

Appendix G

Geotechnical Planning Review Report

Hong Kong International Innovation
and Technology Hub Limited

**Application for Amendment of
Plan Under Section 12A of the
Town Planning Ordinance (Cap.
131) for Proposed Innovation and
Technology Hub at Various Lots in
D.D. 82 and D.D.86
and Adjoining Government Land,
Man Kam To, New Territories**

**Geotechnical Planning Review
Report**

This report takes into account the particular
instructions and requirements of our client.

It is not intended for and should not be relied
upon by any third party and no responsibility
is undertaken to any third party.

Job number 287082

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ARUP

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Proposed Site Formation Plan

1 Introduction

The Applicant proposes amendments to the Approved Man Kam To Outline Zoning Plan No. S/NE-MKT/4 (“the OZP”) by rezoning the Application Site from “Agriculture” (“AGR”), “Green Belt” (“GB”) and “Government, Institution or Community” (“G/IC”) to a tailor-made “Other Specified Uses” (“OU”) annotated “Innovation and Technology Hub”, with a maximum non-domestic gross floor area (GFA) of 365,180m² and a maximum domestic GFA of 170,400m² (including dormitory) and maximum building heights (BH) of 80, 90, 110 and 120 meters above principal datum (mPD) for four sub-areas respectively, to facilitate the development of the proposed Innovation and Technology (I&T) Hub (**Figure 1.1** refers).

Currently, the Application Site is largely vacant with vegetation and inactive farmland, and covers a portion of the access road from Lin Ma Hang Road leading to the existing River Ganges Pumping Station. The Application Site includes the Development Site (of an area about 102,461m²) and remaining land parcels adjoining the Development Site for better rationalisation of boundary and land use zoning.

An indicative scheme for the development site is proposed with the corresponding site formation for this scheme shown in **Figure 1.3**.

This Geotechnical Planning Review Report provides the following assessment to support the planning application for the proposed residential redevelopment works:

- A summary of the available geotechnical information for the application site from the existing ground investigation records;
- Initial review of the geotechnical issues relating to the proposed development; and
- Proposed schematic site formation plans

2 Site Description

The application site is irregular in shape, has an area of 125863m² and is at Man Kam To in the North District, as shown in **Figure 2.1**. It is on a gentle sloping from site level of about 6mPD near Ping Yuen River to 25mPD near the eastern foot of Lo Shue Ling.

The Site mainly consists of sloping terrain and a general flatland, the flatland of which is located in the northern portion of the Site at an elevation of about +6mPD and was not previously occupied. The sloping terrain is located in the western portion of the Site and the southern portion of the Site at an elevation from 6mPD to 33mPD and was not previously occupied. An existing school is located in the middle portion of the site and is still operating.

The northern part of the site is surrounded by man-made slopes and retaining walls. It is bounded by a few man-made features, namely Feature Nos. 3NW-C/CR226, 3NW-C/CR228, and 3NW-C/R2.

An existing river (Ping Yuen River) is present immediately to the east of the site.

3 Desk Study

A desk study has been carried out to support the geotechnical appraisal. The desk study included a review of the general site history through aerial photograph interpretation (API); the checking of the condition and engineering status of the man-made features within and adjacent to the application site; gathering and review of existing ground investigation (GI) records; and a review of topographic conditions to determine the need (or otherwise) for further assessment of natural terrain hazards. The API is enclosed in **Appendix A** for natural terrain hazard assessment. All salient geological features, hydrology, change of land use, past instability, ground condition and any potential geological or landslide problems have been identified and documented within this.

3.1 Published Geology

The Development Site is covered by the following geological publication and references:

- Hong Kong Geological Survey Sheet 6 (1:20 000) “Solid and Superficial Geology for Hong Kong and Kowloon” (1988);
- Hong Kong Geological Survey Memoir No. 3 (1989)
- Geological Area Studies Programme III – West New Territories (1987);
- The Pre-Quaternary Geology of Hong Kong, with the 1:100 000 Geological Map of Hong Kong (2000); and
- The Quaternary Geology of Hong Kong (2000).

3.1.1 Site Geology

According to the published 1:20,000 scale solid and superficial geological map sheet no.3 (GEO, 1991), the accompany memoir (Lai et al., 1996), as well as the existing borehole records, the rock types that are expected to be encountered within the Application Site are mainly Metasiltstone (Cmp) and Metasandstone (Ctl) of Lok Ma Chau Formation. Fill, debris flow deposits (Qpd), alluvium (Qa) and terraced alluvium (Qpa) will be overlain the in-situ materials. On the structural geology, as depicted in the published geological map, a NE-SW trending fault is recorded around 160m from the Application Site, locally deepened rockhead and fault materials such as slickenside associated with the fault might be encountered. The geological map is shown in **Figure 3.1**.

Limited existing GI records are available in the vicinity of the Application Site, with most GI records are concentrated near the northern portion of the Site. Based on the geological maps and existing GI records, the top layer of the ground is anticipated to consist of fill with thickness ranges from about 0.5m to 5m. Beneath the fill is a thin layer of colluvium with thickness less than 3m, followed by a layer of alluvium with thickness of about 5m to 15m. Below the superficial deposits is the saprolite with thickness up to 40m, with the thickness increases from the west to the east of the Application Site. An interbedded layer of Grade III and Grade V/IV materials with thickness of about 5m to 20m is recorded beneath the saprolite. The engineering

rockhead is encountered at approximately -27mPD (-42mbgl) to 17mPD (-3mbgl), with the rockhead decreases from the west to the east of the Application Site.

3.2 Previous Ground Investigation Records

A search of existing ground investigation records located within 500m of the Site was conducted at the Geological Information Unit (GIU) of the Geotechnical Engineering Office (GEO). This indicates that only limited previous investigations have been conducted in the vicinity of the Site, as summarised in Table 3.1.

Table 3.1-Summary of the Existing Ground Investigation Records.

GIU Ref.	Year	Contractor	Report Title
00554	1979	Gammon (Hong Kong) Limited	River Ganges Catchwater Scheme Site Investigation Final Report
11543	1988	Lam Geotechnics Limited	Fanling/Shek Wu Hui Development Lo Shue Ling Borrow Area Site Investigation Report
14170	1990	Enpack Limited	NENT Landfill Leachate Treatment Phase I and Village Sewerage Site Investigation New Territories East
14743	1979	Kampsax – Kruger Hong Kong	River Ganges Catchment Scheme Geotechnics Submission
15785	1991	Enpack (Hong Kong) Limited	Agreement No. CE50/89 NENT Leachate Treatment Phase I and Village Sewerage Ground Investigation
21064	1995	Geotechnics & Concrete Engineering	Agreement No. CE51/93 Rural Drainage Rehabilitation Scheme - River Ganges Ground Investigation Report
33412	2001	Enpack (Hong Kong) Limited	PWP Item No. 4064CD Rural Drainage Rehabilitation Scheme, Stage 1, Phase 2 - Rehabilitation Works at Ping Yuen River, Ta Kwu Ling, Ground Investigation Works and Sediment Sampling
35660	2002	Vibro (Hong Kong) Limited	School Improvement Programme, Final Phase Package 11 - P429 Sam Wo Public School
35819	2002	Vibro (Hong Kong) Limited	School Improvement Programme Final Phase, Package 5 (Group 1) P450 - Ta Ku Ling Ling Ying Public School

38254	2003	Geotechnics & Concrete Engineering (Hong Kong) Limited	Feature No. 3NW-C/C223 East of L/P N42490 Lin Ma Hang Road, Lo Wu Ground Investigation
43189	2006	DrilTech Ground Engineering Ltd.	Agreement No. CE 6/2004 (GE) Feature No. 3NW-C/C297 East of Community Centre of Sun Uk Lane Tsuen Ta Kwu Ling
43230	2006	DrilTech Ground Engineering Ltd.	Agreement No. CE 6/2004 (GE) Feature No. 3NW-C/C297 East of Community Centre of Sun Uk Lane Tsuen Ta Kwu Ling
55613	2010	Lam Geotechnics Limited	Regulation of Shenzhen River Stage IV Ground Investigation (Hong kong) Volume 1 of 3
57030	2013	DrilTech Ground Engineering Ltd	Agreement No. CE5/2012(HY) Widening of 2 Sections of Lin Ma Hang Road (Sections between Ping Yuen River & Ping Che Road & between Tsung Yuen Ha & Lin Ma Hang)
62676	2015	Geotechnics & Concrete Engineering (HK) Ltd.	Feature No. 3NW-C/CR226 West of River Ganges Pumping Station, Lin Ma Hang Road
62787	2016	Vibro (H.K.) Limited	Ag. No. CE 1/2013 (CE) ... Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery - Design and Construction Application for GI - Phase 2C - Vol. 1 of 4
63639	2016	DrilTech Ground Engineering Ltd.	GI - NTE (Term Contract) Ag. No. CE 51/2013 (HY) Widening of Western Section and Eastern Section of Lin Ma Hang Road - Design and Construction

64666	2017	DrilTech Ground Engineering Ltd.	Ground Investigation - New Territories East (Term Contract), Agreement No. CE 78/2014 (DS), Drainage Improvement Works at North District - Package B - Investigation, Location: Lower Ping Yuen River an
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The general ground conditions for the Site have been reviewed based on the records contained within the above fieldwork reports, which included the records for 3 drillholes as shown in **Figure 3.2**.

Further details of the geology from the existing borehole records could be referred to the Section 3.1.1.

3.3 Registered Man-made Features

3.3.1 General

A total four registered man-made features within or in the vicinity of the site are recorded in the GEO Slope Information System (SIS). A summary of the feature registration numbers, responsible maintenance parties and current study status retrieved from the Landslip Prevention Measures Information System (LPMIS) for these features is provided in Table 3.2, with the feature extent and locations presented in **Figure 3.3**.

Table 3.2: Summary of Registered Features

Feature No.	Sub-division No.	Maintenance	Maximum Height (m)	Length (m)	Slope Angle (Degree)
3NW-C/CR226	-	Lands D	17.4 (Slope) 2.6 (Wall)	98 (Slope) 20.8 (Wall)	40 (Slope) 80 (Wall)
3NW-C/C227	-	Lands D	6.5 (Slope)	46 (Slope)	40 (Slope)
3NW-C/CR228	-	WSD	4 (Slope)	65 (Slope)	39 (Slope)
3NW-C/R2	-	WSD	6 (Wall)	50 (Wall)	90 (Wall)

The detail descriptions of the registered features are presented as follows:

Feature No. 3NW-C/CR226 (partly within the site)

The feature is an east-facing soil cut slope, located in the northern portion. The slope portion is about 17.4m high with a slope angle of 40°. The wall portion is about 2.6m high with a slope angle of 80°.

Feature No. 3NW-C/C227 (partly within the site)

The feature is an east-facing soil slope, located in the northern portion. The slope portion is about 6.5m high with a slope angle of 40°.

Feature No. 3SW-C/CR228 (partly within the site)

The feature is a southeastern-facing soil cut slope, located in the northern portion.

The feature consists of soil cut slope of about 4m in height, with a slope angle of 39°. There is a grave sitting within the slope area.

Feature No. 3NW-C/R2 (partly within the site)

The feature is a southeastern-facing retaining wall, located in the northeastern corner of the site. The feature consists of a retaining wall of about 6m high with a slope angle of 90°.

3.3.2 Stage 2 Study Report

The GIU did not contain the record of any Stage 2 Study Report covering the features around the site area.

4 Natural Terrain Hazard Study

4.1 Natural Terrain Catchment Area

The extent of the natural terrain catchment area affecting the site has been defined in accordance with GEO Report No. 138 (Ho & Roberts, 2016), as “*terrain that has not been modified substantially by human activity but includes where grazing, hill fires and deforestation may have occurred*”. The areal extent of the catchment area overlooking the site has been determined based on the topographic settings of the hillside excluding areas of substantially modified anthropogenic features such as the Feature No. 3NW-C/CR 226 as shown in **Figure 4.1**.

The extent of natural terrain catchment is mainly defined based on the extent of hillside directly affecting the proposed building boundary, any change in building boundary may lead to re-definition of natural terrain catchment. The natural terrain catchment area shall be reviewed during detailed design stage based on the latest building boundary.

The natural terrain catchment area has been sub-divided into twenty-three natural terrain hillside catchments, namely Catchment Nos. MKT-1 to MKT-23.

4.2 Past Instability

According to the Enhanced Natural Terrain Landslide Inventory (ENTLI), landslide incident records and API (**Figure 4.1** and **Appendix A**), 14 relict natural terrain landslides and 4 recent natural terrain landslides are identified within the natural terrain catchment area, which all the 4 recent failures are classified as open hillslope debris slides. The volumes of the recent landslides are estimated ranging between 25m³ and 63m³.

The relict landslides are recorded in variable terrain settings, with all the relict ENTLI scars are recorded as having an extremely low degree of certainty (ENTLK Relict Class C: <10% certainty). The volume of the relict landslides are estimated ranging between 54m³ and 126m³.

4.3 Natural Terrain Hazard Screening of the Site

A Natural Terrain Hazard screening has been undertaken for the proposed development site to examine whether the site may be subjected to natural terrain hazards. Consideration is given to assess the likelihood of a Natural Terrain Hazard Study (NTHS) being required for the site in accordance to the criteria laid out in GEO Report

No. 138. The cross sections show that the angular elevations of the natural terrain catchments from the site range between 7.4° and 24.4° (**Figure 4.2**). The screening process indicates that among the 23 natural terrain catchments 10 of them fall into the “Alert Criteria”, which are catchment nos. MKT-1 to MKT-5, MKT-8, MKT-10 and MKT-16 to MKT-18. The proposed facilities within the site are residential buildings, commercial offices and other densely-populated buildings, which belong to Facility Group 1(a) in accordance with Table 2.2 of GEO Report No. 138. Further natural terrain hazard study is required for the site. In addition to the natural terrain hazard screening, natural terrain catchment nos, MKT-7 and MKT-9 is not at an angular elevation of 20° or more from the site. However, credible debris flow paths are identified within the two catchments, in accordance to the GEO Report No. 138, These two catchments should also be considered for the further natural terrain hazard study. The natural terrain screening is summarized as below:

Catchment No.	Angular elevation of natural terrain $\geq 20^\circ$	Within 50m of ground slopping $> 15^\circ$	Alert Criteria met?
MKT-1	Yes	Yes	Yes
MKT-2	Yes	Yes	Yes
MKT-3	Yes	Yes	Yes
MKT-4	Yes	Yes	Yes
MKT-5	Yes	Yes	Yes
MKT-6	No	Yes	No
MKT-7	No	Yes	No
MKT-8	Yes	Yes	Yes
MKT-9	No	Yes	No
MKT-10	Yes	Yes	Yes
MKT-11	No	Yes	No
MKT-12	No	No	No
MKT-13	No	Yes	No
MKT-14	No	Yes	No
MKT-15	No	Yes	No
MKT-16	Yes	Yes	Yes
MKT-17	Yes	Yes	Yes

MKT-18	Yes	Yes	Yes
MKT-19	No	Yes	No
MKT-20	No	Yes	No
MKT-21	No	No	No
MKT-22	No	Yes	No
MKT-23	No	No	No

4.4 Mitigation Measures for Natural Terrain Hazard

The need of mitigation measures for natural terrain hazard shall be further reviewed in accordance to the workflow laid out in GEO Report 138 during detailed design. If natural terrain hazard is present after undertaking natural terrain hazard assessment (NTHA) and Qualifying Criteria are satisfied for the Empirical Design Approach for Open Hillslope Catchment, empirical design of prescribed flexible barrier may be required.

5 Proposed Geotechnical Works

The development site area is mainly composed of multi level platform, to be sit on a sloping terrain with generally about 26° in elevation. It is surrounded by mainly natural terrain, Ping Yuen River, an existing school and several registered features, where the slope angles range between 39 and 80 degrees. In order to propose an appropriate site formation and foundation scheme, the following factors have to be taken into account:

- The site formation works should be safe and adequate to protect the study area and adjacent ground;
- The site formation works should not have any adverse effect to the area outside the site boundary.

Taking the above-mentioned into consideration, R.C. L-shaped retaining wall, inverted L-shaped retaining wall, cut and fill slopes and platforms are selected for the site formation works. To ensure the slope safety, some of the retaining walls are proposed to be supported by mini piles, which can provide extra lateral restraints against the slope failure. The proposed schematic site formation plans are shown in **Appendix B**.

The proposed site formation work is anticipated to be carried out after the construction of the basement, which temporary excavation and lateral support will be performed. Sheet pile walls pipe pile walls with steel shoring will be adopted for the proposed basement. Details of the proposed excavation and lateral support works will be presented in the excavation and lateral support design submission in the detailed design stage.

Pile foundation will be adopted for the proposed building to minimize the impact to the new building and the adjacent area. Bored piles or H piles will be used to support the buildings with at least several storeys, mini piles will be used to support the locations with only basements. Details of the proposed pile foundation will be presented in the foundation design submission in the detailed design stage.

The slope angle for all the proposed cut and fill slope within the development area are 1:2 and 30° respectively. In the detailed design stage, all the proposed and adjacent slopes and retaining walls will be designed to meet the current geotechnical standards and requirements from the Geotechnical Engineering Office (GEO). In addition, the surface drainage works should be designed in accordance with the requirement of the Geotechnical Manual for Slope.

6 Conclusion and Recommendation

A geotechnical planning review has been conducted for the Proposed Innovation and Technology Hub (I&T Hub) at Various Lots in D.D. 82 and D.D. 86 and Adjoining Government Land, Man Kam To that may affect, or be affected by, natural terrain or man-made slopes or retaining wall features in accordance to GEO Advice Note for Planning Application under Town Planning Ordinance (Cap. 131). The Indicative Scheme of the Development Site comprises a total of five (5) 30-storey to 32-storey residential buildings, one (1) 4-storey club house, three (3) 30-storey to 31-storey ancillary dormitories, three (3) 12-storey data centres, three (3) 15-storey to 16-storey R&D centres and one (1) 6-storey commercial centre. In view of the needs of future residents and users of the I&T Hub, a Transport Interchange and a Sewage Treatment Plant have been proposed in the Indicative Scheme.

The review has been carried out based on the findings of desk studies, aerial photo interpretation (API) and site inspection of the site and the adjacent natural terrain catchments. The site is located at the toe of a few catchments underlain by fine to medium metasiltstone. An existing stream is present immediately to the east of the site.

According to the Enhanced Natural Terrain Landslide Inventory (ENTLI), landslide incident records and API (**Figure 4.1** and **Appendix A**), 14 relict natural terrain landslides and 4 recent natural terrain landslides are identified within the natural terrain catchment area. Moreover, initial natural terrain hazard screening indicates that 10 out of 20 natural terrain catchments fall into the “Alert Criteria” with the maximum angular elevation of 24.4° for the storeys (facility group 1a). Further study of natural terrain hazards in accordance with GEO Report No. 138 is required. Also, by the condition of credible debris flow path according to GEO Report No. 138, catchment nos. MKT-7 and MKT-9 would also be required for further natural terrain hazard study. The need of mitigation measures for natural terrain hazard shall be reviewed by NTHA and prescribed flexible barrier may be required for Open Hillslope landslide hazard.

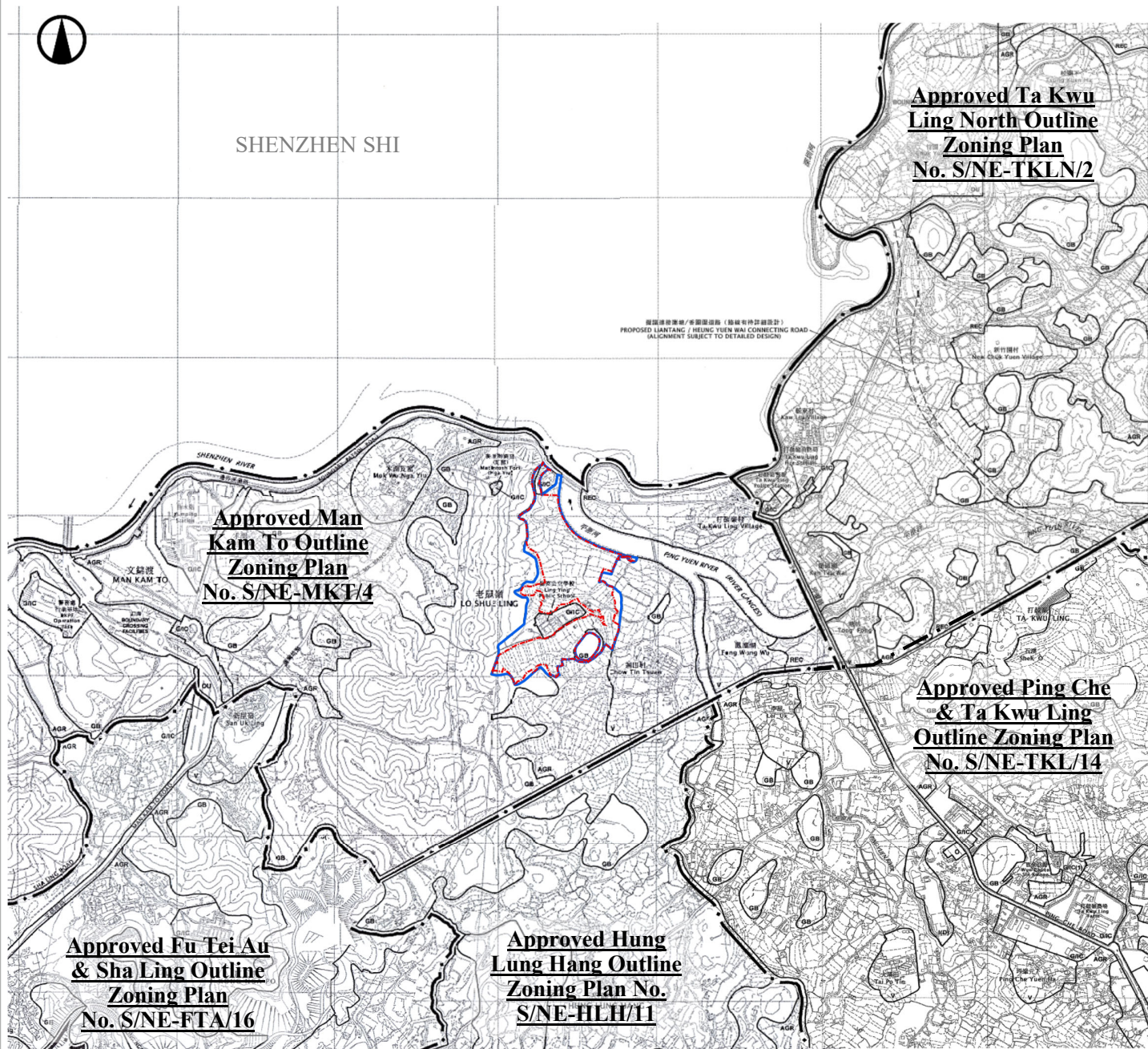
Schematic site formation plans have been proposed. R.C. retaining walls, cut slopes, fill slopes and platforms are selected for the site formation works. Some of the retaining walls are necessary to be supported by mini piles. The effect of the pile installation and retaining wall construction should not cause any adverse effect on the adjacent structures provided that a proper monitoring scheme is carried out.

In conclusion, the proposed redevelopment is considered to be feasible from the geotechnical perspective.

