

# Aviation Public Safety Zone Assessment

**Birchwell Development Ltd**

Dublin

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## Executive Summary

Birchwell Development Ltd, the Client, has requested a population density study for a development on land at Broomfield, Back Road, Malahide, Dublin.

The south side of the development lies within the Outer Public Safety Zone (PSZ) associated with Runway 28R at Dublin International Airport. Residential development within PSZ is limited to a maximum density of 60 residents in any half hectare area.

Cyrrus Limited has been commissioned by Birchwell Development Ltd through Downey Planning to provide advice and demonstrate compliance with the Aviation PSZ requirements. Cyrrus has extensive experience of population density assessments using heat mapping to assess the number of persons affected by noise and visual disturbances by way of aircraft flight paths. The methodology is adapted to identify compliance of the proposed housing development with PSZ requirements.

Cyrrus has worked with the developer on several iterations to achieve compliance with Aviation Safety regulations.

The main findings of this assessment are:

- **The sixth layout revision (08.03.2022) assessed within this report fully complies with the published Aviation Public Safety Zone requirements;**
- Of the identified ½ hectare grid squares, none exceed the stated maximum population density of >60 persons per ½ hectare;
- This development does not compromise the population density of pre-existing dwellings;
- Provided that the Fingal County Development Plan and Regional Spatial and Economic Strategy (RSES) are implemented as published, the housing occupancy rate in Fingal should decrease over the coming years as more housing stock comes online, thereby ensuring ongoing compliance.

Full details of the assessment and evaluation are contained within the body of this report.

## Abbreviations

EMRA	Eastern and Midland Regional Assembly
ERM	Environmental Resources Management
PSZ	Public Safety Zone
RPG	Regional Planning Guidelines
RSES	Regional Spatial and Economic Strategy

## References

- [1] A. & Partners, "St. Marnock's II DAC & Clear Real Estate Investments plc. Portmarnock South Phase 1B Aviation Compliance Report - Ove Arup & Partners Ireland Ltd".
- [2] Environmental Resources Management Ireland (ERM), "Aviation Public Safety Zones Report", 2003.
- [3] Fingal County Council, "Fingal Development Plan 2011-2017".
- [4] Fingal County Council, "Fingal Development Plan 2017-2023 Variation 2".
- [5] Central Statistics Office, "2011 Census of Ireland".
- [6] "18034 PL2102 Masterplan 2 of 2".
- [7] "18034 PL107 Site Plan 5 DRAFT 21.07.21".
- [8] "18034 PL107 Site Plan 5 DRAFT 23.07.21".
- [9] "18034 PL101-108 Masterplan 17.09.21".
- [10] "18034 PL107 SITE PLAN 5 03.02.22"
- [11] "18034 PL107 SITE PLAN (5 OF 6)"
- [12] "18034 PL107 Site Plan 5 of 6 08.03.22"

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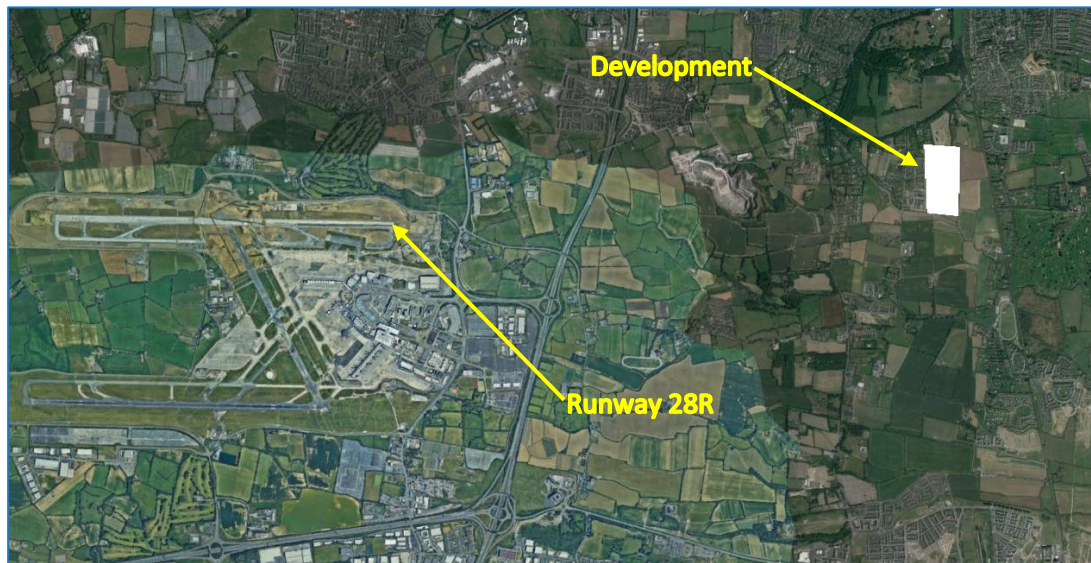
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## 1. Introduction

### 1.1. General

1.1.1. Cyrrus Limited has been commissioned to provide an aviation safety assessment to the developers of a Strategic Housing Development.

1.1.2. The site is located in Broomfield, Malahide within Fingal, County Dublin, Ireland.



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**Figure 1: Broomfield housing development location**

1.1.3. The development site is close to the extended runway centreline of Dublin Airport runway 28R. The site is approximately 5km away from the runway threshold.



## 1.2. Site Development

- 1.2.1. The proposed development comprises two main areas, referred to as 'south side' and 'north side' for the purpose of this study, as shown in Figure 2 and Figure 3.



Figure 2: North side of Broomfield Development





## 2. Aviation Public Safety Zones

### 2.1. Public Safety Zones

- 2.1.1. It has been recognized that the incidence of aircraft accidents is the highest in the immediate vicinity of busy runways. To address the risk of an aircraft accidents to people on ground, Public Safety Zones (PSZ) are established around the runways. PSZs are areas of land at the end of the runways at the busiest airports, within which development is restricted in order to control the number of people on the ground at risk of death or injury in the event of an aircraft accident on take-off or landing.
- 2.1.2. The PSZ at Dublin Airport were determined by Environmental Resources Management (ERM) Ireland in 2003 [2] using best industry practice.
- 2.1.3. The blue lines in Figure 4 depict the outer PSZ, whereas the yellow lines represent the inner PSZ. The south side of the Broomfield development lies within the outer PSZ.

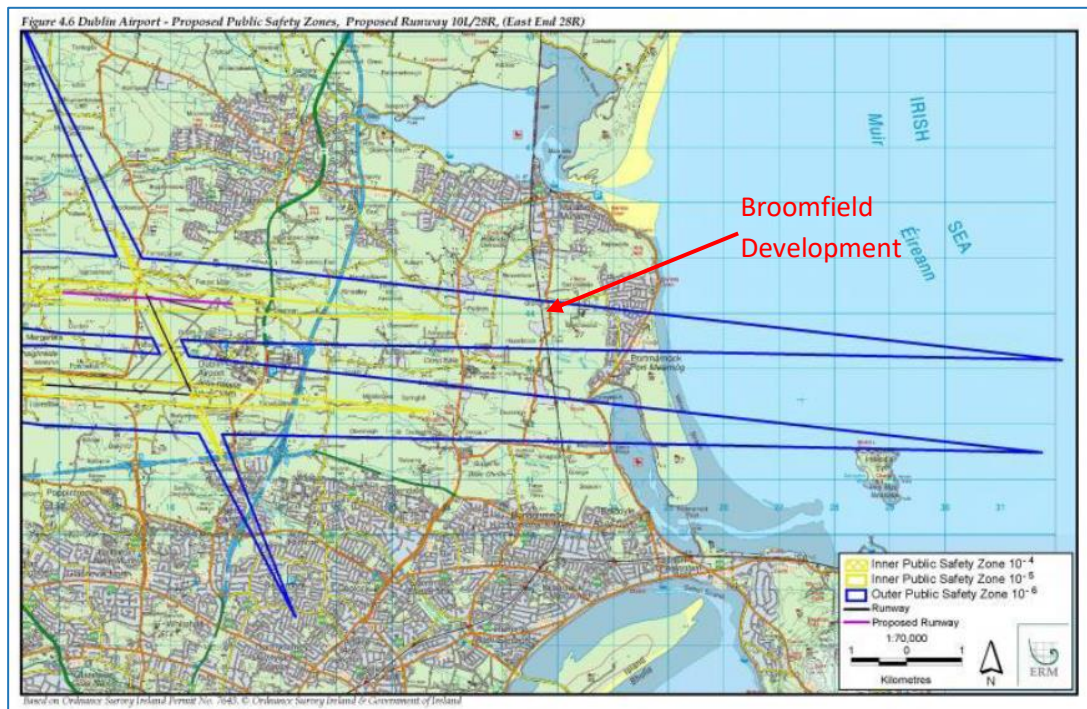


Figure 4: PSZ at Dublin Airport





Figure 5: Development site within PSZ at Dublin

2.1.4. The PSZ restrictions are shown in Figure 6.

<i>Table 6.1 Permitted Developments (applicable to new applications for development)</i>		
Permitted Developments	Public Safety Zone (PSZ)	
	Inner PSZ	Outer PSZ
All developments	No further development (existing developments remain)	see below (existing developments remain)
		<b>Outer PSZ</b>
1. Housing		≤ 60 persons/half hectare
2. Holiday Accommodation		≤ 100 beds per development
3. Retail/Leisure Facilities		≤ 85 persons/half hectare
4. Working Premises		≤ 110 persons/half hectare
5. Institutional Accommodation		No further development
6. Sports Stadia		No further development
7. Limited Use		≤ 220 persons/half hectare
	<b>No restrictions on development beyond Outer PSZ</b>	
<b>Notes</b>		
1. Housing - i.e. residential accommodation, persons at home.		
2. Holiday Accommodation - i.e. hotels, caravan parks.		
3. Retail/Leisure Facilities - i.e. shopping centres, sports halls, sports grounds, swimming pools, bowling alleys, golf clubs.		
4. Working Premises - i.e. factories, offices and facilities where persons are expected to congregate, such as railway stations.		
5. Institutional Accommodation - i.e. hospitals, schools, nurseries, care homes, prisons.		
6. Sports Stadia - i.e. football/rugby stadia.		
7. Limited Use - use not exceeding (approximately) a maximum of 12 hours in one week. i.e. Sunday markets, car boot sales, day fairs.		

