

Project Information

Hope Farm

Phase I

Location:
Hope Farm,
The Haven,
Billingshurst,
RH14 9BN

Latitude: 51.05934403650893
Longitude: -0.47480767401971286

Software: DIALux Evo
Version: 13.0

Revision	Date
01	05 September 2025

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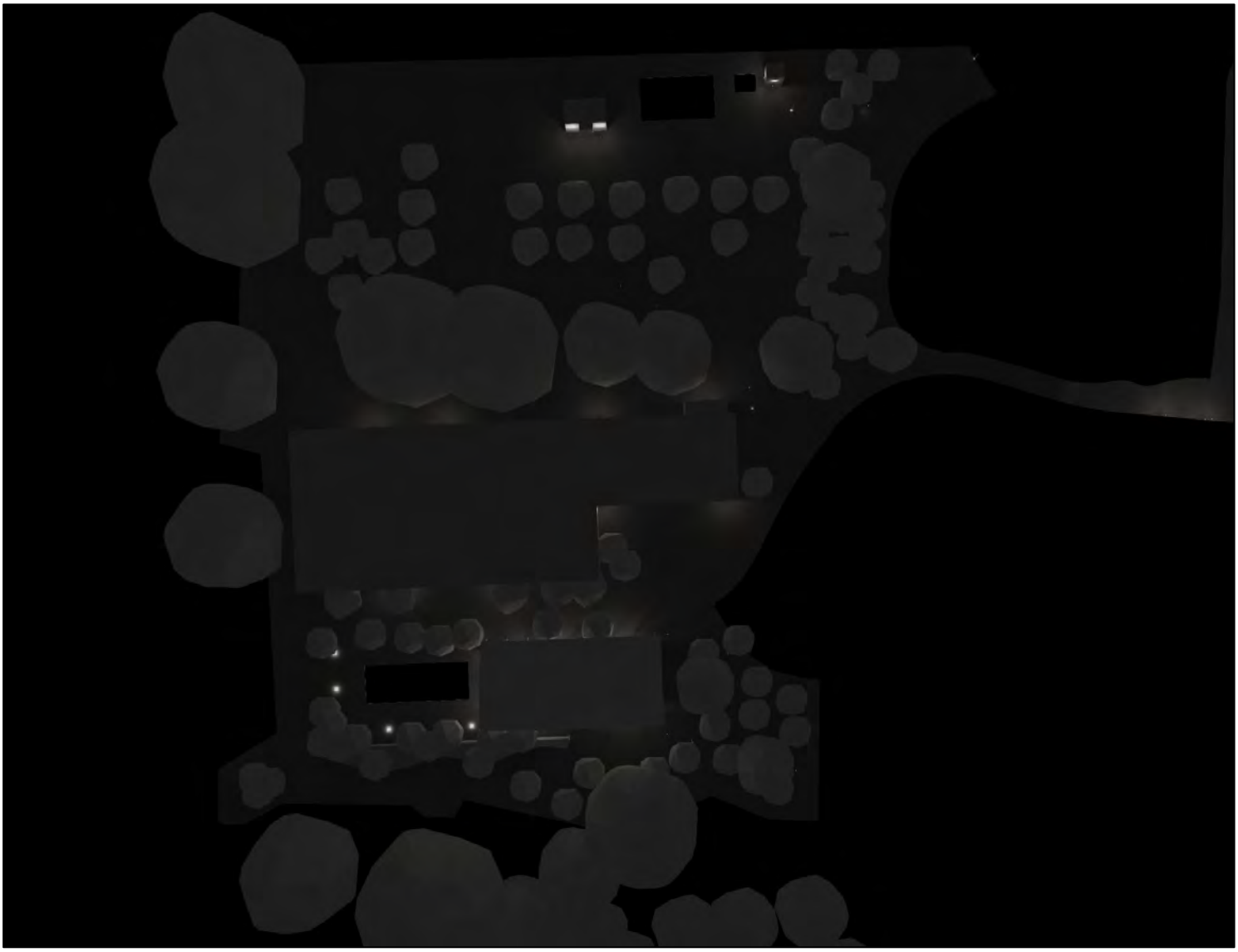
Foreword

This calculation report should be read in conjunction with the Hope Farm Bat Flightline and Dark Corridor Plan Report (Collington Winter Environmental, 2025), to provide the ecological context and technical framework against which the lighting design has been assessed.

The ecological report identifies critical commuting and foraging corridors (notably to the south and east of B4 and B6) that must remain as dark zones. At the same time, the ILP guidance sets out the national best practice thresholds (<1.0 lux at ground level, ideally 0 lux) and mitigation principles to minimise obtrusive light and protect bat behaviour.

The DIALux calculations presented here translate these requirements into quantifiable outputs, demonstrating through isolux plots and tabulated illuminance values that the proposed scheme controls light trespass, avoids upward light, and maintains compliance within the identified sensitive areas.



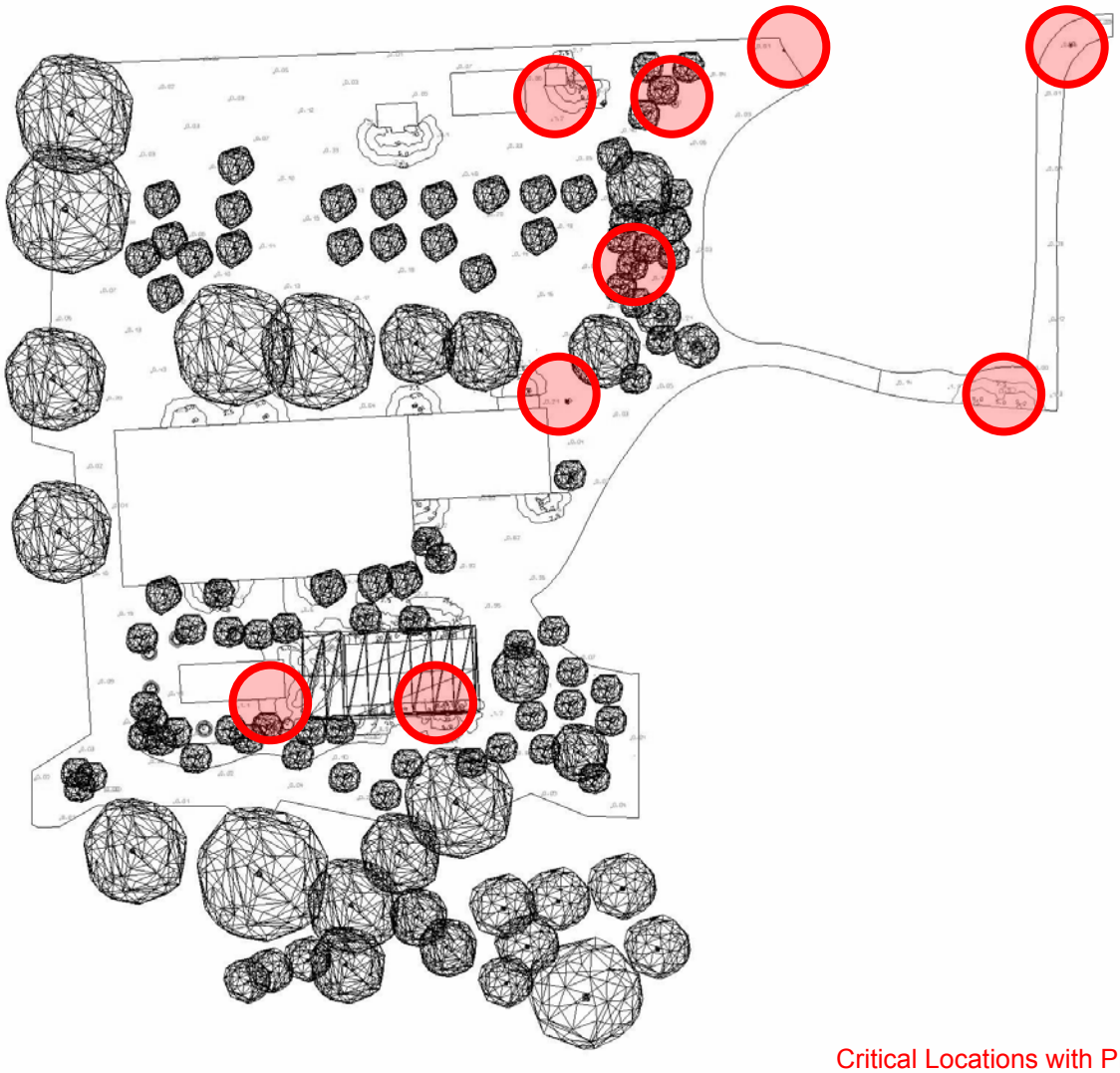
Introduction

Methodology

This report has been prepared to present the external lighting design calculations for Phase I of the Hope Farm development. The purpose of the report is to demonstrate how the proposed lighting scheme responds to planning Condition No. 6, which requires a biodiversity-sensitive design that protects bat commuting and foraging routes in accordance with the Institute of Lighting Professionals (ILP) and Bat Conservation Trust (BCT) Guidance Note 08/23 - Bats and Artificial Lighting at Night.

The calculations were generated using DIALux Evo software, which applied the manufacturer's photometric data (IES/LDT files) to ensure accuracy and reliability, as provided by Hudson Lighting and Lumeneye (Solar Eye). The results include isolux contour plots and tabulated lux values across the site, with a focus on maintaining <1.0 lux at ground level within identified dark corridors as highlighted in the ecological survey. This document aims to provide evidence that the lighting scheme has been designed to minimise ecological impact while providing sufficient illumination for site use and safety. It is also intended as a reference for the project team, ensuring consistency of design intent across all future phases of work.

Figure 1. Aerial View Glow Map



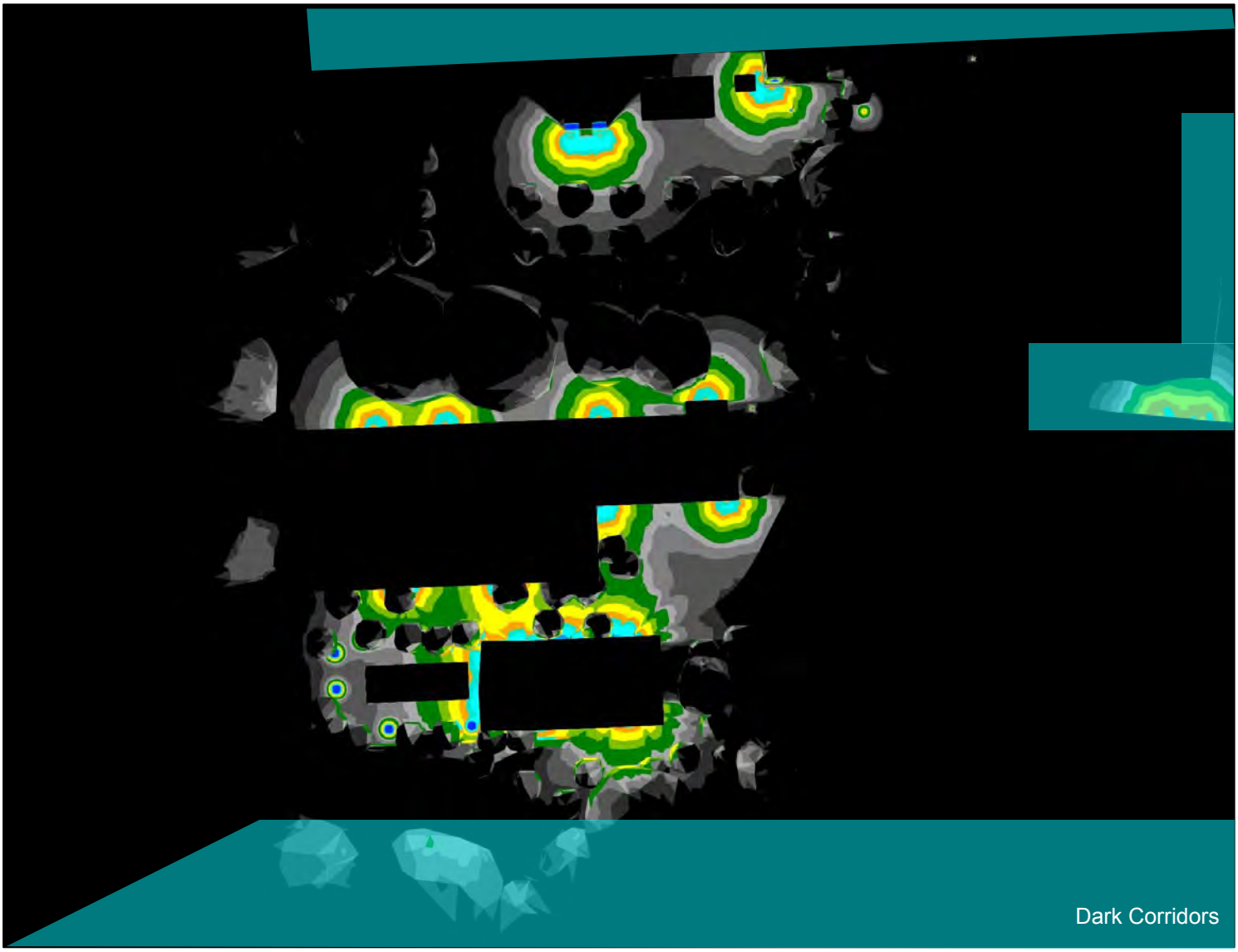
Critical Locations with PIR Allocations

Calculation Considerations

Mitigation Assumptions

In preparing the DIALux calculations, all luminaires have been modelled under a conservative worst-case scenario to ensure a robust and transparent assessment. For this reason, a maintenance factor of 1.0 has been applied, providing results that represent the maximum possible illuminance values. For the SolarEye 80 with Bat Hat, a nominal lumen output of 1 lm has been allocated; however, in real-life applications, the actual luminous flux will be minimal, at approximately 0.232 lm per unit, thereby further reducing the potential ecological impact. The wall-mounted luminaires are equipped with an E27 bulb at maximum output, ensuring calculations reflect the highest possible emission. In practice, these lamps will be housed behind frosted glass diffusers, which reduce overall lumen output by approximately 30%, and will be oriented in a fully downward direction (BUG U0 – no uplight) to minimise spill towards sensitive receptors. Additionally, all fittings located in proximity to the designated bat corridors have been specified with PIR motion-sensor control systems (shown as red annotations in Fig. 2), ensuring operation is restricted to periods of human presence only. These luminaires are identified in the accompanying layout image, which confirms their positioning along the southern corridor. To further reduce ecological impact, the installation will follow restricted working hours, with lights programmed to switch off during nighttime periods when the site is unoccupied. This strategy ensures that no unnecessary illumination occurs beyond essential operational use, maintaining compliance with both ILP/BCT GN 08/23 guidance and the ecological recommendations outlined in the bat survey report.

Figure 2. Aerial Isoline View and PIR Locations



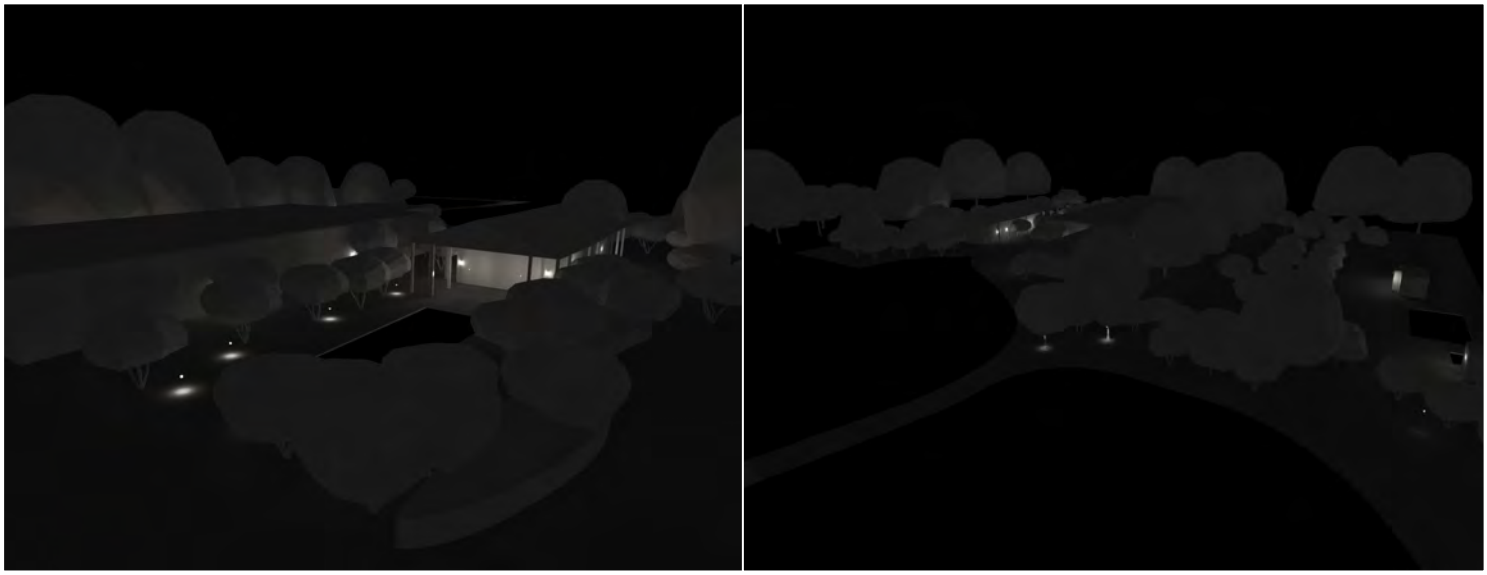
Sensitive Receptors

Locations

The identified sensitive receptors within the Phase I development primarily comprise the southern and eastern bat commuting corridors associated with buildings B4 and B6, as confirmed in the ecological survey. These zones include:

- ➔ Southern boundary of B4 – recognised as a key foraging and commuting corridor, connecting hedgerows and pond habitats.
- ➔ Eastern boundary of B6 – forming a primary flightline towards adjacent pastoral fields and woodland edges.
- ➔ Hedgerow and treeline features along the access driveway and southern garden areas – supporting multiple species, including pipistrelle and brown long-eared bats.
- ➔ These receptors are highly sensitive to artificial light intrusion and have therefore been prioritised within the design to maintain <1.0 lux and, where possible, 0.0 lux conditions.

Figure 3. Aerial Pseudo Colour Map (Blue Denotes Dark Corridors)



Calculation Overview
Process

The outputs include isolux contour plots, tabulated lux values, and complete photometric data derived from the specified luminaires. These results allow for a robust assessment of how the proposed lighting strategy performs in terms of safety, functionality, and biodiversity protection.

In line with UK guidance for bat-sensitive lighting, the design has been carefully developed to minimise upward light spill, control light trespass into adjacent habitats, and reduce spectral impact through the use of warm colour temperatures (2700K). Light levels are maintained only where necessary for human activity, while peripheral and ecologically sensitive areas remain safeguarded by maintaining zones of darkness to support bat foraging and commuting routes.

By balancing ecological protection with practical site use, the calculations demonstrate a lighting approach that is both client-focused and environmentally responsible, supporting planning approval while delivering a safe and considerate nighttime environment for all users.

Figure 4. South East Facing Glow Map
Figure 5. North West Facing Glow Map

Guidance

Publications

Institute of Lighting Professionals (ILP) / Bat Conservation Trust (BCT) Guidance Note 08/23

The ILP/BCT Guidance Note 08/23: Bats and Artificial Lighting at Night is the current national best practice standard in the UK for assessing and mitigating the ecological impacts of external lighting on bat species.

The guidance document explains how artificial light at night (ALAN) can disrupt bat roosting, foraging, and commuting behaviour, and sets out a mitigation hierarchy for lighting design.

In accordance with the ILP Guidance for the Reduction of Obtrusive Light (2020), the Hope Farm site falls within Environmental Zone E2 – defined as a rural, low district brightness area with low ambient lighting levels. Furthermore, the Bortle Dark-Sky Scale places the local night sky quality at approximately Class 4 (Rural/Suburban Transition), indicating a relatively dark environment with limited skyglow. This reinforces the importance of minimising artificial lighting impacts, as any excess spill would significantly alter the baseline night environment.

