



ECOLOGYSOLUTIONS

Part of the ES Group

GREAT WILSEY PARK,
HAVERHILL:
INFRASTRUCTURE
RESERVED MATTERS
APPLICATION

Lighting Strategy for Bats

Pursuant to Condition 44 of
DC/15/2151/OUT

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1. INTRODUCTION

1.1 Background

1.1.1 Ecology Solutions was commissioned by Redrow Homes in October 2018 to prepare materials to address the requirements of planning conditions for the development at Great Wilsey Park (reference: DC/15/2151/OUT). A series of Reserved Matters Applications (RMAs) is to be submitted in early 2019. The location of the site is shown on Plan ECO1. The existing situation is illustrated on Plan ECO2.

1.1.2 Condition 44 requires that such applications be supported by a Lighting Strategy for Bats. The condition states:

All reserved matters applications shall be supported by a lighting strategy for bats based on appendix 4.3 of the ES and the mitigation measures in the relevant sections of the ES and additional supporting reports. The lighting strategy must include:

- **Plan of the phase of development being considered showing the lighting strategy and how it relates to the overall lighting strategy in figure 30 in the ES**
- **Location of features to be protected including existing and new linear features and associated unlit dark corridors or buffer**
- **Location and design of bat boxes, bricks and / or tubes to new buildings, woodland edges and suitable trees.**

Reason: To ensure that wildlife habitats and protected species are not affected adversely by the development.

1.2 Purpose of this Report

1.2.1 This report has been prepared to address the requirements of condition 44, providing details of the lighting strategy for bats to be adopted within the infrastructure phase of the development. Note that this relates solely to the construction and operation of the principal road and cyclepath infrastructure, and not to the residential parcels, which are the subject of a separate application.

2. REVIEW OF OUTLINE ES INFORMATION

2.1 Appendix 4.3: Prevention of Lighting Impacts on Bats

2.1.1 Appendix 4.3 of the ES, cited in condition 44, was produced by Vanguardia Consulting in August 2015. Entitled *Prevention of Lighting Impacts on Bats*, it sets out the principles by which adverse effects on identified bat populations will be avoided during and following development of the site.

2.1.2 The main points of the report are reviewed below to provide context to this strategy. It should be noted that the 2015 report has been given full consideration as part of the development of the Ecological Implementation Strategy, the Landscape and Ecological Management Plan and the Biodiversity Monitoring Strategy, all submitted in support of the Infrastructure Reserved Matters Application.

2.1.3 The introduction of the report notes (at paragraphs 2.3 and 2.4) that:

Artificial lighting that spills onto a route used by bats can deter them. This report shows how this will be prevented whilst allowing the appropriate artificial lighting for the amenity and safety of residents and users of the Development.

All roads on the Development will need to be illuminated. There will be some locations where bat routes cross lit roads. At those points bat hop overs will be provided to assist bats to cross the road undeterred.

2.1.4 The report is therefore clear that there will be necessary interruptions to existing bat flightlines, but that good design can mitigate for these effects. It also makes clear that the safety of residents and drivers is the primary consideration.

2.1.5 Suffolk County Council's lighting requirements, as set out in section 3 of the report, are as follows:

- **Lighting unit: Philips-Indal Stela B Long with 14 LED light source. These units have a particularly sharp optical cut-off, thus containing light spill very well. They emit all of their light downwards; there is no light above the horizontal plane.**
- **Mounting height: 6 metres.**
- **Hours of use: Dusk to midnight, then switched off at midnight until 5 a.m. Lighting levels: 5 lux, and in sensitive areas 3 lux or 2 lux. Specific local amenity and environmental requirements will be considered at detailed design stage when selecting the lighting level for each street and footpath / cyclepath.**
- **Control: Telensa county-wide remote management system- remote setting of light level (dimming) and switching times, down to individual streets and lighting units. Enables any identified light pollution problem to be mitigated in the future**

2.1.6 Regarding the lighting unit, paragraph 3.2 notes that:

...the low illuminance requirements, the possibility of dimming even further when and where necessary, and the excellent optical cut-off characteristic of the preferred lighting unit, all combine to make it much easier to create a lighting solution that has no impact on bats.

2.1.7 Paragraph 5.1 notes that it:

...is widely agreed that impacts on bats can be prevented by reducing light spill below 1 lux along routes used by bats.

2.1.8 Paragraph 5.2 goes on:

...where bat routes cross a lit road in a built-up area it is not possible to achieve this without affecting safety and amenity for road users and pedestrians. In these instances the solution is to provide a bat hop over to encourage bats to raise their flying height above the level of nearby lighting units and thus continue to fly in a dark space.

2.1.9 Section 6 of the report is concerned with street lighting for roads and footpaths / cyclepaths adjacent to sensitive ecological areas. As illustrated in Figure 2a of the report, features such as woodland edges and hedgerows, along which some bat species will typically move, will be a minimum of 15m away from the nearest street lighting unit. Figure 2b of the report (a light spill diagram) shows that in following this protocol, light spill is tightly contained and will not adversely affect the feature in question.

2.1.10 Section 8 provides an illustration, at Figure 4, of a typical bat hop-over arrangement at lit crossing points.

2.2 ES Mitigation Measures

2.2.1 Mitigation measures in terms of the potential effects of lighting on bats are set out in Appendix 9.8 of the ES, the Bat Survey Report. These are summarised below.

- No lighting of trees identified as bat roosts;
- Minimum 15m buffer along woodland edges, to maintain a lighting level of 1 lux or less;
- Woodland remains connected to dark corridors that extend to the wider environment;
- Dark corridors across the site designed to ensure and incorporate habitats of value to bats for foraging, potential roosting and commuting into the wider area;
- Dark corridor routes for bats to incorporate natural dark routes already present;
- To maintain linkages and an area of darkness (below 1lux) across gaps created by the road accesses through the hedgerows, young plantation woodland and tributary corridor, hop-overs to be established;
- These comprise trees that are already semi-mature (6m in height) planted at either side of the road so that the canopies of these trees will be allowed to interlink over this section of road;
- These standard trees to be planted immediately following the removal of hedgerows / trees to facilitate road access; and
- Green infrastructure to be established early in the process.

- 2.2.2 Construction phase mitigation measures are to include the following:
- During the construction period no lighting to be present at night;
 - Lighting to be directed to where it is needed, to avoid light spillage, particularly along the hedgerow and woodland edges;
 - Buffer zones not to be illuminated; and
 - Any upward lighting should be avoided.
- 2.2.3 These measures have been given full consideration in developing the landscape and lighting strategy for the Infrastructure RMA.

3. INFRASTRUCTURE RMA LIGHTING STRATEGY

- 3.1 Figure 30 of the ES, the Bat Lighting Mitigation Strategy, is included at Appendix 1 to this report. The Infrastructure RMA forms a substantial part of the Redrow site, which is the first phase of the development of Great Wilsey Park.
- 3.2 Figure 30 shows the design and location of bat hop-overs, and the position of dark corridors to serve as bat foraging and dispersal routes. All of these factors have been fully incorporated into the Infrastructure RMA scheme, as illustrated on Plan ECO3.
- 3.3 Across the site, dark corridors have been designed to ensure and incorporate habitats of value to bats for foraging, potential roosting and commuting into the wider area.
- 3.4 It is noted that the dark corridor along the southern plantation shown on Plan ECO3 differs from that proposed in the outline ES. The reason for this is to do with the location of the bat hop-overs. The alignment of the roads, and that fact that the bat hop-overs are best positioned so that there is the shortest distance to cross, necessitated moving them further into the existing plantation. Further micro-siting was required to ensure the optimum distance from lighting columns.
- 3.5 Development will be buffered from features of value to bats, such as hedgerows and woodland edges, that will be incorporated within the dark corridor, the buffer zones have been designed to be of sufficient size (a minimum of 10 or 15m) that will ensure that the features utilised by bats will maintain a light level of below 1 lux.
- 3.6 Habitat corridors to be created extending out of the site to the north have been designed with native species planting (2m in height) which will ensure that a dark corridor (below 1 lux) is maintained on the outer edge of the new habitats to increase linkages to the wider environment and provide additional foraging habitat for bats following completion of the development.
- 3.7 In order to maintain the linkages and an area of darkness (below 1 lux) across the gaps created by the road access through the hedgerows, young plantation woodland and tributary corridor a 'hop-over' will be created. This comprises trees that are already semi-mature (6m in height) planted at either side of the road so that the canopies of these trees will be allowed to interlink over this section of road. To minimise the potential effects to bats (particularly Barbastelle) during the development these standard trees will be planted immediately following the removal of hedgerows / trees to facilitate road access.
- 3.8 Other lighting considerations will also be implemented during construction and incorporated into the development in order to ensure minimal light spill from the site. Lighting will be directed to where it is needed, to avoid light spillage, particularly along the hedgerow and woodland edges; buffer zones will not be illuminated; lighting that is incorporated into the development design will be of a type that has a low attraction to insects; and any upward lighting will be avoided. During the construction period no lighting to be present at night.
- 3.9 The lighting strategy produced by Harttron in association with Royal Haskoning DHV on behalf of Redrow Homes is included at Appendix 2 to this report.

- 3.10 The report details the luminaires to be used, which are equivalent to the model cited in the previous section, as named in Appendix 4.3 to the ES.
- 3.11 The report shows the position of luminaires relative to the bat hop-overs at access road crossings. The figures illustrating horizontal luminance show that in the immediate vicinity of the luminaires the level of 3.69 lux, but that this declines to 0.74 lux a short distance away.
- 3.12 Lighting columns at bat hop-over locations are to be 4m in height rather than 6m as elsewhere in the site. This will increase the volume of the darker areas above the columns. Trees planted in these locations are to be a minimum of 6m in height, and therefore bats will be encouraged to fly up and over the illuminated area below. The design of the columns is directional, with light focused on the ground below rather than upwards.
- 3.13 All LED columns will be appropriately shielded to avoid backwards light spill on dark corridors.
- 3.14 These features will ensure that an effective dark corridor for bats is maintained at the bat hop-over locations.
- 3.15 In initial discussion with Suffolk County Council the street lighting officer suggested 6m columns throughout. However, they are aware of ecological concerns across the scheme so are willing to consider alternative solutions. This being the case we have 4m columns LED columns with direction-focused lanterns are proposed to reduce the light impact in the bat hop-over areas.
- 3.16 Columns cannot be removed in these area since there are specific lighting standards for the adoptable roads (P3) and isolated footway cycleways (P5). The statement by the street lighting officer was also given that that:
- Ultimately, as the adopting highway authority, whilst we appreciate that there might be certain areas where there is a desire to control the lighting levels to minimise environmental impact, this must be weighed up against the need to light the adoptable roads to the required British, European and Suffolk County Council adoptable highway standards.**
- 3.17 In this context, the best compromise between ecological concerns and the safety of the public has been reached.
- 3.18 The Reserved Matters Street Lighting Plans (reference PB8301-RHD-DE-H1-DR-D-1300) at Appendix 3 produced by Royal Haskoning DHV overlays the lighting scheme onto the proposed layout. The lux contours are shown, with the 0.74 contour in blue and the 0.4 contour in purple. It can be seen that this is reached a short distance from the lit routes, and that therefore the large majority of the green spine and linear park, as well as the woodlands, are in darkness.

4. LOCATION OF FEATURES TO BE PROTECTED

- 4.1 The locations of features to be protected, i.e. retained and new habitats, plus trees identified as bat roosts, are shown on Plan ECO3. These features are protected from lighting effects within a designated dark corridor.
- 4.2 The Reserved Matters Lighting Plan at Appendix 3 shows that the majority of the existing and proposed features will be in darkness. The 0.74 lux contour is reached within a short distance of the lit infrastructure.

5. LOCATION AND DESIGN OF BAT BOXES

- 5.1 The Infrastructure RMA does not include any buildings, and therefore all bat boxes proposed are designed for attachment to trees.
- 5.2 The indicative locations of proposed bat boxes are illustrated in Plan ECO3. The following models are to be included (as set out in the Ecological Implementation Strategy and the Landscape and Ecological Management Plan):
- 20 Schwegler 2F Universal Bat Boxes;
 - 20 Schwegler 1FF Flat Bat Boxes; and
 - 5 Schwegler 1FW Hibernation Boxes.
- 5.3 All boxes are to be positioned well away from new light sources, on retained trees. The positions of the boxes are currently shown assume that some will be fitted to newly planted trees, where possible. Where this is not possible they will be relocated to existing trees and woodland where suitable trees exist. All bat box placements will be subject to ground appraisal of the site by the Ecological Clerk of Works. The specifications are shown in Appendix 4.

6. SUMMARY AND CONCLUSIONS

6.1 Ecology Solutions was commissioned by Redrow Homes in October 2018 to prepare materials to address the requirements of planning conditions for the development at Great Wilsey Park (reference: DC/15/2151/OUT). A series of Reserved Matters Applications (RMAs) is to be submitted in early 2019.

6.2 Condition 44 requires that such applications be supported by a Lighting Strategy for Bats. The condition states:

All reserved matters applications shall be supported by a lighting strategy for bats based on appendix 4.3 of the ES and the mitigation measures in the relevant sections of the ES and additional supporting reports. The lighting strategy must include:

- **Plan of the phase of development being considered showing the lighting strategy and how it relates to the overall lighting strategy in figure 30 in the ES**
- **Location of features to be protected including existing and new linear features and associated unlit dark corridors or buffer**
- **Location and design of bat boxes, bricks and / or tubes to new buildings, woodland edges and suitable trees.**

6.3 This document reviews the information set out in Appendix 4.3 (*Prevention of Lighting Impacts on Bats*) and the ES accompanying the outline application. These measures have formed the basis of the approach taken to lighting and landscaping of the Infrastructure RMA and consideration of its affect on local bat populations.