7 References

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Figures



LEGEND



Application Site

Development Site

ZONING

AGR

Agriculture

GB

Green Belt

V

Village Type Development

G/IC

Government, Institution or Community

G/IC(1)

Government, Institution or Community (1)

OU

Other Specified Uses

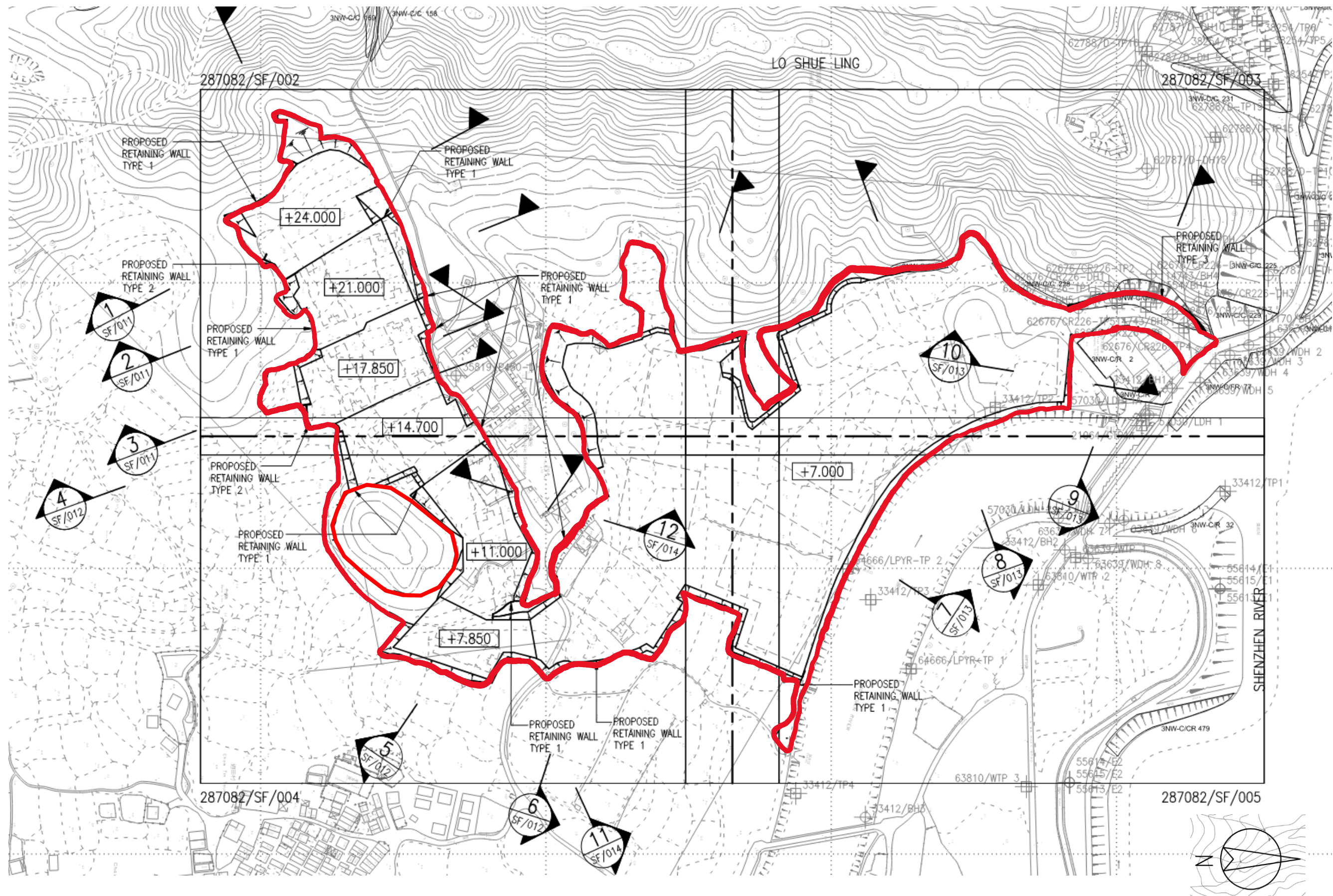
REC

Recreation

I(D)

Industrial (Group D)

Figure No.	Scale	Figure Title
1.1	-	Location Plan
ARUP	Date	Source
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Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title
Proposed Site Formation Plan

Legend
Site Boundary —————

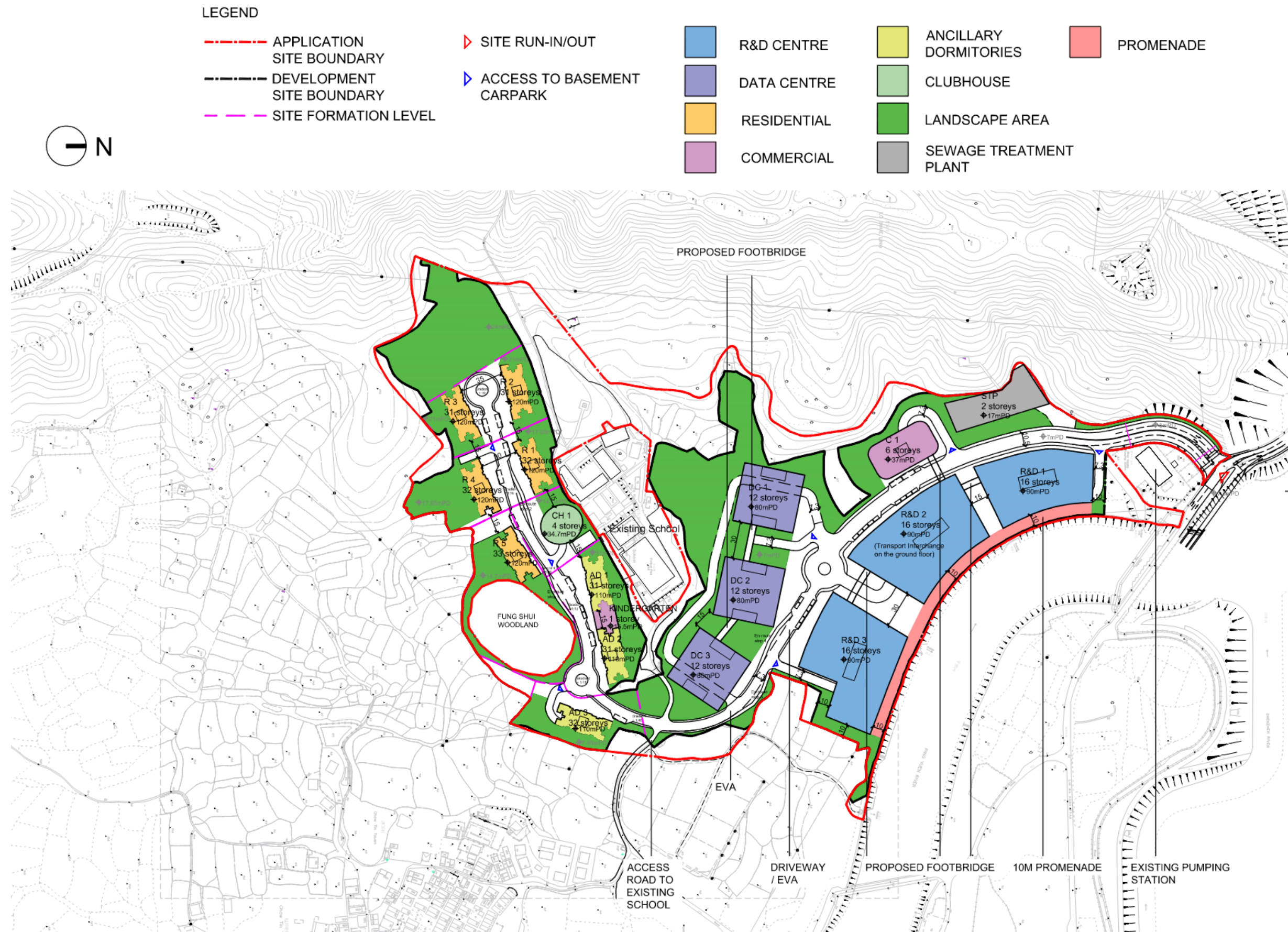
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Job No.
287082

Figure No.
FIGURE 1.2



Job Title

PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title

Newly Proposed Development (Master Layout Plan)

Legend

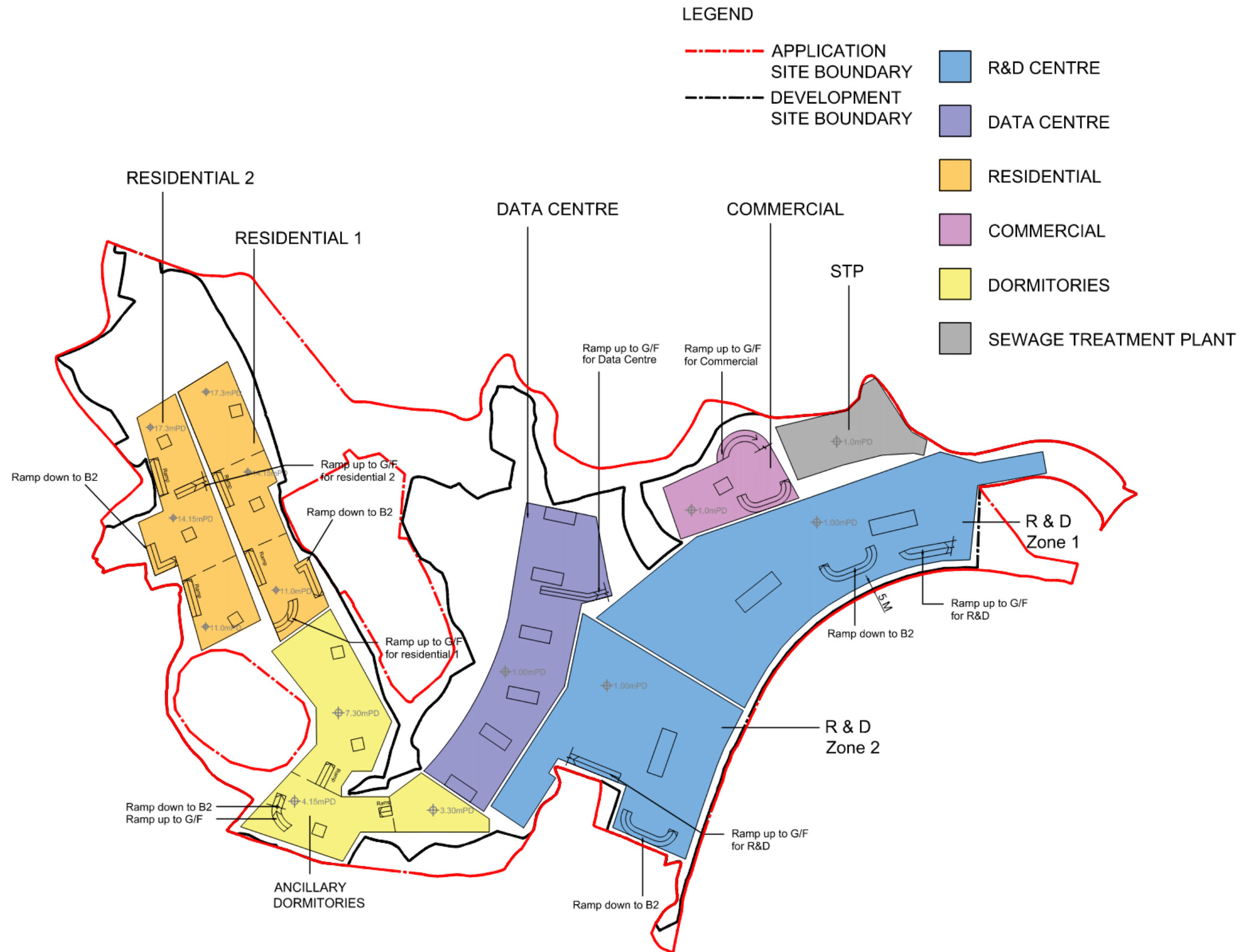
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Job No. 287082

Figure No. FIGURE 1.3



Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title
Newly Proposed Development (B1 Basement Layout)

Legend

ARUP

Scale N.T.S

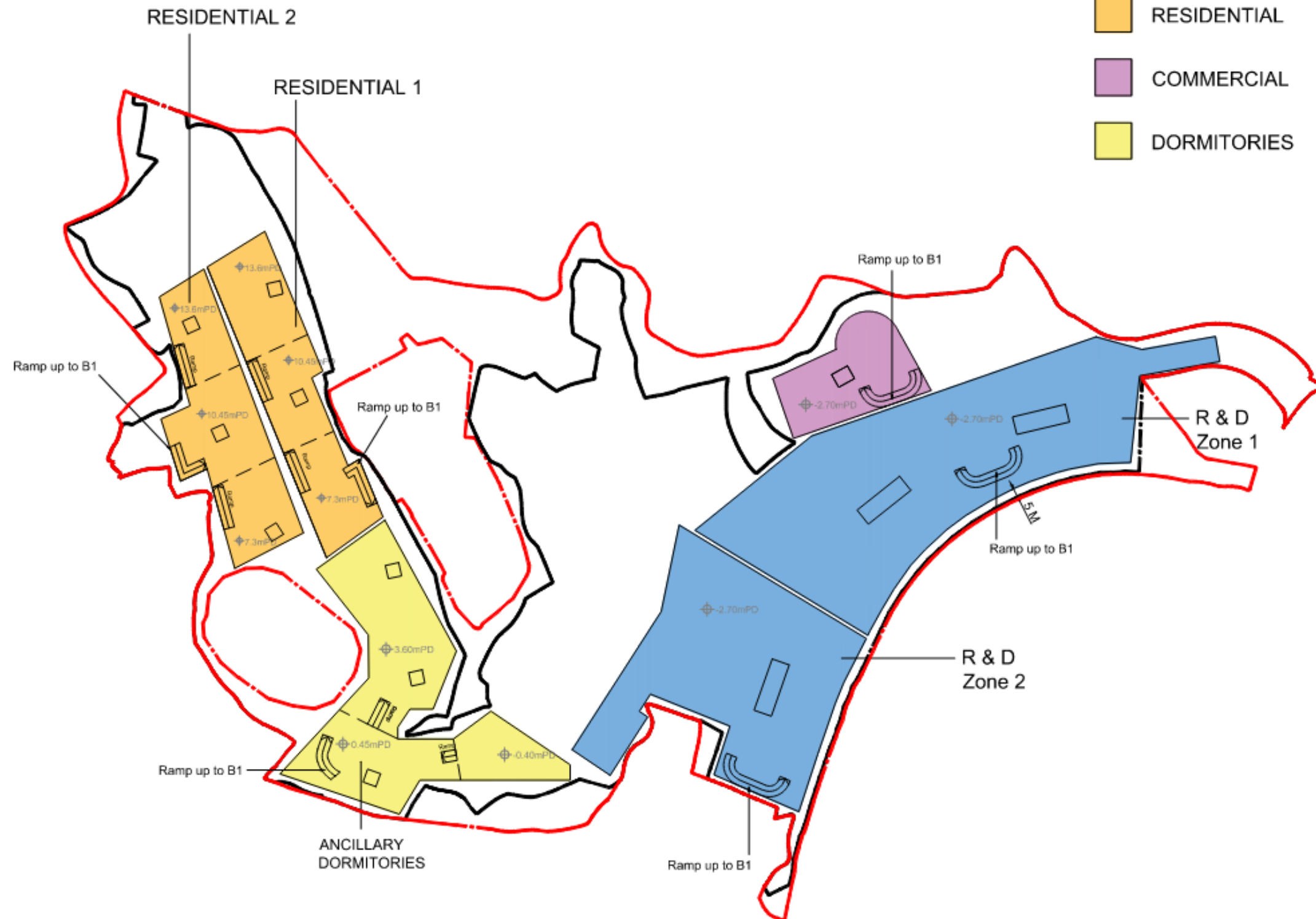
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Job No.
287082

Figure No.
FIGURE 1.4

LEGEND

- APPLICATION SITE BOUNDARY
- DEVELOPMENT SITE BOUNDARY
- R&D CENTRE
- DATA CENTRE
- RESIDENTIAL
- COMMERCIAL
- DORMITORIES



Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title
Newly Proposed Development (B2 Basement Layout)

Legend

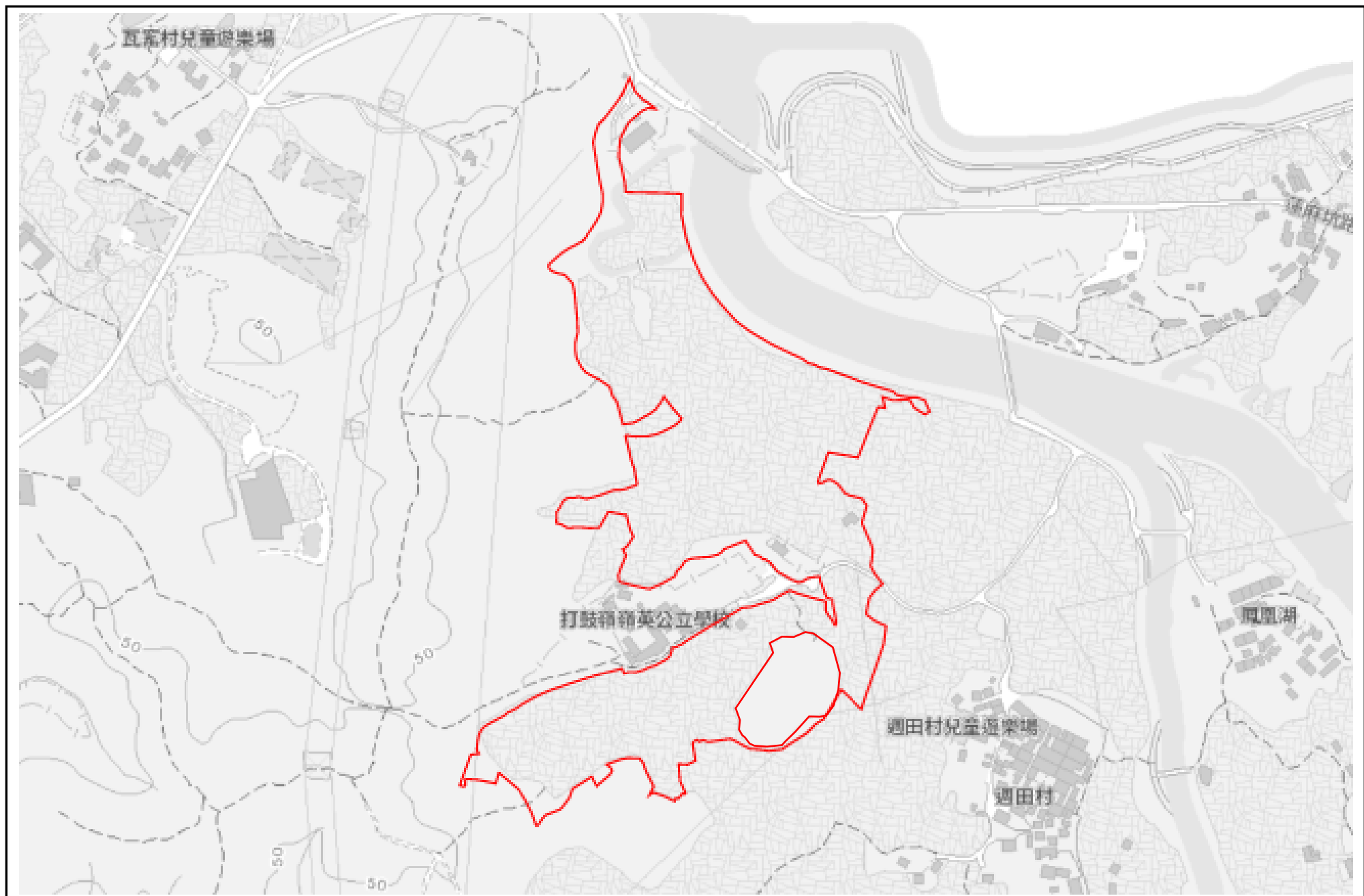
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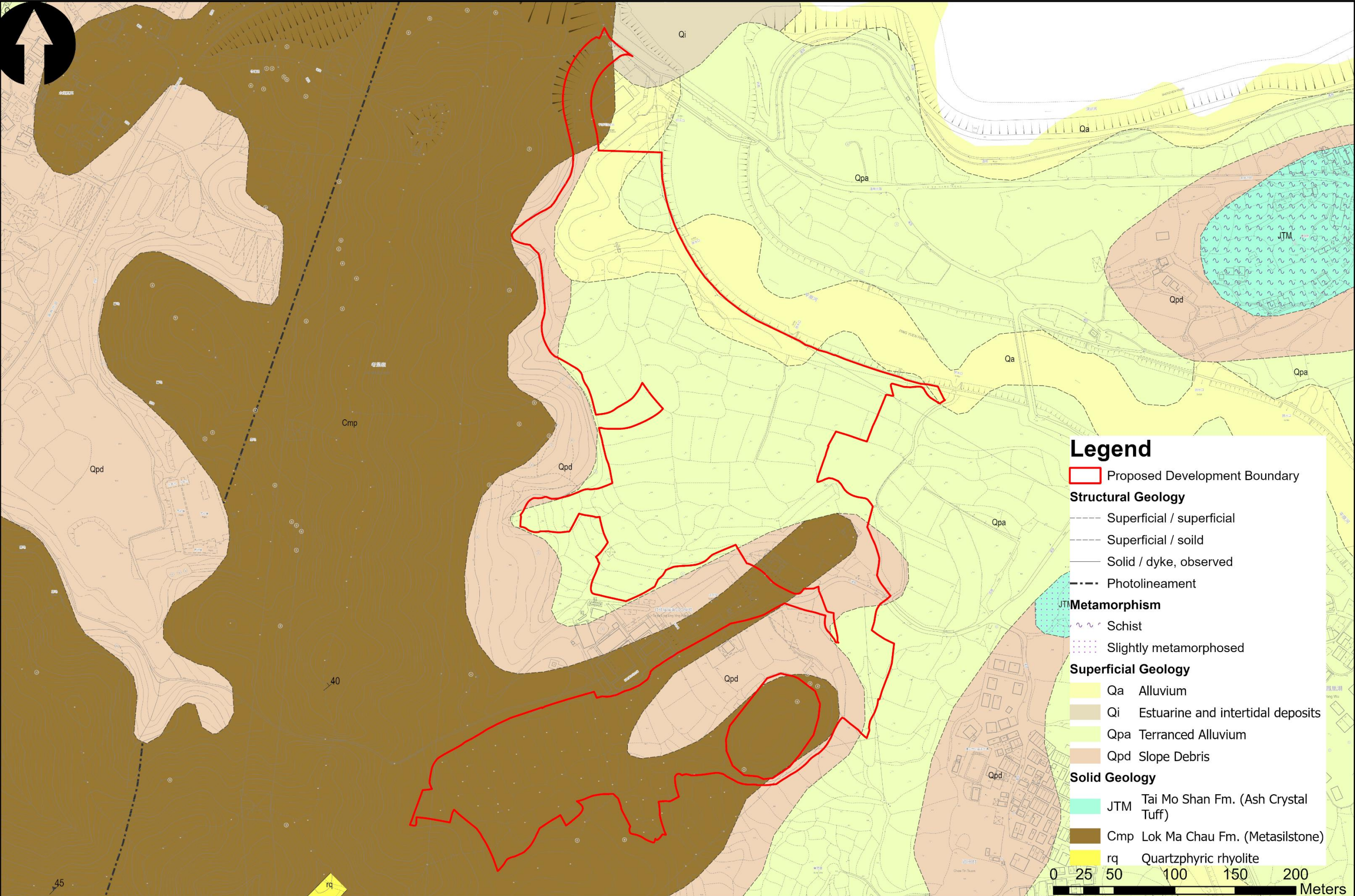
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Job No.
287082

