Appendix 7

Drainage Impact Assessment

Prepared for

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PROPOSED MINOR RELAXATION OF PLOT RATIO (PR) AND SITE COVERAGE (SC) FOR PROPOSED SOCIAL WELFARE FACILITY (RESIDENTIAL CARE HOME FOR THE ELDERLY) (RCHE(S)), TRAINING CENTRE WITH RESIDENTIAL INSTITUTION AND PERMITTED RESIDENTIAL DEVELOPMENT (FLAT) IN LOT 94 IN D.D. 388 AND ADJOINING GOVERNMENT LAND, CASTLE PEAK ROAD – TSING LUNG TAU, TSUEN WAN

DRAINAGE IMPACT ASSESSMENT

Date	**July 2024**
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Project Reference	**CCGCPRAFEI00**
Document No.	**R8290_v2.0**

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CHAPTERS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Project Background

1.1.1 The Application Site is zoned "Residential (Group B)" ("R(B)") under the Approved Tsuen Wan West Outline Zoning Plan (No. S/TWW/21) with building height restriction of 60 mPD. It is also the subject of a previous planning application (No. A/TWW/122) for proposed minor relaxation of PR from 2.1 to 2.52 for a permitted residential development, which was approved with conditions by the Town Planning Board (TPB) on 12 Aug 2022.

1.1.2 The Government has launched the enhanced Incentive Scheme to Encourage Provision of Residential Care Homes for the Elderly (RCHEs) in New Private Developments – Time-limited Enhancements (LandsD's Practice Note Issue No. 5/2023). Echoing the incentive scheme, the applicant has now proposed a composite development which contains both private residential use and RCHE.

1.1.3 Ramboll Hong Kong Limited (Ramboll) was responsible for the previous planning application (No. A/TWW/122) and prepared the drainage impact assessment report (DIAR) as one of the technical supporting documents. Ramboll has been appointed to update the DIAR with respect to the current proposal (including private residential use and RCHE) and latest guidelines (e.g. latest corrigendum) to address the drainage impact and demonstrate the acceptability of the proposal.

1.1.4 Architectural drawings and technical information of the development are provided by the applicant and its project architect.

1.2 Project Location and Environ

1.2.1 The Application Site was formerly occupied by an Acid Factory which was already demolished. Currently, the Application Site is a vacant land and most of the area is covered by vegetations.

1.2.2 The Application Site is bounded by Castle Peak Road (Tsing Lung Tau) on southern side. It is surrounded by Vale Villa – Hong Kong Garden to the north, Hong Kong Garden to the west and Hong Kong Garden Commercial Complex (shopping mall) to the east. Seashore is on the opposite side of Castle Peak Road at over 40m apart.

1.2.3 The surrounding is dominated by existing residential development and associated facilities (e.g. shopping mall of the residential development). A vacant site is located to the further north for G/IC uses.

1.2.4 The location of the Application Site and its surrounding environs are shown in **Figure 1**.

1.3 Proposed Development

1.3.1 The Proposed Development consists of a RCHE and a residential tower with maximum building height of 60mPD. There is also 1 basement floor to cater for car parking area for RCHE, residential and visitor uses.

1.3.2 The tentative completion year is 2032.

1.3.3 The scheme of the Proposed Development is shown in **Appendix 1**. With reference to the scheme, tentatively 20% of the Application Site area will be provided as the greenery area (i.e. one of blue-green drainage infrastructure) which can reduce surface runoff, so as to relieve the increasing pressure on the drainage system due to development and ensure sustainable development in Hong Kong in face of climate-change.

2. DRAINAGE IMPACT ASSESSMENT

2.1 Scope of Work

2.1.1 The aim of this DIA is to assess whether the capacity of the existing drainage network serving the Application Site is sufficient to cope with the stormwater runoff from the proposed development. Drainage Record Plans were referred to the Geoinfo Map for the purpose of this DIA.

2.2 Assessment Criteria and Methodology

2.2.1 The assessment standard complies with Drainage Services Department (DSD) Stormwater Drainage Manual (SDM) (2018 Edition) and corrigendum no. 01/2022, 01/2024 and 02/2024. The Application Site is situated next to and would be connected to the drainage system which is equivalent to an urban drainage trunk system, at least 1 in 200 years return period should be assessed. To take into account the effect of climate change, the runoff is marked up by 16% in accordance with Table 28 of SDM and corrigendum.

2.2.2 The catchment runoff has been calculated using the "Rational Method", as outlined in the DSD SDM:

$$Q = 0.278\, C\, i\, A$$

Where Q = peak runoff in m^3/s

C = runoff coefficient (dimensionless)

i = rainfall intensity in mm/hr

A = catchment area in km

2.2.3 According to surface characteristics of the catchments, the runoff coefficient for paved area is 0.95, and for unpaved area is 0.35.

2.2.4 The rainfall intensity parameter "i" is dependent on the return period, rainfall duration and the time of concentration of the catchment under consideration. Runoff calculations are included in **Appendix 2.**

2.3 Existing Drainage Condition

2.3.1 According to the Drainage Record Plans obtained from DSD, a series of public drainage system is located to the west to southwest of the Site as indicated in **Figure 2**.

2.3.2 The aforementioned drainage system is mainly used for conveying the runoff from upper catchment. It begins with 2400mm x 2400mm box culvert, connected by a series of double drainpipes with a diameter of 1800mm in between, and ends in a 2400mm x 2600mm U-shaped channel with an outfall to the sea.

2.3.3 Based on the site visit conducted on 7/6/2021 for the DIA and updated survey on 03/07/2024, the site is mainly covered by vegetation and no drainage facilities were observed. Therefore, it is assumed that the existing surface runoff would be collected by the nearby slope channel.

2.4 Identification of Catchment

2.4.1 Catchments A to E as shown on **Figure 3** have been identified as related to drainage system under concern.

2.4.2 Catchment E represents the Site Catchment.

2.4.3 As conservative approach, all catchments are assumed to be fully paved, except Catchment A, which is a natural slope.

2.4.4 The areas and the surface runoff of the identified catchments are detailed in **Table 1**.

Table 1 Summary of Areas and Surface Runoff of the Identified Catchments

Catchment	Area (m^2)	Runoff Coefficient (C)	Runoff (m^3/s) under 1 in 200 years scenario
A	306,445	0.35	**7.166**
B1	700	0.95	**0.047**
B2	1,020	0.95	**0.069**
C	6,060	0.95	**0.409**
D	2,900	0.95	**0.196**
E (Site)	3,210	0.83	**0.195**

2.4.5 The calculated runoff from the above catchments for storm return period of 200 years is shown in **Appendix 2**.

2.5 Effluent from Annual Cleaning of Swimming Pool

2.5.1 An open-air swimming pool and rehab facilities with a volume of 167m^3 and 200m^3 will be constructed as part of the Proposed Development respectively. With reference to the EPD's "*Guidelines to Property Managers for Formulation of their House-rules to Protect the Environment*", the direct effluent from annual cleaning of swimming pool should be discharged to stormwater drain.

2.5.2 As conservative approach, it is assumed that the discharge of the effluent from annual cleaning of swimming pool and rehab facilities would be carried out during the rainy day. Furthermore, it is assumed that the water used for cleaning is equivalent to the volume of the swimming pool and rehab facilities (i.e. 167m^3 and 200m^3).

2.5.3 Given that the open-air swimming pool will be designed in accordance with Cap 132CA Swimming Pools Regulations, the minimum time for completely changing the water by circulating through a filtration system of not less than once every 6 hours. For the covered pool, the minimum time for completely changing the water by circulating through a filtration system of not less than once every 4 hours. Considering the discharge time will be controlled by using the same filtration / recirculation system (but discharged to the stormwater drainage system rather than being recirculated), 6 hours for swimming pool and 4 hours for rehab facilities would be adopted for the effluent of annual cleaning water.

2.5.4 Based on the above assumptions, the flow of annual cleaning water is estimated to be 0.022 m^3 /s (i.e. 167 m^3 / 6 hours for swimming pool and 200 m^3 / 4 hours for rehab facilities) and would be included in the peak flow as shown in **Appendix 2**.

