Chapter 10
Construction Noise

10 Construction Noise

Introduction

10.1 This chapter considers the potential effects of the proposed development in relation to noise. An assessment has been made of the significance of construction activity noise associated with the proposed development on the nearby residential receptors. The proposed use of the site is unlikely to introduce any significant source of noise during its operation therefore this has been scoped out of the assessment.

10.2 This chapter should be considered in conjunction with the following chapters, which inform or have been informed by this assessment:

10.3 **Chapter 4: Project Description and Construction, Operation and Maintenance** which provides details of the proposed development; and

10.4 **Chapter 5: Planning Policy Context** which sets out planning policies of relevance to the assessment

10.5 The Noise assessment was undertaken by Hoare Lea.

Scope of the Assessment

10.6 As noted in **Chapter 2: Approach to the EIA**, a separate EIA scoping exercise was not undertaken for the proposed development therefore the scope of the assessment has been informed by the Scoping Opinion received for the KTR Project, together with the professional judgement of the assessment team, further informed by consultation specific to the proposed development as referred to further below.

Effects Assessed in Full

10.7 The effect of construction noise has been assessed in full. The construction noise targets are set out along with the assessment methodology and results of the noise level calculations. Noise mitigation measures are discussed such that noise targets are met throughout the construction phases.

Effects Scoped Out

10.8 On the basis of the desk based work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following topic areas have been 'scoped out' of detailed assessment:

- construction vibration, as no piling will take place;
- works associated with the highways alterations (road widening) as these work will be of very short duration and similar to road maintenance work;
- operational noise, as no noisy plant or equipment will be introduced once the proposed development is operational; and
- operational vibration, as no plant or equipment likely to generate perceptible levels of vibration will be introduced.

Assessment Methodology

Legislation and Guidance

Legislation

10.9 The assessment has been carried out in accordance with the principles contained within the following legislation:

- Environmental Protection Act 1990[i] (EPA); and
- Control of Pollution Act 1974[ii](CopA).

Guidance

10.10 Advice on the role of the planning system in helping to prevent and limit the adverse effects of noise is provided in Planning Advice Note 1/2011[iii] (PAN1/2011). This is accompanied by more detailed advice provided in Technical Advice Note: Assessment of Noise[iv] (TAN-Noise).

10.11 PAN1/2011 and TAN-Noise both note that construction noise control can be achieved through planning conditions that limit noise from temporary construction sites, or by means of the CoPA. The CoPA provides two means of controlling construction noise. Section 60 provides the Local Authority with the power to impose, at any time, construction operating conditions on the site. Section 61 allows the developer to negotiate a prior consent for a set of construction operating procedures with the Local Authority before commencement of works.

10.12 For detailed guidance on construction noise and its control through the planning system, TAN-Noise states that the 2009 version including updates of British Standard BS 5228[v] (BS 5228) is applicable. This version of BS 5228 has, therefore, been adopted as the relevant version upon which to base the construction noise assessment.

10.13 BS 5228 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels, and example criteria which may be considered when assessing effect significance.

10.14 The guidance of BS 5228 has been further supported by Planning Advice Note 50/1996[vi] (PAN50/1996) by applying the guidance relating to the duration of construction working with its adaptation of the thresholds of criteria in BS 5228.

Consultation

10.15 In undertaking the assessment, consideration has been given to the scoping responses received for the KTR Project and other consultation undertaken specifically for the proposed development as detailed in **Table 10.1**.

Table 10.1: Consultation Responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
Environmental Health Officer (EHO) at Dumfries & Galloway Council (DGC), 28th June 2018	Informal telephone conversation with follow-up email.	Scope of assessment to be limited to construction noise. Use of BS 5228 and outline criteria proposed. Working hours to be limited to Monday to Friday 07:00 to 19:00 hours, Saturday 07:00 to 13:00 hours and no working on Sundays or Public Holidays.	The assessment covers the effects associated with construction noise only. BS 5228 has been used for setting criteria and the assessment. Working hours have been noted and form the basis of the assessment.

Study Area

10.16 The extent of the study area includes the planning application site, the existing Glenlee hydro power station and the residential dwellings immediately to the south-east of the site as illustrated on **Figure 10.1** as follows:

- Carville;
- Dunston;
- Tummel;
- Rannoch;
- Tarbert;
- Navar;
- Maree;

- Orrin; and
- Garry.

Desk Based Research and Data Sources

10.17 The noise assessment has been carried out as desk based work. The data source used for the noise assessment was BS 5228, along with information provided by SPEN on the likely type of construction machinery to be adopted on the site, and vehicle usage of the proposed construction access.

Field Survey

10.18 No noise measurement field survey has been conducted. The assessment methodology from BS 5228 does not require specific quantification of prevailing noise levels to conduct a worst case assessment.

