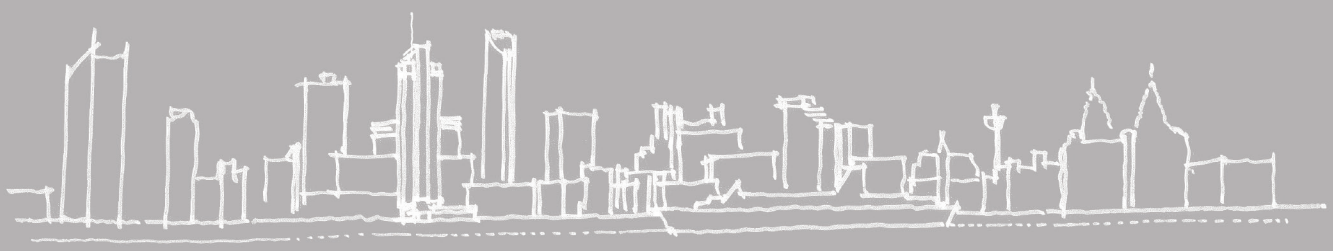
MODALIVING

A DESIGN FOR LIFE

PRINCES REACH, PRINCES DOCK

DAYLIGHT AND SUNLIGHT REPORT

June 2016



Contents

1 Introduction

1.1 Context

Ove Arup and Partners Ltd (Arup) has been commissioned by Moda Living to prepare an assessment of the impact on daylight and sunlight, to accompany a planning application for the proposed development at Princes Dock, Liverpool, L3 1QP.

The Site is presently undeveloped and is bound by William Jessop Way and Princes Dock to the west and Bath Street to the east. The land forms part of the Princes Dock Redevelopment Area.

1.2 Description of Development

In summary, the proposed development comprises a circa 34 storey residential tower (Class C3) comprising circa 304 private rented sector apartments and 40 car parking spaces, plant, storage, reception and recreation areas and hard and soft landscaping on vacant brownfield land.

1.3 Purpose of this report

The purpose of the daylight and sunlight appraisal is to first analyse the existing (i.e. the baseline) daylighting conditions on the windows of neighbouring buildings around the Site, and then to compare and report on the impact of the proposed redevelopment on these neighbouring windows.

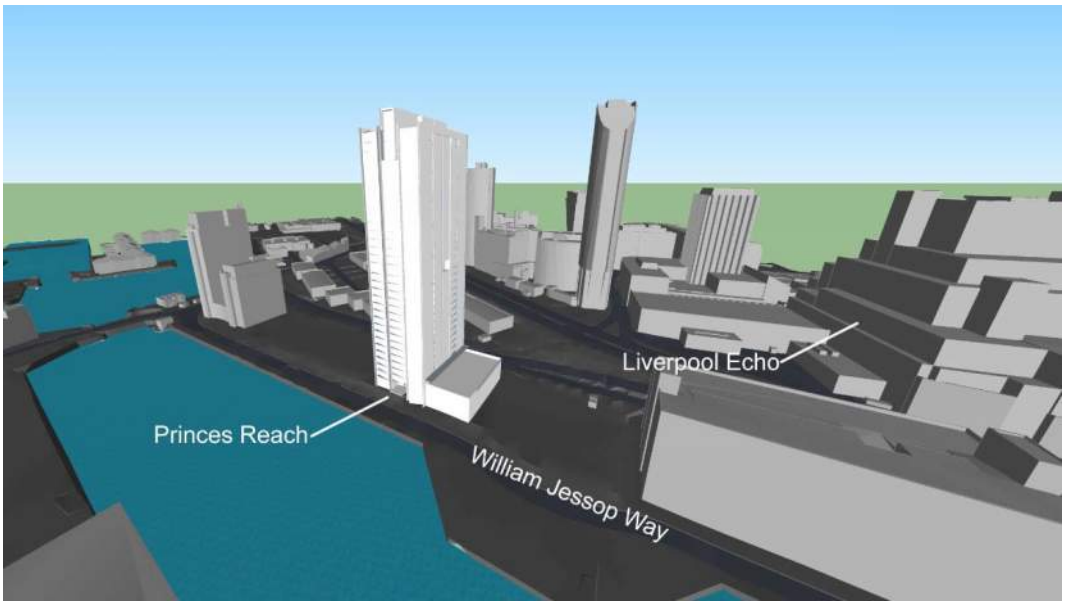


Figure 1: Adjacent, proposed buildings

Two scenarios are considered in the analysis (refer to Figure 1):

- Baseline scenario: all existing neighbouring buildings excluding Princes Reach
- Development scenario: all existing neighbouring buildings including Princes Reach

This report aims to provide stakeholders with an insight into two aspects of daylight performance at the proposed development, specifically daylight availability and sunlight exposure (sunlight hours).

1.4 Report Structure

The report structure is summarised below

1. **Introduction**: context and purpose
2. **Methodology**: Details of assessment methodology
3. **Baseline Conditions**: Determine the baseline lighting conditions
4. **Impact Assessment:** Identify where there may be an environmental impact and comparison with policy/guidance.
5. **Conclusions**:

2 Methodology

2.1 Introduction

Natural lighting forms a crucial part of good building design and is known to positively affect human behaviour by creating an attractive visual environment that encourages well-being and productivity. The design of a building can have a significant effect on the availability of natural light internally and externally.

This section sets out the guidance used in this assessment, and the approach to modelling. Specifically, it covers:

- The best practice guidance applied in this assessment (and the scope)
- Definition of the Vertical Sky Component
- Definition of the Annual Probably Sunlight Hours
- An overview of the approach to modelling
- The approach to impact assessment.

2.2 The Applied Guidance and Scope

To provide a prediction of change in daylight/sunlight performance following development of the Site, three assessments have been undertaken which draw on specific guidance for assessments of this nature. These are in accordance with the guidelines described in the Building Research Establishment (BRE) document 209 *Site Layout Planning for Daylight and Sunlight* (referred to throughout as BRE209). Specifically, they include:

- **Daylight Availability**: According to BRE209 daylight within existing buildings will be adversely affected if the Vertical Sky Component (VSC) is reduced to less than 27% and the VSC is less than 0.8 times its former value as a result of a new development. Analysis of daylight availability has been completed at each window of neighbouring buildings.
- **Sunlight Hours (hours/year)**: Where a window is within 90° of due south, BRE209 proposes it should receive at least 25% of the total Annual Probable Sunlight Hours (APSH) in summer months and at least 5% of APSH in the winter months (Sept 21 – March 21). An adverse impact on sunlight will be experienced if the total number of sunlight hours falls below these recommendations and is less than 0.8 times its former value and the reduction is greater than 4% of APSH. Analysis has been completed at each window of neighbouring buildings.
- **Amenity Space Sunlight**: For garden/amenity spaces, BRE209 recommends that at least half the space should receive at least two hours of sunlight on 21 March. The result a new development should not reduce this by more than 80%. Otherwise, the impact will be noticeable. This is considered applicable to the neighbouring landscape and canal/leisure areas.

Daylight availability and sunlight hours have been analysed using 3D computer simulation techniques. The computer simulation predicts sunlight and daylight performance in the baseline scenario and development scenario. Comparison of the simulation results enables conclusions to be made on daylight/sunlight impact of the proposed development.

To do this, this appraisal requires a series of specific inputs relating to the development and the environment. The assessment has used the following source data:

- 3D Model of the proposed development
- Arup 3D City Model of the surrounding area[1]
- Shadowing Sky Model: CIE standard clear sky model*
- Vertical Sky Component Model: CIE standard overcast sky model
- Daylight data: local Energy Plus Weather (EPW) weather data files (from the Aughton weather station at: 53.55°N, 2.92°W)
- Site Co-ordinates: 53.484°N, 2.228°W. 1.6. Grid Reference SJ337907 (Easting 333734 Northing 390789)

*Commission internationale de l'éclairage (CIE). Standard CIE S003 *Spatial distribution of daylight - CIE standard overcast sky and clear sky* lists a set of luminance distributions, which model the sky under a wide range of conditions, from the heavily overcast sky to cloudless weather. It is intended for two purposes: i) to be a universal basis for the classification of measured sky luminance distributions and ii) to give a method for calculating sky luminance in daylighting design procedures.

[1] It should be noted that fences, trees and other organic planting are excluded from this analysis (and are not required as part of BRE based analysis).

Two metrics are used to consider the impact of the development on the baseline lighting conditions namely Vertical Sky component and Annual Probable Sunlight Hours. These are described below.

2.3 Vertical Sky Component (VSC)

VSC is proposed in BRE209 as a measure of daylight availability. It is described as the ratio of illuminance (incident light on a surface) on the vertical plane and the unobstructed illuminance on the horizontal plane.

In simple terms, this metric represents the area of visible sky from each window as a proportion of the whole sky hemisphere (Figure 2).

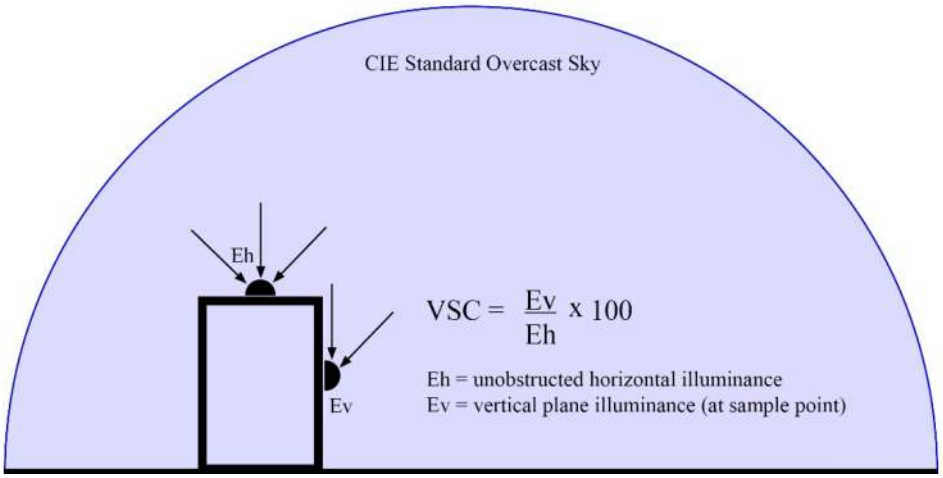


Figure 2: Vertical Sky Component

This metric represents the area of sky visible from each sample point (i.e. window) and therefore, BRE209 requires the CIE standard overcast sky to be used in this analysis.

2.4 Annual Probable Sunlight Hours (APSH)

APSH is the probable number of hours that sunlight will shine on unobstructed ground, allowing for average levels of cloudiness for a given area. Weather data is available for a number of weather stations across the UK, with Aughton (53.55°N, 2.92°W) being the closest to the Site. The EPW[2] dataset provides various climate measurements taken at every hour of a typical year including the time and duration of any sunlight. The CIE clear sky model is used to calculate the sunlight at the times recorded in the EPW dataset. Windows are only considered where they face within 90° of due south.

2.5 Amenity Space Sunlight Exposure

The sunpath is defined as the progress of the sun in the sky over the site (Figure 3). This is presented as a sunlight simulation within a hemispherical projection of

[2] EPW: EnergyPlus Weather data, http://apps1.eere.energy.gov/buildings/energyplus/

the sky above. Coloured bands indicate the position of the sun in the sky above in an annual snapshot; each coloured cell represents one hour of each day/month.

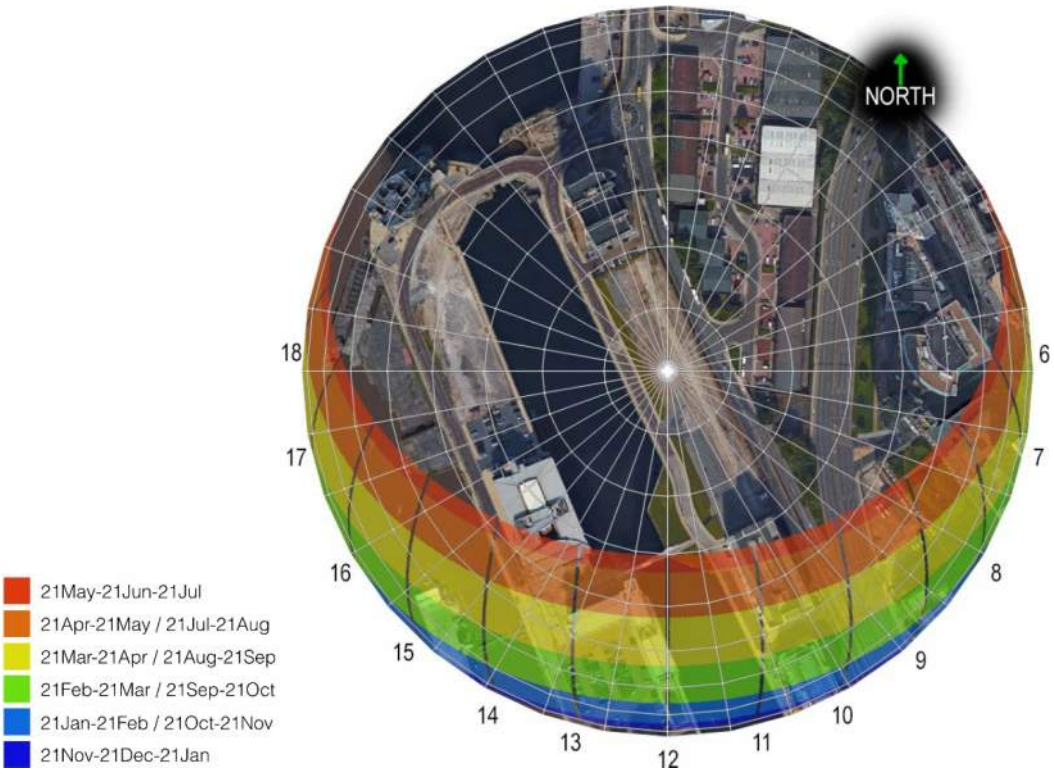


Figure 3: Annual sunlight hours and sunpath

The Radiance software models the sunlight exposure and shadowing for each hour of 21 March (assuming all hours are sunny) of the 3D model. The output is a cumulative model of the sunlight-hours exposure for one day.

