36
To: Howard Waples
Subject: KSL002358 - DCR - Deal - breach modelling

Dear Howard

Information request: Deal - breach modelling

Thank you for your email of 4 January 2011. You asked for confirmation of your three points. Our responses are shown below:

1) *Confirm that we are satisfied that your approach is in accordance with the method set out in the EA guidance.* Confirmed.
2) *Confirm that we are satisfied with use of the allowances set out in Table B.1 of PPS25.* Confirmed. We still require that the guidance of PPS25 is followed with regard to Climate Change adjustment.
3) *Does the Environment Agency object to the use of LiDAR data to obtain crest levels*? You should use the topographical survey where it exists (as this is more detailed than LiDAR) for the base model and ASM's details of the new defences. Where the topographical survey does not exist, the coastal observatory should hold topographical data. This will be more detailed than LiDAR. LiDAR has a 1m resolution here; topographical survey where it exists will be much more accurate and should be used.

I have forwarded your requirements for the base astronomical tide curve to our Flood Forecasting Team and asked them to respond as soon as possible.

The information is provided subject to the enclosed notices.

I hope the enclosed information is sufficient. If you require any further help please contact me.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive.

https://web.questback.com/isa/qbv.dll/SQ?q=8w2Qkfx%2BivseokDpT0B63zPEtigrVPtzrntO%2BbBapSm00Q%3D%3D

Yours sincerely

David Rich

External Relations Officer
Phone 01732 223202
Fax 01732 875057
E-mail KSLenquiries@environment-agency.gov.uk

<<
89_07_SD02 Standard Notice.pdf (42.8KB)

(42.8KB)
>>

Annex D-4 EA Confirmation of Approach

Howard Waples

From: Wilson, Jennifer [jennifer.wilson@environment-agency.gov.uk]
Sent: 14 February 2012 11:35
To: Howard Waples
Cc: Neaves, Barrie; Adrian Fox; Saunders, Martyn; Will Rogers; Mike Ebbs; Elizabeth Rix
Subject: RE: Breach Modelling

Dear Howard

Good morning!

For clarification please read our comments below in **BLUE**.

Kind Regards

Jennifer Wilson
Planning Liaison Technical Specialist (KSL - Kent)

☎ **01732 223272**
✉ **Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH**

From: Howard Waples [mailto:Howard.Waples@urs.com]
Sent: 03 February 2012 16:19
To: Mike Ebbs
Cc: Neaves, Barrie; Adrian Fox; Saunders, Martyn; Wilson, Jennifer; Will Rogers; Elizabeth Rix
Subject: RE: Breach Modelling

Dear Mike,

At the workshop last week we discussed (with Jennifer Wilson and Meriel Mortimer of the EA) what this modelling means for the purposes of developing planning policy, as you are looking to use the data to update the SFRA. Jennifer and Meriel told us that hazard ratings (combined depths and velocity) set out in document FD2320 "Flood Risk Assessment Guidance for New Development" **supersedes** Rapid Inundation Zones for the purposes of planning new development. **This is correct.**

From speaking to Will Rogers, who has been leading the flood risk element of this project I understand that we were expressly told to use the same procedure as used in the SFRA so that comparisons can be made with that output. **This is also correct. To establish what the change in defences would achieve you have to use the same procedure otherwise, no comparison can be made. This was for the purposes of the Deal Issues and Options report.**

Barrie Neaves approved our modelling methodology and output, as witnessed by Adrian and Elizabeth (and detailed in the email below). We just want to be sure which of the approaches you want us to adopt? We can then finalise our

report. **As we understand it, the original agreed methodology related to a particular study - for the Deal Issues and options report. Since that works has been completed it has been decided that this can be used to help update Dover DC's SFRA. However hazard mapping should also be included in the new version of the SFRA. The PPS25 Practice Guide recommends Hazard Mapping as it give a much better idea of the consequence of flooding than the RIZ this will enable the council to produce more informed planning policies.**

We don't have the 1 in 200 year present day hazard mapping (+ climate change) that Meriel requested, but imagine this could be produced fairly easily (if needed). **We'd recommend that this is produced as previously requested.**

Jennifer and Meriel said that following receipt of the hazard rating info they will be able to understand the situation better and discuss with DDC a suitable set of policy wording (for the SFRA amendment presumably?). They mentioned that is may even be possible to construct housing in the RIZ if floor levels were above the flood level, only if there is no reasonably available land at lower flood risk. With respect to us attending that meeting, Im afraid that it's not really part of our scope, but can provide the maps as necessary. **This is correct. The hazard mapping will help us understand the situation better and so advise Dover DC of their best options.**

In summary, the new version of the SFRA should include the results of the updated RIZ mappingand also include hazard mapping. The PPS25 Practice Guide recommends both are included in an ideal situation.

Whilst not within URS's scope, we would be happy to meet with Dover to discuss the requirements of the new SFRA.

Kind Regards,

Howard

Howard Waples MSc, BSc (hons)
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URS Infrastructure & Environment UK Limited
St. Georges House, 5 St. Georges Road, Wimbledon, SW19 4DR, UK
Direct: +44 (0)0208 944 3440
Fax: +44 (0)208 944 3301
howard.waples@urs.com
www.urscorp.eu
Please consider the environment and only print this email if necessary

---

From: Will Rogers
Sent: 25 January 2012 11:59
To: Elizabeth Rix; Will_Rogers@URSCorp.com
Cc: barrie.neaves@environment-agency.gov.uk; Adrian Fox; Howard Waples; Saunders, Martyn
Subject: RE: Breach Modelling

Adrian, Elizabeth, Barrie

Sarah and I have summarised the main points discussed and agreed in the conference call with the Environment Agency and Dover District Council on 23rd January 2012. I hope you can agree it is an accurate record, but if you have any comments, please let me know. I hope today's consultation goes well.

Software Selection for modelling the extent, time and depth of flooding from breaches and overtopping

TUFLOW software has been used to undertaken the modelling assessment. TUFLOW is a modelling package for simulating depth averaged 2D free-surface flows, and is developed by BMT WBM, Australia. TUFLOW is in widespread use in the UK and elsewhere for 2D inundation modelling.
It is noted that as part of the SFRA, completed in 2007, breach modelling was undertaken using JFLOW generalised computer modelling. JFLOW is a coarse modelling approach and as noted within the SFRA, caution must be exercised in interpreting JFLOW derived flood outlines due to the large number of assumptions incorporated into the JFLOW model. The selection of TUFLOW

software for this modelling assessment provides more precise digital modelling. Full details regarding the methodology and assumptions applied within the TUFLOW modelling will be provided in a supporting technical note.

Model Set-Up

A brief description was given of the modelling that has been undertaken. The modelling uses TUFLOW software to model the impact of a breach in the flood defences at 3 discrete locations during the 0.5% AEP event including allowance for climate change to 2112. An additional model simulation has also been undertaken to assess the impact of overtopping of the flood defences (including the new proposed wave wall in Deal) during the 0.1% AEP event including allowance for climate change to 2112.

The model is based upon the ISIS-TUFLOW model prepared for the Pegwell Bay to Kingsdown Coastal Strategy (Environment Agency and Dover District Council March 2008) with the following amendments:

- A finer grid size of 15m has been used across the study area.
- Light Detection and Ranging (LiDAR) data has been used to represent the topography across the study area (as opposed to photogrammetry data).
- Topographic survey data of the coastline from the Channel Coastal Observatory (surveyed in June and July 2011) has been used to verify the LiDAR levels along the coastline.
- Details of the new wave wall proposed for the Deal Town Centre (Deal Pier to Royal Hotel Car Park) have been incorporated into the model.

Breach Locations

Three breach locations have been selected and modelled; (1) 400m north of Sandown Castle; (2) 70m north of Sandown Castle; (3) Adjacent to Harold Road. These are considered to represent worst case breach locations for the area of interest.
Following discussion surrounding the position of breach location 2, it was agreed that breach location 2 is located close enough to Sandown Castle (70m north) to be considered acceptable.
In the Deal town centre, the land rises towards the sea to a level of approximately 6mAOD. This raised spit of land widens as is heads south into Deal town centre, and therefore in order to model a breach scenario that would result in water entering the flood cell, a breach would have to be modelled that is 50m width (i.e. parallel to the coastline), and approximately 30-50m (and in some cases up to 100m) depth (i.e. perpendicular to the coastline). Given the unlikely nature of such a breach event, it has not been considered necessary to consider additional breach locations further south of Harold Road. See figures **attached** showing the coastal levels based on the LiDAR and CCO data.

Breach Parameters

Each breach has been modelled to occur instantly, with a width of 50m, 1 hour before the peak tide to assess the potential impact of rapid inundation of floodwater. The breaches are modelled to remain open for 36 hours. Questions were raised regarding whether the suitability of a 36 hour repair time and the potential for using a 72 hour repair time was suggested. In the light of the fact that this study is primarily interested in the delineation of the Rapid Inundation Zone* and the maximum flood extent (rather than e.g. maximum flood depths and flood hazard ratings), it was agreed that 36 hours provides a sufficient model simulation period.

* *To be consistent with the SFRA, the Rapid Inundation Zone has been defined as the area shown to flood to a depth of >200mm within 30 minutes of the flood defences being breached or overtopped.*

It is noted that for the 0.1% AEP scenario (with climate change to 2112), the model was run for 3 tidal cycles (36 hours), with the peak water level occurring on the middle tide.

Flooding Mechanisms

Modelling of breaches 1 and 2 shows that in the event of a breach in these locations during the 0.5% AEP event including allowance for climate change to 2112, floodwater is modelled to propagate west across the golf course and overtop the lower lying part of the railway line. The LiDAR data shows that the railway line is located at 1.9mAOD At its lowest point in this location.
The potential for creating a flowpath with a new level crossing in this area was discussed. It was considered and agreed that this would result in a negligible difference.

Overtopping

Based upon the LiDAR data, the topographic survey from the Channel Coastal Observatory and the information about the new wave wall provided by the EA, the modelling shows that overtopping during the 0.5% event including climate change to 2112 would be limited to a small area adjacent to Marine Road (just south of Middle Deal), an area further south in Walmer, and the larger area to the north of the Sandwich Bay Estate where the coastal levels are much lower. (It is noted that the peak water level for 0.5% AEP with climate change scenario is 5.64m AOD).

For the 0.1% event including climate change to 2112 (6mAOD), shown in Figure 4, overtopping is shown to occur along the frontage including the areas adjacent to Canute Road, Godwyn Road, Hengist Road, Marine Road, and Wallington Parade (in Walmer).

Conclusions

In response to a question from DDC, the EA confirmed it was happy with the way the modelling had been carried out. Both DDC and EA said the figures would be acceptable for showing the constraints on future development imposed by flooding, and in particularly the extent of the Rapid Inundation Zone. The figures discussed in the call, which show the results of the breach modelling, will be included in the stage 2 report, but without details of the allocation sites. It was agreed the brief for this work, originally discussed on 5 October 2011, had been delivered satisfactorily.

Regards

Will Rogers MA CEng MICE
Associate Director, Water Services, Transportation
URS Infrastructure & Environment UK Limited

URS House, Horne Lane, Bedford, MK40 1TS, UK

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Mobile +44 (0) 7767 346019
will.rogers@urs.com
www.ursglobal.com

From: Elizabeth Rix [mailto:Elizabeth.Rix@dover.gov.uk]
Sent: 19 January 2012 09:01
To: Will Rogers; Will_Rogers@URSCorp.com
Cc: barrie.neaves@environment-agency.gov.uk; Adrian Fox; Howard Waples; Saunders, Martyn
Subject: RE: Breach Modelling

Will,

Thank you. Could we suggest a slot on Monday at 3pm?

Do you have a conference call facility which we are able to dial in to?

Kind regards,

Elizabeth

Elizabeth Rix
Senior Planner
Dover District Council
Council Offices, White Cliffs Business Park, Whitfield, Dover CT16 3PJ
Tel: 01304 872065
Email: elizabethrix@dover.gov.uk
Web: www.dover.gov.uk

From: Will Rogers [mailto:Will.Rogers@urs.com]
Sent: 18 January 2012 16:02

To: Elizabeth Rix; Will_Rogers@URSCorp.com
Cc: barrie.neaves@environment-agency.gov.uk; Adrian Fox; Howard Waples; Saunders, Martyn
Subject: RE: Breach Modelling

Elizabeth

I should be happy to discuss this further with you, Adrian and Barrie. Could we use Monday afternoon please? Any 30 minutes within the period you suggest will be fine. If available, I may be accompanied by one of the modellers.

Regards

Will Rogers MA CEng MICE
Associate Director, Water Services, Transportation
URS Infrastructure & Environment UK Limited

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From: Elizabeth Rix [mailto:Elizabeth.Rix@dover.gov.uk]
Sent: 18 January 2012 14:32
To: Will_Rogers@URSCorp.com
Cc: barrie.neaves@environment-agency.gov.uk; Adrian Fox
Subject: Breach Modelling

Dear Will,

Thank you very much for discussing the modelling. I have discussed this with Adrian and hope that we may be able to suggest a quick conference call to discuss the modelling with you and the Environment Agency. More specifically we'd like to grasp the rationale behind not carrying out a breach analysis in a location nearer to the town, and the evidence (namely LiDAR) which shows why overtopping has not been shown.

The times we would like to suggest are:
Tomorrow between 9am and 10am
Monday 23rd between 2pm and 3.30pm

I wouldn't imagine that we would need more than a 30 minute slot within those times.

Kind regards

Elizabeth

Elizabeth Rix
Senior Planner
Dover District Council
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Annex D-5 Southern Water Correspondence

Maz Rahman

From: "Solbra, Susan" <Susan.Solbra@southernwater.co.uk>
Sent: 11 February 2011 16:49
To: "'Mazedur_Rahman@URSCorp.com'" <Mazedur_Rahman@URSCorp.com>
Cc: "Howard_Waples@URSCorp.com" <Howard_Waples@URSCorp.com>; "Will_Rogers@URSCorp.com" <Will_Rogers@URSCorp.com>; "Malcolm_Crowther@URSCorp.com" <Malcolm_Crowther@URSCorp.com>
Subject: RE: Asset information for Deal strategic development
Attachments: Attachment

Dear Maz,

Southern Water supplies water and provides wastewater services to Deal. I address each service area in turn below.

Asset maps are sent to local councils on a regular basis. If you are working on behalf of Dover District Council, they will already have the information you require. The contact name I have for Doveris Tracey Watson.

a) Wastewater service – wastewater treatment

Deal drains to Weatherlees Hill Wastewater Treatment Works. We have not identified any environmental constraints, and we are committed to meeting the demand from new development. Additional treatment capacity may be required to accommodate the additional flows, and this will need to be planned and delivered through the five yearly asset management plan process. It is important that new development is phased to coincide with provision on necessary wastewater treatment capacity.

Dover's adopted Core Strategy will inform Southern Water's investment planning. We will submit an investment proposal to Ofwat in 2014 as part of the five yearly periodic review of prices.

b) Wastewater service - sewerage

The availability of capacity in the sewers below ground and associated pumping stations will depend on the scale of development proposed. We assessed sites as part of Dover District Council's preparation of development plan documents. The assessment is attached. This indicates, as an example, that there is insufficient capacity to accommodate 200 dwellings at North West Sholden. I hope this information is helpful, but please note that the assessment was carried out in 2008, and capacity available at that time may now have been eroded.

Where capacity is insufficient, the development must connect off-site to the nearest point of adequate capacity. Ofwat, the water industry's economic regulator, takes the view that enhancements required to the sewerage system as a result of new development should be paid for by the development. This ensures that the cost is passed to those who directly benefit from it, and protects existing customers who would otherwise have to pay through increases in general charges.

Most of Deal is served by separate surface water and foul water sewers, with some combined sewers to the north of the town. It is important that surface water from new development is not discharged to existing foul or combined sewers, as this would increase the risk of the system becoming overloaded during periods of rainfall. Alternative means of surface water disposal must be explored, including sustainable drainage (subject to ground conditions and topography, and provision of long term maintenance), or a separately piped system to an approved discharge point. If discharge is proposed to a surface water sewer owned by Southern Water, a capacity check would be required.

c) Water supply – water resources

Deal falls within the Kent Thanet Water Resources Zone. We have not identified any constraints to new development, but the development will need to be co-ordinated with provision of capacity. Southern Water's Water Resources Management Plan (WRMP) outlines the schemes that are planned in this zone to meet the future demand for water. The WRMP is available on our website at:

http://www.southernwater.co.uk/Environment/managingResources/publicConsultation.asp.

d) Water supply – water distribution mains

The same principles apply to water distribution mains as to the sewerage system, i.e:

The availability of capacity will depend on the scale of development.
If capacity is insufficient, the development must connect off-site to the nearest point of adequate capacity.
The cost of the off-site infrastructure must be paid for by the development.

I hope I have supplied sufficient information to meet your requirements. If you have any further queries, please let me know.

Regards,

Susan

Susan Solbra
Development Manager
Asset Management

'01903 272637 (direct)
: www.southernwater.co.uk

+Southern Water, Southern House, Yeoman Road, Worthing, BN13 3NX

From:Mazedur_Rahman@URSCorp.com [mailto:Mazedur_Rahman@URSCorp.com]
Sent: 03 February 2011 16:12
To: Solbra, Susan
Cc: Howard_Waples@URSCorp.com; Will_Rogers@URSCorp.com;
Malcolm_Crowther@URSCorp.com
Subject: Asset information for Deal strategic development
Importance: High

Dear Susan,

As discussed over the phone, the Dover District Council Local Development Framework Core Strategy Policy CP1identifies Deal as a District Centre and a focus for urban development. However, the development is constrained by transport and environmental considerations.

The reason I am contacting you is to find out any constraint and opportunity regarding water supply and drainage (surface & foul) around the prospective development areas. Please see the attached map with the proposed urban extension areas marked with yellow colour (i.e. Sholden, Minters Yard and south of Walmer Station).

Can you please provide a map of the Southern Water asset details for both water mains and sewers (if possible in GIS format), any flooding/capacity related issues and any advice regarding future development?

Your support will be very much appreciated.

Regards,
Maz

Mazedur Rahman BSc Eng (Civil), MSc Eng
Senior Engineer

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 - DoverCoreStrategy&SiteAllocMay08.xls

Annex D-6 Internal Drainage Board Correspondence

Howard Waples

From: Pete Dowling [pete.dowling@riverstouridb.org.uk]
Sent: 11 November 2011 14:52
To: Saunders, Martyn
Cc: Howard Waples; Tim Cuthbert; Hall, Christopher; Mike Ebbs; Elizabeth Rix; Nick Delaney; sally.benge@kent.gov.uk; Barrie Neaves; simon.mason@kent.gov.uk; adeboom@studioreal.co.uk
Subject: Re: Deal Site Visit & Team Workshop

Dear Martyn,

Thank you for inviting me along to the Deal site visit last week. As there were several separate group discussions on the day, I thought I should provide a few comments:

Generally speaking the Stour IDB seeks to ensure that all developments, including Brownfield sites, aim to achieve at most Greenfield runoff rates, or lower if possible. Whilst most developers propose to implement SuDS this is all too often by the use of underground storage. The IDB strongly prefers the use of open SuDS, such as balancing ponds, swales etc, due to the additional benefits they provide in respect of biodiversity and water quality as well as being attractive development features. These open systems are also easier to maintain (and the requirement for maintenance is more evident than with underground systems).

As you are aware, there are a number of existing surface water flooding issues in the North and Middle Deal areas, which are partly a result of un-attenuated historical development and a lack of maintenance of the drainage system (piped network and open watercourses). I therefore agree that, along with improved maintenance, future development of the North and Middle Deal areas has the potential to reduce local flood risk.

It should be noted that water levels have already been increased throughout the Hacklinge Marshes (as a result of the WLMP review) so it is likely that the increased volume of runoff from development in the North & Middle Deal areas will result in increased pumping at Hacklinge Pumping Station (& possibly Black Sluice Pumping Station). However, provided that all future developments attenuate off site flows to no more than Greenfield rates, as long sufficient storage is provided, downstream conveyance capacities including pump capacities should not be an issue.

The RSPB is currently working on a proposal to create a wetland area on land at Minnis Farm, Worth (which has been referred to in the study). The majority of this wetland is likely to be supplied from an elevated (pumped) channel, with the remainder from local runoff, although I believe there are opportunities to reduce the need for pumping here. It may be that this reduction could compensate for any increased runoff from development in the Deal area. However, if the proposed retention level in the wetland area is to be higher than the normal levels in the North & South Streams (upstream of Hacklinge Pumping Station) then increased pumping may be unavoidable.

Whilst the EA's policy on groundwater protection is supported, I believe further consideration should be given to the use of shallow soakaways in the North & Middle Deal areas. This could help limit the amount of runoff entering the surface network and therefore potentially reduce pumping requirements.

IDB consent is required for works involving any watercourse in this area other than Main River (for which the EA's consent is required). At the site visit, I was asked whether or not culverting of watercourses is considered acceptable. The Board is strongly opposed to unnecessary culverting of watercourses but accepts that this is sometimes necessary for improving access. Should a new access road be constructed in this area for instance, I would expect compensatory habitat to be created as part of the scheme.

It is accepted that the principle sea defences for Deal need to be north-south along the coastline. However, I would question the assumption that "any new road would not provide any functional benefit to Deal". If a new road (running east-west) is to be considered as part of the future development plan, and is to extend to the eastern side of the railway line (as discussed at the site meeting), then I believe there may be scope to reduce coastal flood risk in Deal. Whilst the sea defences south of Sandown Castle are 'hard' defences, the embankment to the north is a shale core, protected by a shingle foreshore. Although this section of wall is to be strengthened as part of the Deal Improvement Scheme, it will remain the weakest section of defence. It will therefore be interesting to see the results of breach modelling at this location, to see whether or not a counterwall/road would provide a practical benefit. I do however accept the point

highlighted in the study about sub-surface flows. Surface-groundwater interaction is far from clear in this area although I believe the EA is currently investigating this.

Regards

Pete

Peter Dowling
Engineer to the Board
pete.dowling@riverstouridb.org.uk

APPENDIX B – DRAINAGE NETWORK AND SURFACE WATER FLOODING

E

Legend

more

int

less


to Sandwich / A256
Fowlmead County Park
Sandown Castle
Sholden
Deal Castle
Great Mongeham
Key
Surface Water Network
Foul Water Network
Combined Water Network

Technical Note

Project Title:	Deal - Constraints and Opportunities Strategy
MVA Project Number:	C3A34002
Subject:	Strategic Transport Options
Note Number:	Version: 1.3
Author(s):	Tom Godsmark, Keith Melville, Tim Cuthbert, Martyn Saunders, Chris Hall
Reviewer(s):	Tim Cuthbert, Chris Hall
Date:	21 December 2011

1 Purpose of this Paper

1.1 This paper considers the options for new access to be provided to alleviate traffic constraints within North and Middle Deal.

1.2 It builds upon the analysis undertaken in Stage 1 of the study, which identified key opportunities and constraints in the area. A series of six strategies were considered at that stage. A high level assessment of the strengths and weaknesses of these strategies were considered.

1.3 The headline assessment contained within Appendix E of the Stage 1 Baseline Report recommended that three strategies be carried forward for further investigation. This paper builds on, and refines in light of further evidence, options 1, 2 and 6. The remainder were discounted as they failed to address the key traffic issues within North and Middle Deal.

1.4 This paper considers strategic options suggested by the Stage 1 report. It assesses them against number of transport, environmental designation, heritage and cost factors. The purpose is to identify the feasibility of the road strategies considered.

1.5 The three access strategies considered are:

- A northern route from the A258 around Fowlmead Country Park and south to North Deal
- An east west route connecting North Deal to the A258 via various routes around Sholden
- A series of new connections into the existing street framework of North Deal

1.6 This paper assesses each Strategic Option as a whole. It then provides more detail on conditions at potential component parts, addressing potential individual junctions and sections of highway that make up each option.

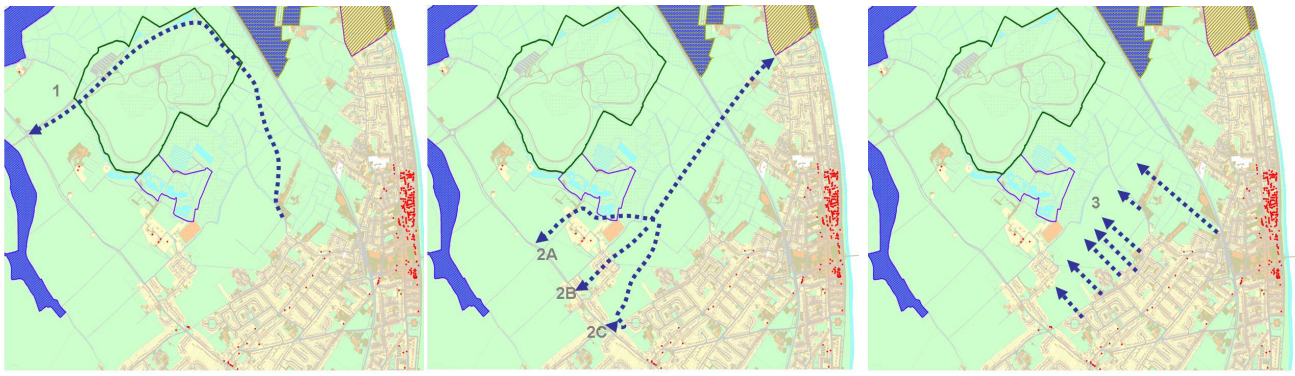


Figure 1.1. Strategic Options

2 The Type of Highway Investigated

2.1 The type of highway considered for North Deal is based on the assumption that a new road and any new junctions will need to have sufficient capacity to accommodate:

- Traffic from the existing urban area
- Additional trips generated by planned growth
- Future trips by development over and above Core Strategy levels.

2.2 Given the need to accommodate the full range of vehicle movements the strategic route assessments are based on the following road specification:

- 7.3 metre carriageway (for strategic route options 1 and 2 only);
- Associated pedestrian and cycleways;
- Street lighting within the built up area and at key junctions in accordance with Kent County Council standards;
- Appropriate landscaping; and
- Suitable junctions

2.3 Each of the options considered has to demonstrate the key transport requirements of a rational route connecting origins and destinations together with an appropriate relationship between costs and the level of usage.

2.4 If any of the options identified within this assessment are progressed then traffic modelling will be undertaken to understand the full impacts. This will have a particular focus on the impacts on the 'hotspot' junctions identified in Figure 4 of the Stage 1 Report and the opportunities to improve their functionality.

3 Indicative Cost Estimate

3.1 For assessment of each option an indicative cost range is provided to give an illustration of scale and highlight the relative costs between options. It is stressed that the estimates are

PRELIMINARY and based on composite rates for infrastructure items drawn from published information and our own records of out-turn construction costs.

3.2 The cost estimates should be viewed with caution and not used for any purposes other than those outlined above. In accordance with HM Treasury Guidance we have applied an optimism bias (contingency allowance) of either 44% or 66% within the cost estimate. The higher contingency is applied to proposals where the expected engineering works are more complex.

4 Habitat and Environmental Considerations

4.1 The following types of site are found in the study area.

4.2 NATURA 2000 Sites (RAMSAR / SAC / SPA / etc)

- Protected by EU Habitats Directive;
- Restrict ability to 'develop' within or close to designated areas (a 200m buffer applies);
- Development cannot be permitted where it is likely to have a significant effect on the designated site. Development can only go ahead if it can be designed to avoid causing an effect or mitigate it sufficiently;
- Failing this development or infrastructure can be permitted where Imperative Reasons of Overriding Public Interest (IROPI), no alternatives can be demonstrated;
- Meeting the IROPI test is likely to be difficult in the Deal context and would still require full compensatory measures i.e. creating equivalent habitat elsewhere.
- NATURA 2000 sites and 200m buffer act as absolute barrier to route alignment.

4.3 UK Biodiversity Action Plan Sites - Coastal Grazing Marsh

- Not protected in legislation;
- Important role in supporting Natura 2000 sites;
- Compensatory habitats required if project adversely impacts sites;
- Impacts can be mitigated for.

4.4 Higher and Entry Level Stewardship Sites

- Not protected in legislation;
- Not an absolute constraint on development.

4.5 These designations have a significant impact on the ability to deliver certain highway alignments, connections and junctions.

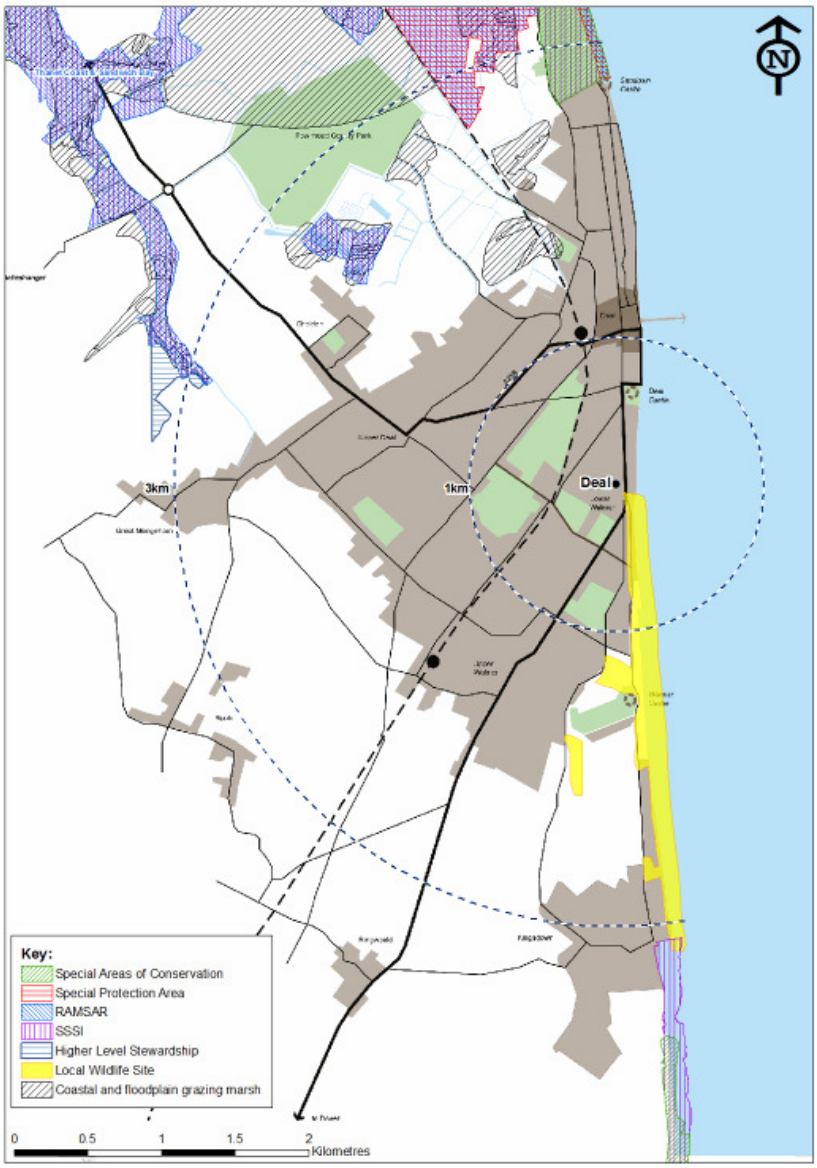


Figure 4.1. Environmental and Habitat Assets

5 Heritage Considerations

5.1 North Deal and Sholden have a number of heritage assets.

5.2 Key assets in are:

- St Nicholas' Church and Graveyard – Grade II*
- Hull Place – Grade II
- Sholden Hall – Grade II
- Roman Villa remains – north east of Sholden.

5.3 Planning Policy Statement 5: Planning for the Historic Environment and The Setting of Heritage Assets: English Heritage Guidance, 2011 sets the framework for assessing the impact on existing heritage assets. This includes;

- Impacts on the Listed Buildings themselves and their setting;
- Impacts of any new access route should consider direct effects on the heritage assets and their setting;

5.4 Heritage considerations will prevent the ability to deliver particular alignments and junctions close to the individual assets identified.

Figure 5.1. Heritage Assets

6 Headline Findings

1. A northern route from the A258 around Fowlmead Country Park and south to North Deal

- Does not meet transportation requirements, excessive distance between North Deal origin and destinations
- Significantly constrained by environmental designations
- Impacts on Fowlmead Country Park
- Cost is out of proportion with traffic served
- Not a feasible solution

2A, B, C: An east west route connecting North Deal to the A258 via various routes around Sholden

- Significantly constrained by environmental designations north of Sholden
- Constrained by, and would dramatically alter, the existing village fabric of Sholden
- Constrained by St Nicholas' Church and Graveyard (Grade II*) and Sholden Hall (Grade II)
- New junction location south of Sholden constrained by proximity to existing junctions
- Not a feasible solution without significant impact, compensation and mitigation in the Sholden Area

3. A series of new connections into the existing street framework of North Deal

- More rational transport solution;
- Provides multiple routes and alternatives for traffic;
- Requires upgrade to new access points in North Deal;
- Requires upgrade to existing highways in North and Middle Deal;
- Requires upgrade to existing junctions in North and Middle Deal;
- This option is recommended for further definition and investigation.

7 Approach

7.1 This technical note examines a range of potential highway access options for the Middle/North Deal development area. It is based on the findings of both a desktop study and detailed site observations recorded on a walk of the area by the consultant team and Council officers on 4th November 2011. The note considers the strengths and weaknesses of each point of access and provides a high level view on traffic capacity and cost of delivery. In total 14 potential points of access are considered as illustrated on the plan below.

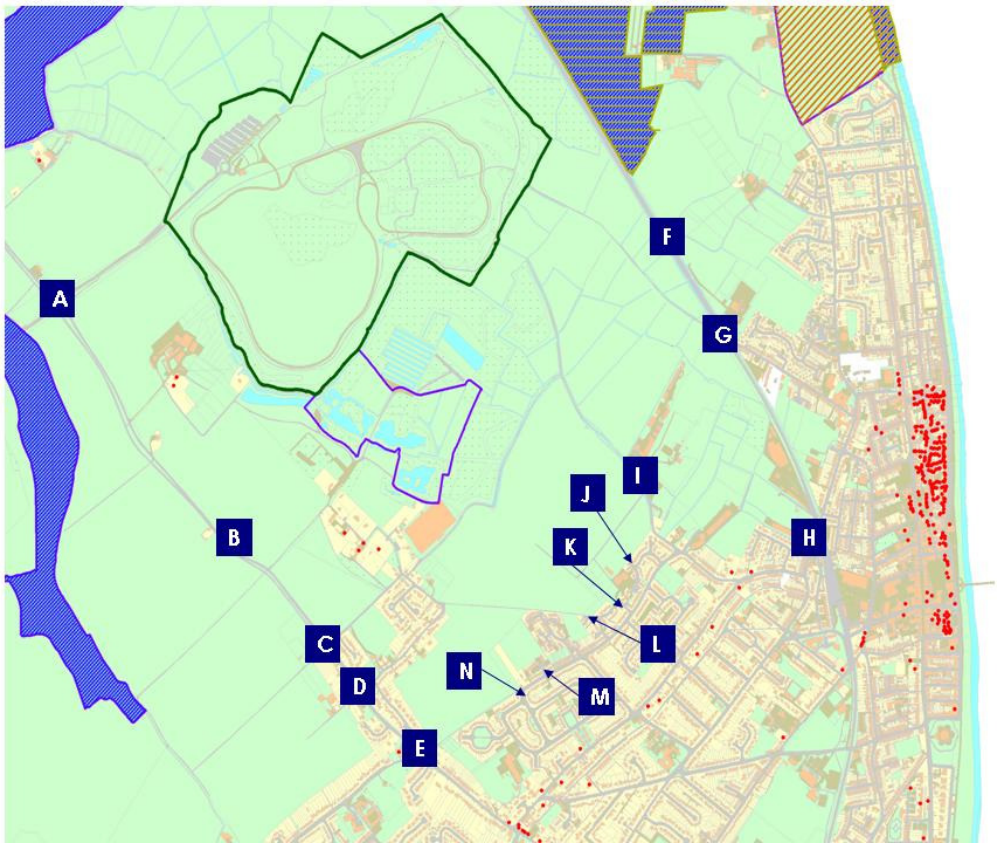


Figure 7.1. Access options north of Deal

Traffic Capacity

7.2 The indicative potential of each access point to carry additional traffic is presented as follows:

- LOW – less than 50 two-way movements at peak times;
- MEDIUM – 50 – 250 two-way movements at peak times;
- HIGH more than 250 two-way movements at peak times

ACCESS STRATEGY OPTION ANALYSIS

7.3 By combining and linking a number of the potential access points shown in Figure 7.1, it has been possible to examine the feasibility of three access strategies, as shown in Figures 6.2 below. Table 1 provides a summary of the transport, environmental, heritage and property issues associated with each of these strategic options together with approximate infrastructure costs.

