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Ramboll Hong Kong Limited

**PLANNING APPLICATION, HYPOTHETICAL STUDY,
HARBOURFRONT STUDY AND HERITAGE EVALUATION FOR
REPROVISIONING OF KONG WAN FIRE STATION**

AIR VENTILATION ASSESSMENT – EXPERT EVALUATION

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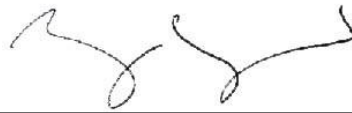
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1. INTRODUCTION

1.1 Project Background

- 1.1.1 The Application Site is situated in Wan Chai District. The Site of the proposed reprovisioning of Kong Wan Fire Station is located at the junction of Lung Hop Street and Fenwick Pier Street abutting the degazetted Lung King Road.
- 1.1.2 Ramboll Hong Kong Limited is commissioned by the Architectural Services Department (ArchSD) to prepare the Air Ventilation Assessment (AVA) Study Report – Expert Evaluation (EE) for the proposed development. Architectural drawings and technical information are provided by the Project team.

1.2 Objectives

- 1.2.1 This AVA-EE report has been prepared to evaluate whether the proposed development would have any impact on the overall air ventilation performance in its surrounding area by comparing with the Baseline Scheme (OZP-Compliant Scheme).

1.3 Application Site and its Environ

- 1.3.1 **Figure 1** shows the location of the Application Site and its environ.
- 1.3.2 The Application Site with an area of 4,156 m² is located at Wan Chai. The Site mainly falls within an area mainly zoned “Open Space” (“O”) and partly shown as “Road” in the Central District (Extension) Outline Zoning Plan (OZP) No. S/H24/9. In the existing condition, the Application Site is used by the Servicemen’s Guide Association and the Fenwick Pier Fleet Arcade is currently built on top of the Site. The existing buildings within the Site will be demolished for the proposed reprovisioning of Kong Wan Fire Station.
- 1.3.3 **Table 1.1** lists the existing and planned developments around the Application Site along with their heights. Height of planned developments of the Central Harbourfront are referenced from the Urban Design Study for the New Central Harbourfront by the Planning Department in 2011 and the OZP. Latest information about the building height of the proposed extension for The Hong Kong Academy for Performing Arts (HKAPA Extension) is referenced from the explanatory statement for the recommended outline development plan for Wan Chai Development Phase II by the Harbourfront Enhancement Committee in 2007 (Explanatory Statement for Wan Chai Development Phase II Recommended Wan Chai North Outline Development Plan no. D/H25/D) where the maximum building height allowed for this planned development is +25 mPD¹.

Table 1.1 Surrounding Existing and Planned Developments

Name of Development	Building Height (mPD)
Central Government Complex	+39 to +126.4
CITIC Tower	+130.8
The Hong Kong Academy for Performing Arts (HKAPA)	+7.2 to +42.4
Telecom House	+99
Shui On Centre	+126.1
Convention Plaza	+168.6
Grand Hyatt	+136.3
Hong Kong Arts Centre	+68.9

¹ https://www.harbourfront.org.hk/eng/content_page/doc/WD_1_2007_AnnexC.pdf

Name of Development	Building Height (mPD)
Proposed Development- The Hong Kong Academy for Performing Arts Extension (HKAPA Extension)	+25
Proposed Development - Central Harbourfront Site 6	+15 to +20
Proposed Judicial Complex for the High Court at Central Harbourfront Site 5	+80 (maximum building height in OZP)
Causeway Bay Ventilation Building	+24.7
Proposed Development - Next to CITIC Tower	+130 (maximum building height in OZP)

Remark: please refer to **Figure 1** for the locations.

1.4 Baseline Scheme (OZP-Compliant Scheme)

- 1.4.1 Noting that the Application Site falls upon the area zoned as "Open Space" ("O") and partly as "Road" in the approved Central District (Extension) Outline Zoning Plan (OZP) No. S/H24/9. An OZP-Compliant Scheme consisting of vacant land at the Application Site is included in the discussion of this report as one of the conditions to be compared with the proposed development.

1.5 Existing Development on Site

- 1.5.1 In addition to the Baseline Scheme, the existing development on the Application Site is also referenced when evaluating the potential change of air ventilation impact brought by the proposed development. It consists of the existing structures located within the Application Site, namely the Fenwick Pier Fleet Arcade and an electricity substation. The Fenwick Pier Fleet Arcade is a 4-storey building with a height of 21.4 mPD. It is currently occupying mainly the central and eastern part of the Application Site. The western part of the Application Site is an open area. The electricity substation is a one storey high structure located near the southeast corner of the Application Site.
- 1.5.2 Surrounding the Application Site is a number of planned and existing developments. To the immediate south of the Site is the HKAPA (+7.2 mPD to +42.4 mPD). To the east and southeast of the Application Site is several G/IC facilities as well as a couple of commercial buildings. Commercial buildings include Grand Hyatt (+136.3 mPD), Shui On Centre (+126.1 mPD), Convention Plaza (+168.6 mPD) and Telecom House (+99 mPD). G/IC facilities includes the existing Hong Kong Arts Centre (+68.9 mPD) while planned developments includes the proposed HKAPA Extension (+25 mPD).
- 1.5.3 To the north of the Application Site is another planned development in Central Harbourfront Site 6 (+15 mPD to +20 mPD) facing Victoria Harbour while to the west of the Site is Central Harbourfront Site 5 (+12.4 mPD to +80 mPD) planned for the proposed Judicial Complex for the High Court. Further west of Central Harbourfront Site 5 is the Central Government Complex (+39 mPD to +126.4 mPD) and to the southwest of the Application Site is CITIC Tower (+130.8 mPD) and the planned Judicial Complex for the High Court where the Harcourt Road Fresh Water Pumping Station is currently located.

1.6 Proposed Scheme

- 1.6.1 **Appendix 1** shows the building layout of the Proposed Scheme.
- 1.6.2 The proposed development consists of one Main Block of +69.22 mPD, one Ancillary Block of +9.42 mPD and a 3-side open drill tower (+61.77 mPD) attached to the main block. A solid fence wall encloses the proposed development on ground level. Open space for vehicle access as well as a landscape area is provided. The proposed development comprises of functional areas and facilities as listed below:

- Divisional Fire Station-cum-Ambulance Depot with a 9-bay appliance room
- Departmental Offices for accommodating FSD's Hong Kong Regional Office
- A Community Life Support Training Centre
- Special training facilities
- A lecture theatre
- An FSD High Command Post
- An Inter-departmental Command Post
- A barrack
- Parking spaces for staff cars, vehicles of offices and police cars and vehicles from other departments

2. SITE WIND AVAILABILITY

2.1 Site Wind Availability Data

RAMS Model

- 2.1.1 According to the Planning Department's website, a meso-scale Regional Atmospheric Modelling System (RAMS) was used to produce a simulated 10-year wind climate at the horizontal resolution of 0.5 km x 0.5 km covering the whole territory of Hong Kong. The simulated wind data represents the annual, winter and summer wind condition at various levels, i.e., 200 m, 300 m, and 500 m above terrain.
- 2.1.2 The RAMS data of the grid (X: 079 Y: 034) has been extracted from the Site Wind Availability Data of Planning Department's website.
- 2.1.3 Based on the wind roses with different heights (200, 300 or 500m) available, the 200 m site wind availability data represents wind data that takes into account the topographical effect around the Application Site. Therefore, a lower level of wind roses at 200 m height is selected to study the prevailing wind condition as it represents the incoming wind to the Application Site and considers the influence on the prevailing winds by the surrounding topography.
- 2.1.4 According to the wind roses at 200 m altitude, the annual prevailing wind directions of the Application Site are ENE, E and ESE while the summer prevailing wind directions for the Application Site are S, SSW, SW.
- 2.1.5 **Figure 2** shows the relevant wind rose diagrams representing the frequency and wind speed distribution at 200 m height during the annual and summer conditions. The wind frequency data under the annual and summer conditions at 200 m altitude are shown in **Table 2.1** below.

Table 2.1 Summary of RAMS Data and Wind Direction

Wind Direction	% of Annual Occurrence	% of Summer Occurrence
0° (N)	2.3%	0.7%
22.5° (NNE)	5.2%	0.8%
45° (NE)	7.4%	1.0%
67.5° (ENE)	12.6%	2.9%
90° (E)	29.5%	11.3%
112.5° (ESE)	8.5%	9.3%
135° (SE)	4.9%	8.8%
157.5° (SSE)	4.6%	9.4%
180° (S)	5.7%	12.1%
202.5° (SSW)	6.0%	13.7%
225° (SW)	5.0%	14.0%
247.5° (WSW)	2.4%	6.0%
270° (W)	2.5%	5.4%
292.5° (WNW)	1.7%	3.1%
315° (NW)	0.8%	1.0%
337.5° (NNW)	1.0%	0.6%

Note: Bold characters highlighted in grey represent the selected prevailing wind directions for evaluation

Term Consultancy for AVA Services - Expert Evaluation on Air Ventilation Assessment of Wan Chai Area

- 2.1.6 For other sources of wind data relevant to the Application Site, the Expert Evaluation Report on Air ventilation of Wan Chai Area (Wan Chai AVA-EE) published by the Planning Department can be referred to. Even though the Application Site is not included as part of the assessment area defined in the report, the Site is still near enough for the report to be taken as reference for the current assessment of air ventilation at the Application Site. According to the Wan Chai AVA-EE, the report uses existing sets of site wind availability data in HKO wind measurement data and MM5 simulated wind data to assess the dominant wind directions under annual and summer conditions in the Wan Chai area. The prevailing wind direction of Location A is taken as reference as it is the closest to the Application Site and it is found that the annual prevailing wind directions in the project area are north-easterlies and easterlies (E, NE) while southerlies (S, SW, SE) and E wind are the dominant wind directions under summer conditions.

HKO Measured Wind Data & Experimental Site Wind Availability for Central Waterfront Investigation Report

- 2.1.7 In addition to the wind data in Wan Chai AVA-EE, the latest HKO wind data of the nearest weather station to the Site and the data from Experimental Site Wind Availability for Central Waterfront Investigation Report commissioned by the Planning Department were also reviewed as possible references.
- 2.1.8 For HKO measured wind data, the nearest weather station to the Site containing annual and summer prevailing wind direction data is at the Hong Kong Observatory Weather Station in Tsim Sha Tsui. Based on the latest available data (measurements from 1991-2020), annual prevailing wind directions are found to be E, NE and W while prevailing summer wind (Jun-Aug) are from E, W, SW directions, extracted wind roses are shown in **Figure 3**.
- 2.1.9 In the wind tunnel study by the Planning Department for the Central Waterfront, the wind flow was measured at four different points with Point 1 and Point 2 closest to our Application Site. At these two points, annual, non-typhoon prevailing wind at a height of 500 m is found to be E, ENE and N (**Figure 4** refers) while no distinctions were made for summer conditions.

Recommendation of Set of Wind Data to be used for Further Discussion

- 2.1.10 The conclusion of dominant wind directions under annual and summer conditions of all the wind availability datasets are largely similar. Among these sets of data, 200 m RAMS data is recommended to be adopted for further analysis of the wind flow around the Application Site in this report. The limitations of the other sources of wind data are discussed below.
- 2.1.11 MM5 wind model is not recommended because the model is unable to effectively account for detailed topographical effects that is necessary for air ventilation assessments. Meanwhile, HKO site wind availability data is taken at a lower height level and data taken at the Hong Kong Observatory Weather Station is largely influenced by its nearby developments and topography. Moreover, as the HKO Weather Station and the Site is separated by Victoria Harbour and the nearby developments of the two areas are quite different, this data cannot be directly taken as site wind availability data input to AVA analysis of the Site. For the wind tunnel study, its wind data is at an altitude of 500 m and it more closely resembles free flow. Topographical effects are less of an influence on the data and it is thus less suitable for qualitative AVA analysis. Finally, the results from the Wan Chai AVA-EE can only be taken as reference as the assessment area does not actually include the Application Site unlike

the RAMS data of the grid chosen. It can only serve to confirm the validity of the RAMS data. Hence, RAMS wind data at 200 m above ground is recommended to be used for directional analysis for the Application Site.

2.2 Topography and Building Morphology

Topography

- 2.2.1 The Application Site is located in the Wan Chai District. The terrain in the vicinity of the Application Site is relatively flat ranging from +3.8 mPD to +6 mPD. Within the Application Site, the Site is located on reclaimed flat land with no slope or retaining wall and an existing topography of +3.7 mPD to +3.9 mPD. Due to the flat nature of the terrain within the Application Site and the surrounding area, it is anticipated that the influence of the topography to the wind flow pattern around the Application Site is negligible.

Existing Building Morphology

- 2.2.2 Based on findings from the site survey, published information in the Statutory Planning Portal under the Town Planning Board regarding planned / committed developments and the 2011 Urban Design Study for the New Central Harbourfront, there are a number of existing and planned low to high rise buildings surrounding the Application Site to the east, south and west directions. The wind flow pattern at the Application Site would be influenced by this surrounding-built environment even without the proposed development at the Application Site. **Table 2.2** can be referred to for building heights of existing surrounding structures.
- 2.2.3 Potential building blockage effect due to the surrounding existing developments is considered moderate. For example, annual prevailing easterly winds towards the Application Site would be blocked by the existing mid to high-rise developments in Grand Hyatt, Convention Plaza, Hong Kong Convention and Exhibition Centre (HKCEC), HKAPA, Hong Kong Art Centre and Telecom House. The prevailing summer southerly winds towards the Application Site would be partially blocked by CITIC Tower and HKAPA.
- 2.2.4 The building height information of identified existing developments was extracted from Geo-Reference Database (BG1000) provided by Survey and Mapping Office/ Lands Department.

Building Morphology – Planned Developments

- 2.2.5 There are several planned developments around the Application Site, namely Central Harbourfront Site 6, HKAPA Extension and Judicial Complex for the High Court. The proposed Judicial Complex for the High Court at Central Harbourfront Site 5 is subject to a height restriction of +80 mPD while the southern site of the Judicial Complex adjacent to CITIC Tower is subject to a height restriction of +130 mPD under the OZP. Site 6 is proposed to have 2-3 storeys buildings for waterfront commercial and leisure use with a maximum height of +20 mPD. The proposed HKAPA Extension has a maximum allowable building height of +25 mPD at the time of its proposal. The building heights of these planned developments were extracted from the sources mentioned in **Section 1.3.3. Table 2.2** highlights the building heights of the surrounding planned developments.
- 2.2.6 Taking into consideration of the various planned developments, the potential air ventilation blockage cause by these planned structures is considered to be moderate. For annual winds, annual dominant easterly pedestrian level winds would be blocked by the proposed HKAPA Extension before reaching the Application Site while summer dominant southerly winds would be blocked by the proposed Judicial Complex for the High Court compared to the existing water pumping station and structures.

Table 2.2 Surrounding Developments

Name of Development	Building Height (mPD)	Location from Application Site
Central Government Complex	+39 to +126.4	West
CITIC Tower	+130.8	Southwest
The Hong Kong Academy for Performing Arts	+7.2 to +42.4	South
Telecom House	+99	Southeast
Shui On Centre	+126.1	Southeast
Convention Plaza	+168.6	East
Grand Hyatt	+136.3	East
Hong Kong Arts Centre	+68.9	Southeast
Proposed Development- The Hong Kong Academy for Performing Arts Extension	+25	East
Proposed Development - Central Harbourfront Site 6	+15 to +20	North
Proposed Judicial Complex for the High Court at Central Harbourfront Site 5	+80	West
Causeway Bay Ventilation Building	+24.7	East
Proposed Judicial Complex for the High Court – Next to CITIC Tower	+130	Southwest

2.3 Summary of Existing Site Wind Availability

- 2.3.1 RAMS wind data is recommended to be used for further directional analysis. According to the RAMS wind availability data, the annual wind directions of the area are mainly from easterlies. From **Table 2.1** above, the wind probability from the E direction is 29.5 %, which is considered to be the dominant wind direction for the area. ENE (12.6 %) and ESE (8.5 %) wind are also dominant prevailing wind directions apart from the E wind.
- 2.3.2 The extensive road network around the Application Site provides air corridor for winds of different directions to pass through the area. For example, under annual E wind condition, the wind would blow through the air corridor along Fenwick Pier Street and Lung Wui Road and provide wind to the downstream areas. ENE wind can pass through Convention Avenue, Lung Wo Road and the open space to the north of the Application Site to reach the Application Site and beyond but a portion of the wind would be obstructed by the planned HKAPA extension.
- 2.3.3 For summer winds, prevailing summer southern winds can pass through Performing Arts Avenue and along Lung Hop Street (passing the Application Site as well) to Victoria Harbour, which is a path for localized southerly winds from the inner-city area to the sea.
- 2.3.4 As the Application Site is surrounded by a number of low to high-rise developments, potential building blockage effect due to the surrounding existing and planned developments is considered medium and unfavourable for wind penetration. Therefore, it is expected that most of the wind would flow along the carriageways at pedestrian level.

3. EXPERT EVALUATION OF AIR VENTILATION PERFORMANCE OF THE PROPOSED DEVELOPMENT

3.1 Evaluation of Merit/Demerit of Design Features of the Proposed Development

3.1.1 Under the Proposed Scheme, good design features beneficial to air ventilation has been incorporated as far as possible into the design of the proposed development taking into account various site constraints (security concerns, specific facilities required on ground floor, space required for daily operations of the fire station, preservation of the trees next to the Site and presence of drainage reserve within the Site). Mitigation measures such as inclusion of open space, building void and optimal building disposition are included in the design. The details of the design measures in the site layout for enhancing the air ventilation of the proposed development and the surrounding areas are summarised below and indicated in **Figure 5** and **Figure 6**.