Figure No.
FIGURE 1.5



<p>Job Title</p> <p>PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO</p>	<p>Drawing Title</p> <p>Site Location Plan</p> <div data-bbox="1064 1348 1355 1444"> <p>Legend</p> <p>—— Development Boundary</p> </div>	<div data-bbox="1751 1348 2139 1412"> <p>ARUP</p> <p>Scale N.T.S</p> </div> <div data-bbox="1751 1412 2139 1476"> <p>Drawn by: KC Date June 22 Checked: DL Approved: DL</p> </div> <div data-bbox="1751 1476 2139 1527"> <p>Job No. 287082 Figure No. FIGURE 2.1</p> </div>
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Legend

Proposed Development Boundary

Structural Geology

- Superficial / superficial
- Superficial / soild
- Solid / dyke, observed
- Photolineament

Metamorphism

- Schist
- Slightly metamorphosed

Superficial Geology

- Qa Alluvium
- Qi Estuarine and intertidal deposits
- Qpa Terranced Alluvium
- Qpd Slope Debris

Solid Geology

- JTM Tai Mo Shan Fm. (Ash Crystal Tuff)
- Cmp Lok Ma Chau Fm. (Metasiltstone)
- rq Quartzphyric rhyolite

0 25 50 100 150 200 Meters

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Scale N.T.S

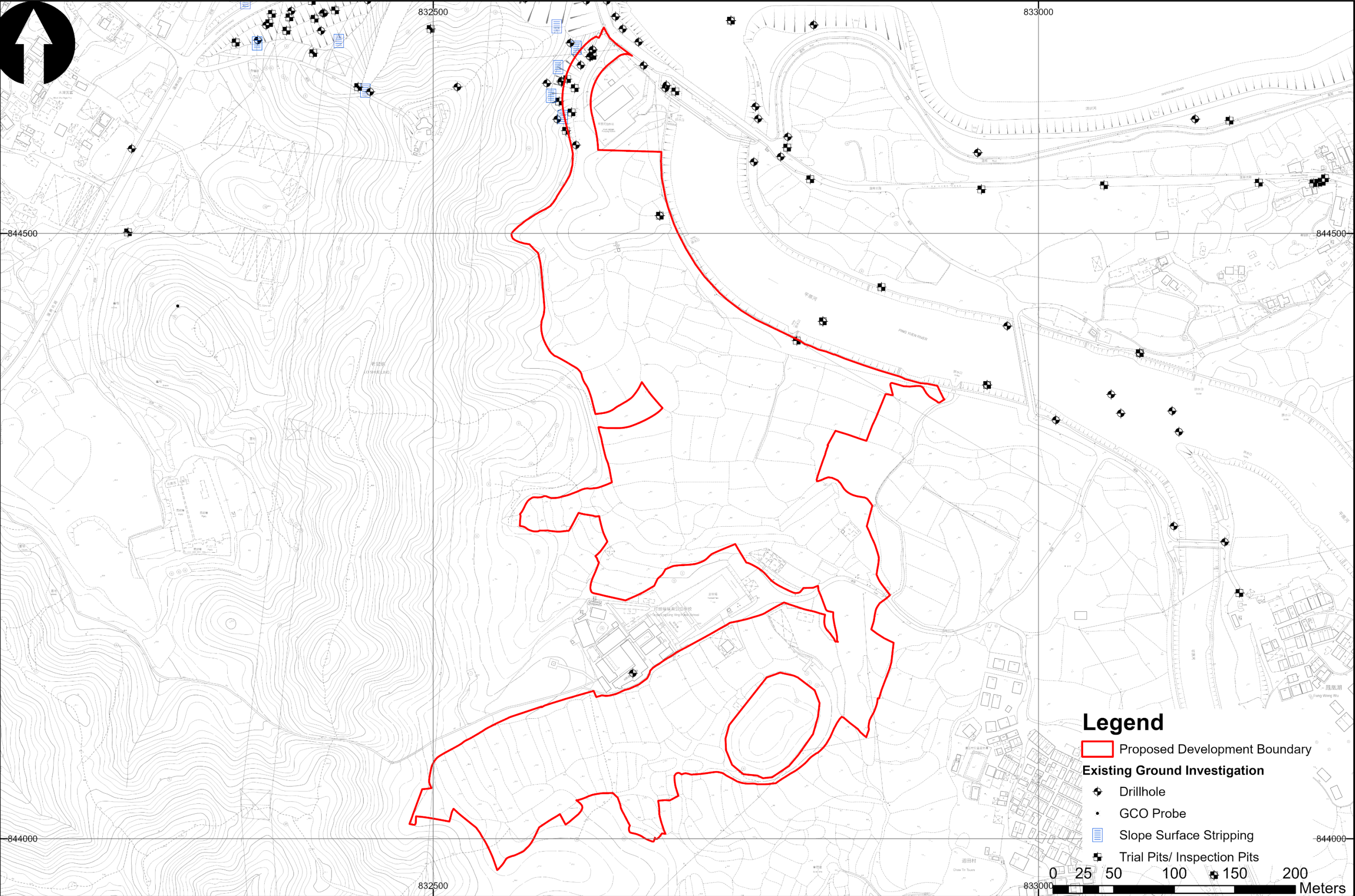
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Job No. 287082

Figure No. FIGURE 3.1

Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title
Part Plan of Geological Map (1988; 1:20,000)



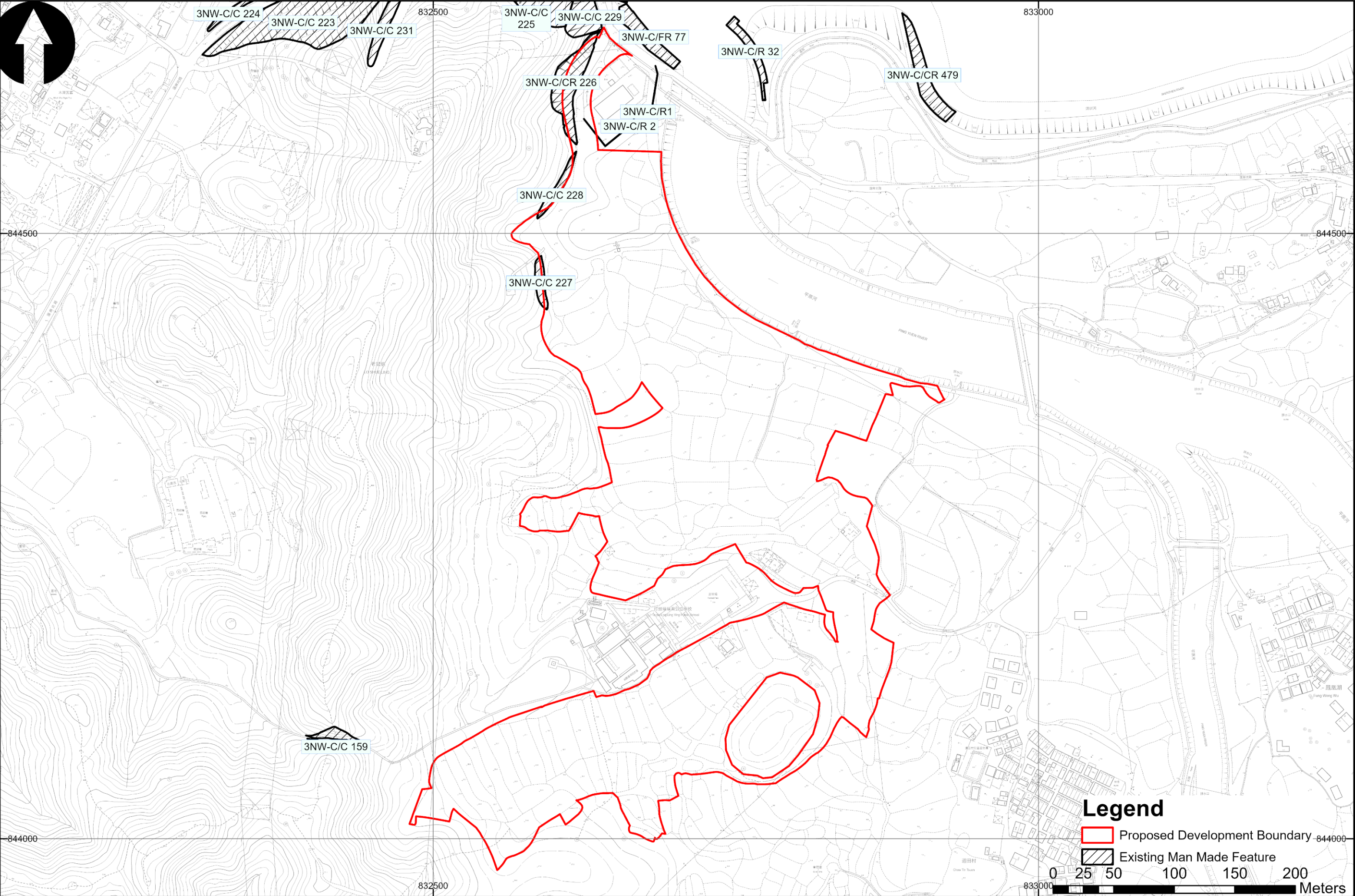
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PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title

Existing GI Location

ARUP			
Scale N.T.S			
Drawn by: KC	Date July 23	Checked: DL	Approved: DL
Job No. 287082	Figure No. FIGURE 3.2		



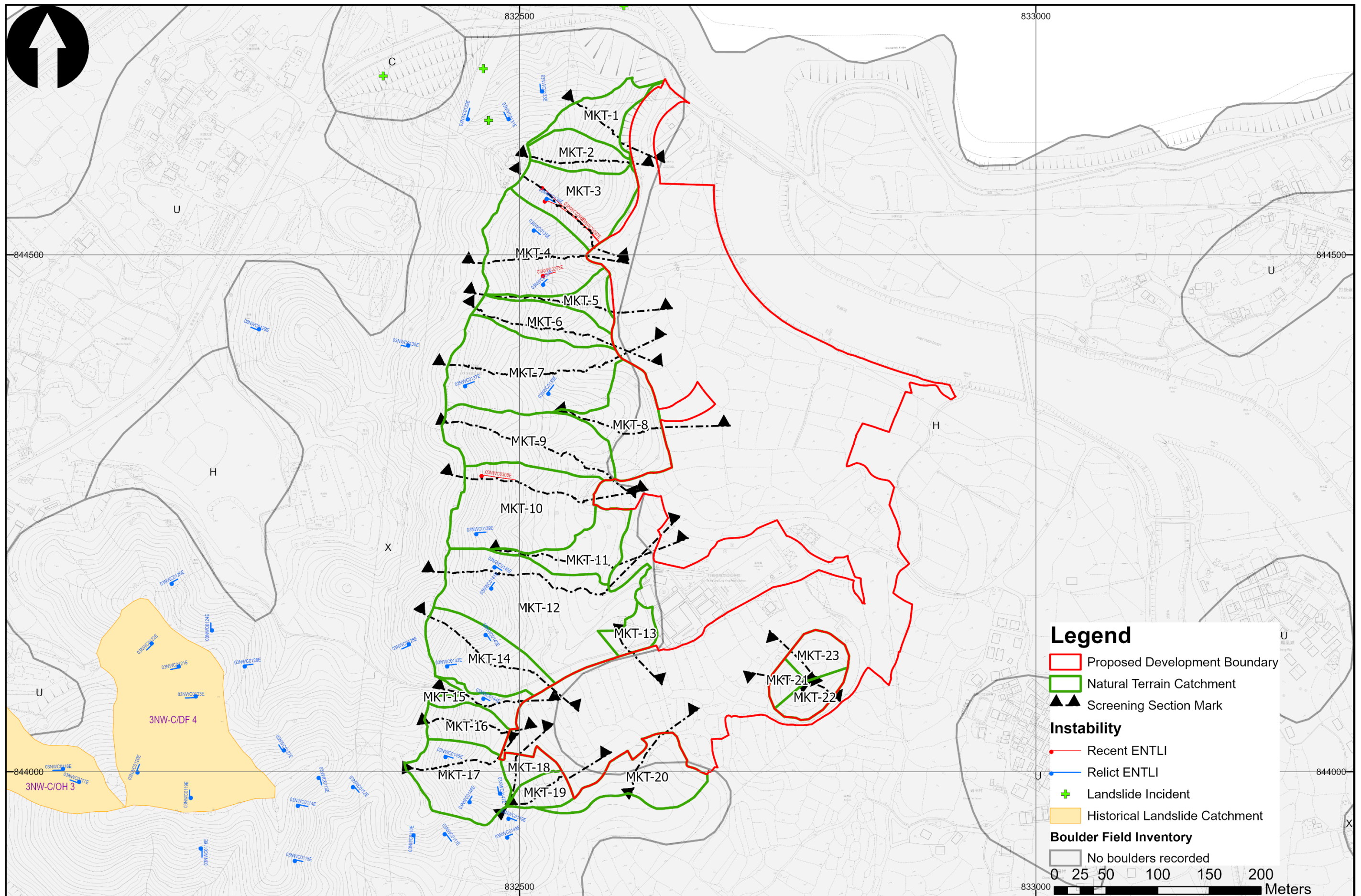
Job Title

PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title

Adjacent Registered Man-made Features

Scale		N.T.S	
Drawn by:	KC	Date	July 23
Checked:	DL	Approved:	DL
Job No.	287082		
Figure No.	FIGURE 3.3		



Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title
Natural Terrain Catchment, Boulder Field Inventory and Instability Records

ARUP

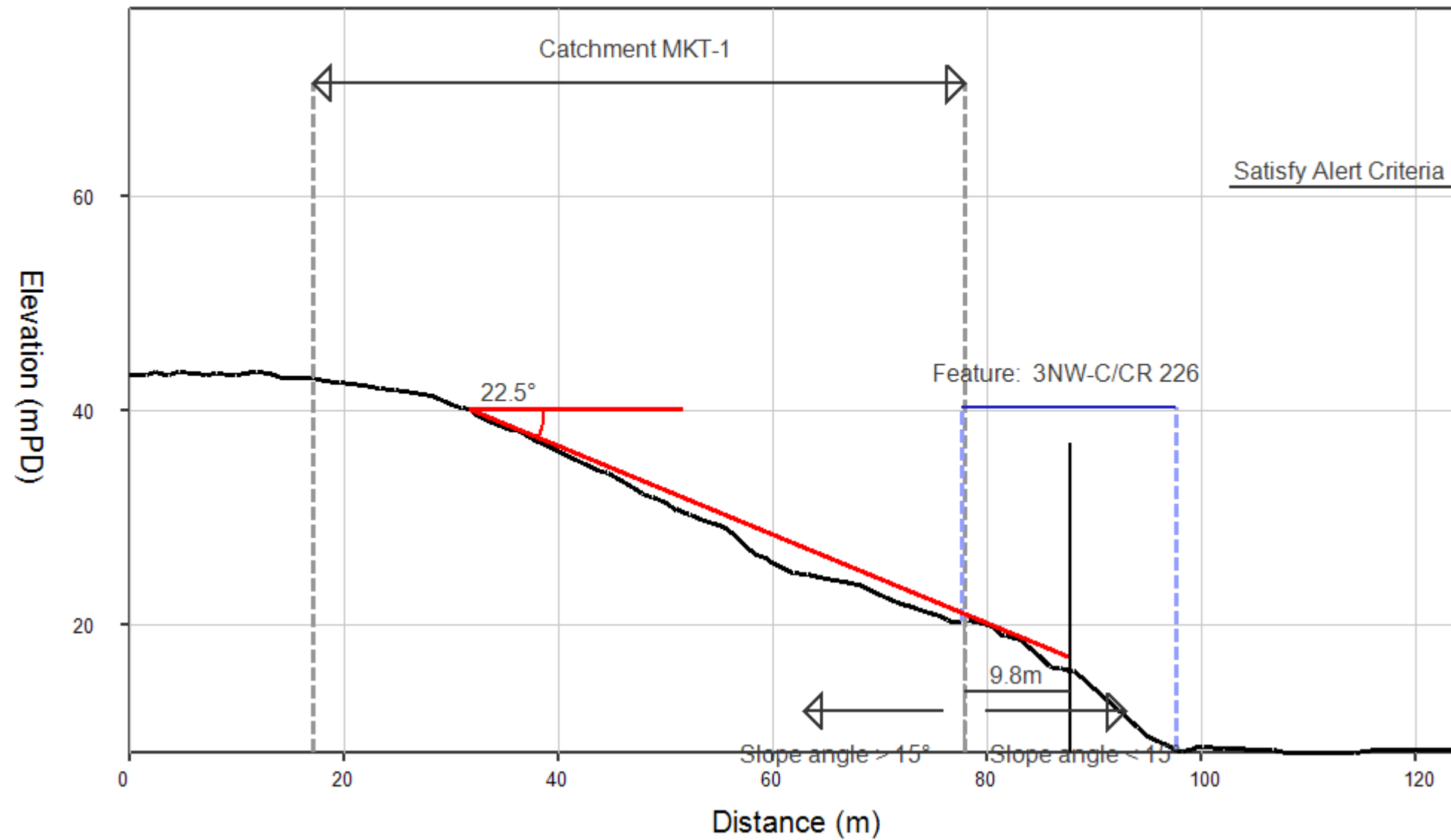
Scale N.T.S

Drawn by: KC Date 30 June Checked: KC Approved: DL

Job No.
287082

Figure No.
FIGURE 4.1

Section 1



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 1**

ARUP

Scale 1:1,000 (A3)

Drawn by: ML Date July 22 Checked: KC Approved: DL

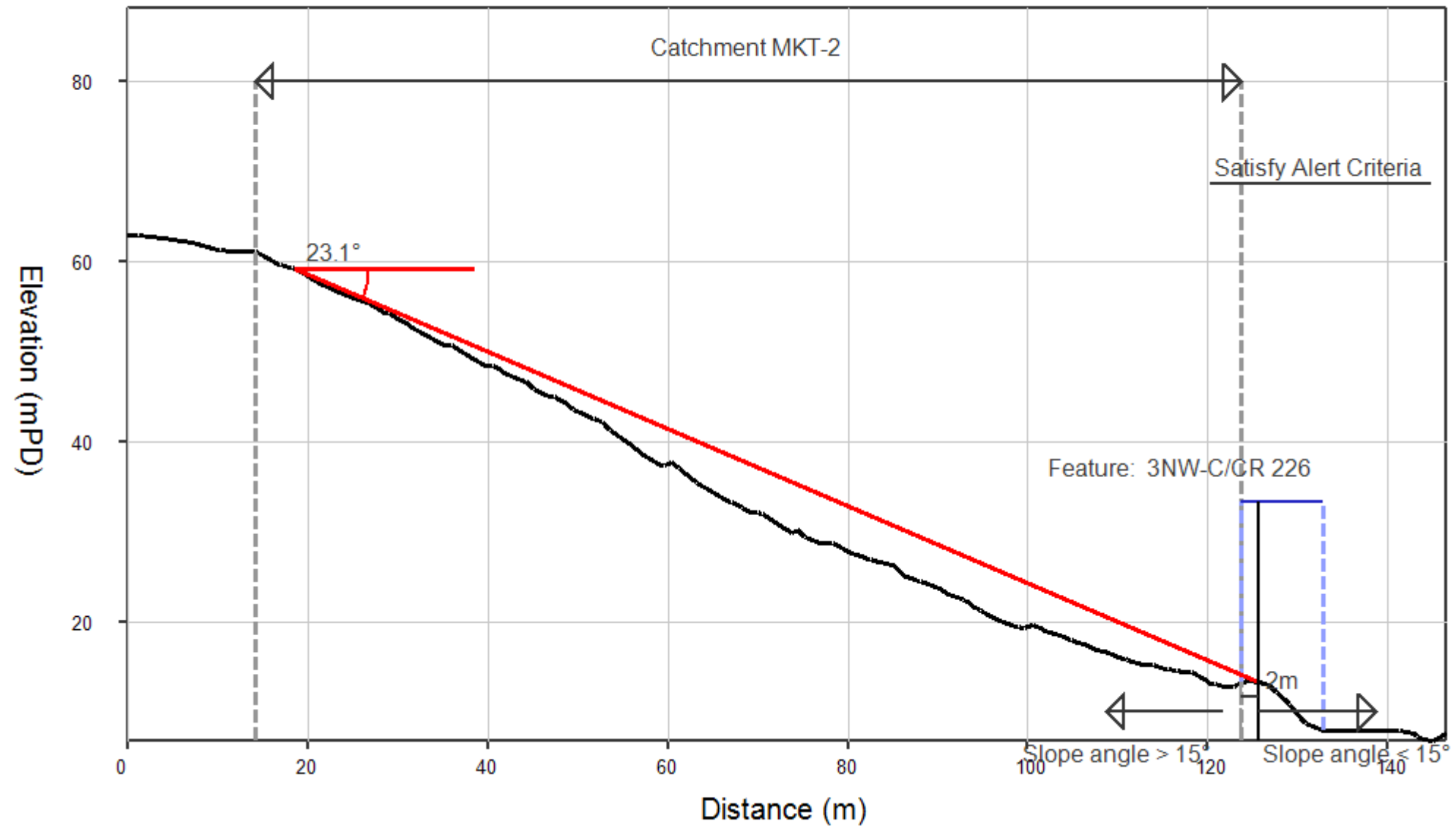
Job No.

287082

Figure No.

FIGURE 4.2a

Section 2



Job Title

PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO

Drawing Title

Natural Terrain Screening Section
Section 2

ARUP

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Drawn by: ML Date July 22 Checked: KC Approved: DL

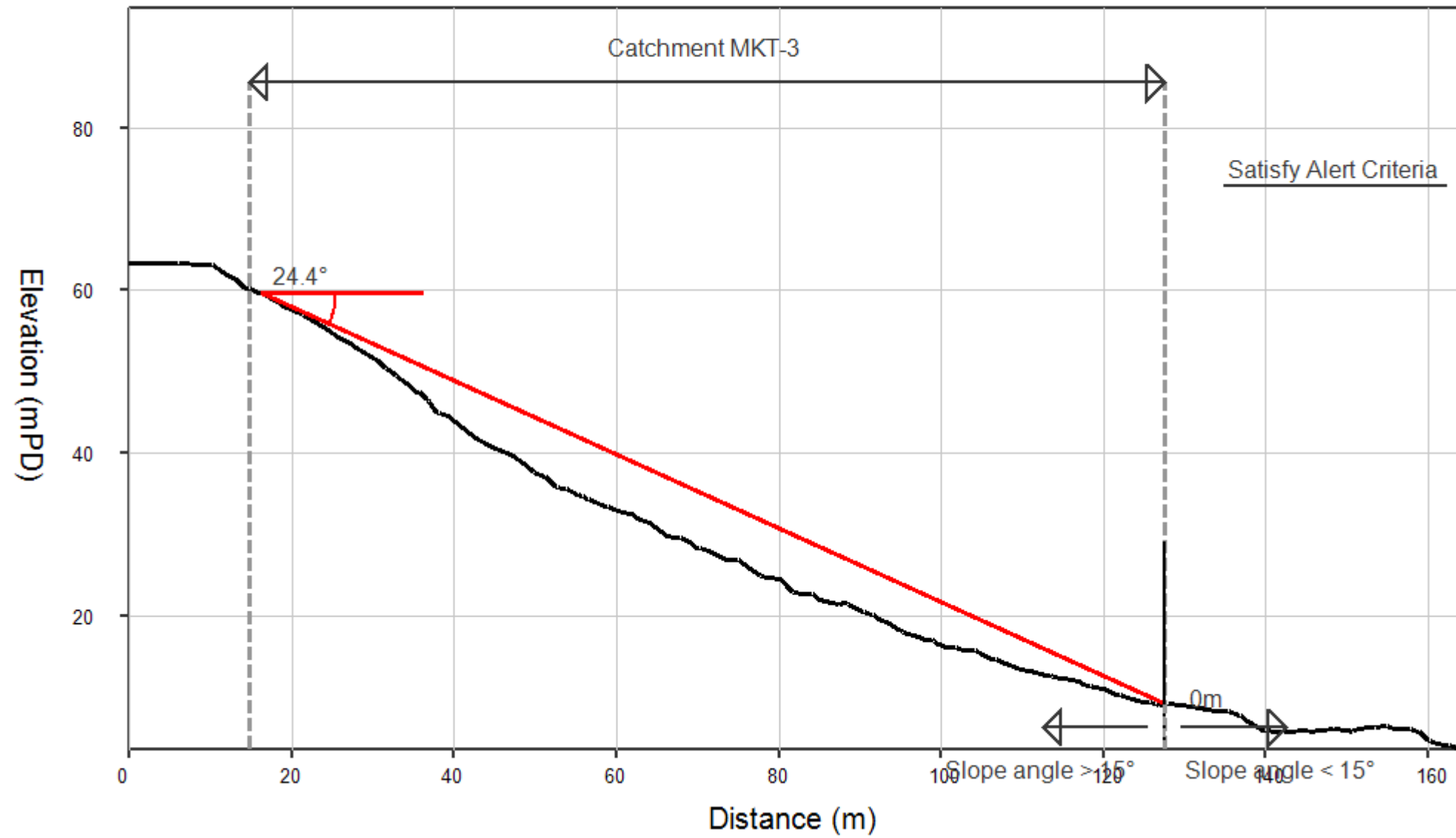
Job No.

