Wivenhoe Quarry

Environmental Setting and Site Design

Tarmac Trading Limited

Report No. K6008-ENV-R002
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1 Introduction

1.1 Report Objectives

Byrne Looby Partners (UK) Ltd (ByrneLooby) have been commissioned by Tarmac Trading Limited (Tarmac) to produce an Environmental Setting and Site Design (ESSD) report. This ESSD forms part of a bespoke permit application for a recovery activity to restore the "land to the south of Colchester Main Road (known as Sunnymead, Elmstead and Heath Farms), Arlesford, Essex, CO7 8DB" (the Site) as required by Planning Permission ESS/17/18TEN.

Planning Permission ref ESS/17/18/TEN has been granted by Essex County Council on 18th December 2020 for the extraction of sand and gravel as an eastern extension to the existing Wivenhoe Quarry, followed by restoration to agriculture and low-level water-based nature conservation habitats, lowland meadow, woodland planting and hedgerow enhancement. The application is for an Environmental Permit to permanently deposit waste on a land as a recovery activity, *i.e.* a "*deposit for recovery permit*"[1]. The recovery activity will be operated by Tarmac. A separate Waste Recovery Plan (WRP) (Report K6009-ENV-R001) has been produced in support of the wider application.

This ESSD describes the Conceptual Site Model (CSM) for the Site and provides an understanding of the Site in its environmental setting. This report has been developed in accordance with electronic Environment Agency Guidance on "*What to include in your environmental setting and site design report*"[2] and sets out the details of the conceptual site model (CSM) and environmental setting and site design (ESSD). This report should be read in conjunction with the supporting risk assessments.

1.2 Site Details

The Site is located between Wivenhoe and Alresford at Elmstead Heath, some 3.5km to the south-east of Colchester, Essex and is centred at National Grid Reference (NGR) TM 05855 22582 (Figure Error**! No text of specified style in document.**.1 and Drawing W328-00062-01-D). The Site is an area of agricultural land, with an active quarry to the west and a former quarry to the south. The land to the north and east is predominantly by agricultural land, isolated dwellings, woodland and water bodies, with the village of Arlesford to the southeast.

The B1027 bounds the northern perimeter of the Site and will provide the main access route. Several residential properties are situated along this road to the north and east of the Site. A Window and Conservatory Centre and Garage are also positioned on this road to the east of the Site. Further residential properties, a storage yard, mast and Shrublands Nursery are located on Cockaynes Lane immediately to the east of the Site. Beyond Cockaynes Lane, there is the village of Alresford ~285m to the south-east.

[1] https://www.gov.uk/government/publications/deposit-for-recovery-operators-environmental-permits/waste-recovery-plans-and-deposit-for-recovery-permits

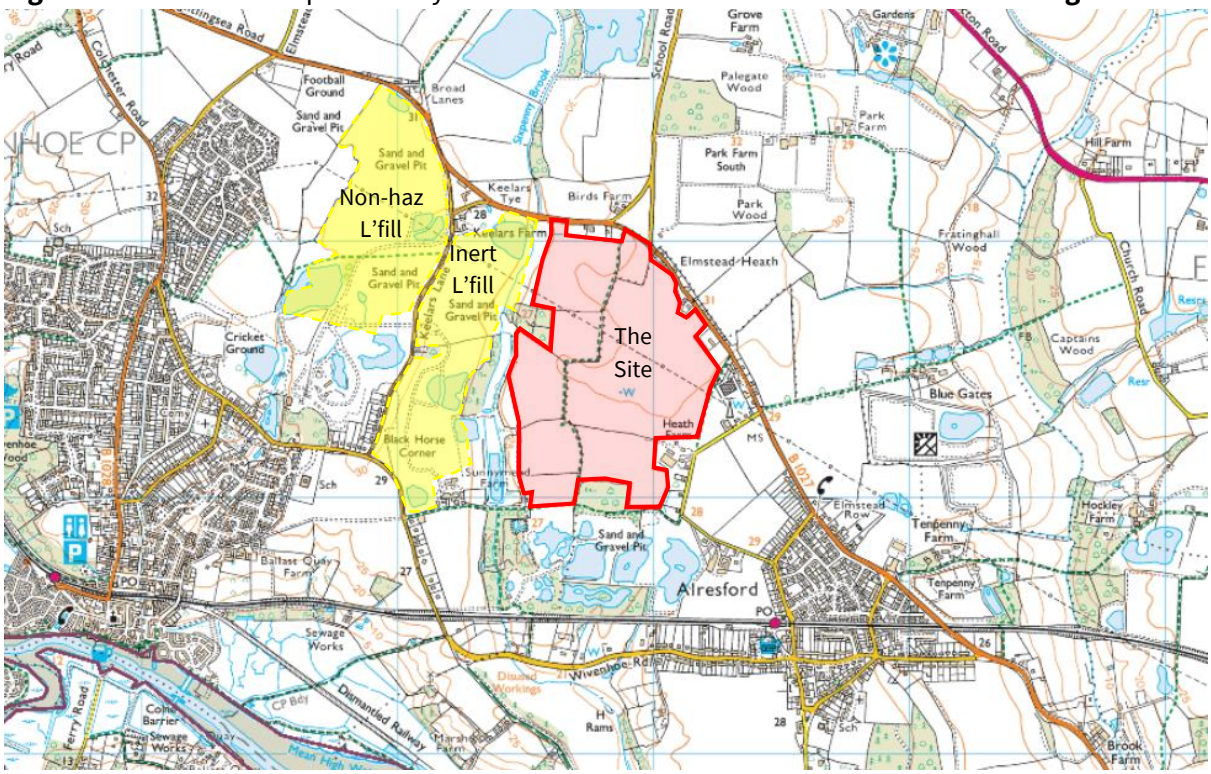
[2] https://www.gov.uk/guidance/landfill-operators-environmental-permits/what-to-include-in-your-environmental-setting-and-site-design-report

To the south, the Site is bound by Cockaynes Wood and a series of former sand and gravel quarries which have been restored to a mixture of lakes and woodland. The land to the south of the Site forms in part a 20.2ha nature reserve managed by the Essex Wildlife Trust and the Cockaynes Wood Trust. To the south of this is a railway line which passes east-west.

There are several watercourses within the local vicinity of the site. The nearest of these is the Sixpenny Brook which flows north to south adjacent to the western boundary of the Site and then flows in an easterly direction to the south of the Cockaynes Wood nature reserve. The Sixpenny Brook flows into the Alresford Creek approximately 3km southeast of the site. Arlesford Creek is a tidal arm of the River Colne formed by the Sixpenny Brook and the Tenpenny Brook a north to south flowing stream, which at its closest is 1.6km to the east of the Site. The Colne Estuary is characterised as a Ramsar site, Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) and Special Protection Area (SPA).

To the west of the Sixpenny Brook are several landfill sites which have been used to restore previous quarry voids. The inert Wivenhoe Landfill (Permit FP3194/LV) occupies the space between the Sixpenny Brook and Keelars Lane, with an earlier biodegradable landfill (Permit RPR/PP3199NN) further west in the quarry between Wivenhoe, Brightlingsea Road and Keelers Lane. Other notable features to the west of the Site include a piggery and Sunnymead Farm.

Figure Error! No text of specified style in document.**.1 – Site Location and Surrounding Features**



Inert L'fill = Mapped Inert Landfill EPR/3194LV Non-haz L'fill = Mapped Biodegradable Landfill EPR/PP3199NN in operational quarry (Note landfill's are smaller than permitted /licensed areas)

The Site covers an area of ~60.9ha and currently exists as agricultural field parcels delineated by hedgerows. The Site is bisected by a Public Right of Way (footpath) and a series of overhead power lines. The topography of the site is almost entirely level and only varies by 3m, rises from ~27mAOD along the western edge of the site to ~30mAOD within the central part of the site. Towards the north-

east the ground elevation remains relatively flat. There is a fall in topography towards the south-east of the Site near Cockaynes Wood with elevations at Willow Lodge at ~27.5mAOD. The site topography is illustrated on Drawing W328-00062-02-D.

The proposed extraction area covers 43.4ha. Details of the proposed working scheme including the application boundary and proposed extraction area are illustrated on Drawing W328-00062-03-D.

2 Source Term

2.1 Historical Land Use

OS maps illustrate that the site area has remained undeveloped since at least 1874. Between 1874 and present day the Site has existed as fields bisected by a footpath. Charity Farm (now Englishes Farm) was present in 1874 to the north of the site along with several other properties further to the north-east along the B1027. Woods Farm (now Heath Farm) was present immediately to the south-east of the site and a gravel pit was noted to the south-west. Other features present in 1874 include Cockaynes Wood to the south of the site and the Sixpenny Brook to the west flowing north to south towards the Villa Pond. A railway line was also present in 1874 to the south of the site.

There have been a limited number of changes to the surrounding area since 1874. Extensive quarrying of the land to the south and west of the site has however been carried out. Historical OS maps indicate that a gravel pit was initially developed in the 1950s to the south-west of the site and Cockaynes Wood. Further quarrying to the south and south-east of Cockaynes Wood was carried out post 1980's, with processing of the excavated material carried out within the earlier south-western phase of working.

Aerial imagery shows the progression of the quarrying to the south of the site during the period 2000 to present day (Figure **Error! No text of specified style in document.**.2 - Figure **Error! No text of specified style in document.**.4) to leave Cockaynes Wood in its current footprint. These pits have since been restored to open water and form part of a 20.2ha nature reserve managed by the Essex Wildlife Trust and the Cockaynes Wood Trust. Following quarrying, spring lines have developed in the northern slopes of the residual quarry which in turn feed into the ponds. The aerial images indicate that groundwater levels were relatively close to the ground surface and as such these lakes are expected to be in continuity with the groundwater. However, inspections also indicate that the westernmost ponds are silted and contain minimal free water.

Historical quarries to the west of the Sixpenny Brook were restored by landfilling (Figure **Error! No text of specified style in document.**.1). Wivenhoe Inert Landfill is present immediately to the west of the Sixpenny Brook and was operated by Tarmac between July 1998 and 2018. Additional historical landfilling (pre-2005) is also present further to the west of Keelars Lane. The entire landscape to the south and west of the site is therefore an artificial artefact.

A piggery has been present to the west of the site since at least 1970. A well is also present on 1970 OS map within the centre of the proposed development site and remains annotated on recent OS maps. Most recently the site has been used for agricultural purposes.

Figure Error! No text of specified style in document.**.2 – Aerial Imagery showing quarrying works during 2000**

Figure Error! No text of specified style in document.**.3 – Aerial Imagery showing quarrying works during 2005**

Figure Error! No text of specified style in document.**.4 – Aerial Imagery showing restored quarries during 2020**

2.2 Proposed Development

The Site is being developed for the extraction of approximately 3.8 million tonnes of sand and gravel. The Site is to be progressively restored to a mixture of agriculture and low-level water-based nature conservation habitats, lowland meadow, woodland planting and hedgerow enhancement. The approved restoration scheme for the site including final ground contours is illustrated on Drawing W328-00062-12-D and presented as a Drawing Extract as Figure **Error! No text of specified style in document.**.5.

The restoration profile and phased planning conditions requires that the final restoration scheme comprises an arc formed by the western and southern flanks of the development are returned to their original ground level for either agriculture (in the west) and low land meadow in the south, which then surround an open water lake feature. The bridleway is to be retained and will separate the western area from the lake. The slopes towards the lake are of a shallow (1 in 30) gradient, which will then steepen to 1 in 10 at the Lake margins, with a slope of 1 in 3 beneath the water line below 26mAOD. The lake is located across the area with the greatest thickness of extractable mineral (Figure **Error! No text of specified style in document.**.6), consequently, some "below post-dewatering water level" fill will be required to ensure stable slope angles.

The proposed restoration scheme at Wivenhoe Quarry will require the import and placement of approximately 1.2 million cubic metres of suitable restoration materials, to supplement the on-site excavated materials *i.e.* interburden and overburden. It is proposed that these works are completed

as a deposit for recovery scheme. The proposed mineral extraction zone covers an area of ~43.4ha and it is this area which will concern recovery activity.

Details of the proposed working scheme including the application boundary and proposed extraction area are illustrated on Drawing W328-00062-03-D, with an illustrated extract of the phase locations presented as Figure **Error! No text of specified style in document.**.7

Figure Error! No text of specified style in document.**.5 – Permitted Restoration Profile**

See Drawing W328-00062-12-D for full details of Restoration Scheme and Drawing Key

Figure Error! No text of specified style in document**..6 – Depths to London Clay (Thames Gp) Bedrock (Extract from Stantec 2018 HRA[3])**

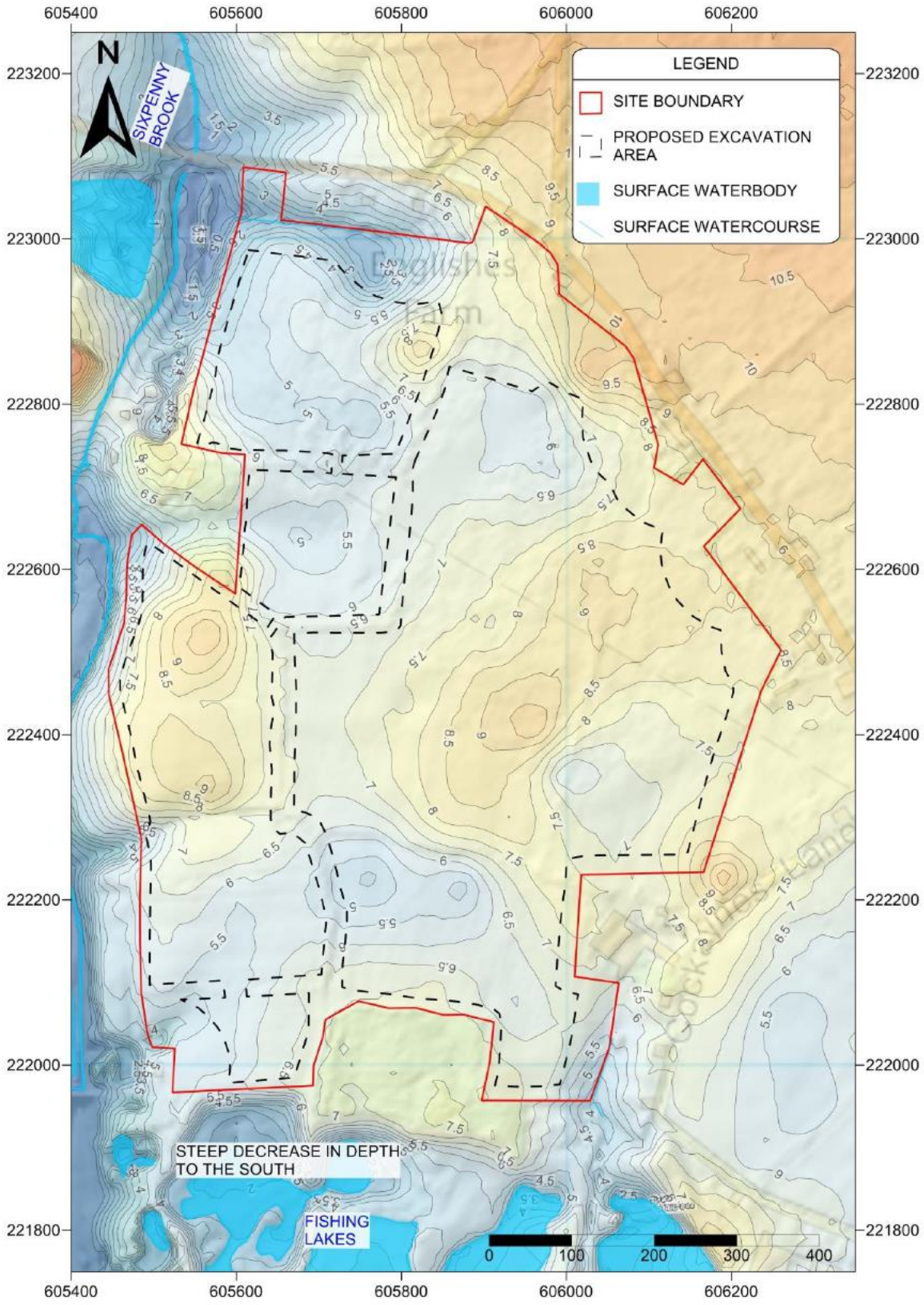


Figure Error! No text of specified style in document.**.7 – Phase Layout and Monitoring Locations**

The site is to be progressively developed in seven phases. Each phase will be excavated to approximately the base of the sand and gravel deposit (*i.e.* to the top of the London Clay). Processing plant, a site office, freshwater lagoon and processed mineral stockpiles will be located within the northern part of Phase 1 once this area has been excavated. Two silt lagoons are to be

developed within the southern part of Phase 1. The northern and southern areas will be separated by a retained hedgerow *i.e.* unexcavated ground.

The quarry will be developed in a phased manner in accordance with the requirements of the Planning Permission. Once the first three phases have been quarried, the restoration of each excavated phase will be completed prior to excavation of the next phase. As Phase 1 will form the mineral processing area, then it will be the first phase to be operated and last to be restored. However, as there is a requirement for only three phases to be active at one time, then in order for Phase 4 to be operational Phase 2 must have been restored, with Phase 5 operations commencing following the restoration of Phase 3.

Overburden, interburden, topsoil and subsoil will initially be used to form amenity screening bunds and then in the restoration of the preceding extraction phases. These materials will be supplemented with imported inert materials where necessary to complete the restoration of a phase. It is anticipated that Phases 2, 3, 4 and 5 will be partially filled with inert restoration materials. Phases 1, 6 and 7 are expected to be restored using only site derived materials. However, the source of material used for restoration will be dependent on how much site derived non-commercially viable material is present. Consequently some imported materials may be required for Phases 1, 6 and 7.

"Footpath 24" which runs from north to south through the central part of the site and separates Phases 1-3 from Phases 4-7 will remain unexcavated. A tunnel will be constructed beneath the footpath to allow excavated material from Phases 4 to 7 to be conveyed to Phase 1 for processing.

Each phase will be worked dry and therefore de-watering will be required. An assessment of the de-watering requirements was completed as part of the planning application for the site and these are detailed in the supporting Hydrogeological Risk Assessment (HRA) produced for the site by Stantec[3] dated 2018. The de-watering works will be carried out under a separate Transfer Licence. The expected radius of influence from the de-watering activity is 447m.

A summary of the depth of each phase, restoration materials and final levels are shown in Table 1. The site layout is illustrated on Figure **Error! No text of specified style in document.**.7.

Table 1 – Proposed Phasing Development Summary

Phase	Position	Base of Excavation, (to Thames Group)	Restoration Level (resultant topographical slope)	Comments
		mAOD	mAOD	
1	Northwest	21.3 to 26.0	26 to 30.0	
2	Southwest	20.5 to 23.9	26 to 29.5	
3	West	19.0 to 22.5	26 to 29.5	
4	Northeast	20.8 to 24.5	21 to 30.5	Restored to open water
5	East	20.0 to 23.5	21 to 28.5	Restored to open water
6	East	20.7 to 23.5	21 to 28.5	Restored to open water
7	Southeast	21.8 to 25.0	28 to 29.5	

Blue highlighted – restoration intended to be with site derived material (if possible)
Green highlighted – restoration with site derived and imported material
Nominal depth of fill assumed in lake area

[3] Stantec (2018) Wivenhoe Quarry Extension. Hydrogeological Risk Assessment. Ref 61272/R1

2.3 Waste Acceptance Procedures

The Planning Permission for the site restricts the types of infilling materials to inert materials only. All wastes will be handled in accordance with the site's Environmental Management System (EMS), which has been compiled for the proposed activity, along with site specific risk assessments that will accompany the Environmental Permit application. This will ensure that the materials to be used are suitable for their intended use.

The site's EMS sets out waste acceptance procedures which have been produced in accordance with the Environment Agency's guidance on *Waste acceptance procedures for deposit for recovery*[4]. All wastes used in the recovery activity will be accepted in accordance with the requirements of Duty of Care. In addition to this, pre-acceptance checks will be carried out to assess the available information and this may include:

- EWC according to the European Waste Catalogue;
- Source and origin of the waste;
- Information on the waste production process;
- Results of any testing e.g. chemical composition, appearance (smell, colour, physical form);

All wastes will be inspected visually on arrival (where possible) and again at the point of deposit. If the waste does not conform to the accompanying documentation, then the load will be rejected in accordance with the rejection procedure set out within the site's EMS.

The waste materials to be used for restoration of the site will be predominantly sourced from local development projects. It is anticipated that a significant proportion of the material accepted will originate from greenfield excavations. Wastes accepted at the site are expected to comprise largely of soils characterised as

- 17 04 05 "*Soils and stone other than 17 05 03*" and
- 20 02 02 "*Soil and stones*".

The full list of waste to be accepted has been taken from Standard Rules Permit SR2015 No. 39 and is included in Table 1 of the WRP. Following placement of the materials, the site will continue to be monitored through the provision of an aftercare scheme supervised by the planning authority.

These materials have an inherently low pollution potential. They do not contain substances at concentrations that may present a risk to surface water or groundwater. After its deposit and subsequent profiling, the already low permeability of this material is further reduced. This further restricts the leachability of any potential soluble components and mobilisation of solids from its compacted surface.

The materials will be tested as per the requirements of European Council Decision 2003/33/EC of 19th December 2002 including those where after a robust source characterisation can be accepted without prior testing providing they:

[4] https://www.gov.uk/government/publications/deposit-for-recovery-operators-environmental-permits/waste-acceptance-procedures-for-deposit-for-recovery

- come from a pre-characterised single source;
- are well characterised and described;
- carry no risk of contamination, for example from a site that has not previously been developed.

3 Pathways and Receptors

3.1 Climate

Average rainfall and wind speed data for the period 1981 - 2010 is available for the Walton-on-Naze[5] Meteorological Office station located ~18.5km to the east of the site. The data is presented in **Table 2**.

Table 2 – Average Rainfall and Wind Speed Data for Walton-on-the-Naze (1981-2010)

Month	Rainfall (mm)	Days of rainfall ≥1 mm (days)	Monthly mean wind speed at 10 m (knots)
January	46.7	9.6	12.2
February	39.8	9.1	11.3
March	39.5	9.7	11.1
April	35.9	8.8	9.9
May	36.7	7.5	9.9
June	36.5	7.6	9.1
July	44.9	7.2	9.0
August	51.7	6.3	9.1
September	53.5	9.1	9.7
October	57.8	10.1	11.0
November	56.1	9.9	10.9
December	49.9	10.8	11.6
Annual	**548.8**	**105.6**	**10.4**

More recent data for the period 2000 to 2017 is available for an Environment Agency rain gauge at Brightlingsea some 4.4km to the southwest of the site (Table 3). This data is taken from Stantec 2018 HRA[3] produced as part of the planning application.

Table 3 – Monthly Rainfall from Brightlingsea (2000 to 2017)

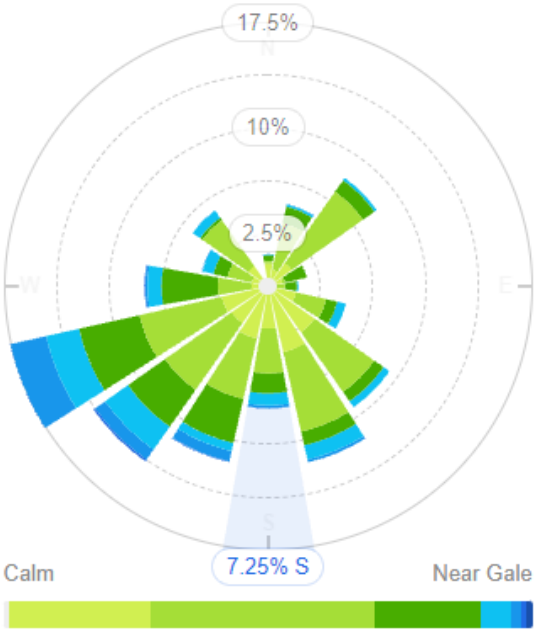
Month	Rainfall (mm)
January	50.7
February	40.1
March	32.4
April	31.7
May	47.0
June	41.7
July	40.6
August	45.8
September	35.7
October	56.3
November	59.8
December	47.5
Annual	**529.3**

[5] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages

Notes: Records for 2000 have been excluded for months January through to July as rainfall data for these times is incomplete. Records for 2007 have been excluded for months August through to October as rainfall data for these times is incomplete. Records for 2017 have been excluded for months October through to December as rainfall data for these times is incomplete.

Wind directional data has been obtained for the Alresford weather station[6] which is the nearest identified Meteorological Office station to the site. The data is presented in Figure **Error! No text of specified style in document.**.8 below. The prevailing wind direction is from the west-south-west.

Figure Error! No text of specified style in document.**.8 – Wind Rose for Alresford weather station**



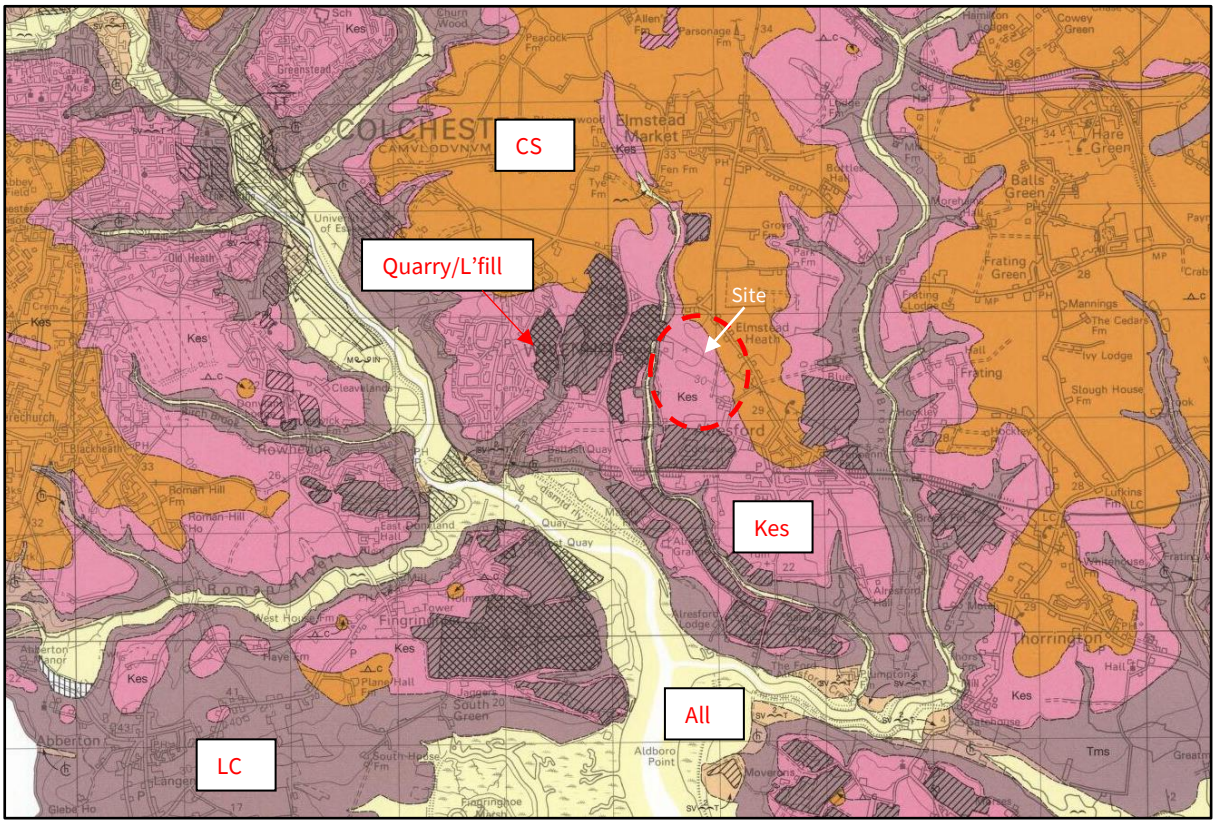
3.2 Geology

The geology at the site comprises of the Kesgrave Catchment Subgroup (superficial sediments) underlain by a marine clay bedrock of the Thames Group (formerly and more widely known as the London Clay). Towards the north-eastern edge of the site, the Kesgrave Catchment Subgroup is overlain by cover loam. Due to the nearby historical quarrying activities, the superficial sediments are expected to be largely absent to the south of the site and to the west of the Sixpenny Brook.

The regional geology is illustrated on Figure Error**! No text of specified style in document.**.9 with further details provided in Table 4 below.

[6] Wind rose obtained from Alresford Wind Forecast, Essex CO7 8 - WillyWeather. Statistics based on 5 year average.