7.4 Table 1 highlights the major environmental impacts and significant costs associated with some of the more aspirational proposals concluding that most are not feasible, deliverable or, in some cases recommended as a technical solution. Only access strategy 3, that involves extending the existing highway network and junction improvements to the north of Middle Deal, is considered to be feasible subject to the quantum of development envisaged.

7.5 Following Table 1 the remainder of this Note considers the relative merits of each access point separately.

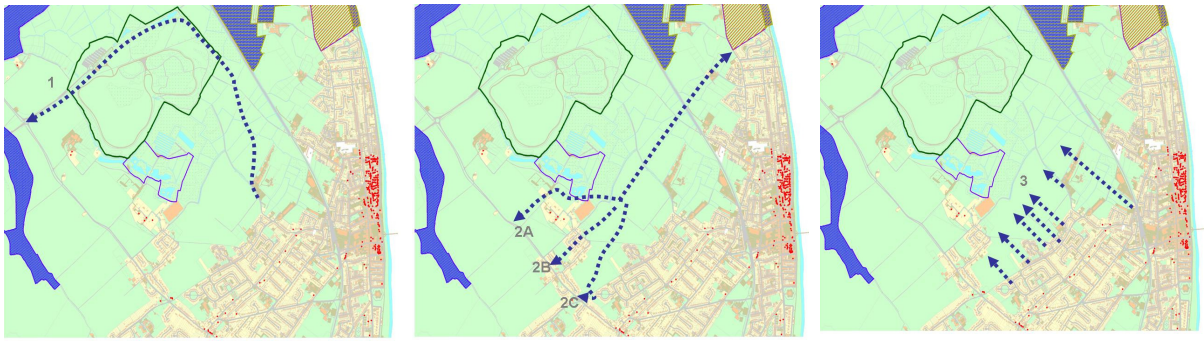


Figure 6.2. Strategic Route Options

Table 1: Access Strategy Summary

Access Strategy		Considerations					Conclusion
Strategy	**Components (as shown in Figure 1)**	**Transport Viability**	**Environmental Constraint**	**Heritage Impact**	**Property Impact**	**Infrastructure Cost (excludes land assembly etc)**	
1 – Access from Betteshanger Roundabout via Fowlmead	A, I,	Indirect route, Capacity in excess of need, Unproven in transport terms	Within 200 metres of: RAMSAR, SAC, Grazing Marsh, Impact on setting of Fowlmead Country Park	N/A	N/A	£4.4mn to £7.3mn	Neither feasible nor recommended.
2a – Access from new A258 junction north of Wards	B, I, F	Suitable level of capacity would be provided	Within 200 metres of: RAMSAR, SAC, Grazing Marsh, Impact on setting of Cottington Lakes	Listed properties at Hull Place, Remains of Roman Villa	Requires land acquisition including operational nursery land	£8.2mn to £13.2mn	Significant environmental and property constraints. Not recommended.

Access Strategy		Considerations					Conclusion
Strategy	**Components (as shown in Figure 1)**	**Transport Viability**	**Environmental Constraint**	**Heritage Impact**	**Property Impact**	**Infrastructure Cost (excludes land assembly etc)**	
2b – Access via existing Sholden New Road and The Street	C & D, I, F	Constrained current traffic capacity in Sholden Village and A258 junctions. Lack of footpaths on The Street	Within 200 metres of: RAMSAR, SAC	Listed properties at Hull Place, Listed properties on The Street	Requires land acquisition to increase traffic capacity through the village	£8.3mn to £13.3mn	Significant heritage, environmental and property constraints. Not recommended.
2c – Access from new A258 junction opposite Mongeham Road	E, I, F	New junction capacity limited by listed St Nicholas Church	Within 200 metres of: SAC, Grazing Marsh	Listed St Nicholas Church and graveyard and Sholden Hall	Requires acquisition of land and residential property	£7.4mn to £12mn	Neither feasible nor recommended.

Access Strategy		Considerations					Conclusion
Strategy	**Components (as shown in Figure 1)**	**Transport Viability**	**Environmental Constraint**	**Heritage Impact**	**Property Impact**	**Infrastructure Cost (excludes land assembly etc)**	
3 - Extending existing framework and junction improvements	H, I, J, K, L, M, N	Enables dispersed approach across improved framework within existing urban area	Avoids environmental designations	N/A	Requires additional connections within extension area.	£2.4mn to £3.75mn	Feasible subject to development quantum and traffic capacity determination.

INDIVIDUAL ACCESS POINT ANALYSIS

8 Access Option A – A258 – Betteshanger Roundabout

8.1 Option A would provide a purpose-built access road from the Betteshanger Roundabout on the A258 skirting the northern boundary of Fowlmead Country Park as shown in Figure 8.1. Whilst it may be possible to utilise or upgrade the existing park access to create the western section of the route, the majority of the link would require new construction. The overall length of new road required to access the development area would be approximately 2.5km running through the existing countryside and Country Park creating a dramatic impact on the character of the landscape and requiring significant reconfiguration of the Park access and parking arrangements.

8.2 If implemented in isolation (ie without any other connections into the existing Middle/North Deal road network) this access option would effectively create a very long cul-de-sac simply serving the development area without creating any wider access improvements. For safety reasons such an arrangement could serve a maximum of 100 dwellings according to Kent County Council standards. The incorporation of a loop system could potentially increase this to 300 dwellings but in both cases the scale of highway infrastructure would not be justified by the traffic volumes associated with such a modest quantity of new development.

8.3 In order to capture any wider transport benefits this route would need to be implemented in conjunction with other new highway connections for example, a new link over the railway line to link into North Deal (Option F below)

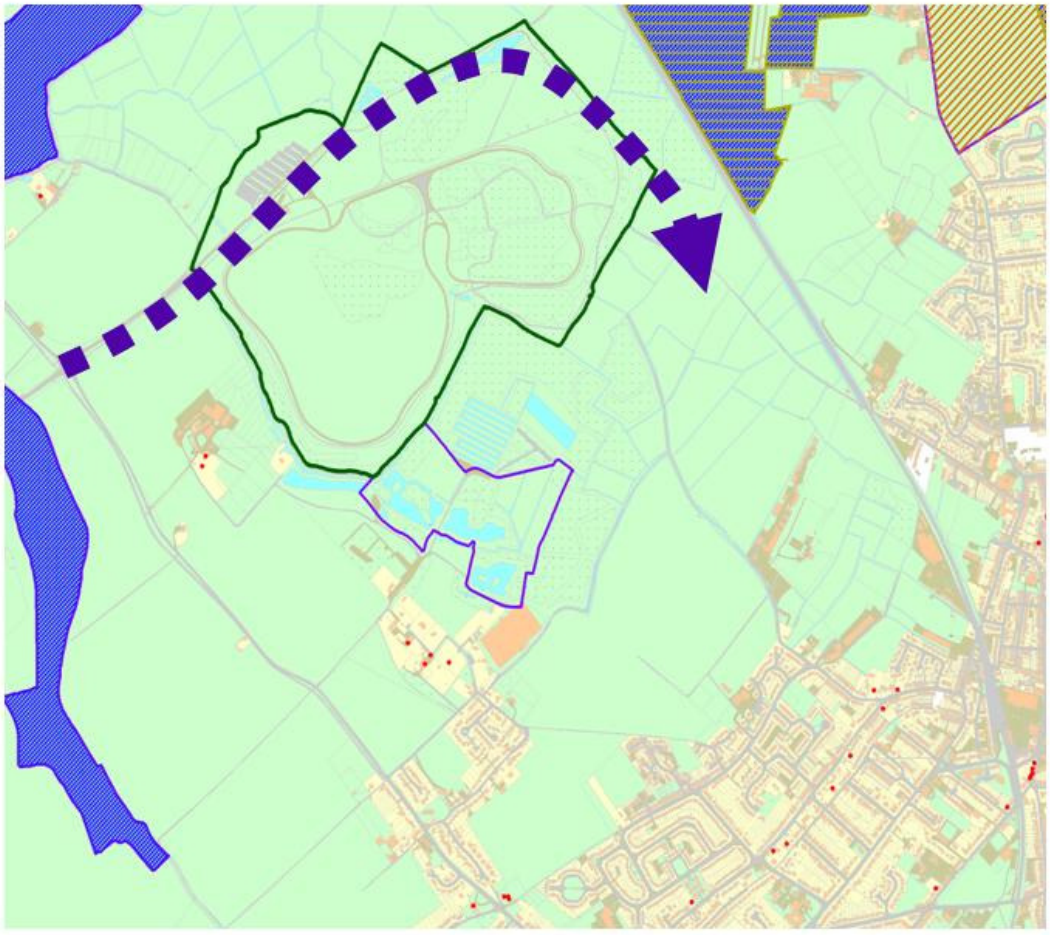


Figure 8.1. Option A Access Plan

Strengths

- Provides an alternative route to the A258 corridor potentially reducing the impacts of development traffic at the critical Manor Road roundabout and in the town centre and surrounding area;
- Links into an existing high standard junction on the A258;
- Provides a new high capacity route;
- Creates a new corridor available for public transport.

Weaknesses

- Circuitous route creates a long stretch of new highway in the countryside;
- Significant cost of construction;
- The road runs within 200m of a RAMSAR wetland site of international importance and would lead to adverse impacts associated with traffic noise, atmospheric pollution and lighting that would be very difficult to justify and mitigate;
- The route around the north and east of Fowlmead Country Park will have a significant impact on the setting of the Park both through the development of the road itself 'severing' the physical and visual link to the wider countryside and the potential increase

in noise and light pollution impacts. Significant public sector investment has been made to establish the Park as a valuable public asset, the impact and value of which is likely to be significantly diminished;

- Despite the scheme's potential high capacity it may be under utilised by both development traffic and other motorists since it is a less direct route than the A258.

Traffic Capacity

- High

Indicative Cost Range

- Cost of 2.6km link – £3.9 to £6.5m
- Cost of modifying access and car parking to country park - £150,000 to £250,000
- Total - £4.1 to £6.8m

Conclusion

Major environmental impacts on protected sites and local landscape coupled with high cost of construction and limited transport benefits indicate that scheme would not be deliverable.

Access Option A - do not pursue

9 Access Option B – A258 - North of the Wards site

9.1 Option B would provide a new access to the north of The Wards site in Sholden as shown in Figure 9.1. The scheme would potentially run alongside the wetland area, close to a Roman Villa and Hull Place, a cluster of Listed Buildings.

9.2 Similar to Option A, if implemented in isolation this access option would effectively create a cul-de-sac simply serving the development area without creating any wider access improvements. For safety reasons such an arrangement could serve a maximum of 100 dwellings according to Kent County Council standards. The incorporation of a loop system could potentially increase this to 300 dwellings.

9.3 In order to capture any wider transport benefits this route would need to be implemented in conjunction with other new highway connections for example, a new link over the railway line to link into North Deal (Option F below).

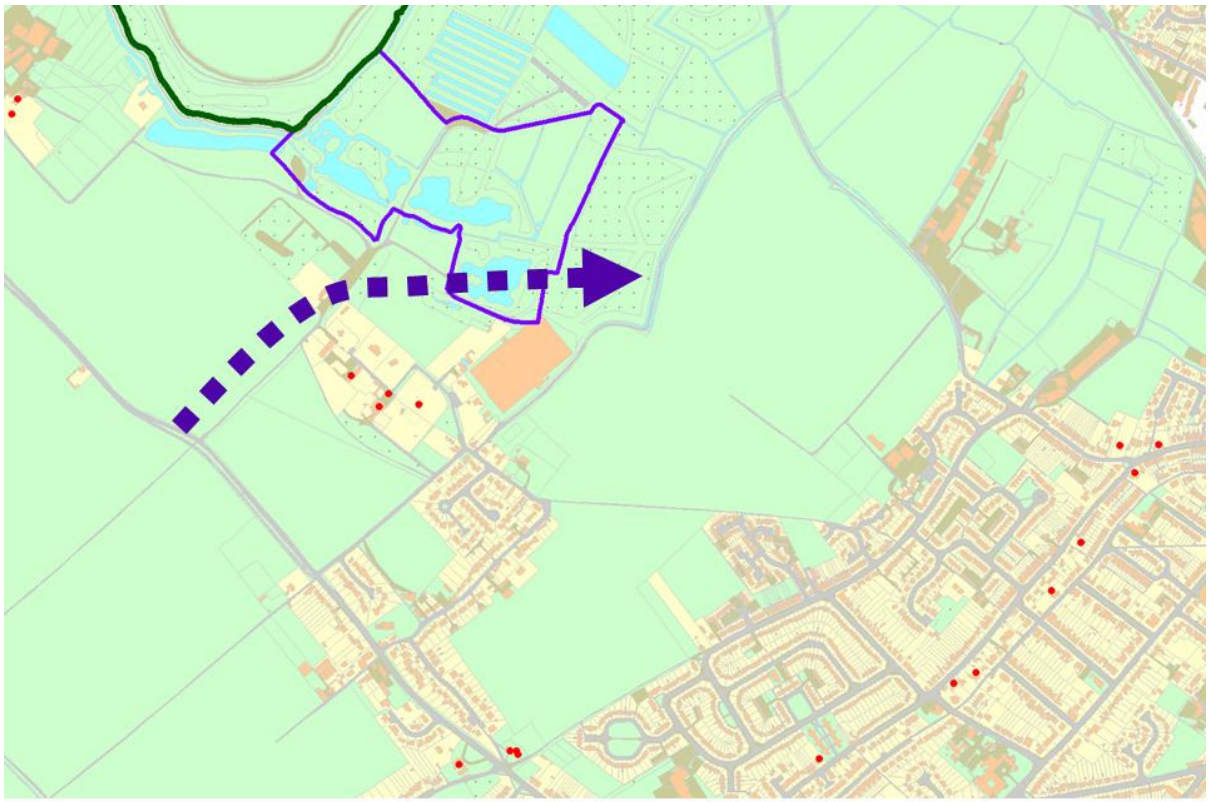


Figure 9.1. Option B Access Plan

Strengths

- Creates a new direct access into the development area from the A258;
- New junction on A258 is feasible at this location;
- If coupled with other access points could relieve pressure of development traffic at the Manor Road roundabout and help redistribute traffic in the Middle/North Deal area;

- Provides a new route for public transport.

Weaknesses

- The road runs within 200m of a RAMSAR wetland site of international importance and would lead to adverse impacts associated with traffic noise, atmospheric pollution and lighting that would be very difficult to justify and mitigate;
- Impact on Listed properties at Hull Place;
- Impact on Roman Villa.

Traffic Capacity

- High

Indicative Cost Range

- New roundabout cost - £100,000 to £145,000
- Cost of 1km access road £1.5m to £2.2m
- Total - £1.6m - £2.4m

Conclusion

Major impacts on environmentally designated sites and heritage sites that are unlikely to be justifiable and difficult to mitigate

Access Option B - do not pursue

10 Access Option C – Sholden New Road

10.1 Option C provides access via Sholden New Road in Sholden as shown in Figure 10.1. Similar to other access options described above, such an access would only act as a cul-de-sac for development traffic unless it is combined with other new routes.

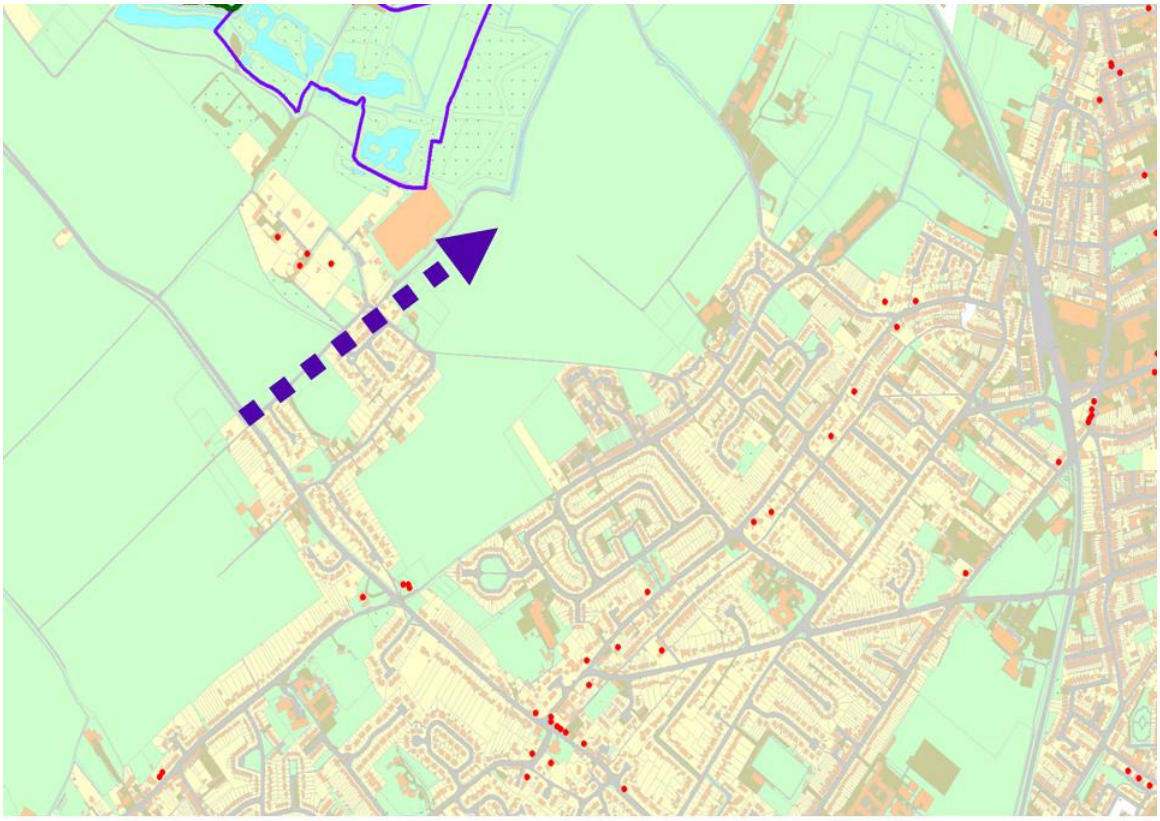


Figure 10.1. Option C Access Plan

Strengths

- A short, direct route into the development area;
- Could provide a new public transport connection;
- Could potentially reduce the wider impact of development traffic with drivers travelling from the North avoiding the A258 Manor Road junction and other local roads within middle/north Deal.

Weaknesses

- The extended link would potentially run within 200m of a RAMSAR wetland site of international importance at Cottington Lakes and would lead to adverse impacts associated with traffic noise, atmospheric pollution and lighting that would be very difficult to justify and mitigate.
- With existing residential properties fronting one side of Sholden New Road and established trees with preservation orders fronting the other the capacity of such a route would be limited;
- Creation of a 'hard edge' to Sholden, and potential significant impact on residential amenity;
- Based on the application plans submitted by Ward Homes there would be no opportunity to connect the adjoining development sites together. This would lead to sub-optimal conditions for public transport, cyclists and pedestrians;

- Current local congestion on this stretch of the A258 may be worsened by increased use of it's junction with The Street.

Traffic Capacity

- Low

Indicative Cost Range

- Upgraded priority junction cost - £50,000 to £75,000
- Cost of 0.5km extended access road £0.75m to £1.1m
- Total = £0.8m to £1.2m

Conclusion

10.2 Option C would improve accessibility to development but would not provide a new strategic connection in its own right. Furthermore, the route's alignment along Sholden New Road would result in an unacceptable impact on the local community and character of Sholden Village.

Access Option C - very limited potential, any movement would need to be regulated.

11 Access Option D – The Street (Sholden)

11.1 Option D provides access via The Street in Sholden as shown in Figure 11.1.

11.2 Similar to Option A, if implemented in isolation this access option would effectively create a cul-de-sac simply serving the development area without creating any wider access improvements. In order to capture any wider transport benefits this route would need to be implemented in conjunction with other new highway connections for example, a new link over the railway line to link into North Deal (Option F below).

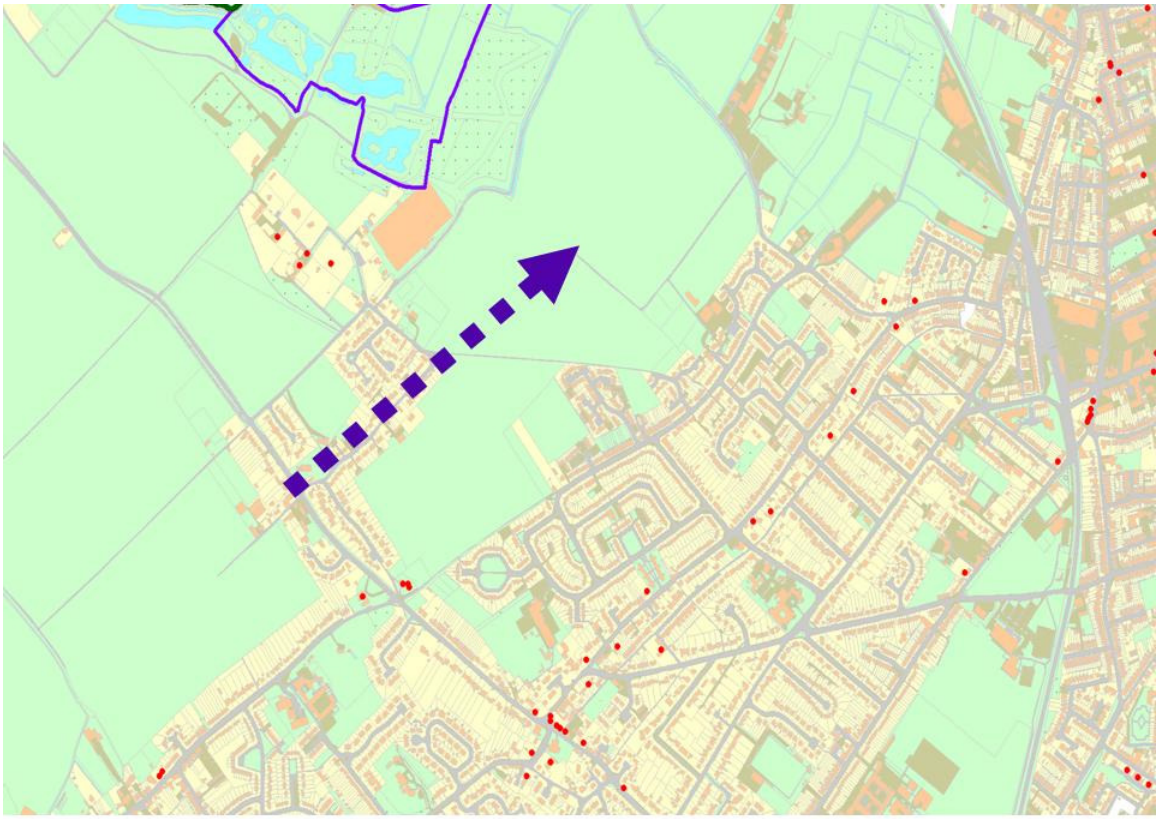


Figure 11.1. Option D Access plan

Strengths

- A short, direct route into the development area;
- Could potentially reduce the wider impact of development traffic with drivers travelling from the North avoiding the A258 Manor Road junction and other local roads within middle/north Deal.

Weaknesses

- The Street is a narrow, poorly aligned village street that is tightly lined with properties, and of insufficient standard to carry any significant volumes of traffic;
- Improvements to The Street would be restricted by a number of listed buildings. Increased traffic flows would significantly impact on the character of the road and reduce residential amenity;
- Potential significant impact on residential amenity;
- The capacity of the existing A258 / The Street junction would be insufficient to accommodate any significant additional traffic from the development. Sub-standard visibility is also an issue. An upgrade to the existing junction would therefore be required;
- Junction upgrades would require the acquisition of third party land;
- Current local congestion on this stretch of the A258 may be worsened by increased use of it's junction with The Street;

- The new junction access on to the A258 would be located close to Sholden primary school, increasing congestion and potential safety concerns.

Traffic Capacity

- Low

Indicative Cost Range

- Upgraded priority junction cost - £50,000 to £75,000
- Cost of 0.5km extended access road - £0.75m to £1.1m
- Cost for local traffic management measures £75,000 - £125,000
- Total = £0.9m to £1.3m

Conclusion

11.3 Option D would improve accessibility to the development area but would not provide a new strategic connection in its own right. Furthermore, the route's alignment along The Street would result in an unacceptable impact on the local community and character of Sholden Village.

Access Option D - do not pursue

12 Access Option E – A258 between Mongeham Road and The Street (Sholden)

12.1 Option E would provide a new access alongside the church on London Road (A258) near Sholden. The required scale of access requires a 50m stagger between the new and existing junctions; as such the new junction would need to be located north of St Nicholas' Church.

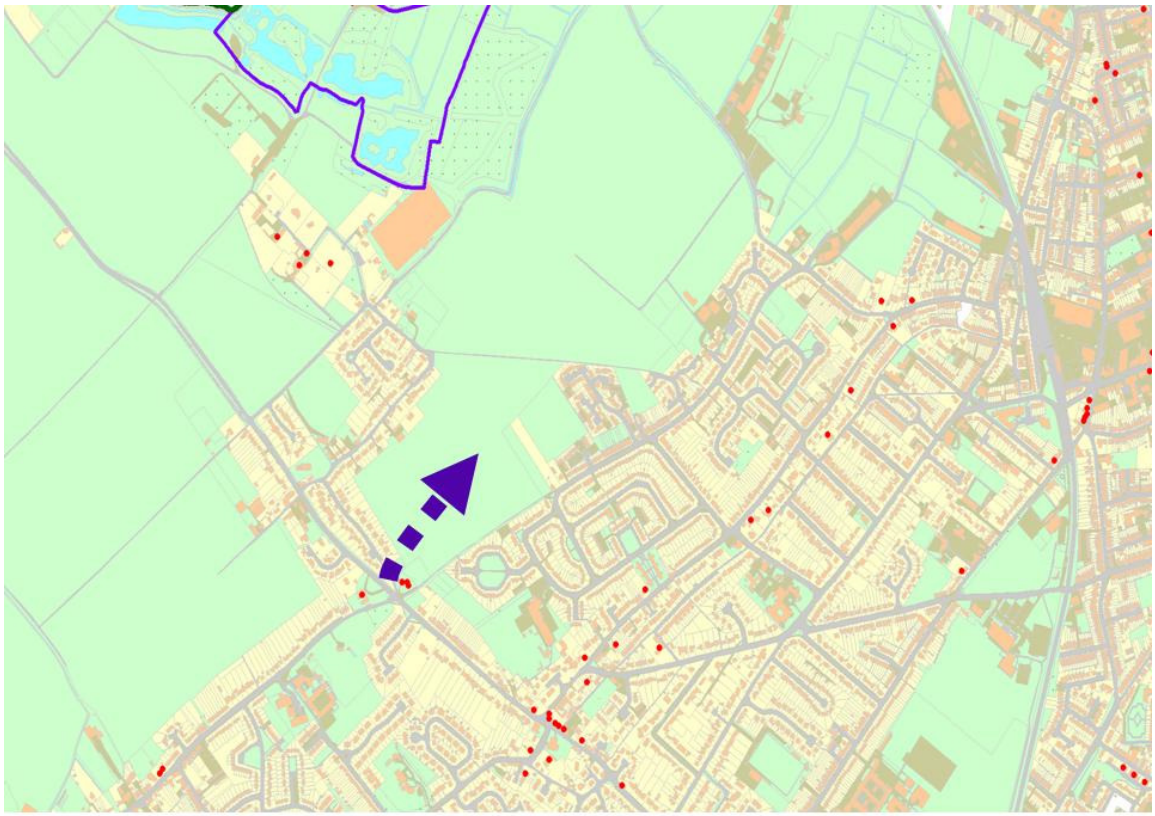


Figure 12.1. Option E Access Plan

Strengths

- A new link that provides additional network permeability;
- A short, direct route into the development area;
- Provides a new public transport corridor.

Weaknesses

- A new junction will lie close to the Grade II* listed St Nicholas Church and Graveyard and Sholden Hall (as shown in Figure 12.2 below). Whilst the buildings are unlikely to be directly affected the impact on their setting (a key test under PPS5) will be affected. Given land availability in the area of the proposed junction it is likely that the junction will need to lie close to the Church. This will require a suitable 'buffer' between the road and Church, limiting the scale of the junction and hence its capacity.

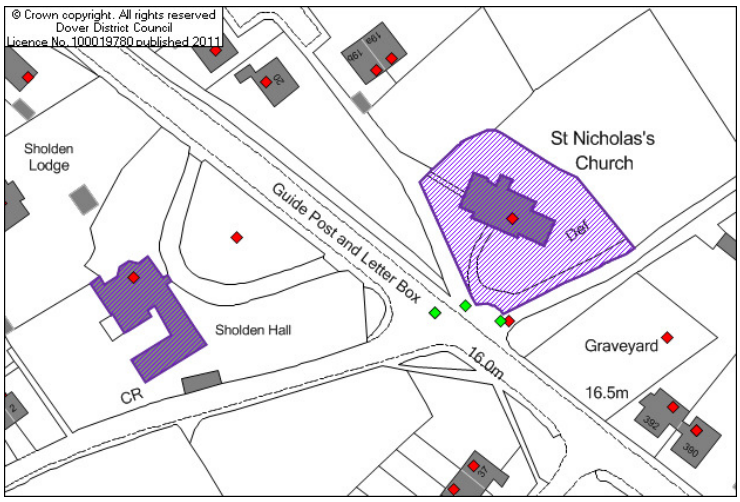


Figure 12.2. Heritage Assets

- Locating a junction to the north of the Church will require the assembly of a number of land parcels, including existing residential property at the southern end of Vicarage Lane. This is most likely to require the successful pursuit of a Compulsory Purchase Order;
- The presence of St Nicholas' Church and Graveyard (which are both Grade II* listed) and the need to provide an appropriate 'stagger' between new and existing junctions (principally Mongeham Road) of 50 metres limits the ability to accommodate a junction of significant capacity which still meets the required design and safety standards.

Traffic Capacity

- Medium

Indicative Cost

- New priority junction cost - £75,000 -£125,000
- Cost of 0.5km access road £0.75m to £1.1m
- Total - £0.8m to £1.2m

Conclusion

12.2 Major impact on heritage assets, coupled with possible requirement for compulsory land purchase and sub-optimal junction arrangements indicate that this option would not be deliverable.

Access Option E - do not pursue

13 Access Option F – Bridge over railway north of Northwall Road

13.1 Option F provides a new connection to North Deal via a new bridge over the railway line that links into Golf Road at a new junction north of Ethelbert Road as shown in Figure 13.1. Whilst potentially deliverable as a new stand alone connection linking into the existing road network at its eastern end (perhaps through the Hillreed development area) the wider accessibility benefits would only be realised by bringing forward this option in conjunction with other access options such as Option I.

13.2 Initial consultation with Network Rail indicates that in principle a bridge would be acceptable subject to consultation on a detailed scheme particularly where it would result in the removal of the existing level crossing at Northwall Road.

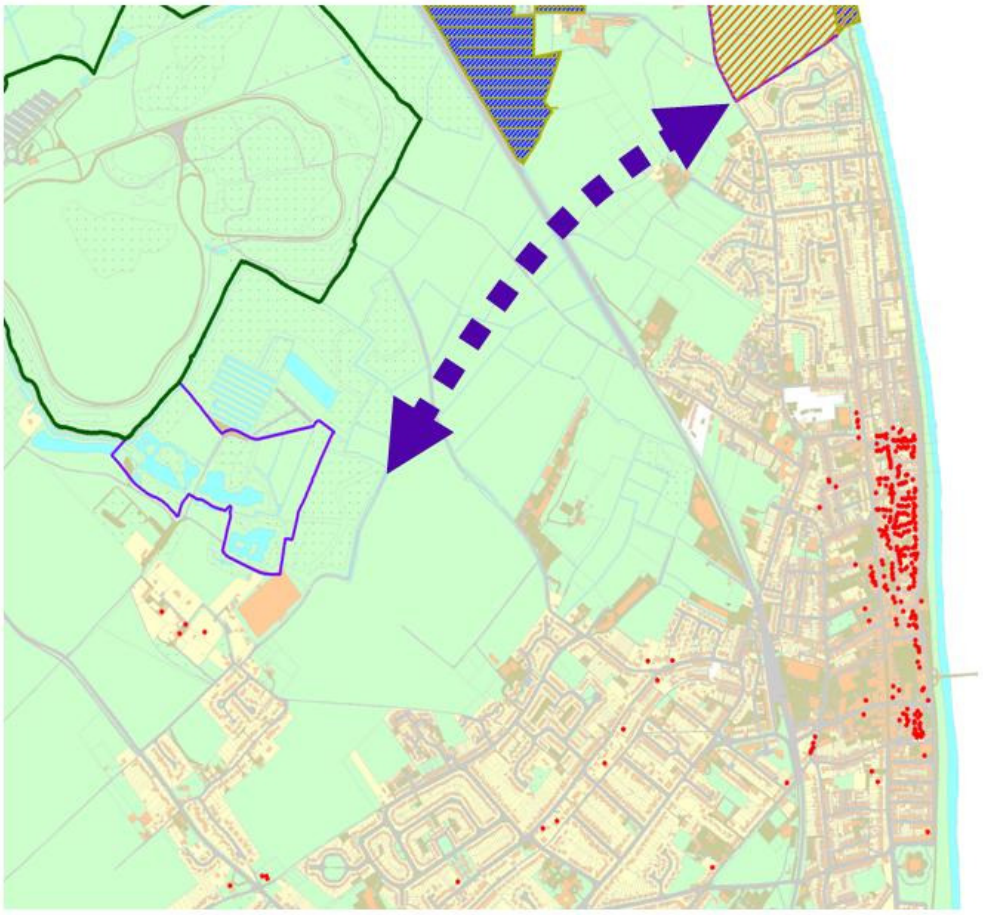


Figure 13.1. Option F Access Plan

Strengths

- Would improve access to and from North Deal;
- Provides a new link across the railway that would also be available for public transport, pedestrians and cyclists;
- Improves connections to the Golf Course
- If coupled with other access points (particularly Option H) could relieve pressure of development traffic and help redistribute traffic in the Middle/North Deal area;
- Opportunity to replace the existing level crossing.

Weaknesses

- Would require a long 'lead in' time and significant consultation with Network Rail to identify a satisfactory alignment and specification which is compatible with potential HS1 services;

- Limited ability of local network in North Deal to accommodate additional traffic;
- Proximity of scheme to RAMSAR site could be an issue (depending on route alignment);
- Potential impact on Special Area of Conservation to east of railway line where the new connection would link to Golf Road;
- Potential land take to 'land' bridge crossing, impact on SAC, SPA and grazing marsh re-establishment area.

Traffic Capacity

- Medium

Indicative Cost Range

- New junction costs (connecting access route to Golf Road) - £100,000 to £145,000
- Bridge costs - £4m to £6.6m
- Cost of 1.3km of link road - £1.95m to £3.24m
- Total £6.1m to £10m

Conclusion

13.3 Option F would improve local accessibility but would not provide a new access option in its own right. It is a relatively high cost option for the envisaged level of benefit and the proximity to a number of designated sites.

