Broad Oak: Initial drainage considerations

INTRODUCTION

Yellow Sub Geo Ltd (Yellow Sub) is supporting Fairfax Acquisitions Ltd (Fairfax) with the promotion of land west of Herne Bay Road, Broad Oak, Sturry Kent (the Site) as a housing allocation for approximately 160 dwellings. This includes providing guidance at this early stage of the development process to ensure that surface water runoff can be adequately managed, and to integrate SuDS within the overall masterplan to maximise the various benefits available.

This technical note has been prepared on behalf of Fairfax in support of the promotion of the Site as a suitable location for residential development. An initial concept plan is appended to this Technical Note.

This technical note gives an overview of the Site conditions as well as opportunities and constraints with regards to surface water management.

SITE CONDITIONS AND CURRENT DRAINAGE ARRANGEMENTS

The Site covers an approximate area of 9.5Ha and is currently a greenfield site - covered primarily with grass and hedges comprising pastoral agricultural land (see Figure 1 for an aerial image showing the Site layout and condition).

Figure 2 presents LiDAR topographical data and inferred current runoff directions. Broad Oak is situated on an interfluve between two river valleys. Ground elevations in the area around the Site slope generally northwards. The southern part of the Site itself slopes in a more easterly direction.

The ground elevation at the Site falls from approximately 52m above Ordnance Datum (m aOD) in the southwest to a minimum of approximately 48.93m aOD in the northeast.

At present, the Site does not have a formal drainage system and surface water runoff will either infiltrate or flow overland with the topography. A northwards flowing drain located at the northern boundary is thought to receive much of the Site runoff with Herne Bay Road also receiving some runoff from the southernmost area.