- The overall layout design of the proposed development has optimised building disposition to favour incoming winds. The single storey ancillary block of the proposed development is placed facing Fenwick Pier Street with the taller Main Block having a setback of at least 14m from the southern site boundary (for a total of 17m from Fenwick Pier Street) minimizing wind disruption to dominant E winds flowing through major wind corridor Fenwick Pier Street. The Main Block also has a setback of 2.9m from the western site boundary to accommodate southern winds flowing through Lung Hop Street.
- In the northern portion of the Main Block, there is a low-level void with height ranging from 6.9m to 10.2m high with a width of around 23.4m favouring south and southwestern wind penetration through the Site to minimize the air ventilation impact brought by the proposed development (see **Figure 6**).
- Proposed open space and landscape area at the centre and southern part of the Application Site is designed to facilitate incoming winds to the building void of the Main Block and benefit S and SSW winds. **Figure 5** has outlined the area of the open space within the Site.

Air corridors

3.1.2 **Figure 7** and **Figure 8** illustrate the prevailing wind from both annual and summer wind directions for the existing situation respectively. **Figure 9** and **Figure 10** depicts the prevailing wind from both annual and summer wind directions for the Baseline Scheme. **Figure 11** and **Figure 12** illustrate the prevailing wind from both annual and summer wind directions with the Proposed Scheme.

3.1.3 Under annual wind conditions, some portion of the annual winds would be blocked by the proposed extension of HKAPA before reaching the Application Site. However, a large portion of E winds would pass through the air corridors of Fenwick Pier Street and Lung Wui Road to reach downstream areas of the Application Site. It is expected there would be high wind availability flowing along Fenwick Pier Street and Lung Wui Road.

3.1.4 For summer southern winds, air corridors along Performing Arts Avenue and Lung Hop Street would facilitate wind flow towards the Application Site and to the waterfront area. Higher wind availability is expected along these two streets. The direct access to Victoria Harbour offers land and sea breeze along these two air corridors due to temperature difference between land and sea throughout the day and night.

Building Disposition and Development Permeability

- 3.1.5 The placement of structures in the Proposed Scheme is specially designed to improve air ventilation performance of the proposed development. The Ancillary Block of the proposed development with low building height is placed facing close to Fenwick Pier Street (major wind corridor for E winds which is the most dominant wind direction annually from RAMS data) with the Main Block further back with a setback of at least 14m from the southern site boundary. This building layout design minimize any negative impact to the important annual easterly winds from the proposed structures and allow as much E wind to reach downstream areas as possible from Fenwick Pier Street while still following other site and use constraints. Furthermore, the location of the 1-storey Ancillary Block complements the building void in the Main Block by allowing for incoming southern wind flow to pass above it into the open space of the Site and to the building void.
- 3.1.6 The Main Block also has a setback of around 2.9m from the western site boundary line to cater to southern winds flowing along Lung Hop Street and the overall placement of the two blocks creates a centralized open space to assist any incoming south to southwestern winds flowing into the Application Site.
- 3.1.7 The other main feature of the proposed design to improve the permeability of the proposed development is the inclusion of a building void at the northern portion of the Main Block. In the northern section of the Main Block of the proposed development, there is a 6.9 to 10.2m high void at ground and first floor levels with a width of 23.4m spanning across most of the northeastern area in the Application Site facilitating passage of southerly winds through the Application Site and beyond. It is expected that wind blockage by the structure of the three-sides opened drill tower (shaped like a staircase) is low due to its limited coverage of the building void. As shown in **Figure 5**, the drill tower is open on three sides and has a staircase with steel balustrade for handrails which is permeable and allows for wind penetration. The only solid structure blocking wind is the column this staircase is centred around and its impact on the wind flow through the building void is limited.
- 3.1.8 Notwithstanding the limited blockage by the drill tower, aided by the Ancillary Block and the open space within the Site, low-level south and southwestern prevailing winds can flow to the building void and out of the Site. Hence, the building void can help to significantly enhance low-level wind penetration through the Site.

3.2 Directional Analysis of the Development

- 3.2.1 As discussed in Section 2.1, it is identified that the dominant annual wind conditions are from E, ENE and ESE directions while the dominant summer wind condition are from S, SSW and SW directions. The proposed development will be evaluated against the dominant wind directions identified in both conditions and compared with the Baseline Scheme and existing development on Site. **Figure 7** and **Figure 8** indicates the expected wind flow for the existing development on Site under annual and summer conditions while **Figure 9** and **Figure 10** indicate the same for the Baseline Scheme. For the Baseline Scheme, the wind flow is similar to the existing condition but there is more space for the wind to flow through the Application Site. **Figure 11** and **Figure 12** shows the expected wind flow under the Proposed Scheme.

E Wind

- 3.2.2 E winds can come from Convention Avenue and Harbour Road and converge on Fenwick Pier Street passing the Application Site into Lung Wui Road and beyond. A significant portion of E wind is blocked by the high-rise Grand Hyatt and Convention Centre and thus most of the wind would flow along the carriageways at pedestrian level to downstream areas of the Application Site (i.e., Fenwick Pier Street and Lung Wo Road).

- 3.2.3 E winds can flow to the Application Site to reach downstream areas (proposed Judicial Complex for the High Court and the Central Government Complex etc.) in mainly three ways, through Fenwick Street, the vacant land to the north of the Application Site and wind flow above the proposed HKAPA Extension. Wind performance across the Baseline Scheme, existing development on Site and the Proposed Scheme is largely identical over the vacant land north of the Site. The Baseline Scheme offers no obstruction to the incoming wind and it benefits the downstream area the most out of the three schemes as there are no structures to block wind flowing from above the HKAPA Extension. The existing development on Site, Fenwick Pier Fleet Arcade, performs slightly worse than the Baseline Scheme as there is a structure which obstructs the wind flow to Lung Hop Street to a small extent.
- 3.2.4 For the Proposed Scheme, the Main Block of the proposed development would block a slightly larger amount of E wind flowing above the HKAPA Extension compared to the existing development on Site due to the increased building height, but it is not significant in the overall picture. Firstly, a large part of the high-level E wind flowing directly to the Main Block Area is blocked by Grand Hyatt and Convention Centre, then the remaining E winds are further obstructed by the planned HKAPA Extension before reaching the Main Block. The limited incoming wind can still flow atop the proposed development leaving a small wake of decreased wind flow at Lung Hop Street at the pedestrian level which would slightly affect the wind availability there but this is mitigated by the capturing of high-level wind by the proposed Judicial Complex next to Lung Hop Street which would improve the pedestrian level wind flow at Lung Hop Street by providing downwash wind. Furthermore, the actual amount of E wind obstructed by the Main Block would not have a large impact on the wind flow pattern since the majority of the wind flow from E direction would be flowing down the major wind corridor along Fenwick Pier Street.
- 3.2.5 The Proposed Scheme performs similarly to the existing development on Site and slightly worse than the Baseline Scheme. Compared to the existing development on Site, wind flow would act similarly under E direction with the proposed development. The difference in height between the Main Block and the Fenwick Fleet Arcade would still block similar amounts of wind flowing to Lung Hop Street. Higher-level E wind can still flow atop the Application Site for both schemes after being partially obstructed by HKAPA Extension while pedestrian level wind can flow along Fenwick Pier Street. Compared to the Baseline Scheme, there would be slightly less wind at Lung Hop Street as there is a structure in the Proposed Scheme to block some of the wind flowing above the Application Site.
- 3.2.6 The mitigation measures incorporated into the Proposed Scheme contributes to the improvement of E wind flow at the surrounding area. The setback of the taller Main Block from the southern site boundary and consequently the previously identified major wind corridor Fenwick Pier Street maximizes the amount of E wind of all levels flowing down Fenwick Pier Street and partially alleviate wind impacts to Lung Hop Street when the eastern wind reaches the intersection between the two streets and the wind partly flows to Lung Hop Street.
- 3.2.7 To sum up, even though the Proposed Scheme performs worse than the Baseline scheme and the existing development on Site, the difference in performance is not significant as the majority of E wind would flow along Fenwick Pier Street and the building setback from the nearby streets provided in the Proposed Scheme makes it so that wind flow through this route is similar across all conditions. Hence, it is anticipated that the proposed development would not have a significant negative air ventilation impact at all levels under E wind conditions.

ESE Wind

- 3.2.8 ESE wind, similar to E wind, can come from Harbour Road and to Fenwick Pier Street passing the Application Site into Lung Wui Road and beyond. ESE wind to the Site is largely blocked by high-rise buildings such as Hong Kong Arts Centre, HKAPA, Shui On Centre and Telecom House.
- 3.2.9 Leftover high-level wind from the blockage of ESE wind from the high-rise buildings of Telecom House and others would flow above the proposed HKAPA Extension and to the Site past Fenwick Pier Street into Lung Hop Street. For the two conditions with structures, any remaining high-level ESE wind reaching the Application Site would be obstructed somewhat by the buildings in the Site in the existing development and the Proposed Scheme which affects wind flow at Lung Hop Street. This impact on Lung Hop Street, however, is counteracted by higher-level winds being able to reach Lung Hop Street by wrapping around the developments and some wind flowing over the developments can be captured by the taller building of the proposed Judicial Complex downstream where it can redirect the wind to pedestrian level and provide downwash wind to Lung Hop Street.
- 3.2.10 Wind from Fenwick Pier Street would behave nearly the same under the three conditions being compared as the setback in the existing development on Site and the proposed setback from Fenwick Pier Street in the Proposed Scheme offers open space at the southern portion of the Site like the Baseline Scheme which allows pedestrian level ESE wind flow to Lung Hop Street. Thus, the performance between the existing development on Site and the Proposed Scheme is anticipated to be comparable.
- 3.2.11 To conclude, while the Proposed Scheme still suffer from some ESE wind loss compared to the Baseline Scheme, the negative impact is not significant as most ESE wind (from Fenwick Pier Street and from the direction of Telecom House) acts similarly under all three schemes.

ENE Wind

- 3.2.12 Lung Wo Road together with the adjoining open space to its south act as the major wind corridor for ENE wind to reach the Application Site. Some portion of the ENE wind would be partially blocked by the HKCEC, the Causeway Bay Ventilation Building and the proposed HKAPA Extension before reaching the Application Site.
- 3.2.13 Under the Baseline Scheme, after being partially blocked by the existing and planned nearby buildings, ENE wind is able to flow through the Application Site and to Lung Wui Road and Lung Hop Street. For the existing development on Site, the slanted building shape of the Fenwick Pier Fleet Arcade partially aligns with ENE wind direction and the structure's setback from Lung Hop Street facilitates ENE pedestrian wind flow to downstream areas.
- 3.2.14 The proposed development is expected to perform worse than the Baseline Scheme and the existing development on Site. However, the negative impact of the proposed development on ENE wind flow is not high as wind flow is not expected to differ considerably compared to the existing development on Site. Both the existing building and Proposed Scheme are mid-rise buildings and both allow high-level winds to pass above the Application Site with a small wake of decreased wind speed behind the building in the downstream area at the junction of Lung Hop Street and Fenwick Pier Street. This wake is small due to the small building coverage of the development. The high-level winds flowing above would slow down after encountering the building at the Application Site and eventually settle down to the pedestrian level and join the wind flow downstream at Lung Wui Road. Other higher-level winds are split by the building and there is wind acceleration near the corners of the building providing increased wind flow which alleviates the wake at the junction. Moreover, the Proposed Scheme has arranged the low-rise ancillary block surrounded by open space to be positioned along Fenwick Street to minimise blockage of ENE wind to the downstream area.

Therefore, the air ventilation impact from the proposed development is insignificant to the downstream area of the proposed Judicial Complex for the High Court and the Central Government Complex.

S and SSW wind

- 3.2.15 For S and SSW wind condition, the wind can flow along the western side of HKAPA and its adjacent Performance Arts Avenue and Fenwick Pier Street to reach the Application Site and beyond. Major wind corridors for S and SSW wind identified are Performing Arts Avenue, the portion of Fenwick Pier Street next to it and Lung Hop Street.
- 3.2.16 The Baseline Scheme performs the best compared with the Proposed Scheme and the existing development on Site for S and SSW wind as wind can flow over the open land of the Application Site with no obstructions to downstream areas. The existing development on Site and Proposed Scheme have worse wind flow due to the existence of structures to obstruct the incoming wind flow but this is compensated by the building shape of the existing building and the proposed mitigation measures in the Proposed Scheme respectively.
- 3.2.17 SSW and S wind flowing from the corridor of Performing Arts Avenue entering the Application Site for the existing development can be facilitated to the downstream area through the slanted building shape aligning to SW direction and the setback of the Fenwick Pier Fleet Arcade from Lung Hop Street. On the other hand, the Proposed Scheme has a setback from Lung Hop Street, albeit smaller than that offered by the existing development on Site, to facilitate southern wind flow. The Proposed Scheme has also provided a pathway for southern wind penetration through the Site with the building void in the northern portion of the Main Block once the wind reaches the proposed landscape area and open space of the Site.
- 3.2.18 For low level winds, once past the landscape area of the Site, SSW and S wind would be slightly obstructed by the solid fence wall enclosing the proposed development. There would be a small wake of decreased wind flow within the open space of the Application Site next to the fence wall but a large portion of wind would still be able to flow into the Site. Within the Site, the open space / drill yard of around 21.5 m in width between the building void and the Ancillary Block provides passage for the incoming wind to recover and flow to the building void and open space in the north. Lower-level wind flowing within the Site is able to flow through the building void above the carpark ramp and pass the fence wall to the north or the open space into the downstream areas. Small wakes are predicted downstream of the fence wall enclosing the proposed development due to the blockage of the wall but it is not anticipated to have significant impact to the downstream open space area and the promenade.
- 3.2.19 Low-level S and SSW winds not passing through the landscape area would be slightly obstructed by the Ancillary Block. The placement of the Ancillary Block to the south of the Application Site would block a portion of the incoming S and SSW wind from the area of HKAPA at pedestrian level. However, because the Ancillary Block is only a 1-storey structure, any wake of decreased wind flow created by the structure is too small to influence the overall wind flow to the building void. Moreover, there is still the open space between the Ancillary Block and the building void for the low-level wind wake to recover. Hence low-level wind flow to the building void is preserved as much as possible.
- 3.2.20 At the building void, as the drill tower has incorporated a three-side open design, blockage on the wind flow through the building void by the drill tower is expected to be insignificant and wind can largely flow through the building void. Overall, with the help of the building void, open space and the placement of the Ancillary Block, low-level S and SSW wind penetration through the Site is enhanced as opposed to the existing development on Site.

- 3.2.21 For higher level S and SSW wind, the wind can flow atop the Application Site and settle to downstream areas of the harbourfront with a small wake of decreased wind flow in the open space immediately downstream of the structure in both schemes. However, because S and SSW wind from the major wind corridor of Lung Hop Street can spread and flow into the open area once past the Site, the impact of the wake is mitigated. Hence, the wind performance of the existing development on Site and the Proposed Scheme is comparable.
- 3.2.22 Overall, with mitigation measures incorporated in the Proposed Scheme, no significant adverse impact to the surrounding wind environment is expected from the Proposed Scheme when compared with the Baseline Scheme and the existing development on Site.

SW wind

- 3.2.23 Under SW wind, wind corridor for SW wind is still mainly Lung Hop Street and Performing Arts Avenue and Fenwick Pier Street. A large portion of SW wind would be obstructed by CITIC Tower and the proposed Judicial Complex for High Court first before reaching the Application Site.
- 3.2.24 The Baseline Scheme has the highest air ventilation performance among the three schemes due to its open space use while the existing development on Site and the Proposed Scheme have comparable performance.
- 3.2.25 The Proposed Scheme would have slightly worse performance compared to the existing Fenwick Pier Fleet Arcade as the shape of the arcade aligns with SW wind with a larger building setback from the western site boundary. Incoming SW winds along Performing Arts Avenue would have more area from the existing building for wind flow to Central Harbourfront Site 6. However, for the Proposed Scheme, some SW wind can still take advantage of the mitigation measures incorporated into the design, such as the building setback along Lung Hop Street, the open space and building void within the Application Site to facilitate wind penetration through the Site. Low-level winds, similar to S and SSW wind, would mostly be able to penetrate through the Application Site and into the downstream areas of open space north of the Site and the promenade. Other winds can also flow through the corridor of Lung Hop Street. Higher level SW wind can flow atop the proposed development and settle to downstream areas while creating a small wake of lower wind speed downstream of the building structure at the open space to the immediate north of the Site. The impact is not significant because wind can flow over to this open space from Lung Hop Street and there would also be some increased wind flow from the building corners of the proposed development where wind is accelerated as it flows around the edges of the development.
- 3.2.26 Even though the Proposed Scheme would likely have worse air ventilation impact than the other two schemes, the difference is not large through the provision of mitigation measures and the fact that the proposed development is also a mid-rise structure which allow high level wind to flow atop and reach the downstream area along the harbourfront. Hence, no significant adverse impact from the proposed development on the surrounding wind environment is anticipated.

3.3 Summary of Relative Air Ventilation Performance

- 3.3.1 The air ventilation performance of the existing area and the proposed development has been appraised. The proposed development has provided air pathways to facilitate wind flow from disposition of structures and provision of open area and building void. Air ventilation performance is similar in both the Proposed Scheme and the existing development as the site area and building footprint are relatively small and the buildings in both layouts within the Application Site allowing winds to flow atop the structures and reach downstream area.