Access Option F – potentially deliverable

14 Access Option G – Northwall Road

14.1 Option G provides a new access from Northwall Road in North Deal as shown in Figure 14.1.

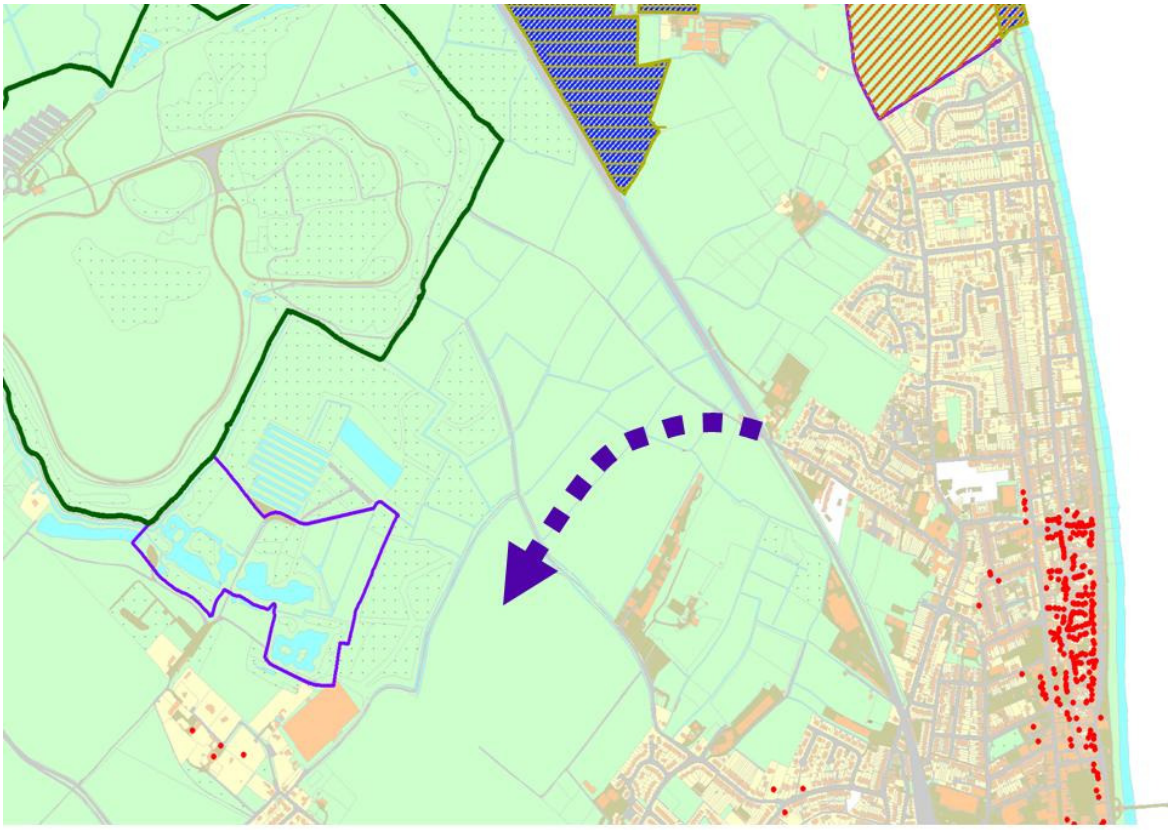


Figure 14.1. Option G Access Plan

Strengths

- Would improve accessibility to and from North Deal for development traffic;
- Provides a new public transport link;
- Potential new connection to existing employment areas.

Weaknesses

- The existing rail crossing would need to be upgraded to cope with additional traffic from development. The scope for improvement is currently uncertain and will potentially be resisted by Network Rail who's overall aim is to reduce the degree of conflict between trains and cars at level crossings (by removing crossings wherever possible and in particular on lines which may accommodate high speed services in the future). This is a key consideration for Deal where HS1 is currently running a pilot schedule. Future development should not jeopardise the opportunity to secure the service permanently and potentially increase services;
- Potential impacts on RAMSAR site to west of railway line (depending on route alignment);
- Northwall Road's junction with Western Road has limited capacity, poor visibility and is adjacent to a school. Increasing traffic from development at this junction is likely to result in congestion and safety concerns.

Traffic Capacity

- Low to Medium

Indicative Cost Range

- Cost of 600 metre access road - £900,000 to £1.3m
- Cost level crossing upgrade - £500,000 to £850,000
- Cost for upgrading Northwall Road - £75,000 to £125,000
- Total - £1.5m to £2.3m

Conclusion

14.2 Traffic concerns along Northwall Road particularly at it's junction with Western Road.

14.3 Inability to improve the quality of the existing crossing or increase usage, particularly if HS1 services are retained and increased.

14.4 Potential impacts at RAMSAR site depending on alignment.

14.5 Access Option G – very limited potential - not suitable as a major access route.

15 Access Option H – Link between Western Road and Minters Yard

15.1 Option H provides a new link between Western Road (north of Bridgeside junction) and Minters Yard, as shown in Figure 15.1.

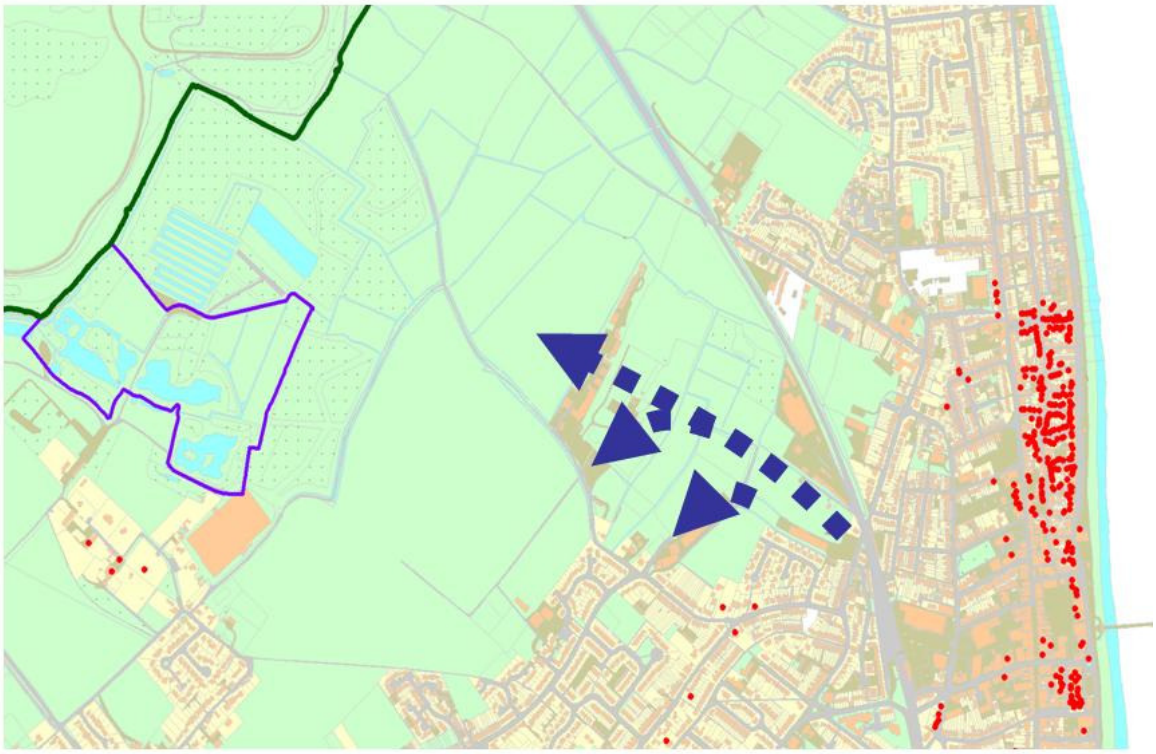


Figure 15.1. Option H Access Plan

Strengths

- Would improve access to and from North and Middle Deal;
- Creates new access option for existing employment sites (Minter's Yard, Southwall Industrial Estate), alleviating pressure on Southwall Road.
- Works well with option F (new bridge over the railway)

Weaknesses

- There is a planned improvement to the current access junction at Albert Road based on the introduction of a priority layout with a right turn pocket (as shown in the diagram below). This layout is unlikely to have sufficient capacity to deal with significant volumes of development traffic. An alternative roundabout or signal controlled junction may be feasible but requires a detailed investigation to address the complexities associated with proximity to the level crossing;

- Limited improvement to transport network;
- Need to relocate some existing employment activities.

Traffic Capacity

- Medium

Indicative Cost Range

- Upgrade junction to roundabout or signals - £150,000- £250,000
- Cost of 0.5km extended access road - £0.75m to £1.1m
- Total - £0.9m - £1.4m

Conclusion

15.2 Due to limited visibility the permitted priority junction can only accommodate relatively low traffic levels. However, subject to further investigations the junction has the potential to be upgraded to either a roundabout or traffic signals to provide additional capacity.

15.3 Access Option H – potentially deliverable

16 Access Option I – Southwall Road

16.1 Option I provides access to the opportunity area east of Sholden via Southwall Road as shown in Figure 16.1.

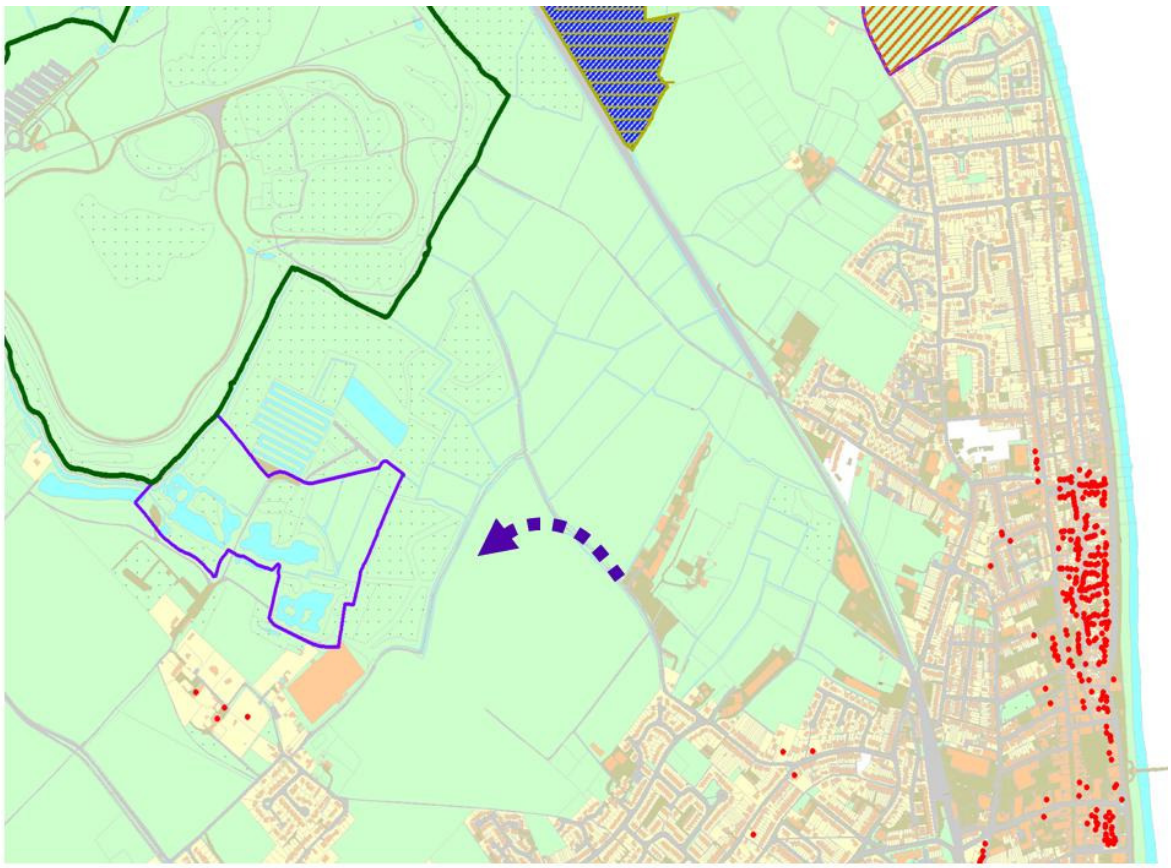


Figure 16.1. Option I Access Plan

Strengths

- Relatively straight forward connection on to existing local network;
- Could provide an alternative route out of the built up area of Middle Deal;

Weaknesses

- Due to tight highway environment with narrow carriageway and on street car parking, traffic capacity for this access is likely to be low;
- Increases traffic in a residential area to an acceptable level.

Traffic Capacity

- Low

Indicative Cost Range

- Cost of 300m access road - £450,000 to £650,000
- Improvements to Southwall Road = £75,000 to £125,000
- Total - £525,000 to £775,000

Conclusion

16.2 Access option I is a potential low capacity point of access that could work in conjunction with a series of similar access points to redistribute the 'opportunity area' traffic across a number of localised access points and create a more permeable environment. Not suitable for large volumes of traffic and likely to receive considerable resistance from local residents.

17 Access Option J – Roman Close

17.1 Option J provides access to the opportunity area via Roman Close as shown in Figure 17.1.

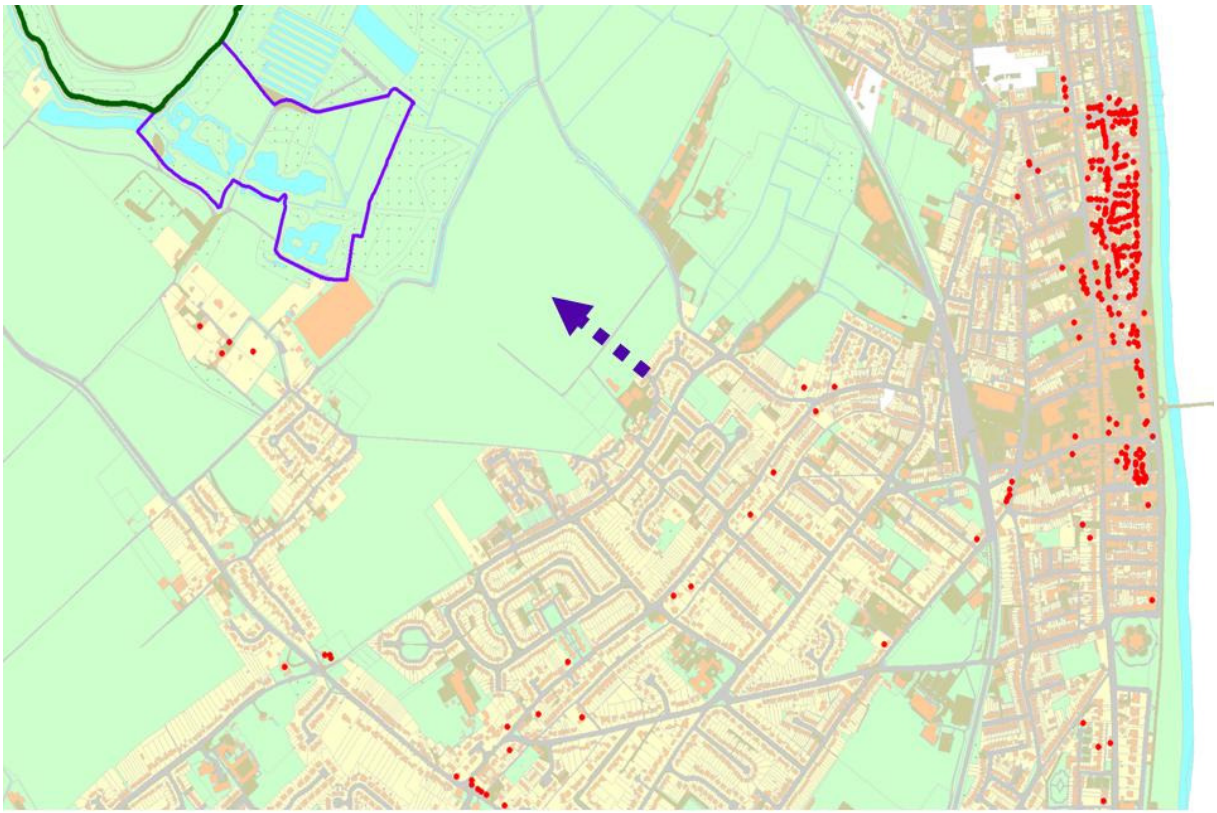


Figure 17.1. Option J Access Plan

Strengths

- Simple connection onto an existing residential street
- Could provide an alternative route out of the built up area of Middle Deal

Weaknesses

- Low capacity access route through an existing residential area
- Would feed some development traffic onto the constrained Middle Deal Road corridor

Traffic Capacity

- Low

Indicative Cost Range

- Cost of 100 metre access road - £150,000 to £250,000
- Improvements to Southwall Road - £75,000 to £125,000
- Total - £225,000 to £375,000

Conclusion

17.2 A potential low capacity point of access that could work in conjunction with a series of similar access points to redistribute the 'opportunity area' traffic across a number of localised access points and create a more permeable environment. Not suitable for large volumes of traffic and likely to meet resistance from local residents.

18 Access Option K – Court Lodge Farm

18.1 Option K provides access to the opportunity area via the existing access to Court Lodge Farm as shown in Figure 18.1.

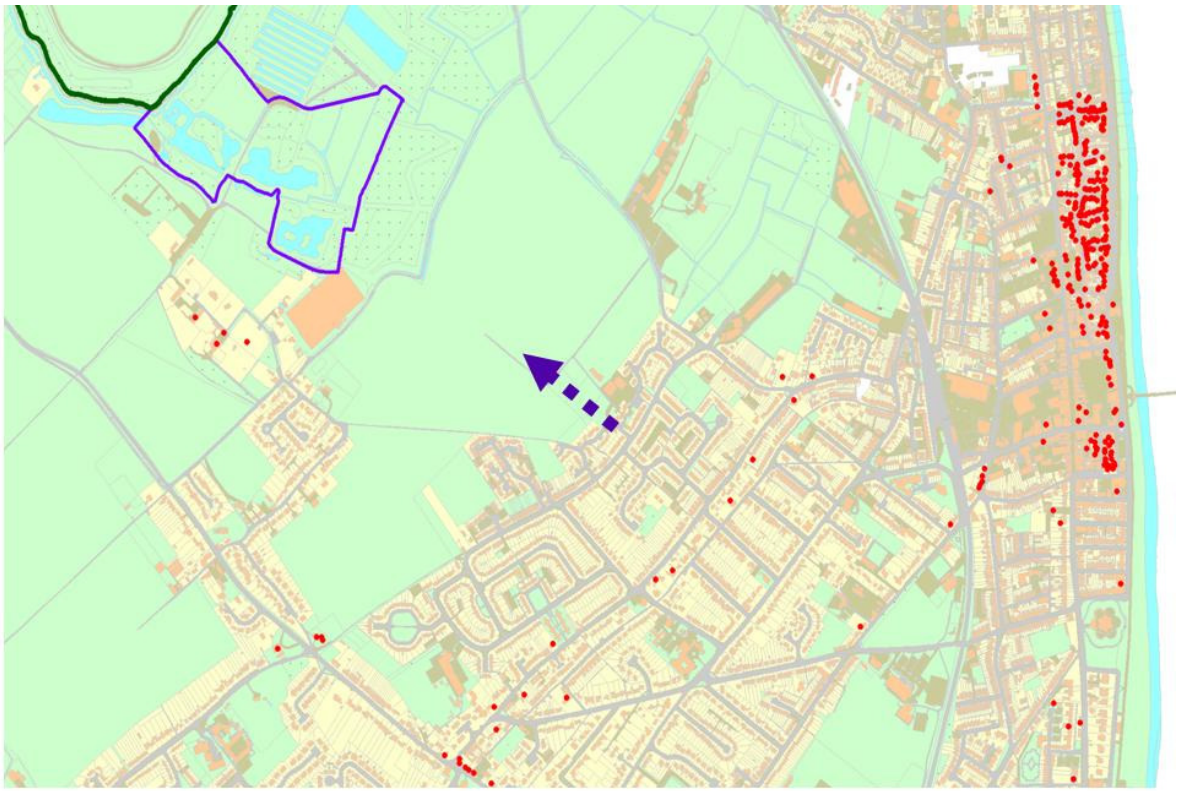


Figure 18.1. Option K Access Plan

Strengths

- Simple connection onto an existing access
- Could provide an alternative route out of the built up area of Middle Deal

Weaknesses

- Depending on the limit of adopted road agreement may be required with the landowner
- Low – medium capacity access route through an existing residential area;
- Would feed some development traffic onto the constrained Middle Deal Road corridor

Traffic Capacity

- Low - medium

Indicative Cost Range

- Cost of 100 metre access road - £150,000 to £250,000
- Improvements to Southwall Road - £75,000 to £125,000
- Total - £225,000 to £375,000

Conclusion

18.2 A potential point of access with limited capacity that could work in conjunction with a series of similar access points to redistribute the 'opportunity area' traffic across a number of localised access points and create a more permeable environment. Not suitable for large volumes of traffic and likely to meet resistance from local residents and the farm owner.

19 Access Option L – Hunters Walk

19.1 Option L provides access to the opportunity area via Hunters Walk as shown in Figure 19.1.

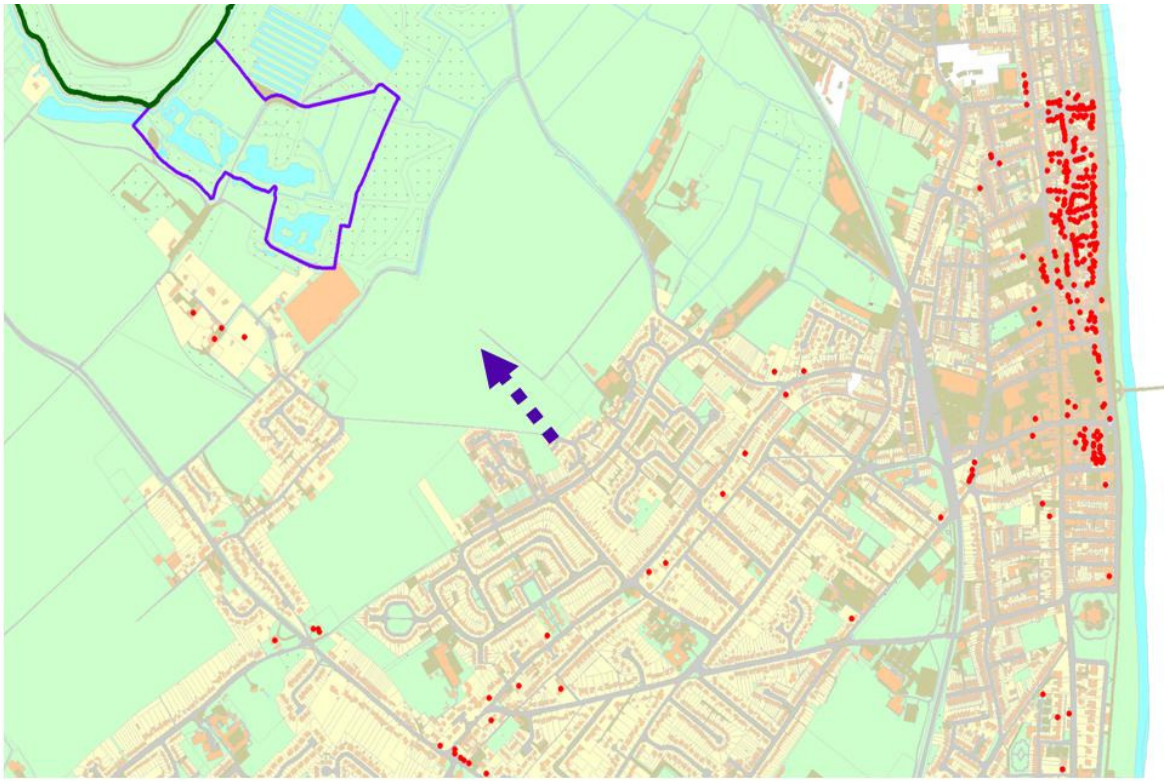


Figure 19.1. Option L Access Plan

Strengths

- Simple connection onto an existing residential street

- Could provide an alternative route out of the built up area of Middle Deal

Weaknesses

- Low –medium capacity access route through an existing residential area
- Would feed some development traffic onto the constrained Middle Deal Road corridor

Traffic Capacity

- Low - Medium

Indicative Cost Range

- Cost of 100 metre access road - £150,000 to £250,000
- Improvements to Southwall Road - £75,000 to £125,000
- Total - £225,000 to £375,000

Conclusion

19.2 A potential point of access with limited capacity that could work in conjunction with a series of similar access points to redistribute the 'opportunity area' traffic across a number of localised access points and create a more permeable environment. Not suitable for large volumes of traffic and likely to meet resistance from local residents and the farm owner.

20 Access Option M North of Church Lane

20.1 Option M provides access to the opportunity area at the location shown in Figure 20.1.

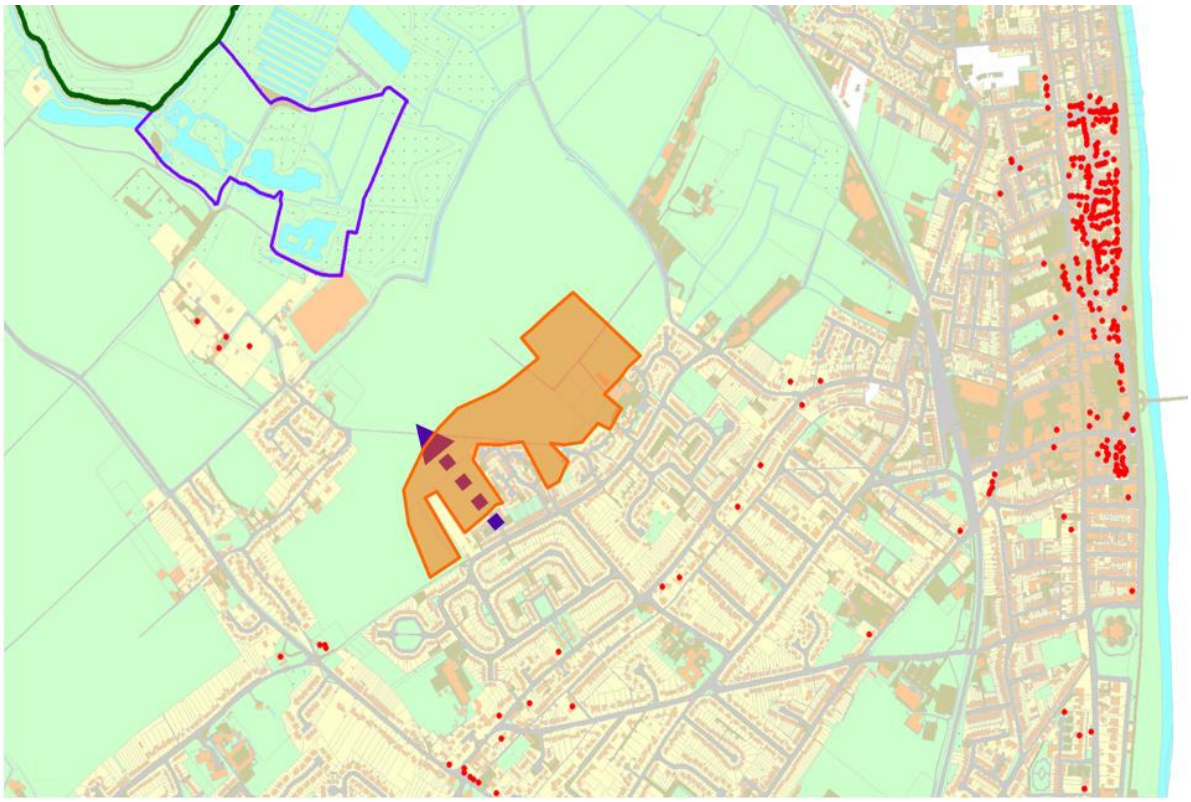


Figure 20.1. Option M Access Plan

Strengths

- Simple connection;
- Opportunity to connect create connection with Hillreed development;
- Could provide an alternative route out of the built up area of Middle Deal if connected to other options.

Weaknesses

- Low capacity access route through an existing residential area;
- Would require the relocation of existing delivery parking at end of Hancocks Close;
- Access route would be constructed through open space within the current proposed layout arrangements for the Hillreed Site;
- Would feed some development traffic onto the constrained Middle Deal Road corridor;
- Land ownership issues.

Traffic Capacity

- Low

Indicative Cost Range

- Cost of 100 metre access road - £150,000 to £250,000
- Improvements to Southwall Road - £75,000 to £125,000
- Total - £225,000 to £375,000

Conclusion

20.2 A potential low capacity point of access that could work in conjunction with a series of similar access points to redistribute local traffic and create a more permeable environment. Not suitable for large volumes of traffic and likely to meet some resistance from local residents.

21 Access Option N –Grantham Avenue

21.1 Option N provides access to the opportunity area via Grantham Avenue as shown in Figure 21.1.

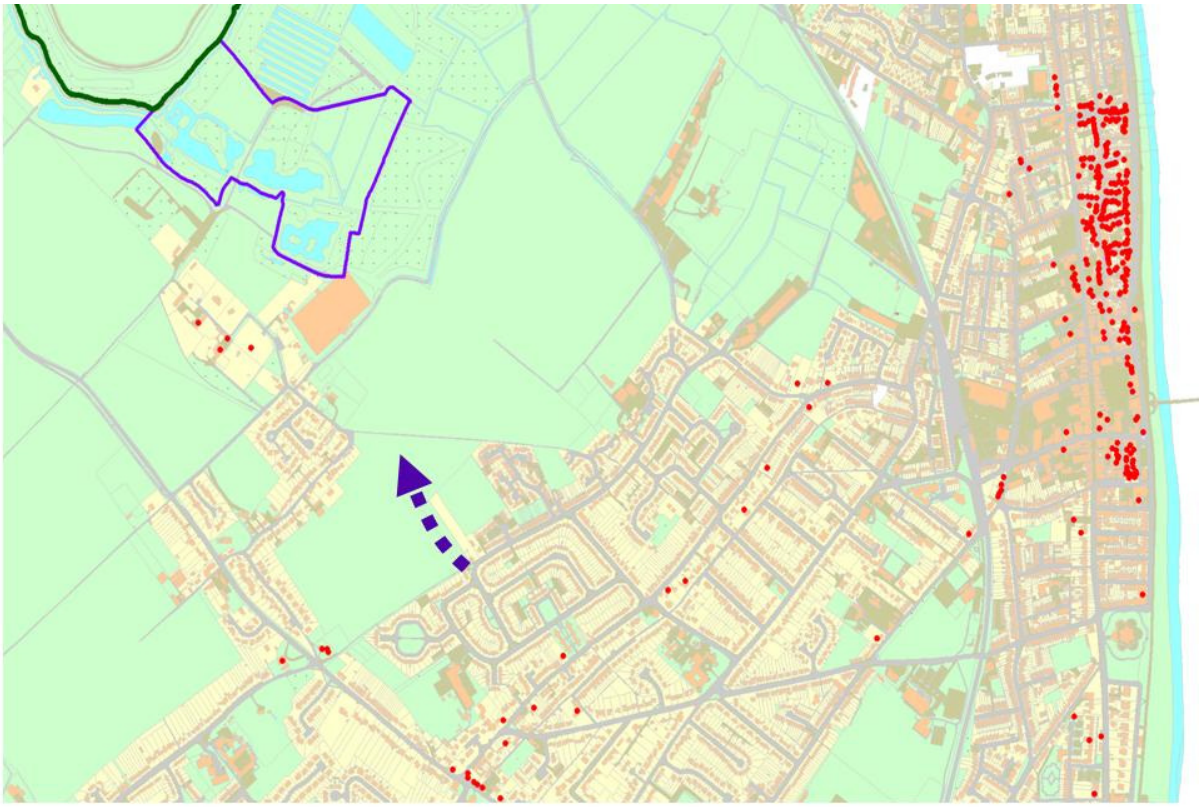


Figure 21.1. Option O Access Plan

Strengths

- Simple connection onto an existing residential street
- Could provide an alternative route out of the built up area of Middle Deal

Weaknesses

- Requires third party land

- Low capacity access route through an existing residential area
- Would feed some development traffic onto the constrained Middle Deal Road corridor

Traffic Capacity

- Low - medium

Indicative Cost Range

- Cost of 100 metre access road - £150,000 to £250,000
- Improvements to Southwall Road - £75,000 to £125,000
- Total - £225,000 to £375,000

Conclusion

21.2 A potential low capacity point of access that could work in conjunction with a series of similar access points to redistribute local traffic and create a more permeable environment. Not suitable for large volumes of traffic and likely to meet some resistance from local residents. Likely to be difficult to deliver.

22 Findings and Recommendations

1. A northern route from the A258 around Fowlmead Country Park and south to North Deal

- Does not meet transportation requirements, excessive distance between North Deal origin and destinations;
- Significantly constrained by environmental designations;
- Impacts on Fowlmead Country Park;
- Cost is out of proportion with traffic served;
- Not a feasible solution; and
- This option is not recommended for further investigation.

2A, B, C: An east west route(s) connecting North Deal to the A258 via various routes around Sholden

- Significantly constrained by environmental designations north of Sholden;
- Constrained by, and would dramatically alter, the existing village fabric of Sholden ;
- Constrained by St Nicholas' Church and Graveyard (Grade II*) and Sholden Hall (Grade II);
- New junction location south of Sholden constrained by proximity to existing junctions;
- Not a feasible solution without significant impact, compensation and mitigation in the Sholden Area; and
- This option is not recommended for further investigation.

3. A series of new connections into the existing street framework of North Deal

- More rational transport solution;
- Provides multiple routes and alternatives for traffic;
- Requires upgrade to new access points in North Deal;
- Requires upgrade to existing highways in North and Middle Deal;
- Requires upgrade to existing junctions in North and Middle Deal; and
- These options are recommended for further definition, investigation and transport modelling.

Technical Note

Project Title:	Deal Flood and Transport Alleviation Model Study
MVA Project Number:	C3A34002
Subject:	Stage 2 Traffic Assessment
Note Number:	1 Version: 1.4
Author(s):	Keith Melville
Reviewer(s):	Tim Cuthbert
Date:	02 April 2012

1 Introduction

1.1 This Technical Note concerns the potential traffic impact of varying levels of future development in the North/Middle Deal area. Its aim is identify the quantity of development that could be supported within the capacity of the highway network as it stands or with selective local highway improvement measures. The timeframe for the assessment is the period up to 2031 ie five years beyond the adopted LDF Core Strategy period; as such it allows for the effects of traffic associated with consented development in Deal together with general traffic growth between now and 2031.

1.2 The analysis is based on the Extended Framework Strategy (EFS) identified during Stage 2 of the Deal Flood and Transport Alleviation Model Study. This strategy seeks to link the development area into the existing road network via a number of connection points thereby creating multiple routeing options for traffic that spread the load and reduce impacts at individual junctions. It also recognises the need for co-ordinated upgrades to the local highway network to mitigate both the impacts of development traffic and general traffic growth between the present day and 2031, the envisaged year of completion.

1.3 The EFS includes a new connection to the development area via Albert Road and a new link across the railway (bridge or level crossing) to the north of the existing crossing at Northwall Road. It is acknowledged that implementing a new link across the railway will face a number of constraints that would need to be addressed, in particular health & safety issues that Network Rail may have in relation to a level crossing or alternatively the cost and environmental impact associated with providing a new bridge. However, for the purpose of this assessment it has been assumed that both the link across the railway and the development link via Albert Road are in place in the future.

1.4 The assessment has been undertaken using a bespoke Transport Assessment Model developed by MVA Consultancy and tailor-made for the Deal network. It builds on the comprehensive baseline traffic data collected in February 2011 across the town and is consistent with analysis recently submitted in connection with the Ward and Hillread consented developments. The methodology including assumptions about background traffic growth has been discussed and agreed with the Kent County Council as the Highways Authority.

1.5 In order to ensure a robust assessment, the future mode share for trips to/from and within Deal has been assumed to be the same as it is today. However, going forwards a key part of the transport strategy for the town should be the promotion of more sustainable modes of transport particularly walking, cycling and travel by public transport. The means of achieving more sustainable travel are discussed further in Section 6 of this Note.

