Children's Care Home, Pegswood

Flood Risk Statement and Drainage Strategy

March 2020

FAIRHURST

CONTROL SHEET

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Contents

1 INTRODUCTION

Fairhurst have been appointed to undertake a flood risk statement and drainage strategy at a proposed development for a children's home in Pegswood, Northumberland (Appendix A). The latest proposed layout comprises of development on a parcel of land that used to be a children's care centre before its demolition. The site is 0.13ha in size.

The site is located in Pegswood, Northumberland (National Grid Reference: NZ 22464 87656). There are no watercourses passing through the site. The nearest watercourses are a drainage ditch (located approximately 200m north of the site) and the Bothal Burn (c. 420m east of the site). An overview of the site is provided in Figure 1.

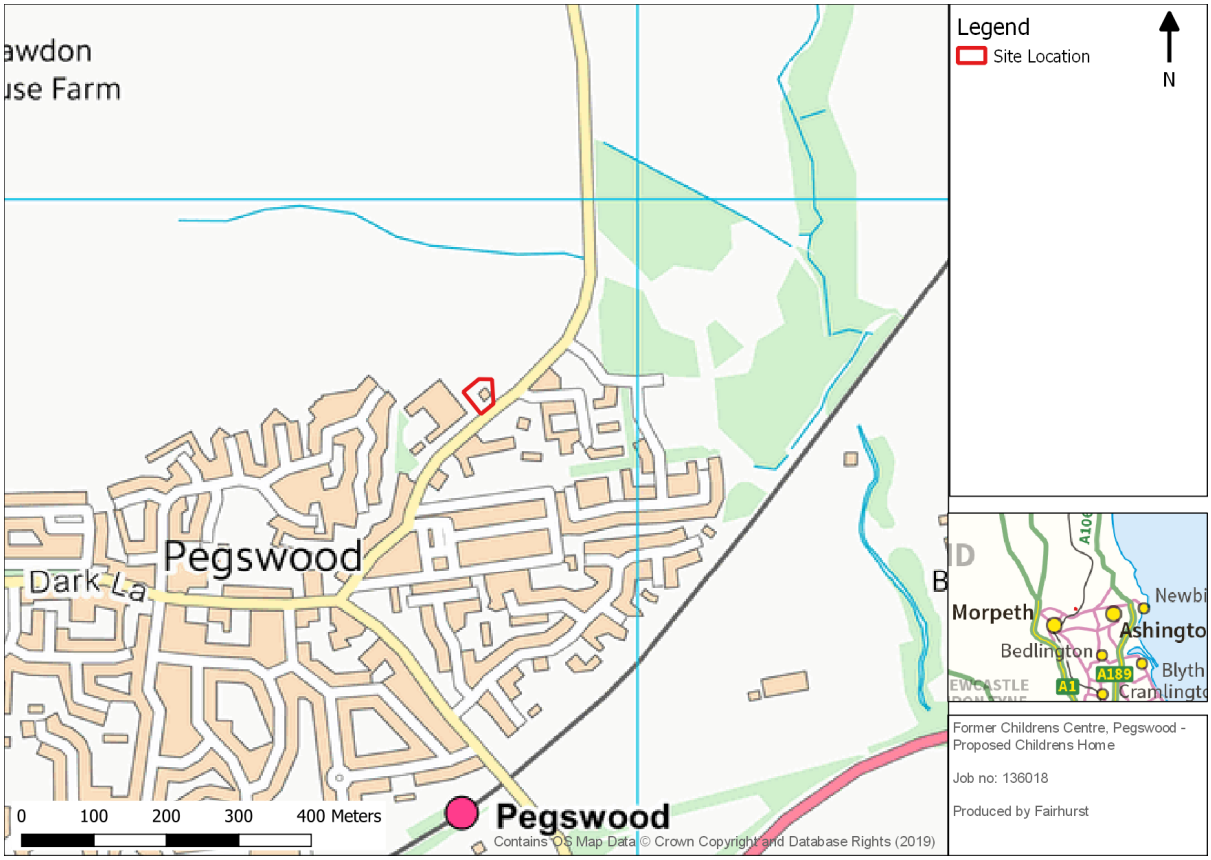

Figure 1: Site Location.

