THORNTON O'CONNOR
TOWN PLANNING

Development Plan Submission

Submission In Respect of the *Draft South Dublin County Development Plan 2022-2028*

Relating to Lands to the North and East of Greenogue and Aerodrome Business Parks, Rathcoole, Co. Dublin

Submitted on Behalf of Greenogue Management

September 2021

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Planning Department
South Dublin County Council
County Hall
Tallaght
Dublin 24
D24 YNN5

Wednesday, 15th September 2021

Dear Sir/Madam,

RE: SUBMISSION IN RESPECT OF THE PUBLICATION OF THE *DRAFT SOUTH DUBLIN COUNTY DEVELOPMENT PLAN 2022-2028* IN RESPECT OF LANDS TO THE NORTH AND EAST OF GREENOGUE AND AERODROME BUSINESS PARKS, RATHCOOLE, CO. DUBLIN

1.0 INTRODUCTION

1.1 Purpose of this Letter

Thornton O'Connor Town Planning in conjunction with Kavanagh Burke Consulting Engineers[1], JBA Consulting[2], Airport Planning and Development Limited[3] and B-Fluid[4] has been retained by Greenogue Management[5] to prepare this Submission to South Dublin County Council in respect of the publication of the *Draft South Dublin County Development Plan 2022 -2028*.

The lands subject to this submission are located to the north and east of the Greenogue and Aerodrome Business Park, Rathcoole, Co. Dublin, as shown in the aerial photograph at Figure 1.1.

[1] Unit G3, Calmount Park, Ballymount, Dublin 12.
[2] No. 24 Grove Island, Corbally, Limerick.
[3] Lancaster House, 16 Moorfield Business Park, Yeadon, Leeds, West Yorkshire, LS19 7AY
[4] No. 18 Herbert Street, Dublin 2, D02 FK19.
[5] Unit 5, The Plaza, Greenogue Business Park, Co. Dublin.



Figure 1.1: **Aerial Photograph of the Subject Lands (Indicative Boundary Outlined in Red).**

Source: **Google Earth, annotated by Thornton O'Connor Town Planning, 2021.**

The subject lands, which have an area of c. 52 Ha, are zoned Objective 'RU' which aims to protect and provide for the development of agriculture. The lands are currently greenfield in nature. Extracts from the *South Dublin County Development Plan 2016 -2022* zoning maps (No. 4 and 8) are provided below for reference. The lands to the south and west of the subject lands are industrial in nature and are zoned Objective 'EE' (to provide for enterprise and employment related uses).

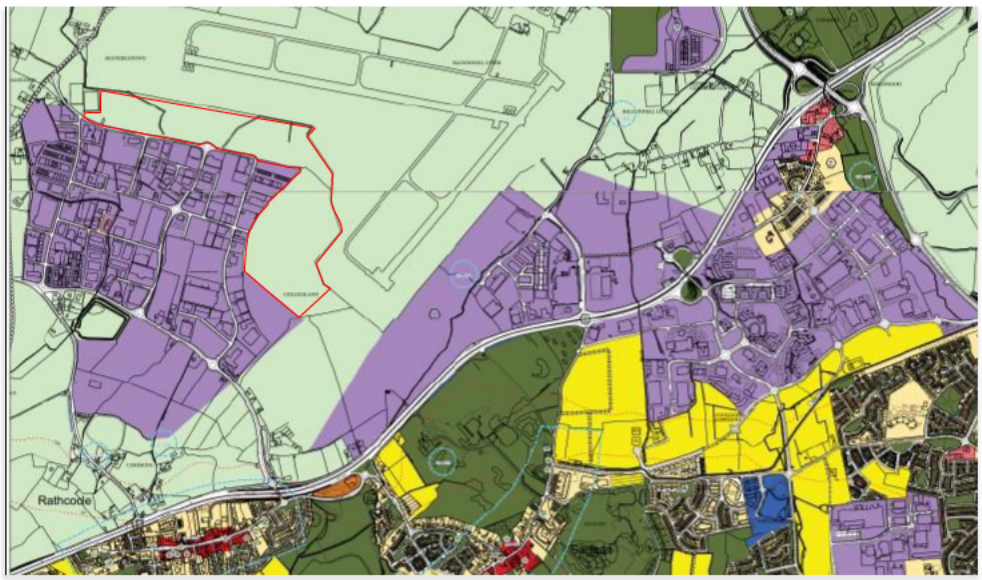


Figure 1.2: **Current Zoning of the Subject Land (Outlined in Red).**

Source: **Extracts from Map Nos. 4 and 8 of the *South Dublin County Development Plan 2016 – 2022*.**

The *Draft South Dublin County Development Plan 2022-2028* does not propose any change to the zoning of the lands as shown in Figure 1.3 below:

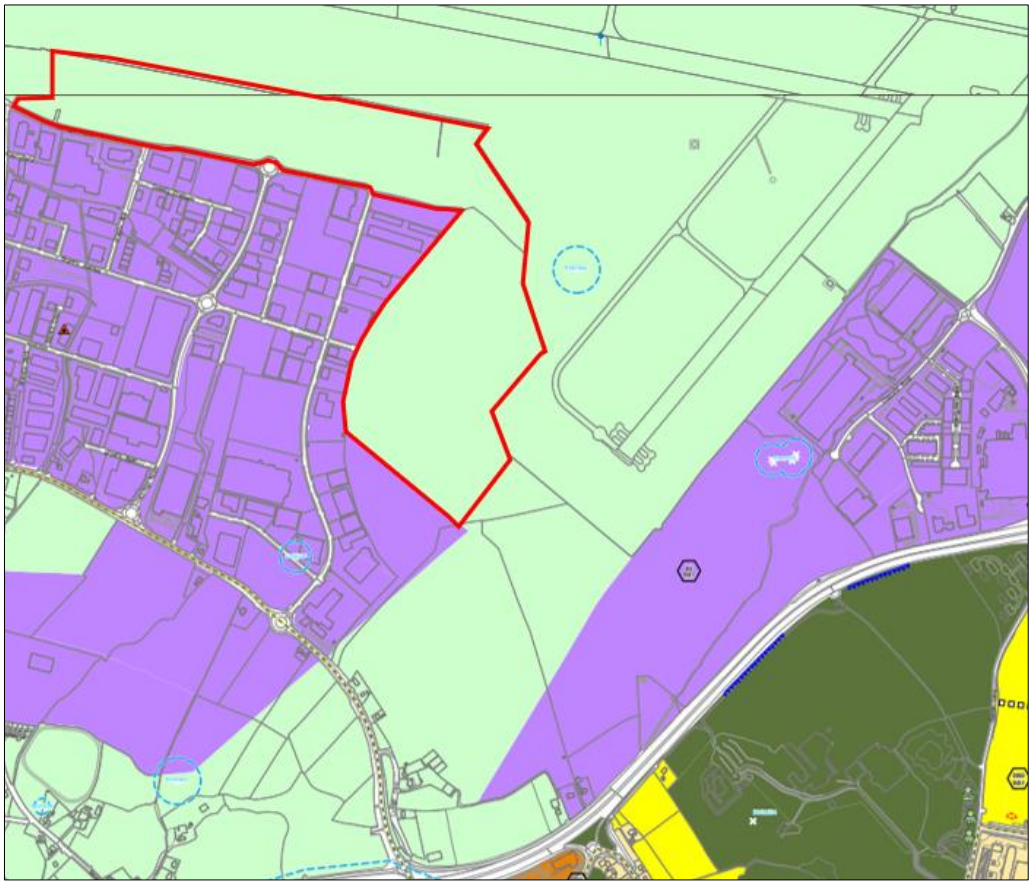


Figure 1.3: **Current Zoning of the Subject Land (Outlined in Red).**

Source: **Extracts from Map Nos. 4 and 8 of the *Draft South Dublin County Development Plan 2022-2028*.**

Key Point: The purpose of this Submission is to present the cogent case that exists for the subject lands to rezoned from Objective 'RU' to Objective 'EE' in the making of the *South Dublin County Development Plan 2022 – 2028.* The lands are strategically positioned to provide for an urgently needed extension to the Greenogue and Aerodrome Business Parks, to allow this purpose built business park agglomeration to continue to contribute to the continued demand by employers for the development of high quality industrial and logistics warehousing and facilities in this area. The rezoning of these lands will form a natural extension to the existing Greenogue and Aerodrome Business Park and strengthen South Dublin County's position as one of the largest employers in the Industrial and Logistics industry within the country.

The lands subject to this report are currently located within the Department of Defence Inner Zone and the Department of Defence Security Zone as indicated on the index zoning map of the *South Dublin County Development Plan 2016 – 2022*. We note that the Department of Defence Inner Zone and the Department of Defence Security Zone are proposed to be removed as part of the *Draft Plan*. Notwithstanding that, this Submission demonstrates that the rezoning of the land to accommodate future industrial development is acceptable having regard to aviation safety.

Key Point: The purpose of this report is to demonstrate that the requested rezoning of the subject lands from their current Objective 'RU' use (*'to protect and improve rural amenity and to provide for the development of agriculture'*) to Objective 'EE' use (*'to provide for enterprise and employment related uses'*) in the *Draft South Dublin County Development Plan 2022 – 2028* is in the interests of proper planning and sustainable development and will allow for the extension of an important and highly functioning business park agglomeration.

The subject lands provide the opportunity for the natural extension of a thriving business park which has seen the re-location of multiple large scale companies (both Foreign Direct Investment and indigenous firms) to this area in recent years. In our opinion the rezoning of the subject lands presents an opportunity for a logical and sequential extension to the established business park environment. Section 4.0 of this report will demonstrate the critical demand for 'EE' zoned lands within this locale.

Section 5.0 of this Submission demonstrates a key concern that the Enterprise and Employment zoned lands in South Dublin are currently focused on providing for the growth and expansion of just one key sector of industrial development – Foreign Direct Investment and the growth of Data Centres. There is a growing shortage of lands available for the traditional user and this shortage will become more pronounced when REGEN lands start to transition and additional displaced industrial users seek new premises.

The rezoning and subsequent development of the subject lands will support the continued growth of enterprise and employment in the County thus reinforcing South Dublin County as a key employment node with the country.

This is discussed further at Section 6.0 of this report.

1.2 Format of This Submission

The following is the format of this submission:

Section 1 provides this **Introduction** to the Site and includes an **Executive Summary** of the Submission

Section 2 provides an Overview of the **Location, Context and Accessibility** of the Subject Lands;

Section 3 details the **Planning Policy** Context;

Section 4 demonstrates the **Demand for Industrial and Logistics Facilities in South Dublin** which is the **Background** to this Submission;

Section 5 sets out the need to Plan for the **Needs of the Varying Types of Industrial Users** and Notes the Shortage of Land Available for the 'Traditional Operator'

Section 6 sets out how the **Rezoning of The Subject Lands Can Assist in the Delivery of High Quality Industrial and Logistics Facilities** and Contribute to the South Dublin County's position as a Vital Employment Node in the Country;

Section 7 provides a **Conclusion**.

1.3 Executive Summary

Purpose of This Submission- Rezone Lands from 'RU' to 'EE'

The subject lands are located on 'RU' zoned lands and are contiguous to lands zoned for Enterprise and Employment (EE). The purpose of this Submission is to seek the rezoning of the lands from Objective 'RU' to Objective 'EE' to allow for the development of the lands to provide Enterprise and Employment uses that augment the industrial business park environment that exists in Greenogue and Aerodrome and provide further opportunities for job creation

Future Development to Respect Department of Defence Requirements

The subject land's location within the current Department of Defence Inner Zone Limit does not present any impediment to the rezoning of the subject land - the current *South Dublin County Development Plan 2016 – 2022* acknowledges that lands within the Department of Defence Security Zone and Department of Defence Inner Zone should not be prevented from being developed, subject to adherence with specified requirements However, we note that the Department of Defence Inner Zone is proposed to be removed from the *Draft Plan*.

Technical Assessments Demonstrate No Reason Subject Lands Cannot be Zoned for Industrial Development

This Submission includes a variety of technical assessments including an Aviation Safety Assessment, a Wind Shear and Turbulence Analysis and a Strategic Review of Flood Risk, all of which conclude that there is no technical reason that the subject lands cannot be zoned for industrial development. Any future application will also need to demonstrate that it will not result in negative impacts following the undertaking of development specific assessments (as is the norm with such applications).

Industry Research Demonstrates Continued Demand for Industrial Facilities and Critical Shortage That Exists

Research demonstrates that there is a growing demand for modern high quality industrial and logistics facilities in the Dublin South West area. The rezoning of the subject lands to objective 'EE' as part of the *South Dublin County Development Plan 2022 -2028* would provide the opportunity for the continued development of such facilities as an extension to an established highly functioning business park environment.

Industry Research Also Highlights the Need to Consider the 3 Key Typologies of Industrial User - the Future Growth of the 'Traditional' User is Currently Not Being Catered for in Zoning

Recently published research notes that there are different 'tiers' of industrial type uses. Greenogue and Aerodrome Business Parks cater for 'traditional' user types. By contrast, Grange Castle caters for largely Foreign Direct Investment (FDI) and Date Centre user types and Citywest and Baldonnell largely cater for campus style office environment with some indigenous logistics. It is imperative that the location of the zoning of enterprise and employment land ensures that it is catering for the expansion of all 3 No. key industrial user groups.

Identifying the Problem – Where are 'Traditional Users' Expected to Develop?

Jones Lang La Salle have published a research paper that clearly sets out that with Fonthill, Citywest, Baldonnell and Greenogue at capacity, there is not sufficient zoned Enterprise and Employment zoned land available to cater for the 'traditional user' (i.e., the type of user that predominates in Greenogue and Aerodrome Business Parks). We are advised that many of such users are unlikely to be considered appropriate for lands at Grange Castle and many of these business are local and Irish businesses that will be forced to travel to other Counties to obtain appropriate lands for industrial development/expansion.

The Redevelopment of the REGEN Lands and Associated Displacement of Uses May Compound the Problem

The Draft Development Plan envisages that a substantive number of businesses to be displaced on REGEN lands will relocate to the Greenogue and Aerodrome Business Parks with the Draft Plan further noting that the Greenogue and Aerodrome Business Parks represent a key identified location to provide for a future employment landbank. It is key to recognise that sufficient land is not available to allow this to happen.

The Rezoning of the Subject Lands Presents a Logical Solution – Consolidating and Augmenting a Vibrant and Expanding Business Park That Caters for Indigenous Industry

We respectfully suggest that the subject lands could play a key role in providing the solution for urgently needed additional lands for the 'traditional user'. Greenogue and Aerodrome is currently a key industrial hub for 'traditional users' but due to significant demand over the past 6 No. years is close to being built out. We submit that the subject lands present a logical extension to the business parks to create further employment opportunities that are in urgent demand for traditional users.

2.0 LOCATION, CONTEXT AND ACCESSIBILITY OF THE SUBJECT LANDS

2.1 Location of the Subject Site – Site 'Wraps Around' Existing Business Parks

The subject site, which has an area of c. 52 Ha, is located to the north of College Road/ Jordanstown Road and to the east of Jordanstown Road and existing industrial development at Greenogue and Aerodrome Business Park, Rathcoole, Co. Dublin. The lands essentially 'wrap around' the existing business parks. Casement Aerodrome (Baldonnel) is located to the north and east of the subject lands. The western portion of the subject lands have been in industrial use for the past 10- 15 No. years. The remaining lands are currently used for intensive wheat cultivation.

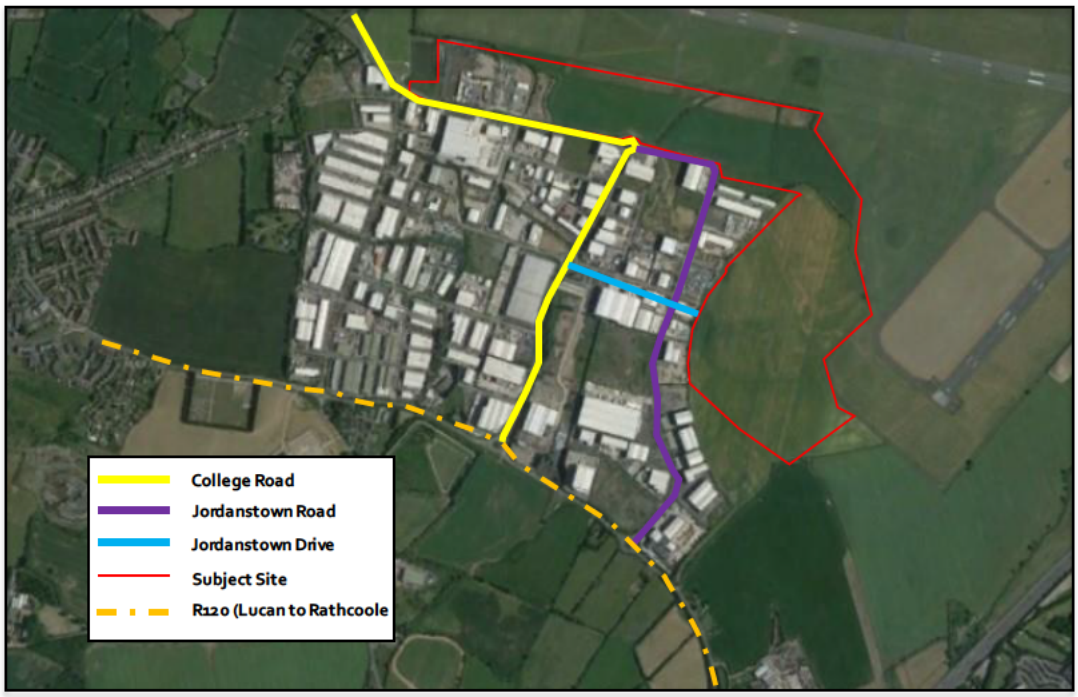


Figure 2.1: **Aerial Photograph Identifying the Location of the Subject Lands (Red line is Indicative Only) With Industrial Use at Western Portion.**

Source: **Google Earth, annotated by Thornton O'Connor Town Planning, 2021.**

The R120 (Lucan to Rathcoole) runs along the southern boundary of the business parks providing excellent accessibility to the N7 Naas Road and wider national road networks.

2.2 Surrounding Context

The wider surrounding context of the Greenogue and Aerodrome Business Park is primarily agricultural in nature with clusters of industrial parks to the north and east. Newcastle Village is located to the east of the Greenogue and Aerodrome Business Park and Rathcoole Village is located to the further south of the N7.

An aerial photograph of the surrounding context is provided at Figure 2.2.

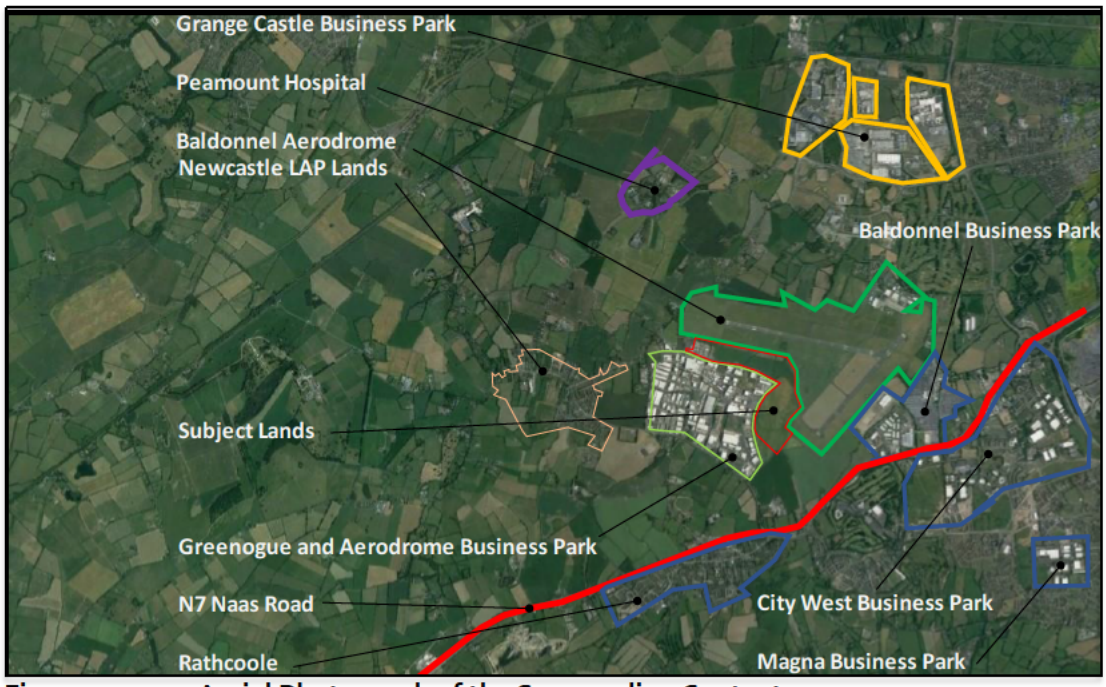


Figure 2.2: Aerial Photograph of the Surrounding Context.

Source: Google Earth, annotated by Thornton O'Connor Town Planning, 2021.

It should also be noted that Adamstown SDZ and Clonburris SDZ are located c. 4 km north and c.5 north-east (as the crow flies) of the subject lands respectfully providing major centres of population in close proximity to the subject lands.

2.3 Accessibility of Subject Lands

The subject lands have very good accessibility through the existing road networks and provision of public transport in the locale. In addition, footpaths connect the business parks to Newcastle to the west and to Rathcoole to the south.

Road Network

As previously mentioned, the business parks including the subject lands are served by the Lucan to Rathcoole R120, this regional road connects to the N7 Naas Road at Junction No. 4 which is located less than 1 km to the south of the subject site. The N7 Naas Road provides connectivity to the wider road network surrounding Dublin, including the M50 motorway, Dublin Airport and the Port Tunnel which provides access to Dublin Port.

Bus Services

The subject lands are currently served by an hourly Dublin Bus Route (No. 68) from Hawkins Street to Newcastle/Greenogue Business Park. The image below illustrates the bus stops served by the No. 68 bus which provide further connectivity to alternative bus routes and modes of public transport in Dublin City and environs.

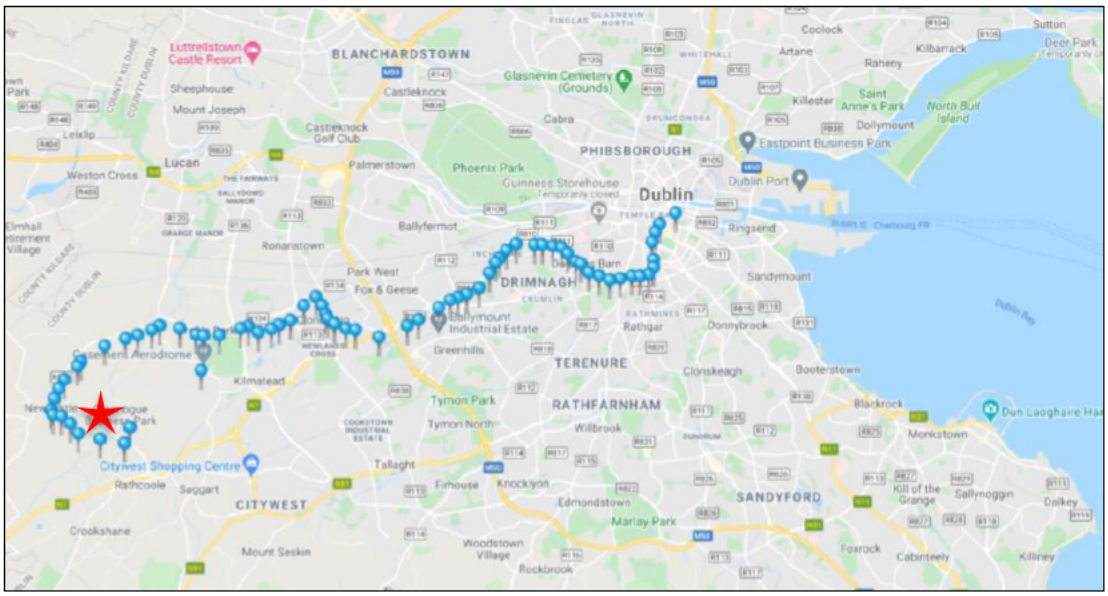


Figure 2.3: **Dublin Bus Route No. 68 serving the Subject Lands (Indicated with a Red Star).**

Source: **Dublin Bus, annotated by Thornton O'Connor Town Planning, 2021.**

In addition, the subject lands will be served by the Proposed Bus Connects Network which will provide 2 No. additional frequent bus routes:

- Orbital Route W6: Maynooth – Celbridge – Citywest – Tallaght (Frequency 30 No. mins).
- Local Route L56: Newcastle – Clondalkin – Red Cow (Frequency hourly).

An additional single daily peak time route (No. X56) between Newcastle – Peamount – City Centre will also be provided.



Figure 2.4: **Extract from Bus Connects Proposed Routes indicating the Subject Site.**

Source: **https://busconnects.ie/media/2027/saggart-area-map.pdf, annotated by Thornton O'Connor Town Planning, 2021.**

Rail Services

The Luas Red Line is accessible from Teach Sagart (c. 7 No. min drive/ 14 No. minute cycle), Fortunestown or City West (also benefits from a Park and Ride) (c. 7 min drive/18 No. min cycle).

The Hazelhatch and Cellbridge Train Station is located c. 5 km to the north-west of the subject lands (10 No. min drive/18 No. min cycle). There are 5 No. routes operating at the Hazelhatch and Cellbridge Train Station:

- Dublin Heuston – Cork;
- Dublin Heuston – Galway;
- Dublin Heuston – Limerick and Ennis;
- Dublin Heuston – Waterford; and
- Grand Canal Dock and Dublin Heuston – Portlaoise.

3.0 PLANNING POLICY CONTEXT

3.1 Zoning of The Subject Lands in The *South Dublin County Development Plan 2016 -2022*

As noted at Section 1.1 of this report the subject lands are located on 'RU' zoned lands and are contiguous to lands zoned for Enterprise and Employment (EE).

The extract from the Index map below also demonstrates that the subject lands are currently located within the Department of Defence Inner Zone and part located within the Department of Defence Security Zone. However, these designations are proposed to be removed as part of the Draft Plan.

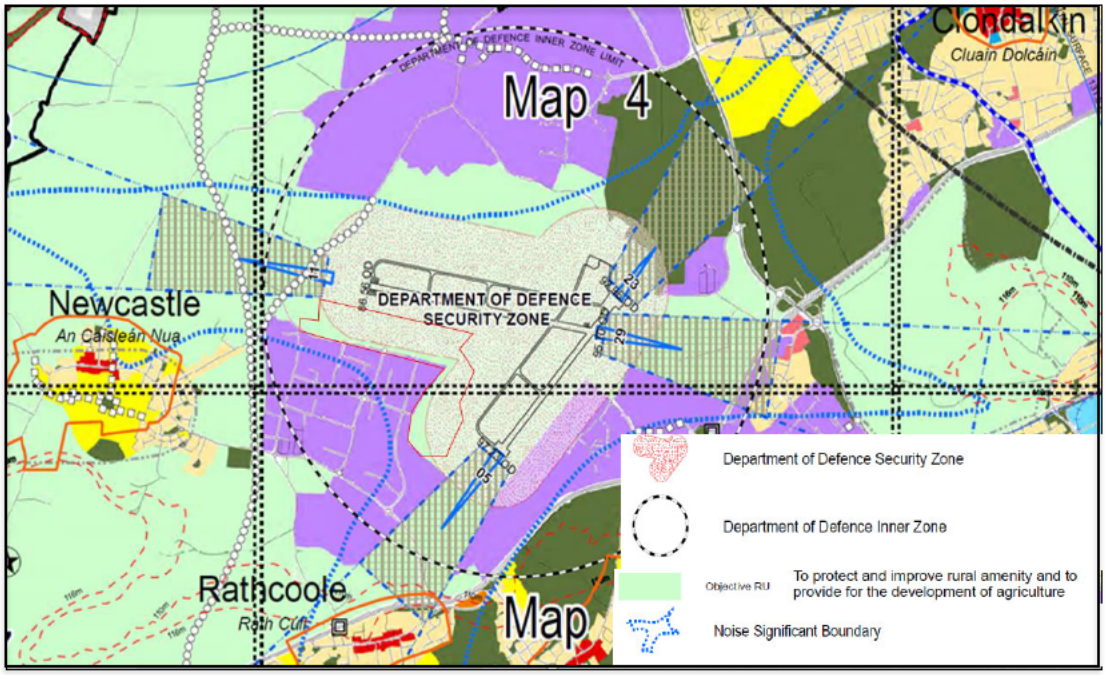


Figure 3.1: **Index Zoning Map showing Subject Site (Red line is Indicative Only).**

Source: ***South Dublin County Council Development Plan 2016-2022*** **(Annotated by Thornton O'Connor Town Planning).**

Department of Defence Inner Zone

The *South Dublin County Council Development Plan 2016-2022* states in IE8 Objective 5:

> *'Within the Department of Defence Inner Zone, in addition to the Obstacle Limitation Surfaces for the Aerodrome,* ***no buildings or structures exceeding 20m in height above ground level should be permitted except where specifically agreed following consultation with the Department of Defence*** *that the proposed development will not affect the safety, efficiency or regularity of operations at the aerodrome.'*

Key Point: Whilst we note that the Department of Defence Inner Zone is proposed to be removed from the *Draft Plan*, we further comment that the subject land's location within the current Department of Defence Inner Zone Limit does not present any impediment to the rezoning of the subject land given that the majority of the Greenogue and Aerodrome Business Park is also located within this area. Similarly, 'EE' Zoned lands located in Grange

Castle and Baldonnel Business Parks are located within this designation. As such, this designation does not restrict the proposed rezoning of the subject land to Objective 'EE'.

3.2 Department of Defence Security Zone

The *South Dublin County Development Plan 2016 -2022* stipulates that:

> *'In considering appropriate development within the Security Zone adjacent to the Aerodrome, the following requirements shall be addressed either as part of a development submission or as a condition of permission where appropriate:*
>
> ***Sterile Zone:***
> - *A sterile zone shall be created from the existing Aerodrome boundary fence to the boundary of the development, subject to a minimum width of 2.5 metres. This zone shall be gated with access confined to Defence Forces Personnel (or other by arrangement). The Department of Defence reserves the right to install alarm systems in this area.*
>
> ***Boundary Fence of Development:***
> - *A 3-metre-high clear visibility fence with integrated ram defence barriers, shall be erected where the development shares a boundary with the Aerodrome.*
>
> ***CCTV:***
> - *Any new development along the aerodrome perimeter shall be covered by tilt and zoom cameras with a minimum zoom of 20:1, or an improved magnification as agreed. Facilities shall be provided for the images from these cameras to be shared with the military authorities as and when required.*
>
> ***Building Restrictions:***
> - *No buildings shall be located within 10 metres of the edge of the Sterile Zone (use of this area for car parking may be acceptable).*
> - *Site layout to be designed with roads and yard areas located near the aerodrome boundary to provide clear lines of sight for monitoring and surveillance.*
> - *Buildings overlooking the perimeter shall have limited windows (with frosted glass) above ground floor level.*
> - *Roofs shall be secure and only accessible using high lift machinery. Roof surfaces shall provide no opportunity to remain hidden from view. Roofs on perimeter side shall have no view into the aerodrome.'*

Key Point: The current *South Dublin County Development Plan 2016 – 2022* acknowledges that lands within the Department of Defence Security Zone and Department of Defence Inner Zone should not be prevented from being developed, subject to adherence with specified requirements as set out above. The designations currently pertaining to the subject lands (proposed to be removed as part of the *Draft Plan*) thus do not present any impediment to rezoning the subject land from 'RU' to 'EE'.

It should be noted that the development of lands in Baldonnel Business Park also currently located within the Department of Defence Security Zone and Department of Defence Inner Zone have been granted permission under by SDCC under Reg. Refs.: SD19A/0370,

SD20A/0215, SD20A/0319, SD17A/0362 and SD18A/0266 during the lifetime of the current Development Plan.

As part of this rezoning Submission, a proposed conceptual masterplan vision for the rezoning of the subject lands has been assessed by a multi-disciplinary team of assessors. A Landscape Masterplan prepared by JBA Consulting showing the conceptual development vision for the lands is attached as Appendix A.

To ensure that any future development of the lands poses no risk to Aviation Safety, an 'Aerodrome Safety Assessment' has been prepared by *Airport Planning and Development (APD) Ltd.* The Assessment is attached as Appendix B, and it concludes that:

> *'There is* ***no reason related to Aviation Safety that the lands cannot be developed to provide an appropriately designed employment related use that respects the requirements of the Department of Defence****. Any future planning application at the lands will also be required to provide a development specific Aviation Safety Assessment that demonstrates that the scheme as proposed can be provided without affecting the use of the adjacent lands at Casement Aerodrome.'* [Our Emphasis].

The report further confirms that:

> *'The proposed development area is located outside the technical safeguarded area of the CADF, and there is no adverse effect on the operation of this equipment. In addition, there is no adverse effect on the operation of the Aerodrome Identification Beacon.'*

Key Point: An Aerodrome Safety Assessment is enclosed as part of this rezoning submission. The Assessment notes that a development specific Aviation Safety Assessment will be required to be prepared in respect of any future application at the land but also notes that an assessment of the conceptual masterplan developed has proven that there is no aviation related reason that the lands cannot be rezoned to provide for enterprise and employment uses.

A further Assessment undertaken to prove that the rezoning of the lands will not hamper aviation safety is a Wind Shear and Turbulence Analysis which has been prepared by B-Fluid Limited and is attached as Appendix C. The assessment concludes that

'The proposed masterplan is not causing any "unsolvable" critical impact on the runaways 10/28 and 04/22 that cannot be mitigated adopting the measures outlined in section 9.1 (Mitigation Options) of this report.'

Thus, it is clear that any future development of the lands can be designed to have regard to mitigation measures recommended to reduce any potential for wind shear impacts and ensure no impact to aviation safety.

3.4 Demonstrating That the Development of the Lands Will Not Contravene Development Plan Policies – Flood Impact

The conceptual masterplan has also been assessed for Flood Impact. A '*Strategic Review of Flood Risk*' is attached as Appendix D. The Review concludes that:

> *'The flood risk to the area has already been significantly reduced by the adjacent SD19A/0370 development and can be further reduced by the stated measures to reroute and store extreme flood flows around the edge of the site.* ***The proposals reduce flood risk and provide protection to the 0.1%AEP standard for cross catchment flows from the Camac and therefore protect a significant amount of existing development within Greenogue Business Park*** *whilst not increasing flow to the downstream Baldonnel/Griffeen system.*[Our Emphasis].

Key Point: There is no reason related to Flood Impact that the subject lands should not be developed.

3.5 *Ireland 2040: National Planning Policy Framework* Encourages the Growth of Employment in Appropriate Locations

The National Planning Framework is the government's long-term overarching guidance document for shaping the future growth of the country which is focused on achieving 10 No. key strategic outcomes and priorities. The strategic objectives pertaining to 'Compact Growth' and 'A Strong Economy, supported by Enterprise, Innovation and Skills' are relevant to the rezoning of the lands subject to this report.

The extension of the existing industrial use at Greenogue and Aerodrome Business Park will accord with the core principle of promoting a Compact City by extending a fully developed and serviced Business Park and thus maximising existing resources and infrastructure. The rezoning of these lands to Objective 'EE' will also provide opportunities for increased employment in this accessible location.

Thornton O'Connor Town Planning refer to Section 3.7 of the NPF which states that:

> *'Sustainable enterprise thrives in supportive business environments that enhance competitiveness and productivity with good supporting infrastructure.'*

Furthermore, noting that:

> *'At an urban scale, it is important to identify locations where enterprises can access competitively priced development lands, utilities and commercial properties to the highest standards available internationally.'*

Key Point: The National Planning Framework recognises the need to create business environments that enhance competition with competitively priced lands. The proposed rezoning of the subject lands from Objective 'RU' to Objective 'EE' will encourage market competition and ensure that the established, high quality designed and serviced Business Park at Greenogue is permitted to expand in accordance with demand.

3.6 East & Midlands Regional Assembly – *Regional Spatial and Economic Strategy* 2019 -2031

The *Regional Spatial and Economic Strategy 2019 -2031* (RSES) for the East & Midlands Region acknowledges the important relationship between housing and employment in achieving 'Compact Growth' as set out in the NPF. The RSES outlines that:

> *'The NPF sets out ambitious targets to achieve compact growth with 50% of housing to be provided within or contiguous to the built-up area of Dublin City and suburbs. To achieve this, the MASP identifies strategic residential and* ***employment corridors along key public transport corridors existing and planned, that contain development opportunities.*** *These include; Dublin Docklands and Poolbeg West, former industrial lands including* ***Naas Road****…'* [Our Emphasis].

The rezoning of the subject lands will support the continued interaction of residential and employment uses in South Dublin with the subject lands' location near major population nodes.

The subject lands are excellently located in close proximity to the N7 Naas Road which provides connectivity to a wide spectrum of towns and villages in South Dublin and beyond. Notwithstanding this, Newcastle Village is located directly to the east of the Greenogue and Aerodrome Business Park (within walking distance) and Rathcoole Village is located further south of the N7. In addition, Adamstown SDZ and Clonburris SDZ are located north of the Greenogue and Aerodrome Business Parks and are also easily accessible from the subject lands (as set out in Section 2.0 previously). It is our opinion that the rezoning of the subject lands to Enterprise and Employment would be in line with the vision of the RSES which stipulates that:

> *'The provision of increased employment* ***densities to support envisaged population growth*** *will require enhanced co-ordination between the local authorities, enterprise agencies and regional stakeholders to ensure the* ***sequential delivery of serviced sites in central accessible locations****, including…'* [Our Emphasis].

In achieving the envisaged employment densities in accessible locations, the RSES provides the following guidance:

> *'The Economic Strategy sets out Guiding Principles for the location of strategic employment areas that include access to;*
>
> - ***suitable locations*** *(depending on the extent to which an enterprise is people or space intensive or subject to environment constraints);*
> - ***serviced sites*** *(based on whether an industry is dependent on a particular infrastructure such as energy, water, transport or communications networks);*
> - ***connectivity*** *(including access to international markets that requires proximity to an airport/port);*
> - ***skilled labour force*** *(proximity to third level education and lifelong learning) and*
> - ***local strengths*** *(a diverse sectoral mix, research, innovation and technology centres, start-up hubs and incubators, emerging clusters or cross industry value chains)'*

As previously outlined throughout this report, the proposed rezoning from the current 'RU' Objective to the proposed 'EE' Objective as part of the making of the *South Dublin County*

Development Plan 2022 – 2028 would facilitate the natural extension of the existing Greenogue and Aerodrome Business Park. The existing Greenogue and Aerodrome Business Park has a successful and established reputation and currently contains over 450 No. companies ranging from local start-up to international businesses which demonstrates the 5 No. principles of suitable location, serviced sites, connectivity, skilled labour force and local strengths as set out in the RSES. It is our professional planning opinion that the rezoning of the subject lands would further harness and consolidate the success of Greenogue and Aerodrome Business Park as a strategic employment area as envisaged by the RSES.

As outlined at Section 1.1 of this report, the subject lands would form a natural extension to the existing Greenogue and Aerodrome Business Park thus our Client would be in a position to realise the potential of these lands within a relatively short period of time. This is discussed further at Section 5.0 of this report.

Key Point: The RSES acknowledges the symbiotic relationship between population growth and employment and identifies 5 No. principles to achieve strategic employment in supporting compact growth. It is our professional planning opinion that the lands subject to this rezoning submission which would form a natural extension of the existing 'EE' zoned lands would accord with these principles.

4.0 RATIONALE FOR THE REZONING OF THE SUBJECT LANDS FROM RURAL AMENITY USE TO ENTERPRISE AND EMPLOYMENT USE AS PART OF THE *SOUTH DUBLIN COUNTY DEVELOPMENT PLAN 2022 -2028*

Recent research carried out by leading industrial and logistics industry experts provide substantive and impartial findings which indicate the continued demand for a high caliber of development to meet the market demand which exists. This section of the report will provide an overview of this research which illustrates the prevailing trends in the industrial and logistics industry.

4.1 The Industrial and Logistics Industry is Faced with Continued Capacity Challenges

In February 2021, Savills published *Dublin Industrial and Logistics Market Q4 2020*[6] research which anticipates the continued growth of the Industrial market. The research highlights that:

> *'despite Covid-related headwinds, the* ***Industrial and Logistics market has remained relatively robust****. Looking at the market fundamentals Ireland has a growing population and a return to annual growth in personal consumption expenditure has been forecasted by the Central Bank for 2021. As such we would expect to see the recovery continue into the new year.'* [Our Emphasis].

In addition, Savills highlight that:

> *'the greatest challenge to take-up was not Covid but a* ***lack of suitable space for potential occupiers****'.* [Our Emphasis].

The *Dublin Industrial Market Report Q4 2020*[7] presents a similar outlook for the Industrial Market for 2021 outlining that:

> *'The global public health crisis and the ending of the Brexit transition period changed how Ireland utilised real estate. The crisis of 2020* ***demonstrated the importance of in-country storage and last-mile logistics to mitigate potential supply chain delays****.'*

Key Point: It is clear from industry research that demand for industrial units is expected to continue. However, the activity may in the short term become severely constrained by the limited capacity for the market to supply the large volumes of space required. It is evident that there is a need for the development of additional modern industrial facilities in Dublin to cater for the current and projected demand. Additional zoned lands in appropriate locations are required to cater for this demand.

[6] market-in-minutes--industrial-and-logistics--q4-2020.pdf (savills.co.uk)
[7] CBRE Ireland Dublin Industrial Logistics MarketView Q4 2020.pdf (llnwd.net)

4.2 Continued Major Demand for Industrial and Logistics Space in the Dublin South-West Area

The *Dublin Industrial & Logistics MarketView, Q1 2021 – Significant Increase in Demand for Industrial Property From Both Occupiers & Investors Alike*[8] published by the CBRE on 7th April 2021 reports on the substantial need for the supply of industrial buildings to satisfy the market. The CBRE report states that the up-take in the industrial & logistics sector during Q1 2021 in Dublin South West (N7) and Dublin North (M2) represented 45% and 37% respectfully of the overall take-up during this quarter in Dublin. The fraction of the industrial take-up in South West Dublin in the area of the N7 over the period of Q1 2020 to Q1 2021 is illustrated in the green in the below graph.

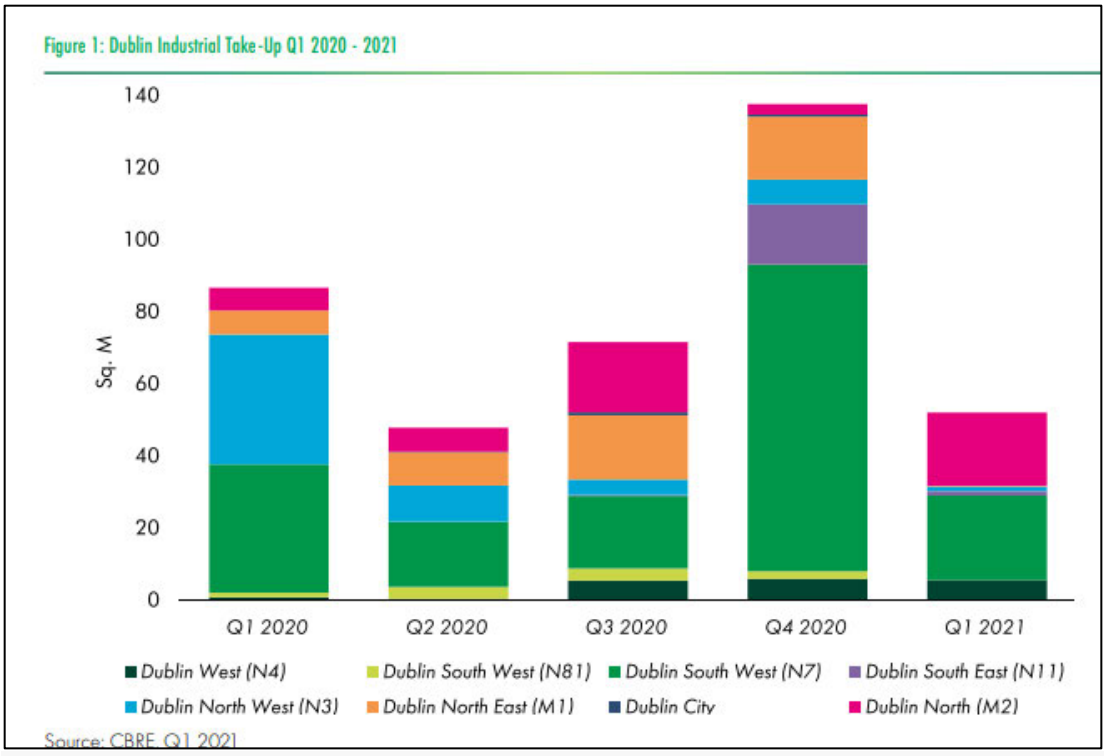


Figure 4.1: Industrial Take-Up in Dublin with the Dublin South West (N7) Region Illustrated in Green.

Source: Extract from *Dublin Industrial & Logistics MarketView, Q1 2021*.

The CBRE report[9] f states that:

> '*overall demand for* ***modern logistics facilities more than doubled quarter-on-quarter****. At the end of the first quarter of 2021, there was* ***active requirements for more than 185,000 square metres*** *of industrial accommodation*' [Our Emphasis].

In identifying the continued demand for modern facilities, CBRE warn that:

> '*...****scarcity of new accommodation is forcing some occupiers to consider short-term lets until such time as new buildings can be delivered****, either on a build-to-suit or*

[8] Q1 Ireland Dublin Industrial MarketView 2021_QGEI.pdf (llnwd.net)
[9] ibid

speculative basis. This in turn is putting upward pressure on rental values for secondary and provincial accommodation. There is a particular shortage of buildings extending to up to 3,000 square metres at present.' [Our Emphasis].

It is clear that there is an opportunity for Dublin South West to capitalise on the unrelenting demand for modern warehousing and logistic facilities in the long term.

Key Point:

Research demonstrates that there is a growing demand for modern high quality industrial and logistics facilities in the Dublin South West area. The rezoning of the subject lands to objective 'EE' as part of the *South Dublin County Development Plan 2022 -2028* would provide the opportunity for the continued development of such facilities as an extension to an established highly functioning business park environment.

As detailed in Section 5.0 of this Submission, a key challenge to be acknowledged is that the lands zoned to cater for industrial expansion over the next 6 years are predominantly lands that will cater for Foreign Direct Investment and Data Centre development. There is likely to be a severe shortage of land available for traditional users. A key request of this Submission is that the variety of industrial users are catered for in the zoning of land.

5.0 DIFFERENTIATING BETWEEN THE NEEDS OF DIFFERENT INDUSTRIAL OPERATORS AND THE NEED TO PROVIDE FOR 'TRADITIONAL INDUSTRIAL BUSINESSES'

In the consideration of zoning of industrial lands, it is important to recognise the different 'tiers' of industrial type uses. Greenogue and Aerodrome Business Parks cater for 'traditional' user types. By contrast, Grange Castle caters for largely Foreign Direct Investment (FDI) and Date Centre user types and Citywest and Baldonnell largely cater for campus style office environment with some indigenous logistics. The needs of the 'traditional' user has been discussed in a recent research paper by Jones Lang LaSalle, which is attached as Appendix E for ease of reference.

The paper, entitled '*Review of Enterprise and Employment Zoned Lands in South Dublin County Council (SDCC) Area'* notes in particular that having a large supply of land in Grange Castle to attract FDI and data centre users is essential to the economic success of the county however, other users will need to be catered for in the medium term.

The article describes three key categories of users which are generally separately located across the EE zoned lands in the County as summarised in the Table below:

	Location	User Type
1.	Greenogue /Aerodrome	Light industrial/general industrial/Indigenous occupiers and logistics users (Traditional industrial users), many indigenous
2.	Citywest/Baldonnell	Citywest High quality tech campus style offices and international companies and some indigenous logistics companies while Baldonnell has a blend of local and international occupiers.
3.	Grange Castle	Strategic land bank for foreign direct investment large scale global company type occupiers & Data Centres

Table 5.1: Summary of Industrial User Type by Location

Source: Extract from the Jones Lang LaSalle Research Paper Entitled '*Review of Enterprise and Employment Zoned Lands in South Dublin County Council (SDCC) Area'*

Examples of 'traditional users in the Greenogue and Aerodrome Business Parks are set out below:

Sample of Traditional Users currently Situated in Greenogue/Aerodrome	
Plant and tool Hire	Jewellery Suppliers
Larger Logistic and Transport Companies	Photocopier Repairs & Supplies
Motor Mechanics	Gym Equipment Suppliers
Motor Factors	Log Cabin Supplies
Window and Door Manufacturers	Wholesale Food & Drinks
Waste Management	Medical Devices Suppliers
Tyre & Exhaust Repairs	Drug Manufacturers
Safety Training Centres	Chemical Distribution
Builder Providers and Supplies	Civil Engineering Companies
Metal Fabrication	Steel Supply Companies
Catering Equipment and Supplies	Cabin Hire
Small Scale Food Production	Electrical Equipment Supplies and Manufacture
Small builder lock ups	Gas equipment repair & supply
Printers	Plastic Moulding Fabrication
Sign Writing	Meat Supplies
Traffic Management	Cold Storage
Forklift Hire & Services	Office Fit Out and Furniture Supplies
Wholesale Butchers	D.O.E Centre
Security Monitoring and Alarm Suppliers	Car Valeting
Event Management & Event Hire	Hydraulic Services
Health and Safety Equipment & Supply	Heavy plant sales and service; excavators, dozers etc
Graphic Design	Furniture/kitchen manufacture
Transport depots / Truck Parking	Construction supplies
Aviation Parts Suppliers	Stainless steel and sheet metal manufacturing
Data Centre Supply Chain	

Table 5.2: Summary of Examples of 'Traditional Users' Located in the Greenogue and Aerodrome Business Parks

Source: **Extract from the Jones Lang LaSalle Research Paper Entitled '*Review of Enterprise and Employment Zoned Lands in South Dublin County Council (SDCC) Area*'**

Key Point: The article makes the very important point that there are 1,165 acres of undeveloped Enterprise and Employment zoned lands in the functional area of South Dublin County Council, but the vast majority of such land is in areas that will be retained for FDI and Data Centre users. There is just 85 acres (7%) of land for new and expanding traditional and indigenous industrial users.

The following image is extracted from the research report, and it shows that there is a severely limited percentage of Enterprise and Employment zoned lands that are suitable for the 'traditional' user with the vast majority of lands being allocated to FDI and Data Centres.

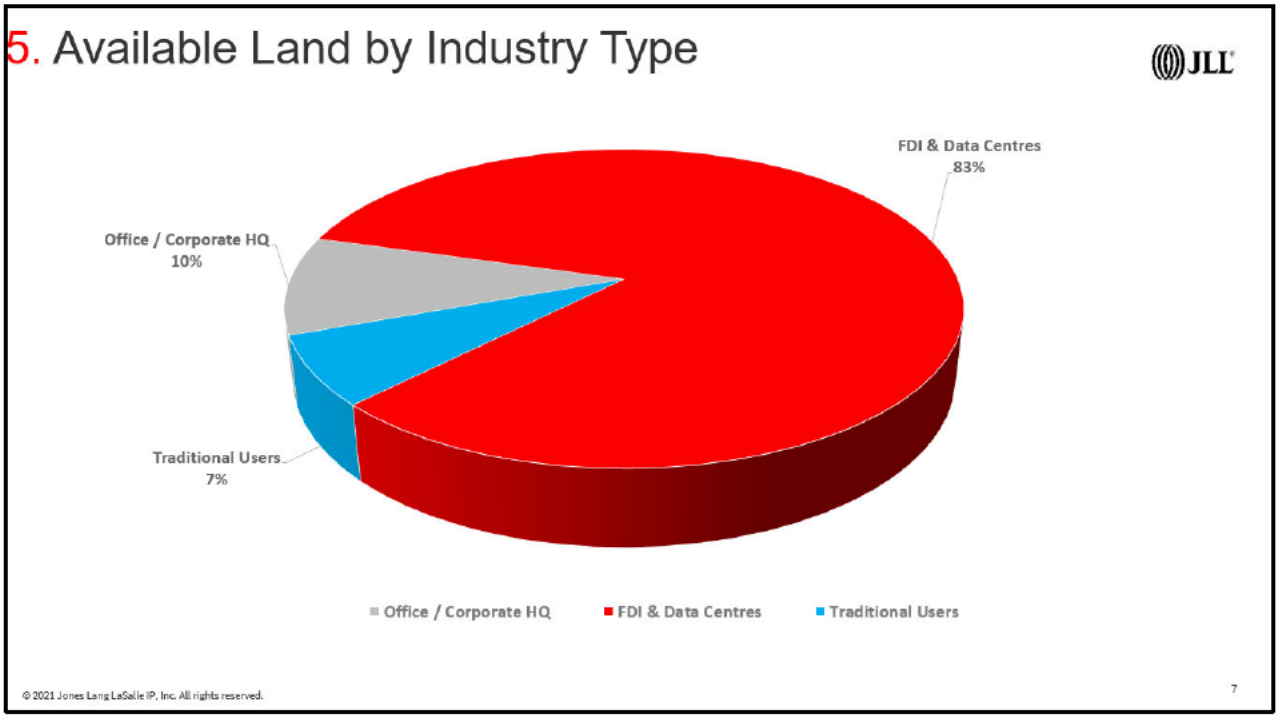


Figure 5.1: **Image Prepared by Jones Lang LaSalle Showing Proportion of Available Zoned Land for the Various Types of Industrial Users**

Source: **Extract from the Jones Lang LaSalle Research Paper Entitled '*Review of Enterprise and Employment Zoned Lands in South Dublin County Council (SDCC) Area*'**

Key Point: The research paper notes that based on current demand, and with Fonthill, Citywest, Baldonnell and Greenogue at capacity, there is not sufficient zoned Enterprise and Employment zoned land available to cater for the traditional user. We are advised that many of such users are unlikely to be considered appropriate for lands at Grange Castle. Many of these business are local and Irish businesses that will be forced to travel to other Counties for industrial development

As noted in Section 5.4 of this Submission, the Draft Development Plan envisages that a substantive number of businesses to be displaced on REGEN lands will relocate to the Greenogue and Aerodrome Business Parks with the Draft Plan further noting that the

Greenogue and Aerodrome Business Parks represent a key identified location to provide for a future employment landbank.

