East Anglia ONE
Offshore Windfarm

# East Anglia ONE Offshore Windfarm

## Construction Noise and Vibration Management Plan
## DCO Requirement 22 and 20 (2) (d)
## Final for Approval

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# 1 Introduction

## 1.1 Project Overview

1. East Anglia ONE Limited (EAOL) was awarded a Development Consent Order (DCO) by the Secretary of State, Department of Energy and Climate Change (DECC) on June 17th 2014 for East Anglia ONE Offshore Wind Farm (EA ONE). The DCO granted consent for the development of a 1200MW offshore windfarm and associated infrastructure.

2. In February 2015 EAOL secured a Contract for Difference (CfD) award to build a 714MW project and ScottishPower Renewables announced its role in leading East Anglia ONE towards construction. In April 2015, EAOL submitted a non-material change application to DECC to amend the consent from direct current (DC) technology to alternating current (AC). In March 2016 DECC authorised the proposed change application and issued a Corrections and Amendments Order.

3. This plan relates to the onshore construction works associated with EA ONE, which based on the AC technology with an installed capacity of 714MW and a transmission connection of 680MW comprises of;

- A landfall site at Bawdsey, Suffolk.
- Up to six underground cables, approx. 37km in length.
- Up to four cable ducts for the future East Anglia THREE project.
- An onshore substation located at Bramford next to existing National Grid infrastructure.

## 1.2 Scope and Purpose

4. This Construction Noise and Vibration Management Plan sets out the mitigation and control measures to be applied to the construction of the EA ONE onshore works to minimise potential noise and vibration impacts on nearby residents and other sensitive receptors during construction. This plan has been produced to fulfil DCO Requirement 22 (1) & (2) and 20 (2) (d) and which state:

***20*** *(2)* (d).*The code of construction practice must include:*
- *a written scheme for noise and vibration management during construction;*

***22****. (1). No stage of the connection works shall commence until a written scheme for noise and vibration management (which must accord with the outline code of construction practice) during construction of that stage has been submitted to and approved by the relevant planning authority. The scheme for noise and vibration management must form part of the code of construction practice.*

*(2). The scheme must set out the particulars of—*

*(a) the construction works, and the method by which they are to be carried out;*

*(b) the noise attenuation measures to be taken to minimise noise resulting from the construction works, including any noise limits; and*

*(c) a scheme for monitoring the noise during the construction works to ensure compliance with the noise limits and effectiveness of the attenuation measures.*

5. The purpose of this Construction Noise and Vibration Management Plan is to ensure that the onshore construction works of EA ONE comply with relevant European and UK legislation, DCO Requirements, environmental commitments as set out in the Environmental Statement (ES), and environmental and construction best practice.

# 2 Legislation and Guidelines

6. The following legislation and guidelines for the assessment of noise and vibration, arising from construction activities, will be utilised throughout the duration of the project:

- Noise and Statutory Nuisance Act 1993.
- Environmental Protection Act 1990.
- Control of Pollution Act 1974 (CoPA).
- Overarching National Policy Statement for Energy (EN-1). Department of Energy and Climate Change (July 2011).
- National Planning Policy Framework (NPPF). Department for Communities and Local Government (March 2012).
- BS7445-1:2003: Description and Measurement of Environmental Noise. Guide to quantities and procedures.
- BS5228-1:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.
- BS5228-2:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration.

# 3 Construction Details

## 3.1 Construction Details

### 3.1.1 Enabling Works

7. The onshore construction works will commence with the enabling works, which includes the establishment of the construction compounds (herein referred to as Construction Consolidation Sites), fencing and securing the working width, the topsoil strip and the installation of a haul road.

8. The onshore construction works will be supported by the installation of nine Construction Consolidation Sites (CCSs) (referenced A to I), these are compounds which will be utilised to provide welfare, site staff accommodation, parking, and secure storage for materials, plant and equipment. The CCSs are categorised as either Primary or Secondary, depending on their intended uses. There are two Primary CCSs; CCS B will be a designated storage and delivery facility and the main administrative compound and CCS E will be a main storage and delivery facility, with designated office space. The remaining seven Secondary CCSs shall be used to access the internal haul road, storage and deliveries. The establishment of the CCS compounds will be one of the first construction activities undertaken.

9. During the construction of the substation, site establishment and laydown areas will be required, including temporary offices, welfare, car parking, materials and equipment storage. The area directly east of the substation will be used as the temporary works area (referred to as Work No 38 within the DCO). At the start of the works the onshore substation compound and temporary works will be temporarily fenced.

10. The linear nature of the onshore cable route site will require fencing to be installed to both sides along the working width, not only to delineate the route but also to prevent possible vandalism and theft which could lead to possible contamination incidents.

11. Topsoil shall be stripped from the haul road location, trench areas and subsoil storage areas and stored. Topsoil storage and management shall be compliant with the recommendations and requirements set out in the Cable Landscape Management Plan (EA1-CON-R-IBR-010129). Topsoil shall be stored to one side of the working width**,** in such a way that it is not mixed with any subsoil. Typically this would be stored as an earth bund of a maximum height of two metres, to avoid compaction from the weight of the soil. Storage time shall be kept to a minimum, to prevent the soil deteriorating in quality. Topsoil stripped from different fields shall be stored separately, as would soil from specific hedgerow banks or woodland strips.

12. A temporary haul road will be installed along the route between the CCS locations and access points onto the local roads. Temporary haul road construction typically involves the placement of suitable imported stone material on a geotextile, however other methods such as soil stabilisation may be used if considered appropriate. In some instances the temporary haul road may comprise temporary trackway rather than stone due to site specific constraints. Following the initial topsoil stripping the haul road will be installed for a width of 5.5m along a designated route. The temporary haul road shall be constructed working from the installed CCS locations in two directions away from the CCS and towards the adjacent CCS along the onshore cable route.

### 3.1.2 Onshore Cable Route

13. The onshore cable route comprises a 37km corridor, between the Suffolk coast at Bawdsey and the substation at Bramford, passing the northern side of Ipswich. The onshore cable works comprise the installation of electricity transmission cables and ducts between the landfall location at Bawdsey and the new substation station, which is adjacent to the existing substation at Bramford. The majority of the route will be constructed using open trenching methods, other than in certain locations where the cable route traverses a number of major transport networks and natural obstacles. To enable the installation of the cable under these features, specialist trenchless techniques will be employed, such as Horizontal Directional Drilling (HDD).

14. Construction activities will be undertaken within a temporarily fenced strip of land, referred to as the working width. The working width is determined by electrical and civil engineering considerations and allows for sufficient space between the cables trenches to prevent the cables overheating, plus space for the associated temporary construction works i.e. soil storage, drainage, haul road installation and work areas for personnel and machinery. In accordance with the DCO, the

working width shall not exceed 55m, except at the HDD locations identified in DCO Requirement 10 (6), where the working width is permitted to be increased to allow for the installation and use of the specialist equipment to undertake the HDD.