2 LOCAL PLANNING POLICY

A draft copy of the Northumberland Local Plan was published in January 2019. It should be noted that the plan is currently at its draft consultation phase and the final version of the plan may be subject to change. The draft version of the plan contains its own section relating to the water environment. The following policy taken from the plan is relevant to this flood risk statement and drainage strategy:

- **Policy WAT 3 - Flooding:**

1. In assessing development proposals the potential for both on and off-site flood risk from all potential sources will be measured, taking into account the policy approach contained within: the relevant Catchment Flood Management Plan; the Northumberland Local Flood Risk Management Strategy; the Northumberland Outline Water Cycle Study; and the findings of Drainage Area Studies.
2. Development proposals will be required to demonstrate how they will minimise flood risk to people, property and infrastructure from all potential sources by:

a) Avoiding inappropriate development in areas at risk of flooding and directing the development away from areas at highest risk, applying the Sequential Test and if necessary the Exceptions Test, in accordance with national policy and the Northumberland Strategic Flood Risk Assessment. Site Specific Flood Risk Assessments will be required in accordance with national policy and guidance;

b) Ensuring that the development will be safe over its lifetime, taking account of climate change, will not increase flood risk elsewhere and where possible, reduce flood risk overall;

c) Assessing the impact of the development proposal on existing sewerage infrastructure and flood risk management infrastructure, including whether there is a need to reinforce such infrastructure or provide new infrastructure in consultation with the relevant water authority;

d) Ensuring that development proposals in areas at risk from flooding are made resistant and resilient, in terms of their layout, mix and/or building design, in accordance with national policy and the findings and recommendations of the Northumberland Strategic Flood Risk Assessment;

e) Pursuing the full separation of foul and surface water flows as follows:

i. A requirement that all development provides such separation within the development; and

ii. Where combined sewers remain, the Council will work with statutory sewerage providers to progress the separation of surface water from foul;

f) Ensuring that built development proposals, including new roads, separate, minimise and control surface water run-off, with Sustainable Drainage Systems being the preferred approach, modified as necessary where minewater is present; in relation to this:

i. Surface water should be managed at source wherever possible, so that there is no net increase in surface water run-off for the lifetime of the development;

ii. Surface water should be disposed of in accordance with the following hierarchy for surface water run-off:

- To a soakaway system, unless it can be demonstrated that this is not feasible due to poor infiltration with the underlying ground conditions;
- To a watercourse, unless there is no alternative or suitable receiving watercourse available;
- To a surface water sewer;
- As a last resort, once all other methods have been explored, disposal to combined sewers;

iii. Where greenfield sites are to be developed, the surface water run-off rates should not exceed, and where possible should reduce, the existing run-off rates;

iv. Where previously developed sites are to be developed:

- The peak surface run-off rate from the development to any drain, sewer or surface water body for any given rainfall event should be as close as reasonably practicable to the greenfield run-off rate for the same event, so long as this does not exceed the previous rate of discharge on the site for that same event; or
- Where it is demonstrated that the greenfield run-off rate cannot be achieved, then surface run-off rate should be reduced by a minimum of 50% of the existing site run-off rate;

g) Full consideration should be given to solutions within the wider catchment area, including blue-green infrastructure based solutions and those providing ecosystem services, with wider solutions especially applied if local solutions could be harmful to biodiversity, landscape or built heritage;

3. In relation to flood alleviation schemes:

a) The early implementation of approved schemes will be supported through development decisions;

b) Any proposal for additional schemes should demonstrate that they represent the most sustainable solution and that their social, economic and environmental benefits outweigh any adverse environmental impacts caused by new structure(s), including increasing the risk of flooding elsewhere.

4. Any works relating to the above, which impact on natural water systems, should consider the wider ecological implications, applying the ecosystem approach, and link into green infrastructure initiatives wherever practicable.

- **Policy WAT 4 – Sustainable Drainage Systems:**

1. Water sensitive urban design, including Sustainable Drainage Systems (SuDS) will be incorporated into developments whenever necessary, in order to separate, minimise and control surface water run-off, in accordance with national standards and any future local guidance.
2. SuDS will be a requirement for any development where it is necessary to manage surface water drainage unless it can be clearly demonstrated:
    a) That SuDS are not technically, operationally or financially deliverable or viable and that any surface water drainage issues resulting from the development can be alternatively mitigated; or
    b) That the SuDS scheme will itself adversely affect the environment or safety, including where ponds could increase the risk of bird strike close to the airport or where existing minewater problems could be exacerbated.
3. SuDS or other water sensitive urban design schemes should be devised to take account of predicted future conditions and, where appropriate, efforts should be made to link them into wider initiatives to enhance the green infrastructure, improve water quality, benefit wildlife and/or contribute to the provision of an ecosystem service.
4. Arrangements must be put in place for the management and maintenance of SuDS over the lifetime of the development, with such arrangements taking account of the cumulative effectiveness of SuDs in the area concerned.