We respectfully highlight that sufficient land is not available to allow this to happen and that the subject lands could play a key role in providing the solution for urgently needed additional lands for the 'traditional user'. Greenogue and Aerodrome is currently a key industrial hub for 'traditional users' but due to significant demand over the past 6 No. years is close to being built out (as detailed in Section 6.0 below) . We submit that the subject lands present a logical extension to the business parks to create further employment opportunities that are in urgent demand for traditional users.

6.0 THE REZONING OF THE SUBJECT LANDS FROM RURAL AMENITY 'RU' TO ENTERPRISE AND EMPLOYMENT 'EE' AS PART OF THE *SOUTH DUBLIN COUNY DEVELOPMENT PLAN 2022 – 2028* WOULD CONTRIBUTE TO ALLEVIATING THE CURRENT UNDERSUPPLY OF SUITABLE FACILITIES

This section of the report will outline the fundamental rationale for the rezoning of the subject lands from Objective 'RU' (to protect and provide for the development of agriculture) to Objective 'EE' (to provide for enterprise and employment related uses).

It has been demonstrated that an imbalance exists in the demand and supply of industrial stock and that 'Dublin South West (N7)' is an area where significant demand for enterprise and employment lands exists – particularly lands for the 'traditional user'. The rezoning of the lands subject to this report would form a natural extension of the Greenogue and Aerodrome Business Parks which in our opinion would represent the proper planning and sustainable development of the area.

6.1 There is Minimal Capacity in the Existing Greenogue and Aerodrome Business Parks to Accommodate New Industrial and Logistics Facilities

There was a large proportion of 'EE' zoned lands available for development of Industrial and Logistics facilities to the north of N7 at the time of adopting the current *South Dublin County Development Plan 2016 – 2022*, particularly to the south of the R120 Lucan to Rathcoole road. An extract from the zoning maps (Nos. 4 and 8) are provided below which illustrates the extent of lands that were available for development (light purple), existing lands in Industrial and Logistics use (dark purple) and their proximity to the lands subject to this report (outlined in red).

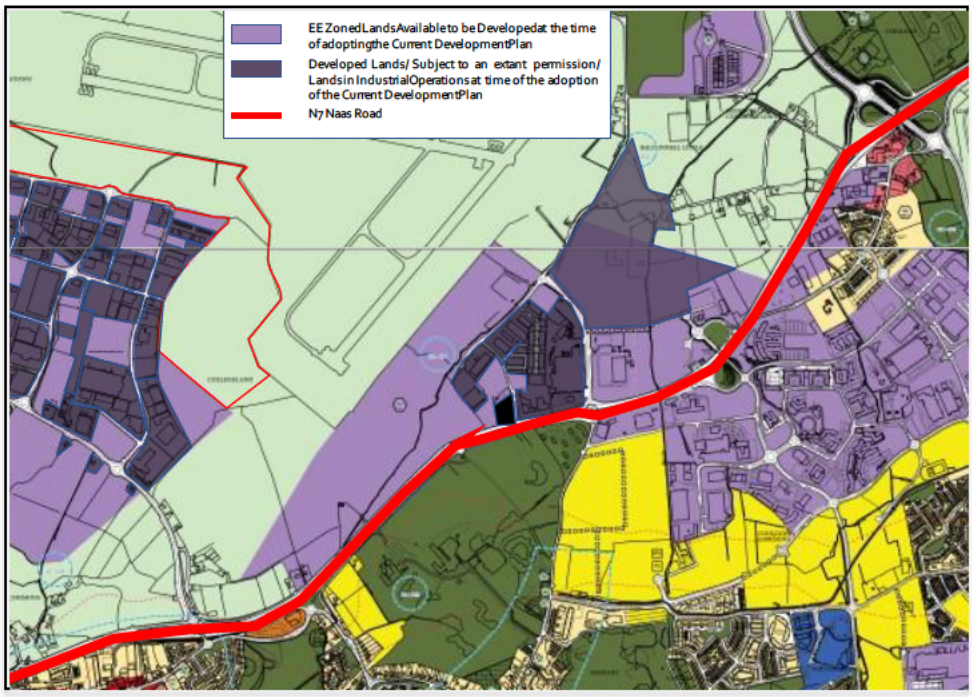


Figure 6.1: **Zoned 'EE' Lands Available at the Time of Adopting the Current Development Plan.**

Source: **Extract from the *South Dublin County Development Plan 2016-2022*, annotated by Thornton O'Connor Town Planning, 2021.**

Over the lifetime of the current Development Plan, there has been significant activity in industrial development by the 'traditional user' in the area including in particular the Greenogue and Aerodrome Business Parks. The lands subject to permitted planning applications are highlighted in orange below. Many of these permissions have been completed/ commenced with construction on-site. Planning applications pertaining to lands in Baldonnel Business Park to the east are also shown below. It is evident that there is a scarcity of remaining 'EE' zoned lands located to the north of the N7.

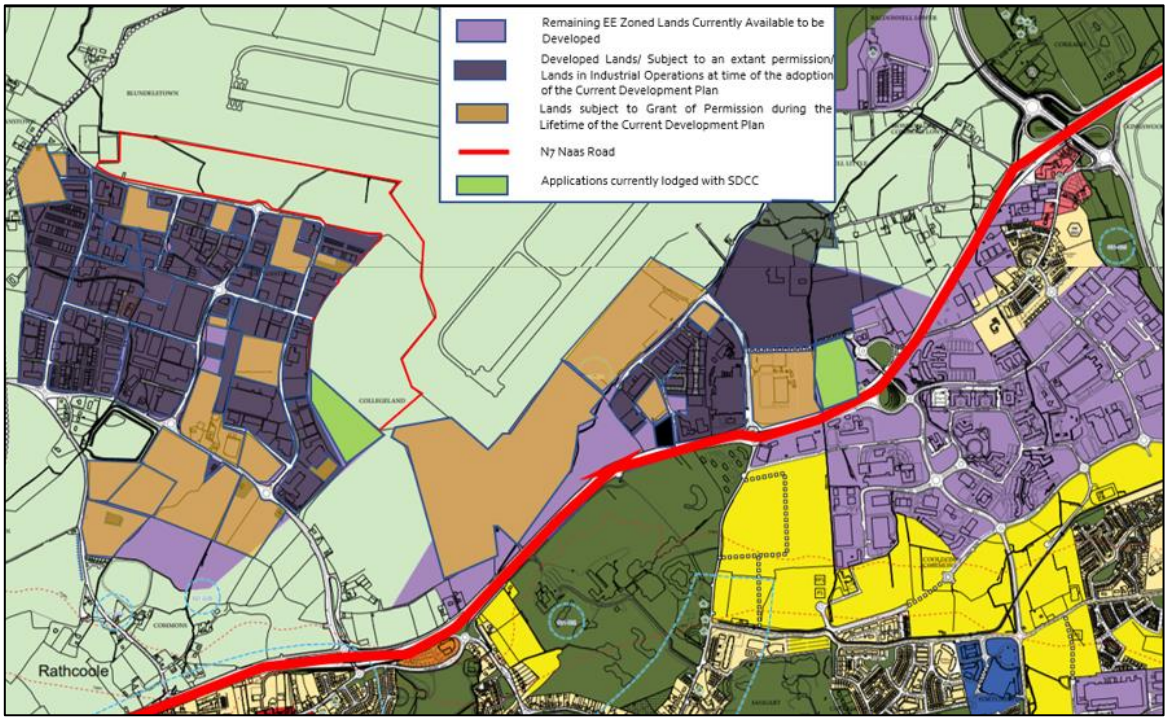


Figure 6.2: **Zoned 'EE' Lands Currently Subject to Planning Permissions or Live Applications**

Source: **Extract from the *South Dublin County Development Plan 2016-2022*, annotated by Thornton O'Connor Town Planning, 2021.**

As shown in the extract below at Figure 6.3, there are few opportunities remaining for Industrial and Logistics Development remaining, particularly plots which are capable of providing larger facilities where there are requirements for modern technology and/or marshalling yards associated with their operational use. It should also be noted that the block of 'EE' zoned lands to the south of the Greenogue and Aerodrome Business Park is still in active agricultural use and has not been offered to the market for development.

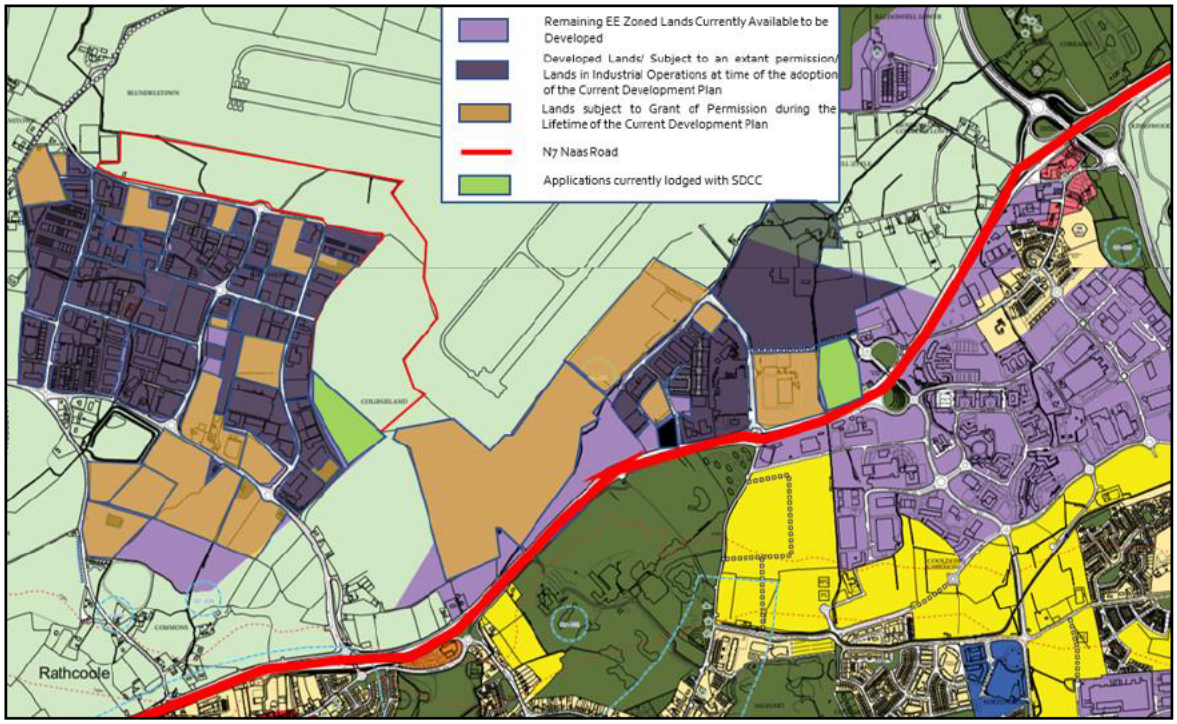


Figure 6.3: **Remaining 'EE' Zoned Lands to the North of the N7 in Light Purple**

Source: **Extract from the *South Dublin County Development Plan 2016-2022*, annotated by Thornton O'Connor Town Planning, 2021.**

Key Point: Figures 6.1 – 6.3 above clearly illustrate that a significant proportion of the lands available for development in Greenogue and Aerodrome Business Parks have received a grant of planning permission during the lifetime of the current *Development Plan* thus it is evident that there is now a shortage of 'EE' zoned lands available in this area directly to the north of the N7 Naas road.

It should also be noted that there is a reasonable period of time until the *South Dublin County Development Plan 2022 -2028* is fully adopted thus it is fair to assume that there would be more development permitted in the intervening timeframe which will further erode the availability of remaining zoned land.

The subject lands, if rezoned, would provide a natural extension to the Business Park environment providing additional capacity for continued growth of 'traditional user' type industrial facilities.

6.2 The Rezoning of The Subject Lands Would Form a Natural Extension of the Existing Greenogue and Aerodrome Business Park and Allow a Functioning Use of a Site that is 'Fragmented' by Its Position

The rezoning of the subject lands from objective 'RU' (to protect and provide for the development of agriculture) to objective 'EE' (to provide for enterprise and employment related uses) represents the logical and sequential development of these lands. An illustrative representation of the subject lands as Objective 'EE' is provided below. In our professional planning opinion, this is the rational and natural extension of the surrounding

'EE' zoned lands. The lands are somewhat 'fragmented' in their current state as they are 'sandwiched' between the Business Parks and the Aerodrome. Their rezoning will allow them to function as part of the Business Park environment yet respect the planning parameters of the location adjacent to the Aerodrome.

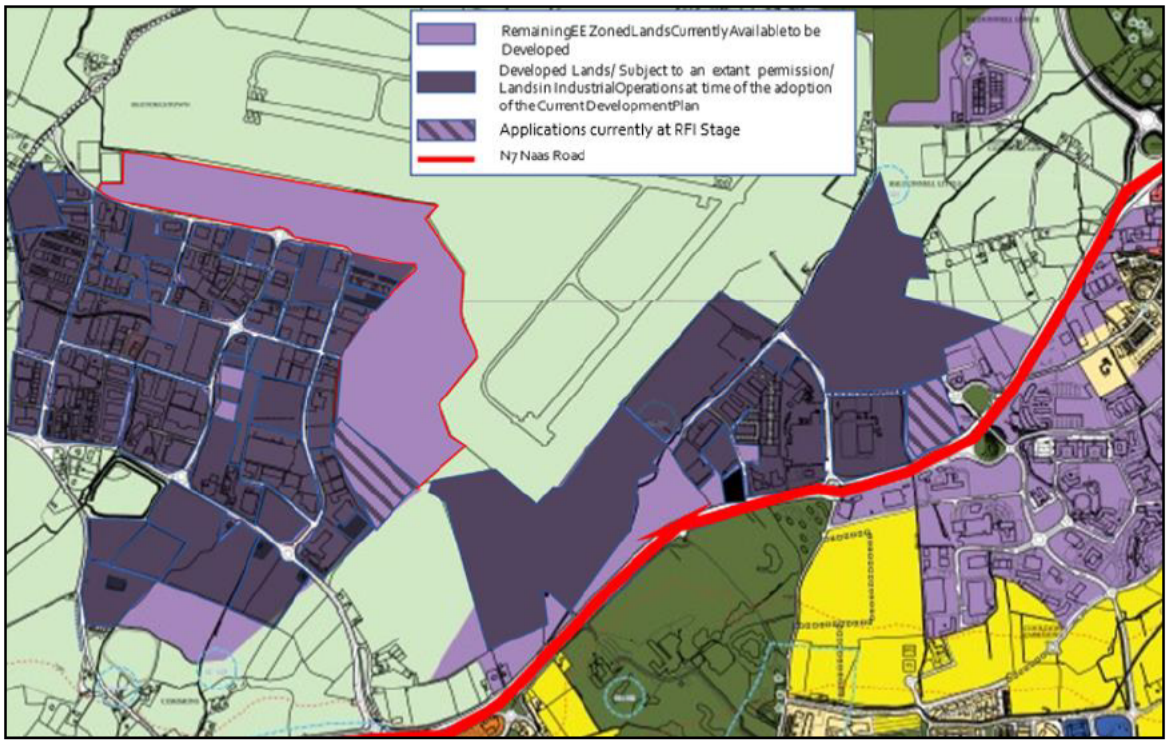


Figure 6.4: **Illustrative Representation of the Subject Lands Zoned 'EE' as Proposed**

Source: **Extract from the *South Dublin County Development Plan 2016-2022*, annotated by Thornton O'Connor Town Planning, 2021.**

Key Point: The rezoning of the subject lands from objective 'RU' (to protect and provide for the development of agriculture) to objective 'EE' (to provide for enterprise and employment related uses) represents the logical sequential development of these lands and the consolidation of the existing 'EE' zoned lands in the locale.

6.3 The Potential of the Proposed Enterprise and Employment Zoned Lands Can Come to Fruition in the Market Within a Considerable Short Period of Time having regard to the Existing Infrastructure that is Currently in Place

As outlined previously at Section 2.0 of this report, the Greenogue and Aerodrome Business Park is excellently located in close proximity to the N7 Naas Road which provides connectivity to the national road network. In addition, Dublin Airport and Dublin Port are easily accessible from this location which further emphasis the attractiveness of this location for industrial and logistics facilities which are permitted uses of Enterprise and Employment zoned lands.

Our Client is vastly experienced in the delivery of industrial and logistics development and is committed to providing high quality facilities to alleviate the current undersupply of appropriate units. In particular, our Client has delivered 325,161 sq m industrial development in the Greenogue and Aerodrome Business Park and is currently on-site (construction stage) delivering 69,678 sq m development. The existing Greenogue and Aerodrome Business Parks provide vital infrastructure which would allow immediate development of the subject lands and as such our Client is in a position to realise the potential of these lands within a relatively short period of time after the adoption of the *South Dublin County Development Plan 2022 -2028* if the lands are appropriately zoned.

Key Point: Thornton O'Connor Town Planning highlight that the rezoning of the subject lands as an extension to the existing Greenogue and Aerodrome Business Parks, in addition to our Client's experience in delivering industrial and logistic facilities presents a significant opportunity for these lands to be developed within a relatively short period of time to address the prevailing shortage and increasing demand as highlighted in Sections 4.0 and 5.0.

6.4 The Uptake in Industrial and Logistic Facilities has Been Strong in this Area of South Dublin Before the Onset of Covid 19 and Brexit as Indicated by the Extensive Planning History of the Area

Whilst the demand for Industrial and Logistic Units has been accelerated by the growth of e-commerce during the Covid-19 pandemic and the effects of Brexit in recent months, the planning history of Greenogue and Aerodrome Business Park demonstrates that the uptake in this location has been persistent over recent years. A summary map of the planning history of Greenogue and Aerodrome Business Parks is provided below for reference. The Planning History of Baldonnel Business Park is also provided for robustness.

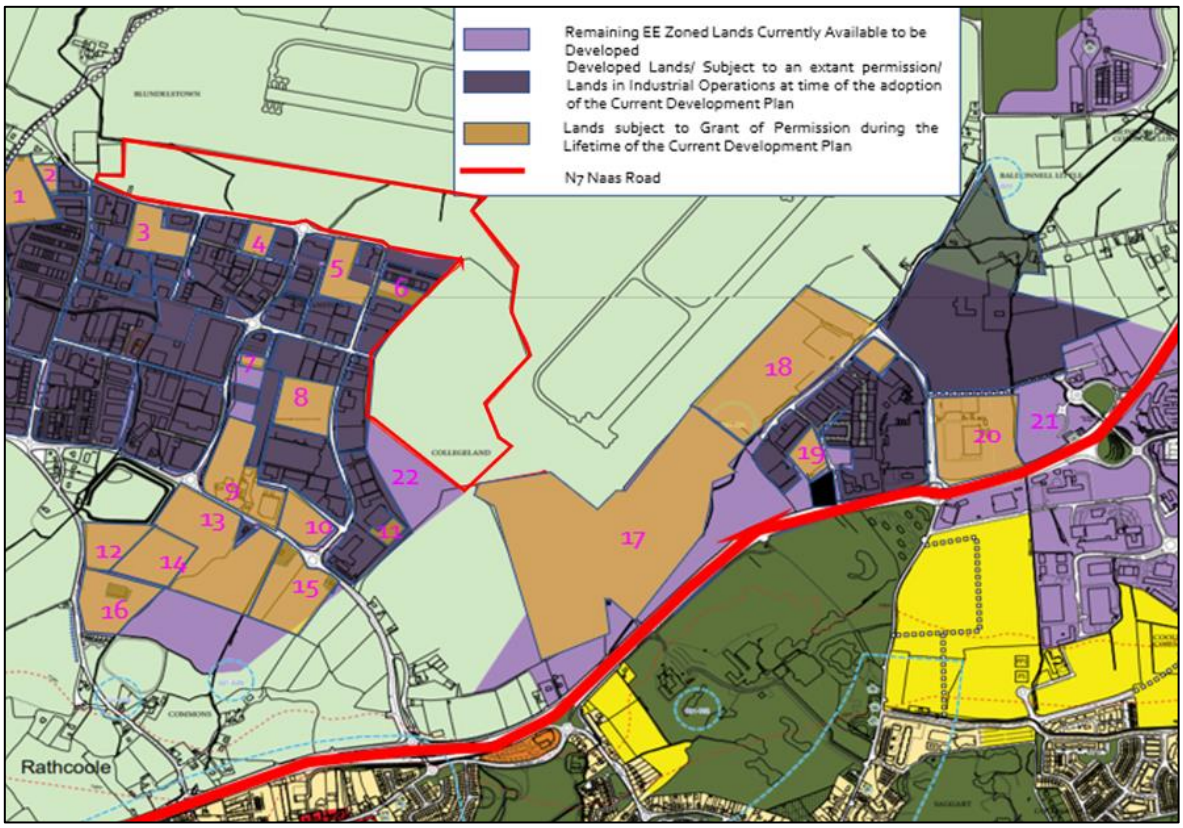


Figure 6.5: **Planning History of Currently Zoned 'EE' Lands during the Lifetime of the Current Development Plan.**

Source: **Extract from the South Dublin County Development Plan 2016 -2022, annotated by Thornton O'Connor Town Planning, 2021.**

It should be noted that sites referenced as Nos. 1,2,3,6,9 and 16 in the above map are fully constructed and operational. Sites references as Nos. 5, 10, 12, 13 and 15 are currently under construction and due to be occupied in 2021/2022. Site No. 22 and 21 are currently subject to planning applications with a *Request for Further Information* having issued in respect of both sites. A corresponding summary table is provided below for reference:

Map Ref	Reg. Ref	Decision date	Description
1	SD18A/0036 Amended by: a) SD20A/0046 b) SD21a/0058)	13.06.2018 13.08.2020 Decision Due 05.05.2021	Warehouse unit 6,461 sq m, 17.40 m high with 568 sq m integrated ancillary offices/staff facilities. a) Canopy, access doors & waste. b) Circa 900 sq m additional office space.
2	SD15a/0178	25.04.2016	Construction of a warehousing/light industrial unit totalling 753 sq m, 8.45 m high comprising: 308 sq m light industrial area, 154 sq m & 91 sq m ancillary integrated office accommodation & staff facilities respectively.
3	SD16A/0074 Amended By: a) SD16A/0330 b) SD17A/0008	27.02.2017 27.02.2017 19.04.2017	10,994 sq m warehousing unit, 19.5 m high plus 524 sq m integrated ancillary office accommodation/staff facilities on two floors with 535sq m mezzanine storage. a) Reducing the warehousing area by 905 sq m. b) Amendments associated with bottle storage.
4	SD16A/0382	02.03.2017	Extend the existing warehousing unit comprising of 1,639 sq m warehousing and 590 sq m of ancillary office and staff facilities
5	SD19A/0171 Amended By: SD20A/0270	21.07.2019 17.12.2020	2 No. (4,922 sq m and 7,032 sq m) warehouses with ancillary three storey office and staff facilities and associated development. A replacement of originally proposed 6 No. dock leveller & 2 No. level access doors with 4 No. dock levellers & 11 No. van docks to building's southern (rear) elevation; relocation of the 74 sq m internal warehouse staff facilities.
6	SD18A/0444	20.20.2019	Retention of storage yard and permission for administration building (c. 40 sq m).
7	SD17A/0195	15.11.2017	1,240 sq m warehouse and 420 sq m ancillary office/staff facilities.

8	SD19A/0264	10.10.2019	Warehouse with ancillary three storey office and staff facilities and associated development with a gross floor area of 14,649 sq m including a warehouse area (13,494 sq m), ancillary office areas (1,099 sq m) and staff facilities (56 sq m).
9	SD15A/0274	28.01.2016	Construction of a warehouse unit and ancillary offices (2.2ha. Site area) fronting Newcastle-Rathcoole Road (R120) consisting of 9,080 sq m warehouse unit (max 17m high), 54sq m of ancillary staff facilities within warehouse area, 816sq m ancillary offices/staff facilities on three floors.
10	SD19A0263	10.10.2019	Warehouse with ancillary three storey office and staff facilities and associated development. The warehouse will have a parapet height of 17 metres with a gross floor area of 11,012 sq m including a warehouse area (10,079 sq m), ancillary office areas (877 sq m) and staff facilities (56 sq m)
11	SD16A/0338	23.01.2017	Works to an incomplete part of a previously approved development (previously granted planning permission under South Dublin County Council register reference SD07A/0367, now elapsed). The subject application comprises warehousing Block B4 (11.55 m high) divided into 8 units totalling 3,484sq m including 720sq m ancillary offices/staff facilities on 2 floors and 2,764 sq m warehousing area.
12	SD19A/0065	23.04.2019	Waste metal facility including waste electrical and electronic equipment (WEEE) and will include the provision of 1 light industrial unit with ancillary office and staff facilities (3,80 sq m with a maximum height of 12.4 metres); screened outdoor storage area (970sq m).
13	SD18A/0265	04.04.2019	Provision of 2 warehouses with ancillary three storey office and staff facilities and associated development. Building A will have a maximum height of 18.3m with a gross floor area of 15,286 sq m including a warehouse area (14,267 sq m), ancillary office area (413 sq m) and staff facilities (606 sq m). Building B will have a maximum height of 17.4m with a gross floor area of 26,384 sq m including a warehouse area (23,421 sq m), ancillary office areas (1,870 sq m) and staff facilities (1,093 sq m).
14	SD19A/0407 Amended by:	24.04.2020	Provision of a warehouse unit with ancillary three storey office and staff facilities and associated development; the building will have a maximum height of 23.7 m with a gross floor area of 13,959 sq m including a warehouse area (12,369 sq m); staff facilities (548 sq m) and ancillary office area (1,042 sq m).

	SD21A/0200	09.09.2021 (at RFI stage)	Amendments principally comprising of an overall increase in the commercial floor area by 15,479sq.m from the permitted 13,959sq.m to 29,438sq.m.
15	S20A/0258	01.04.2021	Demolition of the existing dwelling (252 sq m) and associated domestic garage (49 sq m) and shed (12 sq m) located towards the north-west of the site and the construction of 3 warehouses (5,041 sq m, 6,135 sq m and 9,335 sq m with ancillary office and staff facilities and associated development.
16	SD16A0406 Amended by: a) SD18A/0044 b) SD19A/0196 c) SD20A/0266	27.01.2017 05.04.2018 14.10.2019 RFI Request 17.11.2020	Retention of dry recyclable bailing facility. Provision of a single storey office building. Change of use to a green waste recycling facility. Retain hard standing area.
17	Phase I SD19A/0370 Phase II SD20A/0215 Amended by: SD20A/0319	 29.01.2020 15.10.2020 15.03.2021	Construction of two logistics/warehouse units (Unit C & D) southwest of Mountpark Baldonnell Phase 1 and west of the older original Business Park. Unit C will comprise of a GIA 11,492 sq m (including 592 sq m of associated office space); Unit D will comprise of a GIA 7,856 sq m (including 400 sq m of associated office space). The construction a logistics/warehouse unit (Unit E) southwest of Mountpark Baldonnell Phase 1 and west of the older original Business Park, Unit E will comprise of a GIA 60,747 sq m (including 2,020 sq m of ancillary office space and 4,802 sq m of other ancillary areas. Overall increase of 639 sq m for Units C and D; provision of maintenance ramp to swale; resultant amendments to site layout, minor revisions to flood mitigation strategy, yards, elevations, signage, internal road layout, landscaping, ground works, drainage, gates, fencing, services and utilities and all associated and ancillary site development work

18	SD17A/0362 SD18A/0266	28.11.2017 17.09.2018	Amendments to the permitted scheme under South Dublin County Council Reg. Ref. SD15A/0309 (An Bord Pleanála Ref. PL06S.246392) pertaining to an increase in height by 1.95 m and elevational changes. Omission of Unit C and provision of enlarged Unit B (increasing from 10,967 sq m GFA to 18,617 sq m GFA) with a height of c. 17.65 m including mezzanine level.
19	SD17A/0188	25.01.2018	Retention permission for site clearing and placing of unmetalled surfacing of the site over 9,700 sq m to facilitate HGV parking over 3,128 sq m and retention of temporary site entrance/exit as an interim access/egress subject to permanent replacement gates
20	SD17A/0144 SD17A/0220 (ABP-301182-18)	06.07.2017 17.09.2018	3.04 hectare area of gravel surfacing, the installation of a surface water drainage network and underground Stormtech attenuation system, security lighting to the perimeter of the site. 1.512ha area of gravel surfacing to provide outdoor, uncovered vehicle storage for up to 1,878 No. vehicles.
21	SD21A/0162	13.08.2021 (at RFI stage)	Construction of 2 warehouses with ancillary office and staff facilities and associated development; Unit 1 will have a maximum height of 16.35 metres with a gross floor area of 8,156sq.m including a warehouse area (7,397sq.m), ancillary office areas (362sq.m) and staff facilities (397sq.m); Unit 2 will have a maximum height of 15.35 metres with a gross floor area of 5,990sq.m including a warehouse area (5,031sq.m), ancillary office areas (536sq.m) and staff facilities (423sq.m).
22	SD21A/0140	22.07.2021 (at RFI stage)	Construction of 1 warehouse with ancillary office and staff facilities and associated development. The warehouse will have a maximum height of 16 meters with a gross floor area of 22,966sq.m including a warehouse area (21,113sq.m), ancillary office areas (1,163sq.m) and staff facilities (690sq.m)..

From a review of the Planning History above, it is clear that South Dublin County Council have been supportive of the development of these 'EE' zoned lands to create employment opportunities for 'traditional users' in this area of South Dublin.

Key Point: The rezoning of the subject lands from objective 'RU' (to protect and provide for the development of agriculture) to objective 'EE' (to provide for enterprise and employment related uses) is essential to continue to deliver high quality facilities as part of a successful and established Greenogue and Aerodrome Business Park. As demonstrated in the Planning History set out above, the 'EE' zoned lands have been developed progressively throughout the lifetime of the current *Development Plan* and thus this submission to the *Draft Development Plan* is based on the natural reduction in lands available for development and our opinion that the subject lands represents a sequential and logical extension of the Business Parks creating a function for lands that are currently fragmented by their position 'sandwiched' between a Business Park and an Aerodrome.

We note that the *Draft Plan* recognises the need for the Greenogue and Aerodrome Business Parks to accommodate some of the businesses to be displaced from REGEN lands. The Economic Development and Employment Section of the *Draft South Dublin County Development Plan 2022-2028* states:

> *'The **Greenogue and Aerodrome Business Parks** at Rathcoole/Newcastle, Clondalkin Industrial Estate and Fonthill Industrial Estate are large industrial campuses comprising a mix of largely warehousing and manufacturing facilities, **providing potential for new jobs or any displacement of jobs from the Naas Road or Tallaght REGEN lands over the coming years**. Other smaller industrial estates throughout the County can also offer space for employment throughout the lifetime of the plan.'* [Our Emphasis].

We respectfully state that there is not enough remaining zoned land to accommodate these displaced users in addition to the many new businesses seeking warehouses with proximity to national road infrastructure. The Plan further states that:

> *'The industrial areas comprising a mix of largely warehousing and manufacturing facilities at **Greenogue, Aerodrome**, Baldonnel and Magna Business Parks **provide a significant existing and future employment landbank within this area**. Such areas are capable of providing for a significant proportion of the County's employment growth.'*

We point out that if Greenogue and Aerodrome are to provide additional employment opportunities, a greater extent of appropriately zoned lands is required.

7.0 CONCLUSION

The purpose of this Submission on the *Draft South Dublin County Development Plan 2022 – 2028*, is to demonstrate the cogent rationale for the rezoning of the subject lands from their current Objective 'RU' use (to protect and improve rural amenity and to provide for the development of agriculture) to Objective 'EE' (to provide for enterprise and employment related uses).

Thornton O'Connor Town Planning have presented research carried out by industry experts which describe the significant deficit of suitable industrial and logistics facilities currently available in the market. The research also demonstrates that there are a range of tiers of industrial user, and it is imperative that the planning system provides for all types of industrial occupiers. An analysis of current Enterprise and Employment zoned lands in the functional area of South Dublin County Council has demonstrated that there will be a shortage of available land for the 'traditional' user – such users are currently concentrated at the Greenogue and Aerodrome Business Parks. However, as demonstrated in this Submission, the Greenogue and Aerodrome Business Parks are close to being 'built out' due to considerable growth over the past 6 No. years.

It is our professional planning opinion that the lands subject to this submission would form a natural extension of the existing Greenogue and Aerodrome Business Park, allowing further appropriate expansion of the industrial agglomeration and their rezoning and ultimate development would be fully in accordance with National and Regional Planning Policy guidance.

The strategically located subject lands present an excellent opportunity for the delivery of industrial and logistics Facilities within a relatively short period of time thus supporting South Dublin as key employment node within the country.

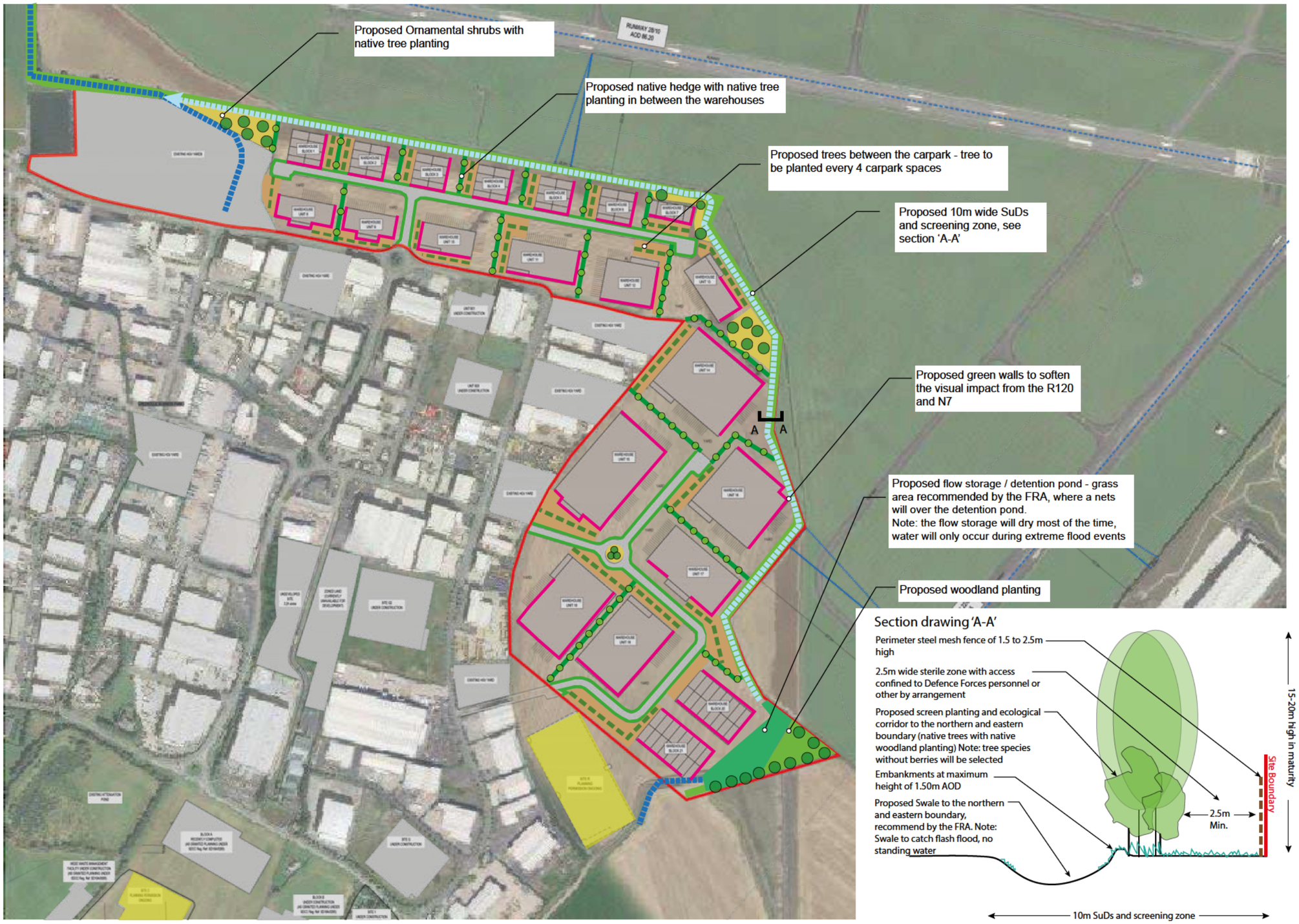
We would be very happy to meet with you to discuss this proposed rezoning and the role that the subject lands can play in the future development this area of South Dublin.

Yours Sincerely

[redacted]

Sadhbh O'Connor
Director
Thornton O'Connor Town Planning

Appendix A: Landscape Masterplan prepared by JBA Consulting Showing Potential Development Concept for Subject Lands



Section drawing 'A-A'

LEGEND

- Site boundary

Planting Strategy

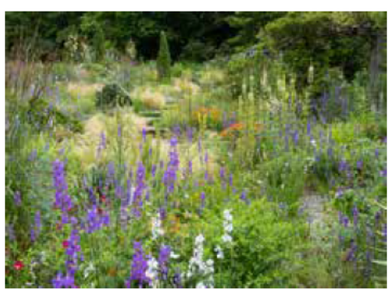
- Proposed 10m wide SuDs and screening zone
- Proposed Flow Storage / Detention pond / grass area recommended by the FRA
- Proposed native wildflower meadows to enhance biodiversity
- Proposed Warehouse Building
- Proposed Carpark area
- Active planning application
- Site ongoing (under-Construction) Building
- Existing watercourse
- Proposed green wall - climbers
- Proposed native hedge planting - in between the warehouse
- Proposed native street tree along the internal spine roads
- Proposed trees between the carpark - tree to be planted every 4 carpark spaces
- Showcasing tree planting - Large trees in SuDs and wildflower meadows
- Showcasing tree planting - Small trees in SuDs and wildflower meadows



Green walls to soften the visual impact of proposal buildings



Ornamental shrubs planting at entrance to proposal buildings



Native wildflower meadow to enhance biodiversity



Native street tree along the internal spine roads



SuDS -Swales planting in locations recommended by the FRA

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Project

Greenogue Bussiness Park CDP

Title

Landscape Strategy

for

Client

Greenogue Management No2 Ltd

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Appendix B: Aerodrome Safety Assessment' prepared by *Airport Planning and Development (APD) Ltd*.

AERODROME SAFETY ASSESSMENT

of

Proposed Development adjacent to Greenogue Business Park Dublin

on the operations of Casement Aerodrome

for

Greenogue Management No2 ClG
Unit 5, The Plaza, Greenogue Business Park, Rathcoole.

August 2021

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5. WIND SHEAR AND TURBULENCE

6. CONCLUSIONS

EXECUTIVE SUMMARY

1 The purpose of this report is to assess the potential impact of proximity to Casement Aerodrome on the development potential of lands having regard to Aviation Safety. This report considers a Masterplan that has been developed by Kavanagh Burke Consulting Engineers which is referred to throughout the report as the 'proposed development'. It is acknowledged that any proposed development at the lands is subject to the appropriate rezoning of the lands. This report demonstrates that there is no reason related to Aviation Safety that the lands cannot be developed to provide an appropriately designed employment related use that respects the requirements of the Department of Defence. Any future planning application at the lands will also be required to provide a development specific Aviation Safety Assessment that demonstrates that the scheme as proposed can be provided without affecting the use of the adjacent lands at Casement Aerodrome.

2 The proposed Units are located to the north and east of the Greenogue Business Park. And are an eastern extension of the existing industrial development. APD has assessed previous development adjacent to the Casement Aerodrome, in terms of Aerodrome Safeguarding and Safety. As with our earlier reports, this report examines the impact of the proposed development together with appropriate mitigation to ensure that all stakeholders will be able to conduct business in a safe and controlled manner.

3 Airport Planning and Development Ltd. have examined the air safety issues associated with the proposed extension of Greenogue Business Park onto lands described in the report adjacent to Baldonell Casement Airfield. APD has also considered the submission from the Department of Defence to the Draft South Dublin Development Plan. APD can confirm that these lands can be developed fully in accordance with international air safety rules and in accordance with the Department of Defence submission to the development Plan dated July 21.

4 In terms of potential impact on the airfield's Obstacle Limitation Surfaces, APD confirms that the proposed development does not affect:

- the Approach and Take-Off Climb Surfaces (APP/TOCS) of either runway.
- the proposed nearest units to either runway, namely Units 1 – 13 (Runway 28/10) and Units 17, 19, 20 and 21 (Runway 22/04) fall below the Transitional Surface, and do not penetrate the Transitional Surface, providing the proposed height permitted is satisfied, as indicated in Table 3.1a and Table 3.1b.
- any other Obstacle Limitation Surface

5 Airport Planning and Development (APD) Ltd has assessed the possible effect of the proposed Greenogue Business Park extension on specific navigational facilities at Casement Military Aerodrome, namely;

i. Doppler Very High Frequency Omni-Directional Radio Range ('BAL' DVOR);
ii. The Distance Measuring Equipment (DME) associated with this DVOR;
iii. The Automatic Direction-Finding Equipment;
iv. The Aerodrome Identification Beacon;

6 At this early Master Planning stage, the proposed location of all building units does not infringe the safeguarded area of the 'BAL' DVOR and its associated DME, or the safeguarded area of the CADF. Currently, there are already restrictions published in the IAA AIP for the DVOR for both Dublin Airport and Casement (Baldonnell) Aerodrome. therefore, the proposed development does not generate any adverse effect on specific navigational equipment

7 In conclusion, on grounds of air safety, it is APD's consideration that the proposed rezoning of the land and future extension of the Greenogue Business Park would not be a threat to the movement of aircraft.

1.0 INTRODUCTION

1.1 APD has assessed previous development adjacent to the Casement Aerodrome, in terms of Aerodrome Safeguarding and Safety. As with our earlier reports, this report examines the impact of the proposed development together with appropriate mitigation to ensure that all stakeholders will be able to conduct business in a safe and controlled manner.

1.1 Ob behalf of the client, Airport Planning & Development (APD) Ltd. examined the proposed Master Plan for the development of Units, in support of a planning application, in respect of;

- aerodrome Safeguarding,
- potential implications of development for Air Navigation Equipment and, a

2.0 SITE LOCATION AND GENERAL LAYOUT

2.1 The proposed Units are located to the north and east of the Greenogue Business Park. And are an eastern extension of the existing industrial development.

2.2 The site lies to the West of the operational Casement/Baldonnell Aerodrome (IATA: N/A, ICAO: EIME). The Aerodrome is the headquarters and the sole airfield of the Irish Air Corps. As the only Military Aerodrome, it facilitates the vast majority of the Irish Air Corps training flights along with operational flights as part of the Irish military commitments. The Aerodrome has 4 available runways utilising 2 paved surfaces. The dimensions and directions are detailed below. Both Runway 22/04 and Runway 28/10 are the relevant runways to consider in assessing implications on the operation of the aerodrome.

	Runways		
Direction	Physical Dimensions	Type of Surface	Strength PCN
22/04	4800 x 150 feet 1463 x 46 meters	ASPHALT	46/F/B/X/U
28/10	6001 x 150 feet 1829 x 46 meters	ASPHALT	52/F/B/X/U

2.3 Figure 2.1 below, shows the Site location in relation to Casement Aerodrome and Figure 2.2 shows the proposed Master Plan for the proposed development.

Figure 2.1 Site Plan



Figure 2.2 Proposed Master Plan



WAREHOUSE	DISTANCE FROM RUNWAY TO NEAREST HEIGHT OF BUILDING	MAX HEIGHT PERMITTED	PROPOSED HEIGHT
BLOCK 1 FFL=88.00	252.90 m	10.80 m	10.00 m
BLOCK 2 FFL=88.00	252.50 m	10.80 m	10.00 m
BLOCK 3 FFL=89.00	252.10 m	10.80 m	10.00 m
BLOCK 4 FFL=89.00	251.80 m	10.80 m	10.00 m
BLOCK 5 FFL=89.50	251.40 m	10.80 m	10.00 m
BLOCK 6 FFL=90.00	251.00 m	10.80 m	10.00 m
BLOCK 7 FFL=91.00	255.90 m	10.80 m	10.00 m
UNIT 8 FFL=89.00	369.90 m	27.40 m	14.00 m
UNIT 9 FFL=89.00	368.50 m	27.40 m	14.00 m
UNIT 10 FFL=90.00	369.10 m	27.40 m	14.00 m
UNIT 11 FFL=90.00	368.40 m	27.40 m	14.00 m
UNIT 12 FFL=90.00	370.20 m	27.40 m	14.00 m
UNIT 13 FFL=92.00	328.40 m	25.50 m	14.00 m
UNIT 14 FFL=93.00	548.40 m	38.00 m	13.50 m
UNIT 15 FFL=92.00	604.30 m	38.00 m	17.50 m
UNIT 16 FFL=93.00	383.60 m	38.00 m	14.00 m
UNIT 17 FFL=94.00	358.40 m	32.00 m	14.00 m
UNIT 18 FFL=93.00	514.80 m	38.00 m	17.50 m
UNIT 19 FFL=93.00	391.30 m	37.00 m	17.50 m
BLOCK 20 FFL=95.00	194.30 m	8.50 m	8.00 m
BLOCK 21 FFL=95.00	204.50 m	9.90 m	9.50 m

3.0 AERODROME SAFEGUARDING CONSIDERATIONS

3.1 The International Civil Aviation Organisation (ICAO) develops the principles and techniques of International Air Navigation and fosters the planning and development of international air transport. Through its many Annexes, ICAO provides nation state aviation regulators with advice on the safe operation and movement of aircraft. In respect of the safe operation and movement of aircraft at airports, aerodromes and airfields, the relevant Annex (Annex 14) provides guidance on the safeguarding of aerodromes. It is expected that nation state Regulators (the Civil Aviation Authority) will enforce the principles of the design and the safeguarding of aerodromes. Most Nation States worldwide, adopt ICAO guidance. The Irish Aviation Authority (IAA) adopts Annex 14 in respect of civil aerodromes, as does the Department of Defence for military establishments; specifically, Casement Aerodrome.

3.2 Accordingly aerodrome owners/operators identify Obstacle Limitation Surfaces (OLS) which define the limits to which objects, such as buildings, boundary fences/walls and vegetation may project into the airspace. The relevant surfaces at Casement Aerodrome are Approach Surface (APPS) and Take-Off Climb Surface (TOCS), Transitional Surface (TS), and Inner Horizontal Surface (HIS).

Assessment of Proposed Development on Obstacle Limitation Surfaces

3.3 In respect of the proposed development, the critical surfaces to consider in terms of aerodrome safeguarding are the Transitional Surface of Runway 28/10, in respect of Units 1–7, and the Transitional Surface of Runway 22/04 Approach (APP), in respect of Units 20 & 21. Consideration has been given to the Take-Off Climb (TOC) and Approach (APP) Surfaces, which slightly impacts on the southern point of the site area, and illustrated at Figure 3.1. The Master Plan for the proposed development is shown at Figure 3.2

Approach & Take-Off Climb Surfaces

3.4 None of the proposed Units are located below the APP/TOC Surfaces, although some of the required flood management works may lie below the APP/TOC Surfaces, but do not penetrate the Surfaces. The proposed development does not affect the APP/TOCS.

3.5 In the interest of ensuring the safety of air movements, however, both aerodrome operators and adjacent dvelopers should adopt measures to minimise potential large bird activity. The proposed development makes provision for areas of surface water retention in times of heavy rainfall and flood mitigation in Swales. Also, any proposed vegetation on the boundary of the proposed development should respect the height limitation imposed by the APP/TOC Surfaces. Having regard to the need to minimise the potential for bird strike on aircraft movements, design mitigation measures are considered at paragraph 3.15-3.16.

Transitional Surfaces

3.6 As noted at parapraph 3.8, the proposed development area falls under the Transitional Surfaces of Runeays 22/04 and 28/10 (see Figure 3.2 and 3.3). The impact of the nearest Units to Runway 22/04 (Units 17, 19, 20 & 21) and the impact of the nearest unit to Runway 28/10 (Units 1-7) has been assessed, and the results are shown at Table 3.1. APD worked with the Architect to demonstrate how the development would not penetrate the Transitional Surfaces . This is based on the finished floor levels and the height of the individual Units parapets/roof ridges to ensure that the buildings do not represent an Obstacle Penetration of the respective Transitional Surface. Accoprdingle, the maxmimum permitted height of Units should not exceed 8.00m (Unit 20), and Blocks 1-7 should not exceed 10.00m.

3.7 The proposed development of Units 1 – 13, 17, 19, 20 and 21 fall below the Transitional Surface, and do not penetrate the Transitional Surface, providing the maximum height permitted is satisfied, as indicated in Table 3.1a and Table 3.1b.

Table 3.1a: RWY 22/04 Transitional Surface –Permitted Development Height

RUNWAY 22/04	**Block 21**	**Block 20**	**Unit 19**	**Unit 17**	**Unit 16**
Finished Floor Level	+95m	+95m	+93m	+94m	+93m
Runway 22/04 Level	+97.15m	+97.15	+97.15m	+97.15	+97.15
At Location Distance from Extended Runway Centreline	204.5m	194.3m	391.3m	358.4m	383.6m
Height of Transitional Surface at Location	**104.9m**	**103.5m**	**131.6m**	**126.9m**	**130.5m**
Maximum building height permitted Height of proposed Unit/s	9.9.m 9.5m	8.5m 8.0m	37m 17.5m	32m 16.0m	36m 14.0m
Clearance available	0.4m	0.5m	19.5m	16.0m	22.0m
Penetration	**NO**	**NO**	**NO**	**NO**	**NO**

Table 3.1b: RWY 28/10Transitional Surface –Permitted Development Height

RUNWAY 28/10	**Units 8-12**	**Block 1-7**	**Unit 13**	
Finished Floor Level (assume AOD + 1.0m)	89-90m	88-90m	92m	
Runway 22/04 Level	86.2m	86.2m	86.2m	
At Location Minimum Distance from Runway Centreline to nearest block	368.4m	251.9m	328.4m	
Height of Transitional Surface at Location	**117.4m**	**100.8m**	**111.7m**	
Maximum building height permitted Height of proposed Unit/s	27.4 14m	10.8m 10.0m	25.5m 14.0	
Clearance available	**13.4m**	**0.8m**	11.5m	
Penetration	**NO**	**NO**	**NO**	

The Inner Horizontal Surface (IHS)

3.8 The transitional surface is a complex surface sloping up to the Inner Horizontal Surface (IHS) from the side of the runway strip and from part of the side of the approach surface, until it intersects with the Inner Horizontal Surface. The IHS is contained in a horizontal plane located 45 m above the elevation of the lowest runway.

3.9 The development of Units 14, 15, and 18 should not exceed a maximum height of 30m (Table 3.1c). The Inner Horizontal Surface of Runway 28/10 is lower than the IHS for Runway 22/04, and is therefore the applicable Surface for determining the maximum height of buildings.

Table 3.1c: Inner Horizontal Surface –Permitted Development Height

RUNWAY 28/10	**Unit 14**	**Unit 15**	**Unit 18**
Finished Floor Level (assume AOD + 1.0m)	+93m	+92m	+93m
Runway 22/04 Level	+86.2m	+86.2m	+86.2m
At Location			
Distance from Extended Runway Centreline	548.4m	604.3m	514.8m
Height of Inner Horizontal Surface at Location	**131.2m**	**131.2m**	**131.2m**
Maximum building height permitted	38m	38m	38m
Height of proposed Unit/s	13.5m	17.5m	17.5m
Clearance available	**24.5m**	**20.5m**	**20.5m**
Penetration	**NO**	**NO**	**NO**

.

The Conical Surface

3.10 A conical surface is a surface sloping upwards and outwards from the periphery of the Inner Horizontal Surface. It represents the level above which consideration needs to be given to the control of new obstructions and the removal or marking of existing obstructions so as to ensure safe visual manoeuvring in the vicinity of an aerodrome. A conical surface is established for every aerodrome. The slope of the conical surface measured in the vertical plane above the horizontal is 5% (1:20). The outer limits of the conical surface are contained in a horizontal plane located 105 m above the inner horizontal surface. The development does not impact on the Conical Horizontal Surface.

The Outer Horizontal Surface (OHS)

3.11 An Outer Horizontal Surface is a specified portion of a horizontal plane around an aerodrome beyond the limits of the conical surface. It represents the level above which consideration needs to be given to the control of new obstacles in order to facilitate practicable and efficient instrument approach procedures, and together with the conical and inner horizontal surfaces to ensure safe visual manoeuvring in the vicinity of an aerodrome. An OHS is established for every aerodrome where the main runway is 1100 m or more in length. The OHS extends from the periphery of the conical surface to a minimum radius of 15,000 m from the aerodrome reference point. The development has no impact on the Outer Horizontal Surface.

Obstacle Free Zone

3.12 An OFZ is intended to protect aeroplanes from fixed and mobile obstacles during Category I, II or III operations when approaches are continued below decision height and during any subsequent missed approach or baulked landing with all engines operating normally. It is not intended to supplant the requirement of other more demanding surfaces or areas. In all cases, it should be noted that the Obstacle Free Zone (OFZ) is not a constraint on the development of Units 1-21.

3.13 It should be noted that no allowance has been made for any additional fixtures located on the roofs such as lighting, aerials, telecom equipment etc in order to avoid any minimal penetration of the Transitional Surface. It should be noted, also, that any low intensity red or yellow aviation lights attached to each Unit should be the subject of consultation with IAC.

3.14 It is noted that IAC may consider the potential upgrade of the Instrument Landing System at some date in the future, although the likely Category has not been designated. As stated earlier in this Report, the assessment undertaken by APD has assumed ILS CAT I facility. The Transitional Surface Assessment does not change, with any higher grade of ILS Category.