- 3.3.2 Then comparing the Proposed Scheme and the Baseline Scheme, while the Proposed Scheme performs worse than the Baseline Scheme for open space usage, the design of the proposed development has maximised the opportunity in improving the air ventilation performance of the proposed development within site constraints through the use of mitigation measures. Mitigation measures such as a building void, maximization of open space, building setback and stepped building layout from a major wind corridor are incorporated in the design of the Proposed Scheme such that it is unlikely that the proposed development will have significant adverse impact to the surrounding wind environment. Hence, it can be concluded the proposed development is unexpected to impose significant air ventilation impacts on the surroundings from an air ventilation perspective.

4. CONCLUSION

- 4.1.1 A qualitative assessment of the wind performance of the proposed reprovisioning of Kong Wan Fire Station in Wan Chai has been conducted.
- 4.1.2 According to the findings of this AVA-EE, annual prevailing wind comes from E, ENE and ESE direction and summer prevailing wind comes from S, SSW and SW directions. Taking into consideration of the existing topography, the location of the existing built areas, planned developments and provision of mitigation measures, it is considered that the Proposed Scheme would not have significant adverse air ventilation impact on the surrounding environment.
- 4.1.3 The proposed development has incorporated mitigation measures to improve the air ventilation performance of the proposed development as much as possible given the various site constraints. Mitigation measures such as optimal dispositions of proposed structures and provision of open area and building void are included in the design to improve air ventilation quality. With these design measures incorporated into the proposed development, significant adverse air ventilation impacts on the surrounding environment from the proposed development is not anticipated.

Figures

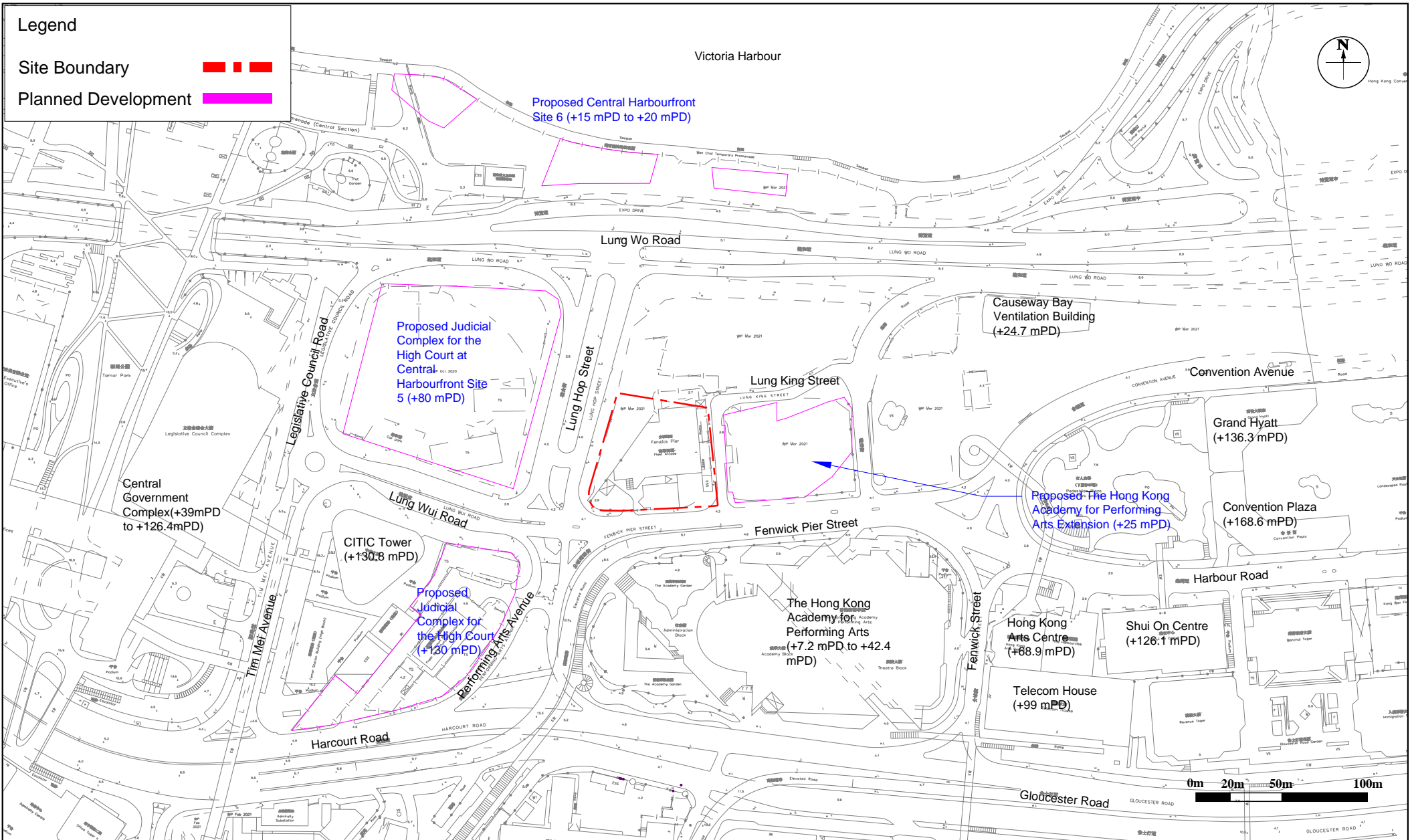


Figure: 1

Title: Location of the Application Site and its Environs

Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station

RAMBOLL

Drawn by: RS

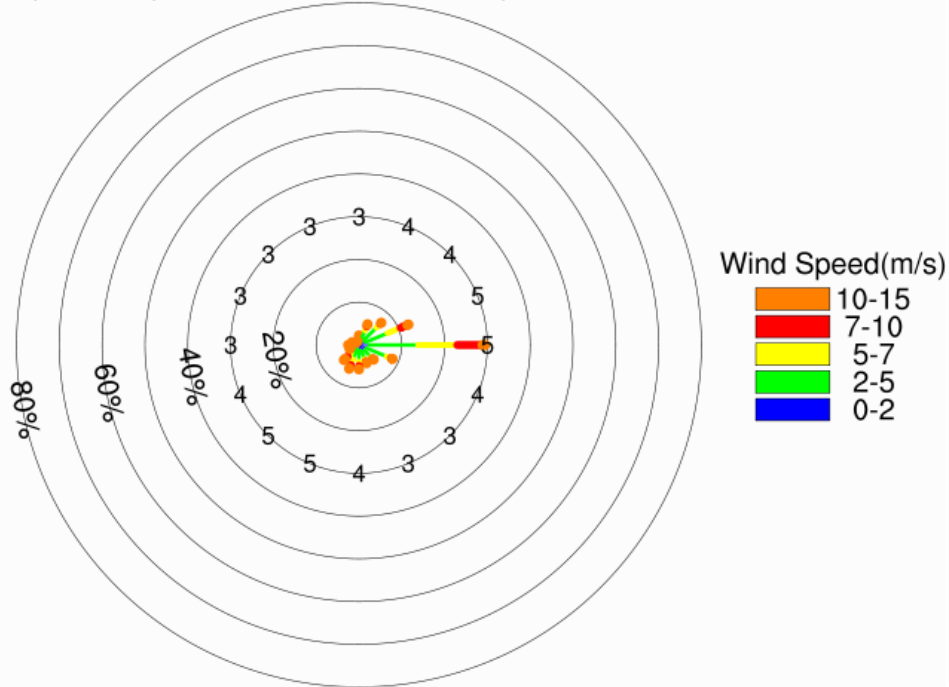
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Rev.: 2.0

Date: Nov 2021

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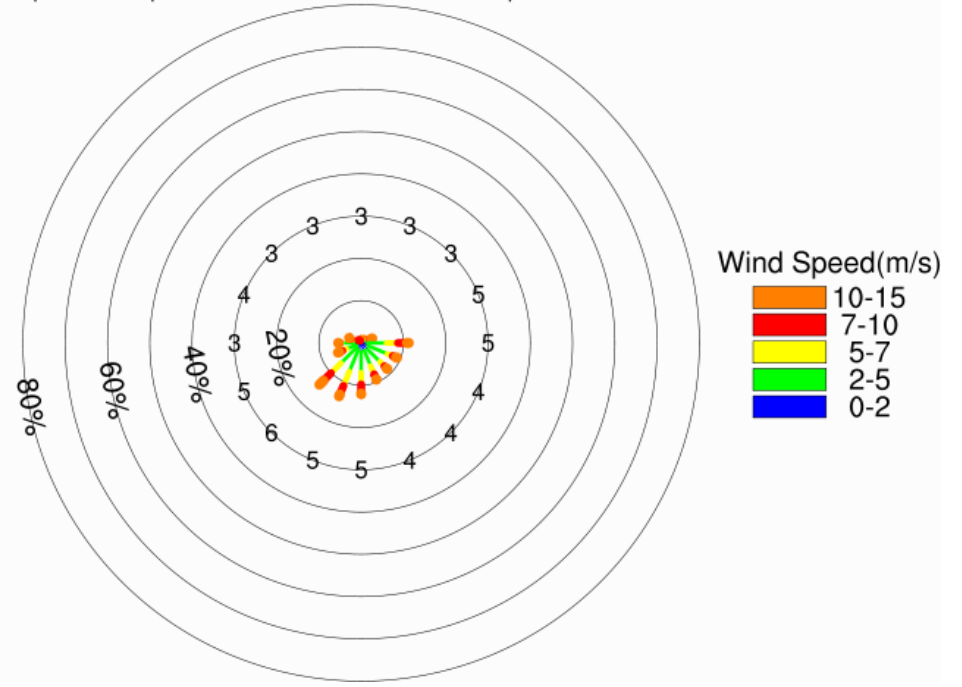
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Summer Condition

Figure: 2

Title: Annual and Summer Wind Roses Representing V_{∞} of the Area under Concern at 200m above ground (X:079, Y:034)

Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Re-provisioning of Kong Wan Fire Station

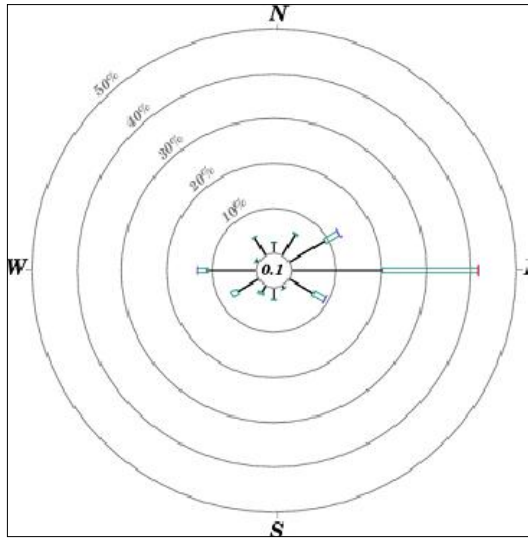
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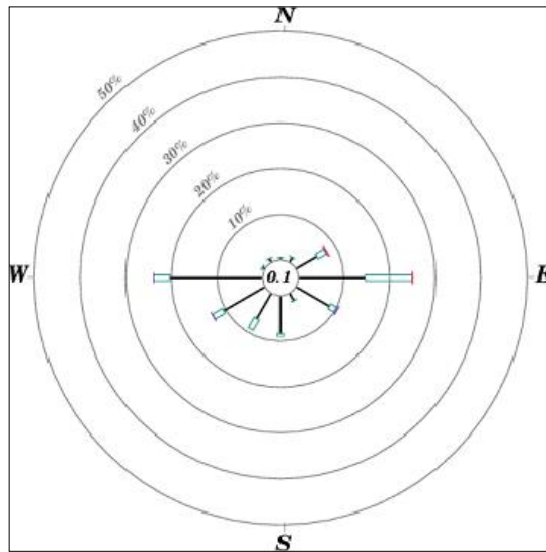
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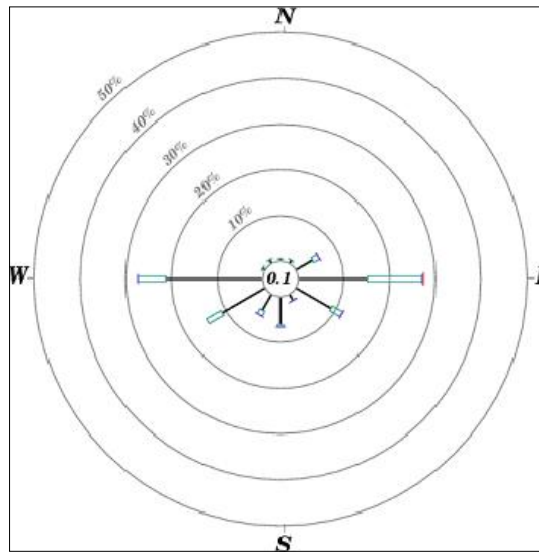
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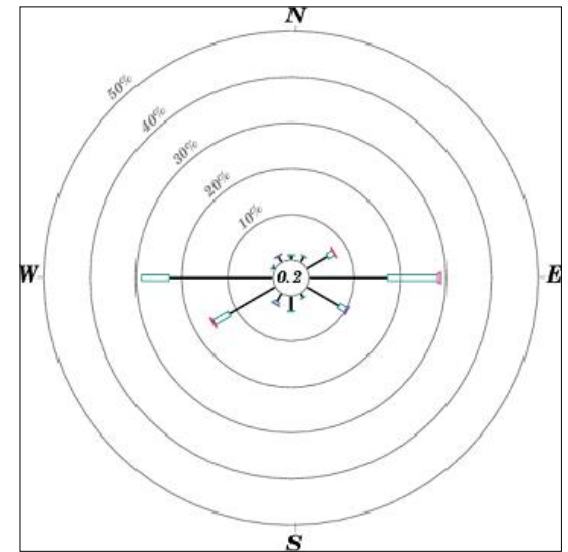
Annual Condition (1991-2020)



Summer Condition - June (1991-2020)



Summer Condition - July (1991-2020)



Summer Condition - August (1991-2020)

Figure: 3

Title: Annual and Summer Wind Roses Extracted from the Hong Kong Observatory Weather Station

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Annual Wind Rose for Non-Typhoon Winds at Point 1

Annual Wind Rose for Non-Typhoon Winds at Point 2

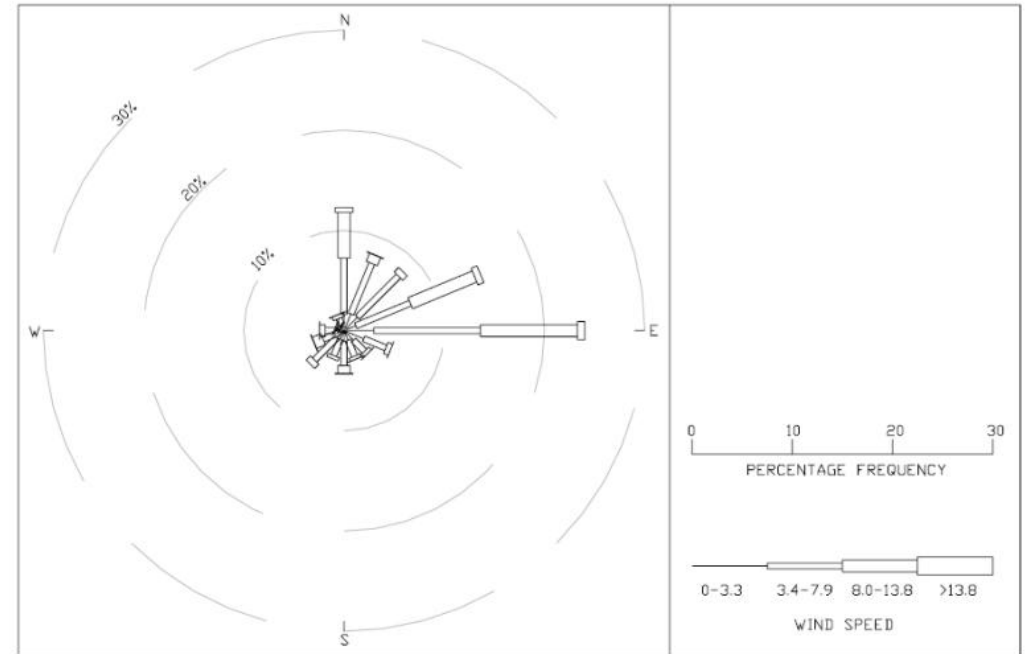
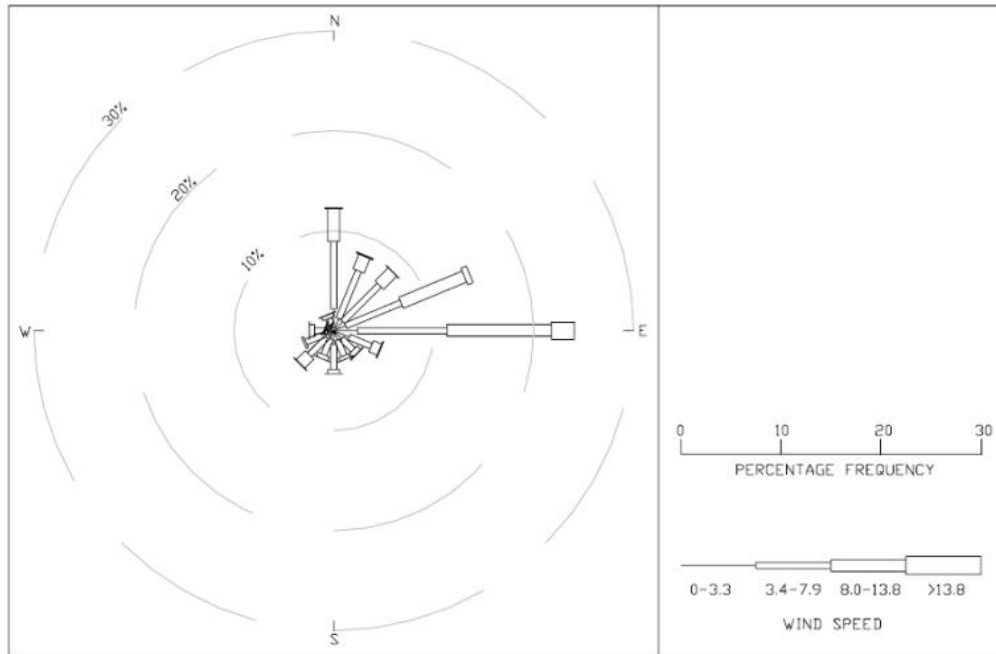