2.6 Modelling Overview

A concise overview of the approach to modelling the change in daylight/sunlight is as follows:

- Construct 1:1 scale 3D model of the redevelopment, terrain and existing buildings.
- Insert sky model. Two sky data sets are used; a) standard CIE clear sky model for the shadowing simulation and b) CIE overcast sky model for the daylight availability simulation.
- Combine scene geometry, materials, sky model data, sample points and viewpoints (facades) into the Radiance simulation model.
- Use of Radiance software to execute two models, sunlight hours (APSH) and daylight availability (VSC), and extract lighting data for each receptor.

2.7 Impact Assessment and Significance

The following sections describe the impact assessment methodology for the daylight and sunlight assessment and the results of the associated computer simulations.

Computer simulations have been carried out to analyse the change in natural light availability on the neighbouring windows/facades expressed in terms of sunlight hours and daylight availability.

Using the Radiance Lighting Simulation and Rendering System, natural lighting has been modelled to predict the natural lighting conditions due to the proposed development. This software is recognised across the industry as being best practice software ideally suited to accurately model light behaviour in complicated environments, with much academic research to support this statement.

2.7.1 Daylight Availability (VSC)

The software described above is used to calculate the illuminance in the vertical plane (Ev) at a set of sample points (refer to Section 3.2). The same algorithms are used to calculate the unobstructed horizontal plane illuminance (Eh). The VSC is the ratio of Eh/Ev expressed as a percentage, Figure 2.

The results are then checked against BRE209 guidance, which in summary, states that daylight may be adversely affected in an existing building if either the VSC measured at centre of existing window is less than 27% and less than 0.8 times its former value as a result of the new development.

The data is presented as a set of coloured sample points mapped over the 3D geometry of the surrounding buildings. Each sample point represents a window location (or in some cases, where detailed 3D models were unavailable, it represents an approximate window location). The samples points are coloured as follows:

- Blue: VSC is greater or equal to than 27%
- Red: VSC < 27%
- Magenta: VSC < 27% and VSC < 0.8 of former value

The output from this modelling is presented in Appendix A1.

2.7.2 Sunlight Hours (APSH)

Sunlight hours modelling will predict the extent and duration of sunlight shadowing experienced by and due to the proposed redevelopment. The computer analyses the direct sunlight landing on the sample points for every daytime hour of the year, excluding overcast hours, based on the EPW weather data.

The sunlight hours ASPH data is presented as coloured points, mapped over the 3D geometry of the buildings, which illustrate the change in sunlight hours in

terms of the BRE209 guidance. Windows on the north façade of a building are beyond 90° of due south and are therefore excluded from this analysis.

Two aspects of ASPH are considered; annual and winter probable sun hours (wASPH). The winter period runs from 21 September to 21 March. Both the baseline and development scenario are presented side-by-side for visual comparison. The samples points are coloured as follows:

- Blue: APSH > 25%
- Red: APSH < 25% or wASPH < 5%
- Magenta: APSH < 25% or wASPH < 5%, APSH/wASPH, < 0.8 of former value and the reduction in APSH is >4% (new development scenario)

The output from this modelling is presented in Appendix A2.

2.7.3 Amenity Space Sunlight Exposure

Sunlight availability is also presented around the site for 21 March. As proposed by BRE209, garden/amenity spaces should receive at least two hours of sunlight on 21 March and the impact of a new development should not reduce this by more than 80%.

Three amenity spaces are in close proximity to the site (Figure 4). One is located between New Quay and Bath Street, the other is near the footbridge adjacent to William Jessop Way. The amenity space near Princes Parade is wholly due south of Plot 3 and therefore will not be affected by any shadowing from the proposed development.

Figure 4: Local amenity spaces

The simulation data is presented as two falsecoloured images placed side-by-side for visual comparison. By inspection of the images, any areas where sunlight changes or becomes available can be identified. Each colour indicates the number of hours a particular area is exposed to sunlight.

The falsecolour images are scaled from blue to yellow, with blue showing the areas with the fewest sunlight hours and yellow showing the areas with the most sunlight hours, as described above.

An example is shown below in Figure 5, below. The image below represents a plan view of the site and the proposed development is marked with a black outline.

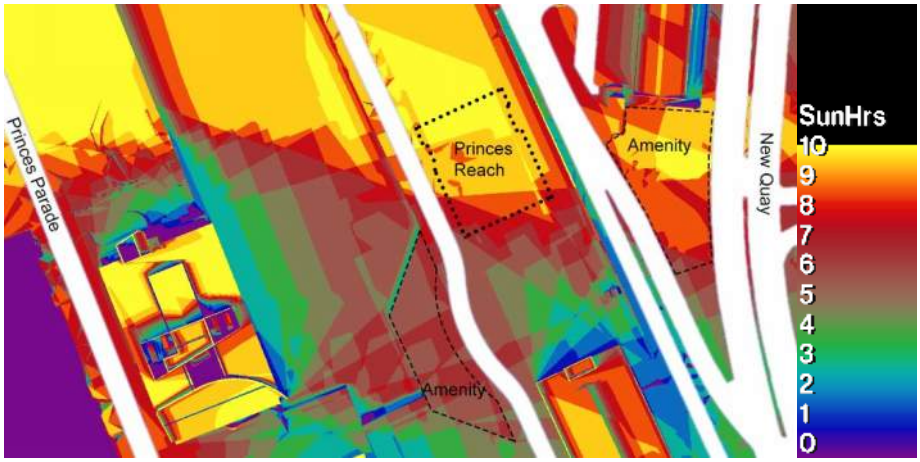


Figure 5: Example of sunlight exposure simulation output

The sunlight exposure on 21 March, resultant from the shadowing effects of the proposed building, and others in the locality, is represented by colours representing the total number of hours exposed to sunlight. The output from this modelling, including a baseline and development scenario image is presented in Appendix A3.

3 Baseline Conditions

3.1 Introduction

This section presents the outputs of the daylight/sunlight modelling, carried out for the proposed development at the Site. The assessment focuses on three daylighting characteristics, as set out in BRE209 and discussed in the methodology section of this report, namely:

- Daylight availability, using the Vertical Sky Component (VSC) metric
- Sunlight hours, using the Annual Probable Sunlight Hours (ASPH) metric
- Sunlight exposure on amenity spaces, maximum exposure on 21 March

This section should be read in conjunction with Appendix A, where the predicted daylight and sunlight performance is identified in detail. All outputs, presented in Appendix A, show net changes in sunlight/daylight availability. This means that the modelling simulation accounts for the existing baseline conditions, and the change in daylighting due to the proposed development.

A number of buildings are considered in the analysis, which may be affected by the new development. These are identified below in Figure 6 and Table 1.

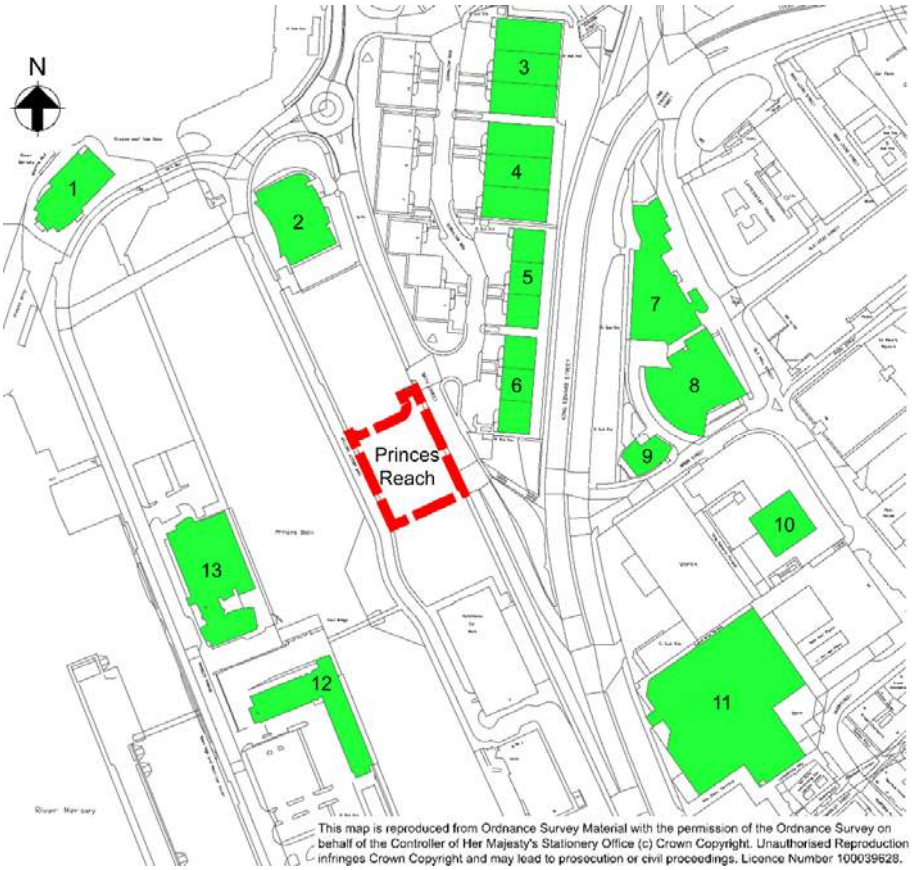


Figure 6: Neighbouring buildings

It is noted that the buildings on Gibraltar Way (ref. 4-6) are destined for future demolition as part of the Liverpool Waters Masterplan.

Building	Type	Building	Type
1- Alexandra Tower	R	8- HM Passport Office	C
2- 1 Princes Dock	R	9- West Tower	RC
3- No. 20-24 Gibraltar Way	L	10- Metropolitan House	C
4- No. 14-18 Gibraltar Way	L	11- Liverpool Echo Offices	C
5- No. 10-12 Gibraltar Way	L	12- No. 10 Princes Parade	C
6- No. 04-08 Gibraltar Way	L	13- No. 12 Princes Parade	C
7- Radisson Hotel	RC		

Table 1: Neighbouring buildings (R=Residential, C=Commercial, L=Light Industry)

3.2 Façade Analysis

The sunpath analysis (Figure 3) identifies adjacent building windows that may experience a reduction in sunlight or daylight as a result of the Princes Reach development. In order to carry out the sunlight/daylight modelling and impact assessment, a series of facades have been selected (Figure 7 to Figure 9) to examine daylighting conditions on windows of adjacent buildings potentially affected by the new development.

With reference to Table 1, the relevant facades are identified below. Window locations are identified with yellow markers on each relevant façade. Daylight has been modelled at each of these locations.

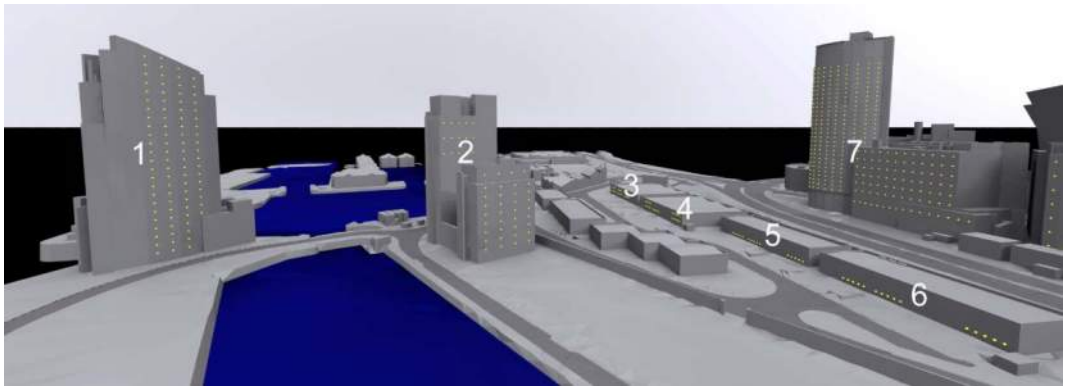


Figure 7: Buildings 1-7 (north of the development)

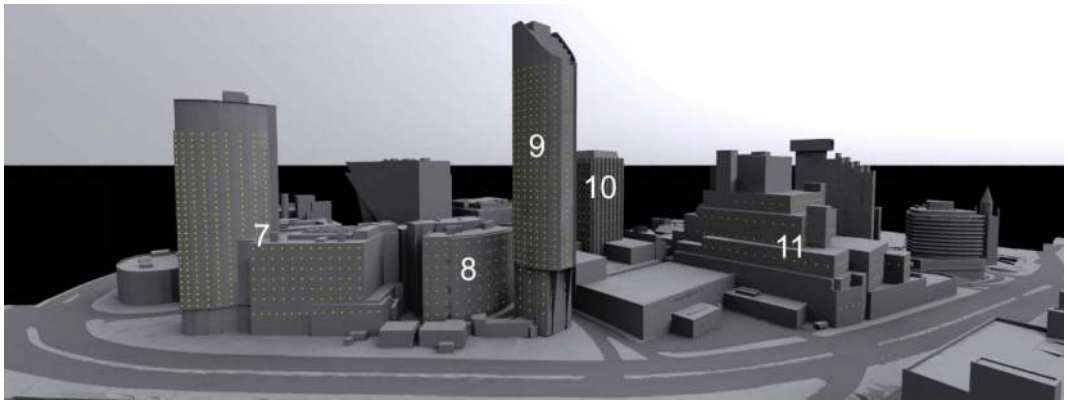


Figure 8: Buildings 7-11 (east of the development)

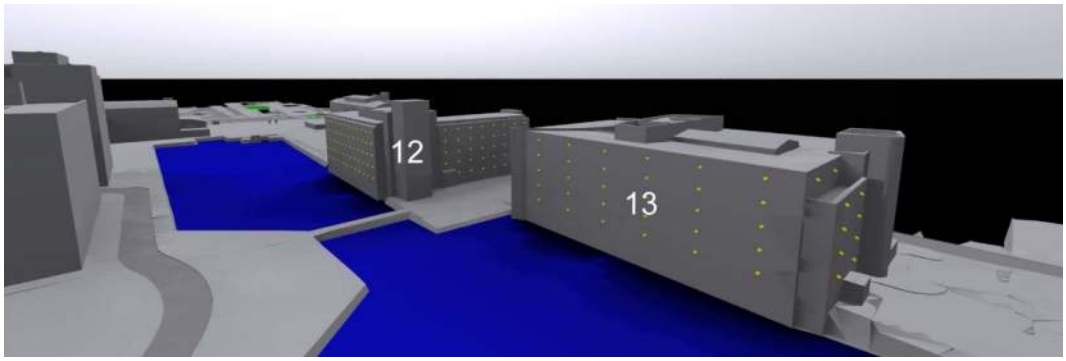


Figure 9: Buildings 12-13 (south-west of the development)

The full findings from the modelling and impact assessment on these facades are presented in detail in the appendices of this report. The findings are presented as 3D views towards the adjacent building façades, with coloured markers identifying the performance of daylight/sunlight at each window (or approximate window location where this detail is not available in the 3D city model). The findings of the baseline and development scenarios are presented side-by-side in these appendices for comparison.