Figure 6: PSZ Development Restrictions

2.1.5. From the ERM report:

*6.2 In some cases, permitted developments are restricted to a maximum density of persons. This density is expressed as the number of persons per half hectare. A half hectare was chosen as this approximates the average maximum aircraft crash area. The maximum density should be applied to any single half hectare within which the proposed development is located.*

2.1.6. The south side of the Broomfield development is restricted to a maximum occupancy of 60 persons in any ½ hectare.

### 3. Methodology

#### 3.1. Cyrrus

- 3.1.1. Cyrrus has extensive experience of population density assessments using heat mapping to assess the number of people affected by noise and visual disturbance by way of aircraft flight paths. The methodology is readily adapted to identify compliance of the proposed housing development with PSZ requirements.

#### 3.2. Average household occupancy

- 3.2.1. The analysis process for a planned development relies on accurately assessing average household occupancy.
- 3.2.2. The Central Statistics Office Census of Population [5] recorded an occupancy rate (persons/dwelling) across the whole of Ireland of 2.67 in 2006 and 2011, but this rose to 2.75 in 2016:

*Census of Population 2016 - Profile 1 Housing in Ireland*

*Census 2016 revealed that the average number of persons per household recorded an increase for the first time since 1966. In 2011 there were on average 2.73 persons per households. The equivalent figure stood at 2.75 in 2016.*

*The largest increase in average household size between 2011 and 2016 occurred in Fingal (2.92 to 3.03), followed by Dublin City where the average number of persons in a private dwelling increased from 2.40 to 2.48. Four counties (Fingal, Meath, Kildare, South Dublin) had at least three persons per household on average in April 2016.*

*The growth in household size was confined to the urban areas (i.e., settlements with a population of 1,500 persons or more) with an increase from 2.64 to 2.69. However, in rural areas, the downward trend in the average number of persons per household continued in the 2011-2016 intercensal period (2.87 to 2.84).*

3.2.3. The Fingal Development Plan 2011-2017 [3] published a Regional Planning Guideline occupancy rate of 2.58 persons per dwelling for 2016, a figure used in previous approved planning applications.

**HOUSEHOLD SIZE**

The average occupancy rate i.e. persons per household or pph, has been decreasing and this trend is set to continue, **Table 3** indicates this decrease.

TABLE 3: AVERAGE OCCUPANCY RATES (PERSONS PER HOUSEHOLD)					
	2002	2006	2010	2016	2022
Dublin City	2.74	2.50	2.39	2.26	2.02
DLR	2.99	2.77	2.61	2.42	2.17
Fingal	3.23	2.95	2.81	2.58	2.32
South Dublin	3.25	3.03	2.83	2.65	2.38
<b>Dublin Region</b>	<b>2.96</b>	<b>2.82</b>	<b>2.58</b>		

Source: 2002 & 2006 Census, RPG April 2007 Update, RPG 2010-2022.

**Figure 7: Fingal Development Plan 2011-2017**

3.2.4. The Fingal development plan has subsequently been superseded by the Fingal Development Plan 2017-2023 [4]. The occupancy rates were adjusted as shown at Figure 8.

Table 2.4 Actual and RPGs Population and Housing Targets for Fingal

Fingal	Census 2006	Census 2011	RPG Target 2016	RPG Target 2022	Estimated RPG Target 2023
<b>Population</b>	239,992	273,992	287,547	309,285	
<b>Housing Stock</b>	89,909	102,793	118,646	142,144	145,340
<b>Persons per hhd*</b>	2.66	2.66	2.42	2.17	

**Figure 8: Fingal Development Plan 2017-2023**

3.2.5. The Regional Planning Guidelines (RPGs) have been superseded by the Regional Spatial and Economic Strategy for the Eastern and Midland Regional Assembly (RSES EMRA). This has been incorporated into the Fingal Development Plan 2017-2023 by way of Variation No. 2 (July 2020). The section of the Development Plan referenced here, including the Table in Figure 8, has all been superseded by this Variation. Variation No. 2 provides a target of 2.68 persons per household by 2023.

3.2.6. For this analysis, the latest figure of 2.68 persons per dwelling has been used.



### 3.3. Process

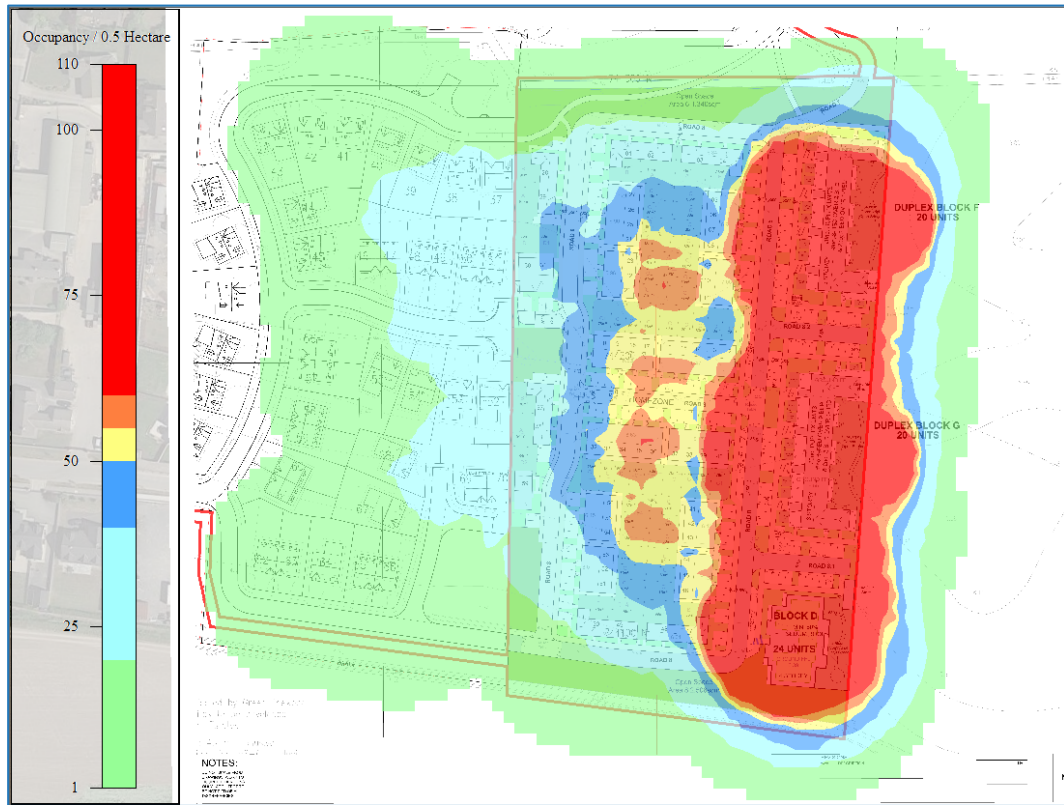
- 3.3.1. Initially, the layout drawings of the south side of the Broomfield development were imported into a Geographic Information System (GIS) program. Information points with an attribute of household occupancy was added to each dwelling (blue), as well as to the existing housing estate (green) to the west of the proposed development, as shown in Figure 9.
- 3.3.2. This assessment uses an occupancy rate (persons/dwelling) of 2.68. 4 occupancy points are allocated per dwelling (occupancy rate of 0.67/point) rather than just one to account for dwellings that bisect the boundary of areas under investigation<sup>1</sup>.



Figure 9: Occupancy points overlaid on original site layout [6]

<sup>1</sup> The length of sides of a square with an area of ½ hectare is only 70.71m.

3.3.3. A population density heatmap was generated to validate the process:



**Figure 10: Initial population density heatmap**

3.3.4. The initial heatmap demonstrated that the existing dwellings indicated a population density of less than 60 persons per ½ hectare. The south side of the Broomfield development shows areas where this population density will be exceeded, particularly around the duplex and apartment blocks, thus further investigation is deemed necessary.

## 4. Analysis of Population Density

### 4.1. Initial Assessment – first iteration

4.1.1. The initial heatmap assessment shown in Figure 10 determined that the population density would exceed the required 60 persons per hectare.