Figure: 4

Title: Annual Wind Roses Extracted from the Experimental Site Wind Availability for Central Waterfront

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Legend

Site Boundary 

Open Space 

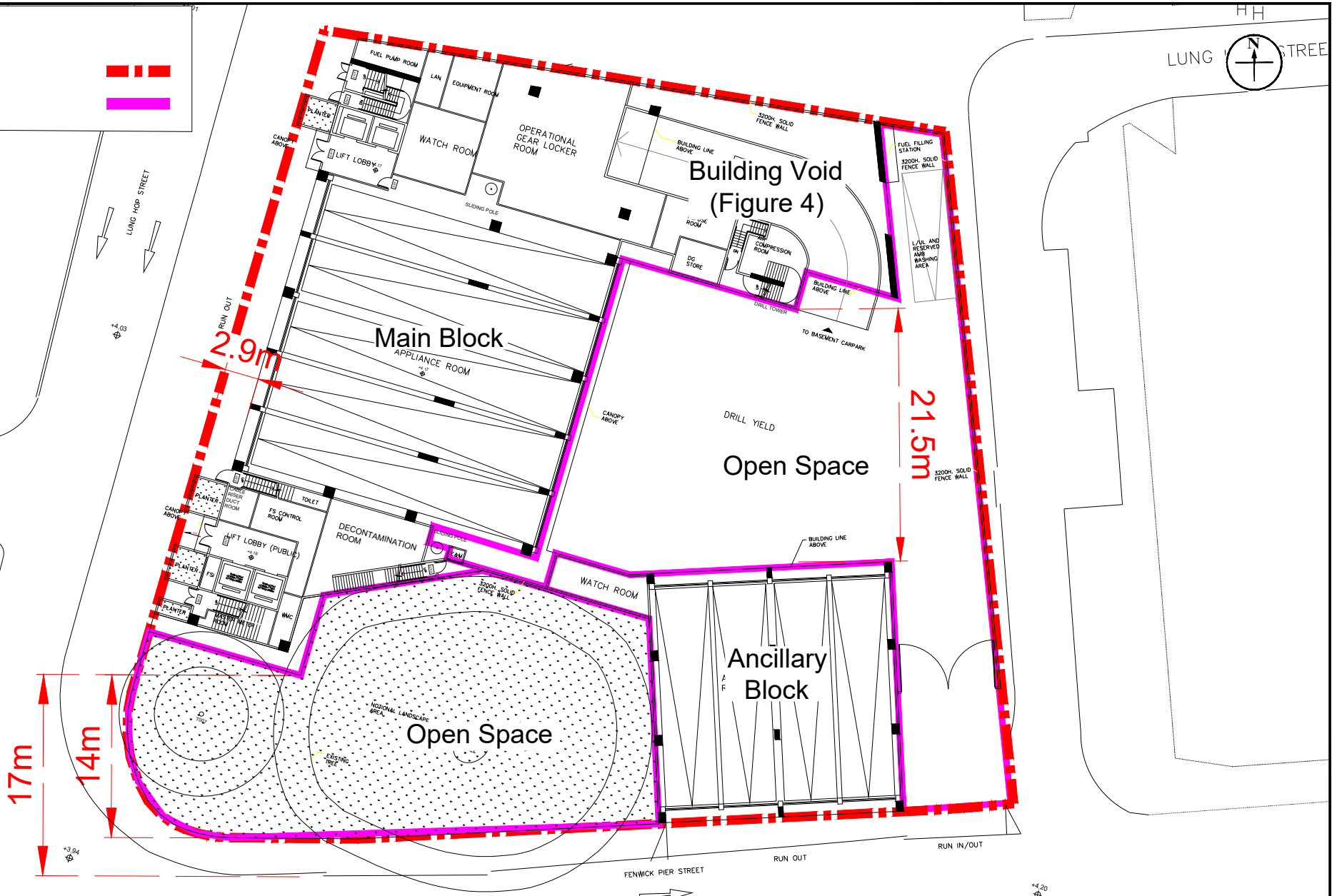


Figure: 5

Title: Proposed Mitigation Measures within the Proposed Development

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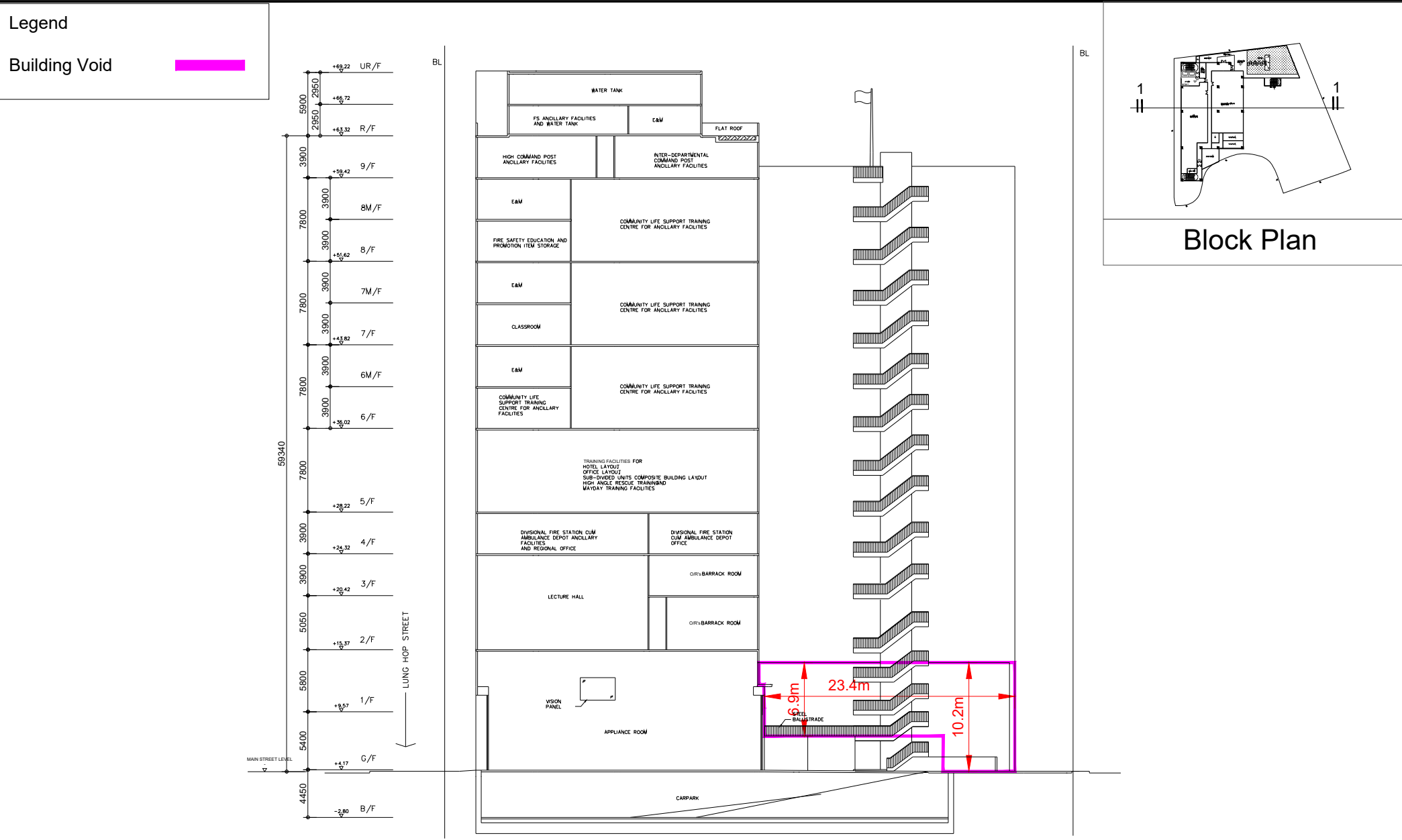


Figure: 6

Title: Location of Main Block Building Void

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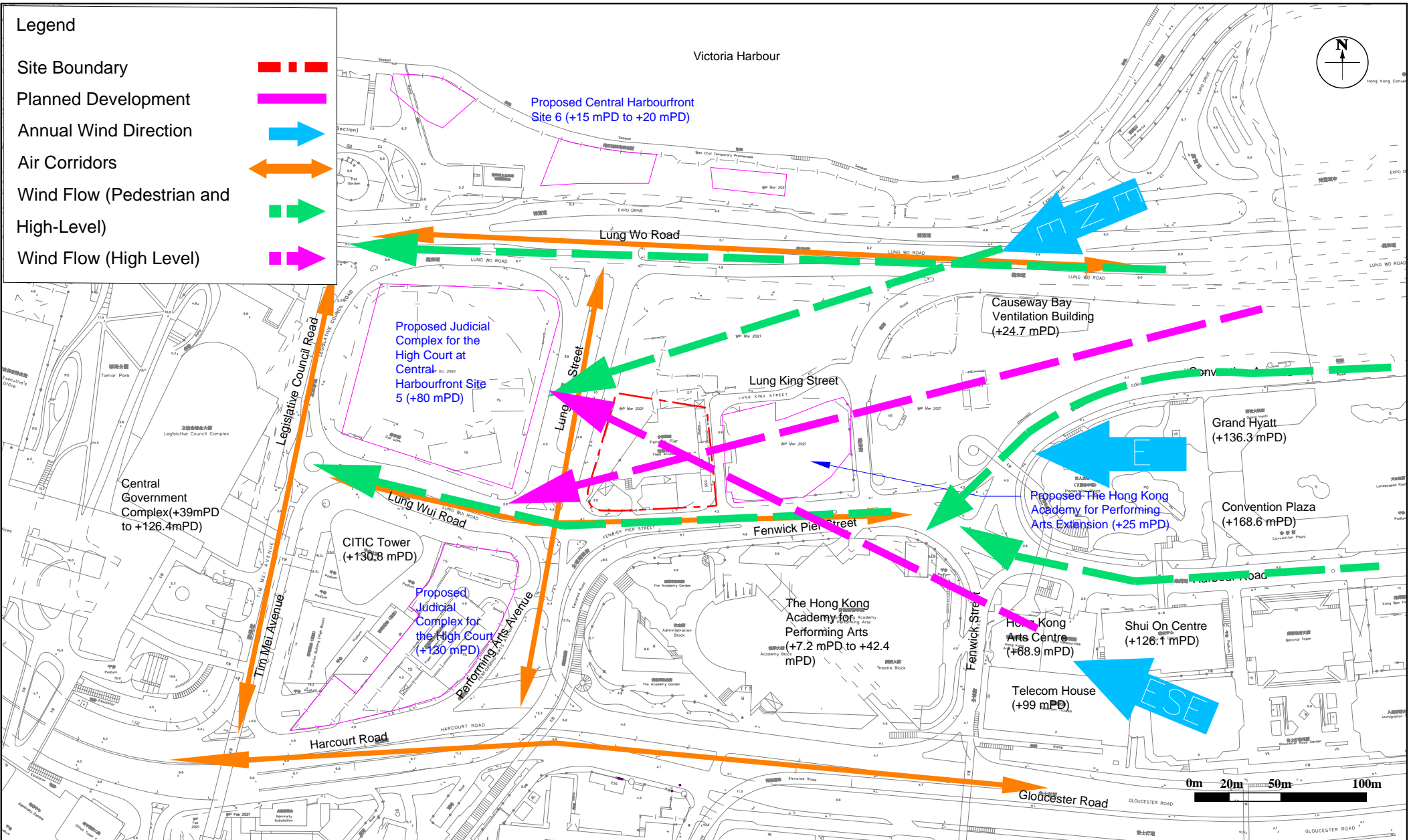


Figure: 7 Title: Illustration of Existing Annual Wind Flow	RAMBOLL
	Drawn by: RS Checked by: KY
Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station	Rev.: 3.0 Date: Jan 2022

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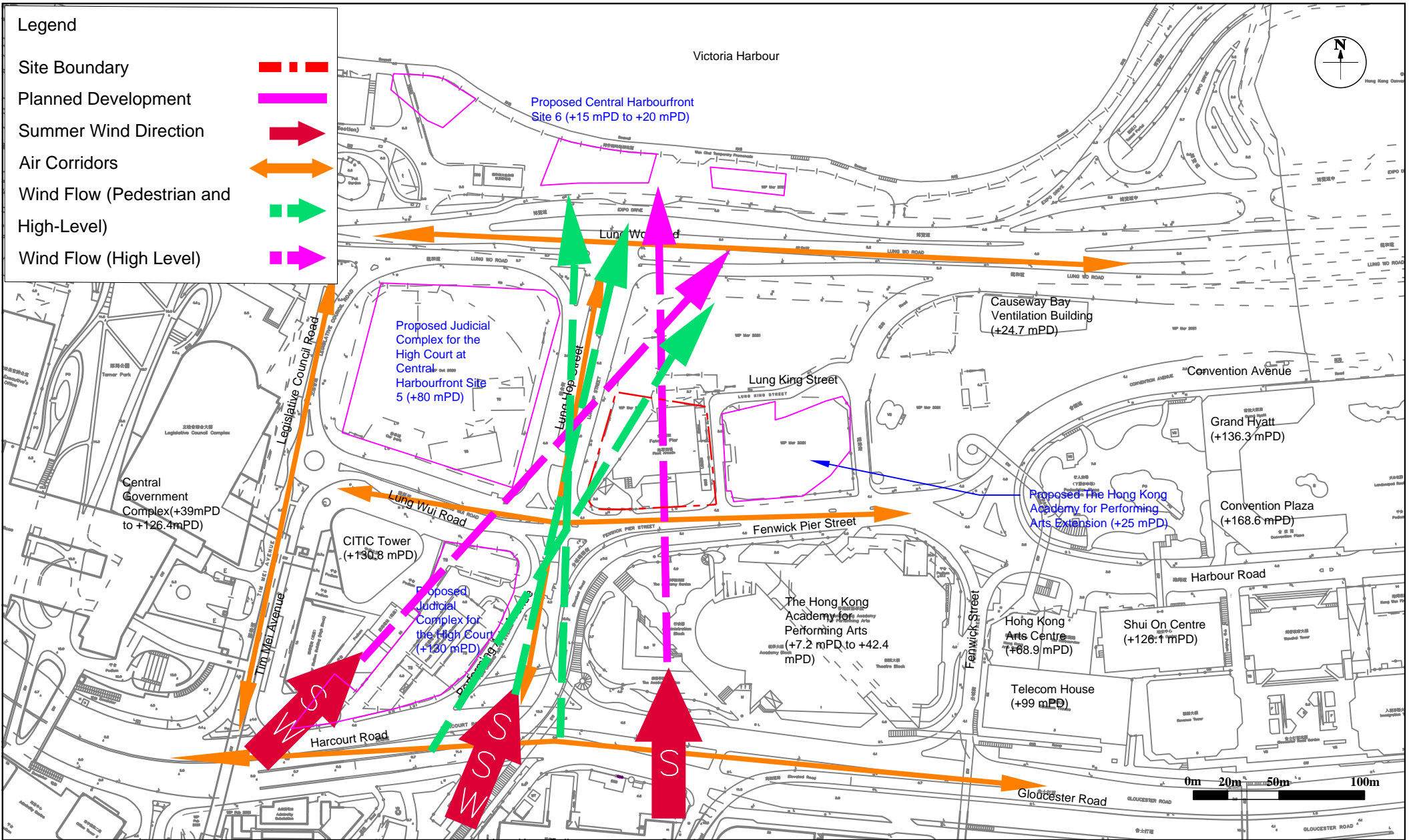


