

### 2.3 Ground Conditions

The British Geological Survey maps show that the site overlies Devensian Till, comprised of Diamicton. Bedrock geology is recorded as Mudstone of the Bowland Shale Formation.

A historical borehole log (Ref: SD73NW182 and SD73NW183) located approximately 500 m north-east of the site within the same geological formation of the site records; 0.2 to 0.3 m topsoil, 2.1 to 2.8 m clay and 9.8 m sand overlying limestone/sandstone. Groundwater was not recorded in the boreholes.

### 2.4 Greenfield Calculations

The greenfield runoff for the site is calculated using the ReFH2.3 statistical rainfall-runoff method with FEH 2013 rainfall data using the default catchment characteristics (Appendix 6).

Table 1 below summarises the total catchment runoff within the site boundary and runoff per unit area for varying return periods. These figures relate to the developable areas that will ultimately discharge into the central and eastern watercourses crossing the site (Appendix 6).

<b>Greenfield runoff</b>					
<b>Catchment</b>	<b>Existing greenfield runoff catchment</b>	<b>Return period</b>			
		<b>1 in 1 yr</b>	<b>1 in 10 yr</b>	<b>1 in 30 yr</b>	<b>1 in 100 yr</b>
Calder Operational Catchment	Central (11.7 ha)	52.0 l/s	104.5 l/s	135.1 l/s	171.6 l/s
		7.3 l/s/ha	14.7 l/s/ha	19.0 l/s/ha	24.1 l/s/ha
	Eastern (7.92 ha)	19.8 l/s	39.7 l/s	51.3 l/s	65.2 l/s
		8.4 l/s/ha	16.9 l/s/ha	21.8 l/s/ha	27.7 l/s/ha

Table 1: Greenfield runoff rates

## **2.5 Drainage Hierarchy**

Surface water disposal should be in accordance with the drainage hierarchy in Building Regulations Part H 2015<sup>1</sup> and Planning Practice Guidance 'Reducing the causes and impacts of flooding', paragraph 080. Disposal via SuDS methods should be considered as the first option. Disposal to the public sewer should be considered only when SuDS methods and disposal to the watercourse are shown to be unsuitable.

### **2.5.1 Sustainable Drainage Systems (SuDS)**

SuDS methods include water infiltration systems such as soakaways, basins and filter strips, together with swales, pervious pavements, detention basins, ponds and other wetland solutions. The various methods are considered in detail in The SuDS Manual (CIRIA C753).

Infiltration type SuDS such as soakaways will not be viable due to the impermeable ground conditions (clay and silt) on the site. Soakaway testing was conducted by Lithos Consulting (Ref: 008/5200/REG/dw). Infiltration rates could not be calculated as the water level did not fall to the 25% effective depth.

An assessment of SuDS methods and their applicability to this site is included in Appendix 6. Source control SuDS features such as permeable paving (Type C) may be suitable to incorporate into the site to provide source control water treatment and attenuation.

### **2.5.2 Watercourse**

There are two unnamed watercourses crossing the site; one on the north-eastern boundary and another in the centre of the site. There is another unnamed watercourse located immediately north-west of the site. These watercourses are all tributaries of Bushburn Brook located approximately 510 m north of the site. Discharge to a watercourse is considered viable, subject to approval from the Lead Local Flood Authority.

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<sup>1</sup> <https://www.gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h>

### **2.5.3 Public Sewer**

A 225 mm and a 300 mm surface water sewer converge south of the site, connecting to a 1300 mm x 1550 mm surface water culvert located beneath the railway embankment on the southern boundary of the site, which ultimately outfall into the watercourse that crosses the centre of the site.