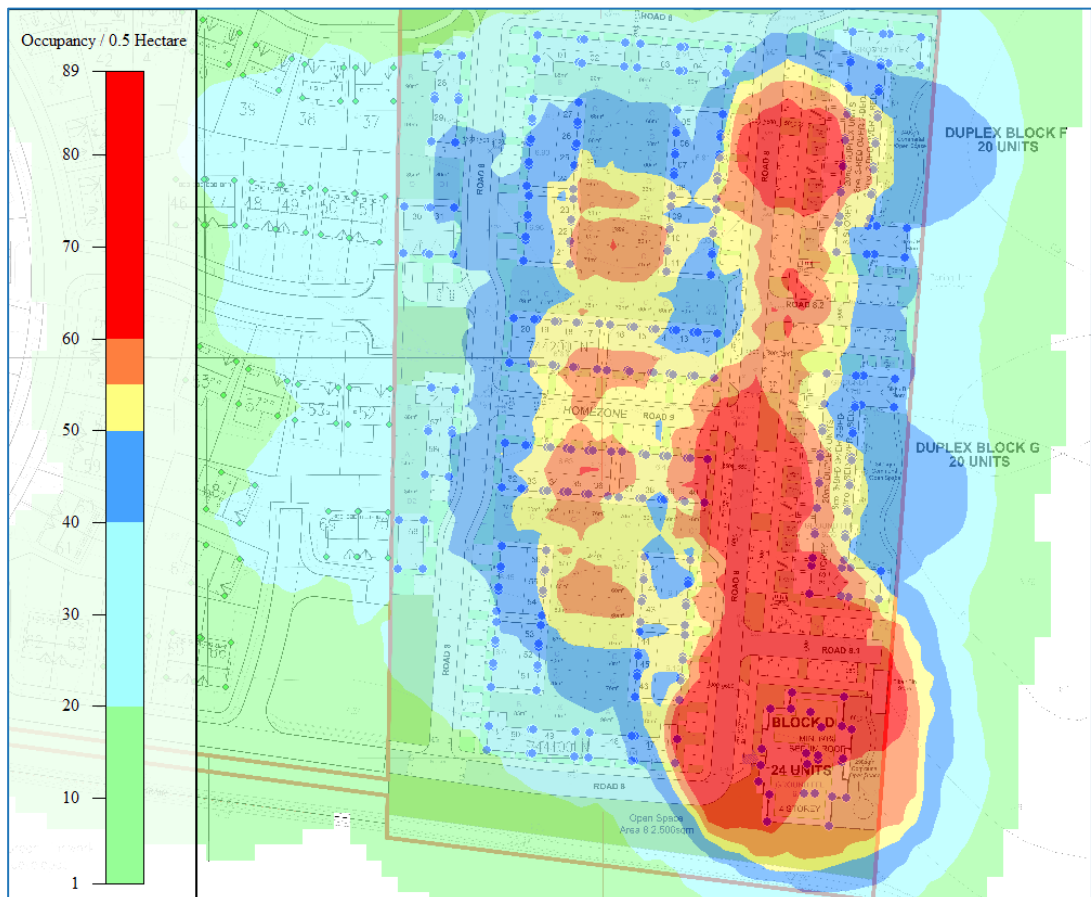
4.1.2. Due to the high dwelling unit density associated with blocks D, F and G a different approach is required for these buildings.

4.1.3. A second simulation is run, using a value of 2.68 persons/dwelling for the houses, but a slightly altered methodology for blocks D, F and G (as used by ARUP – ‘Portmarnock South Phase 1C & Local Centre – Aviation Planning Compliance Report’ [1]) to better reflect the likely occupancy of these units based on the number of beds in each:

Unit Type	Occupancy Rate (persons/dwelling)
1-bed	2.0
2-bed	2.34
3-bed	2.68

**Table 1: Occupancy rate based on the number of beds in a dwelling (2nd iteration)**

4.1.4. The resulting heatmap obtained is shown in Figure 11.



**Figure 11: Population density heatmap – altered approach**

- 4.1.5. Each pixel on the heatmap represents a 3.9m x 3.9m square. The pixels in red indicate a point or area where the population density exceeds 60 persons per ½ hectare in a circle of 5,000m<sup>2</sup> area centred on that pixel.
- 4.1.6. Contemporary reports and the methodology familiar to the regulator looks at the occupancy in ½ hectare grid squares. A ½ hectare grid square is placed over the red and orange areas of the heatmaps. The squares are then manually moved to encompass the maximum number of occupancy points, as shown in Figure 12.

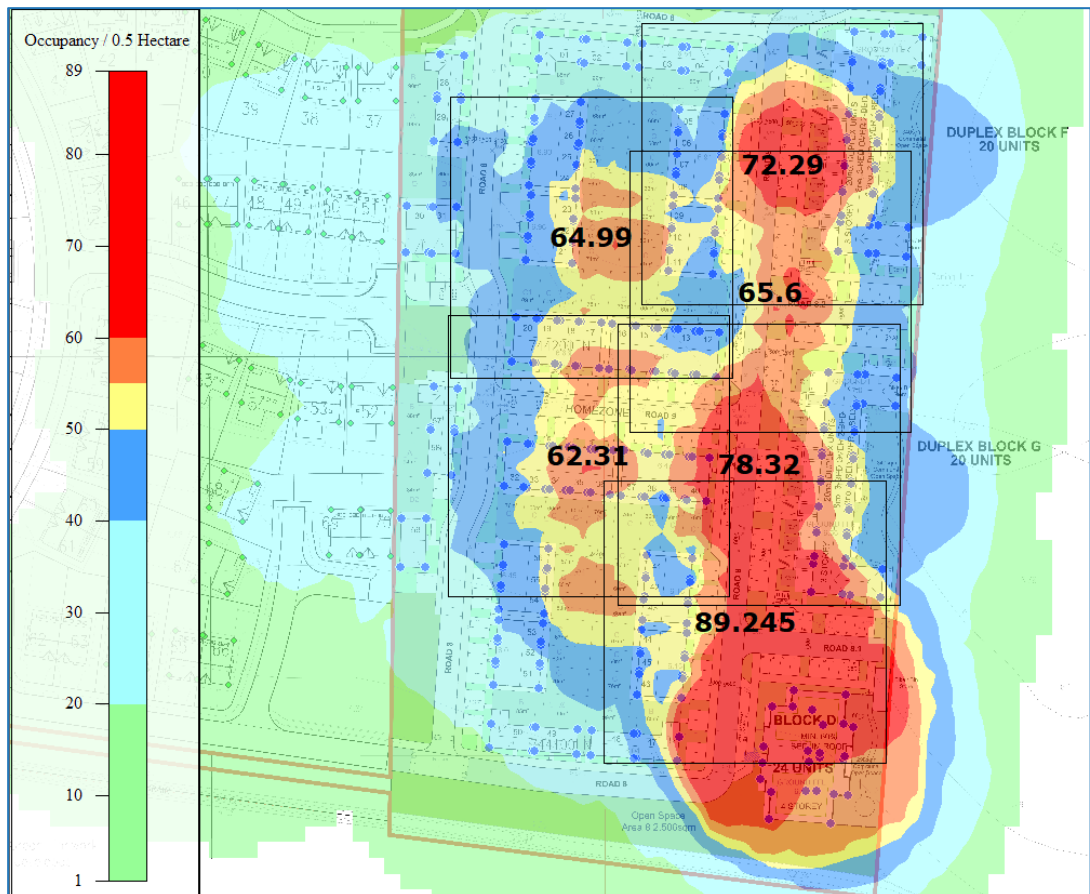


Figure 12: 1/2-hectare grid squares overlaid on heatmap

- 4.1.7. The numbers within the grid squares are the residential population density per ½ hectare square.
- 4.1.8. Figure 12 shows that there are some areas where the population density would exceed the required 60 persons per ½ hectare.
- 4.1.9. The Client worked with Cyrrus to revise the layout. This was an iterative process to ensure all areas remain below the prescribed occupancy limit.

## 4.2. Layout revision – second iteration

- 4.2.1. The revised housing layout (18034 PL107 Site Plan 5 DRAFT 21.07.21) is shown in Figure 13. The Client has removed the Apartment Block D, changed the position and number of units of the duplex blocks F and G, and added more housing units to the east of the development.
- 4.2.2. Information points with an attribute of household occupancy are added to each proposed dwelling (blue), as well as for the existing housing estate (green) to the west of the proposed development. This assessment initially uses an occupancy rate (persons/dwelling) of 2.68 for all houses and apartments.