Figure: 8

Title: Illustration of Existing Summer Wind Flow

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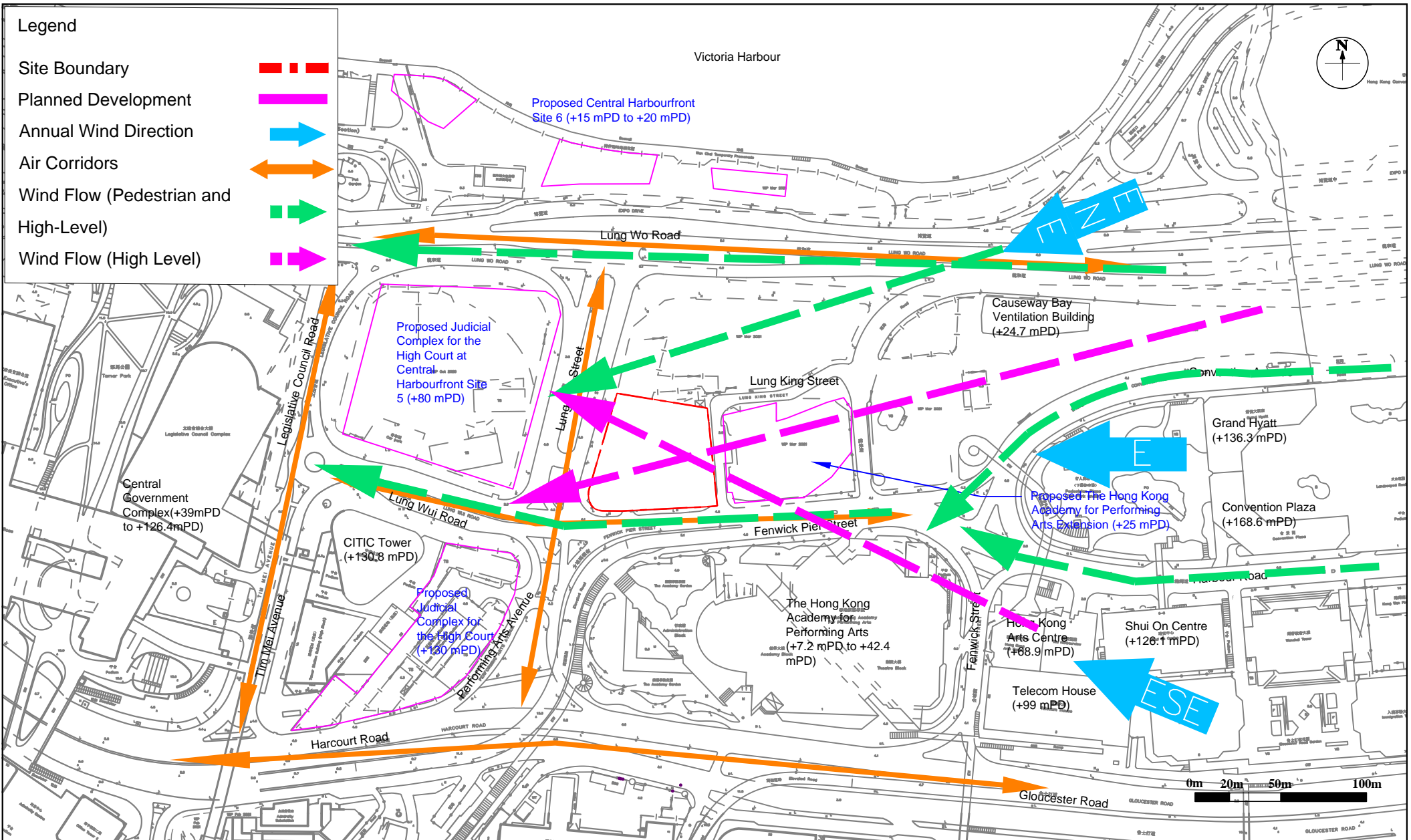


Figure: 9

Title: Illustration of Annual Wind Flow under the Baseline Scheme

Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station

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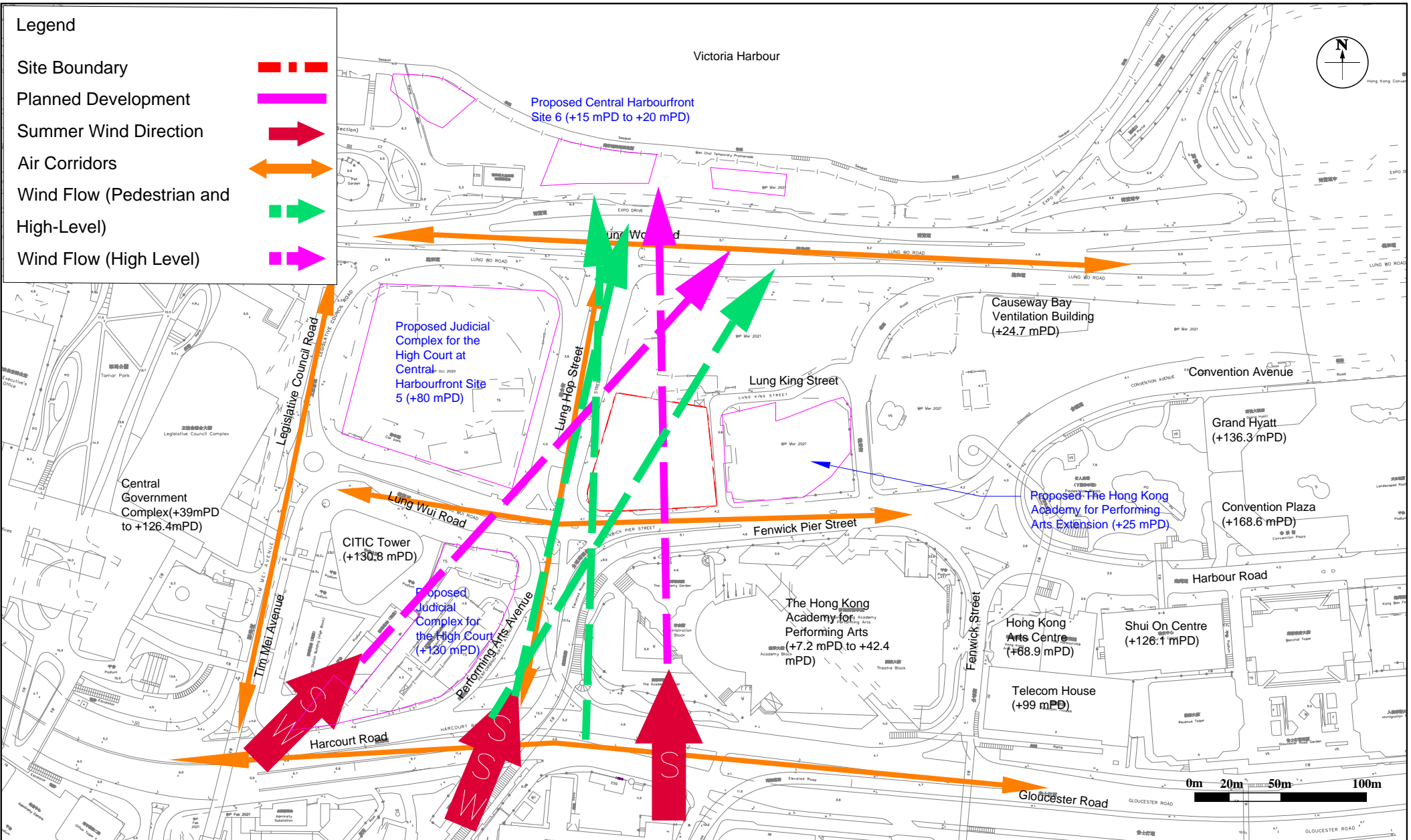


Figure: 10

Title: Illustration of Summer Wind Flow under the Baseline Scheme

Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station

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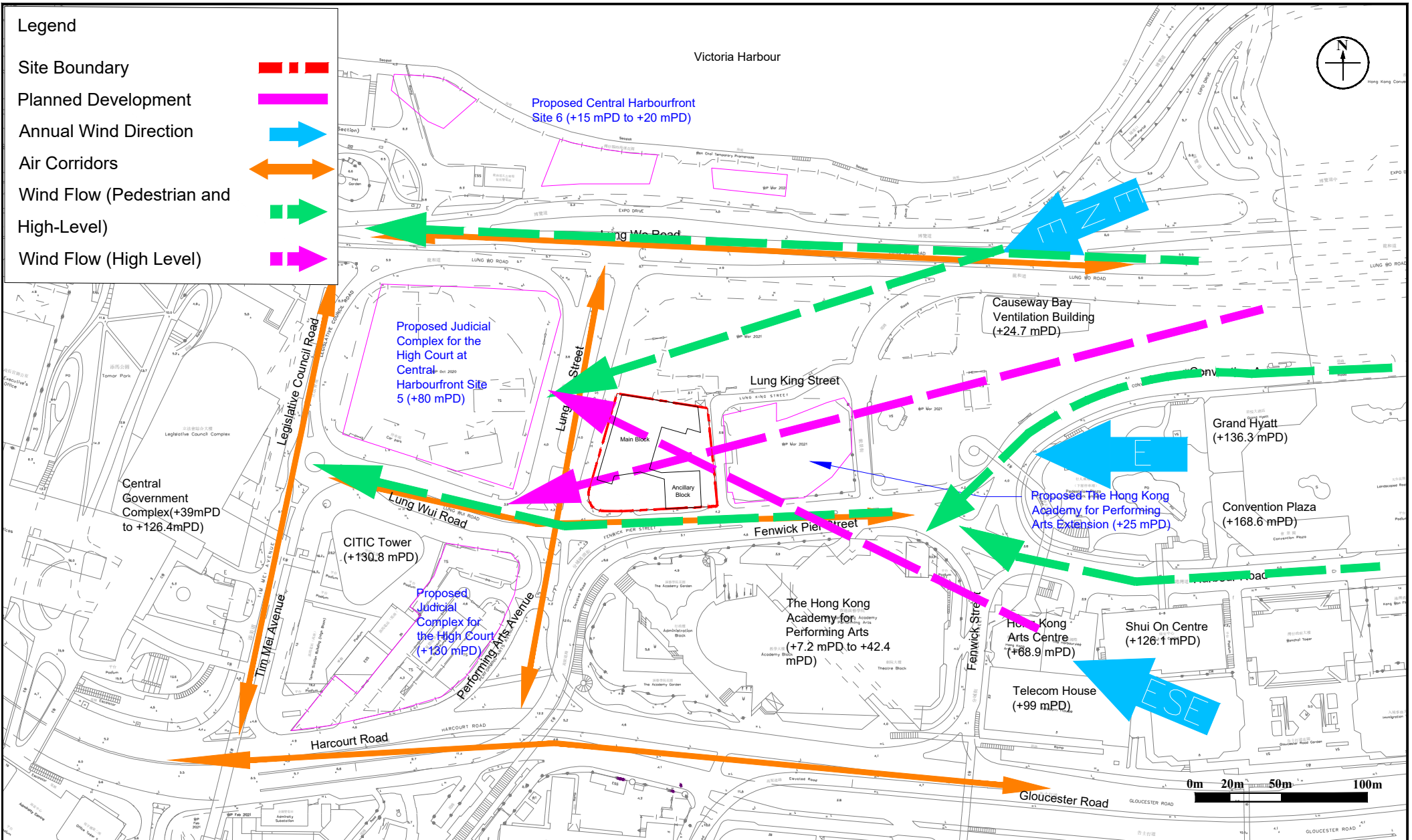


Figure: 11

Title: Illustration of Annual Wind Flow for Proposed Development

Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Re-provisioning of Kong Wan Fire Station

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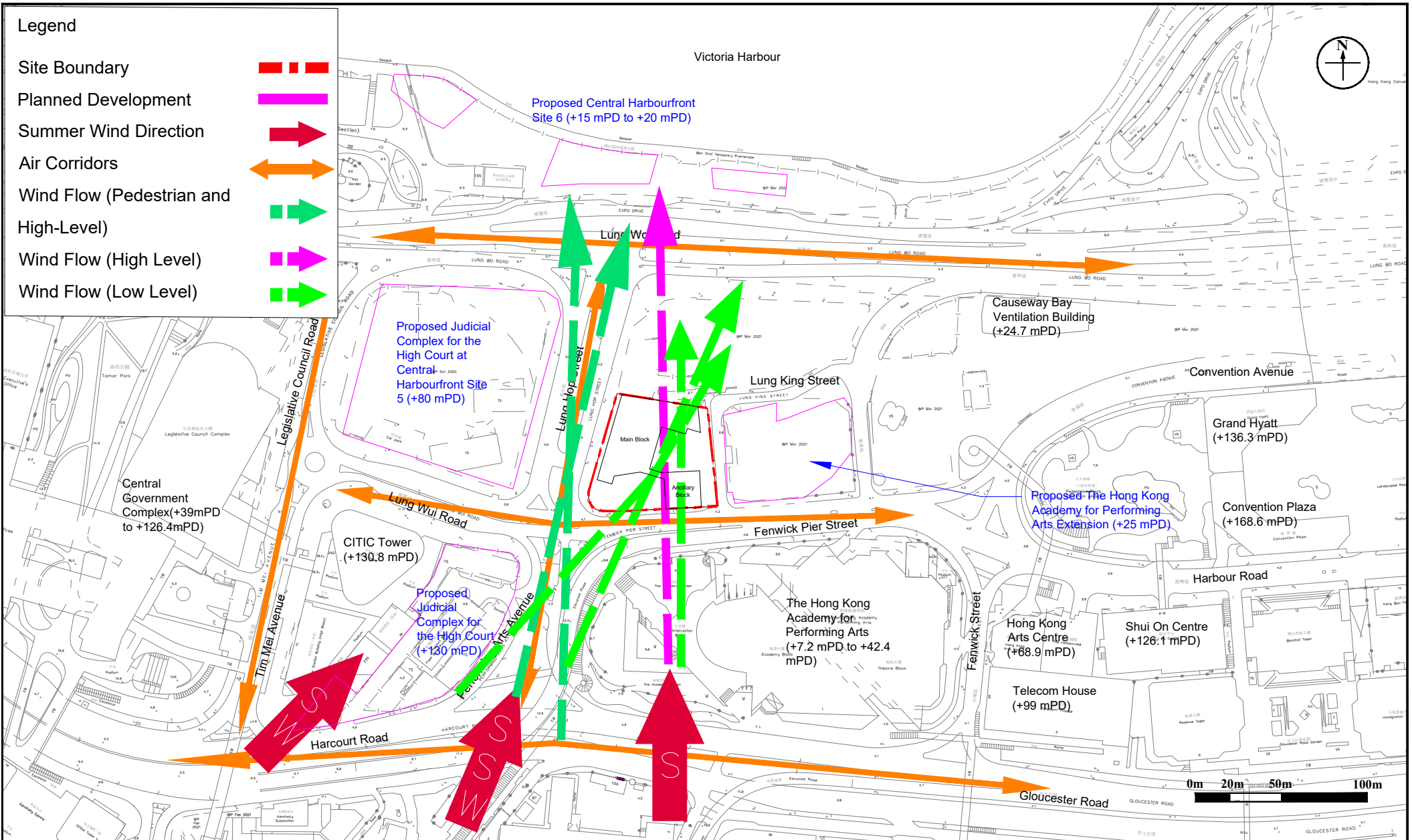


Figure: 12

Title: Illustration of Summer Wind Flow for Proposed Development

Project: Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Re-provisioning of Kong Wan Fire Station

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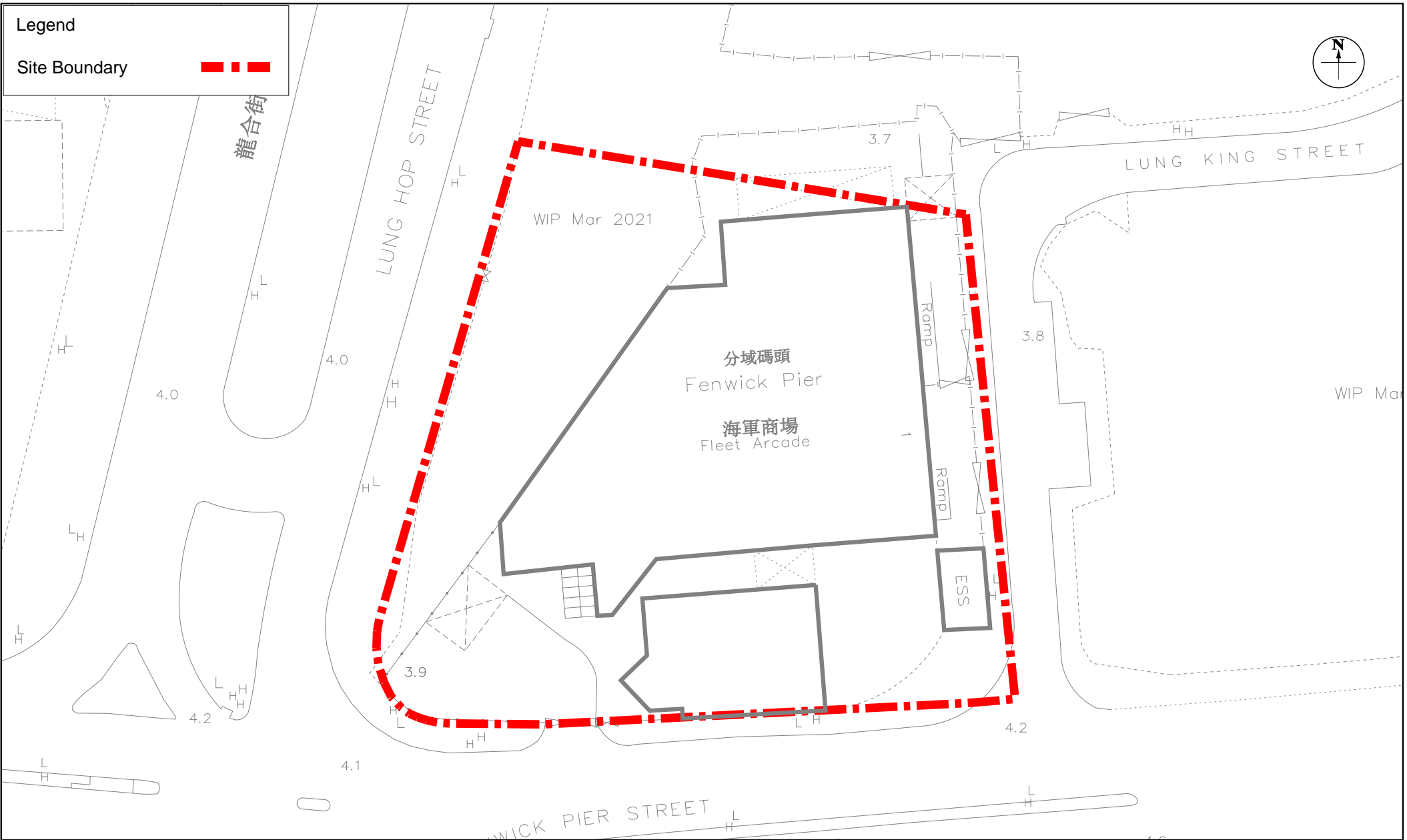
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Appendix 1