Implementations into the DIALux Calculations for this Report:

- ➔ Lux Thresholds: The ILP/BCT guidance cites evidence that light-averse species can be disturbed at levels as low as 0.4–1.0 lux near hedgerows and commuting corridors. The isolux plots confirm that the south corridor remains <1.0 lux, which demonstrates compliance.
- ➔ Dark Corridors: The report requires sensitive ecological routes (e.g., south and east of B4/B6) to be retained as dark buffers, free from obtrusive light. The calculations show how the spill is controlled to maintain these corridors.
- ➔ Contour Plans: GN 08/23 specifically instructs that horizontal and vertical illuminance contour plots should be provided to planners and ecologists to demonstrate compliance with the requirements.
- ➔ Spectral & Design Controls: The use of warm white ≤2700K sources, cowled optics, and zero upward light aligns with the luminaire specifications recommended in the guidance. All light fittings are allocated with 2700K sources in the DIALux File.

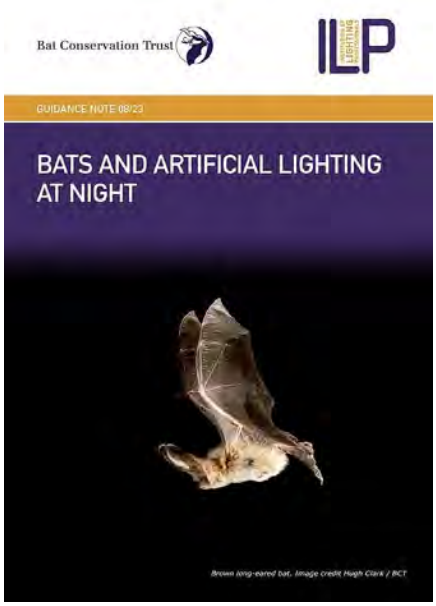
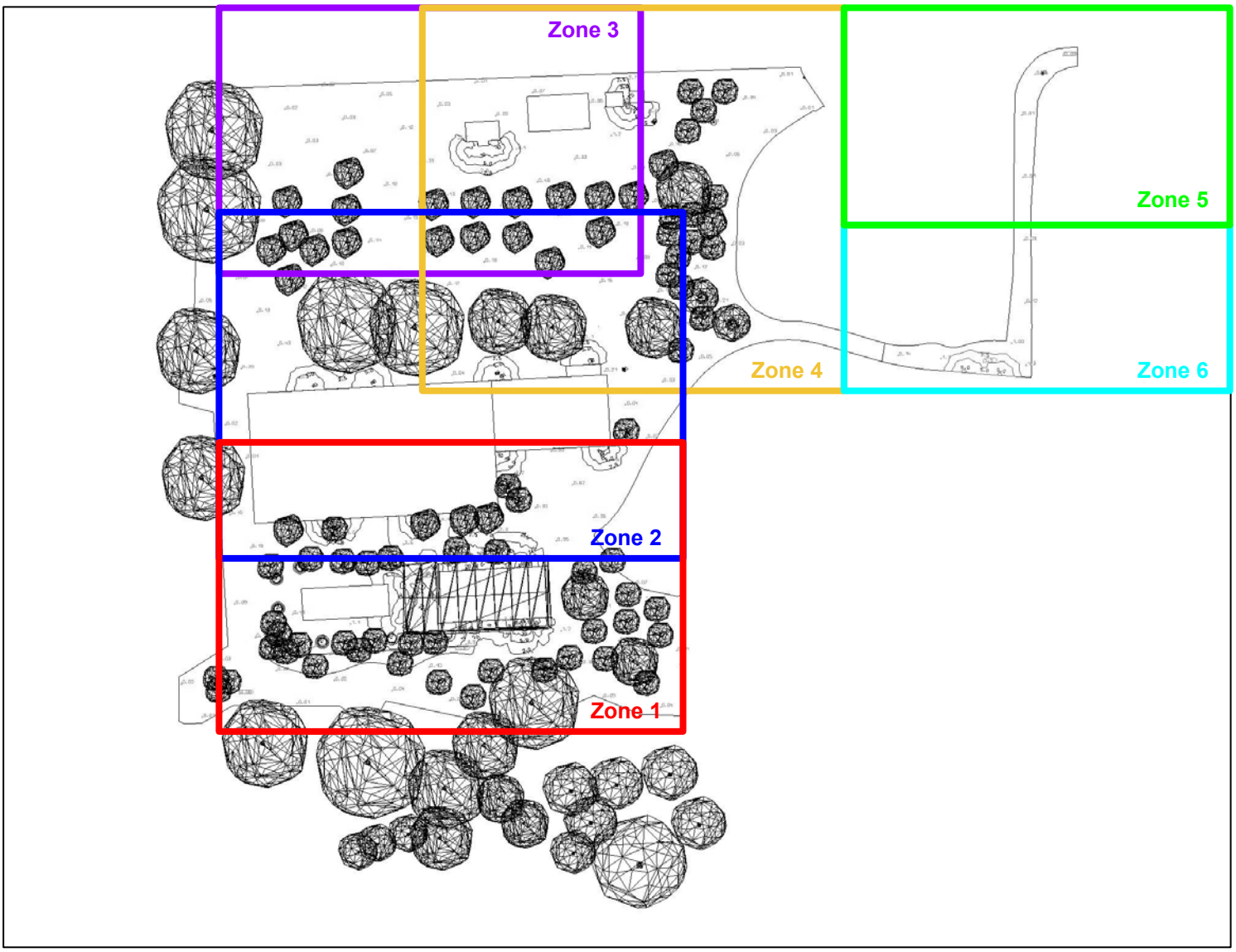


Figure 6. ILP/BCT Guidance Note 08/23

Zone	Surrounding	Lighting environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity



Zones

Coverage Area

Sectional

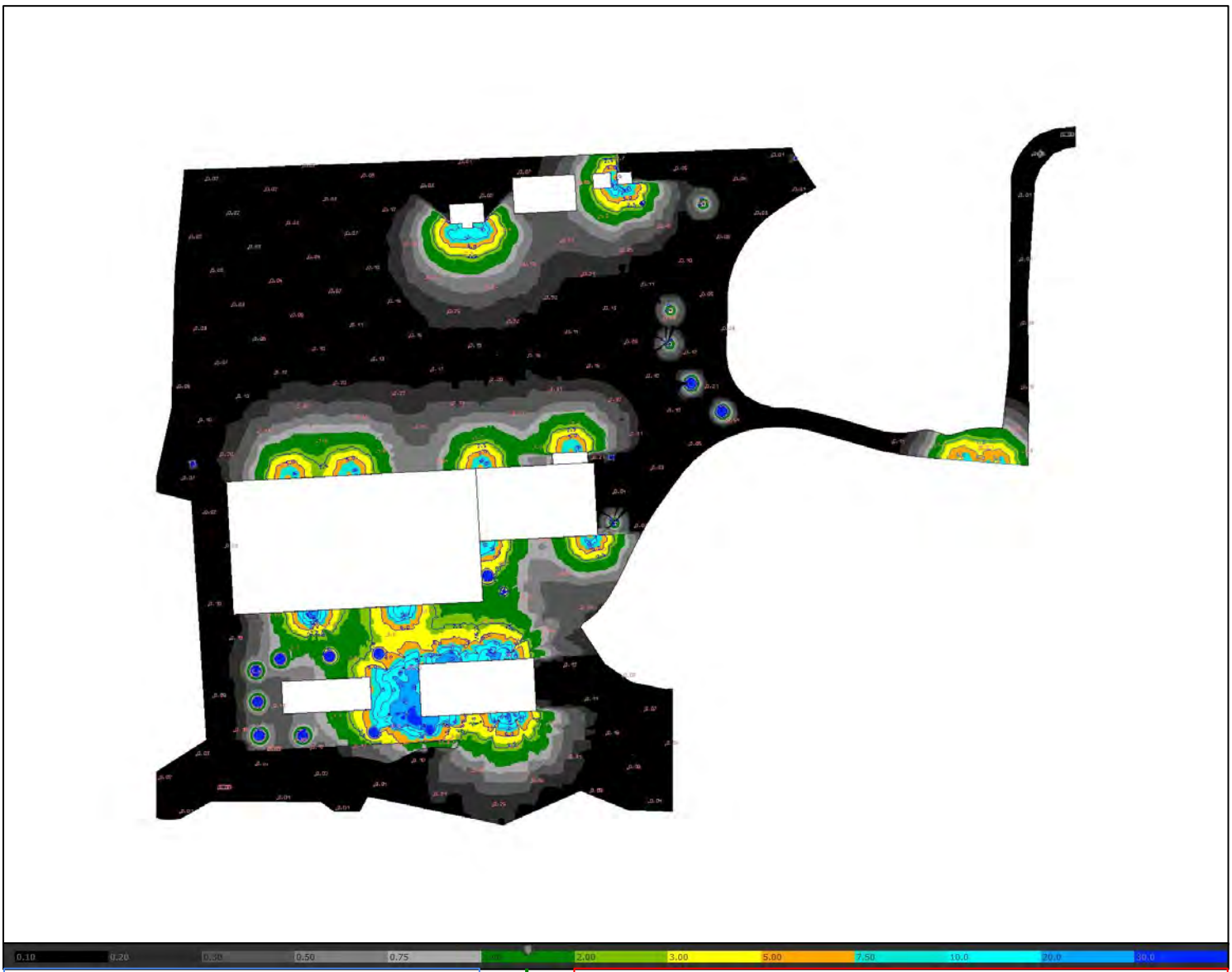
- ➔ Zone 1: Target Lux >1
  - PIR Proposed
- ➔ Zone 2: Target Lux 1
  - Working Hours to be considered, lights will be switched off during nighttime.
- ➔ Zone 3: Target Lux 1
  - Working Hours to be considered, lights will be switched off during nighttime.
- ➔ Zone 4: Target Lux 1
  - PIR Proposed
- ➔ Zone 5: Target Lux >1
  - PIR Proposed
- ➔ Zone 6: Target Lux >1
  - PIR Proposed