6.4 A lighting strategy has been produced by Harttron in association with Royal Haskoning DHV.

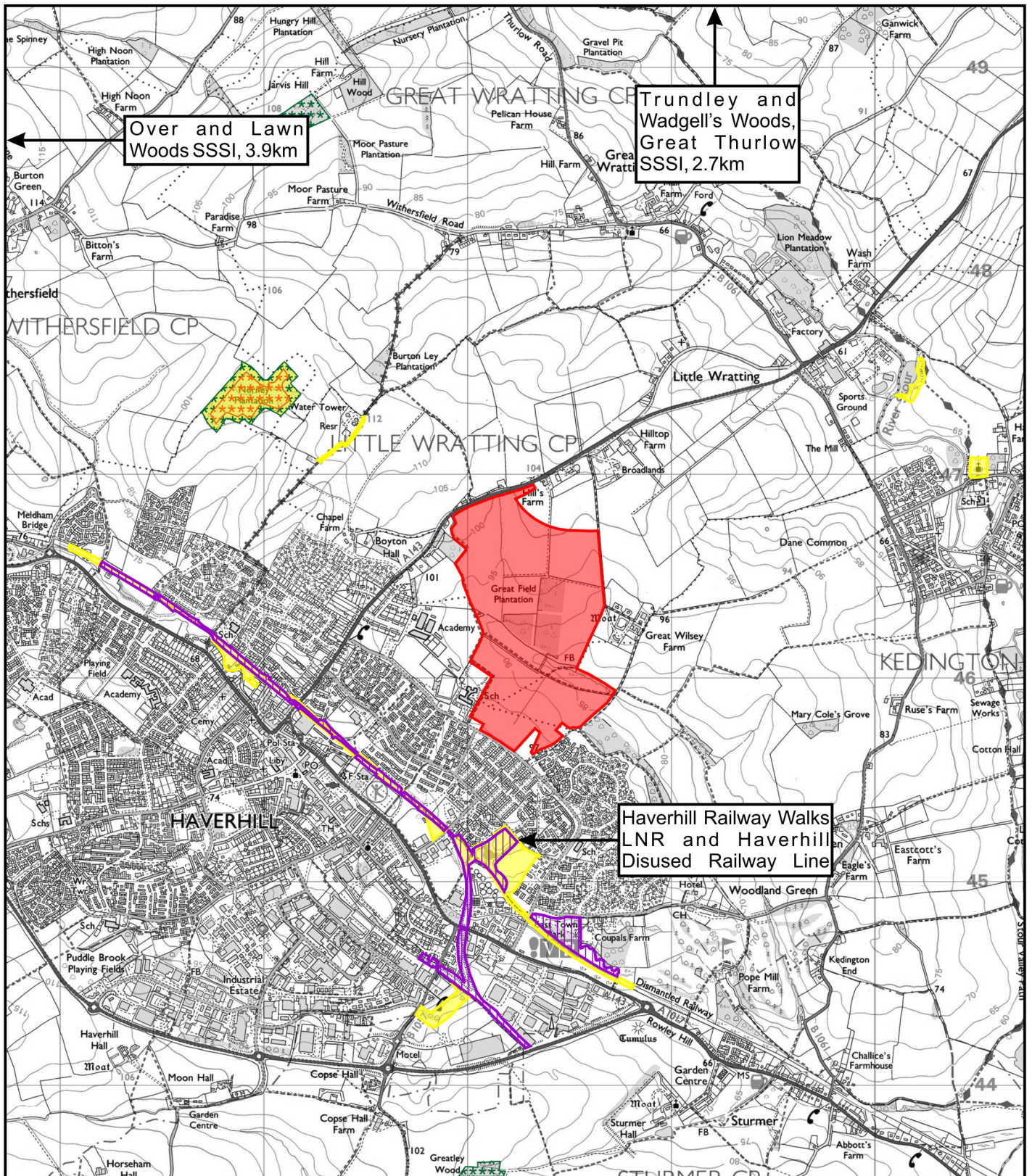
6.5 Luminaires proposed are in line with prescriptions given in the ES. Bat hop-overs have been incorporated at all road access points, with luminaires at this location being 4m in height, less than the 6m of new trees to be planted. Existing and proposed habitat features, including woodlands and hedgerows, will not be lit. Trees identified as bat roosts will not be lit; similarly bat boxes to be installed as enhancements. Specific measures are included to avoid potential adverse effects during construction.

6.6 The approach proposed is in line with the requirements of Appendix 4.3 and the ES, including the overall lighting strategy illustrated on Figure 30. The design and the measures to be adopted will avoid significant adverse effects on bats as a result of lighting. The strategy will ensure that bats will continue to be able to forage, disperse and roost within the site post-development.

PLANS

PLAN ECO1

Site Location and Ecological Designations








Over and Lawn Woods SSSI, 3.9km

Trundley and Wadgell's Woods, Great Thurlow SSSI, 2.7km

Haverhill Railway Walks LNR and Haverhill Disused Railway Line

KEY:

-  SITE LOCATION
-  LOCAL NATURE RESERVE (LNR)
-  COUNTY WILDLIFE SITE (CWS)
-  ANCIENT WOODLAND
-  ANCIENT REPLANTED WOODLAND



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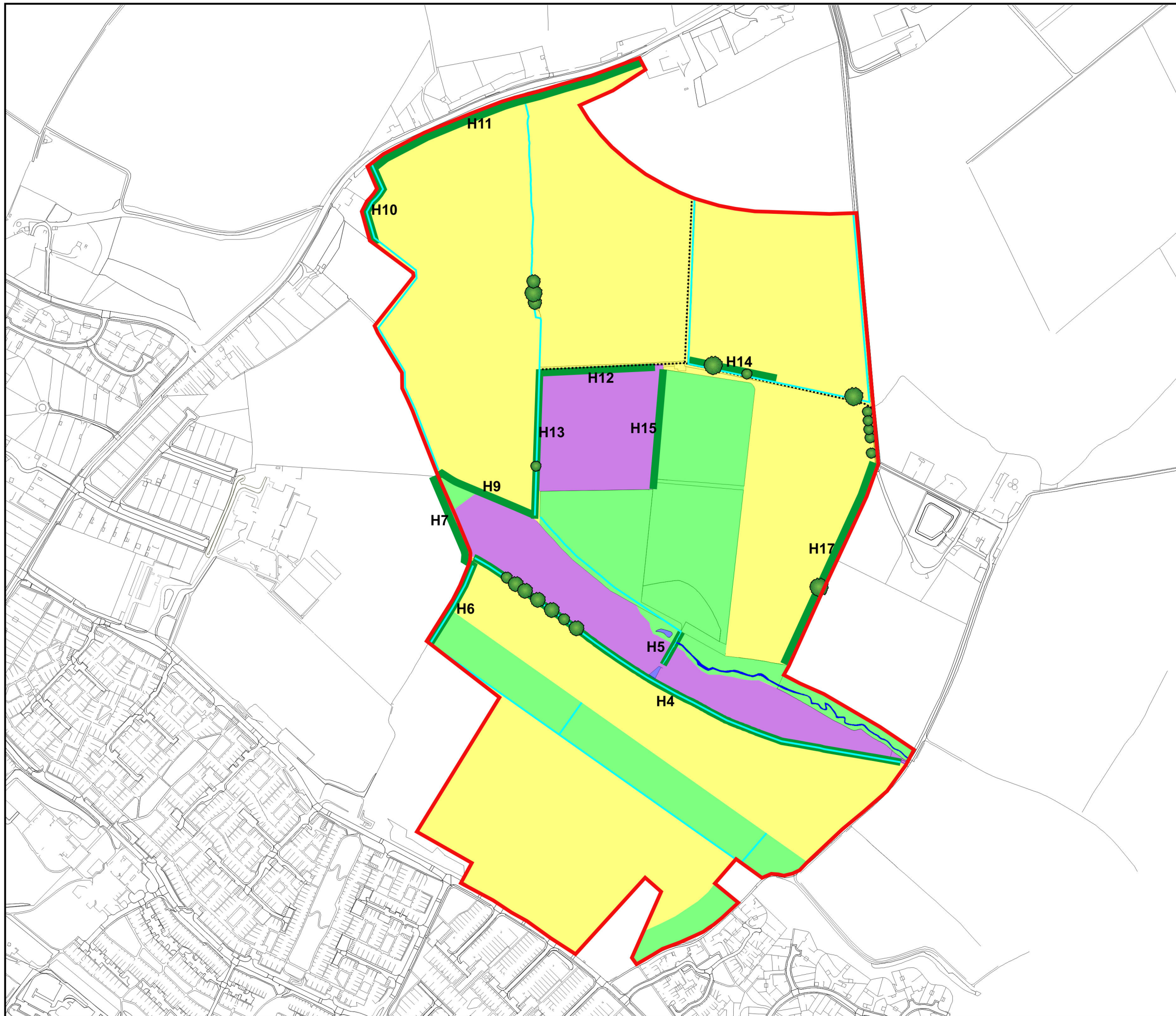
8110: GREAT WILSEY PARK,
HAVERHILL

PLAN ECO1: SITE LOCATION AND
ECOLOGICAL DESIGNATIONS

Rev: A
Jul 2019

PLAN ECO2

Ecological Features



- KEY:**
- SITE BOUNDARY
 - ARABLE LAND
 - WOODLAND
 - IMPROVED GRASSLAND
 - DITCH
 - STOUR BROOK TRIBUTARY
 - POND
 - HEDGEROW
 - TREE
 - TRACK



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HAVERHILL

PLAN ECO2:
ECOLOGICAL FEATURES






Rev: A
Jul 2019

PLAN ECO3

Lighting Strategy



KEY:

-  DARK CORRIDOR
-  CONFIRMED BAT ROOST
-  BAT HOP-OVER
-  45X SCHWEGLER 2F, 1FF AND 1FW BAT BOX
-  BAT FORAGING ROUTES



Based on Exterior Architecture Drawing No. ExA_1868_Illustrative Masterplan



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HAVERHILL

PLAN ECO3:
LIGHTING STRATEGY

Rev: B
Jul 2019

APPENDICES

APPENDIX 1

Figure 30: Bat Lighting Mitigation Strategy (FPCR)

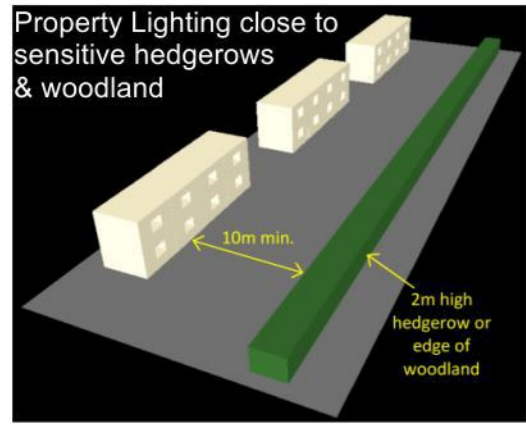


Figure 3a: Properties backing onto bat routes

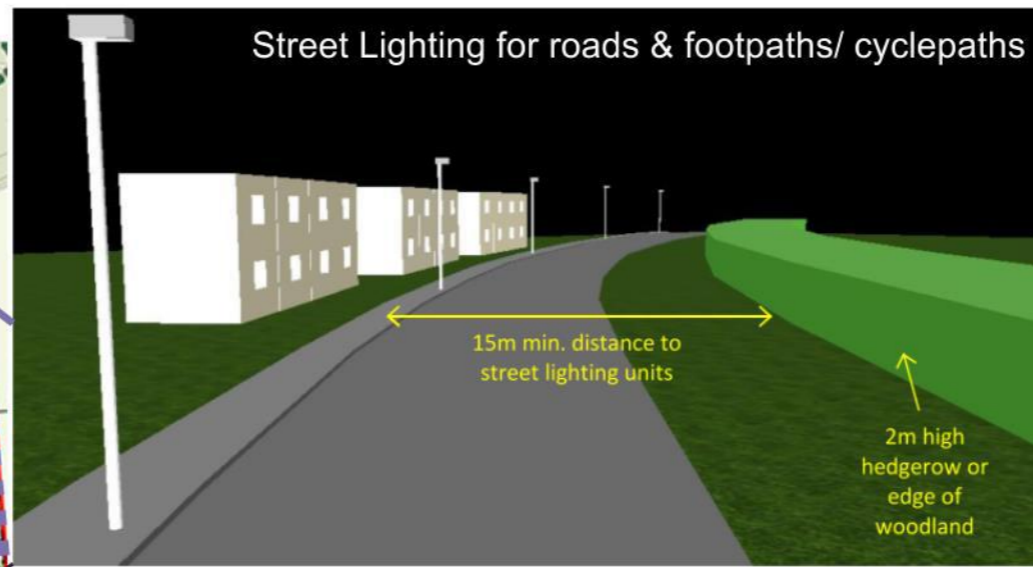
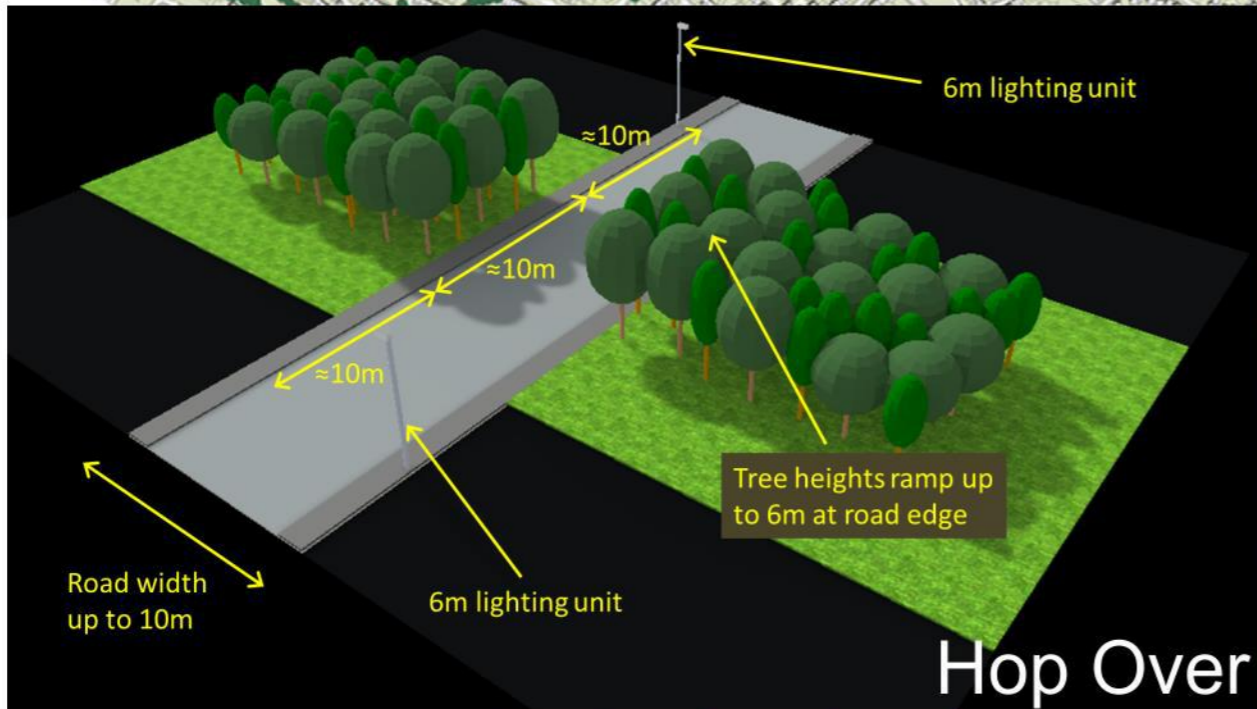


Figure 2a: Street lighting arrangement near bat routes




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-  Development Boundary
-  Proposed Hop Over Location
-  Bat Route - Dark Corridor
-  Lit Cycle Paths
-  Lit Roads

Hallam Land Management Ltd

Great Wilsey Park,
Haverhffolk

 Bat Lighting Mitigation Strategy

NTS @ A3 REH 04/02/2016

 **Figure 30** **REV A**

APPENDIX 2

Outdoor Lighting Report (Harttron)

DATE: 9 July 2019
DESIGNER: SS
PROJECT No: 20320
PROJECT NAME: Haverhill, Suffolk



20320-A-01D

****Grids 2-4 show reduced lighting for bat areas****

P3 with S/P ratio of 1/.61

Outdoor Lighting Report

PREPARED BY: Harttron Ltd,
Units 3-3a,
Second Avenue,
Poynton Industrial Estate,
Poynton
Cheshire
SK12 1ND

T: 01625 850 855
F: 01625 850 856

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1	568119.88	246647.37	70.46	30.00	1.50	1.50
2	Grid 2	568128.26	246483.93	72.00	32.92	1.50	1.50
3	Grid 3	568142.79	245969.60	39.00	91.26	1.50	1.50
4	Grid 4	568388.42	245727.89	151.07	114.00	1.50	1.50
5	Grid 5	567965.46	246484.32	375.00	375.00	1.50	1.50
6	Grid 6	567827.95	246215.09	375.00	375.00	1.50	1.50
7	Grid 7	567883.72	245798.49	375.00	375.00	1.50	1.50
8	Grid 8	568193.36	245651.90	375.00	375.00	1.50	1.50
9	Grid 9	568319.50	245651.84	375.00	375.00	1.50	1.50
10	Grid 10	567970.99	246158.23	375.00	375.00	1.50	1.50

Luminaires



Luminaire A Data

Supplier	Philips
Type	BGP615_DX70_2800_10LED_5.1S_CLO_L90_NW
Lamp(s)	LED-HB 5.1S NW
Lamp Flux (klm)	2.80
File Name	Luma Micro_BGP615_DX70_2800_10LED_5.1S_CLO_L90_NW.ies
Maintenance Factor	0.76
Imax70,80,90(cd/klm)	328.4, 277.9, 0.0
Lamp S/P Ratio	1.61
No. in Project	10