2 Summary of Traffic Impact Assessment

2.1 **Table 1.1** below provides a junction by junction summary of the traffic assessment based around the known hotspots in the network. It indicates the potential of each junction to accommodate development traffic either with the existing configuration of with improvements. Further details are provided later in the note.

Table 1.1: Summary of Deal Traffic Assessment

Junction	Junction Layout Arrangement	Max level of dev (housing units above those identified in Core Strategy	Other Comments
A258 London Road / Manor Road	Existing Roundabout Junction	0	
	Upgrade Option (1) – Signal controlled junction	0	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land
	Upgrade Option (2) – Signal controlled junction (with right turn ban from Manor Road)	300 to 400	Same as option (1), plus: - right turn ban is likely to result in vehicles re-routing, increasing traffic on some local roads.
	Upgrade Option (3) – Larger Signal Controlled junction	>1,000	- Potential to implement pedestrian and cycling crossing facilities - Significant third party land required.
	Upgrade Option (4) – Larger scale Roundabout	>1,000	- Poor option for Pedestrians and Cyclists. - Significant third party land

			required.
A258 London Road / Mongeham Road	Existing Priority Junction	400 to 500	- Difficult for vehicles to turn right out of Mongeham Road
	Upgrade Option – All movement signal controlled junction	TBC	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land - Better control of traffic southbound along A258, thus assisting Manor Road junction operation.
A258 London Road / Albert Road	Existing Priority Junction	400 to 500	
	Upgrade Option – All movement signal controlled junction	TBC	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land
A258 London Road / Queen Street / West Street	Existing signal controlled junction	>1,000	
A258 Dover Road / Cornwall Road	Existing Priority Junction	0 to 100	- Difficult for traffic to turn right out of Cornwall Road.
	Upgrade Option – Signal Controlled Junction	>1,000	- Potential to implement pedestrian and cycling crossing facilities. - Junction within existing highway land
Albert Road / New Development Access road	New Signal Controlled Junction	>1,000	- Proposed design minimises internal queuing within junction, reducing safety risks with railway level crossing

3 Detailed Methodology

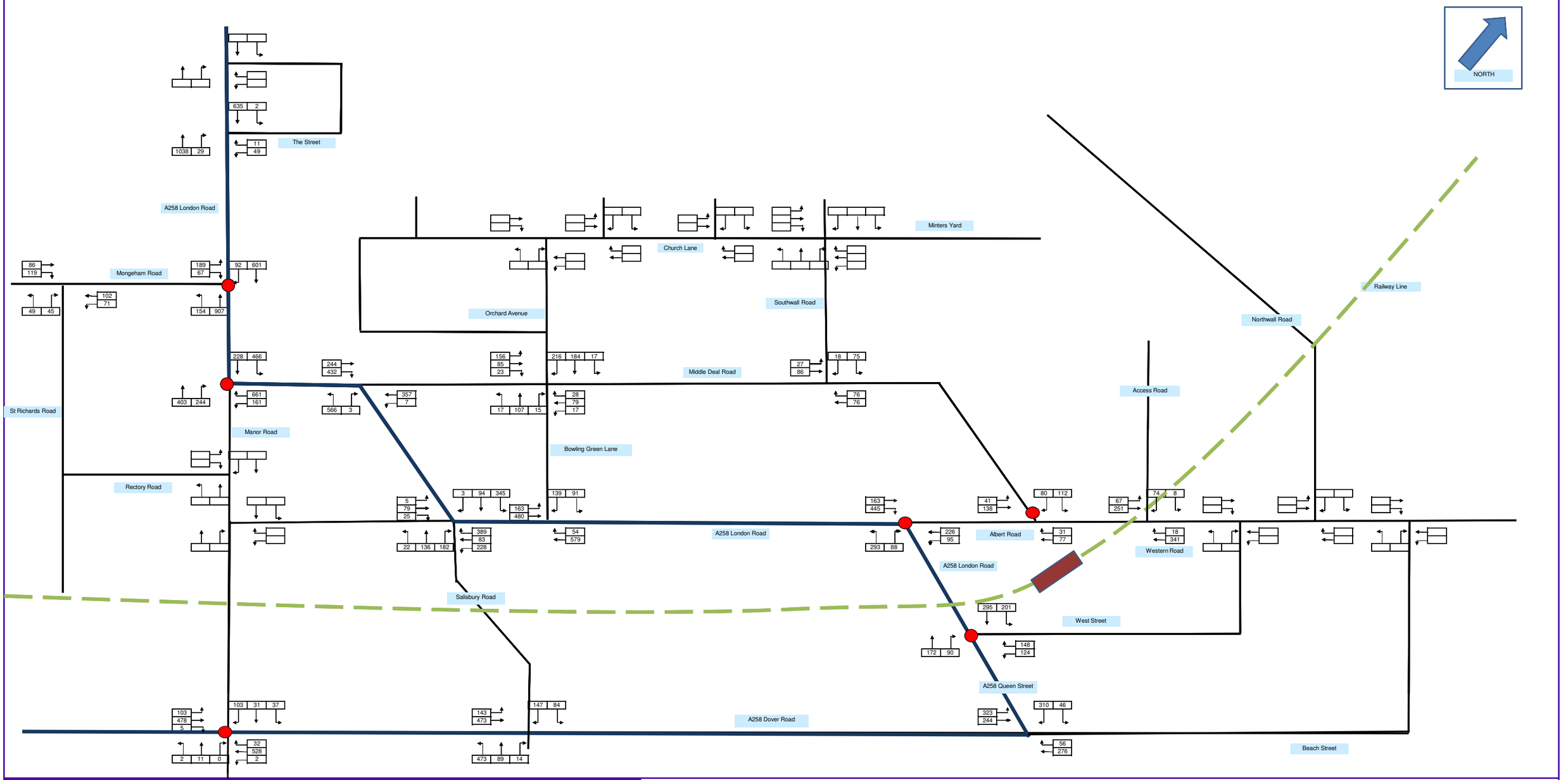
Future Baseline Traffic Flows

3.1 The following methodology was used to derive the future 2031 future baseline for both the AM and PM peak weekday periods.

1) Existing traffic flows were based on traffic surveys carried out within Deal for the Study in February 2011.
2) Background traffic growth from 2011 to 2031 was forecasted by applying local data from the standard Trip End Model 'TEMPRO'. This data indicated that growth between 2011 and 2031 is forecast to be 14.6% over this 20 year period, representing just over 0.6% per annum.
3) Allowance has been made for increases in traffic due to consented developments: Hillread Homes, Ward Homes, Minters Yard and Bettshanger. This was carried out by using the traffic generation and distribution forecast assumptions highlighted within the 'Proposed Residential Development, Land at Sholden and Land at Court Lodge Farm – Supplementary Transport Report' dated January 2011, prepared jointly by the transport consultants working on behalf of Ward Homes and Hillreed Homes.

3.2 It should be noted that TEMPRO includes an allowance for traffic growth that would arise as a result of delivering the core strategy. This means that there is potentially an element of 'double counting' as the Hillread, Ward and Bettshanger developments are included within the core strategy. Whilst this effect does not have a material influence on the general conclusions of the assessment it should be recognised that the inclusion of these committed developments provides a robust (or worst case) future baseline situation.

3.3 **Figures 3.1 and 3.2** show a summary of the 2031 future baseline traffic flows across the highway network during the AM and PM peak periods respectively.



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Deal - AM Peak Baseline Traffic Flows

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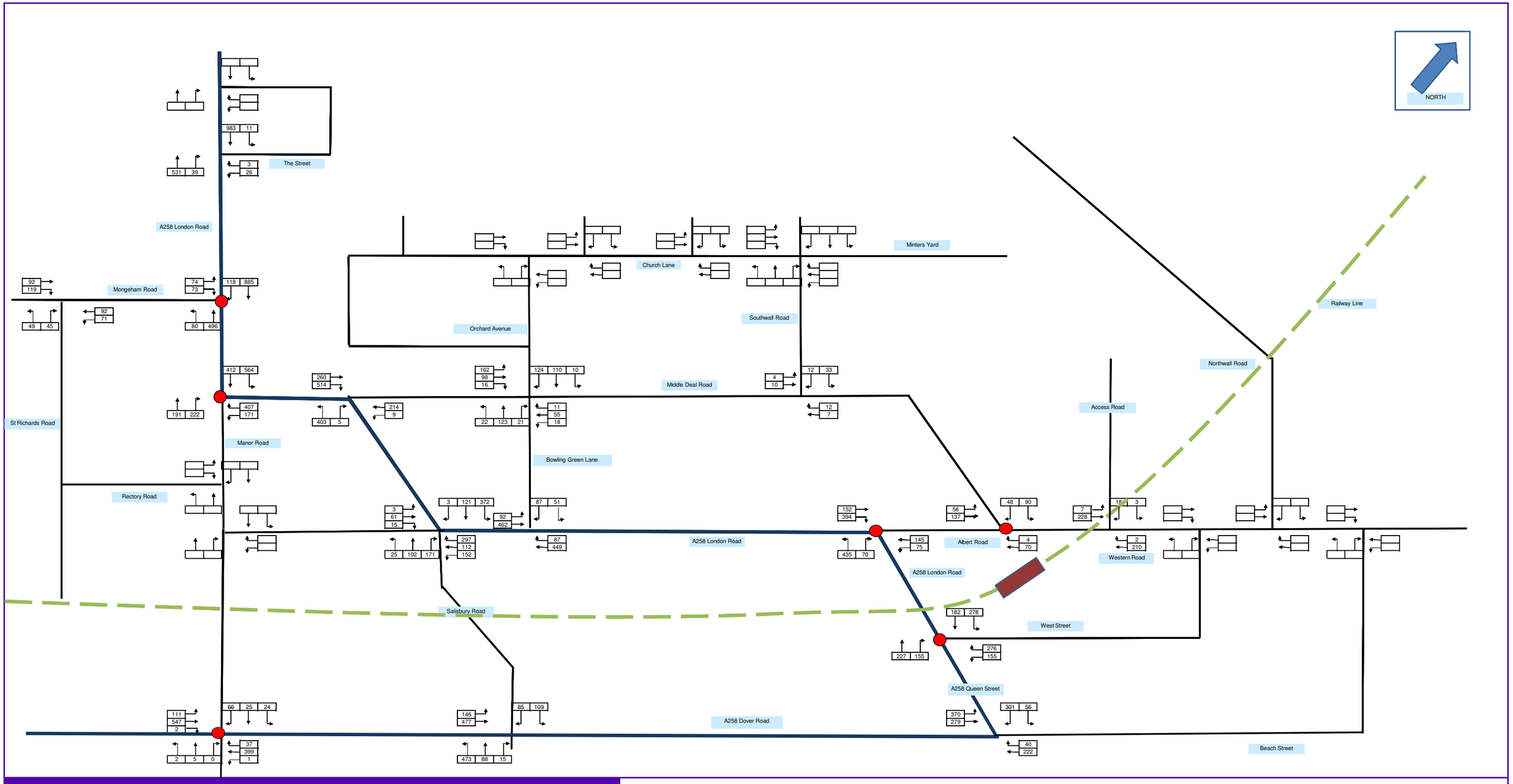

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Deal - PM Peak Baseline Traffic Flows

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Development Traffic Flows

3.4 The 2031 Future Do-Something scenario is based on a situation where housing within North and Middle Deal is developed over and above the allocation agreed within the core strategy. For this Do-Something scenario, our assessment utilises information derived from analysis carried out for the first stage of MVA's Transport Assessment Model (TAM) development process; namely the forecasting of development trips. The TAM derives person trip rates for each proposed land use by utilising information from the 'National Traffic Survey' (NTS) and 'Focus on Personal Travel' (FPT). Such a methodology represents a detailed and sophisticated approach which ultimately produces representative trip rates applicable to the local area.

3.5 The trip rate derived from TAM has then been applied to the 2001 Journey to Work (JtW) Census Data for Middle Deal and Sholden Ward (the ward the proposed development will be located within) to predict the number of trips made by car, to and from the development. The census data produces a car mode share of 58%, as shown in the **Table 3.1** below.

Table 3.1: Summary of 2001 JtW Census Data (Mode Share)

JtW Mode	% share
Train	2%
Bus	3%
Taxi	2%
Car Driver	58%
Car Passenger	8%
Motorcycle	1%
Bicycle	4%
Foot	14%
Home Working	8%
Other	1%

3.6 **Table 3.2** shows the forecast vehicle trip rates per residential unit within Deal as derived from the TAM Model.

Table 3.2: Vehicle Trip Generation Rate (per residential unit)

Time Period	Arrivals	Departures	Total
AM Peak	0.109	0.346	0.455
PM Peak	0.163	0.100	0.263

3.7 These vehicle trips rates have then been applied to varying quanta of residential development. For the purpose of this assessment it has been assumed that development will range between 100 and 1,000 residential units with the actual quantum dependant on the ability of the highway network to accommodate additional traffic.

Development Traffic Distribution and Assignment

3.8 The 2001 JtW Census data was used as a basis for forecasting the distribution of vehicles travelling in and out of the development during the morning and evening peak periods. Analysis of the census data for the Middle Deal and Sholden Ward indicates that out of the householders commuting by car to locations either outside the local area or to within the town centre, 33% travelled north towards Sandwich and 50% south towards Dover and 12% to North Deal (including the town centre).

3.9 Based on this travel information the traffic distribution, shown below in **Table 3.3**, has been applied to this assessment. It should be noted that these vehicle distribution figures have good correlation to the figures agreed by the Kent Highway Authority for the recent Ward Homes and Hillread Homes development planning applications.

Table 3.3: Development Traffic Distribution

Direction	Vehicle proportions
North (to/from Sandwich)	33%
West (to/from Mongeham Road)	5%
North Deal (including Town Centre)	12%
South (to/from Walmer and Dover)	50%

3.10 Development traffic was then manually assigned on to the highway network based on likely trip patterns derived from an understanding of movements built up from our review of transport baseline conditions within Deal.

3.11 The new road connection to development via Albert Road and the new link across the railway have both been included within this manual assignment of development traffic. Given its location at the heart of the development area and its relatively direct route towards the A258, it has been assumed that a significant proportion (around 80%) of development traffic will use the Albert Road link.

3.12 Conversely, it is assumed that only a small proportion of traffic (around 5%) will use the link across the railway during the morning and evening peak periods as it is unlikely to be used by many commuters, although it does provide an alternative route south via the seafront. The benefits of such a new east-west link would be to facilitate improved highway access to North Deal, the seafront, the Golf Course and act as potential alternative route to the town centre and A258, thus displacing some traffic from other congestion hot-spot locations. Furthermore, the link would provide a good opportunity to improve public transport, cycling and pedestrian accessibility to and from development.

3.13 **Figures 3.3 to 3.12** show a summary of the development flows across the highway network during the AM and PM peak periods respectively for a range of development quanta from 200 to 1,000 residential units.

3.14 **Figures 3.13 to 3.22** combined the future baseline and development traffic to derive the future do something for the AM and PM peak periods respectively.

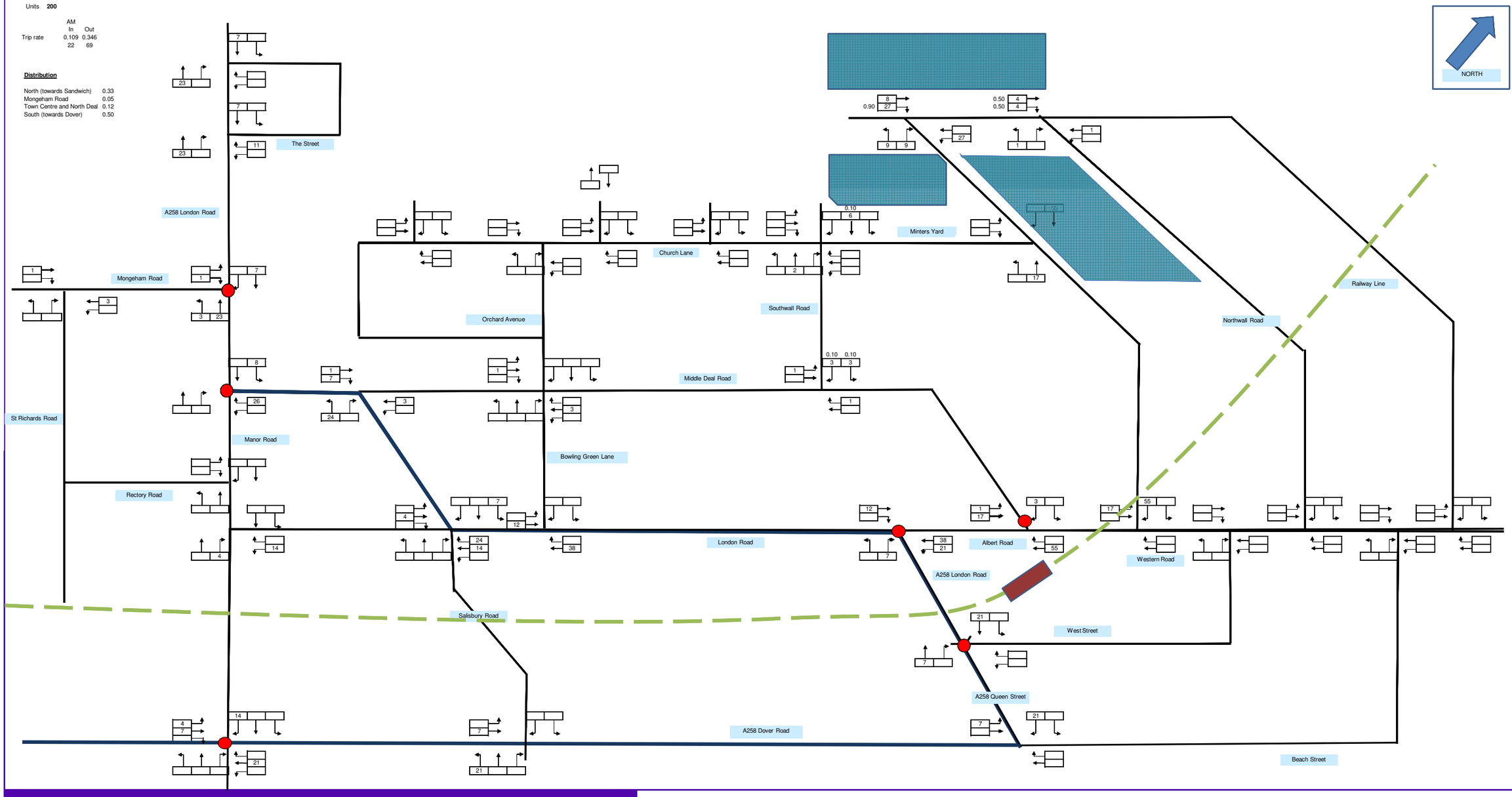
AM peak

Units **200**

	AM In	AM Out
Trip rate	0.109	0.346
	22	69

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - AM Peak Development Traffic Flows 200 units

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Figure 3.3

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AM peak

Units **400**

	AM In	AM Out
Trip rate	0.109	0.346
	44	138

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50

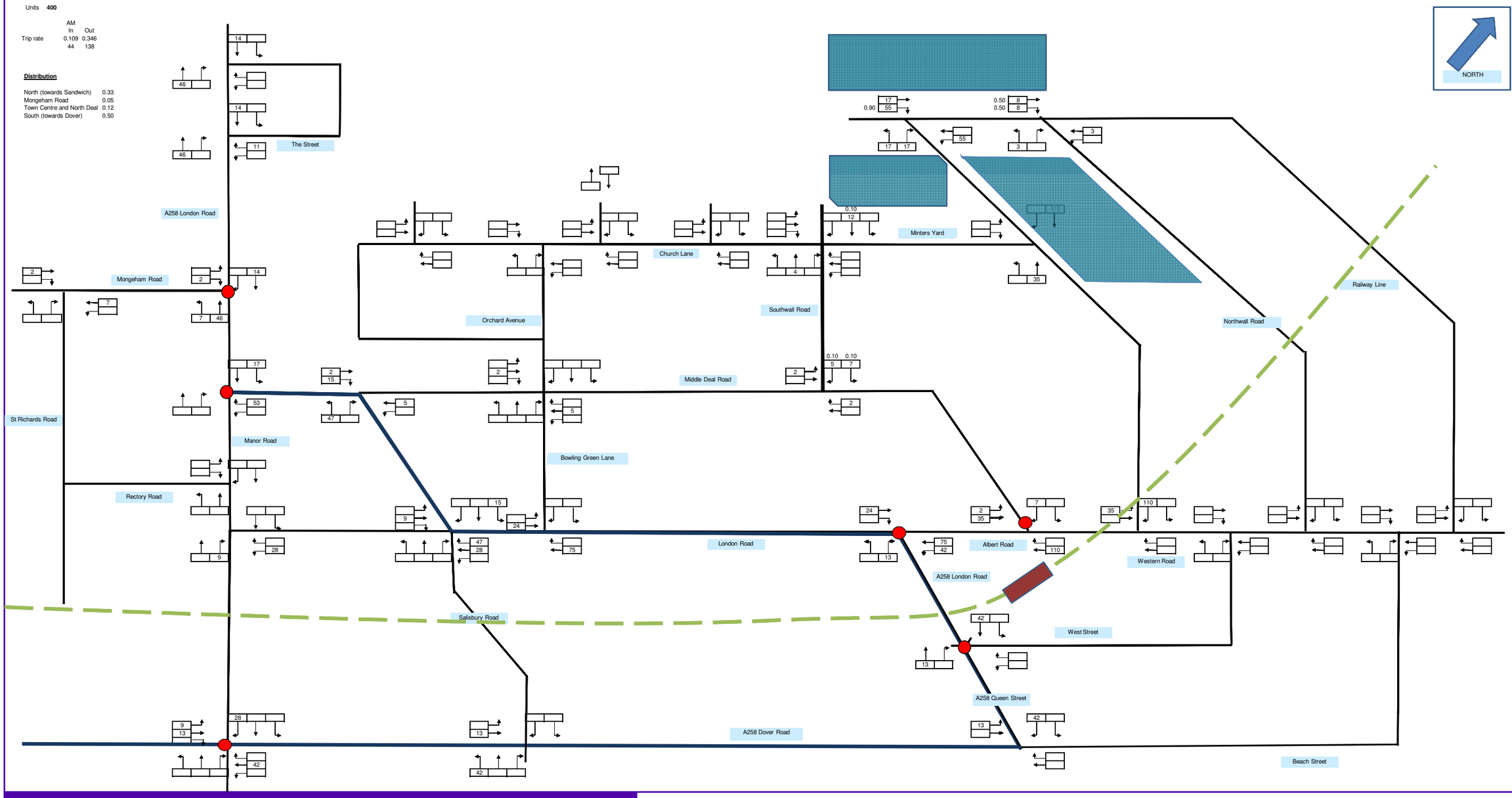

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Figure 3.4

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AM peak

Units **600**

	AM In	AM Out
Trip rate	0.109	0.346
	65	208

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50

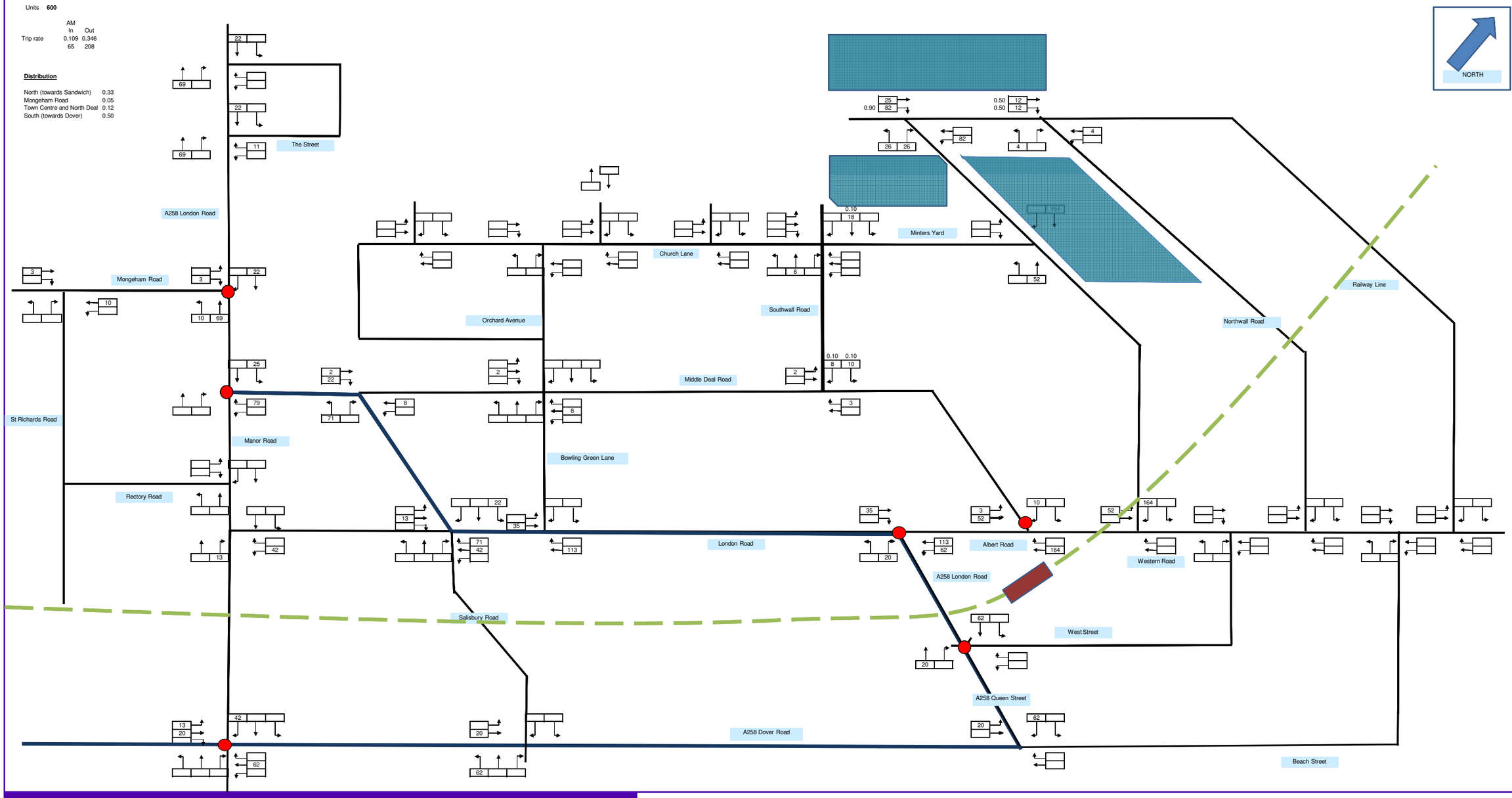

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Figure 3.5

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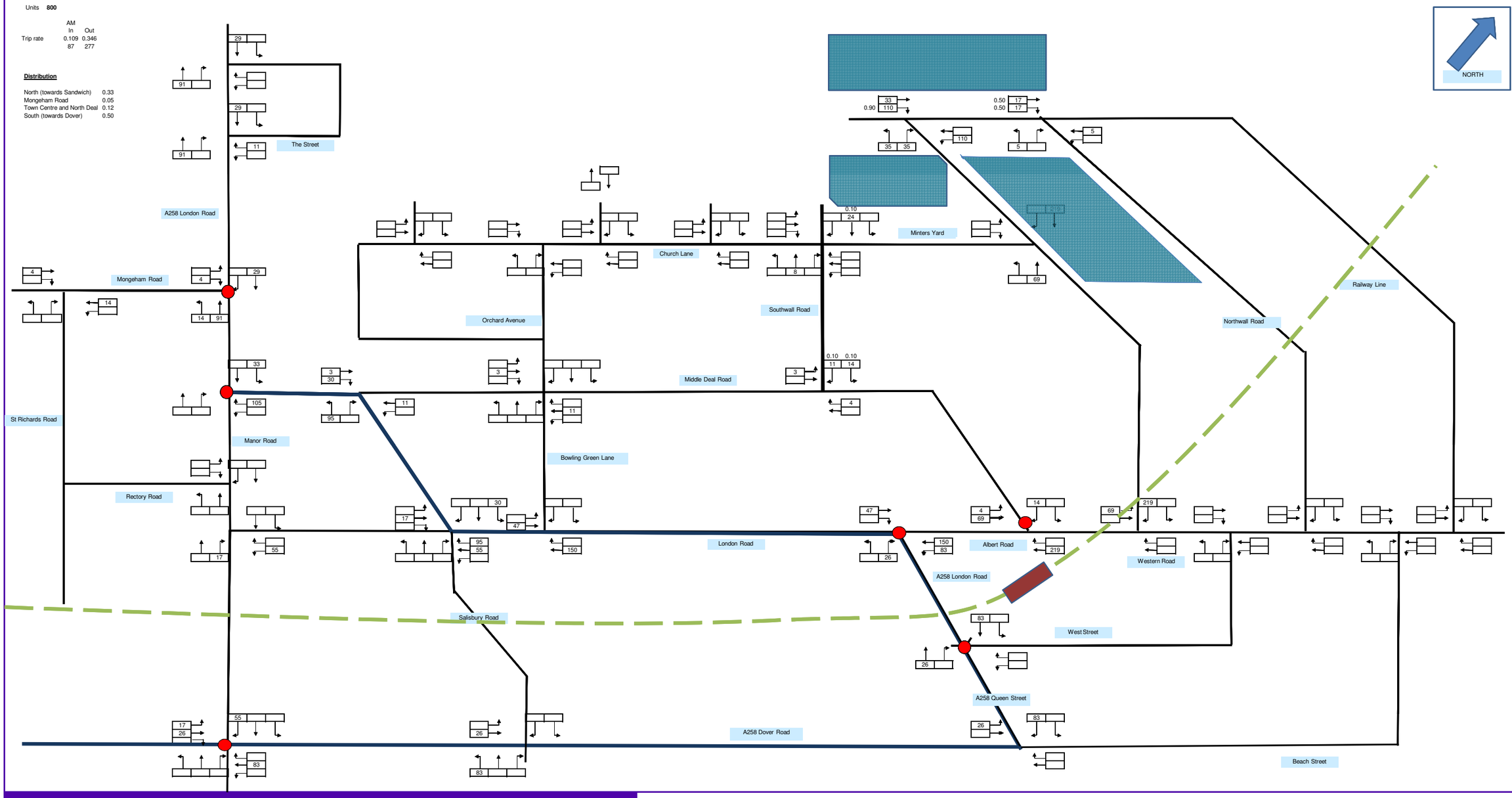
AM peak

Units **800**

	AM In	AM Out
Trip rate	0.109	0.346
	87	277

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - AM Peak Development Traffic Flows 800 units

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Figure 3.6

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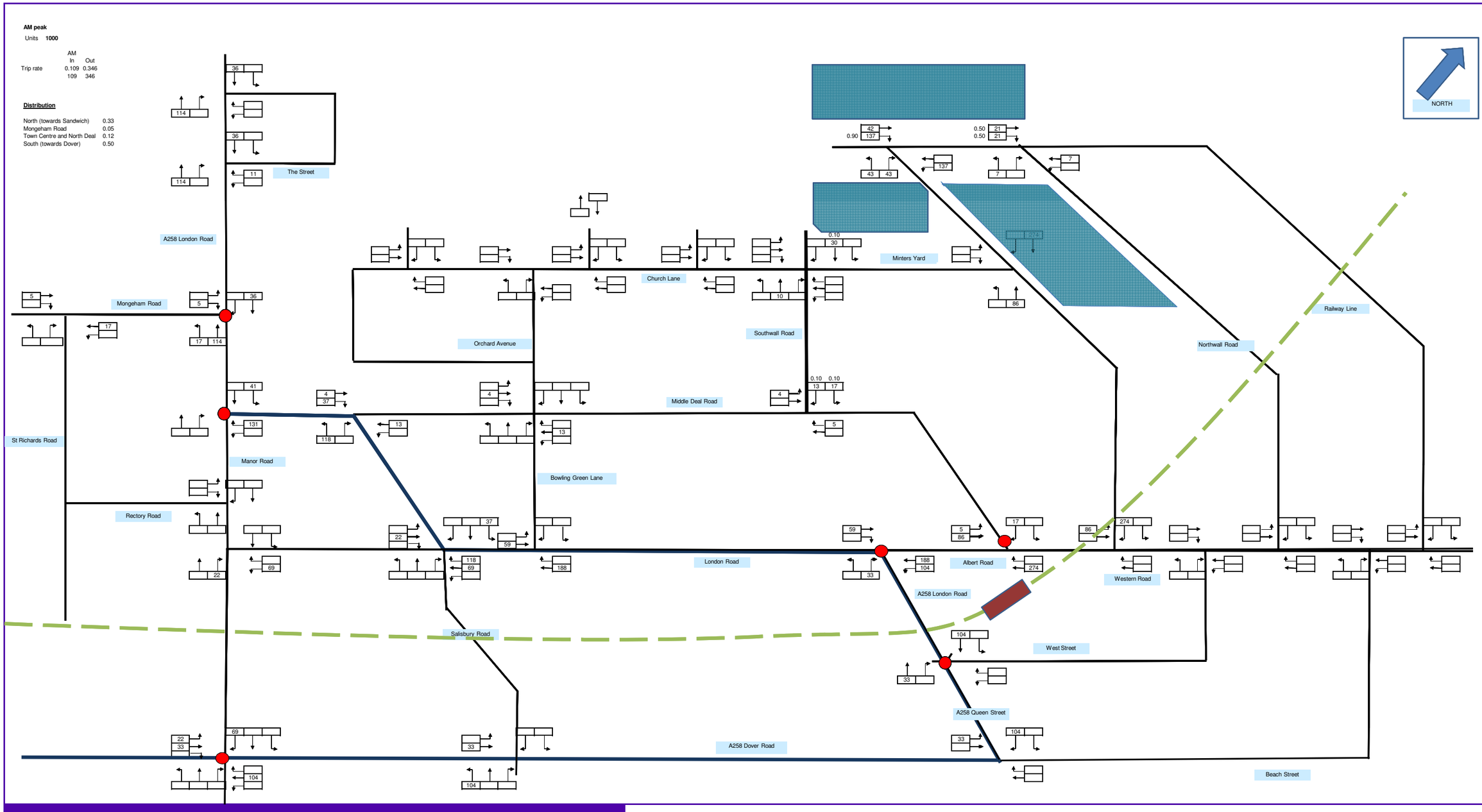
AM peak

Units **1000**

	AM In	Out
Trip rate	0.109	0.346
	109	346

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - AM Peak Development Traffic Flows 1000 units

