Barnhorn Green

Infrastructure Technical Report

On behalf of **Marchfield (Strategic Land) Ltd.**

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1 Introduction

1.1 Purpose of Report

1.1.1 This report outlines the existing and proposed infrastructure that will facilitate development of a 25.5 hectare area of land west of Bexhill known as Barnhorn Green. It provides a summary of the pre-planning work and consultations undertaken in regard to transport, highways, utility services, flood risk and drainage. Sections are also provided on ground conditions, air quality, energy and programme.

1.1.2 Key information is presented in summary of investigations, preliminary design and consultations with authorities. Where consultations with authorities have been protracted and advice may have varied over time, the report focuses on the most current correspondence and position. The work summarised in this report was undertaken between 2011 and 2014.

1.1.3 This report has been prepared by Peter Brett Associates LLP for Marchfield (Strategic Land) Ltd (MSL) as a supporting technical document to the land marketing and sale process.

1.2 Development Proposals

1.2.1 The development area comprises 25.5 hectares (63 acres) of primarily agricultural land situated to the north of Barnhorn Road (A259) on the west side of Bexhill. A location plan denoting the site boundary is provided in Appendix A.

1.2.2 A resolution to grant outline planning permission occurred in August 2013 (ref RR/2012/1978/P). Subject to the signing of a S106 Agreement this will allow for a mixed development comprising 275 dwellings, up to 3500m^2 of employment floor space, a nursing home of up to 60 beds, a doctor's surgery for up to 10 GPs and a one form entry primary school, together with associated landscaping, drainage and highways infrastructure.

1.2.3 There is an intention to apply for a revised outline planning permission to accommodate amended development proposals. These proposals will omit the primary school, for which the education authority now considers there to be no need, and will increase the total number of residential units to 300. In addition, the nursing home will be relocated to the frontage of the site within Phase 1 (see below).

1.2.4 The change in development proposals, and especially the increase in residential units, is considered in this report against the infrastructure proposals and the loadings assumed in the original utility service and highways capacity assessments.

1.2.5 It should be noted that since consultations with utility providers commenced around 2011, the intended development usage has varied as the master plan has evolved to suit local market conditions and needs. These variations were not resubmitted to utility providers each time as they were not deemed sufficient enough to affect the preliminary nature of capacity assessments and supply proposals. For detailed utility loading assumptions used in consultations, please refer to the full Foul Sewage and Utilities Assessment report provided in the Strutt and Parker information pack. It will be necessary to progress utility supply applications on the basis of the final master plan.

1.2.6 This report is produced on the basis that the site will be sold and developed in two phases. The west side of the site will be developed in Phase 1, followed by the east side of the site in phase 2. Development in phases 1 and 2, for the purpose of infrastructure considerations, is shown on a Phasing Strategy Plan in Appendix A and is assumed to be as described below.

1.3 Development Phase 1

1.3.1 Phase 1 shall include up to 198 residential units, a nursing home, a doctors surgery and employment land, together with associated infrastructure. If there were insufficient market interest in the proposed employment floor space, the number of residential units within Phase 1 could potentially be increased to approximately 225.

1.3.2 The Phase 1 development will need to include all highways access and improvement works required to serve the complete development. All off-site utility reinforcement works would be undertaken to provide capacity for the complete development. Primary estate roads into the Phase 2 area would be constructed ready for future access. New utility supplies would be extended into the Phase 2 boundary ready for future network construction. Phase 1 will also require works within the north east green area to provide surface water attenuation features and landscaping of public green space.

1.4 Development Phase 2

1.4.1 Phase 2 will include potentially up to 144 residential units and the associated on-site infrastructure.

1.5 Limitations

1.5.1 The advice contained in this report is based on outline development proposals and is not informed by a detailed master plan. Utility supply advice, including network capacity, off-site reinforcements, programme and cost information, has been derived from initial consultations with utility suppliers and cannot be guaranteed by Peter Brett Associates.

1.5.2 Infrastructure cost estimates and programmes provided should be considered as preliminary and for guidance only. Actual costs and programmes will need to be determined following detailed design of the development and the on and off-site utilities and highways works.

1.5.3 The summary information in this report is derived from the full report documents provided in the Strutt and Parker information pack, which should be referred to for detailed advice and limitations.

2 Highways and Transport

2.1 Introduction

2.1.1 This section of the report has been prepared in order to provide a summary of transport and highways matters in regards to the Barnhorn Green site. Information is provided on the work undertaken to date relating to highway matters and relevant correspondence with Rother District Council, East Sussex County Council and Highways Agency officers.

2.2 Site Location and Context

2.2.1 The site is located on land north of the A259 Barnhorn Road and west of Willow Drive in Little Common, Bexhill-on-Sea.

2.2.2 From the strategic highway network the site is accessed via the A259 which forms a part of the east-west strategic trunk road network within the area, linking the coastal towns of Hastings in the east and Eastbourne to the west, and also providing access to Brighton and Lewes via the A27. Ashford International station is also readily accessible from Bexhill, as is the channel port of Dover.

2.2.3 The site is located within walking distance of the local amenity centre at Little Common, providing a variety of local shops, restaurants, a post office and a primary school. Within near proximity of the site there is also a wide choice of retail and leisure activities including hotels, museums and a golf course.

2.2.4 The nearest large supermarket is located 3.9 km (2.4 miles) away in the larger district centre of Bexhill which also provides further retail and business opportunities, as do the centres of Hastings and Eastbourne approximately 11km (6.8 miles) and 17km (10.6 miles) away respectively.

2.2.5 The site is located near to existing cycle networks which run along the A259 Barnhorn Road. In the wider context, National Cycle Route 2, primarily a signed on-road route, runs along the sea front.

2.2.6 The site is located within walking distance of local bus stops with the nearest being located approximately 125m (via the A259) from the A259 Barnhorn Road site access for the 99 service and approximately 350m from the Oakleigh Road access, at the Little Common roundabout (for an additional four services). The Little Common area is served by a total of six bus services consisting of five local services and one high frequency strategic service providing connections to Silverhill, Hastings and Eastbourne.

2.2.7 There are three railway stations near the site (Bexhill, Collington and Cooden Beach). The nearest station is Cooden Beach, located approximately 2.4km (1.5 miles) south of the proposed Barnhorn Road site access via Cooden Sea Road; which equates to around a 10 minute journey by bicycle assuming an average speed of 4m/s.

2.2.8 Two Public Rights of Way (PROW) currently run through the site, one running north to south towards the east of the site, splitting towards the north forming a link between the site and the A259 Barnhorn Road via Kites Nest Walk (11b), and one running east to west towards the south west corner of the site (12A). The PROW are shown on the masterplan. The development of parameter plans has ensured that the PROW will remain in place once the development has been completed. Improvement works are required to be undertaken to these PROW as detailed in the S106 agreement.

2.3 Site Access

2.3.1 In order to provide a permeable, well connected site that integrates into the surrounding residential areas, three access points will be provided.

2.4 All mode access

2.4.1 The main access point into the site will be provided in the form of a signal controlled junction from the southern boundary of the site onto the A259 Barnhorn Road, adjacent to the Greyhorses. This junction will allow access for all modes and will be the sole access for private vehicles. The access will consist of stop lines along the A259 with two right turn bays (one into the site and one into Greyhorses) and a signal controlled crossing across the minor arm to assist with east-west pedestrian movements. The proposal requires the closure of the access to no. 116 Barnhorn Road which will be re-located along the access road, within the site. This property is in the ownership of MSL.