Luminaire B Data

Supplier	Philips
Type	BGP615_DX70_3400_20LED_5.1S_CLO_L90_NW
Lamp(s)	LED-HB 5.1S NW
Lamp Flux (klm)	3.40
File Name	Luma Micro_BGP615_DX70_3400_20LED_5.1S_CLO_L90_NW.ies
Maintenance Factor	0.76
Imax70,80,90(cd/klm)	328.4, 277.9, 0.0
Lamp S/P Ratio	1.61
No. in Project	1



Luminaire C Data

Supplier	Philips
Type	BGP615_DM70_6000_20LED_5.1S_CLO_L90_NW
Lamp(s)	LED-HB 5.1S NW
Lamp Flux (klm)	6.00
File Name	Luma Micro_BGP615_DM70_6000_20LED_5.1S_CLO_L90_NW.ies
Maintenance Factor	0.76
Imax70,80,90(cd/klm)	405.6, 354.6, 0.0
Lamp S/P Ratio	1.61
No. in Project	83

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	A	568367.84	245805.05	4.00	135.00	0.00	0.00	0.30			
2	A	568384.20	245829.56	4.00	297.00	0.00	0.00	0.30			
3	A	568409.10	245827.17	4.00	107.00	0.00	0.00	0.30			
4	A	568426.42	245846.45	4.00	313.00	0.00	0.00	0.30			
5	A	568172.11	245979.73	4.00	344.00	0.00	0.00	0.30			
6	A	568189.31	246000.22	4.00	155.00	0.00	0.00	0.30			
7	A	568185.83	246020.78	4.00	337.00	0.00	0.00	0.30			
8	A	568151.28	246506.07	4.00	278.00	0.00	0.00	0.30			
9	A	568175.34	246496.87	4.00	95.00	0.00	0.00	0.30			
10	B	568153.22	246681.67	4.00	298.00	0.00	0.00	0.30			
11	A	568135.73	246663.99	4.00	113.00	0.00	0.00	0.30			
12	C	568180.64	246833.94	6.00	174.00	0.00	0.00	0.30			
13	C	568177.48	246794.98	6.00	177.00	0.00	0.00	0.30			
14	C	568177.53	246760.40	6.00	183.00	0.00	0.00	0.30			
15	C	568179.53	246726.08	6.00	183.00	0.00	0.00	0.30			
16	C	568163.99	246699.19	6.00	344.00	0.00	0.00	0.30			
17	C	568191.49	246691.30	6.00	276.00	0.00	0.00	0.30			
18	C	568176.88	246672.21	6.00	115.00	0.00	0.00	0.30			
19	C	568222.88	246693.15	6.00	263.00	0.00	0.00	0.30			
20	C	568283.18	246683.77	6.00	260.00	0.00	0.00	0.30			
21	C	568307.15	246671.71	6.00	209.00	0.00	0.00	0.30			
22	C	568297.21	246633.38	6.00	353.00	0.00	0.00	0.30			
23	C	568306.32	246590.73	6.00	177.00	0.00	0.00	0.30			
24	C	568292.29	246557.72	6.00	2.00	0.00	0.00	0.30			
25	C	568292.28	246519.53	6.00	359.00	0.00	0.00	0.30			
26	C	568298.41	246500.19	6.00	93.00	0.00	0.00	0.30			
27	C	568334.28	246503.02	6.00	91.00	0.00	0.00	0.30			
28	C	568265.41	246499.26	6.00	93.00	0.00	0.00	0.30			
29	C	568233.08	246498.25	6.00	93.00	0.00	0.00	0.30			
30	C	568127.17	246501.80	6.00	284.00	0.00	0.00	0.30			
31	C	568095.81	246494.58	6.00	285.00	0.00	0.00	0.30			
32	C	568066.09	246487.79	6.00	285.00	0.00	0.00	0.30			
33	C	567989.64	246465.37	6.00	19.00	0.00	0.00	0.30			
34	C	568009.15	246474.75	6.00	286.00	0.00	0.00	0.30			
35	C	568009.32	246445.60	6.00	198.00	0.00	0.00	0.30			
36	C	568008.53	246407.73	6.00	12.00	0.00	0.00	0.30			

Layout Continued

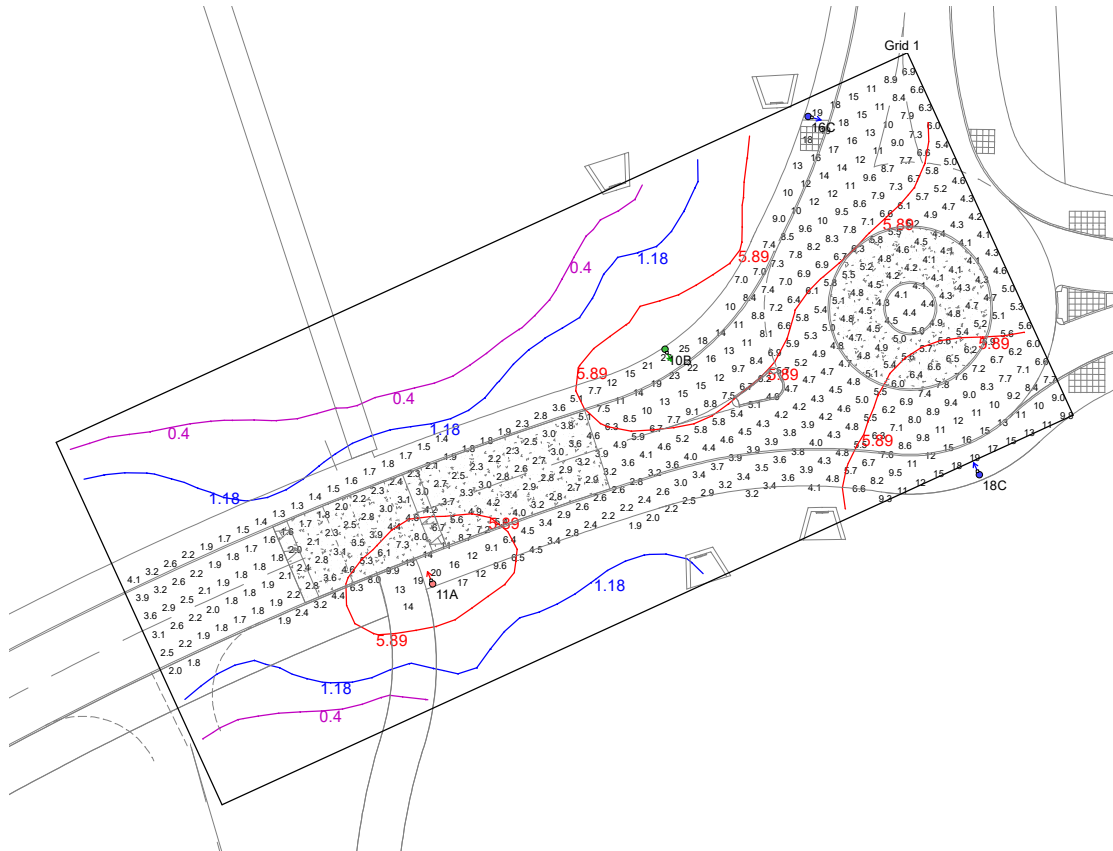
ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
37	C	567989.43	246500.14	6.00	206.00	0.00	0.00	0.30			
38	C	567962.54	246524.64	6.00	28.00	0.00	0.00	0.30			
39	C	567976.17	246563.20	6.00	150.00	0.00	0.00	0.30			
40	C	567981.19	246586.39	6.00	298.00	0.00	0.00	0.30			
41	C	567971.42	246543.70	6.00	187.00	0.00	0.00	0.30			
42	C	568013.30	246606.68	6.00	310.00	0.00	0.00	0.30			
43	C	568075.70	246632.03	6.00	123.00	0.00	0.00	0.30			
44	C	568101.22	246659.97	6.00	301.00	0.00	0.00	0.30			
45	C	568042.85	246624.81	6.00	305.00	0.00	0.00	0.30			
46	C	568022.04	246374.11	6.00	34.00	0.00	0.00	0.30			
47	C	568055.94	246348.58	6.00	215.00	0.00	0.00	0.30			
48	C	568071.00	246316.61	6.00	193.00	0.00	0.00	0.30			
49	C	568074.33	246280.07	6.00	186.00	0.00	0.00	0.30			
50	C	568084.64	246247.36	6.00	200.00	0.00	0.00	0.30			
51	C	568088.49	246213.31	6.00	177.00	0.00	0.00	0.30			
52	C	568080.03	246182.40	6.00	153.00	0.00	0.00	0.30			
53	C	568059.19	246158.67	6.00	346.00	0.00	0.00	0.30			
54	C	568072.11	246138.96	6.00	200.00	0.00	0.00	0.30			
55	C	568075.95	246111.60	6.00	48.00	0.00	0.00	0.30			
56	C	568106.48	246104.40	6.00	233.00	0.00	0.00	0.30			
57	C	568125.20	246077.71	6.00	52.00	0.00	0.00	0.30			
58	C	568149.97	246060.48	6.00	54.00	0.00	0.00	0.30			
59	C	568184.75	246050.15	6.00	241.00	0.00	0.00	0.30			
60	C	568214.45	246034.69	6.00	214.00	0.00	0.00	0.30			
61	C	568225.97	246011.60	6.00	62.00	0.00	0.00	0.30			
62	C	568185.59	246033.83	6.00	26.00	0.00	0.00	0.30			
63	C	568253.35	245994.84	6.00	54.00	0.00	0.00	0.30			
64	C	568176.20	245951.89	6.00	157.00	0.00	0.00	0.30			
65	C	568156.20	245933.72	6.00	329.00	0.00	0.00	0.30			
66	C	568133.34	245905.55	6.00	315.00	0.00	0.00	0.30			
67	C	568107.48	245886.04	6.00	313.00	0.00	0.00	0.30			
68	C	568091.60	245851.08	6.00	150.00	0.00	0.00	0.30			
70	C	568069.53	245817.49	6.00	355.00	0.00	0.00	0.30			
71	C	568287.30	245981.18	6.00	219.00	0.00	0.00	0.30			
72	C	568299.45	245953.60	6.00	52.00	0.00	0.00	0.30			
73	C	568331.33	245944.80	6.00	238.00	0.00	0.00	0.30			

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
74	C	568360.93	245916.69	6.00	52.00	0.00	0.00	0.30			
75	C	568395.09	245901.60	6.00	235.00	0.00	0.00	0.30			
76	C	568446.74	245886.46	6.00	273.00	0.00	0.00	0.30			
77	C	568450.62	245865.20	6.00	164.00	0.00	0.00	0.30			
78	C	568416.60	245879.04	6.00	69.00	0.00	0.00	0.30			
79	C	568481.29	245883.79	6.00	112.00	0.00	0.00	0.30			
80	C	568506.99	245902.65	6.00	283.00	0.00	0.00	0.30			
81	C	568536.14	245904.51	6.00	264.00	0.00	0.00	0.30			
82	C	568563.07	245891.01	6.00	82.00	0.00	0.00	0.30			
83	C	568342.57	245795.51	6.00	313.00	0.00	0.00	0.30			
84	C	568329.01	245769.92	6.00	132.00	0.00	0.00	0.30			
85	C	568306.04	245746.98	6.00	126.00	0.00	0.00	0.30			
86	C	568277.14	245720.83	6.00	138.00	0.00	0.00	0.30			
87	C	568253.77	245698.05	6.00	108.00	0.00	0.00	0.30			
88	C	568601.39	245893.62	6.00	254.00	0.00	0.00	0.30			
89	C	568633.13	245873.05	6.00	71.00	0.00	0.00	0.30			
90	C	568668.18	245871.52	6.00	252.00	0.00	0.00	0.30			
91	C	568382.08	246506.60	6.00	97.00	0.00	0.00	0.30			
92	C	568061.82	245792.68	6.00	331.00	0.00	0.00	0.30			
93	C	568253.48	246689.49	6.00	258.00	0.00	0.00	0.30			
94	C	568200.33	246497.26	6.00	88.00	0.00	0.00	0.30			
95	C	568037.58	246481.34	6.00	283.00	0.00	0.00	0.30			

Horizontal Illuminance (lux)

Grid 1

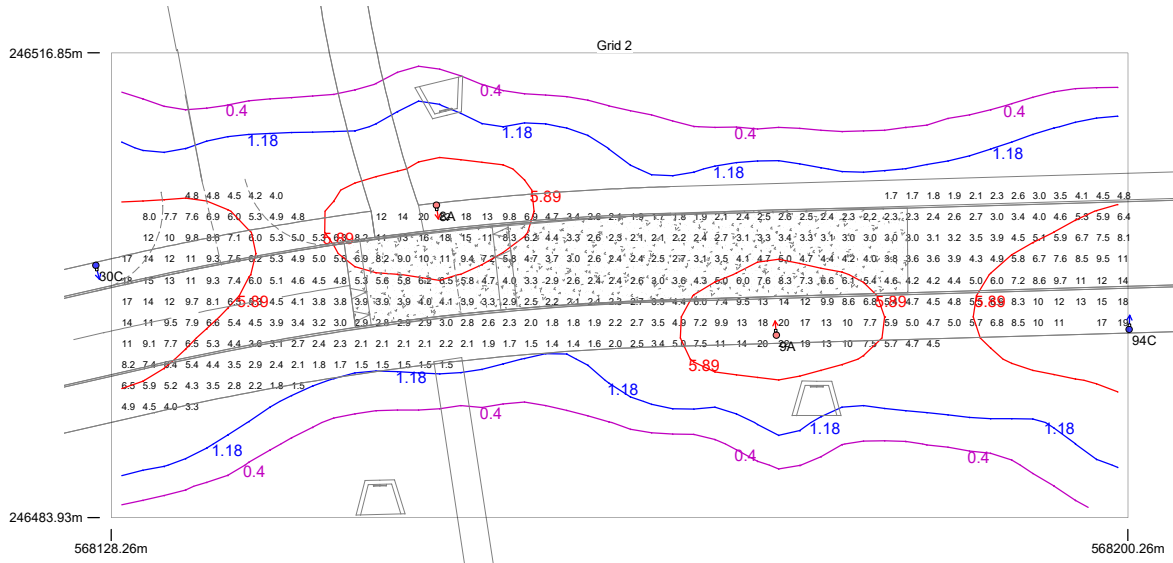


Results

Eav	6.36
Emin	1.32
Emax	26.82
Emin/Emax	0.05
Emin/Eav	0.21

Horizontal Illuminance (lux)

