CHAPTER 12: DRAINAGE AND FLOOD RISK

Introduction

12.1 This chapter assesses the impact of the proposed development on drainage and flood risk. In particular, it considers the potential effects from construction and operation of the development with respect to:

- Changes in surface water runoff rates and volumes affecting off site and downstream receptors
- Generation of foul sewage
- The risk and consequences of fluvial and other flooding sources

12.2 The chapter describes the methods used to assess the impacts, the baseline conditions currently existing at the site and surroundings, the potential direct and indirect impacts of the development arising from drainage and flood risk, the mitigation measures required to prevent, reduce, or offset the impacts and the residual impacts. It has been written by Abbeydale BEC Ltd.

12.3 This Chapter is informed by a FRA (418040FR October 2014) that is presented as **Appendix 12.1**. Since March 2011 groundwater levels within and around the quarry area have been monitored on a monthly and then quarterly basis and are presented as **Appendix 11.4 and 11.6.**

Planning Policy Context

National Planning Policy

National Planning Policy Framework[i]

12.4 National Planning Policy Framework (NPPF) and the accompanying Technical Guidance sets out the Government's national policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. In exceptional circumstances where new development is necessary in flood risk areas the policy also aims to ensure it is safe, without increasing flood risk elsewhere, and where possible, reducing flood risk overall.

12.5 NPPF advocates the use of a risk based sequential test, in which new development is directed towards the areas of lowest risk of flooding. The different areas of flooding by the following Flood Zones:

- **Flood Zone 1**:Low probability of flooding (less than 1 in 1000 annual probability of river or sea flooding in any year);
- **Flood Zone 2**:Medium probability of flooding (between a 1 in 100 and 1 in 1000 annual probability of river flooding and between a 1 in 200 and 1 in 1000 annual probability of tidal flooding in any year);
- **Flood Zone 3a**:High probability (1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding in any year); and
- **Flood Zone 3b**:The functional floodplain (where water is stored in times of flood, including water conveyance routes, annual probability of 1 in 20 or greater in any given year).

12.6 In addition, NPPF Technical Guidance outlines the type of land use, defined by the flood risk vulnerability that is appropriate in each Flood Zone. For example, more sensitive developments that would be most severely affected in the event of flooding, such as hospitals, should not be permitted in areas at high probability of flooding, although leisure and tourism developments may be allowed in Flood Zone 3a.

The Water Framework Directive (2000)[2]

12.7 The aim of the Water Framework Directive (WFD) is to establish "good ecological and chemical status in all surface waters and groundwaters". It also promotes the importance of sustainable water use. During the implementation process, Local Planning Authorities must not act in a way to compromise the WFD's aims. As part of the planning process, powers to control diffuse pollution at the source should be introduced to meet the obligations under the WFD.

12.8 The WFD is implemented via river basin management plans, which will be produced for each river basin district every six years.

Flood and Water Management Act (2010)[3]

12.9 The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

12.10 The Flood and Water Management Act also introduces the concept of the Sustainable Drainage Systems (SUDS) Approving Bodies (SAB). These bodies are likely to be the same as the Lead Local Flood Authority i.e. for this location it will be the Staffordshire Moorlands District Council. Once the SAB is set up, the SAB will be required to adopt any approved SUDS unless it serves a single property or forms part of a public highway, provided it meets the design standards specified in the National Standards for SUDS. Any SUDS features that form part of the development will need to meet the SAB's requirements and approval unless suitable alternative management procedures are in place.

12.11 Further standards and guidelines, which will determine the full extent of the Act, are yet to be published, although some have been issued in draft form.

Flood Risk Regulations (2009)[4]

12.12 The Flood Risk Regulations implement the requirements of the European Flood Directive (2007), which is a sister directive of the Water Framework Directive (2000). The purpose of the Regulations is to ensure a consistent approach to managing flood risk, including the publication of Preliminary Flood Risk Assessments (PFRA), hazard and risk maps and flood risk management plans.