3.3 Daylight Availability (VSC)

VSC is recommended in BRE209 guidance as a measure of the availability of daylight. It is defined in detail in Section 2.3 of this report.

Analysis of daylight availability using the VSC measurement has been completed at each window of neighbouring buildings described in Section 3.2.

In summary of BRE209, daylighting may be adversely affected if the VSC is less than 27%. This effect is considered more significant in an existing building if the VSC is reduced to lower than 80% of its former value as a result of the new development. The daylight simulation data has therefore been assessed against three scenarios described below:

1. VSC ≥ 27%
2. VSC < 27%
3. VSC < 27% and < 0.8 of former value

Note: the third scenario is only a consideration in comparison with the baseline scenario. The first two can occur at the baseline.

A typical example of the analysis output is provided in Figure 10, which shows how daylight availability has changed compared to the baseline scenario.

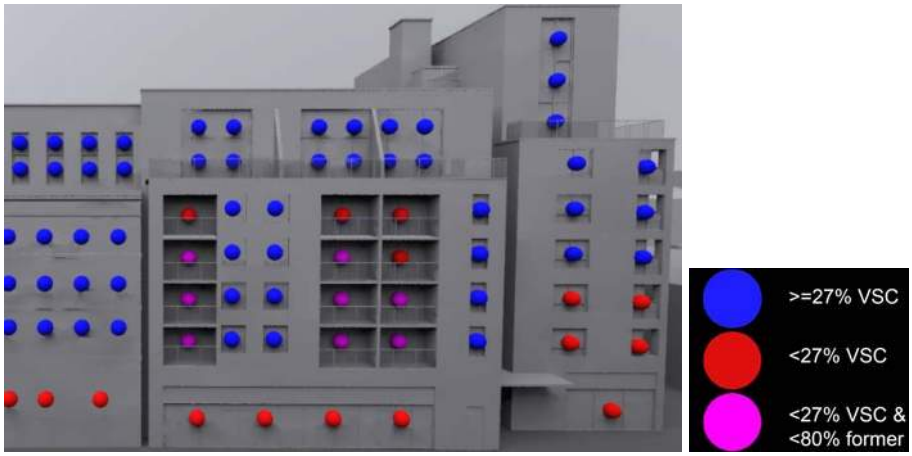


Figure 10: Typical output of daylight modelling

3.3.1 Baseline Scenario (VSC)

The findings of baseline the VSC daylight availability analysis on the neighbouring buildings are summarised in Table 3. Each sample point (see Figure 6) represents a window on the neighbouring buildings.

Ref.	Building	Total Samples	Scenario 1 VSC≥27%	Scenario2 VSC<27%
1	Alexandra Tower	89	89	0
2	No. 1 Princes Dock	51	51	0
3	No. 20-24 Gibraltar Way	25	25	0
4	No. 14-18 Gibraltar Way	25	25	0
5	No. 10-12 Gibraltar Way	15	15	0
6	No. 04-08 Gibraltar Way	15	15	0
7	Radisson Hotel	316	316	0
8	HM Passport Office	63	41	22
9	West Tower (commercial)	15	15	0
9	West Tower (residential)	240	240	0
10	Metropolitan House	120	112	8
11	Liverpool Echo Offices	101	96	5
12	No. 10 Princes Parade	104	104	0
13	No. 12 Princes Parade	40	40	0

Table 2: Summary of baseline VSC sample points (windows)

3.3.2 Development Scenario (VSC)

The same sample points were tested in the development scenario. The analysis findings are presented below in Table 3.

Ref.	Building	Total Samples	Scenario 1 VSC ≥27%	Scenario 2 VSC <27%	Scenario 3		
					VSC<27%, <80% former	Range of change from baseline	
						Min	Max
1	Alexandra Tower	89	89	0	0	0	0
2	No. 1 Princes Dock	51	51	0	0	0	0
3	No. 20-24 Gibraltar Way	25	25	0	0	0	0
4	No. 14-18 Gibraltar Way	25	25	0	0	0	0
5	No. 10-12 Gibraltar Way	15	15	0	0	0	0
6	No. 04-08 Gibraltar Way	15	12	0	3	72	72
7	Radisson Hotel	316	316	0	0	0	0
8	HM Passport Office	63	36	27	0	0	0
9	West Tower (commercial)	15	15	0	0	0	0
9	West Tower (residential)	240	240	0	0	0	0
10	Metropolitan House	120	108	12	0	0	0
11	Liverpool Echo Offices	101	96	5	0	0	0
12	No. 10 Princes Parade	104	104	0	0	0	0
13	No. 12 Princes Parade	40	40	0	0	0	0

Table 3: Summary of changes to VSC sample points (windows)

According to BRE209, a reduction to less than 80% of the former value is considered to have an effect on daylight. Table 3 also highlights the greatest change in VSC as a percentage of its former value.

3.3.3 Summary of Findings (VSC)

- All neighbouring residential premises are predicted to be unaffected by the proposed development.
- The Passport Office, Metropolitan House, and the Liverpool Echo Offices are predicted to experience a VSC<27%. However, this only applies to a small number of windows and the change is not less than 80% of the baseline value.
- It is noted that the majority of affected windows on the Passport Office, Metropolitan House, the Liverpool Echo Offices have a VSC<27% in the baseline scenario. This is mainly the due to the proximity of adjacent existing buildings.
- The greatest change in VSC is predicted on Nos. 04-08 Gibraltar Way, where a number of windows are predicted to see a reduction to 72% of the former value; i.e. less than the 80% recommendation of BRE209.

The specific windows affected can also be identified by inspection of the images in Appendix A1. Discussion around significance of these impacts is contained in Section 4 of this report.

3.4 Sunlight Hours (APSH)

BRE209 recommends the use of Annual Probable Sunlight Hours (defined in Section 2.4 of this report), for use in assessing change in sunlight hours.

Where a window is within 90° of due south of the proposed development, BRE209 proposes it should receive at least 25% of the total Annual Probable Sunlight Hours (APSH) in summer months and at least 5% of APSH in the winter months from September 21 to March 21 (wAPSH).

In summary of BRE209, sunlight may be adversely affected if APSH<25% or wAPSH<5%. A more significant effect will be experienced if the APSH/wAPSH is reduced to less than 80% of its former value and the reduction is greater than 4% of APSH. The sunlight availability data has therefore been assessed against three conditions, described below, and an example is provided in Figure 11**.**

1. APSH > 25% or wASPH > 5%
2. APSH < 25% or wASPH < 5%
3. APSH < 25% or wASPH < 5%, APSH/wASPH < 80% of former value and reduction in APSH is >4%

Note: the third scenario is only a consideration in comparison with the baseline scenario. The first two can occur at the baseline.

A typical example of the analysis output is provided in Figure 11, which shows how sunlight availability has changed compared to the baseline scenario.

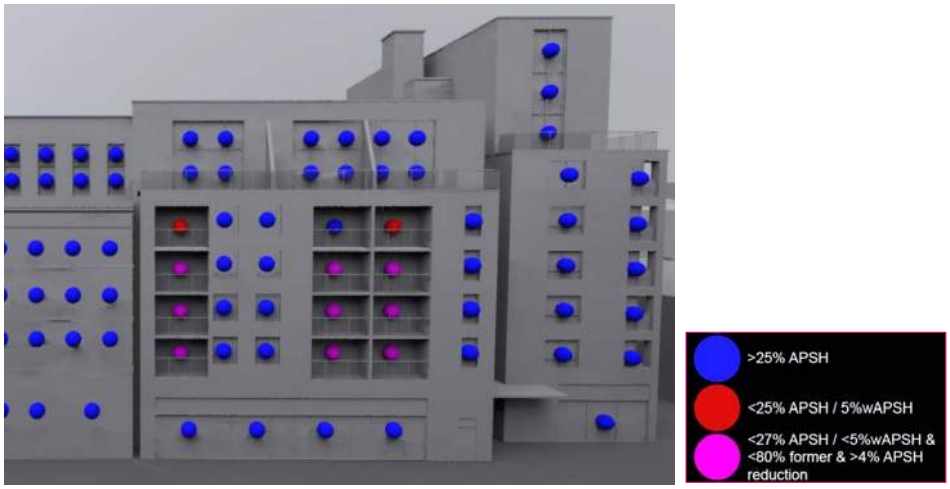


Figure 11: Example output of sunlight APSH modelling (shown in full in Appendix A2)

Analysis has been completed at each window of neighbouring buildings, shown in Section 3.2 and is presented using the analysis facades. The predicted percentage change in sunlight hours on the façades of all adjacent buildings analysed can be observed in full in the images in Appendix A2. The change in APSH on the selected buildings is summarised in Table 4.

3.4.1 Baseline Scenario (APSH)

The findings of the APSH sunlight availability analysis on the neighbouring buildings are summarised in Table 4. Each sample point (see Section 3.2) represents a window on the neighbouring buildings.

Ref.	Building	Total Samples	Baseline APSH≥25% or wASPH > 5%	Baseline APSH<25% or wASPH < 5%
1	Alexandra Tower	89	89	0
2	No. 1 Princes Dock	51	51	0
7	Radisson Hotel	228	228	0
8	HM Passport Office	63	60	3
9	West Tower	30	30	0
10	Metropolitan House	60	60	0
11	Liverpool Echo Offices	55	52	3

Table 4: Summary of baseline ASPH sample points (windows)

3.4.2 Development Scenario (APSH)

The same sample points were tested in the development scenario, the findings are presented below in Table 5.

Ref.	Building	Total Samples	APSH ≥25% or wASPH > 5%	APSH <25% or wASPH < 5%	APSH <80% former	Range of change from baseline	
						Min	Max
1	Alexandra Tower	89	89	0	0	0	0
2	No. 1 Princes Dock	51	51	0	0	0	0
7	Radisson Hotel	228	228	0	0	0	0
8	HM Passport Office	63	60	3	0	0	0
9	West Tower	30	30	0	0	0	0
10	Metropolitan House	60	60	0	0	0	0
11	Liverpool Echo Offices	55	52	3	0	0	0

Table 5: Summary of changes to ASPH sample points (windows)

According to BRE209, a reduction to less than 80% of the former value of APSH is considered to have an adverse impact on sunlight availability.

3.4.3 Summary of Findings (APSH)

- In the baseline scenario, all windows facing within 90° of south on all adjacent buildings are generally not predicted to experience APSH<25%.
- Three windows on the Passport Offices and three windows Echo Offices experience wAPSH<5% in the baseline scenario.

- The same three windows on the Passport Offices and three windows on the Echo Offices continue to experience wAPSH<5% in the development scenario, but still remain above 80% of the baseline value.

The affected windows can be identified in Appendix A2. Discussion around significance of these impacts is contained in Section 4 of this report.

3.5 Amenity Space Sunlight

Presently the site is generally undeveloped apart from No. 1 Princes Dock and the multi-storey car park to the south, as shown in Figure 4. Two amenity spaces were considered in detail. One is located between New Quay and Bath Street, the other is near the footbridge adjacent to William Jessop Way.

The Amenity Space Sunlight simulation calculates the total accumulated sunlight for 21 March (it is not a measure of average exposure). The total possible sunlight exposure on this day is presented in Appendix A3 and Figure 12/Figure 13 overleaf.

BRE209 recommends that for a space to appear adequately sunlit throughout the year at least half of the amenity area should receive at least two hours of sunlight on 21 March. If this reduced to 80% of its former value then the loss of sunlight is likely to be noticeable.

3.5.1 Baseline Amenity Sunlight

The hours of sunlight predicted in the baseline scenario in a clear day are indicated below in Figure 12. Discrete sunlight exposure values and the outline of the development plots are also shown for clarity.