2.6 Proposed Drainage System

2.6.1 Due to the large capacity of the existing drainage system near the Application Site, it is proposed to discharge the Site runoff into the aforementioned drainage system.

2.6.2 Runoff from within the site (Catchment E) and the immediate upstream catchment (Catchment B1) will be collected.

2.6.3 A new drainage layout is proposed as shown in **Figure 2**. A new stormwater terminal manhole (STMH-1) will be constructed at the southwest of the Site. In order to connect to the existing government stormwater manhole SSH4000781, a concrete drainage pipe of 450mmØ with a gradient of 1:100 fall would be constructed.

2.7 Capacity of Proposed Drainage Layout

2.7.1 As shown in **Table 2** below, both the existing drainage pipes and the proposed drainage pipes have sufficient capacity to accommodate for the peak surface runoff based on the return period of 200 years of the Application Site. The detail calculation can be referred to **Appendix 2**.

Table 2 Drainage Capacities of Storm Drains under 200 years Return Period

Manhole		Size, mm	No. of Pipe	Total Runoff (m^3/s)	Capacity (m^3/s)	% of Capacity Used	Remark
From	To						
Proposed Drainage Pipes							
STMH-1	SSH400781	450Ø	1	8.10	0.37	66%	OK
Existing Drainage Pipes							
SSH4000781	SSH4004628	1800Ø	2	8.10	26.61	30%	OK
SSH4004628	SSH4004629	1800Ø	2	8.10	25.34	32%	OK
SSH4004629	SSH4006140	1800Ø	2	8.10	26.48	31%	OK

2.7.2 Under the worst-case scenario with the Proposed Development (i.e. including the effluent form annual cleaning of swimming pool in the peak flow), the usage of the existing and proposed storm drain amounts to not more than 66% of the capacity based on the return period of 200 years. Therefore, there will be no unacceptable drainage impact arising from the worst-case scenario of the Proposed Development

2.7.3 Considering that the further downstream drainage system is a 2000mm x 2000mm box culvert and a 2400mm x 2600mm U-shaped channel, it would have sufficient capacity to convey the runoff from the upstream pipeline. Moreover, in design principal, the downstream pipe would always have sufficient capacity to convey the runoff collected by the upstream pipe. Thus, it is considered that the cumulative runoff would not have adverse impact to the further downstream drainage system (i.e. 2000mm x 2000mm box culvert and 2400mm x 2600mm U-shaped channel) as well

2.7.4 In addition, based on **Table 2**, the runoff generated from the Site is only $0.217m^3/s$ whereas the minimum capacity of the existing drainage pipe is about $25.34m^3/s$, which means that the runoff from the Site contributes to only 1.16% of the pipe capacity. Therefore, the runoff from the Site is not likely to cause adverse impact to the existing public drainage system.

3. OVERALL CONCLUSION

3.1 Proposed Drainage Layout

3.1.1 The proposed development will be provided with greenery amounting to at least 20% of the site area.

3.1.2 A terminal manhole of STMH-1 is proposed to collect the surface runoff from the Application Site as shown in **Figure 2.**

3.1.3 In order to connect between the STMH-1 and existing government stormwater manhole SSH4000781, a concrete drainage pipe of 450mmØ with gradient of at least 1:100 fall is proposed.

3.2 Conclusion

3.2.1 Based on the drainage impact assessment results, the existing and proposed drainage system will have adequate capacity to cater for additional flow from the Application Site after development.

3.2.2 In addition, the runoff generated from the Site is only $0.217m^3/s$ whereas the minimum capacity of the existing drainage system is about $25.34m^3/s$, which means that the runoff from the Site contributes to only 1.16% of the capacity. Therefore, the runoff from the Site is not likely to cause adverse impact to the existing public drainage system.

3.2.3 As shown in **Appendix 1**, there are no building, structure and other permanent obstructions located within the 3m buffer distance from the external wall of the culvert or channel. Thus, the Proposed Development would not cause adverse impact to the existing box culvert.

3.2.4 This DIA confirms the feasibility of the Proposed Development in terms of impacts to the public drainage system.

Figures

Figure: 1

Title: Location of the Subject Site and its Environs

Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

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Date:	Jul 2024

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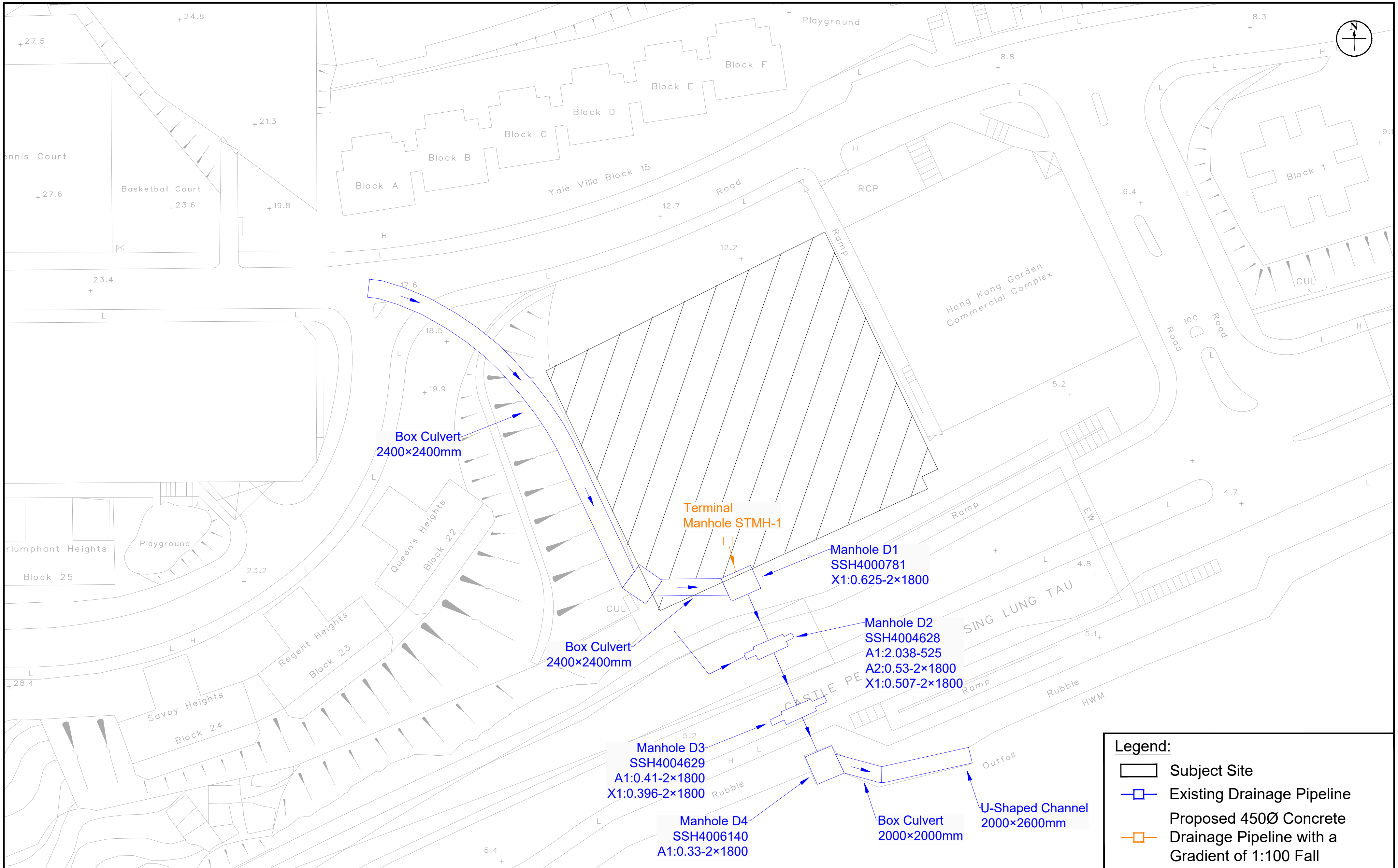

Figure: 2

Title: Existing Drainage System in the Vicinity of the Subject Site and Proposed Drainage Pipeline

Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan

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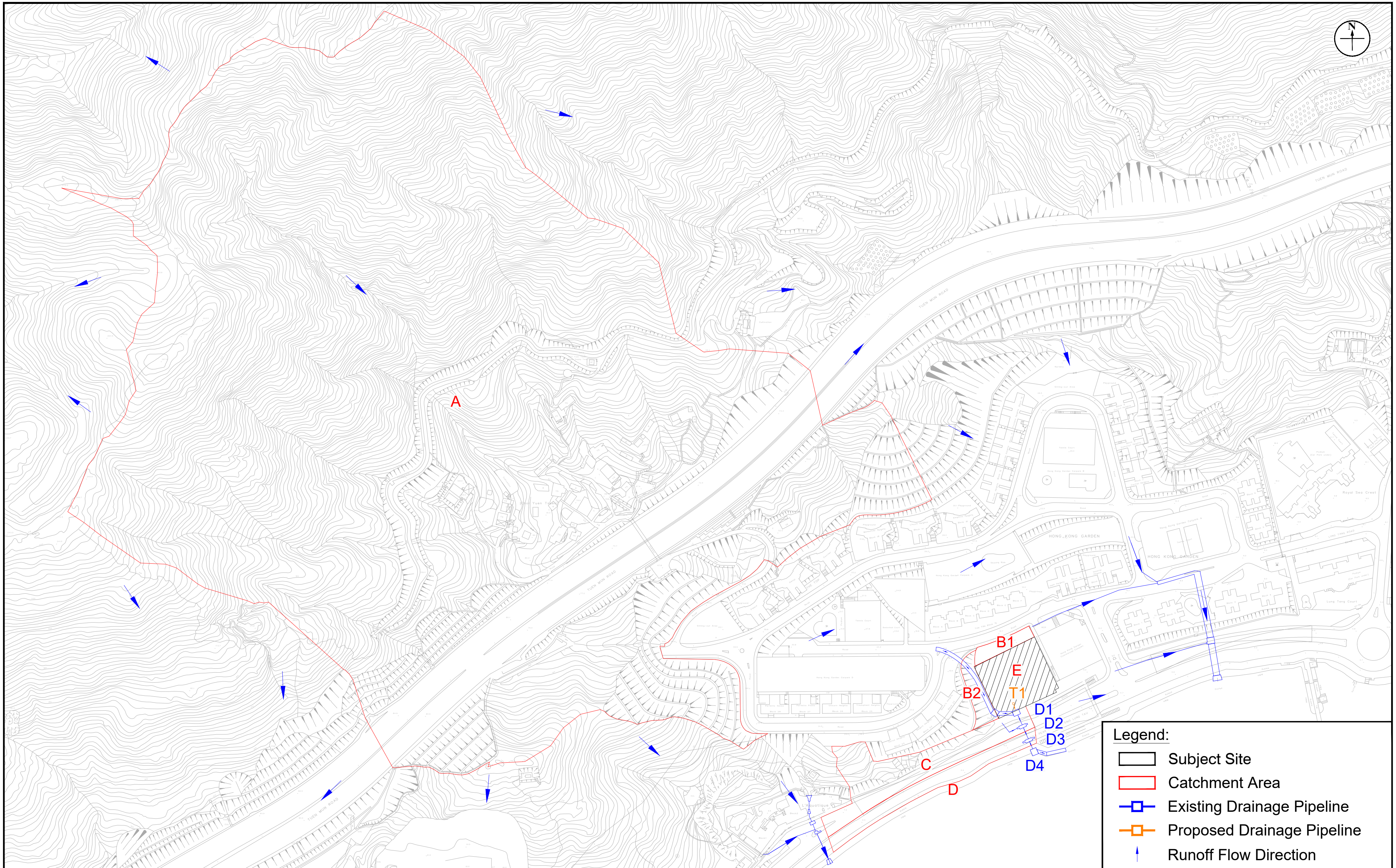

Figure: 3

Title: Existing Drainage System and Catchment Area in the Vicinity of the Subject Site and Proposed Drainage Pipeline

Project: Proposed Minor Relaxation of Plot Ratio (PR) and Site Coverage (SC) for Proposed Social Welfare Facility (Residential Care Home for the Elderly) (RCHE(s)), Training Centre with Residential Institution and Permitted Residential Development (Flat) in Lot 94 in D.D. 388 and adjoining Government land, Castle Peak Road - Tsing Lung Tau, Tsuen Wan n

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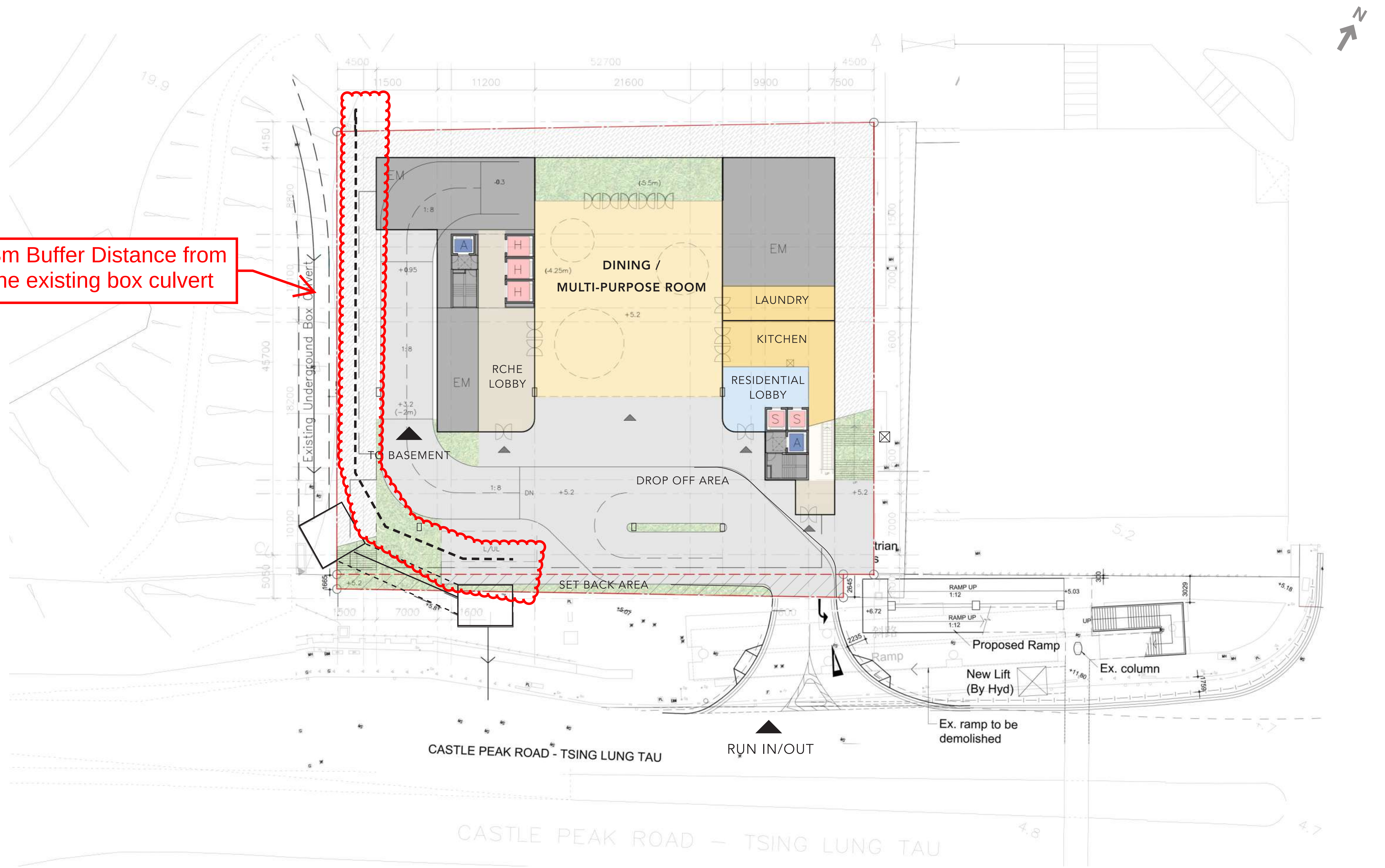
Appendix 1 Indicative MLP of the Proposed Scheme