Assessing Significance

Sensitivity

10.19 Sensitivity has been determined on the basis of following the guidance provided in TAN-Noise. The assignment of sensitivity to various noise sensitive receptor types is given in TAN-Noise as per **Table 10.2**:.

Table 10.2: Sensitivity of Receptor

Sensitivity	Description	Example Noise Sensitive Receptor
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate Quiet outdoor areas used for recreation Conference facilities Theatres/Auditoria/Studios Schools during the daytime Hospitals/residential care homes Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	Buildings not occupied during working hours Factories and working environments with existing high noise levels Sports grounds when spectator noise is a normal part of the event Night Clubs

10.20 The nearest identified noise sensitive receptors are the residential properties to the south-east of the site. The sensitivity allocated to the noise sensitive receptors from **Table 10.2**: is 'High'.

Magnitude

10.21 The magnitude of effect has been assessed based on the descriptive definitions provided in TAN-Noise, as provided in **Table 10.3** and the objective criteria from BS 5228 and guidance in PAN50/1996.

10.22 BS 5228 informative Annex E provides example criteria of absolute noise limits for construction activities and has been used to determine the significance of any construction noise effects within this assessment. The criteria do not represent mandatory limits but rather a set of example approaches intended to reflect the type of methods commonly applied to construction noise. In broad terms, the example criteria are based on a set of fixed limit values which, if exceeded, may result in a significant effect unless ambient noise levels are sufficiently high to provide a degree of masking of construction noise.

10.23 The range of guidance values detailed in BS 5228 Annex E has been used to numerically define the magnitude levels, as per **Table 10.3**. The presented levels have been normalised to free-field[1] daytime noise levels occurring over a time period, T, equal to the duration of a working day onsite. BS 5228 Annex E provides varied definitions for the range of daytime working hours which can be grouped for equal consideration. The values presented in **Table 10.3** have been chosen to relate to daytime hours from 07:00 to 19:00 on weekdays and 07:00 to 13:00 on a Saturday. In addition, as noted in PAN50/1996, where noise levels may be higher than usual for brief periods but which would not represent a sustained temporary impact, effects can be considered separately. For construction activities which may be expected to occur for less than 4 weeks in a year, the magnitude of corresponding effects is reduced.

10.24 The proposed construction works at the site will generally only be conducted Monday to Friday between approximately 07:00 to 19:00 hours in summer (April to September), and 08:00 to 17:00 hours (or as daylight allows) in winter (October to March). Hours will be 07:00 to 13:00 hours on Saturdays and there will be no working on Sundays or public holidays.. This forms the basis of the assessment in the present chapter. If any work was proposed outside of these core hours, this would be discussed with local residents before being agreed with D&GC through the CEMP. Therefore, only the daytime criteria of BS 5228 need to be applied.

10.25 The resulting construction works criteria are presented in **Table 10.3**.

Table 10.3: Classification of Magnitude of Adverse Noise Effects

Descriptors for Magnitude of Effect	Descriptor for Adverse Effect on Residential Properties	Daytime Criteria for Construction Noise	Short Duration Construction Noise Criteria: Activity Duration up to Four Weeks
Major	Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm. Trigger level for temporary rehousing, or reasonable cost thereof, as set-out in BS 5228.	Monday to Saturday, > $L_{Aeq,(working)}$ 75 dB	Monday to Saturday, > $L_{Aeq\ (working)}$ 85 dB
Moderate	Causes an important change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area. Trigger level for noise insulation works or cost thereof as set-out in BS 5228.	Monday to Saturday, > $L_{Aeq,(working)}$ 65 dB ≤ $L_{Aeq(working)}$ 75 dB	Monday to Saturday, > $L_{Aeq(working)}$ 75 dB ≤ $L_{Aeq(working)}$ 85 dB
Minor	Noise can be heard and may cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. Potential for non-awakening sleep disturbance. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life. Most stringent threshold value from BS 5228 method relevant to the site.	Monday to Saturday, > $L_{Aeq,(working)}$ 55 dB ≤ $L_{Aeq(working)}$ 65 dB	Monday to Saturday, > $L_{Aeq(working)}$ 65 dB ≤ $L_{Aeq(working)}$ 75 dB
Negligible	Noise can be heard, but does not cause any change in behaviour or attitude, e.g. increasing volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Monday to Saturday, ≤ $L_{Aeq,(working)}$ 55 dB	Monday to Saturday, ≤ $L_{Aeq(working)}$ 65 dB

10.26 Only the adverse effect descriptions have been included in **Table 10.3** as the introduction of construction noise to a receptor location is unlikely to be viewed as beneficial.

[1] Free-field is a term used in acoustics to mean in the absence of significant reflections, with the exception of the ground.

Significance

10.27 As noted in paragraph 10.20, the nearest identified receptors are all residential and therefore of 'High' sensitivity.