2.4.2 The location of the access within an established residential area will result in existing driveways on Barnhorn Road south being located within the junction itself. The access to No. 118 (Barnhorn Road north) is also located at the stop line of the eastbound approach. Whilst this may be unusual for a new junction layout it is not an uncommon occurrence at existing junctions across the highway network and it has been approved by the Highways Agency.

2.4.3 The access allows a slightly sub-standard visibility splay to the left (due to third party land ownership), however, the Highways Agency approved the design and did not require any departures from standards to be applied for.

2.4.4 Autotrack analysis has been undertaken to confirm that the junction will be able to accommodate buses if required.

2.4.5 The access is required to be implemented prior to commencement of the development (as per condition 5 of the draft planning conditions) and will therefore be the responsibility of the phase 1 developer.

2.4.6 The site access can be seen on drawings 22421-012-006 and 22421-004-22 in Appendix B.

2.5 Pedestrian and Cyclist Access

2.5.1 To ensure the site is highly accessible by sustainable modes, two additional site access points will be provided for pedestrians and cyclists; one at Spring Lane and one at Oakleigh Road. These will also form emergency access points for the development. A third pedestrian only access point will be provided into the site from Barnhorn Road via the existing Public Right of Way at Kites Nest Walk.

2.5.2 The access points have been designed to create a permeable environment, giving priority to pedestrians and cyclists where possible and to encourage travel by sustainable modes. The Spring Lane and Oakleigh Road access points can be seen on drawings 22421-004-24 and 22421-004-23 respectively in Appendix B.

2.5.3 As set out in the draft S106 agreement, details of these works need to be submitted to the Council prior to commencement of development and implemented prior to occupation of the first dwelling.

2.6 Public Transport and Emergency Vehicle Access

2.6.1 The local bus service provider, Renown, has confirmed that there is capacity on the existing routes to serve the site. However, in order to ensure future bus access can be obtained (if required) the Oakleigh Road access has been designed to accommodate buses, with a bus

gate provided within the site in order to restrict private vehicular access. The timing of the implementation of the bus gate will be determined at the detailed application stage.

2.6.2 Emergency vehicle access will be gained from both the Spring Lane and Oakleigh Road access points. Removable bollards will be provided at the Spring Lane access in order to prevent public vehicle access to and from the site.

2.6.3 The Spring Lane and Oakleigh Road access points can be seen on drawings 22421-004-24 and 22421-004-23 respectively in Appendix B.

2.6.4 As the site could be sold in two phases, the phase 1 purchaser may need to implement an emergency access from Spring Lane or Oakleigh Road to serve phase 1. This will need to be agreed with the Council. It may be possible to agree an alternative temporary access via The Broadwalk.

2.7 Internal Network

2.7.1 Successful places to live and work should feature a legible hierarchy of routes and spaces. The internal road network has been outline designed from a hierarchical approach, with the primary vehicular route being provided through the centre of the site between the A259 vehicular access in the west to Oakleigh Road in the east. The route, which has been designed with the aim of reducing vehicular speeds and creating a pleasant and permeable environment for pedestrians and cyclists, will readily allow buses to travel through the site should this be required in the future. The employment, doctors surgery and nursing home will all be accessible directly off the main spine route. Secondary routes will provide links to the residential areas and tertiary routes, reflecting the importance of their place and movement functions.

2.7.2 A network of legible dedicated pedestrian and cycle routes will be achievable within the site, linking employment and residential areas, providing key connections to the surrounding residential areas and to encourage the use of these modes.

2.7.3 In line with the Transport Assessment, a total of 502 car parking spaces were assumed to be provided for residential use (including 1 disabled space for every dwelling built to mobility standards) and 163 were assumed to be provided for employment uses.

2.7.4 It was assumed that approximately 362 safe and secure cycle parking spaces will be provided in order to encourage the use of this mode.

2.8 Transport Assessment

2.8.1 A review of national, regional and local planning policy has been provided within the Transport Assessment and a description of how the proposed development responds to these policy documents has been presented.

2.8.2 In order to understand the existing highway conditions within the vicinity of the site, traffic count data was collected in June 2009 and again in April 2011. The data collected in 2011 was used to provide up to date traffic flows at the Little Common roundabout. 2011 traffic flow data for the Ravenside roundabout was obtained from East Sussex County Council in August 2011.

2.8.3 Development trips for the residential elements of the site were generated using a 2009 ‘cordon’ trip rate assessment. The trip generation for the remaining land uses were generated using the TRICS database.

2.8.4 Development traffic was distributed on the highway network in accordance with the strategic model for Bexhill for the ‘With Link Road’ and ‘Without Link Road’ scenarios.

2.8.5 The Little Common and Ravenside roundabouts were modelled for capacity using Junctions 8 software for the '2011 Observed', '2022 Base' and '2022 With Development' scenarios.

2.8.6 The Ravenside roundabout was found to work within capacity during both the AM and PM peak periods of all scenarios, both 'With the Link Road' and 'Without the Link Road' and as a result, no mitigation was required.

2.8.7 The modelling results for the Little Common roundabout showed that the roundabout was over the desired capacity during all three scenarios for both the 'With Link Road' and 'Without Link Road' scenarios. In order to offset the impact of the proposed development on the two arms shown to be over the desired (and / or theoretical) capacity (Little Common Road and Barnhorn Road), mitigation measures were proposed which are anticipated to achieve nil detriment. These measures are discussed in section 2.12 below

2.8.8 A link capacity analysis has been undertaken along the A259 at Glyne Gap. The results show that under the '2022 Base' scenario, the link is predicted to operate over theoretical capacity during both the AM and PM peak periods. As the proposed development is only anticipated to add 11 vehicles to the link in the AM peak and 27 vehicles to the link in the PM peak, the effect of the development is considered to be negligible. As a result, no mitigation has been proposed.

2.8.9 Since the planning application was submitted it has emerged that the school is no longer required to form part of the development proposals and, to maintain an efficient use of land, it will be replaced by 25 residential units in a revised application. An additional scenario of densification to provide an overall residential quantum of circa 350 units has also been suggested and has been tested for junction capacity at the A259 / Site Access and Little Common roundabout junctions. The results of the assessments show that in terms of capacity, whilst the site access arm of the A259 Barnhorn Road / Site Access junction is still predicted to operate above desired capacity, the junction is predicted to operate better than for the proposals in the original application. The mitigation proposed at the Little Common roundabout is still predicted to mitigate the impact of this development scenario.

2.8.10 The Highways Agency and Rother District Council (no doubt in liaison with ESCC as the wider highway authority) would need to confirm that the increase in trips to and from the site, the results of the junction capacity assessments and the continued proposal for a single vehicular access (plus emergency access) are acceptable.

2.9 Travel Plan

2.9.1 A Framework Travel Plan was submitted to Rother District Council as part of the planning application with the aim of reducing the number of vehicular trips to, from and within the site by providing a range of sustainable alternatives, encouraging the use of these modes and reducing the need to travel. A Full Travel Plan for the residential and employment uses breaching the Rother District Council Travel Plan Thresholds has subsequently been submitted and agreed by Rother District Council as it forms part of the S106 agreement. The Travel Plan is required to be implemented prior to occupation. In line with East Sussex County Council Travel Plan Guidance, the residential Travel Plan aims to achieve a 2% modal shift away from the private car each year, with the overall goal of a 10% reduction over a five year period. The Travel Plan is provided in the Strutt and Parker information pack.