Figure 7. Plan of Phase 1 Showing Zonal Breakdown of Calculation Areas

Pseudo Colour Maps

Aerial View

Legend Description

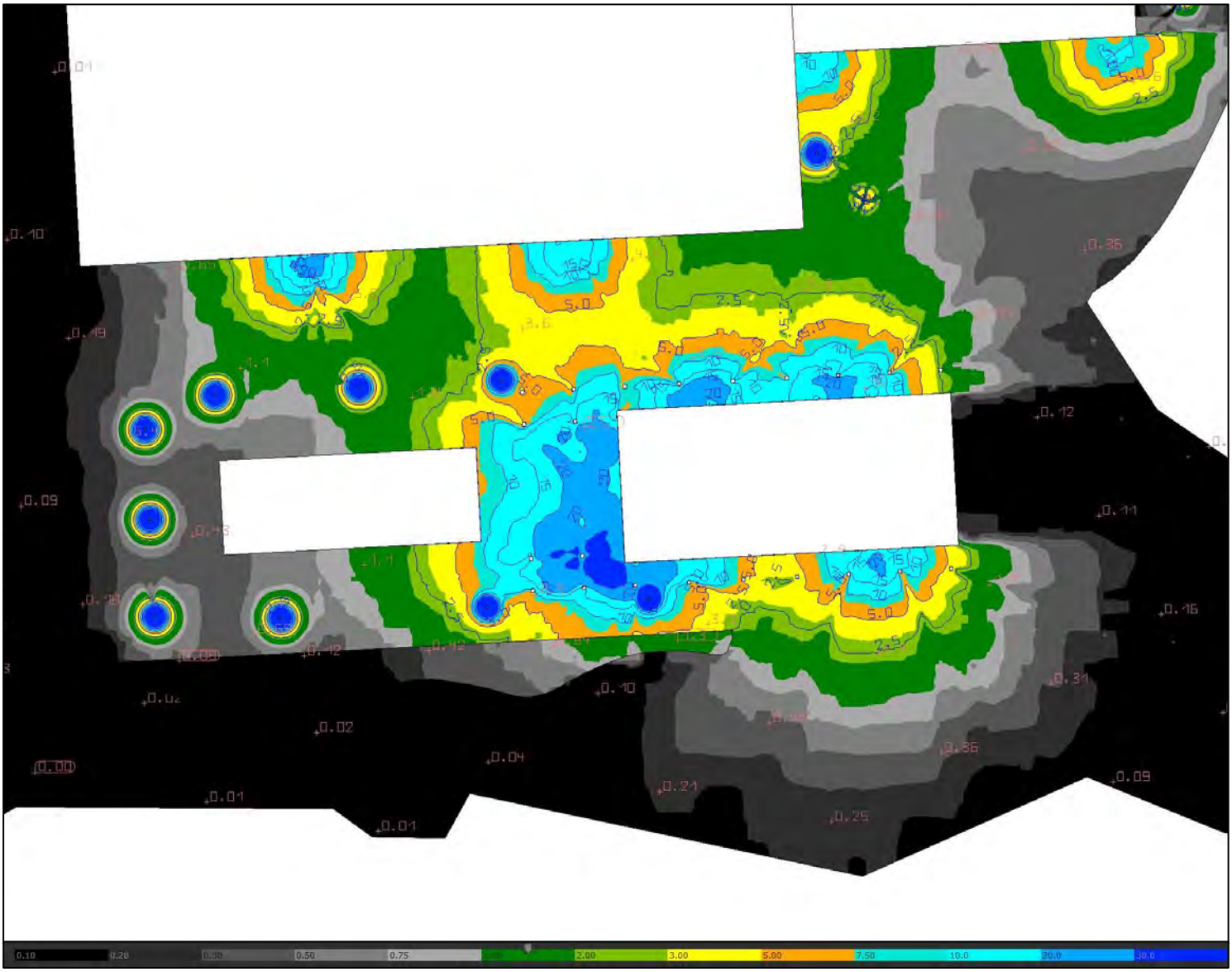


Lux Level Less than 1 Lux

Lux Level Greater than 1 Lux

Highlighted Colour Contour Indicates = 1 Lux

Figure 8.0. Phase 1 Pseudo Colour Plan with Value Chart and Isolines

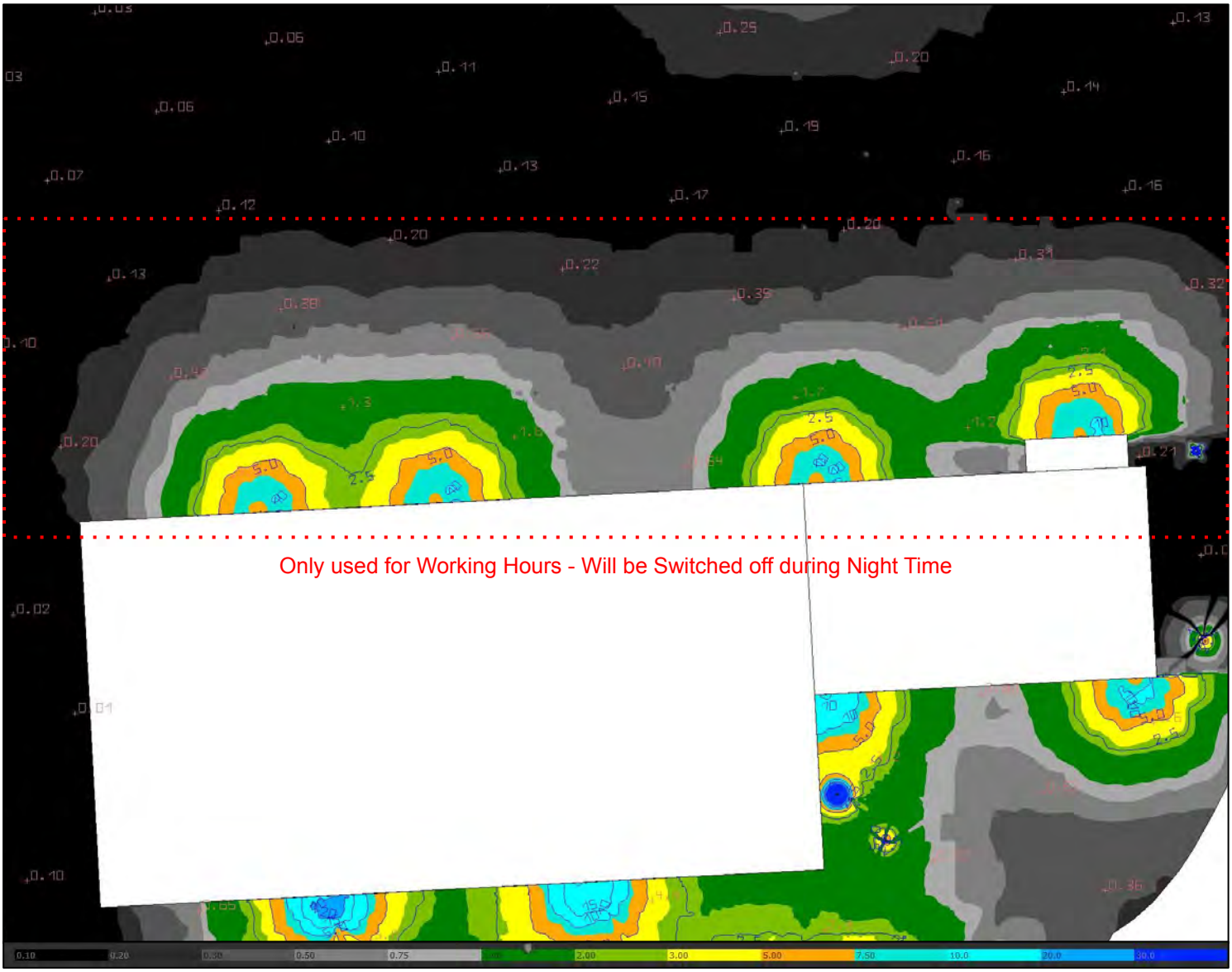


Pseudo Colour Maps

Zone 1

Lux Levels

Figure 8.1 Zone 1 Pseudo Colour Plan

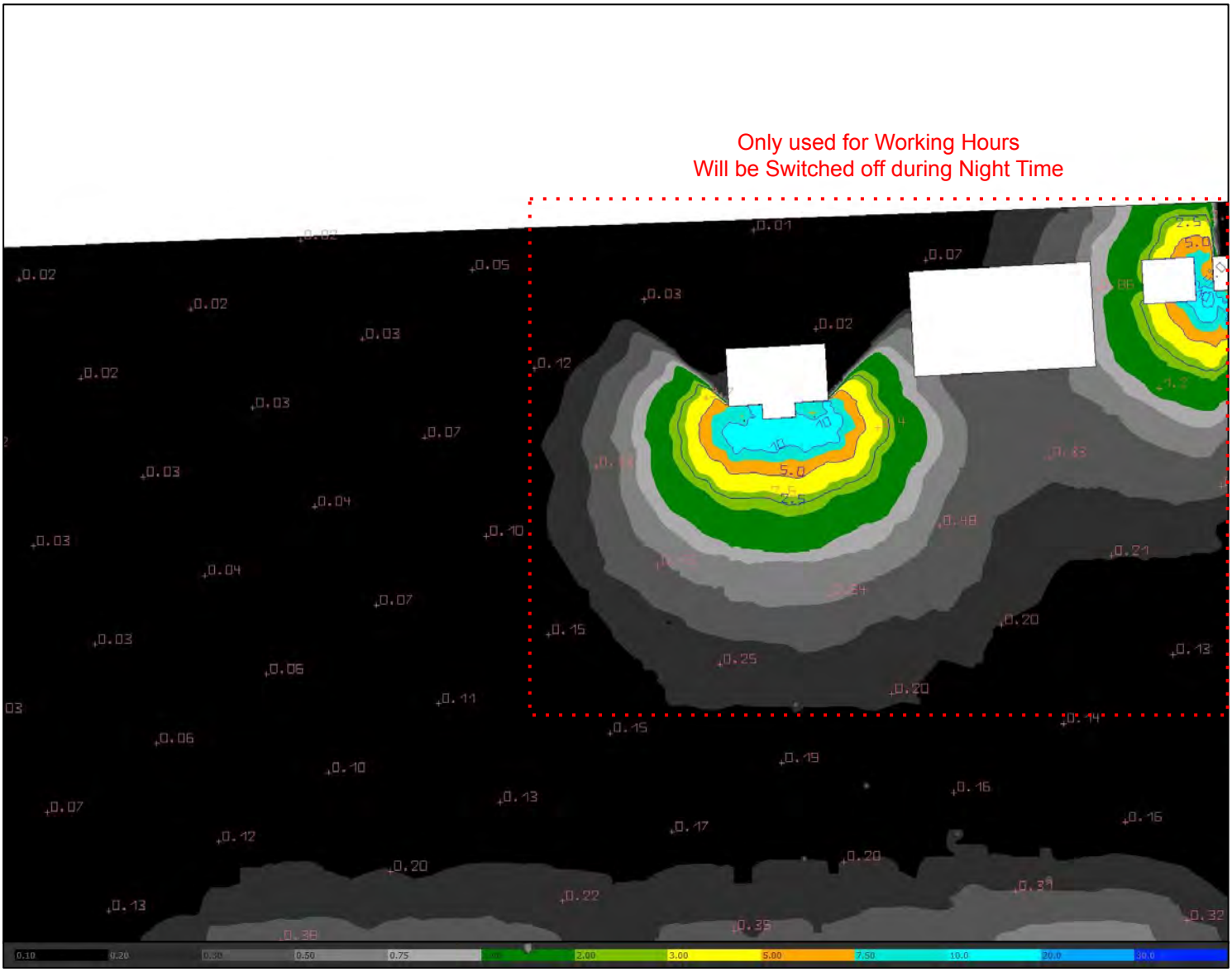


Pseudo Colour Maps

Zone 2

Lux Levels

Figure 8.2. Zone 2 Pseudo Colour Plan

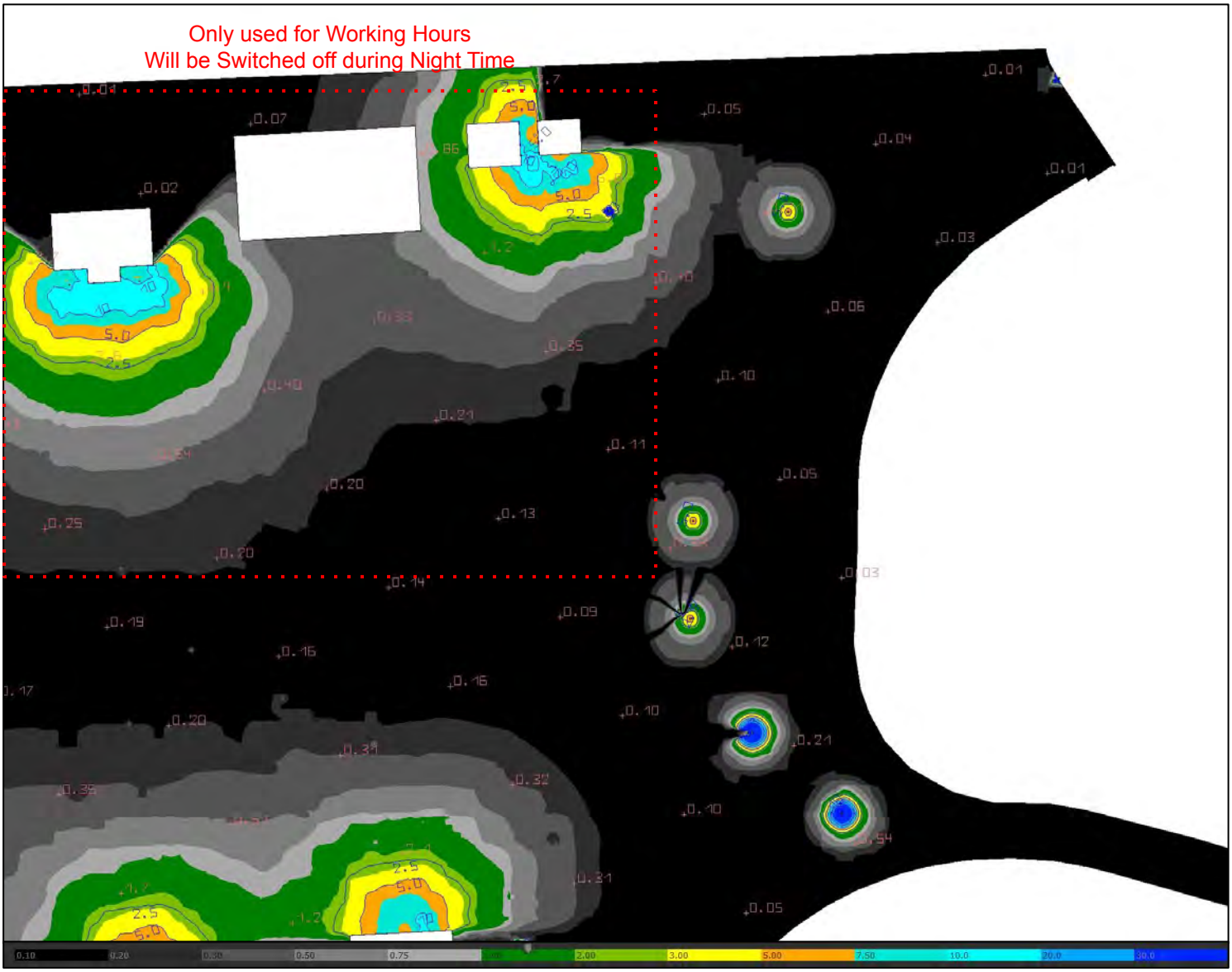


Pseudo Colour Maps

Zone 3

Lux Levels

Figure 8.3. Zone 3 Pseudo Colour Plan

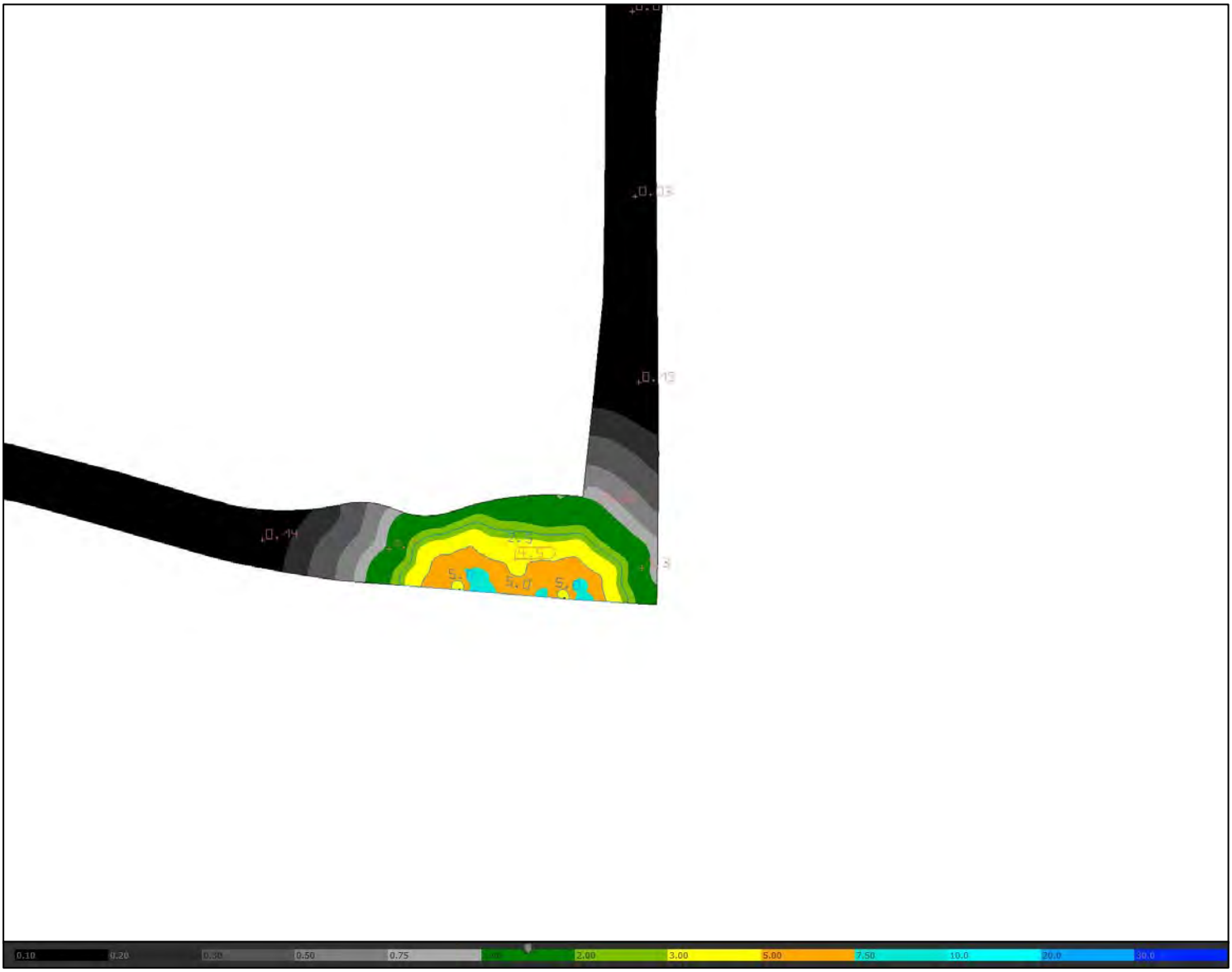


Pseudo Colour Maps

Zone 4

Lux Levels

Figure 8.4. Zone 4 Pseudo Colour Plan

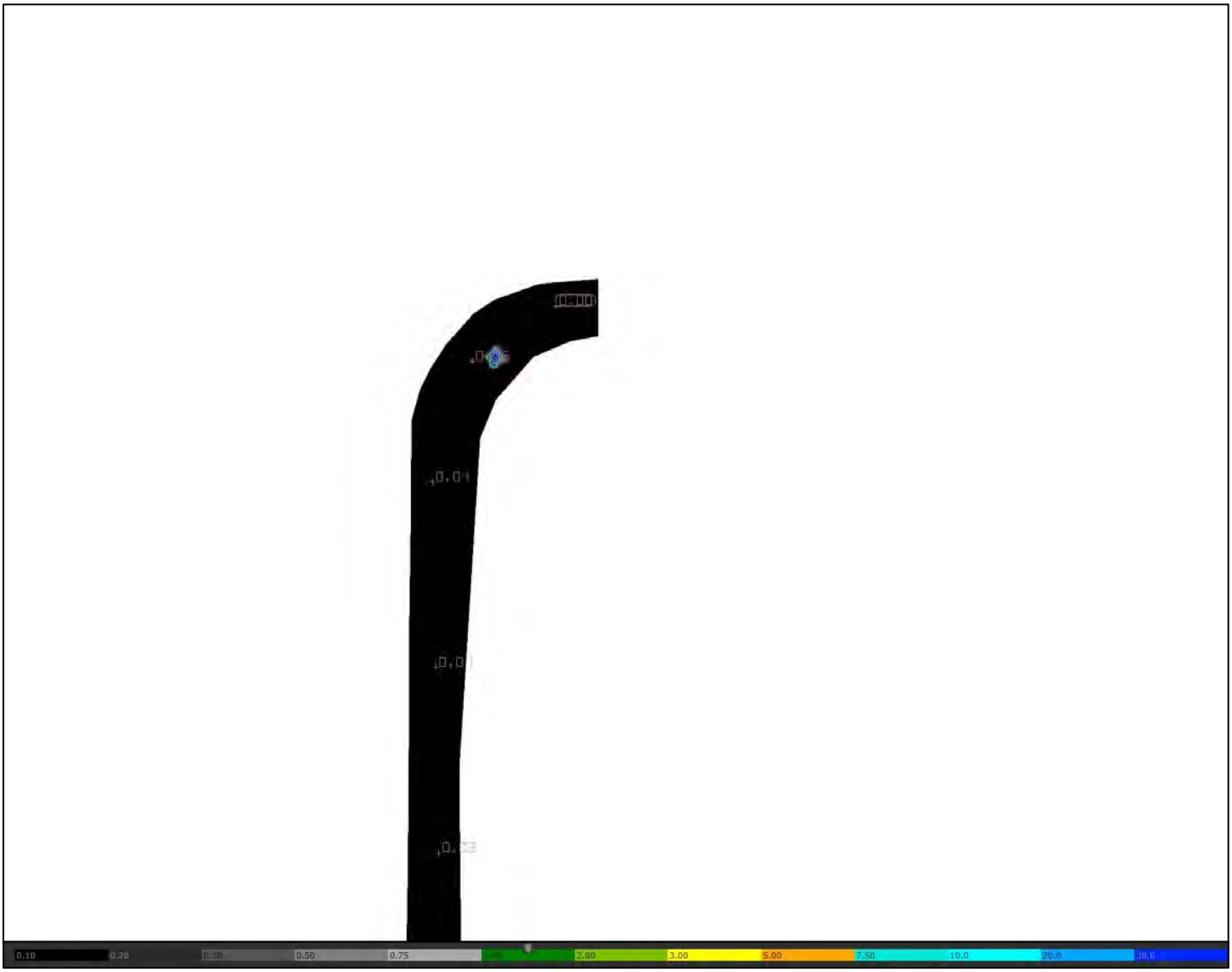


Pseudo Colour Maps

Zone 5

Lux Levels

Figure 8.5. Zone 5 Pseudo Colour Plan



Pseudo Colour Maps

Zone 6

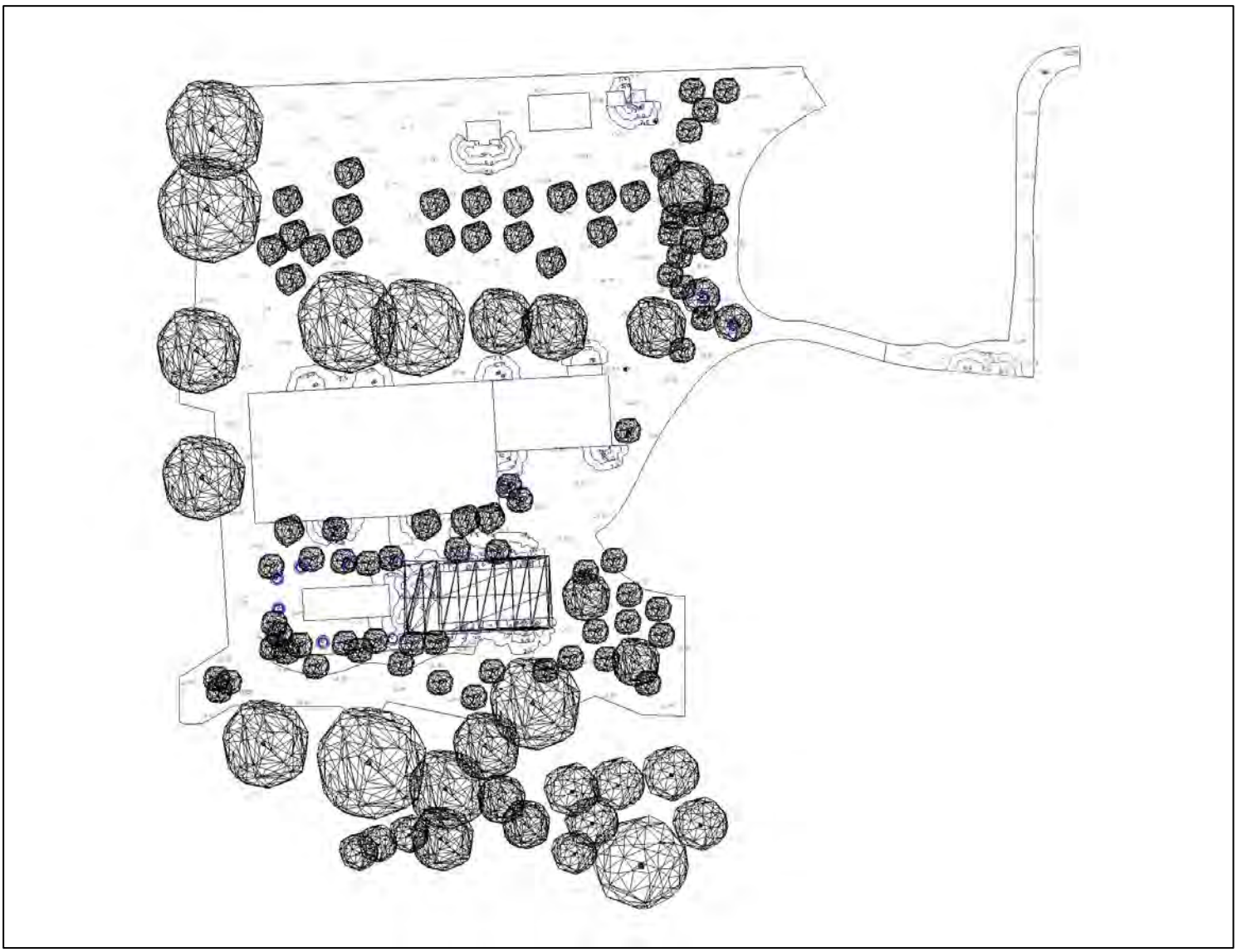
Lux Levels

Figure 8.6. Zone 5 Pseudo Colour Plan

Isoline Contour Maps

Aerial View

Legend Description



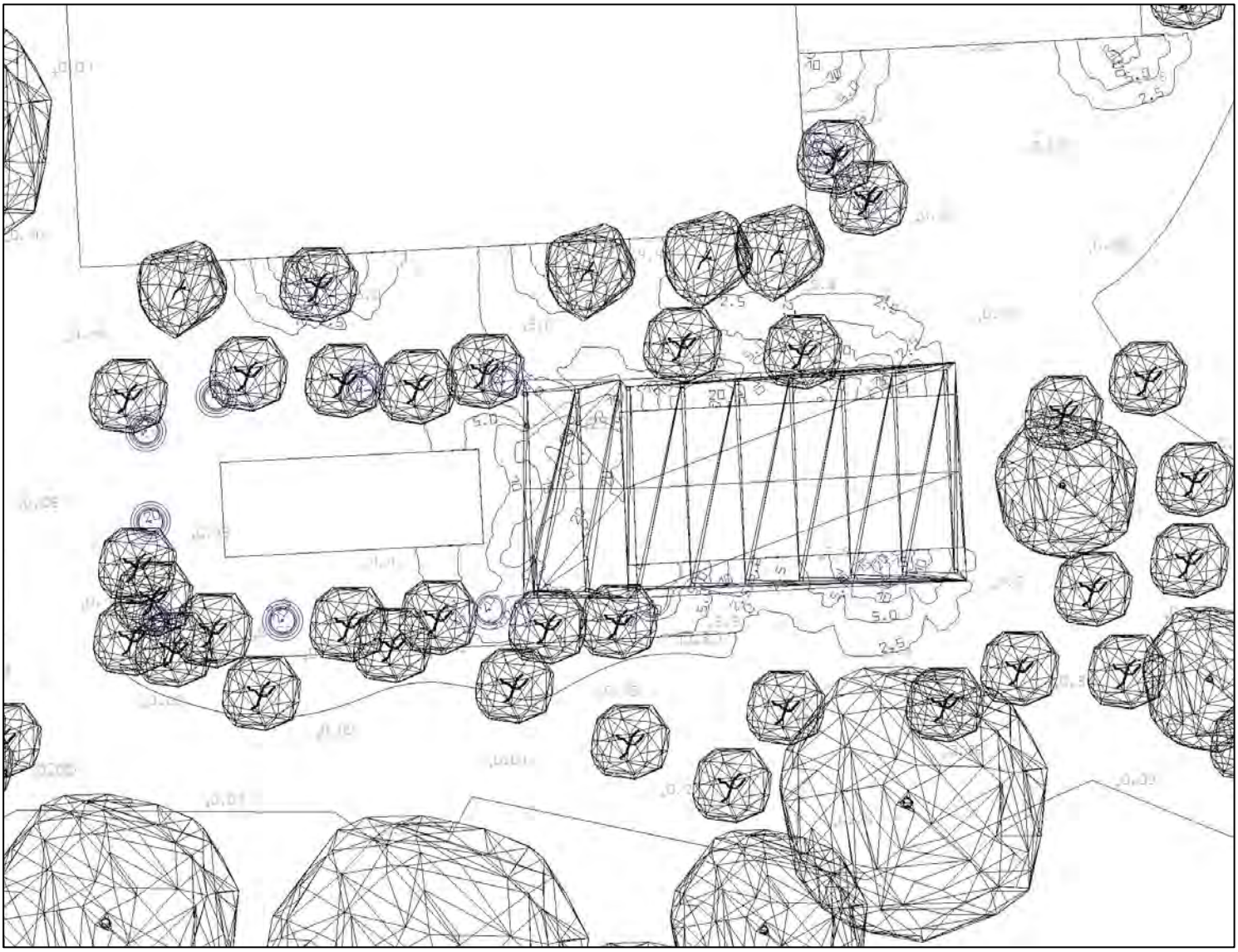
The Blue indicates:

Contour lines represent isolux curves, which connect points of equal illuminance across the calculation surface.