10.28 The relationship applied between magnitude of effect and sensitivity which is used to determine the level of significance is provided in **Table 10.4**. The principle of TAN-Noise has been followed, although, the references used have been labelled differently to those of TAN-Noise as defined in **Table 10.5**.

Table 10.4: Significance of Effects

Magnitude of Effect	Level of Significance at Receptor 'High' Sensitivity
Major	Major
Moderate	Moderate
Minor	Minor
Negligible	None

Table 10.5: Significance Descriptor Equivalence to TAN-noise

Significance of Effect	Equivalent TAN-noise Descriptor
Major	Very Large: These effects represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.
Moderate	Large: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.
Minor	Moderate: These effects, if adverse, while important, are not likely to be key decision making issues.
None	Slight: These effects may be raised but are unlikely to be of importance in the decision making process.

10.29 For this assessment, **major** and **moderate** effects are considered to be significant in the context of the EIA Regulations.

Assessment Limitations

10.30 The calculations have been based on specific construction plant noise levels provided as guidance in BS 5228. BS 5228 states: *"Values of the sound power levels for a particular type and size of machine and the equivalent continuous sound pressure levels for the site activities … will apply in the majority of cases, but can be lower or higher due to the make and maintenance of the machines, their operation and the procedures adopted when work is carried out."* Therefore, there could be potential for a variation gap in the source noise levels.

10.31 It is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant noise effects.

Existing Conditions

10.32 The existing Glenlee hydro power station and the proposed development are located in a rural area. The nearest main road is the A762 approximately 460m to the east. There is a small collection of nine residential properties to the south-east of the site.

10.33 The local noise climate is considered likely to comprise:

- distant road traffic;
- local road traffic;
- substation operation at Glenlee hydro power station;
- natural noise sources (e.g. birds, wind in trees etc.); and
- agricultural activity.

10.34 The prevailing noise levels are, therefore, considered to be predominantly low both for ambient and background noise.

Implications of Climate Change

10.35 Qualitatively, the UKCP18[vii] projects the following for Dumfries and Galloway:

- an increase in summer and winter temperatures;
- an increase in dry spells, particularly in summer months;
- an increase in winter rainfall; and
- an increase in wind speeds, including an increase in the frequency of winter storms.

10.36 The speed at which sound travels through dry air is affected by temperature; however such an increase as forecast is negligible in terms of the arrival time of sound at the receptors assessed. The increase in temperature as a result of climate change would therefore not have any material effect on the findings of this assessment. Other predicted changes in weather patterns would not affect the assessment.

The 'Do Nothing' Scenario

10.37 There is no other planned construction activity for the site. Environmental noise levels will remain as prevailing until any future development may occur or there is a change to the local road network and agricultural activity.

Micrositing

10.38 The proposed development layout has been designed to give consideration to the construction noise effects as far as possible, however it is possible that further micrositing of temporary works may be required. The design of the substation extension is considered to be sufficiently progressed that micrositing of the permanent infrastructure is unlikely to be necessary however any minor (non-material) changes would be within the site boundary, and would be agreed with Dumfries and Galloway Council.

Design Considerations

10.39 An initial review of the proposed construction work and operation strategy for the proposed development was conducted by SPEN and Hoare Lea. This resulted in identifying that noise is to be a consideration only for the construction stage as the operation of the installation is known from experience not to generate noise or vibration of an adverse level.

Assessment of Effects

10.40 The assessment of effects is based on the project description as outlined in **Chapter 4: Scheme Description**. Unless otherwise stated, potential effects identified are considered to be negative.

Construction Effects

Predicted Construction Effects

10.41 The main construction works are associated with forming the platform to accommodate the new substation equipment. The main earthworks will consist of approximately a 24 week programme[2], comprising two tasks which are detailed further in **Table 10.6** to **Table 10.10** below:

- Soil handling:
  - top soil removal;

[2] The full construction programme will be over 50 months as noted in **Chapter 4: Project Description and Construction, Operation and Maintenance**.

- softer subsoil removal; and
- import of material for platform.

- Rock removal.

10.42 The working day will be between 07:00 to 19:00 hours with up to two hours of break, therefore, a ten hour working day with plant expected to be operating up to 75% of the time during the working day. On a Saturday the working hours will be 07:00 to 13:00 hours and therefore working time will be lower.

10.43 The types of plant/machinery proposed for the construction works along with the source of the activity noise levels from BS 5228, or other, are provided in **Table 10.6**.