2.9.2 The Travel Plan will need to be monitored on an annual basis for a period of five years in accordance with the TRICS Standardised Assessment Methodology (SAM). In line with East Sussex County Council Travel Plan Guidance, the first monitoring period (or year one 'baseline' survey) should take place within three months of first occupation of the site. If the Travel Plan targets are not met, a number of additional measures will need to be implemented as set out within the Travel Plan.

2.9.3 The phase 1 purchaser will appoint Travel Plan Coordinators no later than three months prior to occupation of the site. The posts will be filled for a minimum of five years.

2.10 Off Site Highway Works

2.10.1 Existing local residents have expressed concern over the balance of activity on the A259 leaning too far towards the throughput of traffic, creating challenges for those who live along the road, or who need to access facilities close to it. The opportunity to cross the road is limited, and residents also reported difficulties in being able to negotiate the private driveways that give access to the properties along the A259.

2.10.2 In response to resident's concerns and to enhance the local area for those travelling by sustainable modes, ease existing congestion on the local highway network and to ensure the effects of the development have been mitigated, a suite of coordinated off-site measures will be implemented. These can be seen on drawing 22421-012-006 in appendix B and are as follows:

2.11 A259 Barnhorn Road (between the site and Little Common roundabout)

2.11.1 Measures will include:

- New site access signal controlled junction including right turn bay facility, and signal controlled crossing on the minor arm.
- Introduction of a two-stage zebra crossing within the vicinity of Kites Nest Walk to facilitate movement across the A259, give priority to pedestrians and to provide a link to the existing Public Right of Way
- Introduction of refuges, islands and hatching to reduce vehicle speeds and facilitate movement across the A259.
- Junction surface treatment and informal right turn bays to lower vehicle speeds and facilitate vehicle flows along the A259.

2.12 Little Common Roundabout

2.12.1 Measures will include:

- Introduce road markings on the circulatory and approaches to define two lanes of traffic and therefore increase capacity.
- Reduce the width of the circulatory by building out footways and relocating existing pedestrian refuges on approaches, enhancing the local environment for pedestrians and assuming a more conventional roundabout layout.
- Remove the existing pedestrian crossing along Little Common Road and replace with a staggered crossing further north to reduce queues on the exit arm.
- Create a two lane approach on A259 Barnhorn Road west arm to increase capacity.
- In addition, the existing bus stop to the northern side of the roundabout is proposed to be relocated to the opposite side of the circulatory to allow buses to manoeuvre in and out of the bay more easily and to reduce delays on the circulatory.

2.13 Safety Audits

2.13.1 The above off site highway proposals have been subject to a Stage 1 Road Safety Audit and a Non-Motorised User Audit, both of which have been approved by the Highways Agency.

2.13.2 The results of a collision data assessment revealed that there are two existing accident cluster locations within the vicinity of the site; Kites Nest Walk and east of the Greyhorses. It is considered that collisions may be a result of restricted visibility from Kites Nest Walk and the bend in the carriageway to the east of the Greyhorses which possibly shields drivers from queues building up ahead.

2.13.3 These issues have been addressed as part of the off-site highway works along the A259 Barnhorn Road which are predicted to reduce vehicular speeds by reducing carriageway widths, providing additional crossing facilities for pedestrians and creating a more permeable environment.

2.14 Public transport infrastructure

2.14.1 The developer will provide a contribution of £181 per dwelling via the S106 agreement to improve four local bus stops on Barnhorn Road. The improvements will include the provision of shelters, low floor kerbing, real time information and screens at the Doctors surgery providing up to date public transport information.

2.14.2 This contribution is payable prior to the first occupation of the first dwelling in each phase and hence will be paid by the purchaser(s) on a phase by phase basis.

2.15 Phasing/Delivery of Off-site Highways Works

2.15.1 The delivery and implementation of the works on the local highway network (i.e. Spring Lane and Oakleigh Road) are set out within the Section 106 agreement. The delivery and implementation of the works on the trunk road network are set out within the planning conditions (5, 6, 7 and 24).

2.16 Developer Obligations

2.16.1 The phase 1 purchaser will, therefore, be responsible for the delivery of the following highways works:

i. The A259 all mode site access, traffic calming and crossing (conditions 5, 6 and 7), prior to commencement of development.

ii. The Oakleigh Road and Spring Lane site accesses, prior to occupation, although the Spring Lane or Oakleigh Road access may be required for emergency access during construction of the development (as per the S106 agreement).

iii. Delivery of the Little Common Roundabout improvements scheme (condition 24), prior to occupation of the first residential unit.

2.17 Developer contributions required for the travel plan

2.17.1 The developer shall contribute a cost of £56,430 for the employment uses and £42,000 for the residential use (total of £98,430 for the five years including monitoring and review) for the Travel Plan. Details of these costs are provided in an appendix to the Travel Plan within the Strutt and Parker information pack.

2.17.2 The phase 1 purchaser will be responsible for the appointment of a Travel Plan Coordinator as well as payment of the Council's residential Travel Plan auditing fee as per the S106 Agreement.

2.17.3 Monitoring for a five year period in line with Standardised Assessment Methodology.

2.18 Densification and land use changes

2.18.1 It is understood that an application to replace the school with an addition of 25 residential units will be submitted. The addenda provided with the application demonstrate that this scenario sits within the previous assessment and no further mitigation is required in pure capacity terms.

2.18.2 It is further understood that a densification of the site to accommodate approximately 350 units may be possible depending on the chosen density and mix of units. The results of the assessment for this revised scenario demonstrate that in terms of capacity, the A259 Barnhorn Road / Site Access junction is predicted to operate better, than for the proposals in the original application for 275 units and the school site.

2.18.3 Whilst the design of the junction has not changed since the application was submitted (with the exception of the removal of the pelican crossing), the Highways Agency would also have to confirm that the proposed layout of the junction (including the location of the stop lines in relation to existing driveways and the relaxation of the intervisibility zone to the east of the junction) is still acceptable. The Highways Agency's approval of these issues and the junction model will be crucial. We do not believe that there is a technical case that the HA could advance such that they could adopt a different position to the one they took in respect of the current planning application, but we would advise that their views should be sought at an early stage.

2.18.4 Rother District Council (no doubt in liaison with ESCC as the wider highway authority) would need to confirm that the increase in trips to and from the site (in the PM peak) associated with this alternative scenario is acceptable from a single vehicular access and that no secondary access is required aside from the existing emergency access points.

2.18.5 The results of the Little Common Roundabout assessments show that the proposed mitigation will still achieve nil-detriment. We do not consider that the HA could advance a technical argument to view this junction differently than they did for the planning application, but this would need to be discussed and confirmed with them.

2.18.6 On the basis that the HA confirmed that the technical work, along with the proposed mitigation measures, then we would expect that Rother District Council would have to accept the revised position. We would suggest that early engagement with the HA, to seek to agree their response, would be the preferred way to neutralise this possibility.

3 Flood Risk and Surface Water Drainage

3.1 Flood Risk Assessment

3.1.1 A Flood Risk Assessment for the site was undertaken in 2012, following consultations with the local planning authority and Environment Agency. The Flood Risk Assessment report is contained in the Strutt and Parker information pack.