15. There are two basic techniques to be used for the installation of the cable ducts during the construction of the onshore cable route. These are:

- **Open Cut techniques**; where a trench is excavated and the cable ducts laid in the trench before reinstatement, using the excavated material; and
- **Trenchless Technique**; typically HDD, where a pit is excavated to access the crossing and from which a drill is passed through the ground on one side of the obstacle to a receiving pit created on the opposite side. The bore is then gradually enlarged to receive the duct, which is the technique that will be used to pass under roads, main rivers and other sensitive sites.

16. For the open cut technique two trenches will be excavated for the EA ONE ducts and cables and an additional trench will be excavated in parallel for the cable ducts that will be installed to serve EA THREE in the future. An indicative cross section showing the open trench working width layout is included in Appendix 1. As the trench excavation progresses, subsoil will be removed to create the trenches to working depth for duct installation, the subsoil will be temporarily stored separately from the topsoil, and then reused to backfill the trenches.

17. Particular care will be taken when backfilling the trenches with the excavated material (subsoil) to reinstate it in the order in which it was excavated, again to minimise any disruption to the existing ground drainage pattern. The ducts will be installed in the trench, where they will be bedded on and then surrounded and topped by Cement Bound Sand (CBS) or equivalent which will gradually set and harden in situ as water is absorbed. Above this, the subsoil will then be used to reinstate the trench to the previous level.

18. Where, due to the existence of obstacles, it is not possible to install the cable ducts using the open trench method, trenchless installation techniques shall be used. The onshore cable route traverses a number of major transport networks and natural obstacles, to enable the installation of the cable across these features specialist techniques are required, namely the use of HDD. These key locations are referred to a 'Category 1' HDD sites as identified in Table 3-1.

19. These HDD sites will require additional equipment, storage and ancillary facilities to that required for the conventional open trench installation methods in order to accommodate the drilling activities. As such, a specialist HDD compound will be set up at each side of the HDD location to enable the specialist plant and materials to be delivered directly.

20. In addition to the above major features, a number of other features have been identified where the conventional open cut trenching technique are not appropriate. At these locations 'trenchless' methods will also to be implemented, which will comprise of a smaller HDD or auger bore. These sites are referred to as 'Category 2' HDD/trenchless. As the features to be crossed are less significant, they will not require any additional compounds and works will take place within the standard working width. Table 3-1 provides a list all the HDD / trenchless locations.

Table 3-1 HDD / Trenchless Locations

| Reference | Category | Location/ Feature | Approximate Length (m) | Max Width (m) |
|---|---|---|---|---|
| HDD-01 | Cat 1 | Millers Wood off Bullen Lane | 200 | 130 |
| HDD-02 | Cat 2 | Somersham Watercourse | 70 | 55 |
| HDD-03 | Cat 2 | Pound Lane | 60 | 55 |
| HDD-04 | Cat 1 | River Gipping and Network Rail track west of A14 | 385 | 130 |
| HDD-05 | Cat 1 | A14 Trunk Road and Old Ipswich Road | 200 | 160 |
| HDD-06 | Cat 2 | River Fynn | 30 | 55 |
| HDD-07 | Cat 2 | Lodge Road | 60 | 25 |

| | | | | |
|---|---|---|---|---|
| HDD-08 | Cat 1 | A12 Trunk Road | 165 | 120 |
| HDD-09 | Cat 2 | Top Street | 90 | 55 |
| HDD-10 | Cat 2 | Sandy Lane | 90 | 50 |
| HDD-11 | Cat 1 | Martlesham Creek and Network Rail tracks south of Woodbridge | 650 | 160 |
| HDD-12 | Cat 2 | Waldringfield Road | 70 | 55 |
| HDD-13 | Cat 2 | Watercourse east of Howe's Farm | 50 | 55 |
| HDD-14 | Cat 1 | Kirton Creek | 550 | 110 |
| HDD-15 | Cat 2 | Sewage works outfall watercourse | 50 | 55 |
| HDD-16 | Cat 1 | River Deben | 700 | 55 |
| HDD-17 | Cat 2 | Queen's Fleet | 70 | 55 |
| HDD-18 | Cat 1 | Landfall, Bawdsey | 1000 | 160 |
| HDD-19 | Cat 2 | Bramford Road | 60 | 55 |
| HDD-20 | Cat 2 | Grundisburgh Road | 50 | 55 |

21. The HDD technique is expected to be used at the majority of locations on the route where a trenchless method is required. This involves creating an access pit on either side of the obstacle to facilitate the installation of the drilling equipment and allow drilling under the obstacles, at an appropriate depth allowing the installation of the ducts. The HDD sites will have two access points, one either side of the HDD location, the drilling rig will be positioned on one side of the feature with ducting placed at the opposite side ready to be pulled back through the opening on completion of drilling.

22. Once the cable duct installation is completed then works will commence on the installation of the EA ONE cables within the pre-installed ducting system. As the onshore cabling typically comes on drums of up to 1,300m in length, jointing bays will be required along the cable route to join each section of cable together. These jointing bays will be constructed at regular intervals along the onshore cable route to allow cable pulling and jointing at a later stage. The joint bay with be excavated to size and a concrete poured floor with concrete or blockwork walls surround will be installed and topped with concrete slabs to leave ground cover to a depth of 1.1m.

23. Further details on the construction methodology for the onshore cable route are presented in the Cable Method Statement (EA1-CON-R-IBR-021238).

### 3.1.3 Onshore Substation

24. The EA ONE onshore substation will be located within a fenced compound (150m by 190m) to the north of the existing National Grid Bramford Substation. The substation will contain electrical equipment including power transformers, switchgear, reactive compensation equipment, harmonic filters, cables, control buildings and other associated equipment, which will largely be outside with a number of the components being within the buildings.

25. The construction of the substation will include a number of key stages; include enabling works, foundations and building construction and equipment installation and commissioning. The enabling will include grading and earthworks to remove any unsuitable materials from the substation area and provide a level platform at an elevation of 56m AOD. Where possible, the materials excavated will be reused on site as engineering fill or landscaping depending on material properties. The enabling works will also include the construction of the main concrete access road.

26. Following the completion of the site grading, works will commence of the excavations for foundation for the building and trenches to accommodate electrical infrastructure and installation of the drainage networks.

27. The building is largely comprised of steel and cladding materials, with brick/blockwork at the base. The structural steelwork will be fabricated and prepared off site and delivered to site for erection activities using cranes. The composite cladding panels (e.g. Kingspan) will be delivered to site ready to erect and be fixed to the steelwork.

28. For the installation and commissioning phases a variety of specialist activities are required. The main items of electrical infrastructure, for example transformers, will be delivered sealed to site. Due to their size and weight they will be delivered via specialist means and offloaded with the use of a mobile crane (please see Traffic Management Plan (EA1-CON-R-IBR-009583) for details of abnormal load transport procedures). The smaller electrical components will be constructed on site using small mobile plant and lifting apparatus.

### 3.2 Schedule and Working Hours

29. The onshore construction works are proposed to start works in January 2017 and are planned to take approximately 2 year to complete.