287082

Figure No.

FIGURE 4.2b

Section 3



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 3**

ARUP

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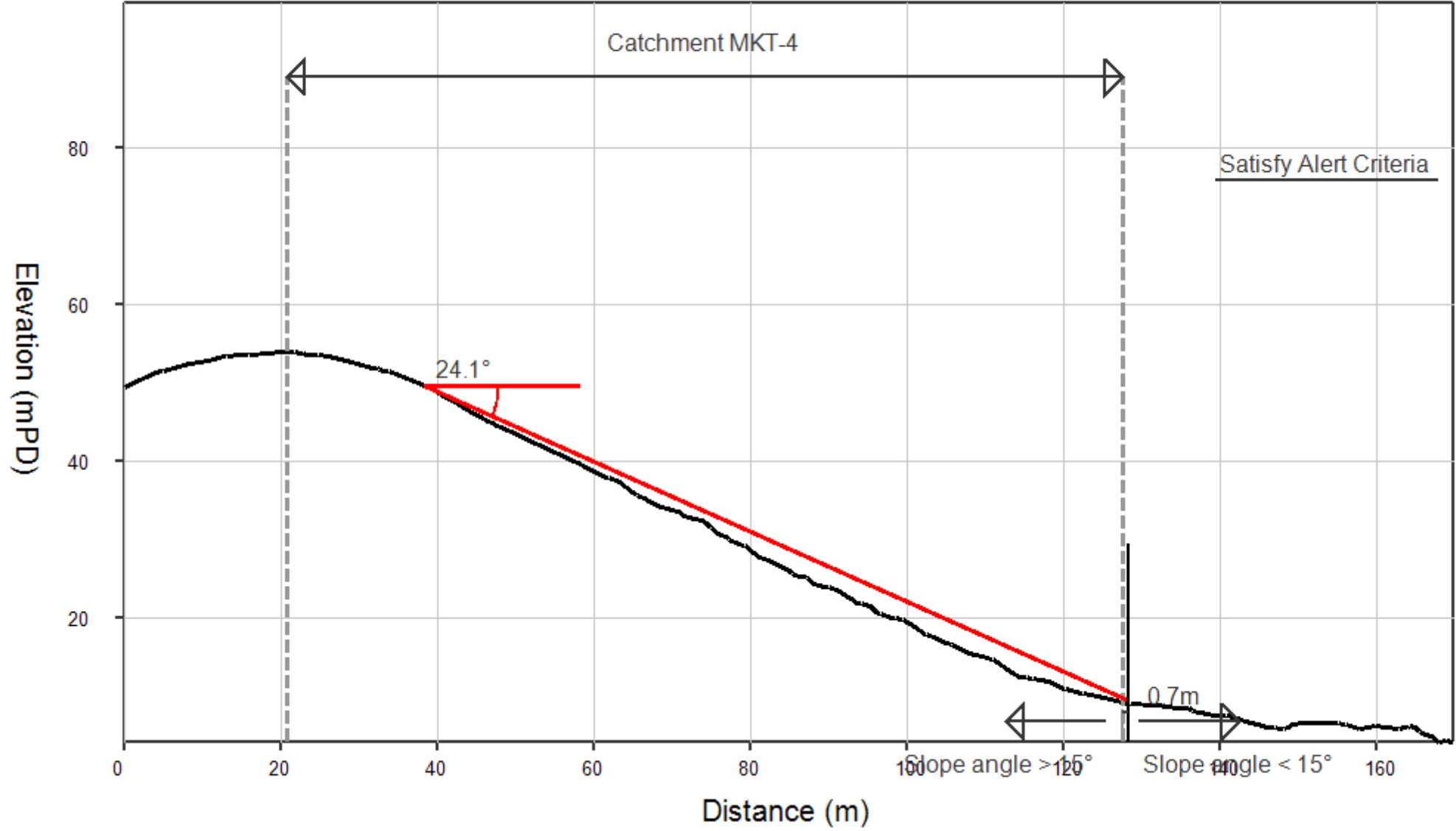
Job No.

287082

Figure No.

FIGURE 4.2c

Section 4



Job Title
**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 4**

ARUP

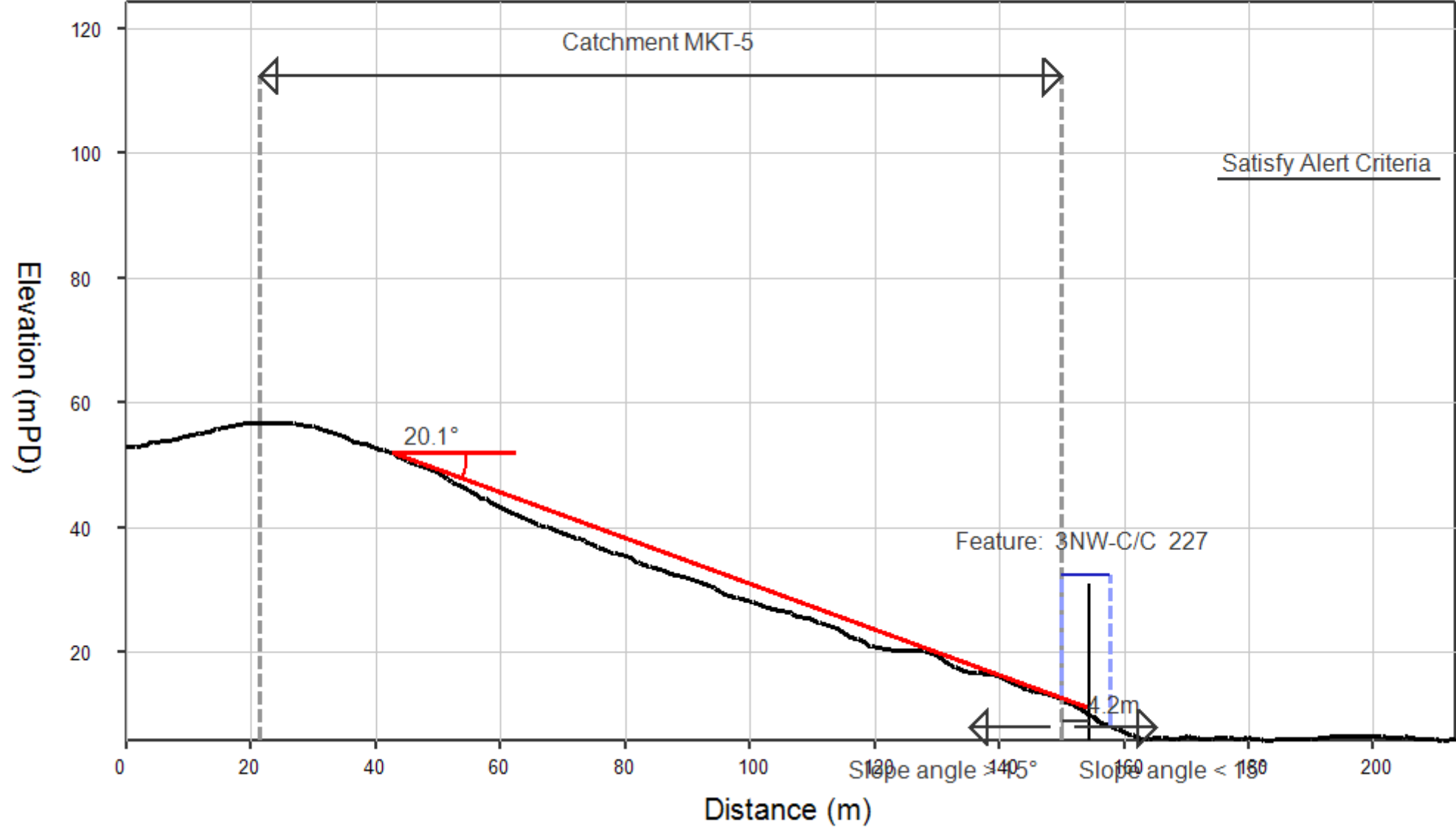
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Drawn by: ML Date July 22 Checked: KC Approved: DL

Job No.
287082

Figure No.
FIGURE 4.2d

Section 5



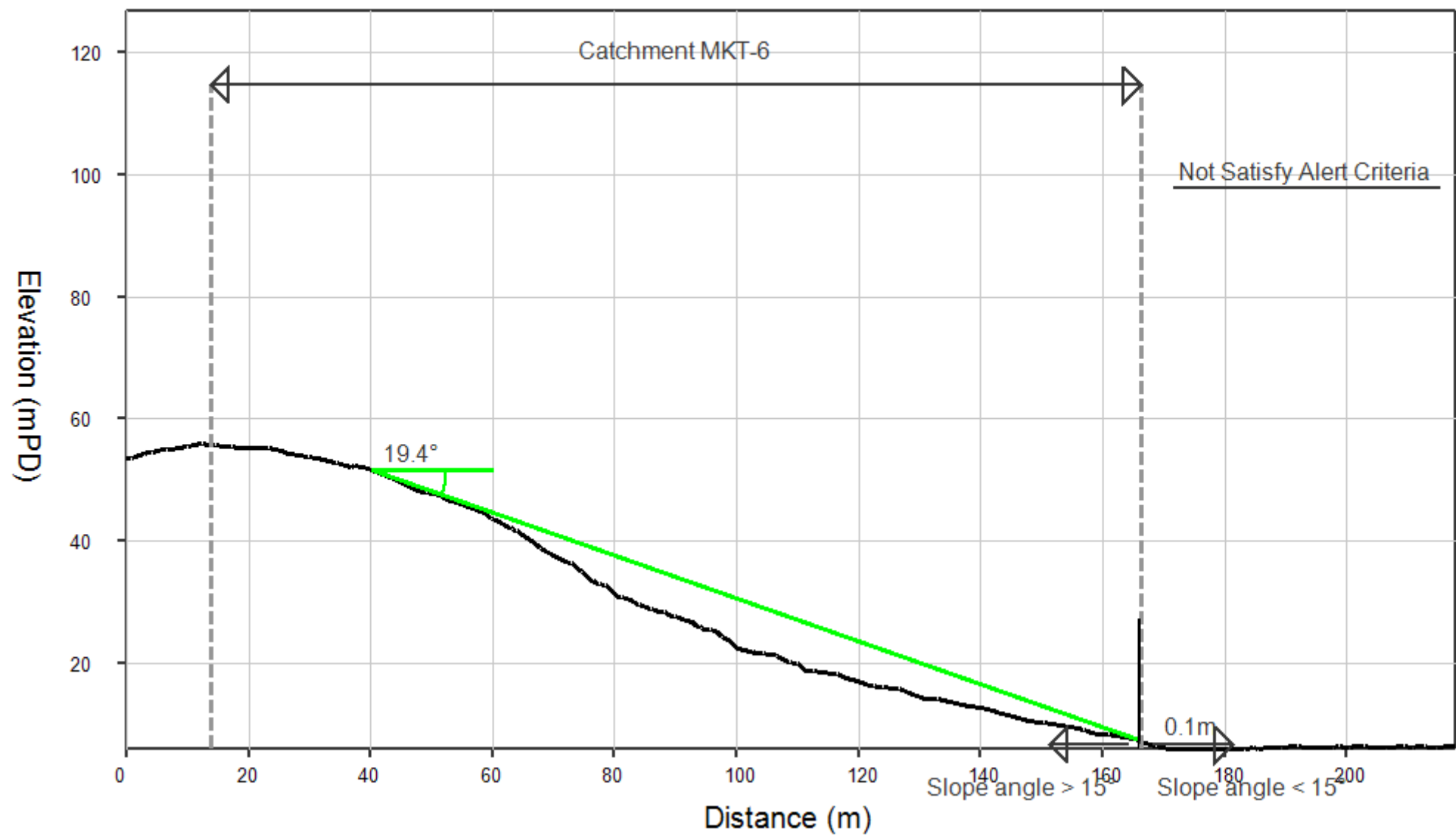
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**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 5**

ARUP

Scale 1:1,000 (A3)			
Drawn by:	ML	Date	July 22
Checked:	KC	Approved:	DL
Job No.	287082	Figure No.	FIGURE 4.2e

Section 6



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 6**

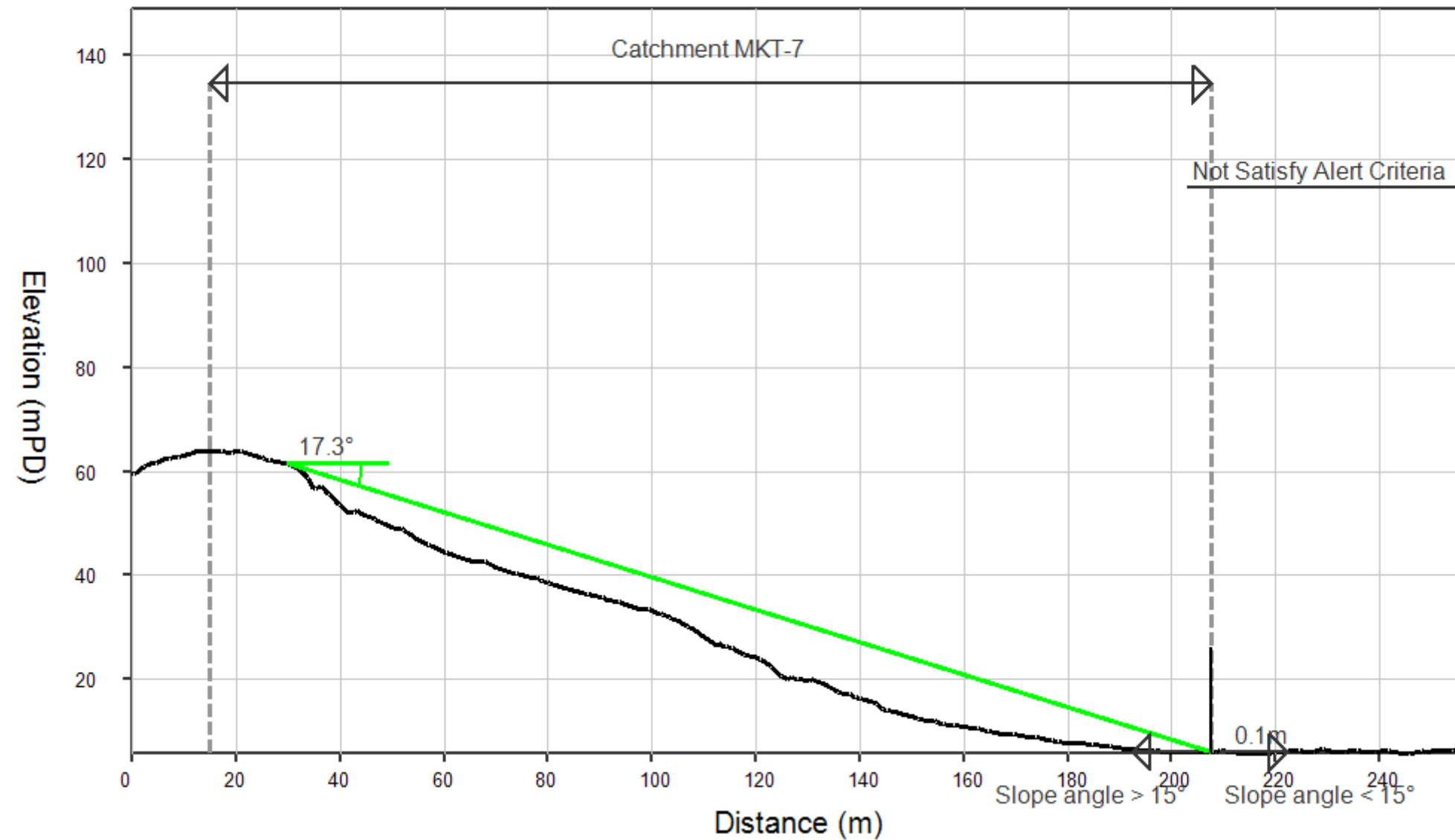
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Drawn by: ML Date July 22 Checked: KC Approved: DL

Job No. 287082 Figure No. **FIGURE 4.2f**

Section 7



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 7**

ARUP

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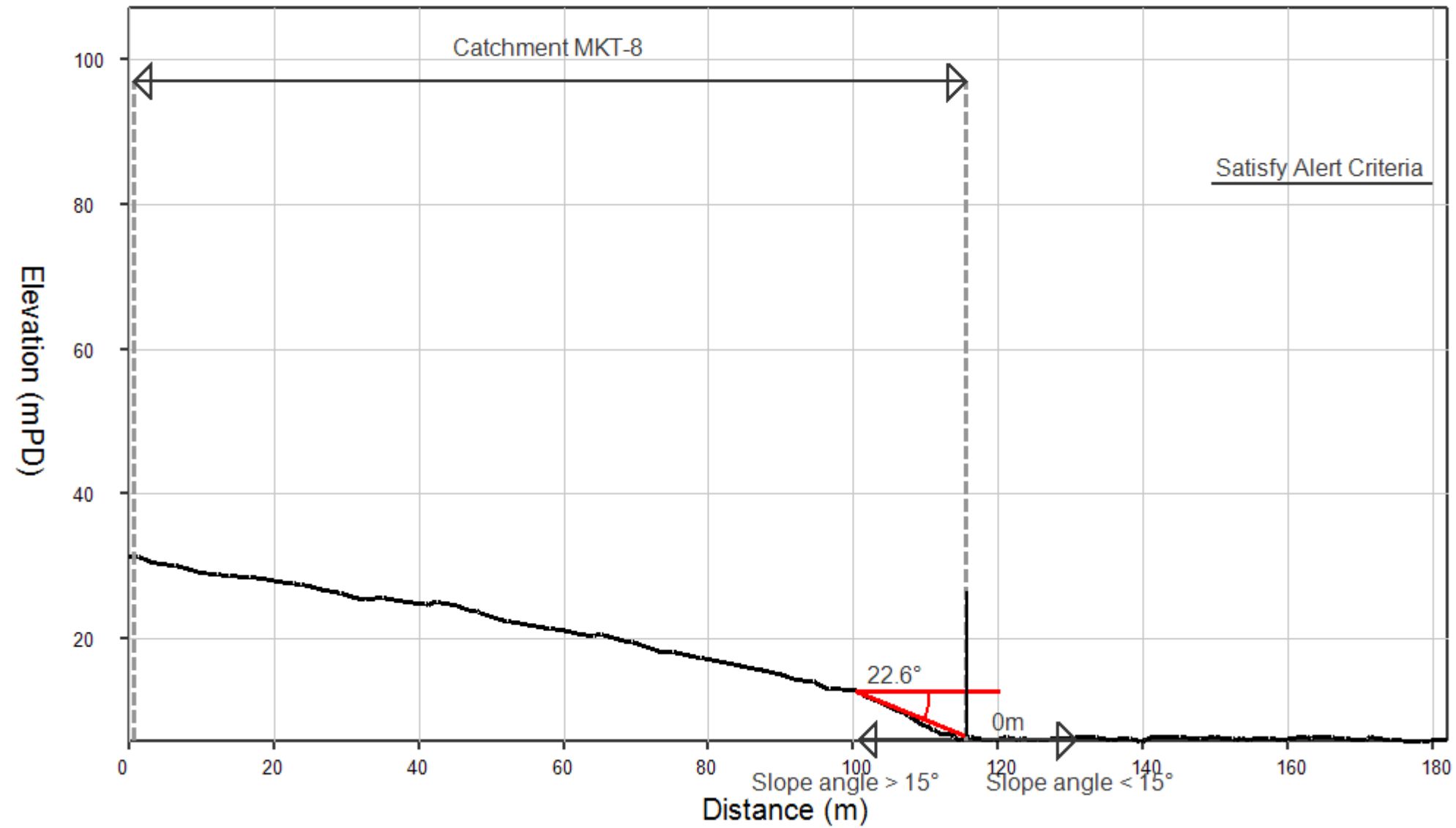
Job No.

287082

Figure No.

FIGURE 4.2g

Section 8



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 8**

ARUP

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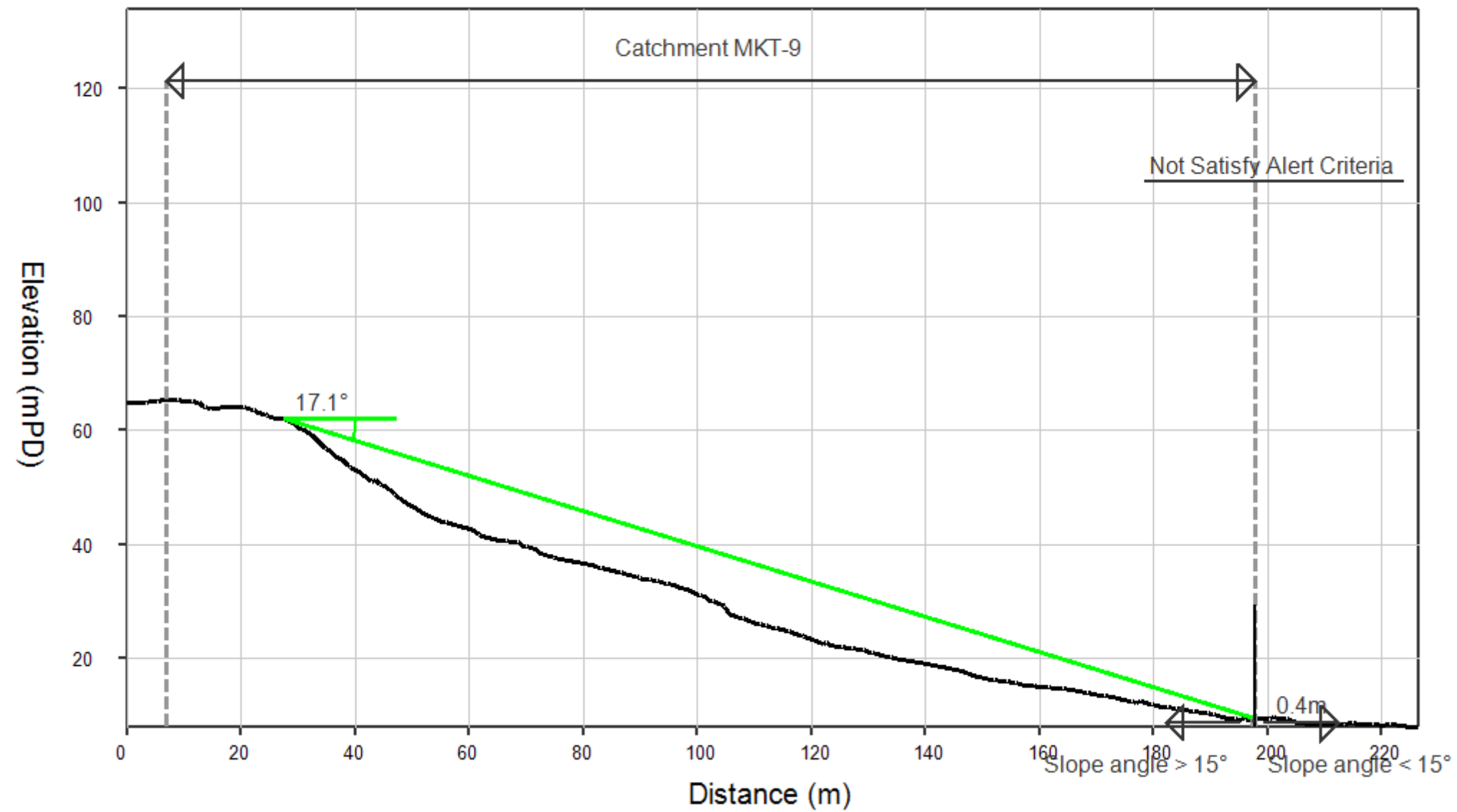
Job No.