3 SOURCES OF FLOOD RISK INFORMATION

3.1. Environment Agency (EA)

The EA Flood Maps show the development to be located in Flood Zone 1, as shown in Figure 2. This means that the site is outside of the area which is at risk from extreme fluvial or tidal flooding and the site is therefore not at risk from inundation during a 0.1% AEP (Annual Exceedance Probability) event.

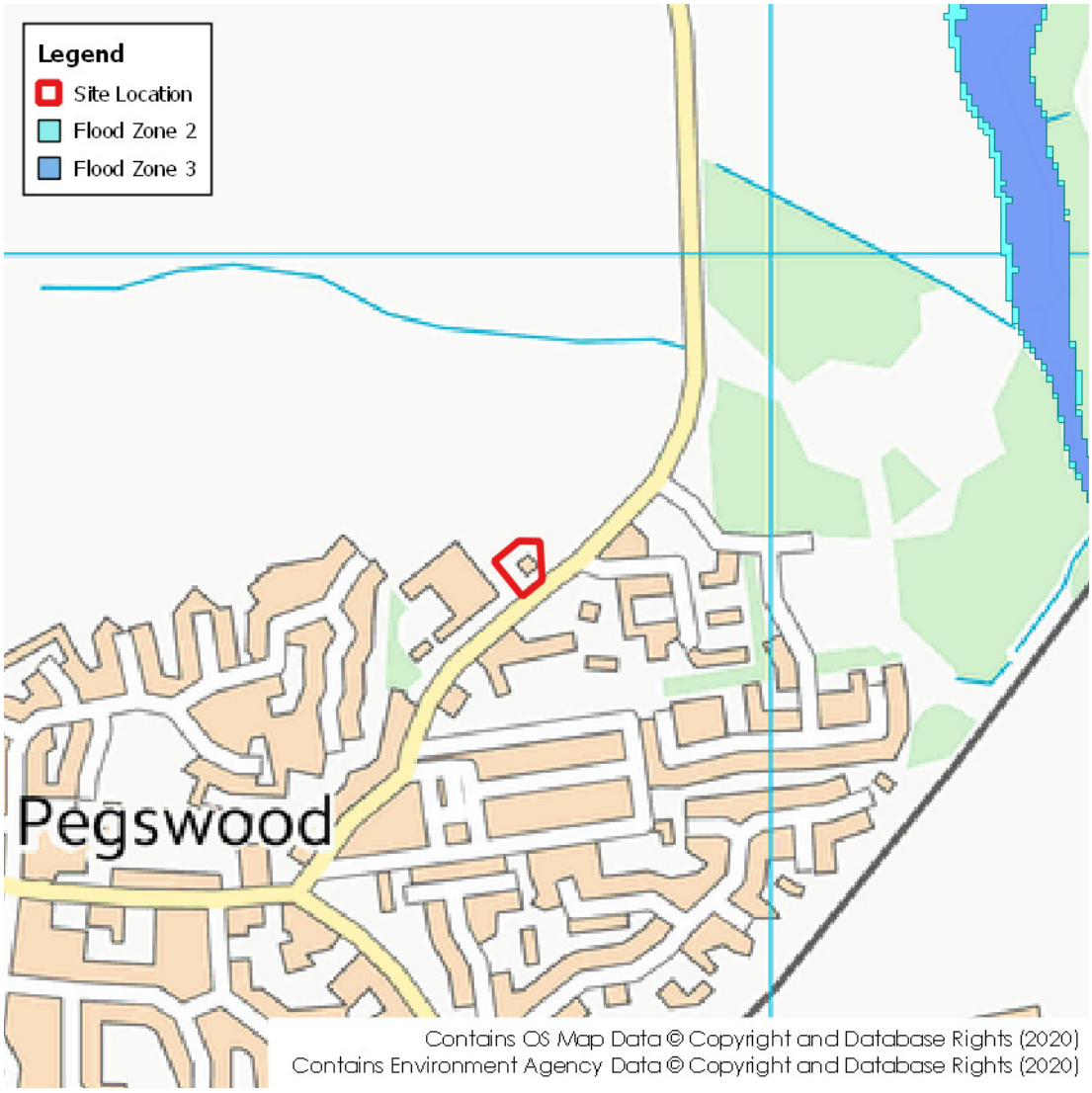

Figure 2: Extract from EA's flood map for planning.