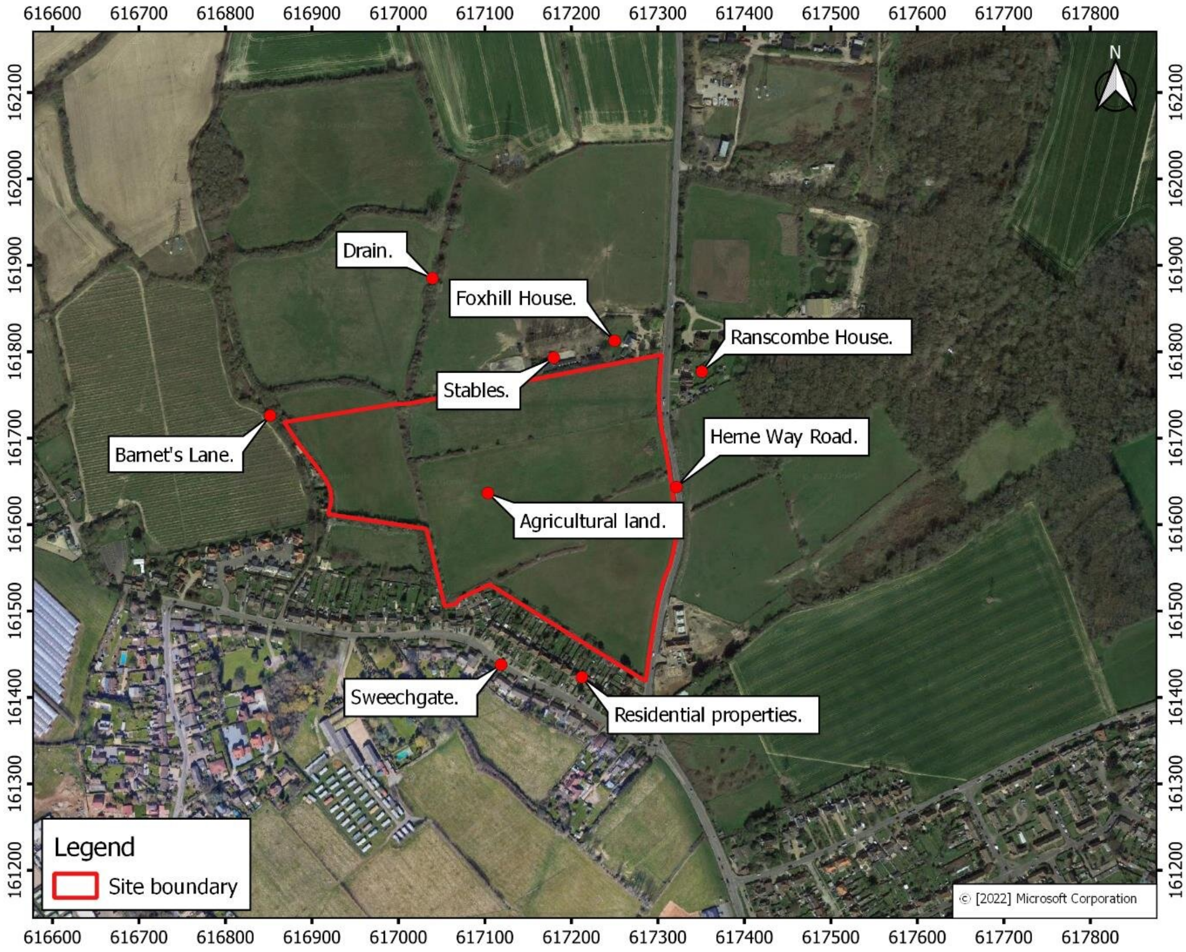

Figure 1 Current Site conditions

Hydrological descriptors for the Site are provided in Table 1. In general, the mean annual rainfall is below the national average and the Base Flow Index (BFI) is relatively low (indicating that most of the incident rainfall is diverted to runoff – which is unsurprising given the local geology as described below.

Table 1 Hydrological point descriptors

Descriptor	Value
NGR	TR 17133 61615
Bfihost19	0.327
Propwet	0.21
Saar6190	625 mm

According to the British Geological Survey (BGS), the southernmost extent of the Site is underlain by superficial Head Deposits (gravel, sand, silt and clay) with superficial deposits absent across the remainder of the Site. The bedrock present beneath the Site comprises the London Clay Formation (to a depth of c. 30 m according to nearby

BGS borehole logs). Given the nature of the bedrock, a clayey matrix to the Head deposits may be expected.