Wildife Habitat - Swale Design Mitigation

3.15 The proposed large scale development will need to make make provision for areas of surface water retention in times of heavy rainfall and flood mitigation. The Irish Air Corps, may suggest a number of measures to reduce the possibility of bird strike, such as

- Any proposal for substantial areas of the Swales should be covered with netting and a perimeter fence.
- Within such areas there should be:
  - Perimeter Steel mesh fence of 1.5 to 2.4 m high
  - Polypropylene UV stabilised netting mesh of size 75mm x 75mm which is 1.5mm thick held in place with steel tension wires fixed to steel fence posts. This will prevent medium to large birds such as geese, ducks, crows, swans etc. accessing any standing water in the netted areas.
- Grass cutting and netting maintenance should be managed by the property management company.
- Any proposed swales should be incorporated within embankments at a maximum height of 1.50m AOD to ensure that such embankments do not penetrate Obstacle Limitaion Surfaces,, in particular the Approach and Take-off Climb Surfaces of Runway 22/04.

3.16 It is important that the Construction Management Plan for the development of the Units incorporates requirements for mitigating against the potential for attracting birds, and other wildlife, during the construction phase. This must include arrangements for maintaining site tidiness/cleanliness, bird scaring etc., and measures to minimise the movement of wind-blown material building materials and dust.

4.0 IMPLICATIONS FOR AIR NAVIGATION EQUIPMENT

Project

4.1 As required, Airport Planning and Development (APD) Ltd has assessed the possible effect of the proposed Greenogue Business Park extension on specific navigational facilities at Casement Military Aerodrome, namely;

5 Doppler Very High Frequency Omni-Directional Radio Range ('BAL' DVOR);
6 The Distance Measuring Equipment (DME) associated with this DVOR;
7 The Automatic Direction-Finding Equipment;
8 The Aerodrome Identification Beacon;

4.2 It should be noted that this section of the report has been written without a site visit to the above aerodrome. However, reference has been made to the latest published data concerning the aerodrome as detailed in the Irish Aviation Authority's Aeronautical Information Publication (AIP).

4.3 It is also important to note that this report uses criteria that relate to the International Civil Aviation Organisation (ICAO) taking account of the fact that the Irish Aviation Authority (IAA) operates to international safety standards. However, there is no access to any variations in these standards set by the military aviation authorities in Ireland as such information is restricted.

4.4 It should be noted that ICAO exists to regulate purely civilian aspects of international aviation and promulgates Standards and Recommended Practices (SARPS) which member states agree to comply with whenever possible. Although the Irish Department of Defence has no direct link with ICAO, in common with similar Defence Organisations in other states, it complies with ICAO SARPS on the proviso that they do not conflict with military requirements.

Methodology

4.5 The scope of works has involved desk-top study, analysis of relevant plans and drawings, photographic data annotated with magnetic bearings, distances and elevations, data extracted from the IAA's AIP, and study of relevant emails together with associated plans of the proposed building developments at the aerodrome.

4.6 Further, documentation and legislation associated with ICAO & Euro-control has been studied.

4.7 It should be noted that APD Ltd has previous experience of working with the IAA on other projects in Ireland including the Air Traffic Control (ATC) organisation at Dublin Airport and projects to the south east of Casement Military Aerodrome and a planning project at Kerry Airport. In addition, the author of this Section of the report has been associated with APD Ltd for eighteen years and has over thirty-five years' experience in Air Traffic Control (ATC) and airport operations at a major regional airport in the UK.

Airspace at Casement (Baldonnell) Military Aerodrome

4.8 Casement Military Aerodrome is located just outside the Dublin Control Zone as it operates within military designated airspace. This airspace is designated EIR15 which covers a rectangular area from ground level up to 3,000ft with a further allocated sector of airspace (EIR16) extending in sections to the west and south west of EIR15. There are also two associated Military Training Areas (Areas 3 and 4) from ground level up to FL450 (approximately 4,500ft above mean sea level).

4.9 Aeronautical data on the aerodrome is published in the IAA's AIP for the benefit of pilots and indicates that the aerodrome has a DVOR navigational facility (identification 'BAL') with associated Distance Measuring Equipment (DME) co-located on the aerodrome. In addition, there is a surveillance radar system overlaid with Secondary Surveillance Radar (SSR) data, an Instrument Landing System (ILS) on runway 10, and other associated ATC systems and equipment.

4.10 Military aircraft operations associated with the aerodrome are segregated from Dublin Airport's controlled airspace and their associated civil aircraft operations. This is achieved through separate route structures as well as ATC radar systems operated by Air Traffic Controllers.

Regulatory Aspects – Irish Aviation Authority

4.11 In order to provide a background to the potential impact of the proposed development, it is considered important to understand the regulatory aspects under which the IAA functions. The IAA is a commercial semi-state organisation which has the following main functions:

- Provision of Air Traffic Management
- Related services in Irish controlled airspace
- Safety regulation of the civil aviation industry in Ireland.

4.12 The IAA operates to international safety standards set by the organisations detailed below and provides air traffic management services in the 451,000 square kilometres of airspace controlled by the ATC authorities in Ireland. This airspace experiences a high number of air traffic movements between Europe and North America as well as air traffic movements to/from the main airports at Dublin, Shannon and Cork:

- ICAO
- European Joint Aviation Authorities (JAA)
- Euro-control
- European Civil Aviation Conference (ECAC)
- European Aviation Safety Agency (EASA)

4.13 It is a legislative requirement that every navigational facility requires a technical area to be safeguarded against the possibility that structures erected within that area cause interference to signals radiated by that facility.

4.14 For these reasons, European Union regulations require Air Navigation Service Providers (ANSPs) to implement a Safety Management System (SMS) to include risk assessments and mitigation where required with reference to all changes to ATC Service systems.

4.15 With regard to the technical safeguarding of navigational facilities and landing aids, this normally involves two processes with one covering physical protection and the other radio spectrum protection. The safeguarding process seeks to prevent any development near a radio transmitter or receiver site which may degrade a radio signal because a combination of object size, material, proximity and radio wavelength can make a development an efficient reflector or diffractor of such signals thereby potentially affecting flight safety.

4.16 Where navigational equipment is used to provide safety related functions, there are three sources from which assurance evidence can be provided:

- System lifecycle
- Hardware lifecycle
- Software lifecycle

4.17 The Irish Aviation Authority (IAA) requires any developer to provide such assurance evidence on the basis that a proposal will **not** have the potential to cause interference or adverse effects to any Communication, Navigation or Surveillance (CNS) facilities.

4.18 The IAA promotes and regulates the safety of aviation in Ireland and states that *"it is committed to developing and implementing effective strategies, regulatory frameworks and processes to ensure that aviation activities under its oversight achieve the highest practical levels of safety*". Safety is the overriding priority that governs current ATC operations and future activities with their Safety Regulatory Division (SRD) having four separate divisions:

- Regulatory Performance and Personnel Licensing
- Airworthiness
- Flight Operations
- Aeronautical Services

4.19 There is also associated Euro-control and EASA documentation applicable connected with the technical safeguarding of navigational facilities covering the need to manage Building Restricted Areas (BRAs).

Technical Safeguarding – Navigational Facilities

4.20 Euro-control and ICAO have established harmonised protection zones for navigational facilities and require a BRA to be established because developments within such an area have the potential to cause unacceptable interference. Because of this, all buildings or developments within such restricted areas should be assessed using the practical standard procedures specified to allow EU member states to assess planning applications using a known process.

4.21 Bearing in mind that the IAA operates in compliance with ICAO Standards and Recommended Practices (SARPS) and Euro-control requirements, this technical safeguarding study has been based primarily on this international documentation.

4.22 The associated Euro-control documentation applicable with reference to the technical safeguarding of navigational facilities also covers the need to manage BRAs.

4.23 The relevant procedures for Technical Safeguarding are normally based on a two-step process:

Step 1 – This involves a detailed review to assess if a development is acceptable as each type of navigational facility must have its own safeguarded surfaces using a shape of a specific form with the dimensions of each dependent upon individual facility types. For omni-directional navigational facilities such as a DVOR, the assessment utilises a designated frame of defined dimensions whereas directional facilities such as an Instrument Landing System (ILS) use an adapted shape. If a proposed development falls within the frame, then further analysis has to be reviewed or outright rejection of the development made.

Step 2 – If it is necessary to undertake such further analysis, then it is recommended that aerodrome authorities obtain specific recommendations or data from the supplier of their navigational equipment. Alternatively, a further option is to seek guidance from the appropriate regulatory authorities. In Ireland, the IAA has a specific department where detailed analysis can be undertaken involving all aspects of the development including the possible effects of radio signals in space.

4.24 As it is important to review the technical safeguarding aspects associated with a number of proposed Units in the Greenogue development in relation to the navigational facilities identified at paragraph 4.1, a study has been undertaken based on the following table. This uses the criteria specified under each of the main navigational facilities to identify any Building which falls within the specified area. The results of this exercise, covering all of the possible location of buildings on the Master Plan, have been considered.

Doppler VHF Omni-Directional Radio Range ('BAL' DVOR)

4.25 Aircraft equipped with a DVOR receiver can receive automatically the magnetic bearing of the aircraft from the DVOR selected and a pilot can lock on to and maintain any radial with this normally undertaken through operation of the autopilot. There is no restriction on the number of aircraft able to use a single DVOR simultaneously but it is emphasised that such equipment is limited to line-of-sight which may be affected at lower altitudes by terrain obstacles.

4.26 As it is necessary to examine the potential effects of the proposed building developments on the 'BAL' DVOR, the first task is to review the designated technical area or BRA. The designated frame for assessment of a DVOR covers specified dimensions with the first being a circle of 230 metres radius at ground level from the site centre with a slope at 1:50 (2%) out to 900metres radially from that site centre.

4.27 If an examination is undertaken of the proposed building developments listed in the above table, the calculations indicate that **the location of all buildings lie below the relevant technical safeguarding slope.** The following table is a sample of those buildings closest to the relevant navigational facility listed below.

Building No.	Building Height (m)	Distance from DVOR (m)	Distance from CADF (m)
7	10.0	789	583
13	14.0	744	569
14	13.5	679	531
16	14.0	721	629
17	14.0	819	743
20	8.0	1010	973

At future detailed planning stage, it will be important to review final building details to ensure that there is no adverse impact.

4.28 It is noted that high terrain does already have a limiting effect on some DVOR radials at varying altitudes, **as there has been a restriction published in the IAA's AIP covering both Dublin Airport and Casement (Baldonnell) Aerodrome in respect of this DVOR. This is due to rising terrain to the south of the facility outside the aerodrome boundary.** The AIP states that **"BAL DVOR is unusable in sector Radial 150 degrees Magnetic to Radial 170 degrees Magnetic below 5,500ft above mean sea level outside 20 nautical miles due to terrain".**

Distance Measuring Equipment (DME)

4.29 It is worth noting that the IAA AIP for Casement (Baldonnell) Aerodrome also states that *"due to rising terrain to the south of the facility, aircrew may observe 'BAL' DME unlocks in sectors Radial 150 degrees Magnetic to Radial 175 degrees Magnetic from the DVOR and Radial 195 degrees Magnetic to Radial 205 degrees Magnetic from the DVOR below 4,500ft above mean sea level outside 20 nautical miles.* It is emphasised that these aspects relate only to terrain outside the aerodrome boundary.

Casement Automatic Direction-Finding Equipment (CADF)

4.30 Modern digital automated direction-finding equipment is usually sited on an aerodrome and provides ATC at that aerodrome with data on any aircraft transmission covering the relative bearing to or from that particular equipment. The data is normally presented to ATC as a digital read-out as well as a radial line on an associated display enabling a pilot to be notified immediately (if necessary) of the bearing information. It enables the aircraft bearing to be determined more accurately for the pilot and can normally be selected by ATC on Very High Frequency (VHF) or Ultra High Frequency (UHF) channels the latter of which being operated more often by military organisations.

4.31 This type of equipment has generally been in operation for many years with refinements introduced from to time as it is normally used by Air Traffic Controllers in conjunction with modern radar systems. The technical safeguarding of this equipment comprises a circle at ground level of radius 120 metres centred on the navigational facility with a 2% (1:50) slope from ground level at the facility out to a range of 450 metres radially. The location of this equipment and its distance from the proposed developments has been checked against the safeguarded slopes to identify if there is any infringement. As all the Building Numbers identified in the table at paragraph 4.24 are located beyond the specified technical safeguarding criteria, there should be no adverse effect on the operation of this equipment.

Aerodrome Identification Beacon

4.32 An Aerodrome Identification Beacon is a light beacon installed at an aerodrome to indicate its location to pilots at night or by day when weather conditions require the use of aerodrome lighting. As a general principle, an Aerodrome Identification Beacon is required at an aerodrome where visual approaches are carried out at night or where night flying training is undertaken. There are no safeguarding requirements laid down for an Aerodrome Identification Beacon other than the fact that any such lighting should not infringe any aerodrome Obstacle Limitation Surface (OLS). This aspect is fully met at the aerodrome.

Radio Site Clearance Process

4.33 Radio signals can also be degraded by radio interference from other radio sites such as a local radio station. The radio site clearance process associated with safeguarding against third party radio site development is normally undertaken by a government agency. In the case of the established aerodrome frequencies and navigational facilities at Casement Military Aerodrome, this process will have already been completed in the past.

Recommendations

4.34 This report has identified the fact that the siting of all the proposed Units does not infringe the safeguarded area of the 'BAL' DVOR and its associated DME. Consideration has been undertaken, also, with respect to the safeguarded area of the CADF and it has been established that there is no adverse effect on the specific navigational equipment.

4.35 At future detailed planning stage, the final design of buildings should ensure any potential infringement of navigational equipment is avoided.

5.0 LOW LEVEL WIND SHEAR AND TURBULENCE

Overview

5.1 Low Level Wind-Shear and Turbulence that occurs at an aerodrome generates a safety risk to aircraft during certain phases of flight and particularly during the latter stages of final approach, landing and take-off. The Dublin Institute of Technology (A. O'Connor and D. Kearney) states that "*wind-shear presents a formidable force that, coupled with a micro-burst, can overpower any aircraft".* For information, a micro-burst is produced by a thunderstorm or very heavy rain shower and is an intense downdraught of sinking (wet or dry) air that results in a violent outrush near ground level which can generate significant damage to an aircraft at these critical stages of flight.

Relevant Aviation Documentation

5.2 There are a number of documents and reports available covering the subject of the effects of Low-Level Wind-Shear and Turbulence at an aerodrome amongst which are the following:

- National Aerospace Laboratory of the Netherlands report NLR-CR-2006-261;
- ICAO Manual on Low Level Wind-Shear and Turbulence (Document 9817);
- ICAO Annex 3 – Meteorological Services for International Navigation;
- ICAO Document 8896 – Manual of International Meteorological Practice;
- Low Level Wind-Shear – Sky Library;
- National Airports Safeguarding Framework – Management of Risk of Building Generated Wind-Shear and Turbulence at Airports;
- Severe Wind Shear at Hong Kong Airport – 2017 Report;
- Low Level Wind-Shear and Turbulence – Institute of Technology, Dublin

5.3 The occurrences of wind shear / turbulence are normally associated with sudden changes in wind direction and speed caused by buildings and other similar structures outside the runway strip (even when in conformity with the required Obstacle Limitation Surfaces) **when the wind is from the particular sector where the buildings/structures are located**. It is also important to understand the two potential effects of surface wind at low levels particularly as all low-level turbulence involves wind-shear to a degree but large-scale wind-shear does not necessarily involve turbulence. In order to clarify this aspect, it is worth noting the specific definitions associated with these two phenomena:

5.4 **Wind-Shear**: Low Level Wind-Shear is defined as a sudden change of wind velocity and/or direction in either the vertical or horizontal plane which can present a severe risk to flight safety when aircraft are departing from or landing at an aerodrome. It is commonly associated with passing weather frontal systems, thunderstorms and/or temperature inversions with strong upper-level winds. It can involve directional wind changes of one hundred and eighty degrees or more and speed changes of fifty knots or more. There are two variations of Wind-Shear:

Vertical Wind-Shear: This is defined as a change of horizontal wind direction and/or speed with height, as would be determined by means of two or more anemometers mounted at different heights on a single mast.

Horizontal Wind Shear: This is defined as a change of horizontal wind direction and/or speed with horizontal distance as would be determined by two or more anemometers mounted at the same height but at specified distances parallel to a runway.

5.5 **Low Level Turbulence**: This form of turbulence normally occurs when airflow is restricted by surface friction or a physical obstruction and occurs because friction slows the wind in the lowest layers causing the air to turn over in turbulent eddies which can cause fluctuations in winds and vertical velocities. It can be associated with a frontal system, with thunderstorms or convective clouds (such as towering Cumulus or Cumulonimbus), with micro-bursts or with the surrounding terrain or buildings.

5.6 Issues involving building generated wind-shear/turbulence become safety-critical when a significant obstacle, such as a large building(s) is/are located in the path of a crosswind to an operational runway or its final approach/initial departure track. The wind flow will be diverted around and over the building(s) causing the crosswind direction and speed to vary at different points on the runway or approach/departure track and can even cause a sudden change of direction from a headwind to a tailwind.

5.7 Meteorological documentation indicates that wind-shear is always present in the atmosphere to a degree and is especially noticeable below 600m above ground level (approximately 2000ft) where frictional drag on the air closest to the earth's surface causes changes in both direction and wind speed with height. This layer is normally referred to as the "friction layer" which can be further sub-divided as follows:

- Surface boundary layer from the earth's surface up to around 100 metres above it in which air motion is controlled predominantly by friction with the earth's surface;

- The "Ekeman Layer" from around 100 metres up to at least 600 metres in which the effect of friction, while still significant, diminishes progressively with increasing height and other factors such as the Coriolis force and horizontal pressure gradient force, become increasingly important.

Recommendations

5.8 Given our appreciation of the possible impact of wind shear and turbulence on aircraft movements, and having regard to the scale of proposed development and existing/committed buildings about the two runways at Casement Military Aerodrome, it was recommended that a specific report should be commissioned by the client. This can be reviewed by APD Ltd from an operational Air Traffic Control perspective as necessary.

6.0 CONCLUSIONS

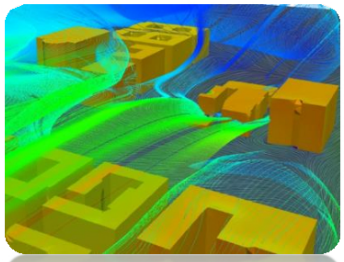
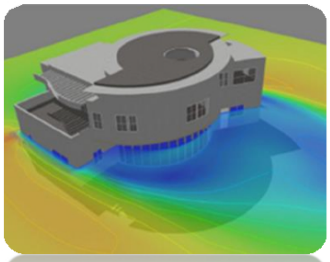
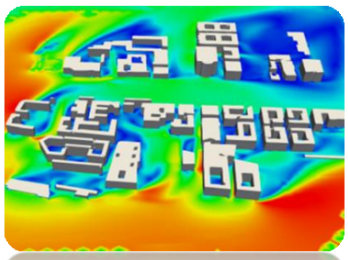
6.1 During the construction phase of these building developments, it is essential that procedures are in place concerning the operation of cranes on site (which will exceed the finished elevations of the buildings). These will need to be carefully controlled in order to maintain safe aerodrome operations with aerodrome operators expecting 28 days' notice of their possible activity in ideal conditions. This action should be undertaken in close coordination with the Department of Defence at the aerodrome prior to commencement of each significant phase of the project with any additional procedures put in place.

6.2 The number of warning lights/obstacle lights on proposed buildings should not present any penetration of the Obstacle Limitation Surfaces with the actual number on buildings to be agreed with the IAC and Department of Defence.

6.3 In respect of possible adverse effect on the airfield's navigation equipment, the rezoning of the land for industrial development is not a reason to oppose the proposed development. At the detailed design planning stage, it will be important to ensure that building heights do not have a potential adverse impact on aerodrome safeguarding.

6.4 The proposed development area is located outside the technical safeguarded area of the CADF, and there is no adverse effect on the operation of this equipment. In addition, there is no adverse effect on the operation of the Aerodrome Identification Beacon.

Appendix C: Wind Shear and Turbulence Analysis which has been prepared by B-Fluid Limited

WIND SHEAR AND TURBULENCE ANALYSIS

Greenogue Masterplan Development, Greenougue, Rathcoole Co.Dublin

Prepared by: B-Fluid Ltd.| Buildings Fluid Dynamics Consultants

For: Greenogue Management N2 CLG

B-Fluid
Buildings Fluid Dynamics

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1. EXECUTIVE SUMMARY

B-Fluid Limited has been commissioned by Greenougue Management N2 CLG to carry out a Wind Shear and Turbulent Assessment for the Greenogue Masterplan Development at Greenogue, Rathcoole Co. Dublin.

This consists in a technical analysis of the potential impact of the proposed masterplan which include the development of N.21 Logistics/Storage Units, accounting for the cumulative effect with the existing and already permitted units in the area, on wind generated hazards to low flying fixed wing and rotor aircraft operating on and in the vicinity of the adjacent Casement Aerodrome at Baldonnell.



Figure 1.1: View of Proposed Masterplan

The aim of this study is to assess if the wind shear and turbulence caused by the proposed masterplan in the vicinity of the aerodrome could cause aircraft instability during landing and take off and, to identify which units of the development, will need to be provide with mitigation measures to avoid any hazard or effects to the runaways 10/28 and 04/22. The criteria for this type of assessment, based on the National Aerospace Laboratory of The Netherlands (NLR), provides that buildings at and around the airport should be assessed in accordance with:

- The "1:35 height rule": any building that lies within the 1:35 height regime is deemed acceptable. In other words, the distance from the runway centreline to the closest point of the building should be more than 35 times the height (above runway level) of the building. Thus, a building with a height of 10 metres would be acceptable if it is located more than 350 metres perpendicular from the runway centreline (or extended runway centreline) and a building with a height of 20 metres would need to be located more than 700 metres from the runway centreline (or extended runway centreline).

- The "7-knot (3.6 m/s) along wind criterion": the variation in mean wind speed due to wind disturbing structures must remain below 7kt (3.6 m/s) along the aircraft trajectory at heights below 200 ft. The speed deficit change of 7kt must take place over a distance of at least 100m.
- The "6-knot (3.09 m/s) cross-wind criterion": the variation in mean wind speed due to wind disturbing structures must remain below 6 knots across the aircraft trajectory at heights below 200ft. The speed deficit change of 6 knots must take place over a distance of at least 100m.
- The "4-knot (2.06 m/s) turbulence criterion": the standard deviation of wind speed must remain below 4 knots at heights below 200ft.

Given the first criterion above, and given the fact that the proposed heights for the different units are:

- Unit 1, 2, 3, 4, 5, 6, 7 with an height of 10m;
- Unit 8, 9, 10, 11, 12, 13 with an height of 14m;
- Unit 14, 15, 16, 17, 18, 19 with an height of 17.5m;
- Unit 20 with an height of 8m;
- Unit 21 with an height of 9.5m;

The distances of the units from both runways in order to not have impact on them should be as follows:

- Unit 1, 2, 3, 4, 5, 6, 7 at a distance of at least 350m;
- Unit 8, 9, 10, 11, 12, 13 at a distance of at least 490m;
- Unit 14, 15, 16, 17, 18, 19 at a distance of at least 612.5m;
- Unit 20 at a distance of at least 280m;
- Unit 21 at a distance of at least 332.5m;

Thus, in view of the above, the proposed units impact on both runways 10/28 and 04/22 expect units 1, 2 and 8 which impact on runway 10/28 only.

In general, wind tunnel testing or Computational Fluid Dynamics (CFD) is required to assess the wind shear and turbulence when a proposed development does not pass the 1:35 rules.

The results of the wind modelling study will be utilised by the design team to mitigate/ review the units that may cause aircraft instability during landing or take off, in terms of wind shear and turbulence in order to develop a masterplan which will be in line with the criteria detailed above for both runaways.

The wind shear and turbulence modelling study is performed through a Computational Fluid Dynamics (CFD) analysis which simulates the movement of wind within the prescribed area. The simulations are carried out using the concept of Large Eddy Simulation (LES) and Reynolds Average Navier Stokes (RANS).

The following report describes the wind shear and turbulence assessment performed and the rational of the methodology and assumptions that B-Fluid Ltd. has adopted for the assessment scenarios. This

report aims to outline also the CFD (Computational Fluid Dynamics) parameters used to simulate the modelled scenarios and shows the results of the simulations carried out.

In particular:

- The wind profile was built using the annual average of meteorology data collected at Dublin Airport Weather Station. In particular, the local wind climate was determined from historical meteorological data(over 30 years of data available from 1985-2020) recorded 10 m above ground level at Dublin Airport. These data were also compared with local wind rose data collected at the Casement Aerodrome over a period of 5 years between 2015-2020.

- From this, a wind speed profile was determined, to be used in the CFD analysis to generate the wind profile around the building in each of the selected directions.

- The results of the preliminary wind flow simulations have shown that some minor funnelling effects are expected in-between the units. However, these phenomena do not increase the wake effects on the runways.

- A comparison for the wind shear close to the ground shows that the proposed buildings slightly expand the existing shears.

- Wind speed increases with height. Higher wind speed is therefore predicted at 30 m above ground. Highest wind deficit is obtained at the wake of nearby building. The wind shear and wind deficit results are proportional. The variation of the velocity from the mean speed is less than 6 knots (3 m/s) along the analysed flight path at a height below 60 m.

- Highest turbulence intensity occurs near the ground and in the wake of upstream buildings as expected. The mean wind speeds at these locations are generally low.

- The RMS (standard deviation) is below 4 kt (2.06 m/s) for an approaching wind of 7 m/s at 10 m above ground for the pre-development and post development scenarios. In general, the turbulence due to the proposed developed is increased by approximately 6 m/s. Turbulence levels for some flight paths are reduced due to reduced mean wind speed while the increase in turbulent intensity is moderate but insignificant.

The assessment has been carried out in two steps:

- ”Step 1 - Preliminary Wind Assessment of the Development”: in this case the assessment has considered the impact of wind on the existing area including the proposed Greenougue Masterplan in Rathcoole. For this scenario, the analysis have identified the critical areas of the proposed development. A statistical analysis of 30 years of historical weather wind data has been carried out to find the most critical wind speeds and directions and the frequency of occurrence of the same.

- ”Step 2 - Wind Shear and Turbulence Model”: in this case a wind shear and turbulence assessment has been carried out to assess if the wind shear and turbulence caused by the new development in the vicinity of the aerodrome is causing aircraft instability during landing. For this scenario three wind directions have been used for each runways, which correspond to the critical wind directions impacting both the development and the aerodrome runways. This analysis has been carried out as a comparison between a condition without the proposed units (pre-development case) and with the proposed units (post-development case).

The results of the study has shown that the proposed masterplan is not causing any ”unsolvable” critical impact on the runaways 10/28 and 04/22 that cannot be mitigated adopting the measures outlined in section 9.1 (Mitigation Options) of this report.

In particular, it must be noted, that the majority of the units proposed will not need to be mitigated and their effects on the runaways are within the acceptance criteria in terms of wind shear and turbulence effects generated on both runaways.

During the next design stages, a revision of the design will be carried out for units 13, 14, 16, 17, 20 and 21 to mitigate the effects highlighted by this analysis and summarized as follows:

- Wind shear generated by Units 16 and 17 are slightly higher than other units on runway 04/22, reducing the height of the units should be considered as, due to their current proposed height, they can impact on both runways when strong winds occur from South-West.
- Although the heights of the Units 20 and 21 do not cause high turbulence on runway 04/22, it is advisable to review their design/mitigation in terms of height/location to avoid any impact on the landing path zone due to their proximity to this runaway.
- A revision/mitigation of the design in term of height/location is also advisable for units 13 and 14 as, based on their proposed orientations and heights, they are currently impact both runways in terms of wind shear ad turbulence, particularly when strong winds occur from the West and South-West.

2. PROJECT DESCRIPTION

2.1 INTRODUCTION

This technical report presents a wind shear and turbulence assessment carried out for the proposed N.21 units in Greenougue, Rathcoole, Co. Dublin. The assessment has been carried out throughout the following scenarios:

- "Step 1 - Wind Assessment of the Development": in this case the assessment has considered the impact of wind on the existing area including the proposed N.21 units. For this scenario, the analysis have identified the critical areas of the proposed development. A statistical analysis of 30 years of historical weather wind data has been carried out to find the most critical wind speeds and directions and the frequency of occurrence of the same.

- "Step 2 - Wind Shear and Turbulence Model": in this case a wind shear and turbulence assessment has been carried out through CFD simulations, to assess if the wind shear and turbulence caused by the new masterplan in the vicinity of the Casament Aerodrome at Baldonnel is causing aircraft instability during landing on both runaways 10/28 and 04/22 nearby the proposed development. For this scenario, different wind directions have been used, which correspond to the critical wind directions impacting both the units of the development and each of the aerodrome runways.This analysis has been carried out as a comparison between a condition without the proposed units (pre-development case) and with the proposed units (post-development case).

The following Figure shows the development and the domain considered.

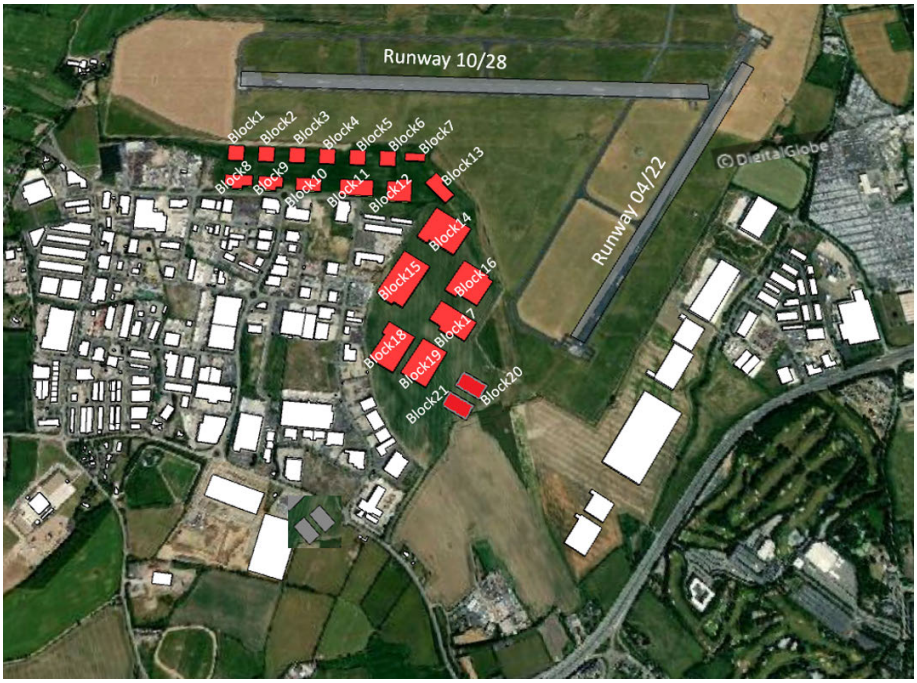


Figure 2.1: Post-development Model

The wind shear and turbulence study, has been carried out through CFD modelling by B-Fluid Ltd. In the following paragraphs, reports on all the project information and modelling assumptions used throughout the CFD study, together with results of the simulations carried out, are presented.

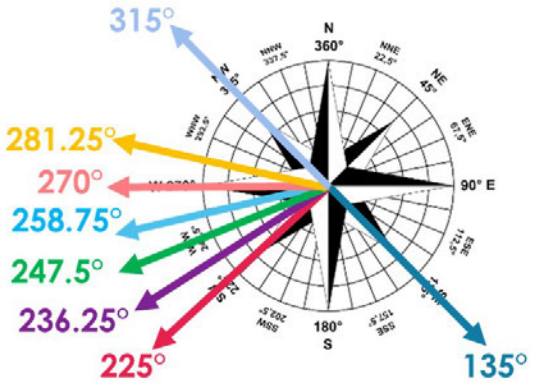
2.2 OBJECTIVE OF THE WIND SHEAR AND TURBULENCE MODELLING

The CFD wind model is adopted to to identify areas of concern and assess if the wind shear and turbulence caused by the new development in the vicinity of the aerodrome is causing aircraft instability during landing and take off. The objective is to analyse the wind shear and turbulence conditions before and after the construction of the warehouses, in order to make sure that the development does not introduce any instability along the landing path.

For the first step of the analysis the preliminary wind assessment of the development, 8 different scenarios have been modelled, in order to take into consideration all the different relevant wind directions. In particular, a total of 8 compass directions on the wind rose are selected. For each direction, the reference wind speed is set to the 5% exceedance wind speed for that direction, i.e. the wind speed that is exceeded for only 5% of the time whenever that wind direction occurs. Figure 2.2 shows the 8 directions selected.

For the second step, the wind shear and turbulence assessment, three wind directions have been used, which correspond to the critical wind directions impacting both the development and the aerodrome runways. These are in particular the wind directions at 135°, 225°, 236°, 247°, 258°, 270°, 281°, and 315°. This analysis has been carried out considering all units of the proposed development in cumuative assessment with the existing and permitted units in the area..

The details of the design wind adopted are described in the next sections of this report.



Velocity (m/s)	Direction (°)	Frequency
5.601	225	11.233
4.626	135	6.849
5.847	236.25	6.792
6.049	258.75	6.747
6.034	247.5	6.689
5.888	270	5.662
4.994	315	4.338
5.503	281.25	3.904

Figure 2.2: Summary of the dominant wind directions in Dublin

2.3 DEVELOPMENT DESCRIPTION

The proposed masterplan will include the construction of N.21 units in this new industrial / logistics development at the established Greenougue Business Park, Rathcoole, Co. Dublin. The figure that follows shows a plan of the proposed development.



Figure 2.3: Plan of N.21 Proposed Logistic Warehouses

The proposed heights for the units are:

- Unit 1, 2, 3, 4, 5, 6, 7 with an height of 10m;
- Unit 8, 9, 10, 11, 12, 13 with an height of 14m;
- Unit 14, 15, 16, 17, 18, 19 with an height of 17.5m;
- Unit 20 with an height of 8m;
- Unit 21 with an height of 9.5m;

3. STUDY METHODOLOGY

3.1 WIND IMPACT ASSESSMENT ON BUILDINGS

3.1.1 PLANETARY BOUNDARY LAYER AND TERRAIN ROUGHNESS

Due to aerodynamic drag, there is a wind gradient in the wind flow just a few hundred meters above the Earth's surface – "the surface layer of the planetary boundary layer".

Wind speed increases with increasing height above the ground, starting from zero, due to the no-slip condition. In particular, the wind velocity profile is parabolic. Flow near the surface encounters obstacles that reduce the wind speed, and introduce random vertical and horizontal velocity components. This turbulence causes vertical mixing between the air moving horizontally at one level, and the air at those levels immediately above and below it. For this reason, the velocity profile is given by a fluctuating velocity along a mean velocity value. Figure 3.1 shows the wind velocity profile, as described above.

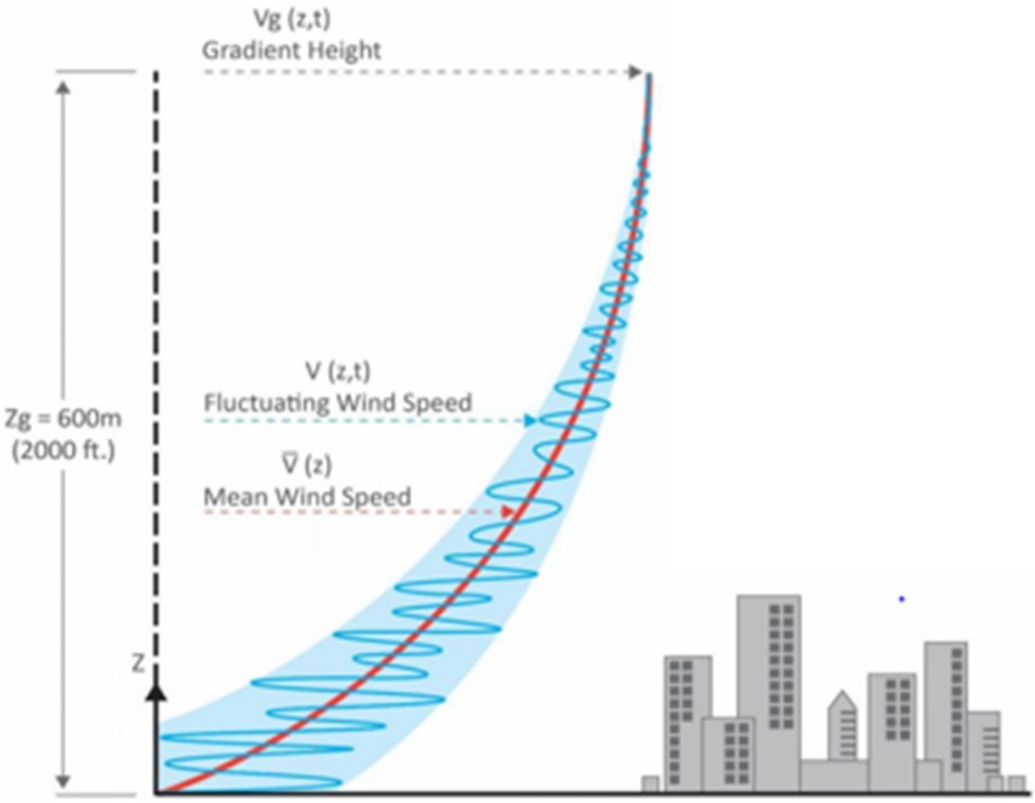


Figure 3.1: Wind Velocity Profile

Two effects influence the shape of the wind speed profile:

- Contours of the terrain: a rising terrain such as an escarpment will produce a fuller profile at the top of the slope compared with the profile of the wind approaching the slope.

- Aerodynamic 'roughness' of the upstream terrain: natural roughness in the form of woods or man-made roughness in the form of buildings. Obstructions near the ground create turbulence and friction, lowering the average wind speed. The higher the obstructions, the greater the turbulence and the lower the windspeed. As a general rule, windspeed increases with height.

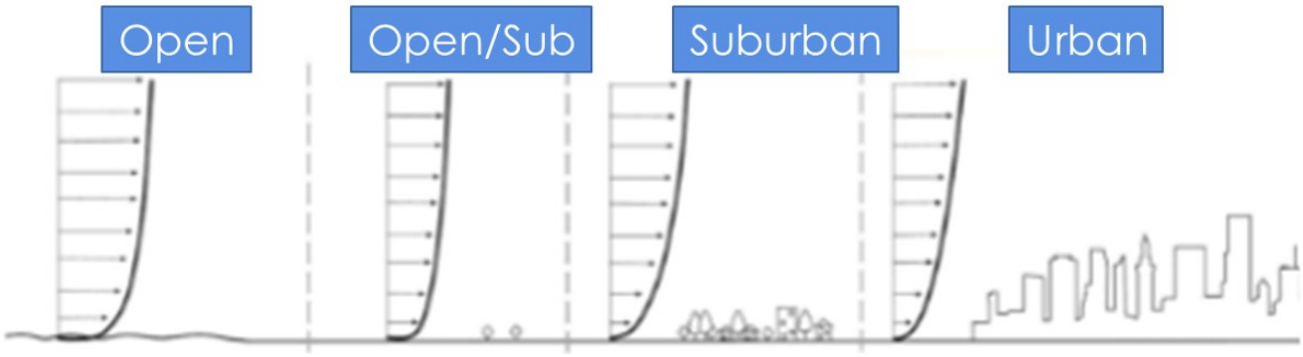


Figure 3.2: Wind Velocity Profile for different terrains

In order to assess the wind conditions in a particular area, it is important to know (Figure 3.3):

- Weather conditions in the area
- Location and orientation of the site
- Buildings distribution in the area
- Flow patterns at the building

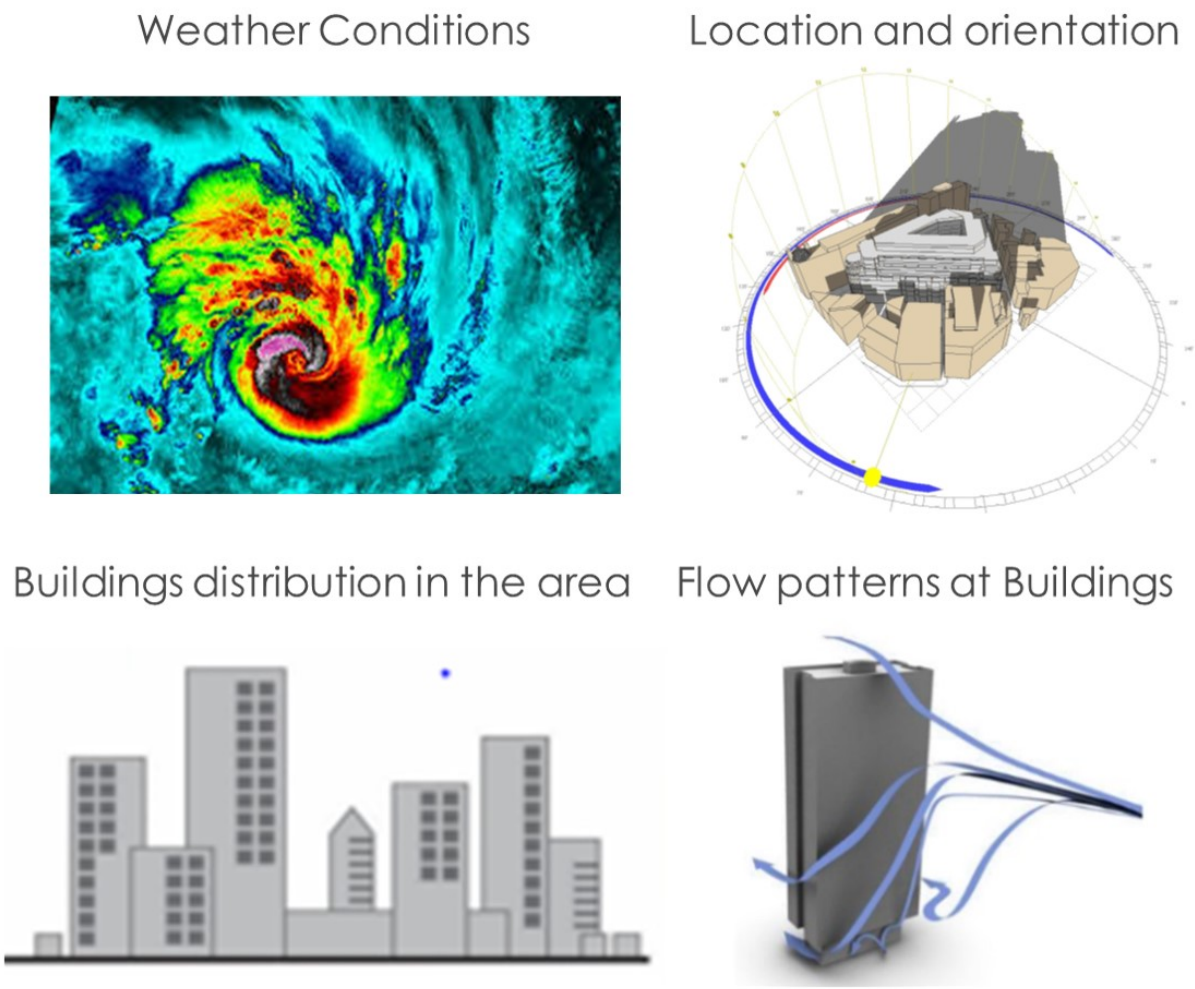


Figure 3.3: Parameters to know for Wind Conditions Assessment

Moreover, it is important to understand key flow features (Figure 3.4):

- Broad Building Face creates "DOWNWASH"
- Low Building Upwind Increases Wind Effects
- Gaps Between Buildings Increases Wind Velocity
- Low Building Upwind Increases Wind Effects

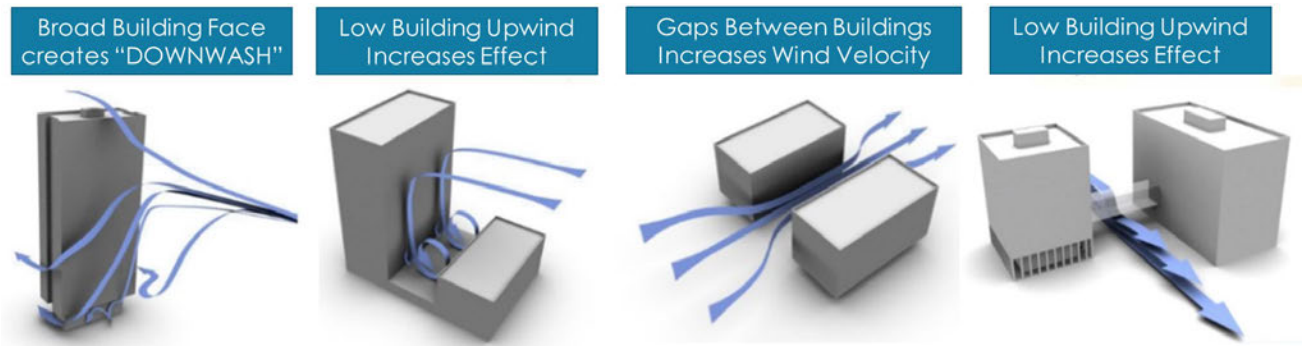


Figure 3.4: Parameters to know for Wind Conditions Assessment

3.2 ACCEPTANCE CRITERIA

3.2.1 WIND SHEAR AND TURBULENCE

Wind shear and turbulence caused by buildings in the vicinity of airports can cause aircraft instability during landing or take-off.

The instability which building-induced wake effects can cause to an aircraft is significantly reduced once the aircraft has touched down (upon landing) or is at reasonable height (200ft off the ground prior to landing). After touch-down, the aircraft has increased stability/support from contact with the runway pavement and above 200 feet, both the consequences of a drop in altitude or a change in wind bank are considerably less and the pilot has increased latitude and so time to correct an induced effect on the aircraft prior to touch-down.

Wind shear and turbulence guidance criteria due to obstacles at and around airports were developed by the National Aerospace Laboratory of The Netherlands (NRL).

The NLR report (NLR-CR-2006-261) contains the following acceptance criteria, which have been used for this analysis:

- The "1:35 height rule": any building lies within the 1:35 height regime is deemed acceptable. In other words, the distance from the runway centreline to the closest point of the building should be more than 35 times the height (above runway level) of the building. Thus, a building with a height of 10 metres would be acceptable if it is located more than 350 metres perpendicular from the runway centreline (or extended runway centreline) and a building with a height of 20 metres would need to be located more than 700 metres from the runway centreline (or extended runway centreline).
- The "7-knot (3.6 m/s) along wind criterion": the variation in mean wind speed due to wind disturbing structures must remain below 7kt (3.6 m/s) along the aircraft trajectory at heights below 200 ft. The speed deficit change of 7kt must take place over a distance of at least 100 m.
- The "6-knot (3.09 m/s) cross-wind criterion": the variation in mean wind speed due to wind disturbing structures must remain below 6 knots across the aircraft trajectory at heights below 200ft. The speed deficit change of 6 knots must take place over a distance of at least 100m.
- The "4-knot (2.06 m/s) turbulence criterion": the standard deviation of wind speed must remain below 4 knots at heights below 200ft.

The wind shear criteria are depicted schematically in Figure 3.5.

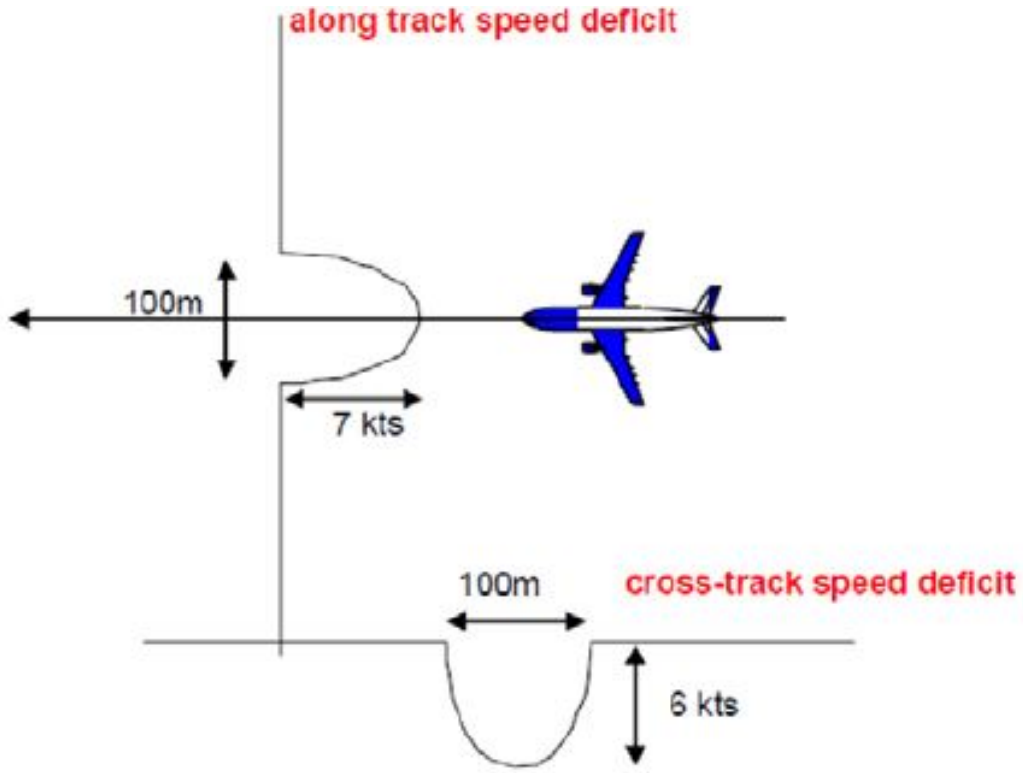


Figure 3.5: Wind Shear and Turbulence Criteria

Given the first criterion above, and given the fact that the proposed heights for the different units are:

- Unit 1, 2, 3, 4, 5, 6, 7 with an height of 10m;
- Unit 8, 9, 10, 11, 12, 13 with an height of 14m;
- Unit 14, 15, 16, 17, 18, 19 with an height of 17.5m;
- Unit 20 with an height of 8m;
- Unit 21 with an height of 9.5m;

The distances of the units from both runways in order to not have impact on them should be as follows:

- Unit 1, 2, 3, 4, 5, 6, 7 at a distance of at least 350m;
- Unit 8, 9, 10, 11, 12, 13 at a distance of at least 490m;
- Unit 14, 15, 16, 17, 18, 19 at a distance of at least 612.5m;
- Unit 20 at a distance of at least 280m;
- Unit 21 at a distance of at least 332.5m;

Thus, in view of the above, some of the proposed units impact the runaway 10/28 only, some of these impacts the runaway 04/22 only and some other units, like unit 14, 13, for example, impact both runaways of the Baldonnell Aerodrome.

In general, wind tunnel testing or Computational Fluid Dynamics (CFD) is required to assess the wind shear and turbulence when a proposed development does not pass the 1:35 rules.

Turbulent (gust) wind flow environment in an urban environment can be modelled with wind tunnel. However, small building features are better modelled in CFD versus wind tunnel testing, where model buildings are typically built to a scale of around 1:400 or similar. This is important when modelling small structures in the vicinity of airports or assessing the benefit of small canopies, porous screens and blades provided to mitigate adverse wind conditions. Moreover, wind tunnel measurements are performed at a few selected points within the tested model while CFD can provide comprehensive output of the entire flow field.

A high number of CFD studies have been published in the International Conferences and Journal of Wind Engineering and Industrial Aerodynamics in the past decades. CFD predictions of wind flow around bluff bodies have been compared and validated against wind tunnel and full scale measurements in the open literature. In general, good correlation is obtained when best practice guidelines are used for the modelling.

4. LOCAL WEATHER DATA

In this chapter, a statistical analysis of 30 years of historical weather wind data has been carried out to find the most critical wind speeds and directions and the frequency of occurrence of the same. The aim of this assessment has been to identify the wind microclimate of the area that may cause critical conditions for the landing aircraft.

4.1 SITE LOCATION AND SURROUNDING AREA

Greenougue Business Park is one of Ireland's premier logistics locations situated south west of Dublin City Centre, adjacent to the N7 (Naas Road). The location provides rapid access to over 1.27 million people within a 30 minute drive. The site is ideally located for national distribution, situated directly adjacent to the N7 (Naas Road), the main arterial route linking Dublin with the key provincial cities of Cork, Limerick and Waterford. The site is adjacent to Casement Baldonnell Military Aerodrome on the North and East side of the development.

The site is shown in Figure 4.1. The modelled area for the wind modelling study comprises a 3km^2 area around the proposed Greenougue development, which includes the aerodrome, as represented in Figure 4.1.

