# APPENDIX 6.3: METHODOLOGY FOR OPERATIONAL PHASE ASSESSMENT

## Atmospheric Dispersion Modelling

1.1 The atmospheric dispersion model AERMOD (Lakes Environmental, Version 11.2) has been used to assess the potential air quality impacts associated with the operation of the proposed battery manufacturing facility. This dispersion model is widely used and accepted for the purpose of undertaking assessments to support both planning and Environmental Permit applications.

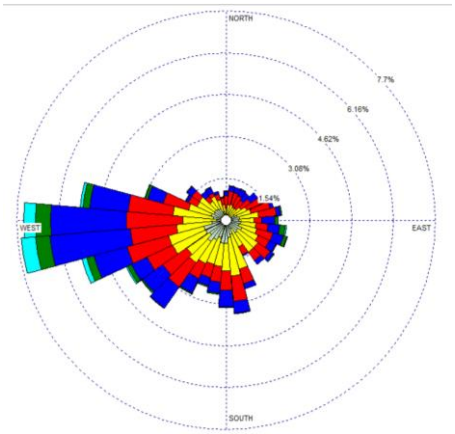
### *Meteorological Data*

1.2 The meteorological data used in the air quality modelling has been obtained from ADM Limited and is from the Newcastle Airport recording station, covering the period between 1st January 2018 and 31st December 2022.

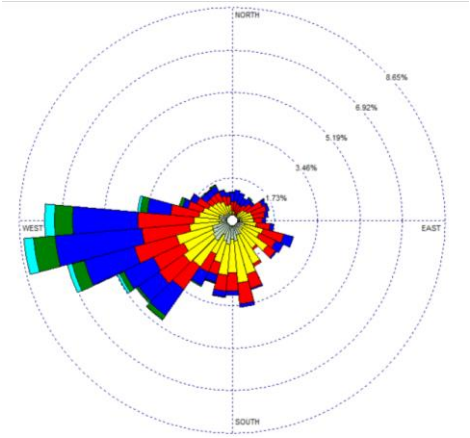
1.3 The site is located at an altitude of approximately 38m AOD. The Newcastle Airport recording station is located approximately 19km to the north west, at an altitude of approximately 81m AOD. This recording station is considered to be most representative of the conditions at the site.

1.4 The 2018 to 2022 wind roses for the Newcastle Airport meteorological recording station are shown in Figure 6.3/1. Each year has been run separately in the model.

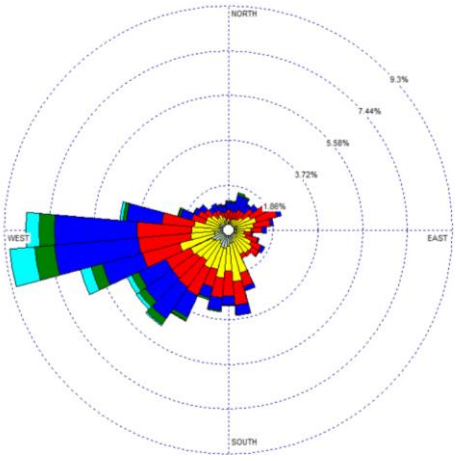
**Figure 6.3/1: 2018 to 2022 Wind Roses for Newcastle Airport Meteorological Station**



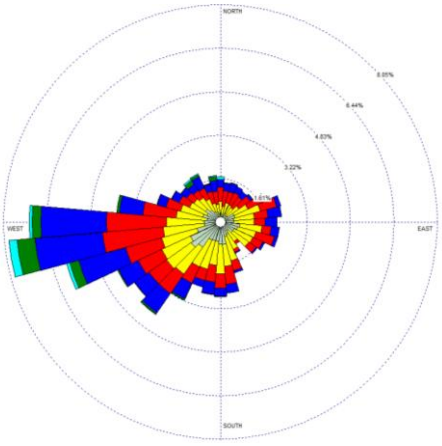

**2018**



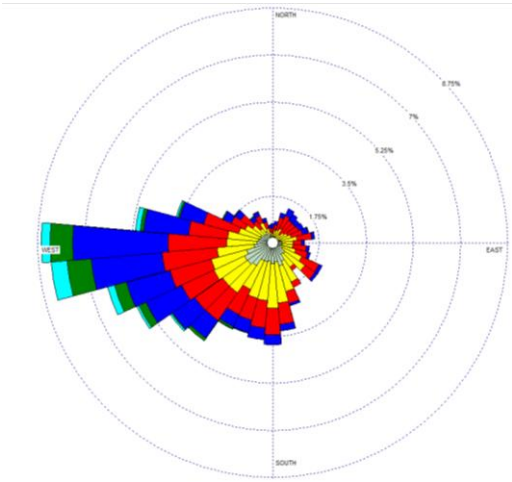

**2019**




**2020**




**2021**




**2022**

### *Surface Characteristics*

1.5 The predominant characteristics of land use in an area provides a measure of the vertical mixing and dilution that takes place in the atmosphere due to factors such as surface roughness and albedo.