The online EA flood risk from surface water map (Figure 3) shows the majority of the site to be at a very low risk from surface water flooding. There are areas of the site however that are at a low risk from surface water flooding. This means that the site is at risk from an event between a 0.1% and 1% AEP event.

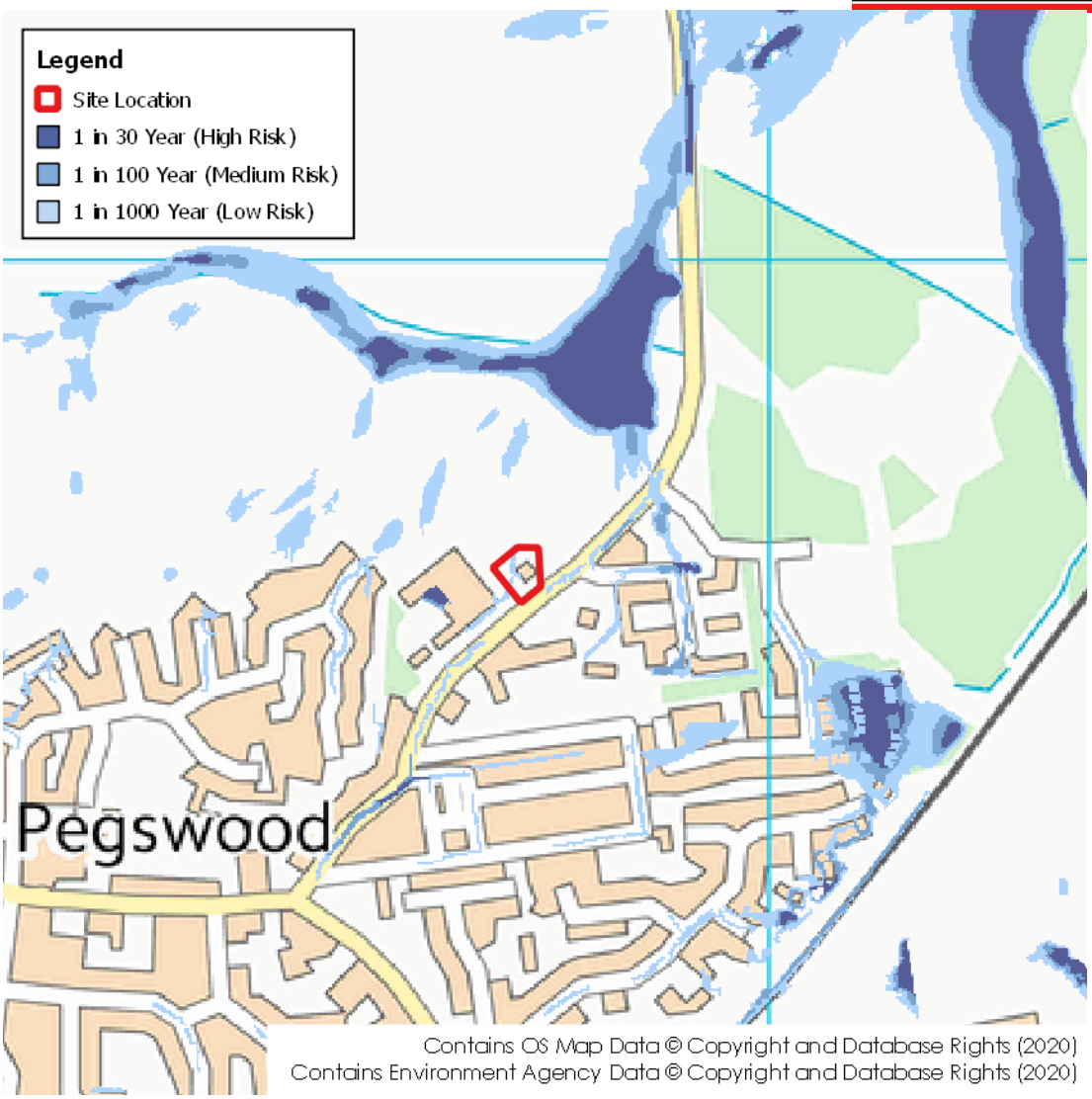

Figure 3: Extract from the EA's flood risk from surface water map.