3.1.2 The entire site, excluding a small area of proposed open space to the north, is located within Flood Zone 1, low risk. Hydrological and hydraulic modelling of the Picknell Green Stream has demonstrated that the proposed built development is located outside of the 0.1% (1 in 1000 year event) fluvial flood plain. The flood zone extents are shown on the Drainage Strategy Drawing included in the Flood Risk Assessment report.

3.2 Drainage Strategy

3.2.1 A conceptual drainage strategy has been developed in accordance with the specific requirements of the National Policy Planning Framework, Environment Agency guidance, and the Code of Practice for SuDS.

3.2.2 In accordance with Environment Agency requirements, surface water run-off is to be restricted to the Greenfield rate for all rainfall events up to 1% probability (1 in 100 year storm) including climate change. The Environment Agency have advised that they would expect staged discharge controls, which would require demonstration of compliance for the 1 in 1 year, 1 in 30 year and 1 in 100 year rainfall events.

3.2.3 Existing ground levels fall across the site to the north towards the Picknell Green stream (from elevations of approximately 21m to 6m). The stream borders the northern boundary of the site, flowing east to west and eventually discharging to the sea at Normans Bay approximately 4km (2.49 miles) along the coastline. Run-off from the site currently drains to the stream with no formal drainage infrastructure in place other than field ditches along the east and west site boundaries.

3.2.4 Infiltration drainage is not considered viable for the site due to poor soil infiltration rates and moderately high ground water levels typically 2- 3m below existing ground. The drainage strategy has been developed to convey runoff, via open channels and SuDS attenuation features, to the Picknell Green Stream to the north of the site.

3.2.5 As the existing catchment drains to the Waller's Haven, which is the primary water source for the Pevensey Levels, control of water quality is of significant importance. Measures are to be implemented in order to filter, store and treat run-off, principally to trap and remove pollutants and sediment before discharge to the watercourse. Such measures are incorporated in the outline drainage strategy and can readily be included in the detailed design of the site.

3.2.6 Further to the attenuation measures, it is proposed that a section of the Picknell Green stream will be widened to increase flow capacity and reduce flood risk. The approximate extents are shown on the Conceptual Drainage Strategy Drawing in the Flood Risk Assessment within the Strutt and Parker information pack, and also on the Surface Water Features plan in Appendix C. The widening will be designed on the south side of the watercourse within the development site boundary.

3.2.7 To prevent erosion at surface water outfalls where flows will be concentrated, measures are to be implemented to reduce flow velocity and avoid bed scour. These measures will distribute flows through terraced landscape features, planting and gabions.

3.2.8 In order to avoid pumping of surface water, the route of surface water drainage is proposed to follow existing site topography, while avoiding crossings of existing hedgerows and locations of trees. The site is naturally split into two surface water catchment areas with separate outfalls to the Picknell Green Stream. These catchments compliment the phasing of the development.

3.3 Greenfield Runoff Rates

3.3.1 Greenfield run off rates for the site were calculated in accordance with recognised methodology, IH124, and are summarised below.

3.3.2 Table 3.1 Greenfield runoff rates

QBAR	5.15 l/s/ha
1 in 1 year	4.38l/s/ha
1 in 30 year	11.86l//ha
1 in 100 year	16.45l/s/ha

3.4 Development Areas

3.4.1 The proposed overall development area (that would be positively drained) is assessed as 14.4ha. Assuming a typical conservative permeability ratio of 0.75, the resultant impermeable area is 10.8ha. The area of other open space is approximately 11.1ha.

3.5 Drainage Modelling and Storage Volumes

3.5.1 Further to the Flood Risk Assessment, additional hydraulic modelling was undertaken in May 2014 to test the storage volumes necessary for the contributing catchment areas of the development. The topography of the site dictates that surface water will drain from two distinct catchment areas, in the east and west, to separate discharge points on the existing watercourse. These east and west catchment areas were modelled as Networks A (east) and Network B (west) incorporating areas of development as shown on the Surface Water Features Plan in Appendix C.

3.5.2 It is proposed that both networks will include upper and lower attenuation ponds. Modelling demonstrated that the control of discharge from the upper ponds can be varied, allowing design flexibility to suit the desired landscaping proposals. The lower ponds will include flow controls to achieve the allowable greenfield runoff rates.

3.5.3 Assessment of storage volumes required in each network has been undertaken in Micro-drainage and are summarised below.

3.5.4 Table 3.2 Attenuation pond storage volumes required

	Developed Area (ha)	Impermeable Area (ha)	Storage Volume Required (m3)
Network A total	7.9	5.92	4,000
Upper Pond	5.15	3.86	2,900
Lower Pond	2.75	2.06	1,100
Network B total	6.5	4.88	3,250
Upper Pond	1.8	1.34	750
Lower Pond	4.7	3.54	2,500

3.5.5 The above storage volumes are conservative as they do not allow for the beneficial attenuation provided in other SuDS measures within the development. Additionally, outfalls have been modelled using simple controls rather than optimised to maximum allowable rates for different return periods. The Network A lower pond is modelled with a single hydro-brake and the Network B lower pond is modelled with 2 hydro-brakes. Network A and B upper ponds have been modelled with single hydro-brakes set to the nominal 1 in 1 year discharge rate for each network. The calculations demonstrate that required pond storage is likely to be less onerous than the figures presented in the Flood Risk Assessment.

3.5.6 The total target storage volumes for the various SuDS measures presented in the Flood Risk Assessment report have been reviewed against the further modelling undertaken in May 2014. This concluded that pond volumes could be offset against volumes provided across the development in open channels and swales. Given the existing topography of the site and the possibly limited opportunity for level storage channels, the revised balance of pond storage and other SuDs measures below would be a reasonable assumption. Modelling has demonstrated that there is considerable flexibility in the provision of storage features, which can be tailored to suit detailed design requirements.

3.5.7 Table 3.3 Target storage volumes for various SUDs measures

SuDS measures	Approximate Storage Volume (m3)
Sub-base storage	470
Bio-retention	45
Open channels	200
Attenuation ponds	7,250

3.6 SuDs Adoption

3.6.1 It is anticipated that government legislation will, in due course, require SuDs schemes for developments such as Barnhorn Green to meet national standards to the approval of a SuDs Approval Body. These national standards are not yet finalised and as at June 2014, an Approval Body within East Sussex County Council had not been established. It is likely however that the programme for the development will result in SuDs being designed, approved and ultimately adopted by an Approval Body within East Sussex County Council.

3.6.2 Design of SuDs for the development should be progressed on this assumption, making use of available recognised publications and inviting early engagement from the Council if they are able to offer it. Flexibility should also be allowed in the detailed design to ensure there is sufficient space for surface water drainage.

3.7 Phased Responsibility

3.7.1 The phase 1 purchaser will need to implement the surface water attenuation ponds and controls to discharge flows at the west of the site within the permitted rates.

3.7.2 It is also likely that the surface water attenuation ponds, controls and features in the north east green space will need to be implemented in full by the phase 1 purchaser in order to receive flows from some parts of the phase 1 development.

3.7.3 It may be possible to design and construct these features in the north east green space at a reduced scale sufficient only for the needs of phase 1 and such that they could be expanded and altered for the phase 2 development, but there would be inefficiencies and additional costs associated with this strategy. It would also be necessary to demonstrate that flood risk protection and water quality issues were robustly addressed in the temporary scenario.