1.6 The meteorological data has been processed using AERMET, the supporting meteorological pre-processing software (Lakes Environmental, Version 11.2), to enable the surface characteristics to be set in the model.

1.7 The values set within the model are included in Table 6.3/1.

**Table 6.3/1: Surface Characteristics Included in Model**

| Setting | Urban | Cultivated Land |
|---|---|---|
| Albedo | 0.2075 | 0.28 |
| Bowen ratio | 1.625 | 0.75 |
| Surface roughness | 1m | 0.0725m |

1.8 Buildings can also have a significant influence on the behaviour of the local airflow and 'downwash' can occur, where an emission plume can be drawn down in the vicinity of buildings. There are a number of existing buildings near to the sources of the emissions, as well as the proposed buildings, and therefore building effects have been included within the model.

1.9 Further details of the buildings included in the model are provided later in this appendix.

### *Terrain*

1.10 To consider the impact of terrain surrounding the Proposed Development, on the dispersion of pollutants, OS Terrain 5 data has been used in the model (in x.y.z format). This has been processed using the in-built AERMAP terrain processor.

### *Emission Parameters*

1.11 A number of emission sources have been considered within the air dispersion model. These relate to different parts of the battery manufacturing process, and further information on the process is included in Chapter 6 of the Environmental Statement.

1.12 The forty-two sources considered within the assessment, and the pollutants considered for each source, are as follows:

- 6 No. stacks associated with the boilers.
- 21 No. stacks associated with N-Methyl-2-Pyrrolidone (NMP) emissions.
- 10 stacks associated with Ethyl Carbonate (EC) emissions.
- 5 stacks associated with Diethyl Carbonate Solvent Vapour (DEC) emissions.

1.13 Information regarding the flues for the sources has been provided by the client.

**Table 6.3/2: Model Parameters for Sources Included in Model**

| Parameter | Input in Model | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Boiler Stack (1 of 6)** | **VOC 1-7** | **VOC 8-9** | **VOC 10** | **VOC 11** | **VOC 12-14** | **VOC 15** | **VOC 16-19** | **VOC 20-23** | **VOC 24-27** | **VOC 28** | **VOC 29** | **VOC 30** | **VOC 31** | **VOC 32** | **VOC 33-36** |
| Flue location | 433167, 558781 | 433148, 558773 | 433165, 558780 | 433105, 558753 | 433105, 558753 | 433380, 558835 | 433327, 558721 | 433196, 558669 | 433198, 558664 | 433209, 558675 | 433116, 558655 | 433147, 558586 | 433148, 558586 | 433149, 558583 | 433162, 558555 | 433243, 558564 |
| Base elevation | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD | 38.70m AOD |
| Exhaust height[a] | 36m | 33m | 33m | 33m | 33m | 19m | 19m | 33m | 33m | 33m | 33m | 33m | 33m | 33m | 33m | 33m |
| Exhaust diameter | 0.45m | 0.45m | 0.45m | 0.30m | 0.41m | 0.40m | 0.45m | 0.46m | 0.45m | 0.46m | 0.30m | 0.29m | 0.29m | 0.37m | 0.26m | 0.46m |
| Exhaust gas flow at exit | 6660 $Am^3/hr$ (1.850 $Am^3/s$) | 10080 $Am^3/hr$ (2.800 $Am^3/s$) | 10080 $Am^3/hr$ (2.800 $Am^3/s$) | 4564 $Am^3/hr$ (1.268 $Am^3/s$) | 7560 $Am^3/hr$ (2.100 $Am^3/s$) | 8460 $Am^3/hr$ (2.350 $Am^3/s$) | 10432 $Am^3/hr$ (2.898 $Am^3/s$) | 11376 $Am^3/hr$ (3.160 $Am^3/s$) | 10080 $Am^3/hr$ (2.800 $Am^3/s$) | 11376 $Am^3/hr$ (3.160 $Am^3/s$) | 4082 $Am^3/hr$ (1.134 $Am^3/s$) | 4082 $Am^3/hr$ (1.134 $Am^3/s$) | 4082 $Am^3/hr$ (1.134 $Am^3/s$) | 6624 $Am^3/hr$ (1.840 $Am^3/s$) | 3358 $Am^3/hr$ (0.933 $Am^3/s$) | 11376 $Am^3/hr$ (3.160 $Am^3/s$) |
| Exhaust efflux velocity | 12.00m/s | 18.00 m/s | 18.00 m/s | 17.90 m/s | 16.00 m/s | 19.00 m/s | 18.00 m/s | 19.00 m/s | 18.00 m/s | 19.00 m/s | 16.00 m/s | 18.00 m/s | 18.00 m/s | 17.00 m/s | 18.00 m/s | 19.00 m/s |
| Exhaust gas exit temp. | 128°C | 25°C | 20°C | 20°C | 20°C | 20°C | 20°C | 25°C | 25°C | 20°C | 20°C | 20°C | 20°C | 25°C | 25°C | 25°C |