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Figure 3.7

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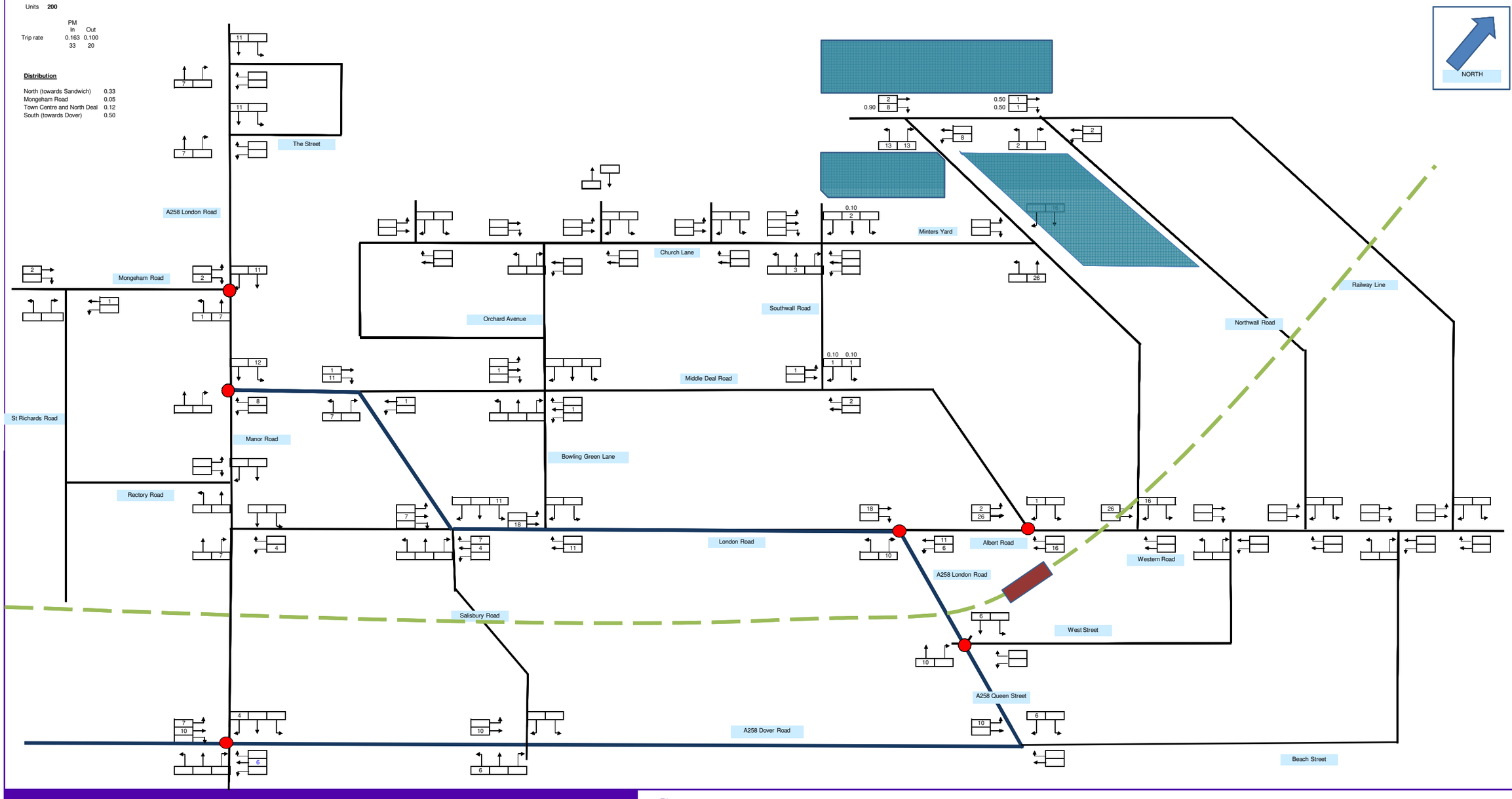
PM peak

Units **200**

	PM In	Out
Trip rate	0.163	0.100
	33	20

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - PM Peak Development Traffic Flows 200 units

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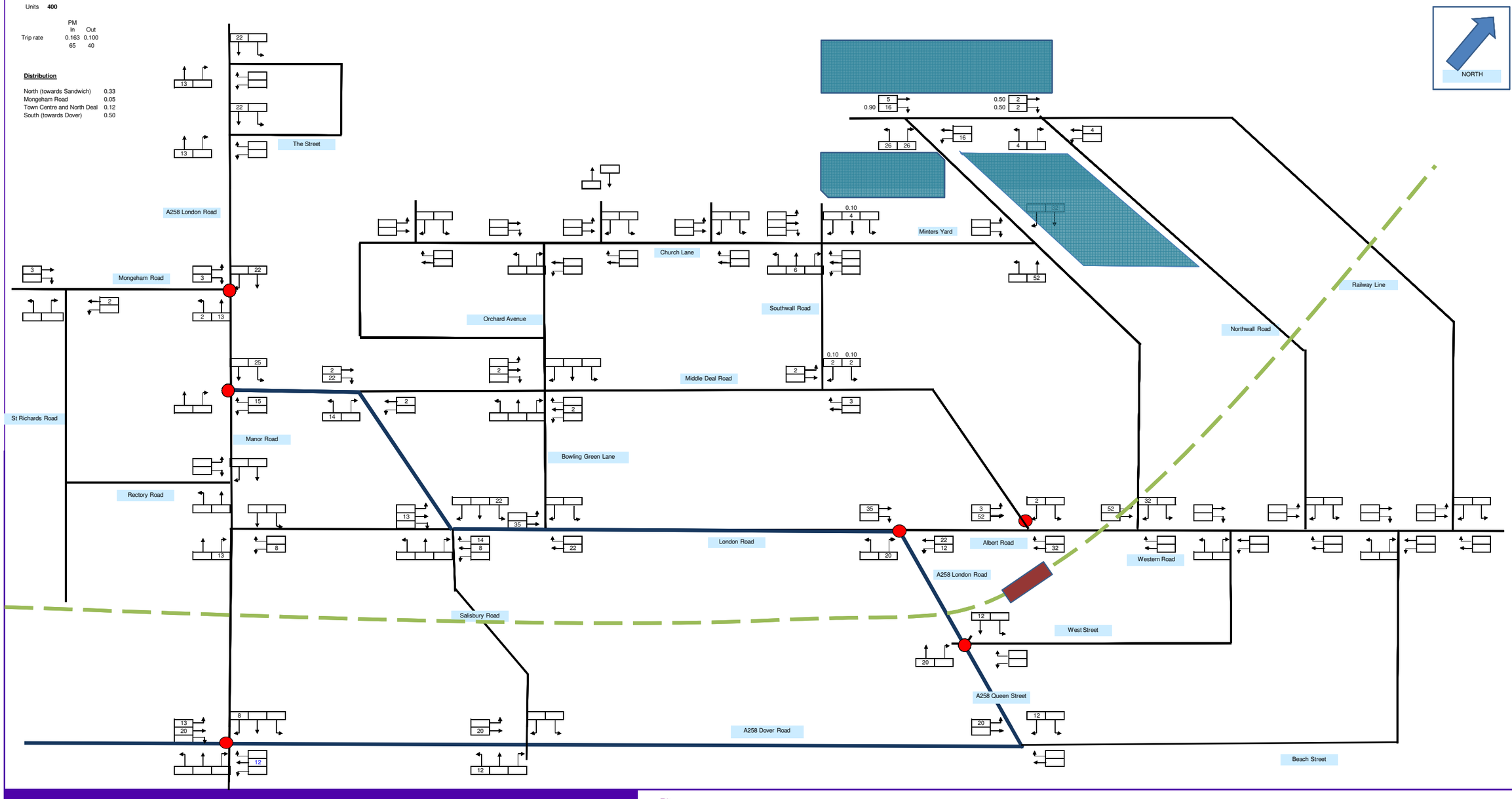
PM peak

Units **400**

	PM In	PM Out
Trip rate	0.163	0.100
	65	40

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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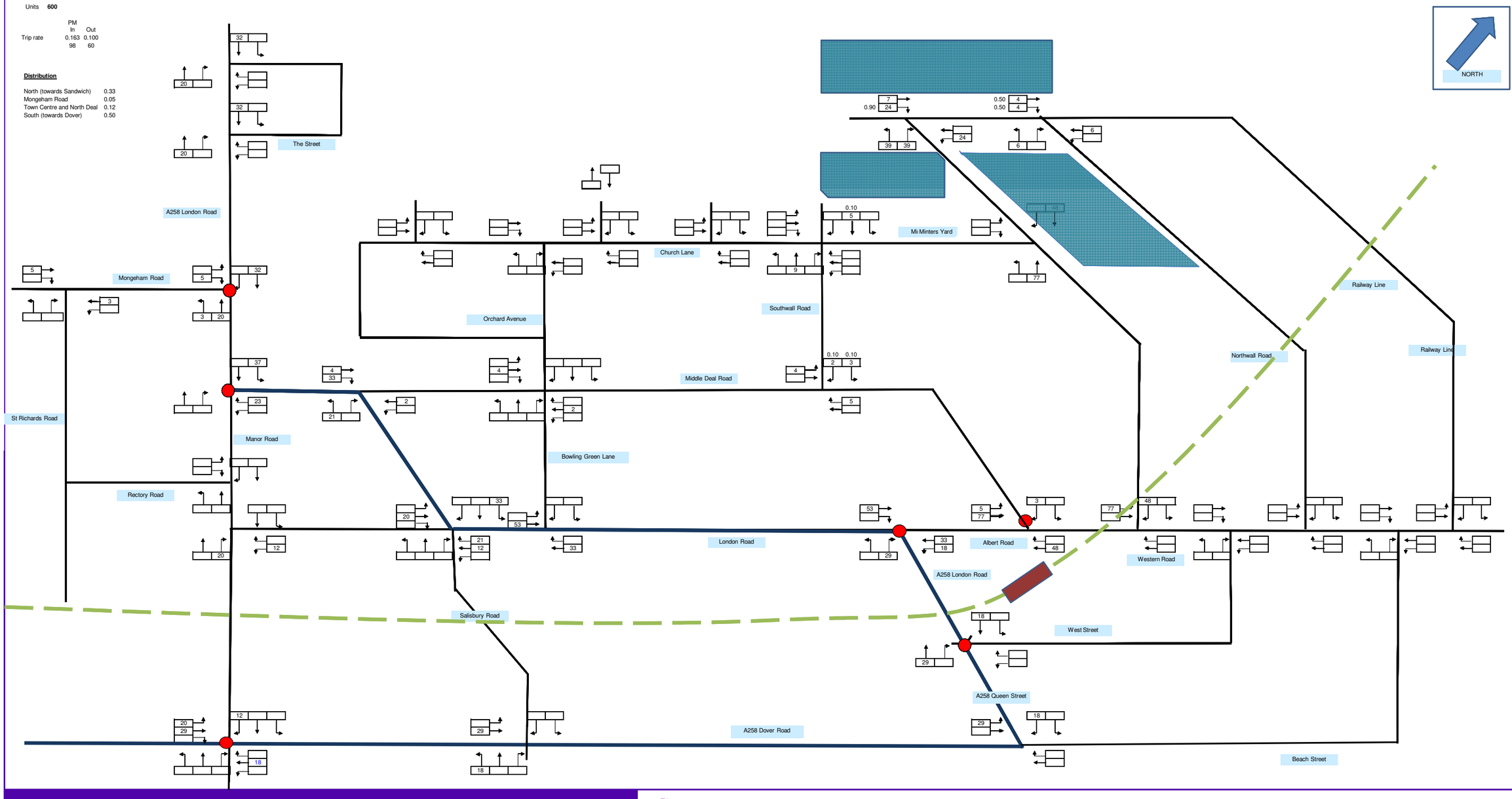
PM peak

Units **600**

	PM In	Out
Trip rate	0.163	0.100
	98	60

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - PM Peak Development Traffic Flows 600 units

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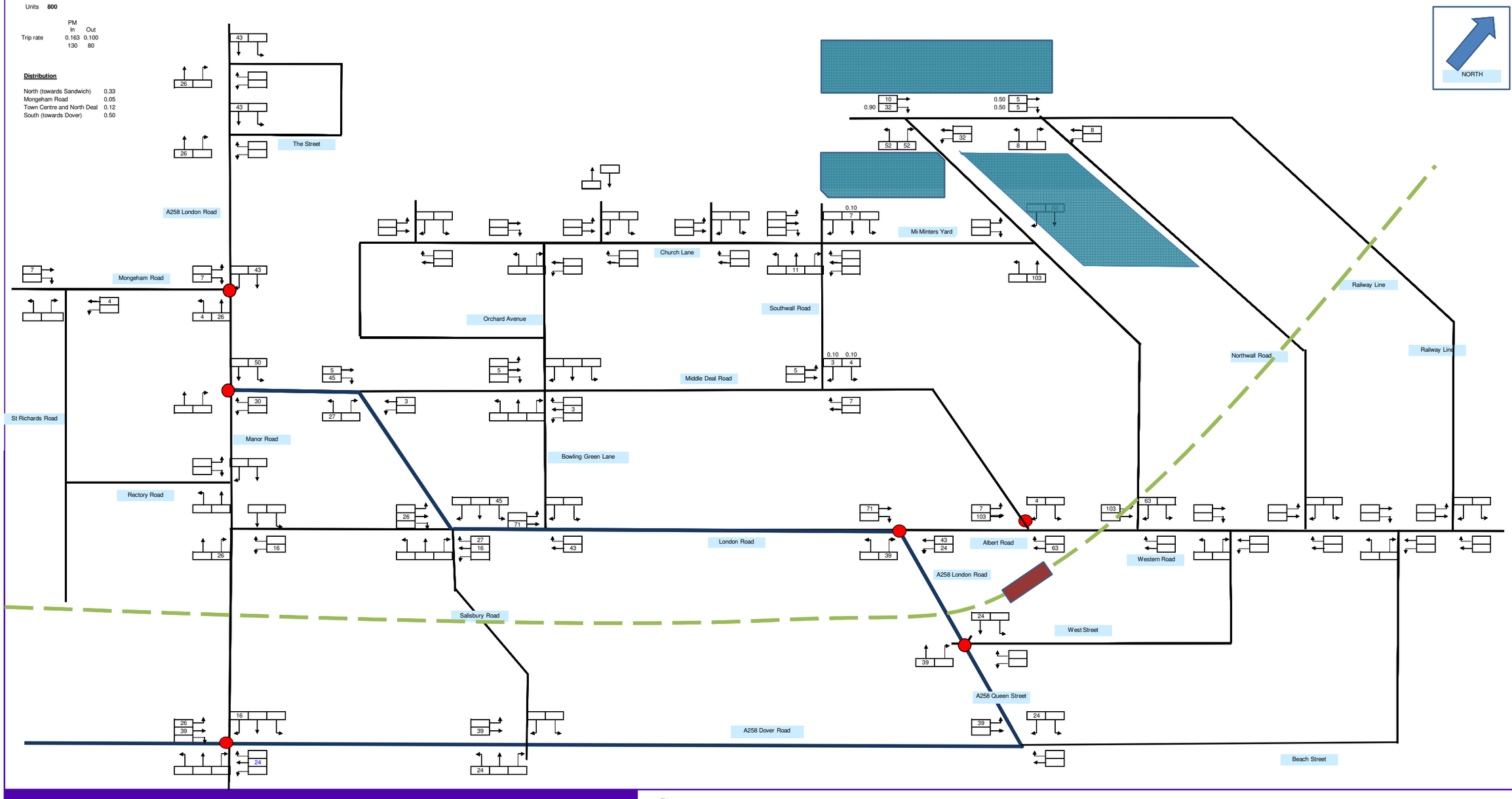
PM peak

Units **800**

	PM In	PM Out
Trip rate	0.163	0.100
	130	80

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - PM Peak Development Traffic Flows 800 units

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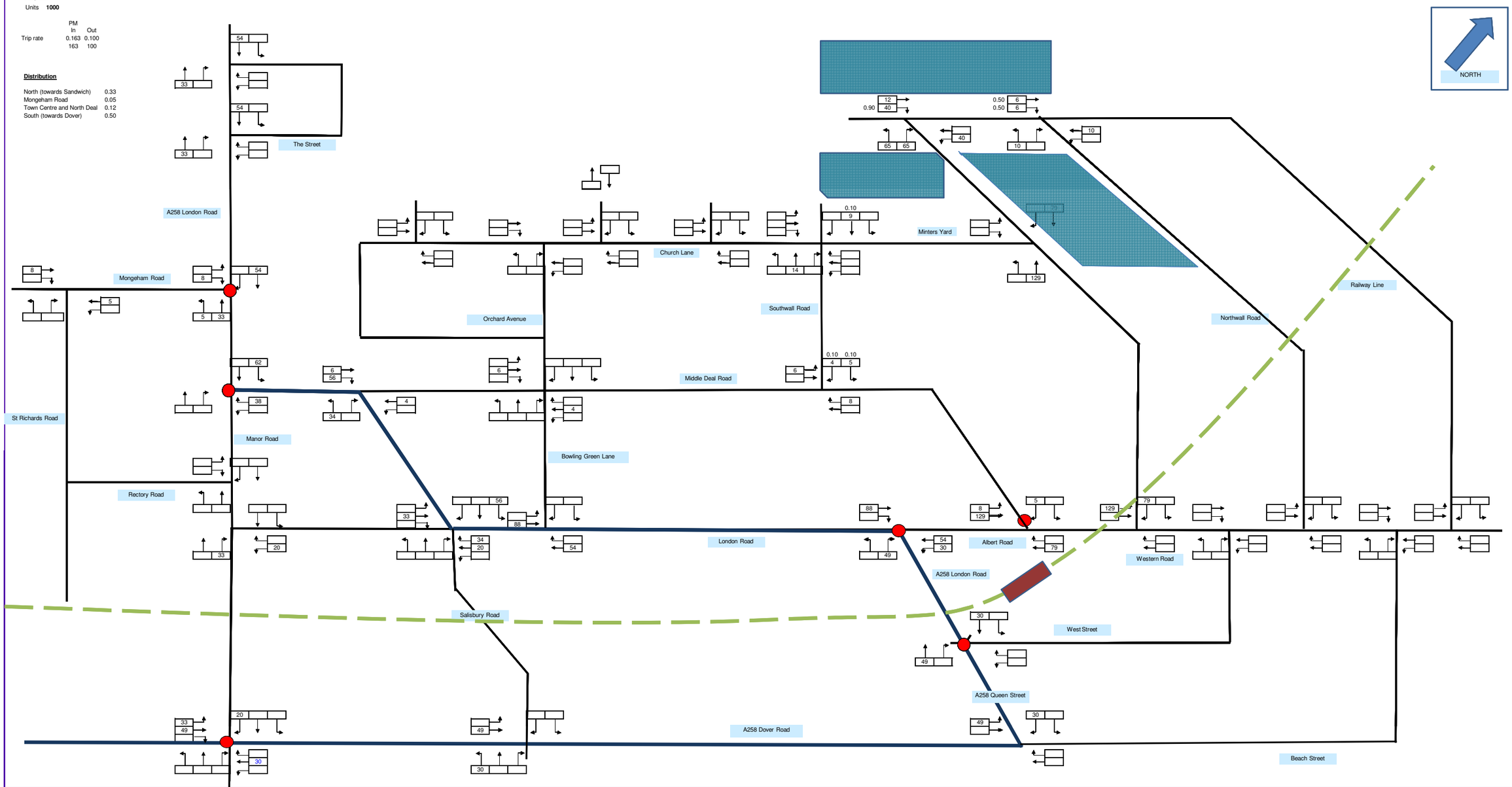
PM peak

Units **1000**

	PM In	PM Out
Trip rate	0.163	0.100
	163	100

Distribution

North (towards Sandwich)	0.33
Mongeham Road	0.05
Town Centre and North Deal	0.12
South (towards Dover)	0.50



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Deal - PM Peak Development Traffic Flows 1000 units

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Figure 3.12

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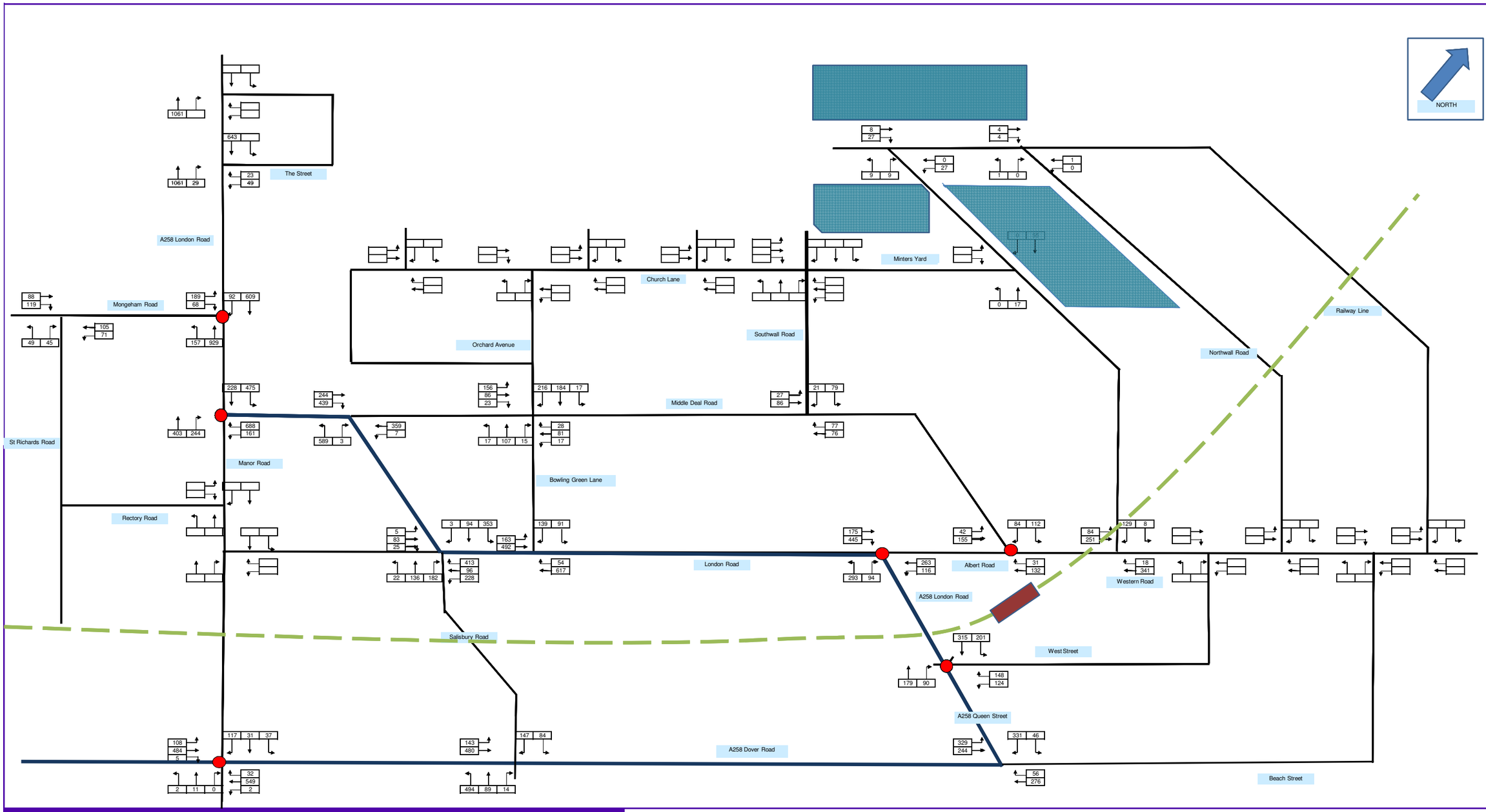

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Deal - AM Peak Future Do Something Traffic Flows - 200 units

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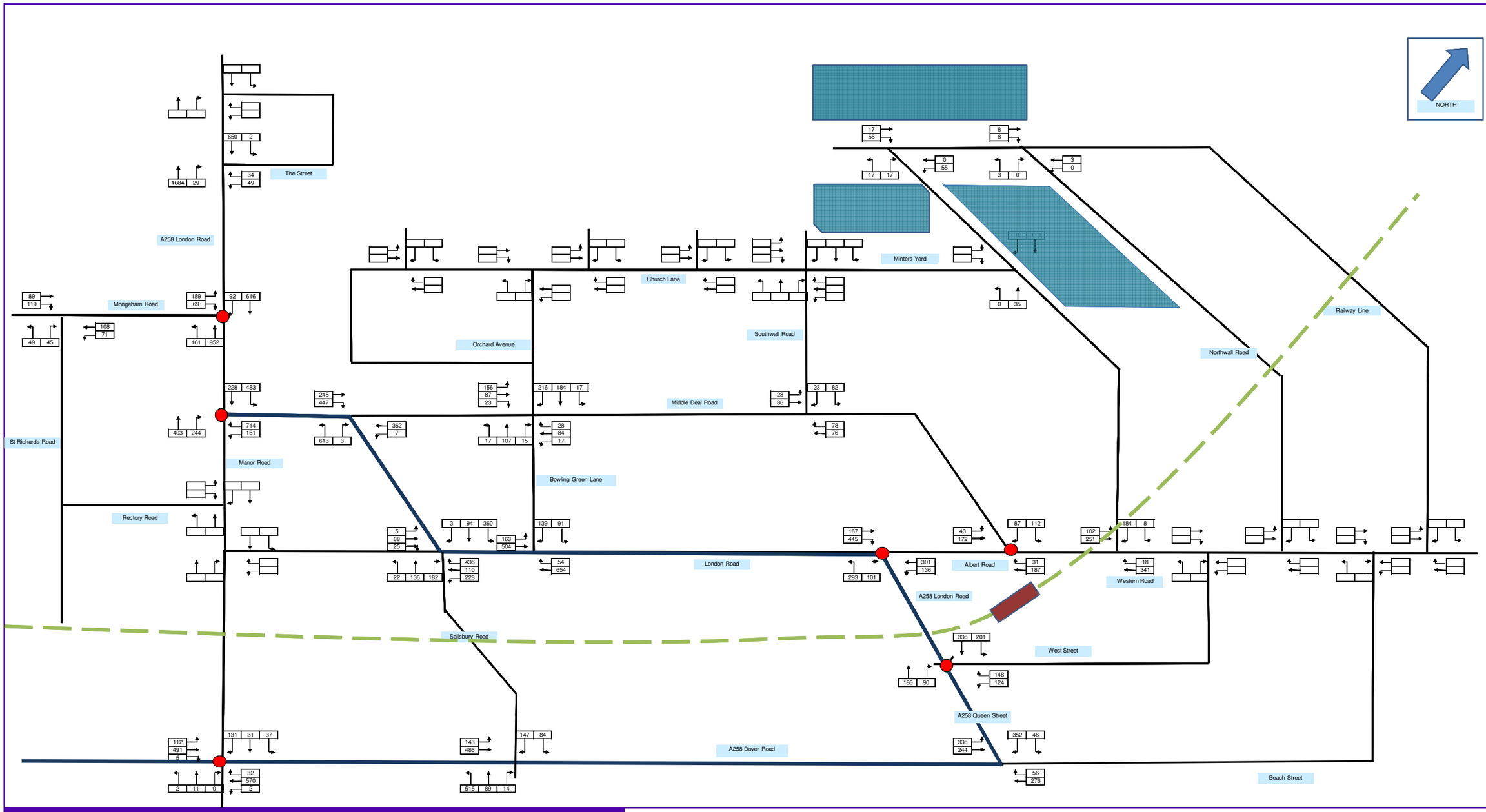

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Deal - AM Peak Future Do Something Traffic Flows - 400 units

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Figure 3.14

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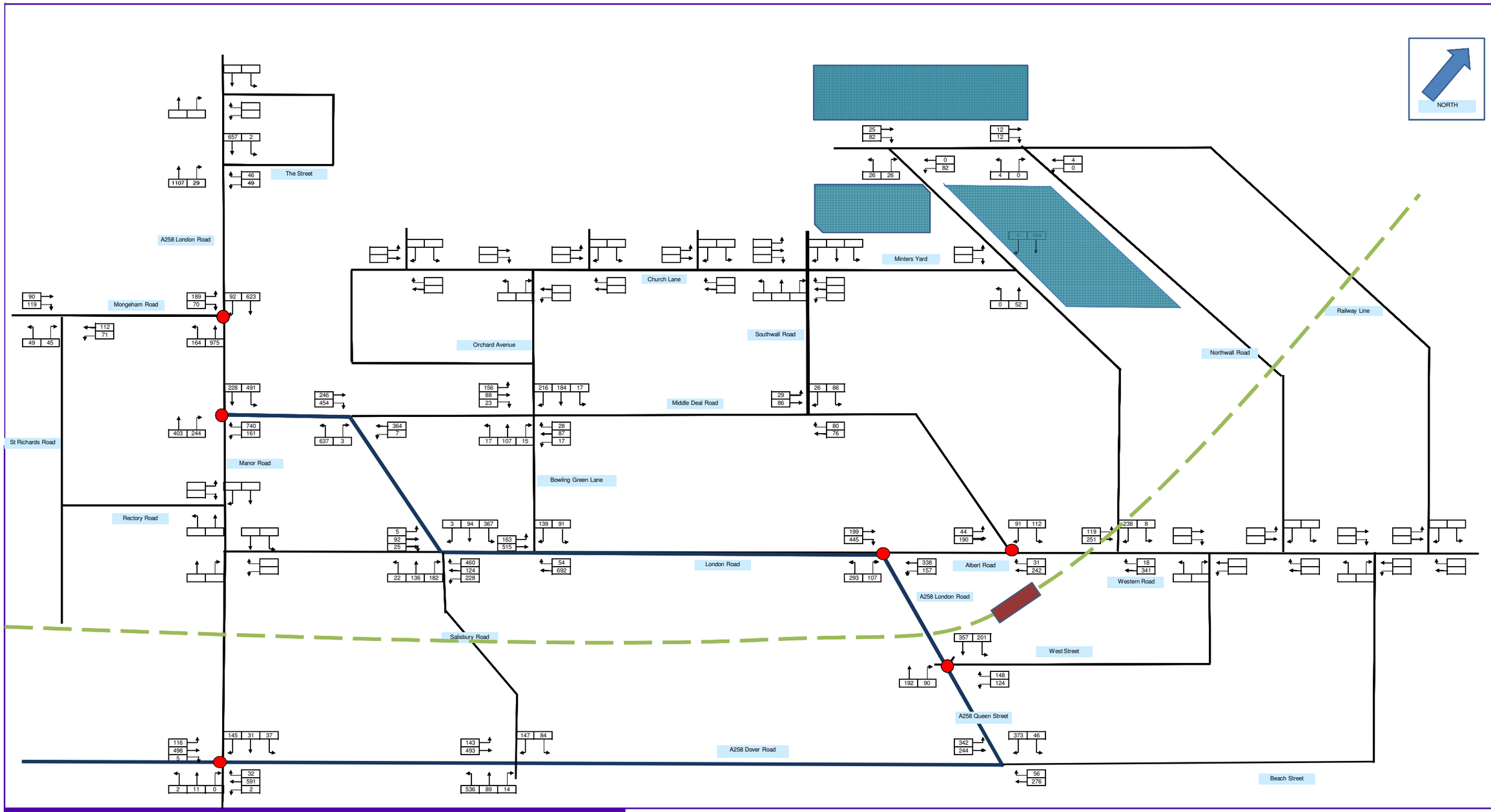

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Deal - AM Peak Future Do Something Traffic Flows - 600 units

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Figure 3.15

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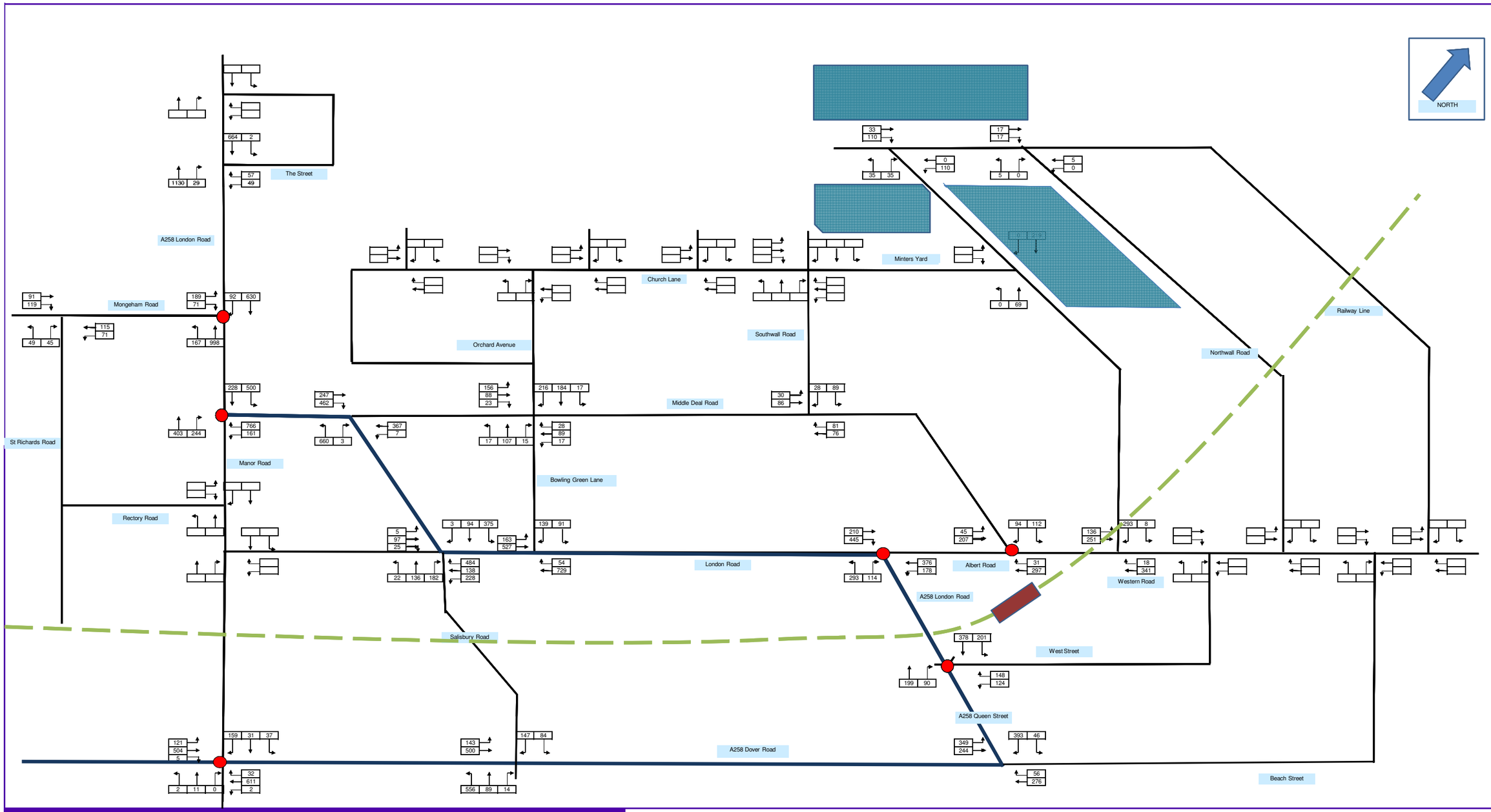

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Figure 3.16

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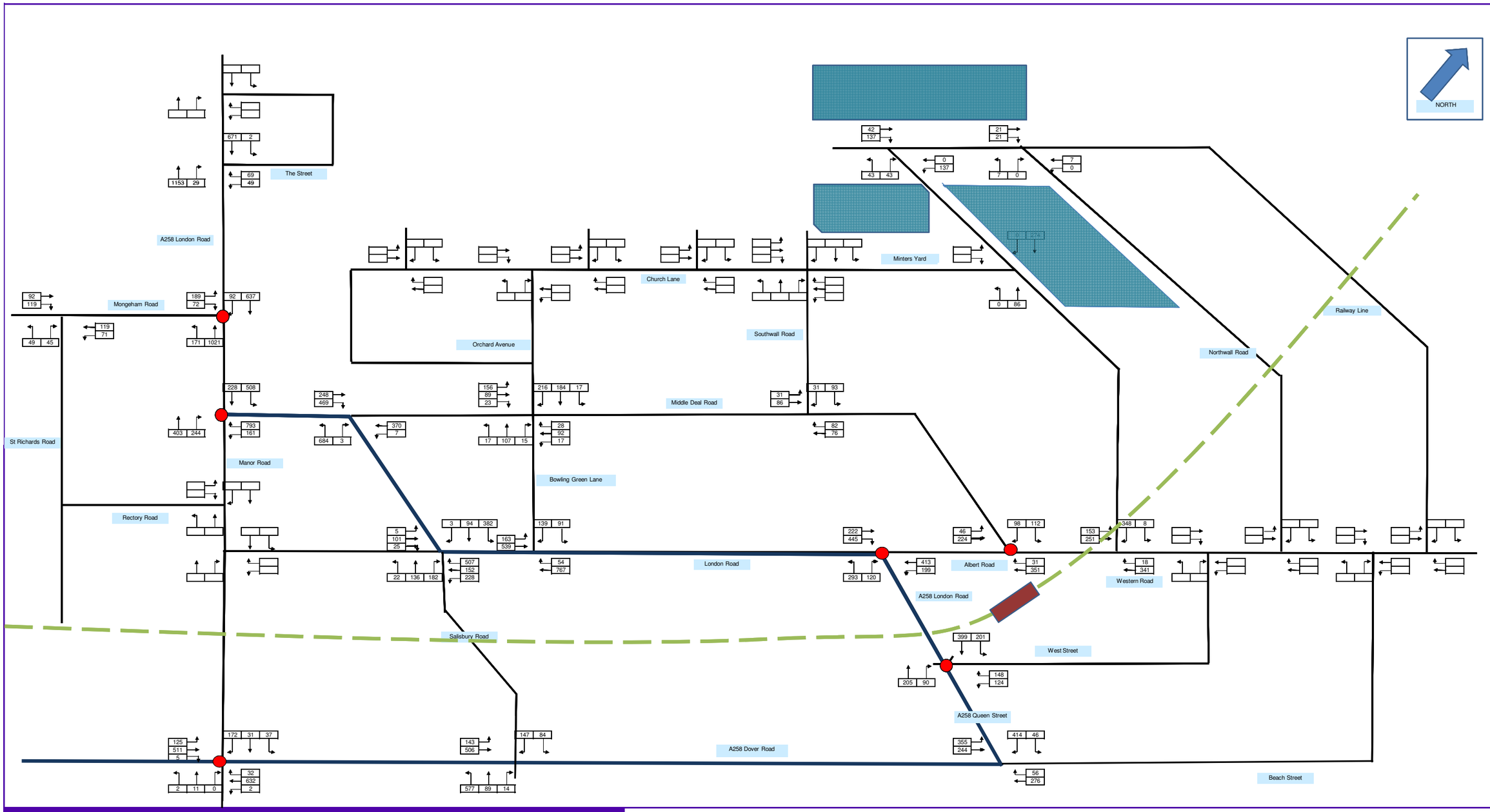