3.7.4 It should be assumed that the phase 1 purchaser will implement all surface water attenuation ponds and controls, and undertake the improvements to the receiving water course to reduce flood risk. This will ensure that the whole site is properly served by the strategic drainage measures early in the development programme.

4 Foul Drainage

4.1 Introduction

4.1.1 This report should be read in conjunction with the Foul Sewage & Utilities Assessment Report dated September 2012 prepared by Peter Brett Associates LLP and commissioned by MSL. A copy of the Assessment Report including existing Southern Water sewer records is provided in the Strutt and Parker information pack.

4.1.2 This report is based on the findings of the foul water loading calculations previously undertaken by Peter Brett Associates LLP. It should be noted that the results of these calculations were used in 2012 and 2013 when consulting with Southern Water in relation to new off-site infrastructure works.

4.1.3 The results indicated a maximum foul water discharge rate of 14.6 l/s from the previously proposed development which comprised of 300 residential units and included a nursing home, retirement complex and an industrial area.

4.1.4 Although recent changes to the intended development proposals have not been resubmitted since the 2012 loading assessment and report, it is considered that the anticipated foul flows quoted in previous consultation with Southern Water are commensurate with the latest development proposals. Foul water loading requirements should be finalised at detailed design stage.

4.1.5 A summary of Southern Water proposals dated March 2013, in respect to new off-site infrastructure, is presented in Section 4.3 below.

4.2 New on-site Infrastructure

4.2.1 The proposed on-site drainage system, including pumping station design, should be designed to meet the requirements of Sewers for Adoption 7th Edition in anticipation of adoption by Southern Water under S104 of the Water Industry Act 1991.

4.2.2 The site topography permits the majority of the site to drain via a gravity drainage system to the location of a main proposed development pumping station as shown on drawing C214098/001 in appendix D.

4.2.3 Due to topography constraints, a smaller secondary pumping station may be required situated towards the north-west corner of the site and its foul flows pumped onwards to the main development pumping station. It may be possible to design out this secondary pumping station subject to achieving a reasonable depth of the main pumping station to accept all flows by gravity drainage. This will need to be assessed during detailed design and value engineering. Vehicle access will need to be provided to the primary and, if required, the secondary pump stations.

4.2.4 It is anticipated that foul flows from the entire development site would be pumped from the main pumping station via a rising main and discharging into Southern Water existing manhole reference MH 9803 at grid reference TQ 709 079. This manhole is located immediately south of the development site along Kite's Nest Walk.

4.2.5 An indicative layout of the on-site foul water drainage system is presented on the combined utilities plan in Appendix D

4.2.6 A basic estimation of foul water emergency storage requirements in accordance with Sewers for Adoption 7th Edition was undertaken in June 2014. This suggested that a total storage

volume of around 55m^3 will be required for the development. This will readily be incorporated into detailed drainage design.

4.3 New off-site Infrastructure

4.3.1 Subsequent to the 2012 Utilities Assessment Report, further correspondence has been received from Southern Water in respect to their letter dated 21st March 2013. This letter is contained in the Foul Sewage & Utilities Assessment Report within the Strutt and Parker information pack and its contents are summarised as follows.

4.3.2 The distance between the development site and the nearest point of treatment capacity at Bexhill and the Hastings waste treatment works is approximately 7km (4.35 miles). This distance is considered excessive and ultimately prohibitive for the installation of a new sewer and hence alternative options involving localised sewer upsizing have been considered.

4.3.3 Budget estimates for two options of localised sewer upsizing have been provided by Southern Water. Detailed proposals of the options are presented on Southern Water drawing numbers 5109207/WA/090 and 5109207/WA/180 included in the Foul Sewage & Utilities Assessment Report within the Strutt and Parker information pack. Option 2 also includes minor modifications to an existing sluice gate.

4.3.4 The two options relate to two separate phases of localised sewer upsizing that could be implemented sequentially, in order to achieve the overall capacity improvement of 14.6 l/s for the entire development.

4.3.5 Option 1 relates to an initial phase of development incorporating 140 dwellings, a 150 unit retirement complex and 1700m^2 of commercial use area (as per previous development proposals). The forecast foul flow discharge generated by this development is 8.1 l/s. A budget cost estimate for Option 1 is £250,184.

4.3.6 Option 2 relates to the entire development incorporating 275 dwellings, a 150 unit retirement complex and 5000 m^2 of commercial use area (as per previous development proposals). The forecast foul flow discharge generated by this development is 14.6 l/s. A budget cost estimate for Option 2 is £358,405.

4.3.7 Although recent intentions for development usage differ from the options above, it is considered that the anticipated foul flows are commensurate with the latest development proposals.

4.3.8 Southern Water has requested an upfront payment of £52,650 to design, procure, price and plan the works.

4.3.9 It should be noted that the cost estimates above are subject to change following more detailed investigations by Southern Water at design stage.

4.3.10 Southern Water offer two payment options for the work carried out under Section 98 of the Water Industry Act. These payment options follow Section 99 and 100 of the Water Industry Act:

4.3.11 Option A: 12 Year Guarantee Agreement option whereby the developer pays annually the deficit between the annual borrowing costs (interest and capital) of a loan for the cost of providing the upgrade works, and the total for drainage charges collected during that year. The deficit is paid annually for 12 years.

4.3.12 Option B: Commuted Sum Payment Option whereby the developer pays on completion of the work required to provide the upgrades the deficit between the actual cost of the upgrade works and an estimate of the annual deficits over 12 years.

4.3.13 The actual cost of the upgrade works should be balanced by the revenues from infrastructure charges made over 12 years, on the basis of section 98 of the Water Industry Act. On this assumption, it is anticipated that the actual cost to the developer(s) are likely to be nil.

4.4 Existing Infrastructure (on site)

4.4.1 An existing foul water rising main extends across the west of the site from Spring Lane pumping station to the existing sewer at Kite's Nest Walk. The alignment of the rising main conflicts with land areas intended for residential development.

4.4.2 It would be necessary to divert the alignment of the existing rising main along highway routes of the proposed development. A suggested route for the diversion is indicated on the combined services drawing in Appendix D.

4.4.3 An indication of the budget cost estimate to divert the 400m rising main is £100,000.

4.4.4 The indicative budget cost estimate for the new on-site drainage is £698,250. This is based on estimated prices and the assumption of one main pumping station, 500m of rising main, 375m of gravity drains and 62No manhole chambers but will be subject to change on development of the detailed design.

4.4.5 2.5% of the total on-site drainage cost would be chargeable by Southern Water for adoption under a Section 104 Agreement.

4.4.6 It should be noted that Southern Water has not undertaken any formal assessment of these costs estimates and the figures provided should be considered as indicative only.

4.5 Phased Responsibility

4.5.1 The phase 1 developer will need to construct all phase 1 on-site foul drainage, the primary foul pumping station and rising main to discharge to the agreed outfall location. If detailed design dictates that the secondary pumping station is also required, this will be also be implemented by the phase 1 developer.

4.5.2 The extent of off-site sewer reinforcement work will be subject to an assessment of loading for the final development proposals, and detailed investigations and design by Southern Water. It has previously been advised that off-site sewer upsizing could be implemented in two stages, which are expected to be commensurate with the requirements of a two phase development. This should enable the responsibility for off-site reinforcement works to be divided between the phase 1 and 2 purchasers.