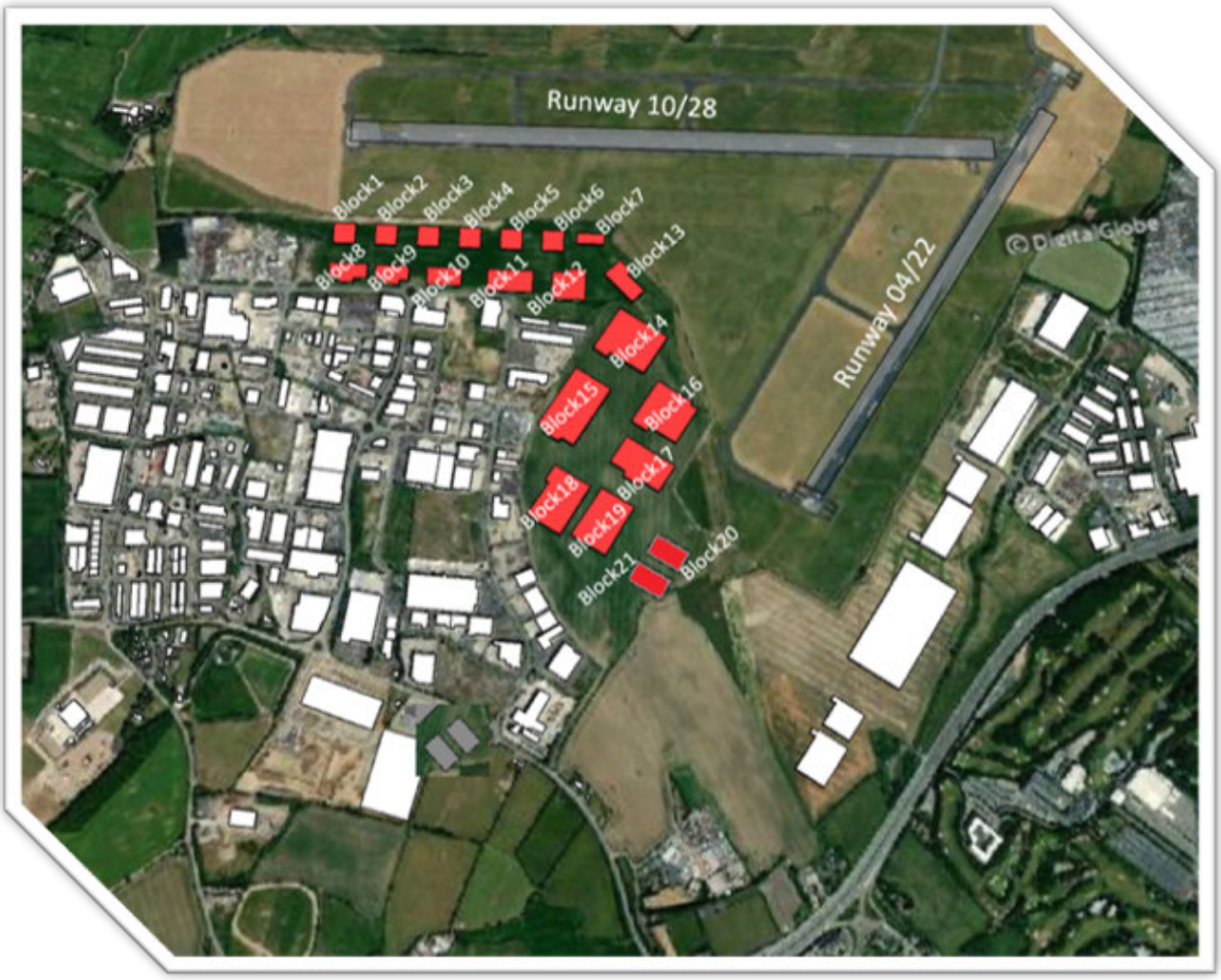


Figure 4.1: Extents of Analysed Area (3km^2 Area)

4.1.1 TOPOGRAPHY AND BUILT IN ENVIRONMENT

Figure 4.2 shows an aerial photograph of the terrain surrounding the subject site at Greenougue, Rathcoole. The development site is located south west of Dublin City Centre, adjacent to the N7 (Naas Road), in Rathcoole, Co. Dublin. It is adjacent to the Casement Military Aerodrome. The surrounding context is mainly low-level residential, agricultural and commercial uses.



Figure 4.2: Site Location

4.2 WIND MICROCLIMATE CONDITIONS

The simulations consider the whole development being exposed to the typical wind condition of the site. The building is oriented as shown in the previous sections. The wind is applied in the CFD model as a velocity boundary condition with a prescribed profile, which specifies the wind magnitude variation with the height and the wind direction.

The wind profile is built using the annual average of meteorology data collected at Dublin Airport Weather Station and compared with those of the Casement Aerodrome. Figure 4.3 shows on the map the position of the proposed site and the position of Dublin Airport.

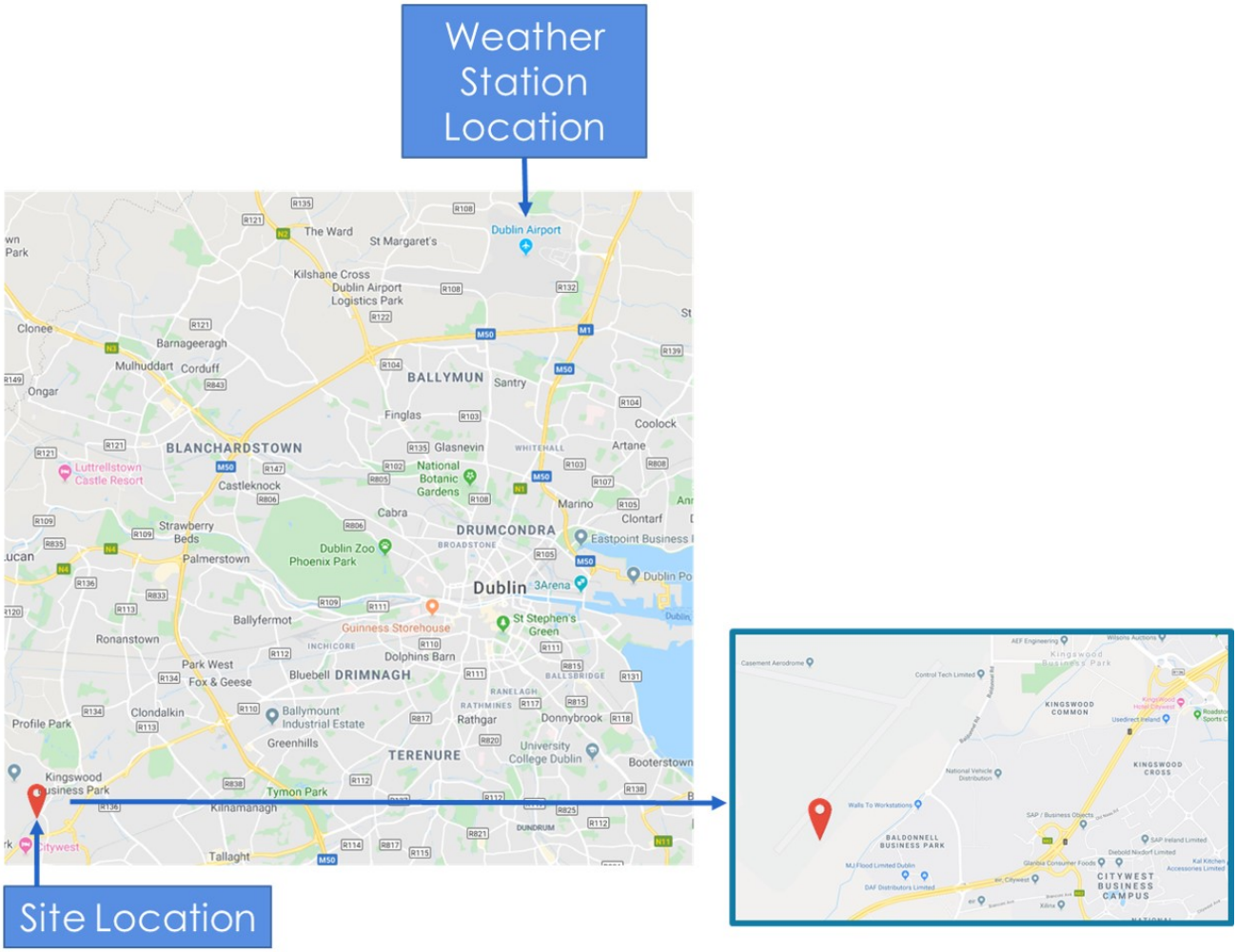


Figure 4.3: Map showing the position of the site and Dublin Airport

4.3 LOCAL, MAXIMUM AND MEAN WIND CONDITIONS

4.3.1 LOCAL WIND CONDITIONS

As stated above, the local wind climate is determined from historical meteorological data recorded at Dublin Airport. Two different datasets are analyzed for this assessment as follows:

- The meteorological data associated with the maximum daily wind speeds recorded over a 30 year period between 1985 and 2020 and,
- The mean hourly wind speeds recorded over a 10 year period between 2009 and 2020. The data is recorded at a weather station at the Dublin airport, which is located 10m above ground or 71mOD.

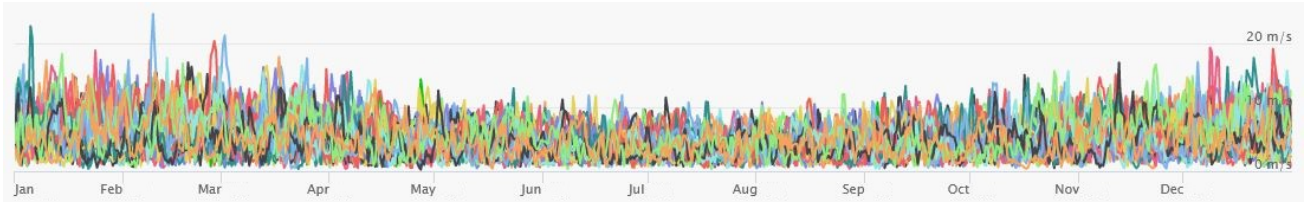


Figure 4.4: Local Wind Conditions - Wind Speed (10m) 1985-2020

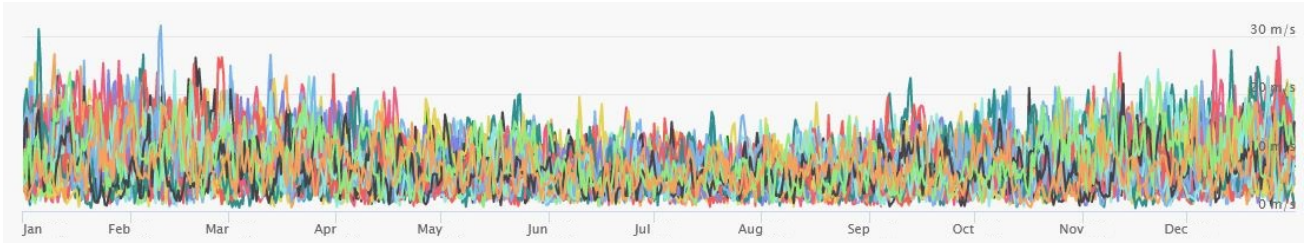


Figure 4.5: Local Wind Conditions - Wind Gust (10m) 1985-2020

Figure 4.6 presents the wind speed diagram for Dublin, which indicates the number of days per month, during which the wind reaches a certain speed. In Figure 4.7, the wind rose for Dublin shows how many hours per year the wind blows from the indicated direction, confirming that the predominant directions are WSW, W, and SW. The above data were also confirmed by the recording taken from a more local wind station at the Casement Aerodrome situated on the north of the site. These local recording provide the wind data over a period of 5 years between 2016 and 2020 as shown in Figure 4.8.

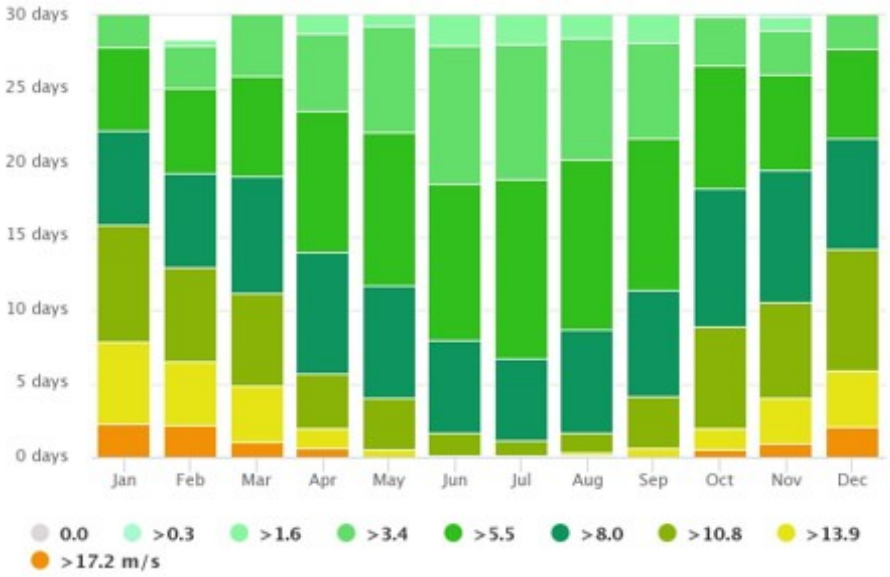


Figure 4.6: Dublin Airport Wind Speed Diagram

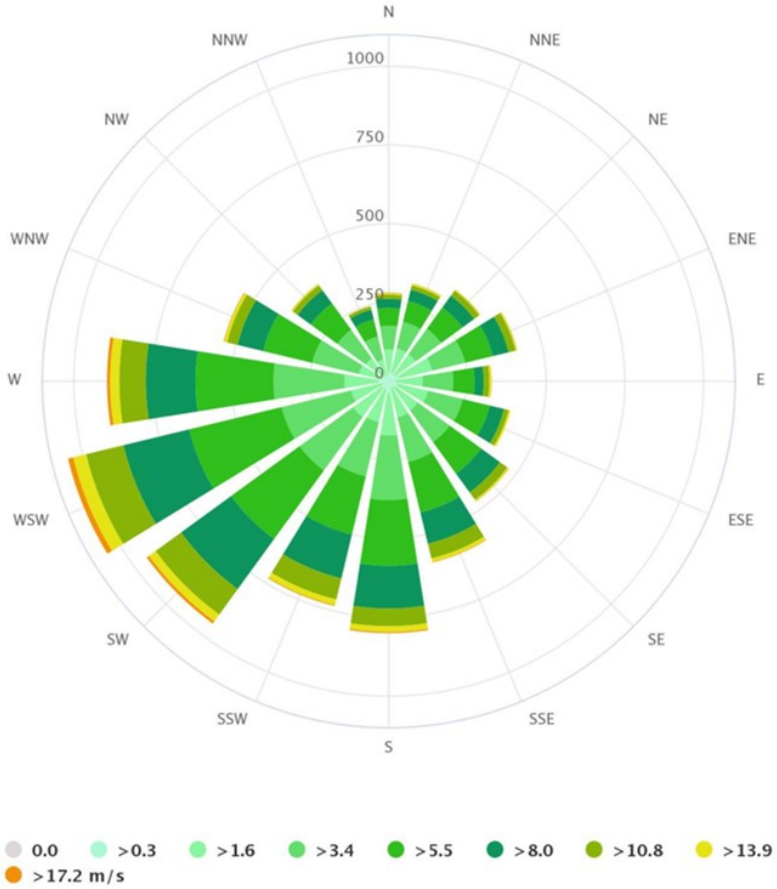


Figure 4.7: Dublin Airport Wind Rose

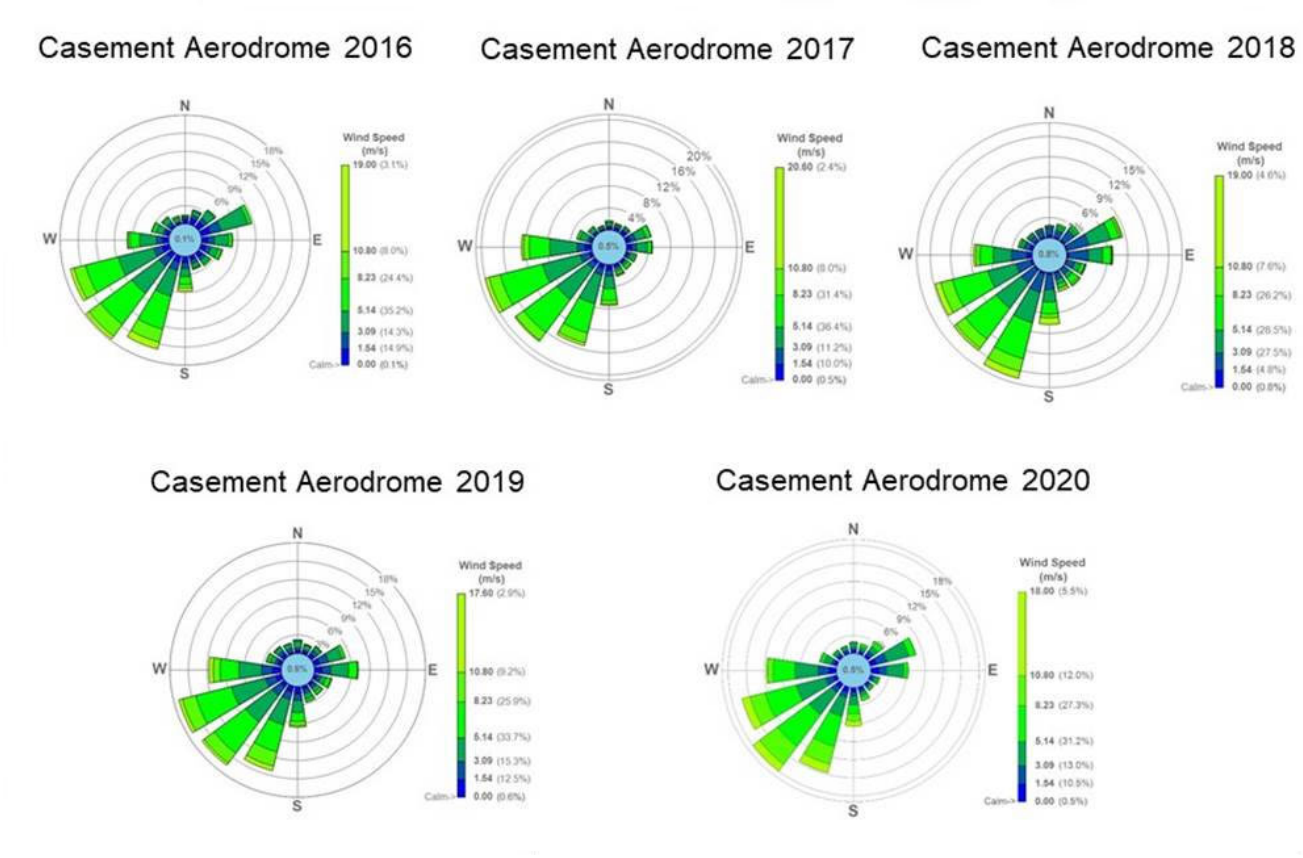


Figure 4.8: Casement Aerodrome Wind Rose

4.3.2 MEAN AND MAXIMUM WIND CONDITIONS

Examination of the daily wind data reveals that the wind predominantly blows from West and Southwest directions, however, there is a secondary wind from the Southeast. It is apparent that winds from other directions are rare. Maximum daily wind speeds of nearly 30 m/s were recorded in the past 30 years, however, the maximum daily winds are commonly found between 6 m/s and 15 m/s. the strongest winds arise from the West and Southwest.

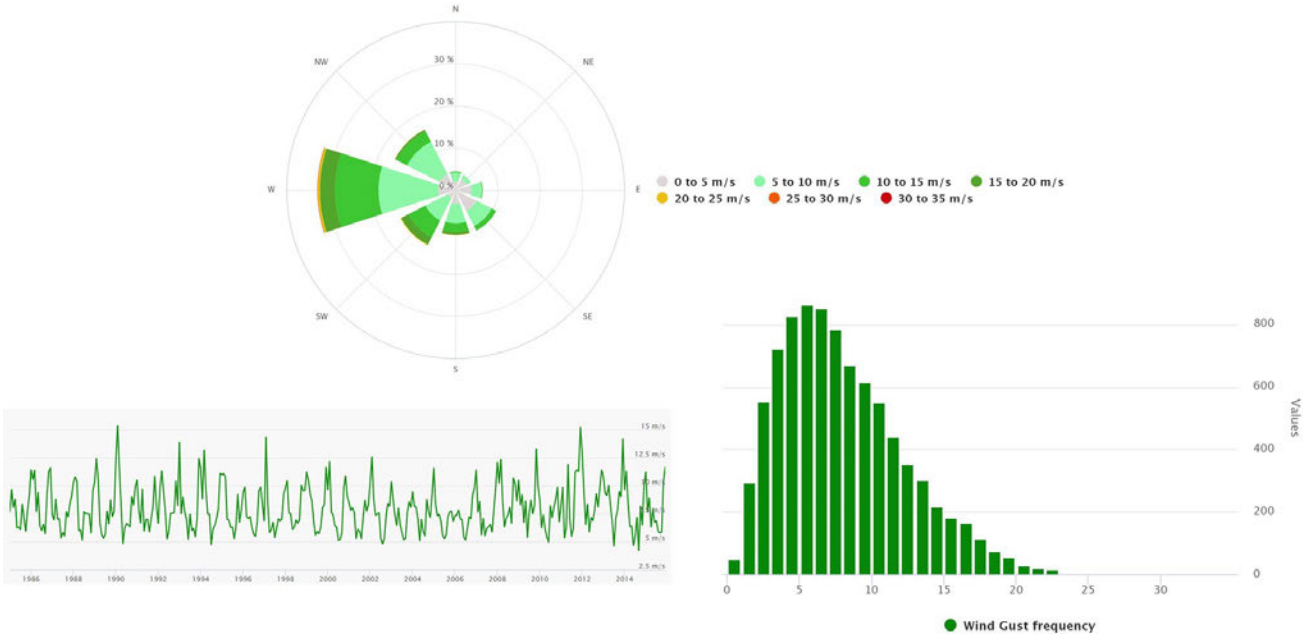


Figure 4.9: Maximum Wind Conditions

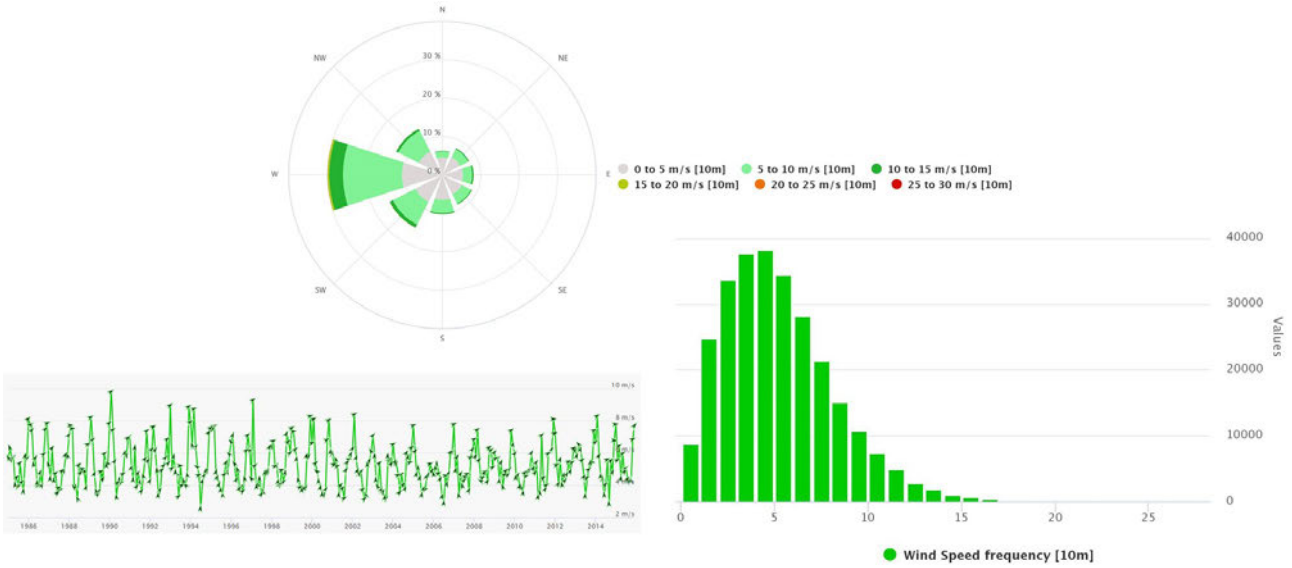


Figure 4.10: Mean Wind Conditions

Based on the criterion of occurrence frequency, the main wind directions to be considered for the preliminary wind analysis of the site are presented in Figure 4.11. For each direction, the reference wind speed is set to the 5% exceedance wind speed for that direction, i.e. the wind speed that is exceeded for

only 5% of the time whenever that wind direction occurs. A total of 8 directions have been selected from these directions, starting from the top of the table.

The preliminary wind assessment will mainly focus on these 8 prevailing wind directions from above. Other wind directions will be discussed if deemed necessary for the study.

Velocity (m/s)	Direction (°)	Frequency
5.601	225	11.233
4.626	135	6.849
5.847	236.25	6.792
6.049	258.75	6.747
6.034	247.5	6.689
5.888	270	5.662
4.994	315	4.338
5.503	281.25	3.904
4.974	292.5	3.436
5.357	213.75	3.288
4.736	123.75	3.105
4.406	146.25	2.751
5.101	303.75	2.648
5.246	112.5	2.500
4.121	157.5	2.386
4.581	101.25	2.340
4.169	45	2.180
3.558	90	2.135
4.801	202.5	2.021
3.689	78.75	1.963
3.627	168.75	1.495
4.285	67.5	1.370
4.863	56.25	1.279
4.042	191.25	1.199
4.630	326.25	1.164
3.844	11.25	1.142
4.418	337.5	1.062
4.787	348.75	0.982
4.006	22.5	0.959
3.555	180	0.879
4.059	33.75	0.845
0.700	0	0.011
Selected Conditions : 32	Total Coverage : 95.35 %	

Figure 4.11: Main Wind Directions Occurrence Frequency

For the second step of the analysis, the wind shear and turbulence assessment, the wind directions used have been taken from the historical weather data analysis presented above and they are the ones that not only are frequent in Dublin, but also have an impact on both the development and the runways. This means that these directions are the ones for which the wind impacts the units first and the related runway straight after. These directions are:

- 135°
- 225°
- 236°
- 247°
- 258°
- 270°
- 281°
- 315°

The velocity adopted for this part of the analysis has been chosen accordingly to the historical weather data analysis as the maximum velocity registered in these directions over the years 1985-2020. This velocity has been found equal to 6 m/s. To be conservative, a velocity of 7 m/s has been assumed.

5. CFD MODELLING METHOD

5.1 CFD MODELLING METHOD

Computational Fluid Dynamics (CFD) is a numerical technique to simulate fluid flow, heat and mass transfer, chemical reaction and combustion, multiphase flow, and other phenomena related to fluid flows. CFD modelling includes three main stage: pre-processing, simulation and post-processing as described in Figure 5.1. The Navier-Stokes equations, used within CFD analysis, are based entirely on the application of fundamental laws of physics and therefore produce extremely accurate results providing that the scenario modelled is a good representation of reality.

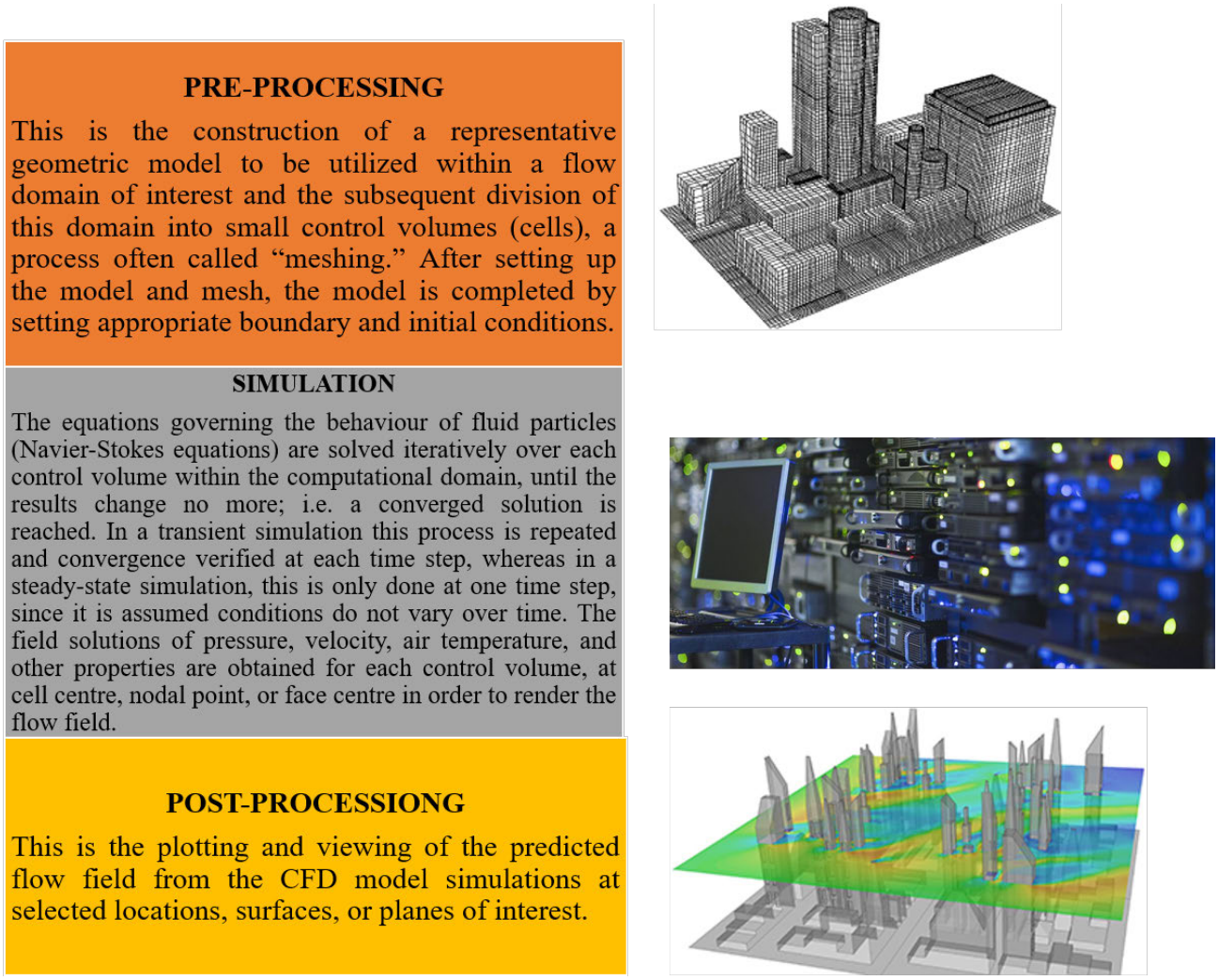


Figure 5.1: CFD Modelling Process Explanation

5.2 OpenFoam SOFTWARE DETAILS

This report employs OpenFoam Code, based on the concept of Large Eddy Simulation (LES) and Reynolds Avarage navier Stokes (RANS) and the post-processing visualisation tool Paraview version 5.5. OpenFoam is a CFD software released and developed primarily by OpenCFD Ltd, since 2004. It has a large user base across most areas of engineering and science, from both commercial and academic organisations. OpenFOAM has an extensive range of features to solve anything from complex fluid flows involving chemical reactions, turbulence and heat transfer, to acoustics, solid mechanics and electromagnetics. Quality assurance is based on rigorous testing. The process of code evaluation, verification and validation includes several hundred daily unit tests, a medium-sized test battery run on a weekly basis, and large industry-based test battery run prior to new version releases. Tests are

designed to assess regression behaviour, memory usage, code performance and scalability.

5.2.1 NUMERICAL SOLVER

This report employs a CFD code based on the concept of LES and RANS simulations, which is used to solve anything from complex fluid flows involving chemical reactions, turbulence and heat transfer, to acoustics, solid mechanics and electromagnetics. Quality assurance is based on rigorous testing. The process of code evaluation, verification and validation includes several hundred daily unit tests, a medium-sized test battery run on a weekly basis, and large industry-based test battery run prior to new version releases. Tests are designed to assess regression behaviour, memory usage, code performance and scalability.

The solver directly calculates the mass and momentum equations for the large eddies that comprise most of the fluid's energy.

To reduce computational time and associated costs the small eddies within the flow have been solved using the widely used and recognised Smagorinsky Sub-Grid Scale (SGS) model. The small eddies only comprise a small proportion of the fluids energy therefore the errors introduced through the modelling of this component are minimal.

The error introduced by modelling the small eddies can be considered of an acceptable level. Computational time will be reduced by modelling the small eddies (compared to directly solving).

5.3 COMPUTATIONAL MESH

The level of accuracy of the CFD results are determined by the level of refinement of the computational mesh. Details of parameters used to calculate the computational mesh are presented in Table 5.1. Figures 5.2 to 5.4 show the mesh generated for this project. The grid follows the principles of the 'Finite Volume Method', which implies that the solution of the model equations is calculated at discrete points (nodes) on a three-dimensional grid, which includes all the flow volume of interest. The mathematical solution for the flow is calculated at the center of each of these cells and then an interpolation function is used by the software to provide the results in the entire domain.

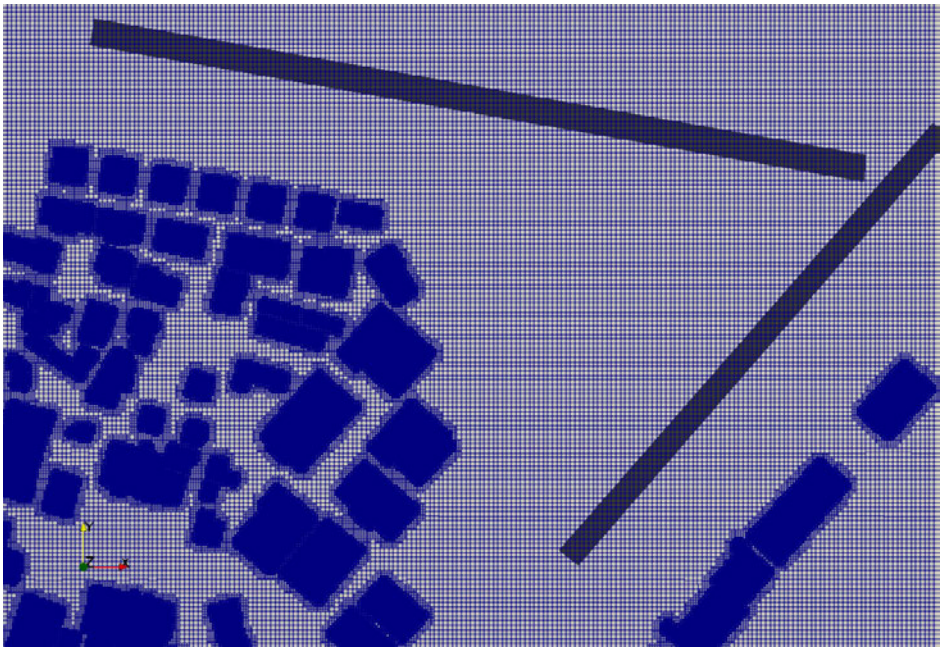


Figure 5.2: Development and Domain Mesh Example - Top View

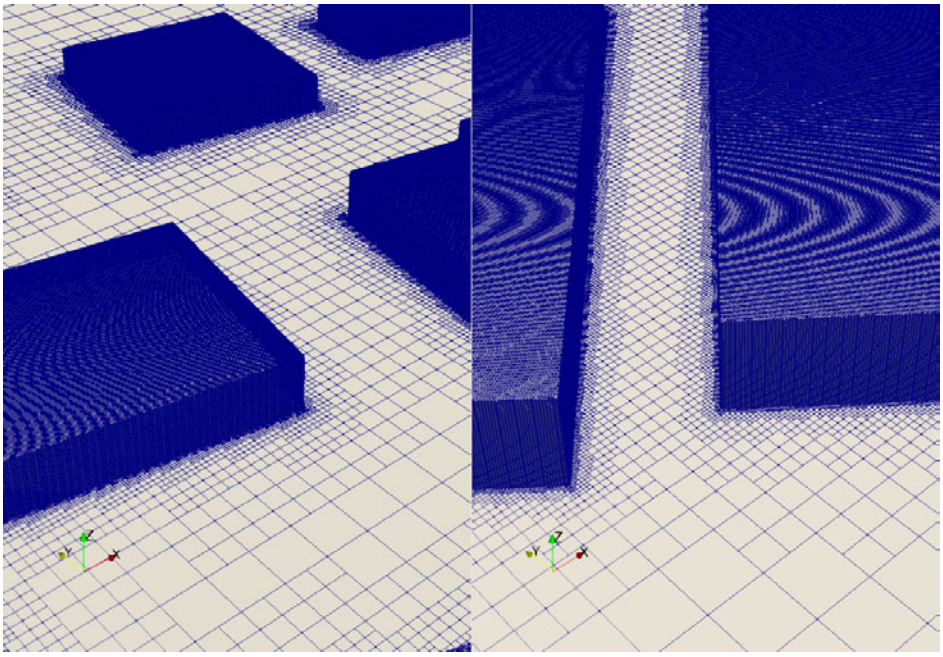


Figure 5.3: Development Mesh Example - Details of Warehouses C and D

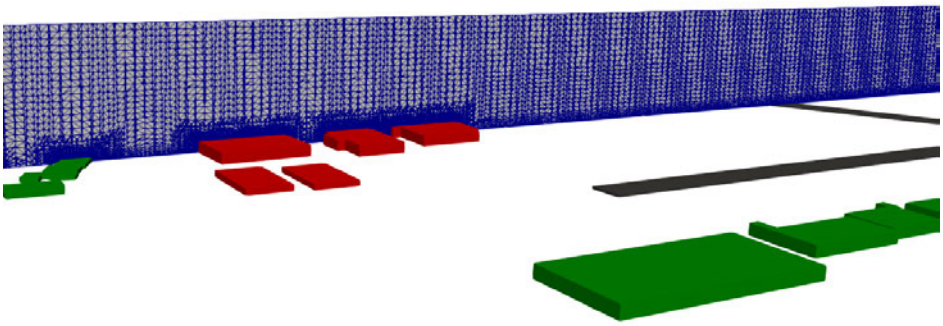


Figure 5.4: Development Mesh Example - Vertical Slice through the Mesh

5.4 BOUNDARY CONDITIONS

A rectangular computational domain was used for the analysis. The wind direction were altered without changing the computational mesh. For each dimension, an initial wind velocity was set according to the weather data collected, in order to consider the worst case scenario. Surfaces within the model were specified as having ‘no slip’. This condition ensures that flow moving parallel to a surface is brought to rest at the point where it meets the surface, all the other domain boundaries are set as ”Open Boundaries”.

PARAMETERS TO CALCULATE COMPUTATIONAL MESH	
Air Density ρ	$1.2kg/m^3$
Ambient Temperature (T)	$288K(approx.15C^{\circ})$
Gravity Acceleration (g)	$9.8m/s^2$
dx	0.5 m at the building 1m in the surroundings 2m-5m elsewhere
Background Mesh cells ratio	1:1
Total mesh size	Approx. cells number = 15 million

Table 5.1: Parameters To Calculate Computational Mesh

5.5 LOGARITHMIC WIND PROFILE

The wind velocity data provided by the historical data collection and by the local data measuring are used in the formula below for the logarithmic wind profile to specify the wind velocity profile (wind velocity at different heights) to be applied within the CFD model:

$$v_2 = v_1 \cdot \frac{ln\frac{h_2}{z_0}}{ln\frac{h_1}{z_0}} \tag{5.1}$$

where:

- v_1 = wind speed measured at the reference height h_1
- h_1 = reference height to measure v_1
- h_2 = height of the wind speed v_2 calculated for the wind profile
- z_0 = 0.4 [m] roughness length selected (see table in Figure 5.5 below)

Roughness Classes and Lengths

Roughness class	Roughness length z_0	Land cover types
0	0.0002 m	Water surfaces: seas and Lakes
0.5	0.0024 m	Open terrain with smooth surface, e.g. concrete, airport runways, mown grass etc.
1	0.03 m	Open agricultural land without fences and hedges; maybe some far apart buildings and very gentle hills
1.5	0.055 m	Agricultural land with a few buildings and 8 m high hedges seperated by more than 1 km
2	0.1 m	Agricultural land with a few buildings and 8 m high hedges seperated by approx. 500 m
2.5	0.2 m	Agricultural land with many trees, bushes and plants, or 8 m high hedges seperated by approx. 250 m
3	0.4 m	Towns, villages, agricultural land with many or high hedges, forests and very rough and uneven terrain
3.5	0.6 m	Large towns with high buildings
4	1.6 m	Large cities with high buildings and skyscrapers

Figure 5.5: Roughness length and class to be used for the logarithmic wind profile

The wind profile used in the model has been calculated using the formula above and is represented in Figure 5.6.

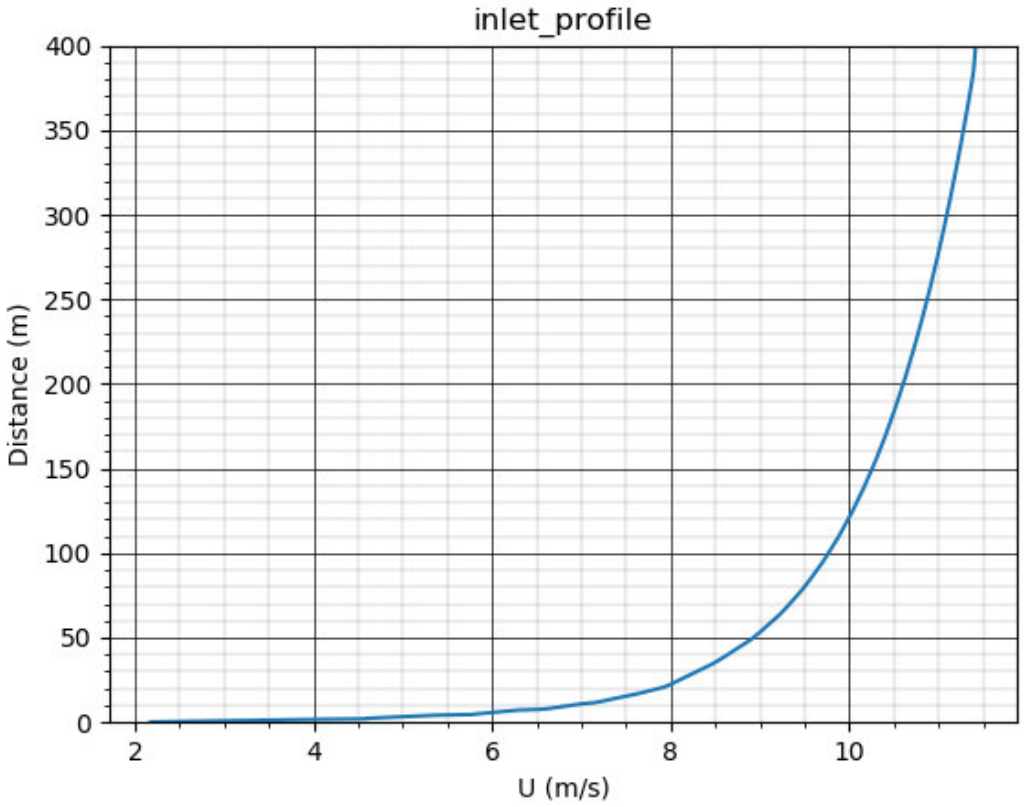


Figure 5.6: Wind profile used in the model

6. CFD MODEL DESIGN

6.1 CFD MODEL DETAILS

This section describes all the elements included in the geometrical and physical representation of the model. Any object which may have a significant impact on wind movement are represented within the model.

To be accurate, the structural layout of the building being modelled should include only the obstacles, blockages, openings and closures which can impact the wind around the building.

It is important to remember that a CFD simulation approximates reality, so providing more details of the geometry within the model will not necessarily increase the understanding of the bulk flows in the real environment.

6.2 MODELLED GEOMETRIES

The CFD simulation study has been carried out considering the following different geometries:

- The "Post-development case" which include all the N.21 units of the proposed development.

Therefore final model layout for cumulative assessment, dimensions and orientation are outlined in the table below (Table 6.1).

	MODELLED GEOMETRY DIMENSIONS		
	Width	Length	Height
Building	1130m approx	130m approx	20 approx
CFD Mesh Domain	2600m approx	2400m approx	200m approx

Table 6.1: Modelled Geometry Dimensions

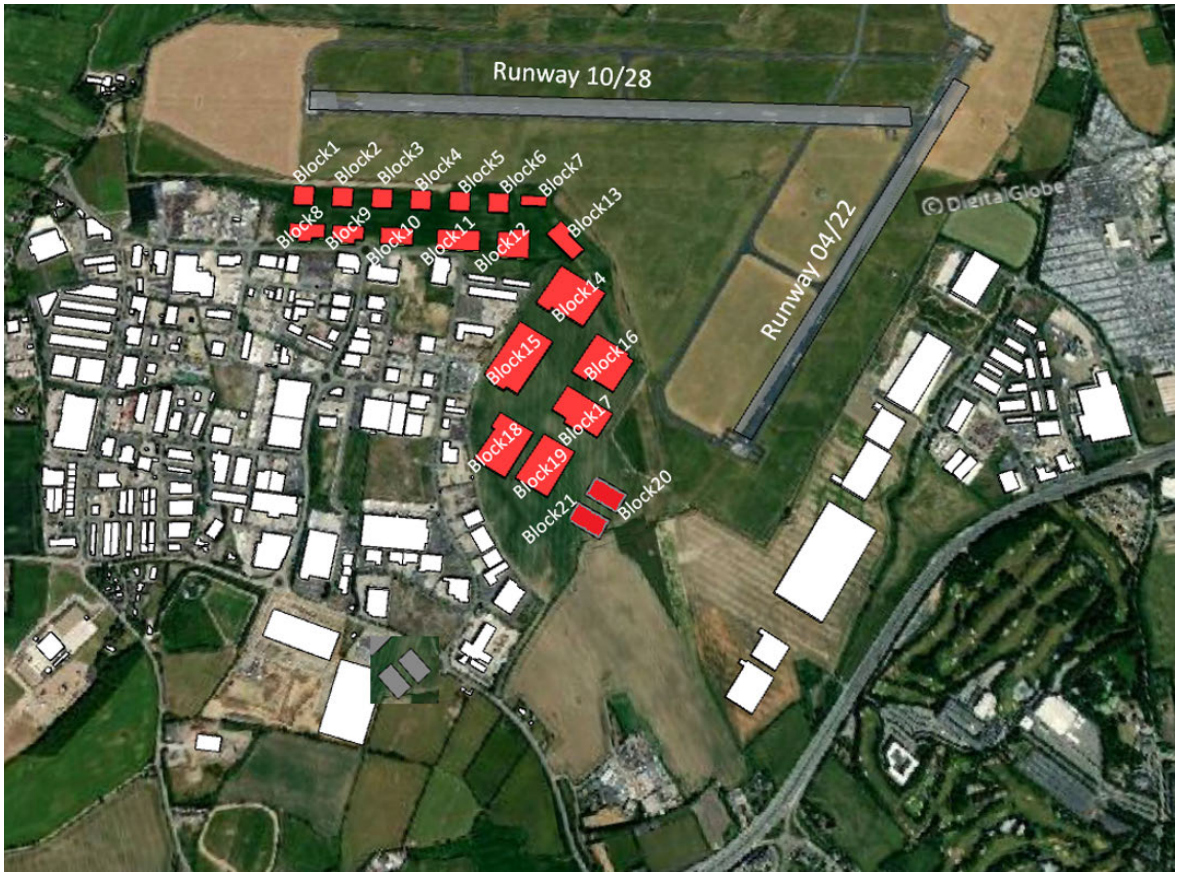


Figure 6.1: Post-development model

7. WIND RESULTS

7.1 WIND IMPACT

This section shows the CFD results of the wind assessment. In this case the assessment has considered the impact of wind on the existing area including the proposed Greenogue Masterplan Development and the adjacent buildings (post-development case). The wind simulations have been carried out on dominant wind directions for the impact on the runawys 10/28 and 04/22. The images within the following subsections show the flow velocity results obtained.

From the simulation results the following observations are pointed out:

- The results of the simulations have shown that the proposed Greenogue Masterplan Development do not introduce major critical impacts on the existing environment and do not appear to be impacted negatively by the adjacent buildings once constructed.

- There are some funneling effects in-between the units, however these phenomena does not increase the wake effects on the runways.

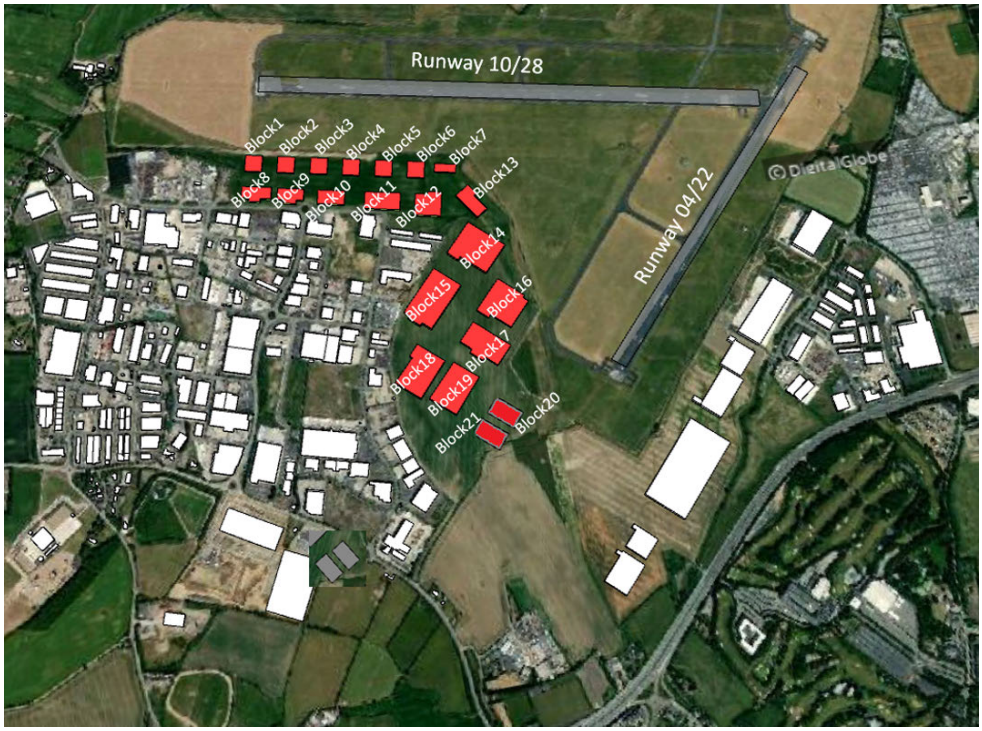


Figure 7.1: Masterplan Development and adjacent domain buildings

7.1.1 Flow Velocity Results

Results of velocity at slice location of 1.5m and 10m above the ground are presented in Figures 7.2 to 7.17 for the previously selected 8 angles for wind assessment of Ground Floor Level of the proposed Greenogue Masterplan.

For each of the modelled directions, no major issues where founded except for the corners areas where some acceleration and detachment flow phenomena are occurring in-between the units, however these phenomena are not considered to be critical or cause an increase the wake effects on runways.