EA mapping does not show any records of historic flooding within c. 1.5km of the proposed site boundaries. This does not mean that no flooding has ever occurred on site; simply that it has never been recorded by the EA.

EA flood risk from reservoirs mapping does not show the site to be at a risk from reservoir flooding.

3.2. Strategic Flood Risk Assessment

Northumberland County Council has published two Strategic Flood Risk Assessments (SFRAs). The Level 1 SFRA was published in September 2010 and the Level 2 SFRA was published in October 2015. Neither document contains any relevant information for the site.

3.3. Water Company

Northumbrian Water (NWL), the sewerage operator in the region, is required by OFWAT to maintain a record of flooding incidents due to hydraulic capacity problems on the sewerage

network. A request was made to NWL for any historical records of sewer flooding that they hold for the site. NWL identified that there were no records of sewer flooding within the vicinity of the site. A copy of recorded flooding from NWL is provided in Appendix B.

4 POTENTIAL SOURCES OF FLOOD RISK

4.1. Fluvial (River Flooding)

Extreme fluvial flood events have the potential to cause rapid inundation of properties whilst posing a threat to the welfare of occupants and potentially preventing emergency access to properties and essential infrastructure.

The proposed site is located entirely in Flood Zone 1. This means that data held by the EA indicates a low risk of fluvial flooding for the site. The nearest mapped source of fluvial flood risk is from the Bothal Burn, located approximately 420m east of the site. Land surrounding the Bothal Burn is classified as Flood Zone 3, meaning that it is at risk from flooding during the 1% AEP (Annual Exceedance Probability) event. A review of the topographic survey (Appendix C) suggests the site at its lowest elevation is 50.20m AOD, in comparison to 2m LiDAR the Bothal Burn is c. 29m AOD. This is a c 21m difference in elevation from the nearest Flood Zones 2 and 3 and the site. Because of the distance of the site from the Bothal Burn and the difference in elevation between the two points, there is considered to be a low risk of fluvial flooding from this source.

A drainage ditch c. 200m north of the site is not deemed to pose a flood risk to the site due to the distance between the site and the elevation of the ditch. No 1m or 2m LiDAR is available for the area of the drainage ditch, as an alternative 50m LiDAR has been used. It shows that the ground level closest to the ditch is c. 45m AOD, c. 10m lower than the lowest site level. If the ditch were to flood it could be expected that over the 200m distance any out of bank flows would dissipate before arriving at site.

There are no other watercourses within the nearby vicinity of the site which are perceived to pose a flood risk.

4.2. Infrastructure Failure

The failure of conveyance infrastructure such as culverts or bridges could increase the risk of flooding at the site. The nearest culvert is located approximately 200m north of the site and carries flows from the drainage ditch underneath Butcher's Lane and into the Bothal Burn. The perceived likelihood of this culvert failing is low. Even if such an event was to occur, the site is at such a distance from the culvert flows from here are unlikely to affect the site.

The Bothal Burn c. 500m east of the site crosses underneath the East Coast railway line in what appears to be a culvert appears to be culverted. If the culvert were to block or fail this could pose a flood risk, however due to distance and changes in elevation the risk from a failure of this culvert is deemed to be low.

The Bothal Burn also appears to be culverted underneath the A197 road c. 800m south east of the site. Due to distance the risk from a failure is low.

There is no other infrastructure that is expected to pose a risk of flooding to the site in the event of failure.

4.3. Sewer Flooding

NWL sewer plans shows a 225mm PVC foul sewer, to the west of the site, running through the ground of Pegswood first school. A combined 225mm diameter sewer also runs south of the site within Longhirst Road. Failure of any of these will have the potential to cause flooding in the local area. A map of the NWL sewer assets is included in Appendix D.