Grid 2

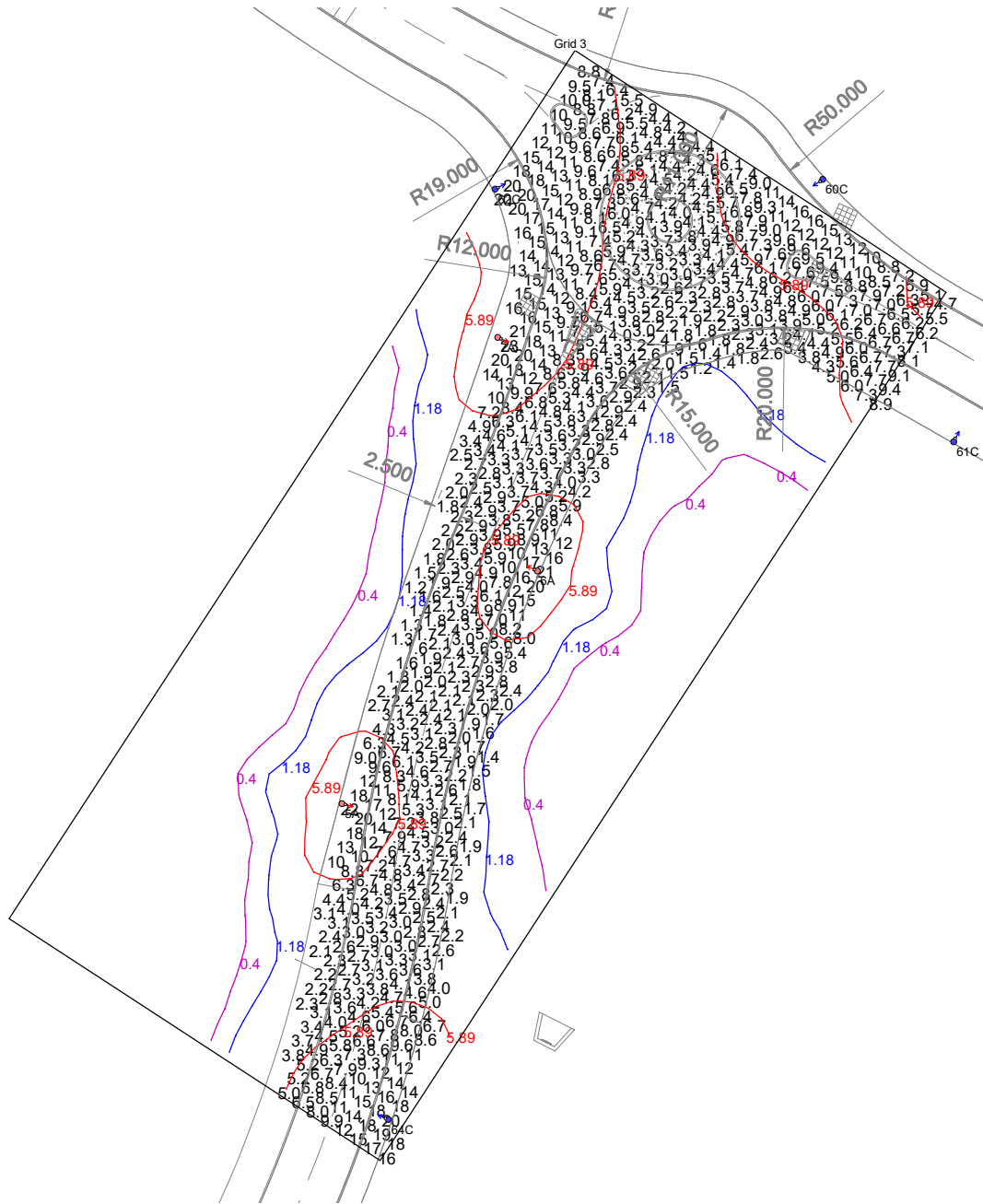


Results

Eav	6.01
Emin	1.42
Emax	22.13
Emin/Emax	0.06
Emin/Eav	0.24

Horizontal Illuminance (lux)

Grid 3

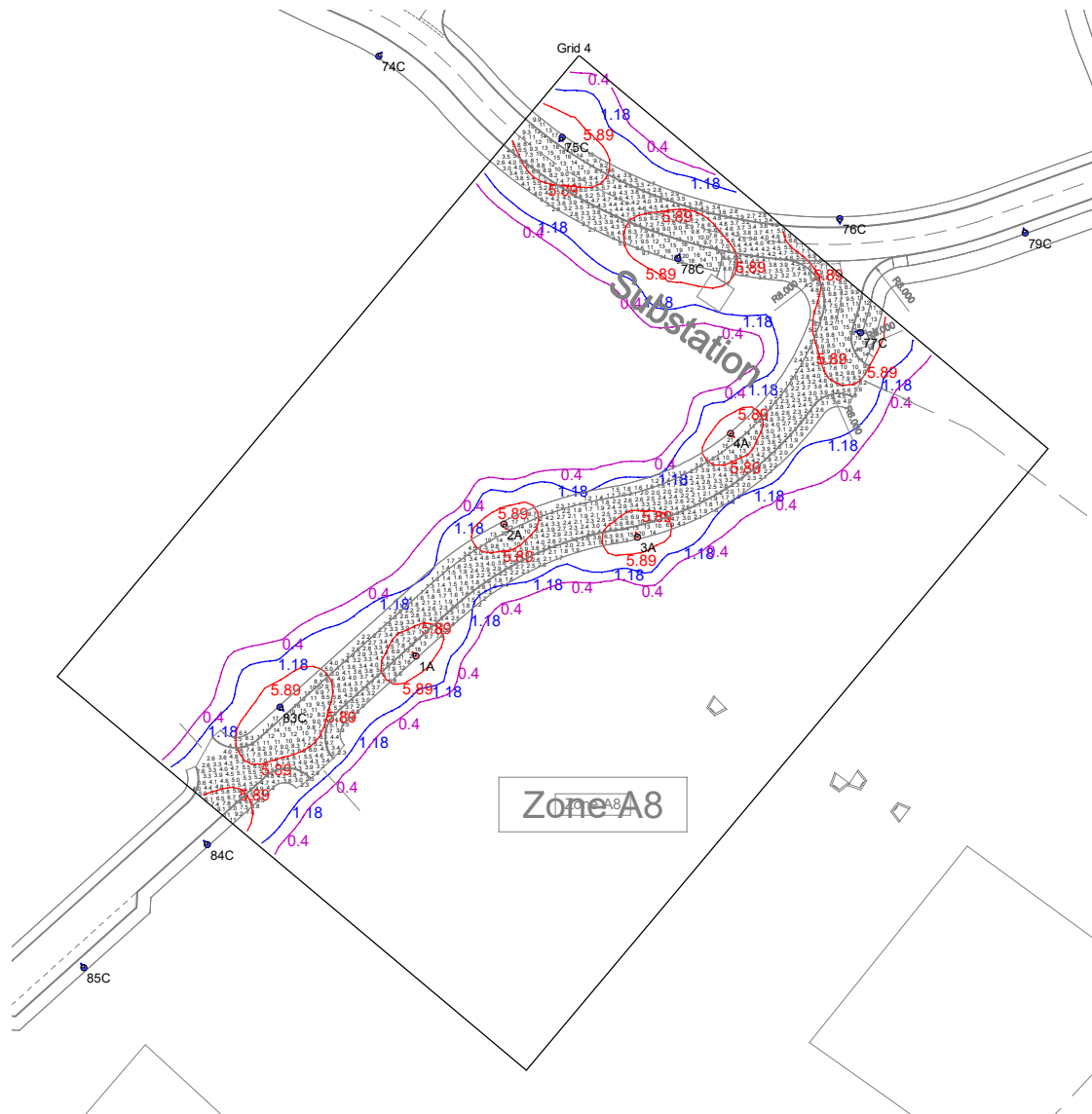


Results

Eav	6.35
Emin	1.23
Emax	23.49
Emin/Emax	0.05
Emin/Eav	0.19

Horizontal Illuminance (lux)

Grid 4

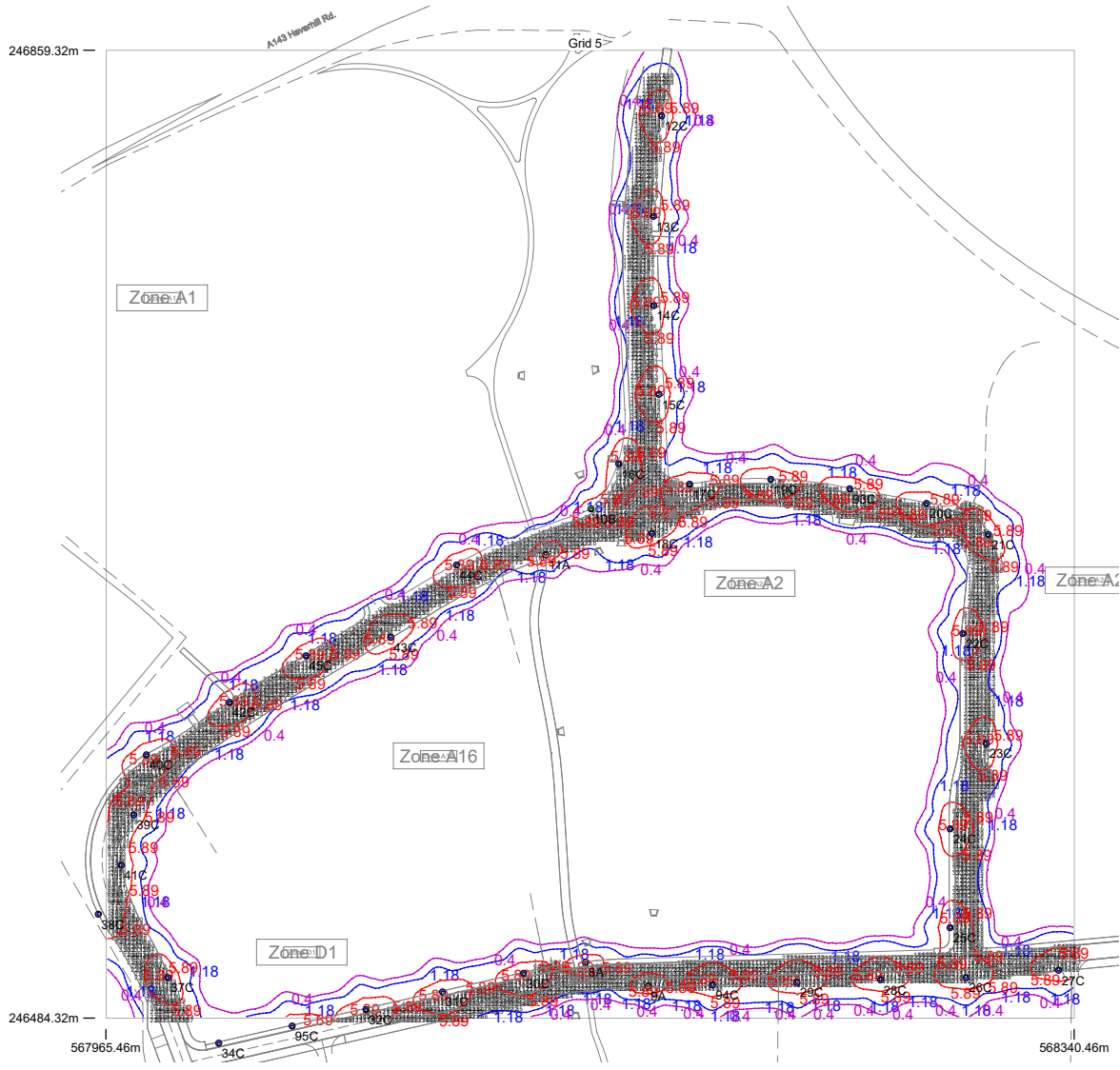


Results

Eav	6.06
Emin	1.20
E _{max}	21.53
Emin/E _{max}	0.06
Emin/Eav	0.20

Horizontal Illuminance (lux)

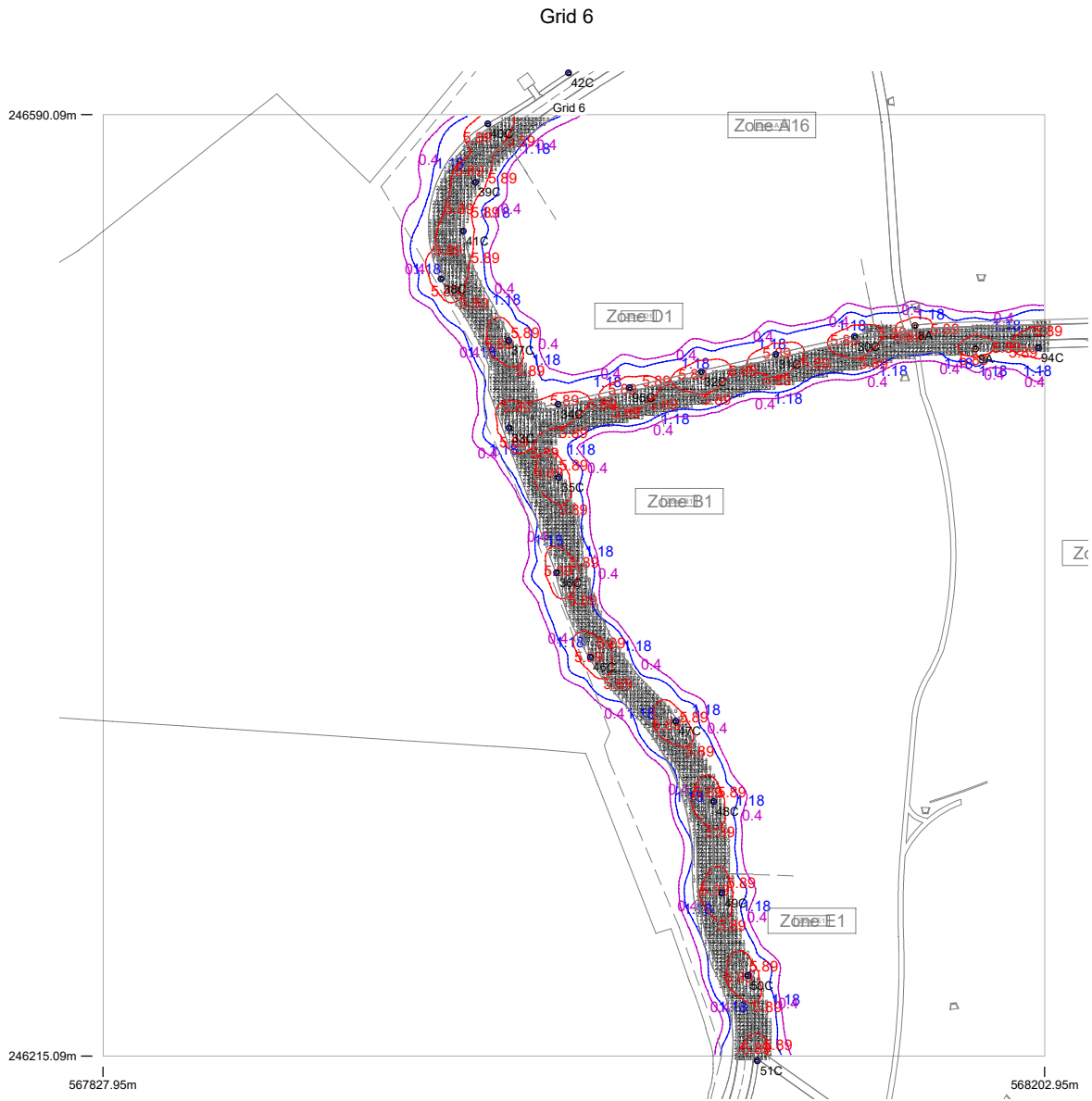
Grid 5



Results

Eav	6.58
Emin	1.19
Emax	26.79
Emin/Emax	0.04
Emin/Eav	0.18

Horizontal Illuminance (lux)