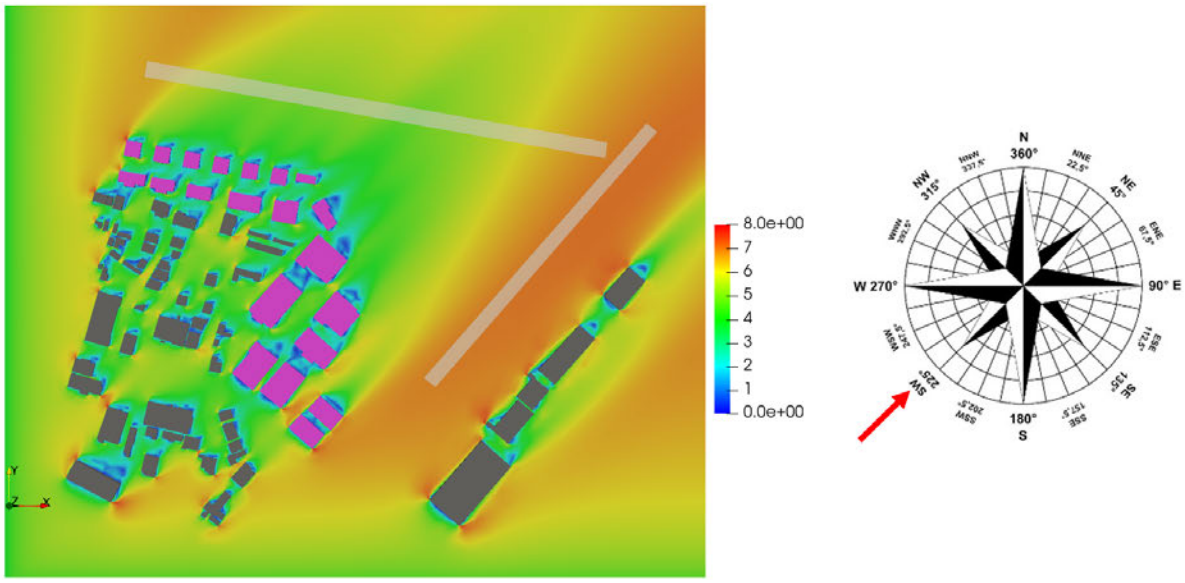


Figure 7.2: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 225°

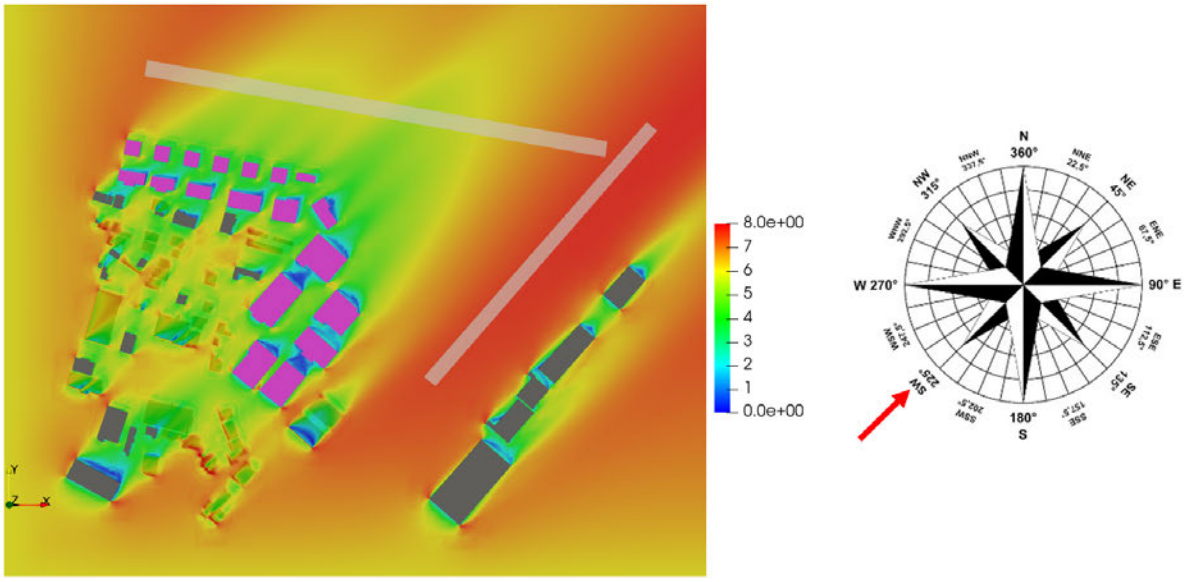


Figure 7.3: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 225°

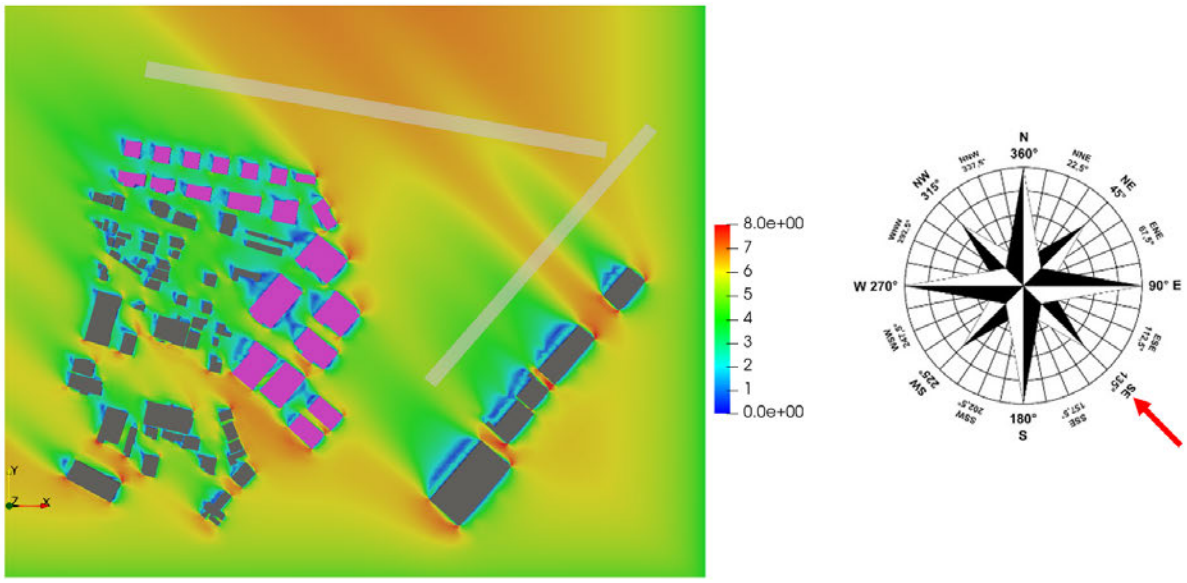


Figure 7.4: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 135°

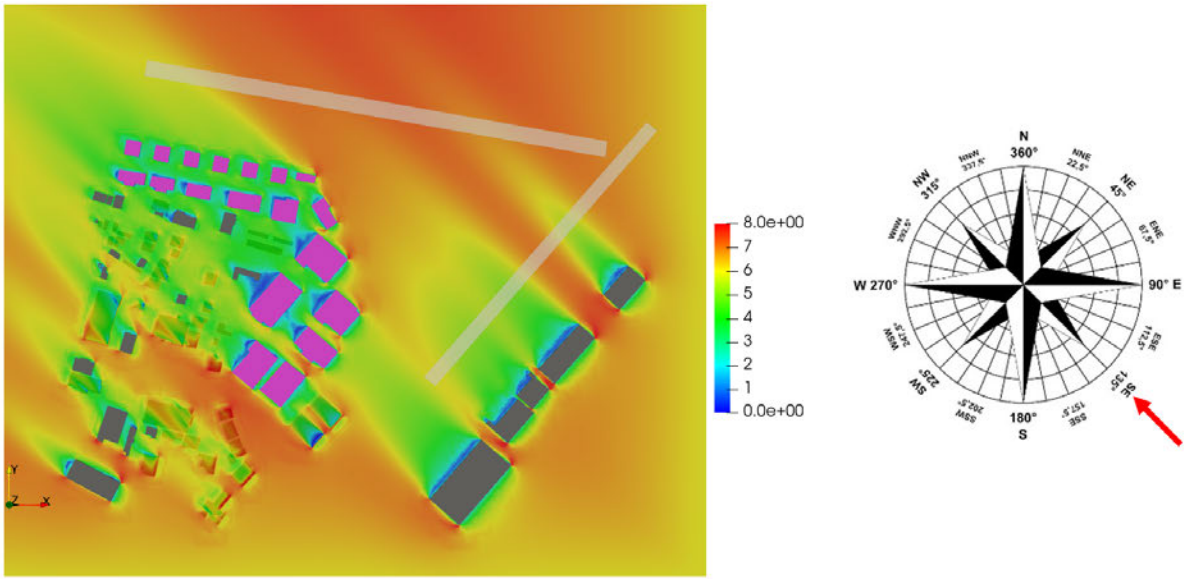


Figure 7.5: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 135°

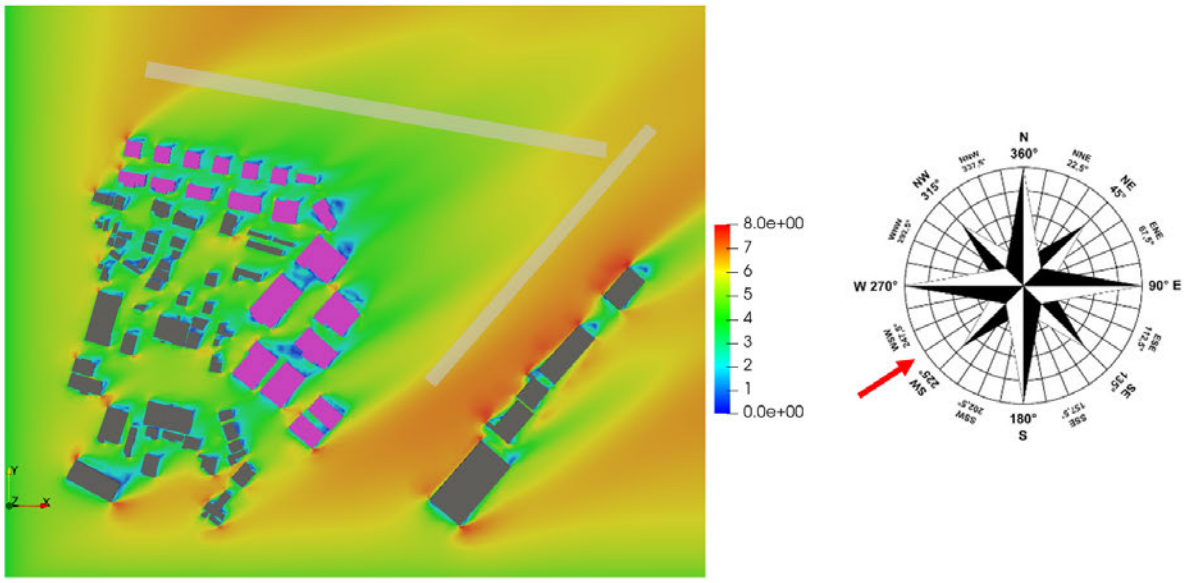


Figure 7.6: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 236°

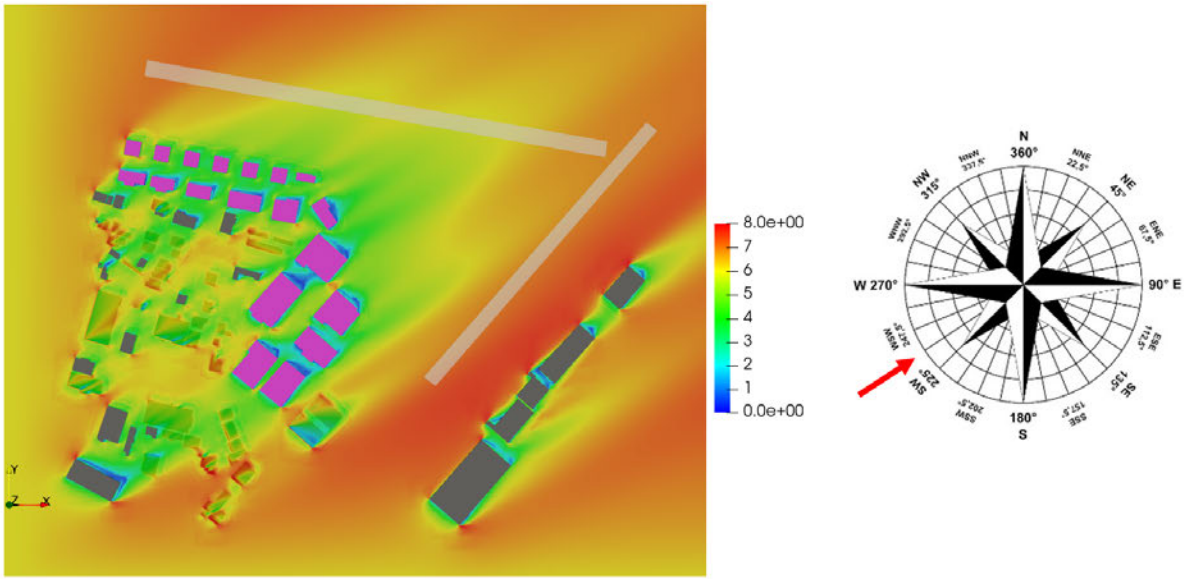


Figure 7.7: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 236°

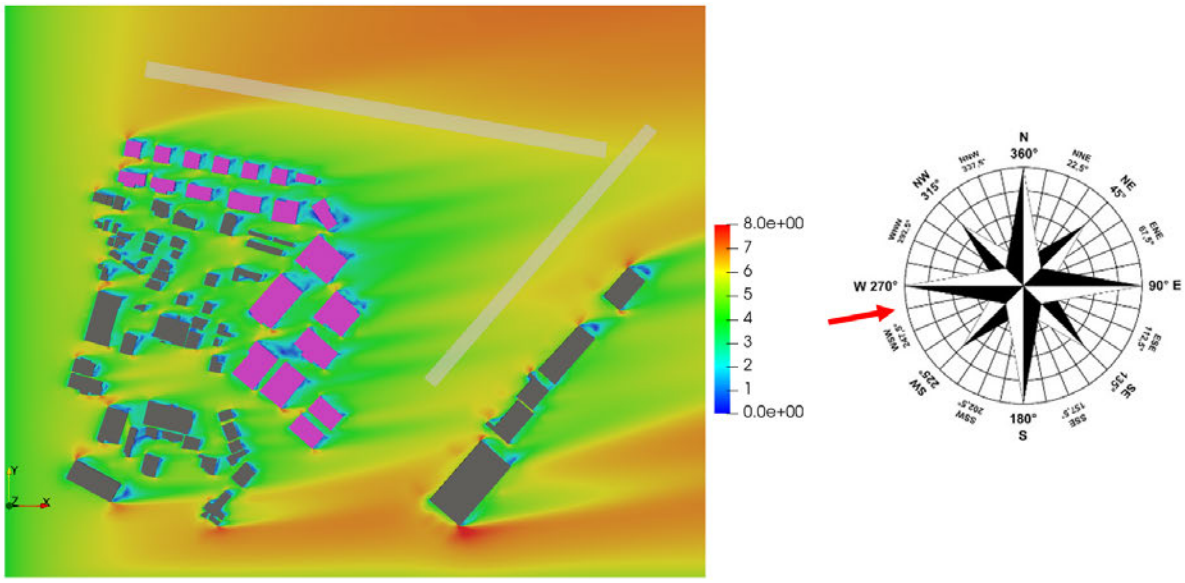


Figure 7.8: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 258°

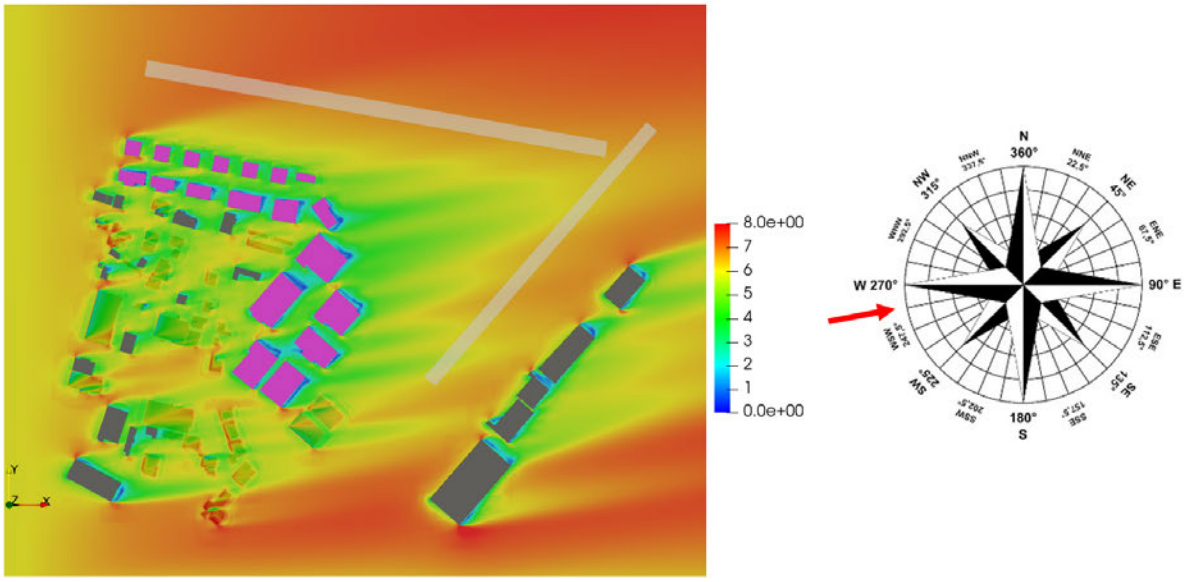


Figure 7.9: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 258°

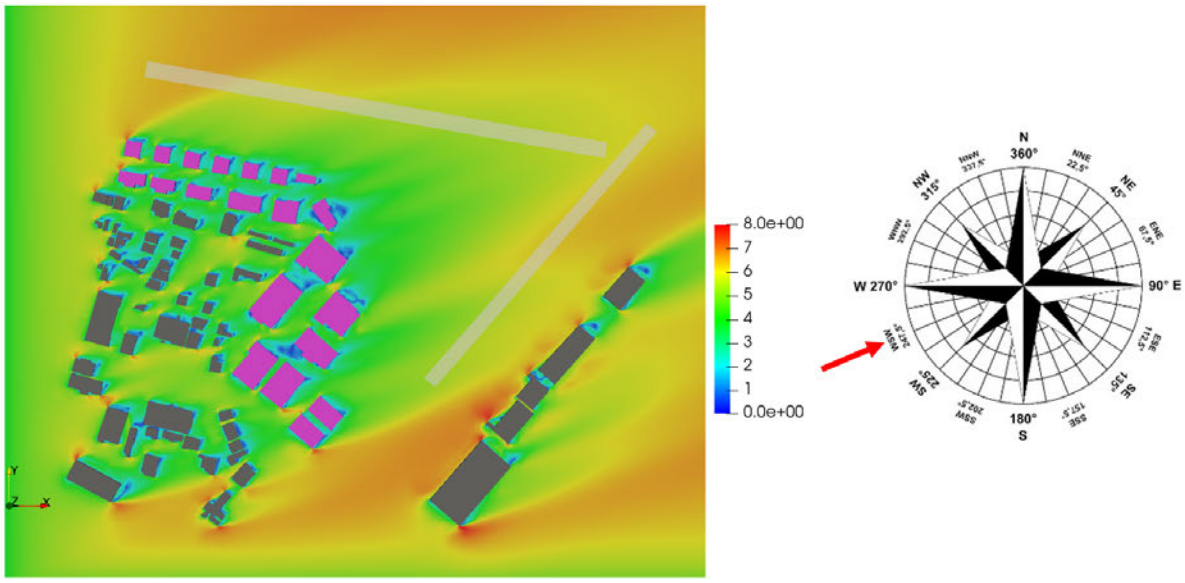


Figure 7.10: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 247°

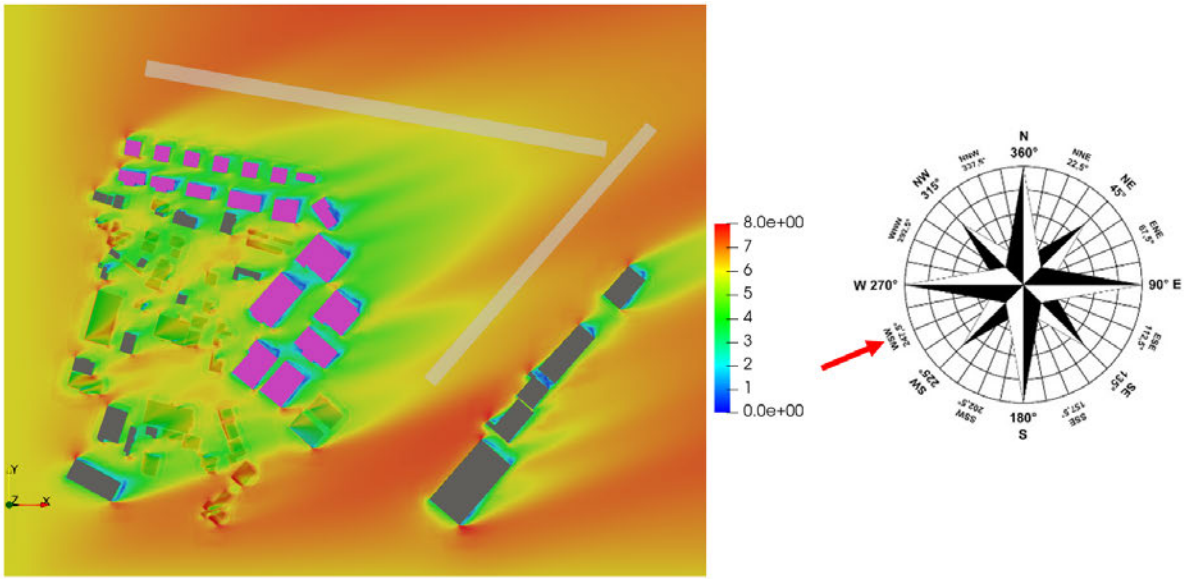


Figure 7.11: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 247°

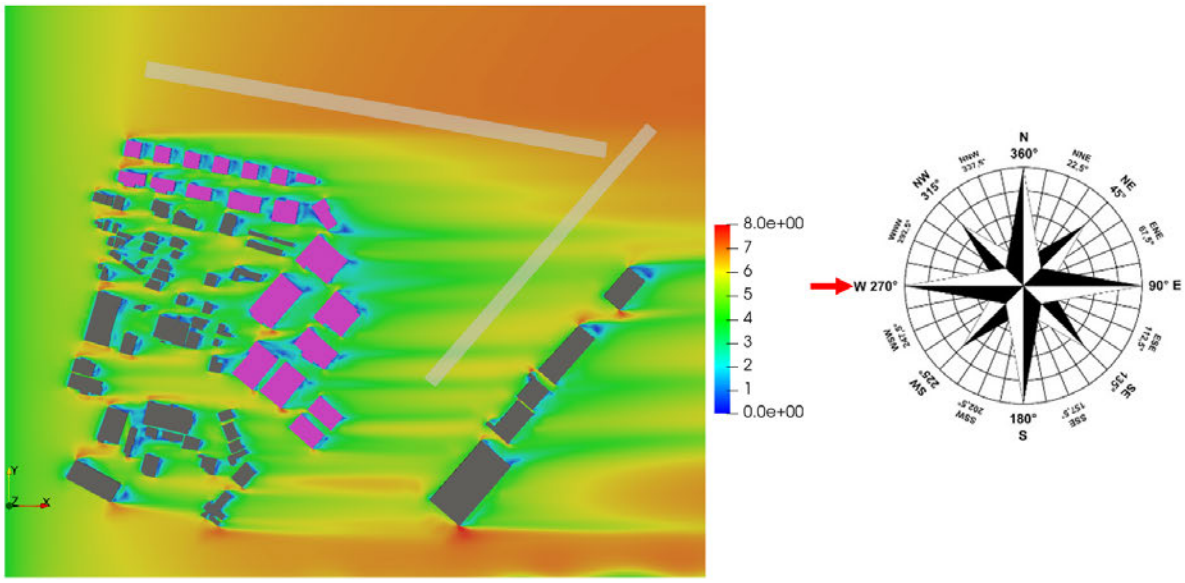


Figure 7.12: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 270°

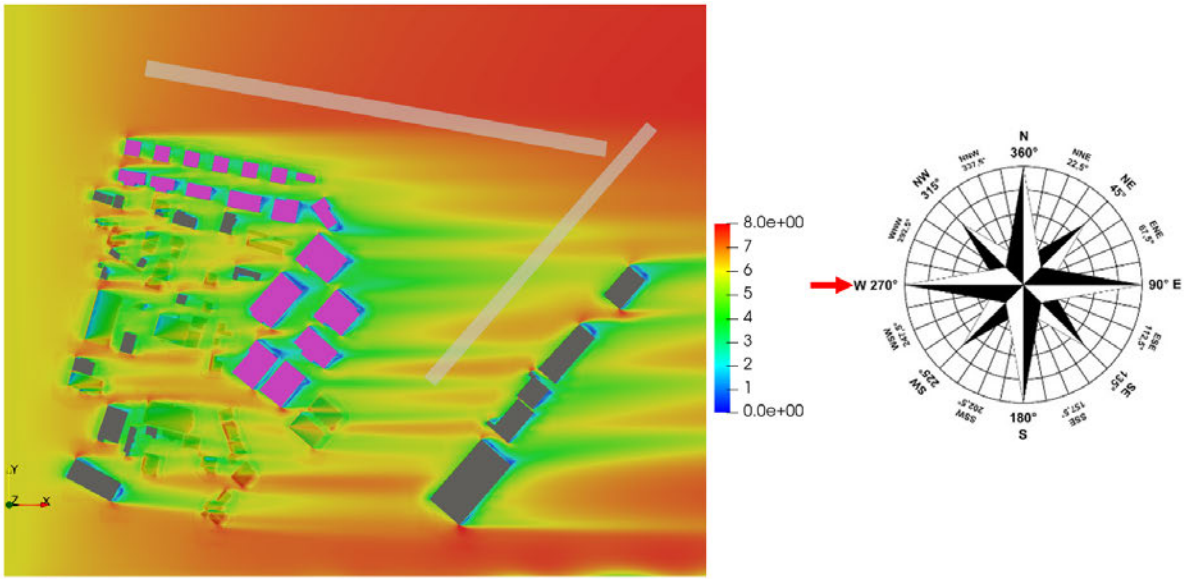


Figure 7.13: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 270°

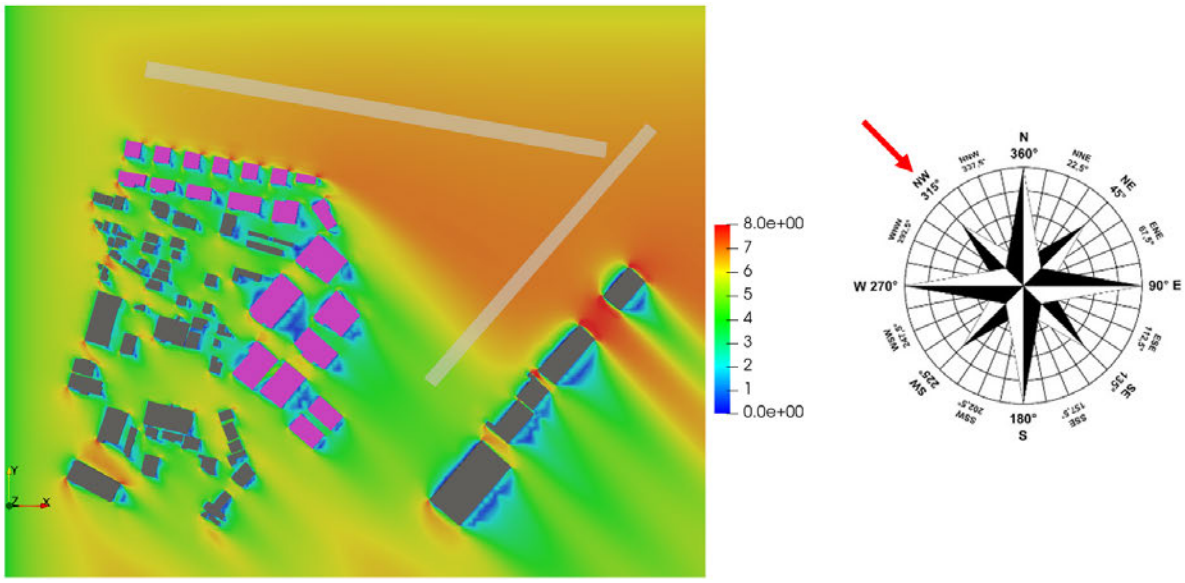


Figure 7.14: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 315°

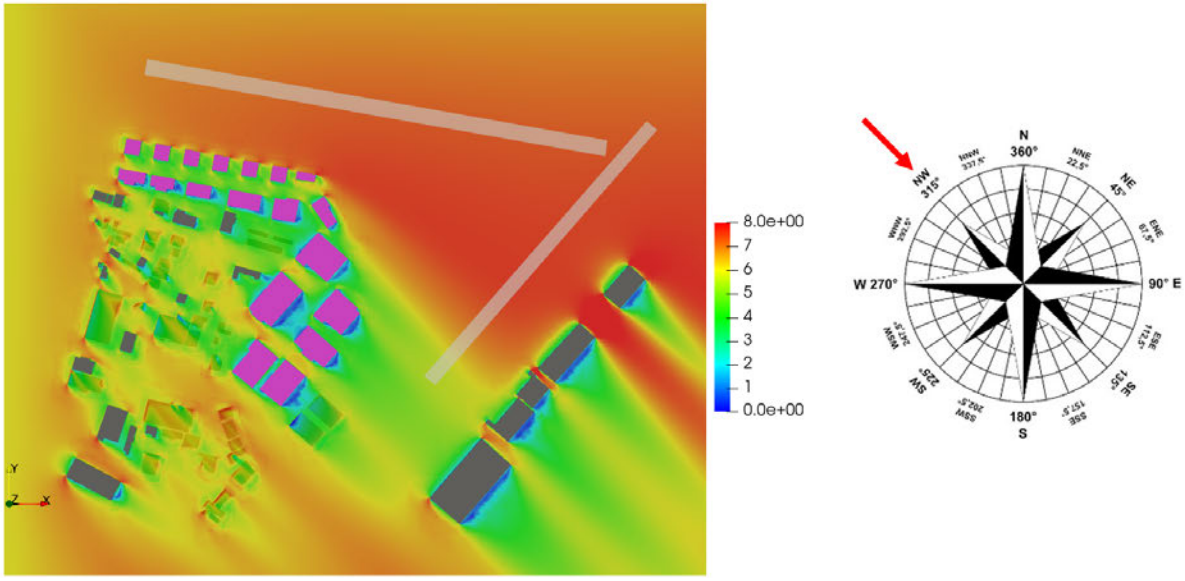


Figure 7.15: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 315°

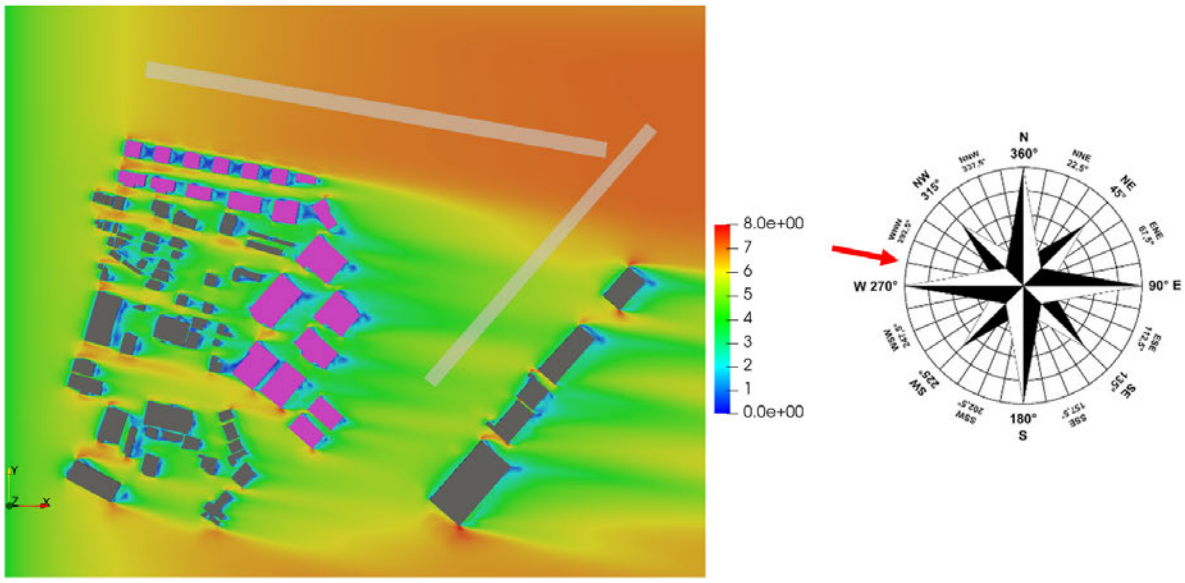


Figure 7.16: Flow Velocity and Wind Results at Z=1.5m above the ground - Wind Direction: 281°

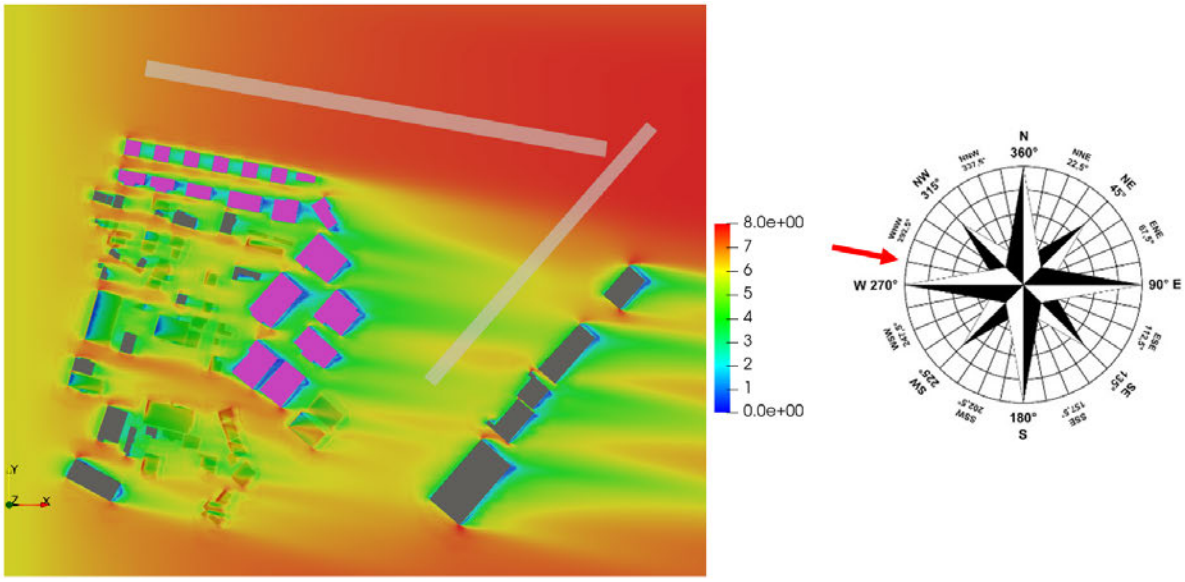


Figure 7.17: Flow Velocity and Wind Results at Z=10m above the ground - Wind Direction: 281°

8. WIND SHEAR AND TURBULENCE RESULTS

8.1 Runway 04/22

This section shows the CFD results of the wind shear and turbulence assessment on runway 04/22, for both a condition without the proposed Greenogue Masterplan Development (pre-development case) and with the proposed Greenogue Masterplan Development (post-development case).

The wind simulations have been carried out on the wind directions that not only are frequent in Dublin, but also have an impact on both the development and the runway. This means that these directions are the ones for which the wind impacts the warehouses first and the runway straight after, as shown in Figure 8.1. These directions are for the runaway 04/22:

- 247.5°
- 270°
- 281.5°

Other wind directions are not influenced by presence of the proposed warehouses as either are not occurring in the area or are impacting the runway 04/22 before impacting the proposed Greenogue Masterplan.

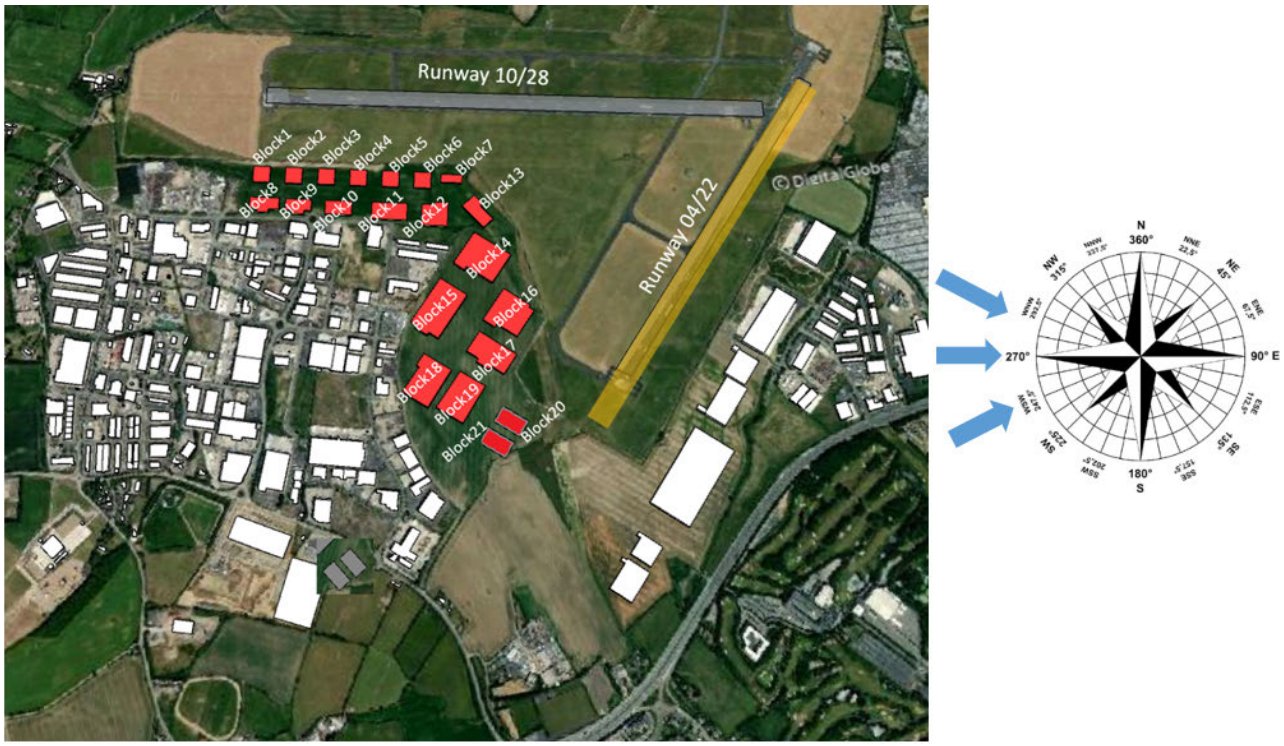


Figure 8.1: Summary of the wind directions selected for the wind shear and turbulence assessment

The velocity to use in this part of the analysis has been chosen accordingly to the historical weather data analysis as the maximum velocity registered in these directions over the years 1985-2020. This velocity has been found equal to 6 m/s. To be conservative, a velocity of 7 m/s has been taken.

The results present the parameters outlined within the acceptance criteria previously described in Section 3.2. The images within the following subsections show the results obtained.

8.1.1 Wind Shear

In this section, results are presented for the previously selected 3 wind directions for wind shear assessment of the proposed Greenogue Masterplan Development. Results are presented as a comparison

between a condition without the proposed Greenogue Masterplan Development (pre-development case) and with the proposed Greenogue Masterplan Development (post-development case).

Figures 8.2 and 8.3 show the wind speed at 1 m above the ground respectively for the pre-development and the post-development case, for the 247.5° wind direction. Figures 8.4 and 8.5 show the wind speed at 1 m above the ground respectively for the pre-development and the post-development case, for the 270° wind direction. Figures 8.6 and 8.7 show the wind speed at 1 m above the ground respectively for the pre-development and the post-development case, for the 281.5° wind direction. Dark blue represents still conditions at 0 m/s and red represents the strongest wind speed.

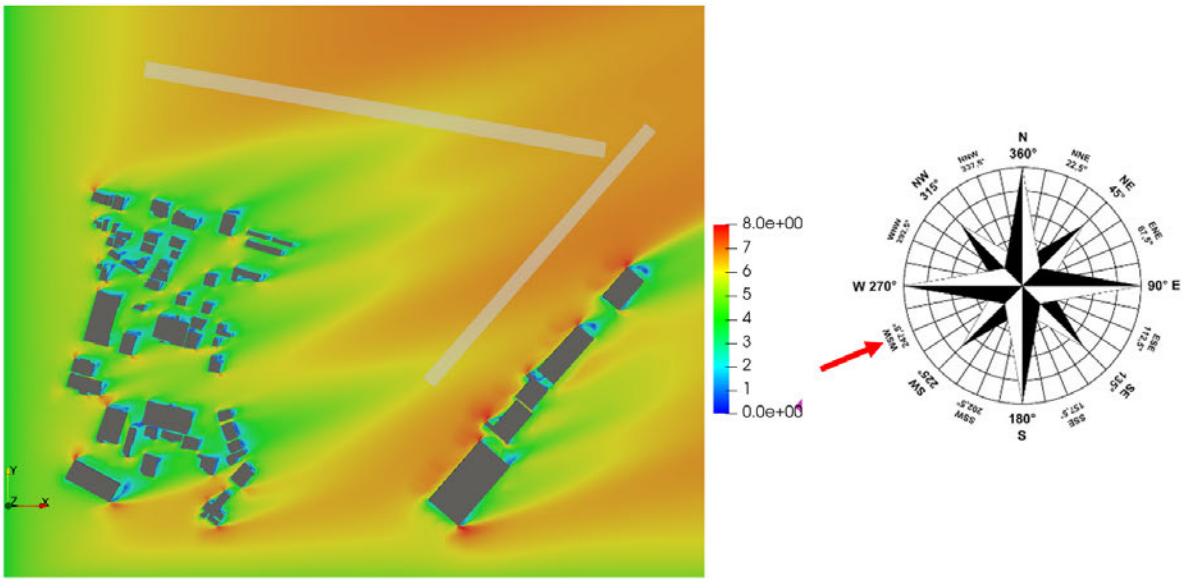


Figure 8.2: Velocity magnitude - Pre-development case - Wind Direction: 247°

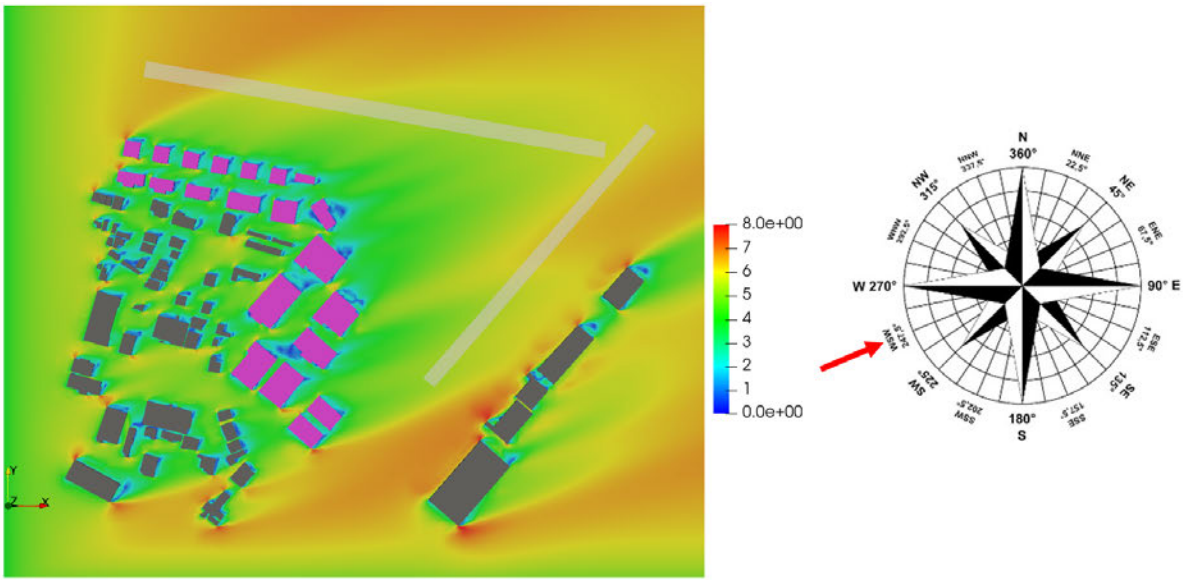


Figure 8.3: Velocity magnitude - Post-development case - Wind Direction: 247°

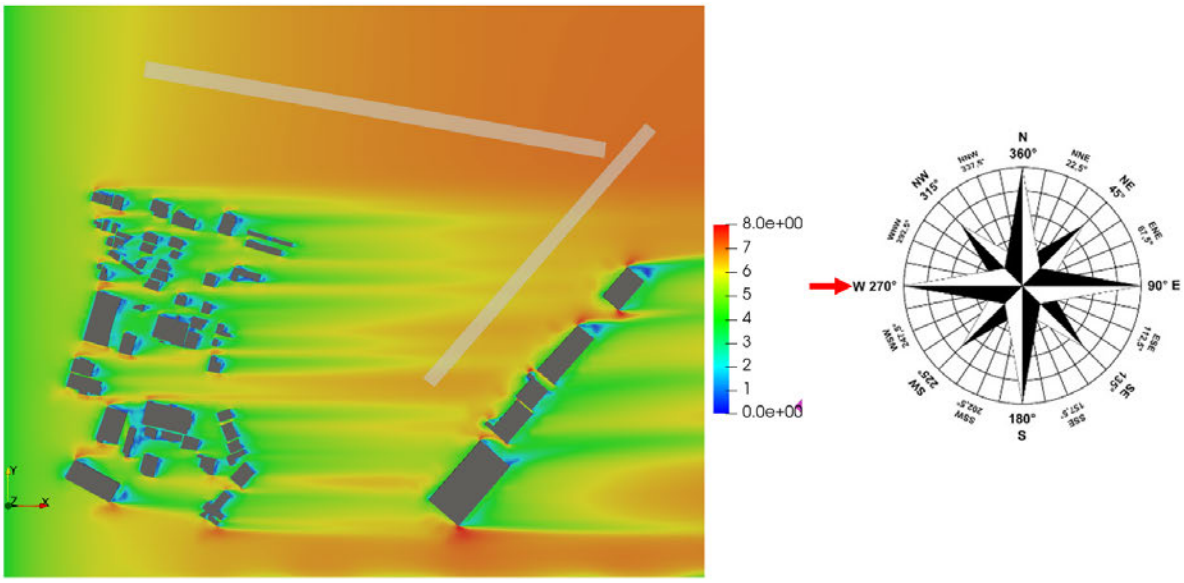


Figure 8.4: Velocity magnitude - Pre-development case - Wind Direction: 270°

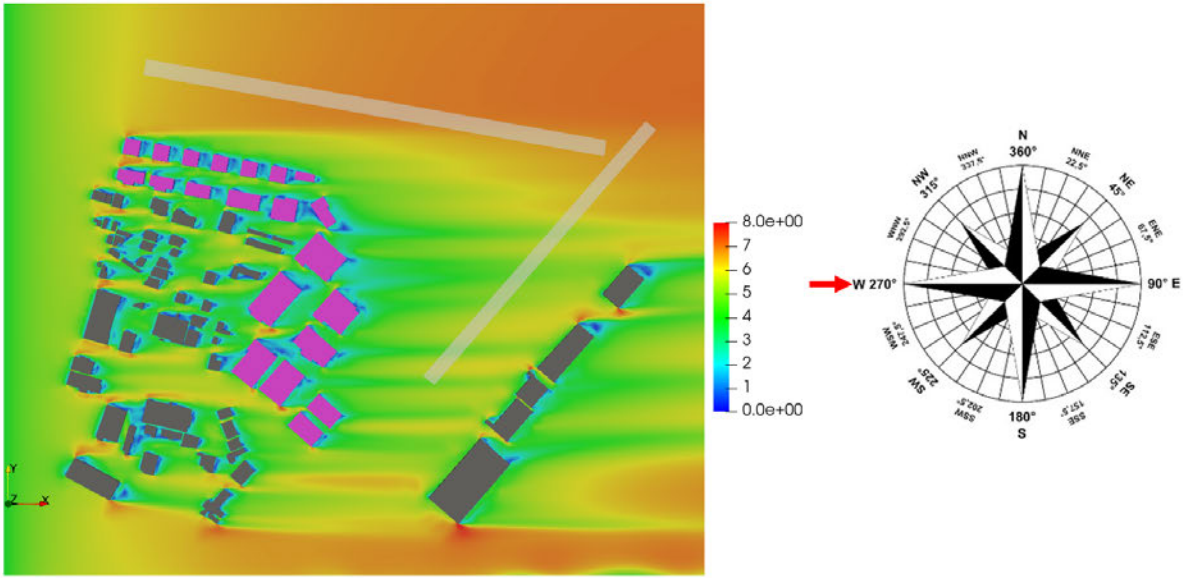


Figure 8.5: Velocity magnitude - Post-development case - Wind Direction: 270°

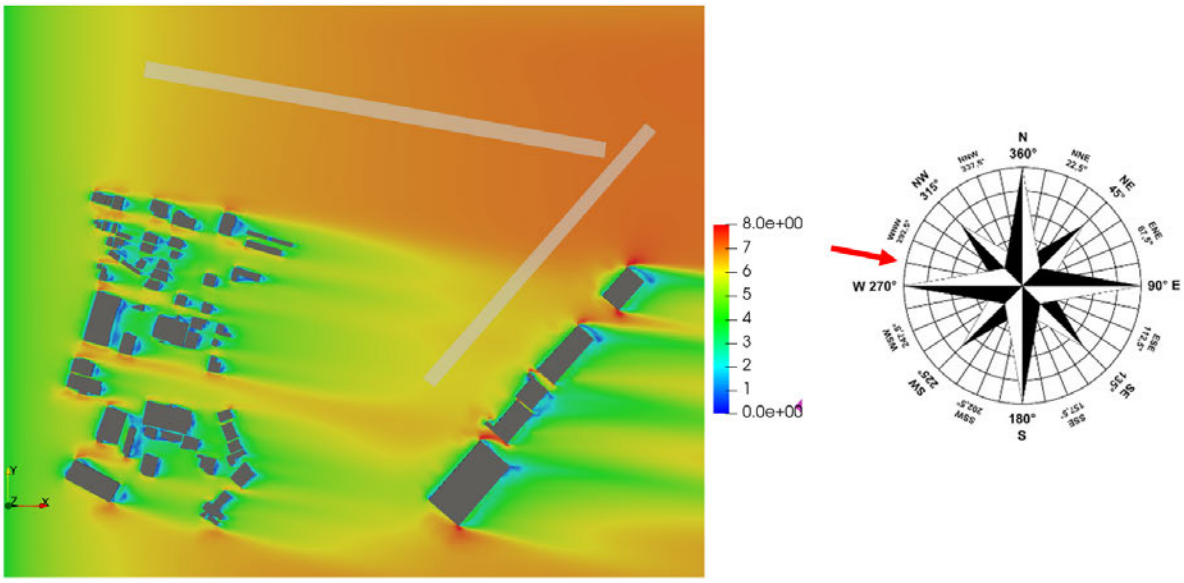


Figure 8.6: Velocity magnitude - Pre-development case - Wind Direction: 281°

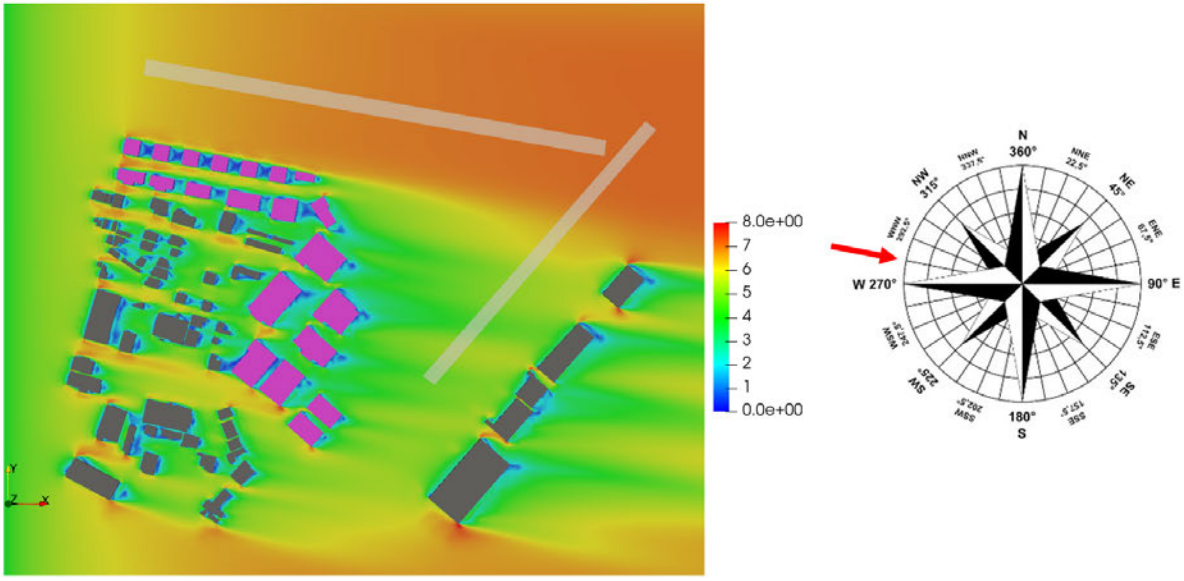


Figure 8.7: Velocity magnitude - Post-development case - Wind Direction: 281°

The following conclusions can be reached from the figures:

- The CFD model captures the fluid flow characteristics in significant detail.
- Wind is approaching the site as per the given boundary conditions. Wind is then accelerated near the edges and stagnated and recirculated behind the buildings.
- Wind is funnelling through the gap between the proposed development as anticipated.
- There is a minor variation in wind speeds along the width of the runway.

In the wind shear and turbulence modelling study, wind speed and turbulence must be reported at the aircraft trajectory. The approaching angle for landing is usually between 2.7 degrees and 4 degrees, with

3 degrees considered as the average.

Two possible landing scenarios are analysed in this study. Each landing paths of approximately 850 m has a horizantal distance along the runway from the point at which the airplane is 30 meters above the ground to the end of the landing phase. It is assumed that the aircraft glides down with constant speed and its track angel is 3 degree. Landing paths are shown in Figure 8.8.

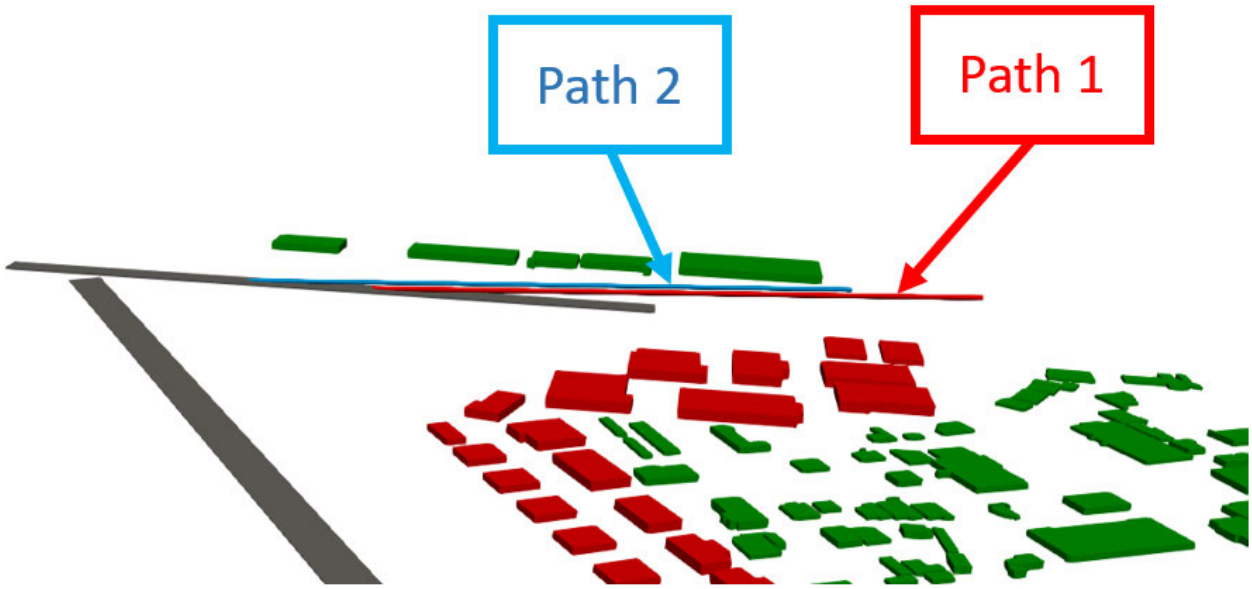


Figure 8.8: Landing Scenarios 1 and 2 at 3 degrees approaching angle

The variation in wind speeds for the selected flight paths are shown in Figure 8.9, for the 247.5° wind direction. The variation in wind speeds for the selected flight paths are shown in Figure 8.10, for the 270° wind direction. The variation in wind speeds for the selected flight paths are shown in Figure 8.11, for the 281.5° wind direction.