## **2.6 Proposals for Surface Water Disposal**

The final design will need the approval of the relevant statutory bodies but will broadly follow these principles:-

- Surface water disposal will likely be via gravity to attenuation basins in the northern portions of the site before discharging via gravity to the central watercourse. This is subject to approval from the Lead Local Flood Authority and ordinary watercourse consent will also likely be required.
- Surface water discharge will likely be restricted to the greenfield runoff rate of the developable catchment area of the central watercourse. The greenfield runoff rate has been proportionally split for the proposed western and eastern development areas to determine the proposed discharge rates, equating to 33.7 l/s and 18.3 l/s, subject to approval from the Lead Local Flood Authority.
- Attenuation storage will be provided for rainfall events up to the return period of 1 in 100 year plus 50% climate change. The total estimated storage volume is approximately 2820 m<sup>3</sup> and 2040 m<sup>3</sup> for the central and eastern drainage networks respectively, subject to detailed design. Attenuation calculations are provided in Appendix 6.
- Source control SuDS features such as permeable paving (Type C) may be suitable (subject to site conditions) to incorporate into the site to provide source control water treatment and attenuation.
- The surface water drainage system will be offered for adoption to United Utilities or a NAV (New Appointments and Variations).

## 2.7 SuDS Maintenance

Maintenance of the potential SuDS systems for this site will be in accordance with the recommendations within The SuDS Manual (CIRIA C753, 2015) as stipulated in Table 2, along with any recommendations provided by suppliers and product specifications.

Table 2 summarises maintenance actions and frequency for each component (surface and sub surface) of the drainage system. Maintenance access requirements such as vehicle and machinery access (where applicable) will also need consideration.

Features adopted by authorities, such as drainage authorities, will be maintained under their normal regime of inspection and maintenance.

The maintenance schedules below should be followed to ensure flood risk on site does not increase through system blockages or poor maintenance. Following the maintenance schedule is required to ensure the drainage features remain functional for the lifetime of the development.

<b><u>SuDS SYSTEM</u></b>	<b><u>ACTION</u></b>	<b><u>FREQUENCY</u></b>
<b>Permeable Paving (Type C)</b>	Initial inspection of porous pavement	Monthly for three months after installation
	General removal of litter and debris. Brush regularly.	Monthly (or more frequently if required)
	Inspect porous pavements for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms for first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Brushing and vacuuming of porous pavements (standard cosmetic sweep over whole surface)	Annually, after autumn leaf fall
	Removal of weeds from porous pavements or management using glyphosate applied directly into the weeds by an applicator rather than spraying	Annually (or more frequently if necessary)

<b>Permeable Paving (Type C)</b>	Remedial work to any depressions, rutting and cracks of the permeable pavement considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure of the permeable pavement by remedial sweeping	Every 15 years or as required
<b>Basin</b>	Inspect surface inlet/ outlet structures removing obstructions and silt as necessary. Check there is no physical damage.	Monthly
	Mow grass access paths and verges surrounding basins at 35 to 50 mm minimum and 75 mm or as specified to provide a cared for appearance and allow pedestrian access.	Monthly or as required.
	Confirm whether a liner is present to hold water or prevent pollution of groundwater to protect.	Annually or every 3 years as required
	Where silt accumulated on apron or around inlet/ outlet, then remove.	Annually or every 3 years as required
	Retain as much existing vegetation as possible to ensure rapid re-colonisation of open areas.	Annually or every 3 years as required
	Undertake silt removal during September-October to minimise damage to protected wildlife and ensure re-growth of aquatic vegetation before winter.	Annually or every 3 years as required
<b>Guttering, gullies and piped drainage system</b>	General removal of litter and debris.	6 monthly, after autumn leaf fall (or as required)
	Cleaning of gullies, drainage channel and drainage channel sump units to remove debris and silt.	6 monthly, after autumn leaf fall (or more frequently if necessary)
	Cleaning of manholes to remove debris and silt.	Annually, after autumn leaf fall (or more frequently if necessary)
	If the system allows rainfall infiltration from above, check filter surface for blockages. Remove and replace infiltration material if deemed necessary.	Annually