12.13 As a requirement of the Flood and Water Management Act, the Government must publish National Standards and consult on them prior to publication. These standards are likely to address the design, construction, maintenance and operation of drainage systems. A consultation draft of standards has been published and covers:

- The runoff destination – with the public sewer as the last resort for the receiving system
- The peak rate of runoff
- The volume of runoff
- The visibility, adaptability and biodiversity of SUDS features
- The water quality treatment

Local Planning Policy

Staffordshire Moorlands Core Strategy [ii]

12.14 In August 2008 Staffordshire Moorlands published a Level 1 Strategic Flood Risk Report (SFRA). This was prepared to comply with the Flood and Water Management Act 2010[2] and Flood Risk Regulations 2009[9].

12.15 In relation to proposed development schemes, encouragement will be given to schemes on brownfield sites except where the development would cause undue harm to the environment or create an unacceptable flood risk.

12.16 Policy SD4 specifically relates to pollution and flood risk and notes that developments should be guided first to areas at low or negligible risk of flooding i.e. schemes that would fall within EA Flood Risk Zone 1.

12.17 Schemes that would be approved should also be designed such that they do not cause an increased risk of flooding either within or downstream of the site. Specific guidance on flood reduction measures would be given in other documents recorded above and may involve temporary on-site storage of run-off.

Churnet Valley Masterplan SPD [iii]

12.18 The final version of the Churnet Valley Masterplan sustainability appraisal was published in March 2014 following consultation with multiple stakeholders. Eight character areas are identified with Moneystone Quarry identified as a key potential re-development sites within the area. Although the EA was consulted and deemed the proposal acceptable, there is no direct reference to reducing flood risk or improving the water environment for the Moneystone Quarry Site.

12.19 Although flood risk is mentioned in the plan this relates to the lower lying areas such as Froghall. As the Churnet Valley Masterplan does not specifically refer to drainage or flood issues associated with the topographically elevated position of the Moneystone Quarry Site, the default strategy to be adopted would be that of the Staffordshire Moorlands Core Strategy.

Approach

Assessment Methodology

12.20 The study area extends to the whole of the Moneystone Quarry Boundaries which include the area of the current planning application boundaries and the near adjoining land. In addition to a detailed assessment of the site, the likely zone of influence of the development beyond the site has been considered. The study area is therefore broadly defined by the approximate extents of the development and the watercourses emerging from the site.

12.21 Key information was reviewed for the FRA (**Appendix 12.1**) including the following:

- Environment Agency (EA) website and Flood Map. (**Figure 12.1 from Appendix 12.1 – Appendix C**)
- Staffordshire Moorland SFRA report and maps, January 2008. (**Figure 12.2 from Appendix 12.1 – Appendix E**)
- Abbeydale BEC Desk Study Report 418040DS, March 2011 (**Appendix 11.2**)
- Abbeydale BEC Annual Monitoring Report, January 2013 (**Appendix 11.4**)
- Abbeydale BEC Quarterly Monitoring Report, July 2014 (**Appendix 11.5**)
- Abbeydale BEC Annual Monitoring Report, February 2015 **(Appendix 11.6)**

12.22 In February 2016, the Environment Agency (EA) released new guidance for applying climate change allowance (CCA) to estimated flood flows in England. The proposed development is improving flood risk beyond the target given in the new Guidance therefore no changes to the FRA provided in Appendix 12.1 have been made as part of the resubmission.

Surface and Sub-surface Water

12.23 Baseline reports were produced in March 2011 at the time of the quarry closure. Since that time monthly and subsequently quarterly monitoring of the groundwater and surface features of the quarry site has been undertaken and reported by Abbeydale BEC.

12.24 In summary since March 2011 the groundwater levels have continued to rise. The rate of rise has been variable and in some locations indicates a potential influence from preceeding weather conditions. In Q3 the lake levels continued to rise from December 2010, beyond the previously anticipated 155m AOD and sat just below the previously installed outfall at 159m AOD in July 2014. Subsequently the lake level have fallen to 155m AOD by January 2016, before rising again in Spring 2016. Streams passing through or adjacent to the Quarry are not anticipated to return to pre-quarry levels although have begun to re-establish themselves.