The Red indicates:

Value chart provides the corresponding numerical illuminance readings at defined grid points, showing how light levels change with increasing distance from the luminaire.

Figure 9.0. Phase 1 Isoline Contour Plan

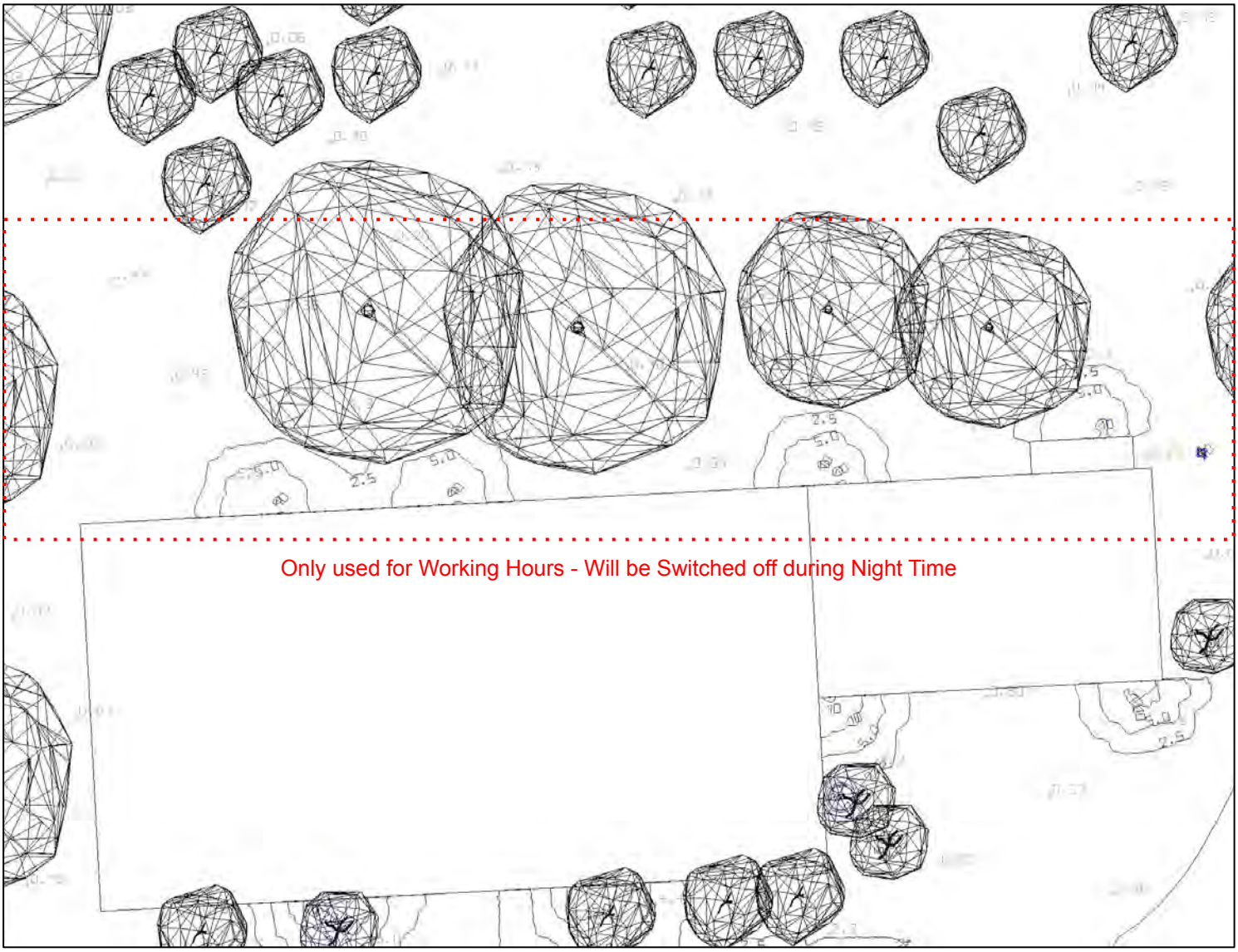


Isoline Contour Maps

Zone 1

Lux Levels

Figure 9.1. Zone 1 Isoline Contour Plan

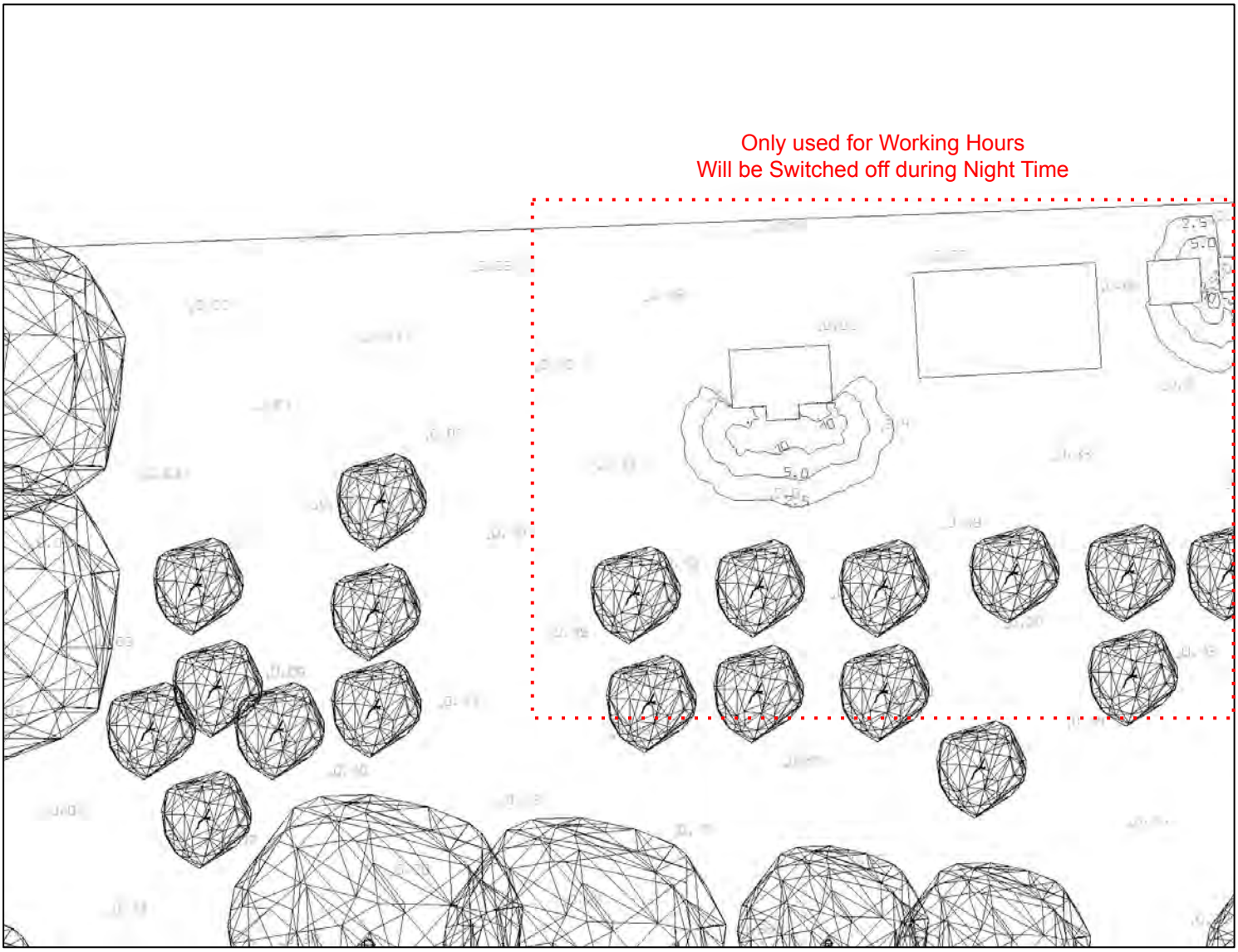


Isoline Contour Maps

Zone 2

Lux Levels

Figure 9.2. Zone 2 Isoline Contour Plan

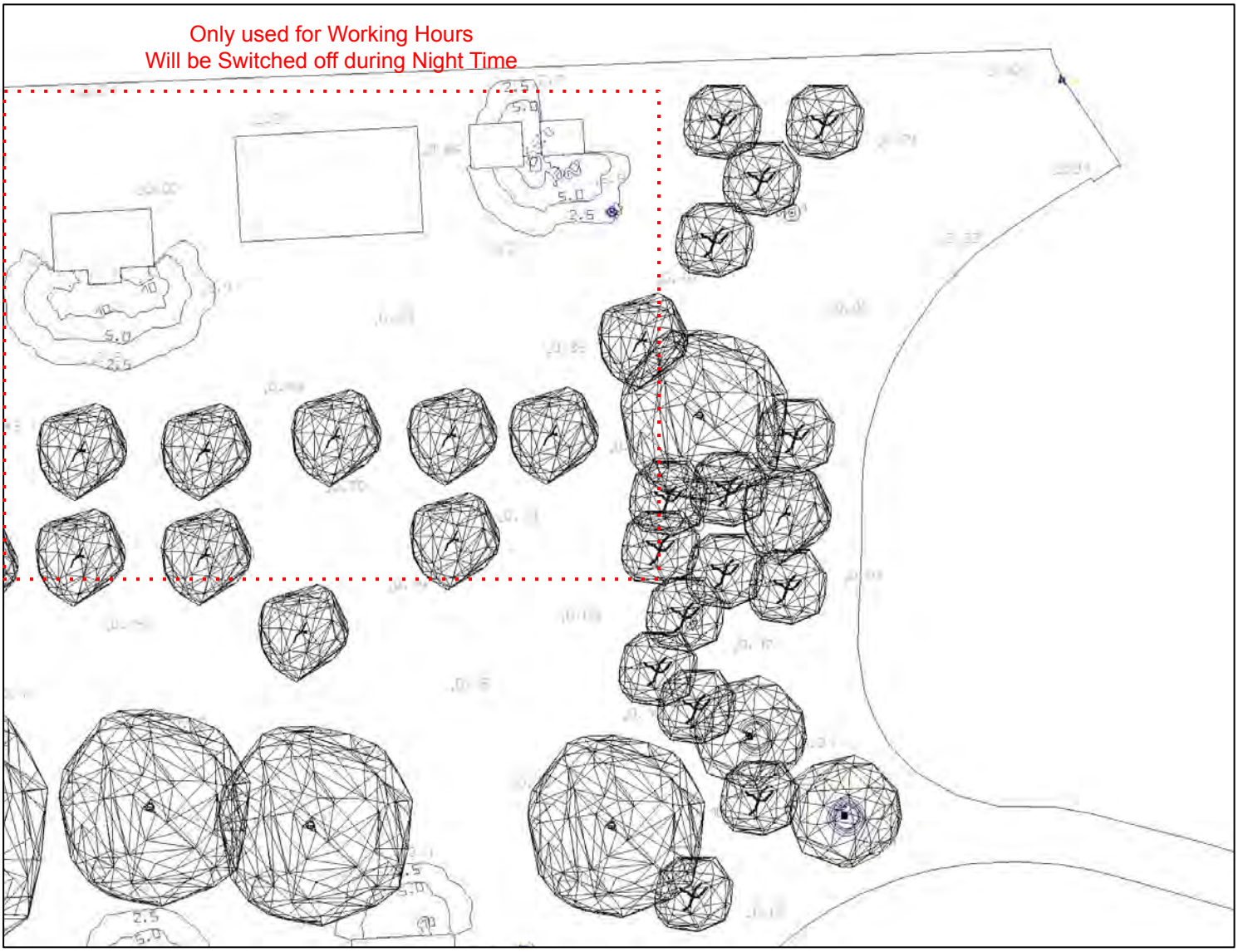


Isoline Contour Maps

Zone 3

Lux Levels

Figure 9.3. Zone 3 Isoline Contour Plan

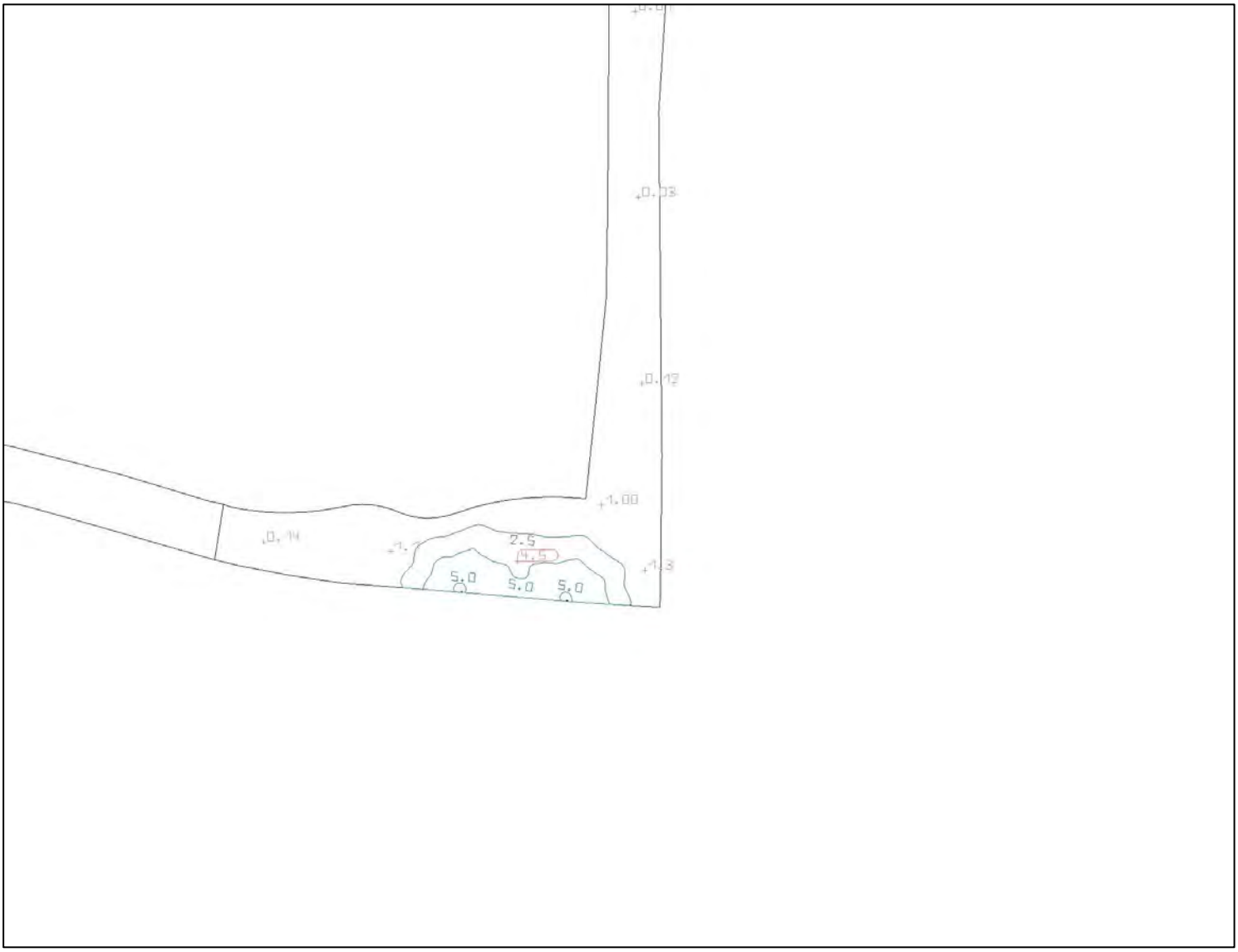


Isoline Contour Maps

Zone 4

Lux Levels

Figure 9.4. Zone 4 Isoline Contour Plan

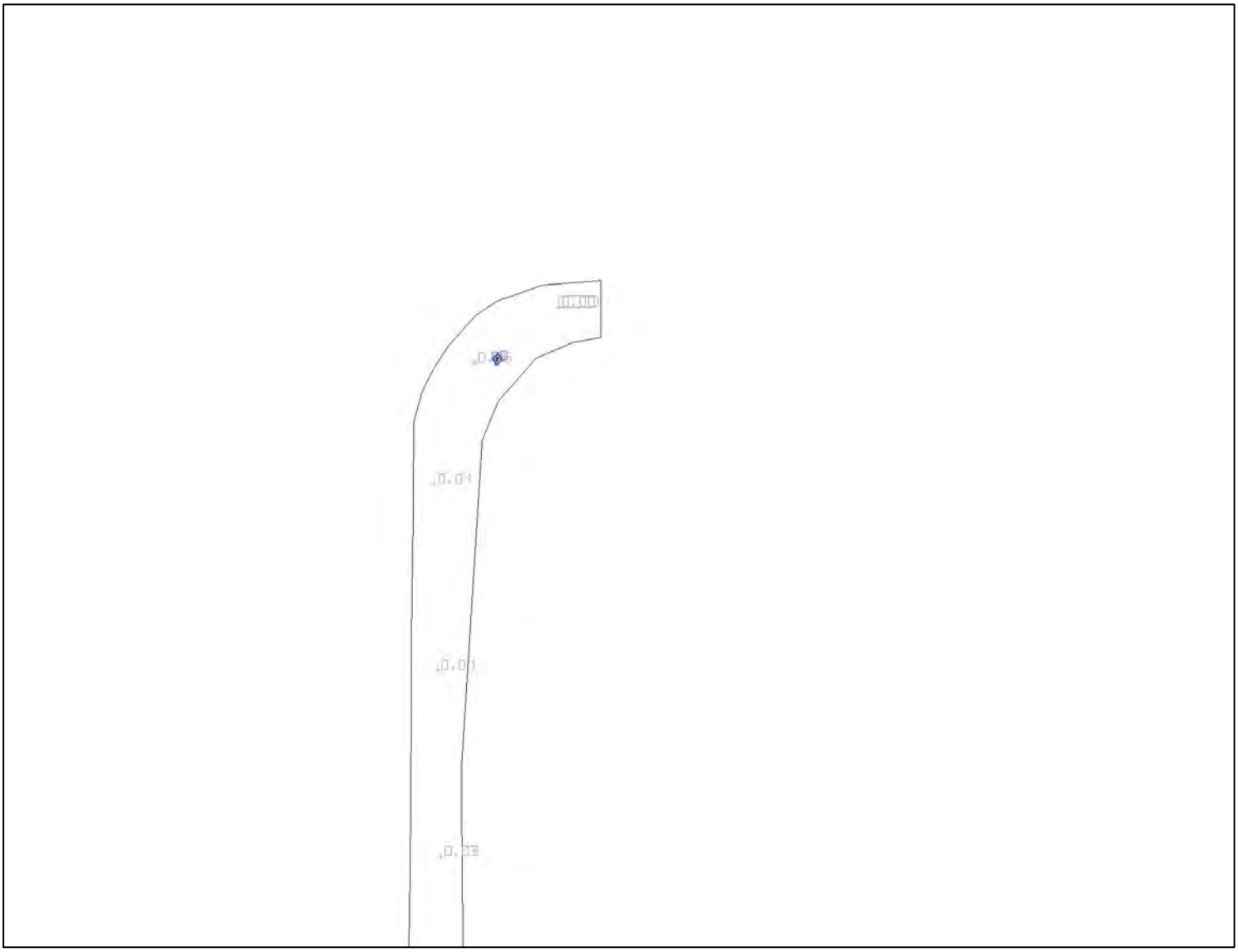


Isoline Contour Maps

Zone 5

Lux Levels

Figure 9.5. Zone 5 Isoline Contour Plan



Isoline Contour Maps

Zone 6

Lux Levels

Figure 9.6. Zone 6 Isoline Contour Plan

Specification

Luminaire Selection

Model Import List

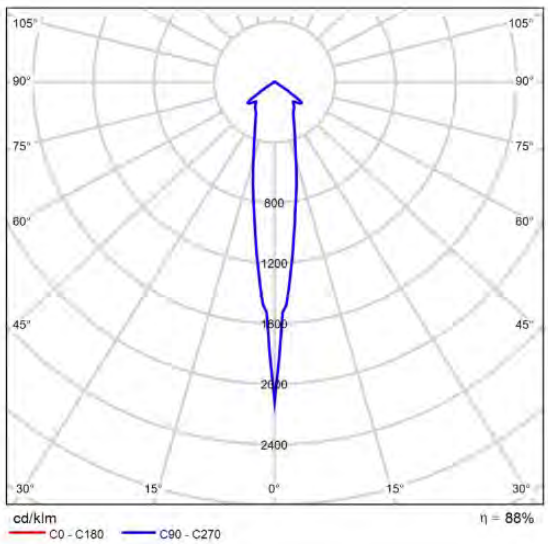
Reference	Manufacturer	Model	Quantity	Wattage	Lumen output	Mounting Heights	Notes
L1	Hudson Lighting	Multi Stem Master	5	1.6W	13 lm	2.0m	RAL 8040
L2	Hudson Lighting	Downward Tree Spot	2	3.6W	107 lm	1.7m	RAL 8040
L3	Hudson Lighting	Eyelid	9	2.6W	31 lm	>0.5m	RAL 8040
L4	Hudson Lighting	Downward Spike Spot	10	3.6W	226 lm	0.8m	RAL 8040
L5	Lumeneye	Bat Hat Solareye 80	26	Off Grid	0.232 lm	0.0m	Output Increased 1 lm
L6	Tala	Globe E27 Bulbs	30	6.0W	600 lm	1.5m - 1.9m	Raised to 870lm to account for non frosted glass