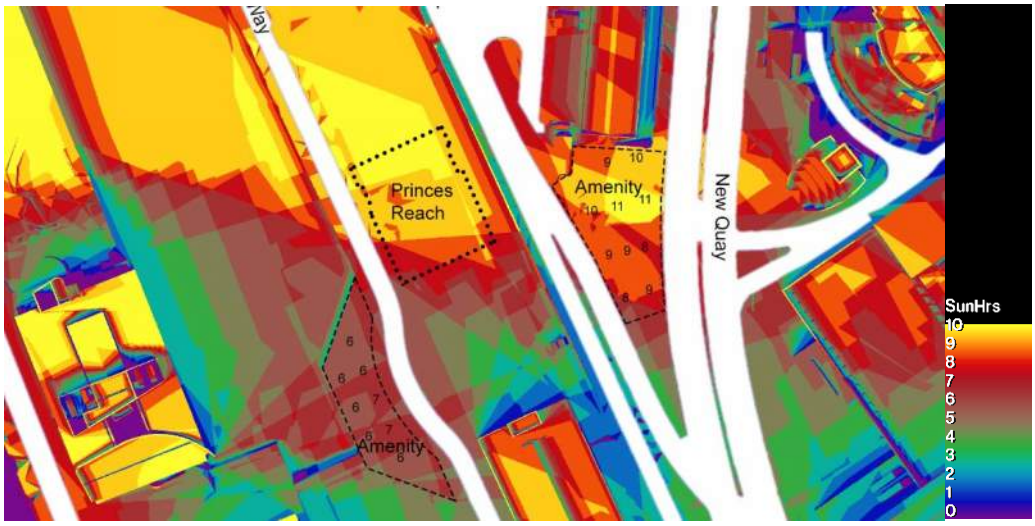


Figure 12: Baseline scenario sunlight exposure

In summary, the average sunlight exposure on 21 March experienced by the amenity sites is indicated below:

Amenity Space Location	Sunlight Hours
New Quay	9.4
William Jessop Way	6.3

Table 6: Sunlight exposure, baseline

No point on each site receives less than two hours of sunlight on 21 March.

3.5.2 Development Amenity Sunlight

The hours of sunlight predicted in the development scenario in a clear day are indicated below in Figure 13. Sample point values are also shown for clarity.

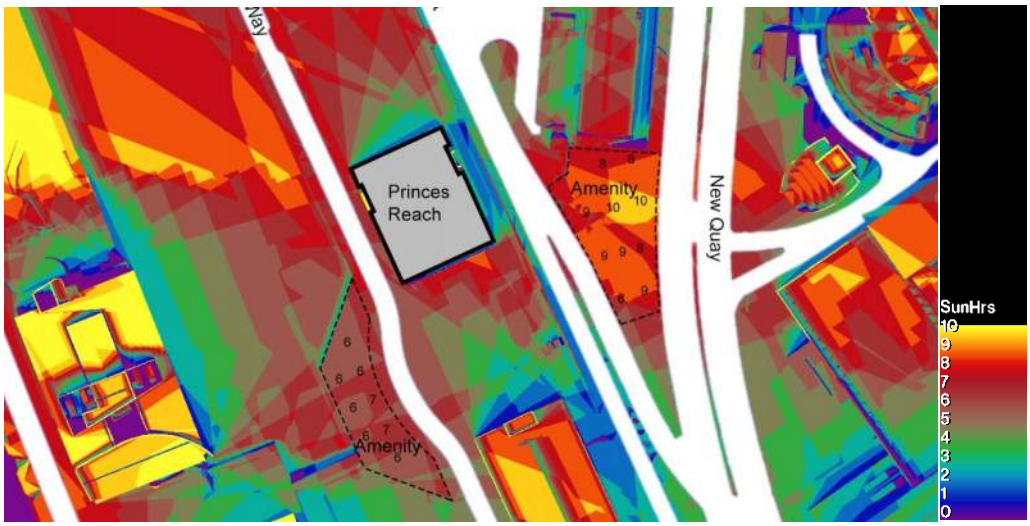


Figure 13: Development scenario sunlight exposure

In summary, the average sunlight hours on 21 March experienced by the amenity sites in the development scenario is indicated below:

Amenity Space Location	Sunlight Hours	% of former value
New Quay	8.8	70%
William Jessop Way	6.3	100%

Table 7: Sunlight exposure, development

No point on each site receives less than two hours of sunlight on 21 March in this scenario.

The greatest change to the sunlight exposure on the New Quay amenity space is found to the north of the site (reduced by approximately 1 hour). It can be observed in Figure 13 that William Jessop Way amenity space is predicted experience no change in sunlight exposure.

There is no other designated public amenity space considered relevant for consideration in this study. However, the results for the wider area are provided for inspection in Appendix A3. The sunlight exposure maps in Appendix A3 are worthy of consideration when planning any planting etc. in the future.

4 Impact Assessment

The analysis provides a prediction of the change to daylight/sunlight on neighbouring buildings, as a result of the proposed development. An attempt to classify the impact on windows in terms of “significance” has been carried out.

As well as the level of impact, the weighting of the significance of a change in daylight/sunlight also depends on the use of a space. BRE209 considers the significance of a reduction in daylight to greater on a living space, e.g. living room, bedroom or bathroom, than a bathroom or corridor. Information on the internal uses of the affected spaces is therefore required to make a comprehensive assessment of the impact on sunlight and daylight. BRE209 also considers that the guidelines can be applied within any non-domestic building where the occupants have a reasonable expectation of daylight, which could include some offices and workshops.

BRE209 guidance generally refers to residential premises; however, it may also be applied to offices and other premises where there is a reasonable expectation of daylight. Presently it is understood that the commercial/residential split is as defined in Table 1.

4.1.1 Daylight Availability (VSC)

The significance of the impact on daylight availability on the adjacent buildings is described by the following categories set out in Table 8.

VSC of development scenario		**Change in Daylight**
VSC > 27%	>80% of baseline	Negligible
VSC < 27%	>80% of baseline	Marginal
VSC < 27%	<80% of baseline	Noticeable
VSC < 27%	<60% of baseline	Most noticeable

Table 8: Impact Assessment VSC

The impact on available daylight considered appropriate to each building is outlined in Table 9. Based on the impact assessment criteria in Table 8, it is shown that the majority of the impact is negligible to Marginal (1208 of 1219 windows), as shown in Table 9.

Building Ref.	Impact (No. affected windows)	Notes
1	Negligible (89)	Residential Use
2	Negligible (51)	Residential Use
3	Negligible (25)	Light Industrial Use
4	Negligible (25)	Light Industrial Use
5	Negligible (15)	Light Industrial Use
6	Negligible (12) Noticeable (3)	Three windows >72% of former value Light Industrial Use
7	Negligible (316)	Residential Use (Hotel)
8	Negligible (35) Marginal (28)	22 windows <27% VSC in baseline scenario Commercial Use
9	Negligible (15)	Commerical Use (lower five floors)
9	Negligible (240)	Residential Use
10	Negligible (108) Marginal (12)	Eight windows <27% VSC in baseline scenario Commercial Use
11	Negligible (96) Marginal (5)	Five windows <27% VSC in baseline scenario Commercial Use
12	Negligible (104)	Commercial Use
13	Negligible (40)	Commercial Use

Table 9: Summary of VSC analysis

Noticeable impacts were predicted to occur on the light industrial premises on Gibraltar Way, in particular Nos. 04-08. Residential premises were generally predicted to be unaffected in the development scenario.

Marginal impacts were predicted to occur on a small number of windows on the Passport Offices, Echo Offices and the Metropolitan Tower. However it is noted that many of the affected windows were VSC<27% in the baseline scenario.

4.1.2 Sunlight Hours (APSH)

The significance of the impact on sunlight availability on these buildings is described by the following categories set out in Table 10.

APSH of development scenario		Change in Sunlight
>25%	>80% of baseline	Negligible
<25%	>80% of baseline	Marginal
<25% (or <5% wAPSH)	APSH/wASPH < 80% of former value and reduction in APSH is >4%	Noticeable
<25% (or <5% wAPSH)	APSH/wASPH < 60% of former value and reduction in APSH is >4%	Most noticeable

Table 10: Impact Assessment APSH

The significance of the changes to sunlight availability (APSH) applicable to each building are described in Table 11.

Building Ref.	Impact (No. affected windows)	Notes
1	Negligible (89)	Residential Use
2	Negligible (51)	Residential Use
7	Negligible (228)	Residential Use (Hotel)
8	Negligible (60) Marginal (3)	Three windows <5% wAPSH in baseline scenario Commercial Use
9	Negligible (30)	Residential Use
10	Negligible (60)	Commercial Use
11	Negligible (52) Marginal (3)	Three windows <5% wAPSH in baseline scenario Commercial Use

Table 11: Summary of impact significance on sunlight availability

The table shows that the majority of the windows assessed do not experience any significant adverse effect on sunlight availability due to the proposed development.

4.1.3 Amenity Space Sunlight

BRE209 recommends that at least half of the area of an amenity space should receive at least two hours of sunlight on 21 March in order to appear adequately daylit. Furthermore, the impact of a new development should not reduce this exposure to more than 80% of its former value; otherwise, the impact will be noticeable.

By observation of the data in Figure 12/Figure 13 it can be seen that both local amenity spaces are predicted to receive at least two hours of sunlight on 21 March.

All sample points on the William Jessop Way amenity space are predicted to experience negligible reduction in sunlight exposure due to the proposed development. The impact on this site is considered negligible.

The average sunlight exposure of the New Quay amenity space is also predicted to be greater than 80% of the baseline value and therefore the impact is considered negligible.

5 Conclusions

Context

Densely populated urban areas by definition will contain many more site constraints and consequently, neighbouring buildings may see a reduction in natural light, especially at ground level.

The applied guidance (BRE209) enables an assessment of the impact of a proposed building on its neighbours. The metrics and thresholds set out in the guide are designed to indicate where a change in daylight will be experienced and whether it will be noticeable. BRE209 also states the guidance it contains is advisory in nature, and there to help the daylight designer. There is no formal requirement to comply with the advice it contains.

Therefore, in the context of this report, BRE209 provides an indication of where sunlight or daylight availability will be affected within the neighbouring buildings. The findings should also be considered in the context in which the development is proposed; a densely populated urban environment, which will inherently result in a compromise in daylight and sunlight availability and therefore some flexibility in interpretation of the BRE209 guidelines is required.

The proportion of the neighbouring residential properties that are likely to experience levels of daylight and sunlight below the guide levels is low. The impacts are therefore relatively localised and do not extend across all residential properties surrounding the site.

The results of this study should also be considered in context with the wider masterplan of the area, which has been subject to an on-going development programme prior to the development of many of the neighbouring developments.

Daylight Availability (VSC)

Applying the BRE209 guidance, the calculations have indicated that a noticeable reduction in daylight availability is predicted on selected windows of the following buildings:

Ref	Building	Affected Windows	Total Windows
6	Nos. 04-06 Gibraltar Way	3	5
8	The Passport Office*	27	63
10	Metropolitan House*	12	120
11	The Liverpool Echo offices*	5	101

* The impact is generally limited to the lower storeys of these buildings and the majority of affected windows are <27% VSC in the baseline scenario. The effect of this impact is therefore not considered significant.

Sunlight Hours (APSH)

The majority of windows assessed are not predicted to experience any significant reduction in available sunlight.

Only No. 04 Gibraltar Way is predicted to experience a significant impact on available sunlight. The other affected buildings (Passport Office and the Liverpool Echo offices) experienced wAPSH < 5% in the baseline scenario and therefore the impact on these windows is not considered significant.

Amenity Space Sunlight

It is predicted that both spaces (Figure 4) will receive at least two hours of sunlight on 21 March.

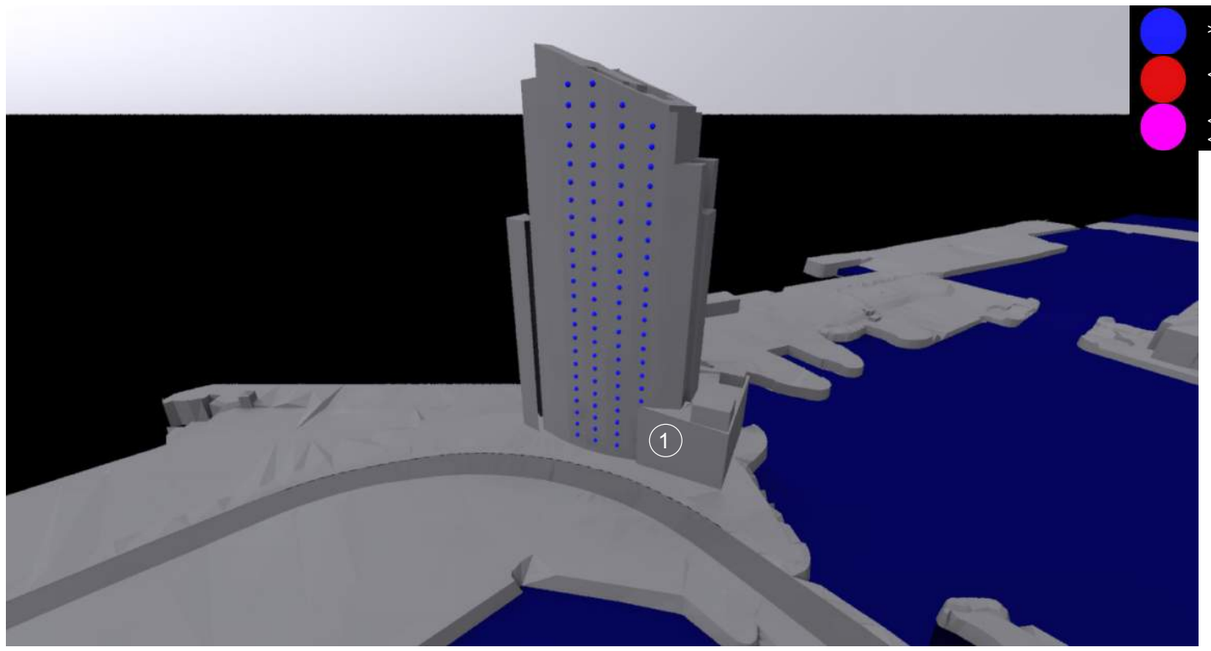
The William Jessop Way and New Quay amenity spaces will only experience a negligible impact on the available sunlight. The development reduces the available sunlight to >80% of the baseline value on 21 March.