1.14 The locations of the stacks included within the model are shown in Figure 6.3/2.

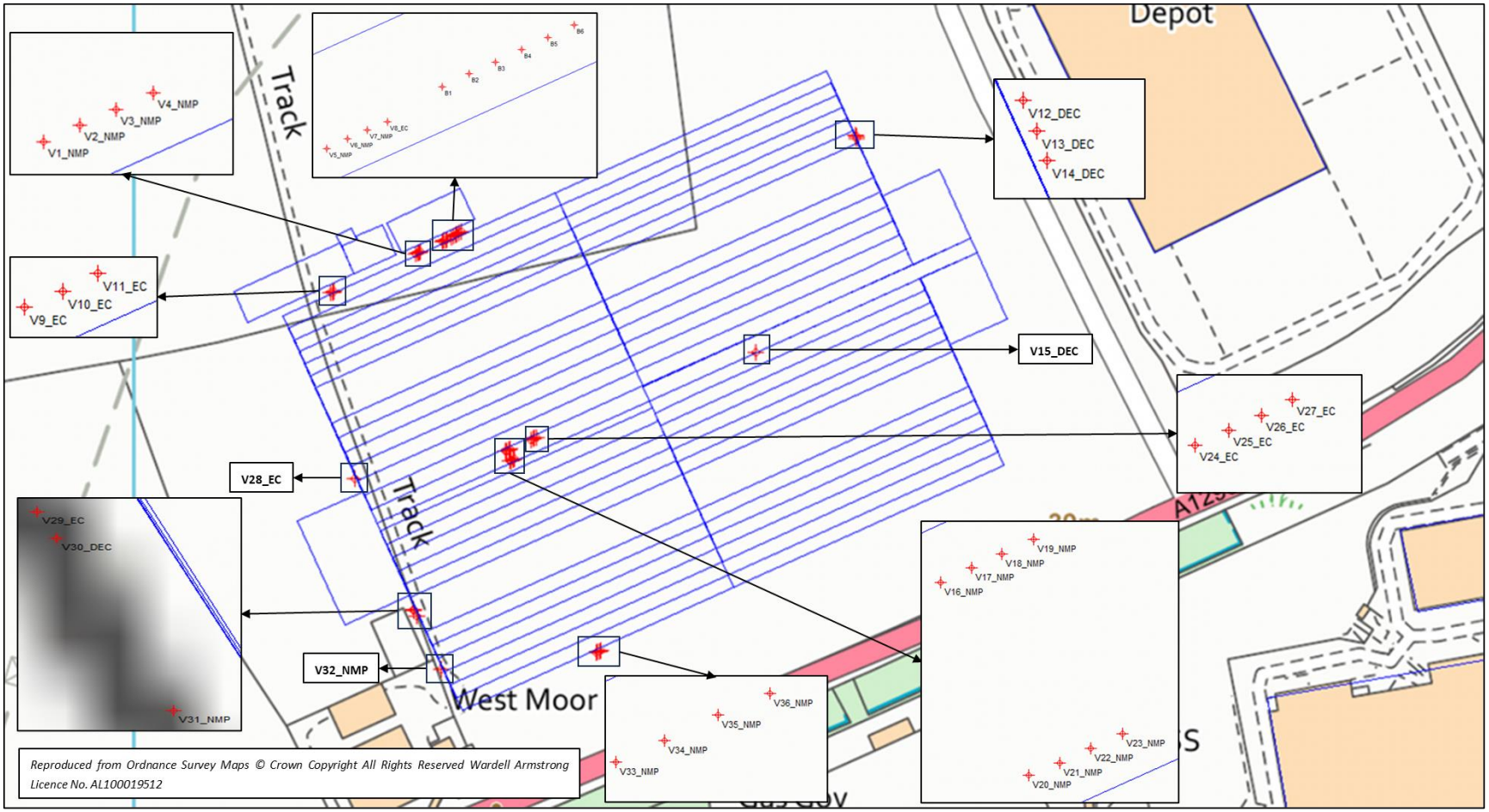



**Figure 6.3/2: Location of Emission Sources in Model**

1.15 The maximum emission concentrations for each substance, as provided by Envision, as well as the calculated emission rates are shown in Table 6.3/3 below.

| Table 6.3/3: Emission Rates for Sources Included in Model | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emitted Substance** | **Input in Model** | | | | | | | | | | | | | | |
| | **Boiler Stack (1 of 6)** | **VOC 1-7** | **VOC 8-9** | **VOC 10** | **VOC 11** | **VOC 12-14** | **VOC 15** | **VOC 16-19** | **VOC 20-23** | **VOC 24-27** | **VOC 28** | **VOC 29** | **VOC 30** | **VOC 31** | **VOC 32** |
| | **Emission Concentration (mg/Nm³)** | | | | | | | | | | | | | | |
| **$NO_X$** | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO** | 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **NMP** | | 2 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 | 2 |
| **Ethyl Carbonate** | - | - | 15 | 15 | 15 | - | - | - | - | 15 | 15 | 15 | - | - | - |
| **DiEthyl Carbonate** | - | - | - | - | - | 20 | 20 | - | - | - | - | - | 20 | - | - |
| | **Emission Rate (g/s)** | | | | | | | | | | | | | | |
| **$NO_X$** | 0.1067 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO** | 0.0213 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **NMP** | - | 0.0051 | - | - | - | - | - | 0.0058 | 0.0051 | - | - | - | - | 0.0034 | 0.0017 |
| **Ethyl Carbonate** | - | - | 0.0385 | 0.0177 | 0.0293 | - | - | - | - | 0.0434 | 0.0158 | 0.0158 | - | - | - |
| **DiEthyl Carbonate** | - | - | - | - | - | 0.0438 | 0.0540 | - | - | - | - | - | 0.0211 | - | - |

### *Treatment of Buildings*

1.16 The proposed building for the battery manufacturing processes has been included within the model. The building has been split into different sections, to represent the different heights of each part of the building.