<b>Guttering, gullies and piped drainage system</b>	Remove sediment from pre-treatment structures.	Annually or as required
	Inspection of all access chambers, inspection chambers, manholes and proprietary storage units to identify and make good any defects as necessary.	Annually
	Inspect inlets, outlets, vents and overflows to ensure they are operating as designed.	Annually
<b>Vortex flow control</b>	Remove Litter and Debris	Monthly
	Cleaning of flow control to remove debris and silt	Annually (or more frequently if necessary)
	Inspect inlets and outlets for blockages and clear if required	Monthly
	Repair any damages to flow control device and manhole	As required
	Repair any damage to manhole cover	As required
	Repair any damage to inlet/outlet	As required
<b>Inlets</b>	Inspection for debris and sediment build up.	Annually (and following poor performance)
	Inspect inlets for blockages and clear if required.	Monthly
	Inspect inlet pipework for blockages, clogging, standing water and structural damage.	Monthly
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate.	As required

*Table 2: SuDS Maintenance*

Method statements will be provided prior to construction. These will include details on how contaminated water, erosion and sediment control will be dealt with during construction.

## **2.8 Proposals for Foul Water Disposal**

Foul effluent should discharge via gravity to the site low point before being pumped to the 300 mm public foul water sewer within the southern boundary of the site (Appendix 6), subject to approval from United Utilities.

The foul water drainage system may be offered for adoption to United Utilities or a NAV (New Appointments and Variations).

## **2.9 Residual Flood Risk**

There is a potential flood risk to site occupiers and to others from surface water runoff as a result of developing the site. The residual risk can be managed by the general flood mitigation measures outlined below.

## **2.10 Mitigation Measures**

The proposed surface water drainage system is designed to current best practice and to the standards laid out in the publication 'Design and Construction Guidance for foul and surface water sewers' and Building Regulations Part H 2015.

In the event of surface water exceedance during extreme rainfall events the site is laid out so that surface water runoff is directed away from houses, including those on neighbouring streets.

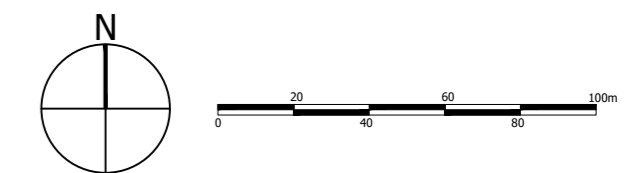
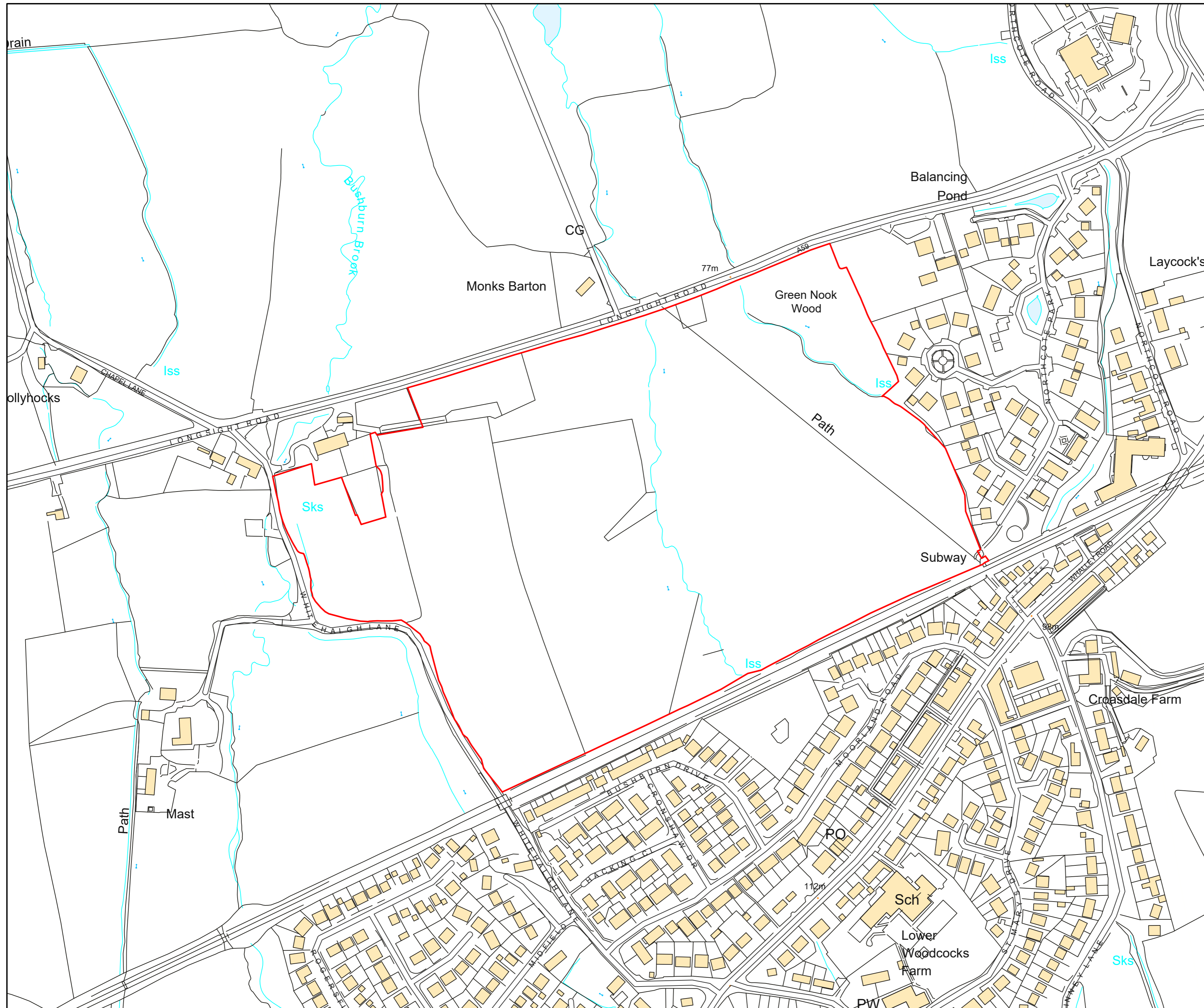
### 3.0 CONCLUSIONS