In the event of a sewer exceedance event from surrounding developments, it is expected that flows will be conveyed along roadways towards low lying elevation areas. It is considered unlikely that flows will enter the site and have an impact upon the proposed development based on available levels information. However any flow that does enter the site will likely pool in low lying elevation points and not enter buildings.

4.4. Pluvial (Overland Flow)

The topographical survey (Appendix C) shows that the centre of the site is relatively flat with ground levels c. 1m higher in the south of the site than the north. The EA's flood risk from surface water mapping shows that parts of the site to be at a low risk from pluvial flooding. This means that the site is shown to be at risk from a 0.1%-1% AEP event. Based on EA mapping, the depth of flooding would be below 300mm and collect mainly in the car park with some flooding against the old children's centre. There are no overland flow routes travelling towards the site.

5 SURFACE WATER DRAINAGE

The development is located within Flood Zone 1. In accordance with the NPPF, the drainage strategy focusses on the management of surface water to ensure flood risk is not increased on or off site. The surface water strategy for the site has been developed in accordance with The Building Regulation Part H Hierarchy.

5.1 Existing Surface Water Runoff

The Modified Rational Method has been used to calculate runoff from the areas that are to be developed as these areas of the site are currently brownfield. The Modified Rational Method uses the following formula to calculate peak runoff:

$$Q = 2.78 * Cv * Cr * Ri * A$$

Where:

Q = Flow Rate (l/s)

Cv = Volumetric Runoff Coefficient

Cr = Routing Coefficient (taken as 1.3)

Ri = Rainfall Intensity (mm/hr)

A = Area (ha)

The discharge rates in litres per second per hectare are summarised in Table 1 and applied to the current impermeable area of the building to be replaced (0.056 ha). For full calculations, see Appendix E.

Table 1: Brownfield runoff rates

Event	Brownfield Runoff (l/s/ha)	Brownfield Discharge Rate (l/s) (0.056 ha)
1 in 1 Year	40.1	2.2
1 in 5 Year	57.7	3.2
1 in 30 Year	80.2	4.5
1 in 100 Year	96.0	5.4

Based on the proposed layout drawing it is assessed that the new building footprint and all car parking spaces will be 0.056ha. Table 1summarises the brownfield discharge rates for the old and new building area. Table 2summarises the greenfield rates for the same area. Micro Drainage outputs for these rates are included in Appendix F. Overall there is an opportunity to provide a reduction in runoff rates from the development post construction as the current site car park, which is to remain post development, has no attenuation to reduce the runoff rate but will be included for in the new drainage design.

Table 2: Equivalent Greenfield runoff rates

Event	Greenfield Discharge Rate (l/s) (0.056ha)
1 in 1 Year	0.2
1 in 5 Year	0.3
1 in 30 Year	0.4
1 in 100 Year	0.5

The Northumberland County Council (Published 2014) states that "Runoff rates should not exceed Greenfield wherever possible. Any re-development should reduce runoff by a minimum of 50% of existing brownfield runoff". In order to offer as much benefit as possible to the wider area a reduction as close as possible to greenfield discharge rates it is proposed that runoff rates will be limited to 3 l/s for all storm events. This is the lowest possible discharge rate that can be accommodated in order to prevent blockages to the drainage system.

5.2 Proposed Surface Water Drainage

The Building Regulations Part H sets out a hierarchy for the choice of discharge point for a rainwater system. In order of priority, the possibilities are given as:

- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
- A watercourse; or where that is not reasonably practicable,
- A sewer.

5.2.1 Discharge via infiltration

A review of the Soilscapes website suggests that soils are "Slightly acid loamy and clayey soils with impeded drainage". A review of the online BGS map identifies no superficial deposits overlaying the site. The site is shown to have a bedrock geology of "Pennine Middle Coal Measures Formation -Sandstone" whilst the superficial geology consists of "Till, Devensian – Diamicton"".

FSR SOIL values range from 0.15 to 0.5 with 0.15 being freely draining and 0.5 being impermeable. Descriptors for the site area indicate a value of 0.45, suggesting that there is limited scope to discharge surface water into the underlying ground.

Given the presence of 'clayey soils' and a SOIL value of 0.45 it is unlikely that infiltration to discharge surface water will be suitable. However prior to the detailed design site specific infiltration tests should be carried out to confirm the feasibility of this option.