Appendix A

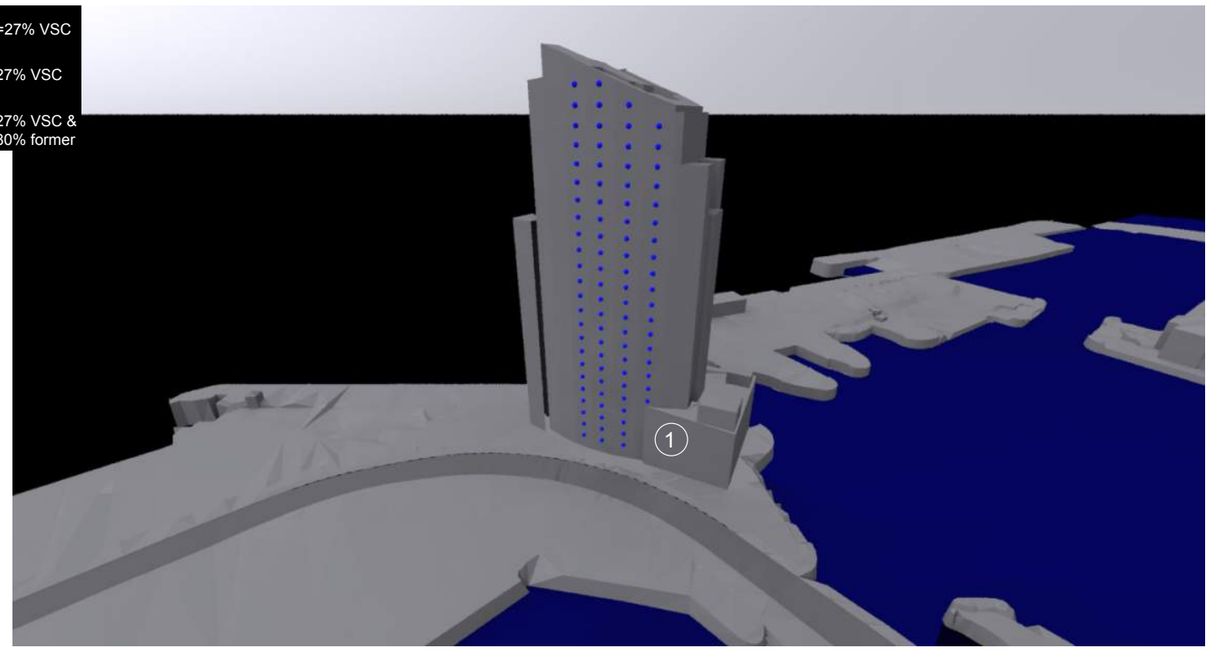
Simulation/Analysis Images

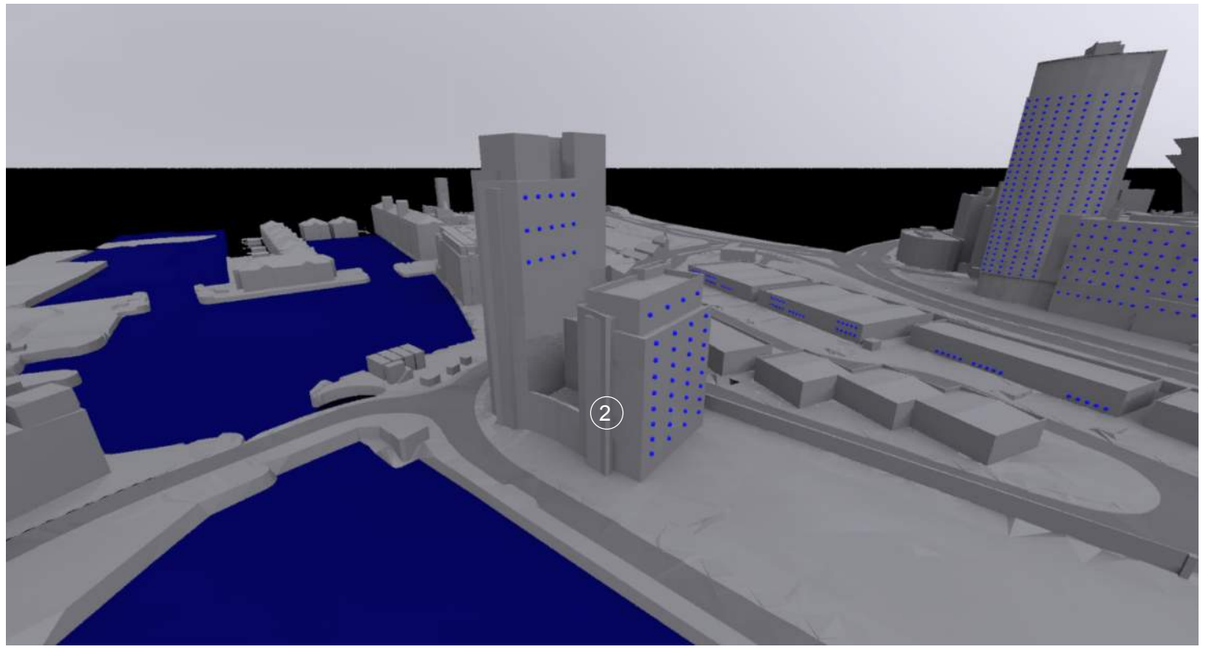
Appendix A1: Daylight Availability (VSC)

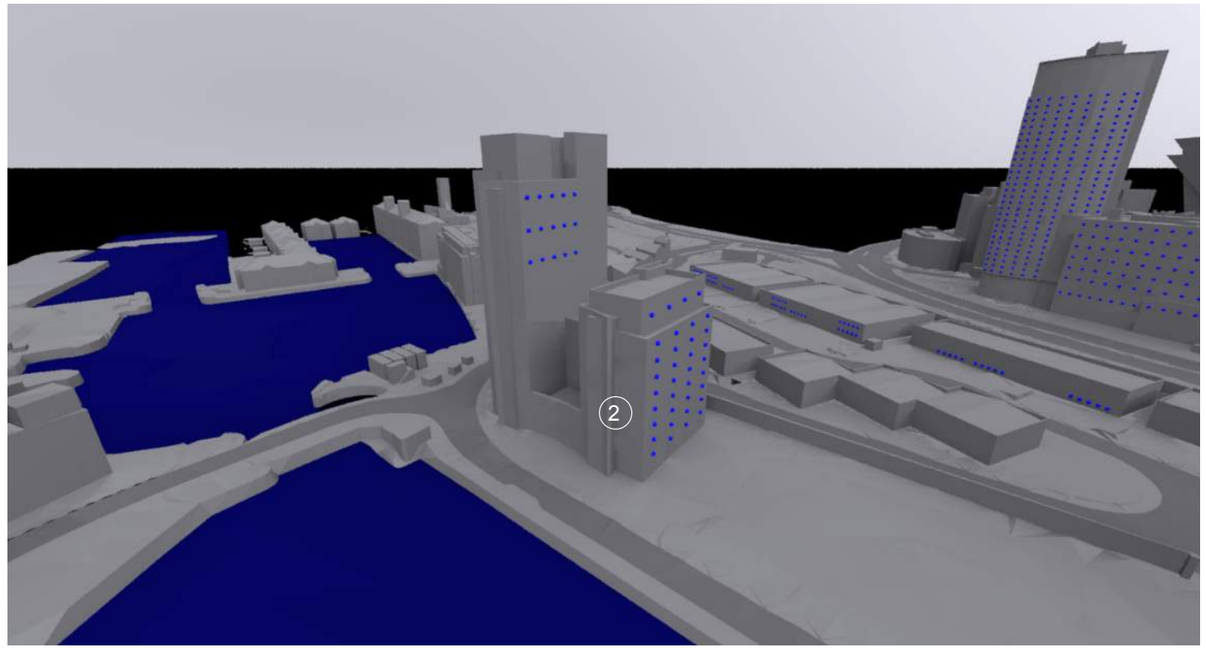
Baseline Scenario



Development Scenario





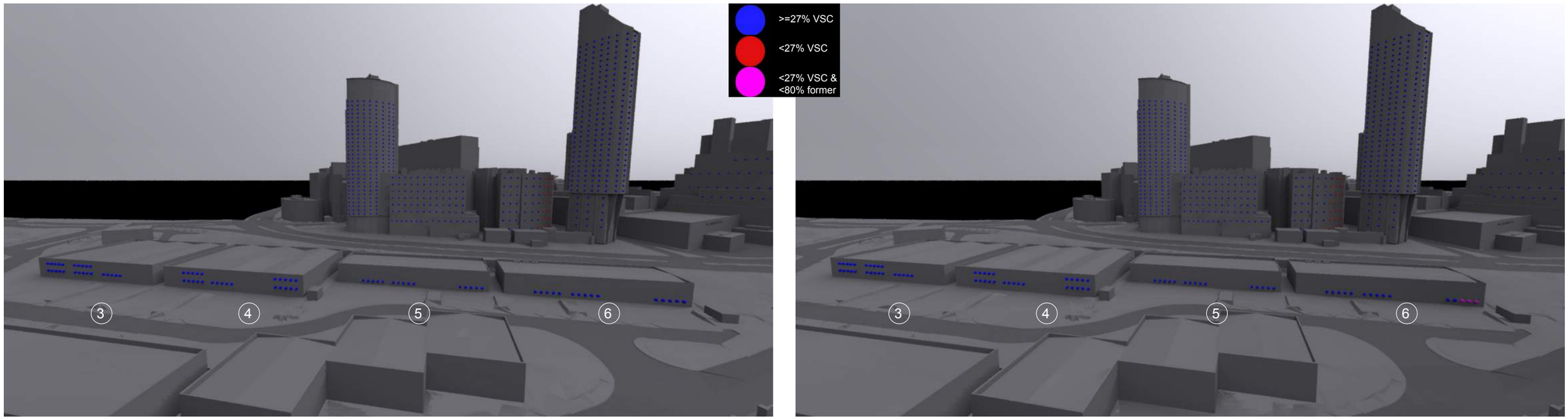


Building References:
(1) Alexandra Tower, (2) No. 1 Princes Dock, (3) No. 20-24 Gibraltar Way,(4) No. 14-18 Gibraltar Way, (5) No. 10-12 Gibraltar Way, (6) No. 04-08 Gibraltar Way,
(7) Radisson Hotel (8) HM Passport Office, (9) West Tower, (10) Metropolitan House, (11) Liverpool Echo Offices, (12) No. 10 Princes Parade, (13) No. 12 Princes Parade,

Appendix A1: Daylight Availability (VSC)

Baseline Scenario

Development Scenario



Building References:

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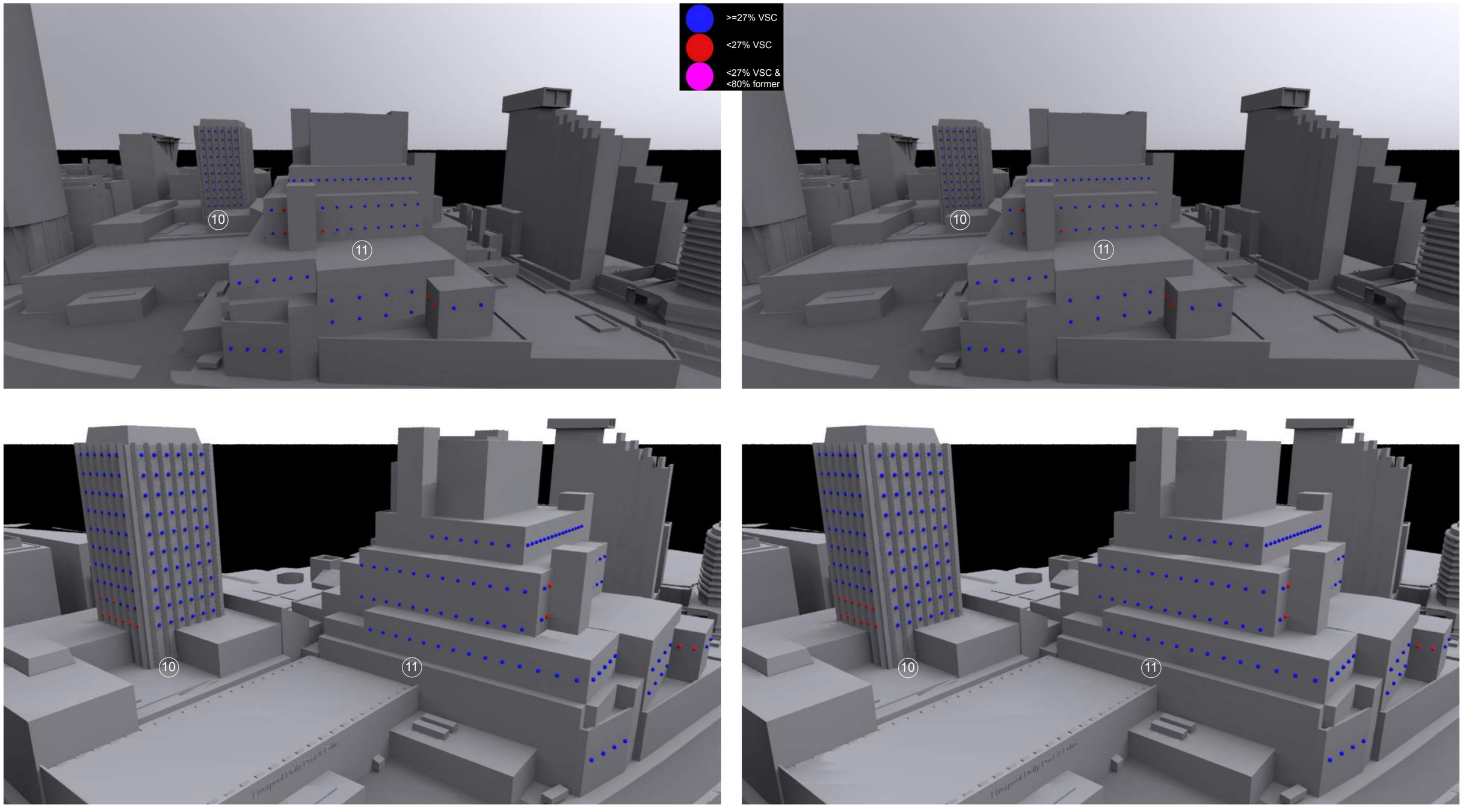
Appendix A1: Daylight Availability (VSC)