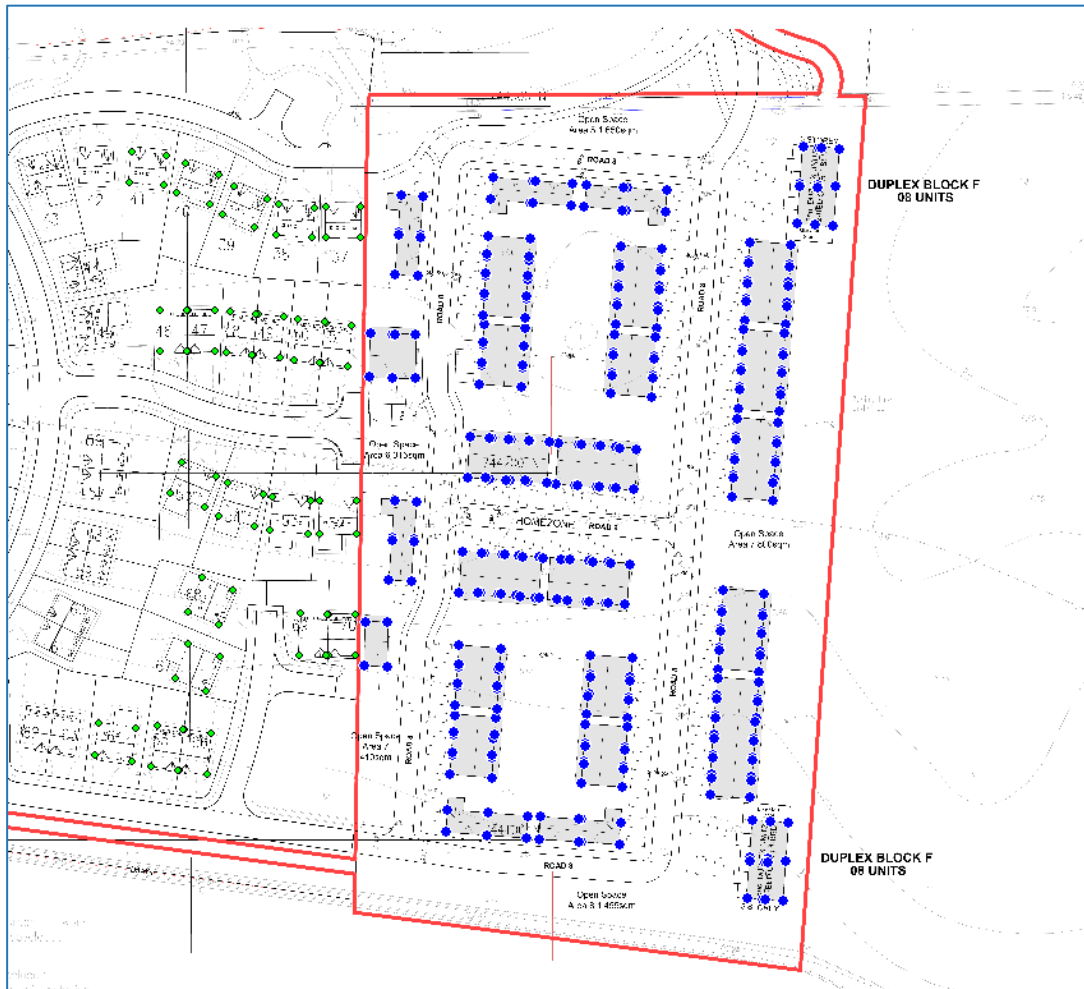
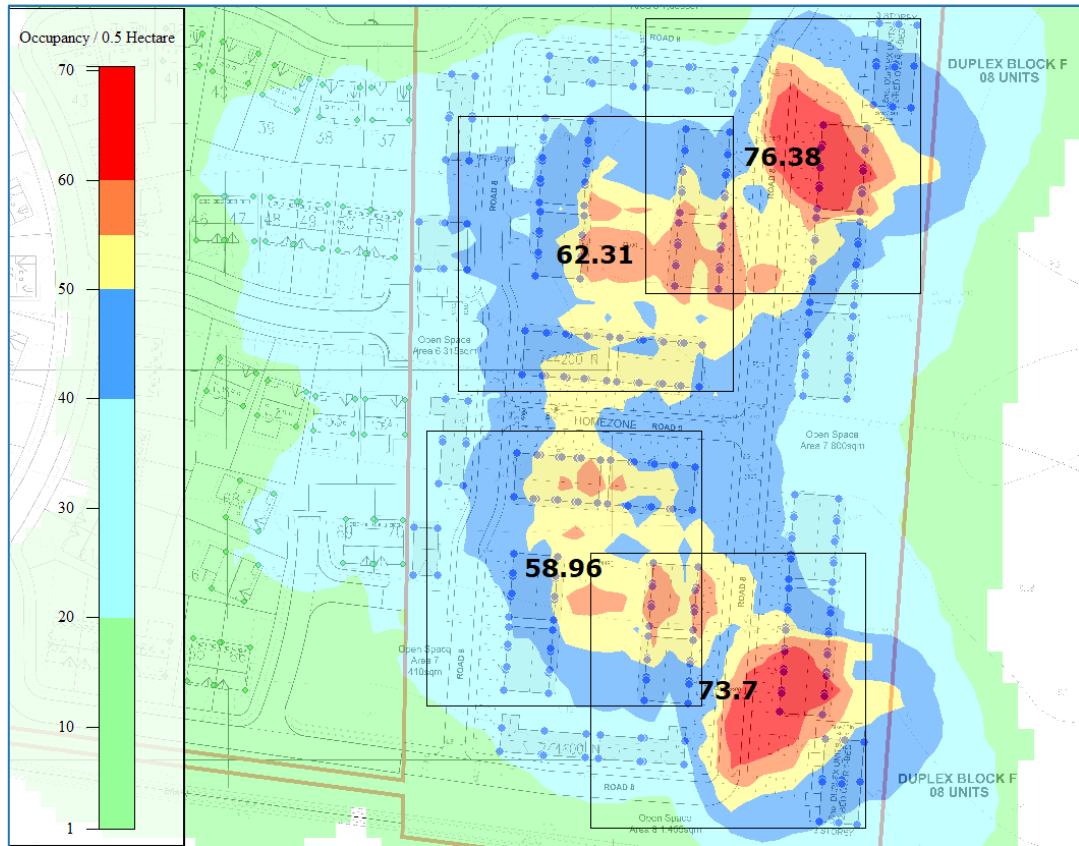


Figure 13: Revised layout and occupancy points (21.07.21) [7]



4.2.3. A population density heatmap is generated to validate the process, as shown in Figure 14.

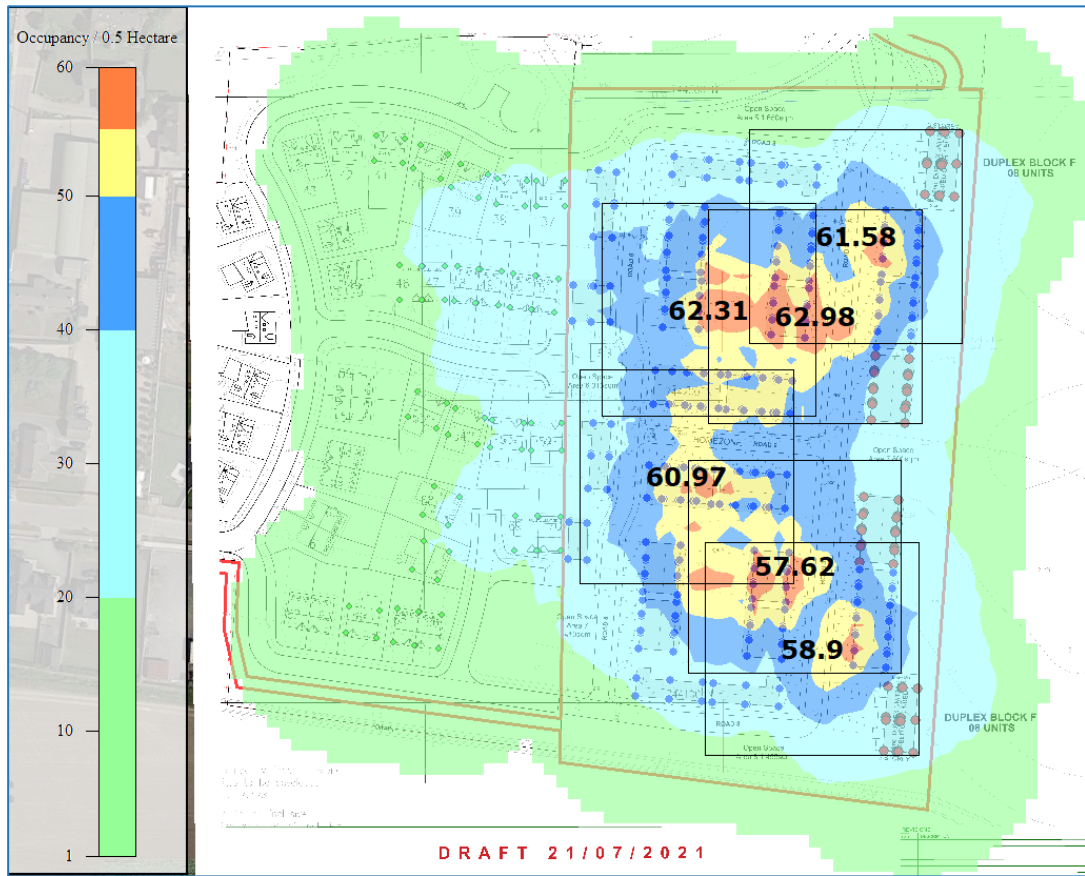


**Figure 14: Initial population density heatmap (Second iteration)**

4.2.4. The red shaded areas in Figure 14 indicate where further investigation is necessary. A second simulation is run, using a value of 2.68 persons/dwelling for the houses, but with the slightly altered methodology for blocks F and G [1] to better reflect the likely occupancy of these units based on the number of beds in each, as shown in Table 1.