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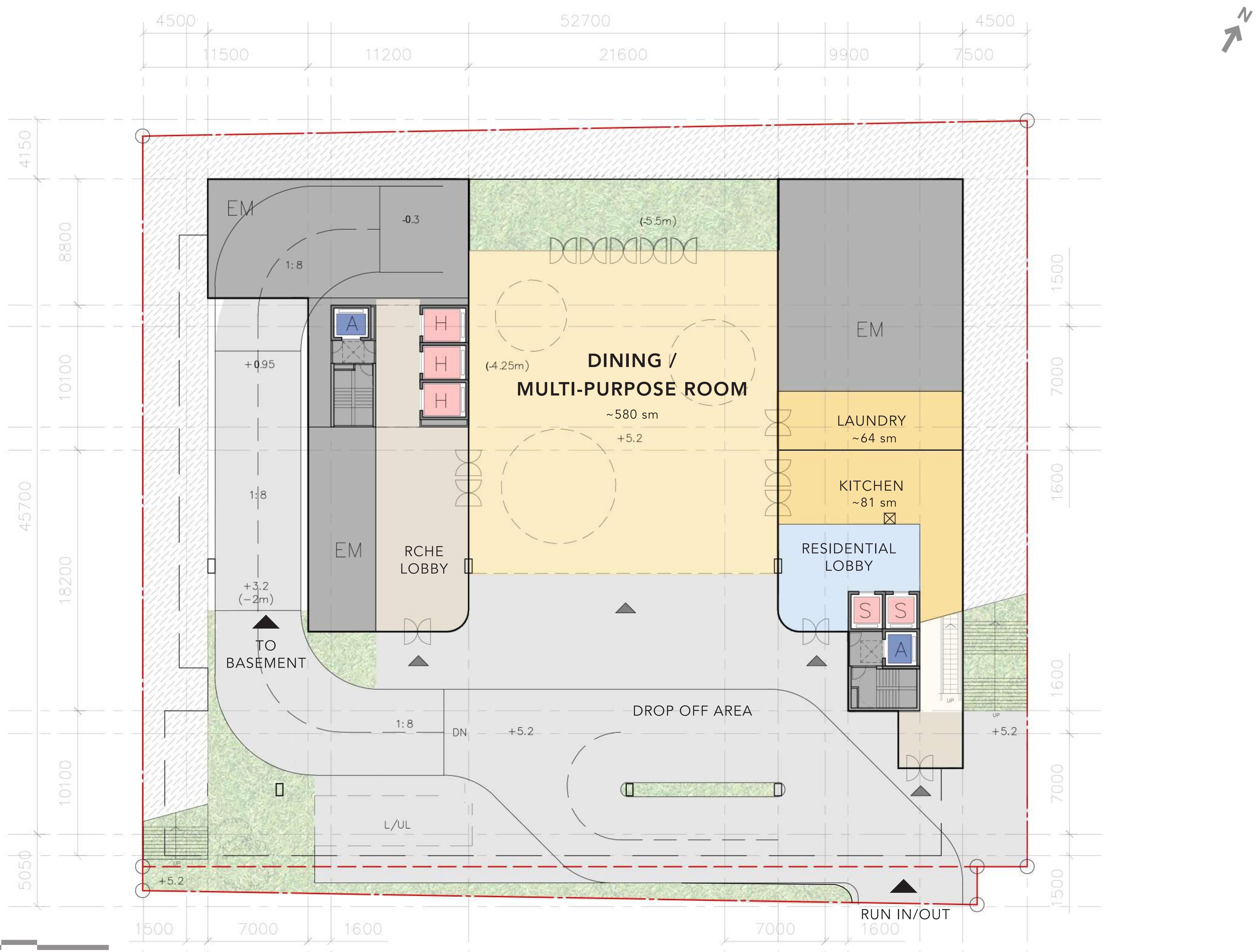

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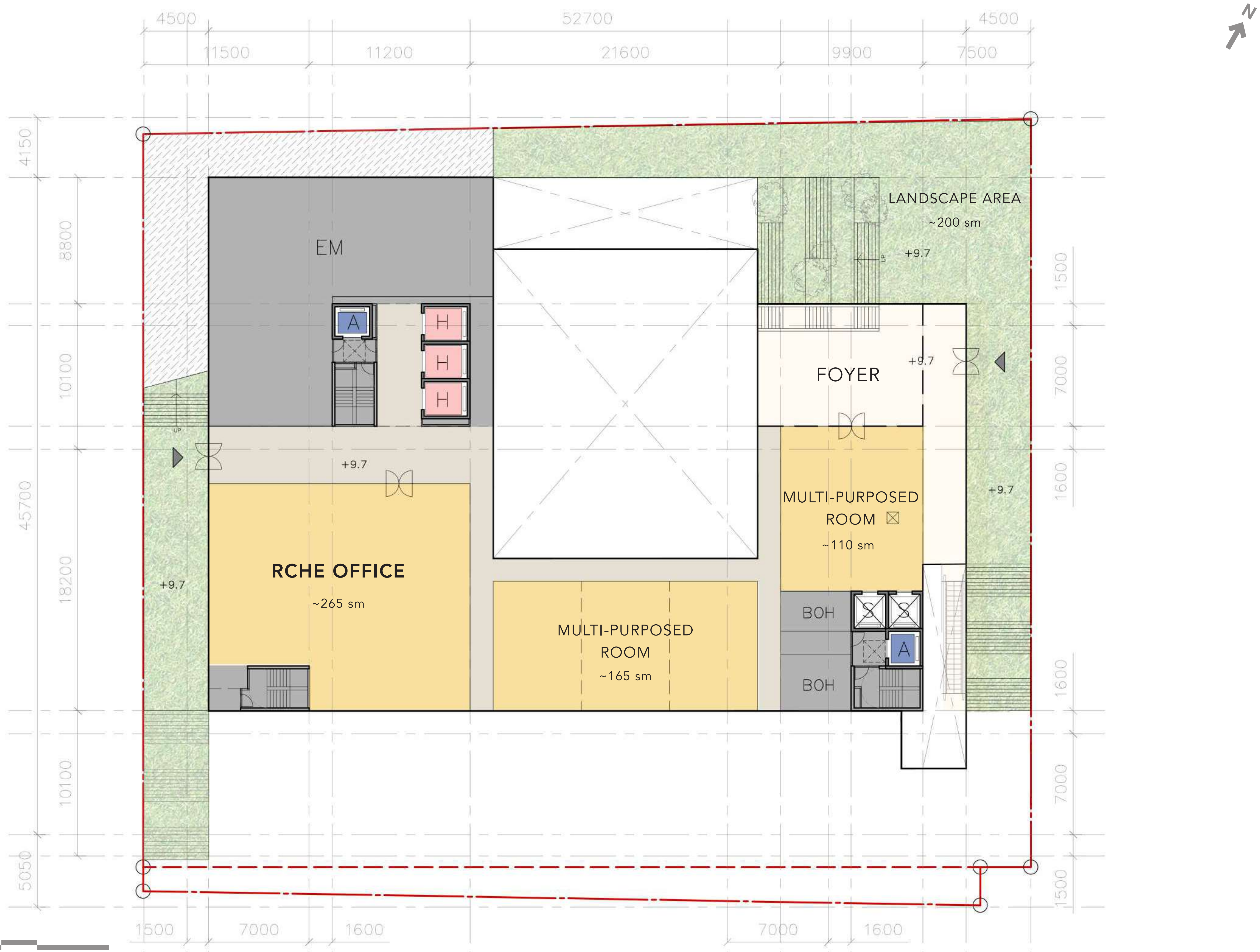