1.17 There are also a number of existing buildings located in the neighbouring industrial area to the south, and the buildings within Phase 1 of IAMP to the north east.

1.18 The buildings included within the model are detailed in Table 6.3/4.

**Table 6.3/4: Onsite Buildings Included in Model**

| Building Number | Building Name in Model | Building Description | Base Elevation (m) | Height of Building (m) | Grid Reference of SW Corner | |
|---|---|---|---|---|---|---|
| | | | | | X | Y |
| 1[a] | BLD_1 | On-site Building 1 | 38.70 | 30.00 | 433078.96 | 558740.09 |
| 2[a] | BLD_2 | On-site Building 2 | 38.70 | 30.00 | 433172.70 | 558533.07 |
| 3[a] | BLD_3 | On-site Building 3 | 38.70 | 16.00 | 433267.77 | 558703.55 |
| 4[a] | BLD_4 | On-site Building 4 | 38.70 | 16.00 | 433315.63 | 558597.67 |
| 5 | BLD_5 | On-site Building 5 | 38.70 | 11.20 | 433271.10 | 558695.81 |
| 6 | BLD_6 | On-site Building 6 | 38.70 | 16.00 | 433111.43 | 558578.35 |
| 7 | BLD_8 | On-site Building 8 | 38.70 | 16.00 | 433429.07 | 558725.26 |
| 8 | BLD_9 | On-site Building 9 | 38.70 | 16.00 | 433451.44 | 558705.23 |
| 9 | BLD_14 | Off-site Building 1 | 38.79 | 12.00 | 433026.14 | 558095.42 |
| 10 | BLD_15 | Off-site Building 2 | 40.50 | 12.00 | 433262.55 | 558264.52 |
| 11 | BLD_16 | Off-site Building 3 | 35.18 | 15.00 | 433725.71 | 558146.97 |
| 12 | BLD_17 | Off-site Building 4 | 36.54 | 25.00 | 433674.63 | 558585.11 |
| 13 | BLD_18 | Off-site Building 5 | 35.96 | 19.00 | 433536.75 | 558773.64 |
| 14 | BLD_19 | Off-site Building 6 | 35.67 | 15.00 | 433659.35 | 559063.87 |
| 15 | BLD_20 | Off-site Building 7 | 36.05 | 15.00 | 433714.85 | 559264.98 |
| 16 | BLD_21 | On-site building 10 | 38.70 | 11 | 433052.94 | 558753.20 |
| 17 | BLD_22 | On-site building 11 | 38.70 | 17 | 433109.49 | 558776.92 |
| 18 | BLD_23 | On-site building 12 | 38.70 | 22 | 433106.86 | 558782.50 |
| 19 | BLD_24 | On-site building 12 | 38.70 | 14 | 433133.53 | 558789.49 |