12.25 In summary since March 2011 the groundwater levels have continued to rise. The rate of rise has been variable and in some locations indicates a potential influence from preceeding weather conditions. In Q3 the lake levels have continued to rise from December 2010, beyond the previously anticipated 155m AOD and currently sit just below the previously installed outfall at 159m AOD. Streams passing through or adjacent to the Quarry are not anticipated to return to pre-quarry levels although have begun to re-establish themselves.

Foul Drainage

12.26 A complete assessment of proposed foul drainage will be made at the detailed design stage. Existing quarry buildings are served by a cesspit located within L3 as shown on **Figure 11.3** and **Figure 11.6 (Appendix 11.3 – Figure 2b and Figure 3)**. With the need for increased capacity by the proposed development the existing system will need to be made redundant and a new more substantial private foul drainage designed. Existing ground slopes will allow most areas to be served by gravity feeds to a proposed private sewage plant on the lower ground south of The Hub. Existing pipework is available to take processed fluids from this area off site to water meadows adjacent to the River Churnet.

Significance Criteria

12.27 The classification of significance aids in the identification of the main environmental effects of the proposed development and what weight should be given to these effects. There is no statutory definition of what constitutes a significant effect and

guidance is of a generic nature. The significance criteria used in this report are set out below:

- Major Beneficial;
- Moderate Beneficial;
- Minor Beneficial;
- Negligible;
- Minor Adverse;
- Moderate Adverse; and,
- Major Adverse.

12.28 An explanation of each of level of significance used in the assessment is given below:

- **Major** - Very large or large change in environmental conditions to a highly sensitive receptor. Effects, both adverse and beneficial, which are important considerations at a national to regional level because they contribute to achieving national / regional objectives, or, likely to result in exceedance of statutory objectives and/or breaches of legislation.
- **Moderate** - Intermediate change in environmental conditions and/or impacts on moderately sensitive receptors. Effects are likely to be important considerations at a district to local level because they contribute to achieving local objectives, or, may result in exceedance of local statutory objectives and/or breaches of legislation.
- **Minor** - Small change in environmental conditions and/or to receptors of limited sensitivity. These effects may be raised as local issues but are unlikely to be of importance in the decision making process.
- **Negligible** - No discernible change in environmental conditions and/or limited impacts to receptors of low or no sensitivity. An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

12.29 Table 12.1, below aims to demonstrate how the combination of impact magnitude and sensitivity of receptor can be combined to evaluate impact significance.

Table 12.1: Impact Significance Matrix

	Magnitude of Change			
Sensitivity	**High**	**Medium**	**Low**	**Negligible**
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible

Assumptions/Limitations

12.30 In practice, and given the role of judgement in the assessment process, there may be some variation between subject areas in the significance rating process. This may be as a result of limited information on the sensitivity of features and / or the complexity of interactions that require assessment in determining magnitude of change.

Baseline Conditions

12.31 A baseline of conditions at the site and surrounding area was prepared and has been reported as to the conditions in December 2010 when the quarry closed in the Abbeydale BEC Desk Study, Environmental Assessment and Flood Risk Reports 418040 DS, EA & FR (**Appendices 11.2, 11.3 & 12.1**). Since that time monthly and subsequently quarterly reports have been produce by Abbeydale BEC to record changes to groundwater and surface features in the intervening periods (**Appendices 11.4 & 11.5**).

12.32 Staffordshire County Council approved a Revised Restoration Plan for the site in March 2014. This restoration plan forms the baseline to be considered as part of the EIA. This section therefore identifies the current, existing baseline and the future baseline assuming full implementation of the Revised Restoration Plan.

12.33 So as to limit repetition the baseline ground conditions provided in Chapter 11 are taken as read.

12.34 To understand the dynamics of the current baseline the period between the Quarries ceasing pumping in December 2010 and the July 2014 monitoring report needs to be considered.