L1 - Hudson Lighting - Multi Stem Master

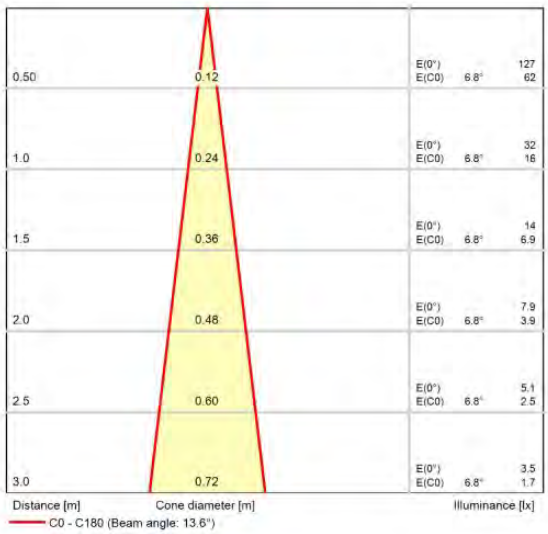
Product Photometric Data Sheet

Model Import Information





Polar LDC



Cone diagram

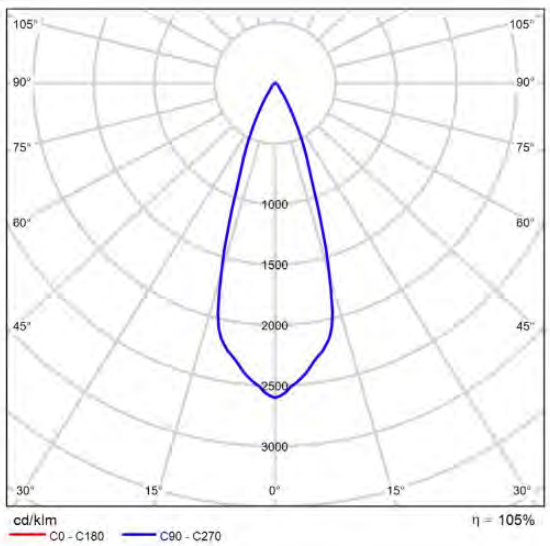
Figure 10. L1 Photometric Data

L2 - Hudson Lighting - Downward Tree Spot

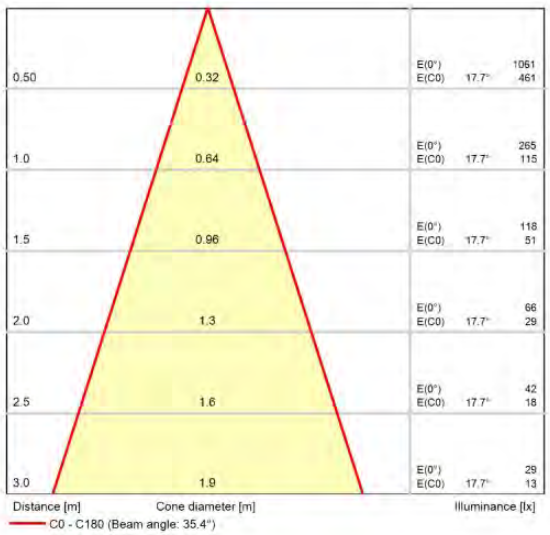
Product Photometric Data Sheet

Model Import Information





Polar LDC



Cone diagram

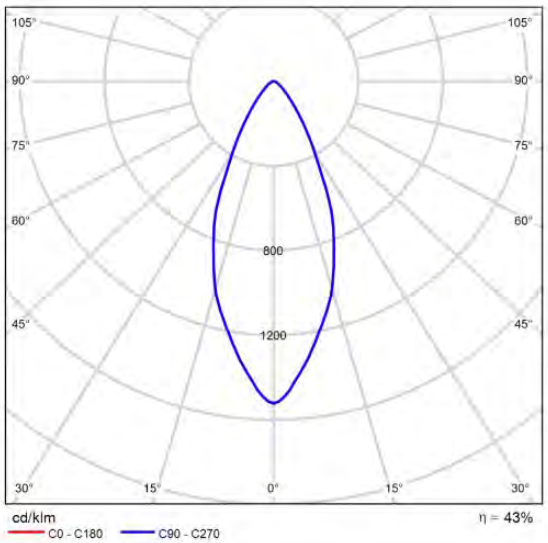
Figure 11. L2 Photometric Data

L3 - Hudson Lighting - Eyelid

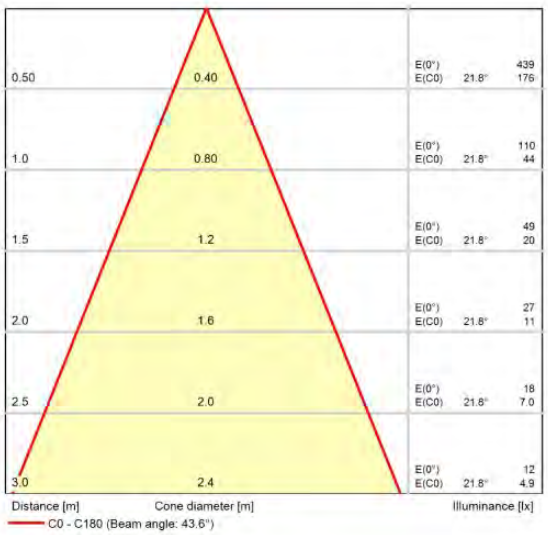
Product Photometric Data Sheet

Model Import Information





Polar LDC



Cone diagram

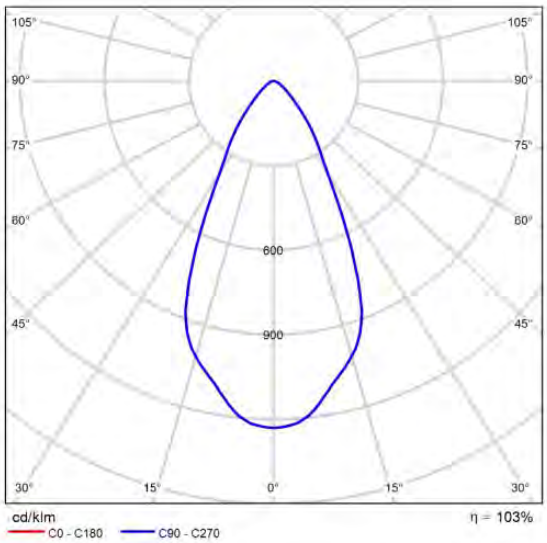
Figure 12. L3 Photometric Data

L4 - Hudson Lighting - Downward Spike Spot

Product Photometric Data Sheet

Model Import Information





Polar LDC

Glare evaluation according to RUG											
ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	9.5	10.4	9.8	10.6	10.8	9.6	10.5	9.9	10.7	10.9
	3H	9.6	10.4	9.9	10.6	10.9	9.7	10.5	10.0	10.7	11.0
	4H	9.6	10.3	9.9	10.6	10.9	9.7	10.4	10.0	10.7	11.0
	6H	9.5	10.3	9.9	10.5	10.8	9.6	10.3	10.0	10.6	10.9
	8H	9.5	10.2	9.9	10.5	10.8	9.6	10.3	10.0	10.6	10.9
	12H	9.5	10.1	9.8	10.5	10.8	9.6	10.2	9.9	10.5	10.9
4H	2H	9.5	10.2	9.8	10.5	10.8	9.5	10.3	9.9	10.6	10.8
	3H	9.6	10.2	9.9	10.5	10.9	9.7	10.3	10.0	10.6	11.0
	4H	9.6	10.2	10.0	10.5	10.9	9.7	10.3	10.1	10.6	11.0
	6H	9.6	10.1	10.0	10.5	10.9	9.7	10.2	10.1	10.6	11.0
	8H	9.6	10.0	10.0	10.4	10.8	9.7	10.1	10.1	10.5	10.9
	12H	9.5	10.0	10.0	10.4	10.8	9.6	10.1	10.1	10.5	10.9
8H	4H	9.5	10.0	10.0	10.4	10.8	9.6	10.1	10.0	10.5	10.9
	6H	9.5	9.9	10.0	10.3	10.8	9.6	10.0	10.1	10.4	10.9
	8H	9.5	9.8	10.0	10.3	10.8	9.6	10.0	10.1	10.4	10.9
	12H	9.5	9.8	10.0	10.2	10.7	9.6	9.9	10.1	10.3	10.8
12H	4H	9.5	9.9	9.9	10.3	10.8	9.6	10.0	10.0	10.4	10.8
	6H	9.5	9.8	10.0	10.3	10.7	9.6	9.9	10.1	10.4	10.8
	8H	9.5	9.8	10.0	10.2	10.7	9.6	9.9	10.1	10.3	10.8
Variation of the observer position for the luminaire distances S											
S = 1.0H		+2.4 / -2.9					+2.2 / -2.8				
S = 1.5H		+4.6 / -4.3					+4.4 / -4.2				
S = 2.0H		+6.4 / -5.6					+6.3 / -5.4				
Standard table		BK01					BK01				
Correction summand		-8.2					-8.2				
Corrected glare indices referring to 2198lm Total luminous flux											

RUG diagram (SHR: 0.25)

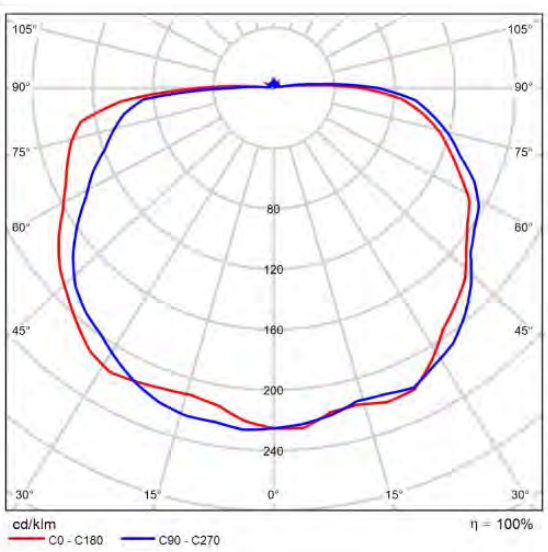
Figure 13. L4 Photometric Data

L5 - Lumeneye - Solareye80 Bat Hat

Product Photometric Data Sheet

Model Import Information





Polar LDC

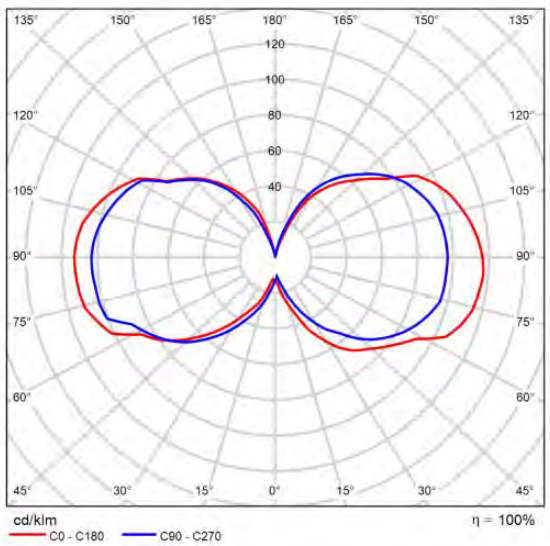
Figure 14. L5 Photometric Data

L6 - Globe - E27 Light Bulb (Wall Lights)