4.2.5. The second population density heatmap obtained, with ½ hectare overlaid grids, can be seen in Figure 15.



**Figure 15: Population density heatmap – altered approach (Second iteration)**

4.2.6. As the values shown within the grid squares are still higher than 60, a further layout revision is required.

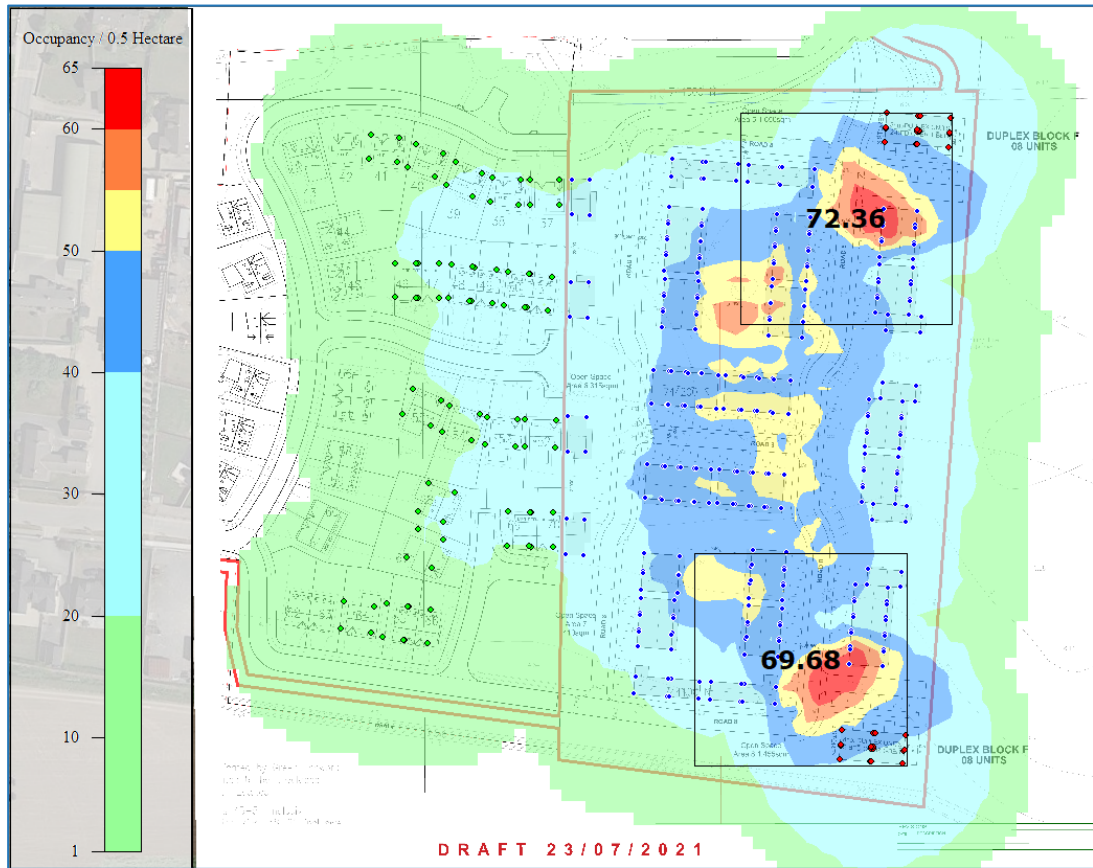
### 4.3. Layout revision - third iteration

- 4.3.1. The third layout revision (18034 PL107 Site Plan 5 DRAFT 23.07.21) submitted by the client is shown in Figure 16. The western units are replaced with 4-bed detached houses and the duplex blocks' orientation has been changed.
- 4.3.2. Information points with an attribute of household occupancy are added to each proposed dwelling (blue), as well as for the existing housing estate (green) to the west of the proposed development. As with the earlier iterations, the assessment initially uses an occupancy rate (persons/dwelling) of 2.68 for each house and apartment.



Figure 16: Revised layout and occupancy points (23.07.21) [8]

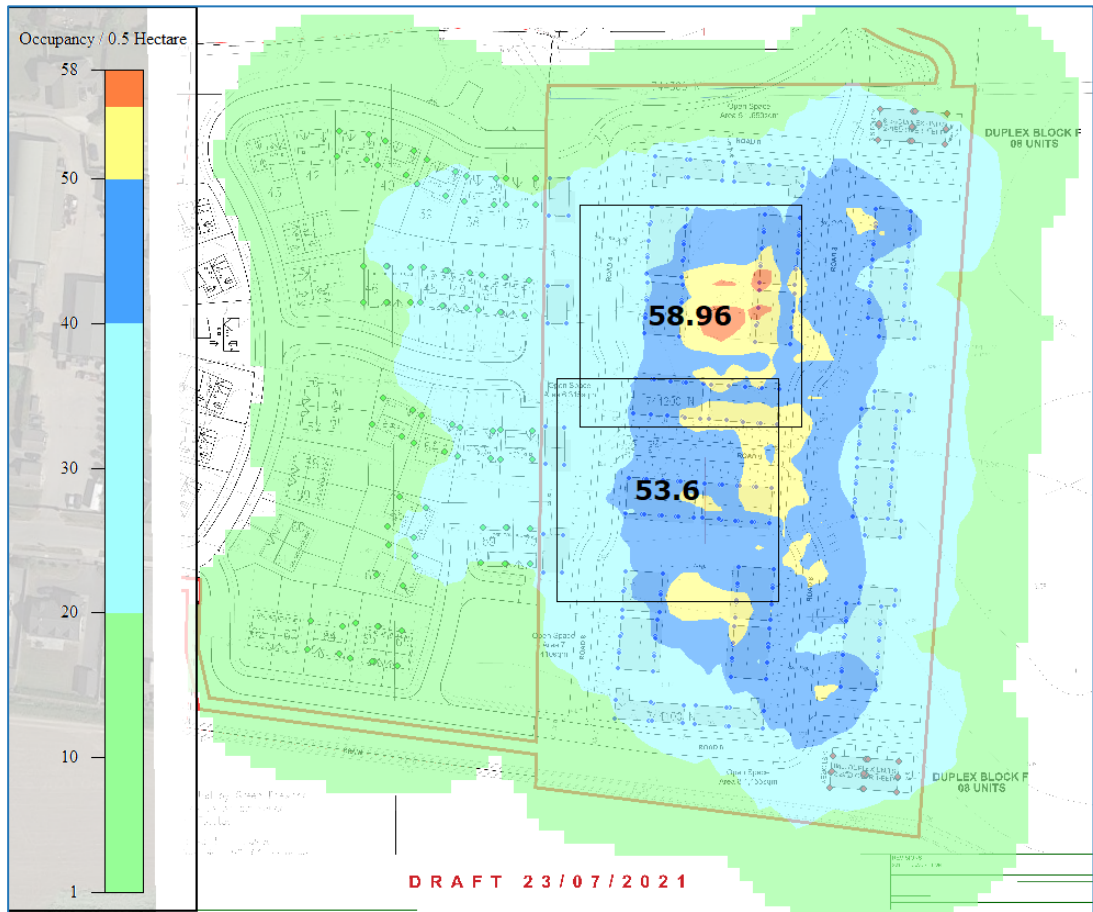
4.3.3. A population density heatmap is generated to validate the process, as shown in Figure 17.



**Figure 17: Initial population density heatmap (Third iteration)**

4.3.4. The red shaded areas in Figure 17 indicate where further investigation is necessary. A second simulation is run, using a value of 2.68 persons/dwelling for the houses, but with the slightly altered methodology for blocks F and G [1] to better reflect the likely occupancy of these units based on the number of beds in each, as shown in Table 1.

4.3.5. A population density heatmap is generated and ½ hectare grids are overlaid on the highest density points (orange) as shown in Figure 18.



**Figure 18: Population density heatmap (third iteration)**

4.3.6. Figure 18 shows no red areas, and the grids placed over the highest density areas show values less than 60 persons per ½ hectare.

#### 4.4. Layout Revision – fourth iteration

- 4.4.1. The Client has come back to Cyrrus with a request to review their latest layout that accommodates a riparian strip to an existing watercourse, which has resulted in the southern Duplex Block E shifting 5 meters to the North.
- 4.4.2. The adjacent terrace housing of 6 type C units has now been reduced to 5 units.
- 4.4.3. The latest layout revision (18034 PL101-108 Masterplan 17.09.21) submitted by the client is shown in Figure 19.
- 4.4.4. Information points with an attribute of household occupancy are added to each proposed dwelling, as well as for the existing housing estate to the west of the proposed development. As with the earlier iterations, the assessment initially uses an occupancy rate (persons/dwelling) of 2.68 for each house and apartment.



Figure 19: Revised layout (17.09.2021) [9]



4.4.5. A population density heatmap is generated to validate the process, as shown in Figure 20. The provided layout includes a change of position of the northernmost block by 3 metres to the north, which accounts for the change of the occupancy value in the top square when compared with the third iteration in Figure 17.