4.5.3 The existing foul rising main crossing the east part of the site from Spring Lane falls within the phase 2 development area. The diversion of this rising main is not expected to be required until phase 2 is implemented.

5 Utility Supplies

5.1 Utilities Assessment Report

5.1.1 This report should be read in conjunction with the Foul Sewage and Utilities Assessment Report dated September 2012 prepared by Peter Brett Associates LLP and commissioned by MSL. A copy of the Assessment Report is contained in the Strutt and Parker information pack.

5.1.2 The Utilities Assessment Report presents a high level desk top study and review of existing utility services information. The purpose of the report was to identify constraints to the proposed development and to establish the need for any diversions and protection required to accommodate the proposed development. The Assessment has been compiled from correspondence received from the incumbent utility providers.

5.1.3 Anticipated loads from the proposed development were estimated as follows:

5.1.4 Table 5.1 Estimated Loads

Utility	Residential	Retirement Complex	Employment
Electricity	593 kW	245 kW	408 kW
Gas	855m^3 peak (7,155,000 kWh annual)	328m^3 peak (2,749,000 kWh annual)	58m^3 peak (735,000 kWh annual)
Potable water	177m^3/day (6.83 l/s)	68m^3/day (2.62 l/s)	20m^3/day (1.39 l/s)
Foul Drainage	14.6 l/s for the whole site		

5.1.5 These calculations were based on 300 gas heated residential units, a retirement complex comprising a 60 bed nursing home, 50 Category II flats & 40 Category I cottages, and 4,000m2 of B1 office/light industrial space.

5.1.6 As discussed in chapter 1, it should be noted that since consultations with utility providers commenced around 2011, the intended development usage has varied as the master plan has evolved to suit local market conditions and needs. These variations were not resubmitted to utility providers each time as they were not deemed sufficient enough to affect the preliminary nature of capacity assessments and supply proposals. For detailed utility loading assumptions used in consultations, please refer to the full Foul Sewage and Utilities Assessment report provided in the Strutt and Parker information pack. It will be necessary to progress utility supply applications on the basis of the final master plan.

5.1.7 The 2012 Utilities Assessment Report has been reviewed and comment is provided below. The purpose of this review has been to present a summary of the proposed utility works and their associated costs.

5.1.8 Copies of relevant correspondence with utility companies are contained in an appendix to the Foul Sewage and Utilities Assessment report provided in the Strutt and Parker information pack.

5.1.9 A combined services drawing indicating the proposed connections into the existing utility networks, including proposed reinforcement works, is contained in Appendix D. The position and type of existing utilities are shown on the drawing but should be considered as indicative only.

5.2 Existing Utilities

5.2.1 Although the site is primarily agricultural land, there are existing services located within the site boundary. These include a buried foul rising main, buried and overhead high voltage cables, overhead 33kv electrical cables and a BT cable. These are shown on utilities record plans contained in an appendix to the Foul Sewage and Utilities Assessment report provided in the Strutt and Parker information pack. A combined utilities plan is also provided in appendix D of this document.

5.3 Electricity Supply

5.3.1 Budget estimates for two options (dated June 2011) were provided by UK Power Networks.

5.3.2 The first option is in the sum of £1,212,000 and relates to a 600 dwelling development. The second option is in the sum of £826,000 and relates to a 300 dwelling development. Both options are based on a combined residential/commercial site.

5.3.3 The cost estimate most relevant to the proposed development is the 300 dwelling option which assumes a loading requirement of 1246kVA. This estimate includes a developer contribution of £76,000 for off-site reinforcement works required to the existing network.

5.3.4 There are 2No 33kV and 1No 11kV existing overhead lines crossing the site. It shall be noted that UK Power Networks reserve the right to retain existing overhead electricity lines in their present location but would be unlikely to unreasonably do so. UK Power Networks has quoted a sum of £525,000 chargeable to the developer, should it be necessary to divert these lines to underground routes.

5.4 Gas Supply

5.4.1 Southern Gas Networks has advised that reinforcement of the existing network may be required to supply the required load and would be subject to a Network Economic Test to determine whether a developer contribution would be required.

5.4.2 Southern Gas Networks connections budget dated June 2011, relating to on-site works to lay new mains and services to supply 300 properties, is in the sum of £180,000. Any developer contribution for off-site reinforcement works would be additional to this sum.

5.5 Potable Water Supply

5.5.1 The 2012 Utilities Assessment Report notes that there was adequate capacity within the existing network to serve the first 50 domestic dwellings.

5.5.2 Budget estimates for two options (dated June 2011) were provided by South East Water.

5.5.3 Option 1 relates to a 600 dwelling development and would involve off-site mains reinforcement works estimated at £178,214, plus on-site mains works at £282,796. In addition to this, Standard connection charges would apply at £525 per connection and an infrastructure charge of £328.28 per connection.

5.5.4 Option 2 relates to a 300 dwelling development with the anticipated loads given in Table 1. The associated budget estimate is for off-site mains reinforcement (500m of 250mm HPPE main along Pear Tree Lane) at £97,467, plus on-site mains at £142,017. In addition to this, standard connection charges would apply at £525 per connection and an infrastructure charge of £328.28 per connection.

5.5.5 A charge of £54 per dwelling is payable upon application to South East Water for all firm quotations.

5.6 Telecommunications

5.6.1 BT Openreach will carry out any network reinforcement work needed outside the site boundary and in the public highway to provide capacity for the development. The developer will only be charged for associated costs that exceed BT's allowance of £3,400 (excluding VAT) per plot.

5.6.2 BT Openreach require a design fee to provide a detailed design and construction cost estimate. An application to BT Openreach is normally only made once outline planning permission for the scheme has been granted.

5.6.3 Peter Brett Associates has previously carried out an assessment of network modifications and diversions that may be required to existing BT apparatus. The conclusions are presented in the 2012 Utilities Assessment Report. Approximate costs of this work are in the order of £25,000.

5.6.4 There are 2No radio telecommunications masts within the site boundary. If these required relocating it would be necessary to consult the operators with regard to the terms of their agreements.

5.7 Summary of Utility Budget Costs

5.7.1 Table 5.2. Summary of budget estimates for utilities works.

Utility Supply	Works	Budget Cost
Electricity (UK Power Networks)	Diversions of overhead lines New infrastructure (gas heated)	£ 545,000 (note 1) £ 826,000 (note 2)
Gas (Southern Gas Networks)	Diversions New infrastructure (gas heated) Developer's contribution for any off-site reinforcement	£ - £ 180,000 £ TBC
Potable Water (South East Water)	Diversions Off-site reinforcement New on-site Infrastructure New service connections Infrastructure charges	£ - £ 97,467 £ 142,017 £ 157,500 (note 5) £ 98,484 (note 6)
Foul Drainage (Southern Water)	On-site drainage including 1no. pump station Section 104 Agreement Off-site reinforcement (Design of Option 2) Off-site reinforcement works Diversion of existing on-site rising main	£ 698,250 £ 17,500 £ 52,650 £ 0 (note 3) £100,000
Telecoms (BT)	Diversions New on-site infrastructure Network reinforcement	£ 25,000 £ TBC £ TBC (note 4)

Notes:
1) Total additional cost to bury the existing 2No 33kV and 1No 11kV overhead lines.
2) 300 dwelling option, includes a developer contribution in the sum of £76,000 for off-site reinforcement.
3) Assumes actual cost of the upgrade works, plus borrowing costs, is less than revenues over 12 years.
4) Developer will only be charged should costs exceed BT's allowance of £3,400 per plot.
5) Based on £525 connection charge x 300 units.
6) based on £328.28 infrastructure charge x 300 units.