Product Photometric Data Sheet

Model Import Information





Polar LDC

Figure 15. L6 Photometric Data

Luminaire Locations

Placements

Extracted Document Information

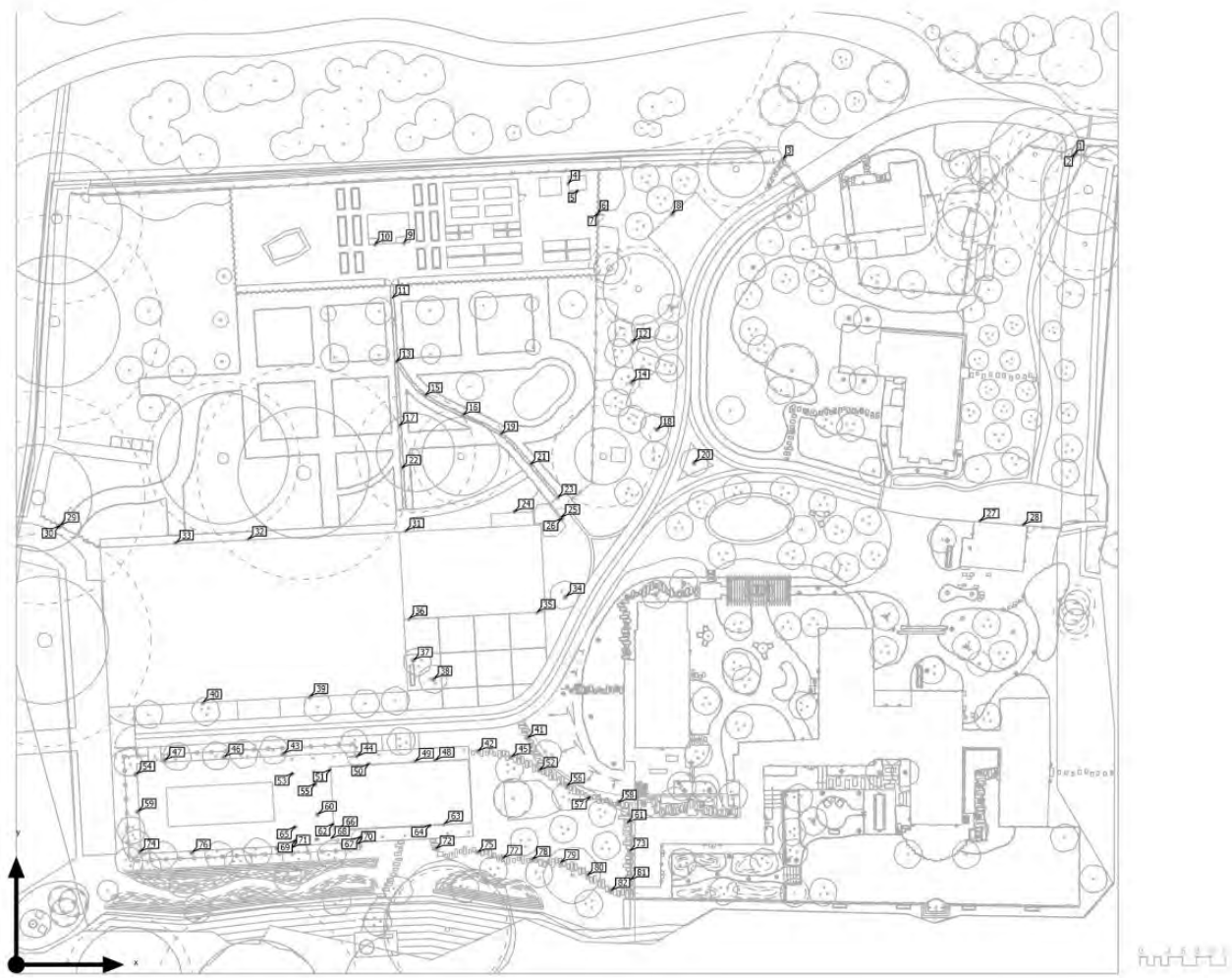


Figure 16. Luminaire Locations

Calculation Planes

Site Wide

Total Count 3 Planes

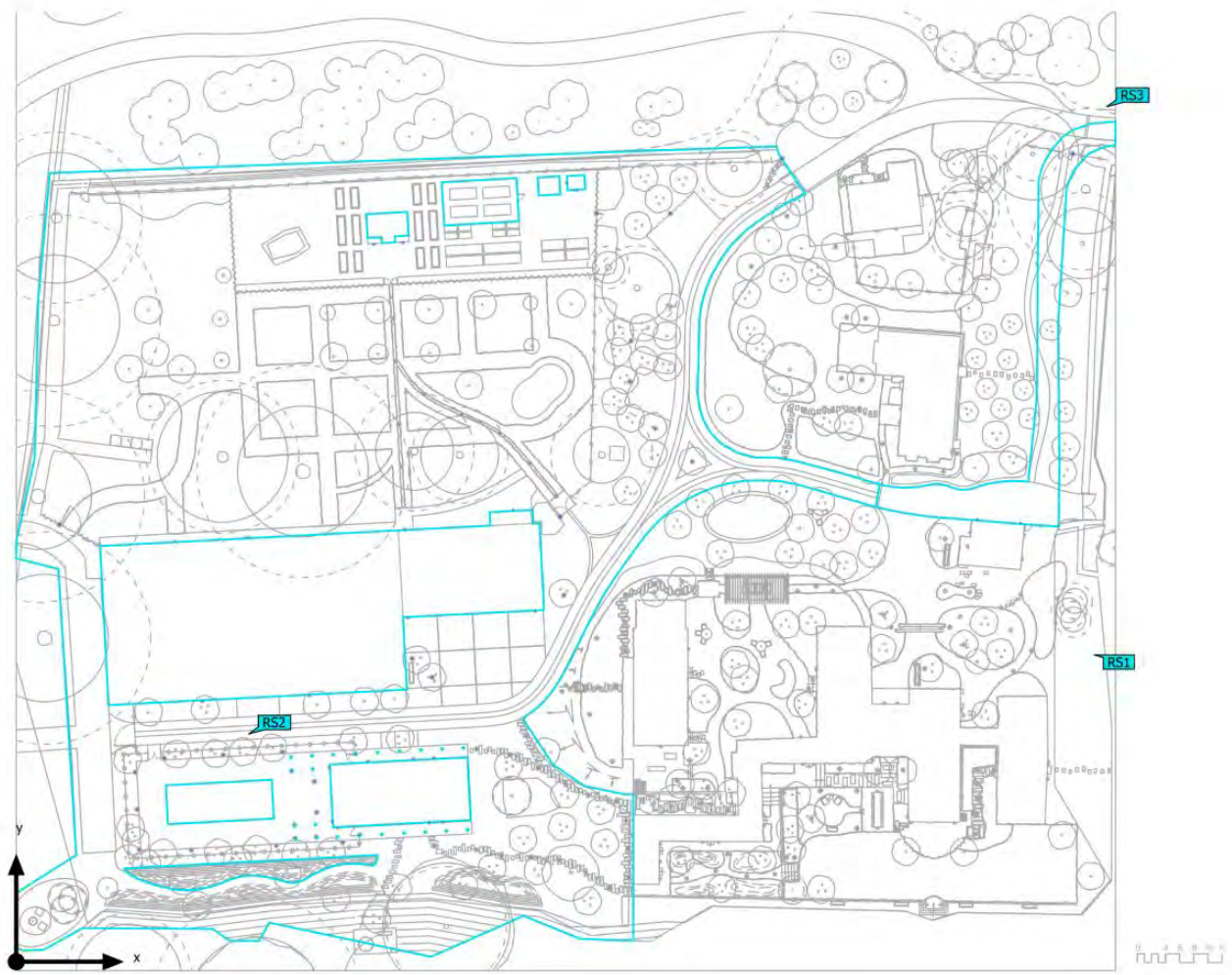


Figure 17. Calculation Plane Locations

Surface Results

Combined

All 3 Calculation Planes

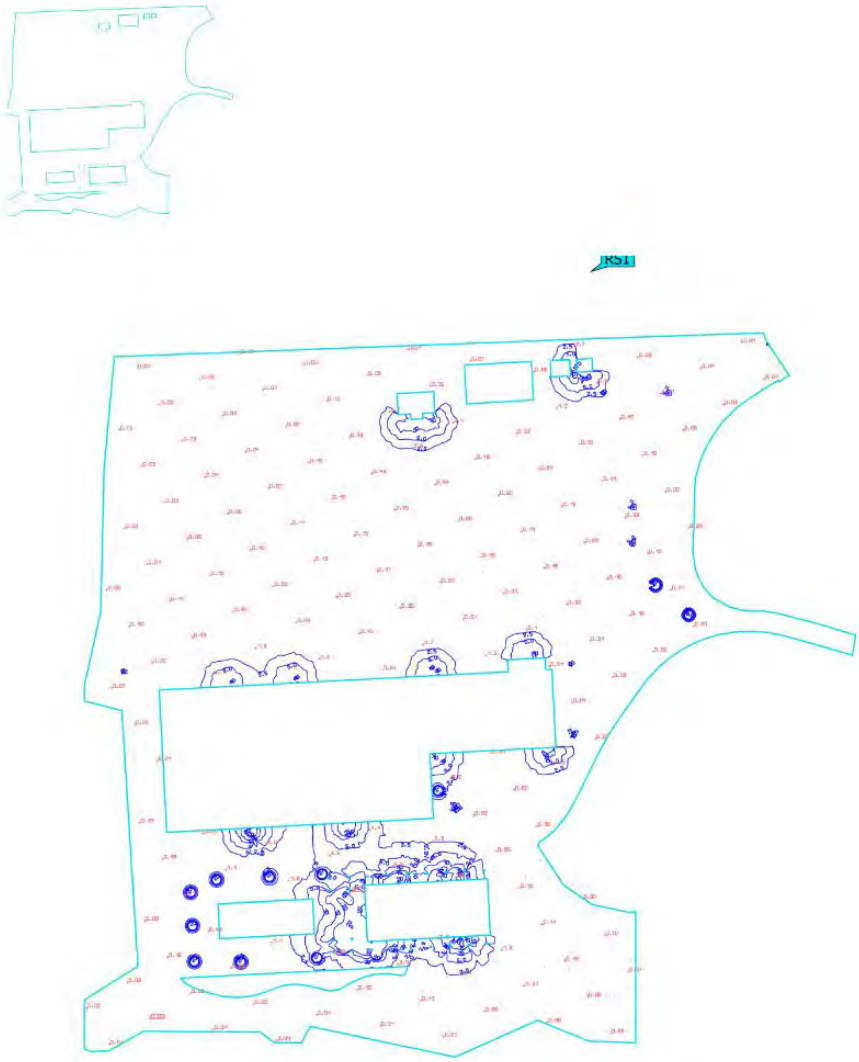
Properties		min	max	U_o (g_1)	g_2	Index
Floor I Perpendicular illuminance (adaptive) Height: -0.000 m	1.37 lx	0.001 lx	4852 lx	0.001	0.000	RS1
Floor III Perpendicular illuminance (adaptive) Height: 1.200 m	0.38 lx	0.055 lx	1.44 lx	0.14	0.038	RS2
Floor II Perpendicular illuminance (adaptive) Height: -0.000 m	1.04 lx	0.003 lx	4239 lx	0.003	0.000	RS3

Figure 18. Surface Plane Locations

Surface Results

Calculation Plane I

Phase I - Part A



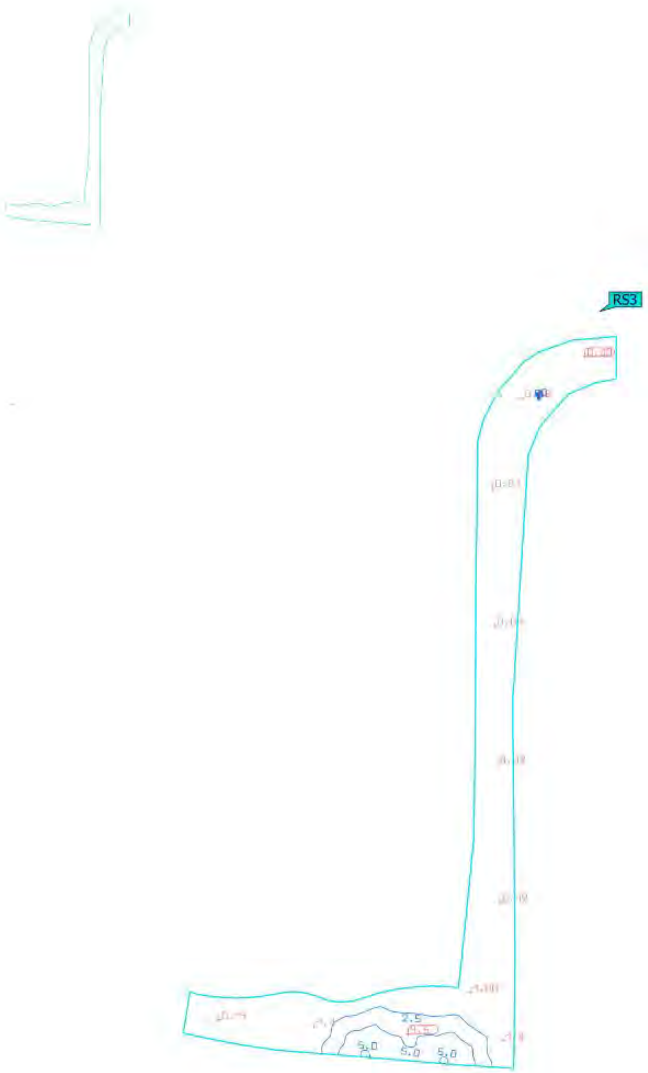
Properties		E_{min}	E_{max}	U_o (g_1)	g_2	Index
Floor I Perpendicular illuminance (adaptive) Height: -0.000 m	1.37 lx	0.001 lx	4852 lx	0.001	0.000	RS1

Figure 19. Calculation Plane 1 Readings

Surface Results

Calculation Plane II

Phase I - Part B



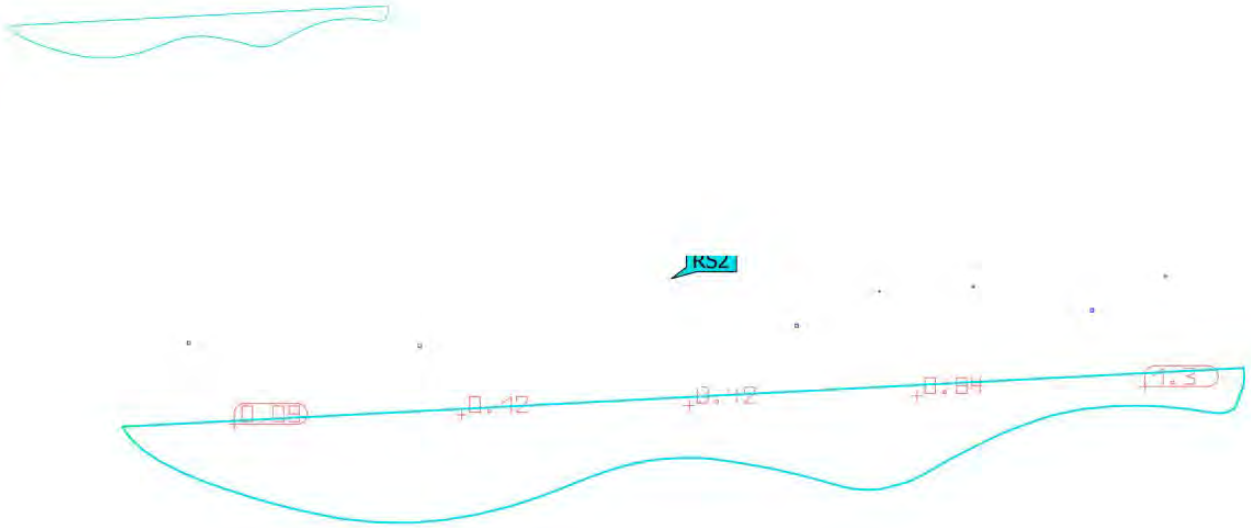
Properties		E_{min}	E_{max}	U_o (g_1)	g_2	Index
Floor II Perpendicular illuminance (adaptive) Height: -0.000 m	1.04 lx	0.003 lx	4239 lx	0.003	0.000	RS3

Figure 20. Calculation Plane 2 Readings

Surface Results

Calculation Plane III

Phase I - Mound (South)



Properties		E_{min}	E_{max}	U_o (g_1)	g_2	Index
Floor III Perpendicular illuminance (adaptive) Height: 1.200 m	0.38 lx	0.055 lx	1.44 lx	0.14	0.038	RS2

Figure 21. Calculation Plane 3 Readings

Conclusion

Summary of Findings

Bat Corridor

The calculation outputs confirm that the perpendicular illuminance (Eh) along the southern bat commuting corridor is consistently maintained below the ecological design threshold of 1.0 lux, with Emin values approaching 0.001 lux across the majority of the corridor. The resulting overall uniformity (Uo) demonstrates that the corridor remains a stable low-illuminance environment, safeguarding its ecological function.

Measured luminance (cd/m²) values are negligible, with results indicating no significant contrast that would risk light trespass into adjacent hedgerows or tree lines. The upward light ratio (RUL) is effectively 0.0 due to the specification of downward-directed, cowled luminaires, ensuring that no luminous flux is emitted above the horizontal plane.

All specified luminaires utilise warm white sources (CCT ≤ 2700 K, CRI ≥ 80), thereby reducing the short-wavelength spectral content that is known to disrupt chiropteran activity. The calculated luminous efficacy (lm/W) of the scheme demonstrates efficient energy performance while maintaining compliance with biodiversity-sensitive thresholds.

In addition, the operating hours of the external lighting have been restricted so that fittings are switched off during the core nighttime period, except where PIR (passive infrared) controls activate luminaires for short durations in response to human presence. This operational strategy prevents unnecessary illumination after sunset, further protecting sensitive receptors and maintaining the integrity of the designated dark corridors.

Taken together, these photometric parameters and operational measures confirm that the southern corridor remains classified as a dark ecological zone. The low levels of illuminance and luminance ensure that the critical bat commuting and foraging routes are preserved in accordance with ILP/BCT GN 08/23 and the ecological recommendations for Hope Farm.

Glossary

C	
CCT	(Engl. correlated colour temperature) Body temperature of a thermal radiator which serves to describe its light colour. Unit: Kelvin [K]. The lesser the numerical value the redder; the greater the numerical value the bluer the light colour. The colour temperature of gas-discharge lamps and semiconductors are termed "correlated colour temperature" in contrast to the colour temperature of thermal radiators. Allocation of the light colours to the colour temperature ranges acc. to EN 12464-1: Light colour - colour temperature [K] warm white (ww) < 3,300 K neutral white (nw) | 3,300 – 5,300 K daylight white (dw) > 5,300 K
CRI	(Engl. colour rendering index) Designation for the colour rendering index of a luminaire or a lamp acc. to DIN 6169: 1976 or CIE 13.3: 1995. The general colour rendering index Ra (or CRI) is a dimensionless figure that describes the quality of a white light source in regards to its similarity with the remission spectra of defined 8 test colours (see DIN 6169 or CIE 1974) to a reference light source.
E	
Environmental zones	The assessment of intrusive light and light immission depends on the environment of the lighting installation. Depending on the standard, 4-6 different zones are defined, ranging from highly protected areas in natural settings to urban areas, commercial zones, and industrial zones.
G	
g1	Often also Uo (Engl. overall uniformity) Designates the overall uniformity of the illuminance on a surface. It is the quotient from Emin to E and is required, for instance, in standards for illumination of workstations.
g1	Actually it designates the "non-uniformity" of the illuminance on a surface. It is the quotient of Emin to Emax and is generally only relevant for certifying the emergency lighting acc. to EN 1838.
I	
Illuminance	Describes the ratio of the luminous flux that strikes a certain surface to the size of this surface (lm/m² = lx). The illuminance is not tied to an object surface. It can be determined anywhere in space (inside or outside). The illuminance is not a product feature because it is a recipient value. Lux Meters are used for measuring. Unit: Lux Abbreviation: lx Formula symbol: E

L	
LMF	(Engl. luminaire maintenance factor)/acc. to CIE 97: 2005 Luminaire maintenance factor that takes the soiling into account of the luminaire in the course of the operating time. The luminaire maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).
M	
MF	(Engl. maintenance factor)/acc. to CIE 97: 2005 Maintenance factor as decimal number between 0 and 1 that describes the ratio of the new value of a photometric planning parameter (e.g. of the illuminance) to a maintenance value after a certain time. The maintenance factor takes into account the soiling of luminaires and rooms as well as the luminous flux reduction and the failure of light sources. The maintenance factor is taken into account either overall or determined in detail acc. to CIE 97: 2005.
O	
Operating times	The assessment of obtrusive light and light immission depends on the operating times of the lighting installation. Depending on the standard, 1-3 different operating times are specified. In the absence of specific details, an operating time between 06:00 and 22:00 can be assumed.
W	
Working Plane	Virtual measuring or calculation surface at the height of the visual task that generally follows the room geometry. The working plane may also feature a wall zone.

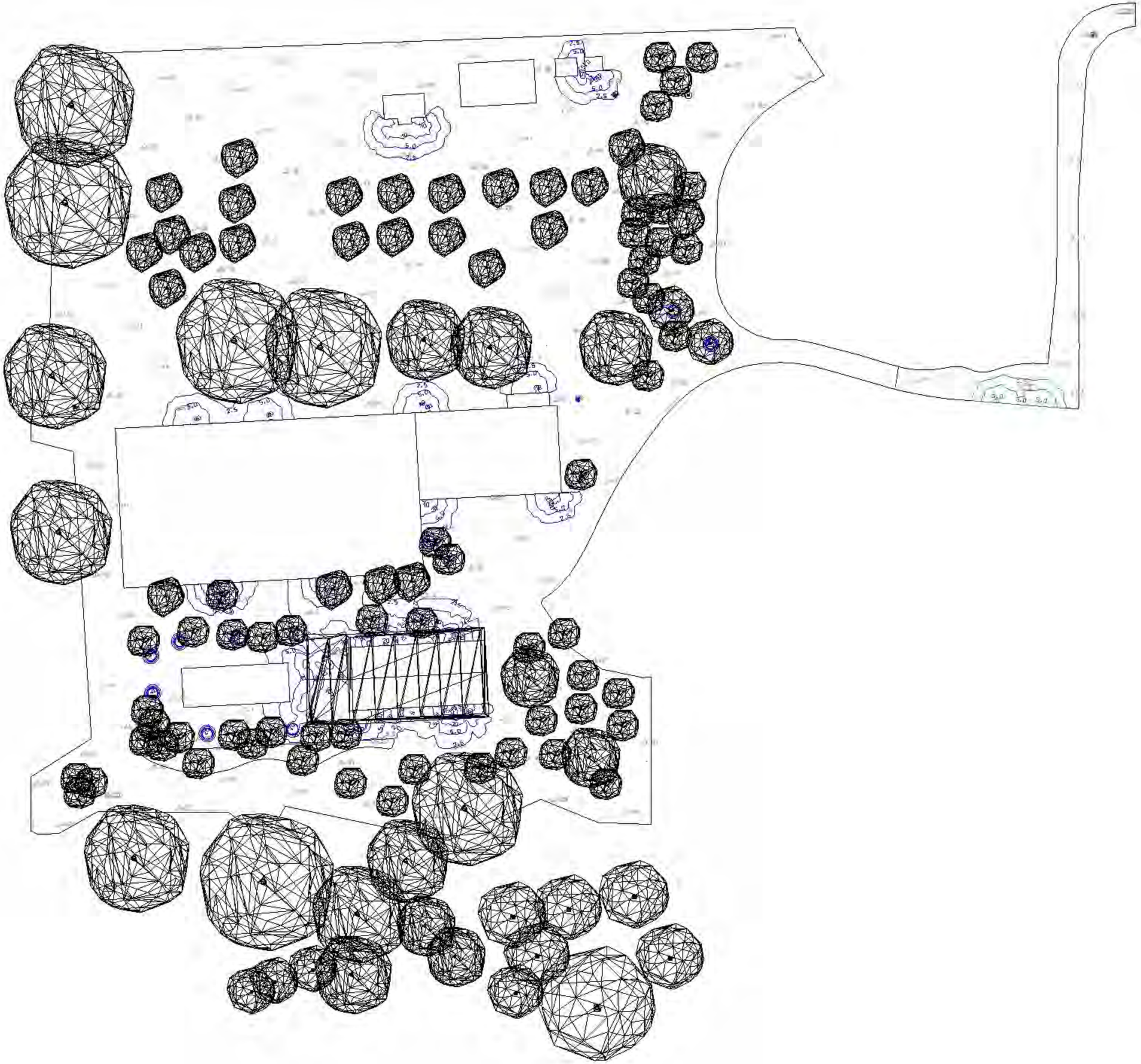
Appendix

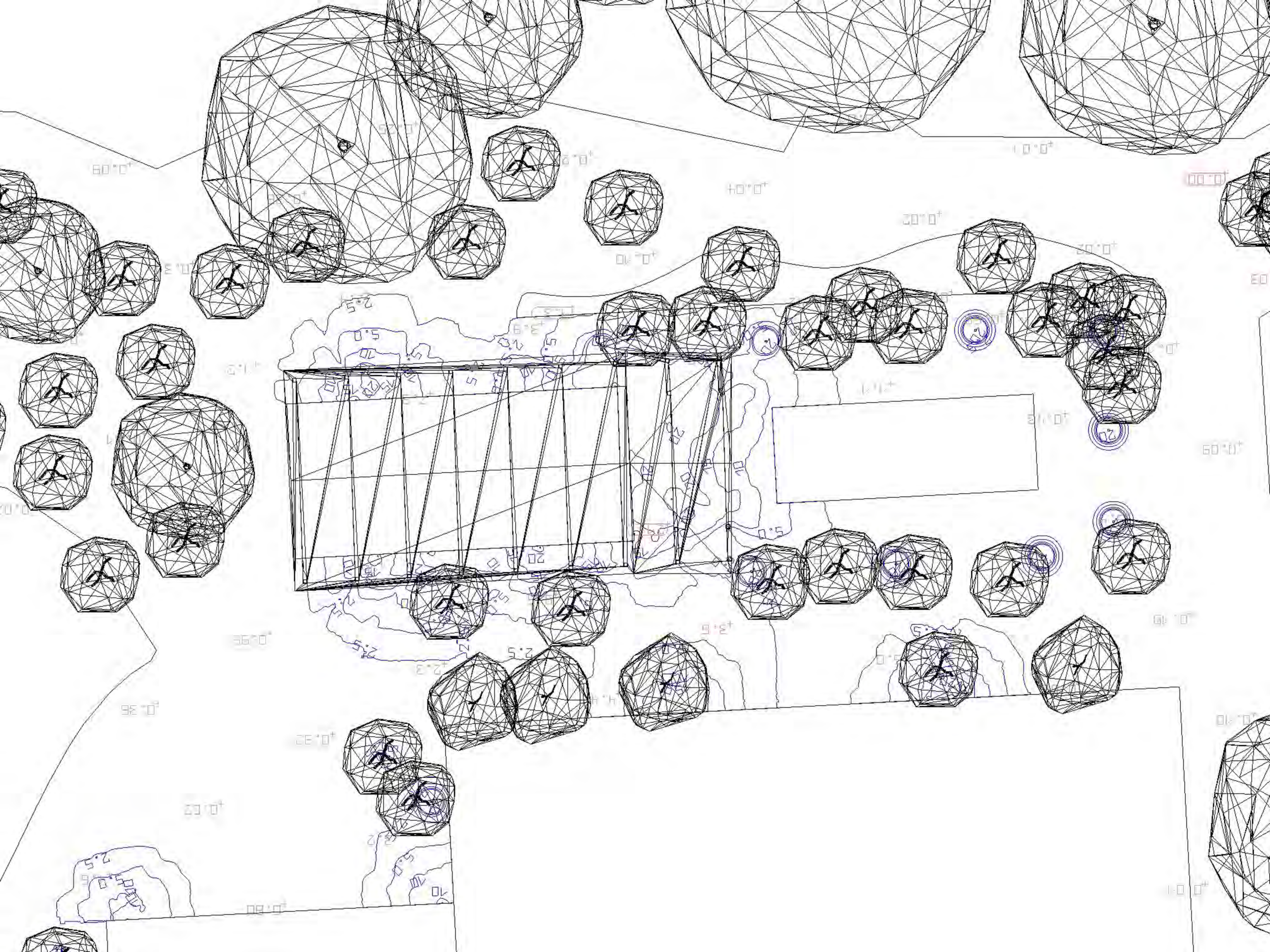
Attached herein is the finalised DIALux Calculation Views, exported directly from the software. This package contains the complete set of calculation surfaces, isolux contour plots, luminaire data sheets, and tabulated illuminance values generated using verified IES/LDT photometric files.