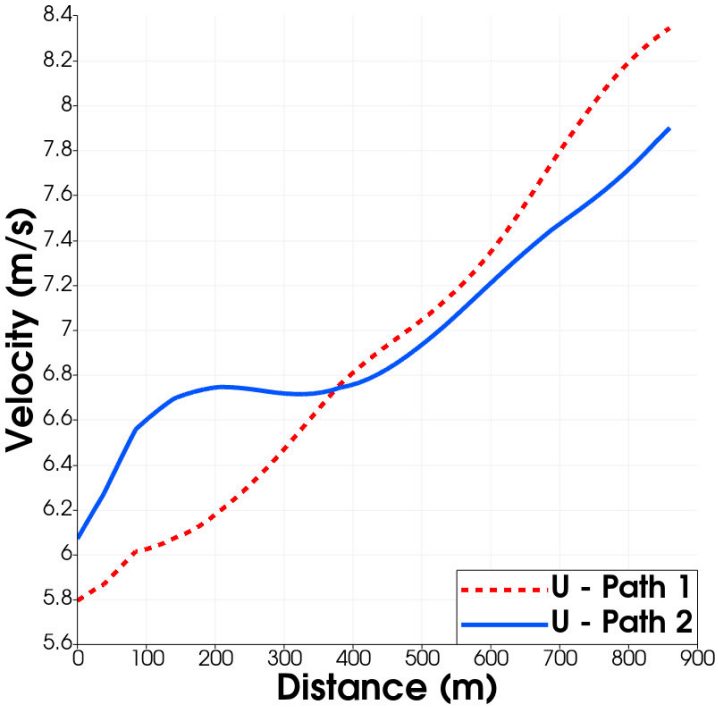


Figure 8.9: Velocity Magnitude along trajectory path 1 and path 2 - Wind Direction 247.5°

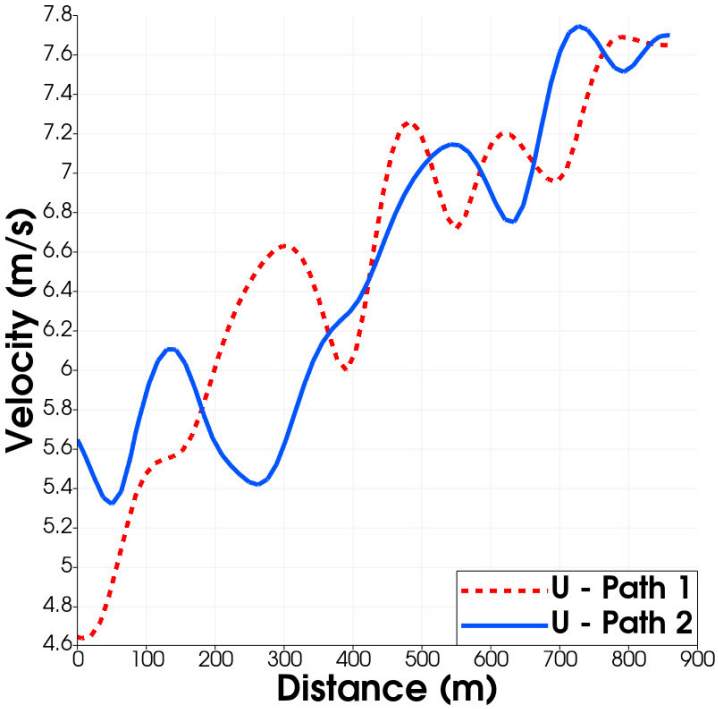


Figure 8.10: Velocity Magnitude along trajectory path 1 and path 2 - Wind Direction 270°

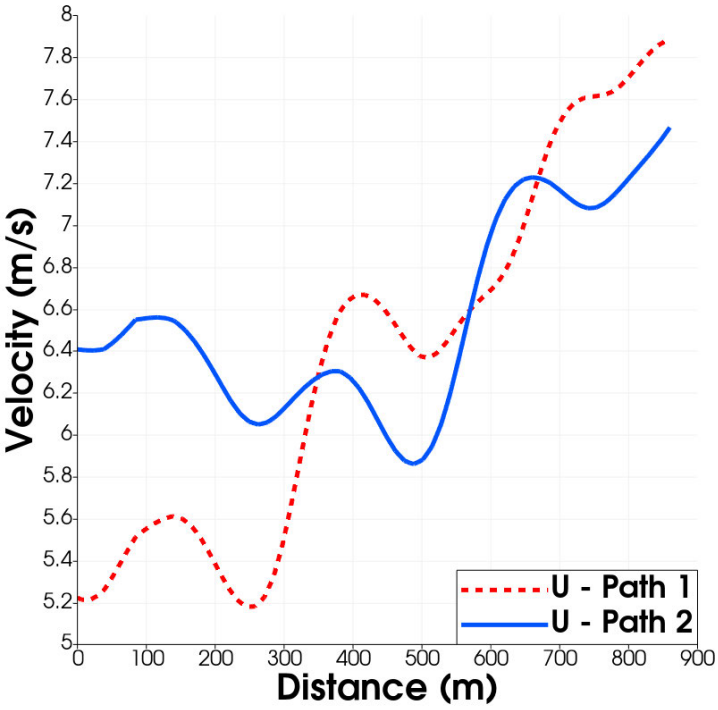


Figure 8.11: Velocity Magnitude along trajectory path 1 and path 2 - Wind Direction 281.5°

From these graphs the following considerations can be made:

- The graphs present the results at variable height of the aircraft trajectories (3 degrees approaching angle).
- The approaching mean wind speed at 10 m above ground is 7 m/s in both scenarios modelled (Pre-development and post-development).
- Wind speed increases with height. Higher wind speed is therefore predicted at 30 m above ground.
- The highest velocity around the building can be found at the top of it.
- The wind shear and wind deficit results are proportional.
- The mean wind speed at the ground = 0.

Therefore, the following major conclusions can be achieved from the graphs in Figures 8.9, 8.10 and 8.11:

- The variation of the velocity from the mean speed is less than 6 knots (3 m/s) along the analysed flight path at a height below 60 m.
- The NASF wind shear criterion is therefore not exceeded for the analysed flight paths.

8.1.2 Turbulence

Figure 8.12 shows the predicted turbulence intensity over the extended computational domain and detailed site topography in the vicinity of the weather station, runway 04/22 and areas of interest.

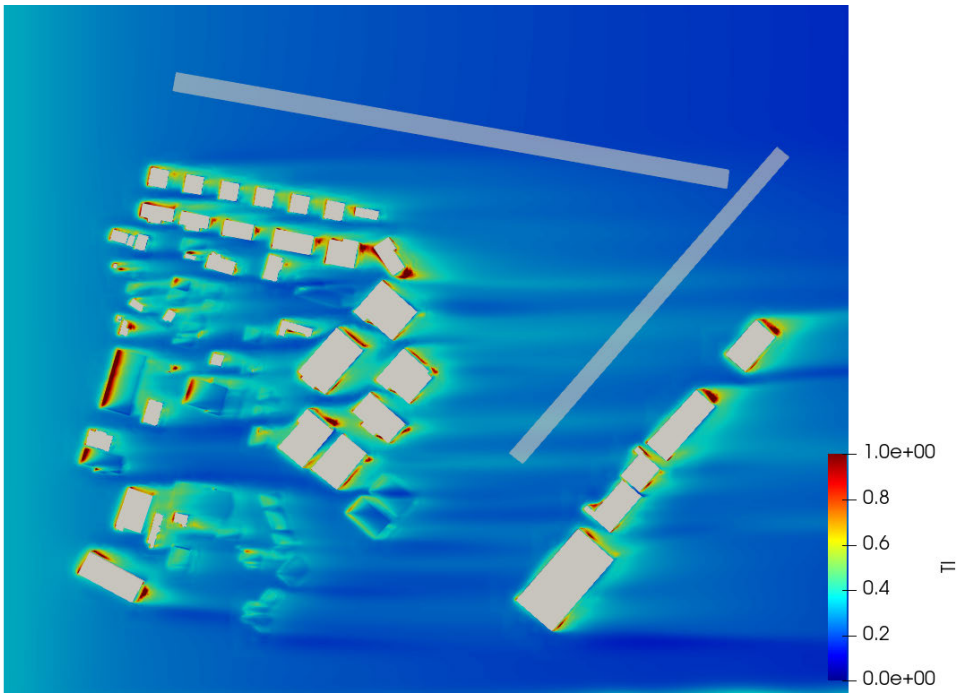


Figure 8.12: Predicted Turbulence Intensity - Wind Direction 270°

The predicted turbulence intensity at flight paths 1 and 2 is shown in Figure 8.13 for wind direction 247.5°. The predicted turbulence intensity at flight paths 1 and 2 is shown in Figure 8.14 for wind direction 270°. The predicted turbulence intensity at flight paths 1 and 2 is shown in Figure 8.15 for wind direction 281.5°.

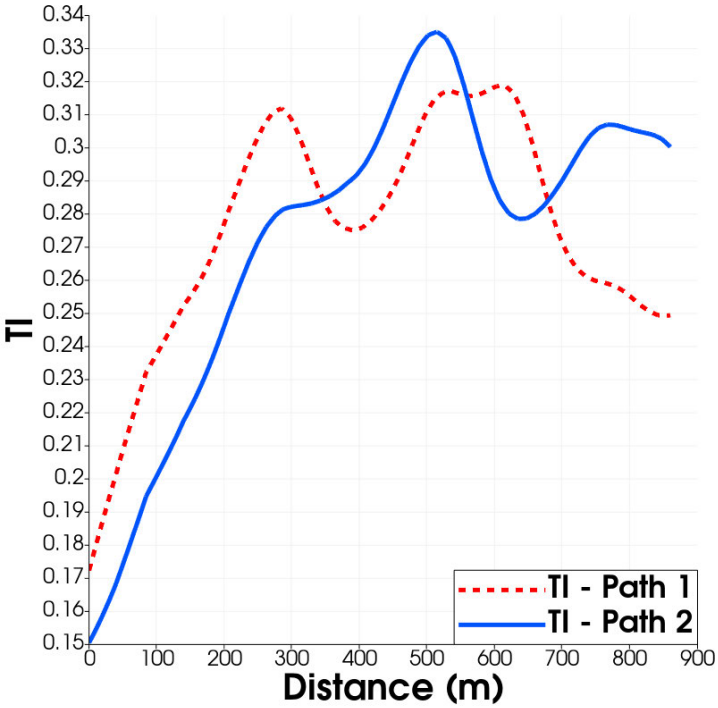


Figure 8.13: Turbulence Intensity along trajectory path 1 and path 2 - Wind Direction 247.5°

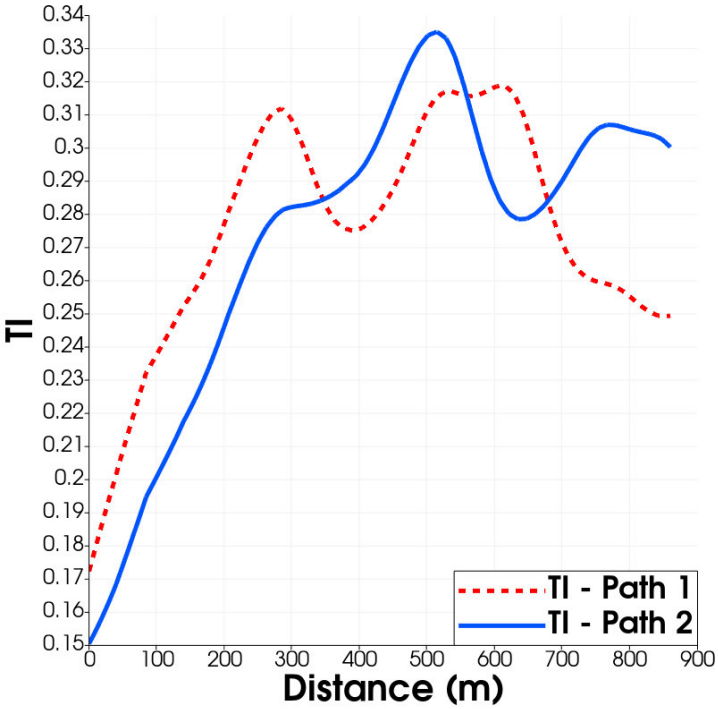


Figure 8.14: Turbulence Intensity along trajectory path 1 and path 2- Wind Direction 270°

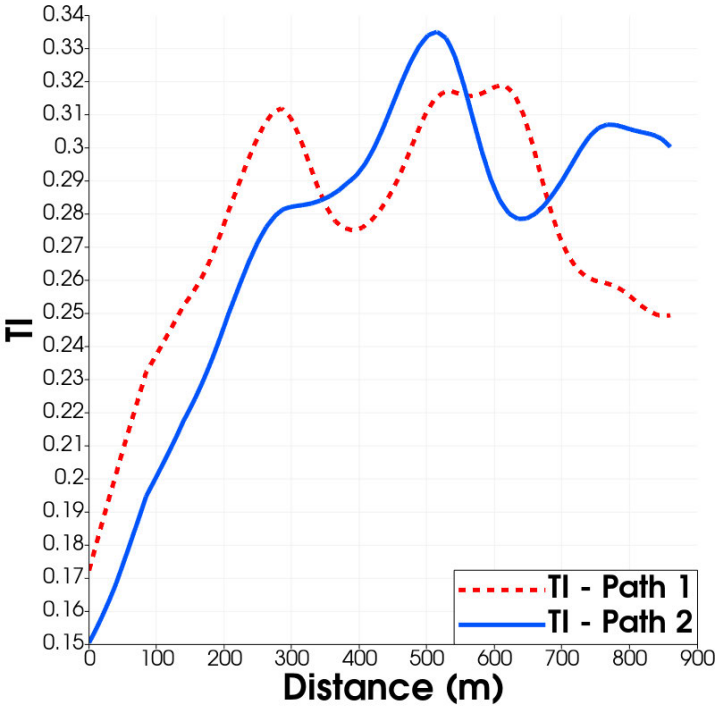


Figure 8.15: Turbulence Intensity along trajectory path 1 path 2- Wind Direction 281.5°

The following major conclusion can be reached:

- Highest turbulence intensity occurs near the ground and in the wake of upstream buildings as expected. The mean wind speeds at these locations are generally low.

The turbulence or root-mean-square (RMS) value along the aircraft trajectory for flight paths 1 and 2 is presented in Figure 8.16 for the pre-development case and in Figure 8.17 for the post-development case, for wind direction 247.5°. The turbulence or root-mean-square (RMS) value along the aircraft trajectory for flight paths 1 and 2 is presented in Figure 8.18 for the pre-development case and in Figure 8.19 for the post-development case, for wind direction 270°. The turbulence or root-mean-square (RMS) value along the aircraft trajectory for flight paths 1 and 2 is presented in Figure 8.20 for the pre-development case and in Figure 8.21 for the post-development case, for wind direction 281.5°.

These results are calculated based on the wind shear and turbulence intensity results.

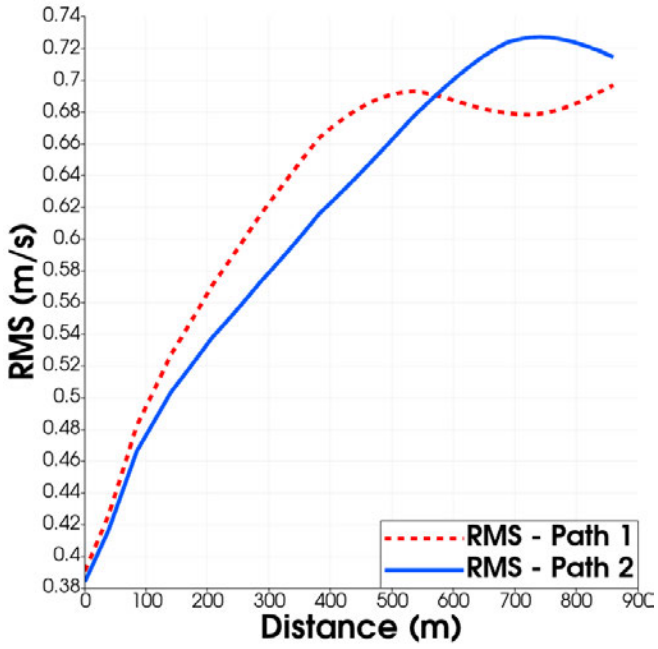


Figure 8.16: RMS (Standard Deviation) Value along trajectory path 1 and 2 - pre-development - Wind Direction 247.5°

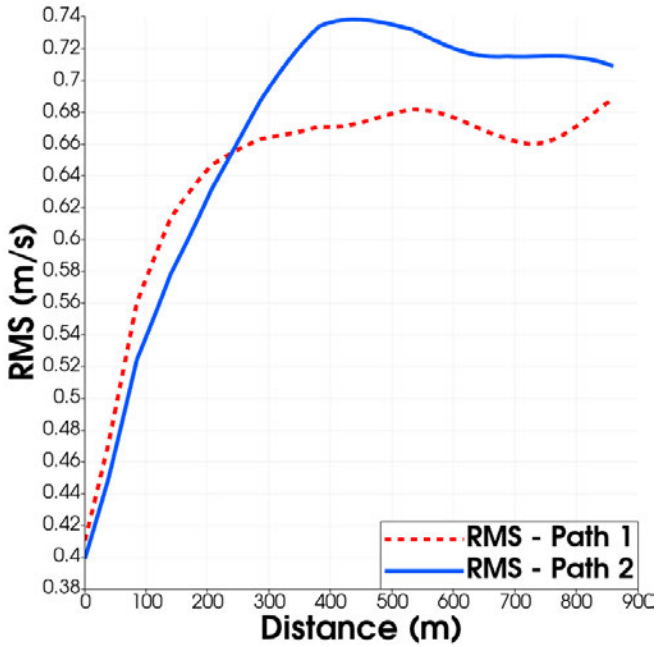


Figure 8.17: RMS (Standard Deviation) Value along trajectory path 1 and 2 - post-development - Wind Direction 247.5°

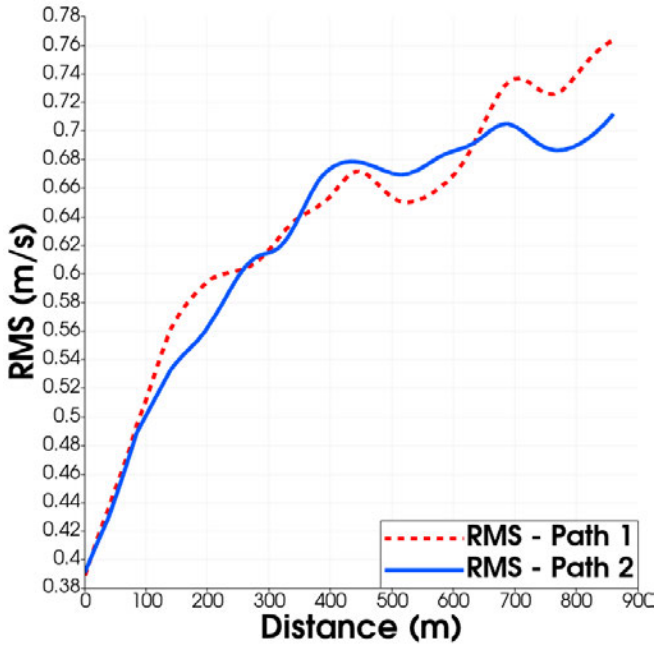


Figure 8.18: RMS (Standard Deviation) Value along trajectory path 1 and 2 - pre-development - Wind Direction 270°

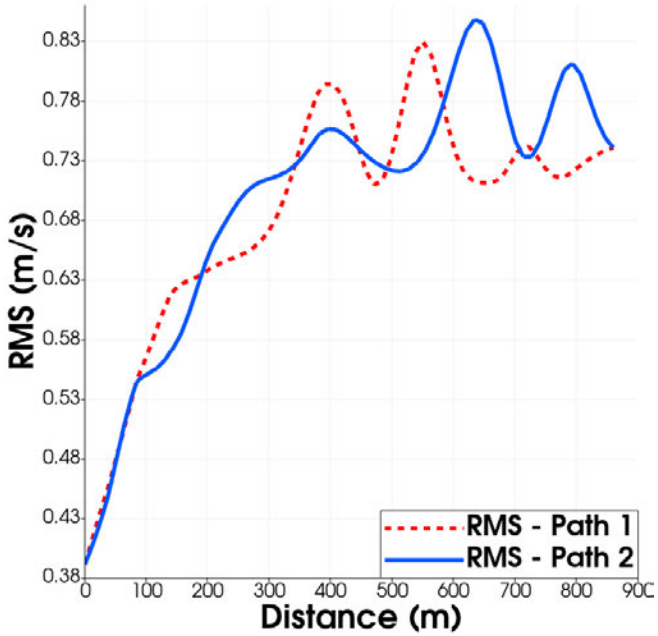


Figure 8.19: RMS (Standard Deviation) Value along trajectory path 1 and 2 - post-development - Wind Direction 270°

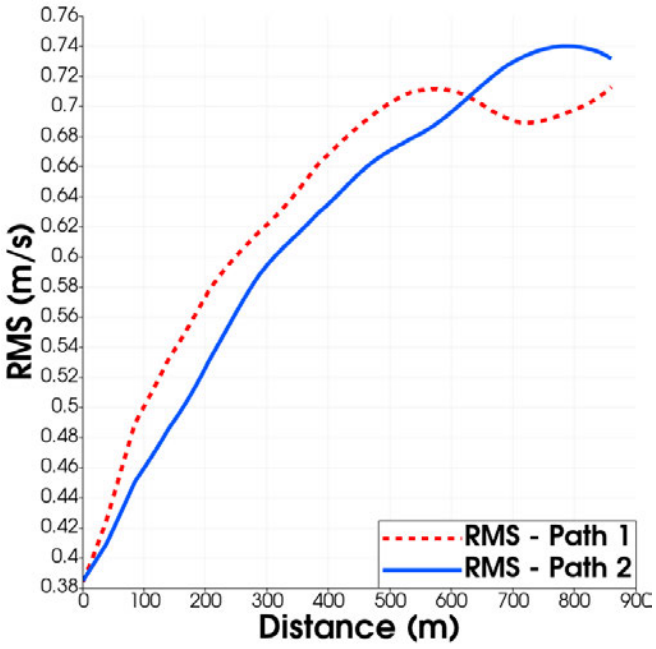


Figure 8.20: RMS (Standard Deviation) Value along trajectory path 1 and 2 - pre-development - Wind Direction 281.5°

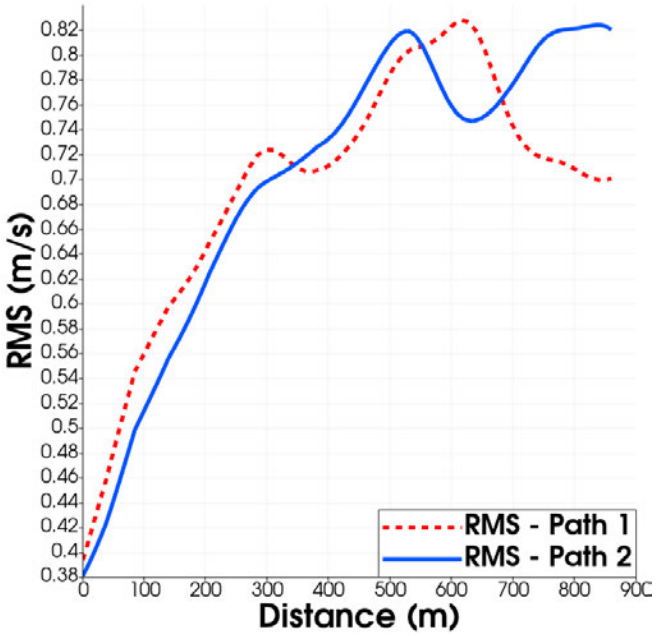


Figure 8.21: RMS (Standard Deviation) Value along trajectory path 1 and 2 - post-development - Wind Direction 281.5°

The following conclusions can be achieved from these results:

- The RMS reduces with reducing crosswind speeds.
- The RMS (standard deviation) is below 4 kt (2.06 m/s) for an approaching wind of 7 m/s at 10 m above ground for the pre-development and post development scenarios.

- Turbulence levels for the flight paths are reduced due to reduced mean wind speed while the increase in turbulent intensity is tolerable.

8.2 Runway 10/28

This section shows the CFD results of the wind shear and turbulence assessment on runway 10/28, for both a condition without the proposed Greenogue Masterplan (pre-development case) and with the proposed Greenogue Masterplan (post-development case).

The wind simulations have been carried out on the wind directions that not only are frequent in Dublin, but also have an impact on both the development and the runway. This means that these directions are the ones for which the wind impacts the warehouses first and the runway straight after, as shown in Figure 8.22. These directions are:

- 225°
- 236.5°
- 247.5°

Other wind directions are not influenced by presence of the proposed warehouses as either are not occurring in the area or are impacting the runways before impacting the proposed Greenogue Masterplan.



Figure 8.22: Summary of the wind directions selected for the wind shear and turbulence assessment

The velocity to use in this part of the analysis has been chosen accordingly to the historical weather data analysis as the maximum velocity registered in these directions over the years 1985-2020. This velocity has been found equal to 6 m/s. To be conservative, a velocity of 7 m/s has been taken.

The results present the parameters outlined within the acceptance criteria previously described in Section 3.2. The images within the following subsections show the results obtained.

8.2.1 Wind Shear

In this section, results are presented for the previously selected 3 wind directions for wind shear assessment of the proposed Greenogue Masterplan Development. Results are presented as a comparison

between a condition without the proposed Greenogue Masterplan Development (pre-development case) and with the proposed Greenogue Masterplan Development (post-development case).

Figures 8.23 and 8.24 show the wind speed at 1 m above the ground respectively for the pre-development and the post-development case, for the 225° wind direction. Figures 8.25 and 8.26 show the wind speed at 1 m above the ground respectively for the pre-development and the post-development case, for the 236.5° wind direction. Figures 8.27 and 8.28 show the wind speed at 1 m above the ground respectively for the pre-development and the post-development case, for the 247.5° wind direction. Dark blue represents still conditions at 0 m/s and red represents the strongest wind speed.

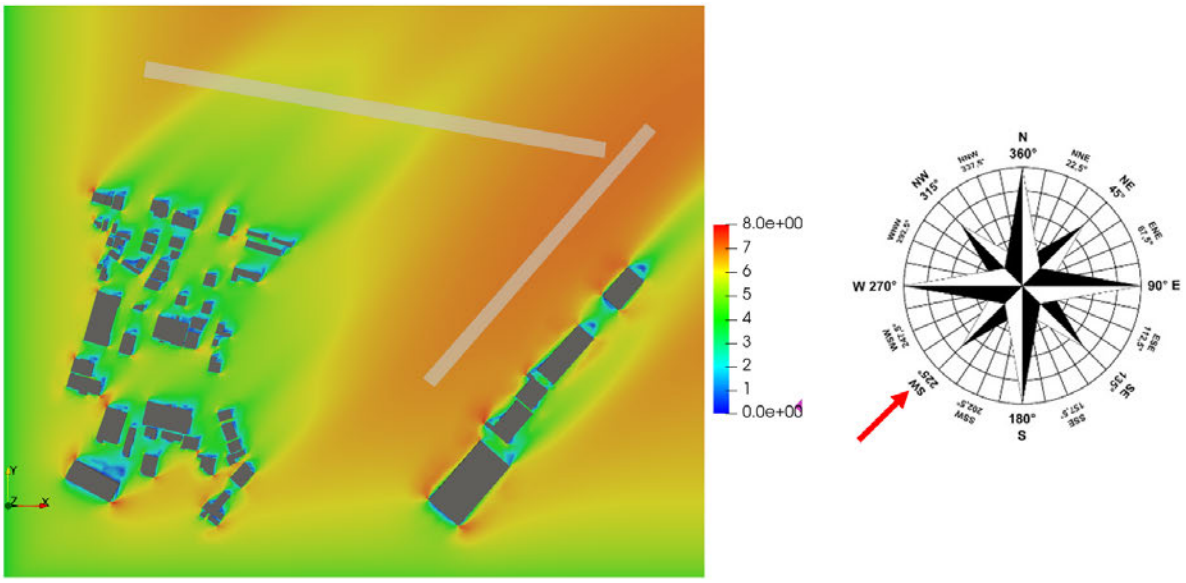


Figure 8.23: Velocity magnitude - Pre-development case - Wind Direction: 225°

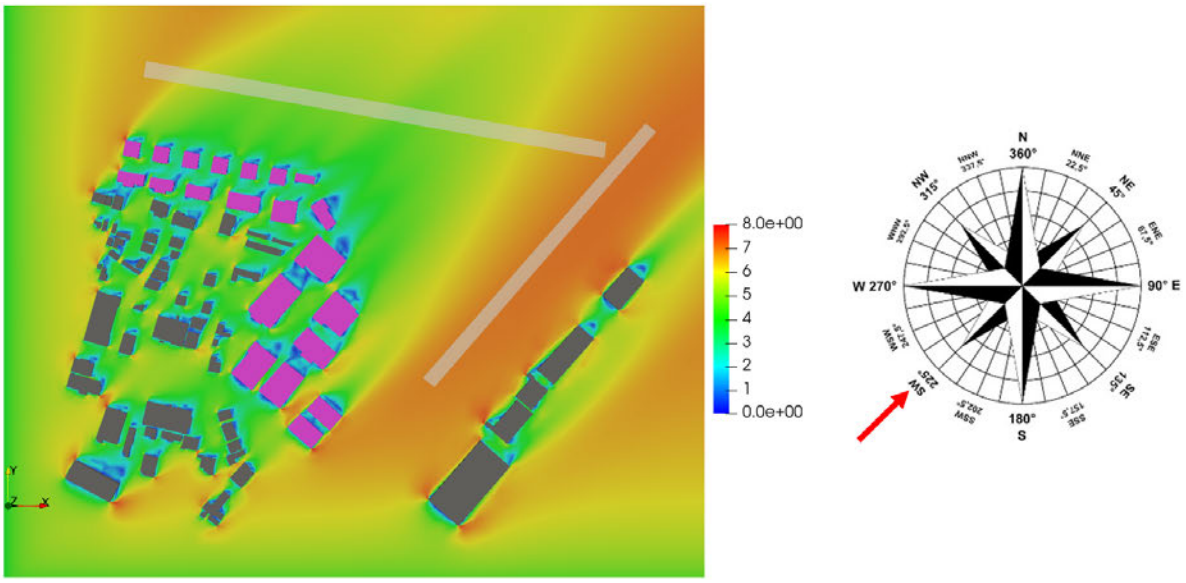


Figure 8.24: Velocity magnitude - Post-development case - Wind Direction: 225°

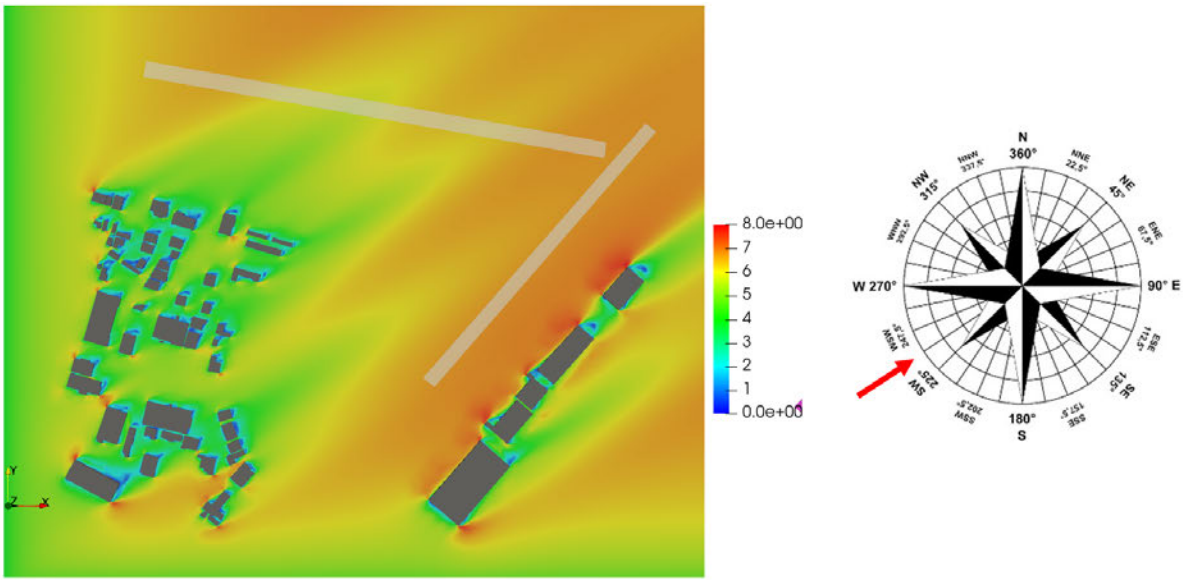


Figure 8.25: Velocity magnitude - Pre-development case - Wind Direction: 236°

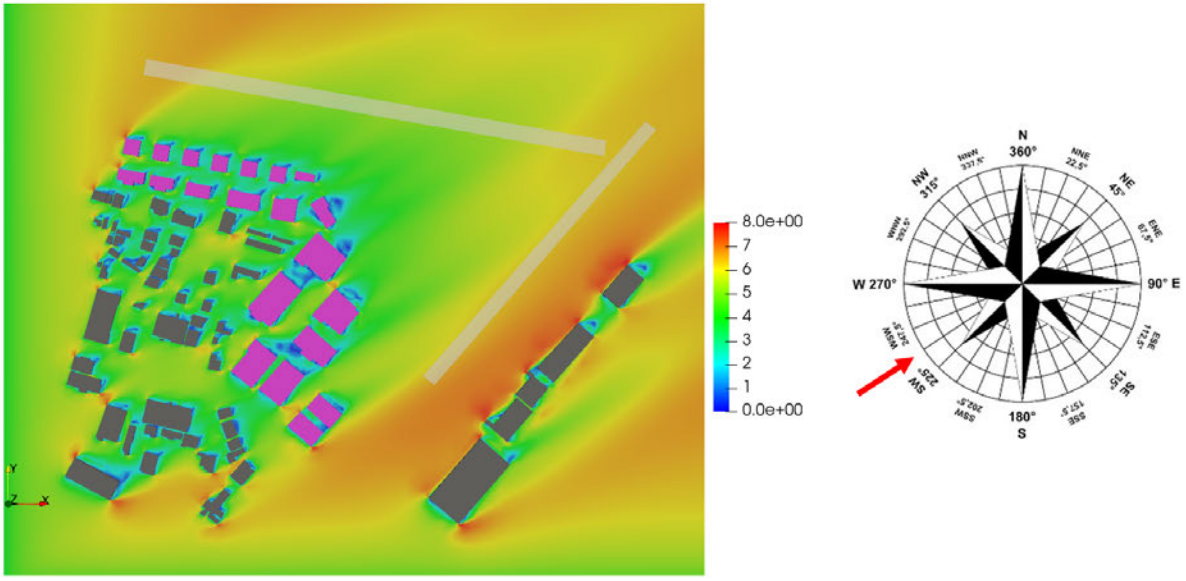


Figure 8.26: Velocity magnitude - Post-development case - Wind Direction: 236°

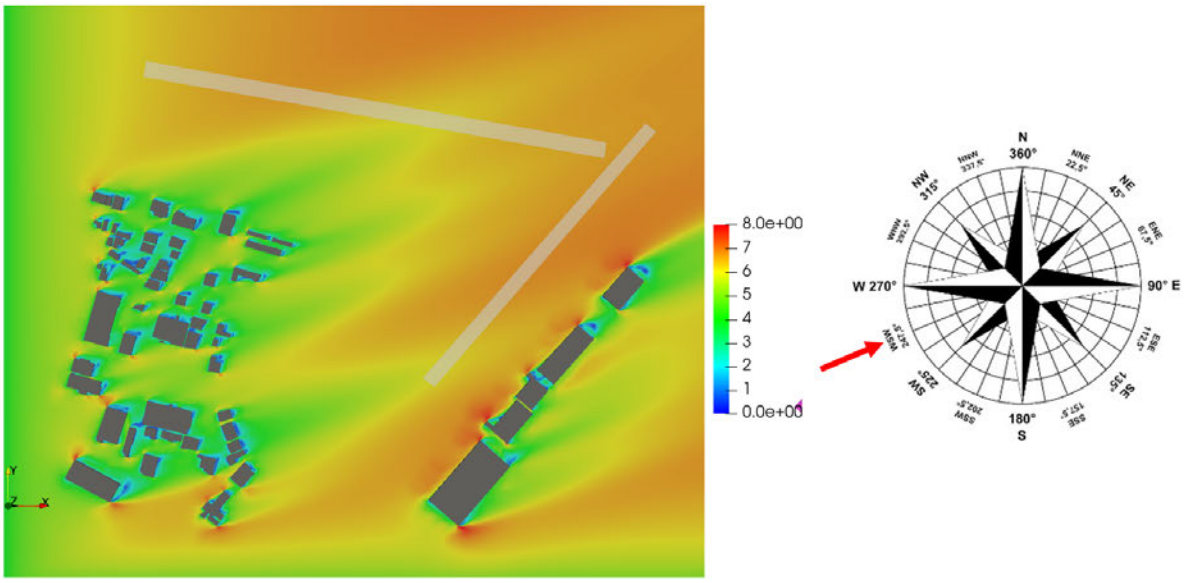


Figure 8.27: Velocity magnitude - Pre-development case - Wind Direction: 247°

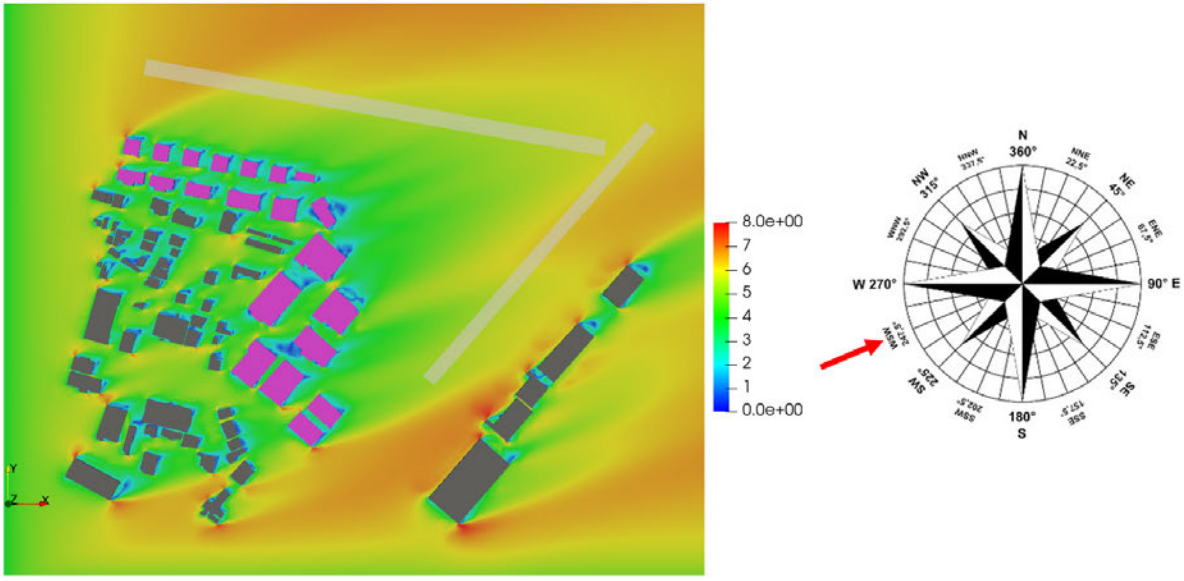


Figure 8.28: Velocity magnitude - Post-development case - Wind Direction: 247°

The following conclusions can be reached from the figures:

- The CFD model captures the fluid flow characteristics in significant detail.
- Wind is approaching the site as per the given boundary conditions. Wind is then accelerated near the edges and stagnated and recirculated behind the buildings.
- Wind is tunnelling through the gap between the proposed development as anticipated.
- There is a minor variation in wind speeds along the width of the runways.

In the wind shear and turbulence modelling study, wind speed and turbulence must be reported at the aircraft trajectory. The approaching angle for landing is usually between 2.7 degrees and 4 degrees, with

3 degrees considered as the average.

Two possible landing scenarios are analysed in this study. Each landing paths of approximately 850 m has a horizantal distance along the runway from the point at which the airplane is 30 meters above the ground to the end of the landing phase. It is assumed that the aircraft glides down with constant speed and its track angel is 3 degree. Landing paths are shown in Figure 8.29.

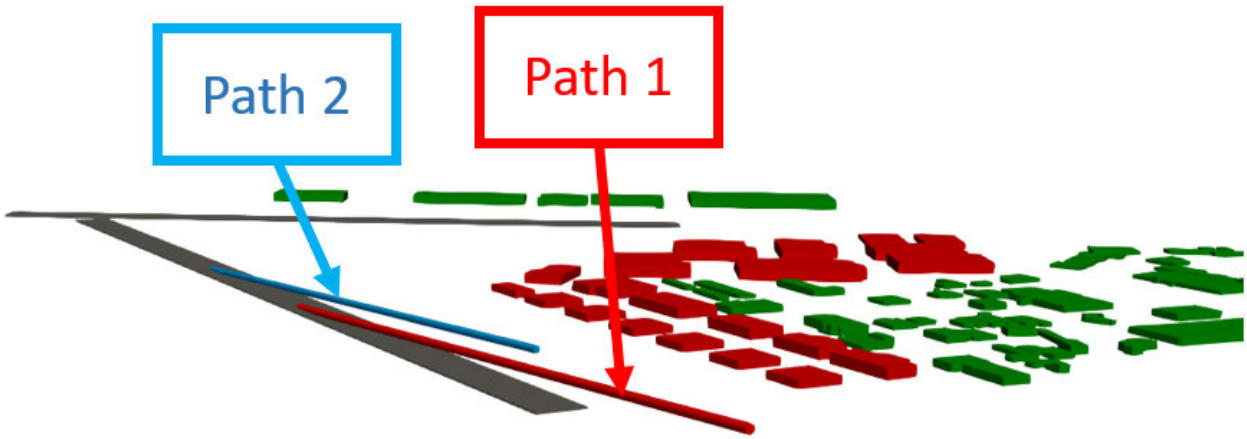


Figure 8.29: Landing Scenarios 1 and 2 at 3 degrees approaching angle

The variation in wind speeds for the selected flight paths are shown in Figure 8.30, for the 225° wind direction. The variation in wind speeds for the selected flight paths are shown in Figure 8.31, for the 236.5° wind direction. The variation in wind speeds for the selected flight paths are shown in Figure 8.32, for the 247.5° wind direction.

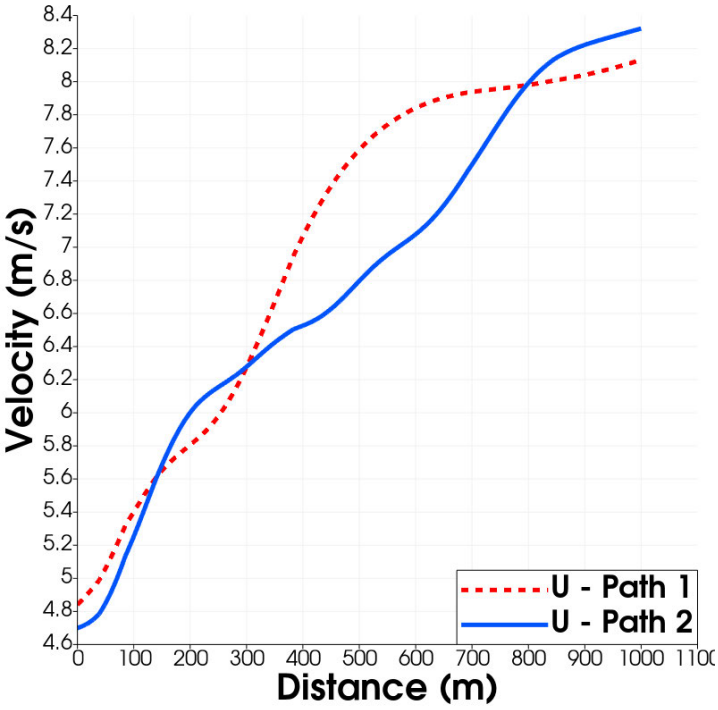


Figure 8.30: Velocity Magnitude along trajectory path 1 and path 2 - Wind Direction 225°

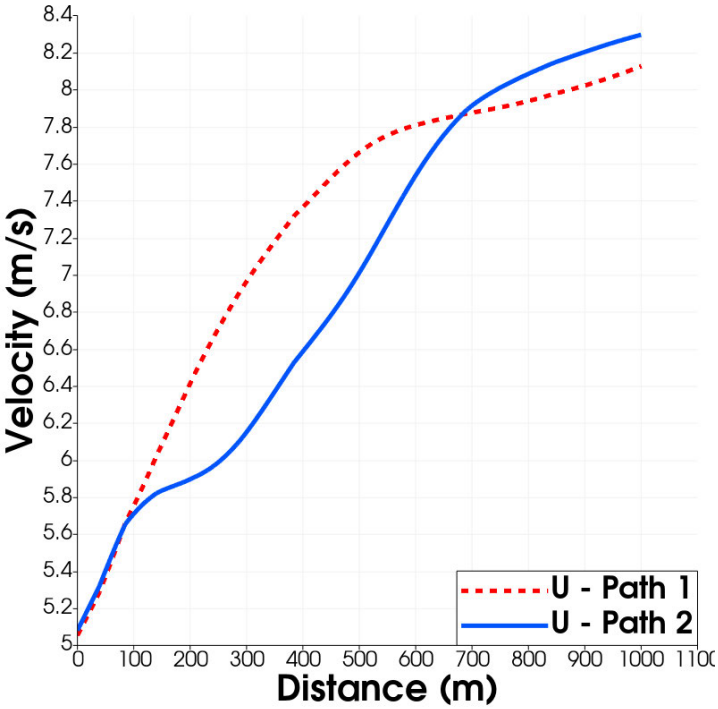


Figure 8.31: Velocity Magnitude along trajectory path 1 and path 2 - Wind Direction 236.5°

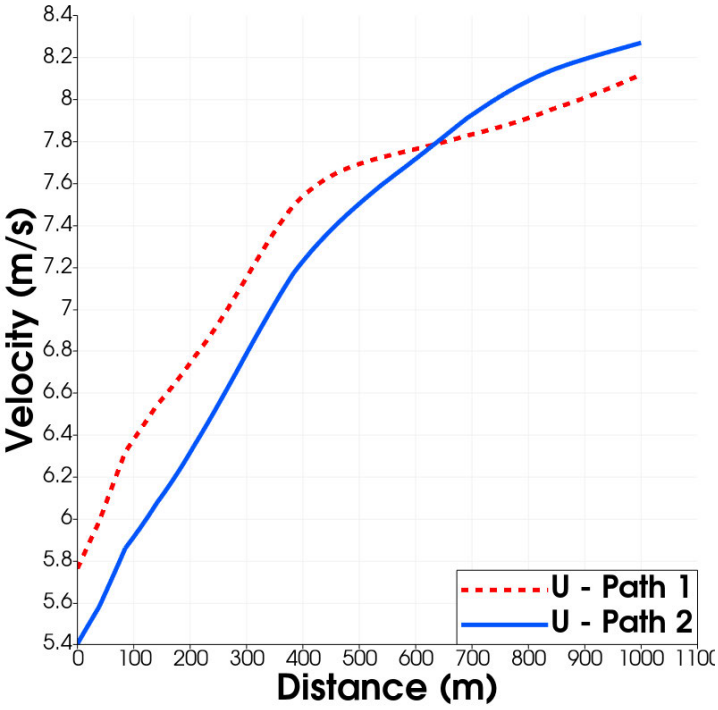


Figure 8.32: Velocity Magnitude along trajectory path 1 and path 2 - Wind Direction 247.5°

From these graphs the following considerations can be made:

- The graphs present the results at variable height of the aircraft trajectories (3 degrees approaching angle).
- The approaching mean wind speed at 10 m above ground is 7 m/s in both scenarios modelled (Pre-development and post-development).
- Wind speed increases with height. Higher wind speed is therefore predicted at 30 m above ground.
- The highest velocity around the building can be found at the top of it.
- The wind shear and wind deficit results are proportional.
- The mean wind speed at the ground = 0.

Therefore, the following major conclusions can be achieved from the graphs in Figures 8.9, 8.10 and 8.11:

- The variation of the velocity from the mean speed is less than 6 knots (3 m/s) along the analysed flight path at a height below 60 m.
- The NASF wind shear criterion is therefore not exceeded for the analysed flight paths.

8.2.2 Turbulence

Figure 8.33 shows the predicted turbulence intensity over the extended computational domain and detailed site topography in the vicinity of the weather station, runway 10/28 and areas of interest.

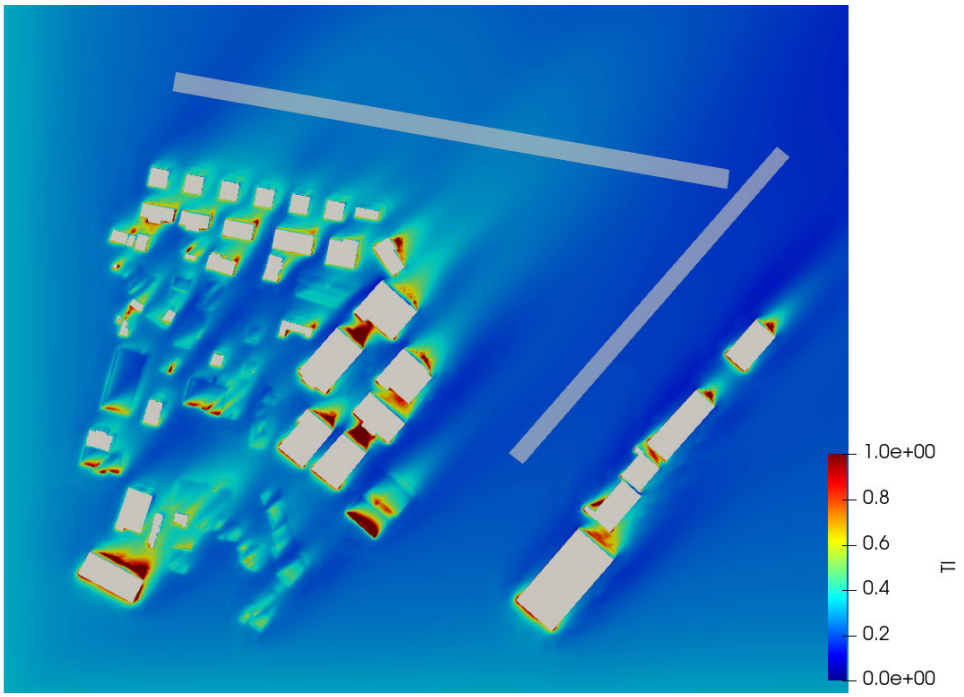


Figure 8.33: Predicted Turbulence Intensity - Wind Direction 225°

The predicted turbulence intensity at flight paths 1 and 2 is shown in Figure 8.34 for wind direction 225°. The predicted turbulence intensity at flight paths 1 and 2 is shown in Figure 8.35 for wind direction 236.5°. The predicted turbulence intensity at flight paths 1 and 2 is shown in Figure 8.36 for wind direction 247.5°.

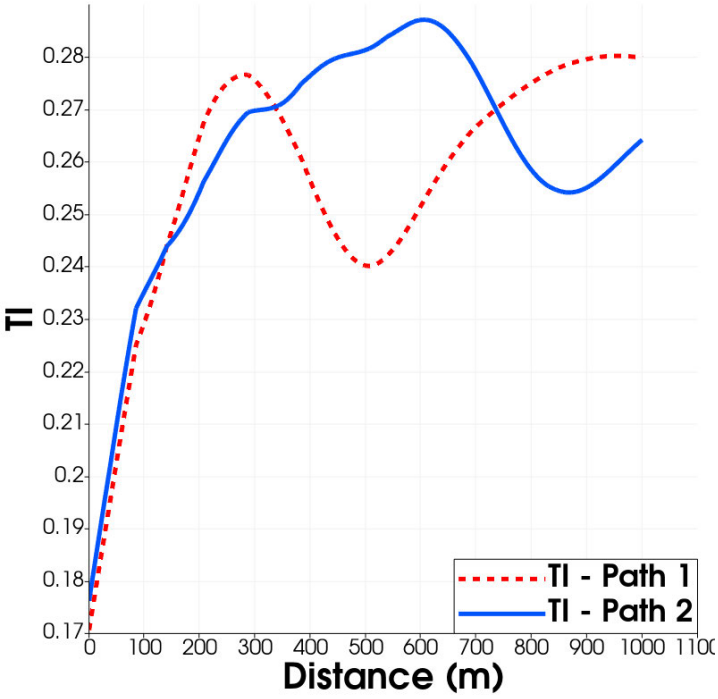


Figure 8.34: Turbulence Intensity along trajectory path 1 and path 2 - Wind Direction 225°

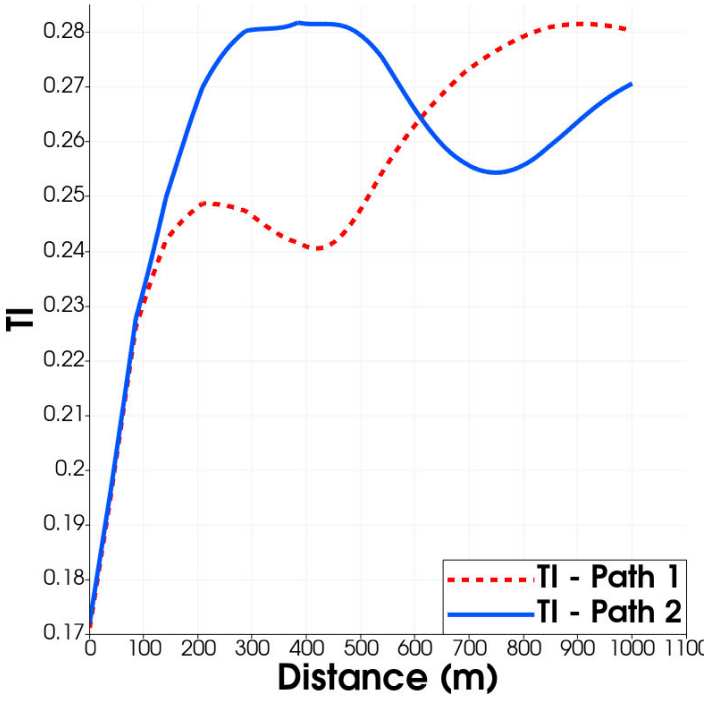


Figure 8.35: Turbulence Intensity along trajectory path 1 and path 2- Wind Direction 236.5°

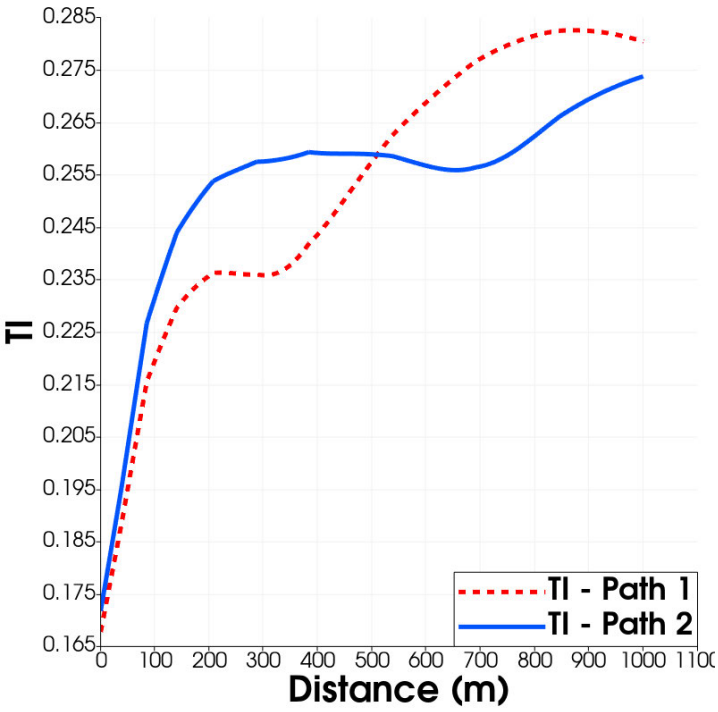


Figure 8.36: Turbulence Intensity along trajectory path 1 path 2- Wind Direction 247.5°

The following major conclusion can be reached:

- Highest turbulence intensity occurs near the ground and in the wake of upstream buildings as expected. The mean wind speeds at these locations are generally low.