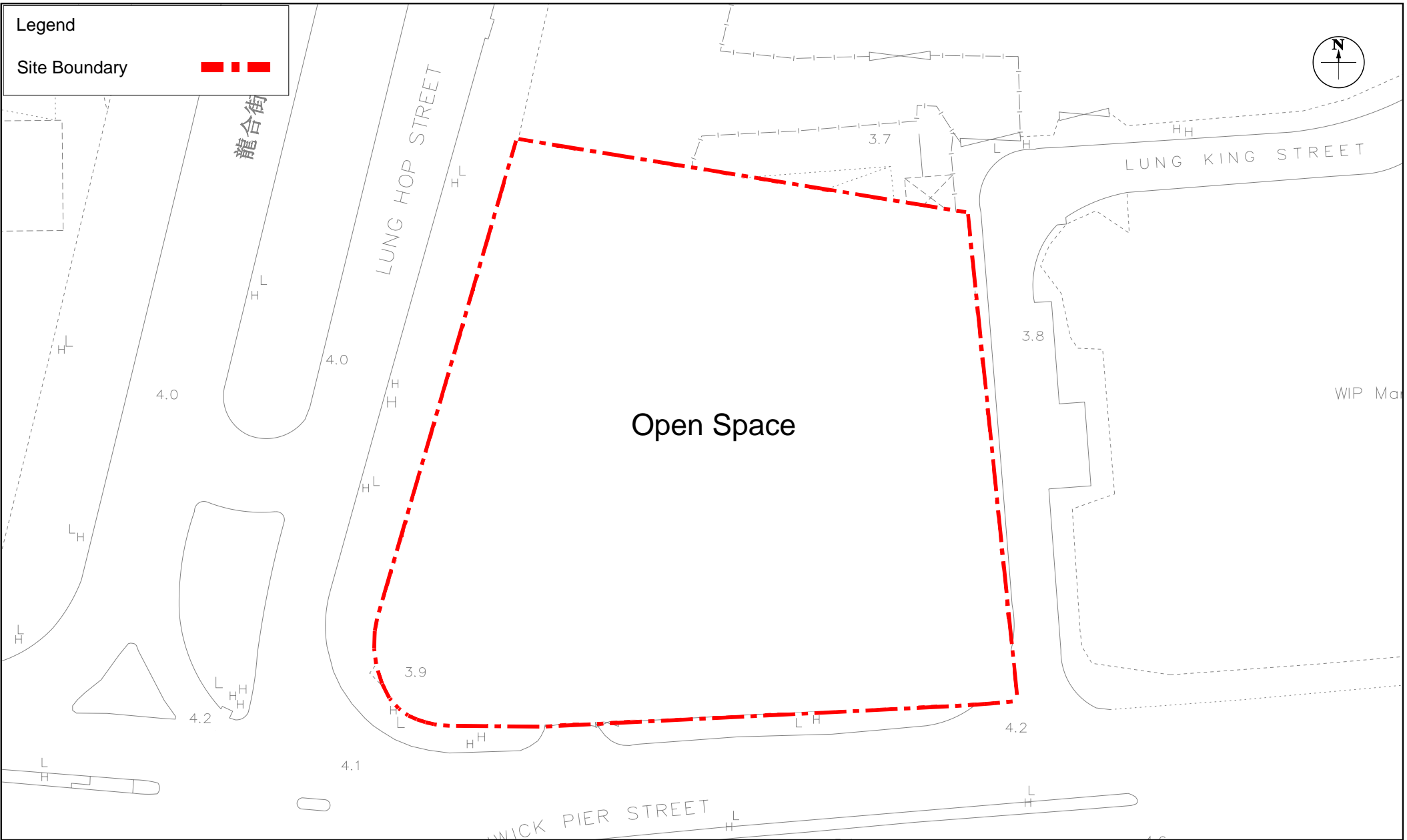
Layout Plan of the Existing Development



Appendix: 1	RAMBOLL	
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	Project:	Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station
	Date:	Jan 2021

Appendix 2

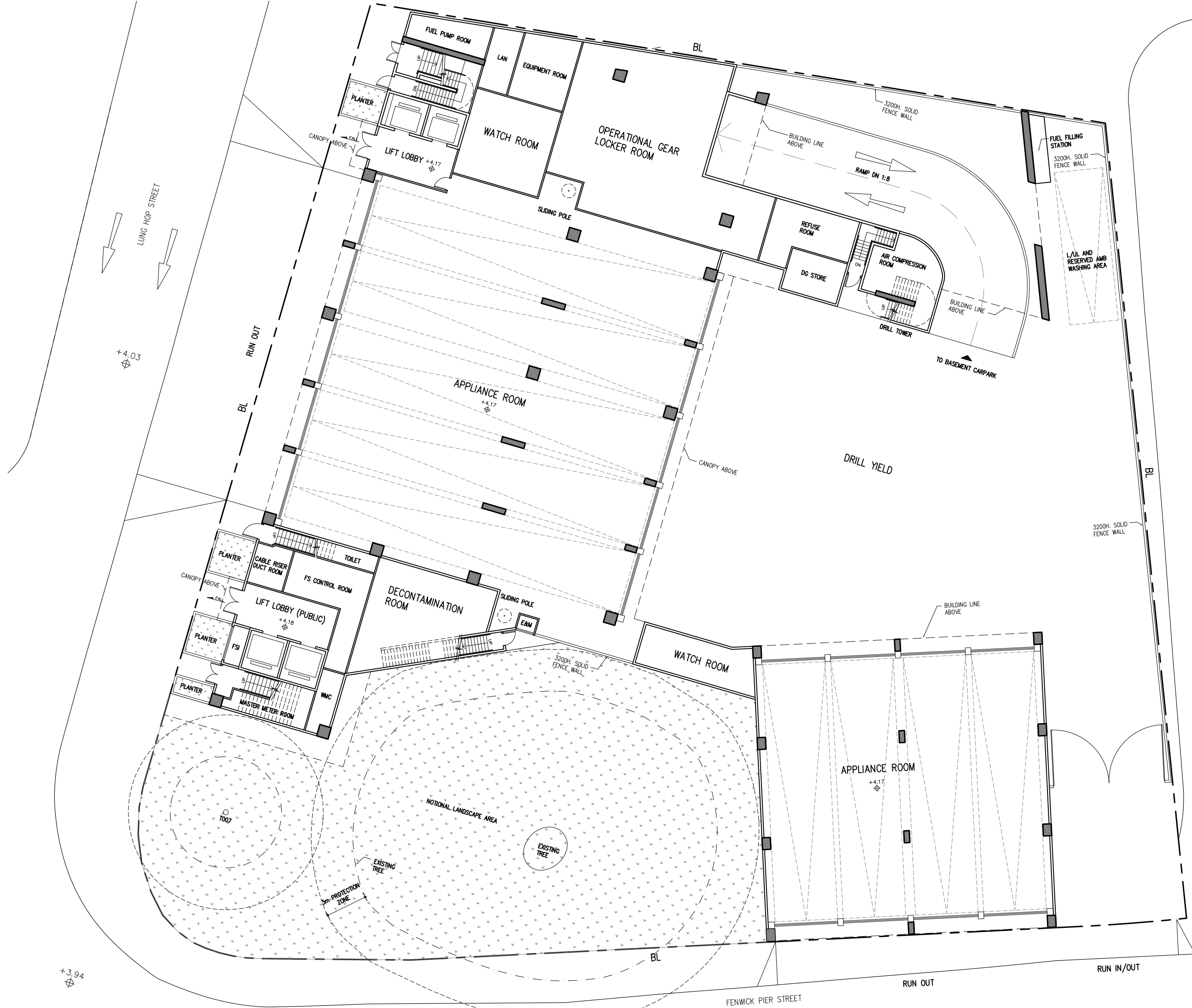
Layout Plan of the Baseline Scheme



Appendix: 2	RAMBOLL	
	Title:	Layout of the OZP-Compliant Scheme
	Project:	Planning Application, Hypothetical Study, Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station
	Date:	Jan 2021

Appendix 3

Layout Plan of the Proposed Development



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PROJECT :
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 Harbourfront Study and Heritage Evaluation
 for Reprovisioning of Kong Wan Fire Station
 (Programme No. 179BF)

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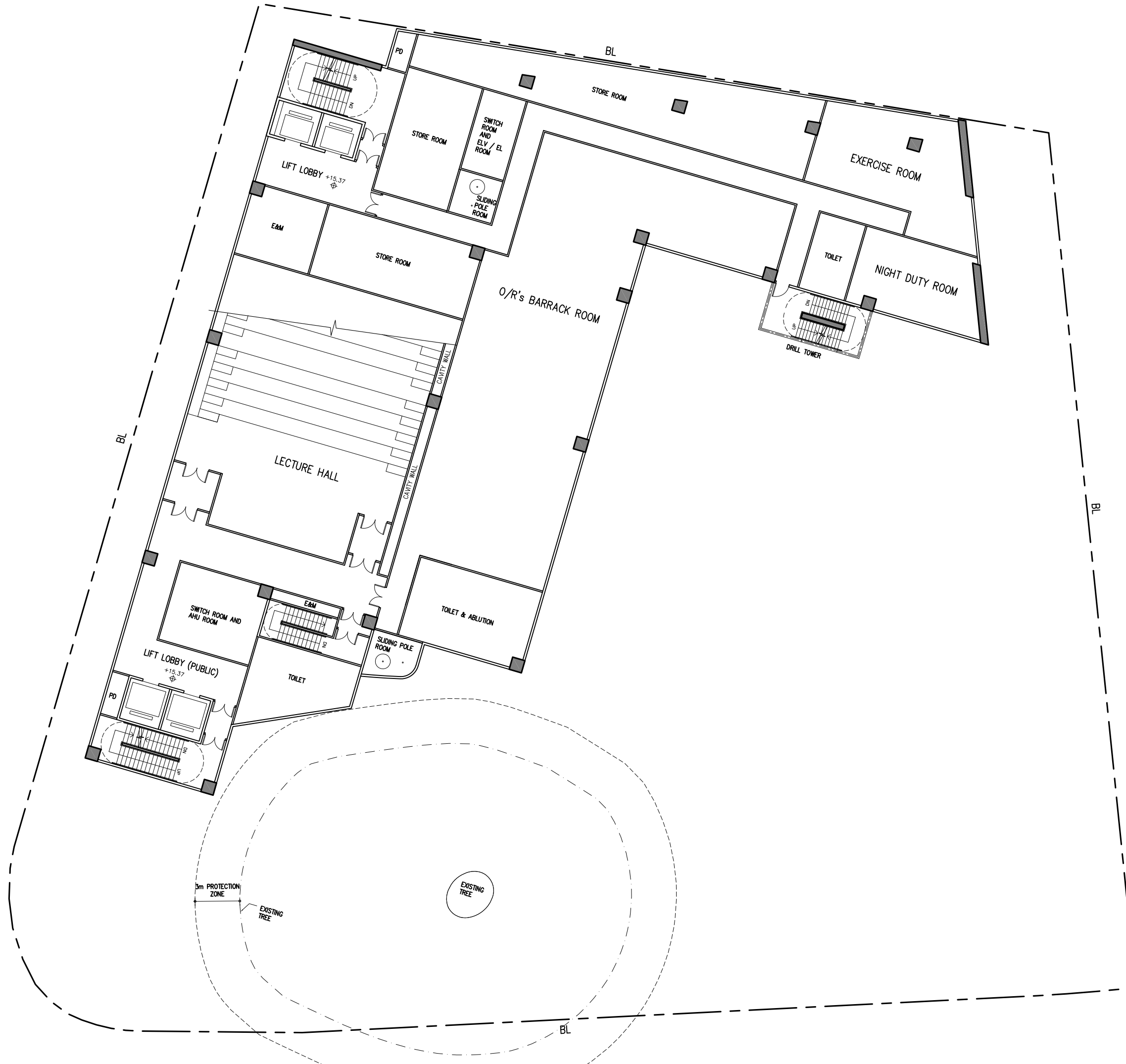
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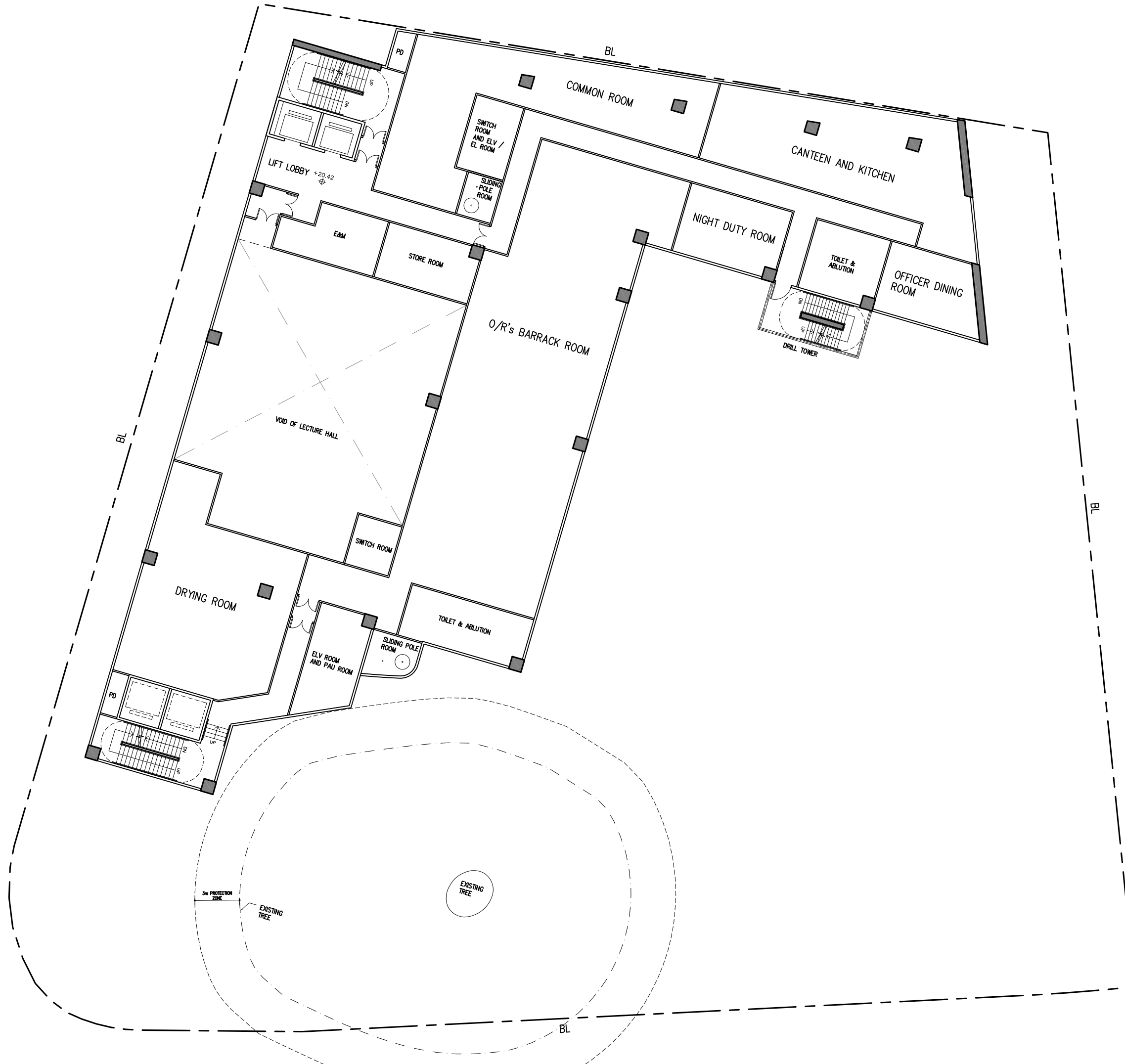
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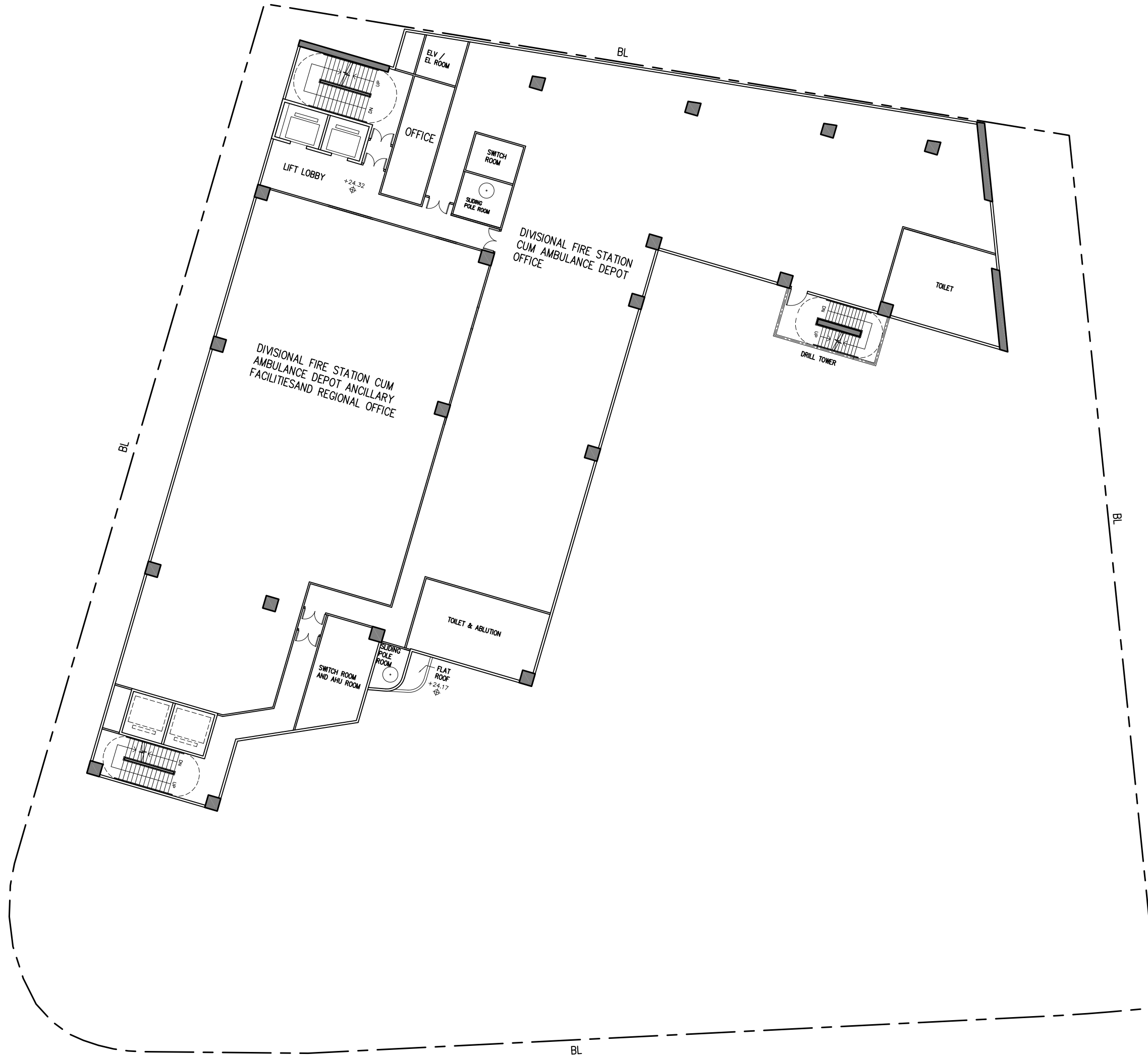
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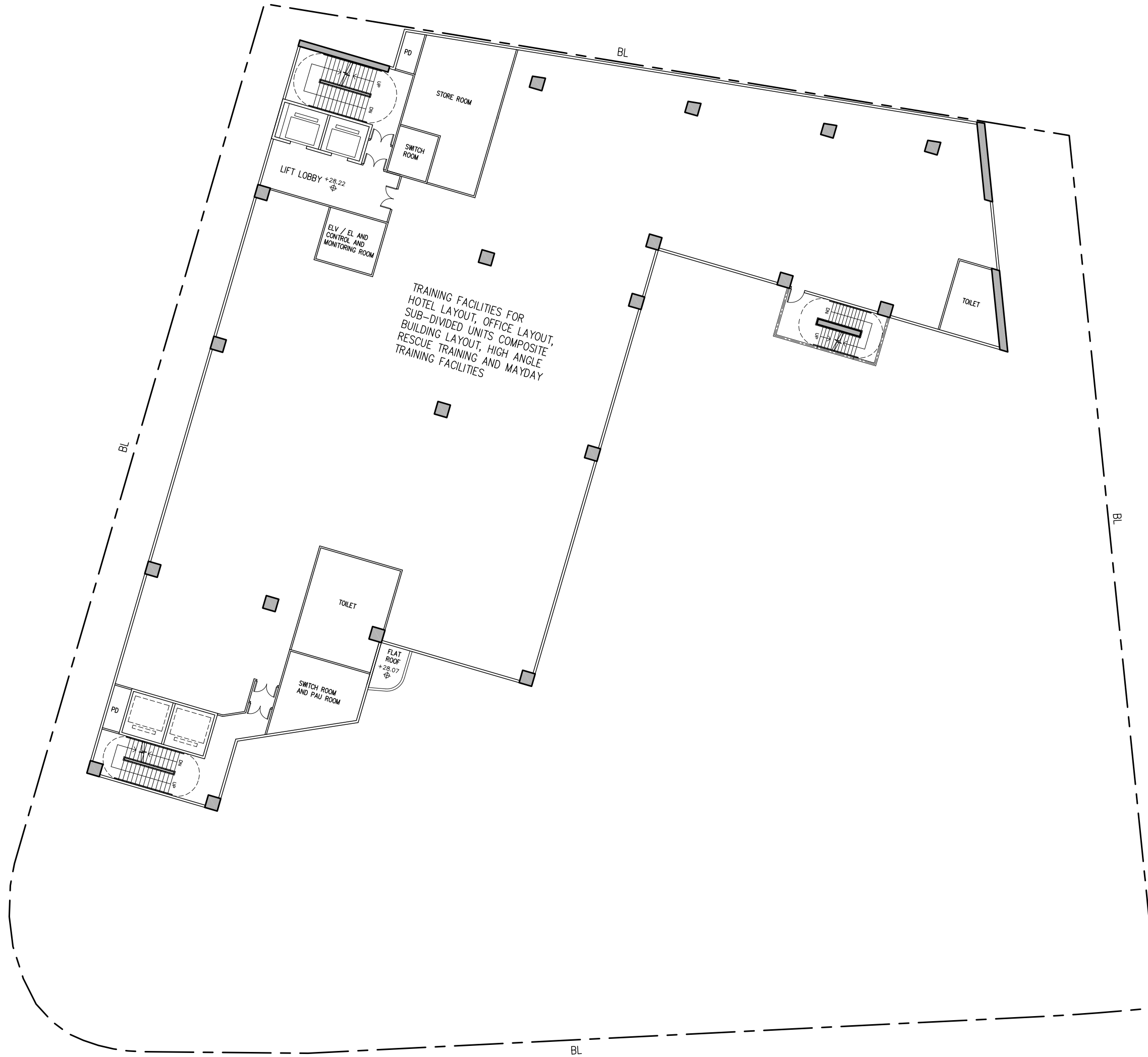
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PROJECT :
 Quotation Contract No. 002/21/PMB203
 Harbourfront Study and Heritage Evaluation
 for Re-provisioning of Kong Wan Fire Station
 (Programme No. 179BF)