30. DCO Requirement 23 defines the construction working hours as follows:

> ***23.***—*(1) Construction work for the connection works and any construction-related traffic movements to or from the site of the connection works shall not take place other than between 0700 hours and 1900 hours Monday to Saturday, with no activity on Sundays or bank holidays, save—*
>
> > *(a) where continuous periods of operation are required as assessed in the environmental statement, such as concrete pouring and directional drilling (subject to sub-paragraphs (3) and (4));*
> >
> > *(b) for internal fitting out works associated with the onshore converter station comprised within Work No. 39;*
> >
> > *(c) for the delivery of abnormal loads to the connection works, which may cause congestion on the local road network; and*
> >
> > *(d) where connection works are being carried out on the foreshore.*
>
> *(2) All construction operations which are to be undertaken outside the hours specified in subparagraph (1) must be agreed with the relevant planning authority in writing in advance, and must be carried out within the agreed times.*
>
> *(3) Construction of Work No. 21 shall not take place other than between 0700 hours and 1900 hours Monday to Saturday, with no activity on Sunday or bank holidays.*
>
> *(4) Construction of Work No. 26 shall not take place other than between 0700 hours and 1900 hours Monday to Friday and 0700 hours and 1400 hours on Saturday, with no activity on Sunday or bank holidays.*

# 4 Noise and Vibration Assessment

## 4.1 Noise Assessment

35. In undertaking the Environmental Impact Assessment for EA ONE a noise and vibration assessment was completed to identify and assess the potential activities associated with the proposed onshore construction works that could lead to noise and vibration impacts on receptors (Environmental Statement Volume 3, Chapter 26 Noise and Vibration). The Environmental Statement (ES) was undertaken by Environmental Resource Management in November 2012 and the Noise and Vibration Assessment by RSK in October 2012.

36. The noise and vibration assessment was done, taking in to account the requirements stated in the Sections 5.11.4 to 5.11.7 of the National Policy Statement EN-1 (NPS EN-1). In this sense, the NPS EN-1 states that, "*where noise impacts are likely to arise, the applicant should include:*

- *a description of the noise generating aspects of the development proposal leading to noise impacts including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise;*
- *identification of noise sensitive premises and noise sensitive areas that may be affected;*
- *the characteristics of the existing noise environment;*
- *a prediction of how the noise environment will change with the proposed development;*
  - *in the shorter term such as during the construction period;*
  - *in the longer term during the operating life of the infrastructure;*
  - *at particular times of the day, evening and night as appropriate;*
- *an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive area; and*
- *measures to be employed in mitigating noise."*

37. To carry out the noise and vibration assessment a worst case scenario was selected taking into account the following aspects:

Table 4-1 Worst Case Criteria

| Worst Case Criteria | Notes |
|---|---|
| **Onshore Cable Route** | |
| Maximum construction period | • Up to 44 weeks. This period could be non continuous,spread over 2 years |
| Construction Hours | • For cable trenching: assumes Mon-Sat12 hour days<br>• For HDD a worst case of 24hour operations |
| Maximum number of vehicle movements | • 29 HGV deliveries per day for each of the sections of Onshore Cable Route;<br>• 45 HGV deliveries per day for each HDD location |
| Maximum number of personnel | • 79 per 500km cable route section per day<br>• 9 per HDD rig per day |
| Spoil and backfill | • Assumes removal off site using tipper trucks. Estimated 25 trucks per week for removal.<br>• Assumes importation of sand for backfill generating 20 trucks per week.<br>• This is worst case. Likely that all spoil will be reused on site. |
| **Onshore Substation** | |
| Maximum construction period | • Up to 46 weeks. This period could be non continuous, spread over 2 years |
| Construction hours | • Assumes 6 day week and 12 hours days |
| Maximum number of vehicle movements | • 14 HGV movements per day |
| Maximum number of personnel | • 100 per day |

38. The methods within BS 5228-1 and BS 5228-2 were used to assess noise and vibration from the onshore construction works, as defined in Section 1.1, and include the onshore cable route, onshore substation, CCSs and HDD locations.

39. In order to assess the noise from road traffic, the method CRTN (Calculation of Road Traffic Noise) produced by the Department of Transport / Welsh Office and the guidance provided by the Highways Agency (Design Manual for Roads and Bridges. Volume 11, Section 3, Part 7 Had 213/11 Noise and Vibration) were taken into account.

40. The noise levels of the equipment to be used for different stages of the onshore construction works are shown in Table 4-2 to Table 4-4.

Table 4-2 Noise Levels of Construction Equipment – Onshore Cable Route

| Noise Levels of Construction Equipment – Cable Installation | | | | | | |
|---|---|---|---|---|---|---|
| **Scenario** | **Activity** | **Plant** | **No.** | **BS 5228 ref.** | **Operational hours %** | **A-weighted SPL (dB(A) at 10 m)** |
| **Onshore Cable Route** | | | | | | |
| A | Site clearance | Chainsaw | 1 | D.2.14 | 25% | 86 |
| B | Topsoil strip | Tracked excavator (22t) | 2 | C.2.3 | 90% | 73 |
| | | Dozer | 3 | C.2.1 | 90% | 75 |
| C | Construction of temporary site access road | Wheeled backhoe loader (8t) | 1 | C.2.8 | 90% | 68 |
| | | Dumper (5t) | 2 | C.4.7 | 90% | 78 |
| | | Vibratory roller (3t) | 1 | C.2.40 | 90% | 73 |
| D | Trench excavation | Tracked excavator (16t) | 1 | C.2.2 | 90% | 76 |
| | | Tracked mobile crane | 1 | C.3.29 | 90% | 70 |
| | | Sheet Piling – Hydraulic jacking | 1 | C.3.9 | 90% | 63 |
| | | Powe Pack | 1 | C.3.10 | 90% | 68 |
| | Trench bedding | Wheeled backhoe loader (8t) | 1 | C.2.8 | 90% | 68 |
| | | Vibratory roller (3t) | 1 | C.2.40 | 90% | 73 |
| | Junction Bay | Welding generator | 3 | C.3.32 | 90% | 73 |
| | | Welder | 3 | C.3.31 | 90% | 73 |
| | | Generator | 3 | C.4.94 | 100% | 75 |
| | | Angle grinder | 2 | C.4.93 | 90% | 80 |
| | | Side boom (Use tracked mobile crane data) | 1 | C.3.28 | 90% | 67 |
| D&E | Pumping | Water pump | 1 | C.4.88 | 100% | 68 |
| E | Cable pulling | Conveyor drive unit | 1 | C.10.20 | 100% | 77 |
| | | Field conveyor (rollers) | 2 | C.10.23 | 100% | 53 |
| | Lower and lay ducting | Side boom (Use tracked mobile crane data) | 3 | C.3.28 | 90% | 67 |
| | | Wheeled backhoe loader (8t) | 1 | C.2.8 | 90% | 68 |
| F | Reinstatement | Wheeled backhoe loader (8t) | 1 | C.2.8 | 90% | 68 |
| | | Tracked excavator (16t) | 1 | C.2.5 | 90% | 76 |
| | | Dumper (5t) | 2 | C.4.7 | 90% | 78 |
| | | Vibratory roller (3t) | 2 | C.2.40 | 90% | 73 |
| G | Horizontal Directional Drilling Entry Point | Drill Rig Option: Smaller Sites – Crawler | 1 | A E Yates* | 100% | 80 at 5 m |
| | | Drill Rig Option: Larger Sites - Track Mounted | 1 | C.3.21 | 100% | 79 |
| | | Power Pack | 2 | C.3.10 | 100% | 68 |
| | | Mixing Unit / Recycling Unit (Pumps) | 2 | C.4.88 | 100% | 68 |
| | | Generator | 1 | C.4.86 | 100% | 65 |
| | Horizontal Directional Drilling Exit Point | Generator | 2 | C.4.86 | 100% | 65 |
| | | Water pump | 2 | C.4.88 | 100% | 68 |