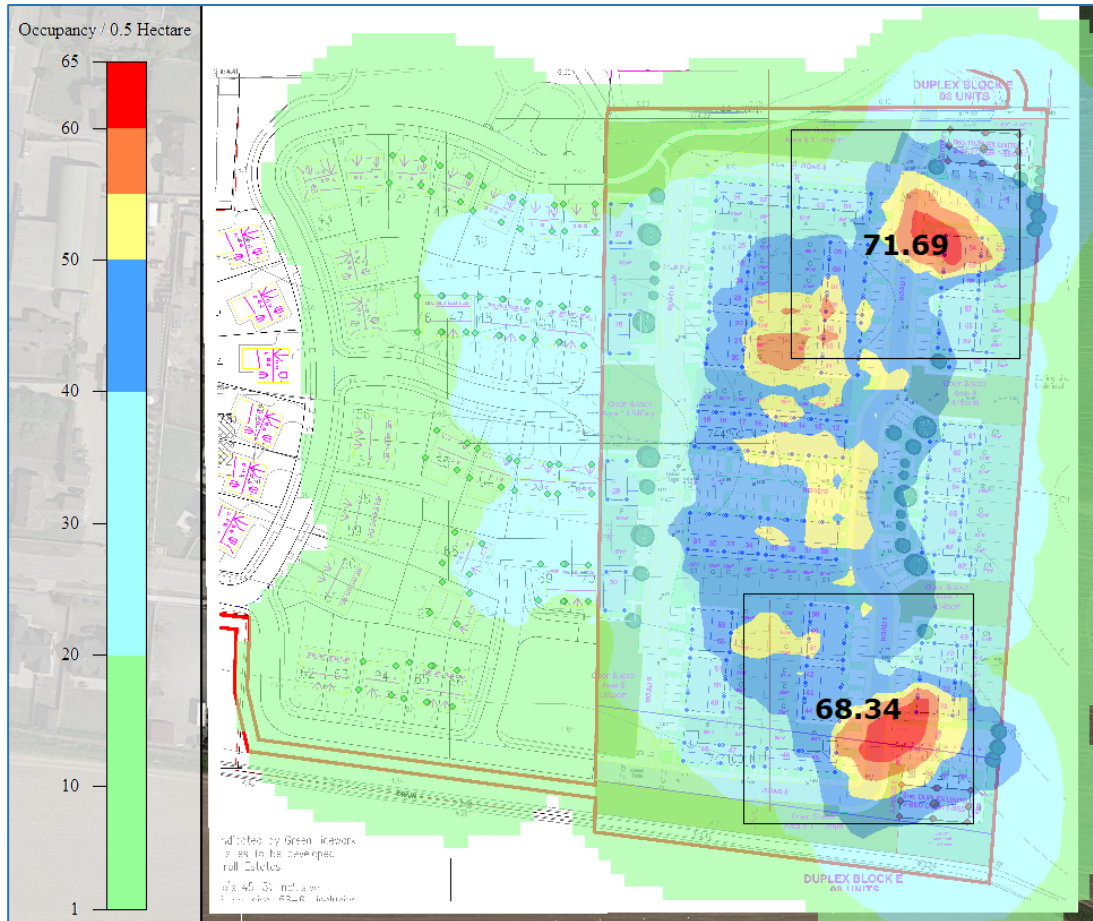
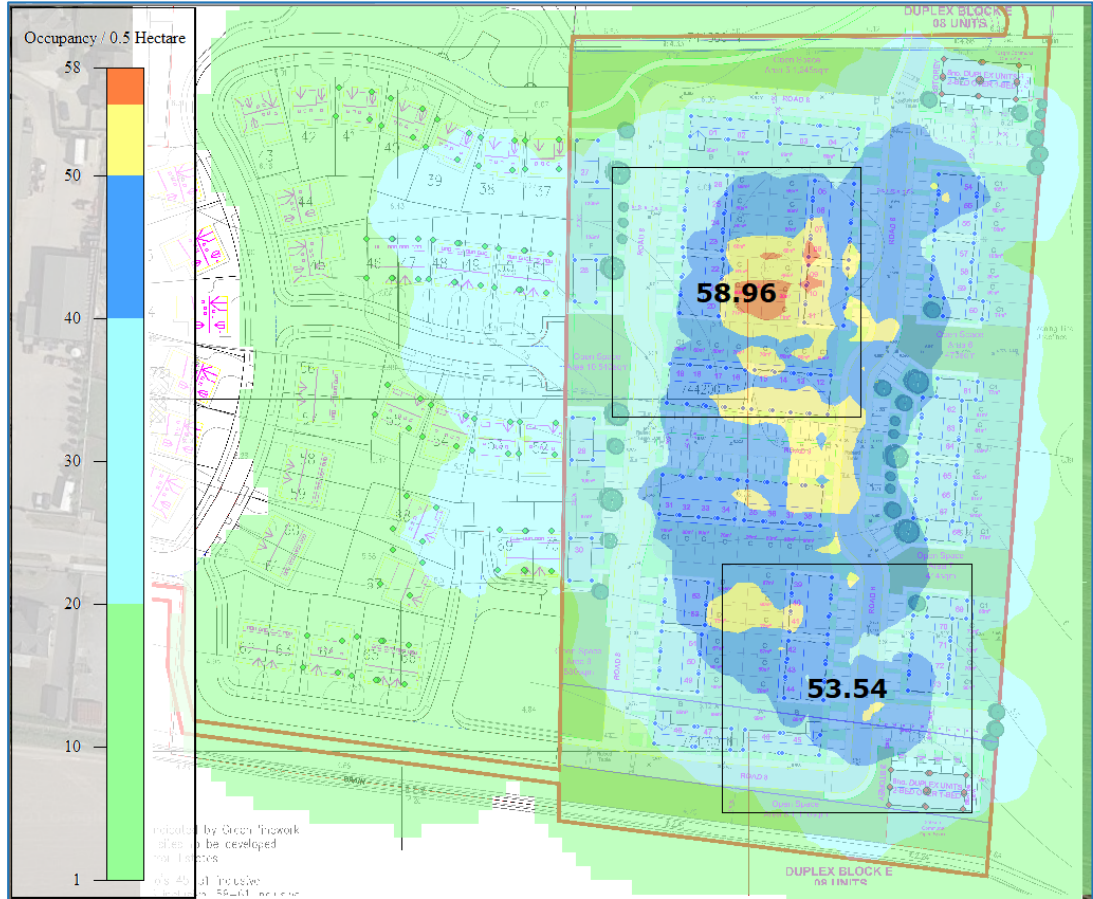


Figure 20: Initial population density heatmap (Fourth iteration)

4.4.6. The red shaded areas in Figure 20 indicate where further investigation is necessary. A second simulation is run, using a value of 2.68 persons/dwelling for the houses, but with the slightly altered methodology for blocks E [1] to better reflect the likely occupancy of these units based on the number of beds in each, as shown in Table 1.



4.4.7. A population density heatmap is generated and ½ hectare grids are overlaid on the highest density points (orange) as shown in Figure 21.



**Figure 21: Population density heatmap (fourth iteration)**

4.4.8. Figure 21 shows no red areas, and the grid placed over the highest density area shows a value less than 60 persons per ½ hectare.

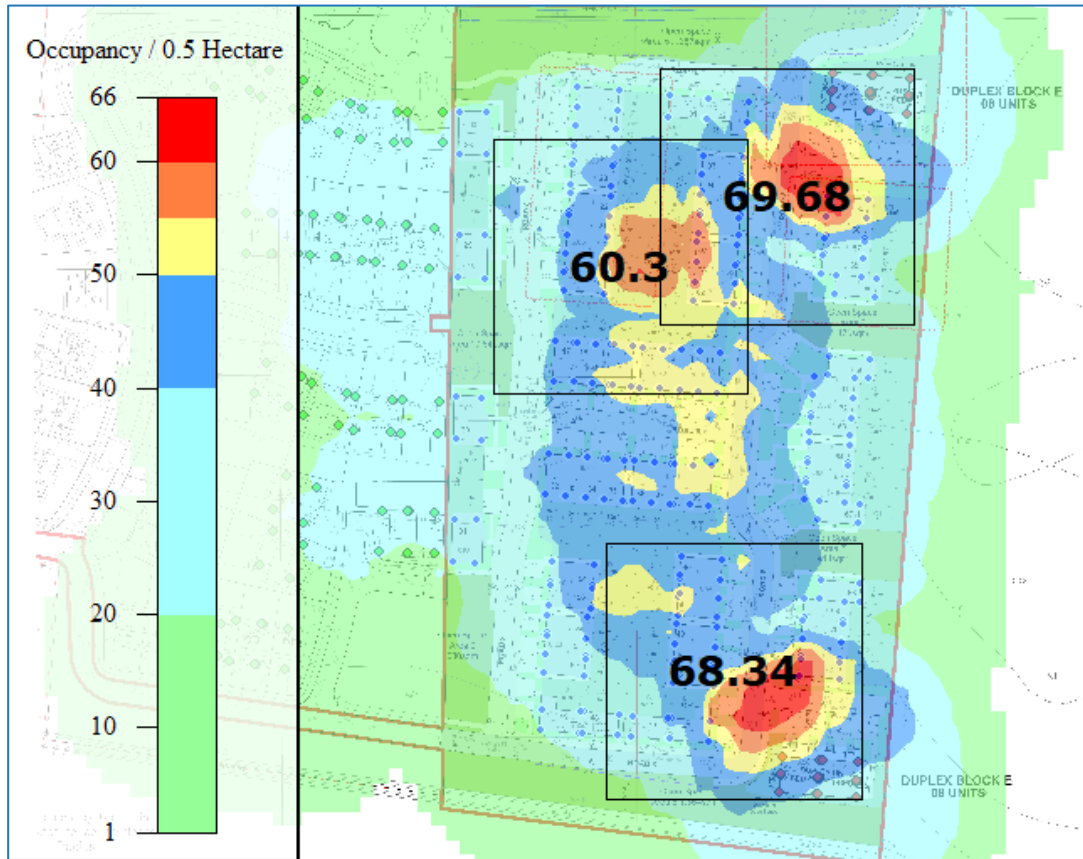
## 4.5. Layout Revision – fifth iteration