Figure Error! No text of specified style in document.**.9 – Geology (Extract taken from BGS Map 224 and 242)**



LC – London Clay Kes – Kesgrave Fm CS – Cover Sands All – Alluvium

Table 4 – Regional Geology Succession

Age	Formation/ Lithology	Description
Pleistocene and recent	Loam	Absent across much of the site. Described by BGS as a variable pebbly sandy clay, locally silty and sandy upper part.
	Cover Sand	Clay, Silt and Sand - Wind Blown Deposits formed up to 3 million years ago in the Quaternary Period. Deposits are aeolian in origin. They are detrital forming lenses, beds and dunes
	Kesgrave Formation	Sand and gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers. Absent at the western boundary of the Site where the London Clay is exposed in the banks of the Sixpenny Brook
Eocene	London Clay (Thames Gp)	Bluish grey silty clay containing occasional thin cementstone lenses. Estimated depth of 20 – 30m at the site based on BGS records.
	Woolwich and Reading Beds (Thames Gp)	Silts, loams and sands in variable proportions. Estimated depth of 22 – 26m. Mottled sands and clays with beds of pebbles. Present beneath the London Clay. Where the London Clay pinches out (approximately 1km to the west of the site) the Reading Beds directly underlie the superficial deposits. Comprises a thickness of some 30m beneath the London Clay to the east. Pinches out approximately 6km to the west of the site. (26m depth)
Cretaceous	Upper Chalk	Soft white limestone with flint bands and nodule. The top of the Upper Chalk at the site is at a level of approximately 30m below Ordnance Datum.

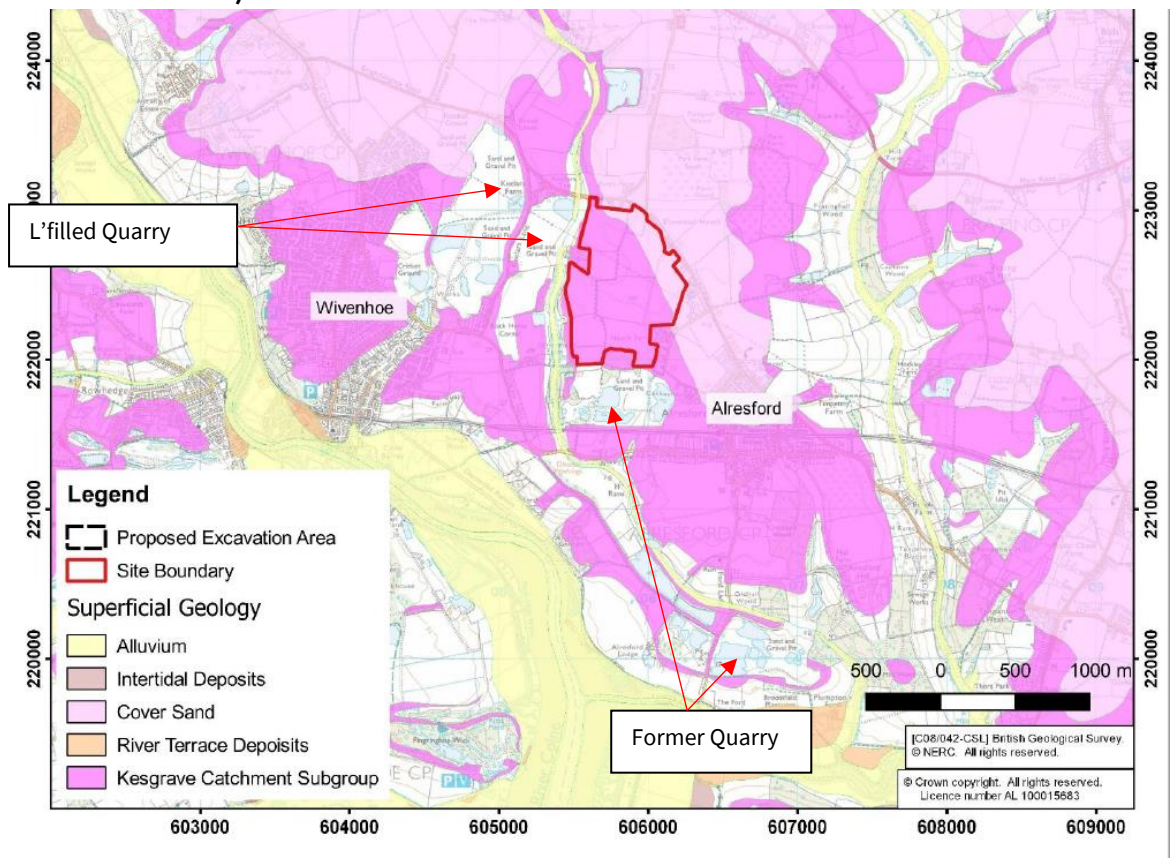
3.3 Local Geology

Numerous site investigation boreholes have been installed at the site. Borehole logs demonstrate that the Kesgrave Catchment Subgroup is comprised of

- Overburden (silty and/or sandy clay/silt with some gravel);
- Upper mineral (fine to medium sand and gravels);
- Interburden (silt or silty clay); and
- Lower mineral (fine to medium sand and gravels).

The composition of the Kesgrave Catchment Subgroup does however vary spatially across the site. The mineral thickness is typically ~5m increasing to 7.5m within the central eastern and central western areas of the site.

Figure Error! No text of specified style in document.**.10 – Superfical Geology (Extract taken from Stantec 2018 HRA[3])**



The Thames Group was encountered beneath the superficial sediments and is described as a grey clay. An illustration of the depth to bedrock was produced for the Stantec 2018 HRA from extensive borehole log records. A comparison of this with the current topography of the site confirms that the height of the top of the Thames Group is variable, deepening within the central part of the site where it is proposed to restore the site to open water. There appears to be a ridge feature which

peaks in the vicinity of BH02 at ~23.6mAOD within Phase 1 and further south at BH09 at ~23.1mAOD which may influence groundwater movement. The top of the bedrock varies between 19.0 and 26.0mAOD within the vicinity of the site as detailed in Table 1, which summarises the mineral exploration investigation conclusions.

Borehole records further to the south of the site are limited. BGS borehole ref TM02SE4 is positioned at NGR TM 05453 21181 some 820m to the south-west of the site and to the west of the Sixpenny Brook. The borehole record for this location identifies the top of the Thames Group at ~14.3mAOD. This suggests that the bedrock dips sharply towards the south in accordance with the surface topography. The bedrock also reduces in the direction of BH05 to the south-west of the site. At BH05, the top of the bedrock is reported to be at 15.8mAOD.

Due to the removal of superficial materials to the south of the site, Stantec 2018 HRA noted a "steep decrease in depth to the Thames Group to the south of the site". This is a former mineral quarry in which the London Clay (Thames Group) is expected to form the base of the lakes to the south of the site with quarry overburden and interburden used for landscaping purposes. Given that the same topographical variation observed in the application for the surface of the London Clay is expected to continue into this quarry, then the base of these lakes will be locally variable and relatively shallow (2 to 5m), and further modified by siltation and vegetation growth.

3.4 Man-made Subsurface Pathways

There are no known man-made sub surface pathways associated with the site.

3.5 Infilled Ground

Infilled ground is present to the west of the Sixpenny Brook in the form of Wivenhoe Inert Landfill operated between July 1998 and 2018. Beyond this is further landfilling operated prior to 2005. The land to the south of the site is also modified using quarry spoil. Several other landfills are noted to the south-west of the site in excess of 1km.

3.6 Hydrology

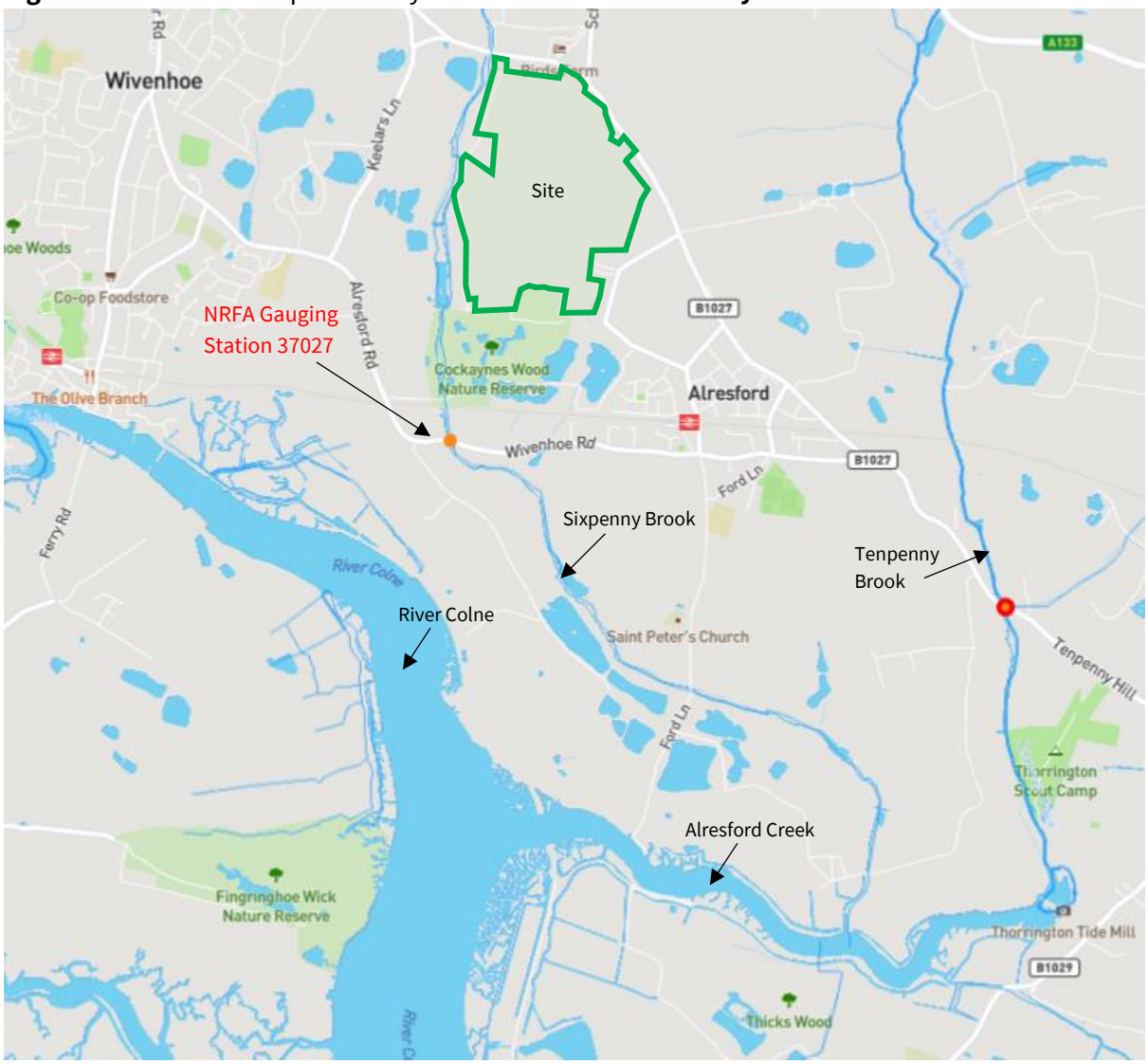
The site is within the catchment of the River Colne (Figure **Error! No text of specified style in document.**.11). The closet water course is the Sixpenny Brook which flows north to south past the western boundary of the site. As the watercourse passes the site it splits into two separate channels, converging a short distance further downstream. It is understood that flow may be limited within the western channel during parts of the year[3]. A lined reservoir used for agricultural purposes is present to the southwest of the site. The water level within this lined reservoir is above that within the Sixpenny Brook.

The Sixpenny Brook flows into the Alresford Creek, a tributary of the River Colne, approximately 3km south-east of the site. The lowest reach of the Alresford Creek is tidal. The Alresford Creek is formed from the Tenpenny Brook and lies ~2km to the south of the site at its nearest point. The

Tenpenny Brook flows from north to south ~1km to the east of the site with contributions from both the Elmstead Brook and Frating Brook.

The River Colne is also tidal as far as Colchester. However, a flood barrier is in place at Wivenhoe to minimise the risk of flooding. At its nearest point to the site, the River Colne is 68m wide at low tide and 310m wide at high tide. The River Colne discharges to the North Sea at Brightlingsea Reach.

Figure Error! No text of specified style in document.**.11 – Nearby watercourses**



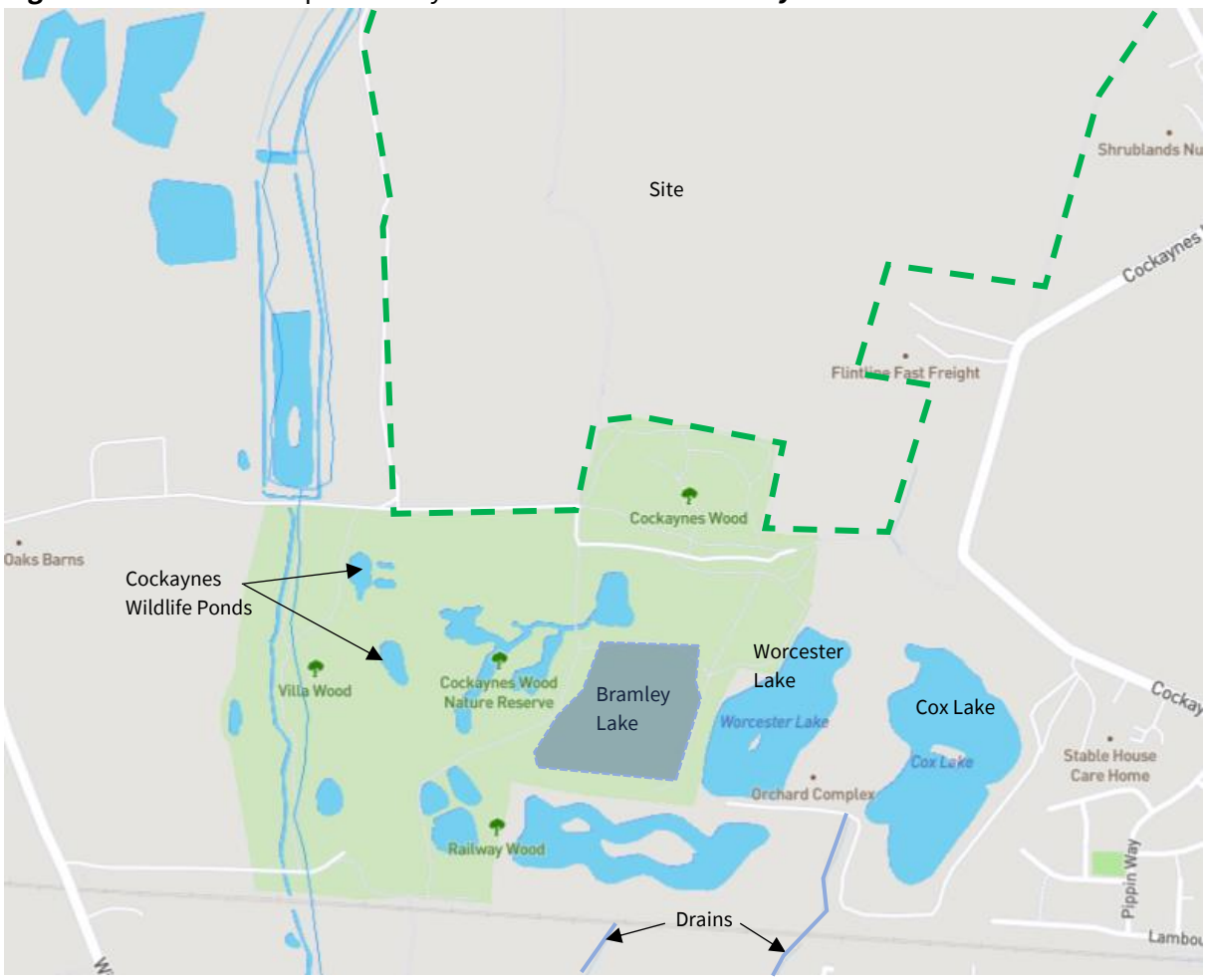
There are a number of nearby lakes formed from historical quarrying activities at Cockaynes Wood (Figure **Error! No text of specified style in document.**.12). The closest of these lakes are a short distance to the south in the former quarry that abuts the site:

- Cox Lake (120m south-east);
- Worcester Lake (165m south of the Site); and
- Bramley Lake (325m south).

The base of Cox Lake and Worcester Lake are lined with clay and are fed by spring flows as well as direct rainfall and runoff[3]. The springs enter the lakes above the *in-situ* clay surface and flow mainly into the Cox and Worcester lakes. The Bramley Lake is mainly fed by overflow from the other two lakes and groundwater inflows. One spring has been identified in the north-western part of the Worcester Lake. It is understood that the lakes outfall to a drain that flows north to south towards a small pond positioned some 600m to the south of the site. This drain appears to originate from Heath Farm.

A series of smaller ponds and a former silt lagoon positioned ~80m from the site boundary form part of the Cockaynes Nature Reserve. An outlet from the lake system is understood to transmit flow to the Sixpenny Brook[3].

Figure Error! No text of specified style in document.**.12 – Nearby water features**



The site is located within Flood Risk Zone 1 which means it is land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding. The site is therefore considered to be at low risk from flooding.

There is a gauging station, part of the National River Flow Archive (NRFA) at Ship House Bridge[7], where the brook is crossed by Arlesford Road to the south of Cockaynes Wood some 550m south of

[7] https://nrfa.ceh.ac.uk/data/station/info/37027

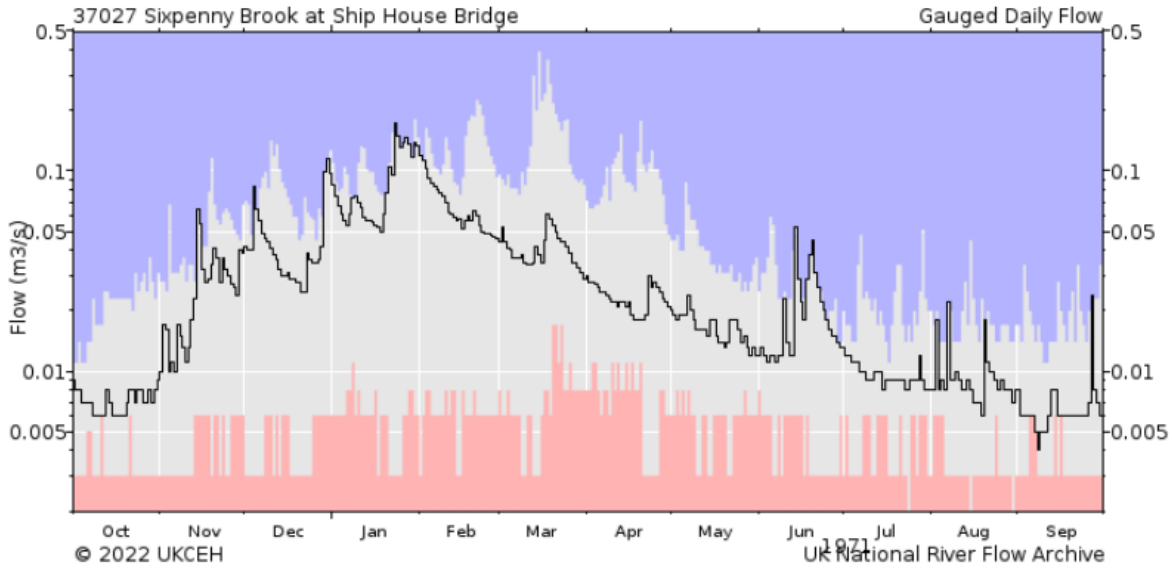
the site. Gauged flows are small at a median rate of 14L/s or 1,210m³/day for the period 1960 – 1971 when the station was operational (Table 5).

The flow rate is seasonally biased with low to negligible flow occurring in summer, with flow rates increasing from November to January, when flow peaked at or about 0.1m³/s (8,640m³/day) and then depleted progressively through the spring (Figure **Error! No text of specified style in document.**.13). The data is therefore indicative that there is little if any real groundwater discharge from the site area into Sixpenny Brook during a large part of the year.

Table 5 –Sixpenny Brook Flow at Ship House Bridge

	m³/s	m³/day
Average	0.025	2,160
Median	0.014	1,210
70th %ile	0.008	691
95th %ile	0.003	259
10th %ile	0.059	5,098

Figure Error! No text of specified style in document.**.13 – Sixpenny Brook Guaged Flow Rates at Ship House Bridge**[7]



Key: Red and blue envelopes represent lowest and highest flows on each day over the period of record. Underlying data supplied by the Environment Agency

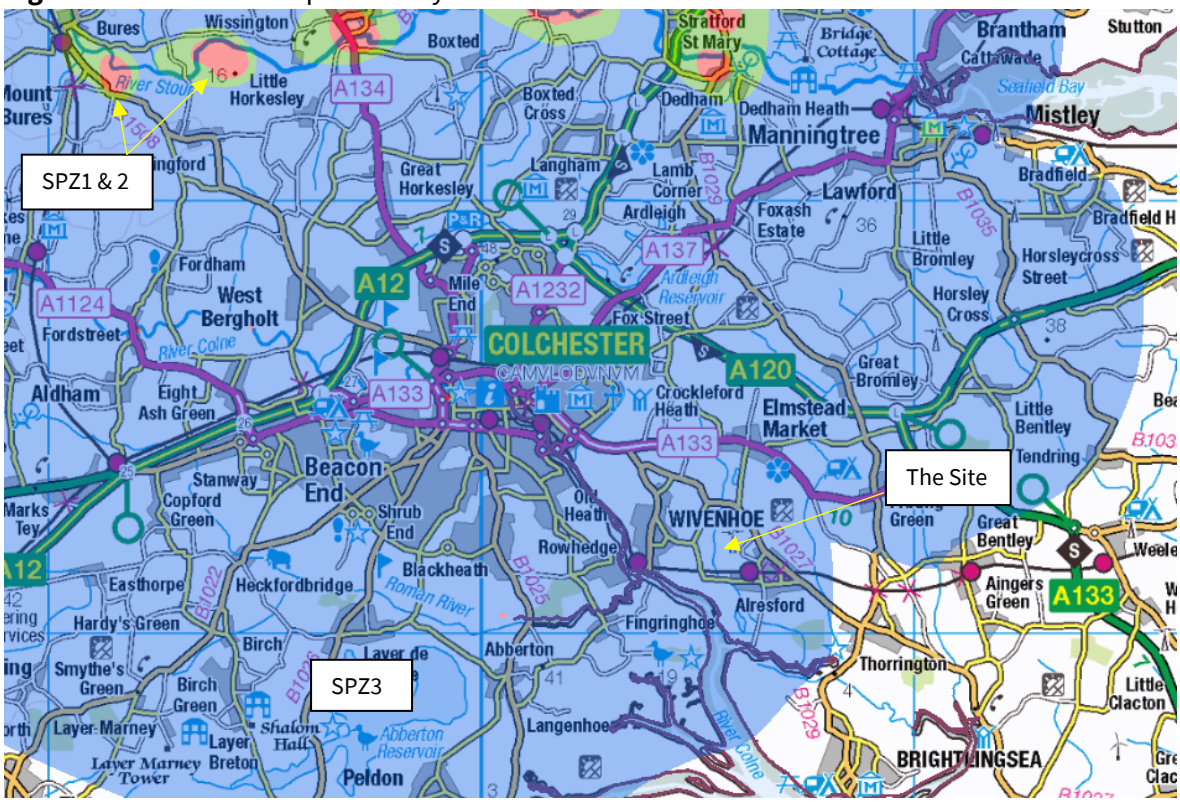
3.7 Hydrogeology (Aquifer Status)

The underlying Thames Group is classified as unproductive strata (non-aquifer) and acts as a natural geological barrier to vertical flow. Its presence isolates the overlying deposits from the underlying Woolwich and Reading Formations and Upper Chalk.

The site is positioned within Source Protection Zone (SPZ) 3 defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. This SPZ is actually part of the Chalk groundwater system and is physically separated from the Site by the London Clay. The SPZ is at the fringes of the catchment centred on an arc of abstractions at Bures,

Little Horkesly and Strafford St Mary some 11km to the northwest. The site is actually downgradient of these abstractions and the catchment boundary limited to the east a short distance from the site by saline intrusion from the coast (Figure **Error! No text of specified style in document.**.14).

Figure Error! No text of specified style in document.**.14 – Source Protection Zones**



The Kesgrave Catchment Subgroup is classified by the Environment Agency as a Secondary A Aquifer (minor aquifer). A Secondary A aquifer is defined by the Environment Agency as "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*". The Cover Sands at the northwest of the site is classified as a Secondary B aquifer which is defined by the Environment Agency as "*predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering."*

3.8 Groundwater Flow

Groundwater flow within the Chalk strata and the lower Thames Group Members (Woolwich and Reading Beds) are physically separate from the quarry and not at risk of influence from the quarrying and restoration works. There is however a perched water system in the superficial strata overlying the London Clay.

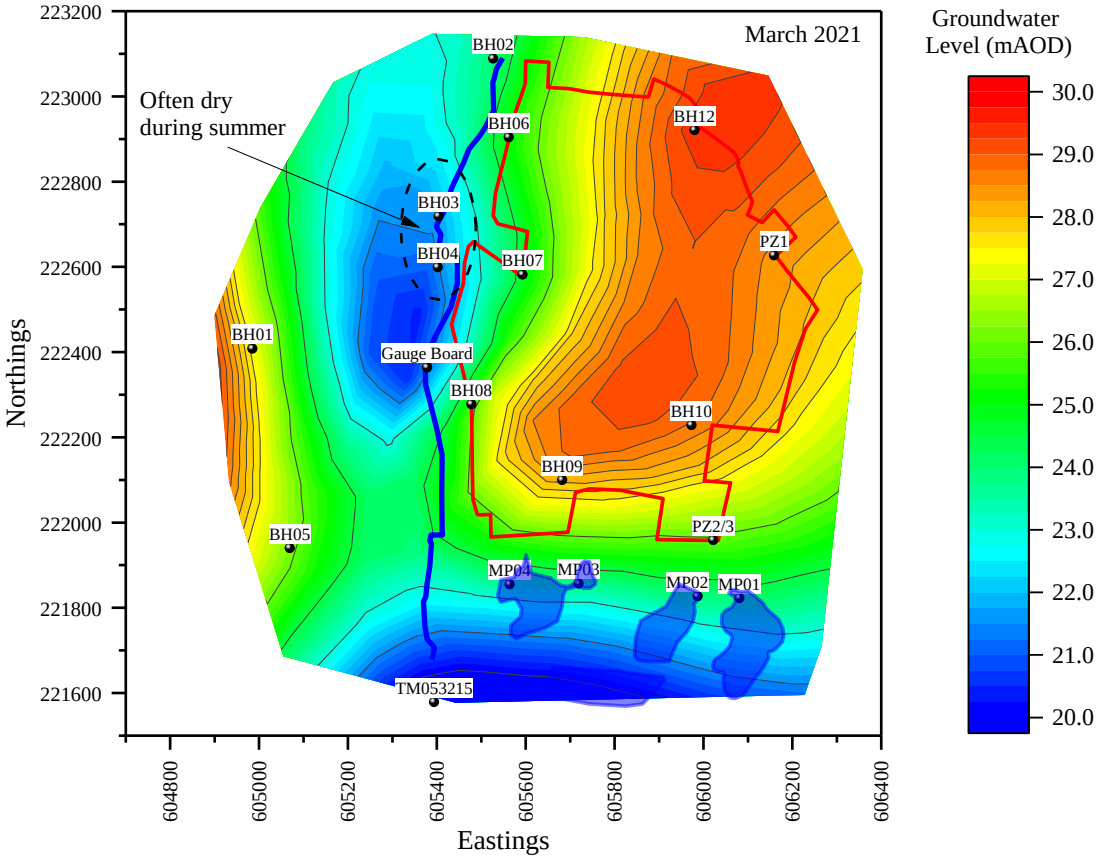
Recharge to the superficial strata is via direct precipitation and infiltration to ground. The infiltrating waters are then diverted laterally to form baseflow to the Sixpenny Brook and the Tenpenny Brook. Hydrogeological recharge to the site area is therefore direct infiltration and groundwater flow from a recharge area to the north.

Mineral extraction will therefore remove a "slither" of this water bearing unit in the southwest corner of the aquifer. Flow will otherwise be diverted directly to Sixpenny Brook, hence long term baseflow patterns will not be interrupted.

The "aquifer unit" itself will remain continuous to the east of the site and southerly flow will similarly not be interrupted (Figure **Error! No text of specified style in document.**.10).

There are however two superficial water systems at the site, which can be correlated to waters in the Cover Sands above a layer of interburden which separates it from the main sands (the Kesgrave Fm) which are the primary target to be exploited by the quarry operations. The Cover sands are limited to the western section of the site. When plotted as a continuous water surface this is expressed as a "ridge of groundwater" which along the central axis of the site, which then declines to the west, south and southeast in the direction of Sixpenny Brook (Figure **Error! No text of specified style in document.**.15).