Table 10.6: Construction Plant/Machinery and Source Noise Levels

Stage of Works	Plant/Machinery Item	Quantity	BS 5228 Item Reference	Activity $L_{Aeq,T}$ dB or Manufacturer's L_w dB(A)
Enabling works	360 deg. excavator (large)	One	Table C.2 (2)	77
	Mobile crane	One	Table C.4 (39)	77
	Delivery vehicle	Five	Table C.8 (21)	80[#]
Access track construction	Mini tracked excavator 5 t trenching	One	Table C.4 (68)	65
	30 t excavator, Komatsu PC290LC8	One	N/A	104*
	Dumper 6 t distributing material	One	Table C.4 (6)	69 (79[+])
	Roller	One	Table C.2 (37)	69 (79[+])
	Wagon / HGV	36 per day	Table C.4 (32)	78
Earthworks for platform – soil handling	30 t excavator, Komatsu PC290LC8	One	N/A	104*
	Dumper 9 t distributing material	Two	Table C.4 (4)	66 (76[+])
	Roller	One	Table C.2 (37)	69 (79[+])
	Wagon / HGV	36 per day	Table C.4 (32)	78
Earthworks for platform – rock removal	Tracked crusher	One	Table C.1 (14)	82
	Pulveriser mounted on excavator	One	Table C.1 (3)	80
	Dumper 9 t distributing material	Two	Table C.4 (4)	66 (76[+])
	30 t excavator, Komatsu PC290LC8	One	N/A	104*
	Wagon / HGV	36 per day	Table C.4 (32)	78
Base construction	30 t excavator, Komatsu PC290LC8	One	N/A	104*
	Concrete pump	One	Table C.4 (25)	82
	Power tools	One	Table D.7 (12)	80
	Agitator (concrete lorry)	One	Table C.4 (26)	75
	Wagon / HGV	Ten per day	Table C.4 (32)	78
Commissioning	360 degree roto telehandler	One	Table C.4 (54)	79
	Telehandler	One	Table C.4 (54)	79
	Mobile elevated work platform	Two	Table C.4 (57)	67
Demobilisation	Mobile crane	One	Table C.4 (39)	77
	Delivery vehicle	Five	Table C.8 (21)	80[#]
Reinstatement and landscaping	Mini tracked excavator 5 t trenching	Two	Table C.4 (68)	65
	Wagon / HGV	One per day	Table C.4 (32)	78

[*] Note that manufacturer's rated sound power level has been used, not BS 5228 data.

[+] Note that the BS 5228 value is a maximum event noise level, which has been converted to an estimate activity $L_{Aeq,T}$ dB by subtraction of 10 dB.

[#] Note that this is an assumed value as BS 5228 doesn't provide an appropriate noise level for the activity type.

10.44 Plant/machinery operating in the proposed construction working area will vary in distance from a closest point to a furthest point to the residential receptors assessed. This is because the working location will change as the construction work progresses. Therefore, two distances have been used in the calculations to provide the range of best and worst case predicted noise levels for all receptors. The distances applicable are provided in **Table 10.7**.

Table 10.7: Distances Between Construction Processes and Receptors

Stage of Works	Minimum Distance to Receptors (m)	Maximum Distance to Receptors (m)	Worst Case Receptors
Enabling works	117	160	All in study area
Access track construction	8	58	Carville*
Earthworks for platform – soil handling	18	97	All except Orrin and Garry
Earthworks for platform – rock removal	18	97	All except Orrin and Garry
Base construction	20	77	All except Orrin and Garry
Commissioning	20	77	All except Orrin and Garry
Demobilisation	117	160	All in study area
Reinstatement and landscaping	18	97	All in study area

[*] Note that all residential properties in the study area are of a slightly further proximity.

10.45 The calculation method adopted is the '*Stationary plant – Plant sound power method*' of BS 5228 for all construction working except that of the temporary access track and temporary construction vehicle holding area usage, for which the '*Mobile plant – On haul roads*' is applied.

10.46 The source noise levels are a mixture of activity $L_{Aeq,T}$ dB and sound power levels. Therefore, to harmonise all sources to sound power levels, the activity $L_{Aeq,T}$ dB values of **Table 10.6** were converted to an equivalent sound power level by adding 28 dB(A) as defined in BS 5228.

10.47 A further adjustment has then been applied to correct the sound power level for the quantity of each item of plant/machinery using the term $+10.\log_{10}$ (quantity) and also the percentage on time using the term $+10.\log_{10}$ (percentage on time / 100). The corrected contribution sound power levels for the use of each plant/machinery item are provided in **Table 10.8**.