12.35 During the quarrying operations prior to December 2010 the west side of Quarry 2 (Q2W (L7)) and the east side of Quarry 1 (Q1E (L4) were used as tailing lagoons and had a continuous covering of surface liquor which was generally acidic (Ph<3) and with fines having settled out were drained back to the Production plant. See **Figure 11.3**. To maintain the volumes of liquor present up to 75,010 gallons (As recorded on EA Licence and in **Appendix 11.2**) of water were pumped up to the Production plant from the River Churnet. A proportion of any surplus liquor flowed through a series of settling ponds connected by Stream D and back into the River Churnet. As part of this process an unrecorded amount of liquor would soak into the surrounding sandstone and again flow towards the River Churnet. See conceptual sections **Figure 11.5**.

12.36 From 2001 inflowing water was also pumped from Quarry 3 (Q3) and added to the water used in the production process. At the time of pumps being turned off in December 2010, water was being extracted from the base of Q3 at 131m AOD, with a 1000 l/day capacity pump, which is understood, on occasions of increased flow, was supplemented by a second pump.

12.37 **Figure 12.3 (Appendix 11.4 – Table 3)** records the level and estimated volume changes within the base of Q3 following the pumps being removed. Until September 2011 liquor continued to seep through the landbridge from the higher L7 lagoon into Q3. However, as shown by **Figure 12.4 (Appendix 11.4 – Figure 6a)** water levels in the borehole in the landbridge started to fall away, until levels close to the base of the sandstone were reached in December 2011.

12.38 During the same period the remaining standpipes around the quarried areas were monitored on a monthly basis and in 418040MM. Table 1 is supplement by earlier readings taken by the quarryman. As shown by contour plots of groundwater levels on **Figure 12.5 (Appendix 11.4 – Figure 5a to 5h)** groundwater levels across the area have risen as Q3 has filled.

12.39 In September 2012 an internal dam holding L8 tailings in the east of the quarry floor was overtopped at 153m AOD, and from that period on Q3 has filled as one lake.

From the quarryman's baseline assessments it had been anticipated that Q3 would naturally fill with groundwater to around 155m AOD. A bench was formed in the quarry at or slightly above 155m AOD to provide a wave cut platform.

12.40 Subsequent monitoring results recorded in Appendix 11.5 records the 155m AOD level being reached in April 2013 and the July 2014 reading being 158.3m and so less than a metre below the quarryman's temporary outfall constructed at 159m AOD to control drainage into Stream A. More recent monitoring results show the lake level dropping back to 155.19m AOD in January 2016, but rising again in the spring of 2016. Current predictions are the lake water level will fluctuate between the predicted 155m AOD level with the potential to reach the outfall level of 159m AOD during winter periods.

12.41 During the winter several small streams run over the northern face of Q3 into the lake. However, during the summer little to no surface run-off has been observed running across the sandstone outcrop. The monitoring confirms that volume changes in the lake are not just the result of surface run-off and evaporation. Substantial volumes of groundwater flow both in from the north side and out to the south side of Q3, changing the lake levels beyond what can be explained by surface run-off and evaporation.

12.42 Since the cessation of pumping in December 2010 increasing groundwater flow has also been indicated in the monitoring and observations made in Streams A, B and C to the lower south and south west of Q3. As indicated by **Figure 12.3** significant increases in flow are recorded in Stream A and the stream head areas just below Q3 outfall have increasingly become wet despite periods of dry weather.

12.43 North of Eaves Lane lagoon L7 in Q2 initially remained flooded, but by September 2011 liquor had drained from the quarry sides except in the lower south east corner forming two hour glass shaped lakes running from the northwest to southeast. During the subsequent period it was seen that sinkholes existed in the south east corner of the quarry and a channel into the tailings from the sink holes gradually drained the south eastern lake.

12.44 Currently there remains a small north western lake and occasional streams running from the higher ground to the north. Several temporary lakes also form in the north east of L7 after periods of rain.

12.45 Where the tailings have been left to drain, vegetation is slowly colonising the surfaces. However, where surfaces remain wet limited vegetation is seen. All vegetation presumably being inhibited by the residual acidity of the tailings.