*[a] Modelled as tiered buildings to take into account the curvature of the roof. The ridge has been set to 30m above base elevation and the eaves at 28m above base elevation*

1.19 The locations of the on-Site buildings are shown in Figure 6.3/3, and the off-Site buildings are shown in Figure 6.3/4 below.

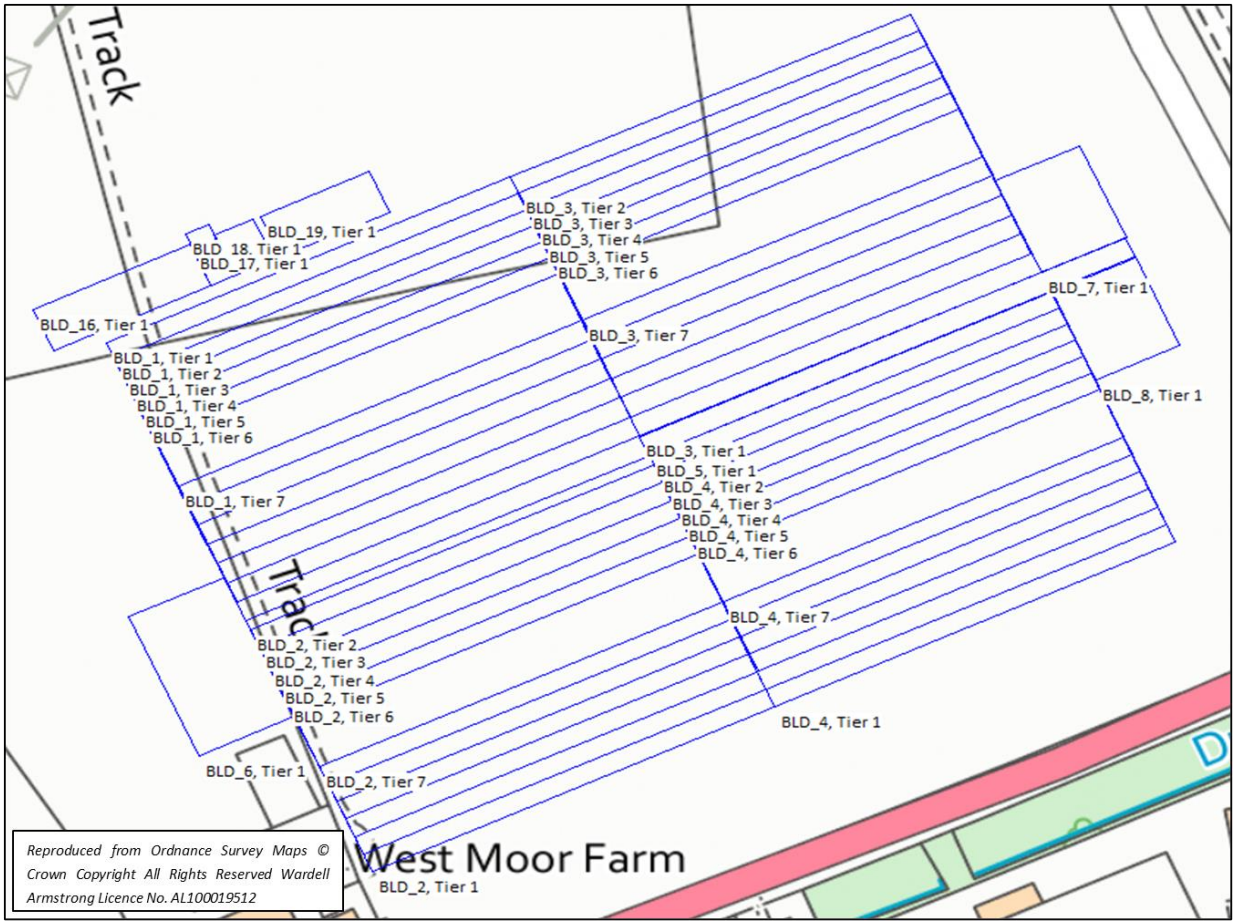



**Figure 6.3/3: Location of On-site Buildings in Model**

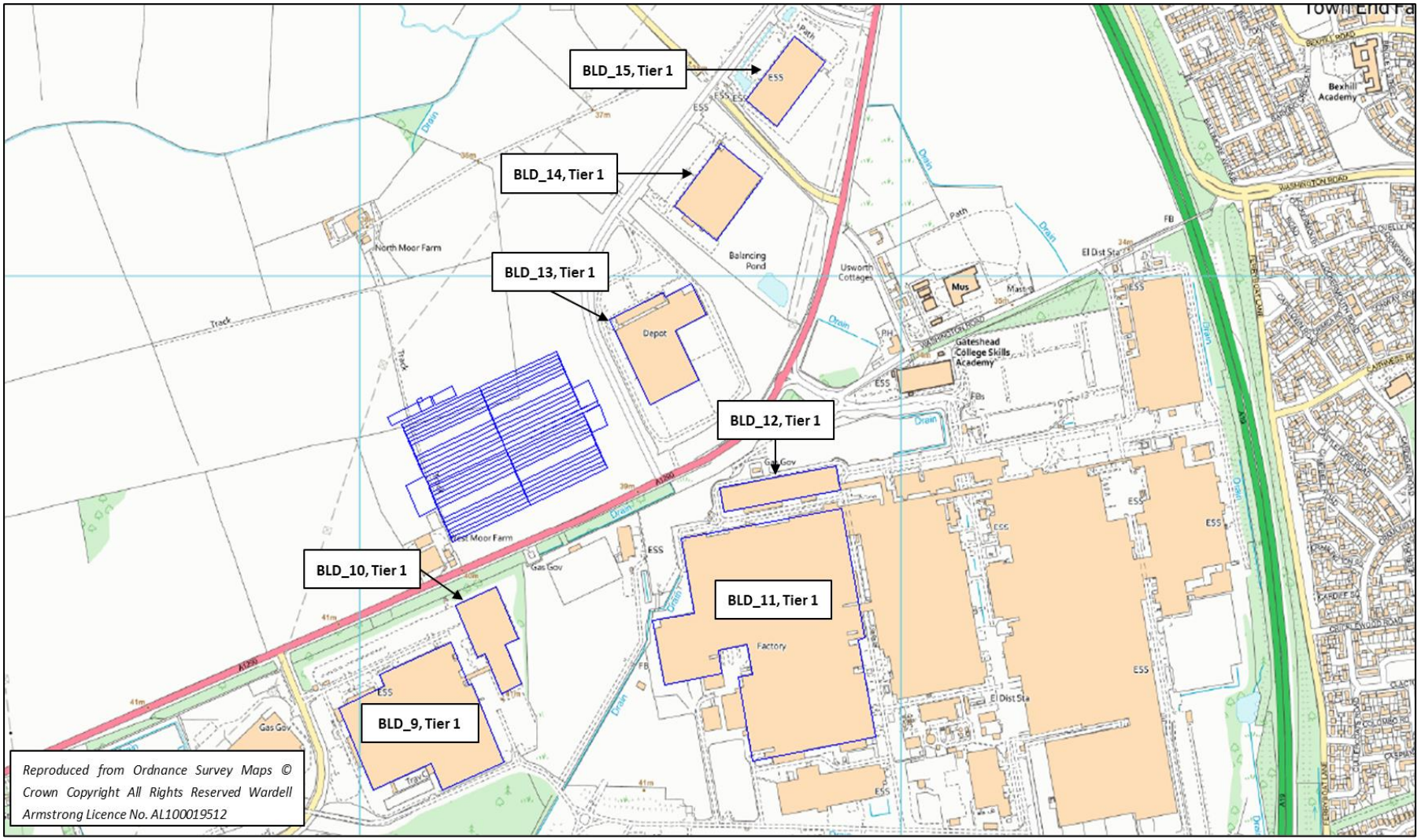



**Figure 6.3/4: Location of Off-site Buildings in Model**