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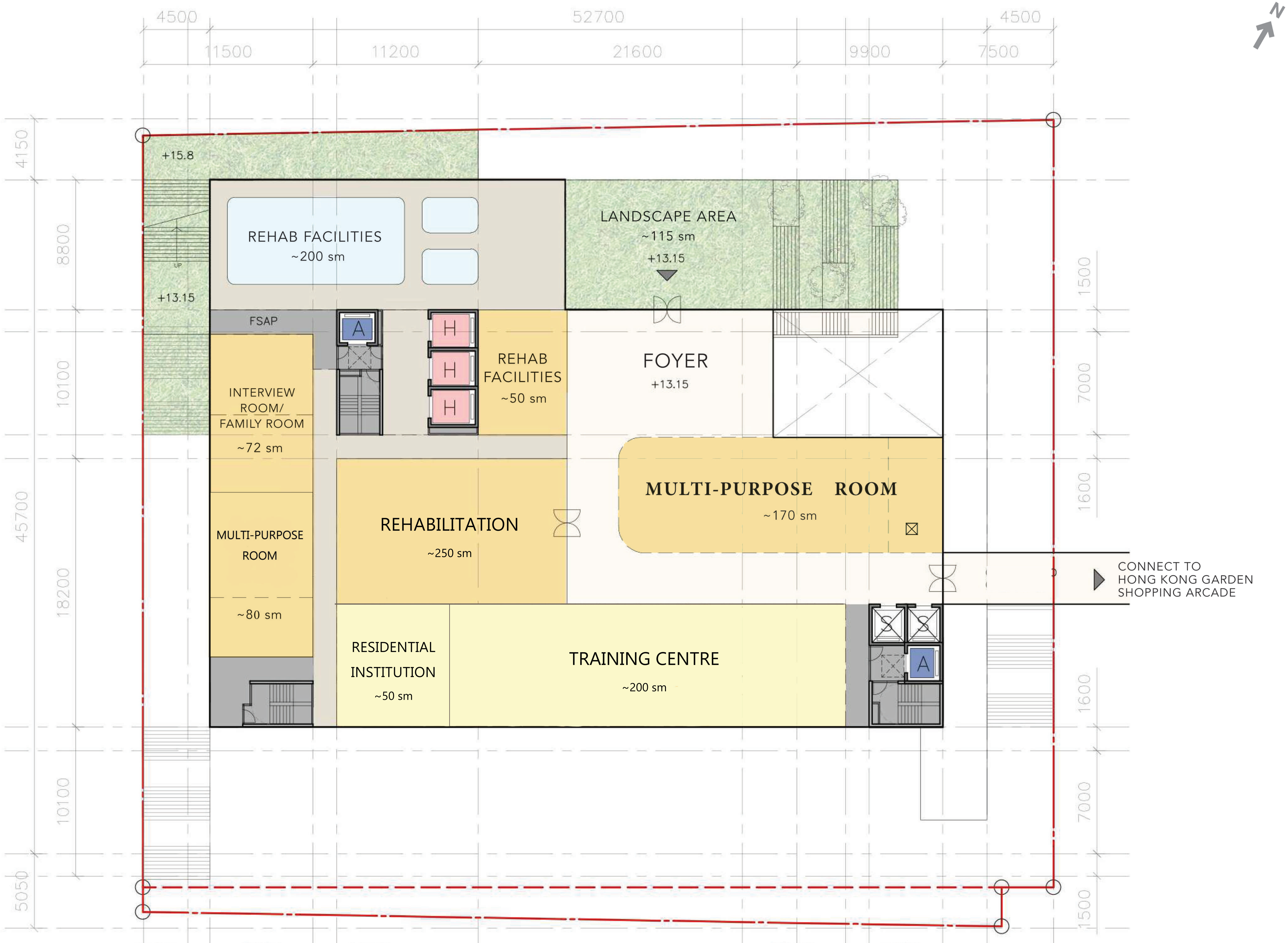

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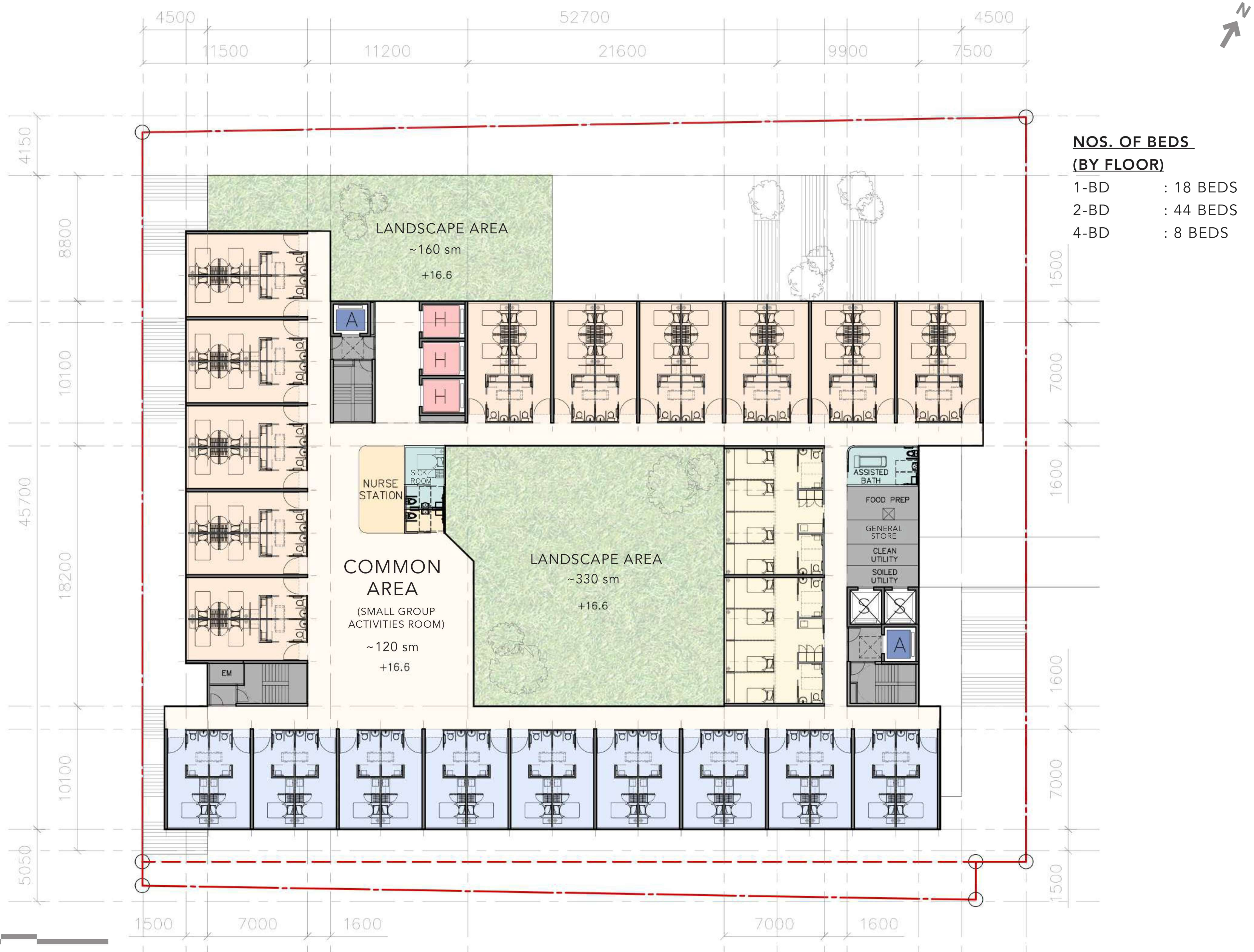

NOS. OF BEDS (BY FLOOR)