Table 4-3 Noise Levels of Construction Equipment – Construction Consolidated Sites

| **Noise Levels of Construction Equipment – Primary Construction Consolidation Sites** | | | |
|---|---|---|---|
| **Plant** | **No.** | **Operational hours** | **A-weighted SPL (dB(A) at 10m)** |
| Wheeled loader | 1 | 80% | 71 |
| Dumper | 1 | 80% | 76 |
| Wheeled mobile telescopic crane | 1 | 80% | 67 |
| Diesel generator for site cabins | 1 | 100% | 65 |
| **Noise Levels of Construction Equipment – Secondary Construction Consolidation Sites** | | | |
| **Plant** | **No.** | **Operational hours** | **A-weighted SPL (dB(A) at 10m)** |
| Wheeled loader | 1 | 60% | 71 |
| Dumper | 1 | 60% | 76 |

Table 4-4 Noise Levels of Construction Equipment – Onshore Substation

| **Noise Levels of Construction Equipment – Onshore Substation** | | | |
|---|---|---|---|
| **Plant** | **No.** | **Operational hours** | **A-weighted SPL (dB(A) at 10m)** |
| **Earthworks** | | | |
| Front end loaders (wheeled) | 1 | 90% | 82 |
| Tracked excavator | 1 | 90% | 77 |
| Wheeled backhoe loader | 1 | 90% | 68 |
| Wheeled loader | 1 | 90% | 71 |
| Dozer | 1 | 90% | 80 |
| Articulated dump truck | 1 | 90% | 76 |
| Road roller | 1 | 90% | 80 |
| Diesel generator for site cabins | 1 | 100% | 74 |
| **Foundation** | | | |
| **Plant** | **No.** | **Operational hours** | **A-weighted SPL (dB(A) at 10m)** |
| Cement mixer truck | 1 | 90% | 75 |
| Truck mounted concrete pump and boom arm | 1 | 90% | 80 |
| Diesel generator for site cabins | 1 | 100% | 74 |
| Building Construction | | | |
| **Plant** | **No.** | **Operational hours** | **A-weighted SPL (dB(A) at 10m)** |
| Wheeled mobile telescopic crane | 1 | 90% | 78 |
| Diesel generator for site cabins | 1 | 100% | 74 |

### 4.1.1 Potential Impacts

41. The Environmental Statement predicted the following impacts:

Table 4-5 Potential Noise Impacts

| | Sensitivity of receptors | Magnitude Impact | Significance of Impact |
|---|---|---|---|
| Onshore Cable Route | Medium | Low | **Not Significant** |
| Horizontal Directional Drilling Sites (HDD) | Medium | Medium | **Moderate Significance** |
| Construction Consolidate Sites (CCS) | Medium | Negligible | **Not Significant** |
| Onshore Substation | Medium | Negligible | **Not Significant** |
| Construction Traffic | Medium | Low | **Not Significant** |

42. Only predicted noise levels at many of the noise sensitive receptors to the HDD works marginally exceed the noise criteria and therefore in it will be necessary to consider noise mitigations measures to minimise disturbance (see Section 0).

## 4.2 Vibration Assessment

43. Vibration levels decay very rapidly with distance from a source, as shown by empirical data presented in BS5228-2. A representative example of HDD given within BS5228-2 is for boring through silts overlying sandstone with a Peak Particle Velocity (PPV) of 8 mm/s at 4.5m from the source, decreasing to a PPV of 2.7mm/s at 7m from the source and 1.8mm/s at 12m from the source. Given the distances between sources of vibration during the construction works and sensitive receptors it is clear that PPV levels would be below the criteria outlined in Table 4-19 at the nearest sensitive receptors to Onshore Cable Route, HDDs and CCSs sites and construction works on the Onshore Substation. Vibration impacts from construction works would be of negligible magnitude on receptors of medium sensitivity and therefore **not significant**.

44. Heavy vehicles on smooth road surfaces do not produce significant levels of vibration at road side receptors. However, vibration can result from sudden wheel impacts as vehicles pass over holes and cracks on the road surface. Potentially this may result in transient exceedances of BS5228-2 criteria. The majority of buildings would be resilient to the worst case vibration levels anticipated. However, a precautionary approach has been considered for listed buildings and non-earthwork related scheduled ancient monuments as these are considered of high sensitivity.

45. Archaeological sites and listed buildings have been identified within 10m of the designated construction HGV routes. 10m is considered the largest distance from the road at which there is potential for vibration impacts from HGV along roads, with a distance of 5m considered as a distance for a potentially significant effect. A review of the scheduled ancient monuments has identified only earthworks / barrows which would not be considered sensitive to the worst case vibration levels anticipated.

46. Listed buildings have been assessed based on distance to the road and also the extent of current use by HGV along these roads using the Suffolk Lorry Route Network. Listed buildings on the existing lorry route would not be subjected to higher vibration levels than are already within the baseline environment. The following listed buildings are within 5m of the road and on a route not designated on the Suffolk Lorry Route Network (with the exception of buildings in Coddenham, which is a restricted route and therefore considered of greater sensitivity):

- Grange Farmhouse, unnamed road, Alderton;
- Red Lion Inn, The Street, Martlesham;
- Red Lion Cottages, The Street, Martlesham;
- Martlesham Hall, Church Lane, Martlesham;
- The Red House, B1078, Coddenham;
- Church Cottages, B1078, Coddenham;
- Gryffon House, B1078, Coddenham;
- The Cottage, B1078, Coddenham;
- The Old Lodge and the Post Office, B1078, Coddenham;
- The Dukes Head Inn, B1078, Coddenham;

- Birdshill, Road between Lodge Road and A12, Seckford;
- Seckford Hall Lodge, Road between Lodge Road and A12, Seckford;
- Barn at Seckford Hall Lodge, Road between Lodge Road and A12, Seckford; and
- Ford House, Woodbridge Road, Gundisburgh.

# 5 Baseline Conditions

47. According with the information included in the ES (Volume 3, Chapter 26 Noise and Vibration) noise measurements were carried out in sensitive receptors along the onshore cable route and in the surroundings of the onshore substation.