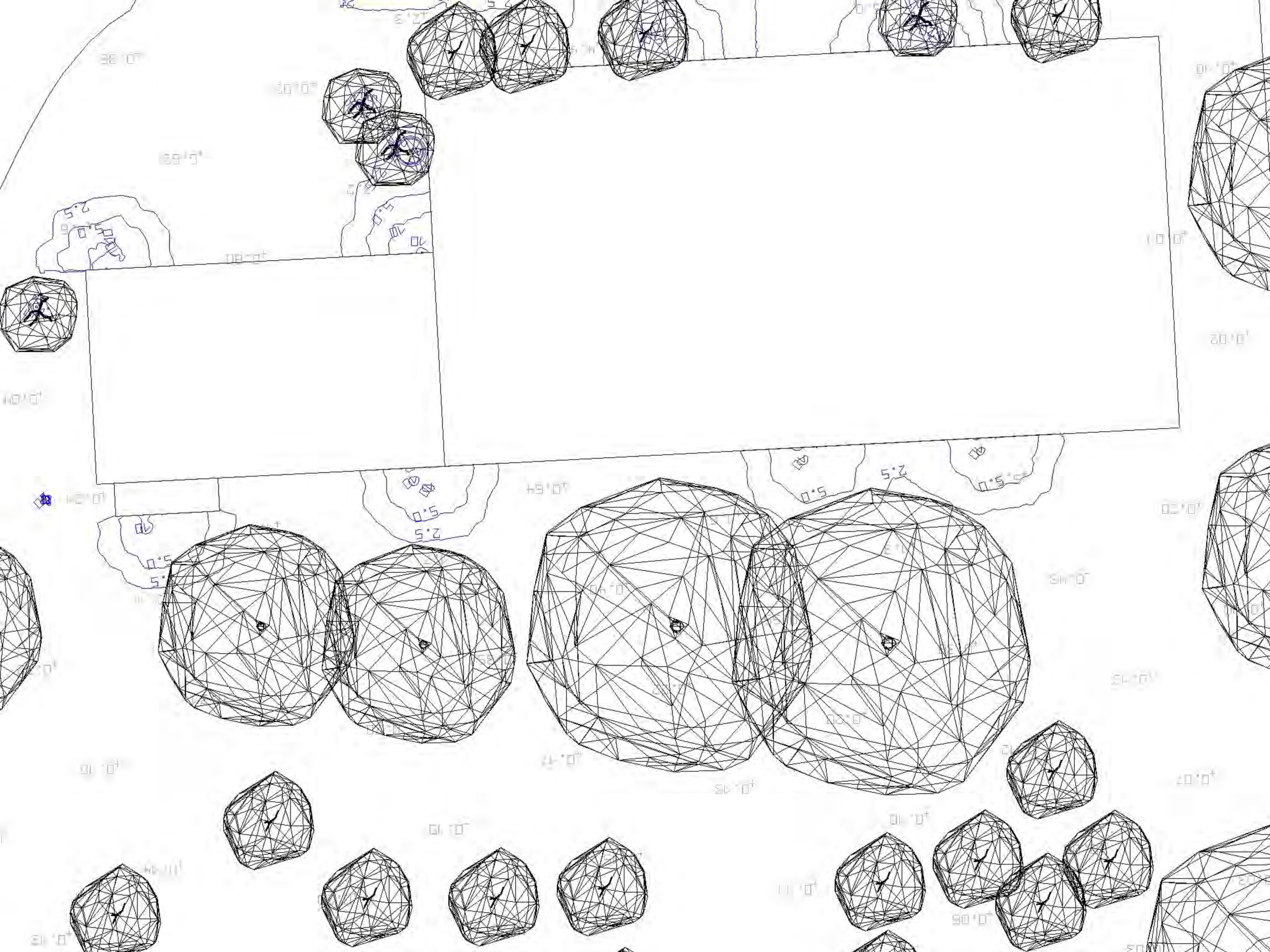
These outputs provide the transparent, unaltered evidence base to demonstrate compliance with both the ILP/BCT GN 08/23 guidance and the ecological recommendations for Hope Farm.

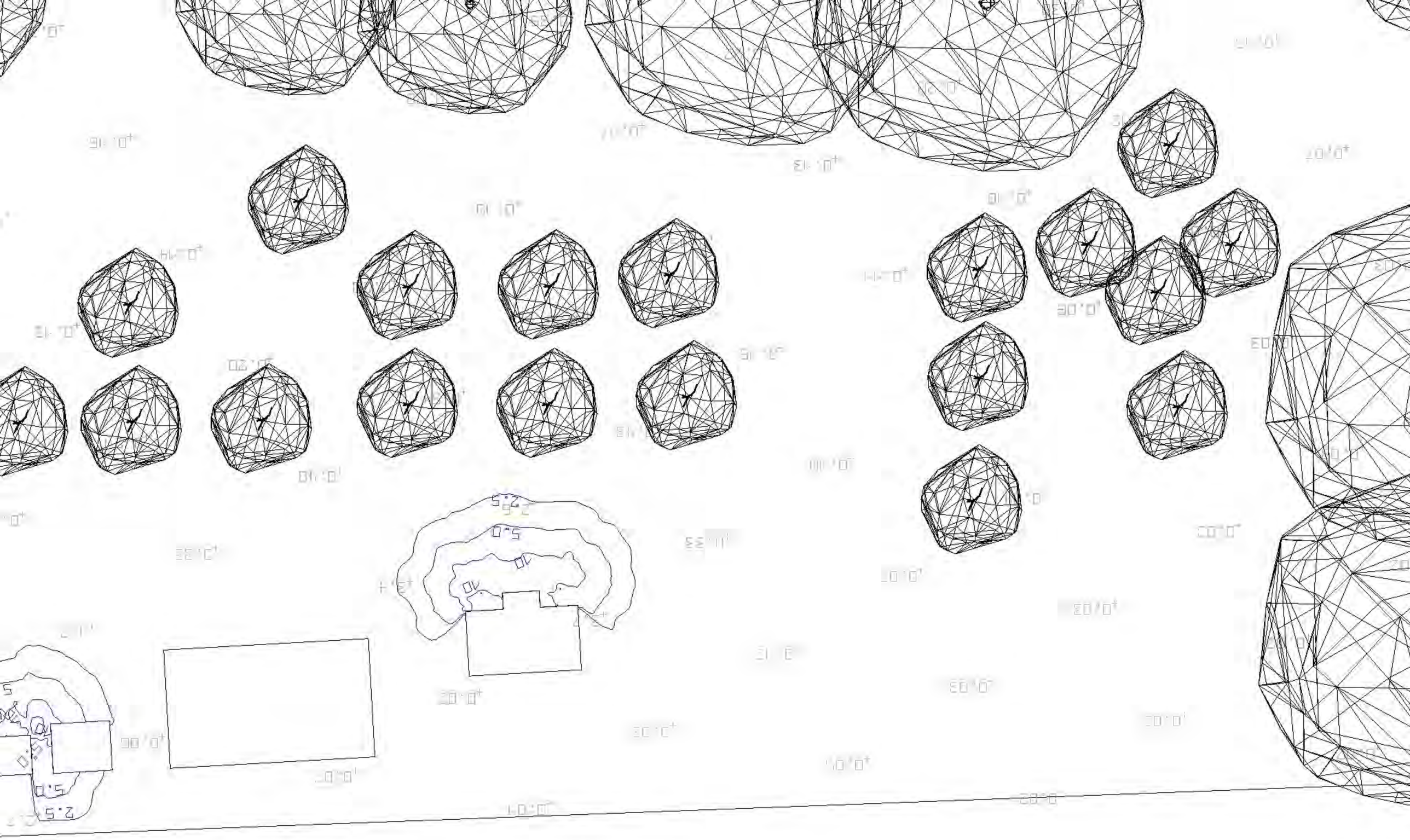


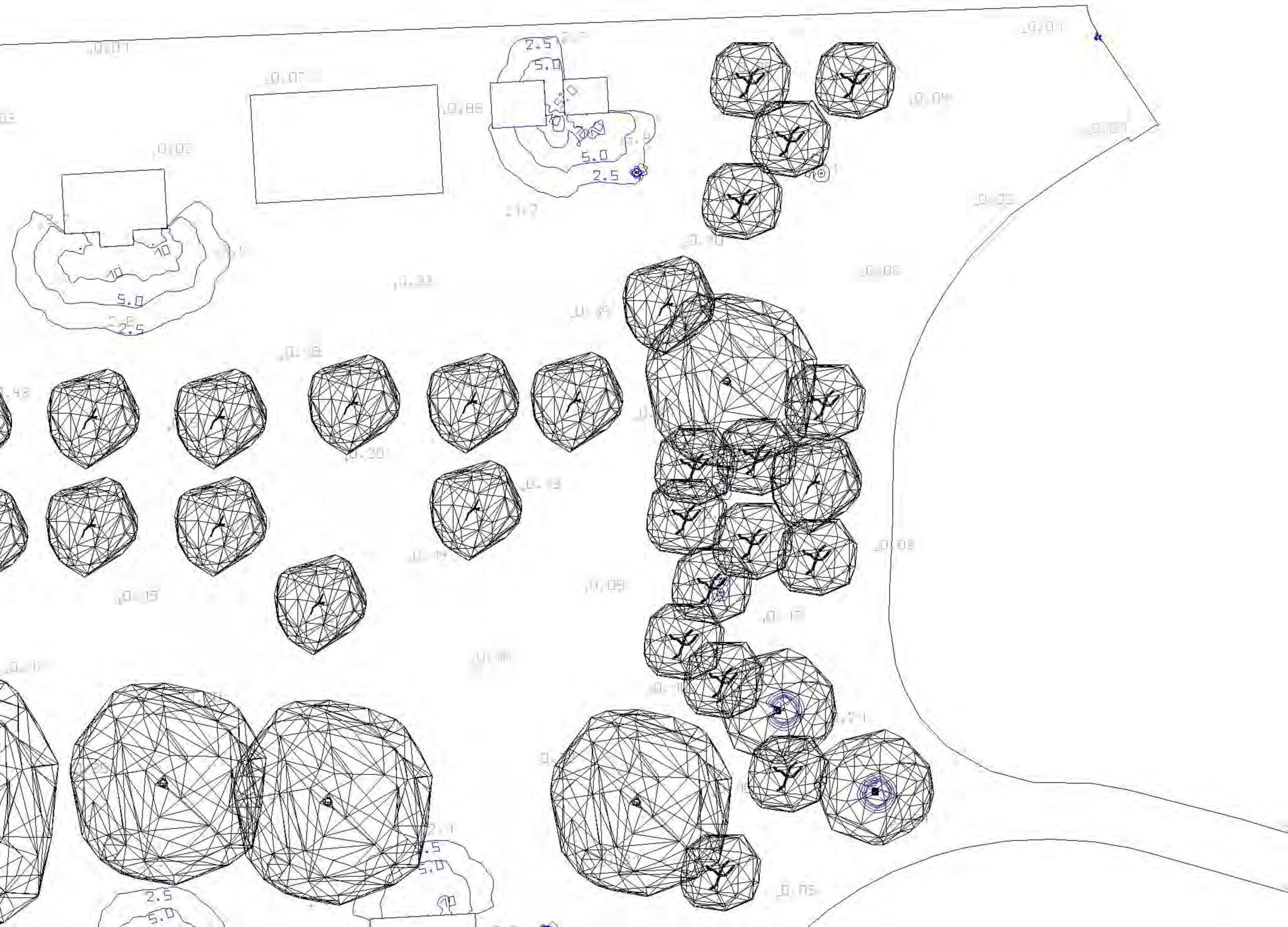








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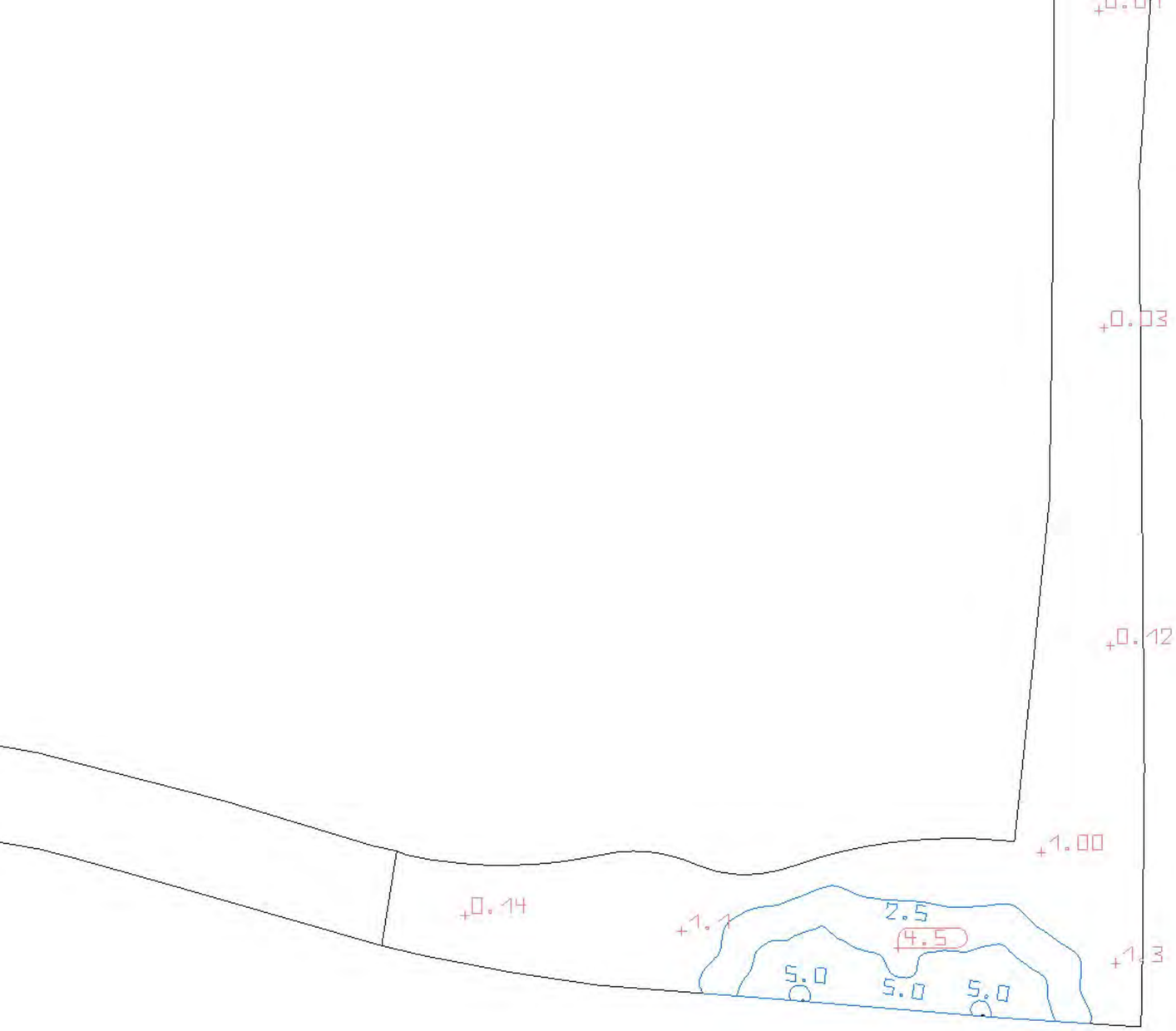
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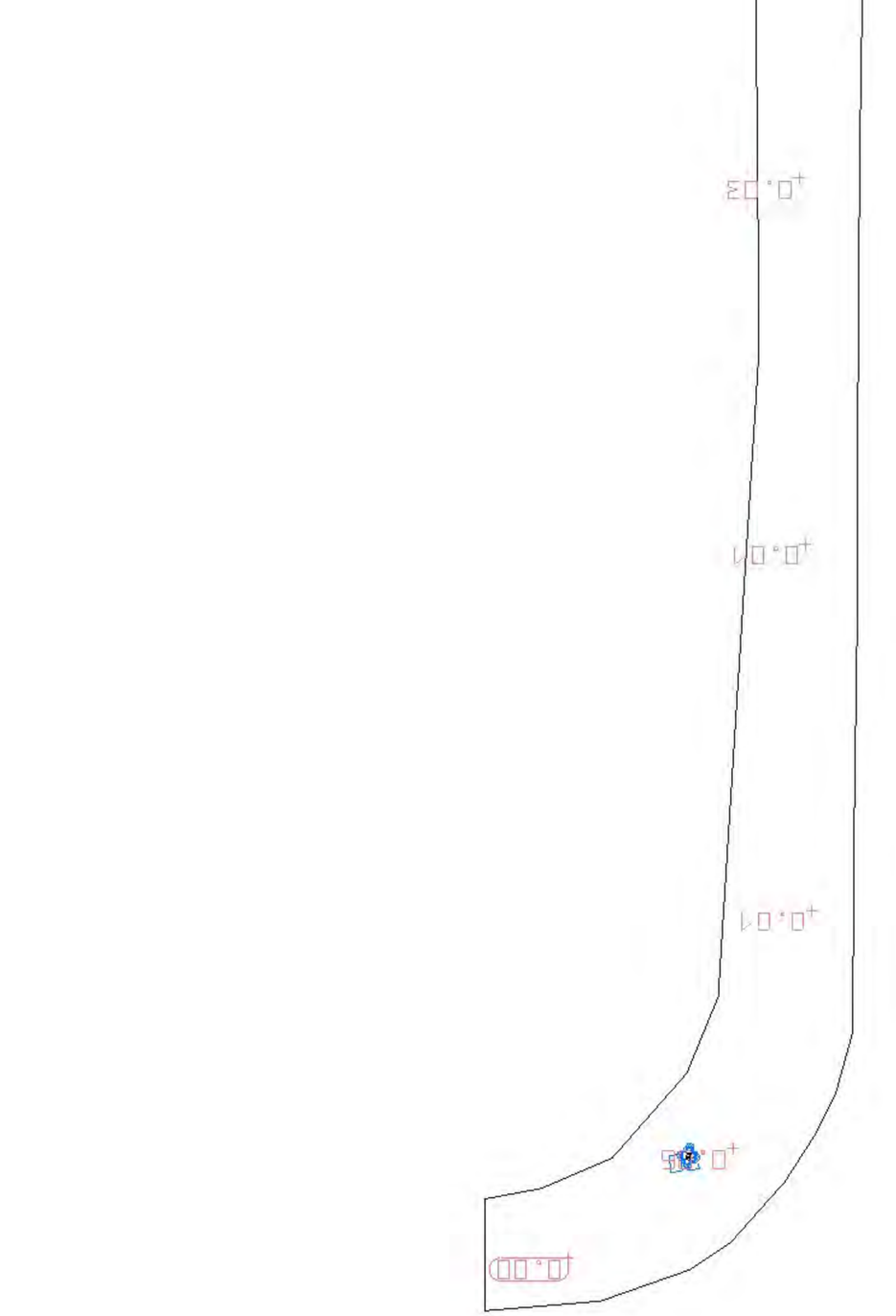