1-BD	: 18 BEDS
2-BD	: 44 BEDS
4-BD	: 8 BEDS

3F

1:250 @ A3

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

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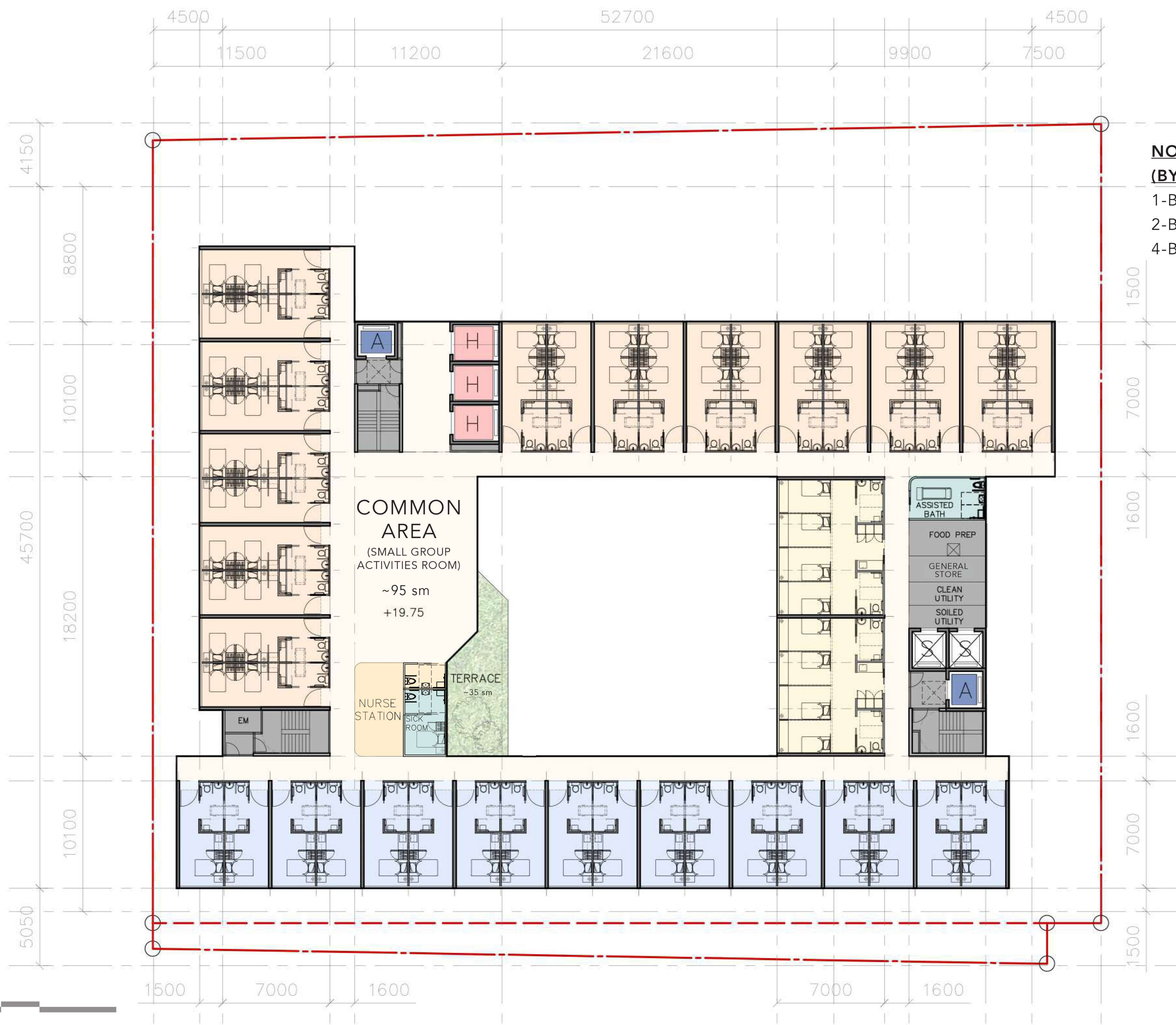

NOS. OF BEDS (BY FLOOR)

1-BD	: 18 BEDS
2-BD	: 44 BEDS
4-BD	: 8 BEDS

4F

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*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

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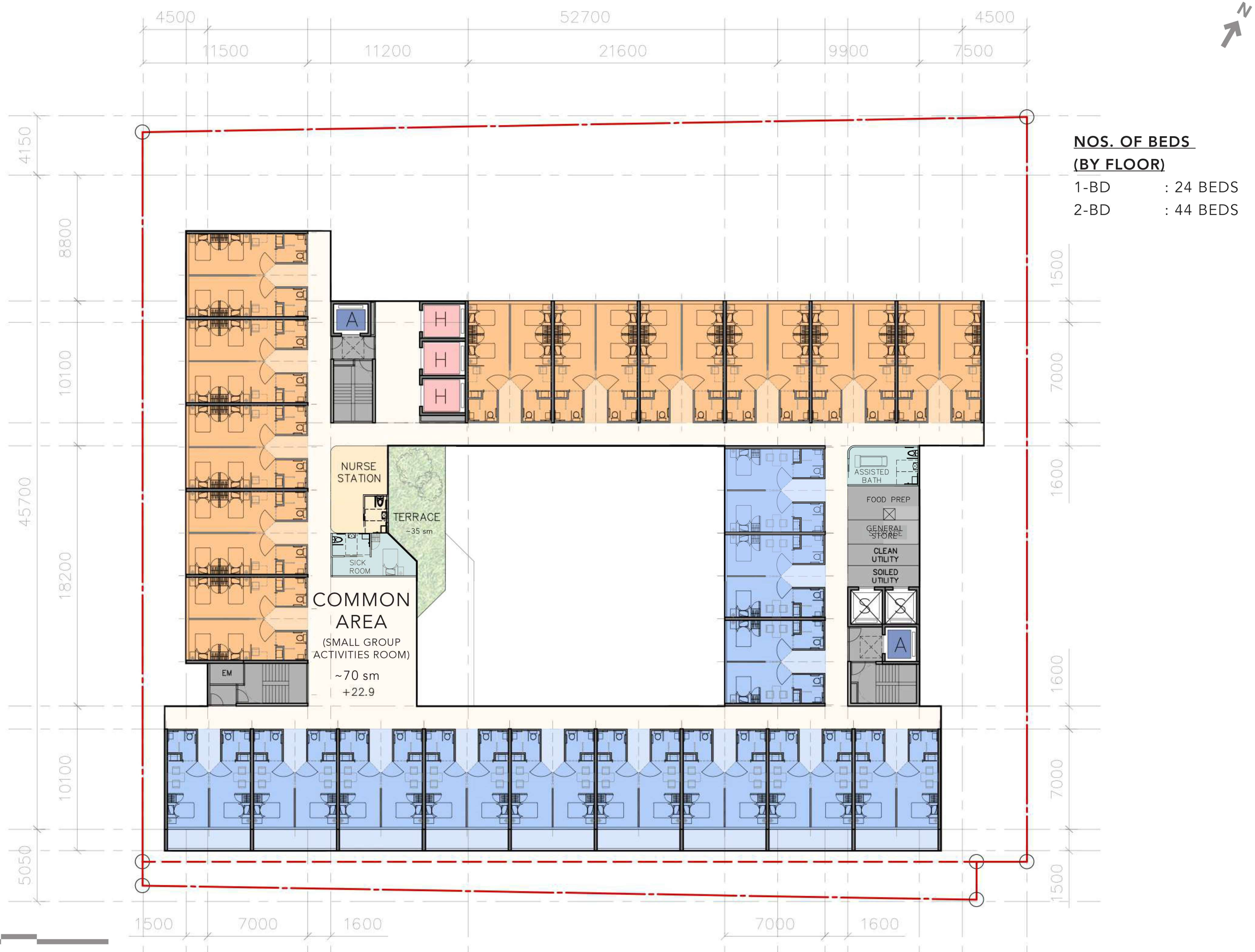

NOS. OF BEDS (BY FLOOR)

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2-BD : 44 BEDS

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*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

_ MATTER

NOS. OF BEDS (BY FLOOR)

1-BD : 42 BEDS

6F

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NOS. OF BEDS
(BY FLOOR)