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Deal - AM Peak Future Do Something Traffic Flows - 1000 units

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Figure 3.17

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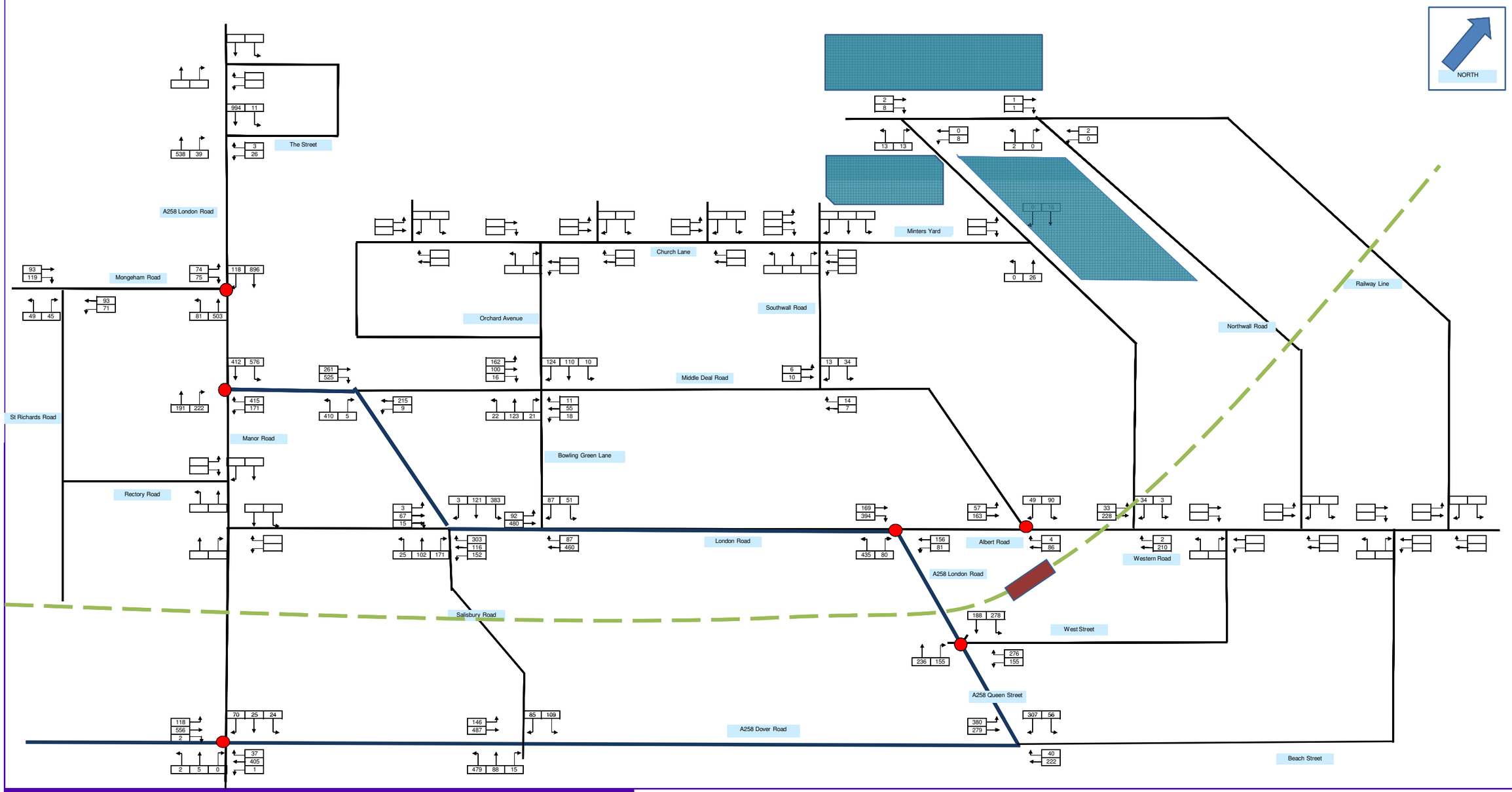

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Deal - PM Peak Future Do Something Traffic Flows - 200 units

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Figure 3.18

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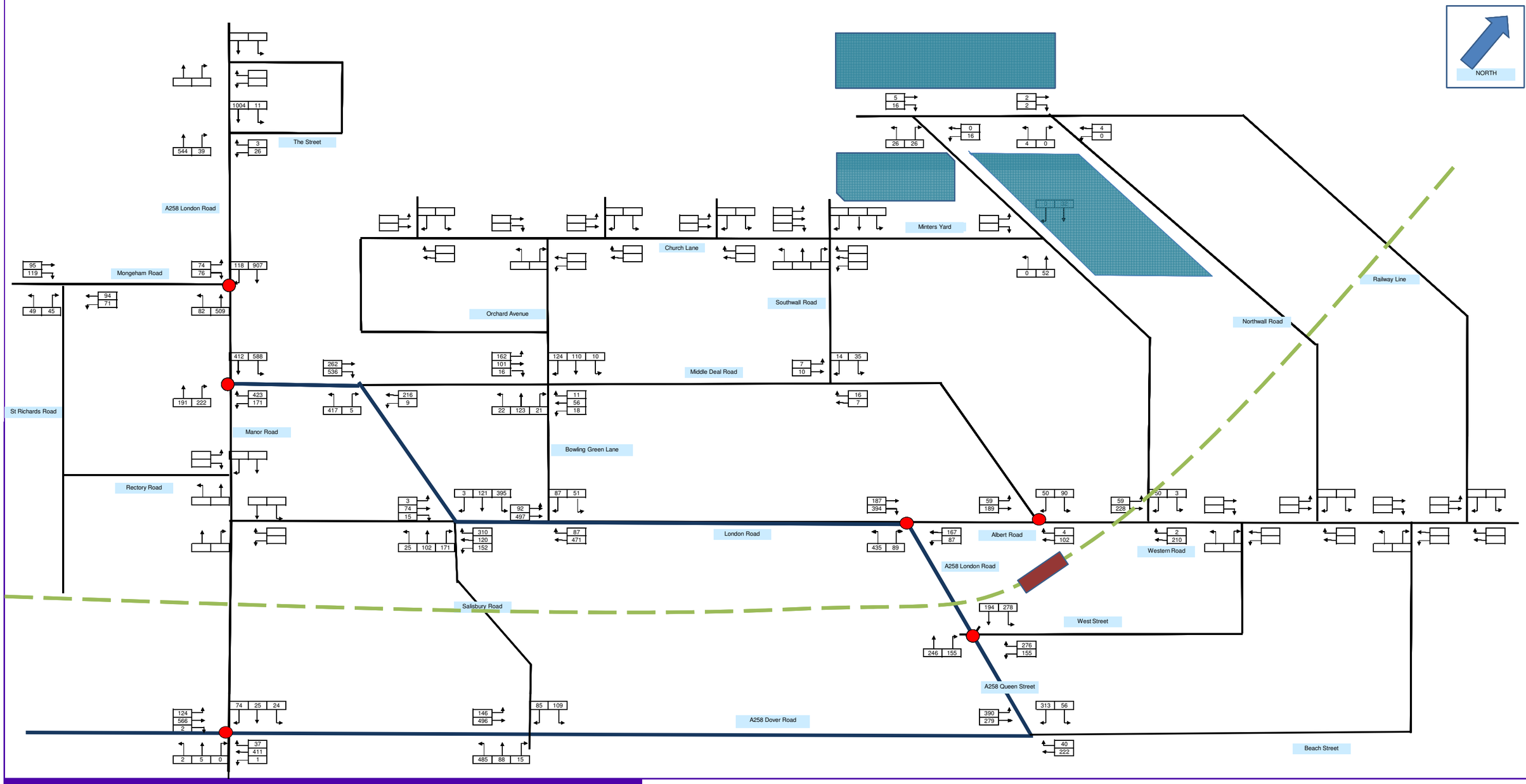

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Deal - PM Peak Future Do Something Traffic Flows - 400 units

Project No.
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Figure 3.19

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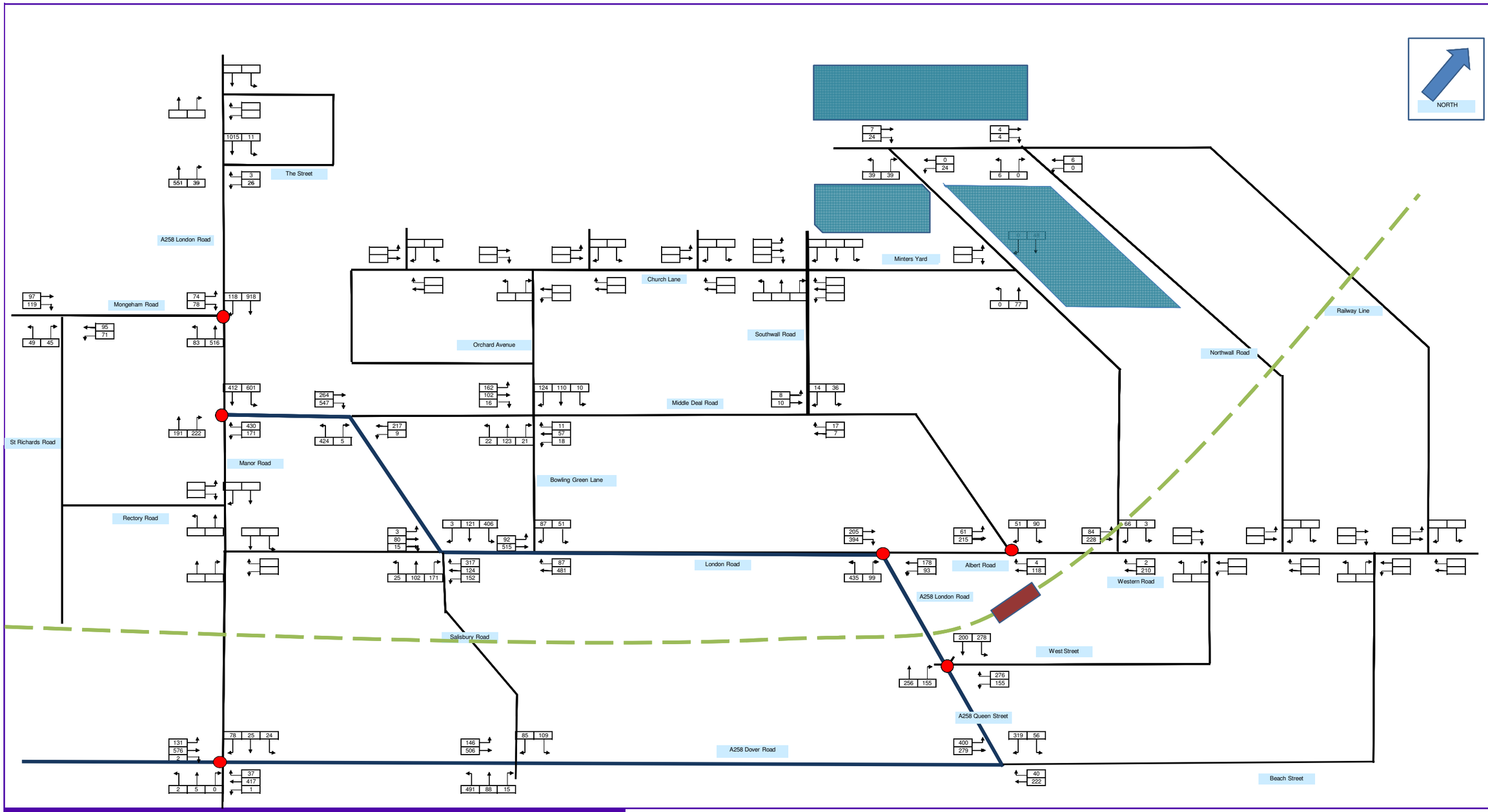

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Deal - PM Peak Future Do Something Traffic Flows - 600 units

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Figure 3.20

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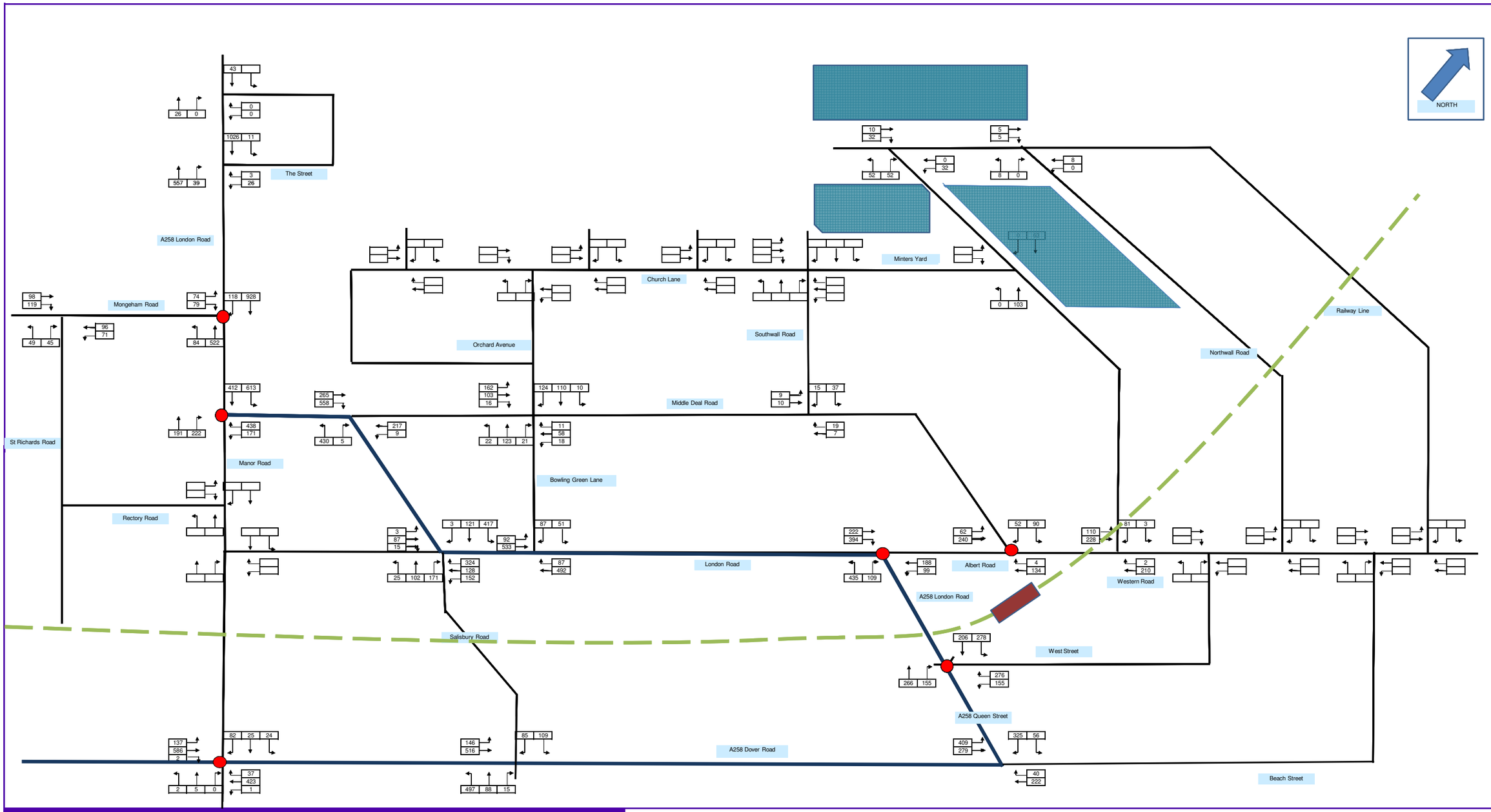

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Deal - PM Peak Future Do Something Traffic Flows - 800 units

Project No.
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Figure 3.21

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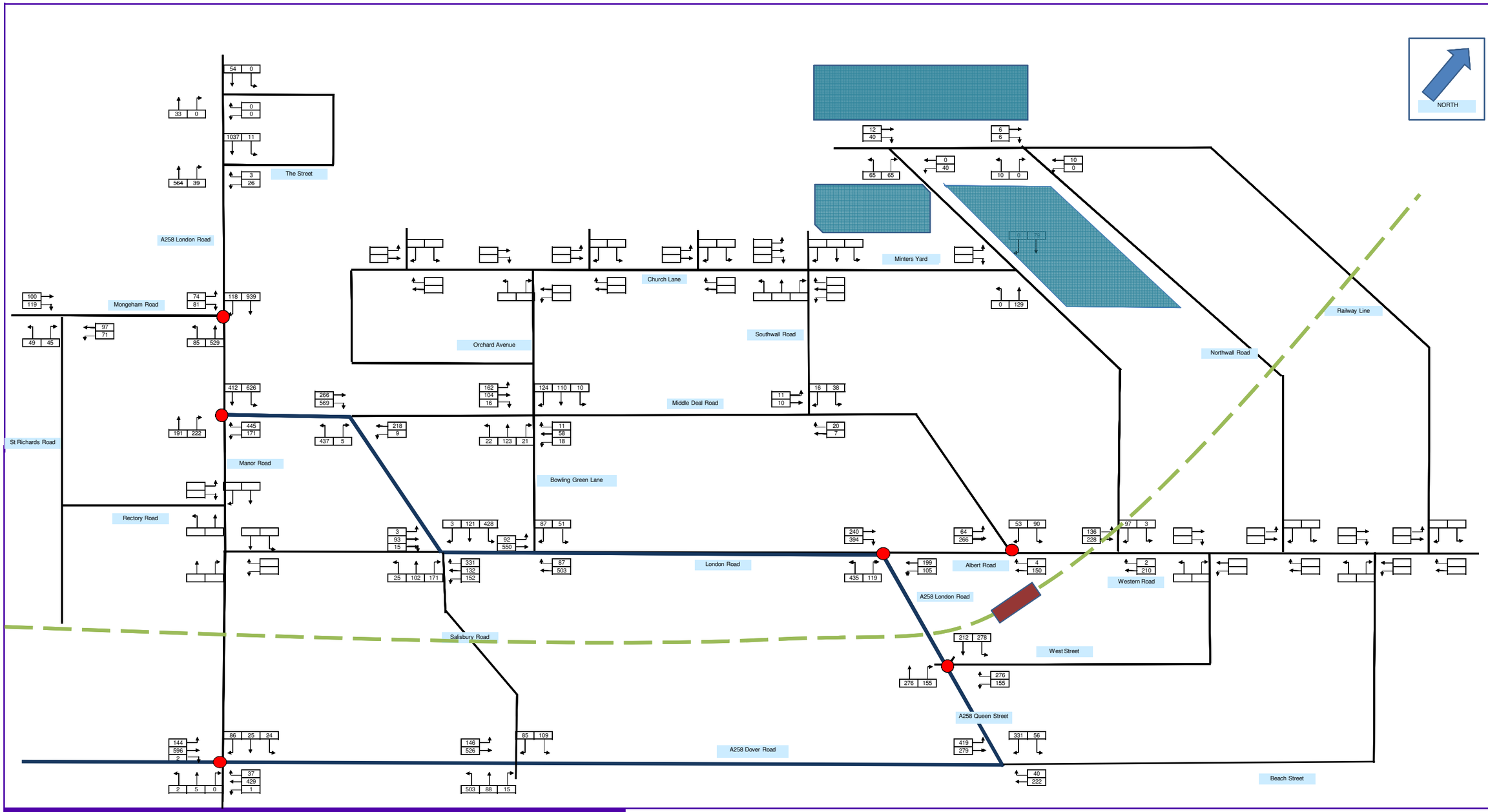

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Deal - PM Peak Future Do Something Traffic Flows - 1000 units

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Figure 3.22

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4 Individual Junction Analysis

4.1 Based on information identified from our review of transport baseline conditions and our forecast future development traffic assignment described above, the following junctions have been identified as potential constraints on the quantum of development that could be implemented.

- A258 London Road / B2056 Manor Road;
- A258 London Road / Mongeham Road;
- A258 London Road / Albert Road;
- A258 London Road /Queens Street / West Street;
- A258 Dover Road / Cornwall Road; and
- Albert Road / New Development Link Road.

4.2 Capacity assessments have been carried out at these junctions using standard industry modelling software for traffic signals (LINSIG), priority junctions (PICADY) and roundabouts (ARCADY).

4.3 In terms of assessing junction performance, the Degree of Saturation (DoS) (for signal controlled junctions) and Ratio of Flow to Capacity (RFC) (for priority junctions and roundabouts) are used to identify its relative operational performance. Congestion will start to occur when the ratio exceeds 90%, although theoretically a junction reaches capacity when the DoS or RFC is at 100%. At high ratio levels the queues and delays are seen as 'unstable' with only slight changes to the traffic flow profiles or very minor incident on the ground creating a much greater queuing situation. As a consequence, queue forecasts at junctions over capacity need to be treated with caution as actual delay forecasts are difficult to predict. For the purpose of this assessment it has been assumed that the cut off point for junction operation acceptability is when the DoS (or RFC) reaches 100%.

4.4 It should be noted that a number of factors have not been taken into account within this assessment which might ultimately reduce the level of queues and delays predicted. Firstly, no mode shift from car to public transport has been assumed. The future transport strategy for the town should include a package of measures which improve public transport, walking and cycling facilities. Such increase in non-car mode attractiveness together with increasing delay on the highway network is likely to encourage a certain amount of mode shift. Secondly in situations when significant highway delays are experienced, peak spreading is likely to occur, with some drivers delaying their journeys to avoid the main peak period. The effect of these changes would be to suppress the peak demand at each junction by perhaps 10%, allowing some flexibility around the maximum quanta of development indicated by the modelling.

A258 London Road / B2056 Manor Road

4.5 Under the EFS, the vast majority of traffic heading to and from destinations north of Deal are required to pass through this tight junction. It is clear from the baseline conditions review that the existing mini-roundabout represents a significant constraint to the ability of Deal's highway network to adequately accommodate additional traffic from development. The junction currently operating at close to capacity during periods of the morning and evening peaks, so it

is recognised that some form of improvements are likely to be required to enable it to operate without significant vehicle delays during the 2031 future baseline and Do Something scenarios.

4.6 To understand how potential junction improvements are likely to affect the level of future vehicle delays and ultimately the quantum of development that can be implemented, a number of junction options have been assessed, namely:

- Existing Mini-Roundabout arrangement (no improvements);
- Option 1 – All movement signal controlled junction;
- Option 2 – Signal controlled junction with banned right turn movement from Manor Road to A258 London Road;
- Option 3 – Larger scale all movement signal controlled junction; and
- Option 4 – Upgraded (Larger scale) Roundabout.

4.7 **Figures 4.1, 4.2, 4.3 and 4.4** show the proposed junction improvements associated with layout options 2, 3, 4 and 5 respectively.

4.8 It should be noted that the signal control junctions associated with options 1 and 2 will require the carriageway to be slightly widened on the western side, although adequate footway widths would still be provided for pedestrians. Furthermore for the purpose of this assessment, these two options do not provide dedicated pedestrian crossing facilities incorporated into the traffic signals. Therefore additional zebra or pelican crossings maybe required.

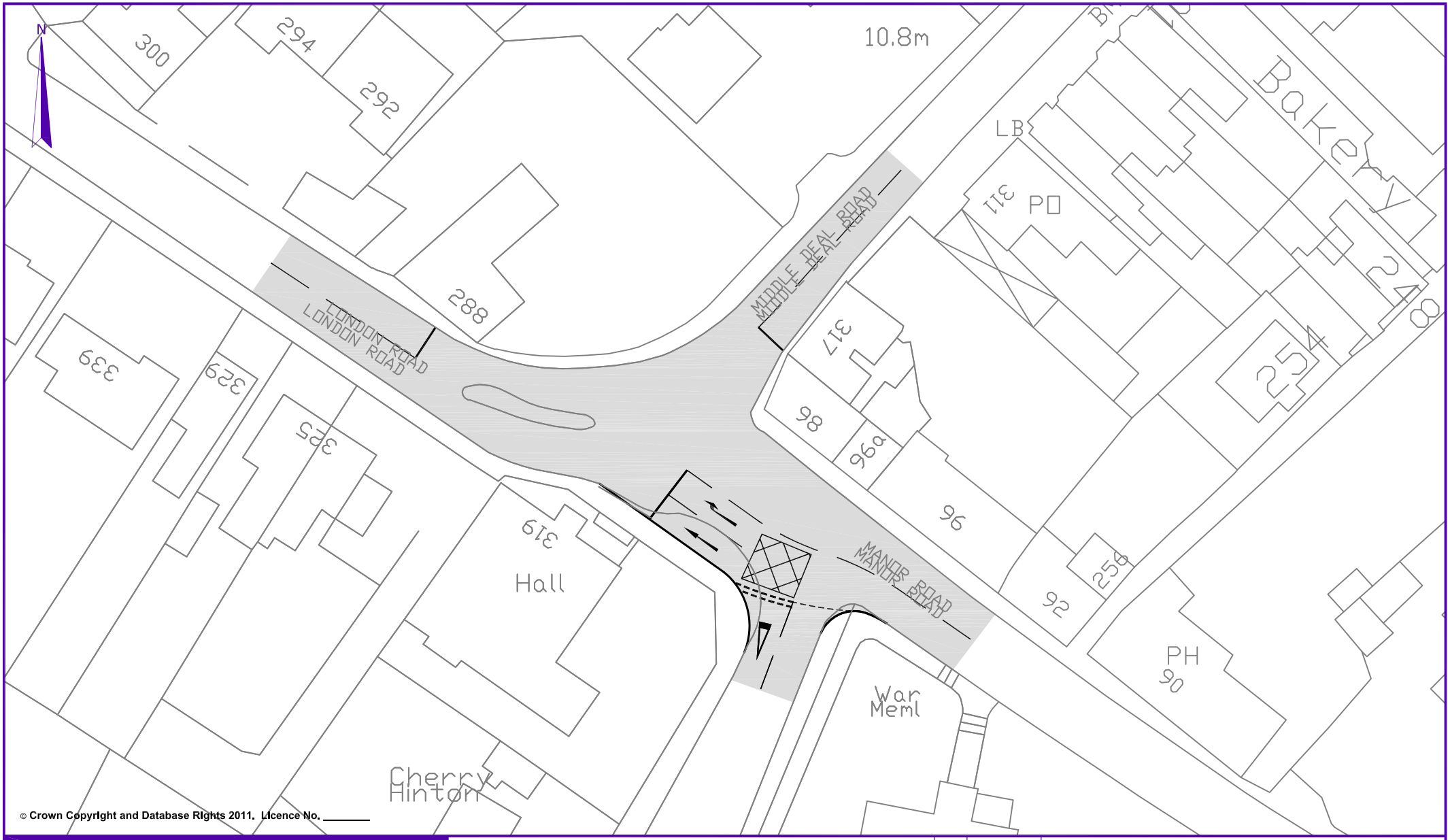
4.9 For Options 3 and 4, the larger scale signal controlled junction and roundabout would require the compulsory purchase of a significant amount of third party land to the north east, although it avoids the listed buildings on the southeast corner of the junction.

Existing Mini-Roundabout

4.10 The future operational performance of the London Road / Manor Road Roundabout has been assessed by using the standard modelling software ARCADY. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.11 **Figure 4.5** shows a summary of the ARCADY junction capacity assessment results for the future baseline and a number of future do-something scenarios ranging from 200 to 1,000 residential units. The graph highlights queues for the most critical approaches during the AM peak (London Road NE approach) and PM peak (London Road NW approach).

4.12 **Table 4.1** also provides details of the maximum RFC and average delay per vehicle for the critical give way approaches and each future scenario.



Deal Flood and Transport Alleviation Model Study

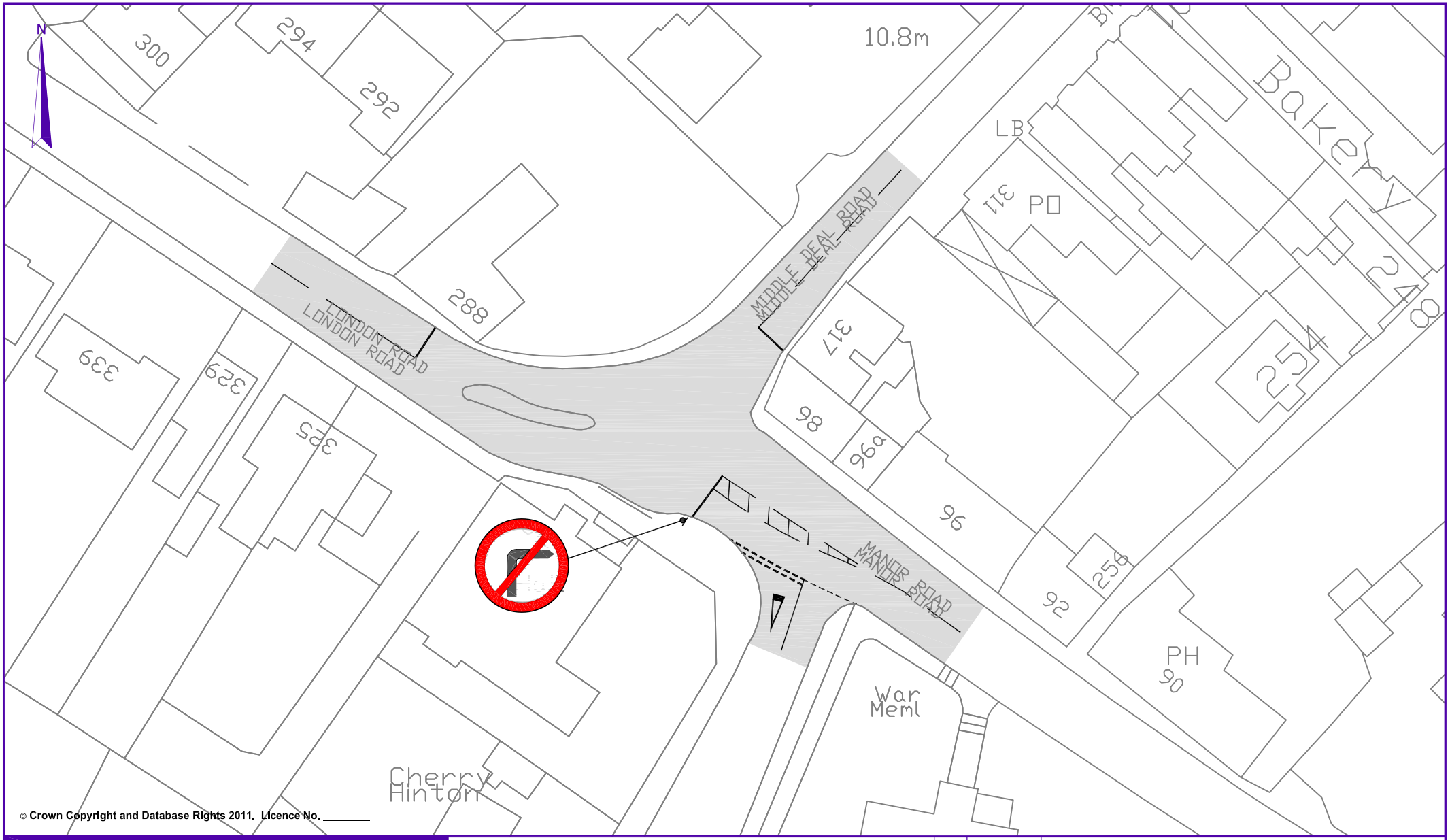
Prepared for Dover District Council
March 2012

Title
A258 London Road / Manor Road Junction
Option 1 - All Movement Signal Controlled Junction

No.	Date	Revision

Project No.	Figure No./Drawing No.	Scale	Rev No.		
C3A340/02	Figure 4.1	1:500 at A4	-	Drawn	SW
				Designed	GS
				Approved	KM

mvaconsultancy



Deal Flood and Transport Alleviation Model Study

Prepared for Dover District Council
March 2012

Title
A258 London Road / Manor Road Junction
Option 2 - Signal Controlled Junction with Banned Right Turn Movement from Manor Road

No.	Date	Revision

Project No.	Figure No./Drawing No.	Scale	Rev No.		
C3A340/02	Figure 4.2	1:500 at A4	-	Drawn	SW
				Designed	GS
				Approved	KM

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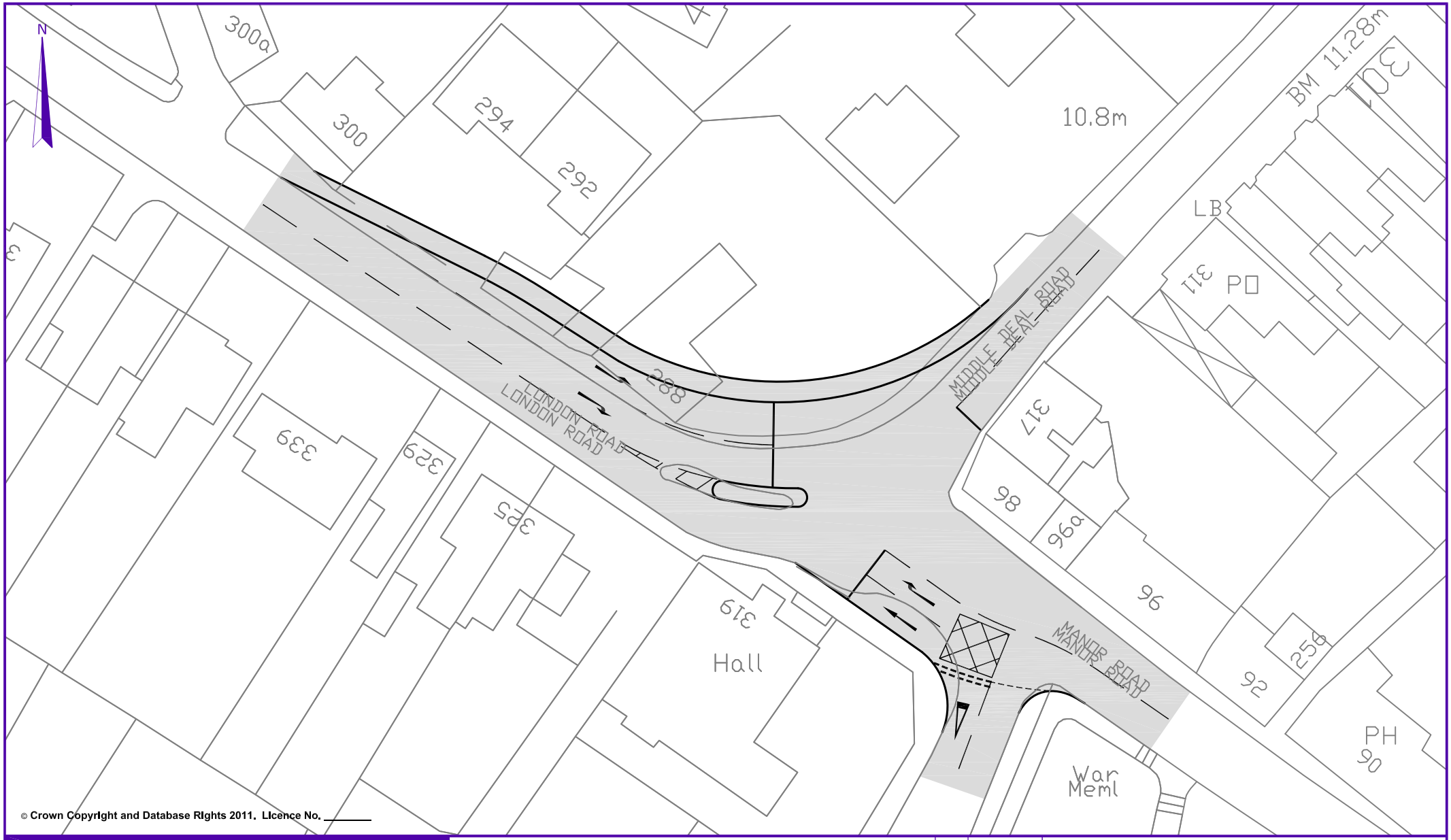


Deal Flood and Transport Alleviation Model Study

Prepared for Dover District Council
March 2012

Title
A258 London Road / Manor Road Junction
Option 3 - Larger Scale Signal Controlled Junction

No.	Date	Revision

Project No.	Figure No./Drawing No.	Scale	Rev No.		
C3A340/02	Figure 4.3	1:500 at A4	-	Drawn	SW
				Designed	GS
				Approved	KM

mvaconsultancy

Deal Flood and Transport Alleviation Model Study

Prepared for Dover District Council
March 2012

Title
A258 London Road / Manor Road Junction
Option 4 - Larger Scale Roundabout

No.	Date	Revision

Project No.	Figure No./Drawing No.	Scale	Rev No.		
C3A340/02	Figure 4.4	1:500 at A4	-	Drawn	SW
				Designed	GS
				Approved	KM

mvaconsultancy

Figure 4.5: A258 London Road / Manor Road (Existing Roundabout)

Table 4.1: A258 London Road / Manor Road (Existing Mini-Roundabout) – Summary of Junction Assessment Results

Modelled Scenario	AM Peak (London Road NE Approach)		PM Peak (London Road NW approach)	
	Max RFC	Average Delay (min per Vehicle)	Max RFC	Average Delay (min per Vehicle)
2011 Existing	0.859	0.38	0.888	0.34
2031 Future Baseline	1.249	5.68	1.156	2.50
2031 Future Do Something (200 units)	1.325	7.72	1.181	3.14
2031 Future Do Something (400 units)	1.365	8.81	1.196	3.46
2031 Future Do Something (600 units)	1.406	9.91	1.210	3.79
2031 Future Do Something (800 units)	1.446	11.01	1.224	4.13
2031 Future Do Something (1000 units)	1.506	12.67	1.239	4.54

4.13 The analysis indicates that the junction will be well over capacity with a RFC ratio above 1.0 for the future baseline scenario with very long delays experienced during both morning and evening peak periods. For example, vehicle queues for the London Road NE approach during the AM peak are forecast to be close to 120 vehicles (around 700 metres). It is therefore considered that some form of junction improvements will be required if development above the core strategy is to be implemented.