5.7.2 It should be noted that the above budget estimates were generally obtained in 2011 and are likely to be subject to uplift to reflect current market values. All budget estimates are provided for guidance purposes only and should be subject to detailed assessments in order to confirm costs for design and construction.

5.8 Revised planning application and effect on utility demands

5.8.1 As an update to the 2011 work, revised utility demands for the site have been re-estimated as follows based on the latest development proposal of 300 residential units, 3,500m^2 employment floor space, a 60 bed nursing home and a doctors surgery for up to 10 GPs:

5.8.2 Electricity: 1,088kW

5.8.3 Gas: 3,962kWh peak (4,877MWh annual)

5.8.4 Potable Water: 16.34l/s peak (172.38m3/day)

5.8.5 The revised development proposals inevitably affect the demands estimated in 2011. There has also been an update of the parameters used with regard to the utilisation of more energy efficiency methods in modern building construction. As a result of these changes the revised estimated electricity demand has reduced slightly, gas has reduced significantly, and the average daily potable water demand has reduced, although there is an increase in the peak flow by approximately 5.5l/s.

5.8.6 Responses from the utility companies to previous capacity enquiries identified that off-site reinforcement to their networks would be required to accommodate the proposed loads. It is anticipated that this would still be the case for electricity and water; however, the predicted gas demand is less than half the previously suggested requirement and therefore it is possible that reinforcement would not be required, or could at least be significantly reduced. Revised capacity enquiries would need to be carried out in order to ascertain the current capacity and availability of the individual networks.

5.8.7 Should permission be granted for densification to 350 units, approximate demands would increase as follows:

5.8.8 Electricity: 1,211kW

5.8.9 Gas: 4,567kWh peak (5,530MWh annual)

5.8.10 Water: 17.96l/s peak (193.38m3)

5.8.11 These electricity and gas demands still fall within the loads requested for 300 units in 2011, as does the average daily water demand, with just an increase in the peak flow. We do not therefore envisage a significant change in position for the utilities from that previously advised

6 Ground Conditions

6.1 WYG Ground Investigation

6.1.1 WYG Environment (WYG) was commissioned by MSL in 2013 to undertake a ground investigation of the site.

6.1.2 The site works were undertaken between the 3rd and 7th June 2013 and the results of the investigation are presented in WYG Report dated March 2014. A copy of the report is provided in the Strutt and Parker information pack and represents the most recent ground investigation information available for the site.

6.1.3 A summary of conclusions from the WYG Report are given below.

6.1.4 The geology of the southern part of the site is typically granular comprising SAND, and the northern cohesive typically comprising firm to stiff CLAY with some SILT.

6.1.5 The WYG Report recommends that proposed properties could be founded on shallow strip footings to granular and cohesive strata including bedrock at varying depths and allowable bearing capacities. However, it is also noted that a piled foundation solution would be necessary if structures were proposed in the area around trial pit 'TP01'. This trial pit is located adjacent to the northern boundary of the site and immediately south of the public footpath crossing of Picknell Green Stream where no development is planned

6.1.6 The CLAY encountered at the site is of low to medium volume change potential and showed plasticity characteristics of low to high plasticity.

6.1.7 WYG advise that reference should be made to NHBC guidelines in respect to the design of building foundations near trees. Additionally it is suggested that suspended ground floors should be adopted, in accordance with NHBC standards, where heave could occur.

6.1.8 The CBR values at the depths taken range between 3.5% and 10.5%. Undrained shear strengths as recorded with a hand shear vane at the locations and level of the CBR tests ranged between 65 and 120kN/m2 which are indicative of firm to stiff CLAY.

6.1.9 WYG recommends that formation levels prior to pavement construction are inspected. Any areas of soft/loose deleterious strata should be replaced with an appropriately compacted coarse grained material and any hard spots should also be removed to guard against reflective cracking in the pavement.

6.1.10 An assessment of the results of the soil analysis did not indicate any potential for harm to human health. No remedial action has been indicated with regard to contamination.

6.1.11 Results for water soluble sulphate do not indicate any requirement for protection of concrete from sulphate attack.

6.1.12 Should any soils require removal from site as waste, they are likely to be classified as 'inert waste' for landfill purposes, subject to assessment of organic content.

6.1.13 Protection of buildings from ground gas is not a requirement.

7 Air Quality

7.1 Air Quality Assessment Report

7.1.1 An assessment was carried out to determine the air quality impacts associated with the construction and operation of the proposed mixed-use development of land to the west of Bexhill. The results of this investigation are contained in the Air Quality Assessment Report dated July 2012 prepared by Peter Brett Associates LLP.

7.1.2 A copy of the report is contained in the Strutt and Parker information pack.

7.1.3 During construction, there is a slight risk of dust annoyance and elevated PM10 concentrations affecting off-site properties. It is therefore recommended that a package of measures is put in place to minimise this risk.

7.1.4 The operational impact of increased emissions arising from the development generated traffic was assessed. Concentrations of nitrogen dioxide and fine particles were predicted at a number of existing residential properties, as well as at proposed properties within the site. The impact on nitrogen oxide concentrations and nitrogen / acid deposition at the Pevensey Levels Ramsar, pSAC and SSSI was also assessed.

7.1.5 Air quality for existing and proposed properties was found to be acceptable, with predicted concentrations below the relevant air quality objectives. The impact of development generated traffic on pollutant concentrations was also found to be negligible.

7.1.6 The impact of additional traffic emissions on the Pevensey Levels Ramsar, pSAC and SSSI was found to be significant adjacent to the A259 (within 5m of the road). Within this distance the vegetation is predominantly not that for which the critical level has been set, and in addition, these areas are subject to appropriate management. The assessment carried out was considered worst-case and the impact was thus judged to be insignificant.

7.1.7 It was concluded that air quality does not provide any constraints to the proposed development.

8 Energy

8.1 Introduction

8.1.1 The need to reduce energy usage within new dwellings will be enforced through step changes in Part L of the Building Regulations, from the current 2013 standards through to 'net zero carbon' in 2016.

8.1.2 New 2013 versions of Approved Documents L1A and L1B came into effect from 6 April 2014. A recent consultation entitled 'Next steps to zero carbon homes – Allowable Solutions' has provided further clarity on the projected Building Regulations target for 2016.

8.1.3 The following targets apply for the proposed development:

i. Building Regulations 2013; and

ii. Building Regulations 2016 if homes are registered with Building Control after 2016;

8.1.4 National and regional policy dictates that any new development should follow the simple energy hierarchy of:

i. Reduce demand;

ii. Use energy more efficiently; and

iii. Only then supply clean, renewable energy where possible or if required by end user.