Figure Error! No text of specified style in document**..15 – Groundwater Piezometric Surface (March 2021)**

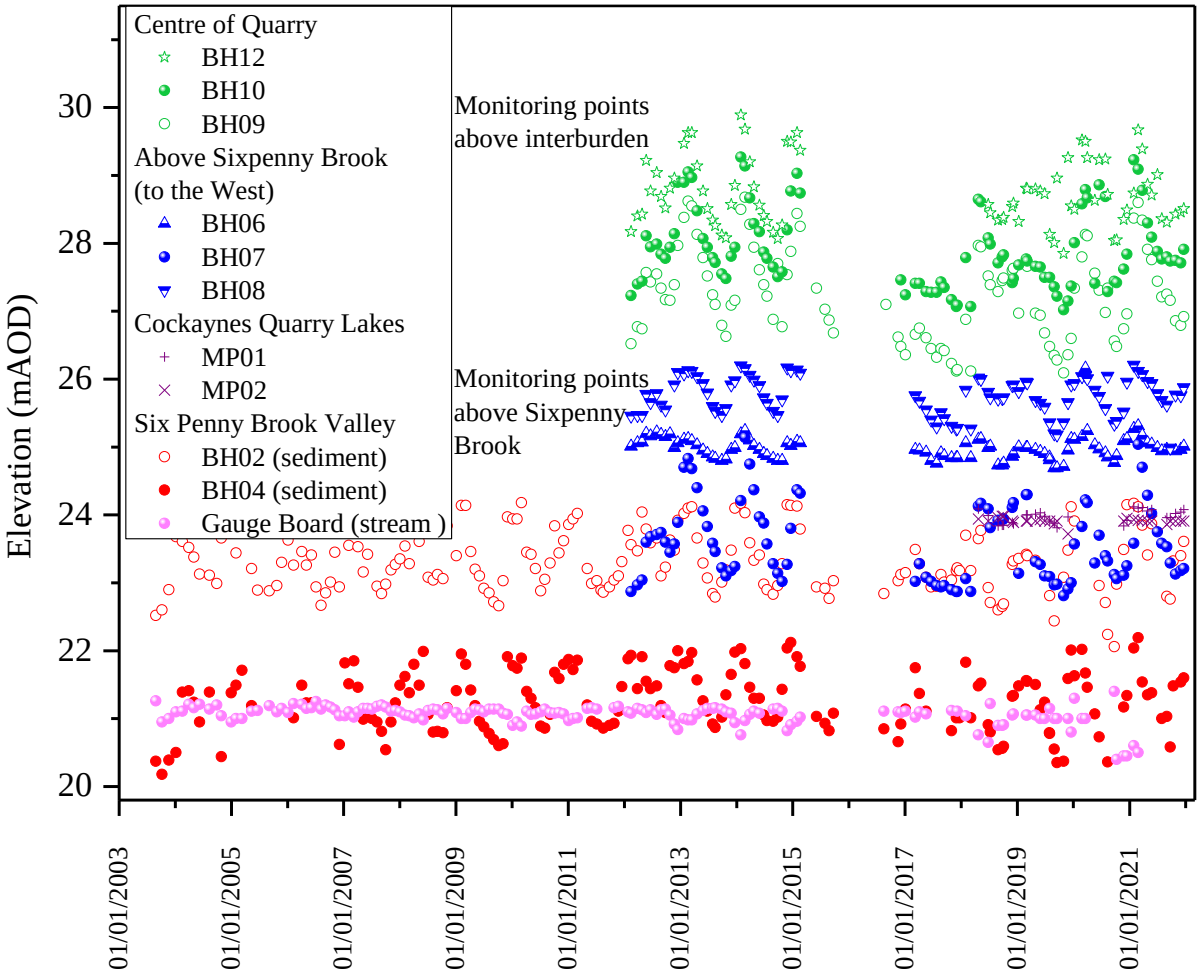


The Kesgrave Fm is continuous across the entire site and it is this surface which forms a continuous waterbody within the footprint of the site. These (Kesgrave Fm) waters will be recharged directly and indirectly from the perched waters above the interburden layer in the east of the site by infiltration through the interburden as well as "decanting" directly into the Kesgrave Fm.

Groundwater elevations within the Kesagrave Fm is in turn influenced by the topography of the London Clay and the stream cut valley topography. Consequently, groundwater recharge from within the site area must decant over the raised topography of the London Clay at or about 23-

25mAOD beneath Phases 1 – 3 and Phase 7 before discharging downslope into the Sixpenny Brook. These levels are illustrated on Figure **Error! No text of specified style in document.**.16 in which BH06 and BH08 indicate the "decant" elevation, with BH07 and the Cockaynes Quarry Lakes water levels controlled by recharge from this decanting / groundwater divide zone and the fall in topography to (and of) the brook.

Figure Error! No text of specified style in document.**.16 – Groundwater Levels**



The Cockaynes Quarry Lakes are themselves artificial constructs and held at a single water level (23.5 – 24.1mAOD) recharged by spring lines in the former quarry walls around the remaining Cockaynes Wood with overflow outlets which form tributary streams to Sixpenny Brook.

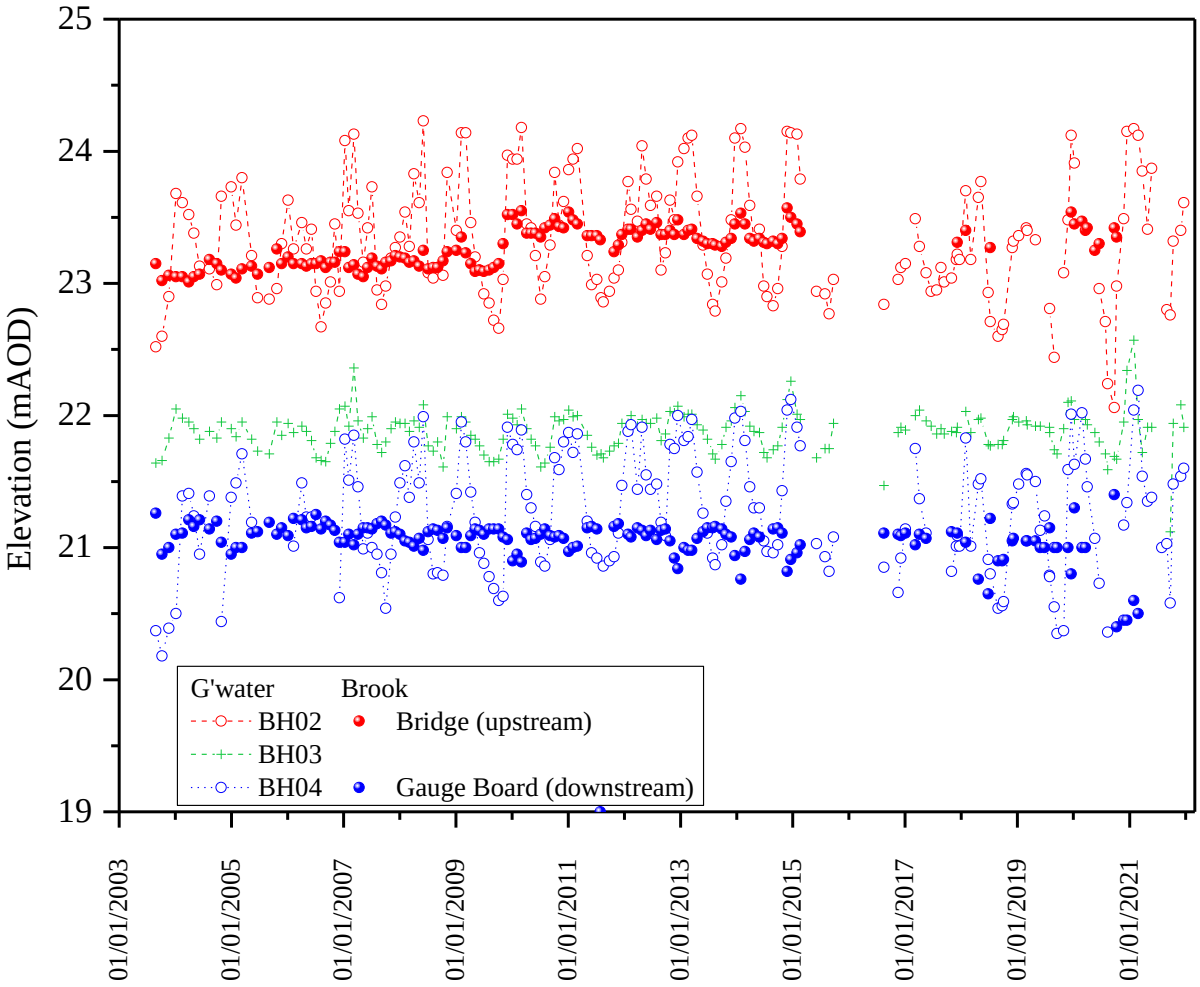
BH07 is not an anomaly as it is located in a depression in the surface of the London Clay which forms a sub-cropping "valley feature" from the main quarry area to Sixpenny Brook near the Phase 3 – Phase 1 interface.

BH02, BH03 and BH04 are located in the "inert landfill" area to the west of Sixpenny Brook. Water levels within these monitoring points is consistent with that of the Sixpenny Brook monitored at the bridge by BH02 and a Gauge Board a short distance downstream of BH04 and upstream of BH08 (Figure **Error! No text of specified style in document.**.17). There is a fall in water level from north to south, with water levels at BH03, located between BH02 and BH04 showing less seasonal variation than BH02 and BH04.

Given that all three monitoring points BH02, BH03 and BH04 are in areas of land disturbed by previous quarrying and restoration works, then there is little inference that can be drawn from the apparent loss of water from the Brook to groundwater as this could be an artefact of recharge via the closed inert landfill and the base of a monitoring point terminating in the London Clay, and is in any case reversed at BH06 and BH08 so any influence is limited in extent. There is also a weir a short distance downstream of the gauging board and therefore to some extent the water level in the brook is artificially stepped.

Notwithstanding the above and irrespective of the cause, the volume change is not significant and demonstrates that the primary constraint is the valley topography and fall in stream level from north to south which is consistent with flow across the surface of the London Clay at approximately 20 - 21mAOD, which then falls in turn to the River Colne some 20m lower at or about sea level.

Figure Error! No text of specified style in document.**.17 – Sixpenny Brook and adjacent Groundwater Monitoring Point Water Level**



3.9 Abstractions

There are a number of known abstraction licences in the vicinity of the site, used variously for mineral washings, crop irrigation and domestic supply, of which there are:

- 7 private water supplies within 500m of the site boundary; and a further
- 6 private water supplies between 500m and 1km of the site
- 2 licensed groundwater abstractions with 500m and
- 1 surface water abstraction within 500m of the site.

as illustrated on Figure **Error! No text of specified style in document.**.18 and Figure **Error! No text of specified style in document.**.19

Figure Error! No text of specified style in document**..18 – Licensed Groundwater and Surface Water Abstractions**

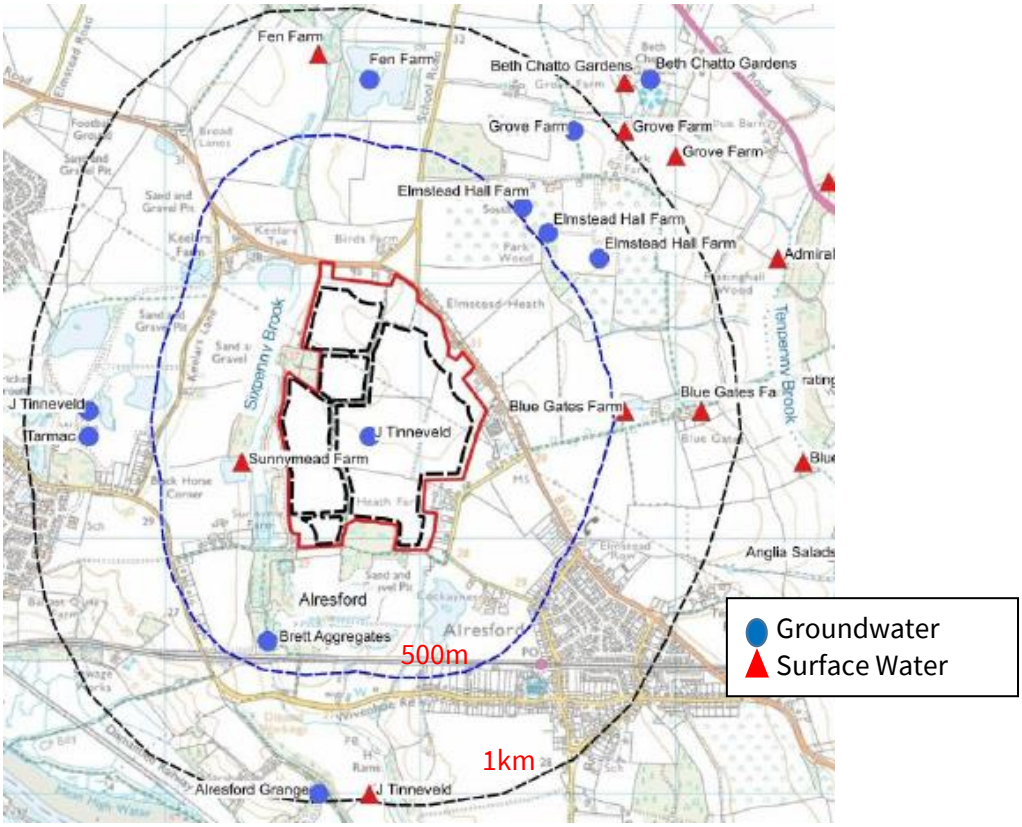


Figure Error! No text of specified style in document.**.19 –Private Water Abstractions**

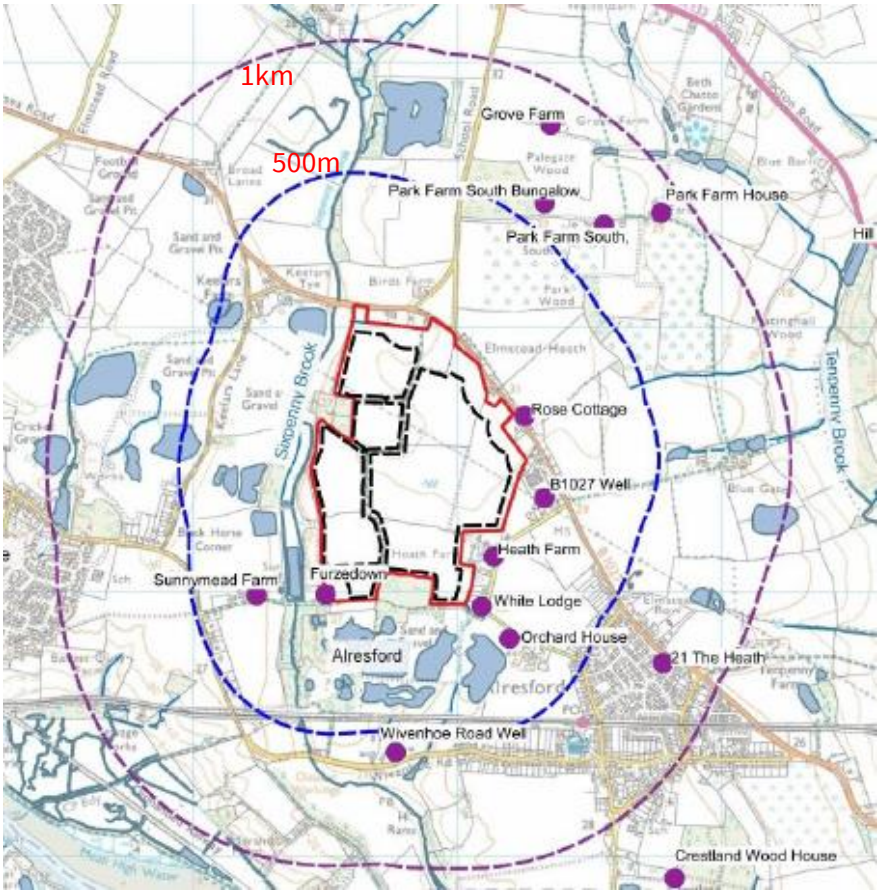


Table 6 –Key Groundwater and Surface Water Abstractions

Name	Licence	Dist	Direction	Use	Vol	Comments
		m			m^3/day	
Private Water Supplies						
Furzedown Cottage		0	SW Corner	Private WS		Domestic Supply-Groundwater Sourced
Rose Cottage		50m	East			
White Lodge		60m	East			
B1027 Well		115m	East			
Orchard House		220m	Southeast			
Sunnymead Fm		260m	West			
Wivenhoe Rd		560m	South			
Sixpenny Brook						
Sunnymead Fm	8/37/25/*S/0222	170m	West	Spray irrigation	22,700	from lined reservoir
J Tinneveld	8/37/25/*S/0041	975m	South	Spray irrigation	683	Reservoir on Sixpenny Brook
Groundwater						
J Tinneveld	8/37/25/*G/0093	0m 745m	Site West	Spray irrigation	6,342	Borehole & Gravel pits
Tarmac	8/37/25/*G/0282	750m	West	Mineral Washing	2,100	Quarry voids
Brett Aggregates	8/37/25/*G/0188	400m	South	Mineral Washing	650	No Longer in use (quarry restored)

The abstractions of relevance are those recharged by baseflow from or to the landfill in the superficial deposits and therefore may be influenced by dewatering in the short term and a change in hydraulic patterns or water quality in the long term after the quarry has been restored.

There are however two boundary conditions, namely The Sixpenny Brook which is recharged from the north and west as well as through the site, and the London Clay basement to the site which forms a hydraulic barrier between the quarry and the underlying Chalk aquifer unit.

The position for Sixpenny Brook, the former quarry to the south of the site and the surrounding Private Water Supplies are more complex and will be discussed in detail as part of the supporting Hydrogeological Risk Appraisal (referenced: K6008-ENV-R004). Notwithstanding this, Stantec 2018 HRA[3] estimated a 446m sphere of influence in the superficial sand deposits during dewatering.

The Chalk itself is hydraulically isolated and therefore no abstractions from the Chalk will be affected.

The abstraction rates identified in Table 6 are not sustainable from the baseflow into Sixpenny Brook if the flow rates from the Ship House Bridge gauging station are correct (Table 5). Consequently, the sustainable recharge source must be from the underlying Chalk Aquifer. This is common practice in this region, where a sustainable recharge can be derived throughput the year, with storage in surface water lagoons, such as from the Sunnymead Farm reservoir.

3.10 Habitats Sites

A search of the Magic website (http://www.magic.gov.uk/) has identified the following habitats/Natura 2000/European sites within a 2km radius of the site:

- Cockaynes Wood Nature Reserve – Priority Habitat and Local Nature Reserve (<10m South of site boundary)
- Wivenhoe Gravel Pit – Site of Special Scientific Interest (640m north-west)
- Essex Estuaries – Special Area of Conservation (1km south-west)
- Colne Estuary – Ramsar Site, Site of Special Scientific Interest and Special Protection Area (1.2km south)
- Upper Colne Marshes - Site of Special Scientific Interest (830m south-west and south of the Colne Estuary)
- Colne Local Nature Reserve - Local Nature Reserve (1.8km west and west of the town of Wivenhoe)

There are no habitats/Natura 2000/European sites within 500m of the site. It is considered unlikely that there will be any significant impact on nearby designated sites from the proposed development due to their proximity to the site.

3.11 Other Receptors

The nearest residential receptors are:

- Rosedene Cottage located 100m north of the proposed extraction area and 250m north of the proposed primary processing plant;
- Furzedown Cottage located at the southwest corner of Phase 2; and
- Properties at Alresford located 100m from the proposed extraction area, with the majority located west of the B1027 and Cockaynes Lane.

3.12 Air Quality

The site is not located within an Air Quality Management Area (AQMA) for PM_{10}, NO_X or SO_2.

4 Conceptual Site Model

A simple relationship can be assessed for the proposed development where the:

- source is the inert restoration fill material
- the pathway is the cast back quarry overburden material (or any remaining *in-situ* unsaturated strata)
- the receptors are
    a) the Sixpenny Brook;
    b) the quarry lakes and Cockaynes Nature Reserve; and
    c) amenity (dust/noise etc) at the residential properties

Two schematic conceptualisations for the site are presented as Figure **Error! No text of specified style in document.**.20 and Figure **Error! No text of specified style in document.**.21, which illustrate how the geology, hydrogeology and the proposed fill profile will inter-relate.

Figure Error! No text of specified style in document.**.20 – Conceptual Site Model (North - South Section)**

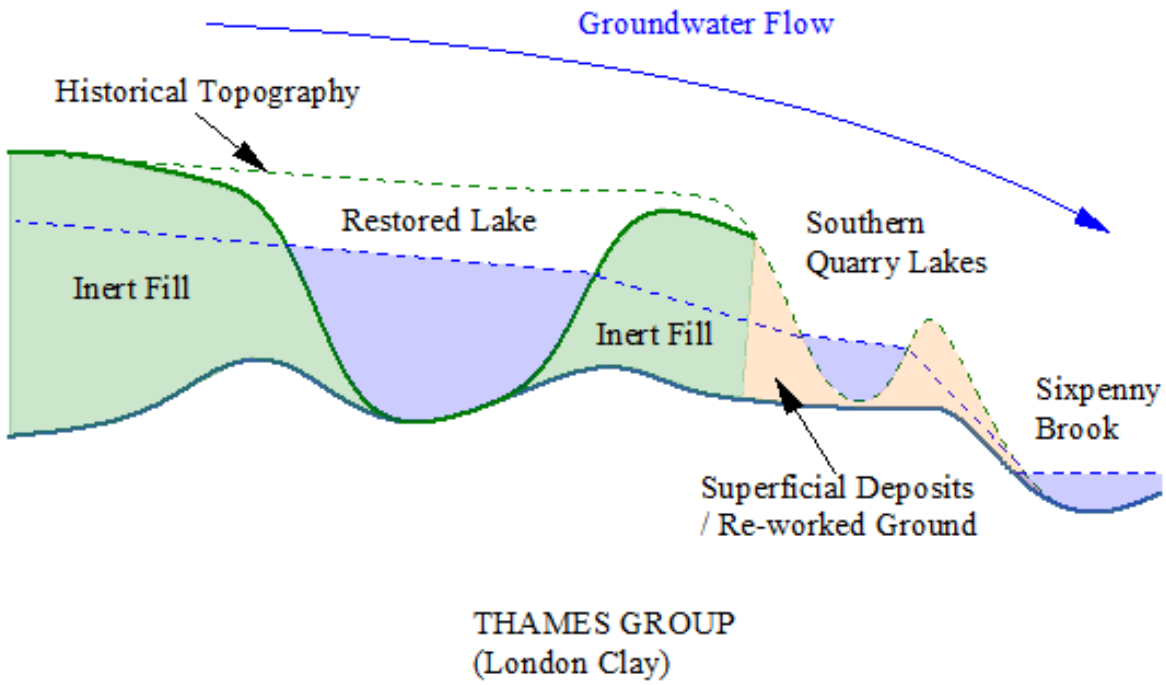
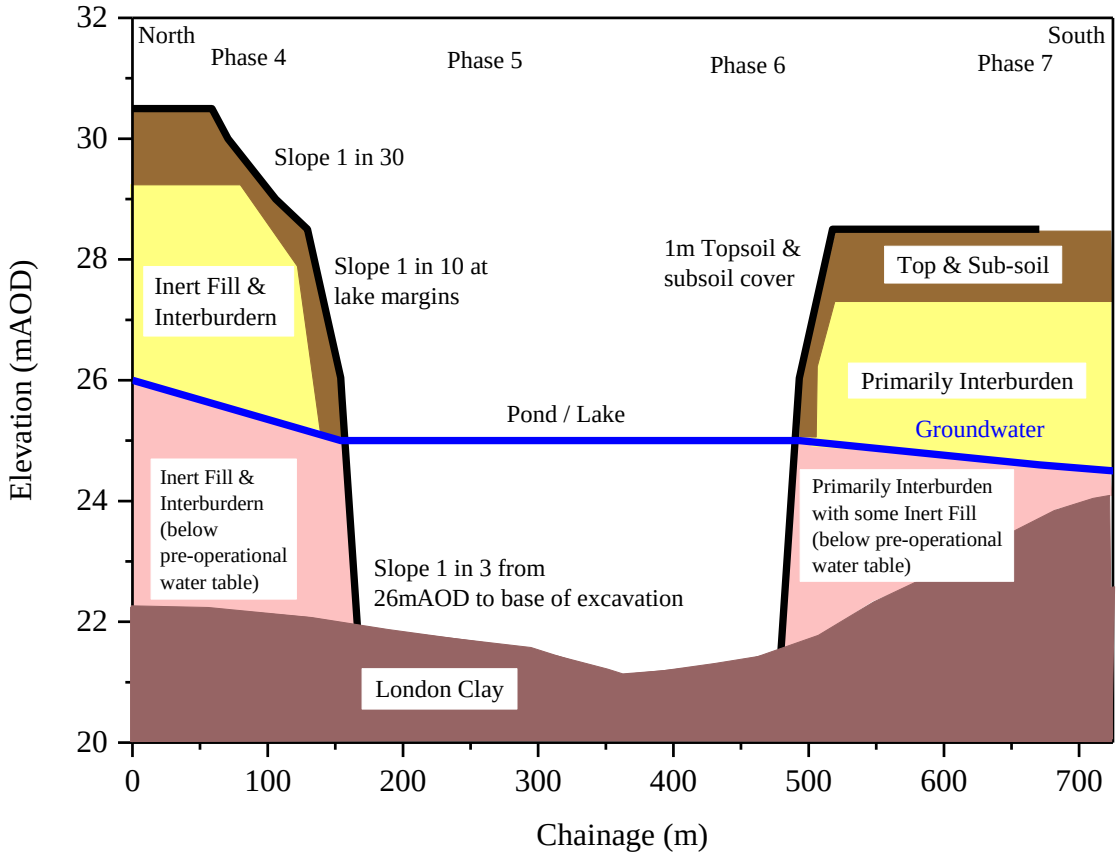


Figure Error! No text of specified style in document.**.21 – Conceptual Site Model Showing Fill Profile through the Lake/Pond Area**



Surface water runoff from the restored land surface will be managed via a mixture of attenuation features and the restored lake to ensure that there will be no increase in run-off volumes above greenfield rates. Run-off will be collected and released to either the Sixpenny Brook or quarry lakes to the south. Reedbeds are to be incorporated along the northern, eastern and western sides of the restored lake feature, including a dedicated reed bed. The reed beds are primarily a biodiversity feature. However, they also have the other advantages such as to low run-off into the restored lake, as well as a water treatment capability.

The infill for restoration is proposed to be predominantly comprised of clean excavation material. Due to the nature of the materials to be accepted at the site:

- Contamination is not expected;
- Soils / infill material will be restricted, hence possible contamination and or potential containing compounds and substances will not be present at concentrations that may cause environmental harm; and
- Topsoil will be excluded from the vertical profile, except as the outer surface layer.

5 Pollution Control Measures

5.1 Site Engineering

The site is to be restored using imported and site derived materials. All works will be undertaken behind amenity bunds intended to attenuate noise and dust caused by the works.

Placement of Material

The quarry void is to be dewatered prior to the placement of any materials. Site derived and imported materials will be placed and compacted before dewatering ceases and the lower section of the infilled profile will be hydrated to the recovered water table. The imported materials will be placed by vehicle at the site of deposit and then spread out to a thickness of 2m – 3m by dozer. The dozer will then compact the material.

Artificial Geological Barrier

The requirements for an inert landfill "liner" is an *in-situ* artificial geological barrier compacted to a hydraulic continuity of $\leq 1x10^{-7}$m/s for the outer component of the imported infill. This hydraulic conductivity component can be readily achieved by a silty sand type material.

The purpose is a chemical attenuation barrier, and not at hydraulic barrier. However, the accompanying Hydrogeological Risk Appraisal (Report K6008-ENV-R04) presents further details on the inter-relationship of the imported and site derived materials with the water system, including the recommendation of mitigation measures where required. However, as noted above, as only inert materials will be imported to the site, the potential for pollution is low and wholly impermeable physical barriers or capping layers are not required.

This outer artificial barrier will be achieved via placement of cohesive material derived from imported or site derived soil forming materials. The soils will consist of at least 10% passing a medium silts to clay particle size grading which can readily achieve a hydraulic conductivity of $\leq 1x10^{-7}$m/s. However, the entirety of the imported fill is expected to meet this criteria and act as a geological barrier when placed.

Notwithstanding the above, the suitability of the material in the outer layers of the restored structure will be specifically selected for purpose and visually inspected to ensure that it meets the criteria for an inert landfill artificial geological barrier, *i.e.* that

- there are no particles greater than 125mm present within the soil used for the barrier layer;
- the material is not oozing excess water; and
- the materials shall be sufficiently plastic to allow the material to be rolled into a sausage of 3mm thickness or less without crumbling.

All site derived material not suitable for mineral processing into a commercial sand or gravel product is expected to meet this criteria.

The material stockpile will be inspected before placement of waste soils at the edges of the site to identify suitability of the material. Any unsuitable materials shall be used to form the central core

of the restoration profile, unless the materials on detailed on visual inspection do not meet the site's acceptance criteria, in which case they will be rejected and removed from site.

Soil will be placed in thin layers ~500mm and compacted via a bulldozer to achieve a hydraulic conductivity of $1x10^{-7}$m/s. Compaction of the artificial geological barrier material shall be achieved using a bulldozer with a minimum incident loading of 3000kg/m^2.

The purpose is a chemical attenuation barrier, and not at hydraulic barrier, consequently a groundwater flux through the infill is to be expected, albeit that expectations are that once compacted, any throughflow will be minimal to negligible.