Option 1 – All Movement Signal Controlled Junction

4.14 The proposal to upgrade the existing roundabout to a signal controlled junction, as shown in Figure 4.1, has been assessed by using the standard modelling software LINSIG. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.15 **Figure 4.6** shows a summary of the LINSIG junction capacity assessment results for the existing, future baseline and a number of future do-something scenarios ranging from 200 to 1,000 residential units. The graph highlights queues for the most critical approaches during the AM and PM peak periods.

4.16 **Table 4.2** also provides details of the maximum DoS and average delay per vehicle for the critical approaches and each future scenario.

Figure 4.6: A258 London Road / Manor Road
(Option 1 - All Movement Signal Controlled Junction)

Table 4.2: A258 London Road / Manor Road (All Movement Signal Controlled Junction) – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max DoS (%)	Average Delay (min per Vehicle)	Max DoS (%)	Average Delay (min per Vehicle)
2011 Existing	77.1	0.53	79.3	0.74
2031 Future Baseline	119.3	6.05	114.1	4.66
2031 Future Do Something (200 units)	120.6	6.34	114.8	4.83
2031 Future Do Something (400 units)	121.9	6.61	114.9	5.18
2031 Future Do Something (600 units)	123.3	6.99	115.5	4.99
2031 Future Do Something (800 units)	124.8	7.21	116.9	5.30
2031 Future Do Something (1000 units)	140.1	10.09	118.3	5.61

4.17 Similarly to the existing roundabout, the proposed signal junction is forecast to be well over capacity with a DoS over 100% during the 2031 future baseline scenario. Vehicle queues during this future scenario are predicted to reach around 90 vehicles (around 520 metres) for the A258 London Road NW approach in the morning peak. It is therefore considered that such a junction arrangement will not be able to adequately accommodate any additional traffic from development above the core strategy.

Option 2 – Signal Controlled junction (with banned right turn from Manor Road)

4.18 The signal controlled junction for option 2 is based on the option 1 junction highlighted above but with a banned right turn from Manor Road. This junction has also been modelling by using LINSIG. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.19 **Figure 4.7** shows a summary of the LINSIG junction capacity assessment results for the existing, future baseline and a number of future do-something scenarios ranging from 200 to 1,000 residential units. The graph highlights queues for the most critical approaches during the AM peak (London Road NE approach) and PM peak (London Road NW approach).

4.20 **Table 4.3** also provides details of the maximum DoS and average delay per vehicle for the critical give way approaches and each future scenario.

Figure 4.7: A258 London Road / Manor Road
(Option 2 - Signal Controlled Junction with right turn ban from Manor Road)

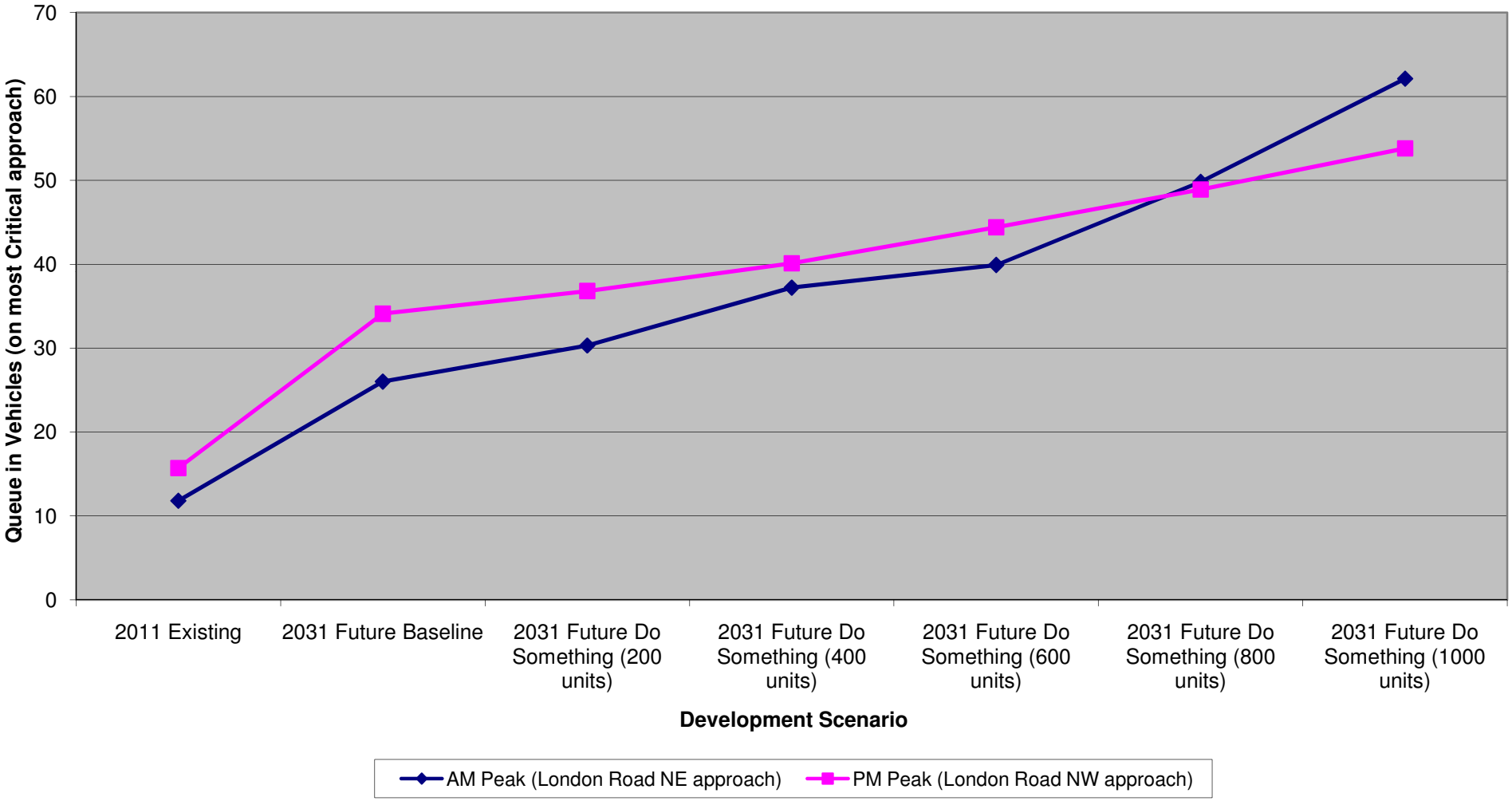


Table 4.3: A258 London Road / Manor Road (Signal Controlled Junction with banned right turn from Manor Road) – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max DoS (%)	Average Delay (min per Vehicle)	Max DoS (%)	Average Delay (min per Vehicle)
2011 Existing	66.8	0.39	74.0	0.37
2031 Future Baseline	95.4	1.07	97.4	0.99
2031 Future Do Something (200 units)	96.5	1.16	98.6	1.12
2031 Future Do Something (400 units)	100.2	1.43	99.8	1.28
2031 Future Do Something (600 units)	101.5	1.87	101.1	1.50
2031 Future Do Something (800 units)	103.8	2.16	102.3	1.74
2031 Future Do Something (1000 units)	106.6	2.85	103.5	2.00

4.21 This proposed signal junction option is forecast to be over capacity in the AM peak with a DoS over 100% if 400 residential units are developed. Vehicle queues for this future scenario are predicted to reach around 30 vehicles (around 180 metres) for the A258 London Road NW approach. It is therefore considered that this junction arrangement option would not be able to adequately accommodate traffic from more that 400 residential units developed above the core strategy.

Option 3 – Larger Scale Signal Controlled Junction

4.22 The proposal to provide a larger scale signal control junction, as shown in Figure 4.3, has been assessed by using LINSIG. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.23 **Figure 4.8** shows a summary of the LINSIG junction capacity assessment results for the existing, future baseline and a number of future do-something scenarios ranging from 200 to 1,000 residential units. The graph highlights queues for the London Road northeast and northwest approaches during the AM and PM peak periods.

4.24 **Table 4.4** also provides details of the maximum DoS and average delay per vehicle for the critical approaches and each future scenario.

Figure 4.8: A258 London Road / Manor Road
(Option 3 - Larger Signal Controlled Junction)

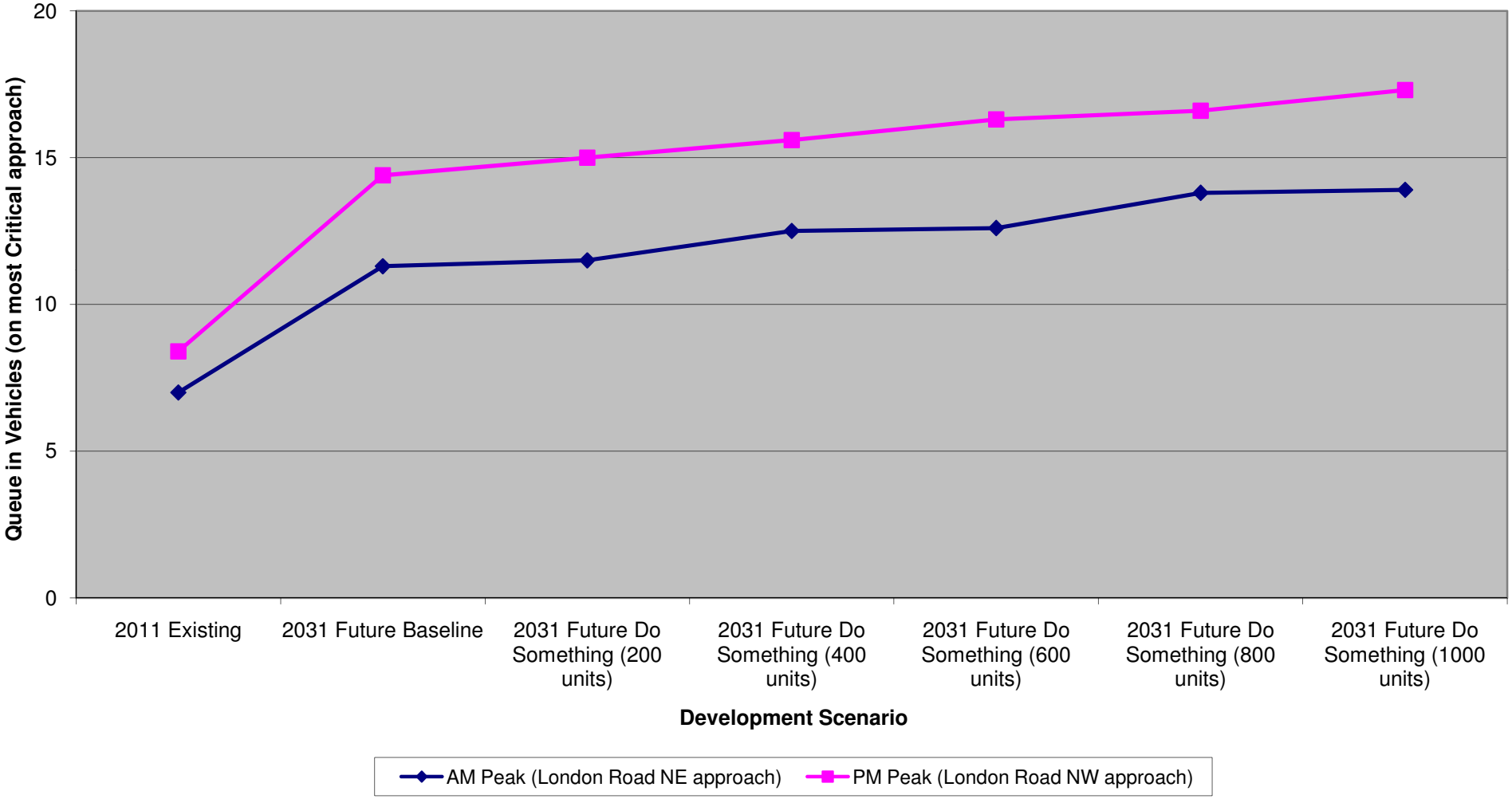


Table 4.4: A258 London Road / Manor Road (Larger scale Signal Controlled Junction) – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max DoS (%)	Average Delay (min per Vehicle)	Max DoS (%)	Average Delay (min per Vehicle)
2011 Existing	59.1	0.32	63.7	0.55
2031 Future Baseline	81.9	0.47	82.7	0.72
2031 Future Do Something (200 units)	82.3	0.50	83.1	0.31
2031 Future Do Something (400 units)	82.3	0.50	84.1	0.32
2031 Future Do Something (600 units)	85.8	0.57	85.1	0.33
2031 Future Do Something (800 units)	85.8	0.57	86.1	0.34
2031 Future Do Something (1000 units)	89.5	0.68	87.1	0.36

4.25 The assessment results indicate that for all future scenarios the junction will operate within its practical reserve capacity. It is therefore considered that no residual queuing will occur at the junction (i.e. all vehicles should be able to discharge across the stopline within one traffic cycle) and the junction can adequately accommodate additional traffic if 1,000 residential units were developed above the core strategy.

Option 4 – Upgraded Roundabout

4.26 The proposal to provide a larger scale roundabout junction, as shown in Figure 4.4, has been assessed by using ARCADY. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.27 **Figure 4.9** shows a summary of the ARCADY junction capacity assessment results for the existing, future baseline and a number of future do-something scenarios ranging from 200 to 1,000 residential units. The graph highlights queues for the London Road northeast and northwest approaches during the AM and PM peak periods.

4.28 **Table 4.5** also provides details of the maximum RFC and average delay per vehicle for the critical approaches and each future scenario.

Figure 4.9: A258 London Road / Manor Road
(Option 4 - Larger Scale Roundabout)

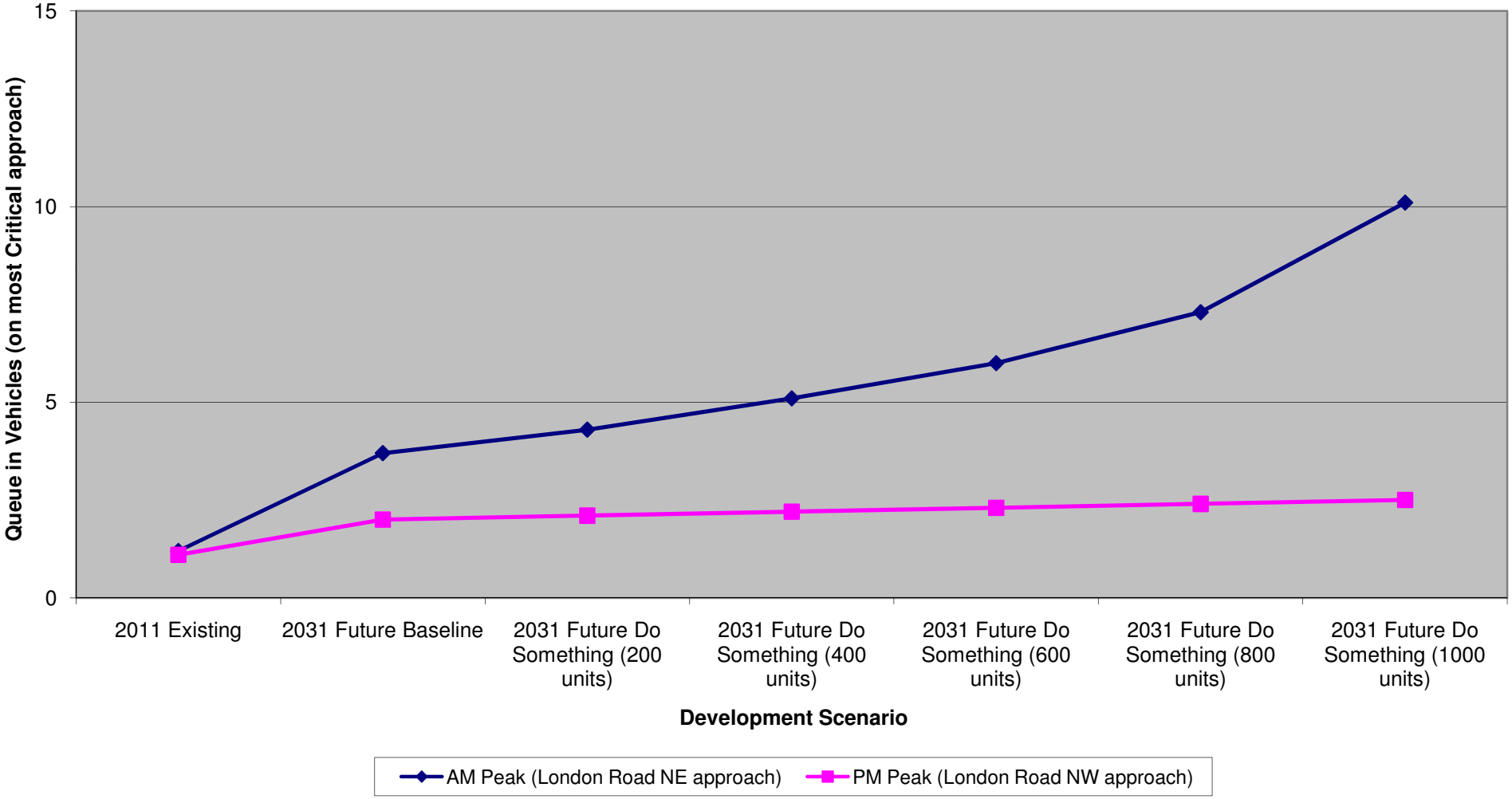


Table 4.5: A258 London Road / Manor Road (Larger scale Signal Controlled Junction) – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max RFC	Average Delay (min per Vehicle)	Max RFC	Average Delay (min per Vehicle)
2011 Existing	0.549	0.11	0.516	0.07
2031 Future Baseline	0.799	0.20	0.677	0.10
2031 Future Do Something (200 units)	0.824	0.22	0.685	0.10
2031 Future Do Something (400 units)	0.851	0.25	0.693	0.11
2031 Future Do Something (600 units)	0.875	0.28	0.702	0.11
2031 Future Do Something (800 units)	0.900	0.31	0.710	0.11
2031 Future Do Something (1000 units)	0.938	0.39	0.718	0.11

4.29 This assessment indicates that for all future scenarios the junction will operate within its capacity. It is therefore considered that the junction can adequately accommodate additional traffic if 1,000 residential units were developed above the core strategy.

Priority Junctions (A258 London Road / Mongeham Road, A258 London Road / Albert Road, A258 Dover Road / Cornwall Road)

4.30 The future operational performance of the Mongeham Road, Albert Road and Cornwall Road existing priority junctions with the A258 have all been assessed by using the standard junction modelling software PICADY. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.31 **Figures 4.10 to 4.12** shows a summary of the assessment results with the forecast queues for each of the give way approaches under a number of future scenarios. To provide a further understanding of how these junctions are likely to operate, **Tables 4.6 to 4.8** also provides details of the maximum RFC and average delay per vehicle for each give way approach and future scenario.

4.32 Based on these capacity assessment results the following conclusions have been drawn.

- **A258 London Road / Mongeham Road.** Significant delays will occur during the AM peak period with queues of around 13 vehicles (about 80 metres) if 500 residential units are developed. Furthermore at this level of development it is estimated the junction operates above its theoretical capacity. It is therefore clear that some form of junction improvements will be required if development is to be above 500 units.

Figure 4.10: A258 London Road / Mongeham Road (Existing Junction Layout)

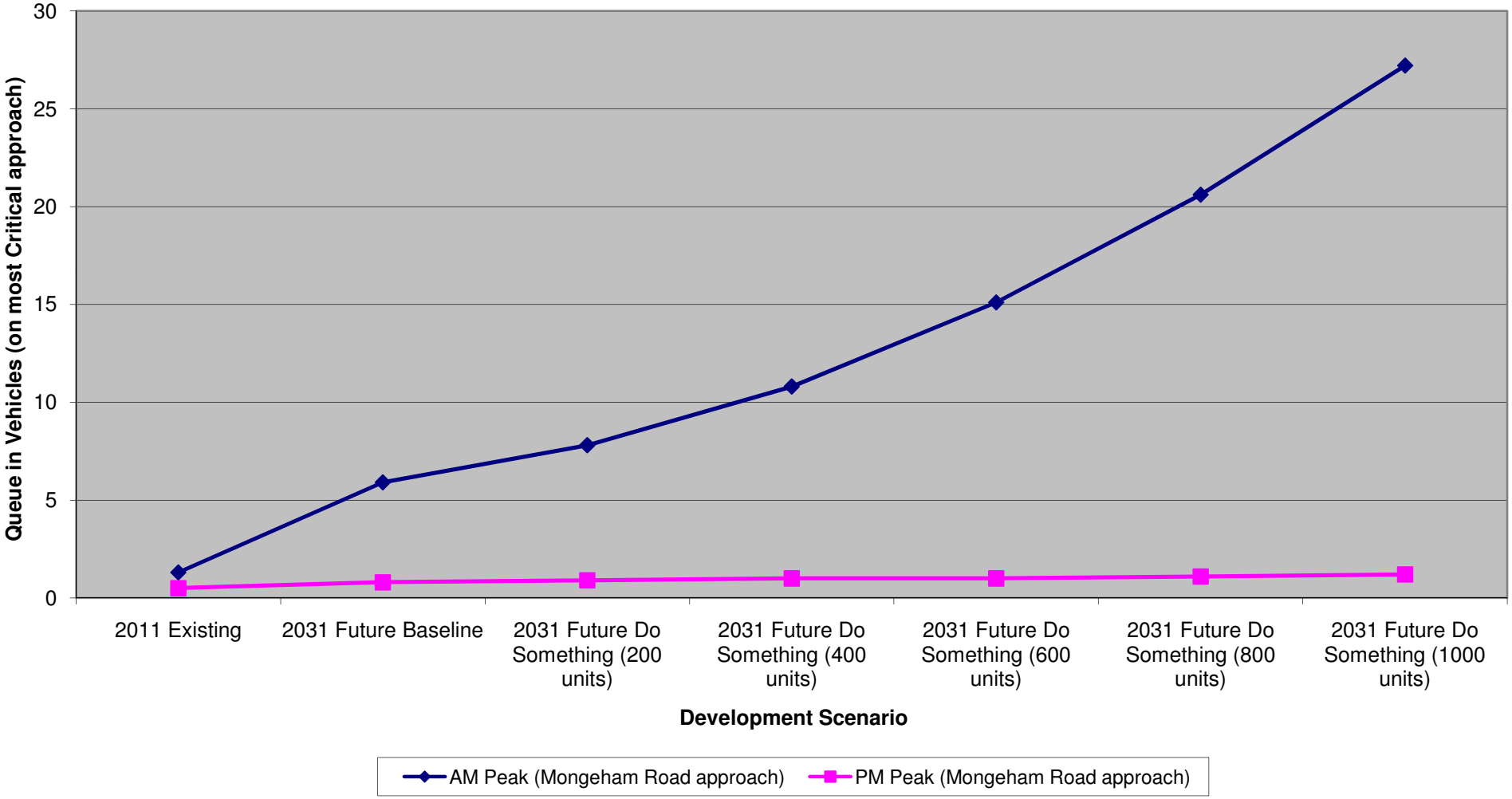


Figure 4.12: A258 Dover Road / Cornwall Road
(Existing Junction Layout)

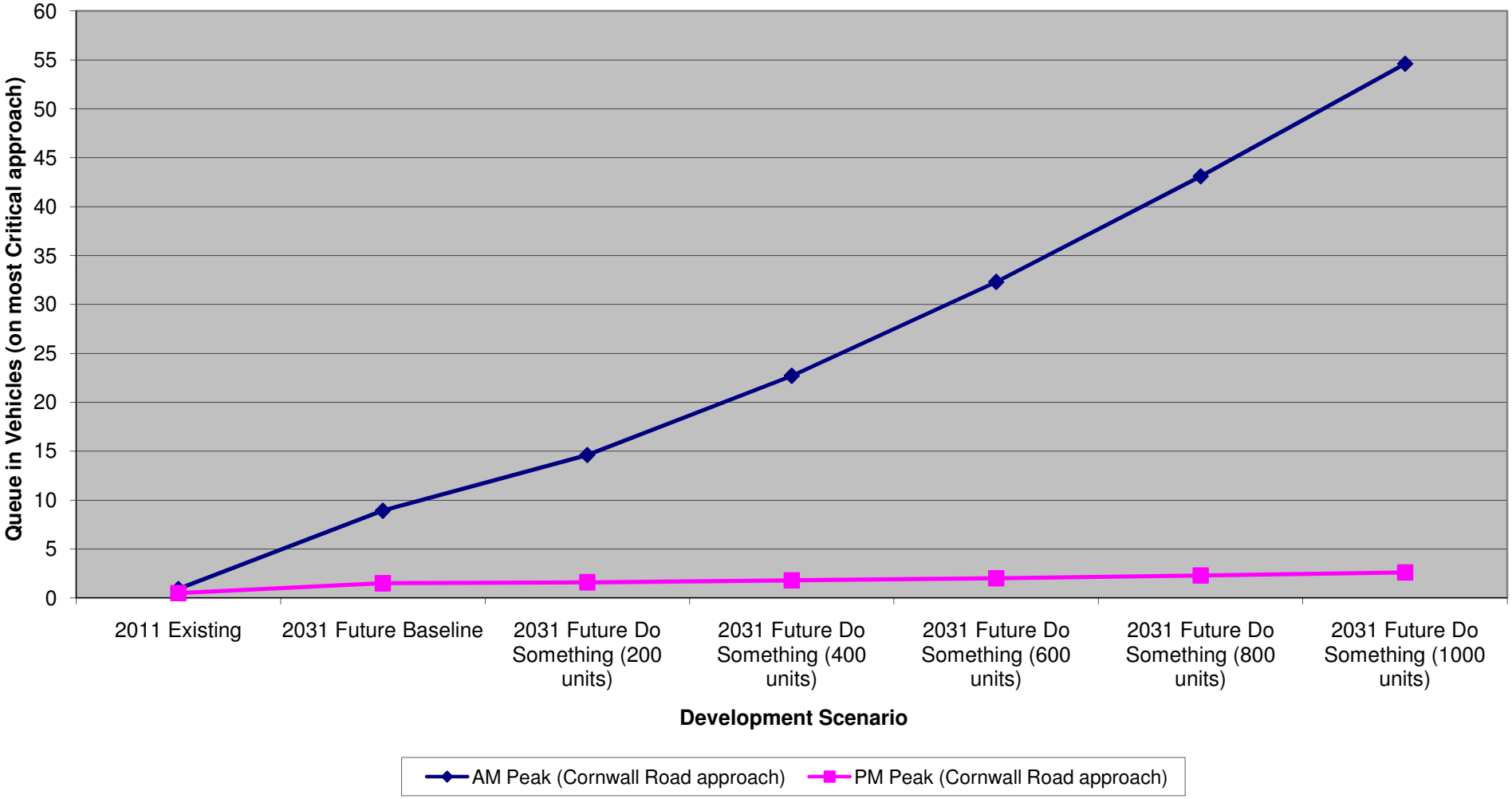
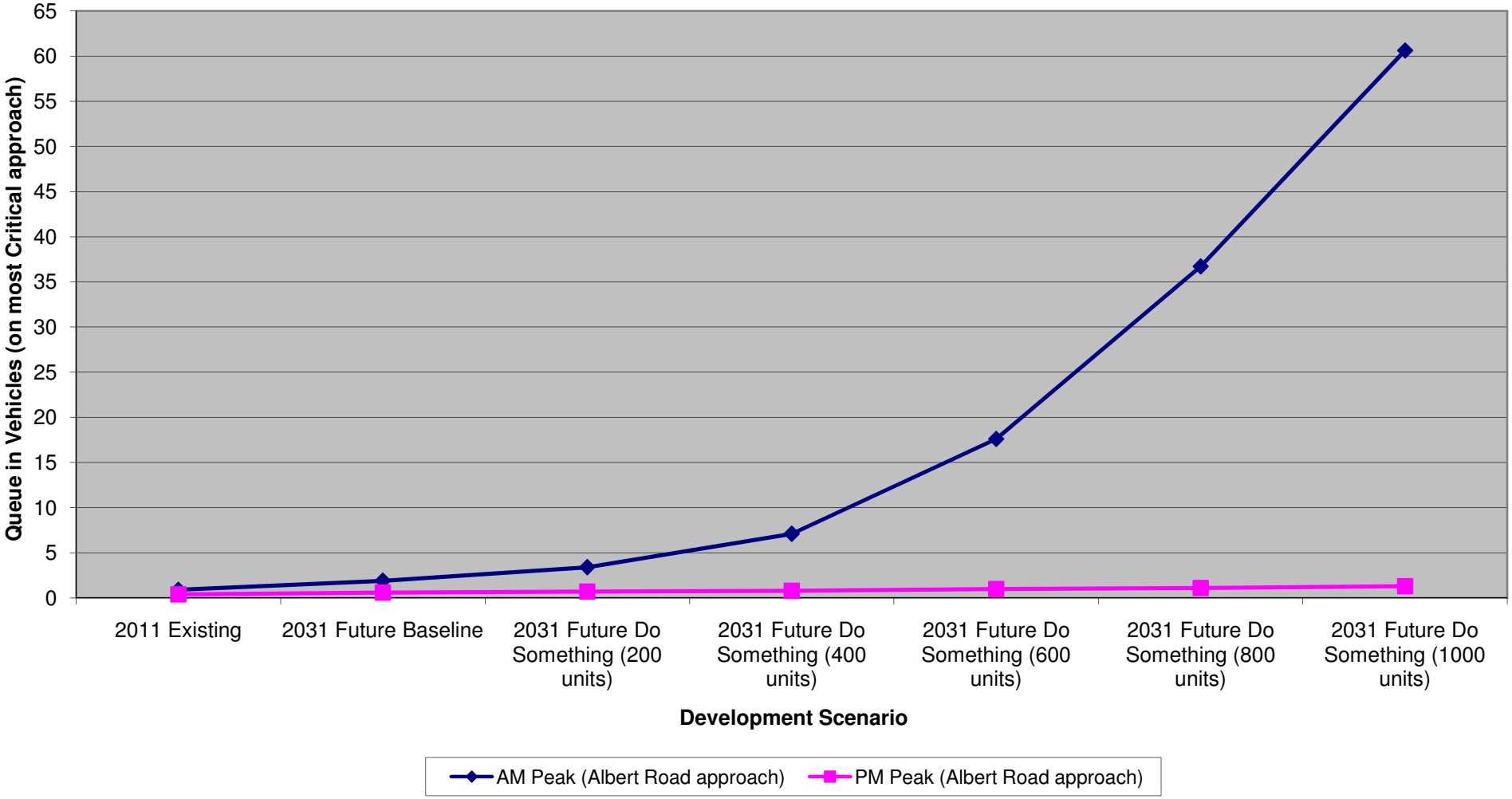


Figure 4.14: A258 London Road / Albert Road
(Existing Junction Layout)



- **A258 London Road / Albert Road.** Significant delays are forecast during the AM peak with vehicles queues around 15 to 20 vehicles (around 90 to 120 metres) if 600 residential units were developed. Similarly to the Mongeham Road junction, it is estimated that the junction will reach 1.0 RFC at around 500 residential units and above this level of development, junction improvements will be required.
- **A258 Dover Road / Cornwall Road**. Very little development traffic can be accommodated within this junction if it's to remain in operation within capacity. Vehicle queues rise steady from the 2031 Future Baseline AM peak scenario with around a 15 vehicle queue at the 200 unit level. In terms of capacity, it is estimated the junction will go above 1.0 RFC with only 100 residential units developed and above this level, junction improvements will be required.