DRAWING TITLE :
 4/F PLAN

SCALE :	PROJECT NO. :
1:250 @A3	2111
DRAWN BY :	DATE :
HY	11-2021
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TW	112111.dwg
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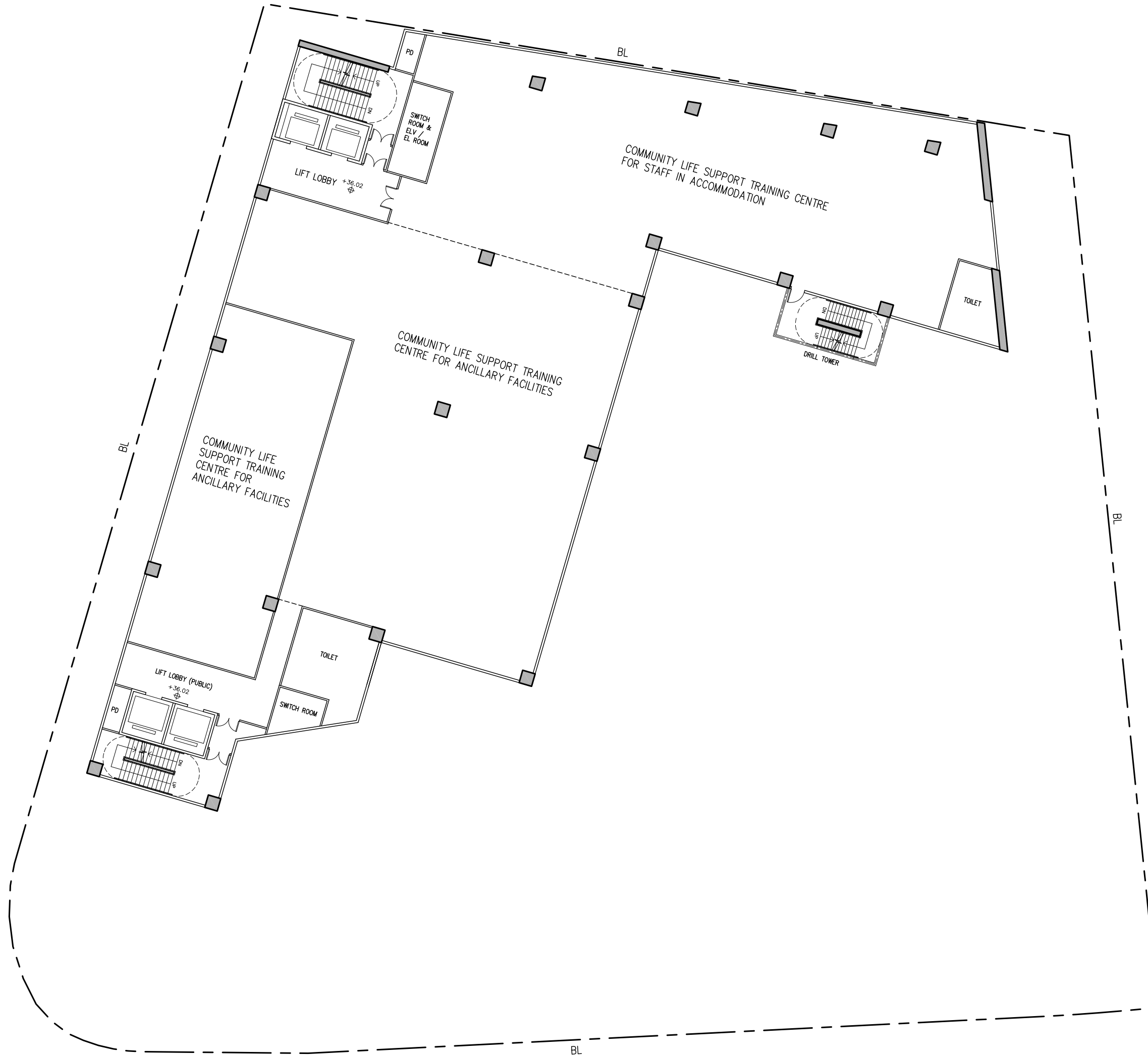
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PROJECT :
 Quotation Contract No. 002/21/PMB203
 Harbourfront Study and Heritage Evaluation for Re-provisioning of Kong Wan Fire Station (Programme No. 179BF)

DRAWING TITLE :
 5/F PLAN

SCALE :	1:250 @A3	PROJECT NO. :	2111
DRAWN BY :	HY	DATE :	11-2021
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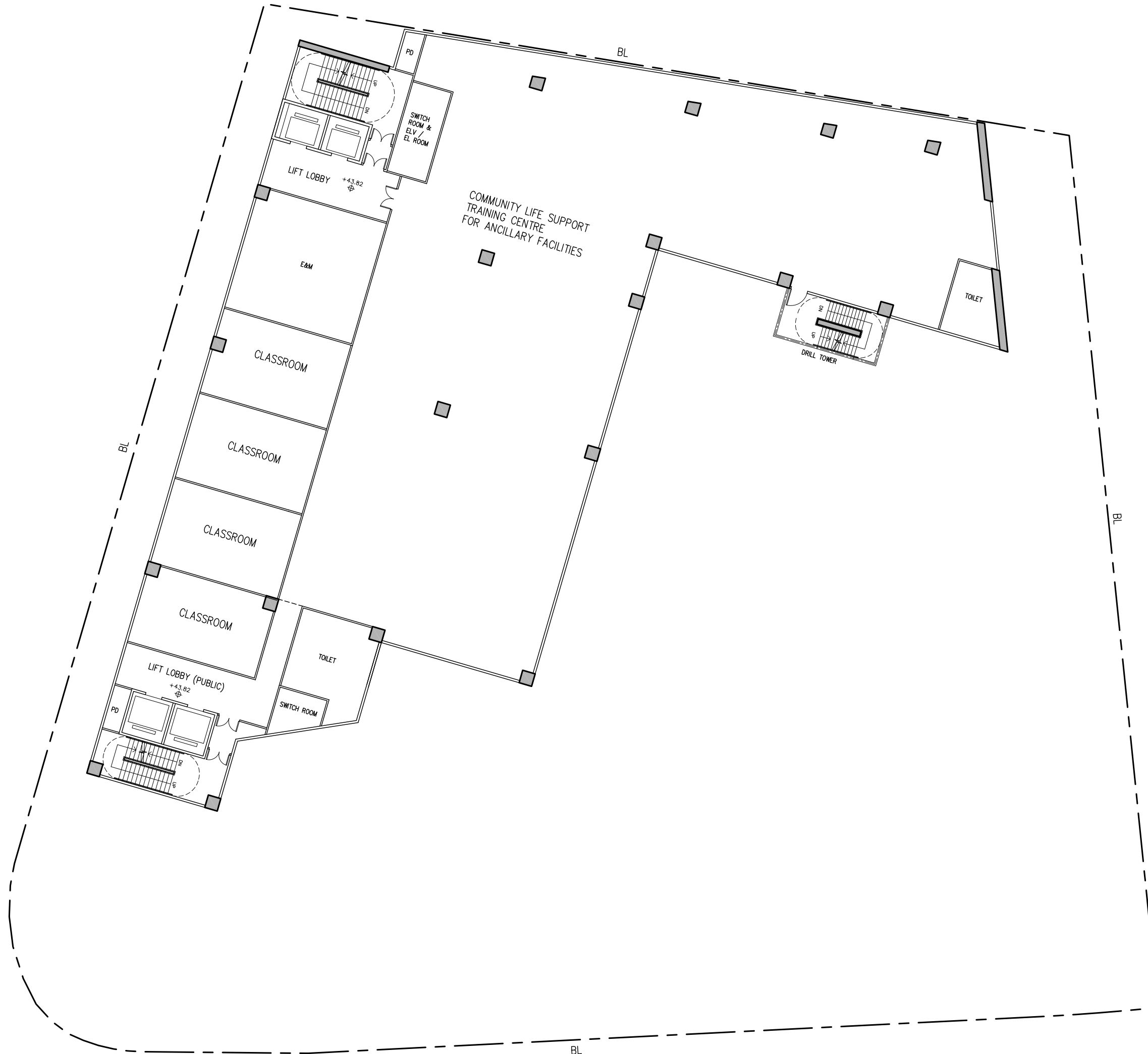
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PROJECT :
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 Harbourfront Study and Heritage Evaluation
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 (Programme No. 179BF)

DRAWING TITLE :
 6/F PLAN

SCALE :	1:250 @A3	PROJECT NO. :	2111
DRAWN BY :	HY	DATE :	11-2021
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APPROVED BY :	DH	DRAWING NO. :	2111-S16-2-108 A



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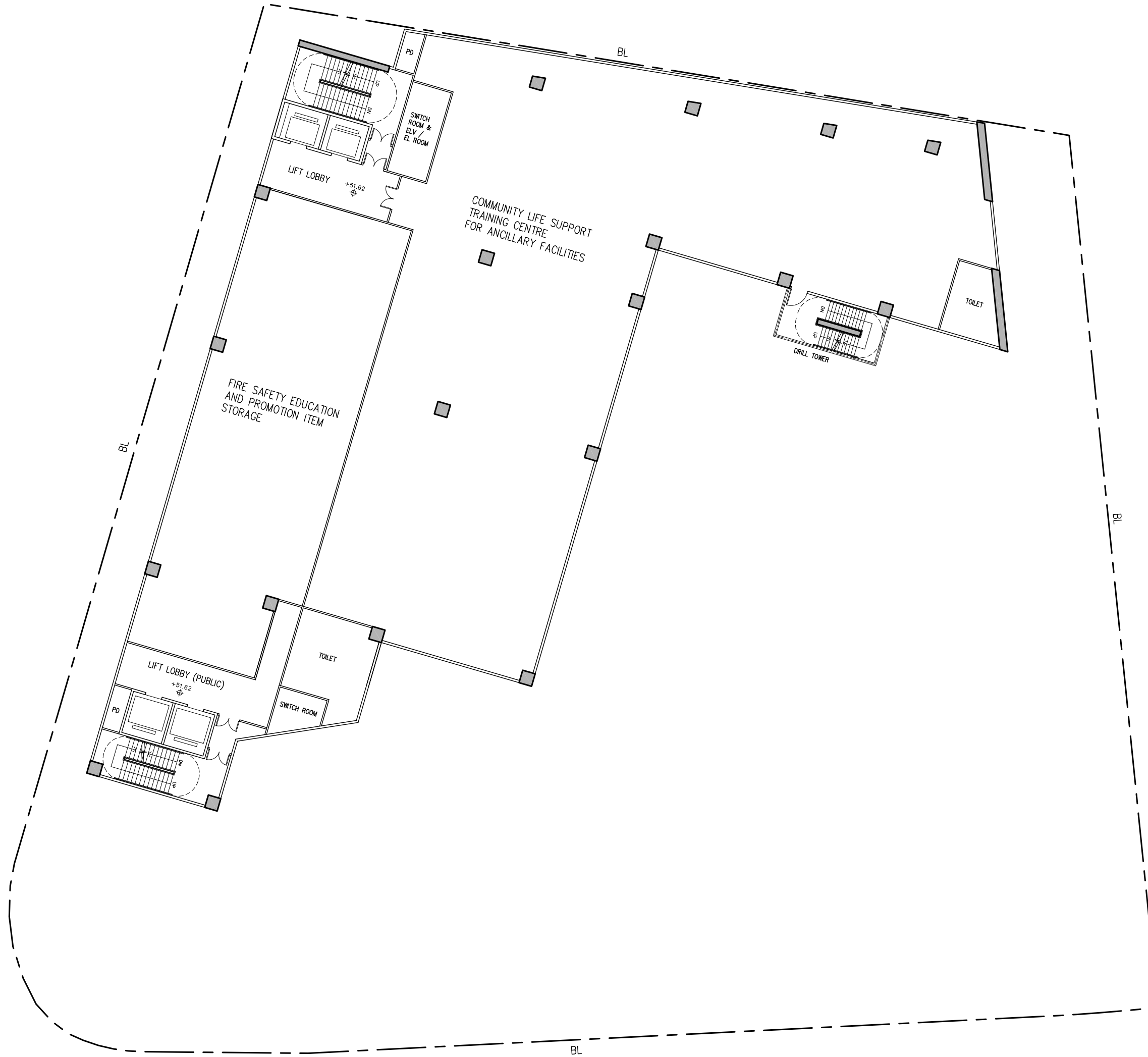
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PROJECT :
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 Harbourfront Study and Heritage Evaluation for Re-provisioning of Kong Wan Fire Station (Programme No. 179BF)