The accompanying Hydrogeological Risk Appraisal presents further details on the inter-relationship of the imported materials with the water system, including the recommendation of mitigation measures where required. However, as noted above, as only inert materials will be imported to the site, the potential for pollution is low and physical barriers or capping layers are not required.

The external slopes of the quarry will be placed against *in-situ* material and there will be no steepening of the external landform outside of the quarry. The existing topography is relatively flat, and the upper surface of the quarry will be returned to a 1 in 30 to 1 in 50 gradient for those areas returned to agriculture or to meadow and then graded into the natural (current) landform contours towards Sixpenny Brook (to the west) and the Cockaynes Wood Quarry to the south.

Internally within the quarry the gradient will be steepened from the low-level meadow from 1 in 30 to a gradient of 1 in 10 at the lake margins between an elevation of ~28.5mAOD to 25mAOD.

Below 25mAOD, the internal quarry profile is expected to be below the current water table and the slope gradient within the lake profile will be increased to 1 in 3 to the base of the quarry at the interface with the London Clay. The base of the London Clay is variable in this zone and may be at 20 - 21mAOD at the centre and north of the lake increasing to 24mAOD at the south and west of the lake.

There is a preference to utilise site derived interburden at the lower extent of the profile, however, the exact quantity available will be dependent on the materials balance identified during operations.

All material will be placed dry into a dewatered quarry.

Dewatering will commence with a centre towards the west of the quarry, the first zone to be operated, and then be moved eastwards where the lowest point in the quarry is located beneath Phases 4 and 5. Dewatering is expected to cease following the completion of Phase 7 to above natural groundwater levels.

5.2 Restoration

The site is to be restored in part to its current function, namely agriculture. The remainder of the site will be restored to an enhanced biodiversity plot through the creation of low level meadow and an open surface water lake.

The lake will be self-sustained and recharged through surface run-off capture with a minor secondary component from groundwater throughflow under the regional hydraulic gradient.

The infill materials will be largely soil forming materials throughout the vertical profile and consistent with a "sub-soil" type material. The upper 1m of the restoration profile will comprise clean soils including a 0.3m thick topsoil layer. Topsoil will be stripped from the entirety of the site area and held in perimeter amenity bunds or other stockpiles. Therefore, as a large proportion for the site area will be returned to a lake feature, there is expected to be a surplus of topsoil available for restoration at an enhanced thickness compared with the existing profile where it is to be returned to agriculture. As the site requires that restoration is undertaken in parallel with quarrying, then it is likely that topsoil from later phases can be directly transferred to a restoring phase over a large part of the working life of the quarry, with amenity bund material used to restore the final phases.

5.3 Landfill Gas Management and Monitoring Infrastructure

The waste types proposed for site restoration are by design inert and non-landfill gas producing. Consequently, landfill gas management is not required.

5.4 Surface Water Management and Monitoring Infrastructure

The site has been designed to return the topography on the west and south of the site to its natural slope angles and gradients and be "greenfield in nature". Enhanced surface run-off caused by impermeable surfaces are therefore not expected.

Surface water in the majority of the site area will however shed to a lake feature which comprises the majority surface area of the restored site. This lake has no surface water outfalls and will return to a seasonally variable water level based on the equilibrium between groundwater flow, surface run-off capture and release rates through the restored fill.

Surface water management is required during the dewatering phase of the mineral extraction and subsequent restoration works to allow construction to take place and placement of material "dry".

Dewatering fluids will be pumped to Sixpenny Brook following silt settlement, between Phase 1, the mineral processing area and the west of the site adjacent to Phase 3.

This discharge will rapidly enter a steady-state and can be construed as a direct transfer of the natural baseflow which currently flows through the site to Sixpenny Brook. In the event that recharge to the existing ponds in the Cockaynes Wood quarry to the south of the site is compromised, this can be supplemented by direct pumping to ensure minimum water levels are maintained.

Water level monitoring is in place for these ponds as part of a routine schedule and baseline levels will be identified at the point that dewatering commences to ensure that the pond ecology is sustained. Note however, that the line of the pathway which crosses the site from north to south will be retained *in-situ*. in the long term this will form a higher permeability conduit for groundwater

flow through the site area and then discharge via Cockaynes Wood and the Cockaynes Nature Reserve in the Cockaynes Quarry.

5.5 Aftercare Management

There are no aftercare management requirements for the site once restored, outside of that stipulated in the Planning Permission. The Planning Permission requires an aftercare scheme detailing the steps that are necessary to bring the land to the required standard for agriculture, amenity and habitats use is submitted and approved by the Mineral Planning Authority prior to commencement of restoration works/infilling/the placement of soils on site. The scheme must provide a strategy for a five year aftercare period.

The site will be returned to agriculture, which will be self-managed by the farmer. The remainder of the site will be returned to a grassland meadow and lake which is intended to develop a natural habitat.

5.6 Technical Standards

The site is a permitted Sand & Gravel quarry, which is to be restored back to agriculture, meadow and a lake using imported wastes under a Recovery Permit and site derived materials.

Minimum standoff distances are required by the Planning Permission, which include:

- a minimum 100m stand-off between the edge of the extraction area and nearby properties
- a 250m stand-off for operating static plant from adjacent properties.

Imported materials are to undergo a strict Waste Acceptance procedure, which includes knowledge of the source, source site historical activities and a Basic characterisation, which where appropriate will include laboratory test data. Contaminated materials, or suspected contaminated materials are to be excluded from the site. The Waste Acceptance procedures are outlined in the WRP.

6 Monitoring

6.1 General

Monitoring is targeted towards the type and phase of operations, which can be considered as being of three types

1) quarry operations
   - general amenity (noise, dust)
   - water resources (dewatering)
   - spillages
2) infilling (Recovery Permit operation)
   - materials acceptance
   - water quality
3) long term (until permit surrender)
   - water quality
   - ground gas

The monitoring schedule is presented as Appendix E.

An Air Quality Assessment and Noise Assessment were submitted with the planning application and provide further details regarding the management of noise and dust. These are appended to the Environmental Risk Assessment (Report K6008-ENV-R03). Waste Acceptance Procedures are included in the WRP submitted with this application and are consolidated as Report K6008-ENV-R005. As previously discussed, landfill gas management is not required as the waste types proposed for site restoration are by design inert and non-landfill gas producing.

The Santec 2018 HRA was submitted with the planning application and has been used to inform the Hydrogeological Risk Appraisal (Report K6008-ENV-R04) submitted with this permit application. Groundwater and surface water monitoring will be undertaken using a series of identified monitoring points. This programme is summarised below. Spillages will be managed in accordance with the Site's EMS.

6.2 Groundwater

Groundwater level monitoring of existing groundwater monitoring boreholes around the Site should continue on a monthly basis until the development commences unless otherwise agreed with the Environment Agency. Once baseline information has been collected at the site the monitoring schedule as proposed in the HRA (Report K6008-ENV-R04) and Monitoring Schedule (Appendix E) will be implemented. BH02, BH04, BH05, BH06, BH07, BH08, BH09, BH12, PZ1 and PZ3 should form the monitoring network.

Groundwater levels should be compared to the baseline to allow groundwater level variations due to seasonal variations and groundwater abstraction to be distinguished from any quarry dewatering effects.

The operation phase monitoring regime should include the following:

- Recording of monthly water level at groundwater monitoring boreholes around the Site (BH02, BH04, BH05 BH06, BH07, BH08, BH09, BH12, PZ1 and PZ3, until such time that the quarry works advance to each individual location).
- Monitoring of water levels in neighbouring private and/or licenced water supply abstraction boreholes if permitted by the owners.

It is proposed to monitor Sunnymead Farm and Cockaynes private groundwater abstractions with the type and frequency to be agreed with the abstractor where access is allowed.

Trigger levels would be set for these boreholes dependent on a period of baseline monitoring and the available drawdown at each location. It may be necessary to add more monitoring locations to this list if more private supplies are identified at a later date.

6.3 Surface Water

The operation phase monitoring regime will include

- Monthly monitoring of surface water levels in Cox Lake and Worcester Lake.
- Monthly monitoring of water levels in the closest pond at Cockaynes Wildlife site.

Tarmac has agreed with Cockaynes wildlife site and Alresford Angling Club to install gauge boards to monitor water levels. These will be monitored for the life of the proposed development, as per Appendix E. A series of trigger levels will be devised for the waterbodies which will be based on a period of baseline monitoring. If these trigger levels are breached due to dewatering and the breach cannot be attributed to natural variability, mitigation measures will be employed. This will involve dewatering water being directed towards the waterbodies until levels are within the expected range.

Monitoring will also be undertaken in accordance with any issued discharge consents.

6.4 Noise

Noise monitoring will be conducted in accordance with Planning Condition 38, 39, 40 and 43 of Planning Permission ESS/17/18TEN. Further details are provided in Report K6008-ENV-R003, Appendix A.

7 Site Condition Report

7.1 Requirements of a Site Condition Report

As the entirety of the area within the environmental permit boundary is subject to the permanent deposition of waste, it is considered that a Site Condition Report (SCR) is not required.

Notwithstanding the above, Tarmac will continue to implement management measures throughout to ensure that any likelihood of contamination to land, surface water and groundwater will be reduced during the operational process on Site.

A copy of the contents of the EMS is attached.

Appendix A – Planning Permission

NOTIFICATION OF DECISION
PLANNING APPLICATIONS ACCOMPANIED BY AN ENVIRONMENTAL STATEMENT

ESSEX COUNTY COUNCIL

TOWN AND COUNTRY PLANNING ACT 1990 (as amended)

TOWN AND COUNTRY PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2011

Extraction of 3.8 million tonnes of sand and gravel as an easterly extension to the existing Wivenhoe Quarry, erection of sand and gravel processing plant and ancillary facilities, new vehicular access onto the B1027 Brightlingsea Road, and restoration to agriculture and low-level water-based nature conservation habitats, lowland meadow, woodland planting and hedgerow enhancement using approximately 1.2 million cubic metres of imported inert waste material.,Land to the South of Colchester Main Road (known as Sunnymead, Elmstead and Heath Farms), Alresford, Essex, C07 8DB - **ESS/17/18/TEN**

NOTICE IS HEREBY GIVEN THAT ESSEX COUNTY COUNCIL has granted the above planning application.

The Environmental Information accompanying the application has been taken into account in reaching this decision.

Copies of the following are available online at https://planning.essex.gov.uk.

1) Planning Application;
2) Environmental Impact Assessment;
3) Development and Regulation Committee Report;
4) Decision Notice – including the content of the decision and any conditions, main reasons and considerations on which the decision is based, including relevant details of policies and proposals in the relevant Development Plan(s);
5) A description, where necessary, of the mitigating measures i.e. the main measures to avoid, reduce and if possible offset the major adverse effects.

The validity of the Council's decision can be challenged by application to the Courts for Judicial Review. Further advice about making a High Court Challenge can be obtained from the Administrative Court at: The Royal Courts of Justice, Queen's Bench Division, Strand, London, WC2 2LL – Telephone number: 0207 9476655 – Website: http://www.gov.uk/courts-tribunals/planning-court

Dated: 8 January 2021

Graham Thomas
HEAD OF PLANNING SERVICE

Essex County Council
County Planning
Place & Public Health
E2 County Hall
Chelmsford
Essex CM1 1QH

Essex County Council

Appendix B – Section 106 Agreement

Appendix C – Environment Agency Correspondence

From: Shelley Bailey - Principal Planning Officer <Shelley.bailey@essex.gov.uk>
Sent: 19 November 2021 14:26
To: Sumner, Lisa <lisa.sumner@tarmac.com>
Cc: Pendock, Mike <mike.pendock@tarmac.com>
Subject: Land South of Colchester Main Road, Alresford, Essex: ESS/17/18/TEN: Permit for recovery

Dear Ms Sumner

Thank you for your letter dated 11th November 2021 regarding the development approved at the above site under ref ESS/17/18/TEN for:

'*Extraction of 3.8 million tonnes of sand and gravel as an easterly extension to the existing Wivenhoe Quarry, erection of sand and gravel processing plant and ancillary facilities, new vehicular access onto the B1027 Brightlingsea Road, and restoration to agriculture and low-level water-based nature conservation habitats, lowland meadow, woodland planting and hedgerow enhancement using approximately 1.2 million cubic metres of imported inert waste material.'*

In your letter, you explained the intention of Tarmac to submit an application to the Environment Agency for an Environmental Permit for the permanent deposit of waste on land as a recovery operation, rather than a disposal operation.

There are several references to 'waste' and 'landfill' in planning permission ref ESS/17/18/TEN. However, the primary concern of the Minerals Planning Authority is that the site is worked and restored in accordance with the approved details.

There are no conditions specifying the type of material/waste to be used, since this is appropriately dealt with by the Environment Agency. Some of the conditions attached to permission ref ESS/17/18/TEN refer to 'waste or restoration material', e.g. Condition 27 states: *'Details of the amount of waste or restoration material deposited and remaining void space at the site shall be submitted to the Minerals and Waste Planning Authority for the period 1 January to 31 December each year…'*

As such, the site can be restored using suitable waste or non-waste inert restoration materials as appropriate.

I hope this assists

Shelley Bailey BSc (Hons), MSc, MRTPI
Principal Planning Officer

Planning Service
Place & Public Health
Essex County Council

Telephone: 03330136824
Email: shelley.bailey@essex.gov.uk | www.essex.gov.uk

Dr Craig Fannin
9 The Courtyard
Phoenix Square
Wyncolls Road
Colchester
CO4 9PE

Our ref: EPR/KB3909FM/A001
Your ref: K6008-ENV-R001

Date: 04/03/2022

Dear Dr Craig Fannin,

Environmental Permitting – Recovery or Disposal Operation
Pre-application Reference: EPR/KB3909FM/A001
Proposed Operator: Tarmac Trading Limited
Regulated facility: Wivenhoe East Quarry
Site Address : Land to the south of Colchester Main Road (known as Sunnymead, Elmstead and Heath Farms), Arlesford, Essex, CO7 8DB

As part of our pre-application discussions, you have submitted information to us that includes your assessment that the activity you wish to undertake at your site amounts to a recovery operation.

We have now fully considered your submission and we would like to advise you that:

We agree with your assessment that your activity is a recovery operation. This advice is based on the information you have provided in relation to waste types, amounts and nature of proposal including any proposed landform. If you change any of these between now and when you submit an application form, this advice may no longer apply. **Please also note that following submission of an application, additional assessment will take place (for example, further assessment of the proposed waste types based on the sensitivity of the site location) and therefore agreement that an operation is a recovery activity does not guarantee that a permit will be granted or a variation issued.**

For the sake of clarity, the following documents are considered to form the approved waste recovery plan;

- Waste Recovery Plan, Project:: Wivenhoe Quarry, Report no: K6008-ENV-R001, dated: December 2021 Rev 01
- Drawing Location Plan, Drawing Number: W328-00062-01-D, Date 21/10/2019. Showing site boundaries.
- Drawing site topography W328-00062-02-D
- Drawing Proposed Restoration Scheme, Drawing Number: W328-00062-D, Date: 21/10/2019. Showing proposed extraction area, existing contours outside of excavations and restoration contour levels within excavated areas.
- Drawing Existing Situation, Drawing Number: W328-00062-02-D, Dated: 21/10/2019. Existing site contours.
- Drawing Proposed Working Plan, Drawing Number: W328-00062-03-D, Dated 21/08/2019. Showing phases of works.

- Drawing Cross Sections, Drawing number: W328-00062-13-D, Date: 21/10/2019. Existing and restoration cross sections and section location plan.
- Request for information email response received 06/01/2022 at 10.13 from Dr Craig Fannin . Confirming waste code, and details of final soil restoration including annotated drawing Working Plan - Progress at year 20 drawing number W328-00062-11-D.
- Request for information email response 18/01/2022 at 13.35 from Dr Craig Fannin – waste placement, site design, compressed cross section pond construction Figure 4 Generalised Profile from Southwest to Northeast.

The following information is **not** considered to form part of the approved waste recovery plan;

- Waste acceptance procedures
- Chemical suitability of the waste
- Slope stability
- Design of attenuation or geological barrier

Prior to submitting an application, we would recommend that you consider the following and if required obtain enhanced pre-application advice to support the application. As the Waste Recovery Plan indicates that waste material will be deposited sub-water table within a sensitive location please consider the following in your permit application.

- the quality of the proposed waste to be deposited below the water table and the engineering mitigation measures needed to ensure the deposit of waste below the water table achieves the requirement of the Guidance - Waste recovery plans and deposit for recovery permits including the need to satisfy Schedule 22 of the Environmental Permitting (England and Wales) Regulations 2016 particularly Schedule 22 Section 6.

- the application will need to address how the waste achieves the geotechnical and chemical standard for a geological barrier for an inert site

- which component of the proposed waste deposit will specifically be classed as the ‘attenuation layer’ or ‘geological barrier’. For example, there needs to be a drawing which shows the applicants explanation and delineates the difference components of engineering and waste.

- Specific detail of the leachable fractions of the proposed waste codes will be needed to support the application. Guidance - Engineering construction proposals for deposit for recovery

- The information provided shows the site is located on Secondary A Aquifer containing groundwater. This means the site falls within a category of being in a sensitive groundwater location irrespective of the additional sensitivities bought about by the Sourec Protection Zone (SPZ) 3 of the groundwater contained in the chalk geology located beneath the London Clay. This is not just constrained to SPZ locations or principal aquifers. Please refer to the guidance on what is consider a sensitive groundwater location. Sensitive locations

Cont/d..

If you have any questions please phone me or email tim.ross@environment-agency.gov.uk

Yours sincerely

Tim Ross

Senior Permitting Officer

Dear Sir / Madam,

'Recovery vs. Disposal' (RvD) assessment – demonstrating recovery within a Waste Recovery Plan

As part of our pre-application discussions, you have sent us evidence to support your case for the activity you wish to undertake being a recovery operation.

We have not yet assessed this evidence but, before we do, we are writing to clarify our approach and to give you an opportunity to provide additional information if you wish.

In our experience it has proved helpful to applicants that we set out our approach up front and allow them an opportunity to consider this further before we commence our assessment. This may prevent avoidable delay.

You are not obliged to provide further information and if you wish for us to proceed at once with our assessment you can confirm this once contacted by the RvD assessor who will complete the assessment.

Definition of recovery

Recovery is defined in Article 3(15) of the Waste Framework Directive (08/98/EC) (WFD) as:

> *'any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy'.*

We cannot authorise a deposit of waste into or onto land as meeting this definition unless we are satisfied that your proposed scheme involves waste "**replacing other materials that would otherwise have been used**"; that is, that you would carry out the scheme with suitable non-waste materials, were waste unavailable.

This is key to the assessment. We must be satisfied that the activity, as proposed, would also go ahead with non-waste material (see 'suitable non-waste' section for more details including our position on the proposed alternative use of non-virgin materials).

We have published guidance on how we approach this, which is available at www.gov.uk/guidance/waste-recovery-plans-and-permits. If you have not already done so, you must read this to understand what should be included in a Waste Recovery Plan.

We will consider all relevant available information including any evidence you provide to support the fact that you would carry out the scheme with non-waste, including the following factors;

- mandatory obligation
- secured funding
- worthwhile financial gain

You will also need to show that you have the necessary permissions in place to do so.

This letter provides further information on how we assess proposals, particularly where one or more of these factors is relied on.

1. Mandatory obligation

If you rely on this factor you need to provide evidence of that obligation and how it relates to the work you propose. Our guidance notes the difference between specific and general obligations, which you should also take into account. We will consider the nature of the obligation, whether it has taken effect, the reasons it has been imposed and the likelihood of it being enforced.

Planning conditions vary in nature and the degree to which they impose an obligation to carry out work. For example, a condition that specifies the extent of the development being permitted does not require that the development be carried out but is included to avoid doubt over the extent of the authorised work. Consequently, such a condition does not impose a mandatory obligation indicating that the work would be a recovery activity.

Planning conditions may also refer to plans to be approved by the local planning authority, for example for restoration after mineral extraction or to provide landscaping. In these cases we need to see evidence of the approved plans and that your scheme is in accordance with what is approved.

The fact that a particular scheme is acceptable to the local planning authority does not necessarily mean they would not agree to a revised scheme which would involve the importation of less material. In appropriate cases we may take this into account. However, if you have evidence that the local planning authority was directly involved in the design of the scheme and/or that they would be unlikely to agree a different scheme, you should provide this.

2. Secured funding

For non-profit making organisations we consider that whether or not they would undertake an activity with non-waste is heavily influenced by the availability of secured funding. Hence, where a proposed activity provides a proportionate benefit that falls within the body's remit (e.g. benefits to wildlife where the organisation is a conservation charity), the fact that funding has been secured can demonstrate that non-waste would be used.

For other entities, such as a business or private individual, we do not consider that the availability of funds adequately indicates that a scheme would proceed using non-waste. We do not consider it likely that, in principle, a business or individual would use such funds to buy in non-waste unless there was some other benefit to them. A business or private individual should therefore provide evidence of worthwhile financial gains, as outlined below, rather than relying on secured funding.

3. Worthwhile financial gain

If you rely on a worthwhile financial gain from using non-waste to carry out your scheme, you need to demonstrate the associated costs and benefits. You should explain why the net financial gain is such that you would proceed with non-waste. We expect the financial gain to be large enough, certain enough and near-term enough to provide a meaningful incentive to proceed.

<u>Costs</u>

You need to provide an evidenced break down of all the costs of completing the scheme not just the costs of non-waste to substitute the waste you propose to you use. This should include any works required to finalise the project to enable you to gain the financial benefit.

You need to include the cost of complying with any planning conditions or obligations and any other relevant requirements. You also need to explain how the expenditure will be financed and include any associated costs (e.g. interest on a loan).

Cont/d..

Where the financial gain is income generation, the total costs should include any ongoing operating costs necessary to obtain that financial gain, for example the costs of providing and maintaining a recreational facility or cultivating the land concerned.

Suitable non-waste

You need to provide evidence of the cost of using a suitable non-waste material. This should include not only the cost of the material but also the cost associated with its transportation and handling (construction costs). You must also include all costs associated with finalising the construction.

Your costs must be based on a "non-waste" that is suitable and available at the time you would commence the work. You need to demonstrate that this is the case. If the non-waste you would use is not virgin material, you need to explain why the material is not a waste.

For the purposes of the assessment, we do not accept as a non-waste alternative any material that would only be a non-waste if it were actually used, for example as a by-product or through DoWCoP.[1] This is because if you obtain a recovery permit, that material would not actually be used for the proposed scheme.

Financial benefit

You need to show how the scheme provides a financial benefit. This could be a capital gain or increased income. In either case you need to provide evidence from a suitably qualified person that the forecasts you make are realistic.

We accept that an increase in the value of an asset may provide an extra incentive to carry out a scheme that would be kept for income generation. However, we do not consider that you can double count between income generation and an increase in capital value to support your case (i.e. ordinarily realising a capital gain requires sale of an asset, whereas income generation relies on the asset being retained). Where your decision to proceed with non-waste would be based on income generated as well as the incentive of a capital gain, you should provide an explanation to enable us to consider the facts presented.

Planning permission

In all cases we need to understand the planning position as all development needs to comply with planning controls. You will require an express planning permission unless there is an established use certificate or your proposal comes within a permitted development order. Without understanding the planning position, we cannot assess whether the development could go ahead with non-waste, what the full financial picture may be or

[1] CL:AIRE; Definition of Waste Code of Practice.

Cont/d..

whether there is an obligation on you to complete your scheme. You should therefore provide details of the planning position.

If a planning condition specifically provides that waste will be used to complete the scheme, you should provide evidence that the planning authority could and would allow non-waste to be used instead. You should be aware that, unless planning is handled by a Unitary Authority, permission for an activity involving waste is dealt with by the County Council, whereas permissions involving development are normally dealt with by the District Council. You may need to confirm with the relevant authority that they would be happy for the scheme to go ahead with non-waste or waste, respectively

Pre-application advice

Under our current charging scheme we can provide you with some 'free' pre-application advice, the amount is dependent on the on the type of application to be submitted. After this point we can charge you for the pre-application advice we provide. We will always tell you in advance if we intend to charge you and you can choose whether to pay the charge or proceed with your application. Our current charging scheme is available on gov.uk.

Once we have assessed your proposals we will advise you whether we consider your proposed activity is recovery. Irrespective of the advice we give, you can still apply for an environmental permit for the recovery of waste. If you decide to make such an application, we will determine that application in accordance with our normal procedures. If we decide to refuse to grant a permit for the activity you applied for you have the right to appeal that decision.

Where, following our pre-application assessment, we consider your proposed use of waste is a recovery operation, this does not guarantee that we will grant you a permit, just that we agree the proposed scheme is recovery. If you decide to make an application for a permit, our determination will involve further assessments, for example of the proposed waste types against the sensitivity of the site location.

Please confirm whether you wish to provide further information to support your submission upon allocation to the RvD assessor. If you do not wish to provide further information, and unless you wish to have your waste recovery plan returned to you, we will proceed with our assessment.

National Permitting Service
Environment Agency

Appendix D – Stability Statement

Seepage Force Estimation

1.1 Side Slope Construction

To create the external slopes of the restoration project the imported inert material will be placed against in situ material that forms the quarry side slopes. All external slope angles will be to the natural topographical contours in order to restore the land to the pre-existing topography.

There will be no steepening of the external landform outside the quarry. The existing topography is relatively flat, and the upper surface of the quarry will be returned to a 1 in 30 to 1 in 50 gradient for those areas returned to agriculture and then graded into the natural (current) landform contours towards Sixpenny Brook (to the west) and the Cockaynes Wood Quarry to the south.

1.2 Lake Construction

The slopes towards the lake are of a shallow (1 in 30) gradient, which will then steepen to 1 in 10 at the lake margins, with a slope of 1 in 3 beneath the water line below 25mAOD

To construct the side slopes of the lake, an inter-bund will be created from inert material to a gradient of 1V:3H or slacker to ensure the global stability of the slopes is maintained during the 'temporary works' (i.e. dewatering and excavation) and in the longer-term when the void is filled with water.

In terms of local stability of the lake side slope, the main risk to the stability of the slope is hydraulic failure of the upstream face or piping during the temporary works. To assess this risk in the macroscale, a $1m^3$ control volume (block) of the infill materials situated at the toe of the upstream face is considered as the critical element.

The seepage thrust applicable to the $1m^3$ control volume of material can be calculated using the following equation (Equation 1):

$$\mathbf{F = i \times \gamma_w \times v} \qquad \text{Equation 1}$$

Where:

F = Seepage thrust (horizontal force)
i = Hydraulic Gradient = δH / d = difference in total hydraulic head / distance = 4m / 100m = 0.04
$\boldsymbol{\gamma_w}$ = Water unit weight = $9.81kN/m^3$
v = Volume of the block (control volume) = $1\ m^3$

Therefore:

$$\mathbf{F = 0.04 \times 9.81kN/m^3 \times 1\ m^3 \sim 0.4kN}$$

If the resistance against sliding of this block which is underlain by London Clay is greater than the seepage thrust, it can be deducted that the piping or 'quick sand' conditions will be unlikely.

The resistance against sliding of the block can be calculated in accordance with BS EN 1997- 1:2004 Section 6.5.3 utilising the following equation (Equation 2):

$$R_d = (V'_d \times tan\delta_k)/\gamma_{R;h} \qquad \text{Equation 2}$$

Where:

R_d : Resistance against sliding
V'_d : Effective normal force applied onto the foundation base
δ_k: Characteristic interface friction angle (between the base of the block and the founding ground i.e. London Clay)
$\gamma_{R;h}$: Partial resistance factor (in 'Design Approach 1', this factor equals unity)

BS EN 1997-1:2004 recommends that the interface friction angle at the base of the foundation (ϕ') be taken as equal to the soil ϕ' value where concrete is cast directly on the ground. The sliding investigated here , however, relates to inert materials against London Clay. Therefore, a coefficient of friction of 0.4 is cautiously justified, noting as per BS EN 1997-1:2004, if it is possible for water or air to reach the interface between a foundation and an undrained clay subgrade, the sliding resistance should be checked with a coefficient of friction of 0.4.

It is assumed that the basal clay is highly plastic hence the relatively low ϕ' of 16° is assigned to the clay. On this basis:

$$tan\delta_k = 0.4 \times \tan 16° \sim 0.11$$

For simplicity and to calculate the normal force applied onto the block, the weight of the overburden is neglected, and the weight of the block is solely considered here. To further err on the side of caution, it is assumed that the block is submerged in water, hence its buoyant unit weight is used in the analysis herein:

V'_d = submerged weight of the block = (γinert waste - γw) × 1 m^3= (19 - 9.81) kN/ m^3 × 1m^3 ~ 9kN

Therefore, based on Equation 2:

$$R_d = 9kN \times 0.11 / 1 = 0.99\ kN$$

Therefore F = 0.4 kN << 0.99 kN i.e. the seepage thrust force is still significantly lower than the basal frictional resistance, hence the likelihood of piping due to the hydraulic gradient of the local groundwater on the upstream face is low.

It should be noted that in the analysis herein, the hydraulic gradient has been calculated in the macroscale and in the simplified modelling approach adopted here, a homogenous and isotropic porous medium has been assumed. In real world, none of these scenarios will apply. Therefore, it is recommended that during the temporary works and particularly throughout the dewatering stage any signs of localised seepage in the base and sidewalls of the avoid are watched for and appropriate remediation e.g. plugging with local clay or bentonite pellets is undertaken, albeit the risk of localised instability due to hydraulic failure is assessed as very low.