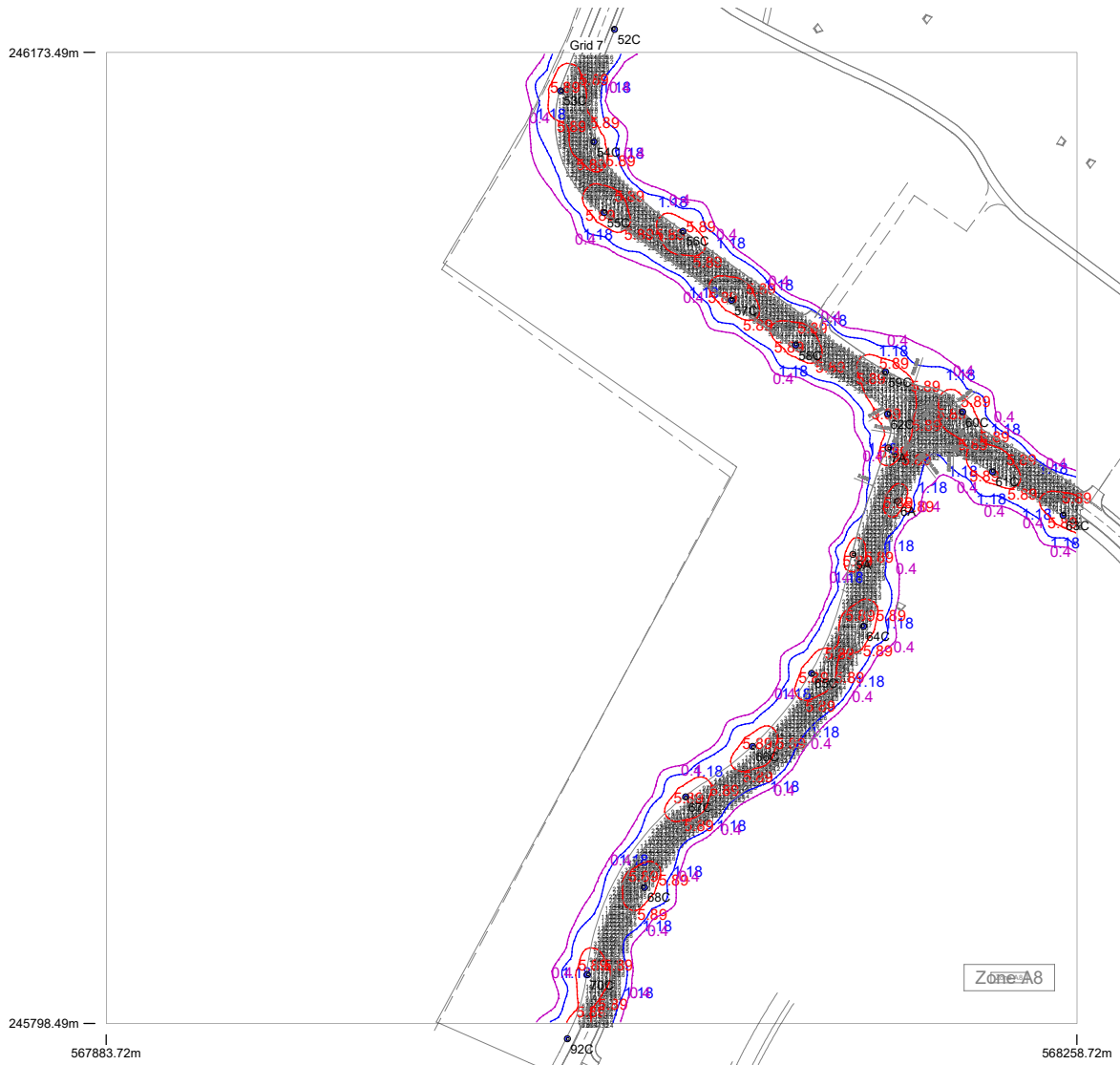


Results

Eav	6.72
Emin	1.19
Emax	21.74
Emin/Emax	0.05
Emin/Eav	0.18

Horizontal Illuminance (lux)

Grid 7

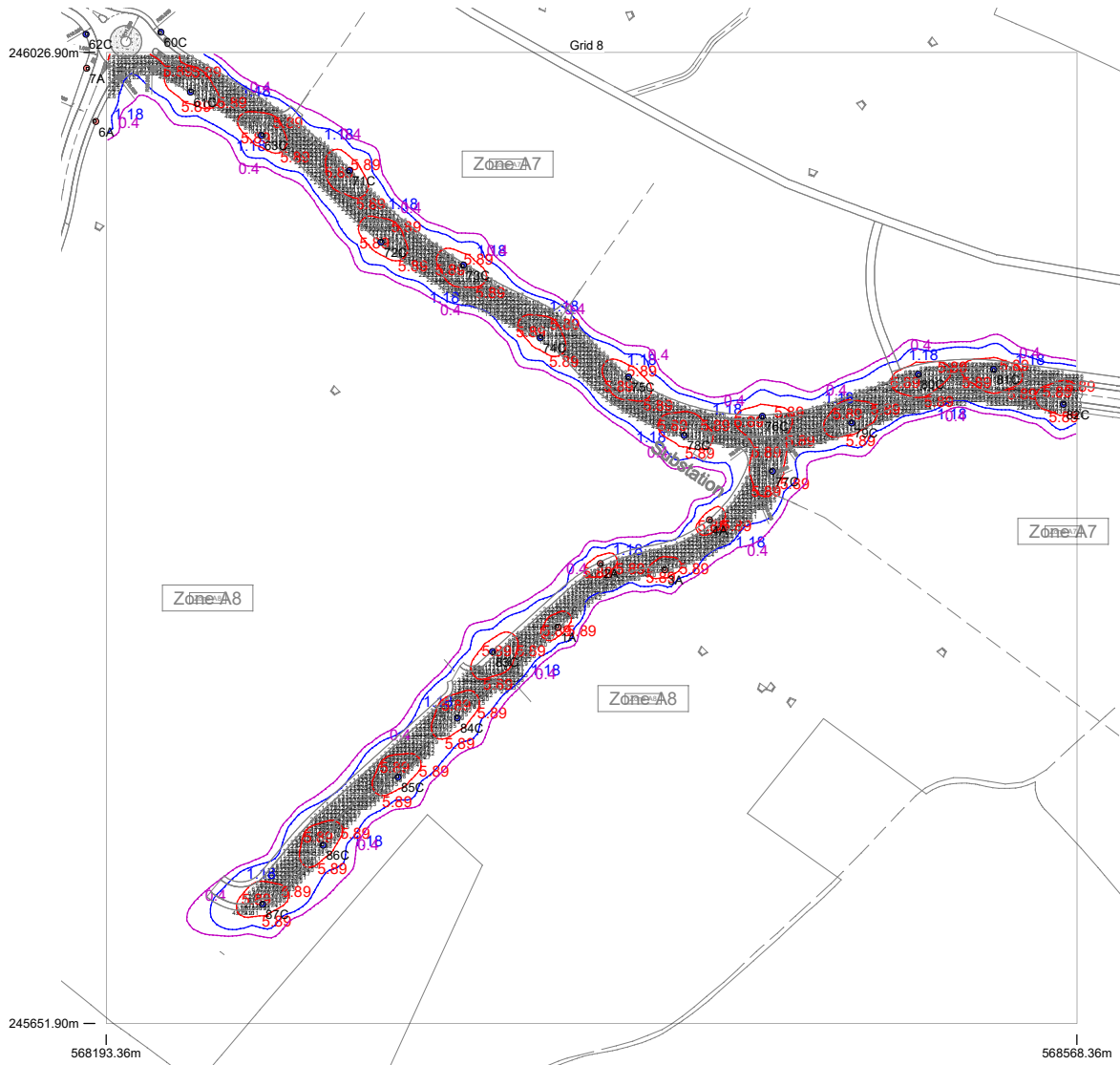


Results

Eav	6.80
Emin	1.19
Emax	23.30
Emin/Emax	0.05
Emin/Eav	0.17

Horizontal Illuminance (lux)

Grid 8

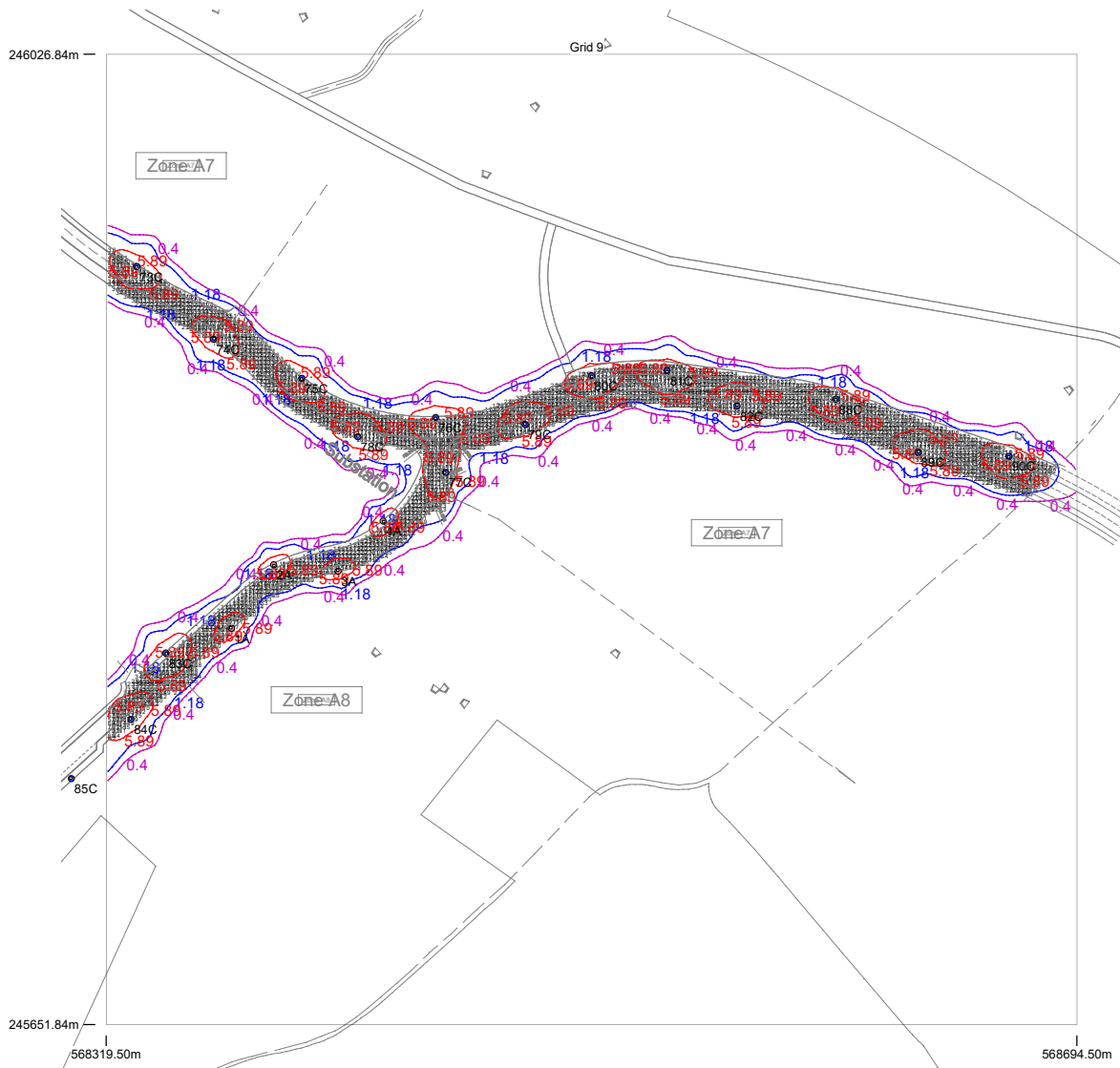


Results

Eav	6.38
Emin	1.19
Emax	21.61
Emin/Emax	0.05
Emin/Eav	0.19

Horizontal Illuminance (lux)

Grid 9



Results

Eav	6.36
Emin	1.19
Emax	21.45
Emin/Emax	0.06
Emin/Eav	0.19

Horizontal Illuminance (lux)

Grid 10



Results

Eav	6.57
Emin	1.22
Emax	21.76
Emin/Emax	0.06
Emin/Eav	0.19

DATE: 9 July 2019
DESIGNER: SS
PROJECT No: 20320
PROJECT NAME: Haverhill, Suffolk



20320-A-02A
Lighting Class:P5
S/P Ratio:1.61
Cyclepaths and footway lighting

Outdoor Lighting Report

PREPARED BY: Harttron Ltd,
Units 3-3a,
Second Avenue,
Poynton Industrial Estate,
Poynton
Cheshire
SK12 1ND

T: 01625 850 855
F: 01625 850 856

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Grid 1	568346.90	245973.63	366.00	144.00	1.50	1.50
2	Grid 2	568044.16	246146.36	366.00	144.00	1.50	1.50
3	Grid 3	568130.04	246499.78	30.00	177.00	1.50	1.50

Luminaires

Luminaire A Data

Supplier	Philips
Type	Long NRN
Lamp(s)	10-30 DS-NW 1 900-7700 NW LED
LampFlux(klm)/Colour	1.40 NW/70
File Name	Stela Long NRN 10-30 DS-NW 1400 LED.Idt
Maintenance Factor	0.76
Imax70,80,90(cd/klm)	664.5, 516.9, 378.9
Lamp S/P Ratio	1.60
No. in Project	27

Layout

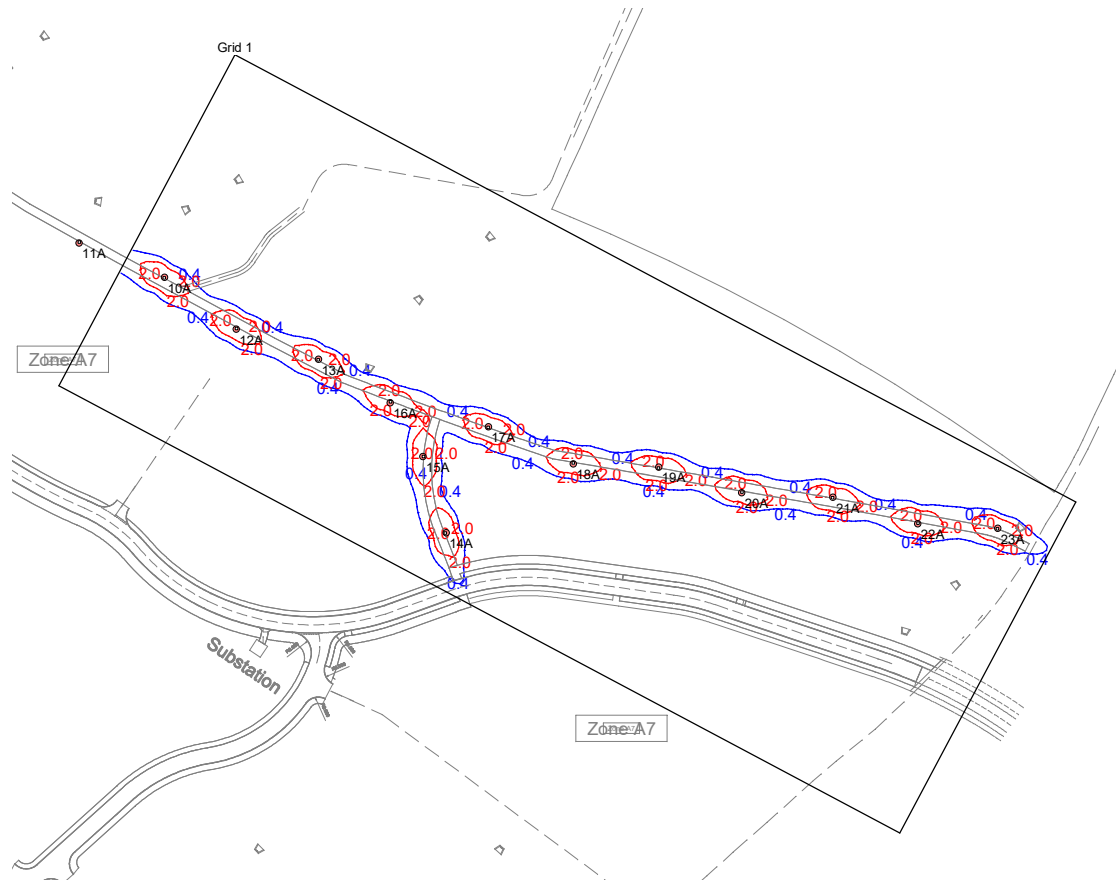
ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
1	A	568102.88	246208.09	6.00	240.00	0.00	0.00	0.30			
2	A	568130.33	246184.67	6.00	56.00	0.00	0.00	0.30			
3	A	568163.07	246172.36	6.00	239.00	0.00	0.00	0.30			
4	A	568191.53	246154.17	6.00	57.00	0.00	0.00	0.30			
5	A	568221.93	246134.71	6.00	218.00	0.00	0.00	0.30			
6	A	568241.29	246104.69	6.00	51.00	0.00	0.00	0.30			
7	A	568271.64	246087.69	6.00	232.00	0.00	0.00	0.30			
8	A	568296.69	246064.33	6.00	59.00	0.00	0.00	0.30			
9	A	568327.30	246049.46	6.00	234.00	0.00	0.00	0.30			
10	A	568387.54	246015.29	6.00	239.00	0.00	0.00	0.30			
11	A	568354.59	246028.50	6.00	61.00	0.00	0.00	0.30			
12	A	568415.02	245995.40	6.00	61.00	0.00	0.00	0.30			
13	A	568446.70	245983.79	6.00	243.00	0.00	0.00	0.30			
14	A	568495.69	245917.08	6.00	197.00	0.00	0.00	0.30			
15	A	568486.69	245946.38	6.00	0.00	0.00	0.00	0.30			
16	A	568474.15	245967.14	6.00	67.00	0.00	0.00	0.30			
17	A	568511.94	245957.83	6.00	249.00	0.00	0.00	0.30			
18	A	568544.53	245943.64	6.00	79.00	0.00	0.00	0.30			

