2 Site setting

2.1 Introduction

2.1 This chapter details the setting of Shapfell Limestone Quarries, with respect to geography, geology, ecology, hydrology, hydrogeology and land use.

2.2 Site location

2.2 Shapfell Limestone Quarries is located 1km to the south east of the village of Shap, approximately 16km south of Penrith. The site address is Shap, Penrith, Cumbria, CA10 3QG and access is gained via the B6261 to the south. The geographical position of the site is shown in the Site Location Plan Drawing No. S25/20.

2.3 Shapfell Limestone Quarries is separated into two distinct sites; Shapfell Quarry, centred at National Grid Reference (NGR) NY 59000 14200 to the east and Shapfell Works, centred at NGR NY 57140 13400 to the west. The two sites are connected via an internal haul road, which crosses the Hardendale Road and the M6. The boundary of the planning application, together with adjoining land controlled by Corus is shown on the Site Plan Drawing No. S25/21, and is described further in Chapter 3.

2.3 Current land use

2.4 Shapfell Quarry is located 1.5km to the east of Shapfell Works, and is operated by Teesside Cast Products to quarry limestone of a specific chemical composition (low sulphur and phosphorus, high calcium carbonate) suitable for conversion to high quality lime. The limestone is removed by drilling and blasting, with an average quarry face height of 18 metres. Blasts of between 10,000 and 000 tonnes of stone are conducted up to three times per week. The shot stone is handled by excavators and transported by 40 tonne dump trucks through a series of internal roads, including the haul road, to the crushing and screening plant located on the Shapfell Works site.

2.5 Shapfell Works comprises the crushing and screening plant, washing plant, lime kilns, lime processing plant, railhead and offices. A brief description is provided below of each activity.

2.6 Stone is discharged at the crushing plant into a grizzly screen and a primary jaw crusher. After crushing and screening the oversize is conveyed to a secondary roll crusher. The undersize from the grizzly and primary screens, termed quarry scalpings, is returned to the quarry by dump truck for use as a restoration material. After secondary crushing and screening the stone is conveyed to an outdoor stockpile. The undersize is conveyed to three tertiary crushers and crushed to produce crushed limestone product.

2.7 At the washing plant the stone is conveyed to a rotary trommel scrubber for washing with water, which discharges to a double deck screen. The washed oversize from the primary screen is conveyed to a classifier screen for separation of the stone into the required size range for feeding into individual kiln surge hoppers.

2.8 Fine grained material from the washing plant, referred to as 'slimes' are also returned to the quarry by dumper truck for use in the restoration scheme.

2.9 Lime (calcium oxide) is produced by heating the washed and screened limestone (calcium carbonate) in four Maerz vertical shaft kilns using the parallel flow regenerative principle. The kilns are of the conventional Maerz design, three of the four kilns have vertical twin shafts, the fourth, which processes the smaller stone has three shafts. During the process the calcium carbonate is calcined, with carbon dioxide being driven off as a gas and calcium oxide remaining. In order to decompose the stone core, the stone surface area is heated to above 1,000 degrees Centigrade to produce soft burnt lime.

2.10 One of two conveyors carries the burnt lime product from the kilns into the lime processing plant, where it is first crushed and graded into a variety of product sizes which include Ground Burnt Lime (GBL), BOS Lime and Fine Lime Products. Lime products will hydrate if exposed to a moist atmosphere and as a precaution they are stored in enclosed bunkers. Each product has its own product bunker. BOS Lime can be dispatched by road wagon or rail wagon, with GBL and Fine Lime being dispatched in bulk by road tanker only.

2.4 Site history

2.11 Prior to the development, both Shapfell Quarry and Shapfell Works were agricultural land utilised for grazing.

2.12 Shapfell Quarry was originally opened in 1960, for the purpose of supplying limestone to the Scottish Steel Industry. In 1972 three Maerz kilns were installed at Shapfell Works for the production of calcined soft burnt lime to meet the requirements of the new Basic Oxygen Steelmaking process. In 1990 a fourth kiln and associated improvements to the limestone and lime handling system were installed.