Baseline Scenario

Development Scenario



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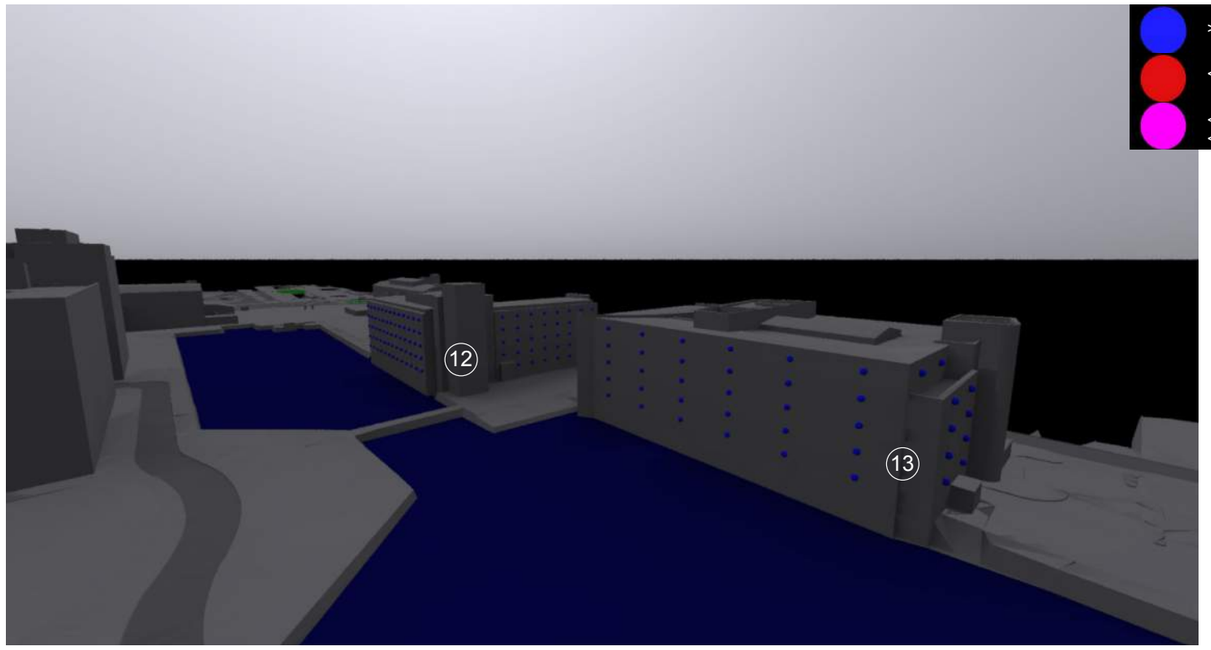
Appendix A1: Daylight Availability (VSC)

Baseline Scenario



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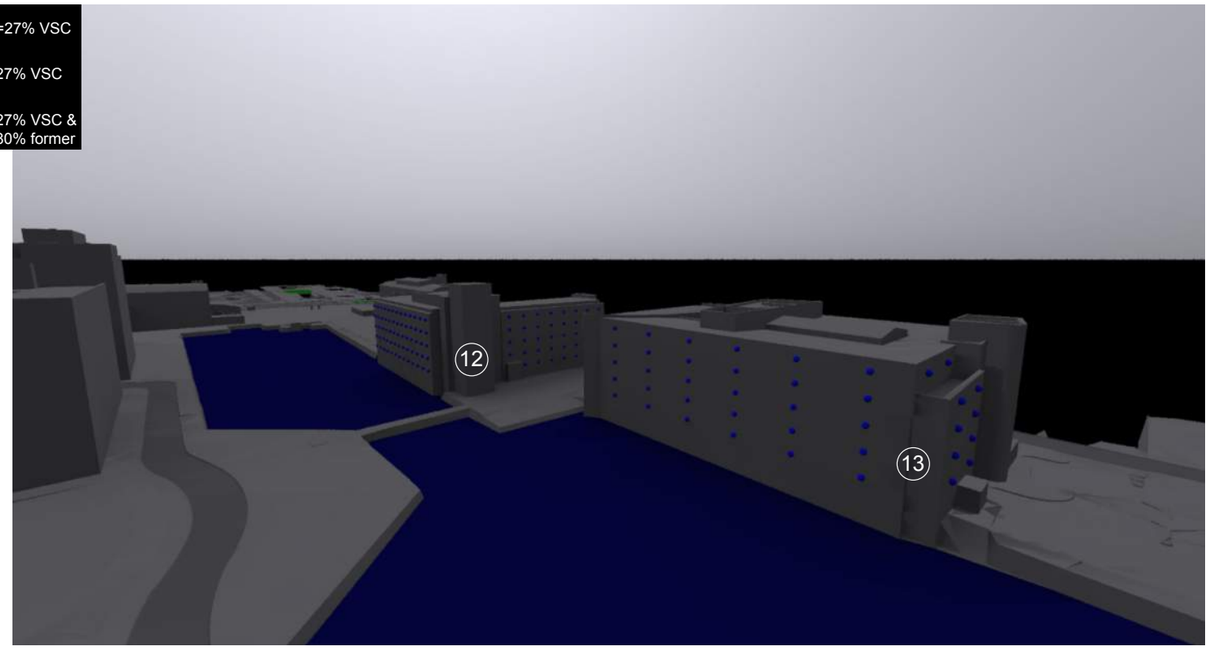

Building References:
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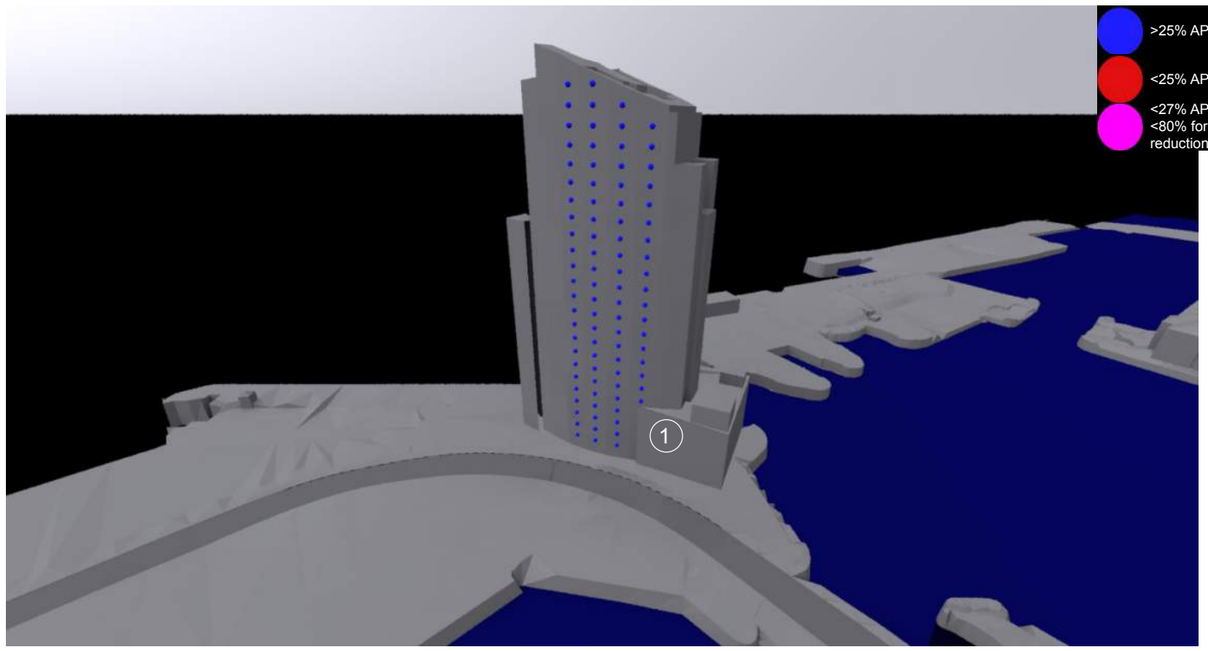
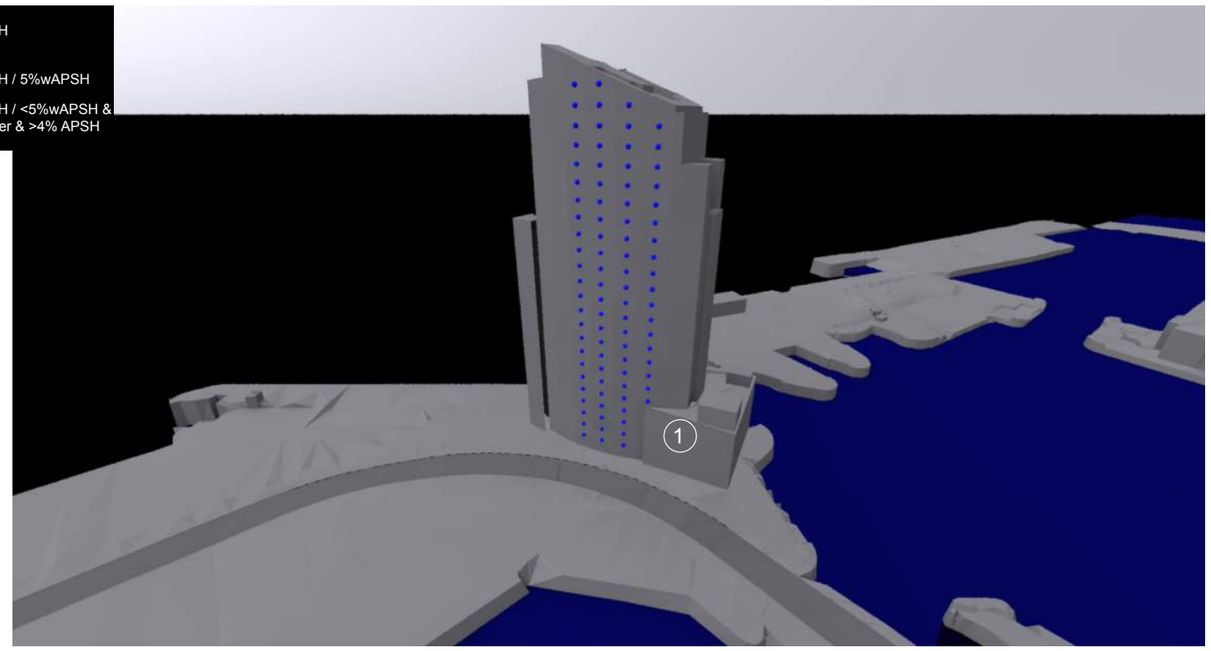
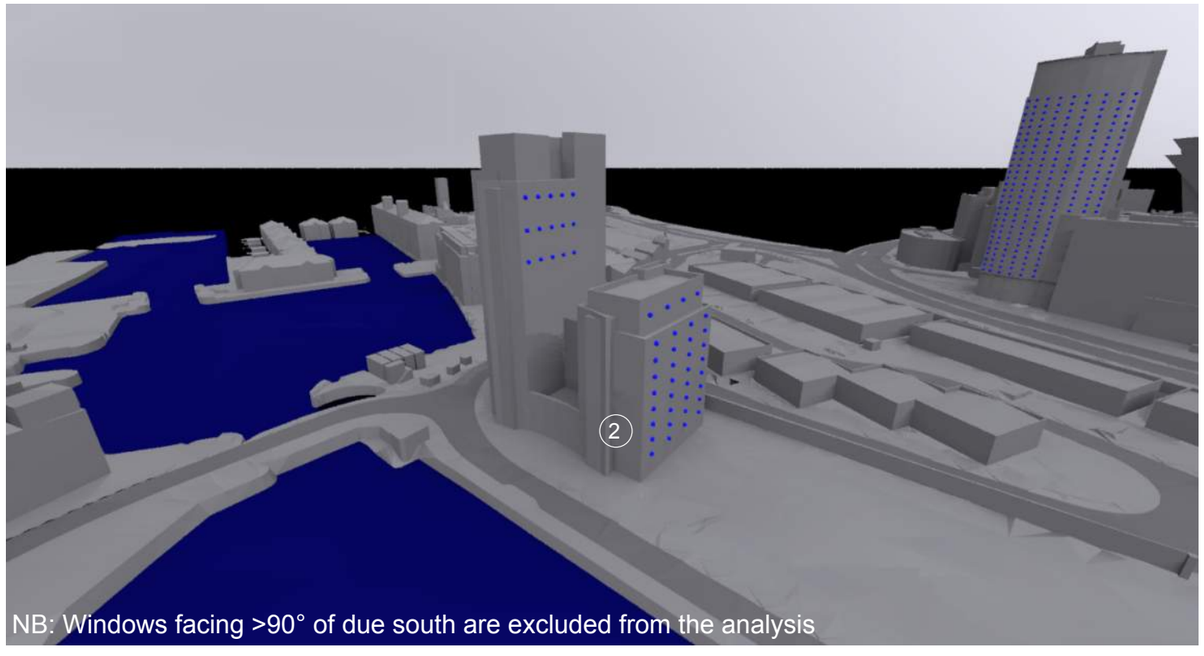
Appendix A2: Sunlight Availability (APSH)