Appendix E – Monitoring Schedule

1.1 Groundwater and Surface Water Monitoring

A groundwater and surface water monitoring programme has been implemented at the site, which has enabled background water quality and elevations to be established. The groundwater body being monitored will be removed as part of the quarrying works and be replaced by "unproductive strata". As there will be no future continuation of the aquifer, the key monitoring objectives are to demonstrate protection of the surface water features downgradient of the site, namely

1) Sixpenny Brook
2) the lakes to the south of the site

Table 1 – Proposed Monitoring Schedule

Location	Sample Point	Parameter	Frequency
Lakes Groundwater	MP2, MP3, MP4 PZ1, PZ3, BH06, BH07, BH08, BH09	Water Level (mAOD)	Quarterly
Groundwater	PZ1, PZ3, BH06, BH07, BH08, BH09	Base of monitoring point (mAOD)	Annual
Lakes Groundwater Sixpenny Brook Dewatering Waters	MP2, MP3, MP4 PZ1, PZ3, BH06, BH07, BH08, BH09 SW01, SW02 DW01	pH, EC Ammoniacal-N, TON, Chloride, Sulphate, TOC, TPH, Potassium, Nickel, Copper, Zinc	Quarterly
Dewatering Waters	DW01	Suspended Solids	Quarterly

1.2 Landfill Gas Monitoring

The waste types proposed for site restoration are by design inert and non-landfill gas producing. Consequently, landfill gas management and monitoring are not required. Landfill gas monitoring for permit surrender will be implemented once the quarry has been restored. Methane emissions surveys will be undertaken at the site to assess surface emissions post completion and restoration of the site.

1.3 Noise Monitoring

Noise monitoring will be conducted in accordance with Planning Condition 38, 39, 40 and 43 of Planning Permission ESS/17/18TEN.

Monitoring will be undertaken at the following locations to ensure that the free field Equivalent Continuous Noise Level (LAeq, 1 hr) at noise sensitive properties adjoining the site does not exceed the following:

Table 2 – Noise Monitoring Limits

Location	Limits
Keelars Farm	55dB LAeq 1hr
Sunnymead Farm	45dB LAeq 1hr
Furzedown Farm	45dB LAeq 1hr
Englishes Farm/Rosedene	54dB LAeq 1hr
Alresford (B1027)	54dB LAeq 1hr
White Lodge, Cockaynes Lane	45dB LAeq 1hr

The following measures are applicable for noise monitoring at the site as required by Planning Permission ESS/17/18TEN:

- Measurements will be undertaken by a competent person
- Measurements will consist of LAeq 5-minute noise levels over 1 hour at each of the monitoring locations identified in Table 2 above
- Measurements shall be made no closer than 3.5 metres from the façade of properties or other reflective surface and shall be corrected for extraneous noise
- For temporary operations, the free field Equivalent Continuous Noise Level (LAeq,1 hr) at noise sensitive properties, listed in Condition 38, adjoining the site shall not exceed 70 dB LAeq 1hr

Further details regarding noise assessment and management to British Standard BS4142 can be found in Appendix F of the ESID (Report K6008-ENV-R02).

Appendix F – Noise Assessment and Management

Walker Beak Mason Limited
01604 771101 | hq@wbm.co.uk | www.wbm.co.uk

ACOUSTIC CONSULTANTS

Ref **5300**

For **Tarmac**

Wivenhoe Quarry, Essex
Restoration by Means of Imported Inert Material
BS 4142 Noise Assessment for Environment Agency

Date 03 October 2022

Author Dr Robert Storey

WBM is the trading name of Walker Beak Mason Limited
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ANC ACOUSTICS & NOISE CONSULTANTS

The Author

Robert Storey BEng PhD MIOA (Senior Consultant) obtained his degree in Mining Engineering from the University of Leeds in 1993 before going on to complete a PhD in "The Acoustic Response of Structures to Blast Induced Ground Vibration" in 1998. He joined WBM in 2007 after working in acoustic consultancy and environmental health since 1999. Robert is involved mainly in environmental noise, working on mineral extraction, waste and industrial projects, including surveys, routine noise monitoring and assessments. He is experienced in noise modelling using SoundPLAN for transportation, industrial and environmental sources.

WBM

WBM (the trading name of Walker Beak Mason Limited) is an established independent acoustic consultancy specialising in architectural & building acoustics, environmental noise, planning issues and expert work. WBM is a member of the Association of Noise Consultants and is also a Corporate Member of the Institute of Environmental Management & Assessment. The consultants are members of the Institute of Acoustics.

Document Control

Revision	Description	Date	Prepared by	Checked by
-	First Draft	26/09/2022	R Storey	S Large
1	Final	03/10/2022	R Storey	S Large

ACOUSTIC CONSULTANTS

Contents

1 Introduction

Tarmac have been granted permission for the extraction and processing of mineral from a new site at Wivenhoe Quarry in Essex under a planning permission dated 18 December 2020 Application Ref. ESS/17/18/TEN.

A noise impact assessment based on the BS 4142 method has been undertaken to support the application for an inert deposit for recovery permit associated with the progressive restoration at Wivenhoe Quarry. The permit applies to infill operations across the new site for areas in which imported inert infill will be used.

This report sets out the calculated noise levels arising from the importation of inert materials and the infilling of the extraction void using those materials, for use in the BS 4142:2014+A1:2019 assessment method for the nearest dwellings to Wivenhoe Quarry.

The calculated noise levels are compared with representative background noise levels at the nearest existing dwellings. Background noise level in the vicinity of the nearest dwellings to the site were established during the noise assessment submitted with the application for planning permission. Extensive baseline noise data was collected in March 2016 and updated in August 2018 when the site was open grassland.

This comparison of the calculated noise levels arising from the importation of inert materials and the infilling of the extraction void using those materials with the background noise levels without any site operations established in March 2016 and August 2018 forms the basis for the BS 4142:2014+A1:2019 assessment method for the nearest dwellings to Wivenhoe Quarry.

To aid comprehension, a glossary of acoustic terms is presented in Appendix A.

A site plan showing the survey and assessment locations used and the proposed phasing (with breakdowns for Years 5, 10, 15 and 20) is presented in Appendix B.

Instrumentation and calibration details for the baseline noise surveys are presented in Appendix C.

The full attended noise survey results obtained in March 2016 and August 2018 are presented in Appendix D.

The full noise survey data from the sound level meters installed in March 2016 and August 2018 are presented in graphical form in Appendix E.

A summary of the weather conditions during the installation periods in March 2016 and August 2018 is presented in Appendix F.

Details of the noise calculation methods used and noise calculation sheets are presented in Appendix G.

2 Environment Agency Requirements for the Assessment

The information that must be submitted to the Environment Agency in a noise impact assessment is provided in the Environment Agency document "*Guidance - Noise and vibration management: environmental permits*" published in July 2021.

3 British Standard 4142: 2014+A1:2019

British Standard (BS) 4142:2014+A1:2019 "*Methods for rating and assessing industrial and commercial sound*" describes methods for assessing the likely effects of sound of an industrial and/or commercial nature on residential properties. It includes the assessment of sound from industrial and manufacturing processes, M&E plant and equipment, loading and unloading of goods and materials, and mobile plant/vehicles on the site. It can be used to assess sound from proposed, new, modified or additional industrial / commercial sources, at existing or new premises used for residential purposes.

The standard describes methods to measure and determine ambient, background and residual sound levels, and the rating levels of industrial / commercial sound.

BS 4142:2014+A1:2019 is not intended to be used for the derivation or assessment of internal sound levels, or for the assessment of non-industrial / commercial sources such as recreational activities, motorsport, music and entertainment, shooting grounds, construction and demolition, domestic animals, people, and public address systems for speech.

This standard is not intended to be applied to the rating and assessment of sound from: … "*h) other sources falling within the scopes of other standards or guidance*."

Guidance for noise associated with minerals sites such as quarries is presented in the “Minerals” sections of the UK Government’s Planning Practice Guidance (Ministry of Housing, Communities and Local Government, 2014). However it is understood that the Environment Agency requires noise associated with the permit application for the importation of inert material for infilling to be assessed using BS 4142, despite other guidance being available.

Ambient sound is defined in BS 4142: 2014+A1:2019 as "*totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far*". It comprises the residual sound and the specific sound when present.

Residual sound is defined in BS 4142: 2014+A1:2019 as "*ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound*".

The background sound level is the $L_{A90,\,T}$ of the residual sound level, and is the underlying level of sound. Measurements of background sound level should be undertaken at the assessment location where possible or at a comparable location.

The measurement time interval should be sufficient to obtain a representative value (normally not less than 15 minutes) and the monitoring duration should reflect the range of background sound levels across the assessment period. The background sound level used for the assessment should be representative of the period being assessed.

The specific sound level is the $L_{Aeq,Tr}$ of the sound source being assessed over the reference time interval, T_r. BS 4142:2014+A1:2019 advises that T_r should be 1 hour during the day and 15 minutes at night.

The rating level is the specific sound level plus any adjustment for the characteristics of the sound (tone, impulse, intermittent or other acoustic feature).

The standard describes subjective and objective methods to establish the appropriate adjustment. The adjustments for the different features and assessment methods are summarised in the table below.

Acoustic Feature	Adjustment for Acoustic Feature		
	Subjective Methods	**Objective Methods**	
Tonality	+2 dB if just perceptible +4 dB if clearly perceptible +6 dB if highly perceptible	Third Octave Analysis	Narrow Band Analysis
		+6 dB if tones identified	Sliding scale of 0 to +6 dB depending on audibility of tone
Impulsivity	+3 dB if just perceptible +6 dB if clearly perceptible +9 dB if highly perceptible	Sliding scale of 0 to +9 dB depending on prominence of impulsive sound	
Intermittency	+ 3 dB if intermittency is readily distinctive	n/a	
Other	+ 3 dB if neither tonal nor impulsive, but otherwise readily distinctive	n/a	

Where tonal and impulsive characters are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant, it might be appropriate to apply a single correction. The rating level is equal to the specific sound level if there are no features present.

The level of impact is assessed by comparing the rating level of the specific sound source with the background sound level. Other factors that may require consideration include the absolute level of sound, the character and level of the residual sound compared to the specific sound, and the sensitivity of the receptor and scope for mitigation.

When the rating level is above the background sound level, a difference of around +5 dB is likely to indicate an adverse impact and a difference of around +10 dB or more is likely to indicate a significant adverse impact, depending on the context.

The lower the rating level with respect to the background sound level, the less likely it is that the specific sound source will have an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

4 Description of Site and Noise Climate

Planning permission was granted by Essex County Council for the extraction and processing of mineral and the restoration of the new Wivenhoe Quarry site on 18 December 2020 (Application Ref. ESS/17/18/TEN).

The restoration scheme for the quarry requires some infilling using imported inert materials.

The site is situated south and west of the B1027 and to the north and west of Cockaynes Lane in Alresford.

The new site is located approximately 500 metres to the east of the previous Wivenhoe Quarry site that was located to the west of Keelar's Lane and has been mainly restored.

The main noise sensitive properties to the site are those to the east on the B1027 in Alresford, to the south-east on Cockaynes Lane and more isolated dwellings to the north on the B1027 (Englishes Farm and Rosedene), to the south-west (Sunnymead Farm and Furzedown) and to the north-west off Keelar's Lane (Keelar's Farm).

This BS4142 assessment concentrates on the nearest properties to the application area that were included in the planning application, but other locations are also considered in the site noise calculations and discussions.

The location of the quarry and baseline survey/assessment locations is shown on the plan in Appendix B which also shows the area over which the permit is being applied for.

Site noise limits for these properties are in place under the current planning permissions for the site.

The main locations selected for site noise calculations in the BS4142 assessment are:

Position	Location Description	Grid Reference
A	Keelar's Farm	E:605244 N:223059
B	Rosedene	E:605825 N:223037
C	Heath Lodge (properties in Alresford off B1027)	E: 606224 N:222611
D	White Lodge	E:606091 N:221949
E	Furzedown	E:605445 N:221616

These locations were chosen for the purposes of this assessment as they are the closest residential properties to the infilling operations using imported inert material.

The noise levels in the area are generally controlled by distant and local road traffic and some local activity including farming. During the baseline noise surveys, birdsong, wind in the trees, aircraft movement and local farming activity were also noted.

The following locations were also considered in the site noise calculations for completeness:

- Englishes Farm;
- The Fieldings, Alresford;
- Blackboard Cottage/Boarding Cottage, Alresford;
- Wilwyn, Alresford;
- Woodlands, Alresford;
- Willow Lodge, Cockaynes Lane; and
- Sunnymead Farm.

The permitted hours of operation are set out in Condition 6 of the planning permission dated 18 December 2020 (Application Ref. ESS/17/18/TEN), which states:

"Except in emergencies to maintain safe quarry working (which shall be notified to the Mineral Planning Authority as soon as practicable):

(a) Other than water pumping and environmental monitoring, no operations, including vehicles entering or leaving the site and including temporary operations as described in condition 39, shall be carried out outside of the following times:

0700 hours to 1800 hours Monday to Friday; and;

0700 hours to 1300 hours Saturdays

or on Sundays or Bank or Public Holidays.

(b) no mineral extraction, materials importation and deposition or mineral processing activities shall take place outside of the following times:

0700 hours to 1800 hours Monday to Friday

or on Saturdays, Sundays or Bank or Public Holidays

For the avoidance of doubt, mineral distribution operations shall not take place outside of the following times:

0700 hours to 1800 hours Monday to Friday; and;

0700 hours to 1300 hours Saturdays

or on Sundays or Bank or Public Holidays.

(c) No operations for the formation and subsequent removal of material from any environmental banks and soil storage areas shall be carried out at the site except between the following times:

0800 hours to 1600 hours Monday to Friday, and

at no other times or on Bank or Public Holidays.

(d) No operations other than environmental monitoring and water pumping at the site shall take place on Sundays, Bank or Public Holidays."

The site operating times are within the daytime period. With regard to BS 4142, the assessment period is therefore 1 hour.

5 Baseline Noise Surveys and Background Sound Levels (2016 & 2018)

5.1 Measurement Description

Extensive baseline noise data was collected in March 2016 and updated in August 2018 when the site was open grassland. The dwellings at which baseline measurements have been made were chosen as being representative of the nearest properties to the new Wivenhoe Quarry site.

Baseline noise surveys were conducted in 2016 on two days at five locations representative of the nearest noise sensitive properties to the site. Twenty sample measurements were made over the two visits which took place on Tuesday 08 March 2016 and Wednesday 16 March 2016.

The measurements were undertaken between about 11:45 and 15:45 on Tuesday 08 March 2016 and between around 08:50 and 12:25 on Wednesday 16 March 2016.

The survey on Tuesday 08 March 2016 was conducted with a west north-westerly wind. The survey on Wednesday 16 March 2016 was conducted with an east north-easterly wind.

A data logging sound level meter was also installed on Tuesday 08 March 2016 in the grounds of Sunnymead Farm to the south of the new Wivenhoe Quarry site. The meter was collected on Wednesday 16 March 2016.

The 2018 surveys were undertaken to update the 2016 baseline noise survey data and consisted of the installation of three sound levels meter and attended sample measurements conducted on two days at the three locations where the sound levels meters were installed.

Three data logging sound level meters were installed on Tuesday 14 August 2018 at Sunnymead Farm, Rosedene and White Lodge on Cockaynes Lane as agreed with the Essex County Council noise consultant. The meters were collected on Tuesday 21 August 2018. A weather station was also installed at Sunnymead Farm for the duration of the installation.

Six sample measurements were made over the two visits which took place on Tuesday 14 August 2018 and Tuesday 21 August 2018. There was no site activity taking place between Tuesday 14 August 2018 and Tuesday 21 August 2018.

The measurements were undertaken between about 12:30 and 15:20 on Tuesday 14 August 2018 and between around 11:40 and 13:20 on Tuesday 21 August 2018.

The survey on Tuesday 14 August 2018 was conducted with a westerly wind. The survey on Tuesday 21 August 2018 was conducted with a very light south-westerly wind.

The 2016 and 2018 measurements were taken at a microphone height of approximately 1.4 metres above local ground level away from reflecting surfaces other than the ground, with a wind shield used throughout each measurement. The sample measurements were of 15 minute duration.

5.2 Measurement Results

A summary of the sample measurement results is presented in the tables below.

The parameters reported are the statistical indices $L_{A10,T}$ and the Background Noise Level, $L_{A90,T}$ as well as the Equivalent Continuous Noise Level, $L_{Aeq,T}$. An explanation of the noise units presented is given in Appendix A.

The instrumentation and calibration details used for the sample measurements and for the installations are shown in Appendix C.

The detailed results of the sample measurements are set out in Appendix D. A summary of the daytime weather conditions during the periods during the sound level meters were installed is presented in Appendix D.

A summary of the sample measurement results from March 2016 is presented below.

Position	Average dB $L_{Aeq,15min}$	Average dB $L_{A90,15min}$	Range dB $L_{A90,15min}$
1. Keelars Farm	65	50	46 to 55
2. Sunnymead Farm / Furzedown	48	39	37 to 45
3. Englishes Farm / Rosedene	52	48	47 to 48
4. Alresford (off B1027) (*)	58	47	44 to 48
5. Cockaynes Lane	49	41	36 to 45

(*) Representative of properties including Wilwyn/Near Dun/The Orchards

The results from the attended sample measurements conducted in August 2018 are summarised in the following table:

Position	Average dB $L_{Aeq,15min}$	Average dB $L_{A90,15min}$	Range dB $L_{A90,15min}$
2. Sunnymead Farm	48	36	34 to 37
3. Rosedene	51	45	45 to 46
5. White Lodge, Cockaynes Lane	41	35	34 to 36

Noise levels at all locations were generally controlled by distant and local road traffic noise, birdsong, breeze in the trees and aircraft movements.

The baseline noise survey locations were chosen to represent the nearest properties to the proposed new Wivenhoe Quarry site in each direction from the site. Position 1 is located to the north west of the main quarry site and is representative of properties to the west of the site. Position 2 is the closest dwelling to the south of the site. Position 3 is representative of the rear of the nearest properties to the north of the site, Position 4 is considered to be representative of the rear of the properties to the east of the site off the B1027 and Position 5 (2016) on the footpath off Cockaynes Lane was considered representative of the rear of the properties to the south-east of the site, the 2018 position was in the garden of White Lodge, the nearest property in that area to the proposed extension.

A summary of the results from the installed sound level meters is presented below. The results from the data logging sound level meters installed at Sunnymead Farm in March 2016 and August 2018 and those at Rosedene and White Lodge in August 2018 are presented in graphical form in Appendix E with the data used in calculation of the average $L_{Aeq,1\ hour}$ and $L_{A90,1\ hour}$ displayed in bold. The average $L_{Aeq,1\ hour}$ and $L_{A90,1\ hour}$ values for the currently permitted and proposed operating hours of the site are presented in the following table.

Position	Average dB $L_{Aeq,1hour}$	Average dB $L_{A90,1hour}$	Range dB $L_{A90,1hour}$
2. Sunnymead Farm (2016)	52	37	30 to 47
2. Sunnymead Farm (2018)	47	36	31 to 43
3. Rosedene (2018)	55	43	38 to 48
5. White Lodge (2018)	46	35	31 to 41

The average figures presented above do not include the period between 11:47 and 16:17 on Thursday 16 August 2018 when rainfall was recorded on the weather station installed at Sunnymead Farm.

To establish representative background noise levels for the three installation locations used in March 2016 and August 2018, further analysis was undertaken to determine the mean, mode and median levels during the proposed operating hours of the site:

Position	Mean dB $L_{A90,1hour}$	Mode dB $L_{A90,1hour}$	Median dB $L_{A90,1hour}$
2. Sunnymead Farm (2016)	37	39	38
2. Sunnymead Farm (2018)	36	35	36
3. Rosedene (2018)	43	44	44
5. White Lodge (2018)	35	35	35

This BS4142 assessment concentrates on the nearest properties to the application area that were included in the planning application. The main locations selected for site noise calculations in the BS4142 assessment are:

Position	Location Description	Grid Reference
A	Keelar's Farm	E:605244 N:223059
B	Rosedene	E:605825 N:223037
C	Heath Lodge (properties in Alresford off B1027)	E: 606224 N:222611
D	White Lodge	E:606091 N:221949
E	Furzedown	E:605445 N:221616

These locations were chosen for the purposes of this assessment as they are the closest residential properties to the infilling operations using imported inert material, which are the subject of the BS4142 assessment.

Based on the baseline survey data collected in 2016 and 2018, the following table presents representative ambient ($L_{Aeq,T}$) and background ($L_{A90,T}$) noise levels at the five assessment locations:

Position	Location	Baseline Survey Location	Representative dB $L_{Aeq, T}$	Representative dB $L_{A90, T}$
A	Keelar's Farm	1. Keelars Farm	65	50
B	Rosedene	3. Englishes Farm / Rosedene	55	44
C	Heath Lodge	4. Alresford (off B1027)	58	47
D	White Lodge	5. Cockaynes Lane	46	35
E	Furzedown	2. Sunnymead Farm / Furzedown	47	36

6 Calculated Site Noise Levels

In order to assess the noise levels for the proposed site operations, the contribution from each significant specific noise source has been evaluated separately and then combined together to give the overall noise level.

The activities that will take place on the site are:

- Extraction of sand and gravel at an average extraction rate of around 200,000 tonnes per annum;
- Stockpiling and processing of the extracted mineral by means of the modern low level processing plant in the replacement plant area located within the proposed extension;
- Transportation of processed mineral off site by road going HGVs via the new access road onto the B1027;
- Infilling of the void with indigenous and imported inert material;
- Restoration of the extraction area using soils materials indigenous to the site.

Once the initial phases of the extraction are complete, the activities taking place on site during the daytime will include the importation of inert material into some areas of the previously excavated phase by means of road going HGVs and grading of the infill material by a dozer.

For the purposes of the assessment to accompany the application for the Environment Agency permit, the overall calculated noise level for the site operations occurring simultaneously (including infilling using imported inert materials) is used. The calculated noise level due to the infilling using imported inert material alone is provided for context.

Note that by Year 20, the processing plant will have been removed and the plant site area will be infilled, which brings the works closer to the northernmost properties, but the aspect of the overall site noise related to mineral extraction and processing will have ceased.

The following assumptions have been made for the calculation of site noise levels for the infilling and associated operations for the restoration at Wivenhoe Quarry.

The fixed and mobile plant items will all operate for 100% of an hour, to represent a reasonable worst case scenario.

Tipping of the inert material in the excavation void is included in the calculations as taking place 10% of the time.

Infilling will take place in some fully extracted phases within the application area concurrently with mineral extraction in subsequent phases. Plans indicating the areas in which imported infill material will be placed over the proposed life of the site are also presented in Appendix B.

The plant items used in the calculations (see Appendix G) are listed in the table below along with the Sound Power Levels (dB L_{WA}) used in the calculations. The plant items will achieve the dB L_{WA} values stated.

As calculations have also been undertaken for the ongoing mineral extraction and processing operations on site (when these processes are expected to take place concurrently with infilling operations), the plant items for those processes are also presented in the table.

Plant Item	**dB L_{WA}**	**Source Height (m)**
Routine Extraction Operations		
360º Excavator for mineral extraction	105	2
Dump Trucks	105	2
Processing Plant	110	6
Loading Shovel at Plant Site	104	2
Dewatering		
Electric Pump/Diesel Generator	90	1
Routine Restoration Operations		
HGVs	104	2
Tipping of indigenous/imported material	107	1
Dozer for grading	108	2
Temporary Operations		
Excavator on overburden / soils	105	2
Dump trucks on overburden / soils	105	2
Dozer	108	2

The calculations in this report are based on the methods contained in BS5228-1: 2009 “Code of practice for noise and vibration control on construction and open sites – Part 1: Noise” as amended BS5228-1:2009+A1:2014.

The nearest extraction/infilling operations will be at least 90 to 100 metres from the dwelling at Furzedown (the closest property to the mineral extraction/infilling operations).

The calculations take into account the existing topography between the site and the receiver locations and the bunding proposed as part of the noise assessment for the original planning

application for the development and an assumed height of working based on the top of the mineral at a depth of 1.5 metres with imported infill material placed to that level.

The bunding, topography and soil storage areas are shown on the plans for the Years 5, 10, 15 and 20 presented in Appendix B.

Infilling by means of imported inert materials will take place progressively and concurrently with mineral extraction as shown on the plans in Appendix B.

The site noise levels for the infilling operations using imported materials calculated at the nearest dwellings is shown in the following table as well as the calculated overall site noise levels including infilling as well as mineral extraction and processing operations when these activities will be taking place at the same time as the infilling operations.

For the purpose of presenting the calculated site noise levels, the “year” in which the operations are closest to the receptor are considered. In the case of some of the locations, two “years” were relevant and therefore two figures are presented for each location, with the worst case used going forward in the assessment.

The calculated site noise levels are given in terms of dB $L_{Aeq,1\ hour,\ free\ field}$.

Site Noise Calculation Location	Calculated Noise Level (Nearest Infilling*)	Calculated Noise Level (Overall Site Noise)
Main Assessment Locations		
A. Keelar's Farm (Year 10)	40	47
A. Keelar's Farm (Year 20)	46	46
B. Rosedene (Year 20)	46	47
C. Heath Lodge (Year 15)	45	47
D. White Lodge (Year 15)	38	41
E. Furzedown (Year 5)	44	45
E. Furzedown (Year 10)	36	40
Additional Assessment Locations		
Englishes Farm (Year 20)	47	48
The Fieldings (Year 20)	49	49
Blackboard & Boarding Cottages (Year 20)	49	49
Wilwyn (Year 15)	48	50
Wilwyn (Year 20)	46	46
Woodlands (Year 15)	39	45
Willow Lodge (Year 15)	39	41
Sunnymead Farm (Year 5)	31	40
Sunnymead Farm (Year 10)	33	41

* Infilling by means of imported material (restoration) + haul road

7 Calculated Site Noise Levels in Context of the Existing Noise Environment

For the BS4142 assessment, the five receiver locations representative of the nearest residential properties to the site have been used for site noise calculations.

The noise monitoring and assessment locations are shown on the plan in Appendix B.

A comparison of the calculated noise levels at the five selected assessment locations closest to the site with the background and residual sound levels at those locations is as follows.

Receiver Location	Calculated Site Noise Level dB $L_{Aeq,1\ hour}$		Representative Background Sound Level dB $L_{A90,15\ min}$	Residual Sound Level dB $L_{Aeq,15\ min}$
	Infilling*	Overall		

A. Keelar's Farm	46	47	50	65
B. Rosedene	46	47	44	55
C. Heath Lodge	45	47	47	58
D. White Lodge	38	41	35	46
E. Furzedown	44	45	36	47

* Infilling using imported materials (restoration) + access road

The overall calculated site noise levels are below the representative background sound level by at least 3 dB(A) at Keelar's Farm and are no more than the representative background sound level at Heath Lodge.

The overall calculated site noise levels are above the background sound levels by up to 3 dB(A) at Rosedene, by up to 6 dB(A) at White Lodge and up to 9 dB(A) at Furzedown during Year 5 (note that the overall calculated site noise is no more than 4 dB(A) above the representative background at Furzedown in Year 10).

Further calculations indicated that once the infilling operations close to Furzedown have advanced 200 metres further from the property, the difference between the overall calculated site noise level and the representative background sound level reduces to 5 dB(A).

The overall calculated site noise levels are below the representative residual sound levels at all the locations considered.

For infilling operations alone, the calculated site noise levels are below the representative background sound levels by at least 4 dB(A) at Keelar's Farm, by at least 2 dB(A) at Heath Lodge and above the representative background sound level by no more than 2 dB(A) at Rosedene, by no more than 3 dB(A) at White Lodge and by no more than 8 dB(A) at Furzedown (during Year 5).

The baseline residual levels at these five locations are 46-55 dB $L_{Aeq,T}$. The noise climate at these dwellings will continue to be controlled by distant and local road traffic on the public highway and some quarry and farming activity.

As stated earlier, seven additional locations were considered in the site noise calculations and the calculated site noise levels are compared with the representative background and residual sound levels at those locations in the following table.

Receiver Location	Calculated Site Noise Level dB $L_{Aeq,1\ hour}$		Representative Background Sound Level dB $L_{A90,15\ min}$	Representative Residual Sound Level dB $L_{Aeq,15\ min}$
	Infilling*	Overall		
Englishes Farm	47	48	44	55
The Fieldings	49	49	47	58
Blackboard & Boarding Cottages	49	49	47	58
Wilwyn	48	50	47	58
Woodlands	39	45	47	58
Willow Lodge	39	41	35	46
Sunnymead Farm	33	41	36	47

The overall calculated site noise levels for the remaining seven locations for which site noise calculations were undertaken are no more than 5dB(A) above the background sound level at all of the receptors apart from Willow Lodge where the difference is 6 dB(A) (the same as for White Lodge, the closest assessment location).