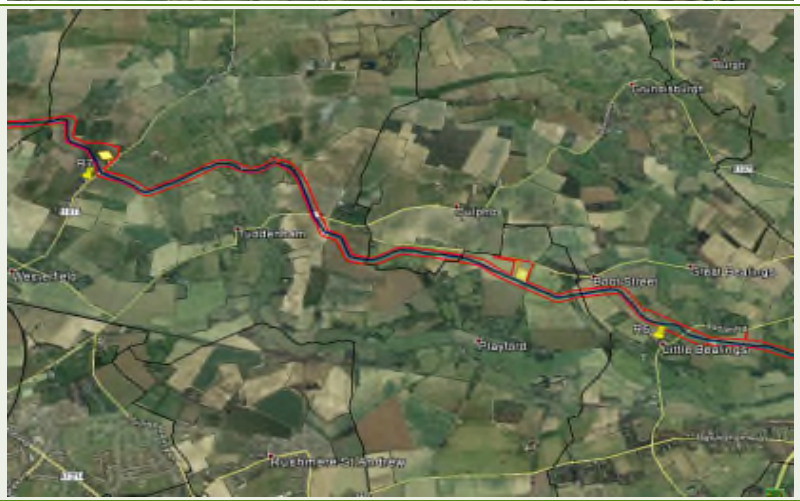
48. Attended measurements were conducted at three sensitive receptors surrounding the onshore substation during the day of the 29th September 2011 and early morning on the 30th September 2011. The closest sensitive receptors identified are isolated houses separated from the site by agricultural land. The three receptors chosen for noise monitoring, and agreed with the local Environmental Health Department, (the nearest three properties) are presented in Table 5-1.

Table 5-1 Noise Sensitive Receptors – Onshore Substation

| Receptor | Coordinates (WGS84) | | Image |
|---|---|---|---|
| | Easting | Northing | |
| MP1 - Bullenhall Farm | 367553 | 5771415 |  |
| MP2 - Hill Farm House | 366275 | 5770453 | |
| MP3 - Burstall Hall | 367393 | 5769843 | |

49. Further measurements were taken on 29th to the 31st May 2012 at locations representing residential receptors nearest to HDD and Construction Consolidation Sites along the onshore cable route and are presented in Table 5-2.

Table 5-2 Noise Sensitive Receptors – Onshore Cable Route – Horizontal Directional Drillings – Construction Consolidation Sites

| Receptor | Coordinates (WGS84) | | Image |
|---|---|---|---|
| | Easting | Northing | |
| R8 - Sycamore House, Somerham Road | 368501 | 5772703 |  |
| R10 - Bramford Road | 369597 | 5773795 | |
| R1 - Premier Inn, Claydon | 370400 | 5773855 | |
| R7 - Pine Lodge (south of golfcourse), Westerfield Road | 374999 | 5773013 |  |
| R6 - Village hall carpark, Little Bealings | 380292 | 5772058 | |

| Receptor | Coordinates (WGS84) | | Image |
|---|---|---|---|
| | Easting | Northing | |
| R2 - Top Street, Martlesham | 382667 | 5771569 |  |
| R3 - Broom Hill Park, Woodbridge | 383819 | 5771462 | |
| R4 - Church Carpark, Church Lane, Martlesham | 383387 | 5770684 | |
| R13 - North of Newbourne | 384726 | 5768701 | |
| R11 - Kirton Lodge / Sluice Farm, Kirton | 385187 | 5764120 |  |
| R5 - Crossing at Red House Farm, Falkenham | 386924 | 5762689 | |
| R12 - Ferry Lane | 391071 | 5762059 | |

50. R9 is represented by location MP1 at Bullenhall for the purposes of assessing the Converter Station and therefore was not measured during this second site visit.

51. Measurements were undertaken at a height of 1.5m and in free-field conditions i.e. >3.5m from a reflective surface using a Norsonic 118 type 1 sound level meter ('SLM') (serial no. 31677) with pre-amplifier and microphone protected by foam windshield and a Norsonic type 1251 acoustic calibrator (serial no. 32194).

52. The calibration of the sound level meters was checked before and after the measurements using the acoustic calibrator, with no drift being observed. The SLMs conform to BS EN 61672-1:2003 Electroacoustics - Sound level meters, and the calibrator conforms to BS EN 60942:2003 Electroacoustics - Sound calibrators. The equipment used has a calibration history that is traceable to a certified calibration institution.

53. Table 5-3 and Table 5-4 present the results of the background noise measurements for Day-time and Night-time:

Table 5-3 Day-time Background Noise Measurements

| Day-Time Background Noise Measurements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ID** | **Date** | **Start** | **Duration (hr:min)** | **LAeq** | **LAF(max)** | **LA10** | **LA90** | **Comments** |
| **Day-time** | | | | **dB(A)** | | | | |
| MP1 | 29/09/2011 | 13:25 | 01:00 | 44.0 | 70.2 | 45.3 | 32.4 | |
| MP2 | 29/09/2011 | 16:10 | 01:00 | 45.2 | 68.2 | 47.8 | 35.8 | |
| MP3 | 29/09/2011 | 14:48 | 01:00 | 41.3 | 64.2 | 44.1 | 37.4 | |
| R1 | 30/052012 | 15:42:04 | 01:00 | 56.5 | 74.8 | 58.3 | 51.7 | Dominated by traffic noise on the A14, ocassiona train to the west and birds |
| R2 | 30/05/2012 | 10:30:25 | 01:00 | 56.3 | 74.8 | 58.4 | -- | Traffic on local road, birds, larger vehicles and sirens on A12 |
| R3 | 29/05/2012 | 16:12:56 | 00:45 | 54.5 | 80.6 | 45.6 | 35.8 | Birds and pedestrians, some boats on Martlesham Creek and occasional passing vehicles |
| R4 | 29/05/2012 | 15:01:49 | 01:00 | 45.2 | 78.0 | 47.1 | 33.8 | Small amount of local traffic, distant A12, trains, birds and breeze in trees |
| R5/R11 | 29/05/2012 | 12:38:00 | 00:55 | 46.2 | 73.4 | 41.1 | 28.1 | |
| R6 | 30/05/2012 | 11:43:00 | 01:00 | 50.5 | 79.3 | 53.1 | 36.5 | Passing vehicles, birds and occasional aircraft overhead |
| R7 | 30/05/2012 | 13:01:08 | 01:00 | 60.7 | 78.8 | 65.5 | 36.3 | Vehicle noise on Westerfeld Road and birds |
| R8 | 30/05/2012 | 16:55:46 | 01:00 | 62.0 | 87.2 | 62.1 | 36.0 | Distant A14, traffic on Somersham Road and birds |
| R10 | 30/05/2012 | 14:33:01 | 01:00 | 60.3 | 76.9 | 64.7 | 44.3 | Traffic on Bramford Road and nearby animals |
| R12 | 29/05/2012 | 10:49:45 | 00:50 | 49.8 | 76.2 | 46.5 | 33.2 | Local traffic, birds and insects |
| R13 | 29/05/2012 | 13:50:00 | 00:50 | 41.2 | 61.4 | 42.7 | 31.1 | Birds, distant farm noise, no traffic, noise from golf course |