12.46 Since 2010 L4 in Q1E has similarly been drained to allow vegetation to grow on the tailing deposits. A reduction in the level of the outfall has kept surface water down during the 2014 summer and should allow vegetation to extend over most of the remaining tailings in the coming year.

12.47 With the removal and covering of substructures in the Production Areas run-off from this area will have been reduced and with increased vegetation cover, further reductions in peak run-off are anticipated. Surface water from L4 and Q1W lake has also been diverted into Q3 so again will reduce the flow across the Production Area. However, to date no surface water has directly entered Q3 from this source, instead draining through exposed sandstone and into the groundwater system below.

12.48 With the removal and covering of substructures in the Production Areas run-off from this area will have been reduced and with increased vegetation cover, further reductions in peak run-off are anticipated. Surface water from L4 and Q1W lake has

also been diverted into Q3 so again will reduce the flow across the Production Area. In Spring 2016 surface water has directly entered Q3 from this source through L5, although most water will still be draining through exposed sandstone and into the groundwater system below.

12.49 Stream B and E located to the west and east of the quarried areas both run as before with limited changes in flow. Whilst Stream A and Stream C have been shown to be influenced heavily by preceding weather conditions.

12.50 Between the railway and River Churnet several acidic springs have been recorded during our monitoring visits. See both **Appendix 11.4** and **Appendix 11.5**. Over time the acidity of these springs has been found to reduce, but occasionally after wetter periods in the weather, pH levels have again reduced. This suggests when groundwater levels rise in the sandstone more acidic ground is exposed to subsurface flows. Also the surface water from the un-capped lagoons are expected to be a greater proportion of the groundwater emerging from the springs.

12.51 Although the baseline has been described for the whole quarry area it should be noted that development is limited in extent, excluding Stream valleys B, C and D and only the head of Stream A adjacent to Q3. The majority of the Production Area is also excluded together with the east side of Q2.

12.52 The quarry area is currently recorded by the EA to lie within Flood Risk Zone 1 with the exception of the River Churnet Valley bottom that is within Flood Risk Zone 3a.

12.53 The whole of the development area is within Flood Risk Zone 1. Consequently there is considered to be negligible risk of flooding to the structures in the red line area with provision made for adequate drainage.

Potential Impacts

12.54 This section details the potential impacts of the scheme and their significance before mitigation measures are applied. The impact assessment is based on the impact to the baseline assuming full implementation of the Revised Restoration Plan.

12.55 The long term aim is to reduce run-off peaks by at least 20%. By increasing vegetation, keeping hardstanding to roof run-off to a minimum and providing a reduced stream gradient by extending the run-off flow path. Considerable improvement on the 20% target can be achieved so significantly reducing the risk of downstream flooding.

Construction

Flood Risk

12.56 During the construction works, there is the potential for the works and vehicle movements to result in compaction of soils that could increase the potential for limited localised flooding, in the form of ponding, within the site itself. This should be considered in light of the low flood risk at the site generally and the lack of any sensitive receptors besides construction workers. It is therefore considered that in the absence of mitigation a **minor adverse** impact could arise.

Surface Water Runoff

12.57 There is a potential for increased surface water run-off during construction in the short term resulting from the removal of the currently sparse vegetation cover and

the potential of increased peak run-off being laden with silt. The implications of this in the various parts of the site

12.58 Initial earthworks are proposed in Q3 and The Hub areas. This has the potential to increase the amount of sediment entering the watercourses, which can lead to silting up. In the absence of mitigation this could result in a **moderate adverse** effect based on the low to medium magnitude of the impact and the high sensitivity of the watercourse running through the SSSI south of Q3.

12.59 Earthworks around Q3 are anticipated to cause temporary siltation of the lake water in the areas of the earthworks. However, due to the depth and past acidity of the water limited pond life has currently developed so there will be a **negligible** impact in the short term.

12.60 Siltation could also extend to the outfall, but retaining the temporary measures at the head of Stream A will result in **negligible** impact from off-site construction siltation.