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
19	A	568577.34	245942.31	6.00	260.00	0.00	0.00	0.30			
20	A	568609.29	245932.48	6.00	77.00	0.00	0.00	0.30			
21	A	568644.26	245930.80	6.00	257.00	0.00	0.00	0.30			
22	A	568676.96	245920.58	6.00	78.00	0.00	0.00	0.30			
23	A	568707.62	245918.84	6.00	249.00	0.00	0.00	0.30			
34	A	568134.34	246649.49	6.00	173.00	0.00	0.00	0.30			
35	A	568136.79	246610.50	6.00	189.00	0.00	0.00	0.30			
36	A	568139.62	246566.30	6.00	3.00	0.00	0.00	0.30			
37	A	568145.76	246523.69	6.00	192.00	0.00	0.00	0.30			

Horizontal Illuminance (lux)

Grid 1



Results

Eav	2.76
Emin	0.77
E _{max}	5.51
E _{min} /E _{max}	0.14
E _{min} /E _{av}	0.28

Horizontal Illuminance (lux)

Grid 2

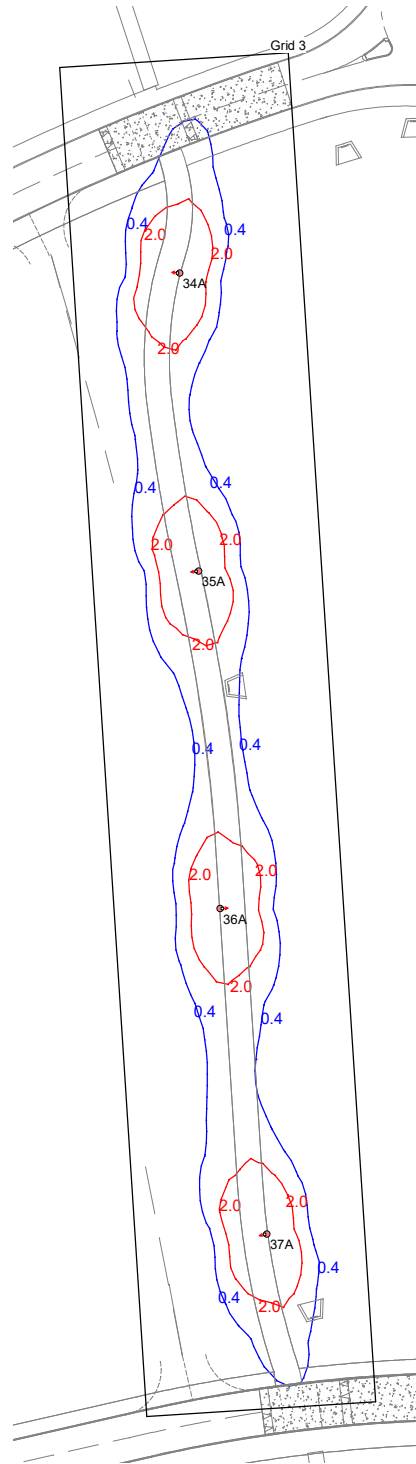


Results

Eav	2.62
Emin	0.63
E _{max}	5.53
E _{min} /E _{max}	0.11
E _{min} /E _{av}	0.24

Horizontal Illuminance (lux)

Grid 3

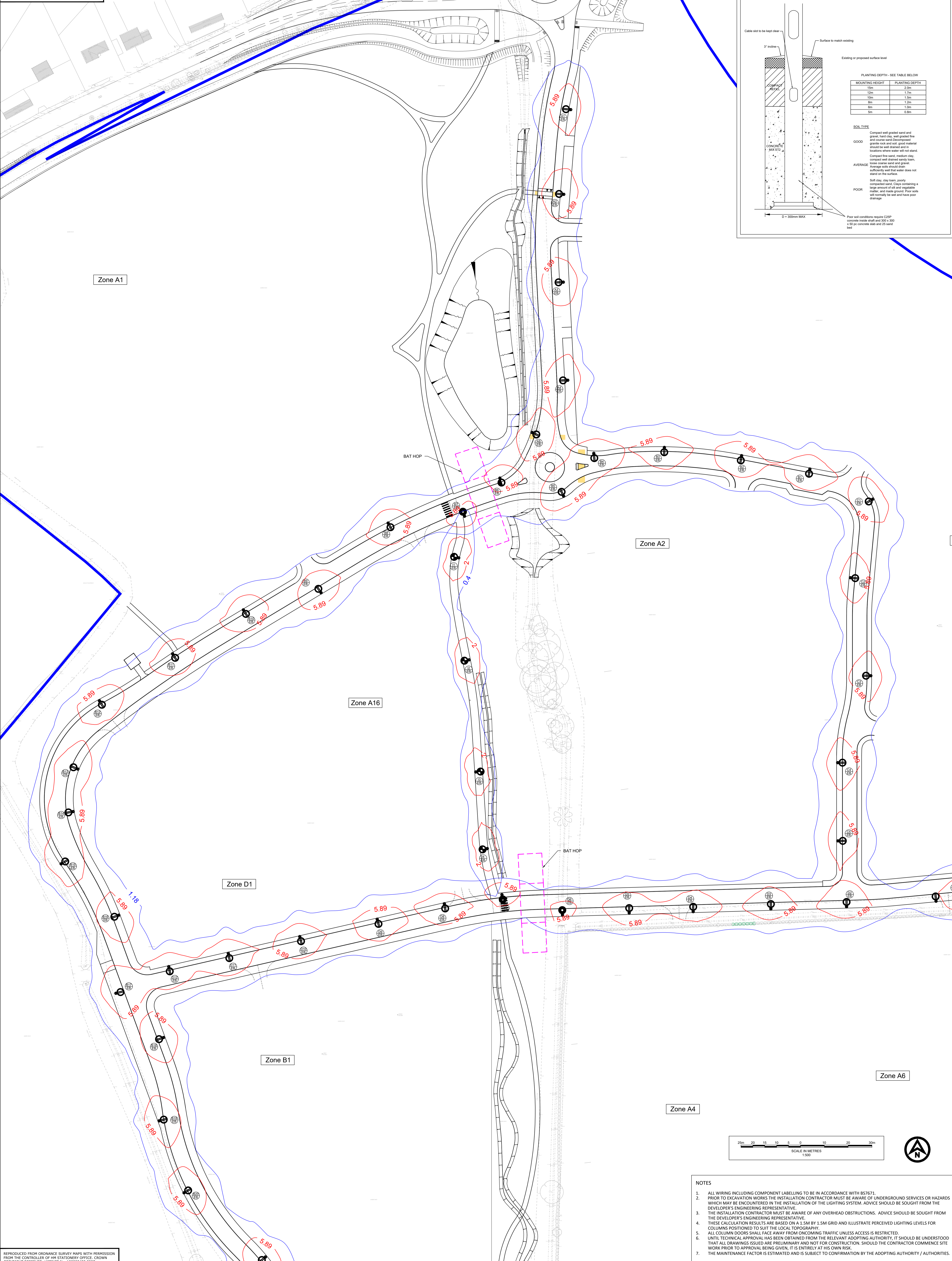
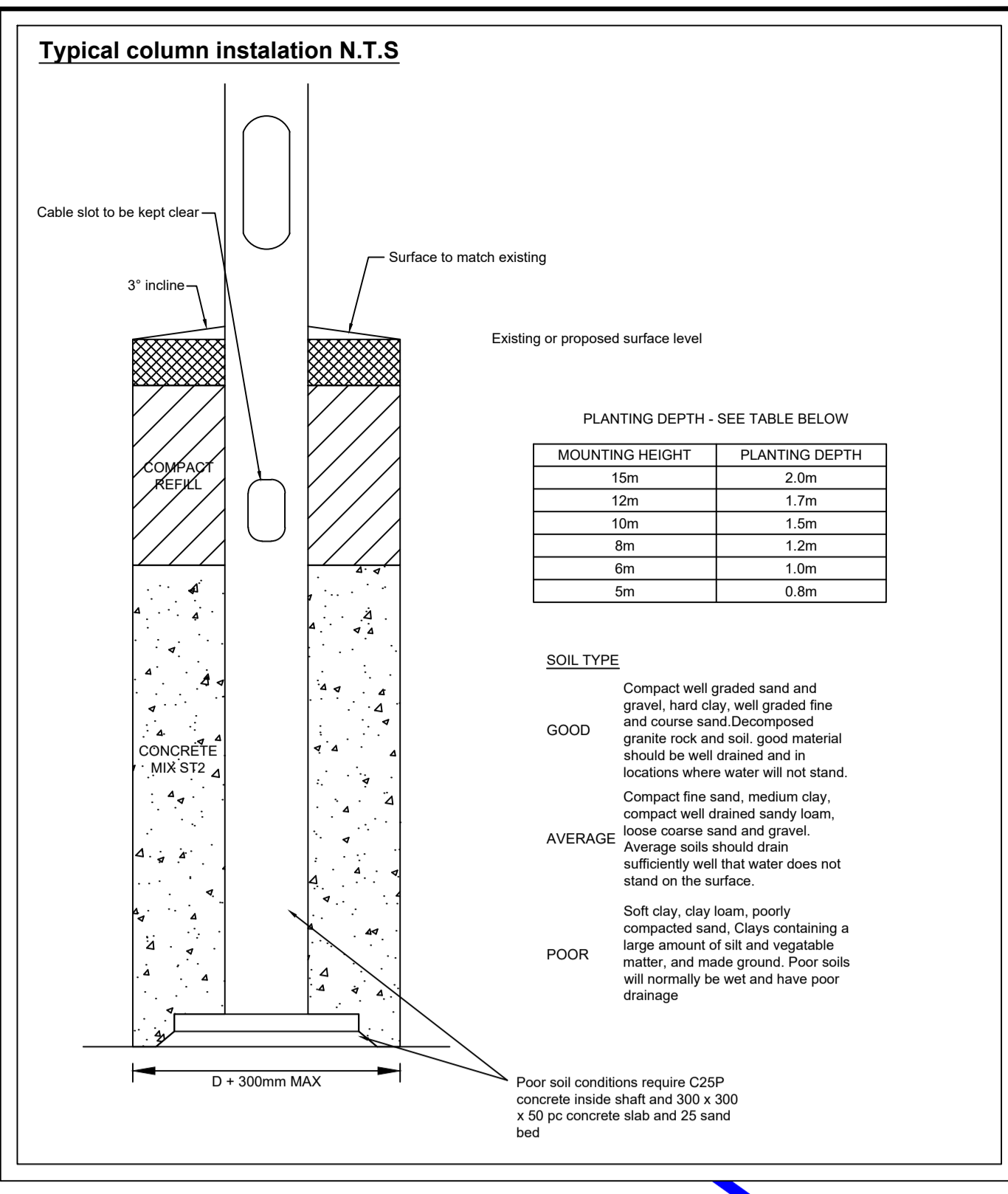


Results

Eav	2.27
Emin	0.49
Emax	5.41
Emin/Emax	0.09
Emin/Eav	0.22

APPENDIX 3

Reserved Matters Street Lighting Plans
(Royal Haskoning DHV)

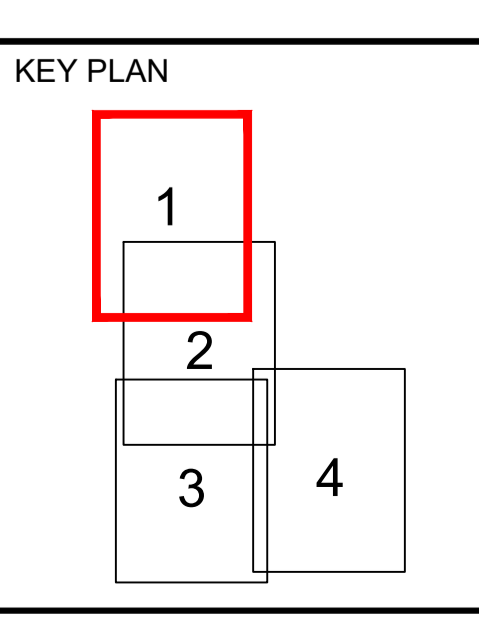


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GENERAL NOTES

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- ALL MATERIALS AND WORKMANSHIP WILL BE AS SPECIFIED IN THE SPECIFICATION UNLESS NOTED OTHERWISE.
- ALL LEVELS, DIMENSIONS AND LOCATIONS ARE TO BE CHECKED BY THE MAIN CONTRACTOR PRIOR TO COMMENCEMENT OF ANY WORK ON SITE.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	5m galvanized tubular steel column Lumen: Philips Micro Luma DX70 4600 Output: 3000lm Cable: 1m Mast: BSRP15_DX70_4600_10LED_5.15_CLO_150_NW_01		5m galvanized tubular steel column Lumen: Philips Micro Luma DX70 3400 Output: 2.4lm Cable: 1m Mast: BSRP15_DX70_3400_20LED_5.15_CLO_150_NW_01
	5m galvanized tubular steel column Lumen: Philips Micro Luma DX70 2400 Output: 2.4lm Cable: 1m Mast: BSRP15_DX70_2400_10LED_5.15_CLO_150_NW_01		5m galvanized tubular steel column Lumen: Philips Micro Luma DM10 1200 Output: 3000lm Cable: 1m Mast: BSRP15_DM10_1200_10LED_5.15_CLO_150_NW_01
	5m galvanized tubular steel column Lumen: Philips Micro Luma DM10 1200 Output: 3000lm Cable: 1m Mast: BSRP15_DM10_1200_10LED_5.15_CLO_150_NW_01		5m galvanized tubular steel column Lumen: Philips Micro Luma DM10 1200 Output: 3000lm Cable: 1m Mast: BSRP15_DM10_1200_10LED_5.15_CLO_150_NW_01



NO	DATE	DESCRIPTION	BY	CHK	APP
1		ISSUE FOR FIRST ISSUE	JBW	PV	DJ

REVISIONS

DRAWING STATUS: **PRELIMINARY**



NOTES

- ALL WIRING INCLUDING COMPONENT LABELLING TO BE IN ACCORDANCE WITH BS7671.
- PRIOR TO EXCAVATION WORKS THE INSTALLATION CONTRACTOR MUST BE AWARE OF UNDERGROUND SERVICES OR HAZARDS WHICH MAY BE ENCOUNTERED IN THE INSTALLATION OF THE LIGHTING SYSTEM. ADVICE SHOULD BE SOUGHT FROM THE DEVELOPER'S ENGINEERING REPRESENTATIVE.
- THE INSTALLATION CONTRACTOR MUST BE AWARE OF ANY OVERHEAD OBSTRUCTIONS. ADVICE SHOULD BE SOUGHT FROM THE DEVELOPER'S ENGINEERING REPRESENTATIVE.
- THESE CALCULATION RESULTS ARE BASED ON A 1.5M BY 1.5M GRID AND ILLUSTRATE PERCEIVED LIGHTING LEVELS FOR COLUMNS POSITIONED TO SUIT THE LOCAL TOPOGRAPHY.
- ALL COLUMN DOORS SHALL FACE AWAY FROM ONCOMING TRAFFIC UNLESS ACCESS IS RESTRICTED.
- UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT ADOPTING AUTHORITY, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ISSUED ARE PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.
- THE MAINTENANCE FACTOR IS ESTIMATED AND IS SUBJECT TO CONFIRMATION BY THE ADOPTING AUTHORITY / AUTHORITIES.