The turbulence or root-mean-square (RMS) value along the aircraft trajectory for flight paths 1 and 2 is presented in Figure 8.37 for the pre-development case and in Figure 8.38 for the post-development case, for wind direction 225°. The turbulence or root-mean-square (RMS) value along the aircraft trajectory for flight paths 1 and 2 is presented in Figure 8.39 for the pre-development case and in Figure 8.40 for the post-development case, for wind direction 236.5°. The turbulence or root-mean-square (RMS) value along the aircraft trajectory for flight paths 1 and 2 is presented in Figure 8.41 for the pre-development case and in Figure 8.42 for the post-development case, for wind direction 247.5°.

These results are calculated based on the wind shear and turbulence intensity results.

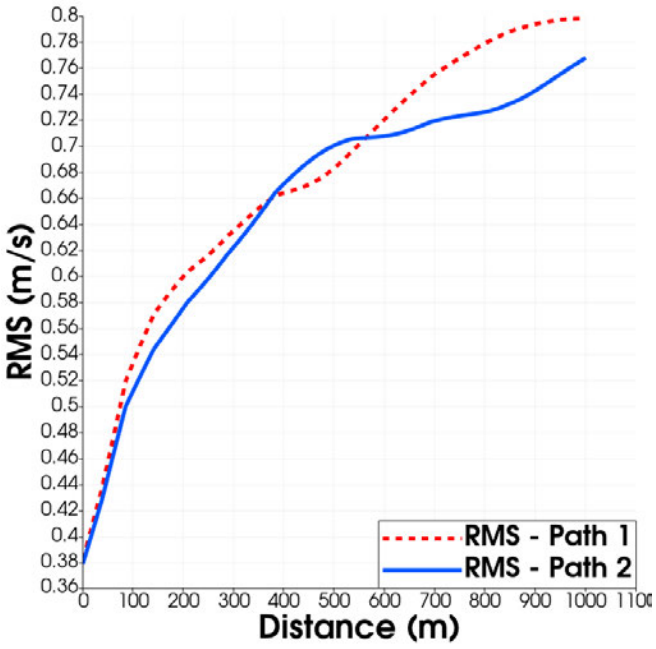


Figure 8.37: RMS (Standard Deviation) Value along trajectory path 1 and 2 - pre-development - Wind Direction 225°

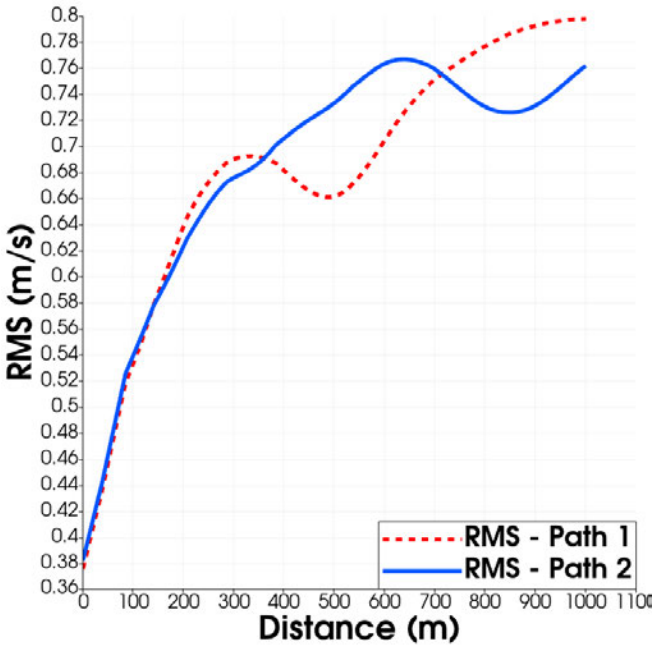


Figure 8.38: RMS (Standard Deviation) Value along trajectory path 1 and 2 - post-development - Wind Direction 225°

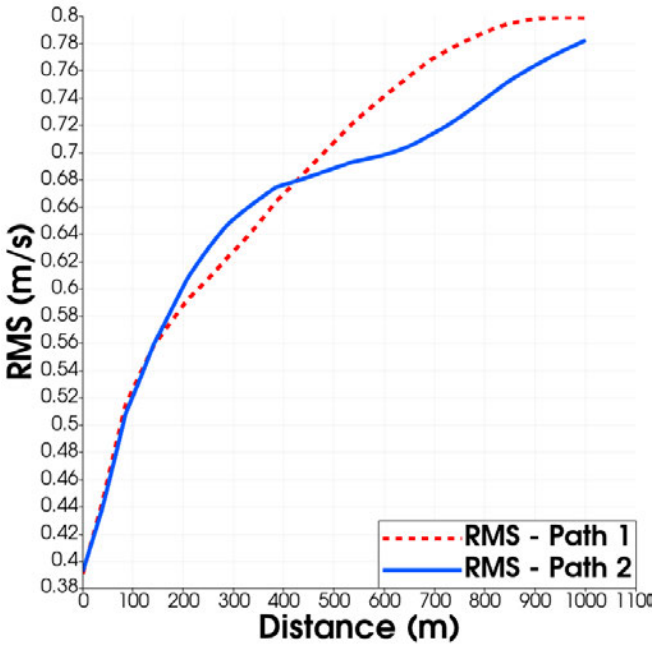


Figure 8.39: RMS (Standard Deviation) Value along trajectory path 1 and 2 - pre-development - Wind Direction 236.5°

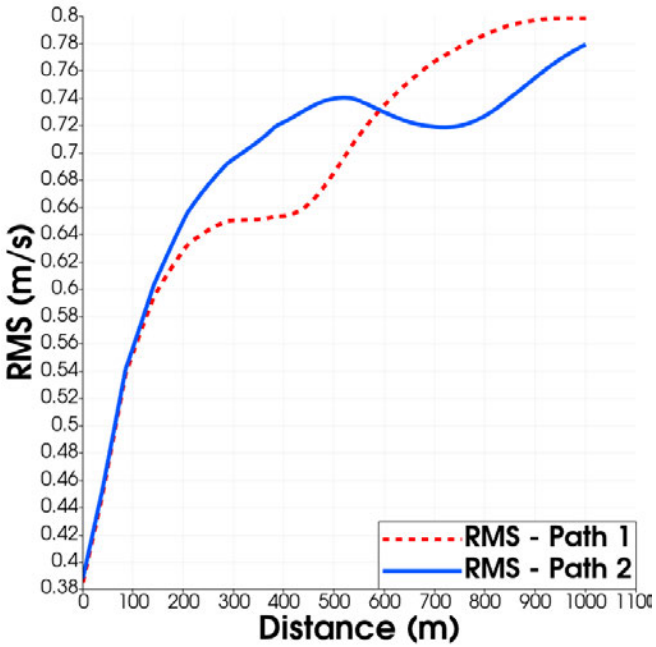


Figure 8.40: RMS (Standard Deviation) Value along trajectory path 1 and 2 - post-development - Wind Direction 236.5°

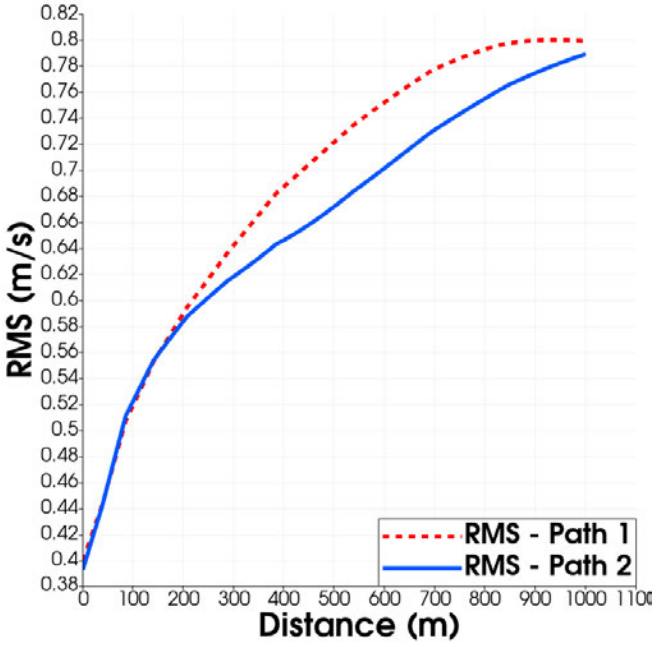


Figure 8.41: RMS (Standard Deviation) Value along trajectory path 1 and 2 - pre-development - Wind Direction 247.5°

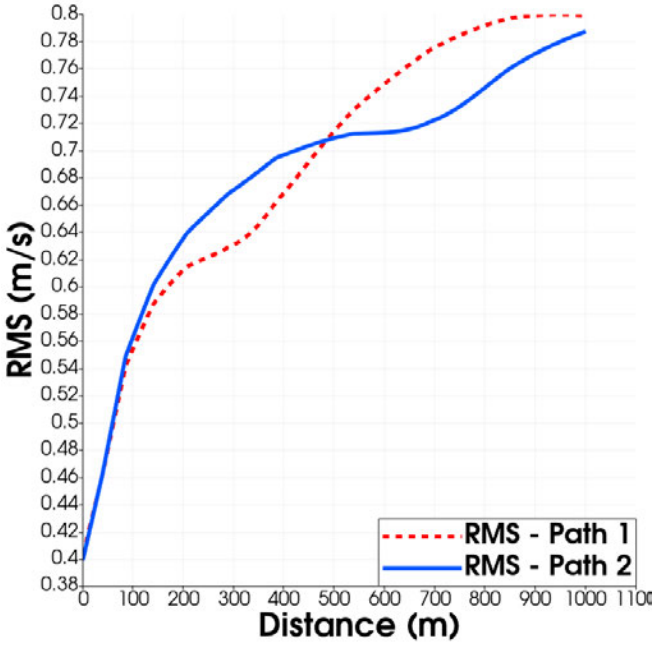


Figure 8.42: RMS (Standard Deviation) Value along trajectory path 1 and 2 - post-development - Wind Direction 247.5°

The following conclusions can be achieved from these results:

- The RMS reduces with reducing crosswind speeds.
- The RMS (standard deviation) is below 4 kt (2.06 m/s) for an approaching wind of 7 m/s at 10 m above ground for the pre-development and post development scenarios.

- Turbulence levels for the flight paths are reduced due to reduced mean wind speed while the increase in turbulent intensity is tolerable.

9. MITIGATION OPTIONS

9.1 MITIGATION OPTIONS

The results Section provided a wind shear and turbulence analysis to verify if the acceptability criterion is satisfied on nearby runways, under the wind conditions and directions considered in this report. Two mitigation strategies are typically recommended and accounted for through the design process, in order to minimise the risk of any wind impact:

A) Building Shape Augmentation: this consist in modification to the massing of the buildings and can be achieved by implementing one or more of the followings items:

1. Reduce building height.
2. Revise aspect ratio (e.g. increase depth and/or reduce width) where possible.
3. Round edges if necessary - not required here.
4. Whereas possible, buildings should avoid being oriented at 45 degrees to the runways.

Windshear generated by Units 16 and 17 are slightly higher than other units on runway 04/22, reducing the height of the units should be considered. Also it should be noted that based on their current height they can impact on both runways when strong wind occur from South-West.

Although the heights of the Units 20 and 21 do not cause high turbulence on runway 04/22, they should be significantly mitigated to be near the landing path zone.

High turbulence and wind shear generated by units 13 and 14 based on their orientations and heights are observed, which might impact on both runways, particularly when strong winds occur from the West and South-West, therefore mitigations should be provided for these units.

B) Operational Plan Management: Risk can also be mitigated through operational procedures. However, this involves the approval of various stakeholders including airport operators.

For this proposed development, certain mitigations were already implemented as part of the design process and in accordance with the mitigation strategy proposed in section (A) above. In general, to be conservative, it must be noted also that all the units modelled in this analysis have been considered as a bulk shape.

10. CONCLUSIONS

10.1 CONCLUSIONS and COMMENTS ON CFD STUDY

This report has presented the CFD modelling assumptions and results of wind shear and turbulence modelling carried out for the assessment of the proposed Greenogue Masterplan Development in Rathcoole, Dublin.

The aim of this study is to assess if the wind shear and turbulence caused by the new development in the vicinity of the aerodrome is causing aircraft instability during landing.

The assessment has been carried out in two steps:

- "Step 1 - Preliminary Wind Assessment of the Development": in this case the assessment has considered the impact of wind on the existing area including the proposed Greenougue Masterplan in Rathcoole. For this scenario, the analysis have identified the critical areas of the proposed development. A statistical analysis of 30 years of historical weather wind data has been carried out to find the most critical wind speeds and directions and the frequency of occurrence of the same.

- "Step 2 - Wind Shear and Turbulence Model": in this case a wind shear and turbulence assessment has been carried out to assess if the wind shear and turbulence caused by the new development in the vicinity of the aerodrome is causing aircraft instability during landing. For this scenario three wind directions have been used for each runways, which correspond to the critical wind directions impacting both the development and the aerodrome runways. This analysis has been carried out as a comparison between a condition without the proposed units (pre-development case) and with the proposed units (post-development case).

The results of the study has shown that the proposed masterplan is not causing any "unsolvable" critical impact on the runaways 10/28 and 04/22 that cannot be mitigated adopting the measures outlined in section 9.1 (Mitigation Options) of this report.

In particular, it must be noted, that the majority of the units proposed will not need to be mitigated and their effects on the runaways are within the acceptance criteria in terms of wind shear and turbulence effects generated on both runaways.

During the next design stages, a revision of the design will be carried out for units 13, 14, 16, 17, 20 and 21 to mitigate the effects highlighted by this analysis and summarized as follows:

- Wind shear generated by Units 16 and 17 are slightly higher than other units on runway 04/22, reducing the height of the units should be considered as, due to their current proposed height, they can impact on both runways when strong winds occur from South-West.

- Although the heights of the Units 20 and 21 do not cause high turbulence on runway 04/22, it is advisable to review their design/mitigation in terms of height/location to avoid any impact on the landing path zone due to their proximity to this runaway.

- A revision/mitigation of the design in term of height/location is also advisable for units 13 and 14 as, based on their proposed orientations and heights, they are currently impact both runways in terms of wind shear ad turbulence, particularly when strong winds occur from the West and South-West.

11. BIBLIOGRAPHY

- Neihad Hussen Al-Khalidy, Building Generated Wind Shear and Turbulence Prediction utilising Computational Fluid Dynamics, WSEAS TRANSACTIONS on FLUID MECHANICS, Volume 13, 2018.

- H. Krüs, J. Haanstrab, R. van der Hama and B Wichers, Numerical Simulations of Wind Measurements at Amsterdam Airport Schiphol, Journal of Wind Engineering and Industrial Aerodynamics, No.91, 2003, pp.1215-1223.

- P. Chan, W. Lo and D. Leung, Low Level Wind Effects of the Hangars at the Hong Kong International Airport. The 5th International Symposium on Computational Wind Engineering, 23 - 27 May 2010, Chapel Hill, NC, USA.

- G., Nieupoort, de Pins, Wind criteria due to obstacles at and around airports, Report NLR-CR-2006-261, National Aerospace Laboratory of The Netherlands, May 2008.

- Simiu, E., 2011, 'Design of buildings for wind: a guide for ASCE 7-10 Standard users and designers of special structures', 2nd Edition, John Wiley and Sons, Inc., Hoboken, New Jersey, U.S.A.

- Building Aerodynamics, Tom Lawson FREng. Imperial College Press, 2001

- Blocken, B., 2015. Computational Fluid Dynamics for Urban Physics: Importance, scales, possibilities, limitations and ten tips and tricks towards accurate and reliable simulations. Building and Environment.

- Franke, J., Hellsten, A., Schlunzen, H., Carissimo, B, Ed. (2007); Best Practice Guidelines for the CFD Simulation of Flows in the Urban Environment, University of Hamburg

Appendix D: A '*Strategic Review of Flood Risk*' prepared by JBA Consulting

Greenogue Business Park, Rathcoole, Co. Dublin

Masterplanning & Strategic Review of Flood Risk

Final Report

September 2021

Greenogue Management No2 Ltd,

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Greenogue Business Park

Rathcoole

Co Dublin

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
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A3-C01 - 10/09/2021	Final Report	Greenogue Management No2 Ltd

Contract

This report describes work commissioned by Con McCarthy on behalf of Greenogue Management No.2 Ltd. Daniel Iordache and Ross Bryant of JBA Consulting carried out this work.

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Principal Analyst

Purpose

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Abbreviations

AEP	Annual Exceedance Probability
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
FFL	Finish Floor Levels
FRA	Flood Risk Assessment
GSI	Geological Survey of Ireland
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
SDCC	South Dublin County Council
SFRA	Strategic Flood Risk Assessment
WL	Water Level

1 Introduction

JBA Consulting was appointed by Greenogue Management No.2 Ltd to undertake a Masterplanning and Strategic Review of a landholding adjacent to the Greenogue Business Park. The report will be used to support a proposal to re-zone a 130acre site from RU (Rural Amenity & Agriculture) to EE (Enterprise & Employment).

1.1 Overview

Underutilised lands adjacent to the northern and eastern boundary of the expanding Greenogue Business Park are shown on the OPW CFRAM flood maps to be potentially impacted by an overland flow route from the River Camac overtopping its banks over 1km to the east.

The current Development Plan zoned a large area of land that adjoins the western bank of the River Camac for EE use, a significant part of the land is located within Flood Zone A and B. The zoning was justified within the SFRA and specifically required detailed FRA at Development Management stage. This policy decision has resulted in granted development (SD19A/0370) that will remove Flood Zone A from the approach to Greenogue Business Park from the River Camac.

In the very near future (site is currently under construction), the baseline Flood Zones will change as a result of the storage solution in the SD19A/0370 site - all that will remain in the 130acre site is Flood Zone B approaching Greenogue Business Park from the east (the Camac River). The remaining overland flow will be minimal and in accordance with the Planning Guidelines the land is suitable for less vulnerable EE land use zoning without the application of the Justification Test for Development Plans.

The remaining risk is at the 0.1% AEP event and/or from a residual risk/exceedance event and is very easily managed, facilitating expansion of development in the area.

The historic floodplains of the Camac and the Baldonnel/Griffeen systems are separate entities and cross catchment flows will be limited to the 0.1% AEP event by the SD19A/0370 site. There is no issue with Green Infrastructure and Water Framework Directive policies contained within the County Development Plan.

On the basis of the above information it is clear that there is no reason why flood risk should prevent the proposed site being considered for re-zoning to EE use. Delivery of the mitigation measures (both on site and a result of SD19A/0370) has the wider impact of further reducing flood risk and residual to the existing properties within the Greenogue Business Park and there is no impact on the receiving Baldonnel/Griffeen system. Risk to the site is managed by appropriate drainage design and finished floor levels.

1.2 Aims and Objectives

This study is being completed to inform the future development of the site taking into account flood risk. It aims to identify, quantify and inform the land use zoning decision making process on the risk of flooding to the 130 acre land holding, and the measures that would be recommended to manage the risk and support the rezoning of the land.

The objectives are to:

- Identify potential sources of flood risk;
- Confirm the level of flood risk and identify key hydraulic features;
- Recommend appropriate flood risk mitigation and management measures which will allow for the long-term masterplanning and development of the site.
- Demonstrate that the landholding is suitable for EE zoning in the context of the OPW / DoEHLG planning guidance, "The Planning System and Flood Risk Management".
- Consider the wider interaction with the Camac Flood Relief Scheme (Camac FRS) and the Green Infrastructure/Water Framework Directive policies of the County Development Plan.

A review of the likely effects of climate change and the long-term impacts this may have on any development has also been undertaken. Development Proposal

The proposed masterplan of the 130acre site comprises of 21 warehouse units with proposed heights varying between 8 and 17.5m. Existing HGV Yards are located at the western part of the

site. The land use associated with the development would be EE - Industrial, Enterprise, Employment. The current zoning is P1 - Agriculture.

Refer to Figure 1-1 for the masterplan site layout.



Figure 1-1: Site Layout

1.3 Report Structure

The report is structured as follows:

Section 2 - Provides an overview of the study location and associated watercourses to the site.

Section 3 - Contains background information and the initial assessment of flood risk.

Section 4 - Gives an overview of the technical to Flood Risk Assessment (FRA).

Section 5 - The conclusions are highlighted.

2 Site Background

2.1 Location

The proposed development comprises the eastern and northern part of the Greenogue Business Park which is located approximately 1km north of Rathcoole Village and approximately 1.6km south-east of Newcastle Village, as shown in Figure 2-1.

The site is currently a greenfield site used for agricultural (crop) purposes. The Baldonnel Casement Aerodrome is located to the north and east, while commercial and industrial warehouse facilities lie to the west (Greenogue Business Park).

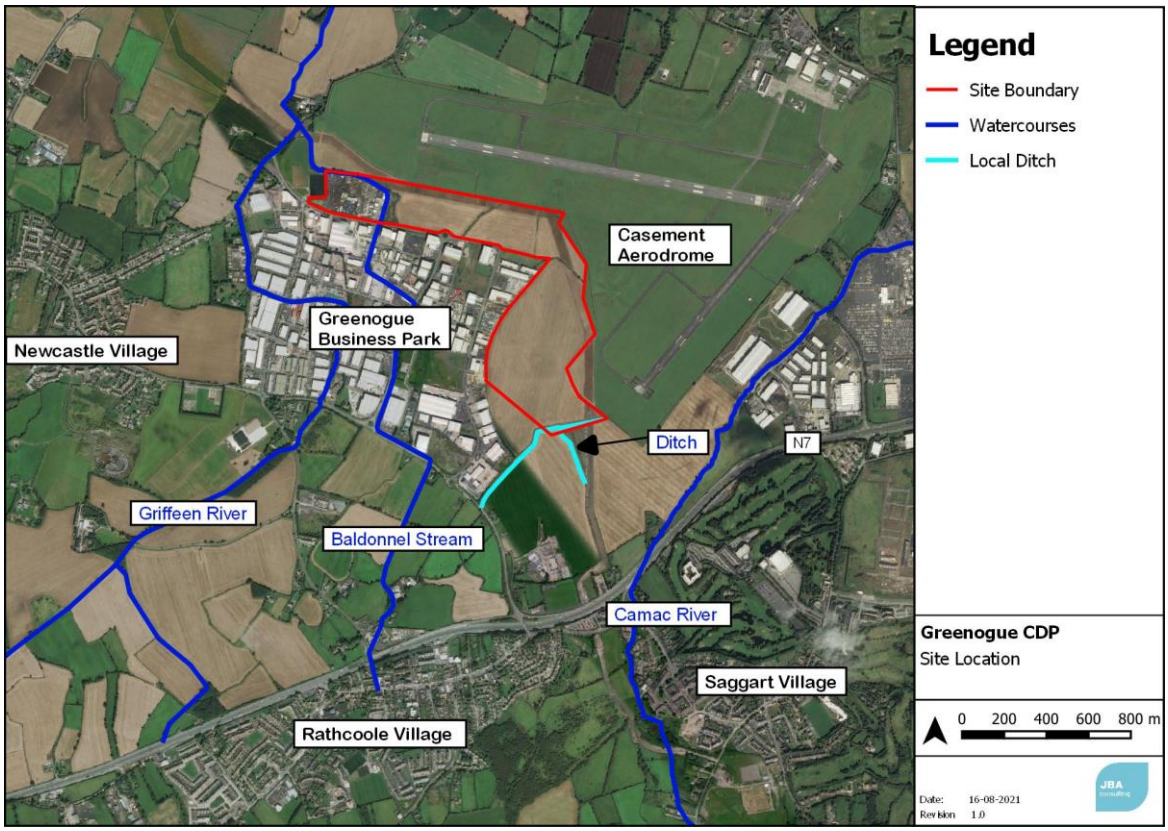


Figure 2-1: Site Location & Hydrological Environment

2.2 Watercourses

As shown in Figure 2-1, the Griffeen River, the Baldonnel Stream and the Camac River are the three main local watercourses in the area, while a ditch flows along the southern site boundary.

The Camac River is located south-east of the proposed development. It flows northwards via culvert under the N7 approximatively 600m from the site. It then continues in a north-easterly direction away from the site and Greenogue Business Park.

The Baldonnel Stream flows northwards in an open channel approximatively 400m west of the site. It then flows via culvert along the Newcastle Road before returning to open channel along College Road within the business park, where it flows in a northerly direction through the site boundary.

The Griffeen River flows from south-west to north-east and lies approximately 700m to the west of the site. It joins with the Baldonnel Stream downstream of the site location.

2.3 Site Topography

The topography across the site ranges from approximately 98mOD to 82mOD, with a slope from south-east to north-west. The Baldonnel Stream flows through the western boundary of the site, the bed levels being approximatively 2m lower than the site topography. A drainage ditch is shown to cross the central part of the site.

The site topography is displayed in Figure 2-2.

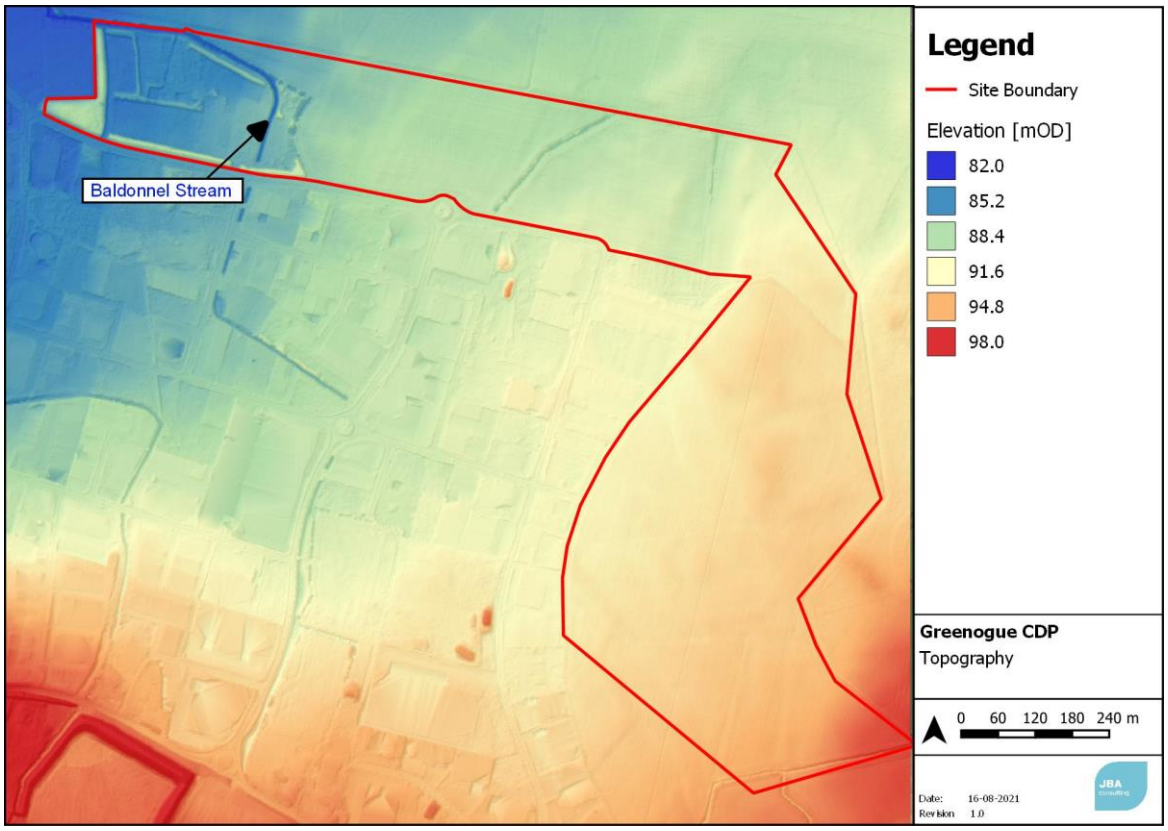


Figure 2-2: Site Topography

2.4 Site Geology

The Geological Survey of Ireland (GSI) groundwater and geological maps indicate that the subsoil within the site is made of moderate permeability Limestone Till. The underlying bedrock is classified as Calp, which consists of dark grey to black limestone and shale.

The bedrock at the site location is shallow therefore, the groundwater vulnerability is deemed 'Extreme.' The groundwater vulnerability classifications reflect the potential risk of groundwater infiltrations through the bedrock and risk of groundwater contamination from the site. There is no evidence of karst features at the site or in the surrounding area, which would commonly be linked to groundwater flooding.

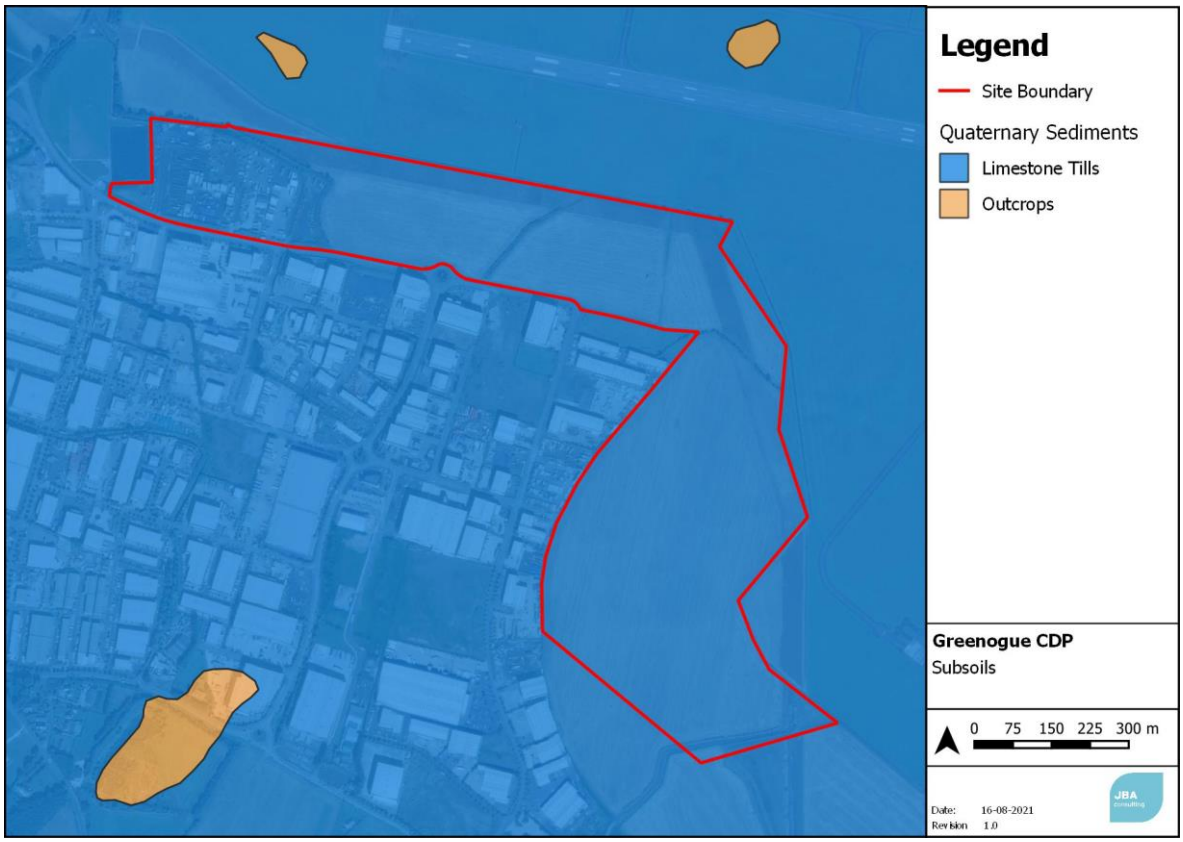


Figure 2-3: Quaternary Sediments

3 Flood Risk Identification

An assessment of the potential and scale of flood risk at the site was conducted using historical and predictive information. This identifies any sources of potential flood risk to the site and reviews historic flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections.

3.1 Flood History

A number of sources of flood information were reviewed to establish any recorded flood history at, or near the site. This includes the OPW's website, www.floodmaps.ie and general internet searches.

3.1.1 Floodmaps.ie

The OPW host a National Flood hazard mapping website, www.floodmaps.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events. See Figure 3-1 for historic flood events in the area, which are listed below.

Review of this mapping shows no instances of historical flooding at the specific site location. However, there are several recorded flood events in the wider regional area.

- (a) 24th October 2011 - Flooding occurred in Greenogue Business Park to commercial unit 525. Heavy rainfall resulted in pluvial flooding at the site, this event also caused significant inundation to adjacent road networks. This site is located approximately 0.5 km west of the proposed development,
- (b) November 2000 - Overtopping of the Griffeen River following heavy rainfall causing flooding along Aylmer Road (70-year return event). Flooding was located approximately 0.4km west of the development site,
- (c) Aylmer Road - Re-occurring flooding occurring from the Griffeen River,
- (d) Newcastle Co Dublin - Re-occurring flooding near Newcastle Village approximately 0.5 km from the proposed development site,
- (e) Rathcoole Bridge - Re-occurring flooding along Rathcoole bridge affecting the Dublin bound slip road traffic to Rathcoole off the N7. This did not impact the site which is north of Rathcoole Village.

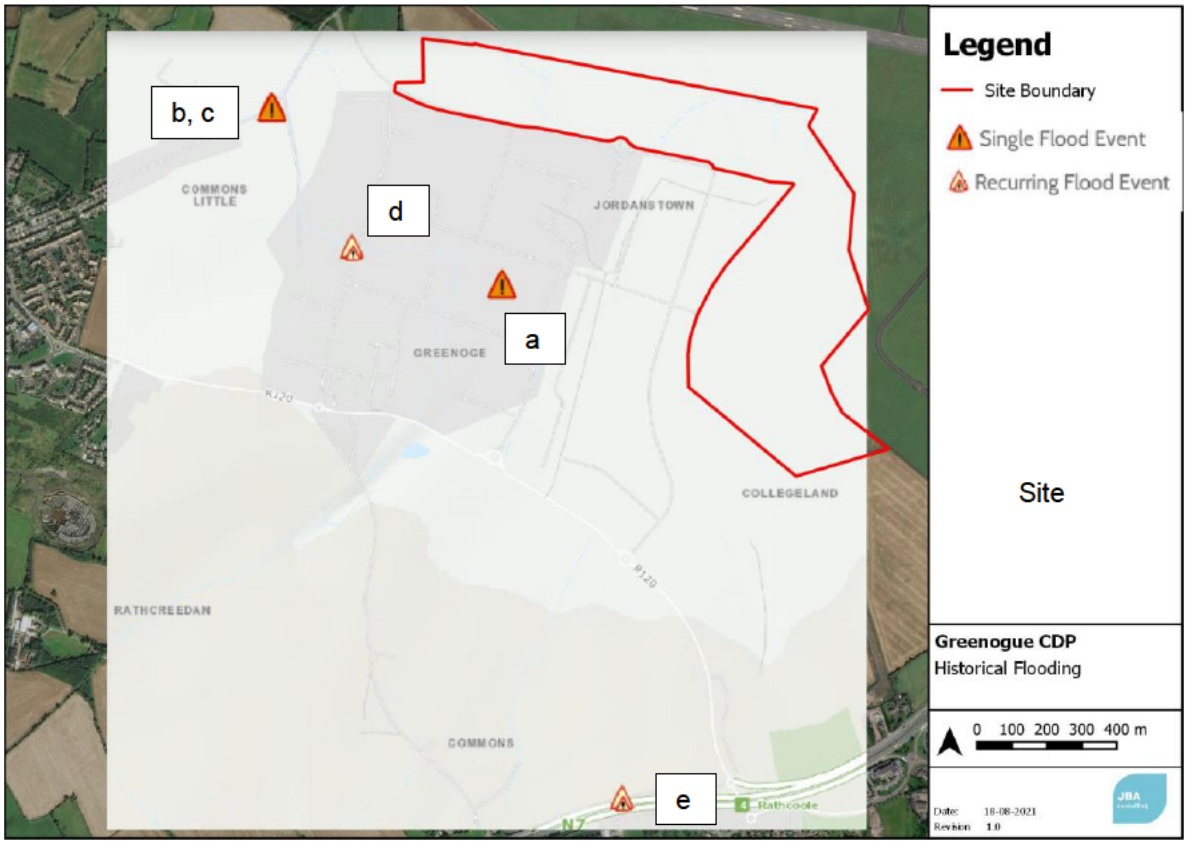


Figure 3-1: Historical Flooding (source: floodmaps.ie)

3.1.2 Internet Searches

An internet search was conducted to gather information about whether or not the site was affected by flooding previously. While there were no results for flooding affecting the site itself, there were reports confirming of flooding in the areas mentioned above.

There is a lack of historic flood information relating to the cross catchment flow that is discussed in the predictive flooding section below. It is the case that there has not been any historic flood event to validate the scale of flooding outlined by the CFRAM model.

3.2 Predictive Flooding

Greenogue Business Park has been subject to three predictive flood mapping and modelling studies.

- Eastern Catchment Flood Risk Assessment and Management Study (CFRAM), January 2016;
- The SDCC Strategic Flood Risk Assessment (SFRA), July 2016.

The level of detail presented in each method varies according to the quality of the information used and the approaches involved. The Eastern CFRAM is the most detailed assessment of the flood extents and supersedes the flood outlines presented by the OPW PFRA study.

3.2.1 Eastern Catchment Flood Risk Assessment and Management Study (CFRAM)

The Eastern CFRAM study is the most detailed mapping undertaken in the Dublin region. It commenced in June 2011 with final flood maps issued during 2016. The study involves detailed hydraulic modelling of rivers and their tributaries. The Baldonnel Stream, Griffeen River and Camac River were all modelled in the CFRAM study which resulted in flood mapping for the 10%, 1% and 0.1% AEP fluvial events. An extract of the flood map covering the site is presented in Figure 3-2.

The CFRAM flood mapping identifies cross catchment flows from the River Camac enter within Greenogue Business Park. The overland flow from the Camac watercourse follows the natural fall in topography in a north west direction toward the proposed development, spilling onto the site during the 0.1% and 1% AEP flood events, affecting the south and central parts of the proposed development.

The Baldonnel Stream flows through the site boundary. As presented in Section 2.3, the channel is deep, therefore no overtopping occurs during the 1% and 0.1% flood events.

Whilst combined overland flows from the Baldonnel and Camac watercourses are shown at the north-western boundary of the site, only minor spill occurs onto the site boundary and only during the 0.1% AEP event. However, this area is not proposed for development as presented in Figure 1-1.

The Griffeen River is not shown to pose a flood risk to the site. As the topography slopes to the north-west, any spill and overland flooding from the Griffeen flows away from the site.

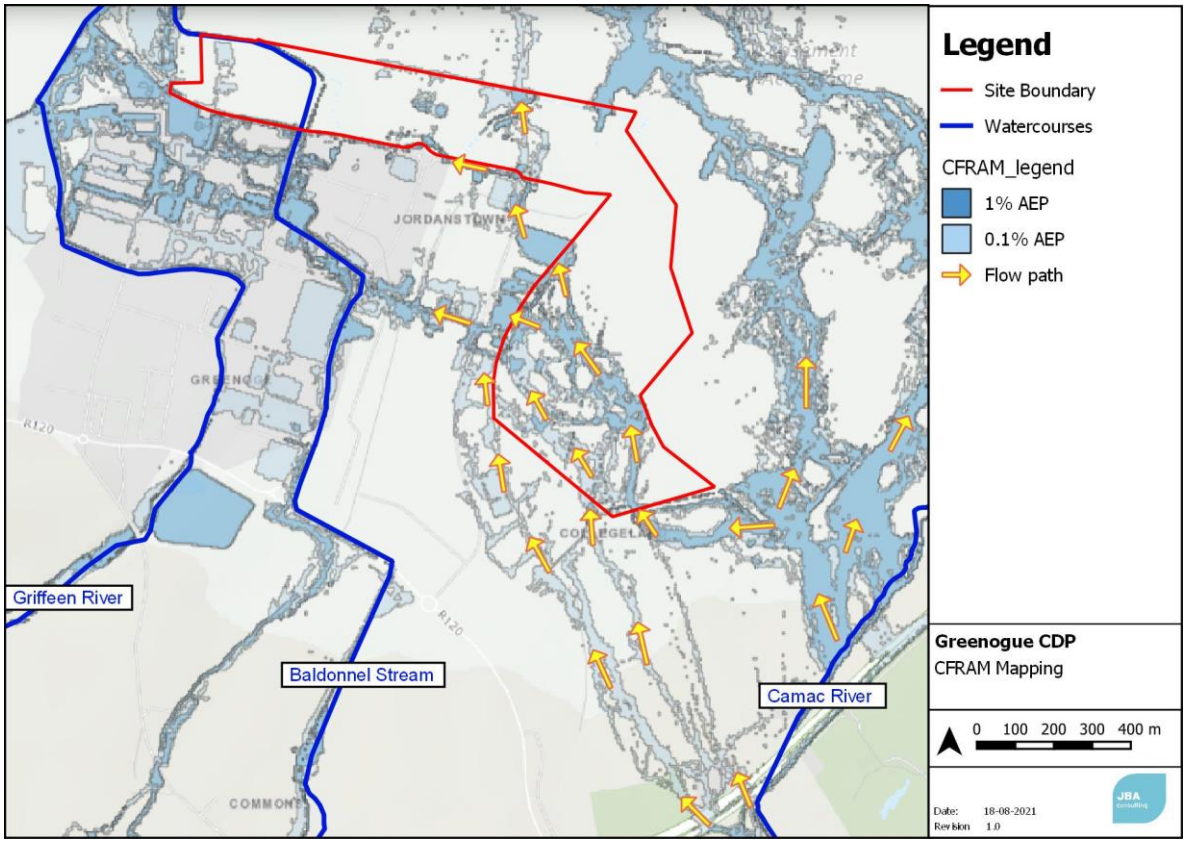


Figure 3-2: CFRAM Flood Extents (prior to SD19A/0370)

3.2.2 Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022

The SFRA for the South Dublin County Development Plan (2016-2022) assisted SDCC in making strategic land-use planning decisions by providing information about flood risk within the County. The assessment is based on the Eastern CFRAM Study flood mapping discussed in Section 3.2.1 and therefore, presents the same flood outlines. CFRAM flood maps were used as part of the SFRA, which includes the Greenogue Business Park.

3.2.3 Amazon Development SD19A/0370

Much of the overland flow impacting the 130 acre site originates from the area now subject to a grant of planning under SD19A/0370. When completed the development will significantly limit overland flows reaching the Greenogue Business Park, by offering flood storage within the SD19A/0370 site. Construction of the development is now at an advanced stage (August 2021).

The context of the Amazon site location in relation to the 130 acre site is shown below in Figure 3-3. The Amazon site was subject to a significant amount of overland flooding from the River Camac for the 1% and 0.1% AEP events (Flood Zone A & B). The lands were zoned EE in the current SDCC development plan 2016-2022 which was subject to a Strategic Flood Risk Assessment.

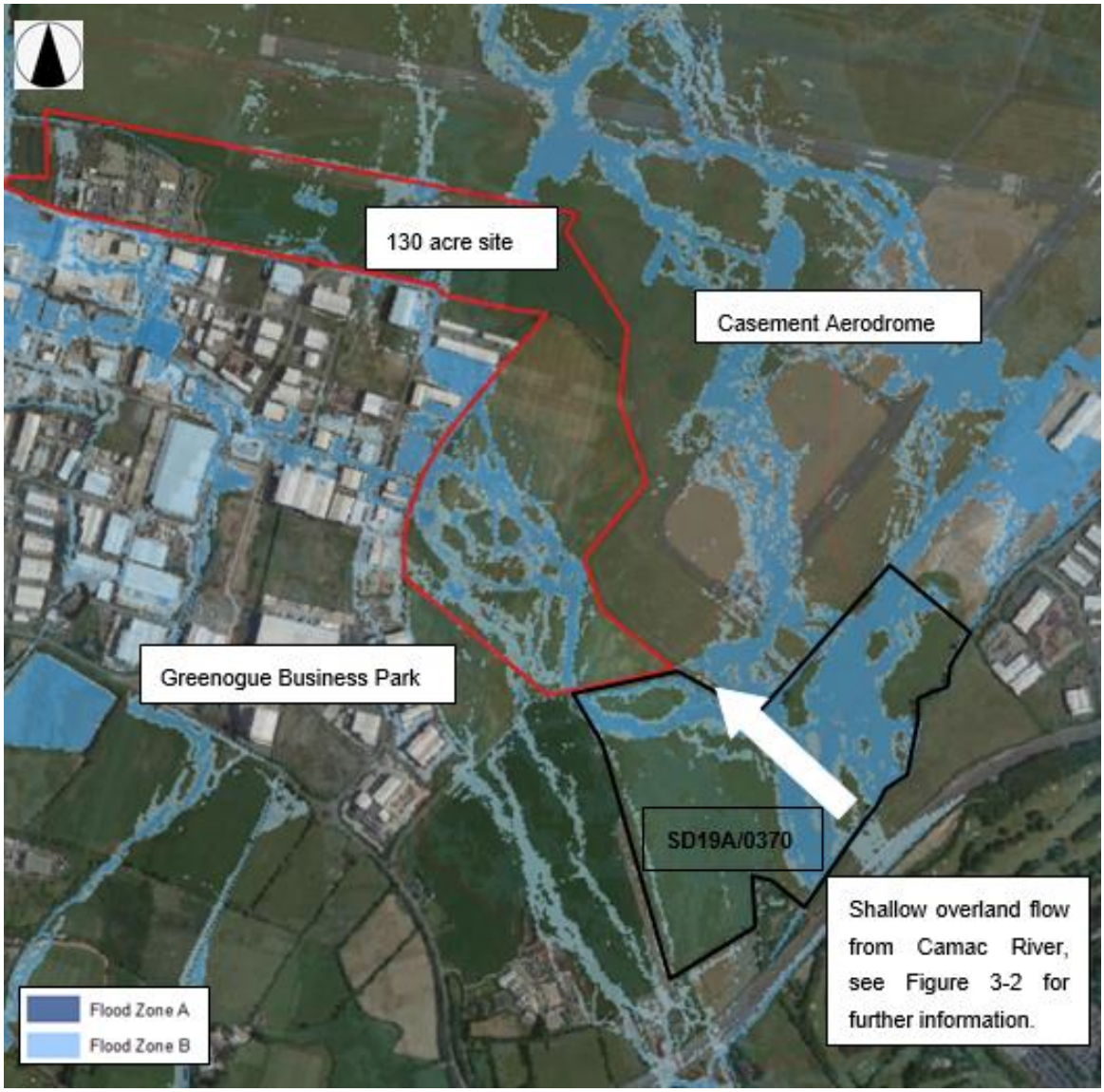


Figure 3-3 Overview of existing Flood Zones and location of SD19A/0370

As part of the site specific FRA for the Amazon development the overland flooding from the River Camac is managed by the provision of flood storage areas and bunds within the site that contain the 1%AEP flood event (Flood Zone A). Under the post development scenario the flooding leaving the site in the direction of Greenogue Business Park and Baldonnel Aerodrome is limited to an overflow in the 0.1% AEP event, as shown below in Figure 3-4. It is therefore the case that the baseline flood pattern will change upon completion and Flood Zone B will remain, Flood Zone A is stored within the Amazon site.

In granting planning application SD19A/0370 SDCC has significantly mitigated the overland flooding problem from the River Camac in the local area and established a precedent for site based solutions not reliant on any other formal flood relief works.

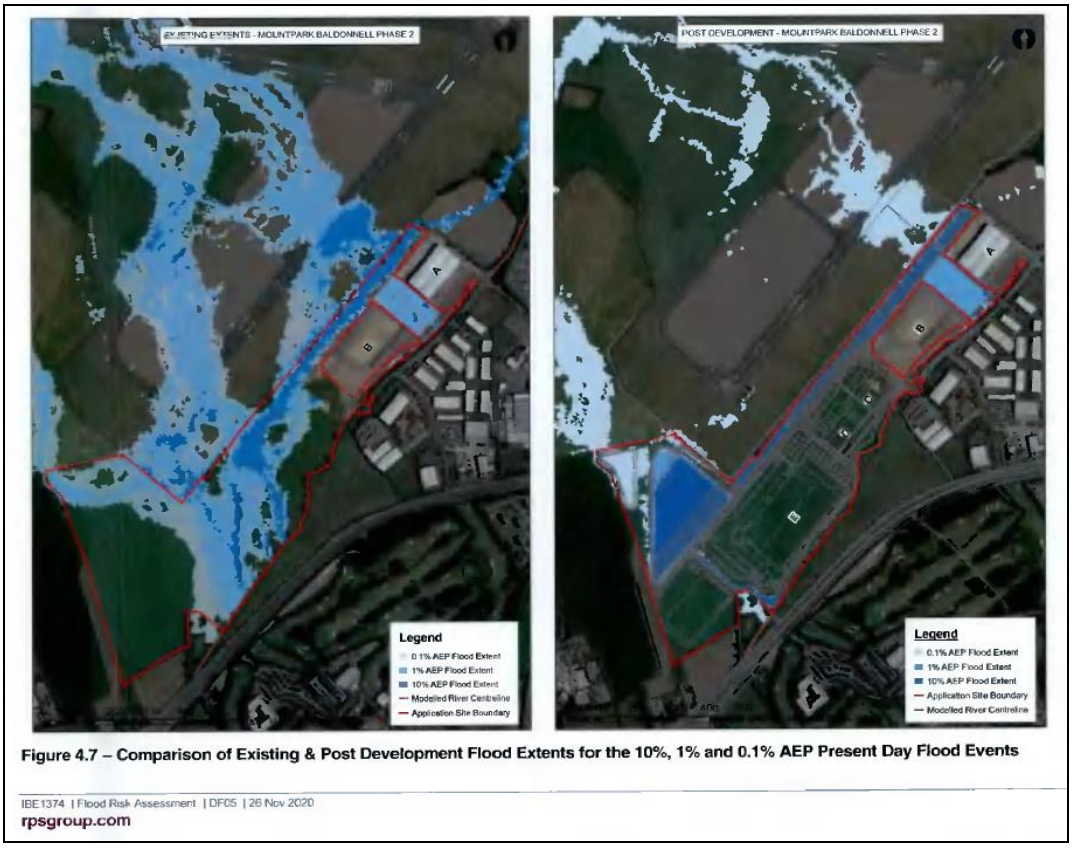


Figure 3-4 Granted Planning Application SD19A/0370 – RPS Flood Risk Assessment, existing & revised flood extent mapping.

3.2.4 River Camac Flood Alleviation Scheme

Dublin City Council and South Dublin County Council in partnership with The Office of Public Works (OPW), have commissioned the River Camac Flood Alleviation Scheme to address flooding within the catchment of the Camac River. Further details are available at https://www.camacfas.ie/.

The Scheme is still in the first stage of development and at present there are no details of the proposed baseline measures for protection of the lands adjacent to the proposed 130 acre site. The Camac is the principal source of risk to the site, but as stated in the previous section, the construction on the Amazon site as detailed under SD19A/0370 will significantly mitigate the impacts of flooding across the proposed development lands to the 1% AEP standard and will therefore significantly reduce the requirement for further mitigation works in the area.

4 Flood Model Assessment

Following on from the data collection and risk identification, this section will assess how to manage the risk of flooding at the site in more detail using a hydraulic model. This will provide clarification of the anticipated Flood Zone extents, updating the information provided by the Eastern CFRAM and that presented in the SD19A/0370 planning application. The information will then be used to configure the site layout and implement mitigation measures that ensure flood risk is effectively managed and that the EE Zoning.

The following sections will detail the process of flow estimation, hydraulic modelling and present the results.

4.1 Hydraulic Model

4.1.1 Model Set-up

The hydraulic modelling was carried out in the following stages:

- A 2D (TUFLOW) model grid enclosing the study area was created;
- The Camac overland flows were represented in the 2D hydraulic model;
- Design simulations were run to derive the 'existing risk' flood extents;
- The hydraulic model was then altered to account for the proposed development, allowing for proposed mitigation measures at the 130 acre site.

4.2 Model Results and Flood Mechanism

The flood extents are displayed in Figure 4-1, showing similar flood extents and flow paths through the site as the Eastern CFRAM mapping.

The Camac overland flows spill onto the southern corner of the site during the 1% (residual risk only) and 0.1% AEP events. The overland flows are then following the natural fall in topography, spilling in a north westerly direction through the site and eventually through the Greenogue Business Park.

The 1% event is listed as a residual risk run as the neighbouring Amazon development eliminates this flow path from the site. The model was run in a residual risk capacity to test a scenario where the adjacent mitigation was removed.

The hydraulic modelling confirms the overland flows from the Camac River are shallow, allowing to be easily conveyed within a proposed storage/swale, as discussed in the following section.

The flood extent mapping clearly shows the significant risk that the Camac flows present to the existing development within the Greenogue Business Park.