An assessment has been undertaken in accordance with BS 4142:2014+A1:2019 "*Methods for Rating and assessing industrial and commercial sound*" for the five nearest dwellings to the infill operations examined above.

8 BS 4142: 2014+A1:2019 Assessment

The information to be reported, as specified in Section 12 of BS 4142:2014+A1:2019, is set out below where relevant.

8.1 (a) Statement of Qualifications

See details about The Author on page 2 of this report.

8.2 (b) Source Being Assessed

1) Description of the main sound sources and of the specific sound

The source under investigation is the importation of inert material and the use of inert residues to restore the mineral extraction area of the existing quarry. The plant items are listed in Section 5 and those within the permit boundary would give rise to the specific sound levels at the off-site receiver locations.

2) Hours of operation

The permitted hours of operation are 07:00 to 18:00 hours Monday to Friday, 07:00 to 13:00 hours Saturday and at no other times or on Sundays, Bank and/or Public Holidays.

3) Mode of operation (e.g. continuous, twice a day, only in hot weather)

The dozer for tipped material will be used on most days, but the period of use in a day will depend on the amount of material to be profiled. All other activities are assumed to occur daily and continuously throughout the assessment period unless otherwise stated.

4) Statement of operational rates of the main sound sources (e.g. maximum load setting, 50% max rate, low load setting)

The measurements and assessment have been based on a "*maximum load setting*" i.e. with all components of the material handling and placement operations relating to infilling taking place simultaneously and for 100% of each hour during the daytime periods stated above apart from the tipping of the inert material in the excavation void which is included in the calculations as taking place 10% of the time.

The ongoing extraction and processing operations (including site dewatering) have also been assumed to be taking place for 100% of each hour during the daytime periods stated above.

5) Description of premises in which the main sound sources are situated (if applicable).

The infilling operation will take place progressively in the various specific areas of the previously extracted phases within the application area (shown on the site plans in Appendix B) concurrently with mineral extraction in the subsequent phases.

Plans of the quarry showing the application area and the schedule of concurrent mineral extraction and infilling by means of imported material is provided in Appendix B.

8.3 (c) Subjective Impressions

1) Dominance or audibility of the specific sound

The specific source is not yet in place but it is expected that the specific sound may be audible at times but would not be expected to be dominant at any of the assessment locations.

2) Main sources contributing to the residual sound.

The noise climate in the area established during the surveys in 2016 and 2018 was affected by road traffic noise, birdsong, wind in the trees, aircraft movement and some local farming activity.

8.4 (d) The Existing Context and Sensitivity of Receptor

The noise climate during the daytime at the five chosen assessment locations is characterised by road traffic noise, birdsong, wind in the trees, aircraft movement and some local farming activity. With regard to sensitivity, the receptor locations are residential properties and are therefore considered to be of “High” sensitivity.

8.5 (e) Measurement Locations and Justification

Measurement locations, their distance from the specific sound source, the topography of the intervening ground and any reflecting surface other than the ground, including a photograph, or a dimensioned sketch with a north marker. A justification for the choice of measurement locations should also be included.

The measurement locations used for the consideration of the baseline noise data were near to existing residential properties. The data were used to determine the acoustic environment and to measure residual (ambient) and background sound levels in the vicinity of the dwellings.

The receptor locations selected for this assessment are the four closest dwellings to the working areas of the site in each direction.

8.6 (f) Sound Measuring Systems, Including Calibrator / Pistonphone

Precision Sound Level Meter

1)	Type	140, NL-52 x4.
2)	Manufacturer	Norsonic, RION x4.
3)	Serial numbers	1404819 (Norsonic 140), 420715, 00586905, 420716 & 00510142 (RION NL-52).

4) Details of the latest verification test including dates

The noise surveys were completed in March 2016 and August 2018 for the purpose of establishing baseline conditions for the planning application submitted in 2020.

8.7 (g) Operational Test

1) *Reference level(s) of calibrator, multi-function calibrator or pistonphone;*
113.9 dB(A) for Norsonic 140 s/n 1404819;
94.0 dB(A) for RION NL-52 s/n's 420715, 00586905, 420716 & 00510142

2) *Meter reading(s) before and after measurements with calibrator, multi-function calibrator or pistonphone applied.*

Norsonic 140 (s/n 1404819):

08 March 2016:	Before 114.0 dB(A) and after 113.9 dB(A);
16 March 2016:	Before 113.8 dB(A) and after 113.7 dB(A);
14 August 2018:	Before 113.7 dB(A) and after 113.7 dB(A);
21 August 2018:	Before 113.6 dB(A) and after 113.6 dB(A);

RION NL-52 (s/n 420715):

08 to 16 March 2016:	Before 94.2 dB(A) and after 94.0 dB(A);

RION NL-52 (s/n 00586905):

14 to 21 August 2018:	Before 93.6 dB(A) and after 94.0 dB(A);

RION NL-52 (s/n 420716):

14 to 21 August 2018:	Before 94.0 dB(A) and after 94.0 dB(A);

RION NL-52 (s/n 00510142):

14 to 21 August 2018: Before 94.0 dB(A) and after 93.5 dB(A).

8.8 (h) Weather Conditions

1) Wind speed(s) and direction(s)

A summary of the weather conditions during the noise monitoring surveys and installation periods in March 2016 and August 2018 is presented in Appendix F.

2) Presence of conditions likely to lead to temperature inversion (e.g. calm nights with little cloud cover) None.

3) Precipitation None.

4) Fog None.

5) Wet ground None.

6) Frozen ground or snow coverage None.

7) Temperature

A summary of the weather conditions during the noise surveys and installation periods in March 2016 and August 2018 is presented in Appendix F.

8) Cloud Cover

A summary of the weather conditions during the noise surveys and installation periods in March 2016 and August 2018 is presented in Appendix F.

8.9 (i) Date(s) and Time(s) of Measurements

Sample Measurements:

08 March 2016: 11:45 to 15:30;

16 March 2016: 08:50 to 12:25;

14 August 2018: 12:30 to 15:20;

21 August 2018: 11:40 to 13:20.

Installed Meters:

08 to 16 March 2016; and

14 to 21 August 2018.

8.10 (j) Measurement Time Intervals

Samples: 15 minutes.
Installed Meters: 1 hour.

8.11 (k) Reference Time Interval(s)

The reference time interval is 1 hour for a daytime assessment between 07:00 to 23:00 hours. A period of 15 minutes is applicable between 23:00 and 07:00 hours.

As the site activities occur during daytime hours, a 1 hour assessment period is used.

8.12 (l) Specific Sound Level

1) Measured sound level(s)

The specific sound level could not be measured, but has been determined from calculation.

2) Residual sound level(s) and method of determination

The average residual sound levels from the attended noise survey measurements (and data from the installed sound level meters) at the five assessment locations in March 2016 and August 2018 were:

Keelar's Farm:	65 dB $L_{Aeq,15\ min,\ free\ field}$
Rosedene:	55 dB $L_{Aeq,15\ min,\ free\ field}$
Heath Lodge:	58 dB $L_{Aeq,15\ min,\ free\ field}$
White Lodge:	46 dB $L_{Aeq,15\ min,\ free\ field}$
Furzedown:	47 dB $L_{Aeq,15\ min,\ free\ field}$

3) Ambient sound level(s) and method of determination

The average ambient sound levels from the attended noise survey measurements (and data from the installed sound level meters) at the four assessment locations in March 2016 and August 2018 were:

Keelar's Farm:	65 dB $L_{Aeq,15\ min,\ free\ field}$
Rosedene:	55 dB $L_{Aeq,15\ min,\ free\ field}$
Heath Lodge:	58 dB $L_{Aeq,15\ min,\ free\ field}$
White Lodge:	46 dB $L_{Aeq,15\ min,\ free\ field}$
Furzedown:	47 dB $L_{Aeq,15\ min,\ free\ field}$

For the sample measurements at the four assessment locations the following "Comments" were made:

Keelar's Farm:	Distant and local road traffic, birdsong, aircraft movements, breeze in trees, commercial activity;
Rosedene:	Distant road traffic, birdsong, aircraft movements, breeze in trees;
Heath Lodge:	Distant and local road traffic, local activity, aircraft movements, breeze in trees, some commercial activity in Alresford;
White Lodge:	Distant road traffic, birdsong, aircraft movements, breeze in trees;
Furzedown:	Distant road traffic, birdsong, aircraft movements, breeze in trees, some distant farm activity.

4) Specific sound level(s) and method of determination

The specific sound levels for the five assessment locations have been determined from calculation as:

- 47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Keelar's Farm;
- 47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Rosedene;
- 47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Heath Lodge;
- 41 dB $L_{Aeq,1\ hour,\ free\ field}$ for White Lodge; and
- 45 dB $L_{Aeq,1\ hour,\ free\ field}$ for Furzedown.

5) Justification of methods

Calculation used as the infilling operations (nor the mineral extraction operations) are not yet taking place at the nearest approach to any of the five assessment locations.

6) Details of any corrections applied

See the Potential Impact of Uncertainty section.

8.13 (m) Background Sound Level(s)

Background sound level(s) and measurement time interval(s) and, in the case of measurements taken at an equivalent location, the reasons for presuming it to be equivalent.

The representative daytime background sound levels based on the attended noise survey measurements (and data from the installed sound level meters) at the five assessment locations in March 2016 and August 2018 were:

Keelar's Farm:	50 dB $L_{A90,15\ min,\ free\ field}$;
Rosedene:	44 dB $L_{A90,15\ min,\ free\ field}$
Heath Lodge:	47 dB $L_{A90,15\ min,\ free\ field}$;
White Lodge:	35 dB $L_{A90,15\ min,\ free\ field}$;
Furzedown:	36 dB $L_{A90,15\ min,\ free\ field}$.

8.14 (n) Rating Level(s)

1) Specific sound level(s)

The specific sound level(s) stated in 8.12 are:

47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Keelar's Farm;

47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Rosedene;

47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Heath Lodge;

41 dB $L_{Aeq,1\ hour,\ free\ field}$ for White Lodge; and

45 dB $L_{Aeq,1\ hour,\ free\ field}$ for Furzedown.

2) Any acoustic features of the specific sound

The potential adjustments for the different features and assessment methods are summarised in the table in Section 3 of this report.

At a separation distance of at least 90 to 100 metres from the dozer to the nearest of the five receiver locations and taking into account the noise attenuation due to soil storage bunding/topography in the vicinity of the closest properties, no requirement for a penalty for tonality, impulsivity or intermittency is expected for the infill operations at the receiver locations.

The nature of a dozer grading material could attract the 'Other' correction of + 3 dB "*if neither tonal nor impulsive, but otherwise readily distinctive*" if the dozer tracks are worn. However, at a separation distance of at least 90 to 100 metres to the nearest of the receiver locations, taking into account the noise attenuation due to soil storage bunding/topography between the infilling area and the property and with the use of a modern dozer the 'Other' correction of + 3 dB has not been included. Therefore no acoustic features corrections are applicable.

3) Rating level(s)

The rating levels for daytime are therefore 0 dB above the specific noise levels stated above resulting in the following rating levels determined in accordance with BS 4142:2014+A1:2019:

47 dB $L_{Ar, Tr}$ for Keelar's Farm;

47 dB $L_{Ar, Tr}$ for Rosedene;

47 dB $L_{Ar, Tr}$ for Heath Lodge;

41 dB $L_{Ar, Tr}$ for White Lodge; and

45 dB $L_{Ar, Tr}$ for Furzedown.

8.15 (o) Excess of the rating level(s) over background sound level(s)

Excess of the rating level(s) over the measured background sound level(s) and the initial estimate of the impacts

The rating levels, the background sound levels and the excess of the rating levels over the background sound levels for the daytime period are presented in the following table:

Receiver Location	Rating Level dB $L_{Ar, Tr}$	Representative Background Sound Level dB $L_{A90,15\ min}$	Excess of Rating Level over Background Sound Level
A. Keelar's Farm	47	50	-3
B. Rosedene	47	44	+3
C. Heath Lodge	47	47	0
D. White Lodge	41	35	+6
E. Furzedown	45	36	+9

When the rating level is above the background sound level, a difference of around +5 dB is likely to indicate an adverse impact and a difference of around +10 dB or more is likely to indicate a significant adverse impact, depending on the context.

8.16 (p) Conclusions of the assessment after taking context into account

Keelar's Farm:

The baseline measurements and assessment demonstrate a rating level of 47 dB $L_{Ar, Tr}$ at Keelar's Farm which is 3 dB below the representative background sound level of 50 dB $L_{A90, T}$ for Keelar's Farm. The residual level at Keelar's Farm is 65 dB $L_{Aeq,T}$.

The conclusion is that the assessment does not indicate an adverse impact at Keelar's Farm.

The soundscape for Keelar's Farm will continue to be affected by distant and local road traffic noise, aircraft movements, birdsong and breeze in the trees with some commercial activity.

Rosedene:

The baseline measurements and assessment demonstrate a rating level of 47 dB $L_{Ar, Tr}$ at Rosedene which is 3 dB above the representative background sound level of 44 dB $L_{A90, T}$ for Rosedene. The residual level at Rosedene is 55 dB $L_{Aeq,T}$.

The conclusion is that the assessment demonstrates a difference between Rating Level and representative background sound level below that which indicates an adverse impact.

The soundscape for Rosedene will continue to be dominated by local (B1027) road traffic noise with distant road traffic, aircraft movements and birdsong. Some quarrying or infilling activity could be audible at times depending on the stage of the development.

Heath Lodge:

The baseline measurements and assessment demonstrate a rating level of 47 dB $L_{Ar,\ Tr}$ at Heath Lodge which is equal to the representative background sound level of 47 dB $L_{A90,\ T}$ for Heath Lodge. The residual level at Heath Lodge is 58 dB $L_{Aeq,T}$.

The conclusion is that the assessment does not indicate an adverse impact at Keelar's Farm.

The soundscape for Heath Lodge will continue to be affected by local activity, distant and local road traffic noise, aircraft movements, birdsong and breeze in.

White Lodge:

The baseline measurements and assessment demonstrate a rating level of 41 dB $L_{Ar,\ Tr}$ at White Lodge which is 6 dB above the representative background sound level of 35 dB $L_{A90,\ T}$ for White Lodge. The residual level at White Lodge is 46 dB $L_{Aeq,T}$.

The assessment indicates that site noise would be above the level indicating an adverse impact (but below the level indicating a significant adverse impact) at White Lodge depending on context.

The calculated site noise levels are below the existing ambient sound levels by around 5 dB(A).

If necessary, the soil storage and screening bunds between the property and the working areas could be augmented to reduce the levels to below those indicating an adverse impact, but as the calculations present a worst case scenario with all mobile plant operating constantly at the nearest possible location simultaneously (which is unlikely to happen) this should not be necessary.

Taking the context of the worst case scenario being unlikely to occur in practice, the duration of the operations in that area and the existing ambient sound levels into account, the conclusion is that there should be no adverse impact at White Lodge.

The soundscape for White Lodge will continue to be affected by distant road traffic noise, aircraft movements, birdsong and local farming activity. Some quarrying and infilling activity is likely to be audible at times.

Furzedown:

The baseline measurements and assessment demonstrate a rating level of 45 dB $L_{Ar,\ Tr}$ at Furzedown which is 9 dB above the representative background sound level of 36 dB $L_{A90,\ T}$ for Furzedown. The residual level at Furzedown is 47 dB $L_{Aeq,T}$.

The assessment indicates that site noise would be around the level indicating an adverse impact (but below the level indicating a significant adverse impact) at Furzedown depending on context.

Considering the context, the calculated site noise levels are below the existing ambient sound levels at Furzedown and once the nearest infilling operations move a further 200 metres from the property, the difference between the Rating Level and the representative background sound level will reduce to under that indicating an adverse impact.

Alternatively a temporary increase in the height of the soil storage and screening bunds in the area in close proximity to Furzedown would also achieve levels below those indicating an adverse impact, but as the calculations present a worst case scenario with all mobile plant operating constantly at the nearest possible location simultaneously (which is unlikely to happen) this should not be necessary.

Taking the context of the worst case scenario being unlikely to occur in practice, the duration of the operations at the nearest point to the property and the existing ambient sound levels into account, the conclusion is that there may be no adverse impact at Furzedown.

The soundscape for Furzedown will continue to be affected by distant road traffic noise, aircraft movements, birdsong and local farming activity. Some quarrying and infilling activity is likely to be audible at times.

8.17 (q) The potential impact of uncertainty

Section 10 of BS 4142:2014+A1:2019 states: "*Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty*."

The largest level of uncertainty is whether the proposed activity gives rise to the calculated noise level at the five receiver locations and whether the specific noise at those locations attracts acoustic feature corrections.

The measurements and assessment have been based on all components of the material handling and placement (apart from the tipping of material) taking place simultaneously and for 100% of each hour during daytime periods. The site noise calculations also assume that the mineral extraction, dewatering and processing operations are also taking place 100% of each hour. The site noise calculations do not include any allowance for air absorption.

If a correction of +3 dB were to be required at the three receiver locations for the nearest and uppermost use of the dozer on the infill for restoration, the rating level would be:

Receiver Location	**Rating Level dB $L_{Ar,\ Tr}$**	**Representative Background Sound Level dB $L_{A90,15\ min}$**	**Excess of Rating Level over Background Sound Level**
A. Keelar's Farm	50	50	0
B. Rosedene	50	44	+6
C. Heath Lodge	50	47	+3
D. White Lodge	44	35	+9
E. Furzedown	48	36	+12

With the inclusion of a +3 dB correction, the excess of rating level over background sound level would indicate that there could be an adverse impact at Rosedene, White Lodge and Furzedown (depending on context as addressed in Section 8.16)) and no adverse impact at Keelar's Farm and Heath Lodge.

The background sound level was determined for the assessment by considering the full range of data from the surveys which covered a range of wind directions and these levels

are considered to be representative of the background sound level that would be normal for the properties in the vicinity of the site.

The prevailing wind direction is from the SW quadrant and as the majority of the surveys were undertaken with a westerly component (with some variation as expected) the survey data is therefore likely to be representative of the normal sound levels in the vicinity of the receptors.

The rating levels used in the assessment are based on the calculated sound levels for the infilling operations and also including the permitted mineral extraction, dewatering and processing operations on site.

If the infilling operations using imported inert material (the subject of the application for the permit) are considered in isolation, the excess of rating levels over background sound levels for the five assessment locations are as follows:

Receiver Location	**Rating Level (Nearest Infilling)* dB $L_{Ar, Tr}$**	**Representative Background Sound Level dB $L_{A90,15\ min}$**	**Excess of Rating Level over Background Sound Level**
A. Keelar's Farm	46	50	-4
B. Rosedene	46	44	+2
C. Heath Lodge	45	47	-2
D. White Lodge	38	35	+3
E. Furzedown	44	36	+8

* Infilling by means of imported material (restoration) + haul road

Considering the infilling operations in isolation, the excess of rating level over background sound level indicates no adverse impact Keelar's Farm, Rosedene, Heath Lodge and White Lodge.

Considering the infilling operations in isolation, the excess of rating level over background sound level indicates a level that represents potential adverse impact (but not significant adverse impact) at Furzedown, depending on context (as addressed in Section 8.16).

The rating levels used are based on the calculated site noise levels at the five assessment locations when the infilling and mineral extraction operations are occurring simultaneously at the nearest point of each working area to the receptor. As the works move away from that nearest point, the noise levels generated would be expected to reduce.

The operator included noise attenuation (and soil storage) bunds in the design of the site as part of the original planning application to reduce site noise levels at the nearest noise sensitive locations and has made every effort to minimise noise at the nearest noise sensitive locations due to the operations on site.

The operation must be considered in the context of the existing ambient noise levels at the assessment locations, the duration of infilling operations at the nearest point to the dwellings, and the noise levels generated by the permitted mineral extraction, processing and dewatering operations at the site.

The assessment indicates that there could be a short term adverse impact at Furzedown and possibly at White Lodge. However, the duration during which this adverse impact could be expected is limited to a very short period of time and could only apply when work occurs in the closest areas to each property.

Examining the infilling operations in isolation, the comparison of rating levels with background sound levels indicates no adverse impact at four of the five the assessment locations throughout the infilling operations. At Furzedown there would be a potential adverse impact (depending on context as addressed in Section 8.16).

9 Summary and Conclusions

Tarmac have been granted permission for the extraction and processing of mineral from a new site at Wivenhoe Quarry in Essex under a planning permission dated 18 December 2020 Application No. Application Ref. ESS/17/18/TEN.

A noise impact assessment based on the BS 4142 method has been undertaken to support the application for an inert deposit for recovery permit associated with the restoration at the new Wivenhoe Quarry site.

The calculated site noise levels are compared with the measured background noise levels at the nearest existing dwellings, as established based on the baseline noise survey data obtained in March 2016 and August 2018.

This comparison of the calculated noise levels arising from the importation of inert materials and the infilling of the extraction void using those materials with the background sound levels forms the basis for the BS 4142:2014+A1:2019 assessment method for the nearest dwellings to the new Wivenhoe Quarry site.

The calculated site noise levels presented for comparison also include the permitted mineral extraction, dewatering and processing operations on site, where appropriate.

The baseline measurements and assessment demonstrate a worst case rating level of 47 dB $L_{Ar,\,Tr}$ which is 3 dB below the representative background sound level of 50 dB $L_{A90,\,T}$ for Keelar's Farm.

The baseline measurements and assessment demonstrate a worst case rating level of 47 dB $L_{Ar,\,Tr}$ which is 3 dB above the representative background sound level of 44 dB $L_{A90,\,T}$ for Rosedene.

The baseline measurements and assessment demonstrate a worst case rating level of 47 dB $L_{Ar,\,Tr}$ which is equal to the representative background sound level of 47 dB $L_{A90,\,T}$ for Heath Lodge.

The baseline measurements and assessment demonstrate a worst case rating level of 41 dB $L_{Ar,\,Tr}$ which is 6 dB above the representative background sound level of 35 dB $L_{A90,\,T}$ for White Lodge.

The baseline measurements and assessment demonstrate a worst case rating level of 45 dB $L_{Ar,\,Tr}$ which is 9 dB above the representative background sound level of 36 dB $L_{A90,\,T}$ for Furzedown.

The conclusion is that the assessment indicates that there could be a short term adverse impact at Furzedown and possibly at White Lodge (depending on context), but only whilst infilling operations are taking place in the nearest small areas to each property.

Taking context into account, the conclusion is that there should be no adverse impact at White Lodge and there may be no adverse impact at Furzedown.

The assessment indicates no adverse impact at the other three assessment locations (Keelar's Farm, Rosedene and Heath Lodge).

Examining the infilling operations in isolation, the comparison of rating levels with background sound levels indicates no adverse impact at four of the five the assessment locations throughout the infilling operations. There remains the possibility of a potential short term adverse impact at Furzedown due to the infilling operations in the nearest area to the property (depending on context).

The soundscape for the five receiver locations considered will continue to be affected by distant and local road traffic noise, aircraft movements, other local activity, birdsong and breeze in the trees, with some quarrying activity and infilling operations audible at times at some locations.

Robert Storey
BEng PhD MIOA
Senior Consultant

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Appendix A – Glossary of Acoustic Terms

General Noise and Acoustics

The following section describes some of the parameters that are used to quantify noise.

Decibels dB

Noise levels are measured in decibels. The decibel is the logarithmic ratio of the sound pressure to a reference pressure ($2x10^{-5}$ Pascals). The decibel scale gives a reasonable approximation to the human perception of relative loudness. In terms of human hearing, audible sounds range from the threshold of hearing (0 dB) to the threshold of pain (140 dB).

A-weighted Decibels dB(A)

The 'A'-weighting filter emulates human hearing response for low levels of sound. The filter network is incorporated electronically into sound level meters. Sound pressure levels measured using an 'A'-weighting filter have units of dB(A) which is a single figure value to represent the overall noise level for the entire frequency range.

A change of 3 dB(A) is the smallest change in noise level that is perceptible under normal listening conditions. A change of 10 dB(A) corresponds to a doubling or halving of loudness of the sound. The background noise level in a quiet bedroom may be around 20 –30 dB(A); normal speech conversation around 60 dB(A) at 1 m; noise from a very busy road around 70-80 dB(A) at 10m; the level near a pneumatic drill around 100 dB(A).

Façade Noise Level

Façade noise measurements are those undertaken near to reflective surfaces such as walls, usually at a distance of 1m from the surface. Façade noise levels at 1m from a reflective surface are normally around 3 dB greater than those obtained under freefield conditions.

Freefield Noise Level

Freefield noise measurements are those undertaken away from any reflective surfaces other than the ground

Frequency Hz

The frequency of a noise is the number of pressure variations per second, and relates to the "pitch" of the sound. Hertz (Hz) is the unit of frequency and is the same as cycles per second. Normal, healthy human hearing can detect sounds from around 20 Hz to 20 kHz.

Octave and Third-Octave Bands

Two frequencies are said to be an octave apart if the frequency of one is twice the frequency of the other. The octave bandwidth increases as the centre frequency increases. Each bandwidth is 70% of the band centre frequency.

Two frequencies are said to be a third-octave apart if the frequency of one is 1.26 times the other. The third octave bandwidth is 23% of the band centre frequency.

There are recognised octave band and third octave band centre frequencies. The octave or third-octave band sound pressure level is determined from the energy of the sound which falls within the boundaries of that particular octave of third octave band.

Appendix A (continued)

Equivalent Continuous Sound Pressure Level $L_{Aeq,T}$

The 'A'-weighted equivalent continuous sound pressure level $L_{Aeq,T}$, is a notional steady level which has the same acoustic energy as the actual fluctuating noise over the same time period T. The $L_{Aeq,T}$ unit is dominated by higher noise levels, for example, the $L_{Aeq,T}$ average of two equal time periods at, for example, 70 dB(A) and 50 dB(A) is not 60 dB(A) but 67 dB(A).

The $L_{Aeq,}$ is the chosen unit of BS 7445-1:2003 "Description and Measurement of Environmental noise".

Maximum Sound Pressure Level L_{Amax}

The L_{Amax} value describes the overall maximum 'A'-weighted sound pressure level over the measurement interval. Maximum levels are measured with either a fast or slow time weighted, denoted as $L_{Amax,f}$ or $L_{Amax,s}$ respectively.

Noise Rating NR

The noise rating level is a single figure index obtained from an octave band analysis of a noise. The NR level is obtained by comparing the octave band sound pressure levels to a set of reference curves and the highest NR curve that is intersected by the sound pressure levels gives the NR level.

Sound Exposure Level L_{AE} or SEL

The sound exposure level is a notional level which contains the same acoustic energy in 1 second as a varying 'A'-weighted noise level over a given period of time. It is normally used to quantify short duration noise events such as aircraft flyover or train passes.

Statistical Parameters L_N

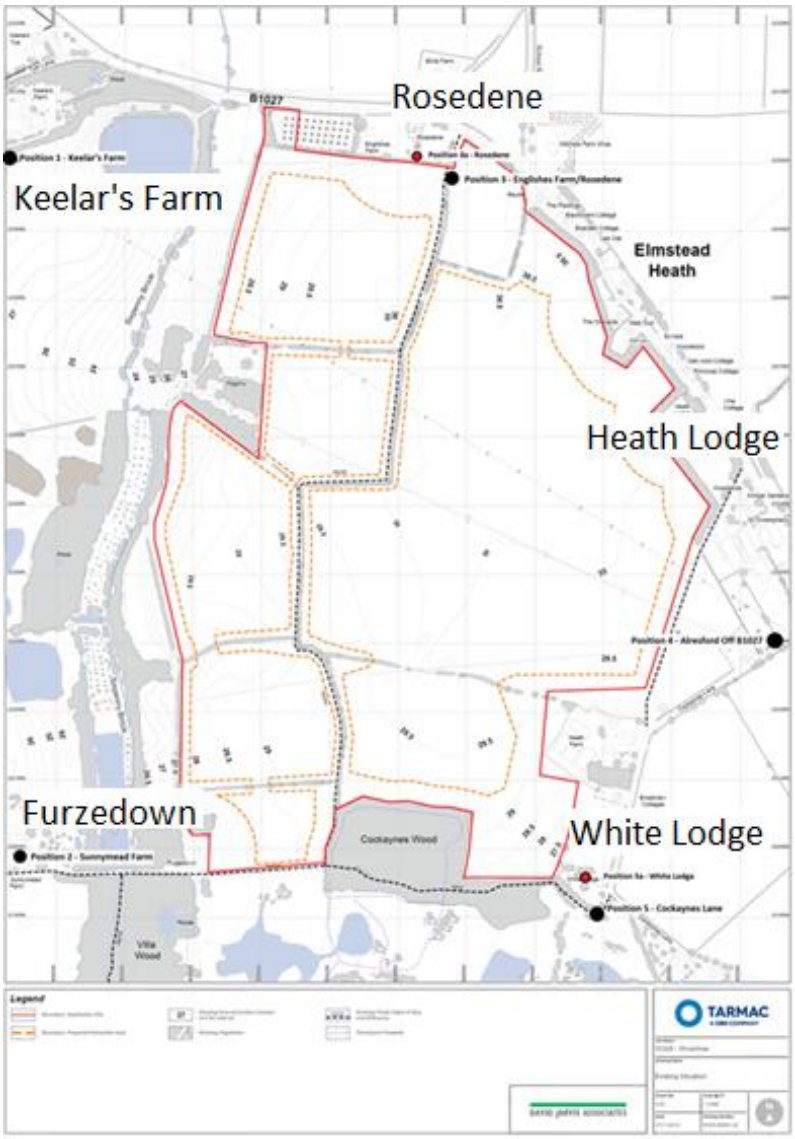
In order to cover the time variability aspects, noise can be analysed into various statistical parameters, i.e. the sound level which is exceeded for N% of the time. The most commonly used are the $L_{A01,T}$, $L_{A10,T}$ and the $L_{A90,T}$.