Table 10.8: Determination of Activity Contribution Sound Power Levels

Stage of Works	Plant/Machinery Item	Quantity Correction Term dB	Percentage On Time Correction Term dB (Percentage On Time)	Activity Contribution Sound Power Level dB(A)
Enabling works	360 deg. excavator (large)	0	-4 (40)	101
	Mobile crane	0	-6 (25)	99
	Delivery vehicle	+7	-20 (1)	95
Access track construction	Mini tracked excavator 5 t trenching	0	-4 (40)	89
	30 t excavator, Komatsu PC290LC8	0	-4 (40)	100
	Dumper 6 t distributing material	0	-1 (72.5)	96
	Roller	0	-10 (10)	87
	Wagon / HGV	+16	-20 (1)	102
Earthworks for platform – soil handling	30 t excavator, Komatsu PC290LC8	0	-3 (50)	101
	Dumper 9 t distributing material	+3	-1 (72.5)	96
	Roller	0	-6 (25)	91
	Wagon / HGV	+16	-20 (1)	102

Stage of Works	Plant/Machinery Item	Quantity Correction Term dB	Percentage On Time Correction Term dB (Percentage On Time)	Activity Contribution Sound Power Level dB(A)
Earthworks for platform – rock removal	Tracked crusher	0	-6 (25)	104
	Pulveriser mounted on excavator	0	-3 (50)	105
	Dumper 9 t distributing material	+3	-1 (72.5)	96
	30 t excavator, Komatsu PC290LC8	0	-3 (50)	101
	Wagon / HGV	+16	-20 (1)	102
Base construction	30 t excavator, Komatsu PC290LC8	0	-3 (50)	101
	Concrete pump	0	-6 (25)	104
	Power tools	0	-10 (10)	98
	Agitator (concrete lorry)	0	-10 (10)	93
	Wagon / HGV	+10	-20 (1)	96
Commissioning	360 degree roto telehandler	0	-13 (5)	94
	Telehandler	0	-13 (5)	94
	Mobile elevated work platform	+3	-13 (5)	85
Demobilisation	Mobile crane	0	-6 (25)	99
	Delivery vehicle	+7	-20 (1)	95
Reinstatement and landscaping	Mini tracked excavator 5 t trenching	+3	-4 (40)	92
	Wagon / HGV	0	-20 (1)	86

10.48 The resulting contribution sound power levels of **Table 10.8** have then been summed logarithmically to provide a total sound power level for each stage of works as provided in **Table 10.9**. The BS 5228 distance correction term for propagation over hard ground ($K_h'=20.\log_{10}(\text{distance}) + 8$) has been subtracted from the stage of works sound power level as a worst case (as the site ground could be compacted during the works).

Table 10.9: Predicted Sound Pressure Levels at the Residential Receptors

Stage of Works	Stage of Works Sound Power Level dB(A)	Reduction for Propagation K_h' dB (Minimum Distance to Receptors)	Receptor Received $L_{Aeq,T}$ dB (Highest Level)	Reduction for Propagation K_h' dB (Maximum Distance to Receptors)	Receptor Received $L_{Aeq,T}$ dB (Lowest Level)
Enabling works	104	49	55	52	52
Access track construction	105	26	79	43	62
Earthworks for platform – soil handling	105	33	72	48	57
Earthworks for platform – rock removal	109	33	76	48	61
Base construction	107	34	73	46	61
Commissioning	97	34	63	46	51
Demobilisation	100	49	51	52	48
Reinstatement and landscaping	93	33	60	48	45

10.49 For the access track usage the prediction equation from BS 5228 has been used to determine the received noise levels at the worst case location of Carville residential receptor, the equation being $L_{Aeq,T} = L_{WA} - 33 + 10.\log_{10}(Q) - 10.\log_{10}(V) - 10.\log_{10}(d)$, where for the access track, Q is four vehicles per hour, V is the average speed of 32km/hr and d is the distance of 8m. The predicted received sound pressure level at the Carville residential receptor is $L_{Aeq,T}$ 55 dB assuming an angle of view of 180 degrees.

10.50 A comparison of the predicted noise levels at the residential receptors with the objective magnitude of effect criteria set out in **Table 10.3** (daytime criteria for construction noise), provides the significance of effects set out in **Table 10.10**.

Table 10.10: Predicted Significance of Effect at Residential Receptors

Stage of Works	Magnitude of Effect	Significance of Effect*	Applicable Receptors
Enabling works	Negligible	**None**	All in study area
Access track construction	Minor to Major	**Major**	Carville (all other receptors are **Moderate**)
Earthworks for platform – soil handling	Minor to Moderate	**Moderate**	All except Orrin and Garry (Orrin and Garry are **Minor**)
Earthworks for platform – rock removal	Minor to Major	**Major**	All except Orrin and Garry (Orrin and Garry are **Moderate**)
Base construction	Minor to Moderate	**Moderate**	All except Orrin and Garry (Orrin and Garry are **Minor**)
Commissioning	Negligible to Minor	**Minor**	All in study area
Demobilisation	Negligible	**None**	All in study area
Reinstatement and landscaping	Negligible to Minor	**Minor**	All in study area
Use of access track	Negligible	**None**	All in study area

* Note that at this stage of the assessment, no account has been made of the duration of the noisiest working.

10.51 As indicated in **Table 10.10** the significance of effect of a number of the construction works will be minor to none. It is portions of the temporary access track and temporary construction vehicle holding area construction, earthworks for platform and base construction which have the potential to result in significant effects. Specifically, in some cases moderate to major adverse noise effects are predicted for some properties, although consideration of the duration of the noisiest works may reduce the magnitude of the impacts.