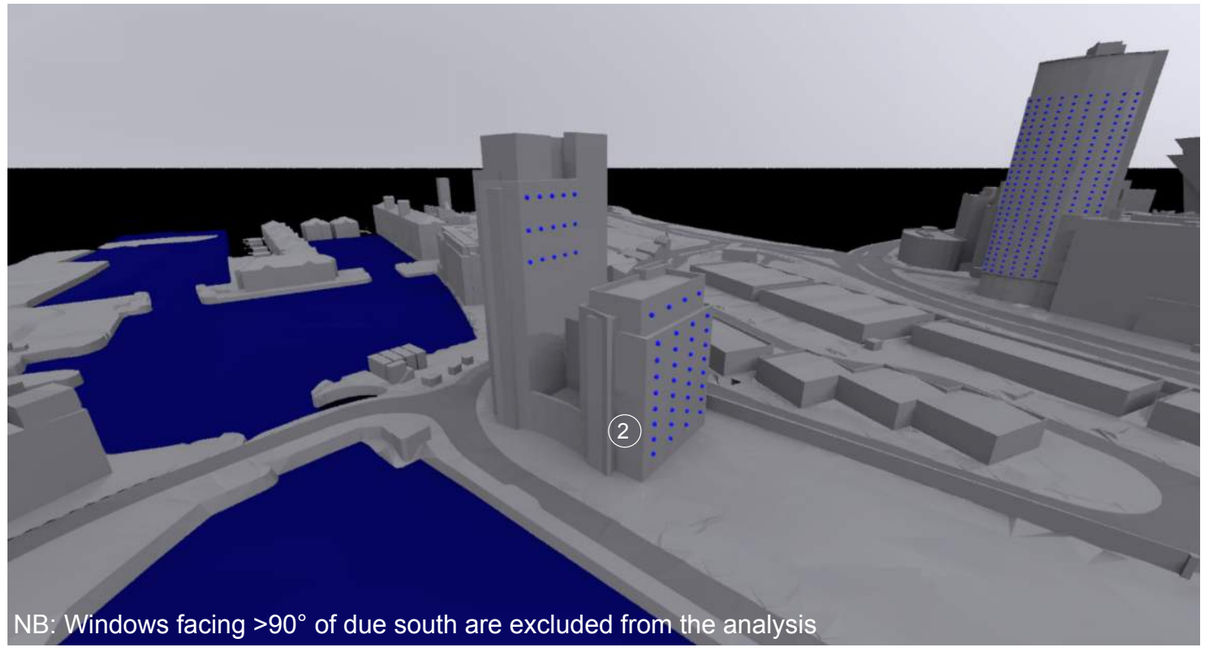
Baseline Scenario



Development Scenario







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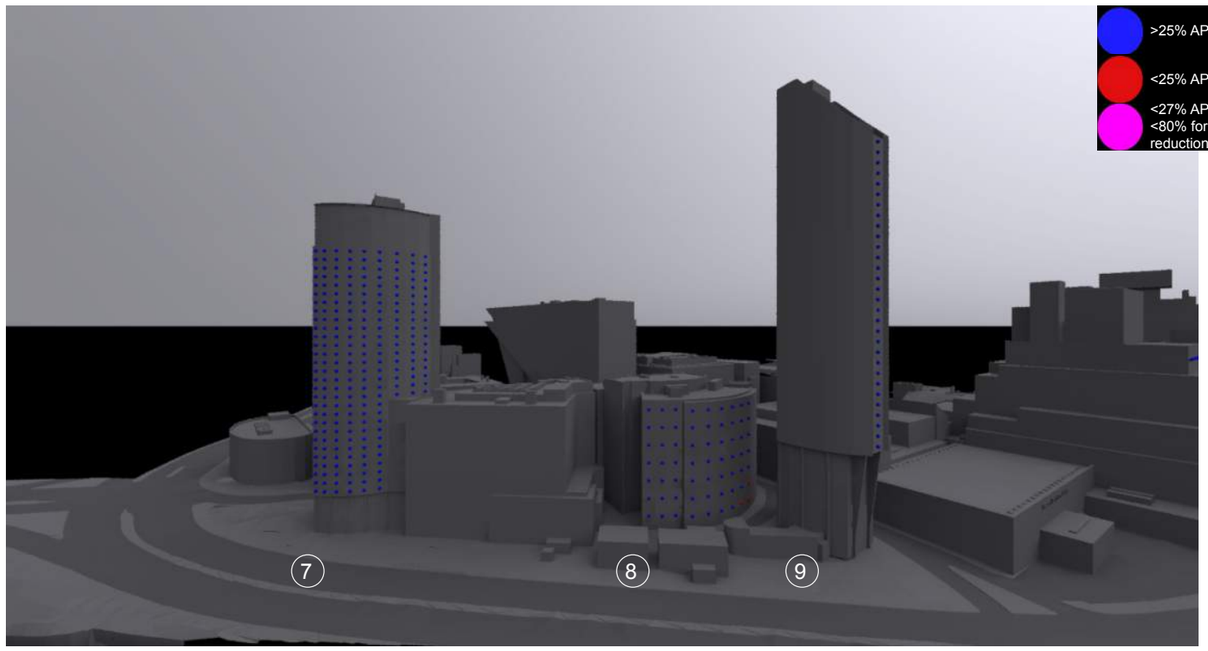
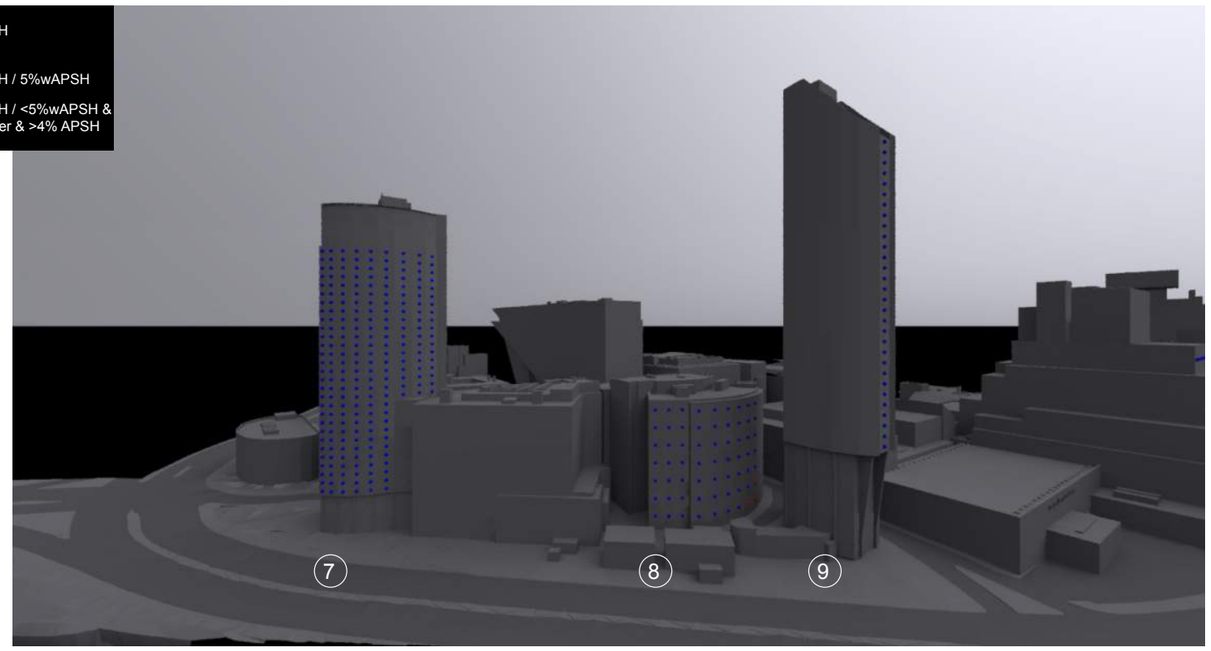
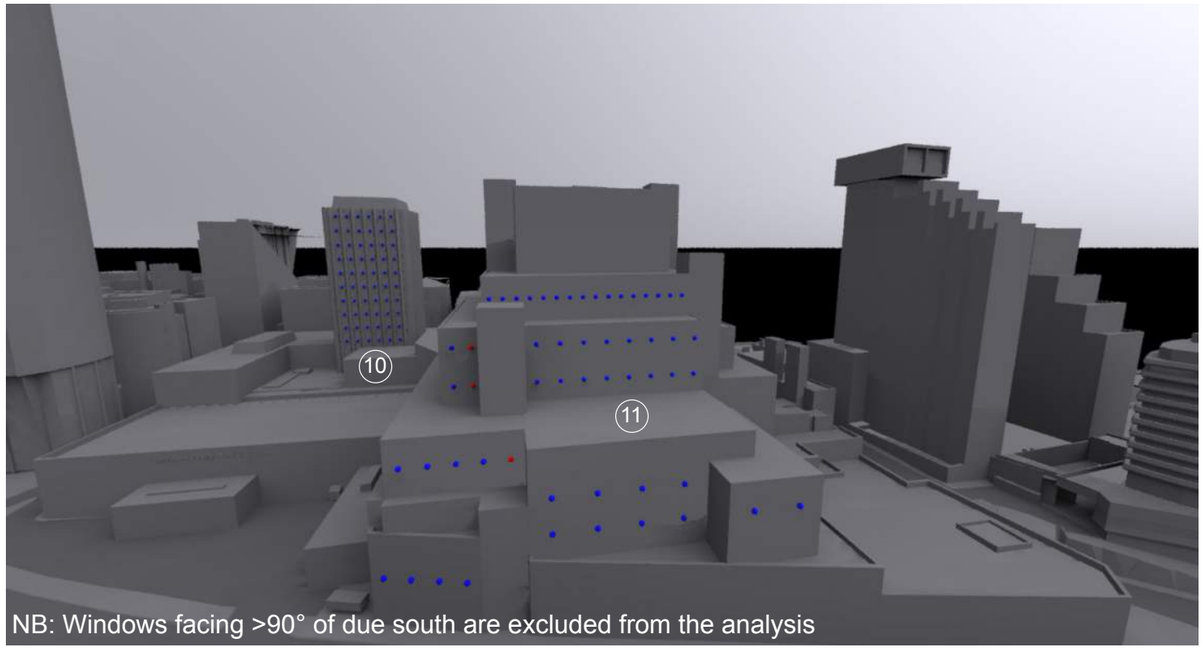
Appendix A2: Sunlight Availability (APSH)