DRAWING TITLE :
 7/F PLAN

SCALE :	1:250 @A3	PROJECT NO. :	2111
DRAWN BY :	HY	DATE :	11-2021
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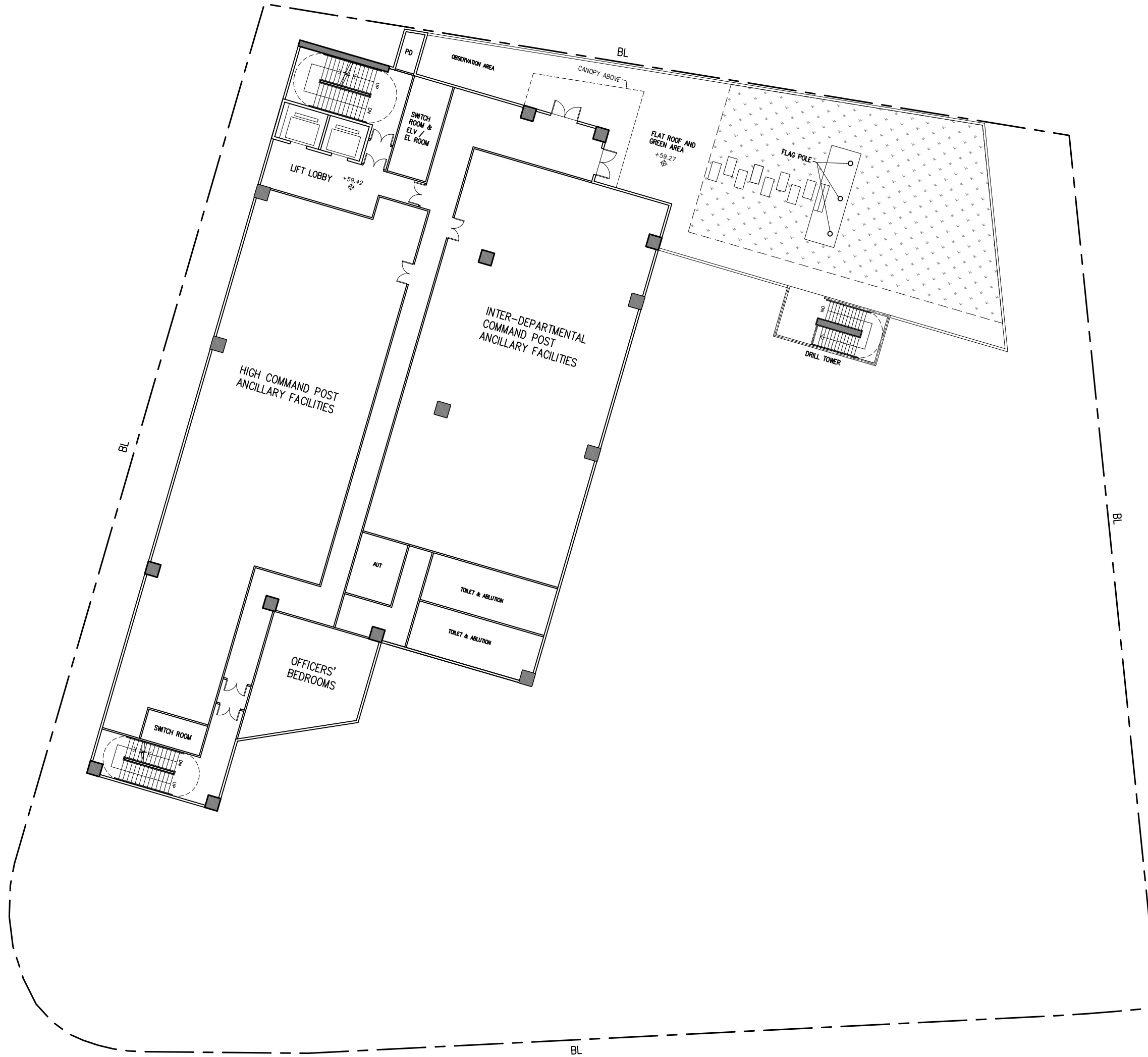
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PROJECT :
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 Harbourfront Study and Heritage Evaluation for Reprovisioning of Kong Wan Fire Station (Programme No. 179BF)

DRAWING TITLE :
 8/F PLAN

SCALE :	1:250 @A3	PROJECT NO. :	2111
DRAWN BY :	HY	DATE :	11-2021
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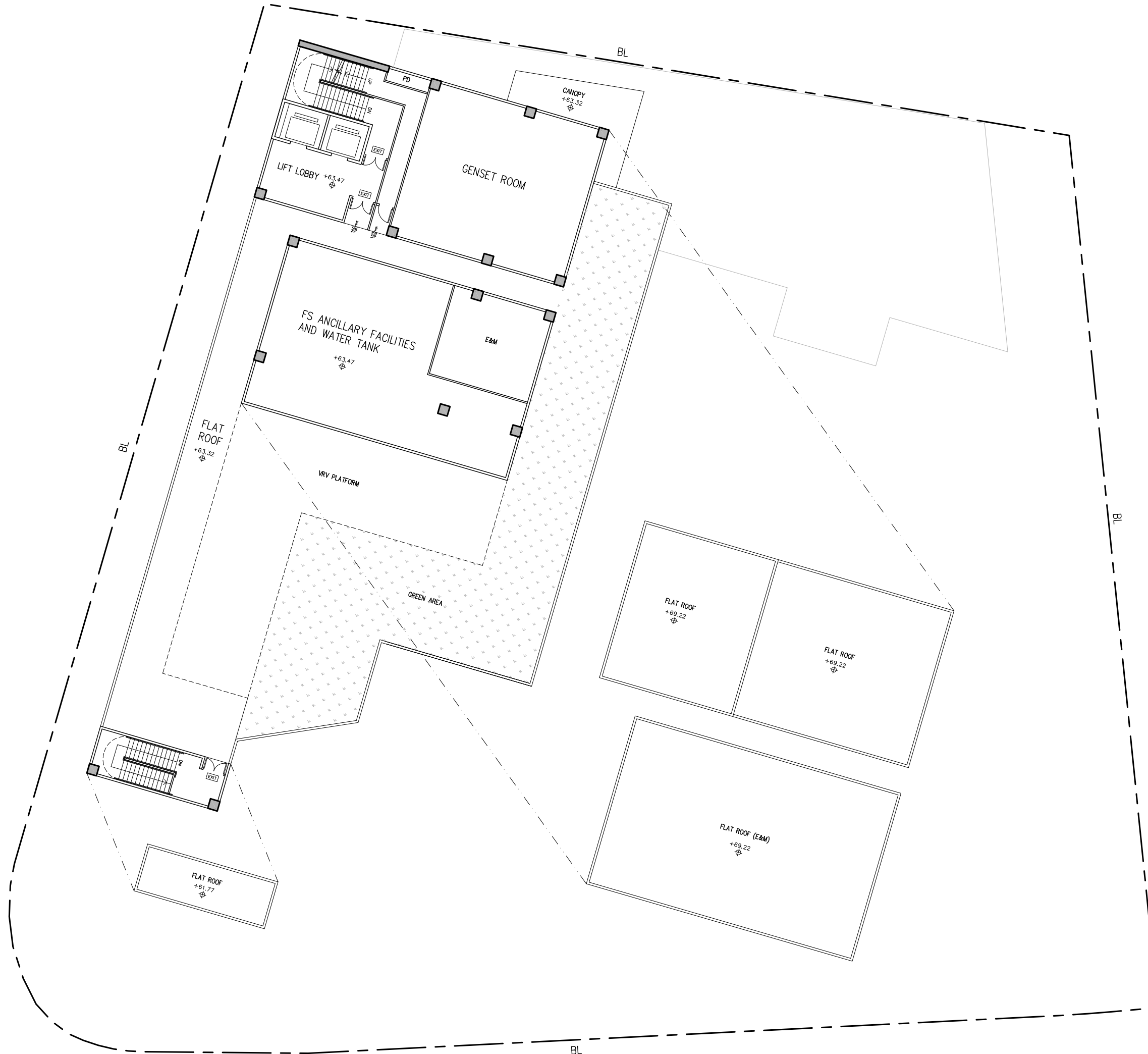
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PROJECT :
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 Harbourfront Study and Heritage Evaluation
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 (Programme No. 179BF)

DRAWING TITLE :
 9/F PLAN

SCALE :	1:250 @A3	PROJECT NO. :	2111
DRAWN BY :	HY	DATE :	11-2021
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-	SECTION 16 SUBMISSION	26/11/2021	TW	DH
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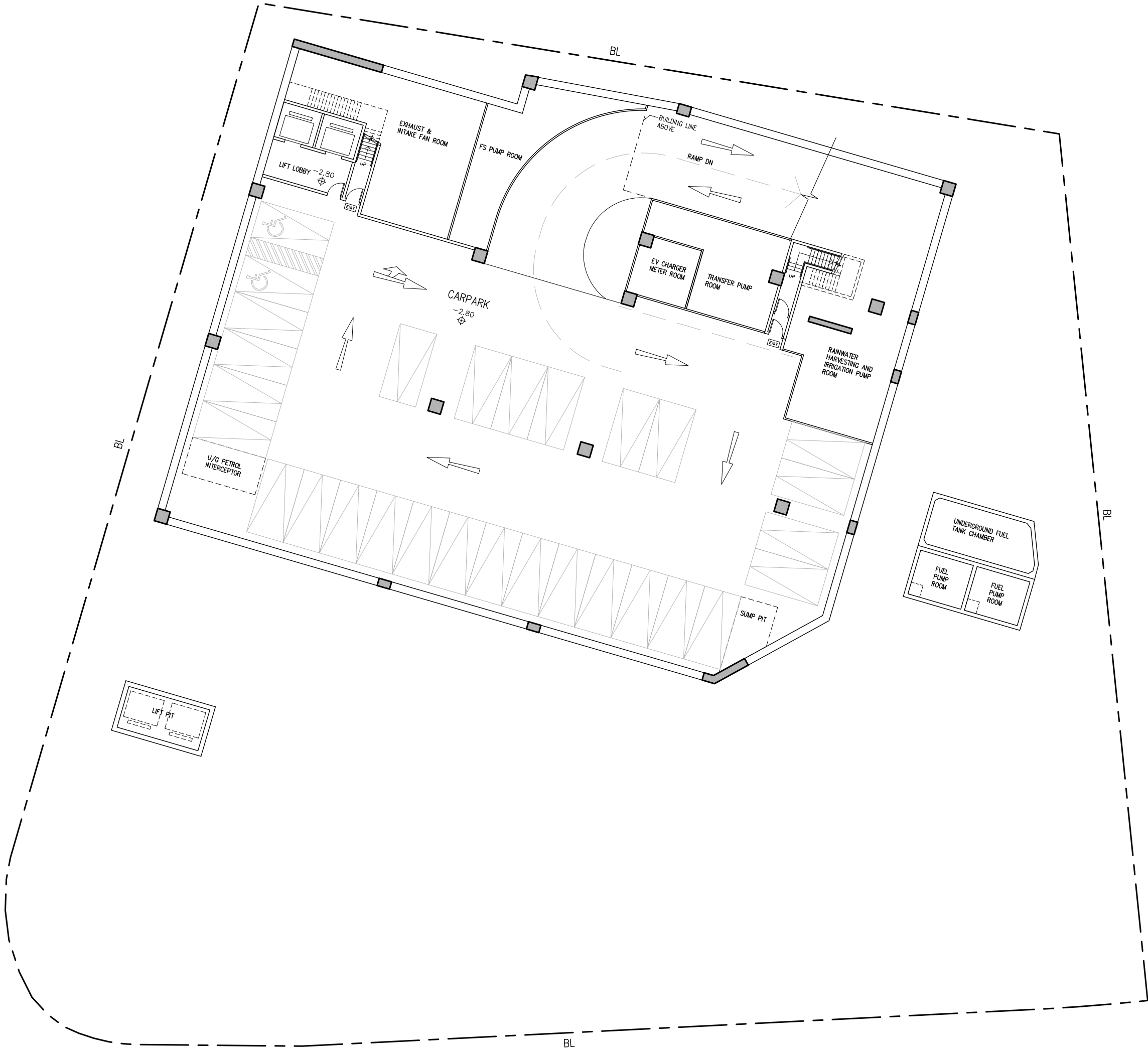
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PROJECT :
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DRAWING TITLE :
 ROOF PLAN

SCALE :	1:250 @A3	PROJECT NO. :	2111
DRAWN BY :	HY	DATE :	11-2021
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C	AMENDMENT ACCORDING TO ArchSD's COMMENTS	6/8 2021	TW	DH
B	AMENDMENT ACCORDING TO ArchSD's COMMENTS	5/7 2021	TW	DH
A	GENERAL AMENDMENT	7/6 2021	TW	DH
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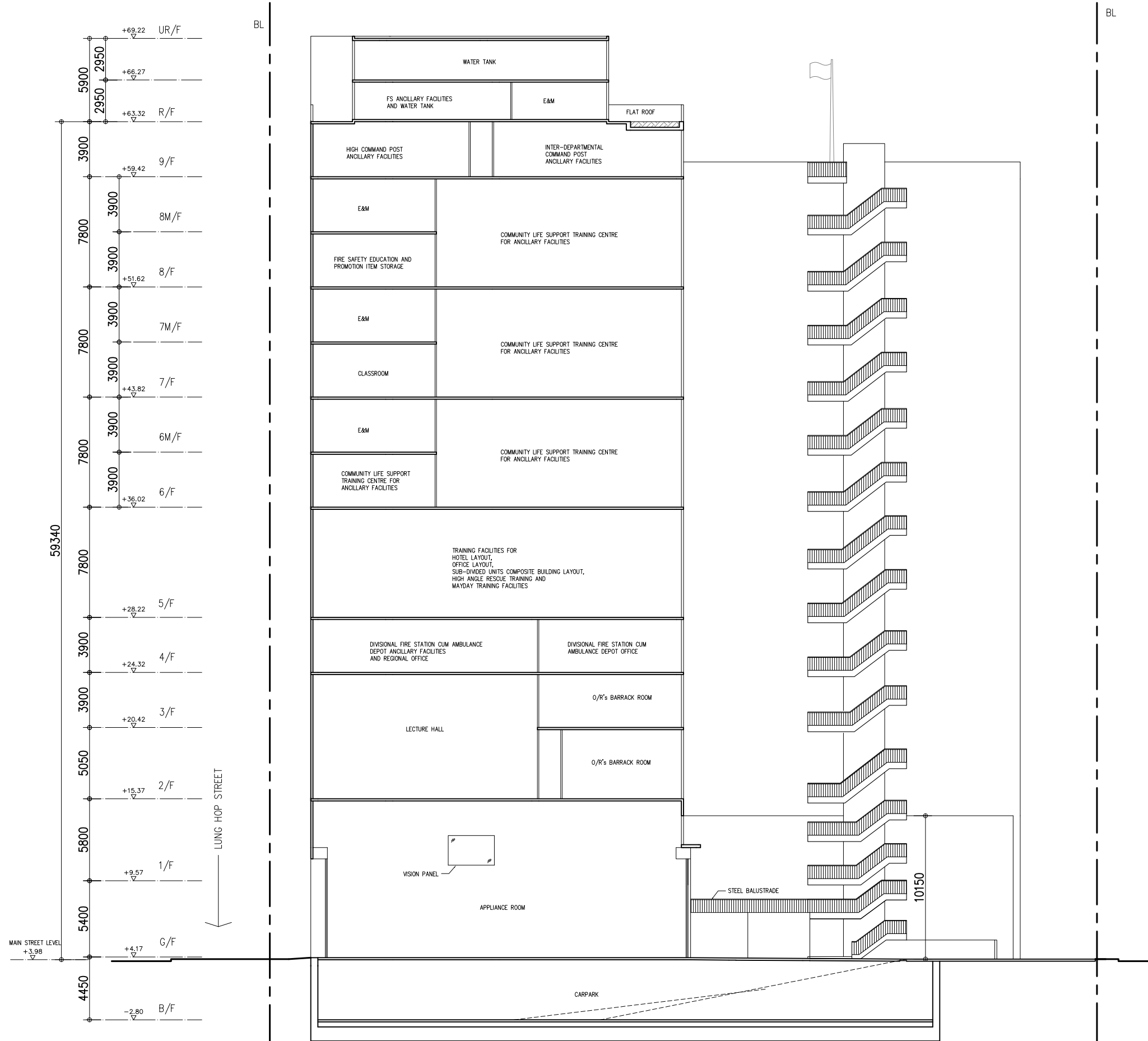
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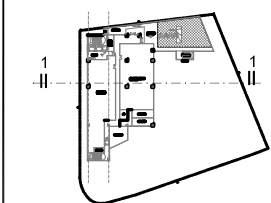
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 BASEMENT FLOOR PLAN

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A	SECTION 16 SUBMISSION	1/26/2022	TW	DH
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DRAWING TITLE :
 SCHEMATIC SECTION 1-1

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1:300 @A3	2111
DRAWN BY :	DATE :
HY	11-2021
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TW	I:\2111\002_179BF\Drawing\Current_working\002_179BF_Schematic_S1.dwg
APPROVED BY :	DRAWING NO. :
DH	2111-S16-2-301 A