Proposed Mitigation

10.52 Substantial reduction of noise at source is not considered feasible as a mitigation measure due to the construction methods and type of plant/machinery required to construct the proposed development. Therefore, the proposed form of noise mitigation for the construction works is the inclusion of a noise barrier which is proposed to be put in place for the duration of construction. An example of a typical permanent noise barrier is shown in **Photograph 10.1**. Works associated with the construction of the noise barrier itself will be of very short duration and so would not be associated with significant effects.

Photo 10.1: Example of a Typical Permanent Noise Barrier[3]

10.53 The noisiest predicted works are the temporary access track and temporary construction vehicle holding area construction works due to their proximity to the eastern boundary. At the closest working location, the predicted excess over the upper threshold for minor significance is +14 dB. The earthworks for platform – rock removal is at worst +11 dB, with the earthworks for platform – soil handling and base construction +7 dB and + 8 dB respectively.

10.54 BS 5228 provides noise barrier screening advice, for which the reduction due to screening has been taken as a reasonable representation based on a worst case at low to mid-frequency (250Hz). The reduction due to screening is directly related to the path length difference which is the difference between the direct path of sound without the noise barrier present and the increased path length with the noise barrier in place. The top of the noise barrier must cut out the direct line of sight between the source of noise (i.e. engine, tracks or attachment interaction with the ground and not the overall item of plant itself) and the receptor location (ground floor windows and doors of residential receptors).

10.55 Based on the local topography and distances to plant/machinery and residential receptors due to noise barrier placement, the noise barrier will need to be 2.5m in height as per **Table 10.11** to provide practical benefit. The noise barrier will be installed as a continuous solid barrier between the rear gardens of the residential properties listed below and the application site as illustrated on **Figure 10.1**[4]:

- Carville;
- Tummel;
- Rannoch (also returned along portion of south-west property boundary);
- Tarbert (also returned along portion of north property boundary);
- Navar;
- Maree;
- Orrin; and
- Garry.

[3] Image provided courtesy of Harlestone Group Ltd.

[4] Note that the location of Dunston is illustrated on Figure 10.1 however as it is located south-east of Carville the noise barrier will not extend to the curtilage of this property.

10.56 It is proposed to retain the section of the noise barrier to the rear of the Rannoch, Tummel, Dunston and Carville properties permanently beyond the end of the construction phase. Other sections of the proposed barrier would be removed following the construction phase.

Table 10.11: Noise Barrier Analysis

Stage of Works	Distance from Source to Noise Barrier m	Distance from Nearest Receptor to Barrier m	Height of Noise Barrier m	Predicted Path Length Difference m	Reduction in Received Noise Level dB
Access track construction	4.5	7.5	2.5	0.31	11
Earthworks and base construction	18	15	2.5	0.14	9

10.57 To be effective at resisting sound transfer directly through the noise barrier material, it will need to be closed off at low level to the ground, contain no small gaps between panels and be of a minimum mass per unit surface area of at least 7 kg/m^2.

10.58 It can be seen even with the 2.5m high noise barrier, there would still be a predicted excess of +3 dB (+14 dB – 11 dB) for the temporary access track and temporary construction vehicle holding area construction works and +2 dB (+11 dB – 9 dB) for the earthworks for platform – rock removal above the upper threshold for minor significance. The earthworks for platform – soil handling and base construction stages are mitigated below the upper threshold of minor significance by the incorporation of the noise barrier.

10.59 Consideration has therefore also been given to the duration of working above the upper threshold of minor significance for the two noisiest activity stages, with the mitigation provided by the noise barrier already taken into account.

10.60 The working areas vary in distance to the receptors considerably, which implies that the worst case working duration will be less than the overall activity working duration for assessment purposes. **Table 10.12**Error! Reference source not found. provides details of the worst case working durations based on the minimum distance away before the predicted noise levels would be $L_{Aeq,T}$ 65 dB (i.e. the upper threshold of Minor significance from **Table 10.3**).

Table 10.12: Construction Working Duration Analysis

Stage of Works	Duration of Activities* (weeks)	Depth / Length of Working Area (m)	Minimum Distance Into Working Area Where $L_{Aeq,T}$ 65 dB At Receptor Is Predicted (m)	Percentage Duration of Activity# (%)	Number of Weeks Above $L_{Aeq,T}$ 65 dB
Access track construction	Approx. 28	50	3	6	Less than 2
Earthworks for platform – rock removal	Approx. 24	59	4	7	Less than 2

* Approximate duration from construction programme. Note that all activities will occur across a working area and will not all occur at the closest location for the full working duration.

An assumption has been made that the percentage of distance across working area is equivalent to the percentage duration of working in that proximity zone.