1. Infiltration type SuDS such as soakaways will not be viable due to the impermeable ground conditions (clay and silt) on the site. Soakaway testing was conducted by Lithos Consulting (Ref: 008/5200/REG/dw). Infiltration rates could not be calculated as the water level did not fall to the 25% effective depth.
2. Surface water disposal will likely be via gravity to attenuation basins in the northern portions of the site before discharging via gravity to the central watercourse. This is subject to approval from the Lead Local Flood Authority and ordinary watercourse consent will also likely be required.
3. Surface water discharge will likely be restricted to the greenfield runoff rate of the developable catchment area to the central watercourse. The greenfield runoff rate has been proportionally split for the proposed west and east development areas to determine the proposed discharge rates, equating to 33.7 l/s and 18.3 l/s, subject to approval from the Lead Local Flood Authority.
4. Attenuation storage will be provided for rainfall events up to the return period of 1 in 100 year plus 50% climate change. The total estimated storage volume is approximately 2820 m<sup>3</sup> and 2040 m<sup>3</sup> for the central and eastern drainage networks respectively, subject to detailed design.
5. Source control SuDS features such as permeable paving (Type C) may be suitable (subject to site conditions) to incorporate into the site to provide source control water treatment and attenuation.
6. Foul effluent should discharge via gravity to the site low point before being pumped to the 300 mm public foul water sewer within the southern boundary of the site, subject to approval from United Utilities.
7. Maintenance of the drainage system will be in accordance with the recommendations provided by suppliers' and product specifications. Maintenance of the potential SuDS systems for this site will also be in accordance with the recommendations within The SuDS Manual.

8. Method statements will be provided prior to construction. These will include details on how contaminated water, erosion and sediment control will be dealt with during the construction phase.
9. Both the surface and foul water drainage systems will be offered for adoption to United Utilities or a NAV (New Appointments and Variations).

## APPENDICES

**APPENDIX 1**



Project  
**LAND OFF LONGSIGHT ROAD,  
 LANGHO**  
 Drawing Title  
**SITE LOCATION PLAN**

Date	Scale	Drawn by	Check by
29.10.2024	1:2500 @ A2	SN	JB
Project No	Drawing No	Revision	
333101612	0100	-	



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**APPENDIX 2**