2.13 In August 2001, a Site Condition Report (SCR) (Ref. 1) was submitted in support of an application to the EA for a Pollution Prevention and Control (PPC) Permit for Shapfell Works. The purpose of a SCR is to establish baseline conditions against which any deterioration in land quality can be assessed. This assessment is made at the point of Permit surrender and any remediation necessary to reinstate the baseline condition is completed under the requirement of the PPC Regulations 2000 (now Environmental Permitting Regulations 2007).

2.14 The SCR is provided within Appendix 2.1 of Volume 4. The report comprised a desk-top study followed by a small-scale intrusive investigation, involving three trial pits located at the engineering garage, washing plant and the lime kilns. Phase 1 of the SCR applied a land ranking method to assess the potential risk posed by each activity at the site. Shapfell Quarry had the highest level of risk, categorised as a moderate risk score due to the proximity of sensitive receptors i.e. the adjacent Crosby Ravensworth SSSI. Soil samples taken during the intrusive investigation indicate high levels of calcium, magnesium and nickel, as would be expected given the geology and the nature of the operations.

2.15 Today, Shapfell Quarry occupies an area of approximately 120 hectares, of which 21.6 hectares has been restored. Table 2.1 provides a breakdown of land-use at Shapfell Quarry by area. The current consented reserves located above 298m AOD will be exhausted by end of March 2009. Chapter 3 provides a detailed development description.

Table 2.1 Proposed and existing development at Shapfell Quarry

	Description	Area (ha)
Proposed Development	Quarry deepening	25.8
	Mitigation reservoir and pipelines	2.9
Existing Operations	Quarry, lagoons and haul road	70.1
	Restoration areas	
Other areas within the existing permissions	Restored and out of aftercare	21.6
	Areas not to be developed	26.8

2.5 Topography and landscape character

2.16 Within the current planning permission boundaries, the topography rises from the lowest ground levels in the northeast, with levels of 310m AOD, to the west at 370m AOD. The original ground levels at the quarry would have ranged between these elevations, with the unworked margins and remaining original ground at 320 to 340m AOD.

2.17 The floor of the quarry falls towards the east following the dip of the strata. The current floor level slopes from 330m to 287m AOD (sump), with a pond of standing surface water located within the central area. It is proposed to deepen the quarry along the direction of the dipping strata, to a final floor level of 266m AOD i.e. at maximum up to 49m below the surrounding ground level. The western restored area lies at levels ranging from 366 to 340m AOD, whilst in the south at Nell's Moss, restoration is to levels comparable with the remainder of the Moss at elevations of 310 to 330m AOD.

2.18 Shapfell Works lies at a lower ground level, varying from 272m AOD at the lowest point at the lime kilns, rising to the south and east to 290m AOD. The kilns are the largest structures on site, at 42m high and are located in the northern portion of the Works.

2.19 Most of the land surrounding Shapfell Limestone Quarries is in agricultural use, as open moorland grazing. On the lower elevations and around the settlings, a strong pattern of stonewalled, mainly irregularly shaped, fields predominates. These fields generally enclose land under permanent pasture, with a few coniferous plantations. The development is also within 2km of the eastern boundary of the Lake District National Park at its closest point.

2.20 Shapfell Limestone Quarries is located within a major communications corridor, with the main London to Scotland West Coast Mainline as well as the A6 and M6 passing within 1km of the site.

2.21 For further details the reader is directed to Chapter 8: Landscape and Visual Impact.

2.6 Geology and hydrogeology

2.22 The 1:10,000 British Geological Survey map indicates that much of the area surrounding the quarry is covered by Glacial Till ('Boulder Clay') described as a mixture of clay, silt and sandstone containing clasts of widely varying size and lithology. The coverage of Till

becomes patchy to the north of the quarry, with large areas to the east along the stretch of Dalebanks Beck absent of any drift cover.

2.23 Recent alluvial deposits of silt, sand and gravel associated with floodplains are indicated along parts of the upper reach of Force Beck and also along its' lower reaches south west of the quarry. Directly north of the quarry alluvial deposits appear to be associated with former tributaries of Trainrigg Sike.

2.24 The quarry is underlain by a sequence of Carboniferous Limestone units, with sandstone and siltstone units, dipping to the east. The limestone quarried at the site is the Knipe Scar Limestone Formation (KNL) described on the 1:10,000 geological map as rhythmically bedded wackestones with thin interbeds of mudstone and siltstone. Regionally this formation is around 100m thick and represents the upper formation in the Great Scar Limestone Group.