SUITE : 6 BEDS
1-BD : 28 BEDS

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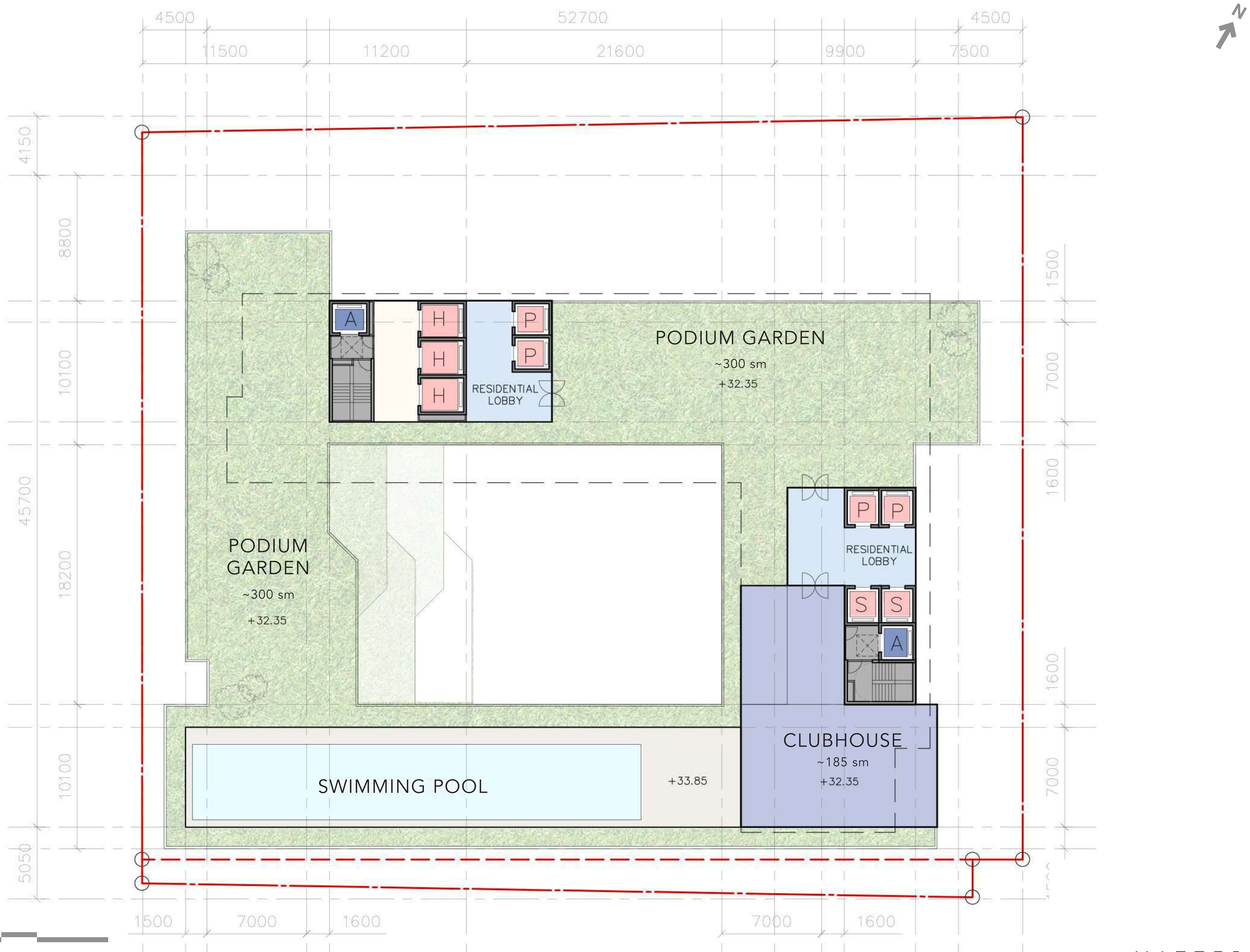

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TYP

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TYPICAL FLOORS - 9,11,13,15/F

*AREAS SUBJECTED TO FURTHER STRUCTURAL AND BUILDING SERVICES CONSULTANTS' COORDINATION

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TYP

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TYPICAL FLOORS - 10,12,14/F

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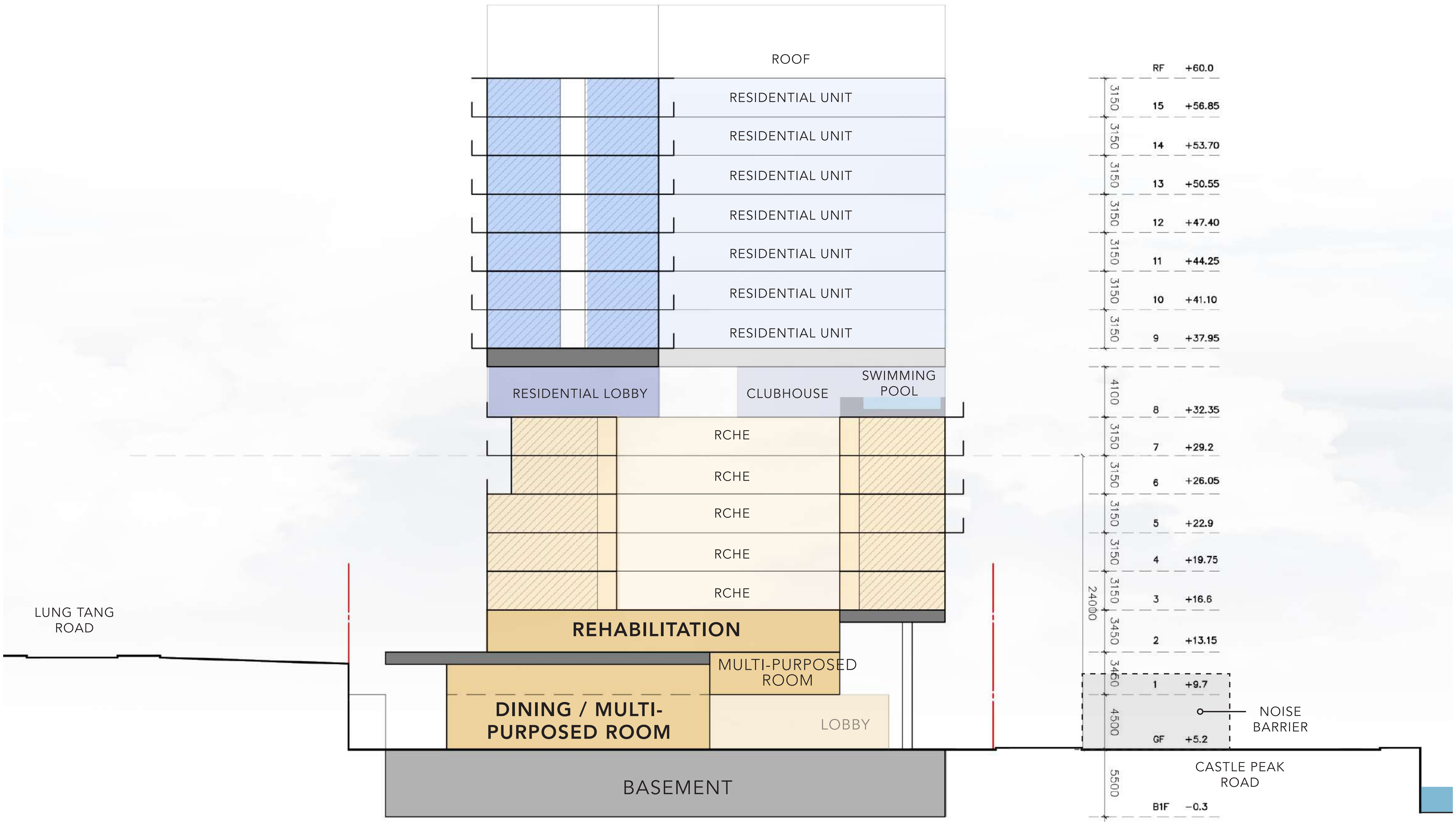