Table 5-4 Night-time Background Noise Measurements

| Night-Time Background Noise Measurements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ID** | **Date** | **Start** | **Durantion (hr:min)** | **LAeq** | **LAF(max)** | **LA10** | **LA90** | **Comments** |
| **Night-time** | | | | **dB(A)** | | | | |
| MP1 | 30/09/2011 | 02:27 | 01:00 | 32.6 | 68.2 | 33.2 | 26.3 | |
| MP2 | 30/09/2011 | 03:34 | 01:00 | 26.9 | 61.7 | 28.5 | 21.6 | |
| MP3 | 30/09/2011 | 03:28 | 01:00 | 35.7 | 67.0 | 37.6 | 27.7 | |
| R1 | 31/05/2012 | 02:20:08 | 00:15 | 45.2 | 58.0 | 48.2 | 39.6 | Dominated by HGV noise on A14 |
| R2 | 30/05/2012 | 03:16:16 | 00:10 | 39.8 | 60.8 | 42.4 | 23.5 | Birds, aircraft and very distant engine noise from Martlesham Creek |
| R3 | 30/05/2012 | 02:34:46 | 00:15 | 37.2 | 68.7 | 35.5 | 28.7 | Engine or generator on Creek, distant vehicle noise from A12 |
| R4 | 30/05/2012 | 02:06:30 | 00:15 | 29.1 | 48.9 | 31.9 | 25.3 | Distant hum of traffic and water cannon in field |
| R5/R11 | 30/05/2012 | 00:39:50 | 00:20 | 32.7 | 45.6 | 34.9 | 29.4 | |
| R6 | 31/05/2012 | 01:08:26 | 00:15 | 27.5 | 47.4 | 27.5 | 22.8 | Very quiet, dripping of recent rain and high level aircraft |
| R10 | 31/05/2012 | 01:53:00 | 00:15 | 53.7 | 79.3 | 43.0 | 28.6 | Traffic on Bramford Road, A14, owls |
| R13 | 30/05/2012 | 01:39:30 | 00:15 | 28.7 | 46.3 | 29.9 | 25.0 | Very distant generator, no audible road noise, sprinkler on golf course |

54. A baseline survey will be carried out prior to any construction works commencing in order to update and characterise the nature of noise and vibration ambient in the vicinity of the onshore construction works to provide a basis for assessments and to ensure that any potential changes during the works are identified and correctly attributable to the construction works.

# 6 Noise and Vibration Criteria

55. Noise levels generated by construction activities were deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65dB, 55dB and 45dB $L_{Aeq}$ from construction noise alone, for the daytime (Monday-Friday 07:00-19:00, Saturday 07:00-13:00), evening and weekend (Monday-Friday 19:00-23:00, Saturday 13:00-23:00, Sunday 07:00-23:00) and night-time (23:00-07:00) periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact.

56. Annex E of BS 5228-1 also provides criteria for providing sound insulation at affected receptors. Exceedance of identified levels trigger a responsibility on the developer to provide noise insulation or a scheme to facilitate temporary rehousing.

57. The standard suggests that noise insulation should be provided, in spite of mitigation measures, in the following cases:

- noise levels exceed the noise insulation trigger level, presented in Table 6-1; or
- the total noise (pre-construction ambient plus construction noise) is 5 dB above the existing airborne noise level for the corresponding times of day, whichever is the higher; and
- for a period of ten or more days of working in any fifteen consecutive days or for a total of days exceeding 40 in any 6 month period.

Table 6-1 Time Periods, Averaging Times and Noise Levels Applicable to Assessing Eligibility for Noise Insulation BS 5228-1:2009 (Annex E).

| **Time Periods, Averaging Times and Noise Levels Applicable to Assessing Eligibility for Noise Insulation** | | | |
|---|---|---|---|
| **Time** | **Relevant Time Period** | **Averaging time, T** | **Noise trigger level dB $L_{Aeq,T}$** |
| Monday to Friday | 07.00-08.00 | 1 h | 70 |
| | 08.00-18.00 | 10 h | 75 |
| | 18.00-19.00 | 1 h | 70 |
| | 19.00-22.00 | 3 h | 65 |
| | 22.00-07.00 | 1 h | 55 |
| Saturday | 07.00-08.00 | 1 h | 70 |
| | 08.00-13.00 | 5 h | 75 |
| | 13.00-14.00 | 1 h | 70 |
| | 14.00-22.00 | 3 h | 65 |
| | 22.00-07.00 | 1 h | 55 |
| Sunday & Public Holidays | 07.00-21.00 | 1 h | 65 |
| | 21.00-07.00 | 1 h | 55 |
| Note 1) Equivalent continuous A-weighted noise level predicted or measured at a point in front of the most exposed windows or doors leading directly to a habitable room (living room or bedroom) in an eligible dwelling | | | |

58. BS5228-2 provides guidance on the control of vibration from construction sites and response limits for cosmetic damage in buildings as reproduced in Table 6-2.

59. **Error! Reference source not found.**Table 6-2 shows the limits at which the vibration level (measured as a peak particle velocity) would result in cosmetic damage at a range of vibration frequency levels.

Table 6-2 Transient Vibration Guide for Cosmetic Damage (from BS 5228-2:2009)

| Transient Vibration Guide for Cosmetic Damage | | |
|---|---|---|
| **Type of Building** | **Peak Component Particle Velocity (PPV) in Frequency Range of Predominant Pulse** | |
| | **4Hz to 15Hz** | **15Hz and above** |
| Reinforced or framed structures<br>Industrial and heavy commercial buildings | 50mm/s at 4Hz and above | 50mm/s at 4Hz and above |
| Unreinforced or light framed structures<br>Residential or light commercial buildings | 15mm/s at 4Hz increasing to 20mm/s at 15 Hz | 20mm/s at 15Hz increasing to 50mm/s at 40Hz and above |
| Note 1) Values referred to are at the base of the building<br>Note 2) For line 2, at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) is not be exceeded | | |

60. BS 5228-2 also presents levels of vibration that may cause complaint, which is predicted to occur between 0.3 mm/s (just perceptible) and 1.0 mm/s (likely to cause complaint). BS 5228-2 values have been taken into consideration in the assessment of vibration levels from construction HGV traffic.

# 7 Noise and Vibration Controls

61. EA ONE onshore construction works will comply with the recommendations set out in BS 5228-1 and BS5228-2 and in the Environmental Statement.

62. Best Practice Measures (BPM) and attenuation measures will be applied during construction works to minimise noise and vibration at neighbouring residential properties and other sensitive receptors arising from construction activities.

63. BPM are defined in Section 72 of the Control of Pollution Act 1974 and Section 79 of the Environmental Protection Act 1990, as those measures which are 'reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications'.