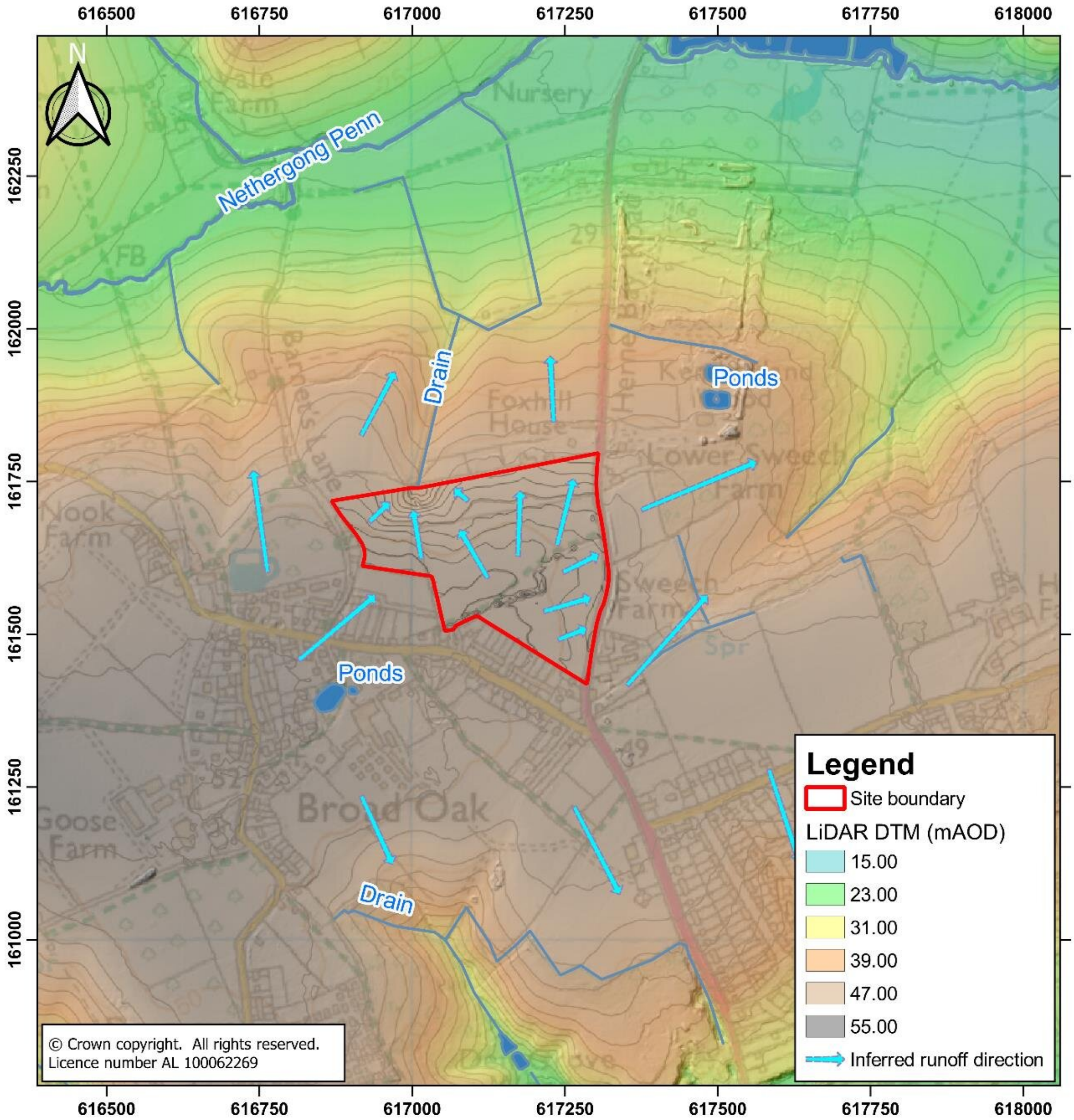

Figure 2 Site topography and current runoff directions

GREENFIELD RUNOFF AND PERMISSIBLE DISCHARGE RATES

The Revitalised Flood Hydrograph (RefH2) method in the 'Rural Runoff' calculator within Causeway Flow was utilised to estimate the greenfield runoff rates for the existing Site using the data presented in Table 1. The 'QBAR' (i.e. 1 in 2.3 year return period) greenfield runoff along with runoff rates for other return period storm events are presented in Table 2. These results represent the runoff from the entire Site; this will be refined down in due course to represent the "positively drained area" only.

Table 2 Greenfield runoff rates

Return period (yrs)	Runoff rate (l/s)
1	45.2
2.3 (Qbar)	**52.1**
30	119.2
100	159.2

The greenfield QBAR runoff rate or 2 l/s/ha (whichever is greater) is generally set as the 'permissible discharge rate' for new developments. 2 l/s/ha results in a total flow rate of 19 l/s (9.5 ha * 2l/s/ha) for the Site. As such, a 52.1 l/s 'permissible discharge' rate may be assumed (i.e. Qbar).

DRAINAGE CONSIDERATIONS

Current Environment Agency (EA) flood risk data indicates that the Site is entirely within Flood Zone 1. Fluvial flood risk is not, therefore, a key consideration when deciding upon the location and nature of SuDS features within the Site boundary.