10.61 It can be concluded from **Table 10.12** that the duration of the noisiest working periods when added together across the works are less than four weeks in a year. Therefore, when considering the residual construction effects, the criteria for assessment are those of the short duration construction criteria of **Table 10.3**.

10.62 In addition to the proposed noise barrier, in partnership with SPEN, the appointed contractors will be required to maintain close liaison with local community representatives, landowners and statutory consultees throughout the construction period. This is likely to include circulation of information about ongoing activities, particularly those that could potentially cause disturbance, including due to noise. A

telephone number will be provided and persons with appropriate authority to respond to calls and resolve any problems made available.

10.63 All construction activities will also be undertaken in accordance with good practice as set out in BS5228-1. All equipment will be maintained in good working order and will be fitted with appropriate noise control at all times (for example, silencers, mufflers and acoustic hoods). All site employees will be advised of the noise sensitive nature of the area and will be informed to adopt the quietest work practices, where appropriate. Site terrain, material stockpiles and suitable work locations will be used so as to screen work locations and maximise the distance between work activities and receptors where possible.

10.64 The proposed mitigation measures will be formally documented with DGC either by way of planning conditions or as part of an agreement under Section 61 of the Control of Pollution Act 1974 for prior consent of works. A CEMP will be secured which will set out a range of management measures related to the construction activities, including the mitigation measures described, as well as the construction working hours. This is detailed further in **Chapter 4: Development Description, Construction, Operation and Maintenance**. As noted above, any work proposed outside the hours of 07:00 to 19:00 hours on weekdays and between 07:00 and 13:00 on Saturdays would be discussed with local residents before being agreed with DGC through the CEMP.

Residual Construction Effects

10.65 Re-evaluation of the predicted noise levels at the residential receptors for the construction working stages, implementing the noise barrier mitigation proposal and other mitigation noted above, and taking into account the duration of noisy works, demonstrates the significance of effects can be reduced to **minor significance** based on the criteria set out in **Table 10.3** and as detailed in **Table 10.13**.

Table 10.13: Residual Significance of Effect Following Mitigation

Stage of Works	Receptor Received Noise Level Range $L_{Aeq,T}$ dB	Magnitude of Effect	Significance of Effect	Applicable Receptors
Access road construction	51 – 68[1]	Negligible to Minor[1]	**Minor**	All in study area
Earthworks for platform – soil handling	48 – 63	Negligible to Minor	**Minor**	All except Orrin and Garry (Orrin and Garry are **None**)
Earthworks for platform – rock removal	52 – 67[1]	Negligible to Minor[1]	**Minor**	All in study area
Base Construction	52 - 64	Negligible to Minor	**Minor**	All except Orrin and Garry (Orrin and Garry are **None**)

[1] The noisiest activity of these combined stages occurs for less than four weeks. Therefore, the stages have been assessed using the short duration construction criteria of **Table 10.3**.

Cumulative Construction Effects

Predicted Cumulative Effects during Construction

10.66 With the exception of the KTR Project, all other known developments that could be constructed at the same time are considered to be such a considerable distance away from the identified residential receptors that they would produce no material increase in the predicted noise levels at the site.

10.67 Based on the indicative construction programmes for the proposed development and the proposed KTR Project, any overlap of works would occur in the commissioning stages of the Glenlee substation extension (spring 2022, autumn 2023 and spring / summer 2024, with final commissioning late 2024). The activity noise levels during the commissioning stage of the Glenlee substation extension with the noise barrier in place are at such a low level of approximately $L_{Aeq,T}$ 54 dB ($L_{Aeq,T}$ 63 dB worst case working -9 dB from noise barrier) at Carville and Dunston that they are unlikely to substantially increase the KTR Project predicted noise effects. No further mitigation needs to be considered for cumulative effects.

Interrelationship between Effects

10.68 Noise from construction vehicle movements on the eastern boundary access track and temporary construction vehicle holding area is directly dependant on the quantity of vehicles per hour and the speed at which they move. The assessment in this chapter has been based on robust assumptions on the associated noise levels and changes in the assumed traffic movements are considered unlikely to affect the conclusions of the assessment.

10.69 Construction traffic on the local road network and operational road traffic have been scoped out of the assessment.

Further Survey Requirements and Monitoring

10.70 The need for monitoring of noise during key periods of the construction programme would be discussed in consultation with D&GC. At the discretion of the contractor, noise measurements could also be instigated should there be a dispute arising over the working practises that cannot be resolved by other means. There will be no requirement for post-construction surveys or monitoring for noise.

Summary of Effects

10.71 **Table 10.14** below summarises the predicted effects of the proposed development on noise.