287082

Figure No.

FIGURE 4.2h

Section 9



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 9**

ARUP

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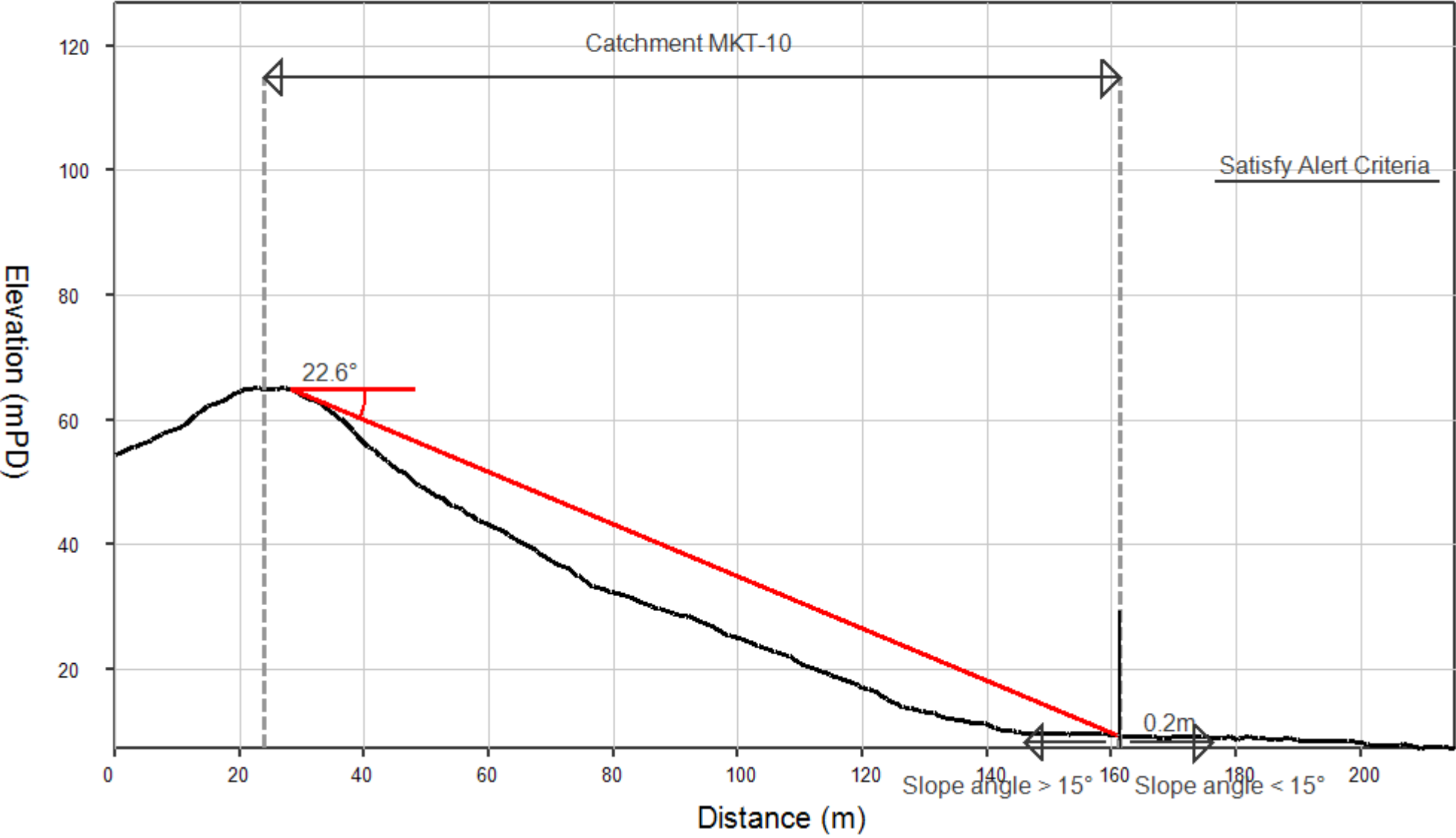
Job No.

287082

Figure No.

FIGURE 4.2i

Section 10

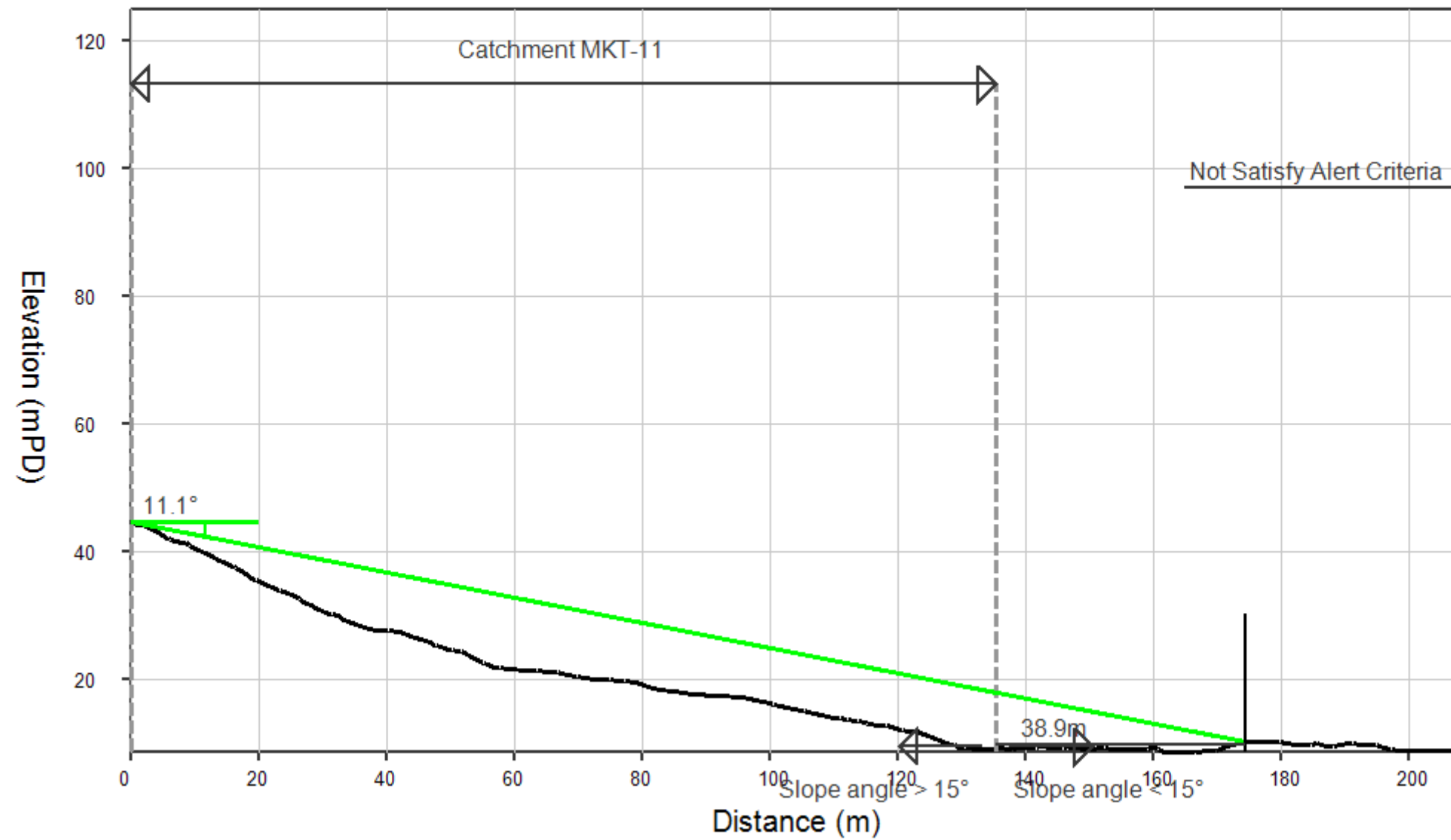


Job Title
**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 10**

ARUP
Scale 1:1,000 (A3)
Drawn by: ML Date July 22 Checked: KC Approved: DL
Job No. 287082 Figure No. **FIGURE 4.2j**

Section 11



Job Title

PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO

Drawing Title

Natural Terrain Screening Section
Section 11

ARUP

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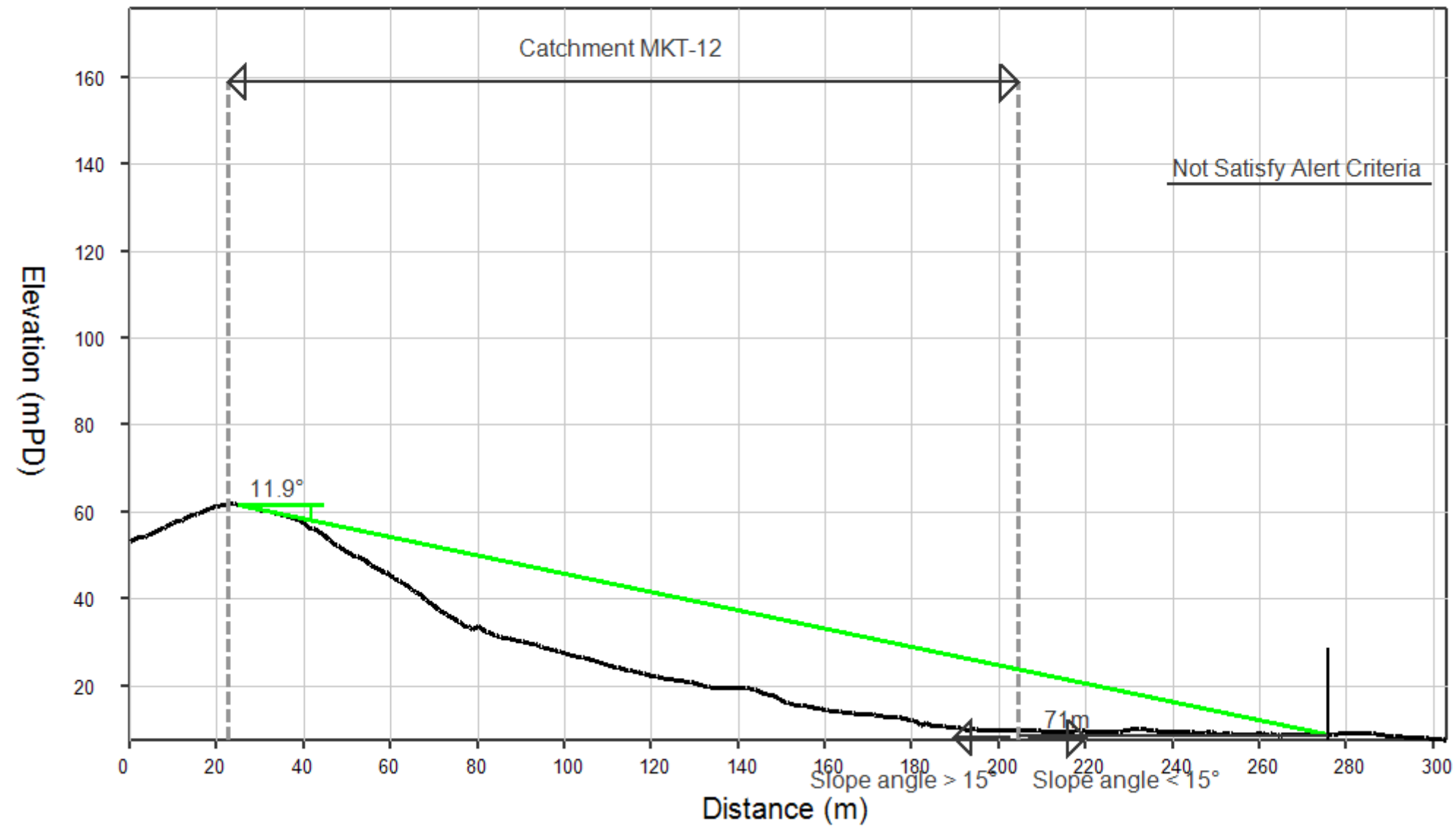
Job No.

287082

Figure No.

FIGURE 4.2k

Section 12



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 12**

ARUP

Scale 1:1,000 (A3)

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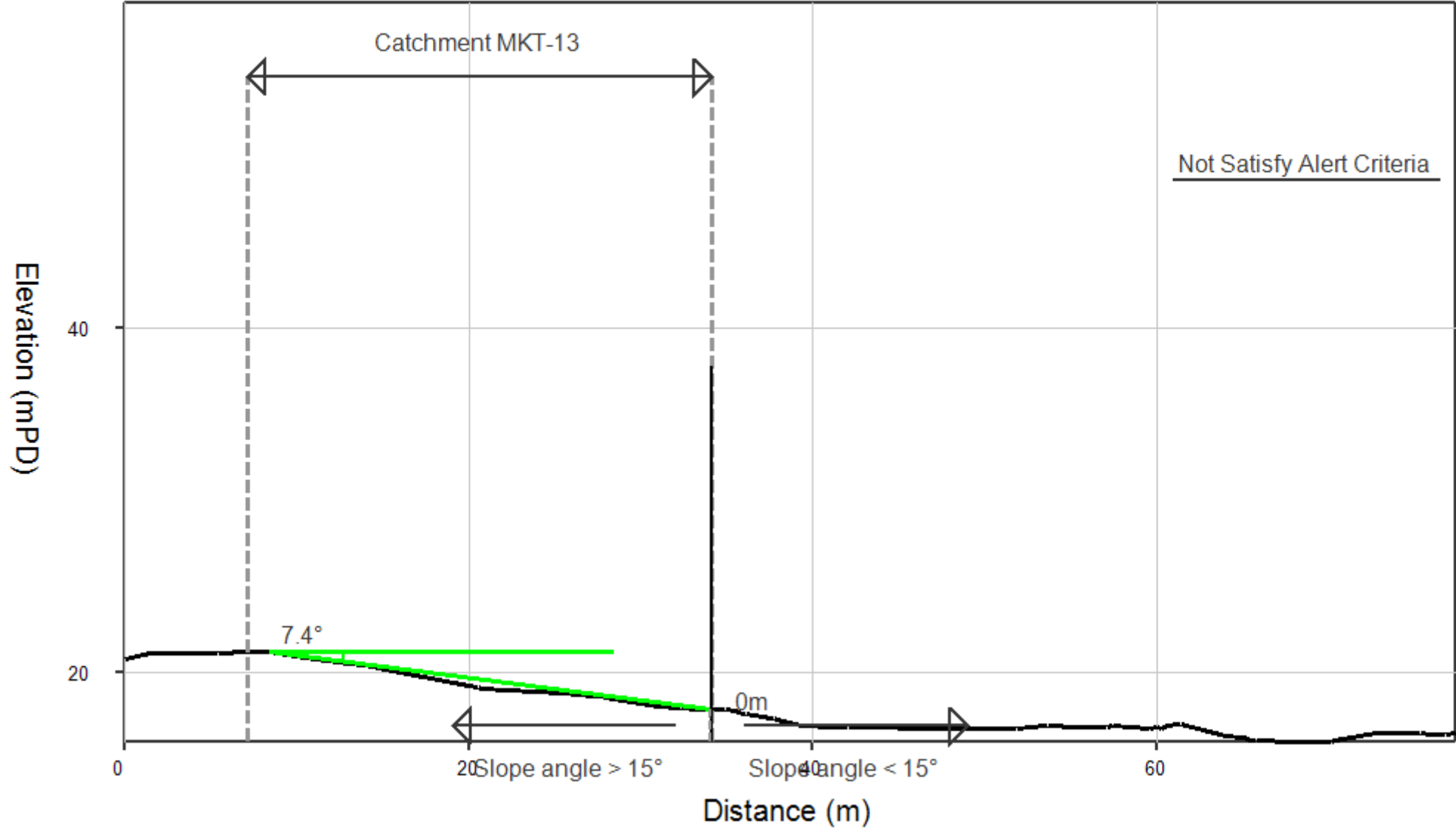
Job No.

287082

Figure No.

FIGURE 4.2I

Section 13



Job Title

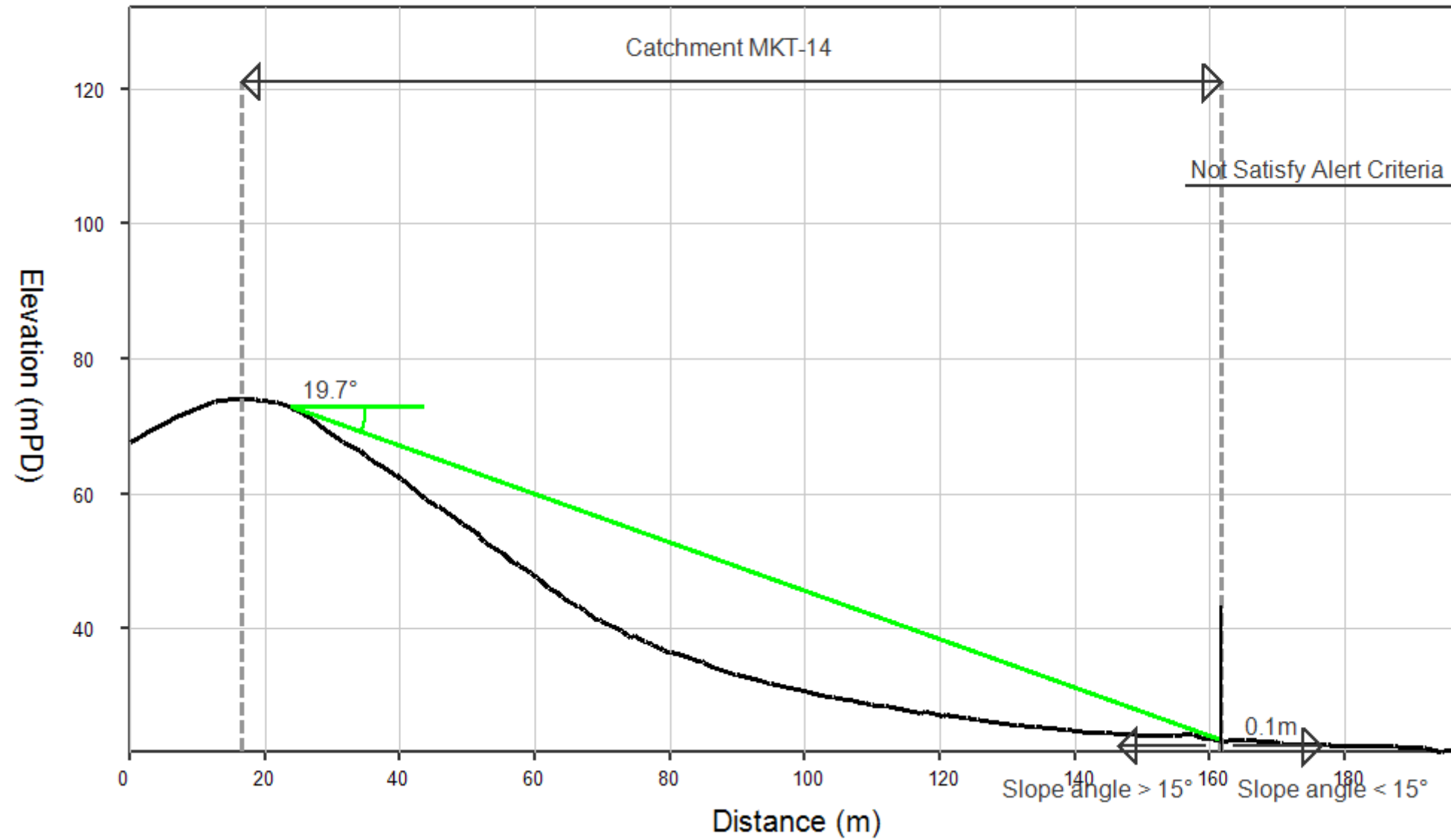
PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO

Drawing Title

Natural Terrain Screening Section
Section 13

ARUP			
Scale 1:1,000 (A3)			
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Checked:	KC	Approved:	DL
Job No.	287082	Figure No.	FIGURE 4.2m

Section 14



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 14**

ARUP

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Drawn by: ML Date July 22 Checked: KC Approved: DL

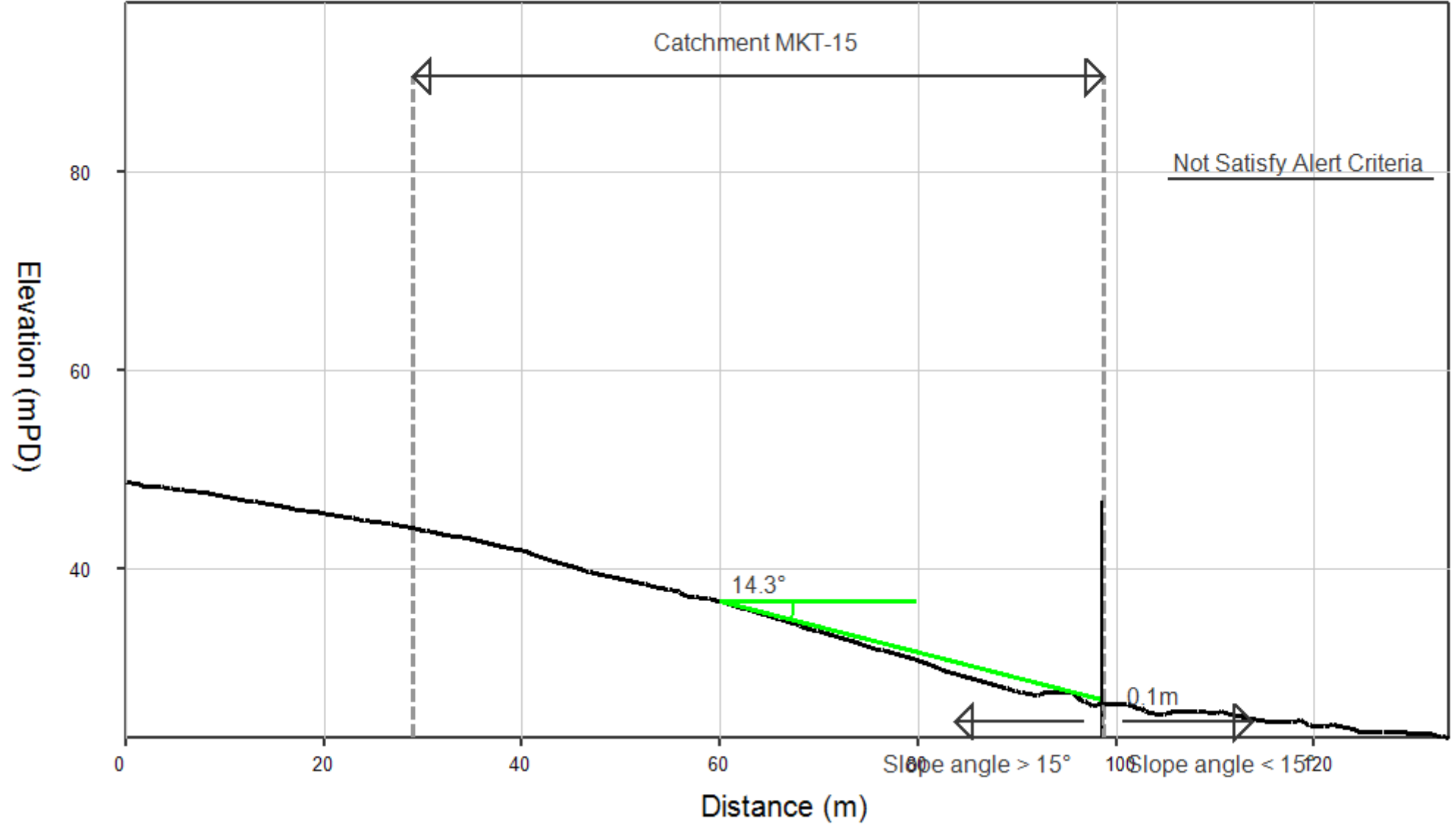
Job No.