12.61 The Hub and car park areas will be drained by Stream D. Siltation and flow limitation resulting from the existing silt ponds down Stream D is considered adequate for the earthworks in the Hub area and will therefore provide a **negligible** impact on surface water running from Stream D.

12.62 Q1E (L4) is to be capped and a number of streams and ponds included within the development of L4. As L4 has limited natural surface flow the existing overflow system is considered adequate to control siltation and flow, with surface water running into Q3 before draining down Stream A resulting in **negligible** impact to Q3 Lake and Stream A water. Consequently, siltation traps are not considered necessary when L4 is being developed.

12.63 During the capping of L7 surface water will continue to drain into the sinkholes in the south east corner of L7. As siltation is ongoing into the groundwater from L7, additional siltation will have **negligible** impact on the existing groundwater.

12.64 During development other smaller areas of earthworks will be required. These are not considered to be of significant extent to cause off site siltation or increased surface flow and therefore have **negligible** impact.

Completed Development

Flood Risk

12.65 The long term aim is to reduce run-off peaks by at least 20% reduction indicated by the Water Framework Directive. By increasing vegetation, keeping hardstanding to roof run-off to a minimum and providing a reduced stream gradient by extending the run-off flow path, considerable improvement on the 20% target can be achieved. This would significantly reduce the risk of downstream flooding and **moderate beneficial** impacts can be achieved in both the medium and long term from this reduction in flood risk.

Surface Water Run-off

12.66 As development proceeds the exposed ground caused by earthworks will be re-vegetated in accordance with the ecological requirements discussed in Chapter 9. The hard areas will be limited to lodge roof areas to the lodges (250 x 72 = 18,000m^2) and The Hub (approximately 1,000m^2). Tarmac hardstanding will be limited to existing areas and several relatively small additional areas (say 2,000m^2)

at the development entrance. With a site area of 51.8ha the hardstanding areas equate to <5% of the site and so can be considered to have **negligible** impact on the additional run-off rate caused.

12.67 As described in more detail in **Appendix 12.1**, the quarrying activities over time increasingly directed surface flow across the various quarried areas into Stream D. By directing the surface water around the upper quarry areas as described above, the pre quarrying Stream A watershed will be re-established. Flow down Stream D and the uncontrolled groundwater flows through the base of the sandstone will be reduced. In re-directing surface flow back down Stream A, **moderate beneficial** impacts are achieved, the most significant benefit being to reduce peak flows in the upper Churnet River. As the flow gradients are reduced to an average gradient of about 1% down Stream A, as opposed to flow down Stream D or groundwater flow route, which water currently flows down with an average gradient of about 6% the peak flow is reduced.

12.68 Run-off from the Hub area and the land below will continue to flow through Stream D as occurred prior to quarry development and so will have **negligible** impact**.**

12.69 Having capped L4 and L7, surface water crossing the previously acidic tailings will thereafter neutralise the pH of the run-off. Improvements will also be gained to surface water run-off gradients. Currently run-off passes down sinkholes into the underlying sandstone, from which monitoring contouring shows flows running in a southerly direction to the River Churnet. By channelling run-off from L7 to L4 and then Q3, run-off gradients are significantly reduced so providing a **moderate beneficial** impact to the peak flow rates and pH of the water entering the River Churnet downstream of the site.

12.70 Q3 Lake levels will have a seasonal variation to encourage the formation of beaches around the lake. This will be achieved by a regulated outfall, with average summer flows passing through pipes in a re-constructed outfall. The level of the new outfall will be determined from a balance between the stabilised level of the lake and the restoration requirements. Peak flows will be restricted in all but the wetter winter periods so will provide **major beneficial** impact to Stream A flows through the highly sensitive SSSI and **moderate beneficial** impact to peak flows in the River Churnet below the confluence of Stream A.

Mitigation Measures

Construction

Flood Risk

12.71 Flooding in the development area is not anticipated, as ground slopes are sufficient to limit localised ponding. However, in the areas of the flatter existing lagoon, a surfaces water flow path assessments may be required and a temporary SuDs strategy will be implemented if required.