5.2.2 Discharge to a watercourse

The nearest watercourse is a drainage ditch, located approximately 200m north of the site. Due to the significant distance between the site and this watercourse, with land in between likely belonging to another party and with no reliable LiDAR levels available a connection is not considered to be feasible.

5.2.3 Discharge to a sewer

Considering that it is not feasible to discharge surface water via infiltration or into an existing watercourse, consultation with NWL will need to be undertaken to understand if the local sewer system can handle the surface water runoff from the site.

NWL sewer plans (Appendix D) confirm the presence of combined and foul sewers within the vicinity of the site. It is recommended that surface water be connected into the 225mm combined sewer upstream of manhole 8701, on Longhirst Road.

It is proposed that the site will discharge surface water at a rate of 3 l/s. This is the lowest possible discharge rate that can be accommodated in order to avoid blockages to the local drainage system. This rate will ensure a benefit to the local area and reduce the risk of sewer water flooding to the development and wider area.

A pre development enquiry with NWL will be required prior to detailed design of the site to confirm if there is sufficient capacity in the network to handle these flows.

5.2.4 Climate Change

To ensure that the proposed discharge rates can be achieved, it will be necessary to provide surface water attenuation within the development. The EA generally advises that a lifespan of 100 years should be used for developments. The Technical Guidance to the NPPF states that for the time period 2085 to 2115, the peak rainfall intensity should be increased by 20% to account for the possible impacts of climate change.

The latest Technical Guidance from the NPPF also states that new developments should understand the flooding implications for the effect of a 40% increase in the peak rainfall intensity. If these implications are significant and could potentially impact the site, another site or put people at risk then measures would need to be looked at to provide more attenuation working towards a 40% climate change increase, or provide additional mitigation allowances, for example a higher freeboard to ensure that there is no risk to the site or offsite developments for the extreme 40% climate change scenario.

In order to ensure no increase in risk as a result of the development the attenuation storage has considered a 40% increase in climate change. Taking into account the lifespan of the development and the anticipated increase in rainfall intensity due to climate change, an estimate for the surface water attenuation volume has been carried out for the development using the industry standard software, Micro Drainage.

On the basis that the new development will result in the same amount of impermeable surface as the previous building, 15.6m^3 of storage will be required (assuming no infiltration)

for the new developed areas of the site as a whole with discharge restricted to 3 l/s. This is for events up to the 1 in 100 year return period with a 40% increase in rainfall due to climate change (Appendix G). These results indicate that a small amount of storage is required to reduce the risk of flooding to the site. This storage can be accommodated in the form of attenuation storage, based on known dimensions of available products it's likely that a volume of c.15m^3 will be used, accompanied by an oversized pipe to make up any shortfall in storage. The size of the attenuation tank may be able to be reduced as part of the detailed design or the oversized pipe removed.The tank would be located east of the proposed children's home between the proposed home and the perimeter fence within the proposed garden.

Should a utility survey be undertaken on site and alternative drainage routes and infrastructure be located then the drainage for the site could be adjusted to utilise these connections where possible. In the absence of this information the above arrangement is considered appropriate to demonstrate there is an opportunity to drain the site post development.

5.3 SuDS

The SuDS Manual (CIRIA C753) details a wide range of drainage techniques some of which have been considered for the proposed drainage design. SuDS can typically be incorporated across a development to decrease runoff and provide treatment where possible. Given the small size of the building it is proposed that an attenuation tank is used to the south east of the children's home, to provide surface water storage during storm events. Road and roof runoff from the building would collect in the tank. Surface water will be discharged from the attenuation tank into a pipe to convey it towards the sewer connection. The outfall of this system would then connect into a NWL combined asset in Longhirst Road at a rate of 3 l/s. Due to the limited space on site and the retention of trees along the site boundary, there is a restriction in the provision of open SuDS that can be used. In addition as the use of the site is for accommodating children open SuDS features which contain open water would provide a significant hazard. The indicative drainage layout for the proposed site drainage can be seen in Fairhurst Drawing 136018/2001 – Indicative Drainage Layout (Appendix H).

The feasibility and suitability of possible SuDS solution will be fully appraised at the detailed design stage of the development. Introducing SuDS onto the development may reduce the volume of storage needed; this will be calculated as part of the detailed design stage. However, it is considered that the information provided demonstrates that a feasible solution is available. This will ensure that flood risk will not increase on, or off, site as a result of the proposed development.