- 4.5.1. The Client has come back to Cyrrus with a request to review their latest layout that reflects a revised road alignment, which has resulted in the northern Duplex Block E shifting 12 meters to the South.
- 4.5.2. The adjacent terrace housings of 3 and 4 type C units have now been reduced to 5 units.
- 4.5.3. The western housing cell has been modified to include the deletion of the wide fronter unit & replacement of previously shown terraces with two terraces of five 3-Bed units.
- 4.5.4. The latest layout revision (18034 PL107 SITE PLAN 5 03.02.22) submitted by the client is shown in Figure 22.
- 4.5.5. Information points with an attribute of household occupancy are added to each proposed dwelling, as well as for the existing housing estate to the west of the proposed development. As with the earlier iterations, the assessment initially uses an occupancy rate (persons/dwelling) of 2.68 for each house and apartment.



**Figure 22: Revised Layout (03/02/2022) [10]**

4.5.6. A population density heatmap is generated to validate the process, as shown in Figure 23.



**Figure 23: Initial population density heatmap (Fifth iteration)**

4.5.7. The red shaded areas in Figure 23 indicate where further investigation is necessary. A second simulation is run, using a value of 2.68 persons/dwelling for the houses, but with the slightly altered methodology for blocks E [1] to better reflect the likely occupancy of these units based on the number of beds in each, as shown in Table 1.

4.5.8. A population density heatmap is generated and ½ hectare grids are overlaid on the highest density points (orange) as shown in Figure 24.

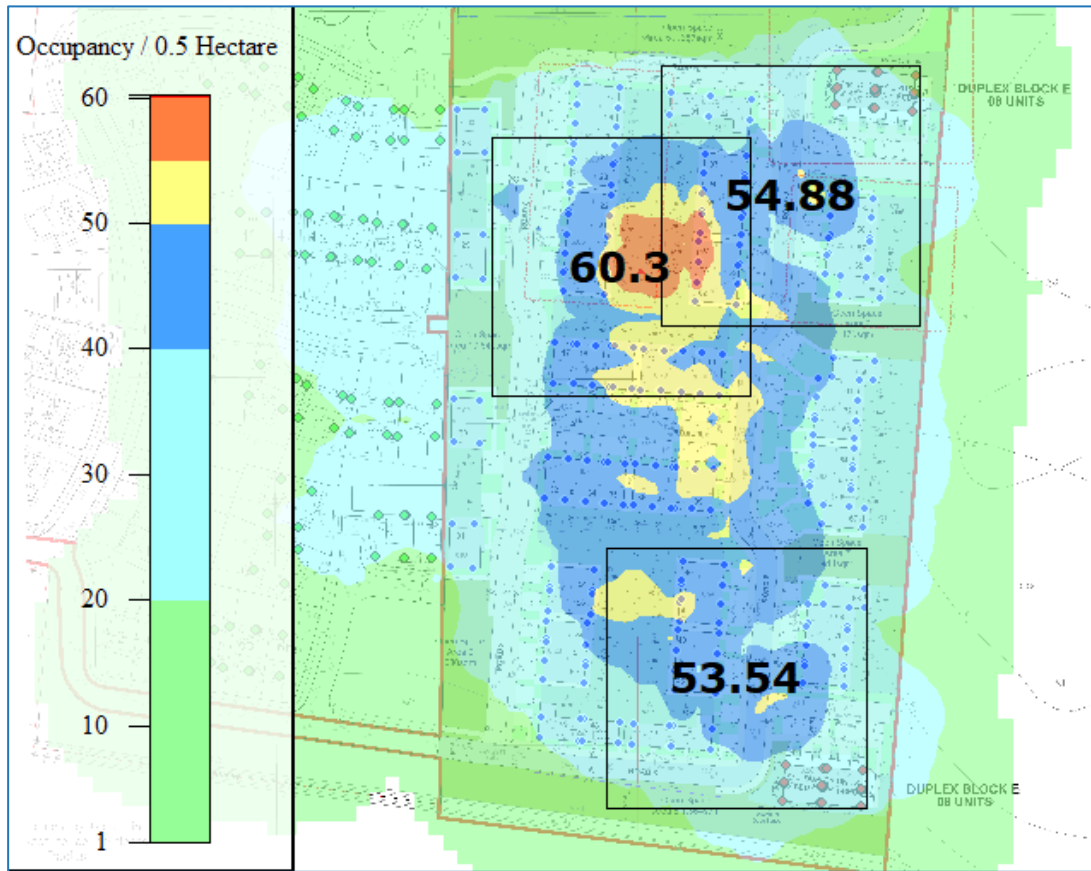


Figure 24: Population density heatmap (fifth iteration)

4.5.9. Figure 24 shows one red area, and the grid placed over the highest density area shows a value higher than 60 persons per ½ hectare. **A further layout revision was required.**

- 4.5.10. The next layout revision (18034 PL107 SITE PLAN (5 OF 6) 04.02.2022) submitted by the client is shown in Figure 25. A unit in the western housing cells has been deleted to reduce the value below 60 persons per ½ hectare.



Figure 25: Revised Layout (04/02/2022) [11]



4.5.11. A population density heatmap is generated and ½ hectare grids are overlaid on the highest density points (orange) as shown in Figure 26.

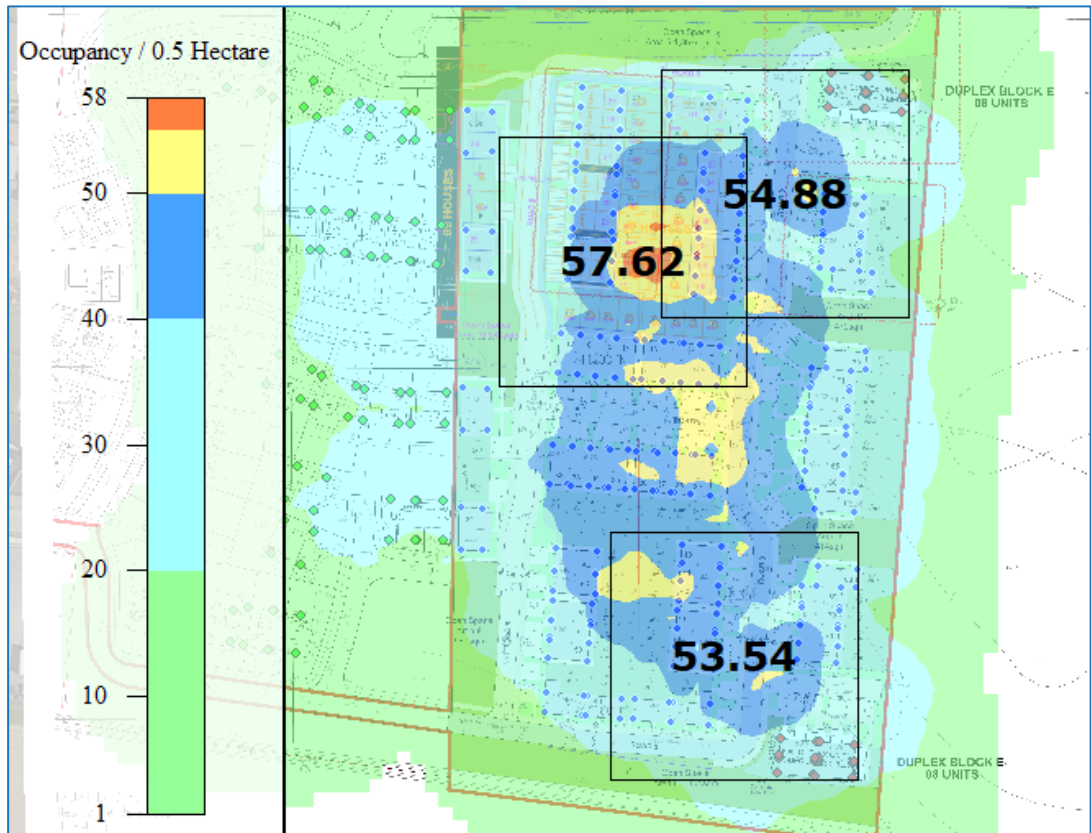


Figure 26: Population density heatmap (fifth iteration - revised layout)

4.5.12. Figure 26 shows no red areas, and the grid placed over the highest density area shows a value less than 60 persons per ½ hectare.