287082

Figure No.

FIGURE 4.2n

Section 15



Job Title
**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 15**

ARUP

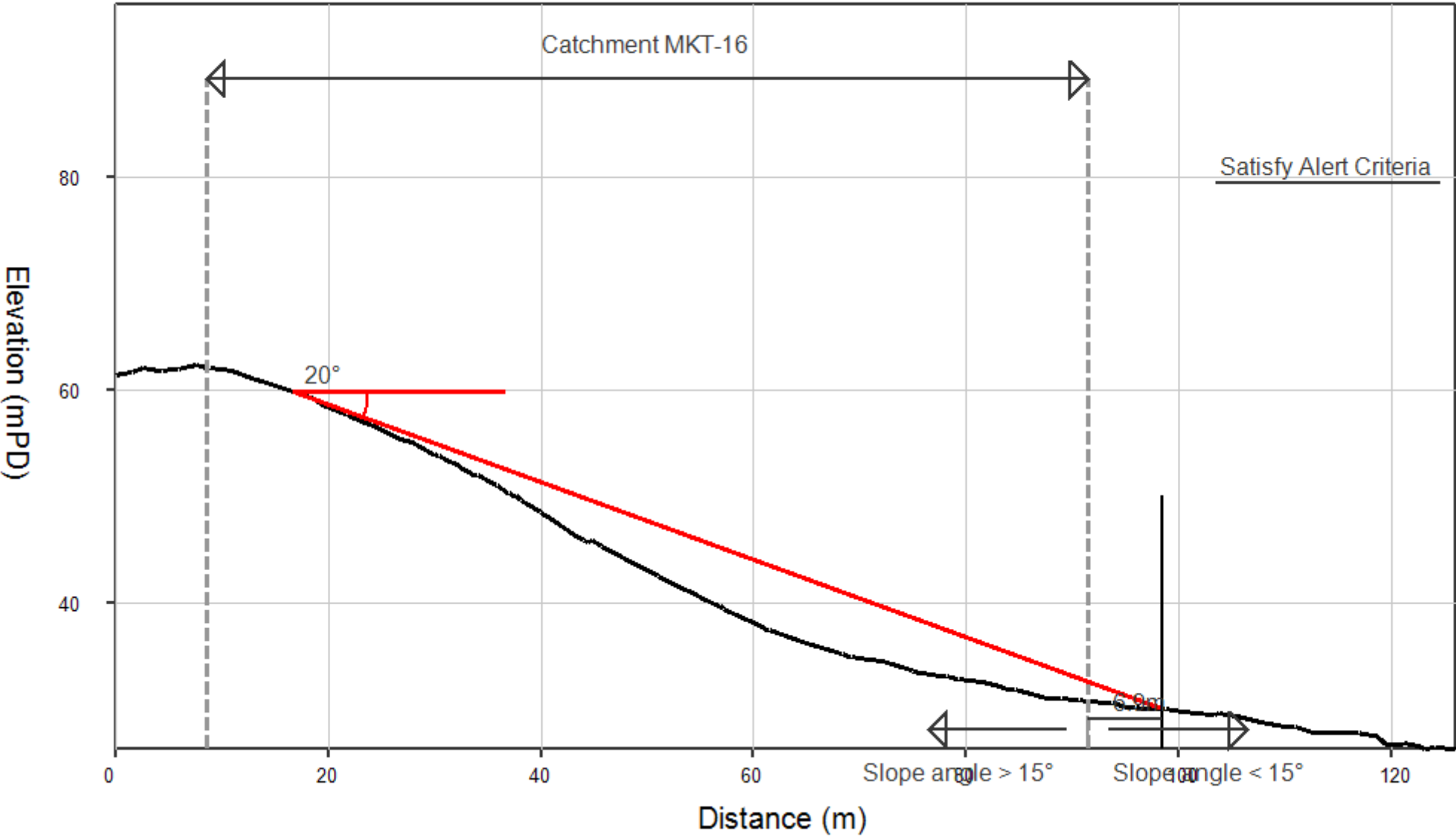
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Drawn by: ML Date July 22 Checked: KC Approved: DL

Job No.
287082

Figure No.
FIGURE 4.2o

Section 16



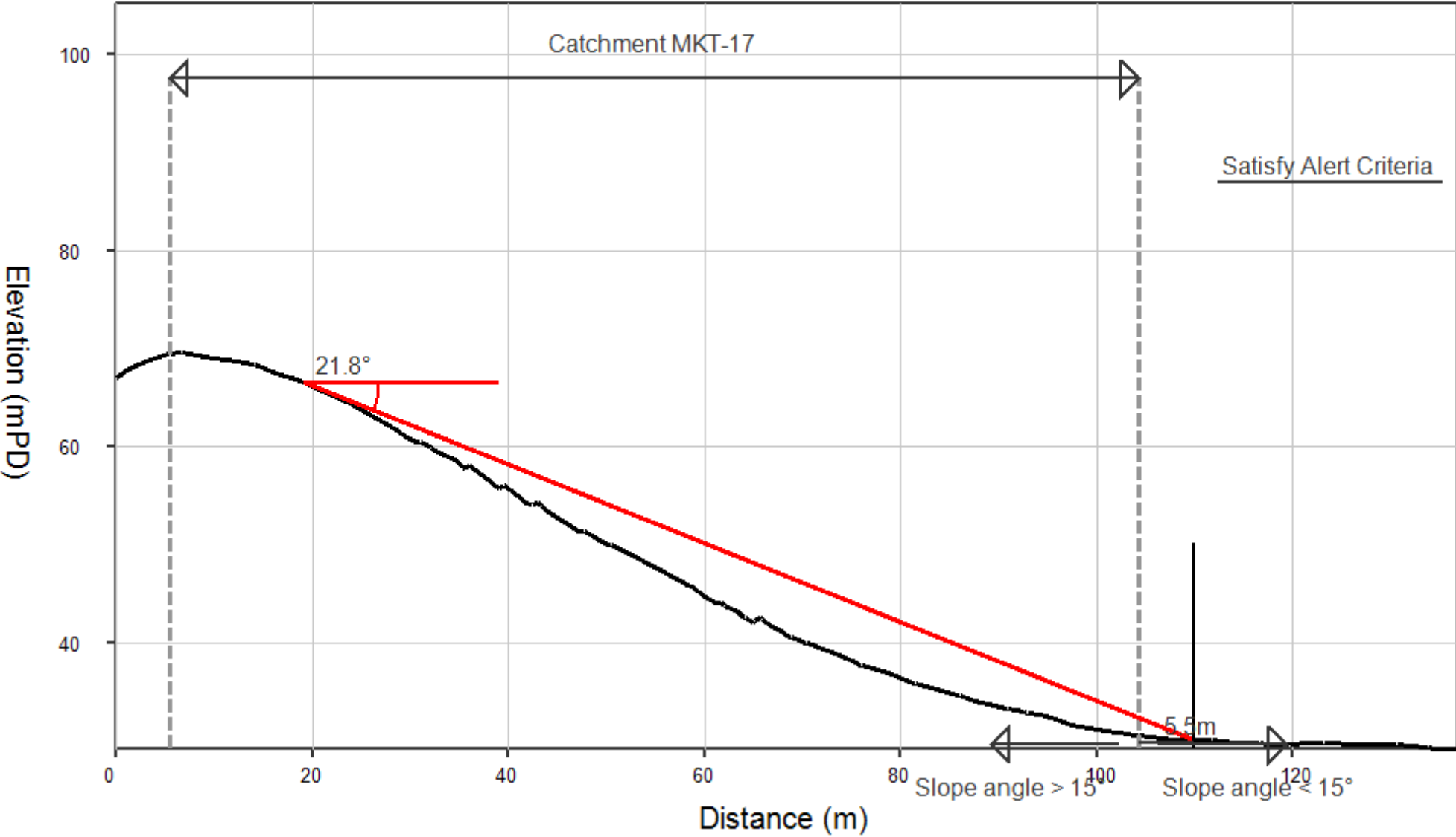
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**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 16**

ARUP

Scale 1:1,000 (A3)			
Drawn by:	ML	Date	July 22
Checked:	KC	Approved:	DL
Job No.	287082	Figure No.	FIGURE 4.2p

Section 17



Job Title

Drawing Title

Natural Terrain Screening Section
Section 17

ARUP

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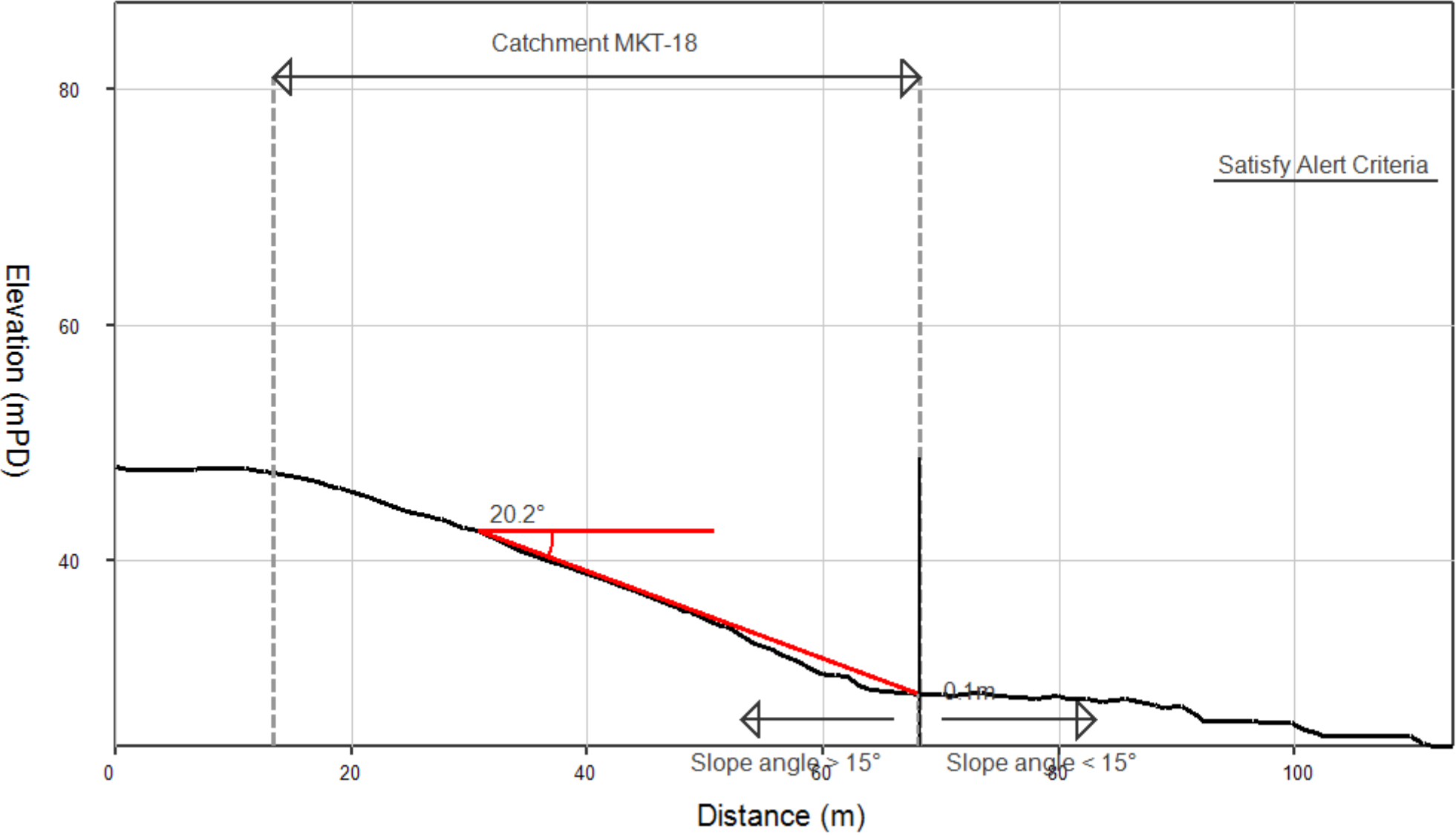
Job No.

287082

Figure No.

FIGURE 4.2q

Section 18



Job Title
**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 18**

ARUP

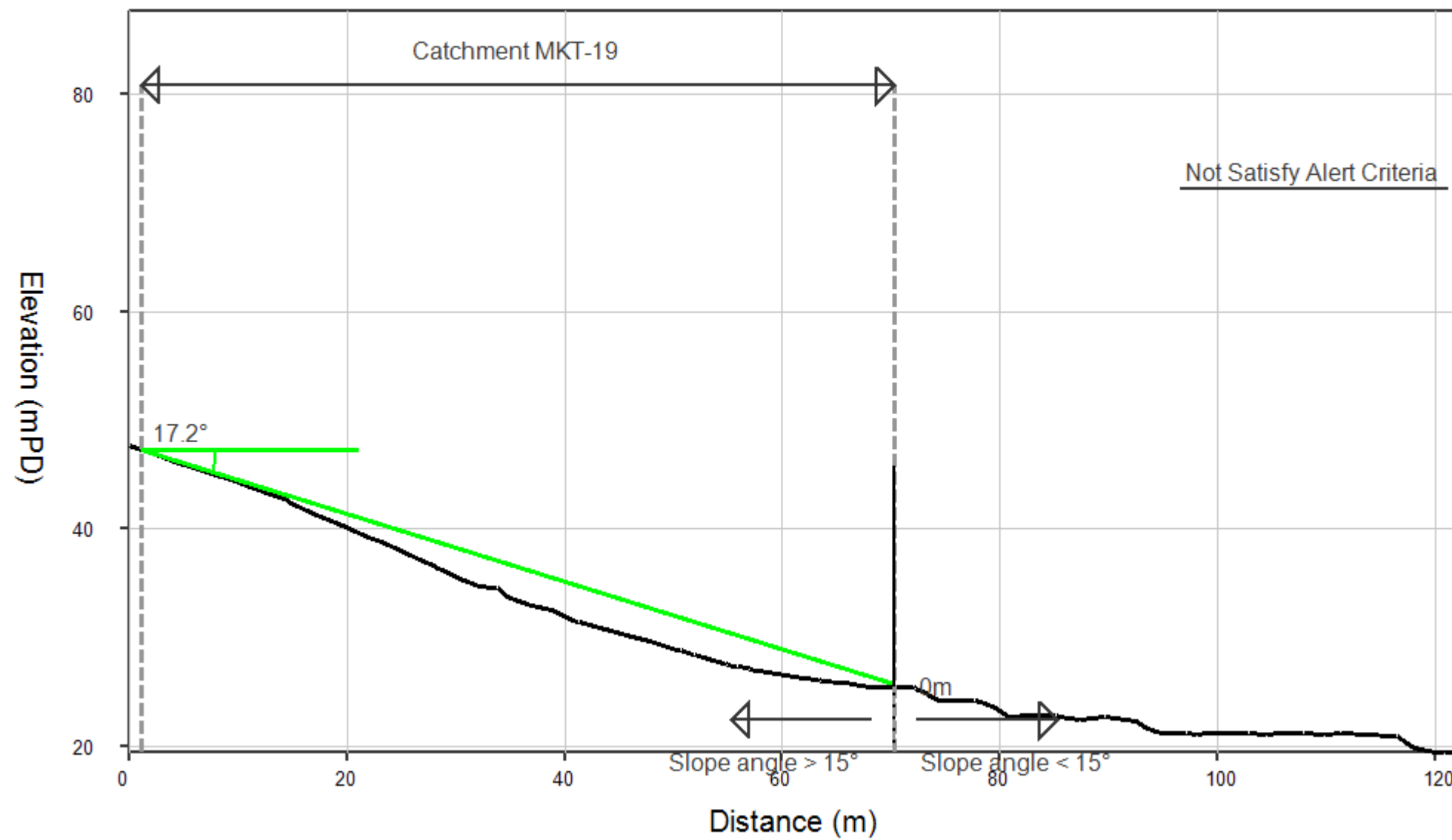
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Drawn by: ML Date July 22 Checked: KC Approved: DL

Job No.
287082

Figure No.
FIGURE 4.2r

Section 19



Job Title

PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO

Drawing Title

Natural Terrain Screening Section
Section 19

ARUP

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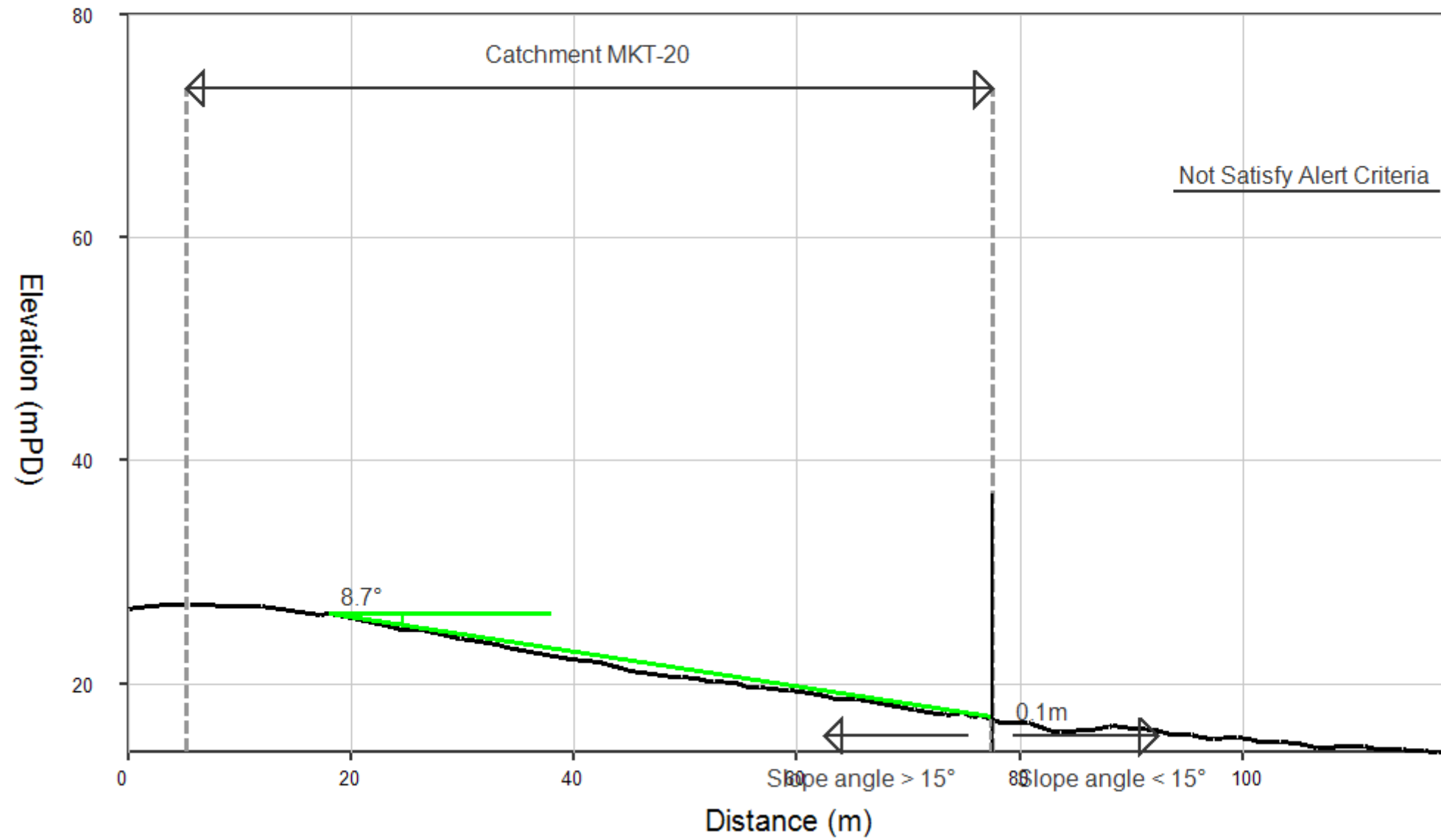
Job No.

287082

Figure No.

FIGURE 4.2s

Section 20



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title

**Natural Terrain Screening Section
Section 20**

ARUP

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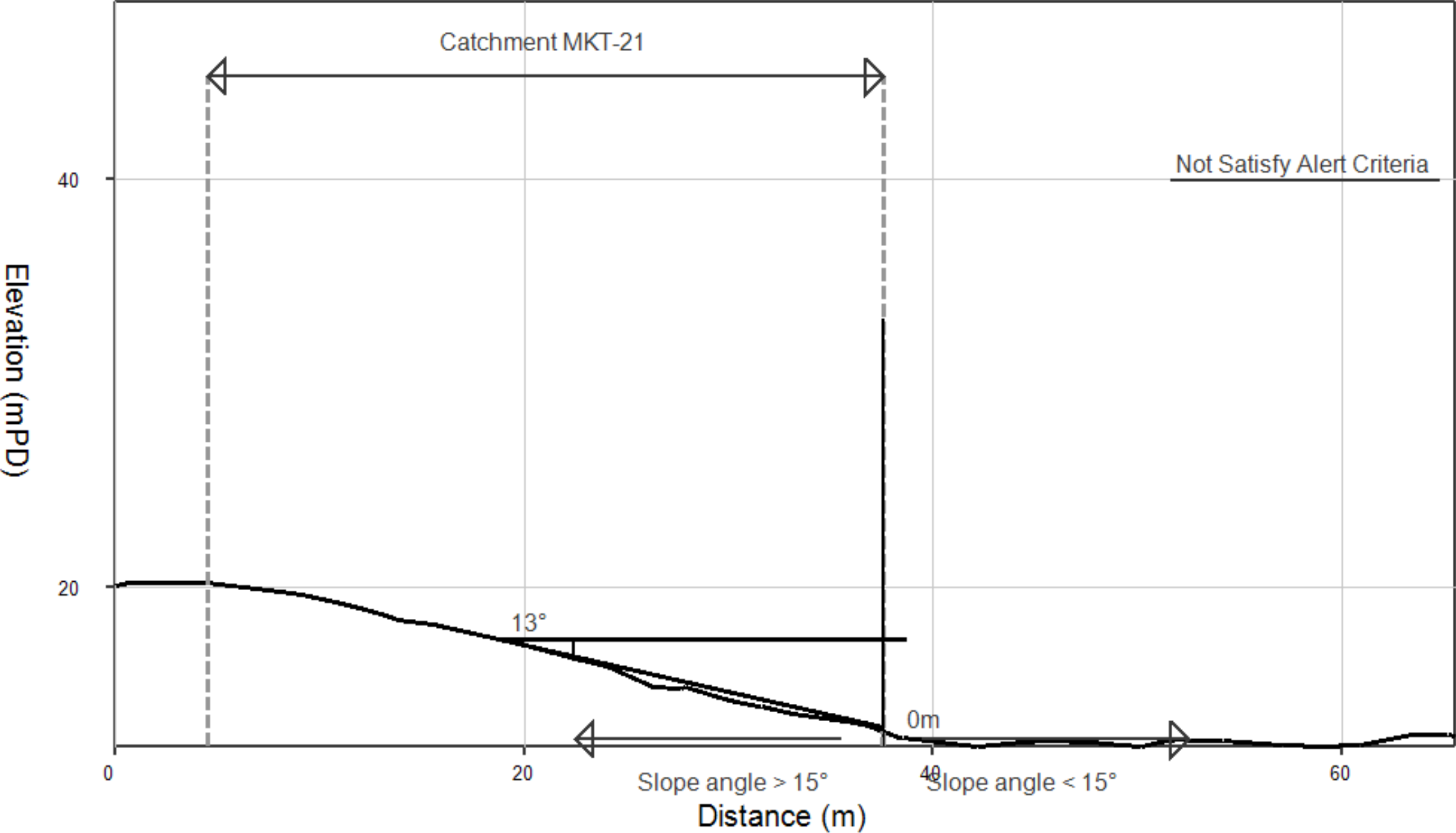
Job No.