6 FOUL WATER DRAINAGE

Foul flows have been calculated based upon Flows and Loads 4th Edition. Foul flows for the proposed children's home are calculated to be 0.01 l/s, using 150 litres per person/per day in a 5 bedroom house with an added population of 2, and then dividing 1050 litres/day.

Foul flows have also been calculated based upon Sewers for Adoption 7th Edition. Foul flows for the proposed children's home are calculated to be 0.04 l/s, using the design flow of 4000 litres/dwelling/day.

It is proposed that foul flows from the site are discharged into the 225mm foul sewer running through Pegswood First School, upstream of manhole 7602.

A Pre Development Enquiry with NWL will be required to confirm there is capacity in local assets to handle the additional flows from the development. However given the reduction in surface water runoff rates into the combined sewer it is likely that changes in the foul flows will not cause any significant impact of the existing network capacity.

7 CONCLUSIONS

This flood risk statement and drainage strategy has been prepared for the proposed children's home in Pegswood, Northumberland. The site is located entirely within Flood Zone 1 and is shown to be at a low risk from surface water flooding.

It is proposed that surface water runoff from the site will be discharged into a combined sewer in Longhirst Road. Surface water rates should be limited to 3 l/s to provide some reduction in runoff rates. A lower rate closer to the equivalent greenfield runoff rates would increase the risk of future blockages.

It is proposed that foul flows from the development will be discharged into a foul sewer running through Pegswood First School. Foul flows will be discharged at a rate agreeable with NWL.

It is concluded that the proposed development is appropriate for the site and there will be no increase in flood risk to the site or surrounding area as a result of the development.

Appendix A

Proposed Site Plan

Appendix B

Northumbrian Water Reported Flooding Response

Appendix C

Topographical Survey

Appendix D

Northumbrian Water Asset Plans

Appendix E

Surface Water Rates

The Brownfield section of the site occupies and area of approximately 0.48 hectares. To calculate the runoff, the Modified Rational Method was used. The Modified Rational Method uses the following formula to calculate peak runoff:

$Q = 2.78 * Cv * Cr * Ri * A$

Where Q = flow rate (l/s)

Cv = Volumetric Runoff Coefficient

Cr = Routing Coefficient (taken as 1.3)

Ri = Rainfall intensity (mm/hr)

A = Area (ha)

Under summer rainfall conditions, Cv ranges from 0.6–0.9, with the lower values representative of rapidly draining soils and the higher values of heavy clay soils. For fully impermeable areas an average Cv value of 0.75 should be used and as such, this will be applied to the site. This is considered fair given the previous development on the site.

The routing coefficient Cr varies between 1 and 2 and accounts for the effect of rainfall characteristics and catchment shape on the peak runoff magnitude. The SuDS Manual (CIRIA C753) recommends a fixed value for Cr of 1.30 for design.

Rainfall intensity has been calculated based on rainfall statistics obtained from maps contained within the Wallingford Procedure Volume 4, as follows:

60 minute, 5 year (M5-60) Rainfall Depth = 18 mm

Rainfall intensities for a range of return periods have been calculated using growth curves obtained from the Wallingford Procedure, as follows:

1 Year: M1-60 = M5-60 * 0.87 = 17 * 0.87 = 14.8 mm

Ri = 14.8 mm/hr

5 Year: M5-60 = M5-60 * 1.11 = 17* 1.25 = 21.3 mm

Ri = 21.3 mm/hr

30 Year: M30-60 = M5-60 * 1.99 = 17 * 1.74 = 29.6 mm

Ri = 29.6 mm/hr

100 year: M100-60 = M5-60 * 2.63 = 17 * 2.08 = 35.4 mm

Ri = 35.4 mm/hr

The discharge rates in litres per second per hectare are summarised in the following table and applied to the total area of the site which is impermeable (0.056 ha).

Table 3: Brownfield runoff rates

Event	Brownfield Runoff Rate (l/s/ha)	Brownfield Runoff Rate (l/s) (0.056ha)
1 in 1 Year	40.1	1.9
1 in 5 Year	57.7	2.8
1 in 30 Year	80.2	3.9
1 in 100 Year	96.0	4.6

Appendix F

Micro Drainage – Greenfield Rates

Appendix G

Micro Drainage – Four Stage Design

Appendix H

Indicative Drainage Layout

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