2.25 The EA classifies the Carboniferous Limestone within the region as a Minor Aquifer of variable permeability. This is in part due to the presence of lower permeability mudstone and siltstone horizons that act as aquitards or aquicludes. The limestone has a very low primary porosity and permeability, with groundwater flow governed by the presence of secondary networks of solution enlarged features and fracture/joint systems.

2.26 For further details the reader is referred to Appendix 2.1 of Volume 4.

2.7 Hydrology

2.27 Shapfell Quarry is located at the head of three surface water sub-catchment boundaries; the River Lowther located approx. 2.5km to the west flowing northwards, the River Leith located approx. 5.8km to the north flowing northwards, and the River Lyvennet located approx. 3km to the east flowing northwards. All three form part of the River Eden Catchment, a major surface water catchment. The River Eden itself is located 16km north of the quarry.

2.28 Force Beck arises as several minor tributaries across open grassland to the south of the quarry, which flow generally to the northwest under the M6, the West Coast Mainline and the A6 at Force Bridge. Beyond the village of Shap, Force Beck is renamed Docker Beck and flows to meet the River Lowther upstream of the hamlet of Thornship, some 2km due west of the site.

2.29 Dalebanks Beck rises at a spring approx. 1km east of the site, beyond the hamlet of Oddendale. The beck flows northeast to meet the River Lyvennet approximately 3km east of the site at Crosby Ravensworth.

2.30 Trainrigg Sike rises at a spring approx. 1.2km north-west of the site and flows northward adjacent to the M6, where it is renamed Gunnerkeld Sike at Gunner Keld and continues on to meet the River Leith, north of Shap Beck, approx. 5km north-west of the quarry.

2.31 There are a number of surface water features within the current planning permission boundaries. A large surface water pond is present within the open excavation, which flows to a sump in the north eastern corner of the quarry, from here it is pumped to the first of two upper settling lagoons located along the haul road. From the upper settling lagoons, the water is allowed to flow by gravity to a series of three further settling lagoons located near the Hardendale Road. Surface water is permitted to discharge from the last lagoon to Force

Beck, via a v-notch weir. This is a consented discharge, Outfall W2, regulated under the conditions of the Works Environmental Permit (see Appendix 1.5). A small, shallow pond is located on the restored area at Nell's Moss.

2.32 There is a further settling lagoon located at Shapfell Works, which discharges to Force Beck. This is a consented discharge, Outfall W1, regulated under the conditions of the Works Environmental Permit (see Appendix 1.5). There is seldom any discharge from Outfall W1, and if the daily recorded pH values or suspended soilds are too high, the water in these small lagoons is pumped to the upper settling lagoons at the quarry.

2.33 For further details the reader is referred to Appendix 2.2 of Volume 4.

2.8 Ecology

2.8.1 Statutory designations

2.34 Three designated tributaries of the River Eden Special Area of Conservation (SAC) lie in the vicinity of Shapfell Quarry, the River Lowther, the River Leith and the River Lyvennet. These three designated rivers are fed by undesignated tributaries, which arise much closer to the quarry; Force Beck, Trainrigg Sike and Dalebanks Beck respectively. The River Eden SAC is designated for its aquatic and riparian vegetation, and for the presence of species such as white-clawed crayfish, otter, Atlantic salmon, lampreys and bullhead (see Appendix 6.11 of Volume 4 for a full list of designated features). SACs are designated under the Habitat Regulations 1994 and EU Habitats Directive (see Chapter 5 for further details)

2.35 The River Eden and tributaries SSSI is included within the River Eden SAC and, in addition to the features for which the SAC is designated, is of importance for its breeding bird assemblage and invertebrates of exposed river sediments. Full details of the interest features of the SSSI are given in Appendix 6.9 of Volume 4. SSSIs are designated under the Wildlife and Countryside Act (1981, as amended) (see Chapter 5 for further details of the Act).

2.36 The Asby Complex SAC lies immediately to the south of the planning application boundary. This site is designated for a number of features including its limestone grassland, limestone pavements (a priority feature), base-rich flushes, petrifying springs (a priority feature), species-rich *Molinia* meadows and the presence of two rare species: Geyer's whorl snail and slender green feather moss. The full list of features for the designation of this site is given in Appendix 6.10 of Volume 4.