287082

Figure No.

FIGURE 4.2t

Section 21



Job Title

**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

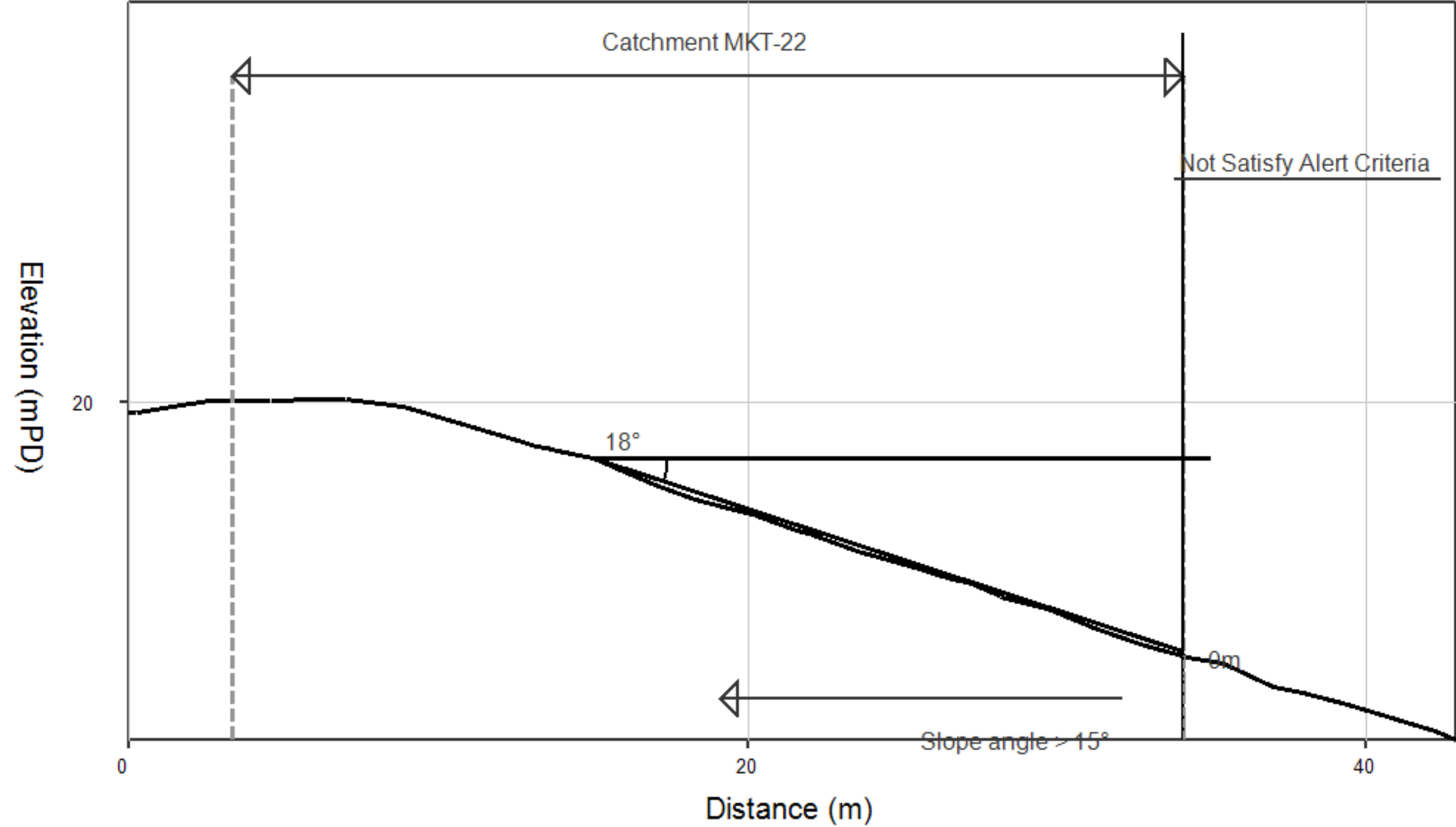
Drawing Title

**Natural Terrain Screening Section
Section 21**

ARUP

Scale 1:1,000 (A3)	
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Checked: KC	Approved: DL
Job No. 287082	Figure No. FIGURE 4.2u

Section 22



Job Title
**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 22**

ARUP

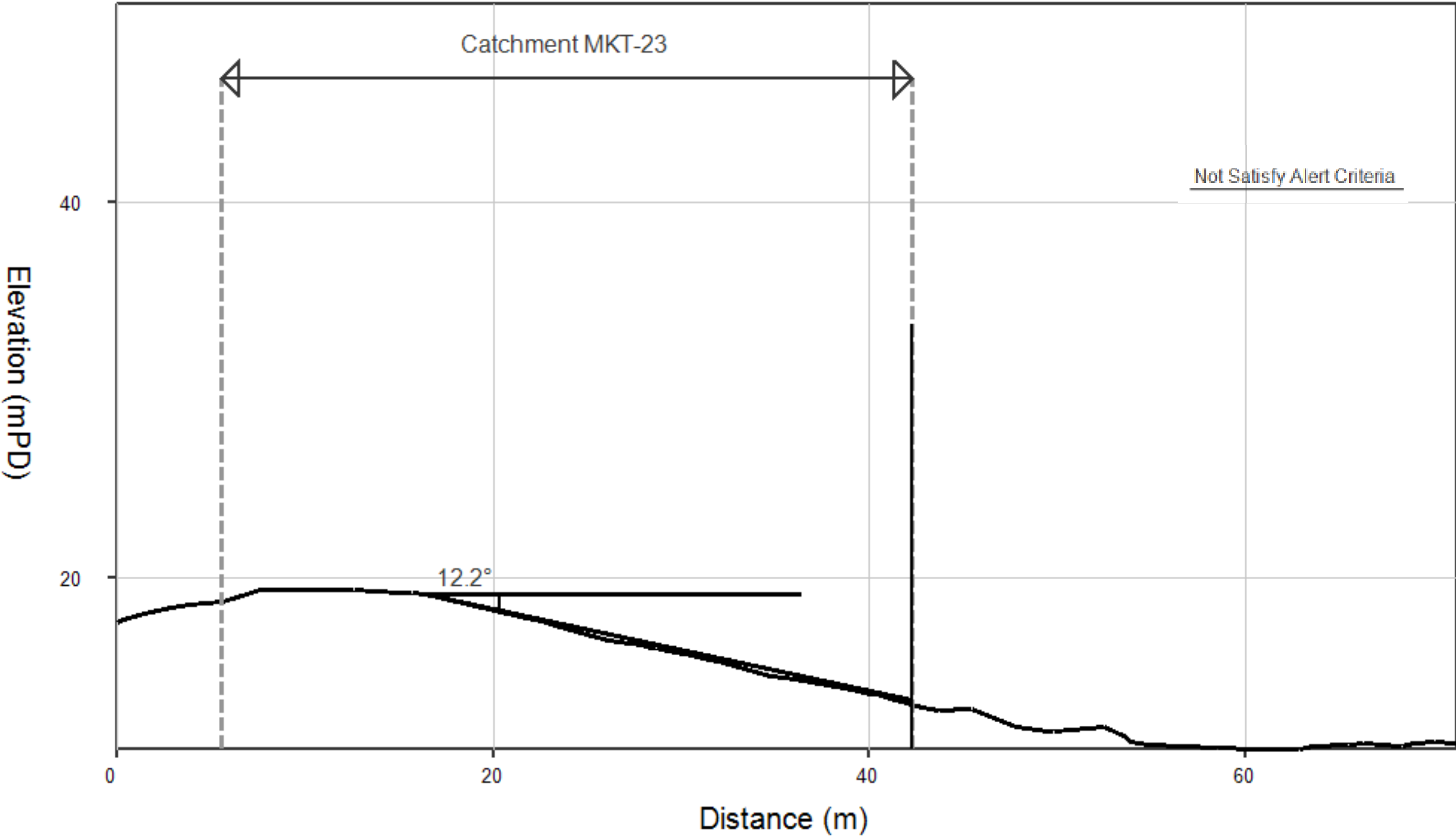
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Job No.
287082

Figure No.
FIGURE 4.2v

Section 23



Job Title
**PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D 82 AND D.D. 86 AND
ADJOINING GOVERNMENT
LAND, MAN KAM TO**

Drawing Title
**Natural Terrain Screening Section
Section 23**

ARUP

Scale 1:1,000 (A3)

Drawn by: ML Date July 22 Checked: KC Approved: DL

Job No.
287082

Figure No.
FIGURE 4.2w

Figure 1.1 Location Plan

Figure 1.2 Proposed Site Formation Plan

Figure 1.3 Indicative Scheme of the Proposed Amendment (Master Layout Plan)

Figure 1.4 Indicative Scheme of the Proposed Amendment (B1 Basement Layout)

Figure 1.5 Indicative Scheme of the Proposed Amendment (B2 Basement Layout)

Figure 2.1 Site Location Plan

Figure 3.1 Part Plan of Geological Map Sheet 6 (1988, 1:20 000)

Figure 3.2 Existing GI Location

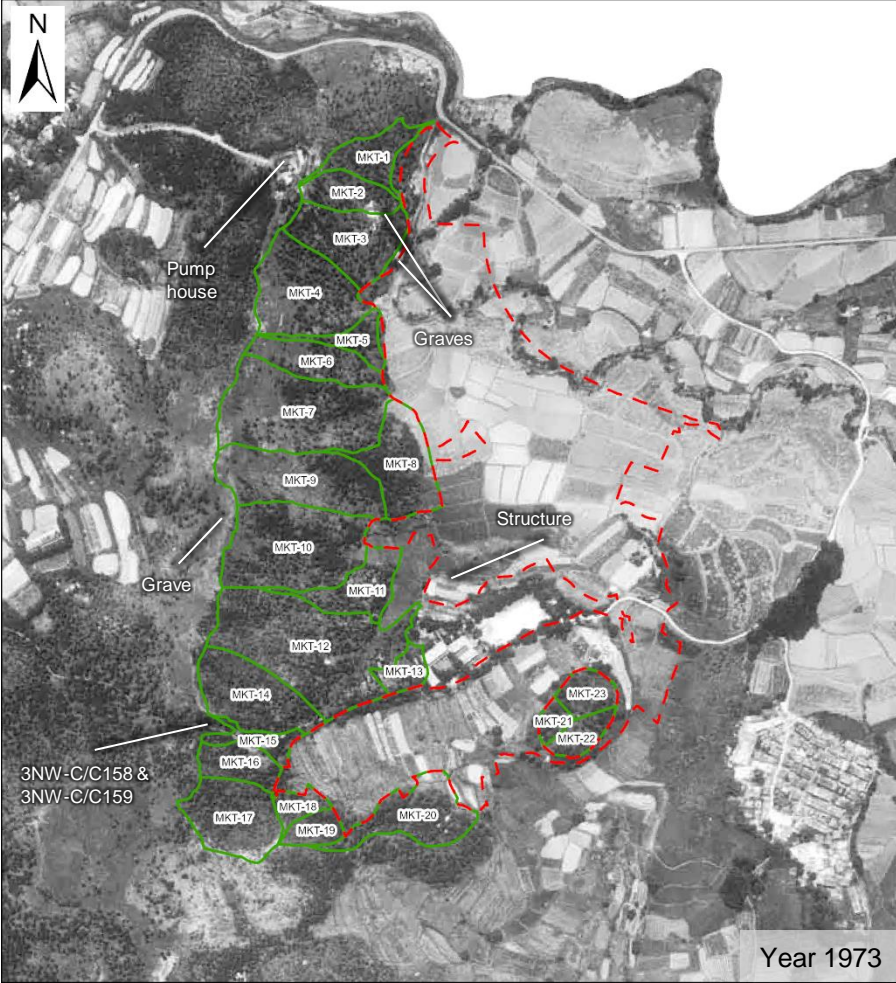
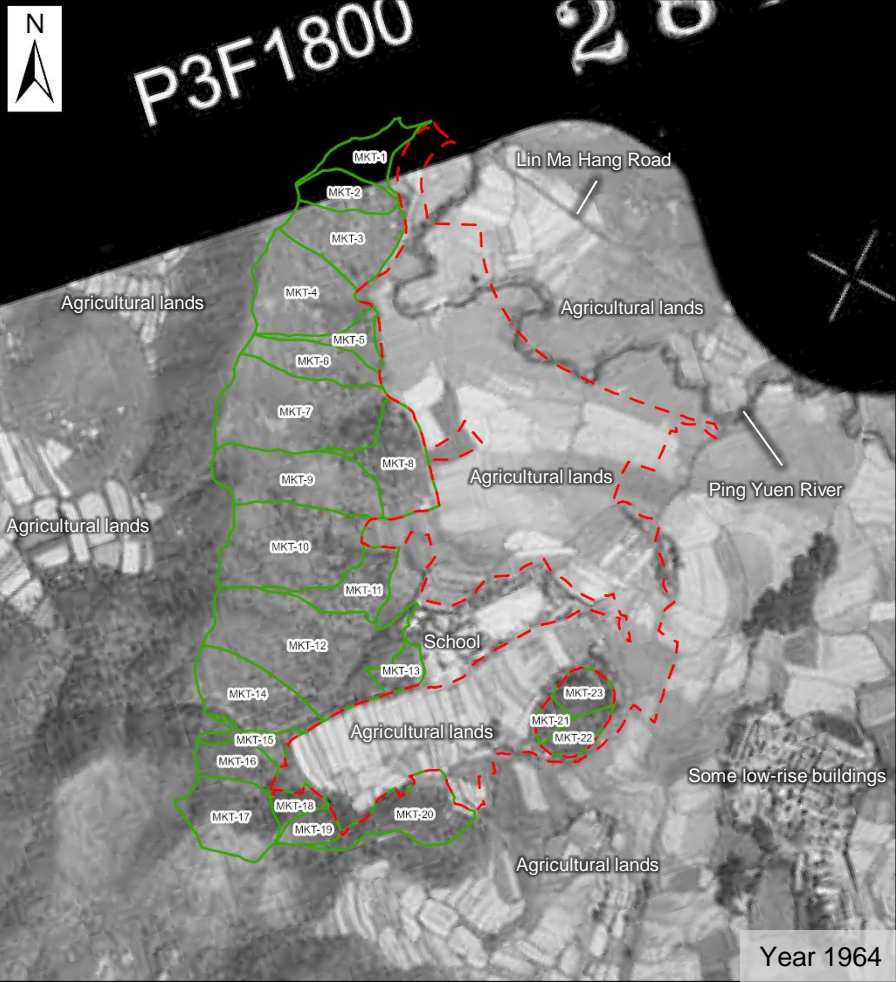
Figure 3.3 Adjacent Registered Man-made Features

Figure 4.1 Natural Terrain Catchment, Boulder Field Inventory and instability Records

Figure 4.2 Natural Terrain Screening Section

Appendix A

Aerial Photograph Interpretation



Year 1964

- The Application Site was located mostly at the agricultural terraces, with the northern portion of the Site located at the Ping Yuen River.
- A school and a playground were identified to the immediately west of the Site.
- Some low-rise buildings were constructed to the southeast of the Site.
- Lin Ma Hang Road was constructed to the northeast of the Site.
- Agricultural terraces were noted at the Site location and in the vicinity of the Site.
- The Site was located at the toe of a natural terrain catchment area. The catchment area is sub-divided into 20 catchments, namely MKT-1 to MKT-20.
- The natural terrain catchments comprised the southwest-facing natural hillside covered by some vegetation with little anthropogenic disturbance. The catchments are westerly bounded a N-S trending ridgeline.
- A school was noted at the toe of the catchment no. MKT-13.
- A footpath was noted across the catchment no. MKT-15.
- A total of 14 relict landslides were observed within the catchment area. The relict landslides were highly degraded and covered by vegetation. In general, they comprise a broad depression with a rounded scarp

Year 1973

- A structure was noted at the western portion of the Site, to the north of the school.
- A road is constructed to the east of the Site, which is connecting with the Lin Ma Hang Road.
- A pump house and road were constructed at the crest of the catchment no. MKT-2.
- Man-made feature nos. 3NW-C/C158 and 3NW-C/C159 were constructed at the crest of the catchment no. MKT-15, most likely in association with the footpath at their toes.
- Some graves were noted within and in the vicinity of the catchment area.
- Reduction in vegetation was noted to the south of the catchment area, most likely in association with hill fire.

Year 1981

- The construction of the River Ganges Pumping Station was in progress to the immediately east of the north portion of the Site.
- The road of Frontier Closed Area Boundary was constructed to the north of the Site.