$L_{A01,T}$ is the 'A'-weighted level exceeded for 1% of the time interval T and is often used to gives an indication of the upper maximum level of a fluctuating noise signal.

$L_{A10,T}$ is the 'A'-weighted level exceeded for 10% of the time interval T and is often used to describe road traffic noise. It gives an indication of the upper level of a fluctuating noise signal. For high volumes of continuous traffic, the $L_{A10,T}$ unit is typically 2–3 dB(A) above the $L_{Aeq,T}$ value over the same period.

$L_{A90,T}$ is the 'A'-weighted level exceeded for 90% of the time interval T, and is often used to describe the underlying background noise level.

Appendix B –Plan Showing Survey/Assessment Locations and Phasing

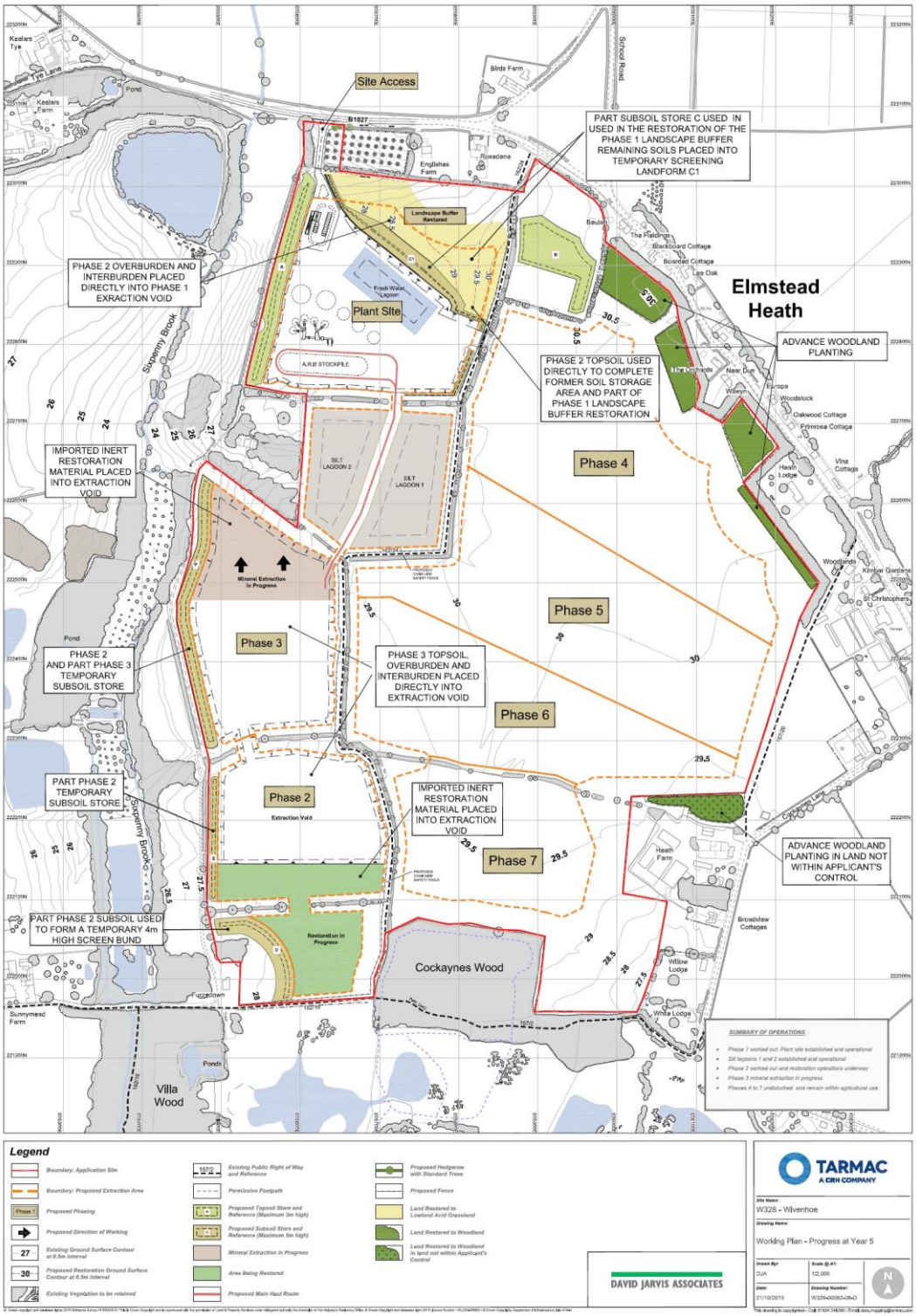


Approximate positions of baseline noise survey locations

Location	Description
1. Keelars Farm	In layby next to chain fence, south of property
2. Sunnymead Farm	On lawn of farmhouse garden
3. Englishes Farm/Rosedene	In field on footpath to south of properties, over bridge
4. Alresford (off B1027)	By nursery entrance on Cockaynes Lane
5. Cockaynes Lane	By bend in footpath to south-east of application site
2. Sunnymead Farm (Install)	On lawn of farmhouse garden
3a. Rosedene (Install)	In rear garden of property
5a. White Lodge (Install)	In rear garden of property

Appendix B (continued)

Phasing Plans:



Appendix B (continued)

Appendix B (continued)

Appendix B (continued)

Appendix C – Instrumentation and Calibration Details

Date and Location of Surveys

Tuesday 08 March 2016 &

Wednesday 16 March 2016

In vicinity of Wivenhoe Quarry, Essex

Survey carried out by

Robert Storey

Weather Conditions

Tuesday 08 March 2016: Dry, cloudy, 8-10^{o}C, WNW wind 0-4 m/s

Wednesday 16 March 2016: Dry, cloudy, some sun, 7-10^{o}C, ENE wind 0-3 m/s

Instrumentation used (Serial Number)

Norsonic 140 Sound Level Meter (1404819)

Norsonic 1251 Calibrator (33321)

Calibration

The sensitivity of the meter was verified on site immediately before and after each survey. The measured calibration levels were as follows:

Survey Date	Start Cal	End Cal
Tuesday 08 March 2016	114.0 dB(A)	113.9 dB(A)
Wednesday 16 March 2016	113.8 dB(A)	113.7 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

Survey Details

Attended sample measurements of 15 minute duration were taken at each of the chosen locations. The microphone was at a height of approximately 1.4 metres above local ground level, with a windshield used throughout.

The start times of each sample are tabulated with the results in Appendix D.

Appendix C – Instrumentation and Calibration Details (continued)

Date and Location of Installation Survey

Tuesday 08 March 2016 to Wednesday 16 March 2016

In the grounds of Sunnymead Farm

Meter Installed & Collected by

Dr Robert Storey

Instrumentation used (Serial Number)

RION NL-52 Sound Level Meter (420715)
RION NC-74 Calibrator (34425556)

Calibration

The sensitivity of the meter was verified on site immediately before and after the measurements with readings as follows:

Dates	Start Calibration	End Calibration
08/03/2016 to 16/03/2016	94.2 dB(A)	94.0 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

Survey Details

Continuous measurements of 1 hour duration were taken at the chosen location over the specified period. The microphone was fitted with a RION WS-15 windshield which was used throughout the measurements.

Appendix C – Instrumentation and Calibration Details (continued)

Date and Location of Surveys

Tuesday 14 August 2018 &

Tuesday 21 August 2018

In vicinity of Wivenhoe Quarry, Essex

Survey carried out by

Robert Storey

Weather Conditions

Tuesday 14 August 2018: Dry, some cloud, sunny at times, 18-21^{o}C, W wind 0-2 m/s

Tuesday 21 August 2018: Dry, sunny, light cloud, 21-26^{o}C, SW wind 0-1 m/s

Instrumentation used (Serial Number)

Norsonic 140 Sound Level Meter (1404819)

Norsonic 1251 Calibrator (33321)

Calibration

The sensitivity of the meter was verified on site immediately before and after each survey. The measured calibration levels were as follows:

Survey Date	Start Cal	End Cal
Tuesday 14 August 2018	113.7 dB(A)	113.7 dB(A)
Tuesday 21 August 2018	113.6 dB(A)	113.6 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

Survey Details

Attended sample measurements of 15 minute duration were taken at each of the chosen locations. The microphone was at a height of approximately 1.4 metres above local ground level, with a windshield used throughout.

The start times of each sample are tabulated with the results in Appendix D.

Appendix C – Instrumentation and Calibration Details (continued)

Date and Location of Installation Survey

Tuesday 14 August 2018 to Tuesday 21 August 2018

In the grounds of Sunnymead Farm

Meter Installed & Collected by

Dr Robert Storey

Instrumentation used (Serial Number)

RION NL-52 Sound Level Meter (00586905)
RION NC-74 Calibrator (34536108)

Calibration

The sensitivity of the meter was verified on site immediately before and after the measurements with readings as follows:

Dates	Start Calibration	End Calibration
14/08/2018 to 21/08/2018	93.6 dB(A)	94.0 dB(A)

Survey Details

Continuous measurements of 1 hour duration were taken at the chosen location over the specified period. The microphone was fitted with a RION WS-15 windshield which was used throughout the measurements.

Appendix C – Instrumentation and Calibration Details (continued)

Date and Location of Installation Survey

Tuesday 14 August 2018 to Tuesday 21 August 2018

In the rear garden of Rosedene

Meter Installed & Collected by

Dr Robert Storey

Instrumentation used (Serial Number)

RION NL-52 Sound Level Meter (420716)
RION NC-74 Calibrator (34425557)

Calibration

The sensitivity of the meter was verified on site immediately before and after the measurements with readings as follows:

Dates	Start Calibration	End Calibration
14/08/2018 to 21/08/2018	94.0 dB(A)	94.0 dB(A)

The meter and calibrator are tested monthly against a Brüel and Kjær Pistonphone, type 4220 (serial number 375806) and a Norsonic Calibrator, type 1253 (serial number 22906) with UKAS approved laboratory certificate of calibration.

Survey Details

Continuous measurements of 1 hour duration were taken at the chosen location over the specified period. The microphone was fitted with a RION WS-15 windshield which was used throughout the measurements.

Appendix C – Instrumentation and Calibration Details (continued)

Date and Location of Installation Survey

Tuesday 14 August 2018 to Tuesday 21 August 2018

In the rear garden of White Lodge, Cockaynes Lane

Meter Installed & Collected by

Dr Robert Storey

Instrumentation used (Serial Number)

RION NL-52 Sound Level Meter (00510142)
RION NC-74 Calibrator (34536108)

Calibration

The sensitivity of the meter was verified on site immediately before and after the measurements with readings as follows:

Dates	Start Calibration	End Calibration
14/08/2018 to 21/08/2018	94.0 dB(A)	93.5 dB(A)

Survey Details

Continuous measurements of 1 hour duration were taken at the chosen location over the specified period. The microphone was fitted with a RION WS-15 windshield which was used throughout the measurements.

Appendix D – Baseline Survey Results (Samples)

Results and Observations

Tuesday 08 March 2016, 11:45 to 15:30

Dry, cloudy, 8-10°C, WNW wind 0-4 m/s

Position	Start Time	Results dB (T = 15 minutes)			Comments
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	
1. Keelars Farm	11:45	65	71	50	Distant and local road traffic, birdsong, aircraft, breeze in trees, HGVs on access road, distant reversing alarm, hum to south-west
3. Charity Farm/Rosedene	12:05	50	53	47	Distant and local road traffic, aircraft, birdsong, building work at property (bricklaying and cement mixer), hum to north-west
5. Cockaynes Lane	12:28	45	49	36	Distant road traffic, birdsong, aircraft, breeze in trees, distant trains, distant dog barking, distant hammering, voice of cyclist, tractor on Heath Road
4. Alresford (off B1027)	12:56	57	60	44	Road traffic (distant and on B1027 plus some local vehicles), birdsong, hum to north, breeze in trees, aircraft, distant dog barking
2. Sunnymead Farm	13:42	43	46	38	Distant road traffic, car on lane to farm, birdsong, breeze in trees, aircraft, distant reversing bleeper, dozer in excavation area just audible

Appendix D – Baseline Survey Results (Samples) continued

Results and Observations

Tuesday 08 March 2016, 11:45 to 15:30

Dry, cloudy, 8-10°C, WNW wind 0-4 m/s

Position	Start Time	Results dB (T = 15 minutes)			Comments
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	
1. Keelars Farm	14:02	64	70	46	Distant and local road traffic, aircraft, breeze in trees, HGVs on access road, hum to south-west just audible at times
3. Charity Farm/Rosedene	14:22	51	53	48	Distant and local road traffic, aircraft, birdsong, building work at property (bricklaying and cement mixer), hum to north-west, distant trains and train horns, voices and whistle of dog walkers, distant horn, car horn on B1027, distant reversing bleeper
4. Alresford (off B1027)	14:43	56	60	46	Road traffic (B1027 and occasional cars on Cockaynes Lane), birdsong, aircraft, breeze in trees, distant power tool in Alresford, distant dog barking
5. Cockaynes Lane	15:03	44	45	38	Distant road traffic, birdsong, breeze in trees, aircraft, car and tractor on Cockaynes Lane, distant bird scarer, distant dog barking, distant train horn
2. Sunnymead Farm	15:26	52	56	45	Road traffic on local road, birdsong, breeze in trees, tractor in field to south, aircraft, dozer in excavation area just audible at times, distant bird scarer, car on lane to farm

Appendix D – Baseline Survey Results (Samples) continued

Results and Observations

Wednesday 16 March 2016, 08:50 to 12:25

Dry, cloudy, some sun, 7-10ºC, ENE wind 0-3 m/s

Position	Start Time	Results dB (T = 15 minutes)			Comments
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	
1. Keelars Farm	08:53	66	70	55	Road traffic (distant and on Keelars Lane), birdsong, breeze in trees, aircraft, HGVs on access road, activity at Sibbons Plant Hire including jet wash
5. Cockaynes Lane	09:16	49	52	45	Distant road traffic, birdsong, breeze in trees, aircraft, distant train horns, occasional cars on lane, voice of dog walker
4. Alresford (off B1027)	09:37	58	61	48	Road traffic (B1027), birdsong, breeze in trees, some vehicles on Cockaynes Lane, car horn on B1027, aircraft, activity at houses
3. Charity Farm/Rosedene	09:58	54	57	48	Road traffic (distant and B1027), birdsong, breeze in trees, voice of dog walker
2. Sunnymead Farm	10:21	45	46	37	Distant road traffic, birdsong, aircraft, lorry and voices at Colchester Fans, distant trains, distant dogs barking, vehicle movements at quarry

Appendix D – Baseline Survey Results (Samples) continued

Results and Observations

Wednesday 16 March 2016, 08:50 to 12:25

Dry, cloudy, some sun, 7-10ºC, ENE wind 0-3 m/s

Position	Start Time	Results dB (T = 15 minutes)			Comments
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	
1. Keelars Farm	10:42	65	70	50	Distant and local road traffic, birdsong, breeze in trees, aircraft, reversing bleeper at Sibbons Plant Hire, HGV on access road
5. Cockaynes Lane	11:03	52	55	45	Distant road traffic, birdsong, aircraft, breeze in trees, helicopter, voices of dog walkers, activity behind properties, voice and whistle of walker, occasional cars on Cockaynes Lane
4. Alresford (off B1027)	11:23	59	62	48	Road traffic (B1027), birdsong, aircraft, breeze in trees, car entering nursery, some cars on Cockaynes Lane, car idling, hammering to east
3. Charity Farm/Rosedene	11:44	54	45	48	Road traffic, birdsong, aircraft, breeze in trees, mini-excavator at property at start and end of measurement, voice of dog walker
2. Sunnymead Farm	12:08	44	47	38	Distant road traffic, birdsong, breeze in trees, aircraft, voices of dog walkers on track, distant trains and train horns

Appendix D – Baseline Survey Results (Samples) continued

Results and Observations

Tuesday 14 August 2018, 12:30 to 15:20

Dry, some cloud, sunny at times, 18-21°C, W wind 0-2 m/s

Position	Start Time	Results dB (T = 15 minutes)			Comments
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	
3. Rosedene	12:34	50	52	45	Road traffic (B1027), birdsong, breeze in trees, aircraft, distant reversing bleeper
5. White Lodge, Cockaynes Lane	13:36	41	44	34	Birdsong, breeze in trees, low light aircraft, distant mowing to west at times, distant road traffic just audible, occasional car on Cockaynes Lane
2. Sunnymead Farm	15:04	40	42	34	Road traffic on Alresford Road, birdsong, aircraft, breeze in trees, brief activity at commercial premises to south, occasional power tool at houses to south-east, cow, distant reversing bleeper to east

Appendix D – Baseline Survey Results (Samples) continued

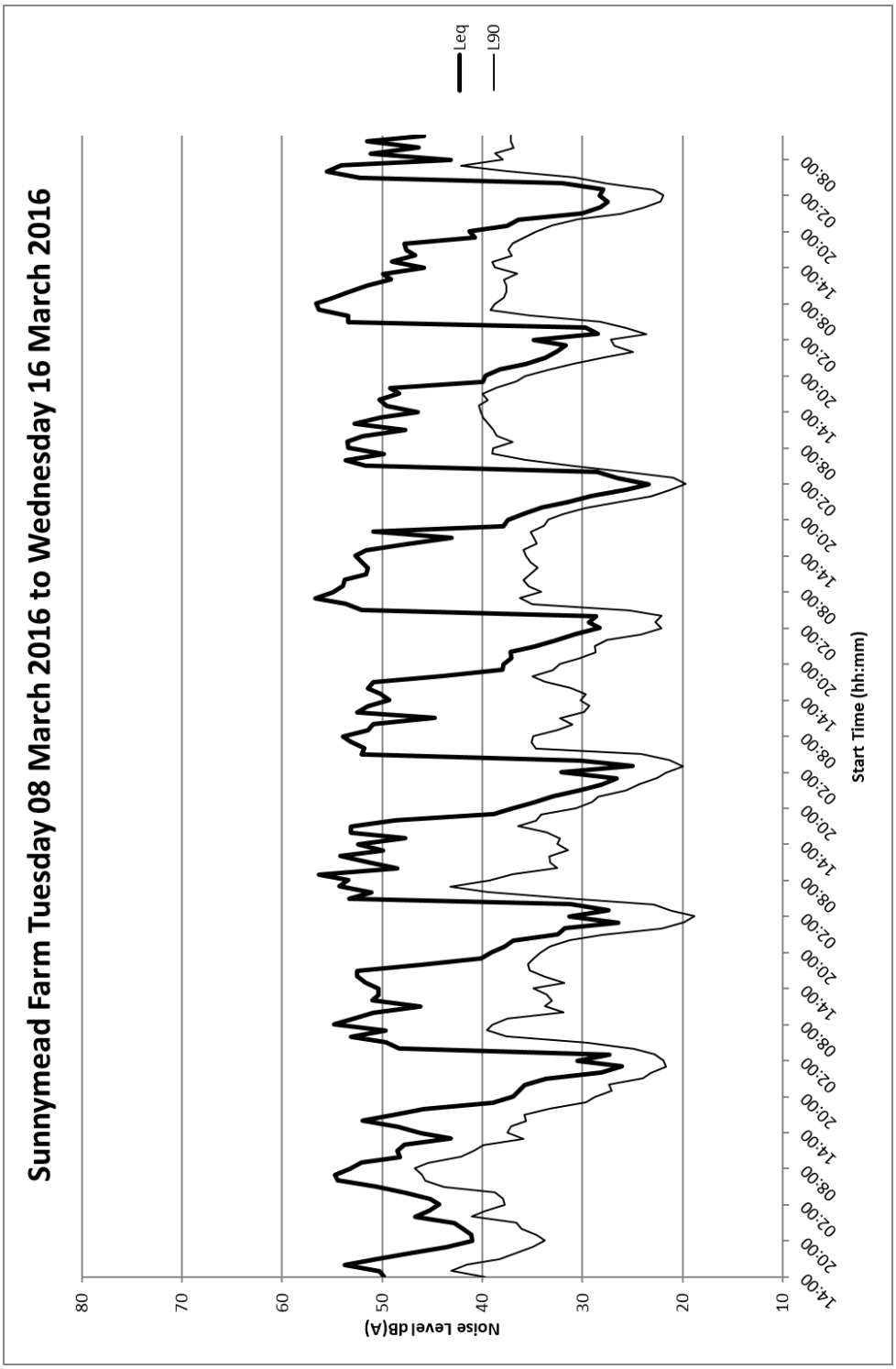
Results and Observations

Tuesday 21 August 2018, 11:40 to 13:20

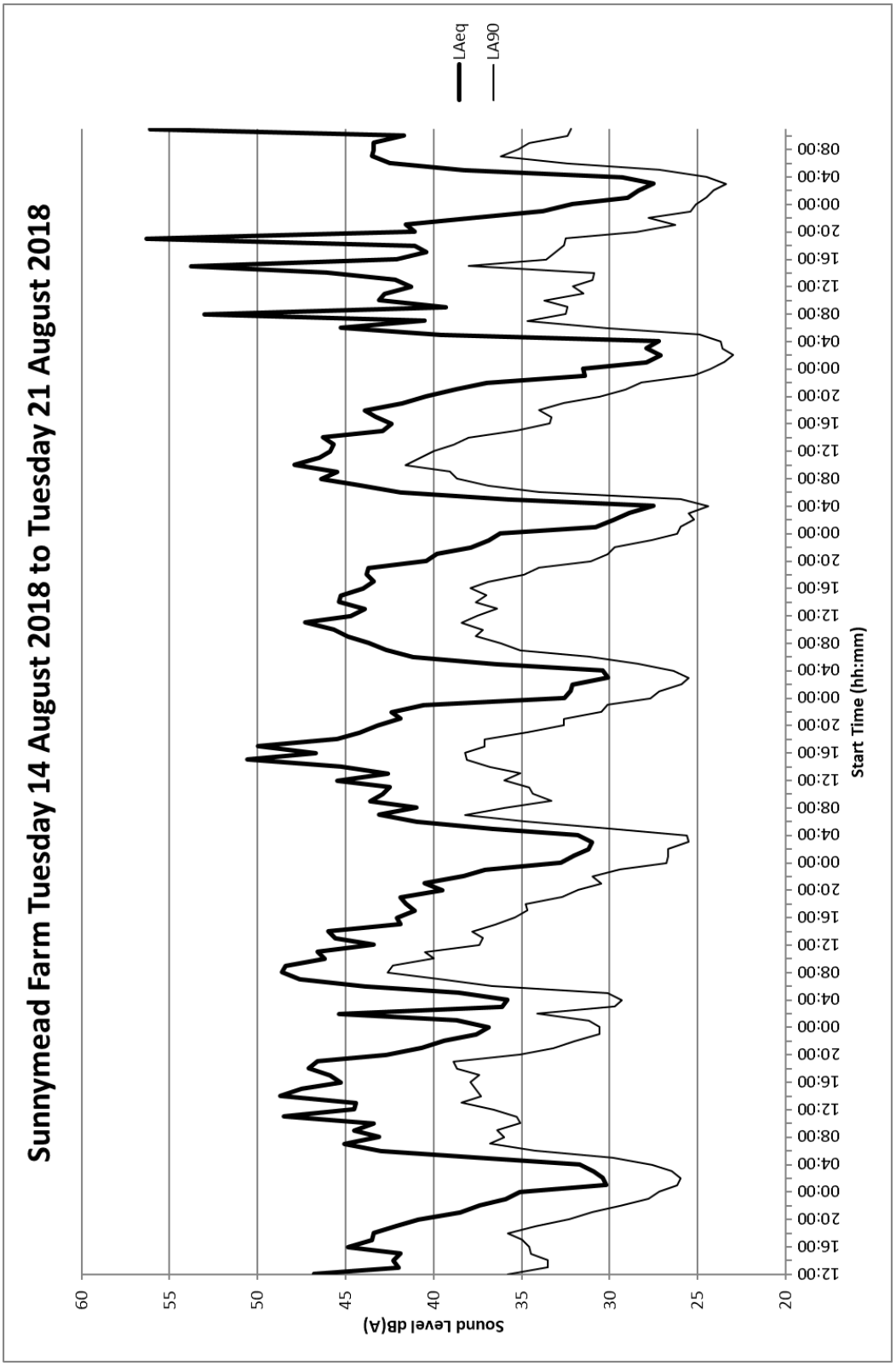
Dry, sunny, light cloud, 21-26°C, SW wind 0-1 m/s

Position	Start Time	Results dB (T = 15 minutes)			Comments
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$	
2. Sunnymead Farm	11:42	51	46	37	Road traffic (Alresford Road), birdsong, aircraft, breeze in trees, dog barking, voice of resident, tractor in field to south, car on track
5. White Lodge, Cockaynes Lane	12:30	42	45	36	Distant road traffic, some vehicles on Cockaynes Lane, low aircraft, birdsong, breeze in trees, train horns, works down Cockaynes Lane audible at times including white noise reversing alarms, reversing bleepers, engine noise and impact noises
3. Rosedene	13:05	52	55	46	Tractor in field behind property to south, low light aircraft, birdsong, breeze in trees, voices at house, road traffic (B1027)

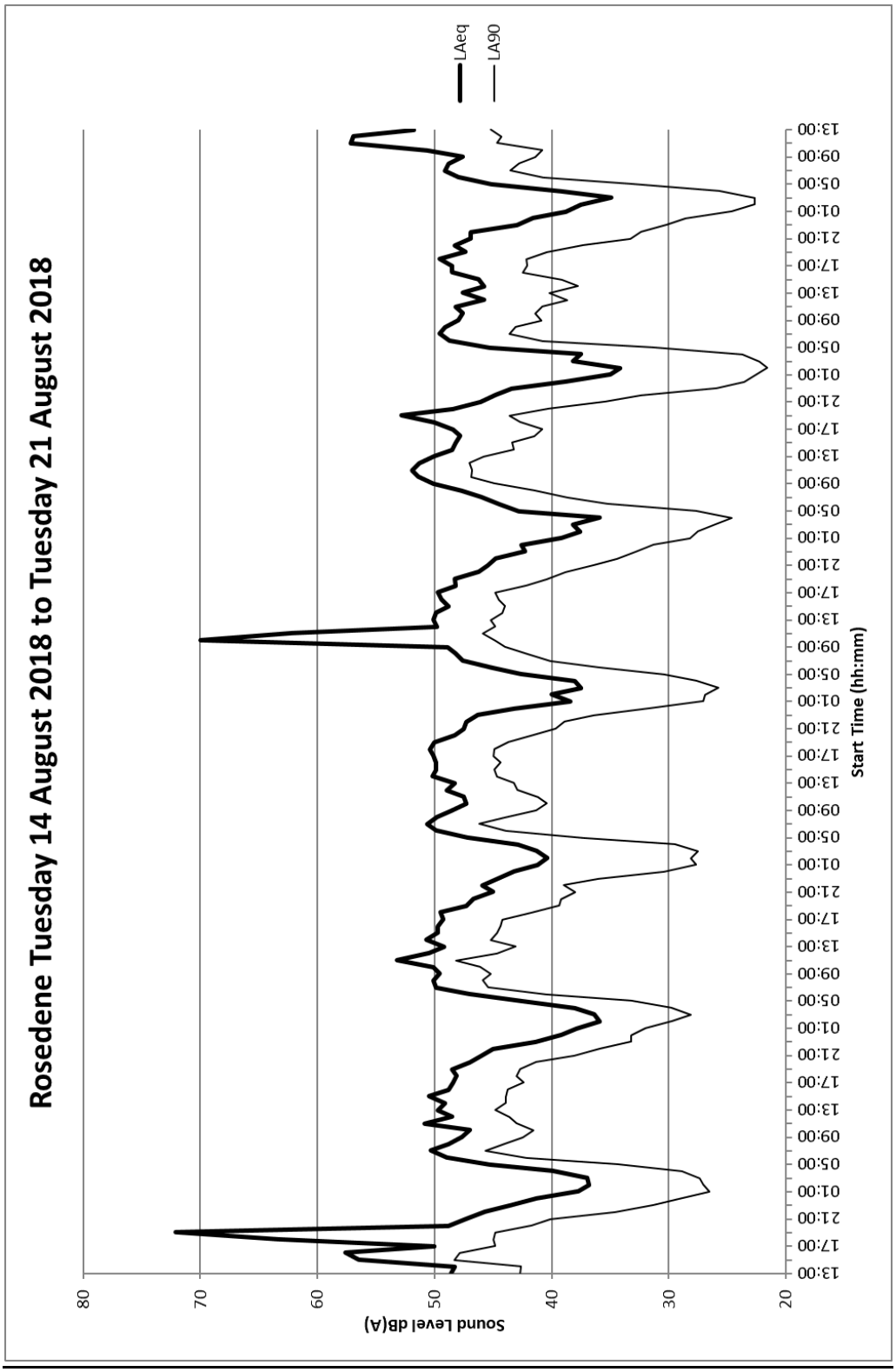
Appendix E – Baseline Noise Data (Installed Sound Level Meters)