Table 10.14: Summary of Effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction Noise	Moderate to Major	Noise Barrier, close liaison with local community, good practice measures.	**Minor**

[i] Environmental Protection Act 1990, Chapter 43, (TSO)
[ii] Control of Pollution Act 1974, Chapter 40, (HMSO)
[iii] The Scottish Government, Planning Advice Note 1/2011 Planning and Noise, March 2011
[iv] The Scottish Government, Technical Advice Note: Assessment of Noise, March 2011
[v] British Standard BS 5228-1:2009 + A1:2014, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (BSI Standards Limited)
[vi] The Scottish Government, Planning Advice Note 50: controlling the environmental effects of surface mineral workings, October 1996
[vii] UK Climate Projections (2019) [online], available at: http://www.metoffice.gov.uk/research/collaboration/ukcp Accessed August 2019

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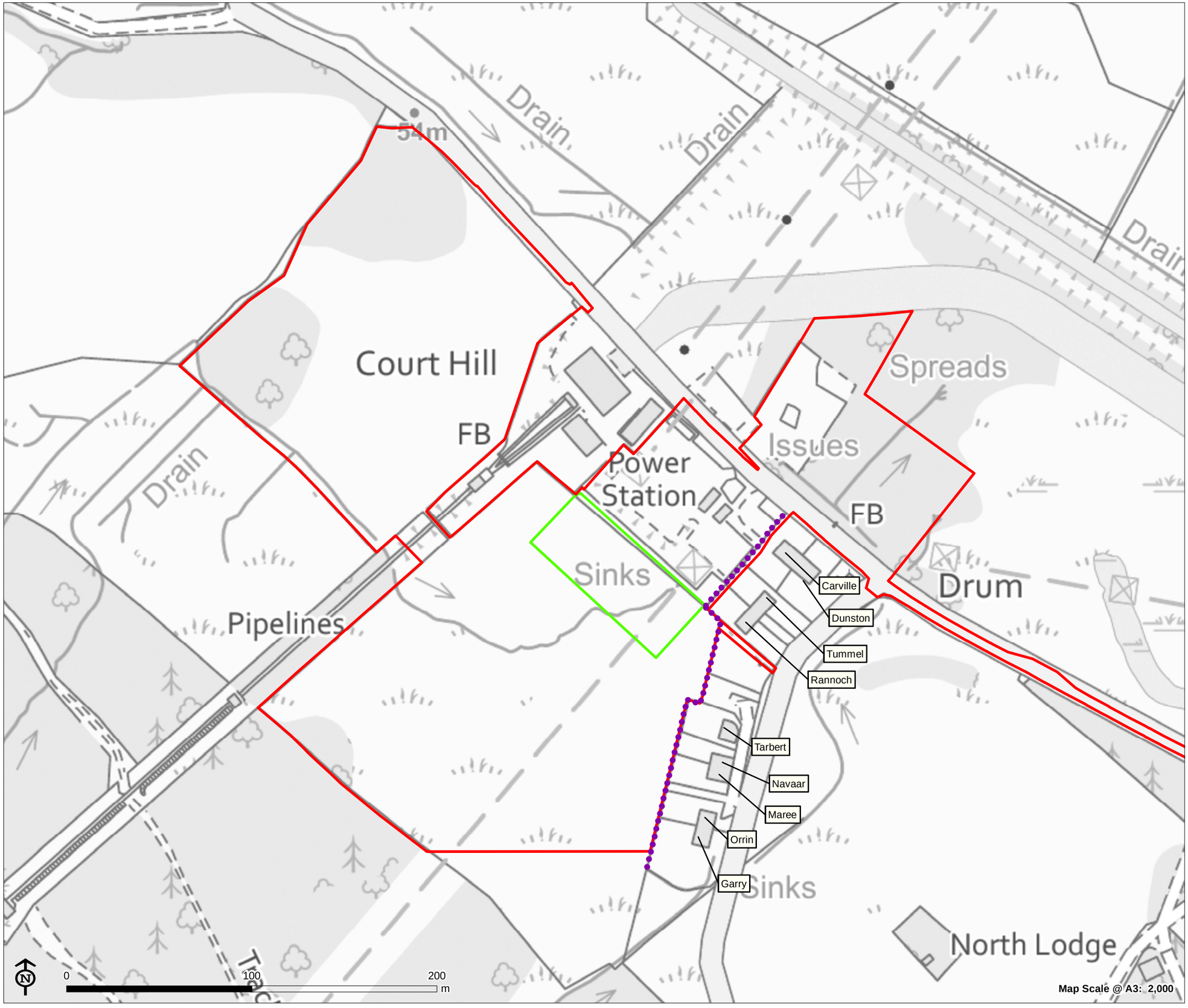
Figure 10.1: Glenlee Substation Extension Nearby Properties and Noise Fence Location

- Planning application boundary
- Substation extension
- Noise fence



CB:JN EB:robertson_s LUCGLA FIG10-01_6118-001_Glenlee_Substation_Noise 27/08/2019