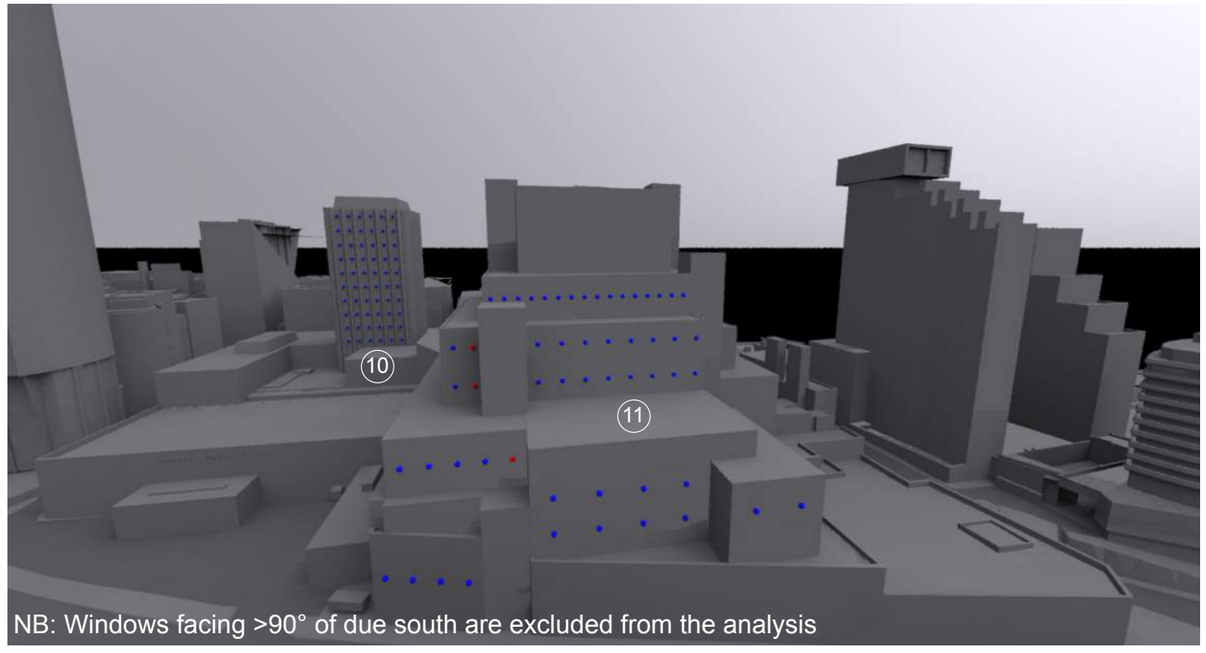
Baseline Scenario



Development Scenario







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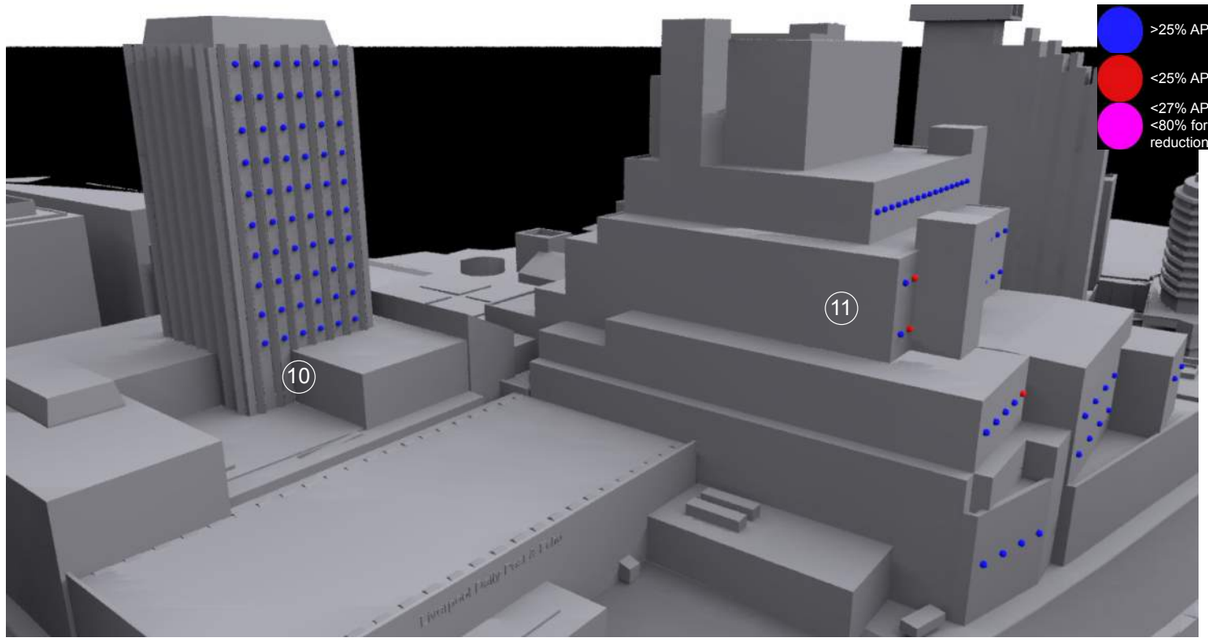
(7) Radisson Hotel (8) HM Passport Office, (9) West Tower, (10) Metropolitan House, (11) Liverpool Echo Offices, (12) No. 10 Princes Parade, (13) No. 12 Princes Parade,

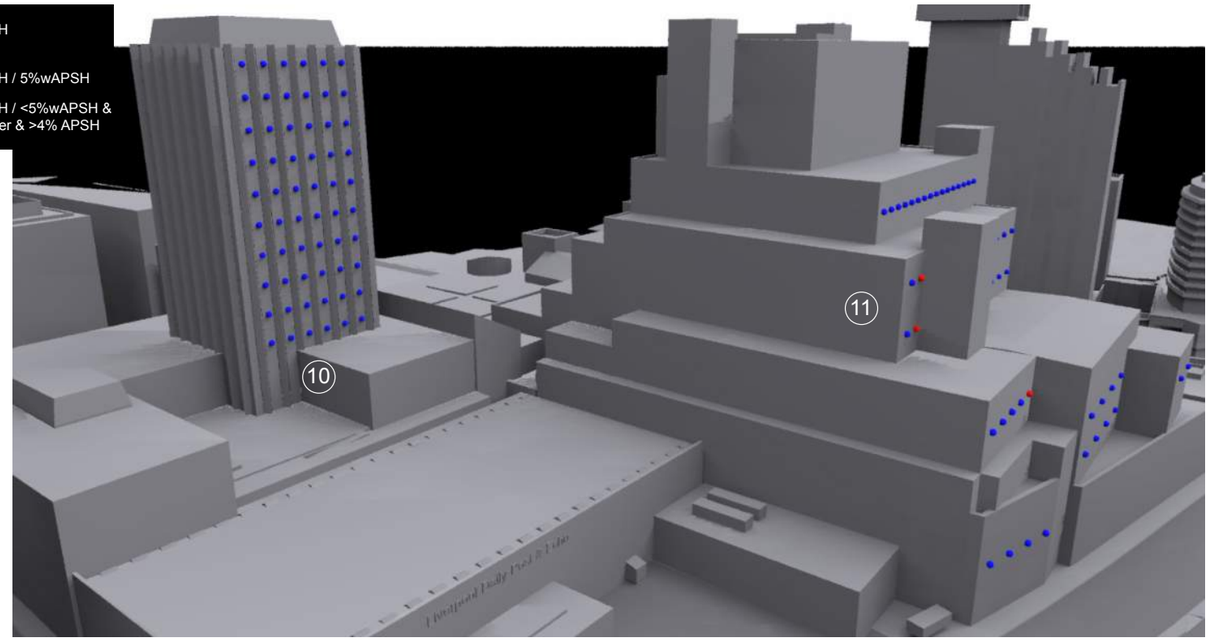
Appendix A2: Sunlight Availability (APSH)

Baseline Scenario



NB: Windows facing >90° of due south are excluded from the analysis

Development Scenario



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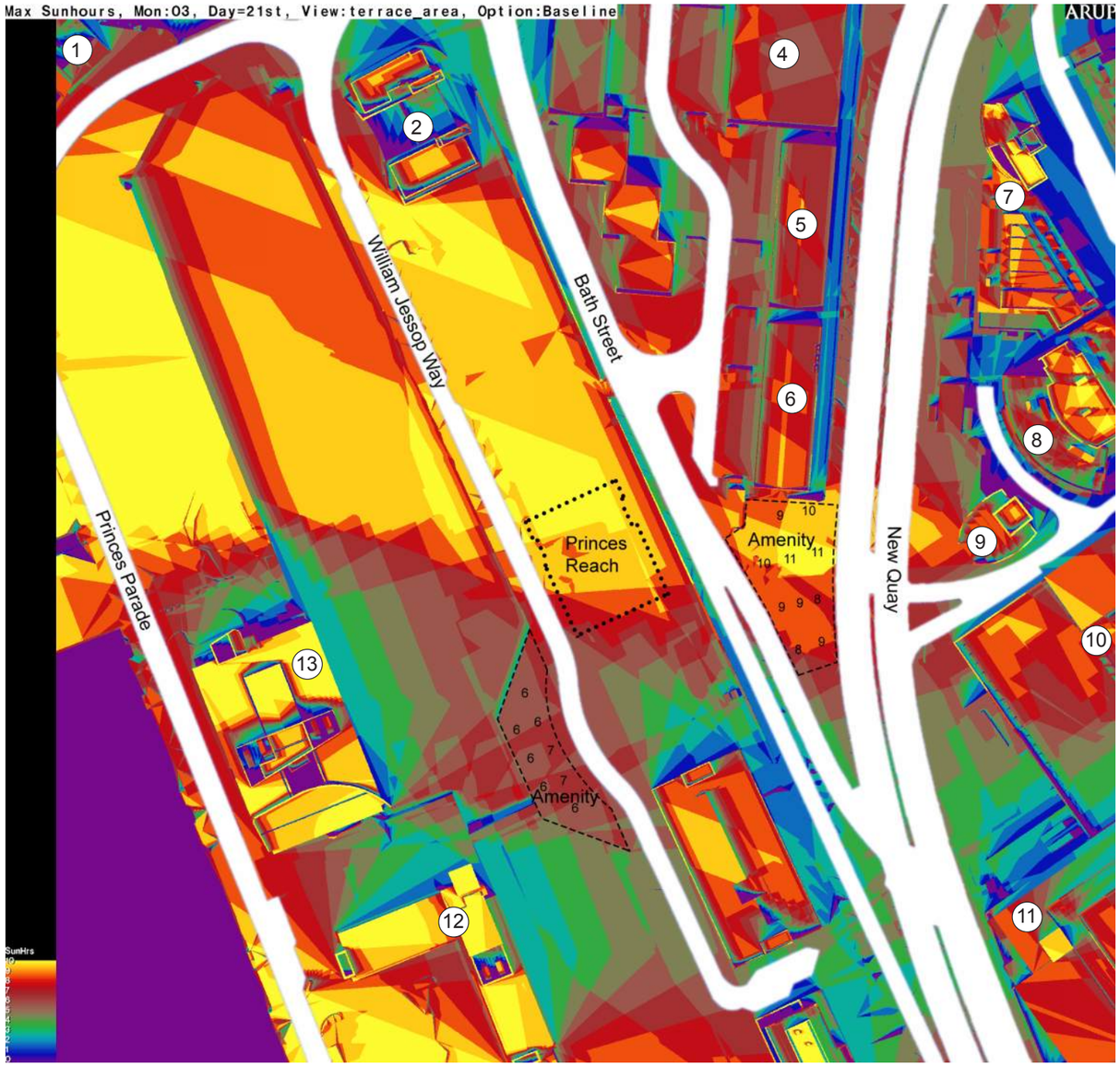
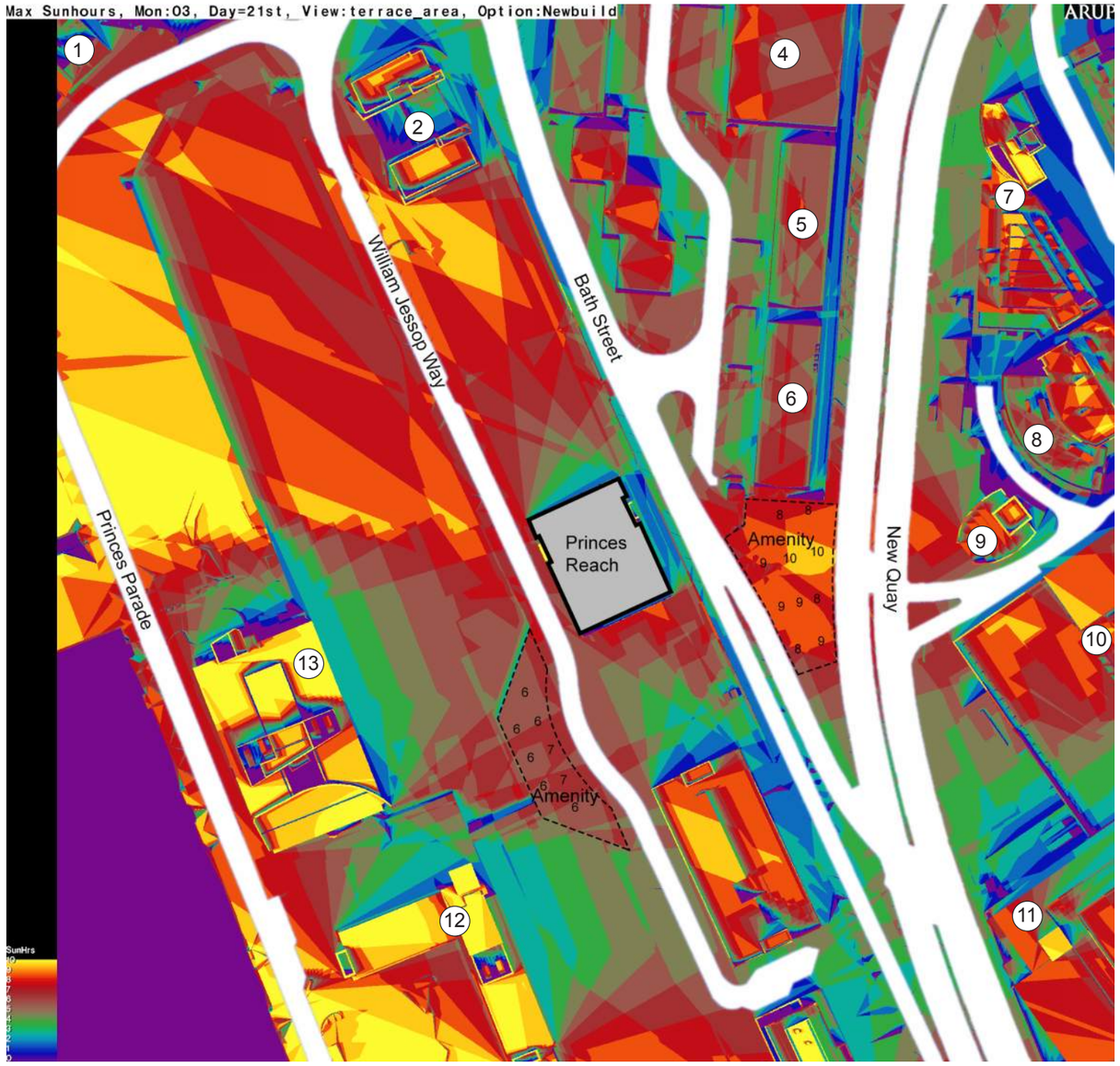
Appendix A3: Amenity Space Sunlight (hours)

Baseline Scenario



Maximum Available Sunlight Hours - Baseline

Development Scenario



Maximum Available Sunlight Hours - Development Scenario

Building References:
(1) Alexandra Tower, (2) No. 1 Princes Dock, (3) No. 20-24 Gibraltar Way,(4) No. 14-18 Gibraltar Way, (5) No. 10-12 Gibraltar Way, (6) No. 04-08 Gibraltar Way,
(7) Radisson Hotel (8) HM Passport Office, (9) West Tower, (10) Metropolitan House, (11) Liverpool Echo Offices, (12) No. 10 Princes Parade, (13) No. 12 Princes Parade,

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