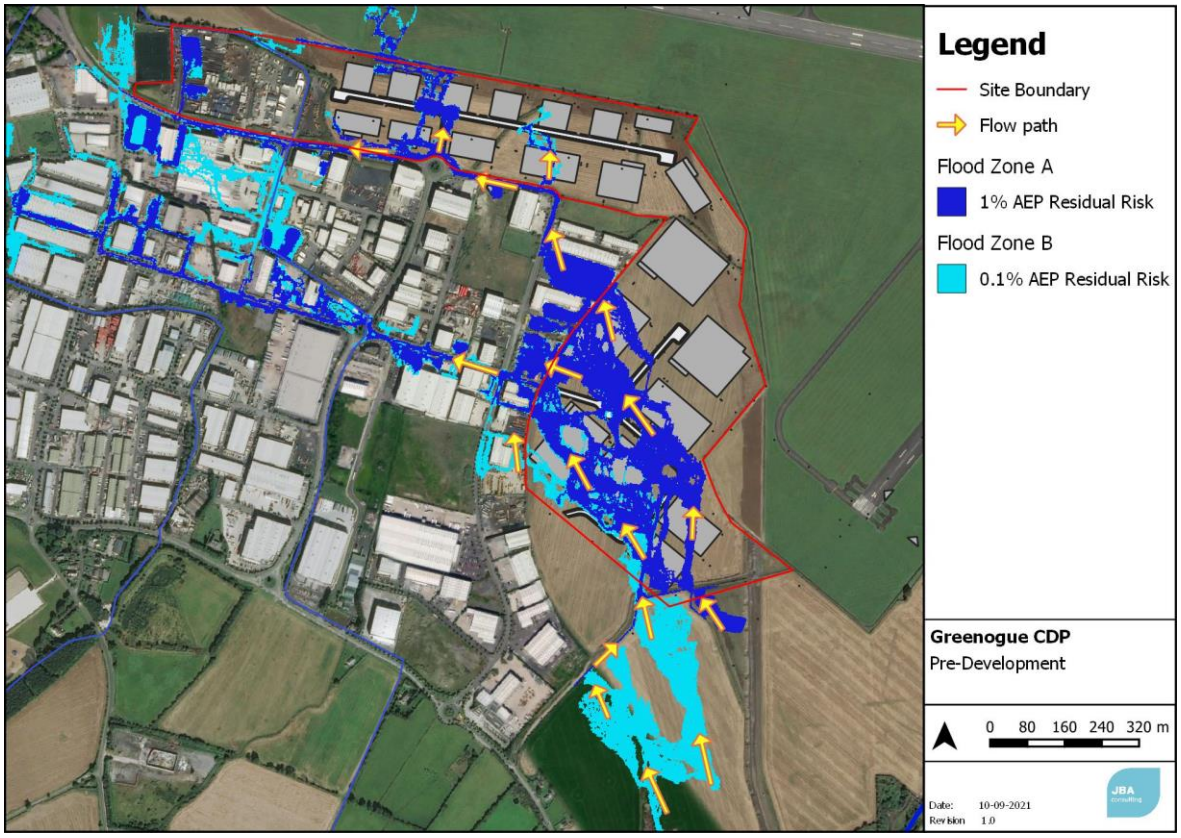


Figure 4-1: Pre-Development Flood Extents

4.3 Post Development Flood Extents

As outlined in Section 1.1 and demonstrated in the previous section the overland flow route is shallow, the post development proposal is to maintain the remaining 0.1% flow route around the 130 acre land holding through landscaping and the provision of a preferential flow path – a swale or dry channel with some integrated storage to not increase the pass-on peak flow to the Griffeen system downstream.

The proposed development masterplan involves the construction of warehouse units. The baseline flood extents have been overlaid on the proposed design, with the mitigation measures in place, as shown below in Figure 4-2.

The following mitigation measures have been proposed:

- The overland flow path across the site is conveyed by an existing drainage ditch (widened to 10m) and by a proposed flow storage.
- The flow conveyed by the storage is being discharged downstream into a proposed swale (5m wide) through a 150mm diameter culvert. The culvert dimension is limited, therefore the maximum depths within the proposed swale are very shallow - less than 150mm.
- The proposed swale runs along the site boundary and joins with the Baldonnel Stream at the downstream-end of the site.

Review of Figure 4-2 shows the proposed storage and swale are able to convey the Camac overland flows, therefore the proposed development is not at flood risk during the 0.1% AEP and a residual risk event where additional overtopping from the Camac occurs.

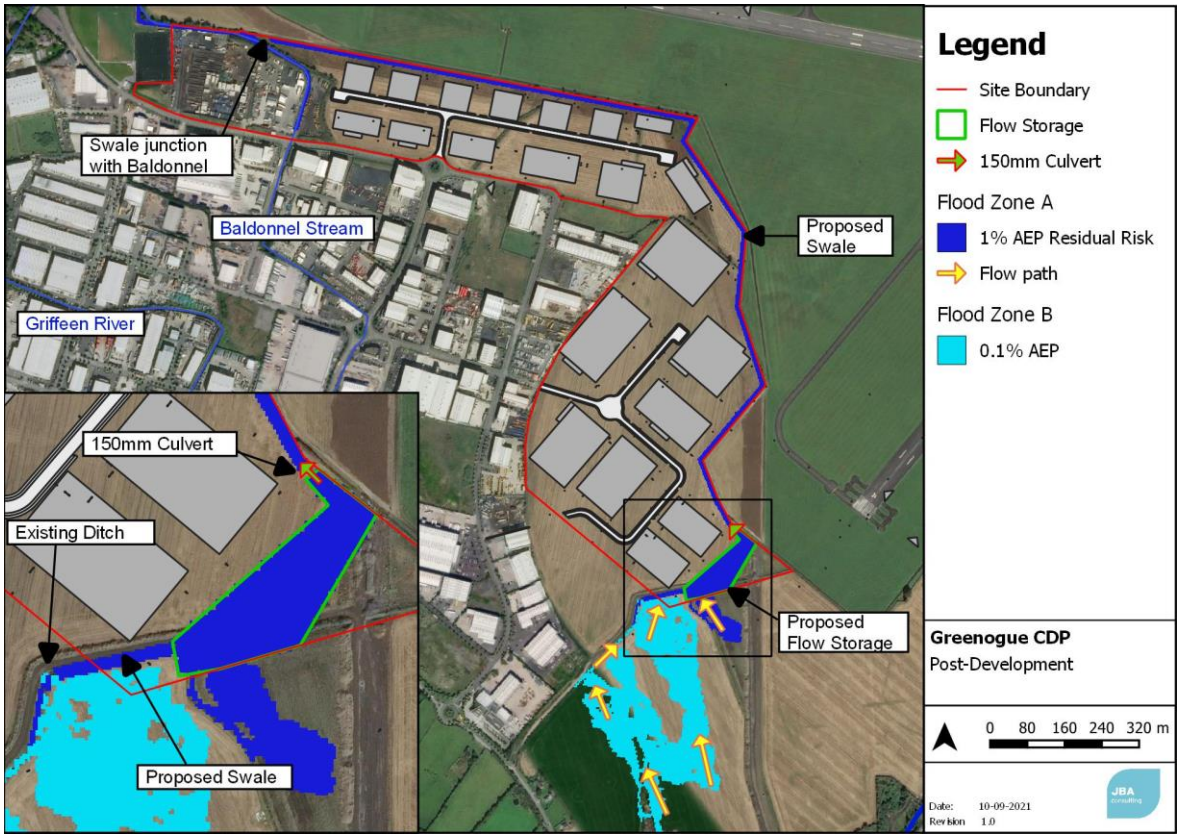


Figure 4-2: Post-Development Flood Extents

Figure 4-2 also provides the reporting locations at key areas, analysis of the monitoring points shows a freeboard of minimum 0.38m is achieved for the 0.1% AEP event.

Table 4-1 and Figure 4-3 provide additional evidence of the impact from the proposed development from the baseline flood events, the pre- and post-development flow flood values and impacts from the 1% AEP and 0.1% AEP events. Review of the details below confirm that there is no increase

in flood risk for the 1% AEP and 0.1% AEP flood events downstream of the site, on the Baldonnel Stream/Griffeen system.

Table 4-1 Water level comparison on the Baldonnel Stream downstream of the Business Park

Location	1% AEP peak flow [m^3/s]			0.1% AEP peak flow [m^3/s]		
	Pre-Development	Post-Development	Impact	Pre-Development	Post-Development	Impact
Baldonnel Stream	3.30	3.30	0	3.46	3.46	0

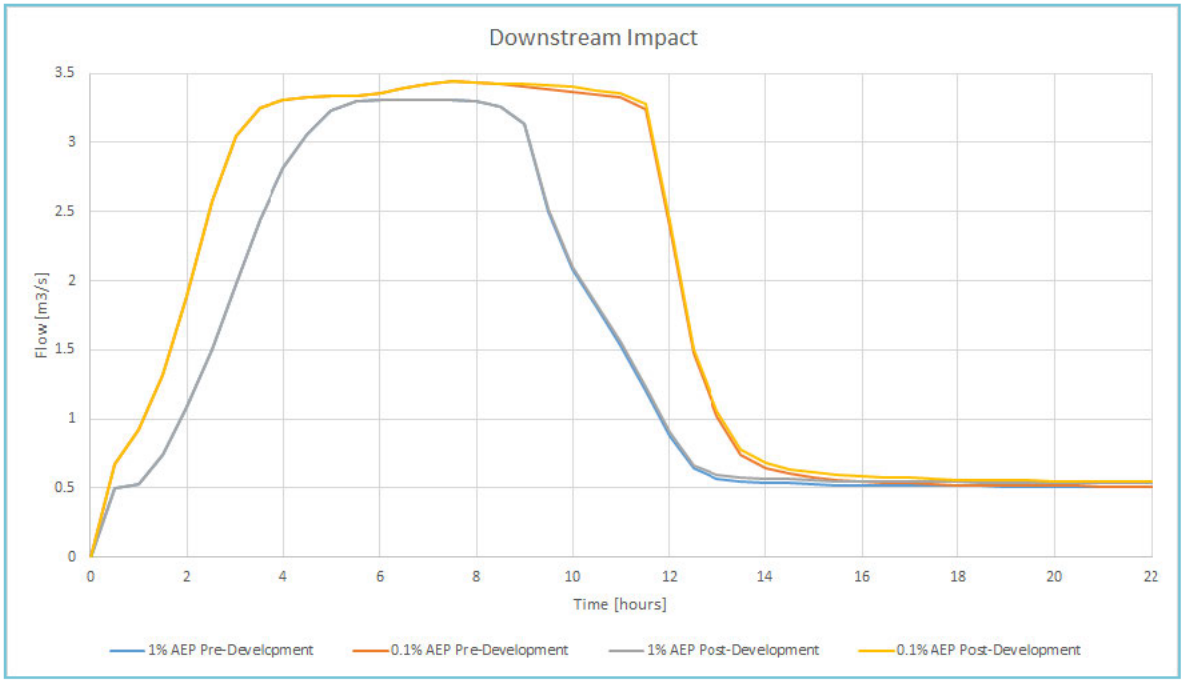


Figure 4-3 Flow hydrograph for 1% and 0.1% events, pre and post-development

5 Flood Risk Assessment and Mitigation

5.1 Flood Risk/Mitigation Measures

From reviewing the available sources of flooding outlined in Section 3, flooding across the site will be limited to the 0.1% AEP return period upon completion of the adjacent development granted under SD19A/0370 and the flood depths are shallow.

The JBA hydraulic model was run with a series of mitigation measures in place, as discussed in Section 4.4. Review of the results shows the flows during the 0.1% AEP event are contained within the proposed flow storage and swale, all the warehouse buildings are located in the central area of the site at low risk of flooding in the post development scenario where the swale is storing and diverting flow around the site. The pass on peak flow (and therefore risk) to the Baldonnell/Griffeen system is not increased as a result of the works and the existing development to the Greenogue Business Park from the river Camac is now protected to the 0.1% AEP standard, resulting in a reduction in overall risk.

In order to manage sustainability and longevity of the flood risk at the site, the following additional mitigation measures were assessed for the proposed new development within the 130 acre site.

5.1.1 Finished Floor Levels

The proposed finished floor levels of the warehouse units maintain a minimum freeboard in excess of the 1% AEP event plus 500mm freeboard. This is in line with both the SFRA and Policy IE 3, Objective 3 of the 2016-2022 County Development Plan .

The FFLs will also be constructed 150m higher than the ground levels for pluvial flood risk mitigation (exceedance).

5.1.2 Access and Egress

The primary access routes onto the proposed development are from College Road and Jordanstown Road. Both access routes are located within Flood Zone C.

5.1.3 Drainage Design/Pluvial Flood Risk

The pluvial flood risk within the site will be managed by the provision of stormwater systems which will capture runoff from hardstanding areas. The site profile will be modified as part of the proposed development.

The increase in the hardstanding area onsite could potentially increase the surface water runoff from the site, if not mitigated. Surface water flow from hardstanding areas will be managed by the stormwater systems, designed in accordance with SDCC Policy IE2 and the GDSDS.

To minimise the risk of pluvial flooding, a threshold of at least 150mm is required from the FFL to the external ground levels for the proposed buildings on site.

5.2 Residual Risk

5.2.1 Climate Change

The model was run with a 20% increase of the flows for the 1% AEP event in order to test the impact of the climate change scenario (MRFS) on the proposed development. The results show the site is not at flood risk for the MRFS scenario, the minimum freeboard provided being 700mm. The flood extents for the 1% AEP MRFS event are presented in Appendix A.

5.2.2 Culvert blockage

To provide a high level of attenuation within the flow storage, the proposed culvert that discharges into the swale is 150mm, the culvert blockage scenario has been assessed.

The model was run with the culvert completely blocked and the results shows the flow storage is able to safely store all the overland flows during the 1% and 0.1% AEP events without overtopping. The freeboard provided is 740mm during the 1% AEP event and 270mm during the 0.1% AEP event. As such, the culvert blockage will not pose a flood risk to the proposed development. For additional safety, a high level spillway connecting to the swale will be constructed to ensure that any potential overtopping does not erode the berm.

Overall the swale is overdesigned and has been tested under a scenario where the flood storage from the adjacent SD19A/0370 development is ignored. The operation of the system is maintained with freeboard in excess of the minimum requirement, as stated in Section 5.1.1.

6 Discussion & Conclusion

JBA Consulting was appointed by Greenogue Management No.2 Ltd to undertake a Masterplanning and Strategic Review of a landholding adjacent to the Greenogue Business Park. As part of the work a detailed Flood Risk Assessment (FRA) of the 130 acre site has been undertaken.

The report is in support a proposal to re-zone the 130acre site from RU (Rural Amenity & Agriculture) to EE (Enterprise & Employment).

6.1 Summary

Underutilised lands adjacent to the northern and eastern boundary of the expanding Greenogue Business Park are shown on the OPW CFRAM flood maps to be potentially impacted by an overland flow route from the River Camac overtopping its banks over 1km to the east.

Under the current Development Plan the zoning of EE lands to the south east in Moneenalion Commons has resulted in granted development (SD19A/0370 - the Amazon site) that will manage the flood risk approaching Greenogue Business Park from the River Camac.

In the near future (the SD19A/0370 site is currently under construction), flood risk across the 130 acre site will be reduced substantially. Flood Zone A is completely removed by the flood storage solution on the Amazon site, what remains is Flood Zone B / the residual overtopping from the Amazon site.

A site-specific hydraulic model has been developed for the study area with the following mitigation measures in place: a flow storage area and a swale, connected by a 150mm diameter culvert. A small berm along the existing drainage ditch was also proposed.

The proposed design has been appraised against the following flood events: 1% AEP (residual risk), 0.1% AEP, climate change, further residual risk (blockage). Review of the results confirm that the overland flow path is successfully stored and diverted around the lands. There is also a low risk of inundation to proposed buildings on site during any flood event. The resulting FFLs provide a minimum freeboard of >500mm above the 1% AEP event. Most importantly the risk to the existing Greenogue Business Park is removed for Camac flows upto the 0.1%AEP event (Flood Zone B), with no negative downstream impacts on the Baldonnel/Griffeen river systems.

The primary access route onto the proposed development is from the Jordanstown Road and College Road. The entrance of the site is situated within Flood Zone C.

Residual risk has also been assessed which includes full removal of the Amazon site mitigation and also blockage of the culvert that connects the flow storage with the proposed swale. Review of the results confirm that the proposed development will not be impacted from the residual risk scenarios.

The Flood Risk Assessment was undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and confirms that the proposed development is appropriate from a flood risk perspective and is in agreement with the core principles of the planning guidelines. Since the SD19A/0370 site will remove Flood Zone A from the site the Justification Test for Development Plan does not need to be applied.

As such this study has confirmed that the proposals adequately manage flood risk to the proposed masterplan site and do not increase flood risk elsewhere. In fact, the proposed design prevents the predicted overland flow path from the Camac impacting existing properties in the Greenogue Business Park.

6.2 Green Infrastructure and WFD

The County Development Plan seeks to promote Green Infrastructure (GI) and assist in achieving obligations under the Water Framework Directive. GI is used to describe an interconnected network of waterways, wetlands, woodlands, wildlife habitats, greenways, parks and conservation lands, forests and other open spaces that adjoin and are threaded through urban areas. Green Infrastructure objectives outlined in the Draft SDCC Development Plan 2022-2027 include policies on Biodiversity, Sustainable Water Management, Climate Resilience, Recreation and Amenity (Human Health and Wellbeing), and Landscape, Natural, Cultural and Built Heritage. These policies promote the use of SUDS and nature-based solutions for flooding and encourage the preservation of riparian corridors in South Dublin.

The development area lies within the Water Framework Directive (WFD) river sub-basin LIFFEY_170 [IE_EA_09L012100], which includes the Griffeen River and its tributaries. The Griffeen rises on the north west side of the Saggart Hills, and flows north east, eventually passing through a culvert under the Grand Canal, and entering the River Liffey at Lucan. The Baldonnell Stream (a tributary to the Griffeen River) passes through the north west corner of the development site in question, then joins the Griffeen approximately 200m downstream of the site.

The Camac River system is located to the east of the site and is in a separate WFD river sub-basin, CAMAC_020 [IE_EA_09C020250]. The Camac flows from Brittas in South Dublin and drains into the Liffey at Heuston Station. In the past, the River Camac has flooded and crossed into the Griffeen River north of the N7 near Greenogue during exceptional flood events. The cross-catchment flows are likely due to high levels of modification in the Camac channel which have caused capacity issues in the Camac channel upstream of the site. This cross-catchment flooding in the 1% AEP event has been addressed by the SD19A/0370, which provides detention areas to store flood waters. Soils analysis of Camac floodplain indicate that the floodplain of the Camac in this area is located in the range of 300-500m south of the area in which the 130 acre site is located. It is outside the historic floodplain and any area that might be considered appropriate for river restoration of the Camac due to its distance from the Camac and the presence of other developments in the area including the Baldonnell Aerodrome, the Baldonnell Business Park, and development SD19A/0370. The GI of the Camac system and the Baldonnel/Griffeen systems are therefore separate entities and the Camac system in particular will be developed further under the Camac FAS. This is clearly highlighted under the County Development Plan in Figure 8.1 and under Policy G1 and G2.

The provision of the flood relief measures identified for the 130 acre site (described in Section 4.3) maintain a green corridor through the 130 acre site and prevent the overland flows from the Camac system flowing through a network of roads and industrial buildings in the Greenogue Estate. The resulting impact on water quality under the current scenario is negative and under the proposals presented within this report the water quality of the cross catchment flow from the Camac to the Baldonnel/Griffeen system will be greatly improved through interception of pollutants in the proposed swale, therefore increasing compliance with the Water Framework Directive.

6.3 Camac Flood Relief Scheme

Whilst the Camac Flood Alleviation Scheme is in its early development the precedent for amending floodplain storage/mitigation outside of the formal Scheme has already been set by the decision of SDCC to grant planning of the Amazon development under SD19A/0370, which effectively delivers a 1% AEP standard of protection to the area, this is the same as an OPW Flood Alleviation Scheme.

The remaining cross catchment flow at the 0.1% AEP is not significant and within this report it has been demonstrated that the proposals offer a solution to existing development and do not increase risk elsewhere in the Baldonnel/Griffeen system.

There is a direct benefit to the Camac Flood Alleviation Scheme in providing the flow route and storage around the 130 acre site for residual risk events, and under the 0.1% AEP standard of protection and there is significant scope for the adjustment of the proposals to offer a greater level of storage if so required under the scheme.

In summary the zoning proposals do not restrict the options of the future scheme, they build on what is already granted under SD19A/0370, increase protection from residual risk and offer a sustainable solution that will be privately funded.

6.4 Conclusion

The findings of the Masterplanning and Strategic Review of the 130 acre landholding adjacent to the Greenogue Business Park confirm that the flood risk to the area has already been significantly reduced by the adjacent SD19A/0370 development and can be further reduced by the stated measures to reroute and store extreme flood flows around the edge of the site.

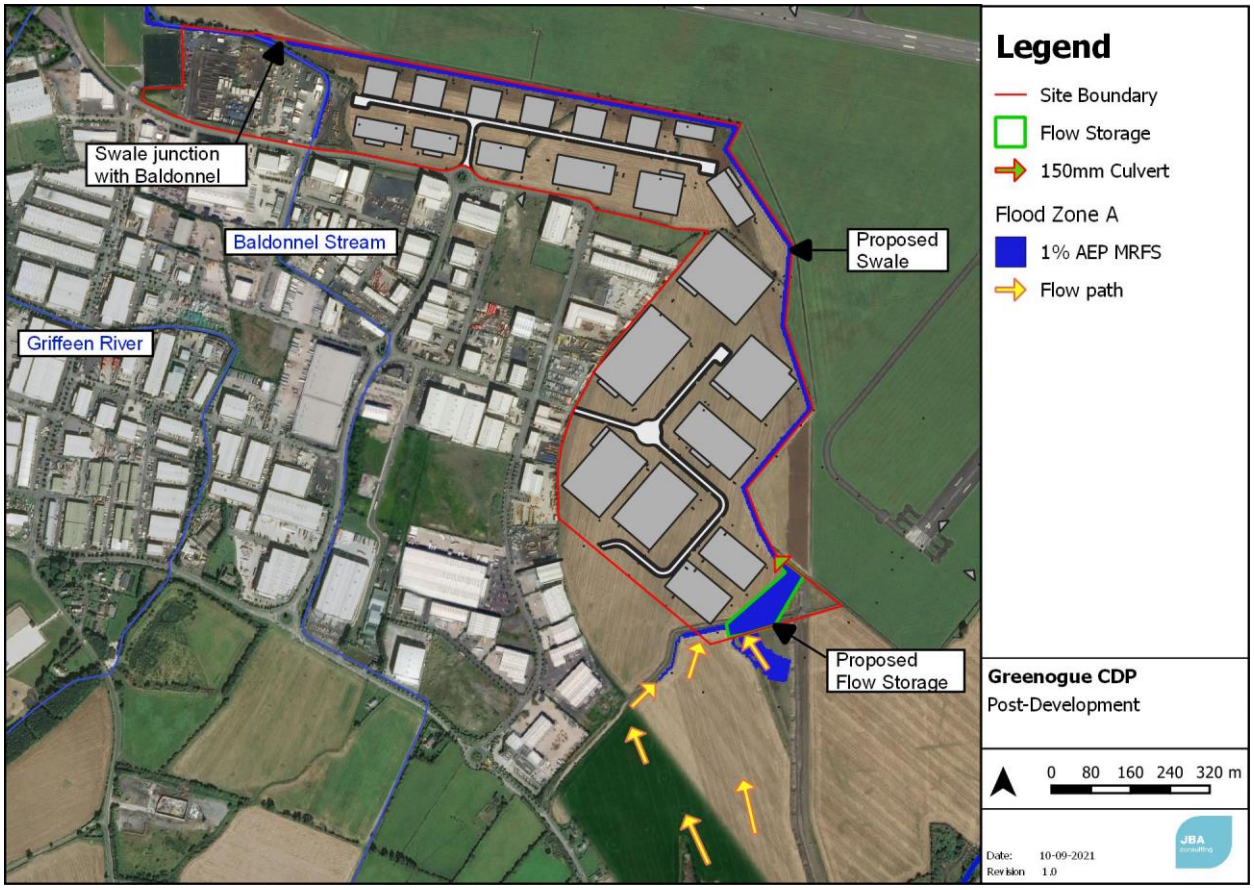
The proposals reduce flood risk and provide protection to the 0.1%AEP standard for cross catchment flows from the Camac and therefore protect a significant amount of existing development within Greenogue Business Park whilst not increasing flow to the downstream Baldonnel/Griffeen system. The proposals provide a viable option tying in with the Camac flood Alleviation scheme, building on the mitigation provided by SD19A/0370. A green corridor is maintained through the proposed zoning which prevents the negative water quality impacts of overland flows passing though a developed industrial site.

In terms of the Planning System and Flood Risk Management Guidelines the proposals are in line with the core objectives therein and since the SD19A/0370 site will remove Flood Zone A from the site the Justification Test for Development Plan does not need to be applied. In summary the opportunity presented by rezoning to Enterprise & Employment across the 130 acre site is positively supported by the findings of this study.

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Appendices

A 1% AEP Climate Change (MRFS) - Flood Extents



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Appendix E: Recent research paper by Jones Lang LaSalle entitled '*Review of Enterprise and Employment Zoned Lands in South Dublin County Council (SDCC) Area*'

Review of Enterprise and Employment Zoned Lands in South Dublin County Council (SDCC) area

September 2021

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1. Introduction
2. Existing Enterprise & Employment Hubs and the Industrial Eco System in SDCC area
3. Types of Occupier in Each Hub
4. Available Land by Hub
5. Available Land by Industry Type
6. What does the Draft Development Plan say about EE land availability?
7. Number of Companies/Employees in each Hub
8. Regeneration Lands (REGEN)
9. Conclusions and questions
10. Methodology

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1. Introduction

Shortage of Supply

The current demand for industrial space is strong. At the same time industrial vacancy rates at a 5-year low. The existing traditional business parks in SDCC are at or nearing capacity and JLL undertook a study to understand the potential pipeline of supply of EE land and where it is.

We estimated there are 471 hectares (1165 acres) of undeveloped land currently zoned EE across the SDCC area. However, large portions of this land is allocated for FDI & Data Centre related uses.

Outside the Hubs of Grange Castle & Citywest there are 85 acres in traditional areas for new and expanding traditional and indigenous industrial users.

Based on current demand, the land available for new and expanding traditional users could be absorbed within the period of the current SDCC plan.

Having a large supply of land in Grange Castle to attract FDI and data centre users is essential to the economic success of the county however, other users will need to be catered for in the medium term.

There is little land left available for traditional industrial development in SDCC.



Hannah Dwyer
Director, Head of Research

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2. Existing Enterprise & Employment Hubs and the Industrial Eco System in SDCC

Greenogue/ Aerodrome/ Ballymount/ Tallaght/Clondalkin/Fonthill

Traditional Industrial Users (TIUs)

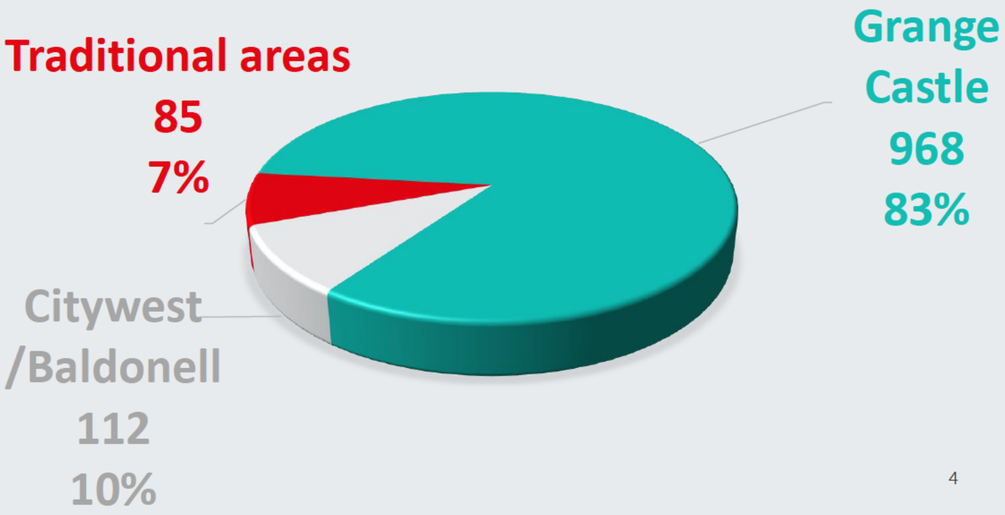
Grange Castle

FDI / data centres

Citywest/Baldonnell

Mix of TIUs, Corporate HQs / Offices

Total available land (acres)



Note: Regarding acreage and usage please refer to our methodology notes at the end of the report.

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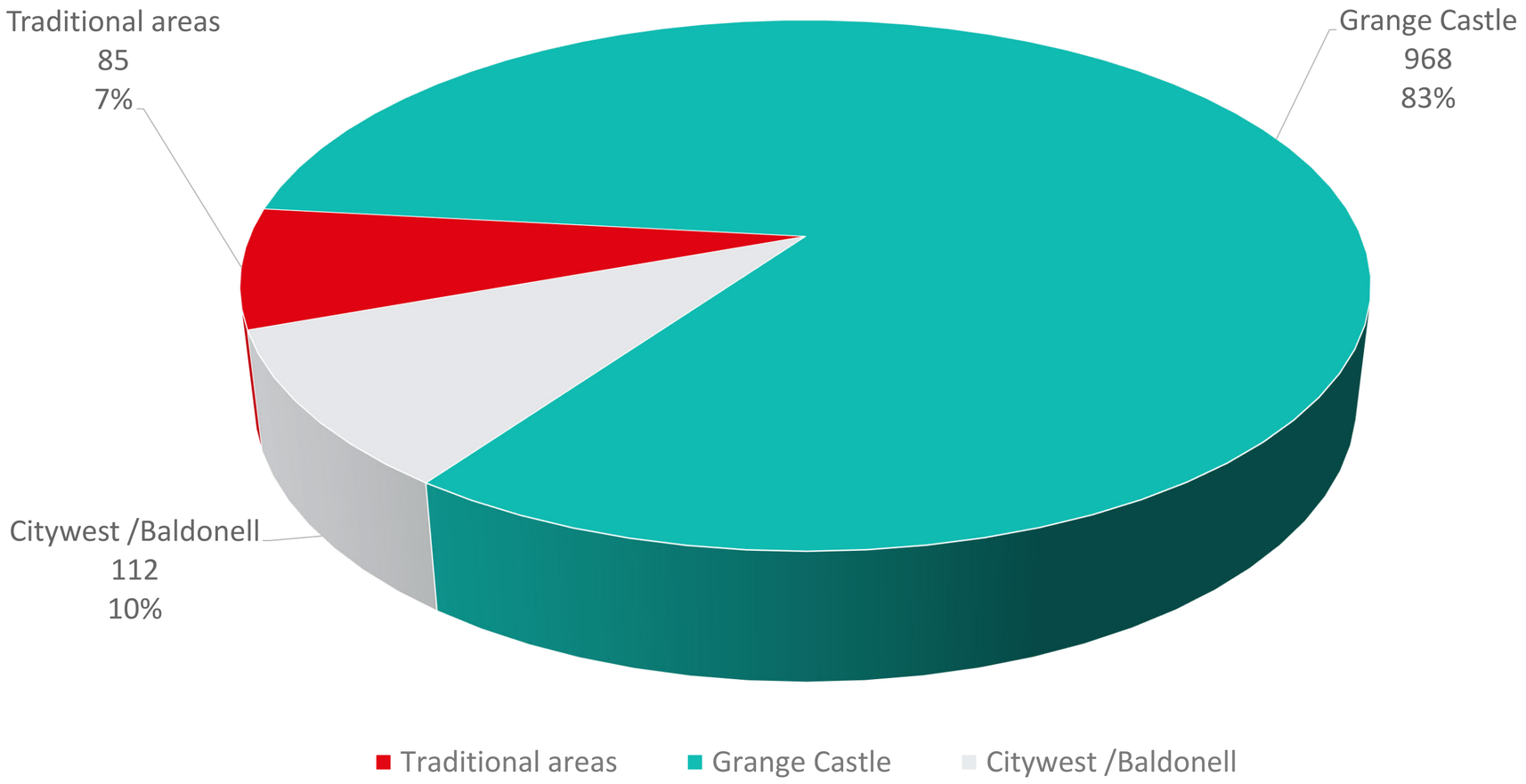
3. Types of Occupier in each Hub

	Location	User Type
1.	Greenogue /Aerodrome	Light industrial/general industrial/Indigenous occupiers and logistics users (Traditional industrial users), many indigenous
2.	Citywest/Baldonnell	Citywest High quality tech campus style offices and international companies and some indigenous logistics companies while Baldonnell has a blend of local and international occupiers.
3.	Grange Castle	Strategic land bank for foreign direct investment large scale global company type occupiers & Data Centres

Sample of Traditional Users currently Situated in Greenogue/Aerodrome	
Plant and tool Hire	Jewellery Suppliers
Larger Logistic and Transport Companies	Photocopier Repairs & Supplies
Motor Mechanics	Gym Equipment Suppliers
Motor Factors	Log Cabin Supplies
Window and Door Manufacturers	Wholesale Food & Drinks
Waste Management	Medical Devices Suppliers
Tyre & Exhaust Repairs	Drug Manufacturers
Safety Training Centres	Chemical Distribution
Builder Providers and Supplies	Civil Engineering Companies
Metal Fabrication	Steel Supply Companies
Catering Equipment and Supplies	Cabin Hire
Small Scale Food Production	Electrical Equipment Supplies and Manufacture
Small builder lock ups	Gas equipment repair & supply
Printers	Plastic Moulding Fabrication
Sign Writing	Meat Supplies
Traffic Management	Cold Storage
Forklift Hire & Services	Office Fit Out and Furniture Supplies
Wholesale Butchers	D.O.E Centre
Security Monitoring and Alarm Suppliers	Car Valeting
Event Management & Event Hire	Hydraulic Services
Health and Safety Equipment & Supply	Heavy plant sales and service; excavators, dozers etc
Graphic Design	Furniture/kitchen manufacture
Transport depots / Truck Parking	Construction supplies
Aviation Parts Suppliers	Stainless steel and sheet metal manufacturing
Data Centre Supply Chain	

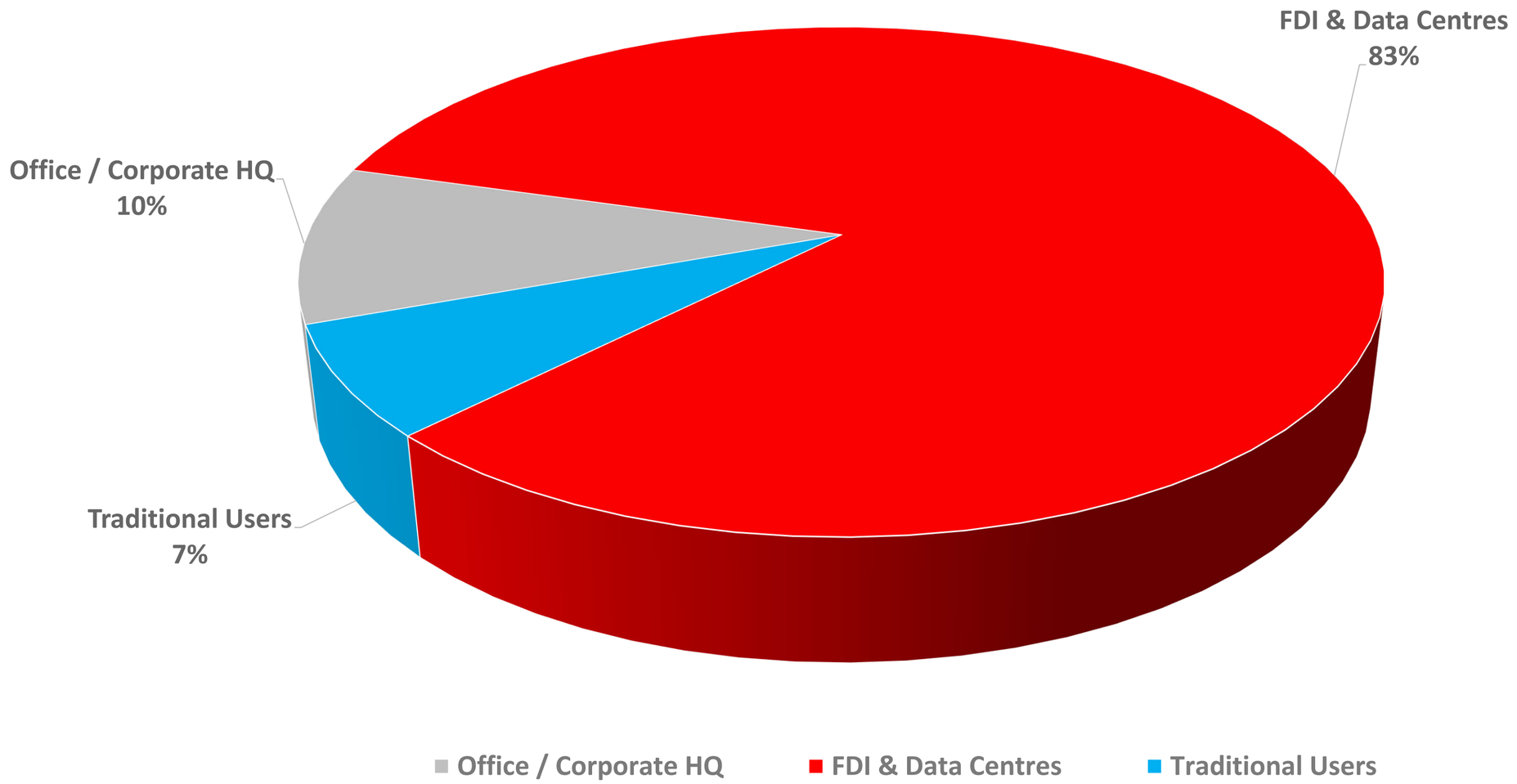
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4. Available Land by Hub



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5. Available Land by Industry Type



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6. What does the Draft Development Plan say about EE land availability?

South Dublin County Council states that there are 550 hectares (1360 acres) of EE zoned land available for development.

Our research suggests that there are 471 hectares (1165 acres). The difference is almost certainly accounted for by recent construction.

The bulk of this remaining land is earmarked for FDI/Data Centres

* *There is some user cross over between the Hubs in terms of user types however in general terms crossover does not materially distort the final breakdown.*

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6. What does the Draft Development Plan say about EE land availability?



Extract from the Economic Development and Employment Section of the *Draft South Dublin County Development Plan 2022-2028*

'The Greenogue and Aerodrome Business Parks at Rathcoole/Newcastle, Clondalkin Industrial Estate and Fonthill Industrial Estate are large industrial campuses comprising a mix of largely warehousing and manufacturing facilities, providing potential for new jobs or any displacement of jobs from the Naas Road or Tallaght REGEN lands over the coming years. Other smaller industrial estates throughout the County can also offer space for employment throughout the lifetime of the plan.'

'The industrial areas comprising a mix of largely warehousing and manufacturing facilities at Greenogue, Aerodrome, Baldonnell and Magna Business Parks provide a significant existing and future employment landbank within this area. Such areas are capable of providing for a significant proportion of the County's employment growth.'

Greenogue, Aerodrome, Baldonnell, Magna & Fonthill Business Parks currently provide approx 23 acres of readily available land.

We estimate this land will be taken up in the lifetime of the current plan.

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6. What does the Draft Development Plan say about EE land availability? contd



3 acres at Greenogue/Aerodrome



12 acres Baldonnell



1.0 acre Fonthill



7 acres Magna

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6. What does the Draft Development Plan say about EE land availability?



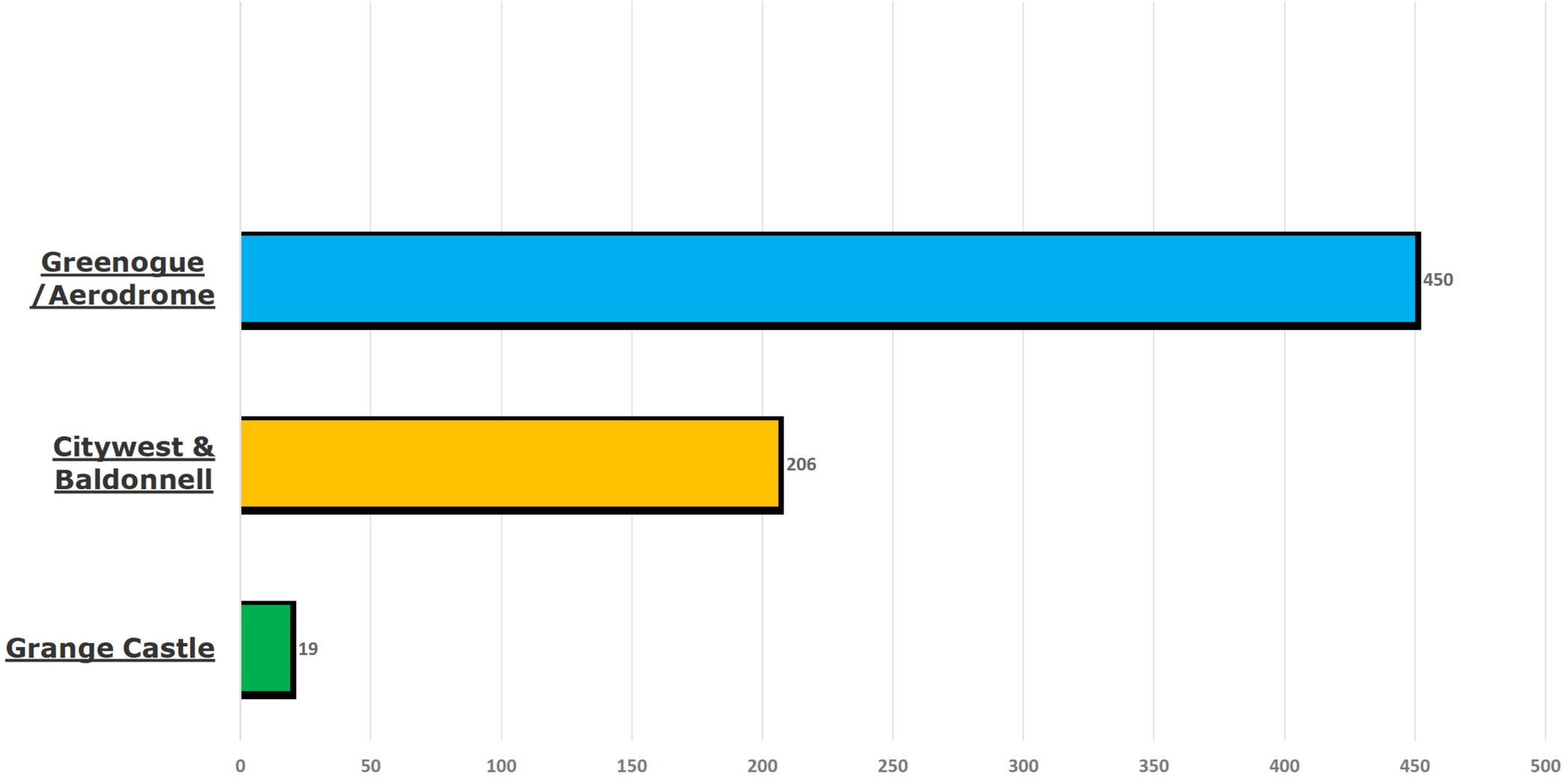
Extract from the Economic Development and Employment Section of the *Draft South Dublin County Development Plan 2022-2028*

'The Citywest Business Campus and Grange Castle Business Park are modern business parks located in the west of the County with capacity to attract large scale industries of regional, national and international significance, due to the availability of large plot sizes, infrastructure and corporate park style environments. These areas have attracted a significant number of blue-chip national and multi-national corporations. Significant investment has been made over the past two decades in infrastructure and services to support these economic areas. Grange Castle Business Park is identified in the MASP as a strategic development area for the promotion of high-tech manufacturing, research and development.'

Approx 900 acres are not available for Traditional Industrial Users

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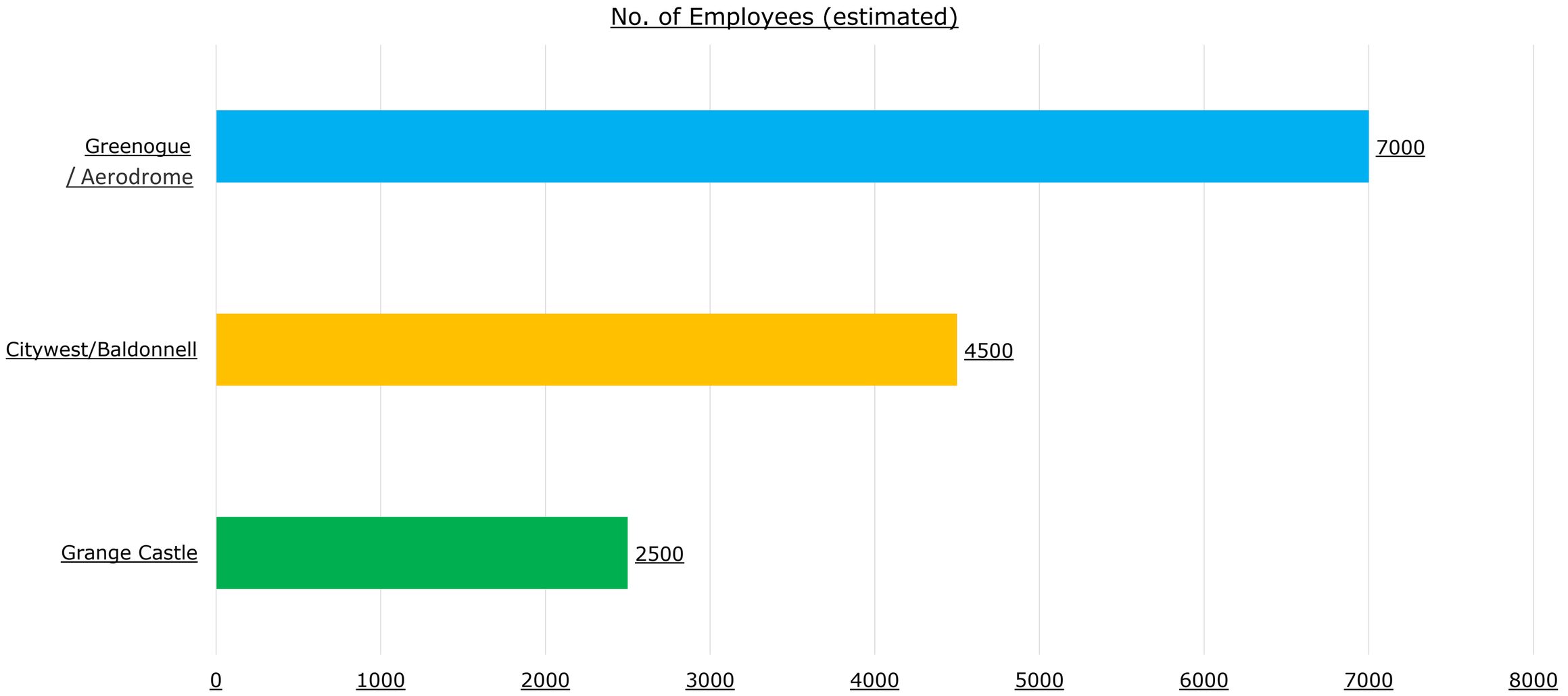
7. Number of Companies in Each Hub*



** Using Greenogue as a Traditional Industrial User Hub reflects the fact that there are many small to medium users in such Hubs*

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7. Estimated employees in Each Hub*



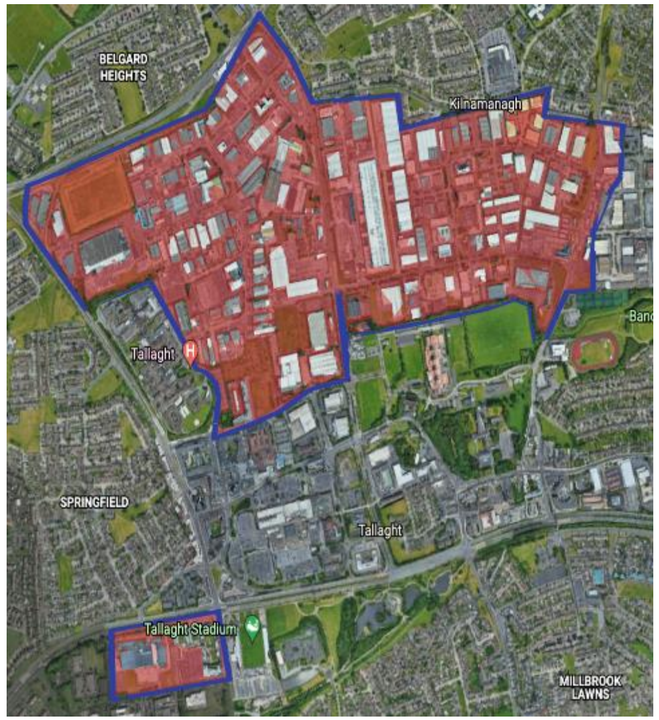
** The numbers employed in various Hubs tend to reflect that the majority of people works in traditional and supporting industries*

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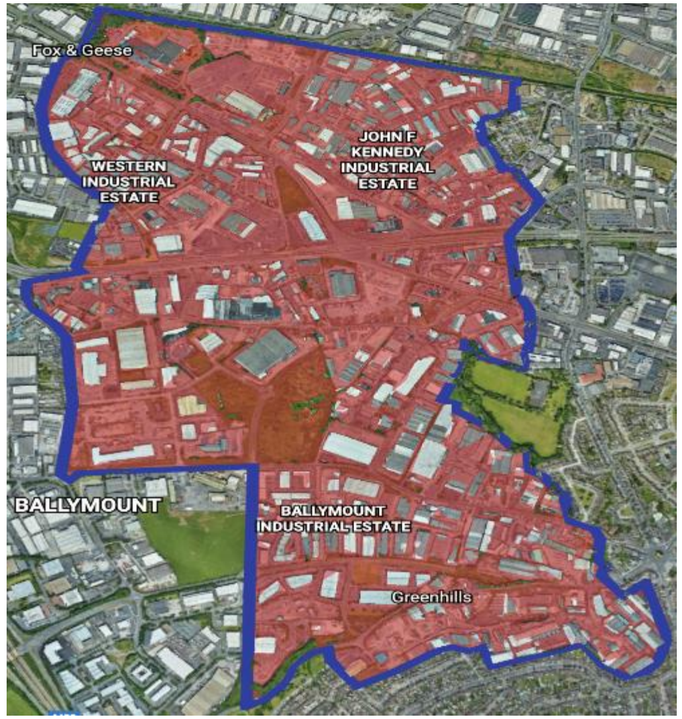
8. Regeneration Lands (REGEN)

South Dublin County Council have designated 425 hectares (1,050 acres) of land for regeneration (REGEN) in the areas of Ballymount and Tallaght.

Tallaght- 350 Acres



Clondalkin- 800 Acres



There is currently no space for this displacement to happen

8. Regeneration Lands (REGEN) contd

According to the published draft development plan it is envisaged that the traditional industrial users in Ballymount and Tallaght will migrate to lands at Greenogue, Clondalkin and Fonthill.

‘ Greenogue and Aerodrome Business Parks at Rathcoole/Newcastle, Clondalkin Industrial Estate and Fonthill Industrial Estate are large industrial campuses comprising a mix of largely warehousing and manufacturing facilities, providing potential for new jobs or any displacement of jobs from the Naas Road or Tallaght REGEN lands over the coming years. Other smaller industrial estates throughout the County can also offer space for employment throughout the lifetime of the plan.’



Greenogue/Aerodrome – 3 acres readily available



Clondalkin Industrial Estate – No land available



Fonthill Industrial Estate – 1.1 acres available

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9. Conclusions and Questions

1. Of the 1165 acres of available zoned lands there is limited availability for development to cater expanding and new traditional users

2. Based on current market demand, the amount of readily available land is likely to reduce to close to zero by the end of the current development plan leaving no options available in the County for the new and expanding traditional industrial user

3. Where will the new and expanding occupier find new premises?

4. Having a large supply of land in Grange castle to attract FDI and data centre users is essential to the sustainable economic well being of the County however it is clear that other users will need to be catered for in the medium term.

5. Based on current demand, and with Fonthill, Citywest, Baldonnell and Greenogue at capacity, there is not sufficient zoned EE land available in the ecosystem to cater for the traditional user in the medium let alone the long term.

6. Existing Traditional User Industrial Estates or either at or nearing capacity and do not have the available zoning land to cater for REGEN displacement

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10. Methodology

As part of a review to understand the short to medium term pipeline of new industrial buildings to meet ongoing demand we undertook a review of available land for the purpose. We undertook a high-level review of the South Dublin County Development Plan 2016 - 2022 mapping (as varied in 2018) to ascertain the current availability of land zoned objective 'EE' Objective To provide for enterprise and employment related uses'.

The exercise utilised Google Earth online mapping tools. The precise measurement would need to be undertaken to determine exact areas therefore it is prudent to allow for a tolerance of +/- 5%. The review takes account of lands zoned EE that remain undeveloped as of 31st August 2021. The exercise excludes EE zoned land where construction has or is about to commence.

It accounts for land that is in planning or has a planning permission for industrial / warehousing use. It is reasonable to assume that such land is likely to be developed in the current plan period given the demand.

The availability of EE zoned land is limited to maps 2,3,4,5,7,8 & 9 of the 2016 Development plan (as varied) The report aims to review the lands zoned 'EE' Under the Current 2016 Development Plan and considers the allocation of EE lands;

- Available for all types of 'EE' Development in 2016 (as varied)
- Land for FDI and Earmarked /Owned for Data Centre Use
- Private/Agri Use or Landlocked (currently unavailable for development)
- Land held by Owner Occupiers
- The availability of Land for Traditional Industrial Users (TIU's)
- CHQ/Office Development Sites

There is some cross over between the Hubs in terms of users, however this crossover does not materially distort the final breakdown.

The report relies on information made available publicly in various press and commercial websites including reports from SDCC & The Irish Times. The information provided is based on current market activity which could be subject to change and may affect the categorisation of lands.

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