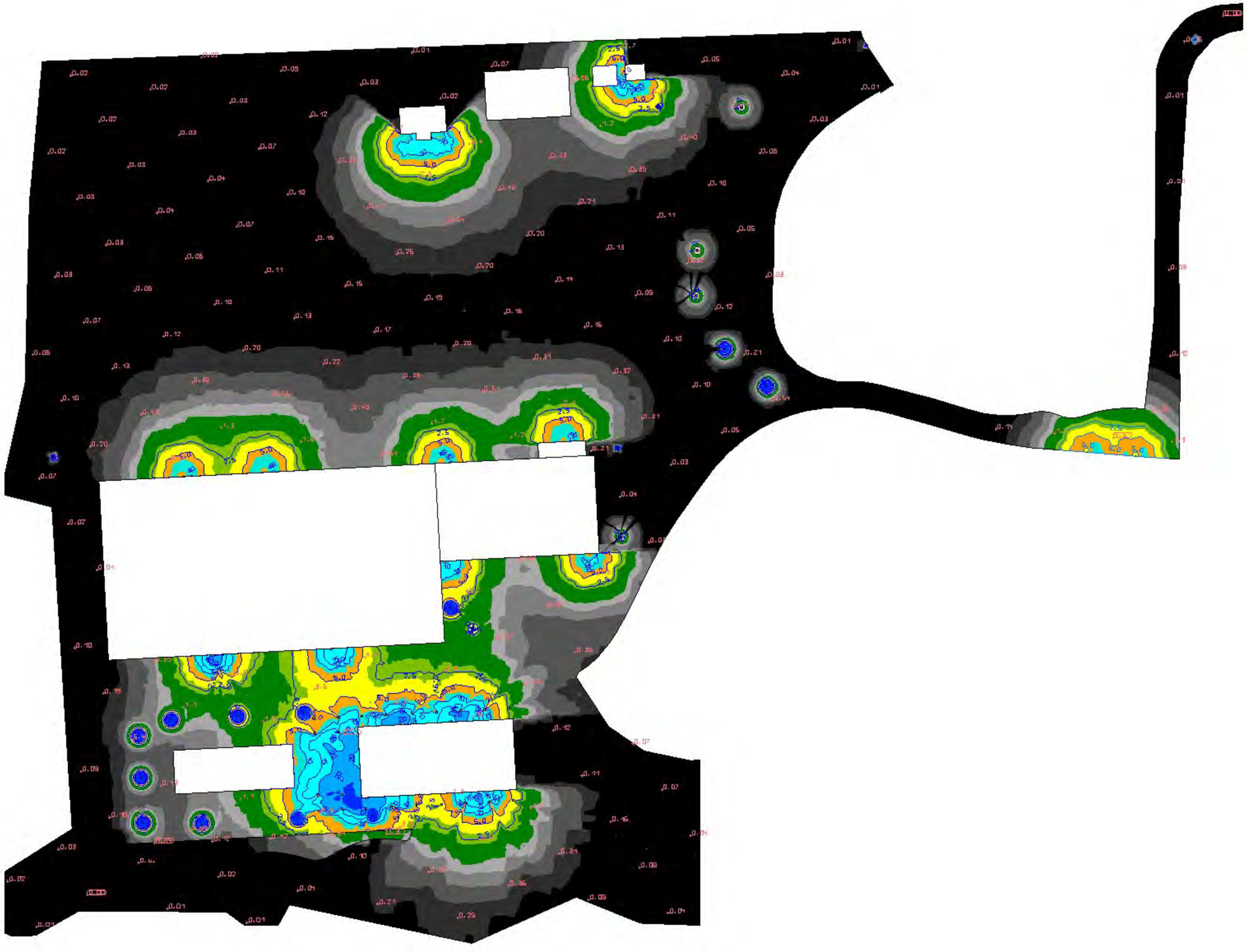

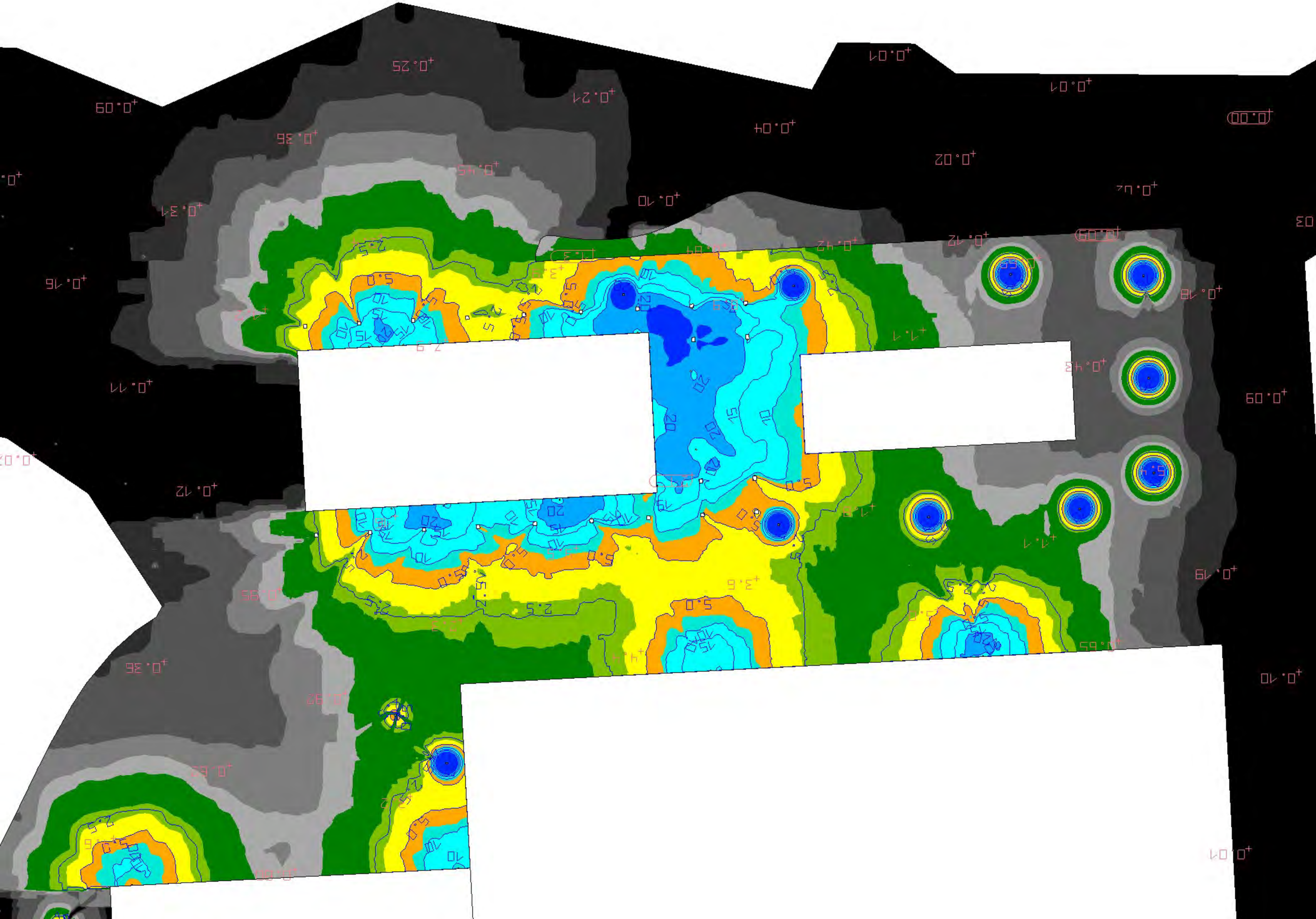

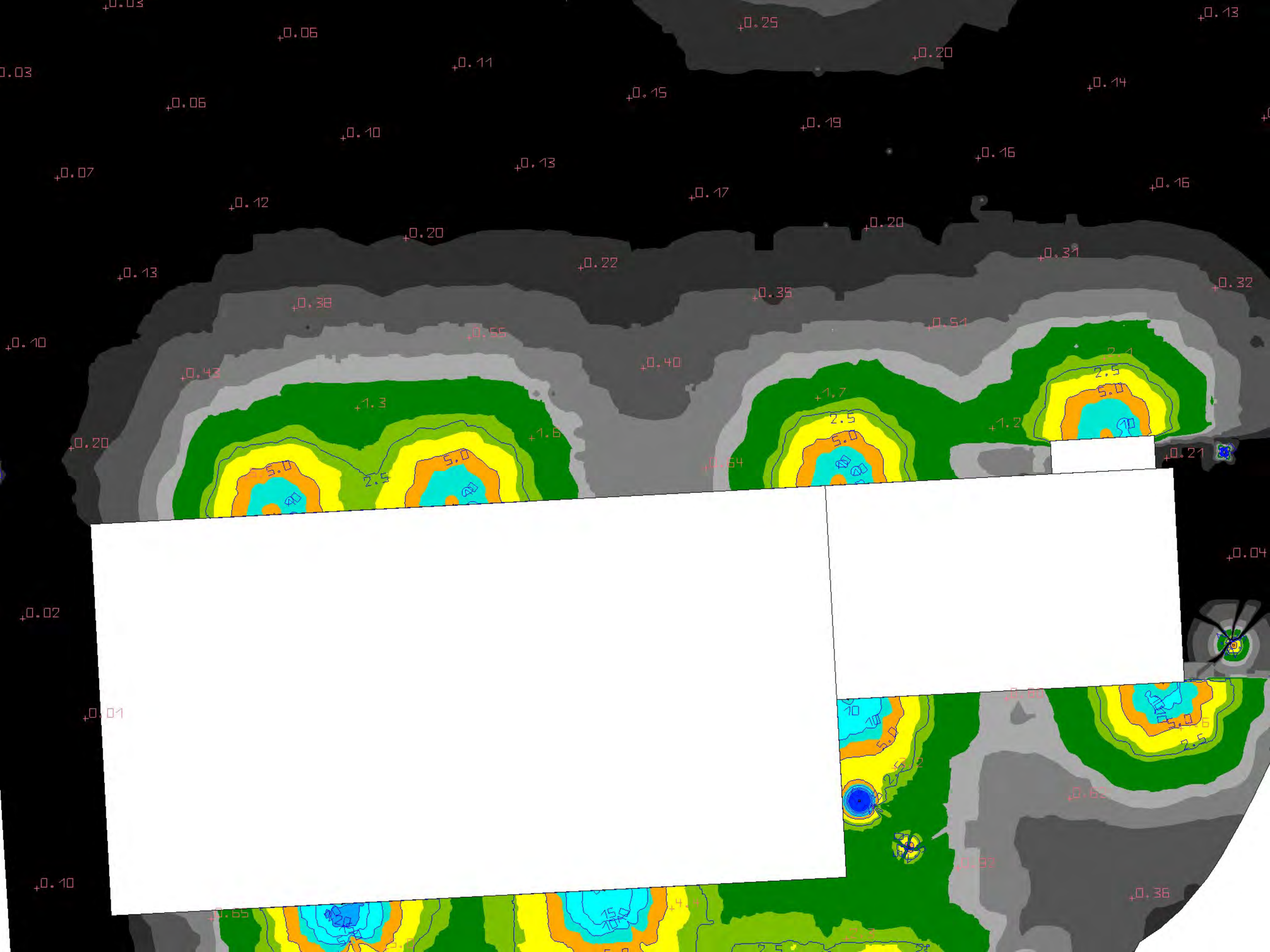
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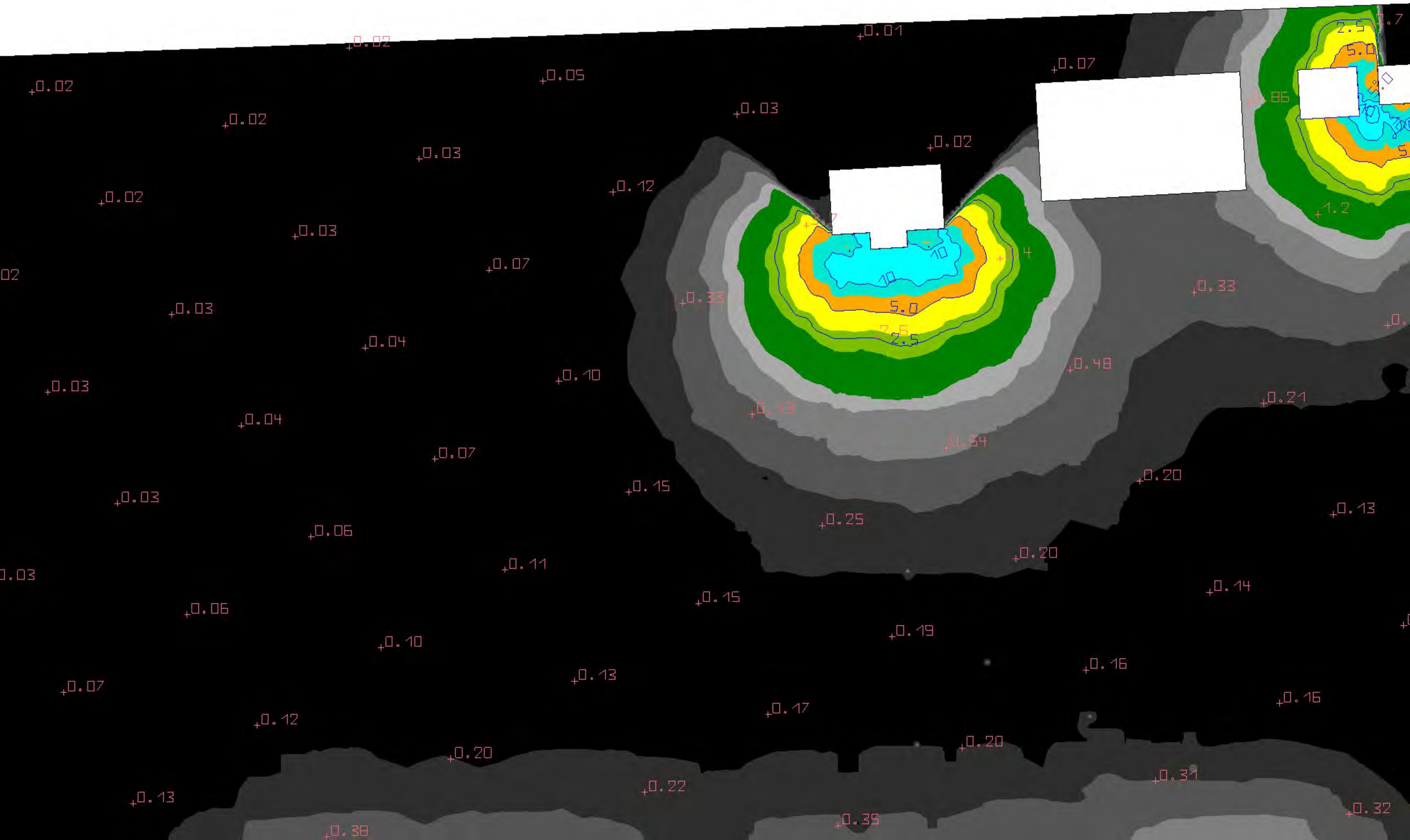
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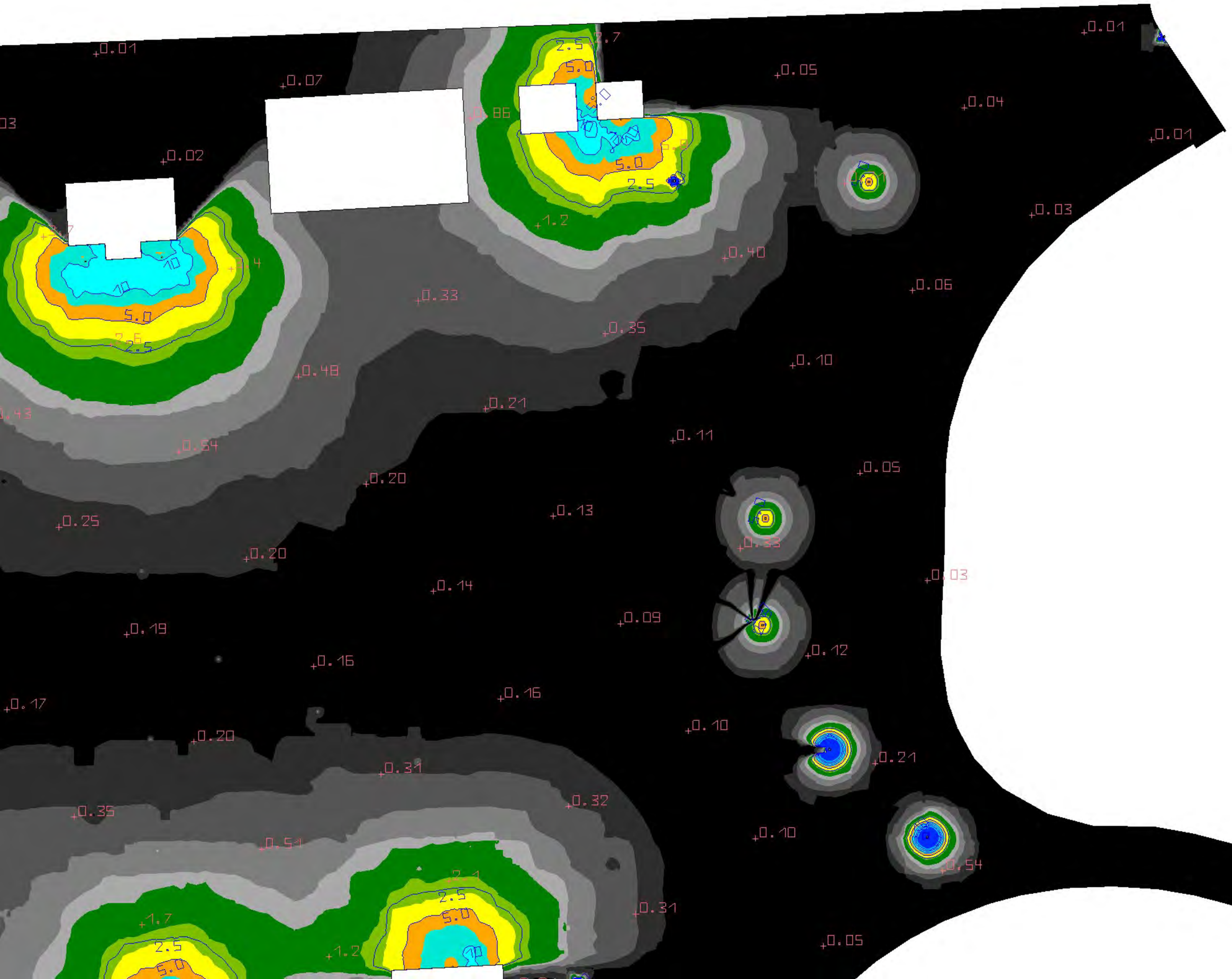

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