2.37 The south-east part of the working quarry area, together with the land immediately adjacent to the quarry and planning application boundaries, lie within the Crosby Ravensworth Fell SSSI. There is no direct land take within the SSSI as a consequence of this planning application.

2.38 The SSSI is notified for its wet and dry heath, limestone grassland, limestone pavement and calcareous flushes, all of which, except wet heath, are Asby Complex SAC interest features. The site is also of importance for its vascular plant assemblage, which consists of bird's-eye primrose *Primula farinosa*, blue moor-grass *Sesleria albicans*, bird's-foot sedge *Carex ornithopoda* and limestone fern *Gymnocarpium robertianum*. Full details of the interest of the

SSSI are given in Appendix 6.9 of Volume 4. Part of the Crosby Ravensworth Fell SSSI is included in the Asby Complex SAC.

2.39 Crosby Gill SSSI lies some 2.5km south east of Shapfell Quarry and adjoins Crosby Ravensworth Fell SSSI. Like the latter SSSI it forms part of the Asby Complex SAC. Crosby Gill SSSI is notified for its calcareous flushes, springs and limestone grassland, all of which are Asby Complex SAC interest features. Full details of the interest of the SSSI are given in Appendix 6.9 of Volume 4.

2.40 Part of the Asby Complex: Gaythorne Plain etc. Limestone Pavement Order (LPO) lies immediately adjacent to Shapfell Quarry, on the northern side of the quarry. It covers the three small limestone pavements shown on Figures 6.1 and 6.2 in Chapter 6. LPOs are designated under the Wildlife and Countryside Act (1981, as amended) (see Section 5 for further details of the Act) and make it an offence to disturb or remove pavement from land protected by an LPO.

2.8.2 Non-Statutory Designations

2.41 Four Cumbria Local Wildlife Sites: Hardendale Meadows, Shap Hay Meadow 2, Potrigg Limestone Pavement and Force Beck Quarry, lie in the vicinity of Shapfell Quarry. Hardendale Meadows and Shap Hay Meadow 2 are of note for their upland hay meadow vegetation with wood crane's-bill Geranium sylvaticum, whilst Force Beck Quarry is a mosaic of neutral and limestone grassland and calcareous flushes. Potrigg is a small area of limestone pavement supporting a number of uncommon plants.

2.42 The verges along both the north and south sides of the Shap to Crosby Ravensworth road west of the junction with the Oddendale road are classified as Special Roadside Verges by Cumbria County Council: C2K (1A) and C2K (1B) respectively. These verges support herb and species-rich grassland (see Chapter 6, Section 6.3.1.3 for details).

2.9 Neighbouring site users

2.43 Shapfell Quarry is located in a rural area. All surrounding receptors within 2km of the planning application boundaries are indicated in Table 2.2 below. The distance to the receptor is taken at its closest point from the planning permission boundaries.

Table 2.2 Distance to receptors

Direction	Distance	Neighbouring site or activity
North	0.0km	Public footpath Unclassified road Castlehouse Scar (coniferous plantation)
	0.2km 0.5km 1.0km	Hardendale Nook Farm Farmhouse at Castlehowe Scar
East	0.0km	Crosby Ravensworth SSSI (Unit 8) Transco High Pressure Pipeline Oddendale Road Public footpath
	1.0km 1.3km 1.5km	Dalebanks Beck High Dalesbanks Haber
South	0.0km	Asby Complex SAC Crosby Ravensworth SSSI (Unit 7) Upper reaches of Force Beck Coast to Coast footpath Hardendale Road
	0.02km 0.2km 0.5km 0.6km 1.8km 2.0km	Force Beck Oddendale B6261 minor highway St Anne's Well Hause Farm Blea Beck
West	0.0km	Shapfell Works Crook Sike Hardendale Road M6 motorway Force Beck
	0.1km 0.3km 0.7km 1.1km 1.2km 1.4km 1.5km 2.0km	Waters Farm Farmhouse at the Nab A6 main highway Small reservoir (recorded as dry) Trainrigg Sike West Coast Mainline Shap village Lake District National Park

2.10 References

1. Site Condition Report. Section 1.3 of PPC Permit Application No. BK0787. Corus Construction & Industrial – Shapfell Works. August 2001. Corus Research,