Table 4.6: A258 London Road / Mongeham Road – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max RFC	Delay (min per Vehicle)	Max RFC	Delay (min per Vehicle)
2011 Existing	0.563	0.23	0.353	0.20
2031 Future Baseline	0.891	0.58	0.462	0.23
2031 Future Do Something (200 units)	0.938	0.70	0.478	0.24
2031 Future Do Something (400 units)	0.988	0.87	0.493	0.25
2031 Future Do Something (600 units)	1.045	1.13	0.509	0.26
2031 Future Do Something (800 units)	1.108	1.49	0.526	0.27
2031 Future Do Something (1000 units)	1.179	2.00	0.543	0.28

Table 4.7: A258 London Road / Albert Road – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max RFC	Delay (min per Vehicle)	Max RFC	Delay (min per Vehicle)
2011 Existing	0.482	0.22	0.294	0.17
2031 Future Baseline	0.671	0.33	0.396	0.20
2031 Future Do Something (200 units)	0.791	0.44	0.429	0.21
2031 Future Do Something (400 units)	0.914	0.65	0.464	0.23
2031 Future Do Something (600 units)	1.039	1.19	0.499	0.24
2031 Future Do Something (800 units)	1.167	2.57	0.535	0.25
2031 Future Do Something (1000 units)	1.297	4.70	0.573	0.27

Table 4.8: A258 Dover Road / Cornwall Road – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	Max RFC	Delay (min per Vehicle)	Max RFC	Delay (min per Vehicle)
2011 Existing	0.483	0.27	0.319	0.21
2031 Future Baseline	0.961	0.91	0.606	0.36
2031 Future Do Something (200 units)	1.038	1.30	0.631	0.38
2031 Future Do Something (400 units)	1.119	1.98	0.657	0.40
2031 Future Do Something (600 units)	1.203	2.98	0.683	0.43
2031 Future Do Something (800 units)	1.291	4.29	0.710	0.45
2031 Future Do Something (1000 units)	1.381	5.84	0.738	0.49

4.33 Given the existing A258 junction with Cornwall Road is forecast to operate over capacity in the morning peak hour if only 100 to 200 residential units are developed, the potential to upgrade it's capacity by installing signal controlled junction within the existing highway boundary has been further investigated.

4.34 Such an upgraded signal junction has been assessed by using the modelling software LINSIG. The results, which are included within Appendix A in this note, indicate that the junction will operate below 100% DoS for the 2031 AM and PM peak future scenario with 1,000 residential units developed. It is therefore considered that this junction would be able to adequately accommodate additional traffic from such a level of development.

A258 London Road / Queen Street / West Street

4.35 The future operational performance of the existing A258 London Road / Queen Street / West Street signal controlled junction has been assessed by using the modelling software LINSIG. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.36 **Figure 4.13** shows a summary of the LINSIG junction capacity assessment results for the existing, future baseline and a number of future do-something scenarios ranging from 200 to 1,000 residential units. The graph highlights queues for the Queen Street eastbound and westbound approaches during the AM and PM peak periods.

4.37 **Table 4.9** also provides details of the maximum DoS and average delay per vehicle for the critical approaches and each future scenario.

Table 4.9: A258 London Road / Queen Street / West Street – Summary of Junction Assessment Results

Modelled Scenario	AM Peak (Queen Street Eastbound)		PM Peak (Queen Street Westbound)	
	DoS (%)	Delay (min per Vehicle)	DoS (%)	Delay (min per Vehicle)
2011 Existing	56.1	0.45	62.6	0.64
2031 Future Baseline	70.8	0.50	81.3	0.91
2031 Future Do Something (200 units)	72.5	0.50	82.2	0.80
2031 Future Do Something (400 units)	74.3	0.51	84.4	0.85
2031 Future Do Something (600 units)	76.0	0.52	83.6	0.82
2031 Future Do Something (800 units)	77.7	0.53	85.9	0.87
2031 Future Do Something (1000 units)	79.4	0.54	85.4	0.84

4.38 This assessment indicates that for all future scenarios the junction will operate within its capacity. It is therefore considered that the junction can adequately accommodate additional traffic if 1,000 residential units were developed above the core strategy.

A258 Queen Street / West Street / St Blenheim Road / Station Access
(Existing Junction Layout)

Albert Road / New Development Access Road

4.39 In earlier work for this study a number of potential highway options to support development growth for Deal have been identified, one of which being a new road link between Albert Road (north of Bridgeside Junction) and Minters Yard.

4.40 At this location there is a planned improvement to the current access junction based on the introduction of a priority junction. However, it is unlikely that such junction arrangement would have sufficient capacity to deal with significant volumes of development traffic, especially given the complexities associated with being in close proximity to the existing railway level crossing.

4.41 Therefore as part this note, a new signal control junction has been designed which should free up the opportunity for development to have a new road access, improving access to North and Middle Deal and alleviating pressure on Southwall Road.

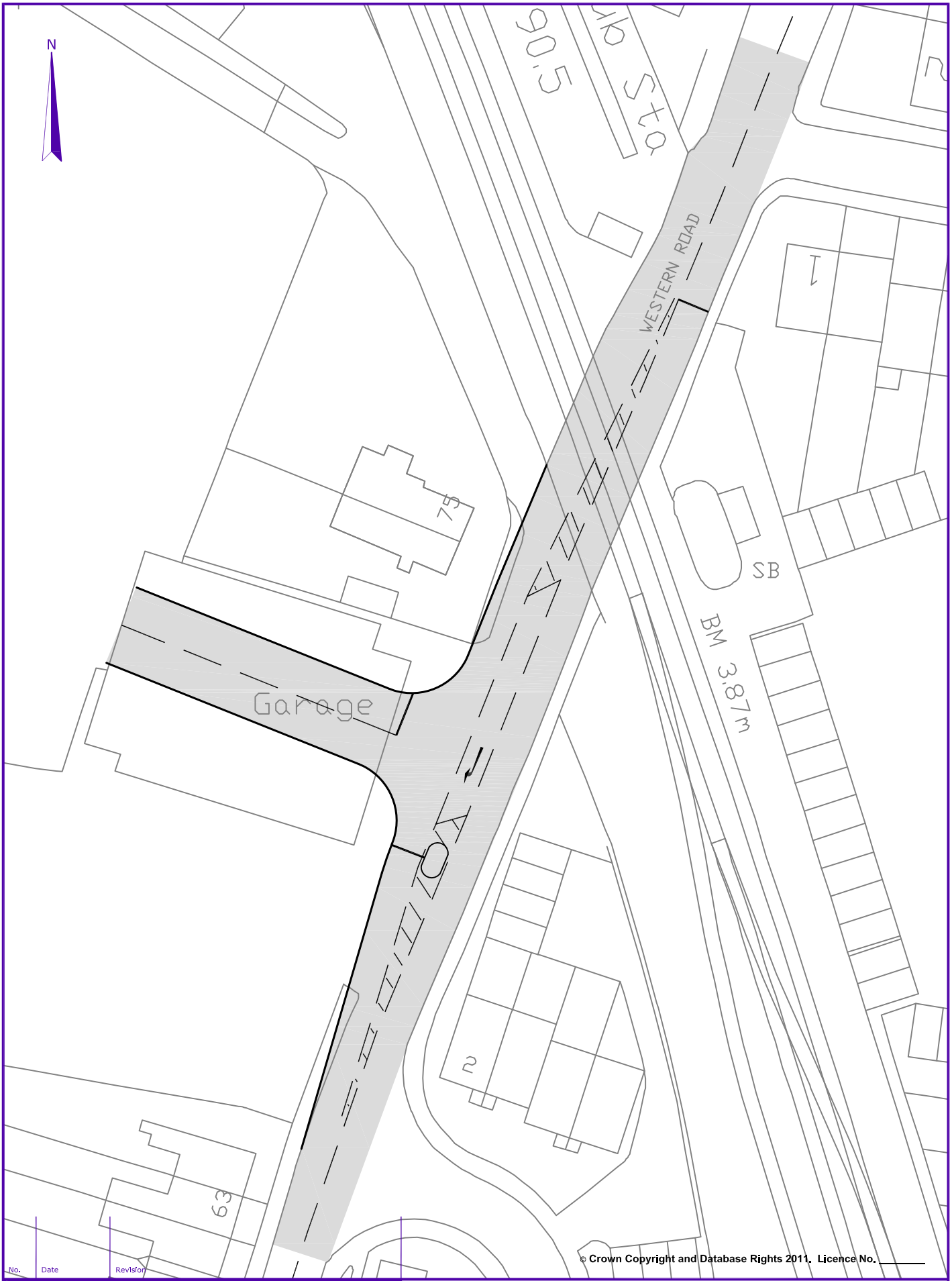
4.42 **Figure 4.14** shows the proposed junction design. On Albert Road southbound approach the stopline has been positioned at the same location as the existing level crossing lights, i.e. upstream from the crossing. This together with a sufficient right turn pocket will minimise the possibility of vehicles queuing internally within the junction, thus removing potential safety concerns with vehicles queue over the crossing.

4.43 The future operational performance of this junction has been assessed by using the standard signal control junction modelling software LINSIG. Full details of the junction assessment outputs are included within **Appendix A** in this note.

4.44 It should be noted that to allow for the effects of the railway crossing on the capacity of the junction a certain amount of lost time has been assumed. For the purpose of this note it has been assumed that 20 minutes during every hour period will be lost to the railway crossing. This based on the crossing being activated 10 times per hour and for two minutes at a time.

4.45 **Figure 4.15** shows a summary of the assessment results with the forecast queues for most critical approach (Albert Road northbound) in terms of vehicle delays. **Table 4.10** also provides the maximum DoS and average delay per vehicle for this approach with each future scenario.

4.46 The results indicate that with 1000 residential units developed the proposed signal controlled junction will operate well within its practical reserve capacity. It is therefore considered that no residual queuing will occur and that it should be able to accommodate development traffic.



Deal Flood and Transport Alleviation Model Study

Prepared for Dover District Council
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Title
Proposed Albert Road / New Development Access Road Junction

Project No.	Figure No./Drawing No.	Rev No.	Scale
C3A340/02	Figure 4.13	-	1:500 at A4

Drawn	SW
Designed	GS
Approved	KM

mvaconsultancy

Figure 4.11: Albert Road / New Development Access (Proposed All Movement Signal Control Junction)

Table 4.10: Albert Road / New Development Access – Summary of Junction Assessment Results

Modelled Scenario	AM Peak		PM Peak	
	DoS (%)	Delay (min per Vehicle)	Dos (%)	Delay (min per Vehicle)
2011 Existing	37.9	0.35	22.6	0.27
2031 Future Baseline	38.3	0.34	25.5	0.28
2031 Future Do Something (200 units)	46.7	0.42	28.8	0.29
2031 Future Do Something (400 units)	54.1	0.49	32.9	0.30
2031 Future Do Something (600 units)	61.1	0.54	37.2	0.33
2031 Future Do Something (800 units)	69.0	0.62	41.7	0.33
2031 Future Do Something (1000 units)	75.2	0.69	46.5	0.37

5 Wider Network Improvements

5.1 The above analysis focuses on specific 'hotspot' junctions where there is known peak period traffic pressure today or envisaged pressure in the future. However, in a complex and constrained highway network like that which has evolved in Deal, ease of movement from one point to another is affected by many factors. For example, at the micro-level, poorly located parking or out of date signal timings can have a significant bearing on the reliability of journey times. Some specific examples of constraints in Deal are listed below:

- On street parking is resulting in reduced highway capacity at certain points throughout the network, most notably during peak times. For example on the A258 in Sholden, opposite Sholden Primary School;
- A number of poorly located bus stops are resulting in reduced highway capacity. For example on the A258 north of Manor Road roundabout, where stopped buses lead to vehicles blocking back into junction;
- Localised traffic congestion due to poor positioning of some pedestrian crossings, for example A258 London Road adjacent to the Manor Road Roundabout;
- Insufficient space for right turning vehicles at junctions can lead to congestion at certain locations across the network. For example on the A258 / Mongeham Road, A258 / Cornwall Road and A258 / West Street;
- A number of directional signs are poorly positioned. For example London Road / Manor Road roundabout;

- Refuse and servicing vehicles operating during peak times can reduce highway network capacity;
- School drop off/pick up activities are resulting in localised congestion. For example along A258 outside Sholden Primary School;
- Parking locations on key routes on the network should be managed appropriately to reduce impact on highway capacity and road safety. Measures should also implemented to encourage more sustainable modes of travel to reduce the need for parking;
- Bus stops near junctions and in areas where vehicle visibility is poor or passing opportunities are unsafe should be relocated further from junctions to the nearest suitable location. Bus stop locations should be reviewed to ensure they are not impacting on capacity of junctions;
- Pedestrian crossing locations across the network should be reviewed and propose repositioning where crossings do not impact on junction capacity and safety. Some pedestrian crossings can also be incorporated into upgraded signalised junctions.

5.2 A proven technique for improving the local highway network for all road users is to address specific problem areas in an holistic way using a corridor approach. This involves reviewing the use of the street by all road users and brings together principles of traffic management, urban design and street de-cluttering to create a more efficient space. Such an approach can be highly effective and helps create a better sense of place.

5.3 It is therefore recommended that alongside selective capacity enhancements at bottleneck junctions, the transport strategy for Deal includes a range of corridor treatments to address local constraints, provide positive measures for non car modes (see below) and enhance the quality of the public realm.

6 Encouraging Sustainable Travel

6.1 New development provides an opportunity to encourage behavioural change in the way people travel. At a strategic level the creation of mixed use development can help reduce commuting and place key services and facilities within a short distance of new homes thereby increasing opportunities for walking and cycling. With good IT infrastructure the opportunities for home working can be maximised; this, coupled with increasingly flexible working arrangements can reduce the traffic pressure during the traditional morning and evening rush hours.

6.2 Development in the Middle/North Deal area is within a 20 minute walk of the town centre. In order to capitalise on this position and encourage more trips to be made on foot, the routes into town should be audited to ensure that they are safe, direct well lit, legible and well maintained. Similarly, the town is highly accessible by bicycle and benefits from the presence of a number of local cycle routes together with National Cycle Route 1. This provides a good footing on which to build more positive cycle facilities into the fabric of the town, through for example, the creation of a wider network of signed routes, provision of more cycle lanes and the introduction of more secure cycle parking.

6.3 Good public transport services are also essential to encouraging more sustainable travel. Middle/North Deal is not currently well served by buses and the strategy should include steps to ensure regular, reliable bus connections to the town centre and surrounding area. There would appear to be an opportunity to serve the development area by diverting or enhancing the

existing cross-town routes. This could provide a connection to the town centre and railway station as well as a link to towns such as sandwich and Canterbury. Initial soundings with the local bus operator have indicated that this sort of arrangement could be self-sustaining and not require subsidy from the local authority.

6.4 Travel Demand Management (TDM) also has a modest but important role to play in the future transport strategy for Deal. TDM covers a wide range of measures that are designed to influence travel behaviour and ultimately reduce the pressure of traffic in towns. Of most relevance to Deal are likely to be residential travel plans, workplace travel plans, off peak servicing, school travel plans, home deliveries, and parking controls/management.

6.5 The overall effect of the measures discussed above could be a reduction in car use in the range of 5-15%

7 Summary and Conclusions

7.1 This assessment has considered traffic conditions relating to varying levels of development beyond LDF Core Strategy commitments in the year 2031. The basis of the assessment is the emerging EFS that seeks to link the development area into the existing road network via a number of connection points thereby creating multiple routeing options for traffic that spread the load and reduce impacts at individual junctions. The EFS includes a new connection to the development area via Albert Road and a new link across the railway (bridge or level crossing) to the north of the existing crossing at Northwall Road.

7.2 Predicting travel behaviour some 20 years into the future is not an exact science particularly given the rising cost of fossil fuels and the global drive towards carbon reduction. However, based on established good practice in Transport Assessment it has been possible to identify the quantity of development that could be supported within the capacity of the highway network as it stands or with selective local highway improvement measures.

7.3 The broad conclusions of the assessment are as follows:

- There will be significant growth of around 15% to 20% in traffic between the present day and 2031 due to the effects of LDF Core Strategy commitments, other consented development and general increases in background traffic. This will push some junctions within the network to or beyond capacity prior to any additional development. Most notably this applies to the highly constrained A258 London Road/Manor Road which carries the vast majority of traffic movements to and from areas to the north of Deal. It also applies to the A258 Dover Road/Cornwall Road junction which forms part of an important movement corridor to the south;
- Improvement options are available at the aforementioned junctions but some require third party land;
- Other traffic sensitive junctions in the network such as the A258 London Road junctions with Mongeham Road and Albert Road have the capacity to accommodate the additional traffic demands of some 400 to 500 housing units in their current configuration or with minor modifications;

- With more significant improvements at the traffic sensitive junctions, new development in excess of 1000 units could potentially be accommodated but the risk associated with delivery of these improvements is significantly higher;
- Alongside selective capacity enhancements at bottleneck junctions, a range of 'corridor style' treatments should be considered to address local constraints, provide positive measures for non-car modes and enhance the quality of the public realm;
- The active promotion of non-car modes, specifically walking, cycling and bus use, coupled with the appropriate use of Travel Demand Measures will be important in checking the growth of traffic in the coming years;
- Peak spreading, mode shift away from the private car and sensitivities within the analysis could potentially reduce the 2031 traffic demands tested in this assessment by up to 10%. This would give some headroom in the levels of development quoted above.

Appendix A – Junction Modelling Output

A258 London Road / Manor Road – Option 1

A258 London Road / Manor Road – Option 2

A258 London Road / Manor Road – Option 3

A258 London Road / Manor Road – Option 4

A258 Dover Road / Cornwall Road – Upgraded Signal Control Junction

mvaconsultancy

A258 London Road / Queen Street / West Street

mvaconsultancy

Deal Transport and Flood Alleviation Model Study

Future Provision of Utilities

1. Context and Purpose of the Report

1.1 The existing utility infrastructure provides adequate service to the existing urban area however, particularly for surface water drainage, at times of high stress the current system operates at or close to capacity.

1.2 As such there is the potential for the capacity of utilities infrastructure to act as a constraint on the future development capacity of North and Middle Deal, particularly as the capacity of existing networks is finite.

1.3 Whilst utility capacity assessments were undertaken as part of the LDF process it is unclear whether any growth beyond the Core Strategy level can be accommodated, particularly given the time elapsed since these assessments were undertaken and the issues identified at the time.

1.4 The purpose of this Report is to review the potential issues facing utilities provision in the future, particularly with relation to opportunities for new development north of the existing urban area. In consultation with utility infrastructure providers it considers at a strategic level the future provision of:

- Water Supply
- Waste Water & Drainage
- Electricity
- Gas

1.5 Each provider has been contacted and a set of key questions posed in order to understand the extent of existing issues, future investment planning and future requirements. The questions asked of providers were:

- Any capacity issues you have identified which exist currently within or close to the Study area;

- The growth assumptions built in to your capacity modelling;
- Future issues which are likely to be caused/exacerbated by further development within the area of search; and
- Planned future upgrades to the existing network and likely delivery dates.

1.6 It should be noted that given the nature of the DTFAM Study, and the stage at which consultation with utilities providers was undertaken, all consultees highlighted their ability to only consider potential issues at a strategic level. They advised further consultation once specific development proposals and site plans had been developed, which extends beyond the scope of this Study, in order to identify any site specific constraints and considerations.

1.7 As such all comments within this report provide an overview of utility provision issues relating to any new development in the area north of Deal between the A258 and the Royal Cinque Ports Golf Course.

2. Summary Assessment

Utility	Existing Constraints	Planned Upgrades	Planned Period	Additional Requirements
Water Supply	None	Continued bulk transfer to Deal reservoir. Universal metering.	2014	Potential new connections to supply network if capacity limited.
Waste Water	Capacity of combined sewers and surface water drainage network.	Maintenance and clearance of ditch network – Stour IDB.	2014	Alternative surface water discharge methods. Potential new sewer/pumping capacity. Potential treatment facilities upgrade.
Electricity Supply	None	None	To 2021/22	Potential need to upgrade circuits and extend switchboard provision at Deal substation
Gas Supply	None	None	2026	Potential reinforcement main connection.

3. Water Supply

3.1 Contact: Susan Solba, Development Manager – Asset Management, Southern Water

3.2 Email following detailed questions via URS as part of Stage 1 baseline development. Review of Southern Water's Water Resources Management Plan (WRMP). The WRMP takes into account the planned level of growth within the Kent Thanet Water Resources Zone which covers Deal.

3.3 Investment plans span five year periods and are informed by the adopted Core Strategy. Sothern Water will submit their next investment proposal to Ofwat in 2014 as part of the five yearly periodic review of prices.

3.4 At present Southern Water have not identified any capacity issues which would restrict the delivery of new development north of Deal in terms of water supply or distribution through the mains system.

3.5 However, capacity is finite therefore the requirement for new infrastructure will be closely linked to the scale of development proposed. Where capacity is not sufficient to supply new development the developer will be responsible for funding the provision of new connections to the nearest point of sufficient capacity.

3.6 Given the nature of the area north of Deal new supply infrastructure will be required to connect the area to the existing network offsite. However, Southern Water have not identified, at this stage, any unusual or additional challenges within the area which would require investment beyond what is considered 'normal' for a new Greenfield development.

4. Waste Water

4.1 Contact: Susan Solba, Development Manager – Asset Management, Southern Water

4.2 Email following detailed questions via URS as part of Stage 1 baseline development. Review of Southern Water's Water Resources Management Plan (WRMP). The WRMP takes into account the planned level of growth within the Kent Thanet Water Resources Zone which covers Deal.

4.3 Investment plans span five year periods and are informed by the adopted Core Strategy. Sothern Water will submit their next investment proposal to Ofwat in 2014 as part of the five yearly periodic review of prices.

4.4 Much of Deal is covered by separate surface water and foul sewers, however there is some combined provision within north Deal, as such future development will be required to ensure different waste water sources are handled in the same manner.

4.5 An assessment of capacity completed in 2008 as part of the LDF process identified some limitations of capacity, particularly to the north west of Sholden, when proposed development locations were considered. Southern Water believe that, given the time elapsed, capacity may have been further eroded.

4.6 Therefore additional capacity is likely to be required for any development beyond Core Strategy levels, with pumping capacity and sewers provided on and off site to make a connection to the nearest point of identified capacity, this will be a cost paid by the developer. Dependant on the scale of growth there may also be a requirement to provide additional treatment capacity, which Southern Water are committed to providing. This will require development phasing to align with Southern Water's investment programme.

4.7 Future development will not be allowed to discharge surface water through existing foul or combined sewers to reduce the risk of system overloads in periods of high rainfall, as such alternative means of discharge will be a required part of site specific development proposals.

5. Electricity Supply

5.1 Contact: Tom Atkinson, Senior Project Designer, Connections, UK Power Networks

5.2 Initial Telephone conversation with follow up confirmation email of discussion.

5.3 Electricity for the area is supplied from the main 132/33kV grid connection at Betteshanger, which is then distributed from the Deal 33/11kV substation at Deal. Planning

Load Estimates for the substation take into account forecasts of 'organic' growth in demand (and hence load) in the area alongside any committed development UK Power Networks have been made aware of. These load projections run to 2021/22, no plans beyond this period exist.

5.4 Having compared the potential extent of new development under the recommended scenarios in the Stage 1 Report (i.e. up to 1,600 new homes) to the capacity beyond the Planning Load Estimates Uk Power Networks anticipate sufficient capacity exists within the current infrastructure for 1,600 non-electrically heated homes.

5.5 Without details of development site locations and boundaries UK Power Networks are not able to assess the capacity of 11kV circuits and therefore identify a potential requirement to provide new 'feeders' from the switchboard at the Deal substation. The provision of new circuit capacity may also require extension of the 11kV switchboard and switchroom to accommodate new circuit breakers at the Deal substation.

5.6 UK Power Networks do highlight the need to review capacity as specific development proposals are brought forward to ensure capacity identified at this point has not been used by other applications that come forward within Deal.

6. Gas Supply

6.1 Contact: Leigh Keegan, Network Support Manager – Third Party Connections, Scotia Gas Networks. Future contact Stephen Allison.

6.2 Email response to original request for information.

6.3 As the supplier of the main gas network Scotia take into account the growth plans adopted by Dover District Council into future modelling to generate a high, medium and low future demand rate, in order to review future infrastructure needs.

6.4 Gas supply to new development can be delivered in a number of ways, therefore making it impossible to cost requirements without specific development proposals and sites. To connect to the gas network a developer now has the opportunity to approach an

Independent Gas Transporter (IGT) to install infrastructure on a site to then be owned and operated by that IGT. Or, the developer can approach a Utility Infrastructure Provider (UIP) who will lay the mains and services for a Distribution Network (DN) such as Southern Gas Networks (SGN) to own and operate from that point forward.

6.5 Development north of Deal is likely to require laying a new reinforcement main. SGN would tend to support the provision which, subject to an Economic Test which takes into account future revenue and the benefit of supplying the main early, SGN will invariably fund the major elements of any works. The IGT or UIP also tend to contribute to new provision (although both have very different mechanisms for assessing value and the need to charge the developer for both on site and off site works) and therefore the developer may not need to contribute. However this is decided on a case by case basis.

6.6 Generally Dover District has good network coverage, as such Scotia do not anticipate significant issues with being able to provide a connection to the network. However, some local circumstances may exist, as such they recommend contacting IGTs or UIPs once sites, development types, phasing etc have been identified.

7. Impact & Conclusions

7.1 None of the utilities providers identified issues which extend beyond what may be expected for any development proposals of the scale and nature under investigation within the DTFAM Study.

7.2 In particular there were no immediate issues identified with regard to accommodating within the existing urban area, with sufficient capacity identified in all areas but the removal of surface water.

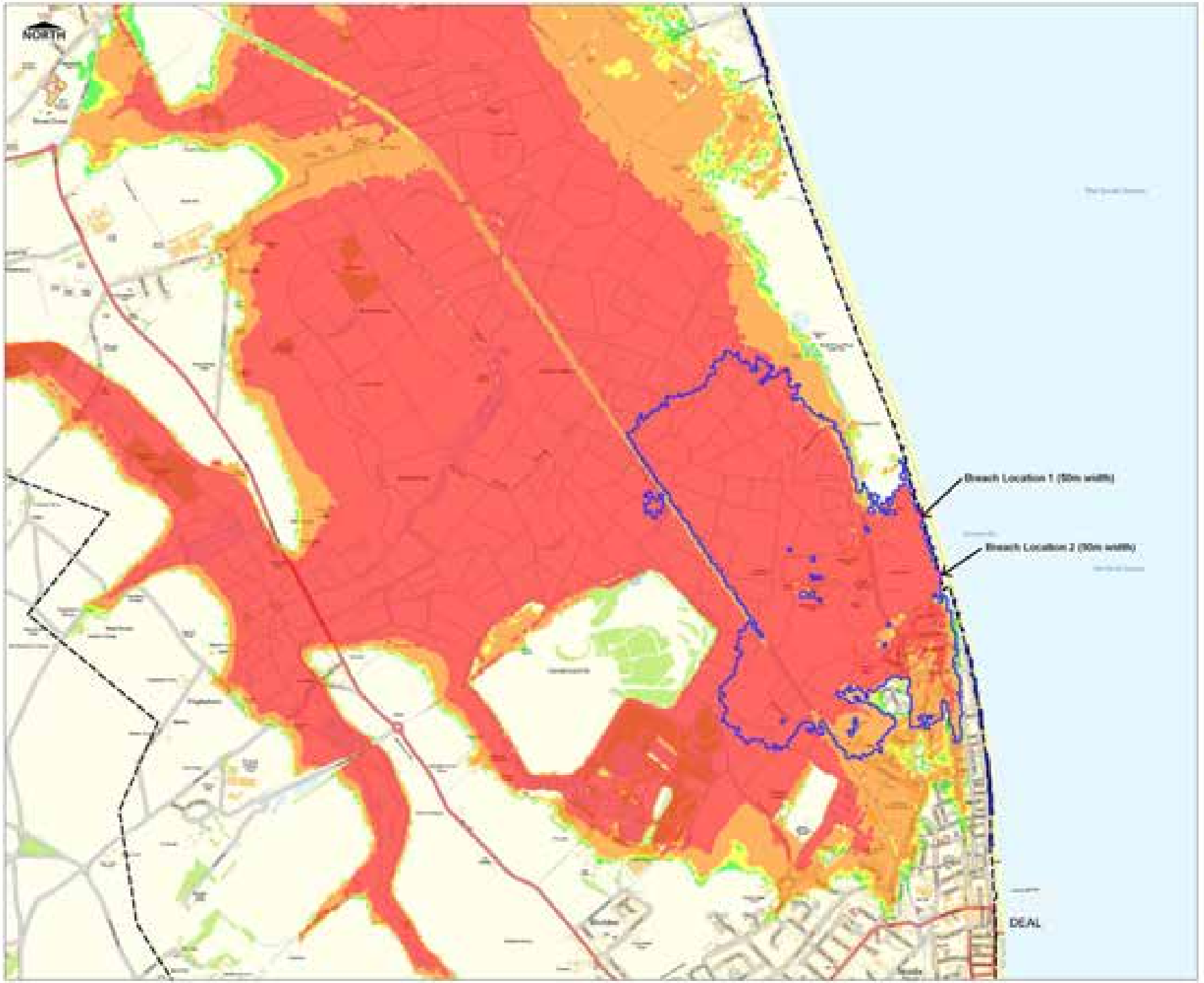
7.3 However, the core focus of the Study is the potential to accommodate development outside of the existing urban area on Greenfield sites to the north of North and Middle Deal. Given these sites have no existing utilities servicing new mains connections would need to be provided. Based on the strategic advice provided these are unlikely to extend beyond the scale of the 'usual' requirements of Greenfield development.

7.4 The key implications for the DTFAM Study moving forward is to ensure that sufficient cost estimates are included within high level cost and viability modelling to ensure the assessments are robust and appropriate for the nature of development proposed.

7.5 The major infrastructure requirement will be the provision of surface water dispersal systems to ensure existing sewers and drains do not become overloaded. This will require the incorporation of 'alternative' management methods such as sustainable urban drainage systems and, potentially, enhancements to the existing ditch and pumping network.

7.6 Further in to the future (and beyond the remit of this study) it will be important to maintain an ongoing dialogue with utilities providers. In the main they are committed to providing additional capacity as it is required, however site specific requirements can only be identified as individual sites are identified and the scale of development for each known.

7.7 The phasing of future development will also be important to ensure capacity can be supplied at the required point, particularly where providers will be required to meet some of the infrastructure delivery costs,



KEY

Model Boundary

Rapid Inundation Zone
(Areas shown to flood to a depth of 300mm within 30 minutes of a breach in the flood defence at location 1 or 2)

Maximum Flood Hazard Rating
(FD2320 EA & Defra 2005)

- Low
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

DEAL AAP FLOOD RISK MODELLING

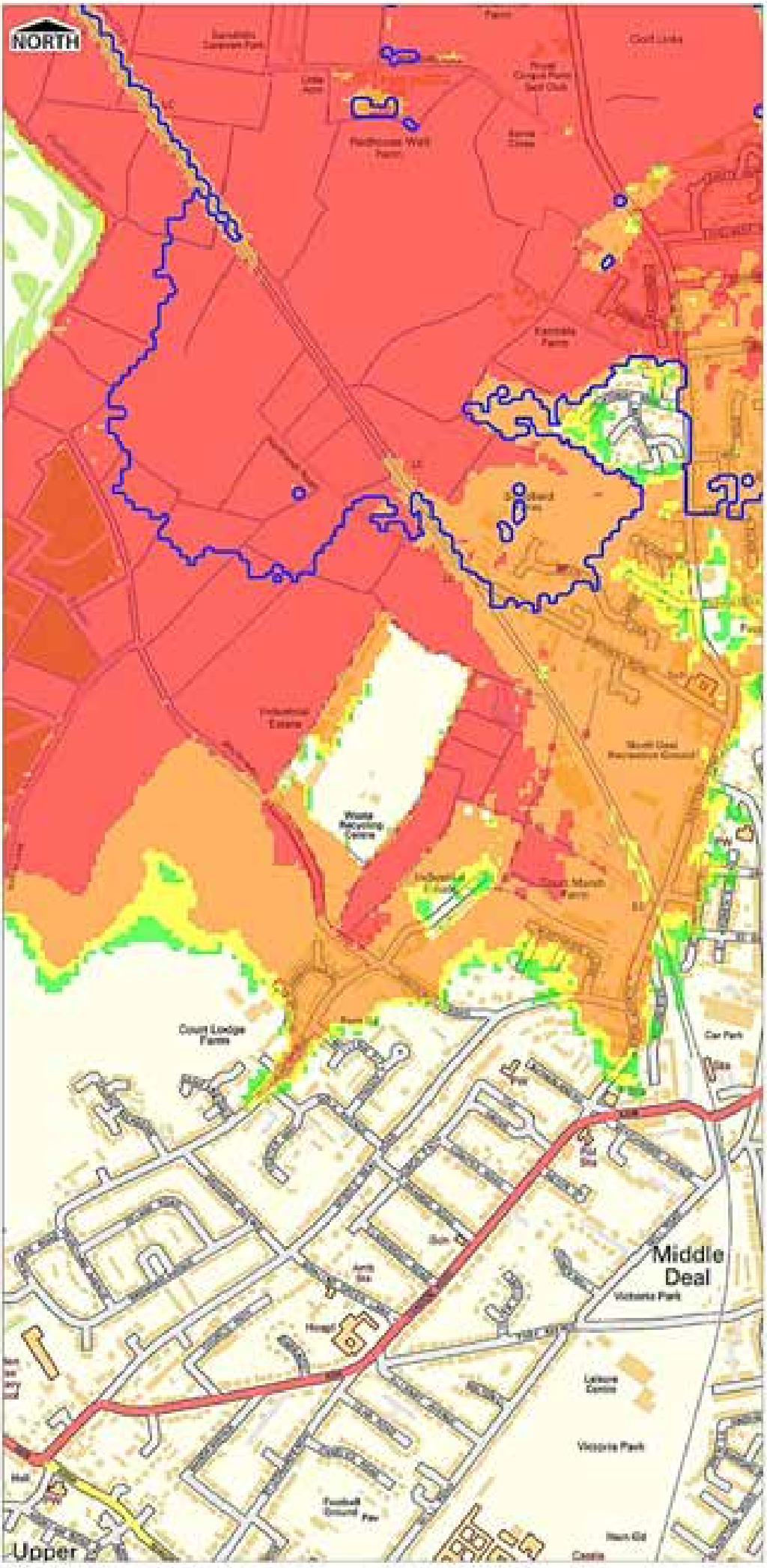
BREACHES 1 AND 2
MAXIMUM FLOOD HAZARD AND R.I.Z.
1 in 200 YR + CLIMATE CHANGE (2110)
(0.5% AEP 2110)

Dover District Council
White Cliffs Business Park
Dover, Kent CT16 3PJ

URS Infrastructure & Environment UK Ltd
St Dunstan's Plaza
London, SE1P 1PL
Tel: (020) 7798 5000

URS

FIGURE X.X



KEY

Model Boundary

Rapid Inundation Zone
(Areas shown to flood to a depth of 200mm within 30 minutes of a breach in the flood defence at location 1 or 2)

Maximum Flood Hazard Rating (FD2320 EA & Defra 2005)

- Low
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

TECHNICAL NOTE

Hydraulic modelling has been undertaken using 2-D hydraulic modelling software TuFlow (ver. TUFLOW-2011-05-AD-w32), to assess the effect of breaches at specified points and/or overtopping of defences.
This map presents the worst case flood hazard rating and rapid inundation zone (RIZ) across the flood cell, resulting from a breach in the flood defences at location 1 or location 2.

Breaches in the defence walls are modelled to occur 1 hour before the peak tidal level to ensure the potential impact of rapid inundation of floodwater. The breach is modelled to remain open for 36 hours.
Flood hazard is calculated as a function of the flood depth and flow velocity at a particular point in the floodplain, along with a variable debris factor and is based on the methodology from Flood Risks to People FD2320 (Defra & EA, 2005). These hazard classifications do not indicate a change in the flood probability. When using flood hazard maps, it should be noted that they represent the hazard arising from one or more specified breach locations, and that the rating will almost certainly vary spatially if the breach locations are in different local areas.
It should be noted that the breach width and depth, though based on EA guidance, are arbitrary and do not necessarily represent the actual dimensions of a potential breach at a given location.
A thorough description of methodology and assumptions is included within the Hydraulic Modelling Report (URS 2012).

FLOODABLE AREAS NOT SHOWN

Land adjacent to watercourses not included within this study. Areas susceptible to drainage system inadequacies or localised ponding. Areas flooded due to debris blockage unless where site specific structures. Areas flooded from alternative breach locations not included in this study.

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DEAL AAP FLOOD RISK MODELLING

BREACHES 1 AND 2
MAXIMUM FLOOD HAZARD AND R.I.Z.
1 in 200 YR + CLIMATE CHANGE (2112)
(0.5% AEP 2112)

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FIGURE X-X

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