Surface Water Runoff

12.72 It is anticipated following further discussions with the EA construction of the new Q3 outfall will require temporary siltation traps at the head of Stream A and regulation of the flow of water down Stream A as the lake levels are reduced. It is proposed monitoring of Stream A will be continued throughout the period of earthworks in Q3. This will allow educated adjustments to construction work to be carried out as required.

12.73 Measures to control impacts to watercourses will be specified in the Construction Environmental Management Plan (CEMP). Standard methods of working for the control of such events are detailed in EA guidance PPG 6. The main risk of hydrocarbon pollution is from vehicle transport and on-site fuel tanks. However, by installing remedial treatment options as a pre-development stage e.g. Oil interceptors in particularly at risk areas.

12.74 In the UK there are legal requirements covering oil and fuels storage that will be adhered to by contractors with plant and equipment on site for a significant duration of time requiring designated storage areas. Currently it is anticipated that the main vehicular areas will be away from surface water bodies. In addition all activities with a particularly high potential to cause pollution should be monitored by a 'responsible person' so reducing the risk, as suggested by PPG 6.

Completed Development

12.75 Despite impacts of the completed development being of negligible or beneficial significance, a series of best practice measures will be implemented to ensure that the site is sustainably drained. These will be included in the detailed specifications provided at the reserved matters stage but the principles described below are proposed.

12.76 Roof areas will be drained to shallow gravel pits or swales around the buildings and hardstanding areas. In the capped areas, such as L4 and L7, swales will be connected to a series of surface streams and ponds which will meander around the development area. This may include some recycling of water locally up-stream, in periods when flow is low. Consequently, existing stream gradients across the lagoons can be reduced.

12.77 Car parking areas and general access tracks will be formed with unbound and free draining Type 1 stone which will allow surface water to enter the groundwater drainage system. In less used car parks, grasscrete will be used. Also, where located in flat areas swales will be used to lower perched water table to at least 0.5m below the surface. In general however, these areas will be located away from main surface water flows.

12.78 Flow into Stream A will pass through an area of reeds in Q3 fronting the outfall. The reeds will assist in the neutralisation of the pH of Stream A as well as providing ecological benefits.

Residual Impacts

12.79 Table 12.1, below, summarises the potential impacts identified earlier in this report, the mitigation measures described in the preceding section and the residual impact once these mitigation measures have been implemented.

Table 12.1: Summary of Mitigation and Residual Impacts

Impact Category	Potential Impact	Mitigation	Residual Impact
Construction			
Flood Risk	Localised flooding / ponding	Flow path assessment and temporary SuDs strategy, if required.	Negligible
Surface Water Runoff	Runoff rates to watercourses	None required	Moderate Beneficial
	Silt laden runoff entering Stream A/ SSSI	Silt traps and monitoring	Negligible
	Silt laden runoff entering watercourses	Measures to be included in the CEMP	Negligible
	Acidic runoff entering watercourses	Monitoring	Negligible
Completed Development			
Flood Risk	Reduction of flood risk associated with the proposed drainage strategy	None required	Moderate Beneficial
Surface Water Runoff	Runoff rates to watercourses	SuDS Strategy	Negligible to moderate beneficial (major beneficial to the SSSI)
	Acidic runoff entering watercourses	Reed beds to be created in Q3	Minor – Moderate Beneficial

Conclusions

12.80 The reports undertaken to date including **Appendix 11.1** to **Appendix 11.6** and **Appendix 12.1** identify potential sources of contamination associated with site drainage and potential flood events. The proposed development is located outside the EA defined flood risk zones. The main impacts relate to the changes in surface water flows but with the measures proposed to control flows and the carrying of sediments these are likely to be of negligible or beneficial significance.

[i] Department for Communities and Local Government (2012) *National Planning Policy Framework,* DCLG, London.
[ii] Staffordshire Moorlands District Council (2014) A Local Plan for the future of Staffordshire Moorlands: Core Strategy Development Plan. SMDC.
[iii] Staffordshire Moorlands District Council (2014) Final Churnet Valley Masterplan: Sustainability Appraisal. SMDC