As shown in

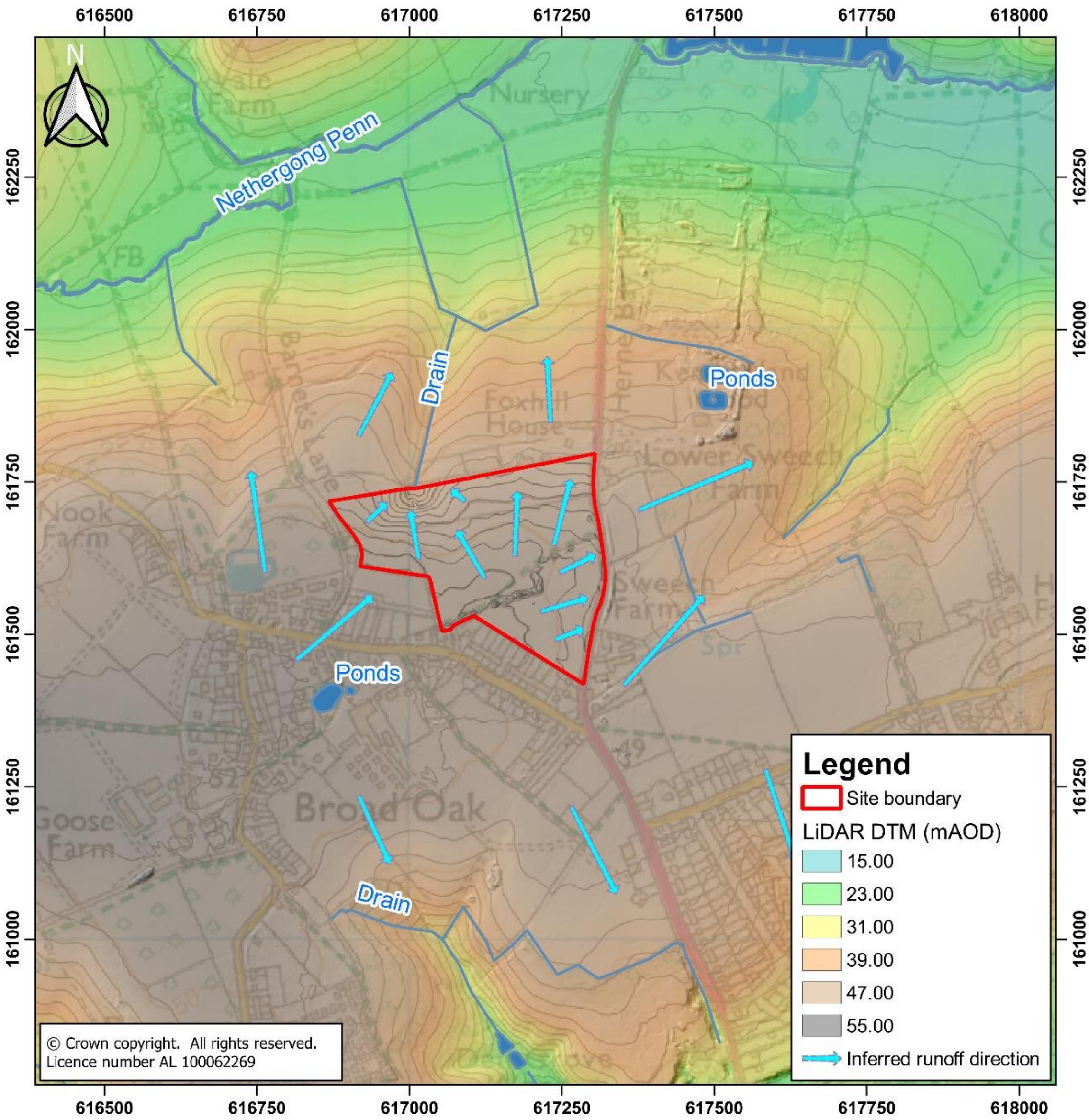

Figure 2Figure 2 the Site falls to the north and east with an overall gradient of c. 1.5%. Therefore, the conveyance of water by gravity via a SuDS train should not prove to be an issue for the Site.

The Site is not within a Source Protection Zone. The geology does not indicate a high potential for infiltration in this area.

WATER DISPOSAL OPTIONS

The outline SuDS Strategy for the proposed development (to be developed in future), will be drafted with due regard to DEFRA's Non-Statutory Technical Standards for SuDS (DEFRA, 2015) and local standards and guidance for surface water drainage on major developments in Kent (Kent County Council, 2019). The Kent local guidance recommends the following hierarchy for the disposal of surface water from new developments:

1. Water reuse; (most preferred)
2. Discharge to ground via infiltration techniques;
3. Discharge to a surface water body;
4. Discharge to a surface water sewer; and,
5. Discharge to a combined sewer (least preferred).

Based on a review of the Site geology from available BGS data (see above), infiltration of surface water to ground does not appear to be a viable option in this instance. On-Site testing (following the BRE Digest 365 methodology) may be undertaken to verify this presumption at some point.

There is a minor watercourse (drain) which flows northwards from the northern boundary to the Nethergong Penn watercourse (see Figure 2). Therefore, discharging surface water to a watercourse is a viable option in this instance. A review of available LiDAR data indicates that the feature is of a reasonable size. Figure 3 presents a cross section through the feature adjacent to the northern boundary of the Site using available LiDAR 1m DTM data.