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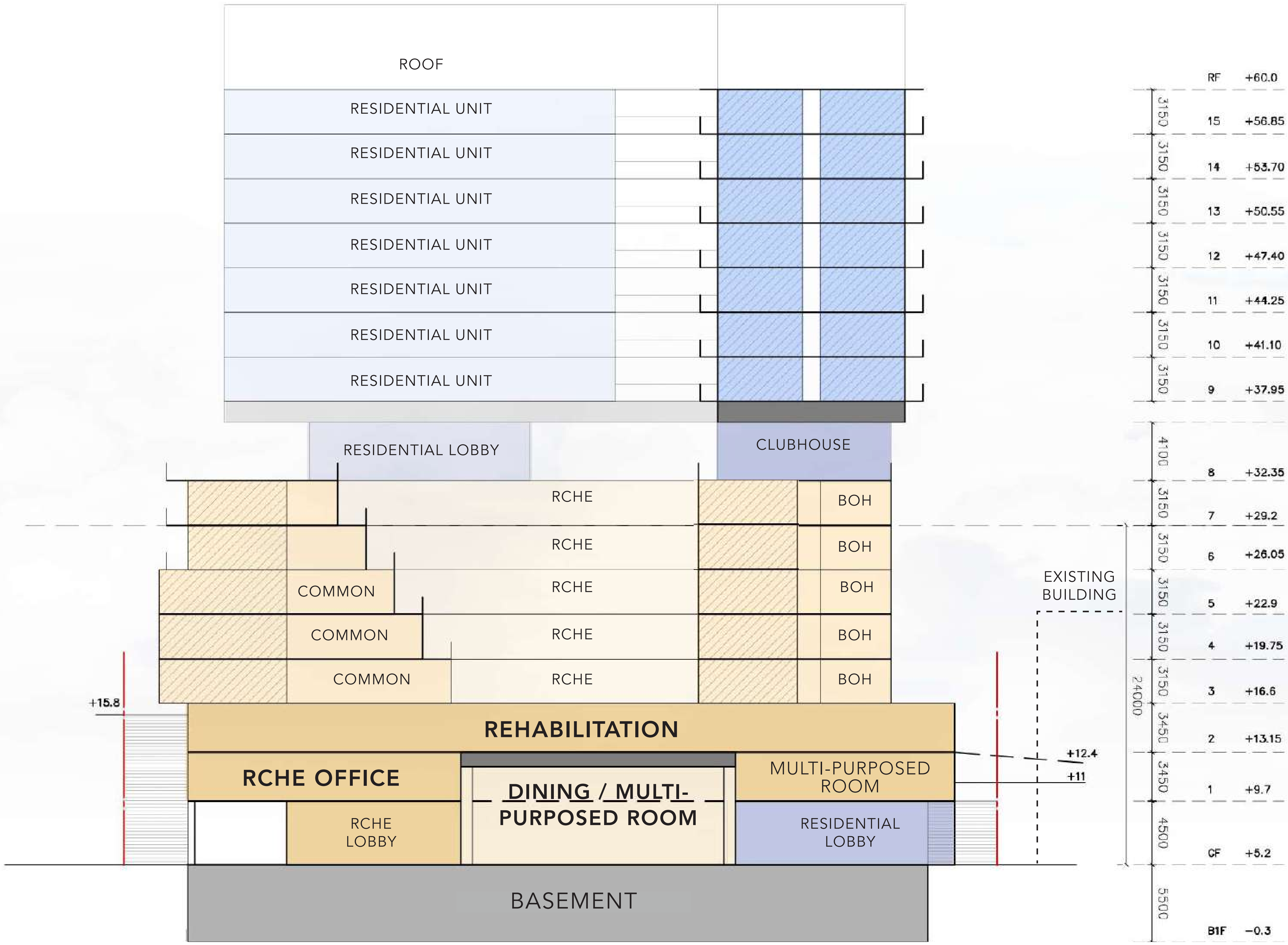

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Appendix 2 Detailed Drainage Impact Assessment Calculations

Calculation of Drainage Capacity for Return Period of 200 Years

Catchment ID	Catchment Area (A), km^2	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
				a	b	c				
Before Development										
Catchment A	0.3064	12.83	12.83	508.8	3.46	0.322	207.17	0.35	0.1073	7.166
Catchment B1	0.0007	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0007	0.047
Catchment B2	0.0010	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0010	0.069
Catchment C	0.0061	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0058	0.409
Catchment D	0.0029	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0028	0.196
Catchment E (Site, unpaved)	0.0033	10.00	10.00	508.8	3.46	0.322	220.29	0.35	0.0012	0.082
Flow from Annual Cleaning of Rehab Facilities(Site)										0.000
Flow from Annual Cleaning of Swimming Pool (Site)										0.000
									Total	**7.97**

Catchment ID	Catchment Area (A), km^2	Inlet time (t_0), min	Duration (t_d), min	Storm Constants			Runoff intensity (i), mm/hr	Runoff coefficient (C)	C x A	Peak runoff (Q_p), m^3/s
				a	b	c				
After Development										
Catchment A	0.3064	12.83	12.83	508.8	3.46	0.322	207.17	0.35	0.1073	7.166
Catchment B1	0.0007	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0007	0.047
Catchment B2	0.0010	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0010	0.069
Catchment C	0.0061	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0058	0.409
Catchment D	0.0029	10.00	10.00	508.8	3.46	0.322	220.29	0.95	0.0028	0.196
Catchment E (Site with 20% unpaved)	0.0033	10.00	10.00	508.8	3.46	0.322	220.29	0.83	0.0027	0.195
Flow from Annual Cleaning of Rehab Facilities(Site)										0.014
Flow from Annual Cleaning of Swimming Pool (Site)										0.008
									Total	**8.10**

Note:
1) Runoff is calculated in accordance with DSD's "*Stormwater Drainage Manual (with Eurocodes incorporated) - Planning, Design and Managemen*t" (SDM), fifth edition, May 2018.
2) To taken into account the effect of climate change, the surface runoff is marked up by 16.0% in accordance to Table 28 of SDM.

Calculation of Drainage Capacity for Return Period of 200 Years

Manhole ID	Manhole ID	Catchment Served	Length	Level (Out)	Level (In)	D	r	A_w	P_w	R	s	k_s	V	Np	Q_C	Total Runoff (Climate Change 16.0%)	% of capacity	Remark
			m	mPD	mPD	m	m	m^2	m	m	-	mm	m/s	-	m^3/s	m^3/s	%	
Propsed Drainage Pipes																		
STMH-1	SSH400781 (D1)	Catchment B1 and E	--	--	--	0.450	0.225	0.159	1.414	0.112	0.010	0.15	2.355	1	0.37	0.26	68%	OK
Existing Drainage Pipes																		
SSH4000781 (D1)	SSH4004628 (D2)	Catchment A to E	10.4	0.625	0.530	1.800	0.900	2.545	5.655	0.450	0.009	0.15	5.229	2	26.61	8.10	30%	OK
SSH4004628 (D2)	SSH4004629 (D3)	Catchment A to E	11.7	0.507	0.410	1.800	0.900	2.545	5.655	0.450	0.008	0.15	4.979	2	25.34	8.10	32%	OK
SSH4004629 (D3)	SSH4006140 (D4)	Catchment A to E	7.3	0.396	0.330	1.800	0.900	2.545	5.655	0.450	0.009	0.15	5.201	2	26.48	8.10	31%	OK

Note:
1. Information of the invert levels and diameters of stormwater pipes and existing manholes are given in the DSD's Drainage Record Plan.
2. The roughness value is assumed to be 0.15mm for concrete pipe in poor condition (Table 14 in DSD's "Drainage Manual - Planning, Design and Management")
3. The velocity is calculated using the Colebrook-White Equation, which can be applied to analyze a wide range of flow condition.
For circular pipes flowing full,

$$V = -\sqrt{(8gDs)}\,\log\left(\frac{ks}{3.7D} + \frac{2.51v}{D\sqrt{(2gDs)}}\right)$$

Legend

D = pipe diameter, m
r = pipe radius (m) = 0.5d
A_w = wetted area (m^2) = p r^2
P_w = wetted perimeter (m) = 2pr
R = Hydraulic radius (m) = A_w/P_w

s = Slope of the total energy line
k_s = equivalent sand roughness, mm
V = Mean Velocity of flow calculated based on Colebrook White Equation, m/s
Q_c = Flow Capacity, m^3/s
Q_p = Estimated total peak flow from the Site during peak season, m^3/s

Np = Number of Pipe