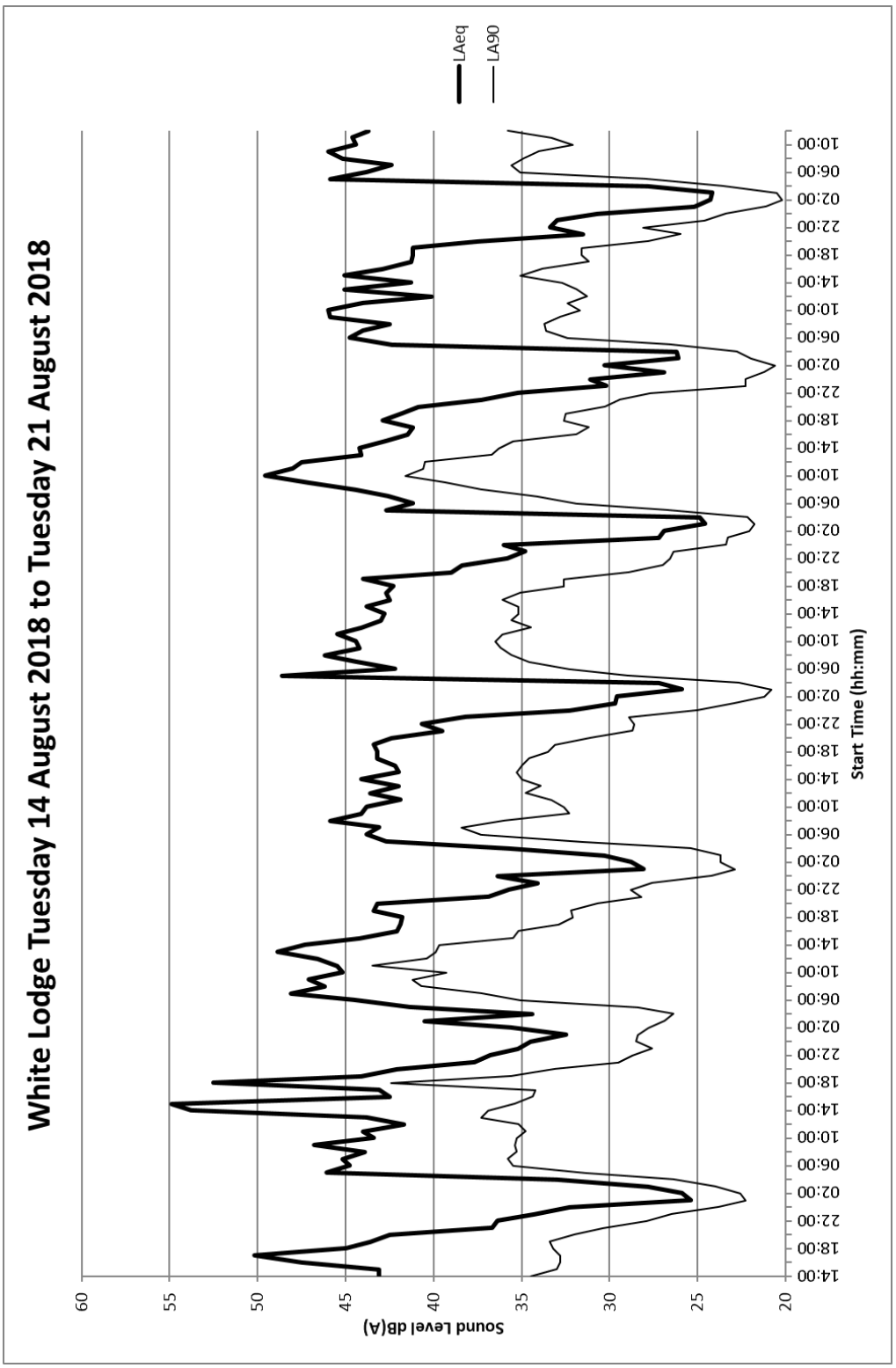
Appendix E - Baseline Noise Data (Installed Sound Level Meters) (continued)



Appendix E - Baseline Noise Data (Installed Sound Level Meters) (continued)



Appendix E - Baseline Noise Data (Installed Sound Level Meters) (continued)



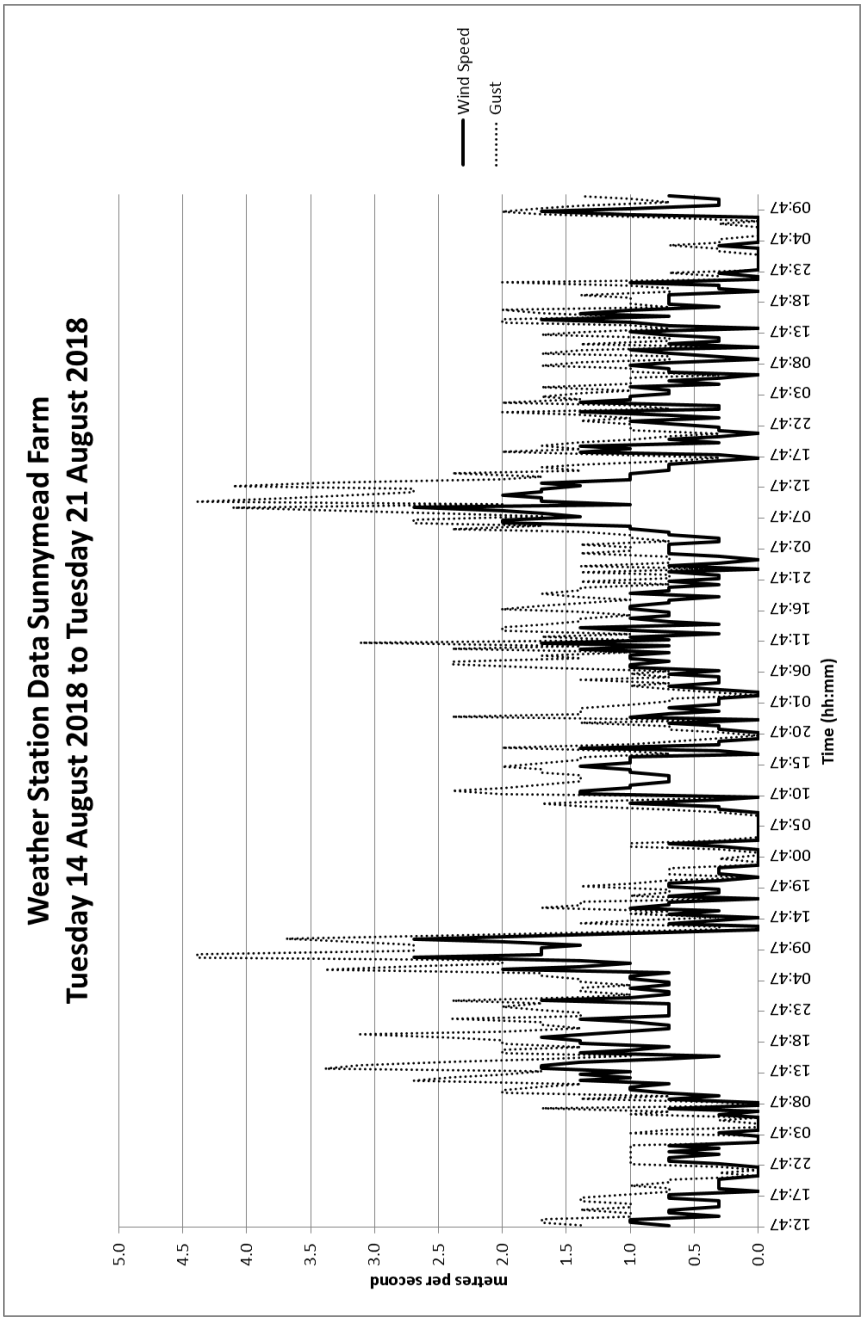
Appendix F – Summary of Weather Conditions (March 2016 & August 2018)

Day and Date	Indicative Daytime Weather Details
Tuesday 08 March 2016	Dry, cloudy, 8 to10ºC, WNW wind 0-4 m/s
Wednesday 09 March 2016	Some rain, cloudy, 4 to 5ºC, ESE/SE wind 2-10 m/s
Thursday 10 March 2016	Dry, cloudy, 4 to 9ºC, N/ENE wind 2-3 m/s
Friday 11 March 2016	Dry, cloudy, -1 to 9ºC, E/ESE wind 2-4 m/s
Saturday 12 March 2016	Dry, cloudy, 4 to 7ºC, ENE/SSE wind 1-2 m/s
Sunday 13 March 2016	Dry, cloudy, 0 to 7ºC, E/ENE wind 3-6 m/s
Monday 14 March 2016	Dry, clear, 3 to 9ºC, ENE/NE wind 5-6 m/s
Tuesday 15 March 2016	Dry, overcast, 5 to 7ºC, N/NNE wind 3-7 m/s
Wednesday 16 March 2016	Dry, cloudy, some sun, 7-10ºC, ENE wind 0-3 m/s

Source: Weather Underground website.
Nearest weather station at Wattisham
and onsite observations.

Appendix F – Weather Conditions (continued)

Summary of the data from the weather station installed in the garden of Sunnymead Farm from Tuesday 14 August 2018 to Tuesday 21 August 2018:



Rain was recorded between 11:47 and 16:17 on Thursday 16 August 2018 and the results during this period were excluded from the data analysis.

Appendix G – Noise Calculation Methods and Summary Calculation Sheets

Specific noise levels are predicted or measured in terms of the Equivalent Continuous Noise Level, $L_{Aeq,T}$ over a given reference time interval, T. In BS 4142:2014+A1:2019 the reference time interval is 1 hour for daytime and 15 minutes for night-time.

The calculation method for any plant which is relatively fixed in location is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "*Method for activity L_{Aeq}*" described in section F.2.2 or the "*Method for plant sound power level*" described in section F.2.3.

The calculation method for site mobile plant such as lorries and dump trucks is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "*Method for mobile plant using a regular well defined route (e. g. haul roads)*" described in section F. 2. 5.

Ground Absorption has been calculated using the technique set out in BS 5228-1: 2009 + A1: 2014, Annex F, assuming 90% soft ground between the site and the receiver locations.

The method of assessing screening is that attributed to Maekawa as used in BS 5228-1: 2009 + A1: 2014, Annex F and various other Government published documents. This method uses the calculated path difference and octave band noise data for each noise source over the frequency range stated in BS 5228-1: 2009 + A1: 2014, Annex F.

The effects of ground absorption are not used in the calculations if screening has been assessed and offers a higher attenuation.

The nearest distances to the respective dwellings, from the various items of plant, have been used in an acoustic model for the site to calculate the reasonable worst case $L_{Aeq,T}$ site noise levels.

Summary site noise calculation sheets for the five assessment locations are included after the explanation of table headings used in the calculation spreadsheets.

Appendix G (continued)

Table at top of page, a summary of the noise sources identified for calculation.

Ref.
Reference number for plant items.

Plant Item
A list of plant items selected as potentially significant noise sources.

Comments on Plant
Typically a reference to where the noise data has been measured or sourced from.

Activity LAeq @ 10 m
The equivalent A-weighted noise level for a nominal period, T, at a distance of 10 metres for this noise source, where appropriate.

Power LWA or LWA / m
The A-weighted sound power level for each plant item. A sound power level can be used to determine an $L_{Aeq,\,T}$ at any distance required, assuming hemispherical propagation.

15 min/1 hour On-time %
The operating time of each plant item given as a percentage of the period, generally taken to be 1 hour.

Capacity Tonnes
Capacity in tonnes of for example a dump truck; when in combination with a daily or hourly amount of material to be moved by dump trucks can be used to determine the number of dump truck movements per day or per hour.

Source Height
The height above the ground at which the actual noise source is located, for example noise sources associated with a medium sized wheeled loader would normally be approximately 2 m above ground level.

2 way flow Q per hour
Used for haul road calculations and specifies the number of vehicles expected on the haul road per hour.

Speed V kph
The expected average speed of the vehicles on the haul road.

Plant Set back(m)
This plant set back, e.g. 10 m, is used when barrier attenuation is being considered to test and ensure that the barrier attenuation is not overstated by placing the noise source too close in behind a bund or barrier.

BS5228 method
The reference number is used in a look up table to indicate which method within BS5228 has been used for assessing this particular noise source.

Appendix G (continued)

Table at bottom of page, dB $L_{Aeq, T}$ noise level contributions from the individual noise sources.

Ref.
Reference number for plant items – to link with table at top of page.

Plant Item
A list of plant items felt to be a potential noise source – to link with table at top of page.

Plan Distance
The distance from the noise source to receptor in metres, when appropriate the worst case scenario is used i.e. the shortest separation distance.

Working Distance
Any further distance correction, in metres, used to alter the distance of the noise source to the receptor, for testing alternative scenarios if required.

Ground Height
The ground height at the location of the noise source, in metres above sea level (Ordnance datum).

Working Height / depth
Any further adjustment to the height of the noise source, for example if noise sources are positioned above or below existing ground level.

Source Height
Indicates the noise source height taking account of the ground height and the height / depth adjustment.

Angle Degrees & Range Metres
Used in the Haul Road Method calculations only and specifies the angle of view and the perpendicular distance to the haul road or extended line of the haul road.

Barrier – Receiver
Distance of any acoustic barrier to the receptor in metres, used to determine path difference.

Barrier Height
The height of the barrier in metres, used to determine path difference.

Path Diff.
The difference in path length from noise source to receptor to which the sound propagation is subjected by introduction of any barrier.

Barrier Atten.
The attenuation in dB(A) caused by the barrier to the resultant dB $L_{Aeq, T}$ for the noise source, based on calculations in octave bands for each noise source.

Appendix G (continued)

Soft Ground %
The percentage of the ground between the noise source and receptor which is taken to be soft, i.e. grass and farmland, rather than hard, i.e. concrete or water.

Ground Atten.
The attenuation in dB(A) caused by any soft ground to the resultant dB $L_{Aeq, T}$ for the noise source, in decibels (not included if barrier attenuation is greater)

Resultant L_{Aeq}
The resulting dB $L_{Aeq, T}$ noise level for the individual noise source at the receptor, including attenuation factors and any mitigation at source.

Appendix G (continued)

TARMAC														
						Receiver Height :		1.5	m		0			
WIVENHOE QUARRY INFILLING														
			Activity	Power LWA	% hourly	Capacity	Source		2 way flow	Speed			BS5228	
Plant Item	Comments on Plant		LAeq @ 10 m	or LWA / m	On-time	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method	
Excavator	WBM Plant Noise Database		77	105	100		2				0	m back	1	Activity
Processing Plant	WBM Plant Noise Database		82	110	100		6				0	m back	1	Activity
HGVs on Access Road	WBM Plant Noise Database		76	104	100		2		12	15	0	m back	4	Haul Road
Dump Trucks within Phases	WBM Plant Noise Database		77	105	100		2				0	m back	3	Defined Area
Loading Shovel at Plant Site	WBM Plant Noise Database		76	104	100		2				0	m back	1	Activity
Dewatering Pump/Generator	Data Sheet		62	90	100		1				0	m back	1	Activity
HGV Movement on internal haul routes	WBM Plant Noise Database		76	104	100		2				0	m back	3	Defined Area
Tipping of Infill	WBM Plant Noise Database		79	107	10		1				0	m back	1	Activity
Dozer grading infill	WBM Plant Noise Database		80	108	100		2				0	m back	1	Activity
Location No.	**A**	**Keelers Farm (Year 10)**												
Receiver Height	31.5	m AOD												
						Representative Background Sound Level				Difference				
Site Noise Level for Items 1 to 6	**46**	**dB LAeq, 1 hour, free field**		Routine Extraction Operations		50	**dB LA90, T**			**-3.8**	**dB**			
Site Noise Level for Items 7 to 9	**40**	**dB LAeq, 1 hour, free field**		Routine Infilling Operations		50	**dB LA90, T**			**-10.0**	**dB**			
Site Noise Level for Extraction and Infilling	**47**	**dB LAeq, 1 hour, free field**		Routine Operations		50	**dB LA90, T**			**-2.9**	**dB**			
Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
Excavator	670	670	29.0	-1.5	29.5	0	0	370	30.0	0.000	0.0	90.0	6.4	34.1
Processing Plant	450	450	25.0	0.0	31.0	0	0	370	30.0	-0.009	0.0	90.0	3.9	45.0
HGVs on Access Road	350	350	27.0	0.0	29.0	35	0	0	0.0	-1.000	0.0	90.0	5.1	32.3
Dump Trucks within Phases	670	670	29.0	-1.5	29.5	0	500	370	30.0	0.000	0.0	90.0	6.4	33.1
Loading Shovel at Plant Site	450	450	25.0	0.0	27.0	0	0	370	30.0	0.037	7.9	90.0	5.6	35.0
Dewatering Pump/Generator	670	770	29.0	-1.5	28.5	0	0	370	30.0	0.000	0.0	90.0	6.7	17.6
HGV Movement on internal haul routes	475	475	26.0	-1.5	26.5	0	500	0	0.0	-1.000	0.0	90.0	5.7	34.7
Tipping of Infill	475	475	26.0	-1.5	25.5	0	0	370	30.0	0.062	9.7	90.0	5.7	25.8
Dozer grading infill	475	475	26.0	-1.5	26.5	0	0	370	30.0	0.035	8.2	90.0	5.7	38.3

Appendix G (continued)

TARMAC														
						Receiver Height :		1.5	m		0			
WIVENHOE QUARRY INFILLING														
Plant Item	Comments on Plant		Activity LAeq @ 10 m	Power LWA or LWA / m	% hourly On-time	Capacity Tonnes	Source Height		2 way flow Q per hour	Speed V kph	Plant Set back(m)		BS5228 method	
HGVs on Access Road	WBM Plant Noise Database		76	104	100		2		12	15	0	m back	4	Haul Road
HGV Movement on internal haul routes	WBM Plant Noise Database		76	104	100		2				0	m back	3	Defined Area
Tipping of Infill	WBM Plant Noise Database		79	107	10		1				0	m back	1	Activity
Dozer grading infill	WBM Plant Noise Database		80	108	100		2				0	m back	1	Activity
Location No.	**B**	**Rosedene (Year 20)**												
Receiver Height	30.5	m AOD												
						Representative Background Sound Level				Difference				
Site Noise Level for Items 1 to 6	**40**	**dB LAeq, 1 hour, free field**		Routine Extraction Operations		44	**dB LA90, T**			**-3.9**	**dB**			
Site Noise Level for Items 7 to 9	**46**	**dB LAeq, 1 hour, free field**		Routine Infilling Operations		44	**dB LA90, T**			**1.7**	**dB**			
Site Noise Level for Extraction and Infilling	**47**	**dB LAeq, 1 hour, free field**		Routine Operations		44	**dB LA90, T**			**2.8**	**dB**			
Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
HGVs on Access Road	200	200	27.0	0.0	29.0	55	0	0	0.0	-1.000	0.0	40.0	1.8	40.1
HGV Movement on internal haul routes	140	140	28.0	-0.5	29.5	0	500	0	0.0	-1.000	0.0	90.0	3.4	44.2
Tipping of Infill	160	160	28.0	-1.5	27.5	0	0	150	31.5	0.746	18.2	90.0	3.6	26.7
Dozer grading infill	160	160	28.0	-1.5	28.5	0	0	150	31.5	0.431	15.7	90.0	3.6	40.2

Appendix G (continued)

TARMAC														
						Receiver Height :		1.5	m		0			
WIVENHOE QUARRY INFILLING														
			Activity	Power LWA	% hourly	Capacity	Source		2 way flow	Speed			BS5228	
Plant Item	Comments on Plant		LAeq @ 10 m	or LWA / m	On-time	Tonnes	Height		Q per hour	V kph	Plant Set back(m)		method	
Excavator	WBM Plant Noise Database		77	105	100		2				0	m back	1	Activity
Processing Plant	WBM Plant Noise Database		82	110	100		6				0	m back	1	Activity
HGVs on Access Road	WBM Plant Noise Database		76	104	100		2		12	15	0	m back	4	Haul Road
Dump Trucks within Phases	WBM Plant Noise Database		77	105	100		2				0	m back	3	Defined Area
Loading Shovel at Plant Site	WBM Plant Noise Database		76	104	100		2				0	m back	1	Activity
Dewatering Pump/Generator	Data Sheet		62	90	100		1				0	m back	1	Activity
HGV Movement on internal haul routes	WBM Plant Noise Database		76	104	100		2				0	m back	3	Defined Area
Tipping of Infill	WBM Plant Noise Database		79	107	10		1				0	m back	1	Activity
Dozer grading infill	WBM Plant Noise Database		80	108	100		2				0	m back	1	Activity
Location No.	**C**	**Heath Lodge (Year 15)**												
Receiver Height	30.5	m AOD												
						Representative Background Sound Level				Difference				
Site Noise Level for Items 1 to 6	**42**	**dB LAeq, 1 hour, free field**		Routine Extraction Operations		47	**dB LA90, T**			**-5.3**	**dB**			
Site Noise Level for Items 7 to 9	**45**	**dB LAeq, 1 hour, free field**		Routine Infilling Operations		47	**dB LA90, T**			**-2.1**	**dB**			
Site Noise Level for Extraction and Infilling	**47**	**dB LAeq, 1 hour, free field**		Routine Operations		47	**dB LA90, T**			**-0.4**	**dB**			

Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
Excavator	330	330	28.0	-1.5	28.5	0	0	80	33.0	0.073	8.1	90.0	5.0	38.5
Processing Plant	610	610	25.0	0.0	31.0	0	0	430	35.0	0.068	10.1	90.0	4.3	36.2
HGVs on Access Road	650	650	27.0	0.0	29.0	15	0	0	0.0	-1.000	0.0	90.0	6.4	24.8
Dump Trucks within Phases	330	330	28.0	-1.5	28.5	0	500	80	33.0	0.073	9.5	90.0	5.0	34.1
Loading Shovel at Plant Site	610	610	25.0	0.0	27.0	0	0	430	35.0	0.191	12.5	90.0	6.2	27.8
Dewatering Pump/Generator	330	430	28.0	-1.5	27.5	0	0	80	33.0	0.072	6.9	90.0	5.6	22.4
HGV Movement on internal haul routes	120	120	28.0	-1.5	28.5	0	500	80	33.0	0.275	14.8	90.0	3.1	32.6
Tipping of Infill	120	120	28.0	-1.5	27.5	0	0	80	33.0	0.378	15.6	90.0	3.1	31.8
Dozer grading infill	120	120	28.0	-1.5	28.5	0	0	80	33.0	0.275	14.0	90.0	3.1	44.4

Appendix G (continued)

TARMAC

Receiver Height : 1.5 m 0

WIVENHOE QUARRY INFILLING

Plant Item	Comments on Plant	Activity LAeq @ 10 m	Power LWA or LWA / m	% hourly On-time	Capacity Tonnes	Source Height	2 way flow Q per hour	Speed V kph	Plant Set back(m)		BS5228 method	
Excavator	WBM Plant Noise Database	77	105	100		2			0	m back	1	Activity
Processing Plant	WBM Plant Noise Database	82	110	100		6			0	m back	1	Activity
HGVs on Access Road	WBM Plant Noise Database	76	104	100		2	12	15	0	m back	4	Haul Road
Dump Trucks within Phases	WBM Plant Noise Database	77	105	100		2			0	m back	3	Defined Area
Loading Shovel at Plant Site	WBM Plant Noise Database	76	104	100		2			0	m back	1	Activity
Dewatering Pump/Generator	Data Sheet	62	90	100		1			0	m back	1	Activity
HGV Movement on internal haul routes	WBM Plant Noise Database	76	104	100		2			0	m back	3	Defined Area
Tipping of Infill	WBM Plant Noise Database	79	107	10		1			0	m back	1	Activity
Dozer grading infill	WBM Plant Noise Database	80	108	100		2			0	m back	1	Activity

Location No. **D** **White Lodge (Year 15)**

Receiver Height 28.5 m AOD

				Representative Background Sound Level		Difference	
Site Noise Level for Items 1 to 6	**38**	**dB LAeq, 1 hour, free field**	Routine Extraction Operations	35	**dB LA90, T**	**3.0**	**dB**
Site Noise Level for Items 7 to 9	**38**	**dB LAeq, 1 hour, free field**	Routine Infilling Operations	35	**dB LA90, T**	**2.6**	**dB**
Site Noise Level for Extraction and Infilling	**41**	**dB LAeq, 1 hour, free field**	Routine Operations	35	**dB LA90, T**	**5.8**	**dB**

Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
Excavator	290	290	28.0	-1.5	28.5	0	0	280	33.0	1.002	15.6	90.0	4.8	32.2
Processing Plant	930	930	25.0	0.0	31.0	0	0	220	34.0	0.072	10.3	90.0	4.9	32.3
HGVs on Access Road	290	290	27.0	0.0	29.0	30	0	0	0.0	-1.000	0.0	90.0	4.8	32.8
Dump Trucks within Phases	290	290	28.0	-1.5	28.5	0	500	280	33.0	1.002	18.3	90.0	4.8	26.4
Loading Shovel at Plant Site	900	900	25.0	0.0	27.0	0	0	220	34.0	0.104	10.6	90.0	7.0	26.3
Dewatering Pump/Generator	290	390	28.0	-1.5	27.5	0	0	280	33.0	0.172	8.6	90.0	5.4	21.6
HGV Movement on internal haul routes	400	400	28.0	-1.5	28.5	0	500	275	33.0	0.118	12.0	90.0	5.4	30.0
Tipping of Infill	400	400	28.0	-1.5	27.5	0	0	280	33.0	0.161	12.6	90.0	5.4	24.4
Dozer grading infill	400	400	28.0	-1.5	28.5	0	0	280	33.0	0.121	11.4	90.0	5.4	36.6

Appendix G (continued)

TARMAC

WIVENHOE QUARRY INFILLING

Receiver Height : 1.5 m 0

Plant Item	Comments on Plant	Activity LAeq @ 10 m	Power LWA or LWA / m	% hourly On-time	Capacity Tonnes	Source Height	2 way flow Q per hour	Speed V kph	Plant Set back(m)		BS5228 method	
Excavator	WBM Plant Noise Database	77	105	100		2			0	m back	1	Activity
Processing Plant	WBM Plant Noise Database	82	110	100		6			0	m back	1	Activity
HGVs on Access Road	WBM Plant Noise Database	76	104	100		2	12	15	0	m back	4	Haul Road
Dump Trucks within Phases	WBM Plant Noise Database	77	105	100		2			0	m back	3	Defined Area
Loading Shovel at Plant Site	WBM Plant Noise Database	76	104	100		2			0	m back	1	Activity
Dewatering Pump/Generator	Data Sheet	62	90	100		1			0	m back	1	Activity
HGV Movement on internal haul routes	WBM Plant Noise Database	76	104	100		2			0	m back	3	Defined Area
Tipping of Infill	WBM Plant Noise Database	79	107	10		1			0	m back	1	Activity
Dozer grading infill	WBM Plant Noise Database	80	108	100		2			0	m back	1	Activity

Location No.	**E**	**Furzedown (Year 5)**					
Receiver Height	27.5	m AOD					
				Representative Background Sound Level		Difference	
Site Noise Level for Items 1 to 6	**38**	**dB LAeq, 1 hour, free field**	Routine Extraction Operations	36	**dB LA90, T**	**2.4**	**dB**
Site Noise Level for Items 7 to 9	**44**	**dB LAeq, 1 hour, free field**	Routine Infilling Operations	36	**dB LA90, T**	**7.7**	**dB**
Site Noise Level for Extraction and Infilling	**45**	**dB LAeq, 1 hour, free field**	Routine Operations	36	**dB LA90, T**	**8.8**	**dB**

Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
Excavator	470	470	28.0	-1.5	28.5	0	0	80	32.0	0.141	9.5	90.0	5.7	34.1
Processing Plant	800	800	25.0	0.0	31.0	0	0	70	32.0	0.138	12.2	90.0	4.7	31.7
HGVs on Access Road	35	35	27.0	0.0	29.0	1	0	0	0.0	-1.000	0.0	90.0	0.6	31.4
Dump Trucks within Phases	470	470	28.0	-1.5	28.5	0	500	70	32.0	0.159	11.6	90.0	5.7	30.0
Loading Shovel at Plant Site	800	800	25.0	0.0	27.0	0	0	70	32.0	0.161	11.9	90.0	6.8	26.0
Dewatering Pump/Generator	470	570	28.0	-1.5	27.5	0	0	70	32.0	0.165	8.5	90.0	6.1	18.4
HGV Movement on internal haul routes	80	80	28.0	-1.5	28.5	0	500	70	32.0	0.733	18.6	90.0	2.3	30.5
Tipping of Infill	90	90	28.0	-1.5	27.5	0	0	80	32.0	1.092	19.8	90.0	2.5	30.1
Dozer grading infill	90	90	28.0	-1.5	28.5	0	0	80	32.0	0.716	17.6	90.0	2.5	43.3

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