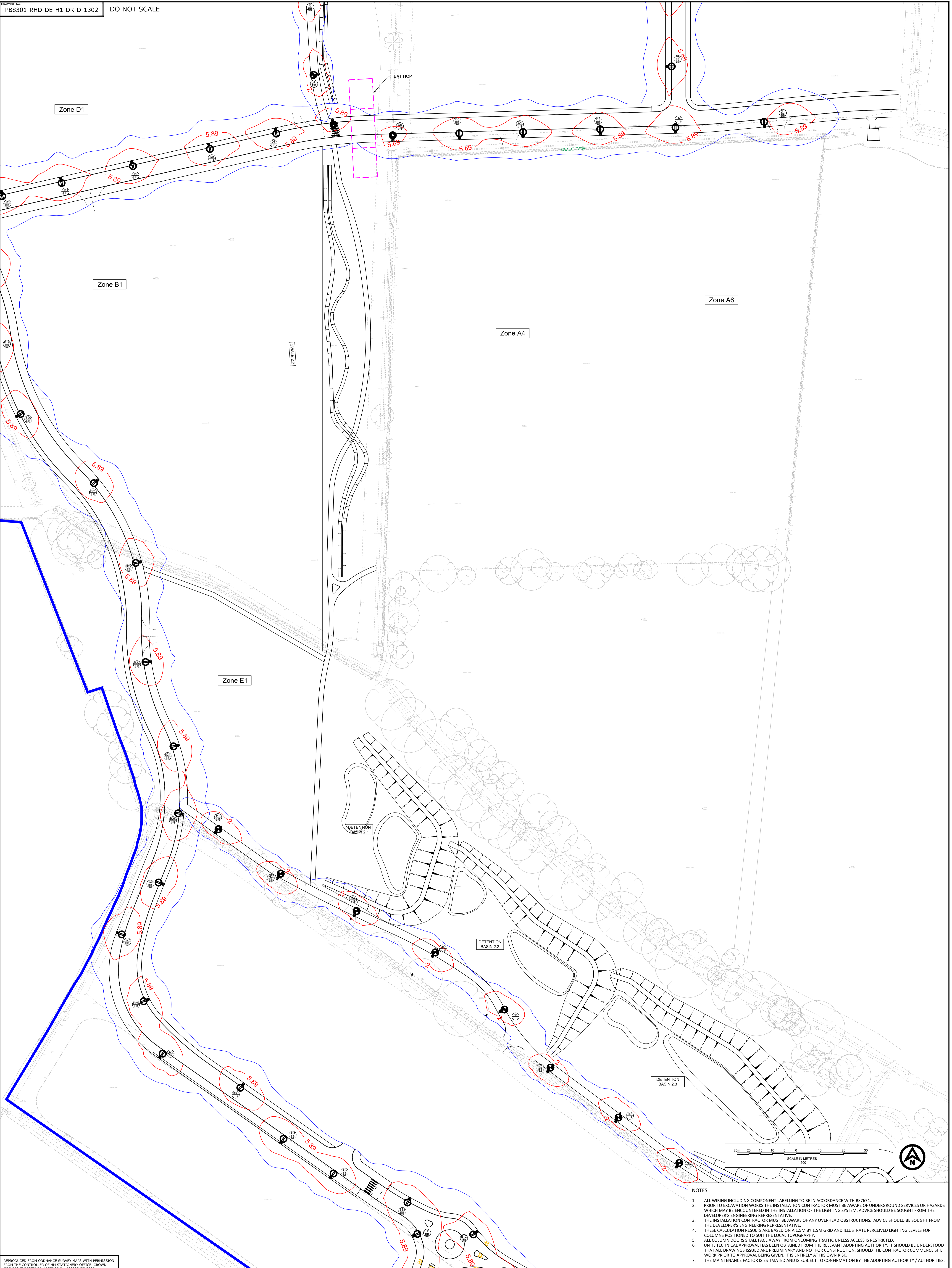
RESERVED MATTERS

STREET LIGHTING LAYOUT SHEET 1 OF 4

PROJECT	GREAT WILSEY PARK
TITLE	RESERVED MATTERS
DRAWN	JBW
CHECKED	PV
DATE	JUL-19
SCALE AT A4	1:500
DRAWING NO.	PB8301-RHD-DE-H1-DR-D-1301
PROJECT NUMBER	PB8301
REVISION	P01

Portland Street, Manchester, M1 3JF
 Tel: +44(0)161 230 2118
 Email: info@haskoningdhv.com
 Website: www.haskoningdhv.com

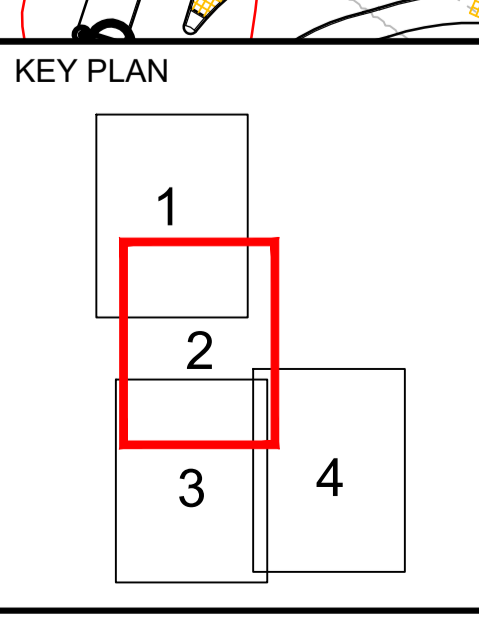
Royal HaskoningDHV
 Enhancing Society Together



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 - ALL LEVELS ARE IN METRES RELATIVE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
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 - THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
 - ALL MATERIALS AND WORKMANSHIP WILL BE AS SPECIFIED IN THE SPECIFICATION UNLESS NOTED OTHERWISE.
 - ALL LEVELS, DIMENSIONS, AND LOCATIONS ARE TO BE CHECKED BY THE MAIN CONTRACTOR PRIOR TO COMMENCEMENT OF ANY WORK ON SITE.

<p>Proposed Column: 5m galvanneal tubular steel column Lantern: Philips Micro Luma DM10 4600 Outreach: 300mm Lumen Output: 4.6klm Candela file: Luma Micro_B02N15_DXT0_4600_20LED_5.15, CLO_L50_NW.nw</p>	<p>Proposed Column: 5m galvanneal tubular steel column Lantern: Philips Micro Luma DM10 3400 Outreach: 300mm Lumen Output: 3.4klm Candela file: Luma Micro_B02N15_DXT0_3400_20LED_5.15, CLO_L50_NW.nw</p>	<p>Proposed Column: 5m galvanneal tubular steel column Lantern: Philips Micro Luma DM10 2400 Outreach: 300mm Lumen Output: 2.4klm Candela file: Luma Micro_B02N15_DXT0_2400_10LED_5.15, CLO_L50_NW.nw</p>	<p>Proposed Column: 5m galvanneal tubular steel column Lantern: Philips Micro Luma DM10 1200 Outreach: 300mm Lumen Output: 1.2klm Candela file: Luma Micro_B02N15_DXT0_1200_4LED_5.15, CLO_L50_NW.nw</p>	<p>Proposed column scheme number EB = Proposed Column number EB# = Proposed DNO connection All numbering to be finalised with the substantive engineer.</p> <p>3.0 lux solex contour line (SS5489-2013) P454 - minimum for with S/P ratio of 1.81</p> <p>3.60 lux solex contour line (SS5489-2013) P454 - E or minimum for with S/P ratio of 1.81</p>
--	--	--	---	--



<p>DATE: 19/07/2019 DESCRIPTION: STREET LIGHTING LAYOUT BY: JAW CHK: AW</p>	<p>DATE: 19/07/2019 DESCRIPTION: STREET LIGHTING LAYOUT BY: JAW CHK: AW</p>	<p>DATE: 19/07/2019 DESCRIPTION: STREET LIGHTING LAYOUT BY: JAW CHK: AW</p>	<p>DATE: 19/07/2019 DESCRIPTION: STREET LIGHTING LAYOUT BY: JAW CHK: AW</p>
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DRAWING STATUS: PRELIMINARY



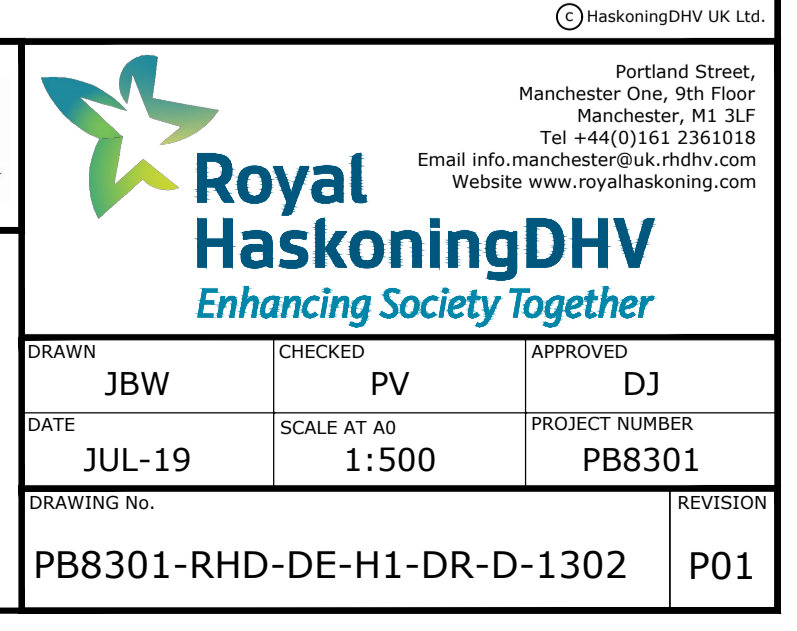
- NOTES**
- ALL WIRING INCLUDING COMPONENT LABELLING TO BE IN ACCORDANCE WITH BS7671.
 - PRIOR TO EXCAVATION WORKS THE INSTALLATION CONTRACTOR MUST BE AWARE OF UNDERGROUND SERVICES OR HAZARDS WHICH MAY BE ENCOUNTERED IN THE INSTALLATION OF THE LIGHTING SYSTEM. ADVICE SHOULD BE SOUGHT FROM THE DEVELOPER'S ENGINEERING REPRESENTATIVE.
 - THE INSTALLATION CONTRACTOR MUST BE AWARE OF ANY OVERHEAD OBSTRUCTIONS. ADVICE SHOULD BE SOUGHT FROM THE DEVELOPER'S ENGINEERING REPRESENTATIVE.
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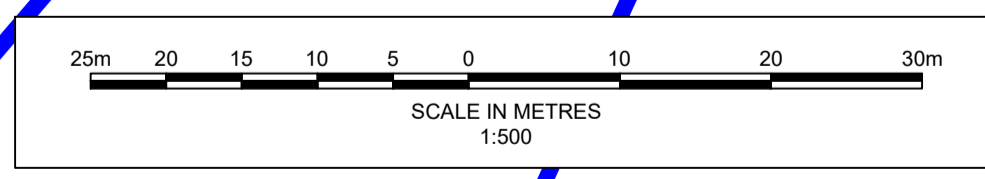
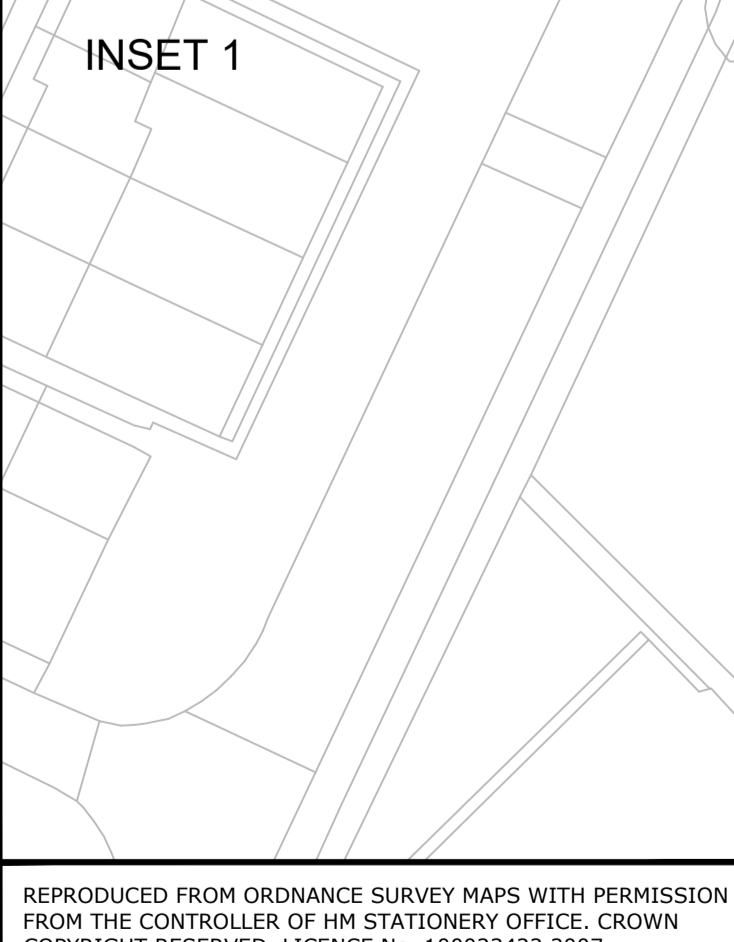
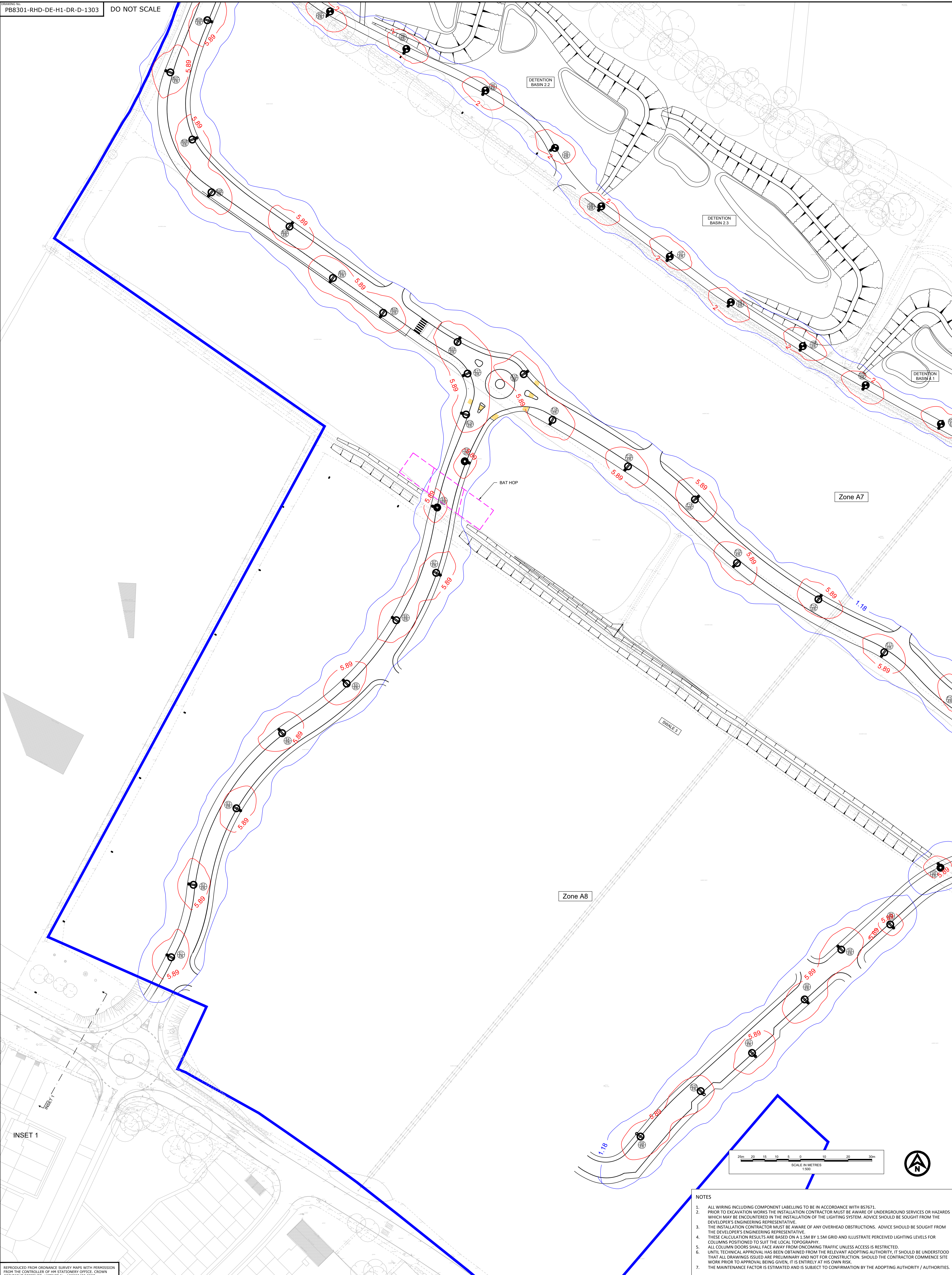
RESERVED MATTERS