8.2 Passive Energy Demand Reduction Measures

8.2.1 The following passive design measures can be incorporated into the design of the buildings to reduce energy requirements:

i. Optimising the U-values of the external fabric to reduce energy loss (e.g. by providing additional insulation);

ii. Reducing the air permeability and thermal bridging coefficient of the building envelope;

iii. Incorporating thermally massive materials to help keep the internal temperatures of the building stable;

iv. Enlarging window areas to maximise the use of natural day-lighting and to enhance passive solar gains, whilst managing overheating;

v. Locating plant rooms away from southern elevations to avoid excessive heat gain and to allow maximum plant efficiency;

vi. Providing passive shading to avoid overheating (e.g. the strategic planting of trees or the use of brise soleil); and

vii. Installing windows on two or more aspects (preferably opposite each other) to allow the through-flow of air and provide effective cross ventilation.

8.3 Active Energy Demand Reduction Measures

8.3.1 The following active design measures could also be incorporated into the mechanical and electrical elements of the buildings:

i. Controls to optimise and compensate for heating variations;

ii. Zonal heating controls (e.g. a Building Management System (BMS);

iii. Time and thermostat control of hot water;

iv. Variable speed drives fitted to appropriate pumps and fans to enhance speed control;

v. High efficiency lighting;

vi. Installing energy display devices to promote user behavioural change;

vii. Using energy-efficient lighting systems (e.g. daylight cut-off and Passive Infra-Red (PIR) lights); and

viii. Ensuring that white goods, if provided, achieve a high rating in the EU Energy Efficiency Labelling Scheme.

8.3.2 The above lists of passive and active measures are not exhaustive and these will need to be considered in more detail as the design of the development progresses.

8.3.3 It is vital to emphasise the importance of maximising long-lasting energy performance improvements to the fabric of a building (a “fabric-first” approach), before adding the optimum renewable or low carbon energy technology, if required.

8.4 Concurrent Building Specifications

8.4.1 Below are presented the concurrent build specifications to achieve Building Regulations 2013 compliance, for both residential and non-residential buildings.

8.4.2 A Target Fabric Energy Efficiency (TFEE) was introduced in the Building Regulations 2013. It is therefore anticipated that the required building specifications to achieve Building Regulations 2016 compliance will be in addition to the values presented below.

8.4.3 A summary of the Part L1A 2013 notional dwelling is shown in the table below. If the dwellings at the proposed development are constructed entirely to the notional dwelling specifications they will meet the carbon dioxide and fabric energy efficiency targets and the limiting values for individual fabric elements and building services. However, developers are free to vary the specification, provided the same overall level of carbon dioxide emissions and fabric energy efficiency performance is achieved.

8.4.4 Table 8.1 Summary of concurrent notional dwelling specification for Building Regulations 2013 Part L1A

Element or system	Values
Opening areas	Same as actual up to 25% of floor area.
External walls (W/m^2K)	0.18
Party walls (W/m^2K)	0
Floor (W/m^2K)	0.13
Roof (W/m^2K)	0.13
Windows (W/m^2K)	1.4
Air tightness ($m^3/(h\ m^2)$)	5
Non-repeating thermal bridging	Standard psi-values from Appendix R, or y value = 0.05 if 0.15 is being claimed.
Ventilation type	Natural (with extracts)
Gas Boiler	89.5% efficient

8.5 Renewable Energy Feasibility Study Summary

8.5.1 A review of the suitability of various renewable and low carbon energy technologies for the proposed development has been undertaken as part of the planning application The variables affecting their suitability include:

i. Environmental constraints (e.g. suitable geology for Ground Source Heat Pumps or the presence of protected ecological species that may be affected by the technology);

ii. Resource constraints (e.g. the availability and reliability of local biomass fuel supplies or the local wind resource);

iii. Social constraints (e.g. visual or health impacts of placing combustion-based technologies near housing);

iv. Infrastructure constraints (e.g. impacts on aviation from wind turbines or the availability of suitable transport infrastructure to import fuel, plant or equipment); and

v. Additional constraints (e.g. energy infrastructure may need to be “invisible” or unobtrusive).

8.5.2 A summary of the findings of the Renewable Energy Feasibility Study is presented below.

8.5.3 Table 8.2 Renewable Energy Feasibility Study Summary

Technology	Technological Risk	Availability	Potential Contribution	Appropriate	Comment
Photovoltaic Solar Panels (PV)	Low	Intermittent	kW (total to MW)	Potential	Can be installed on suitable roofs, but inadequate roof space to achieve the quantity of PV required to meet 100% of the energy demand of each building.
Air Source Heat Pumps (ASHPs)	Low	Baseline	kW	Potential	Bespoke system may be suitable as part of a suite of technologies, subject to noise/visual impacts.
Ground Source Heat Pumps (GSHPs)	Low	Baseline	kW	Potential	Potential support mechanism to final build/energy strategy. Subject to final building design and adequate space for infrastructure.
Solar Water Heating	Low	Intermittent	kW	Limited Potential	Technically feasible but would compete with PV for roof space.
Wind (large scale)	Low	Intermittent	MW	No	Urban wind regime unlikely to be suitable. Potential adverse visual/noise impacts.
Wind (micro)	Medium	Intermittent	kW	No	
Fossil fuel micro Combined Heat and Power (CHP)	High	Baseload	kW	No	The heat demand of buildings is may be suitable for an efficient micro-CHP system.
Fossil fuel CHP (district heating)	Low	Baseload	kW to MW	No	Inappropriate housing density will result in high heat distribution losses.
Biomass heat, power and CHP (district heating)	Medium	Baseload	kW to MW	No	No off-site infrastructure to accommodate a biomass-led approach. Biomass CHP network of this scale not technically proven. Housing density not suitable for district heating. High capital expenditure.

8.5.4 Based on the site's location and the details of the proposed development, it is possible to assign a suite of "effective solutions" out of the renewable and low carbon technologies currently available. As shown above, a suite comprised of the following technologies could potentially be used at the proposed development: solar photovoltaic panels (PV), Air Source Heat Pumps (ASHPs) and Ground Source Heat Pumps (GSHPs).

8.6 Zero Carbon Homes: Fabric Energy Efficiency, Carbon Compliance and Allowable Solutions

8.6.1 The DCLG have set out the pathway to delivering zero carbon homes by 2016. The approach to delivering this standard will be set within the Building Regulations and will comprise three tiers.

i. The first tier will be a fabric energy efficiency standard that increases the baseline energy efficiency of a building through design;

ii. The second tier will be an additional target known as Carbon Compliance. A carbon emission target will be set which will require a new home to either increase the levels of energy efficiency further or install low carbon or renewable energy technologies; and

iii. The final tier is an offsetting mechanism, known as Allowable Solutions, that will require a payment or additional onsite investment to 'top up' and offset the remaining emissions associated with energy usage within a building over a defined period.

8.6.2 It is not yet known exactly what these targets are and how they will be implemented. Therefore any development should be mindful of these additional requirements and costs going forward.

9 Infrastructure Programme

9.1 Outline Programme and Phasing

9.1.1 An outline programme is included in Appendix E showing the activities required for a two phase development process.

9.1.2 Activities are programmed into pre-development, phase 1 and phase 2.

9.1.3 Where durations of activities are shown, these have been advised by utility providers but should be considered indicative only.

9.1.4 It should be noted that the actual obligations placed on the purchaser(s) will be dependent on whether the site is sold in phases. Please refer to further information and a breakdown of responsibilities set out in the Executive Summary provided by Strutt and Parker.

Appendix A Site Plans

Appendix B Highway Access Plans

Appendix C Surface Water Features Plan

Appendix D Combined Utilities Plan

Appendix E Outline Programme