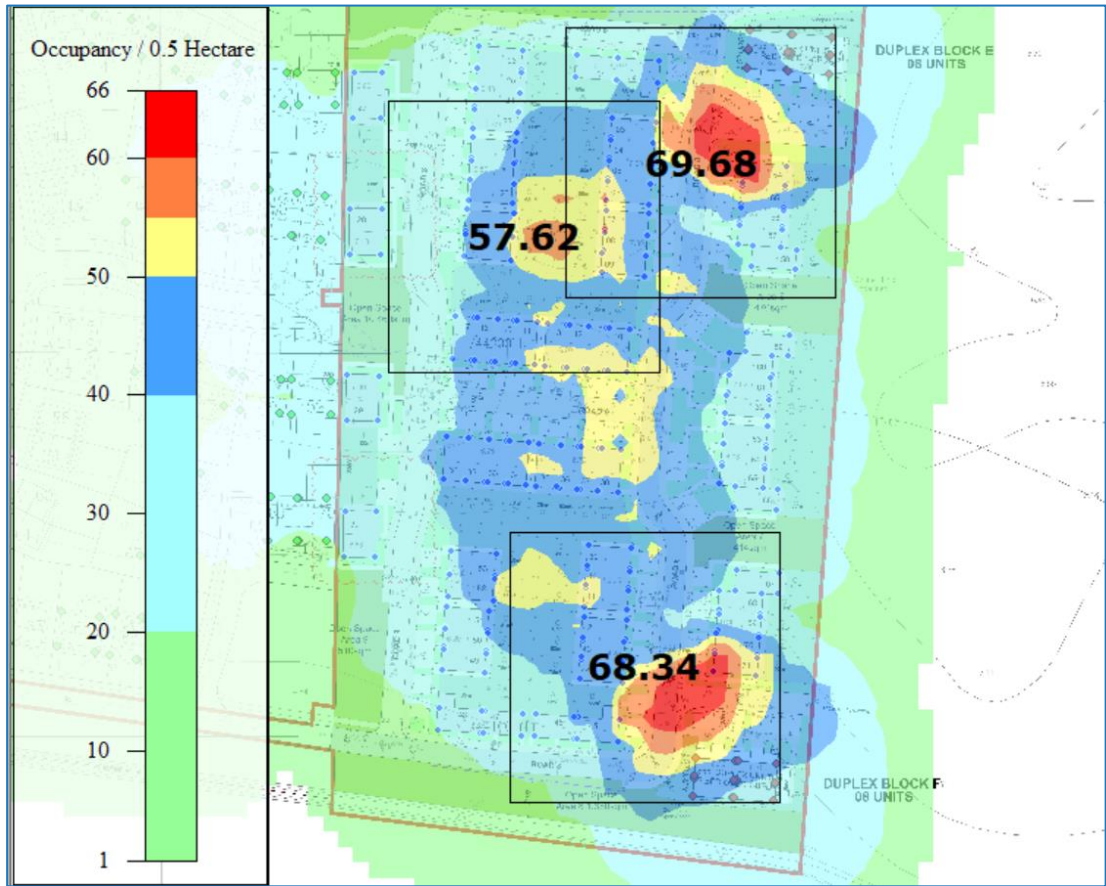
#### 4.6. Layout Revision – sixth iteration

- 4.6.1. The Client has come back to Cyrrus with a request to review their latest layout that reflects the shift of two detached housing on the western boundary 1.5 meters to the South.
- 4.6.2. The latest layout revision (18034 PL107 Site Plan 5 of 6 08.03.22) submitted by the client is shown in Figure 27.
- 4.6.3. Information points with an attribute of household occupancy are added to each proposed dwelling, as well as for the existing housing estate to the west of the proposed development. As with the earlier iterations, the assessment initially uses an occupancy rate (persons/dwelling) of 2.68 for each house and apartment.



Figure 27: Revised Layout (08/03/2022) [12]

4.6.4. A population density heatmap is generated to validate the process, as shown in Figure 28.



**Figure 28: Initial population density heatmap (Sixth Iteration)**

4.6.5. The red shaded areas in Figure 28 indicate where further investigation is necessary. A second simulation is run, using a value of 2.68 persons/dwelling for the houses, but with the slightly altered methodology for blocks E [1] to better reflect the likely occupancy of these units based on the number of beds in each, as shown in Table 1.

4.6.6. A population density heatmap is generated and ½ hectare grids are overlaid on the highest density points (orange) as shown in Figure 29.

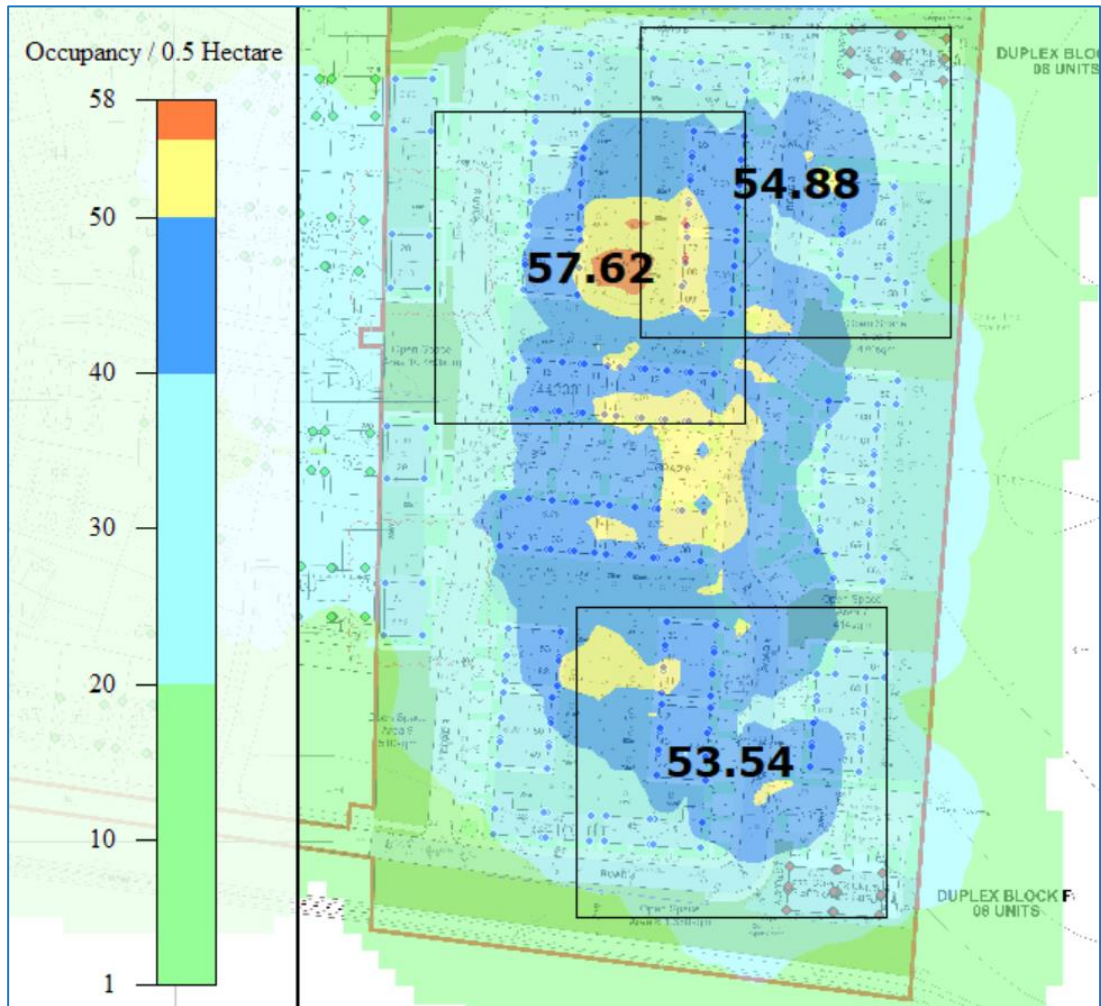


Figure 29: Population density heatmap (sixth iteration)

4.6.7. Figure 29 shows no red areas, and the grid placed over the highest density area shows a value less than 60 persons per ½ hectare.

## 5. Summary

- 5.1. The Broomfield housing development initial site layout indicates a population density that exceeds the value of 60 persons per half hectare.
- 5.2. The Client worked with Cyrrus to revise the layout. This was an iterative process to ensure all areas remain below the prescribed occupancy limit.
- 5.3. The third layout revision (23.07.21) indicates no areas that exceed the desired value of 60 persons per half hectare.
- 5.4. **The latest layout revision (08.03.2022) indicates no areas that exceed the desired value of 60 persons per half hectare.**
- 5.5. This development does not compromise the population density of pre-existing dwellings.
- 5.6. Provided that the Fingal County Development Plan and RSES-EMRA is implemented as published, the housing occupancy rate in Fingal should decrease over the coming years as more housing stock comes online. The resultant numbers will therefore be expected to reduce over time.





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