STREET LIGHTING LAYOUT

SHEET 2 OF 4

<p>PROJECT GREAT WILSBY PARK</p>	<p>CLIENT REDROW</p>	<p>PROJECT NUMBER PB8301</p>	<p>REVISION P01</p>
<p>DRAWN JAW</p>	<p>CHECKED PV</p>	<p>APPROVED DJ</p>	<p>DATE JUL-19</p>
<p>SCALE AS SHOWN</p>	<p>SCALE AT A4 1:500</p>	<p>PROJECT MANAGER PB8301</p>	<p>DRAWING NO. PB8301-RHD-DE-H1-DR-D-1302</p>



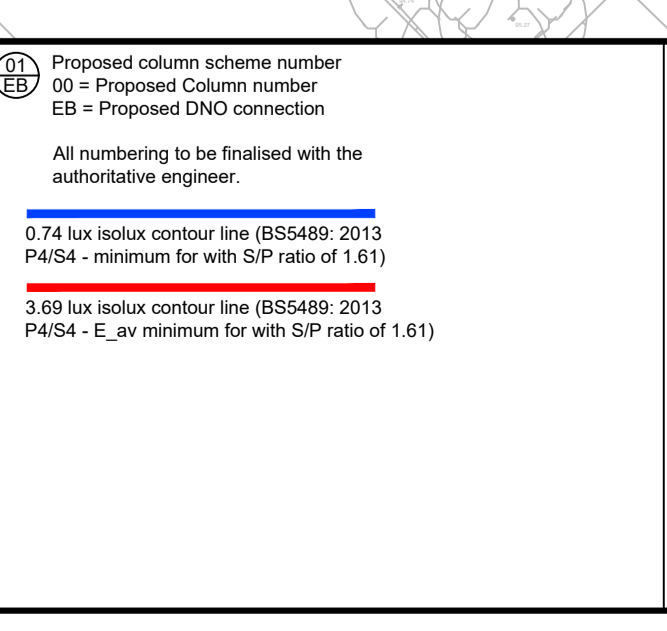


- NOTES**
1. ALL WIRING INCLUDING COMPONENT LABELLING TO BE IN ACCORDANCE WITH BS7671.
 2. PRIOR TO EXCAVATION WORKS THE INSTALLATION CONTRACTOR MUST BE AWARE OF UNDERGROUND SERVICES OR HAZARDS WHICH MAY BE ENCOUNTERED IN THE INSTALLATION OF THE LIGHTING SYSTEM. ADVICE SHOULD BE SOUGHT FROM THE DEVELOPER'S ENGINEERING REPRESENTATIVE.
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 3. ALL LEVELS ARE IN METRES RELATIVE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
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 6. ALL MATERIALS AND WORKMANSHIP WILL BE AS SPECIFIED IN THE SPECIFICATION UNLESS NOTED OTHERWISE.
 7. ALL LEVELS, DIMENSIONS, AND LOCATIONS ARE TO BE CHECKED BY THE MAIN CONTRACTOR PRIOR TO COMMENCEMENT OF ANY WORK ON SITE.

- PROPOSED**
- 01 Column: 6m galvanneal tubular steel column
Lumen: Philips Micro Luma DX70 4800
Outreach: 300mm
Cable: 40m
Mux: BCPN15, DX70_4800_20LED_5.15, CLO_100_NW.wir
 - 02 Column: 6m galvanneal tubular steel column
Lumen: Philips Micro Luma DX70 3400
Outreach: 300mm
Cable: 40m
Mux: BCPN15, DX70_3400_20LED_5.15, CLO_100_NW.wir
 - 03 Column: 5m red-angled galvanneal tubular steel column
Lumen: Philips Micro Luma DM10 1200
Outreach: 300mm
Cable: 40m
Mux: BCPN15, DM10_1200_10LED_5.15, CLO_100_NW.wir
- EXISTING**
- 04 0.74 m sea level contour line (BS5400:2013) P454 - minimum for with SP ratio of 1.61
 - 05 3.89 m sea level contour line (BS5400:2013) P454 - minimum for with SP ratio of 1.61



NO	DATE	DESCRIPTION	BY	CHK	APP
1	2019-07-19	FIRST ISSUE	JBW	PV	DJ
REVISIONS					
DRAWING STATUS: PRELIMINARY					

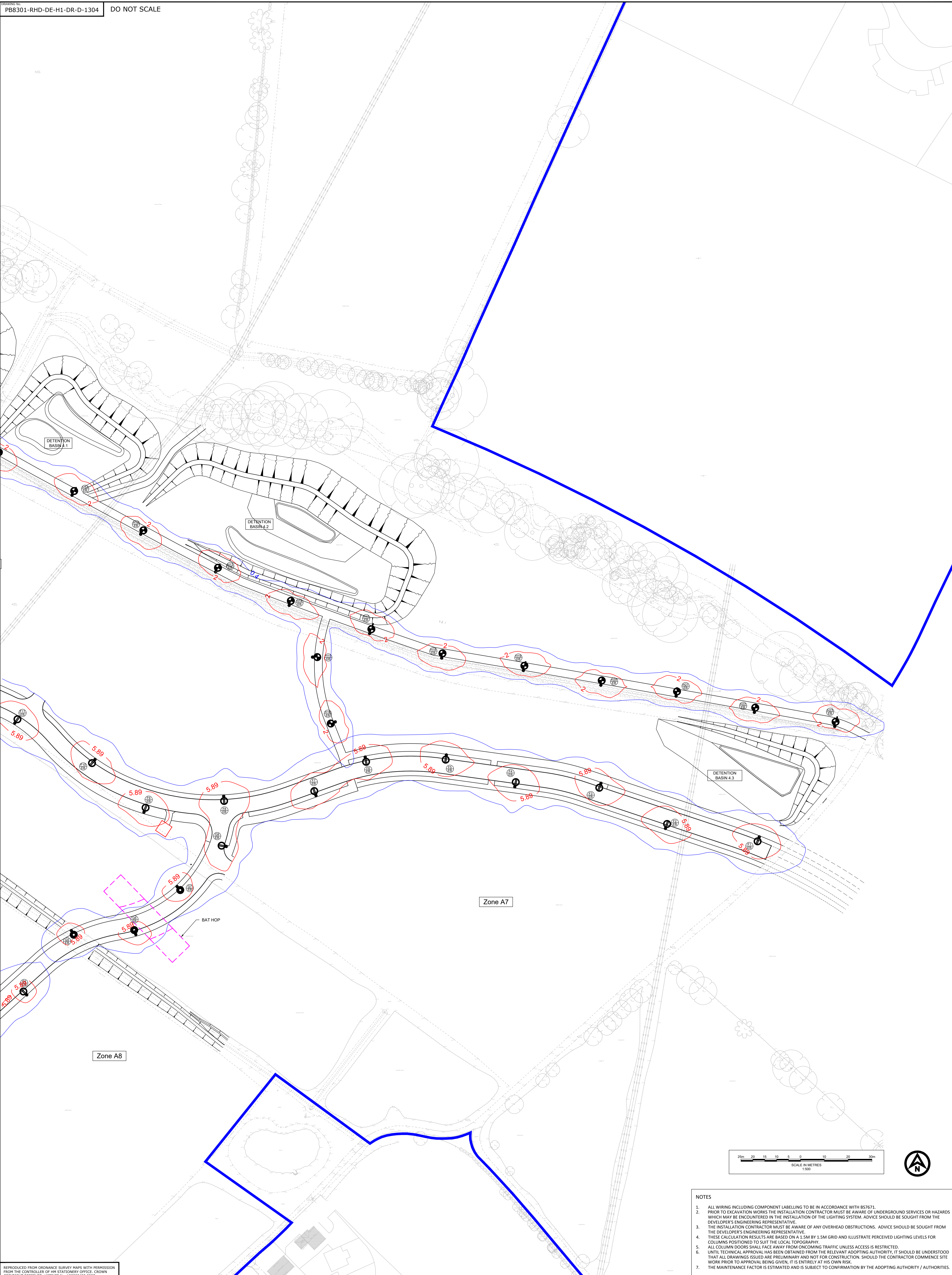
CLIENT	

PROJECT	
RESERVED MATTERS	
STREET LIGHTING LAYOUT	
SHEET 3 OF 4	

DRAWN	JBW	CHECKED	PV	APPROVED	DJ
DATE	JUL-19	SCALE AT A2	1:500	PROJECT NUMBER	PB8301
DRAWING NO.	PB8301-RHD-DE-H1-DR-D-1303				REVISION
					P01

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Enhancing Society Together

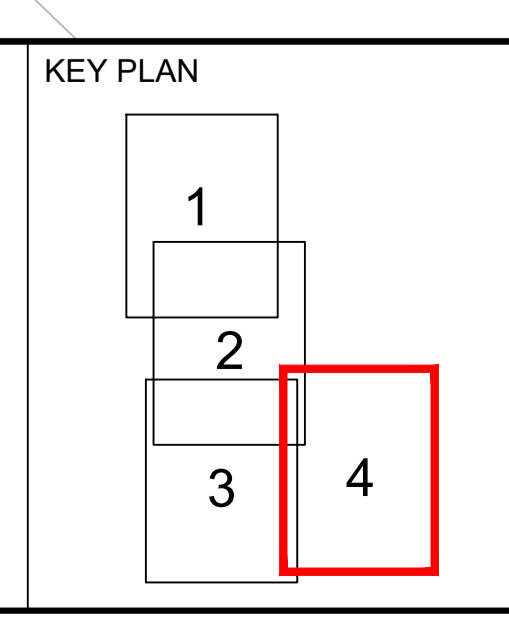


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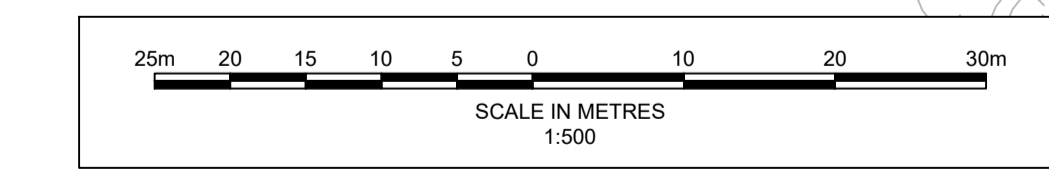
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- Proposed**
 Column: 5m galvanized tubular steel column
 Luminaire: Philips Micro Luma DX70 4600
 Output: 4.8lm
 Canopy: 4.8lm
 Masts: BGP195, DXT9, 2400, 20.0ED, 5.15, CLO, L90, NW sw
- Proposed**
 Column: 5m galvanized tubular steel column
 Luminaire: Philips Micro Luma DX70 2400
 Output: 2.4lm
 Canopy: 2.4lm
 Masts: BGP195, DXT9, 2400, 10.0ED, 5.15, CLO, L90, NW sw
- Proposed**
 Column: 5m m50-hinged galvanized tubular steel column
 Luminaire: Philips Micro Luma DM10 1200
 Output: 1.2lm
 Canopy: 1.2lm
 Masts: BGP195, DM10, 1200, 8.0ED, 5.15, CLO, L90, NW sw

- Proposed column scheme number**
 EB + Proposed Column number
 All numbering to be finished with the adoptive engineer.
- 1.78 luminaire centre line (BS5489: 2013)**
 PAS4 - minimum for all S/P ratio of 1.81
- 3.69 luminaire centre line (BS5489: 2013)**
 PAS4 - E_g minimum for all S/P ratio of 1.81



NO	DATE	DESCRIPTION	BY	CHK	APP
1		FIRST ISSUE			
DRAWING STATUS: PRELIMINARY					



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RESERVED MATTERS

STREET LIGHTING LAYOUT SHEET 4 OF 4

ROYAL HASKONINGDHV
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DRAWN	CHECKED	APPROVED
JBW	PV	DJ
DATE	SCALE AT A2	PROJECT NUMBER
JUL-19	1:500	PB8301
DRAWING NO.	REVISION	
PB8301-RHD-DE-H1-DR-D-0504	P01	

APPENDIX 4

Bat Box Specifications

Bat Boxes

Schwegler bat boxes are made from 'woodcrete' and have the highest rates of occupation of all types of box.

The 75% wood sawdust, clay and concrete mixture is ideal, being durable whilst allowing natural respiration and temperature stability. These boxes are rot and predator proof and extremely long lasting.



2F Bat Box

A standard bat box, attractive to the smaller British bat species. Simple design with a narrow entrance slit on the front.

Woodcrete construction, 16cm diameter, height 33cm.



1FF Bat Box

The rectangular shape makes the 1FF suitable for attaching to the sides of buildings or on sites such as bridges, though it may also be used on trees. It has a narrow crevice-like internal space to attract Pipistrelle and Noctule bats.

Woodcrete construction.

Width: 27cm

Height: 43cm

Weight: 8.3kg



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1FW Bat Hibernation Box

This huge box is designed to provide a protected environment which is particularly important through the cold winter months when bats are hibernating. Three wooden panels within the box imitate crevices for roosting.

Woodcrete construction, 38cm diameter, height 50cm, weight 28kg.

This heavy box requires secure mounting if placed above the ground and should be sited away from public areas.



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