64. The BPM and mitigation measures to be implemented and controlled during the onshore construction works are described in Table 7-1

Table 7-1 Best Practice and Mitigation Measures

| Construction Best Practice Mitigation Measures |
|---|
| **General** |
| • Consideration of noise levels when selecting construction methods and equipment used.<br>• Management of construction operating hours (in accordance with those specified within the DCO).<br>• Training of construction workers on site to ensure noise is considered through all stages.<br>• Implementation of traffic management measures such as agreed routes for construction traffic.<br>• Use of modern, fit for purpose, well maintained plant equipment to minimise noise generation. Plant and vehicles will be fitted with mufflers / silencers maintained in good working order. Use of silenced equipment, as far as possible and low impact type compressors and generators fitted with lined and sealed acoustic covers. Doors and covers housing noise emitting plant will be kept closed when machines are in use.<br>• Where reasonably practicable, vibrating and noisy equipment should be located as far from sensitive premises as possible, and, if on a structure, not on one which is continuous with that of the sensitive premises; contractors and subcontractors should be trained to employ appropriate techniques to keep site noise to a minimum, and should be effectively supervised to ensure that best working practice in respect of noise and vibration reduction are followed.<br>• Minimise drop height of materials.<br>• Start-up plant, equipment and vehicles sequentially rather than all together.<br>• No working during night hours except at specific locations and for specific activities which have been agreed with the Local Planning Authority and should be discouraged as much as possible.<br>• Radios (other than two-way radios used for the purposes of communication related to the works) and other forms of audio equipment (other than associated with safety mechanisms (such as reversing bleepers) shall not be operated during construction activities.<br>• Construction activities with the potential for significant impacts should be discouraged if possible during night hours.<br>• Avoid the use of radios or stereos outdoors where neighbours may be affected.<br>• Avoid shouting, and minimise talking loudly and slamming vehicle doors.<br>• Ensuring engines are switched off when machines are idle.<br>• Noise and vibration should be controlled at source and the spread of noise and vibration should be limited.<br>• Use screens and noise barriers / acoustics screens where deemed necessary.<br>• Regular communication with site neighbours to inform them of the construction schedule, and when noisy activities are likely to occur.<br>• Where necessary, noise monitoring to check noise levels in response to any concerns if raised. |

65. Based on the noise assessment undertaken as part of the ES, the following specific mitigation measures will be introduced to minimise disturbance at nearest residences during HDD works at night at Kirton Creek and Martlesham Creek, where required:

- Screening equipment such that there is no line of sight between receptor windows and the noise emitting elements of the plant on the site; and / or
- The use of silencers (silencer or enhanced enclosure) on the drill rig engine to provide the additional sound reduction. This additional mitigation is unlikely to be required should the plant associated with the drill rig be containerised, as would be expected from a drill rig transported on a trailer.

66. To ensure that excessive vibration levels on the road network are not caused by HGVs travelling over discontinuities in the road (at this stage uncertain), visual checks should be made of roads adjacent to the buildings listed in Section 4.2 by contractors, the construction management team and Environmental Clerk of Works.

# 8 Noise and Vibration Monitoring

## 8.1 Noise Monitoring

67. A scheme of noise monitoring will be implemented and maintained during construction in order to ensure compliance with the noise limits and to verify the effectiveness of the best practice and mitigation measures identified in Section 7. The frequency will be flexible (weekly during initial stages and monthly once compliance with levels established) and should cover all construction activities and stages.

68. The purpose of the noise monitoring is to facilitate data acquisition to demonstrate that the EA ONE onshore works are being constructed within the noise criteria set out in accordance with the BS 5228-1 and in such a manner to minimise the noise impacts at nearby sensitive receptors, and if required in response to complaints.

69. The monitoring locations stated in the ES will be used to plan where monitoring locations will be located. A review of these locations may be considered if changes or updates of the project are observed.

70. Noise monitoring shall be flexible in its frequency and should cover all construction activities and stages according to the construction schedule.

71. Noise short term attended measurements shall be taken by a suitably qualified acoustician in the vicinity of the property in order to assess the fulfilment of the noise criteria stated in Section 6. Where access to a property is not granted to undertake such measurements, measurements shall be undertaken at a location that is considered by the suitably qualified acoustician, to be representative of noise levels at the property or properties in question.

72. The noise measurement sample duration at each location for both day and night-time monitoring will be no less than 30 minutes. Data collected for the identified receptors will include at least the following parameters: $L_{A1}$, $L_{A5}$, $L_{A10}$, $L_{A50}$, $L_{A90}$, $L_{A95}$, $L_{A99}$, $L_{Aeq}$, $L_{Amax}$ and $L_{Amin}$.

73. Type 1 integrating averaging Sound Level Meters and Class 1 Sound Calibrators will be used. Sound Level Meters and Calibrators must fulfil the requirements established in the following British and European standards:

- BS EN 61672-1:2003. Electroacoustics. Sound level meters. Specifications
- BS EN 61672-2:2003. Electroacoustics. Sound level meters. Pattern evaluation tests
- BS EN 61672-3:2006. Electroacoustics. Sound level meters. Periodic tests
- BS 7580-1:1997. Specification for the verification of sound level meters. Comprehensive procedure.
- BS EN 60942:2003. Electroacoustics. Sound calibrators

74. Sound Level Meters and Calibrators shall be calibrated to a traceable standard by a UKAS-accredited laboratory, within a 12-month period before the survey. The Sound Level Meters shall be field-calibrated before and after monitoring using an acoustic calibrator.

75. The Sound Level Meter shall be positioned such that the microphone is located 1.5 m above the ground level in free-field conditions (at least 3.5m from the nearest vertical reflecting surface), at all receptors. A note of the prevailing weather conditions shall be made at the time of the measurements.

## 8.2 Vibration Monitoring

76. It is not anticipated that vibration monitoring will be required during the normal course of construction works. Vibration monitoring would only be adopted upon receiving a complaint or a specific directive from the local authority.

77. Where required vibration monitoring instrumentation will be deployed as close to the sensitive buildings as possible.

78. The instrumentation will be installed, operated and maintained by suitable qualified personnel. Vibration levels shall be measured using instrumentation calibrated to a traceable standard by a UKAS-accredited laboratory according with BS 5228-2:2009.

# 9 Reporting

## 9.1 Noise Report

79. On completion of each noise survey a report shall be prepared in a format suitable submission to the local authority. The report shall be submitted within seven working days of the scheduled date.

80. The report shall contain at least:

- the results of the noise survey;
- details of the instrumentation and measurement methods used;
- calibration details;
- weather conditions and factors that might have adversely affected the reliability or accuracy of the measurements;
- plans of the site and neighbourhood showing the position of plant, associated buildings and notes of site activities during monitoring period(s); and
- time, date and name of person carrying out the measurement.

## 9.2 Vibration Report

81. If required, on completion of a vibration survey a report shall be prepared in a format suitable submission to the local authority. The report shall be submitted within seven working days of the scheduled date.

82. The report shall contain at least:

- the results of the vibration survey;
- details of the instrumentation and measurement methods used;
- plans of the site and neighbourhood showing the position of plant, associated buildings and notes of site activities during monitoring period(s); and
- time, date and name of person carrying out the measurement.