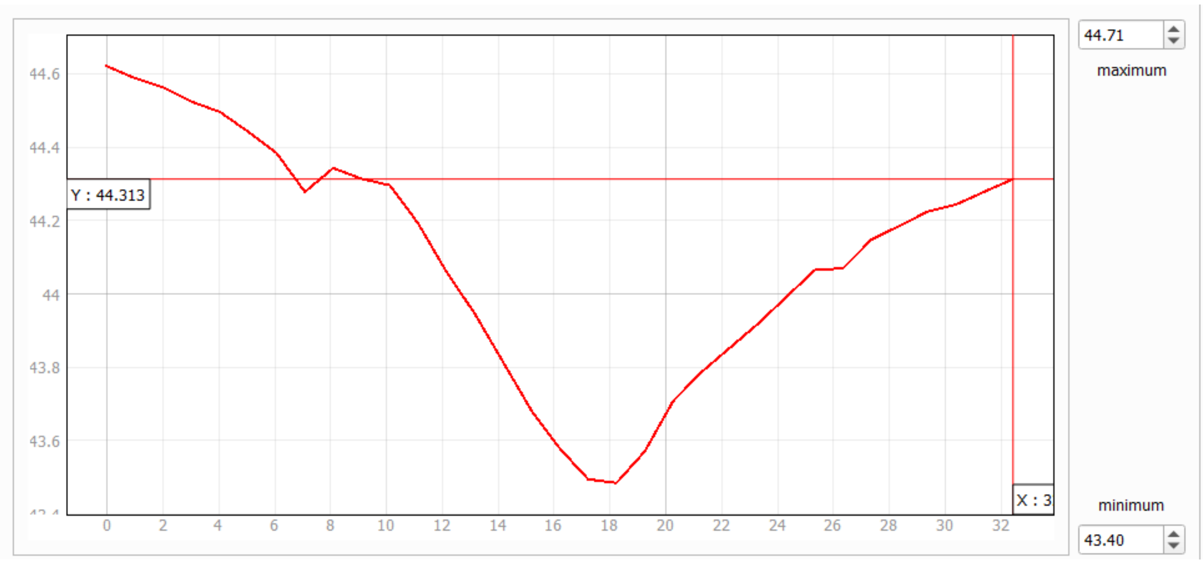

Figure 3 Cross section through stream near northern Site boundary (LiDAR DTM)

Whilst discharge to sewer may be feasible this is not a preferred option unless a discharge to the adjacent drain is not deemed suitable. If required, due to the topography it is likely that this would be viable for much of the Site area.

Water recycling is recommended in the form of water butts but rainwater harvesting cannot be relied on for stormwater management unless sophisticated "smart" systems are employed to ensure storage features are empty ahead of incoming storm events.

ESTIMATED SPATIAL REQUIREMENTS

The storage estimate tool within Causeway Flow has been used to estimate the likely area required if the whole development was to be served by a single attenuation feature – note that this will not be the case and several features will be included across the Site to constitute a "SuDS train". This assessment is based on a 1 in 30 year event, an assumed impermeable area of 5.25 ha (55% of the total Site area) and a permissible discharge rate of 52.1 l/s. A 40% allowance for climate change has also been included.

The results of the analysis yield volumes from 2,226 m^3 to 3,708 m^3 (see Figure 4), which would yield a maximum surface area of 2,966 m^2 when assuming a mean depth of 1.25 m. A circular feature would have a diameter of c. 61 m to achieve this.

In reality, the required surface area would increase when spread over multiple features (as the mean depth would generally be less). In addition to multiple surface attenuation features (such as detention basins and ponds), the proposed development would likely also include vegetated conveyance features (such as swales), permeable paving and water butts.

Storage Estimate

Return Period (years)	30
Climate Change (%)	40
Impermeable Area (ha)	5.250
Peak Discharge (l/s)	52.100
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	0.00000
Required Storage (m³)	Calc
from	2226
to	3708

Figure 4 ***Storage estimate results***

RECOMMENDATIONS AND CONCLUSIONS

Based on published geological data in the vicinity of the Site, the soils, and geology in the area are not well suited for an infiltration based sustainable drainage system. This may be verified by on-Site infiltration testing following the BRE Digest 365 methodology in due course.

On-Site attenuation in surface SuDS features (such as detention basins and swales) with a discharge to the northern drain features is considered the best practicable option at this stage.

The gradient across the Site should allow for a gravity driven SuDS train, with multiple features providing amenity and biodiversity benefits across the area.

Water capture and reuse is also recommended in this instance, either in the form of simple rainwater harvesting butts or more sophisticated systems.

REFERENCES

DEFRA. (2015). *Sustainable drainage systems: non-statutory technical standards.*

Innovyze. (2022). *Literature values for infiltration coefficients.*

Kent County Council. (2019). *Dranage and Planning Policy. Flood risk management strategy guidance.*

Legend

- Site Boundary
- Access
- Emergency Access
- Existing tree belts and hedgerows to be retained
- PROW - Footpath
- Other routes with public access
- Overhead power lines
- Potential Country Park boundary
- Listed Building
- Potential development, incorporating existing vegetation
- Primary Street
- Secondary Street
- Link Road / Courtyard Access
- Potential green infrastructure network
- Potential tree planting to strengthen site boundary
- Potential SUDS Features
- Potential pedestrian / cycling link
- Potential Structural Planting

Fairfax

Fairfax Aquisitions Ltd

project:

Land off:

Herne Bay Road
Broad Oak

title:

Indicative Concept Plan

date: Jan'23 **scale:** N.T.S. @ A2

drawing number:	Rev.
2055/PA.04	

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