# 10 Noise and Vibration Environmental Incident

83. The following situations represent potential noise and vibration environmental incidents and as such will be subject to the relevant controls:

- a complaint received from a member of the public or Local Authority;
- an incident or activity which results in a breach of consent conditions e.g. non-compliance with the working hours, non-permitted plant/equipment or non-compliance with BPM or mitigation measures; and
- measured exceedance.

# 11 Non-compliance with Noise Limits

84. If the noise criteria levels set out Section 6 are exceeded during the noise and vibration surveys as a result of construction works or a complaint is received from local resident, an investigation shall be instigated to identify the cause of the non-compliance.

85. Such an investigation may involve the identification and cessation of the activity or activities considered to be the cause of the non-compliance and/or the investigation of the mitigation measures to reduce the noise or vibration emission levels from the activity or activities, for example the replacement of the noisy plant with quieter alternatives and/or the use of temporary screens.

86. Any deviation from agreed working practices shall be identified immediately and conformance to the working practice reinstated.

87. A further noise or vibration survey shall be undertaken as soon as possible following the implementation of mitigation to re-assess the noise or vibration levels against the guideline levels.

# 12 Training

88. All site personnel should be trained to employ appropriate techniques to keep noise to a minimum, and should be effectively supervised to ensure that best working practice in respect of noise reduction is followed.

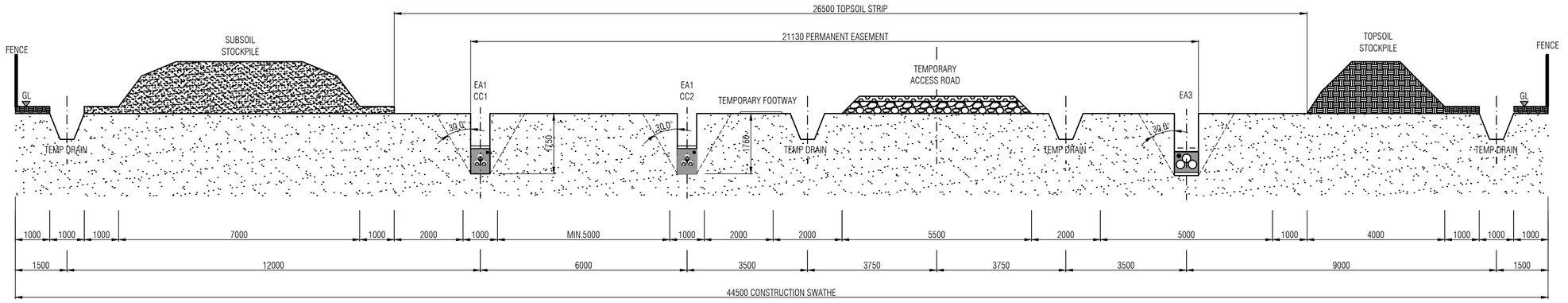
89. All employees should be advised regularly of the following, as part of their training:

- the proper use and maintenance of tools and equipment;
- the positioning of machinery on site to reduce the emission of noise to the neighbourhood and to site personnel;
- the avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment;
- the protection of persons against noise; and
- the operation of sound measuring equipment (selected personnel).

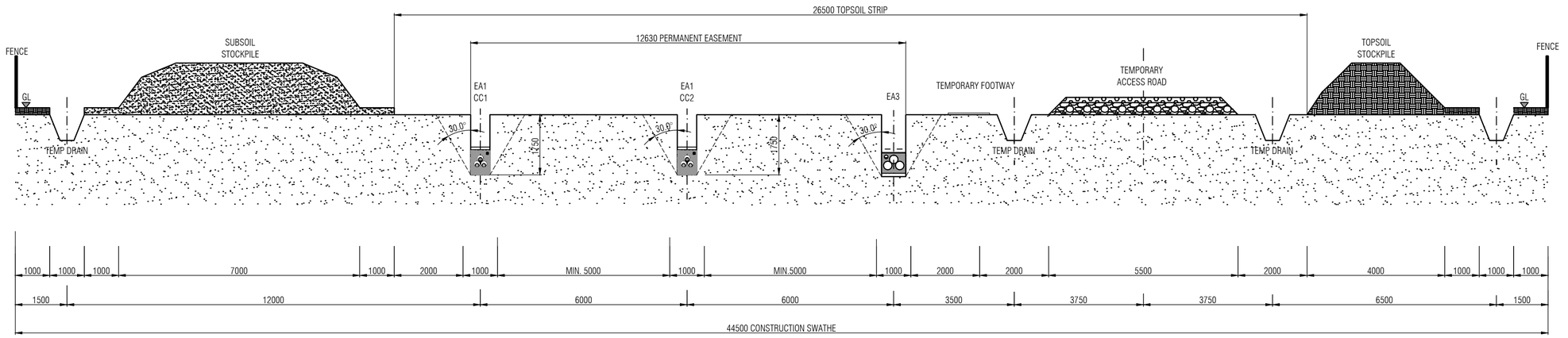
90. All site personnel will be made aware of the noise and vibration issues covered in this Noise and Vibration Management Plan during site induction.

# Appendix 1 Construction Swathe Indicative Cross Section

## VIEW FROM SHORE LANDING TOWARDS SUBSTATIONS OPTION 1




## VIEW FROM SHORE LANDING TOWARDS SUBSTATIONS OPTION 2




NOTES:
1- PASSING PLACES EACH 250 m.(FIG.1)
2- TURN ARROUND AREAS EACH 750m. (FIG.2)
3- "V" BUCKET MAY BE USED (SEE PHOTO)

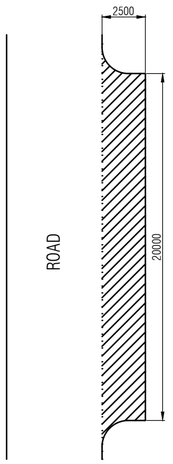



FIGURE 1

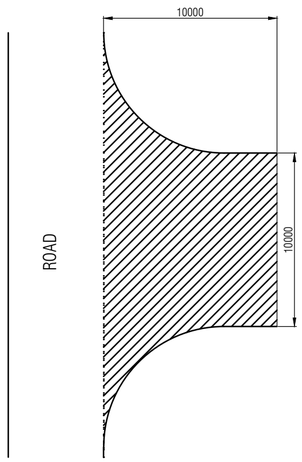



FIGURE 2

"V" BUCKET

| Rev. | Date | Prepared | Reviewed | Approved | Reason / Description of changes. |
|---|---|---|---|---|---|

IBERDROLA Engineering & Construction

Status Stamp:

Project: EAST ANGLIA

Location: BAWDSEY TO BRAMFORD

Contractor:

Status Stamp:

Drg. Title: CONSTRUCTION SWATHE TYPICAL CROSS SECTION

Client: SCOTTISHPOWER RENEWABLES

Date of First Issue: 15-07-2016

| Prepared | Reviewed | Approved |
|---|---|---|
| IMFE | GRAT | FEBO |

Drg. No.: EA1-GRD-E-IEC-007883

Contractors Drg. No. :

Sheet: 1 | Next: - | Rev: 0

Scale: 1:100 | Size: A2