Job Title

PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title

**Aerial Photograph Interpretation
Year 1964 to 1981**

Legend

- Development Site
- Natural Terrain Catchment

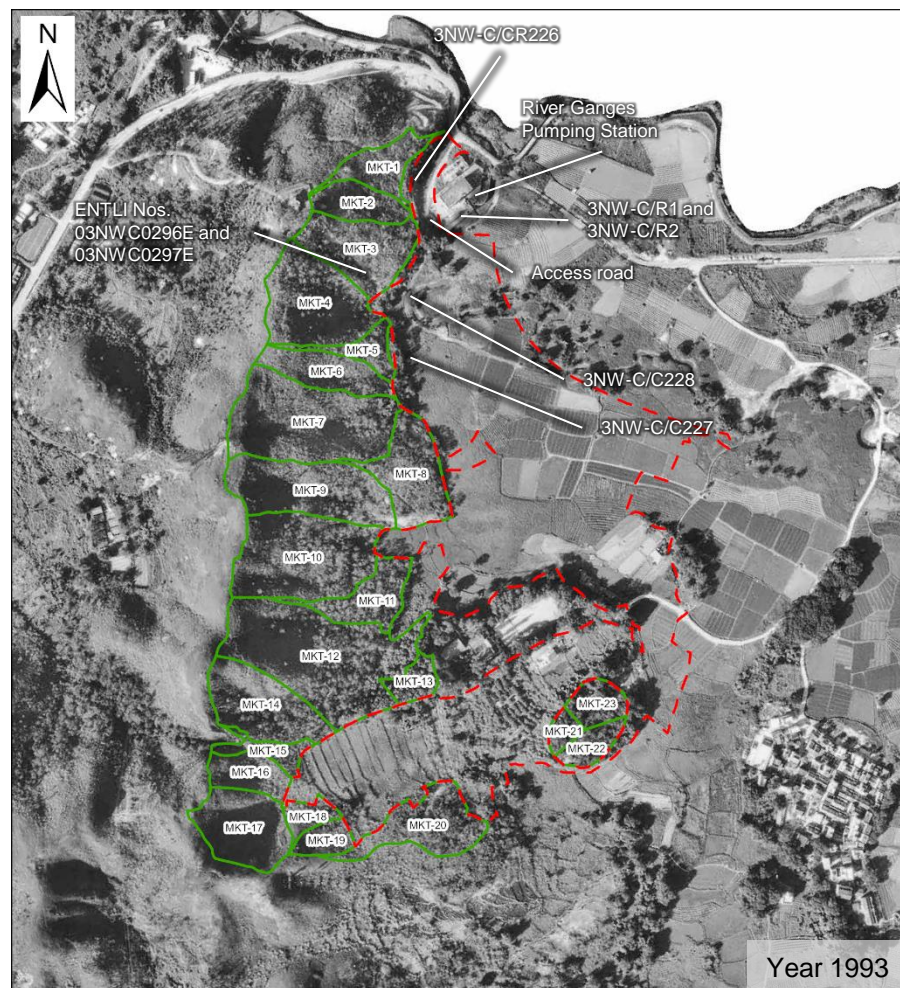
ARUP

Scale N.T.S

Drawn by: ML Date July 23 Checked: KC Approved: DL

Job No.
287082

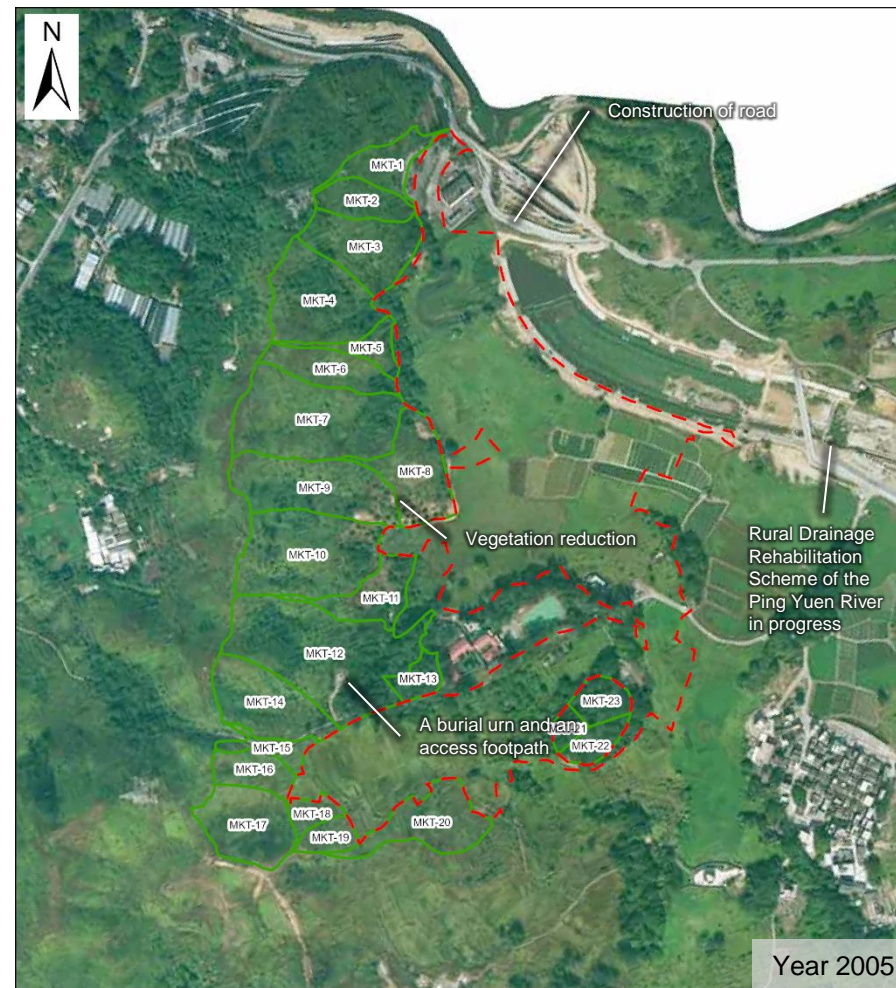
Figure No.
FIGURE A1



Year 1993

Year 1993

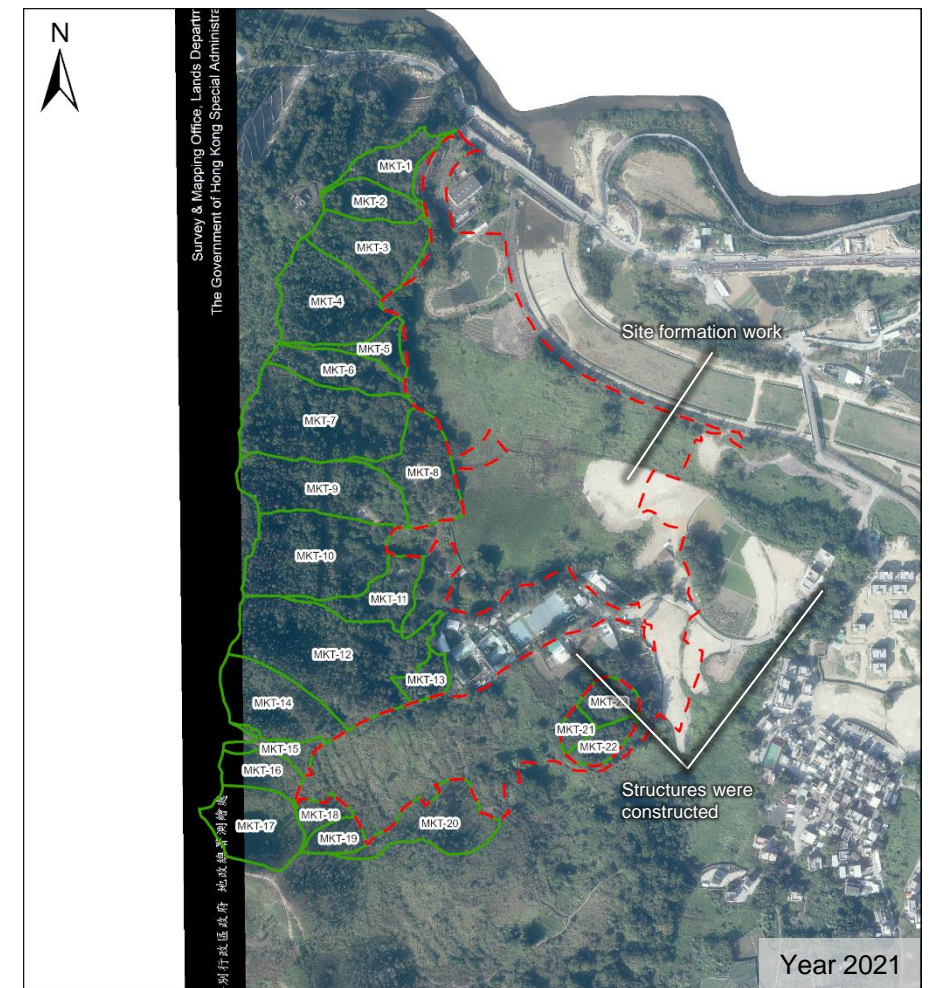
- The River Ganges Pumping Station was constructed between 1981 and 1993. The man-made features nos. 3NW-C/CR226, 3NW-C/R1 and 3NW-C/R2 were constructed within at the northern portion of the Site and to the north of the Site respectively, most likely in association with the construction of the pumping station.
- An access road to the pumping station was constructed at the northern portion of the Site. Man-made feature no. 3NW-C/C228 was constructed at the toe of the catchment no. MKT-3, most likely in association with the construction of the access road.
- A burial urn and an access footpath were noted at the toe of the catchment no. MKT-5. Man-made feature no. 3NW-C/C227 was constructed at the toe of the catchment no. MKT-5, most likely in association with the construction of footpath.
- Recent landslides, ENTLI Nos. 03NWC0296E and 03NWC0297E, were evident in the middle portion of the catchment no. MKT-3. The landslides were estimated with volume of 50m³ and 25m³ respectively.



Year 2005

Year 2005

- Reduction in vegetation was noted at the southern portion of the catchment no. MKT-8.
- A burial urn and an access footpath were noted at the southern portion of the catchment no. MKT-12.
- The construction of the Rural Drainage Rehabilitation Scheme of the Ping Yuen River was in progress to the immediately east of the Site.
- Most agriculture terraces within the Site were abandoned and covered by vegetation.
- Constructions of roads were noted to the east and to the north of the Site, which connecting with the Lin Ma Hang Road.



Year 2021

Year 2021

- Construction works for the roads and the Ping Yuen River were completed between 2005 and 2021.
- Structures were constructed in the middle portion and to the east of the Site.
- Site formation work was noted at the western portion of the Site, most likely in association with the construction of the structures.

Job Title

PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D 82 AND D.D. 86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO

Drawing Title

**Aerial Photograph Interpretation
Year 1993 to 2021**

Legend

- Development Site
- Natural Terrain Catchment

ARUP

Scale N.T.S

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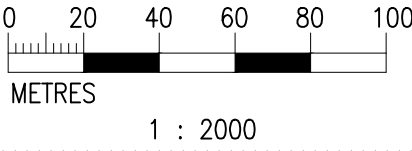
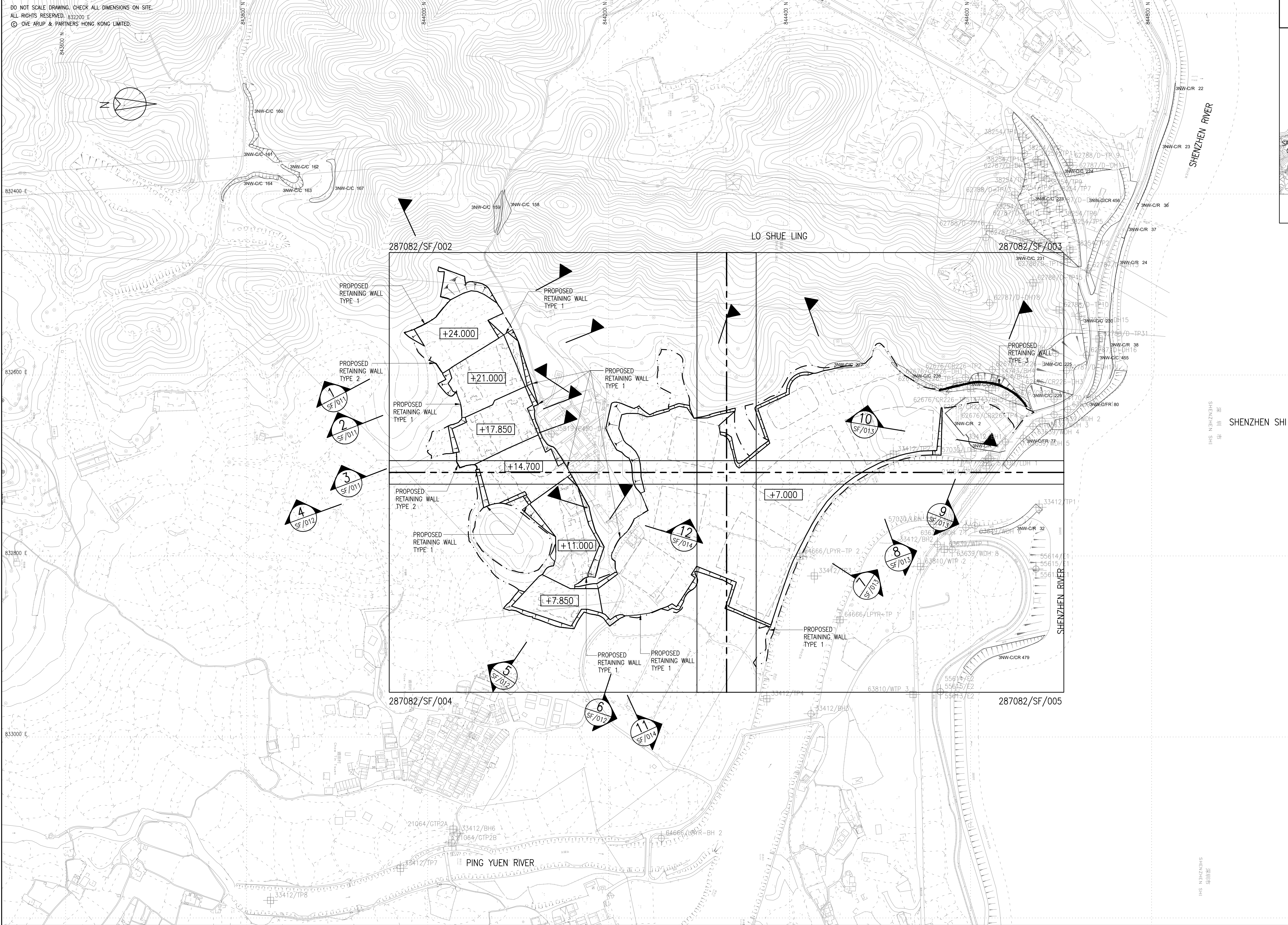
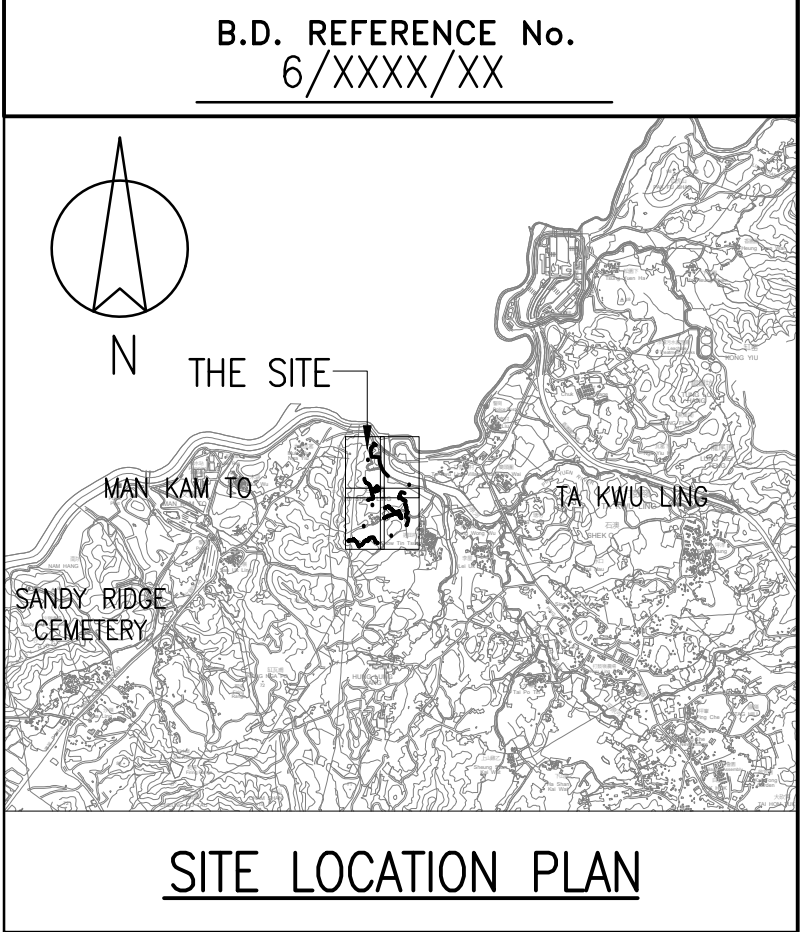
Job No.
287082

Figure No.
FIGURE A2

Appendix B

Proposed Site Formation Plan

A1 DO NOT SCALE DRAWING. CHECK ALL DIMENSIONS ON SITE.
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Plot by : Andy Chee					
Plot Time : 21/7/2023 11:11 AM					
Mark	Date	By	Rev.		
-	06/22	KC	DRAFT		

LEGEND

---	SITE BOUNDARY		PROPOSED MAX. 30 DEGREES FILL SLOPE	+7.000	PROPOSED FORMATION LEVEL
⊕	EXISTING BOREHOLE		PROPOSED MAX. 1 IN 2 CUT SLOPE		
⊕	EXISTING TRIAL PIT				

Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D. 82 AND D.D.86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO, NEW TERRITORIES

Drawing Title
MASTER SITE FORMATION LAYOUT PLAN

Drawing Status
DRAFT

ARUP

Scale	1:2000 @A1, 1:4000 @A3
Dwn.	AC
Date	06/2022
Chd.	DL
Passed	JS
Job No.	287082
Drawing No.	SF/001
Rev.	-

A1
DO NOT SCALE DRAWING. CHECK ALL DIMENSIONS ON SITE.
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Plot by : Andy Chee
Plot Time : 21/7/2023 11:15 AM

Mark	Date	By	Rev.
-	06/22	KC	DRAFT

LEGEND

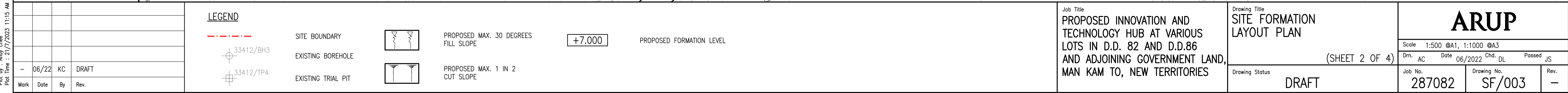
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	EXISTING BOREHOLE		PROPOSED MAX. 1 IN 2 CUT SLOPE		
	EXISTING TRIAL PIT				

Job Title
PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D. 82 AND D.D.86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO, NEW TERRITORIES

Drawing Title
SITE FORMATION LAYOUT PLAN
(SHEET 1 OF 4)
Drawing Status
DRAFT

ARUP

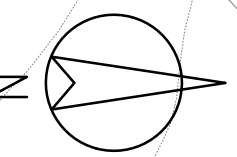
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Dwn.	AC	Date	06/2022	Chd.	DL	Passed	JS
Job No.	287082	Drawing No.	SF/002	Rev.	-		



A1

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MATCH LINE
FOR CONTINUATION
SEE DWG NO. 287082/SF/002



RETAINING WALL
TYPE 2

A
SF/012

PROPOSED
RETAINING WALL
TYPE 2

+14.700

PROPOSED
RETAINING WALL
TYPE 1

+11.000

PROPOSED
RETAINING WALL
TYPE 2

PROPOSED
RETAINING WALL
TYPE 1

+7.850

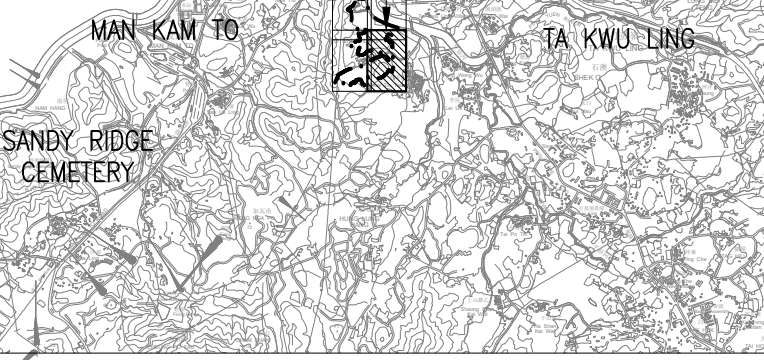
12
SF/014

PROPOSED RETAINING WALL TYPE 1

B.D. REFERENCE No.
6/XXXX/XX

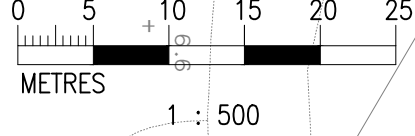


THE SITE



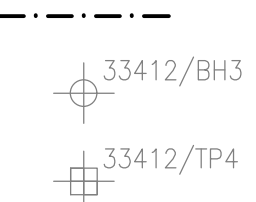
SITE LOCATION PLAN

MATCH LINE
FOR CONTINUATION
SEE DWG NO. 287082/SF/005

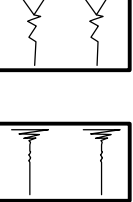


1 : 500

LEGEND



SITE BOUNDARY
EXISTING BOREHOLE
EXISTING TRIAL PIT



PROPOSED MAX. 30 DEGREES
FILL SLOPE
PROPOSED MAX. 1 IN 2
CUT SLOPE

+7.000

PROPOSED FORMATION LEVEL

Job Title
PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D. 82 AND D.D.86
AND ADJOINING GOVERNMENT LAND,
MAN KAM TO, NEW TERRITORIES

Drawing Title
SITE FORMATION
LAYOUT PLAN

(SHEET 3 OF 4)

DRAFT

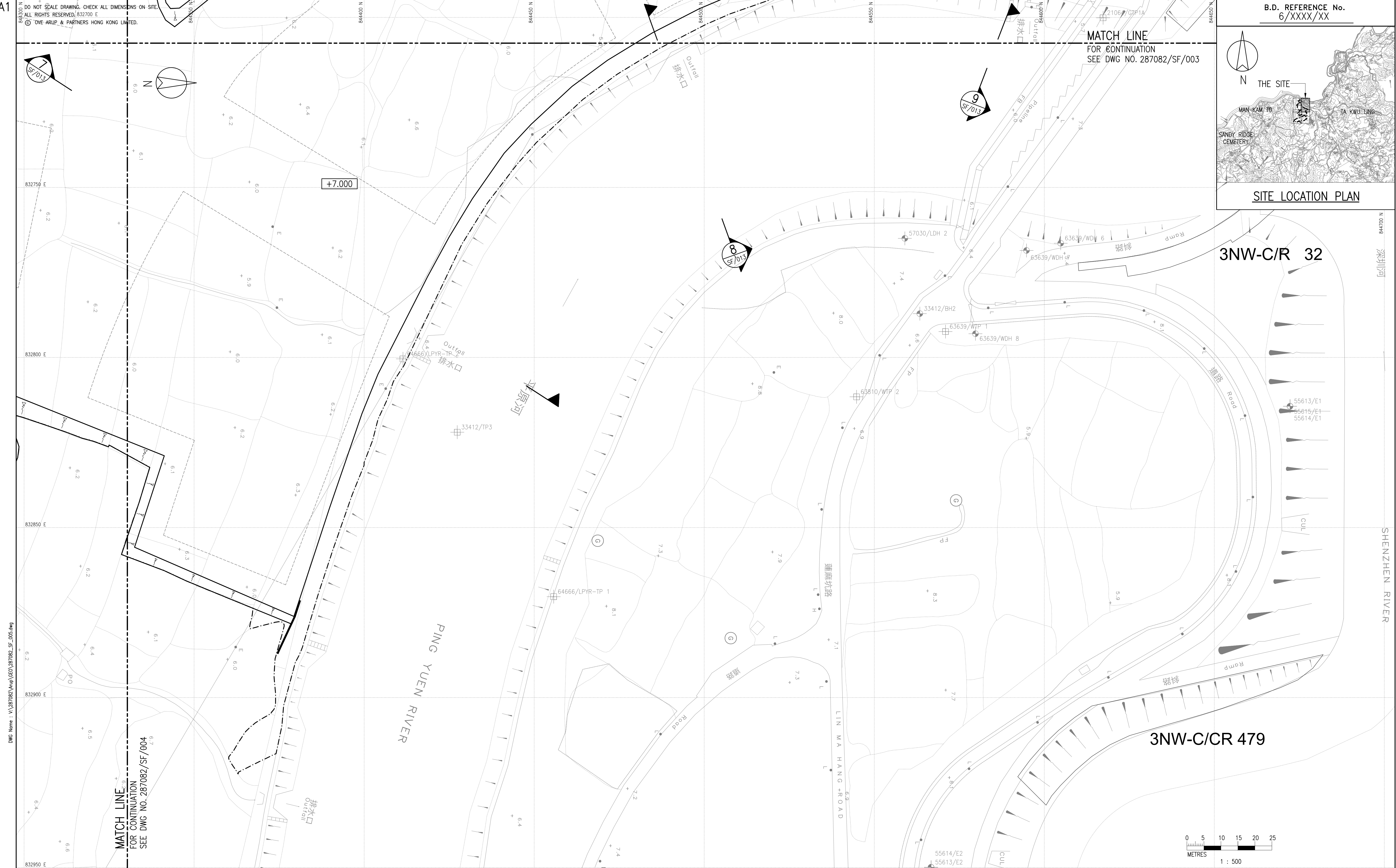
ARUP

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Drm. AC Date 06/2022 Chd. DL Passed JS
Job No. 287082 Drawing No. SF/004 Rev. -

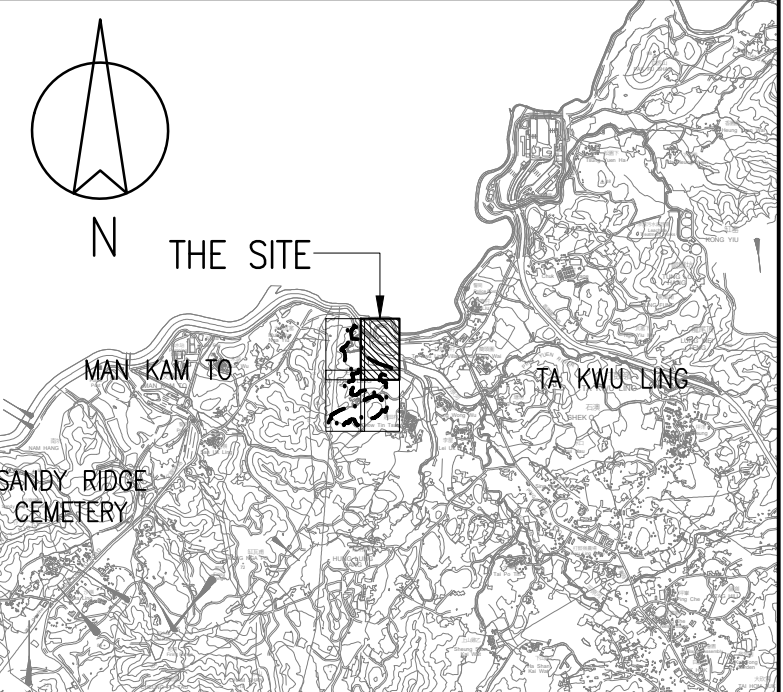
Plot by : Harold Tong				
Plot Time : 7/8/2023 3:41 PM				
Mark	Date	By	Rev.	
-	06/22	KC	DRAFT	

A1

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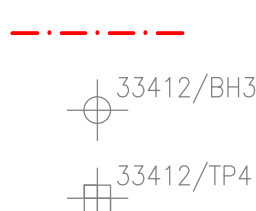


SITE LOCATION PLAN

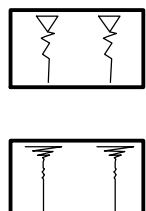
3NW-C/R 32

3NW-C/CR 479

LEGEND



SITE BOUNDARY
EXISTING BOREHOLE
EXISTING TRIAL PIT



PROPOSED MAX. 30 DEGREES
FILL SLOPE
PROPOSED MAX. 1 IN 2
CUT SLOPE

+7.000

PROPOSED FORMATION LEVEL

Job Title
PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D. 82 AND D.D.86
AND ADJOINING GOVERNMENT LAND,
MAN KAM TO, NEW TERRITORIES

Drawing Title
SITE FORMATION
LAYOUT PLAN

(SHEET 4 OF 4)

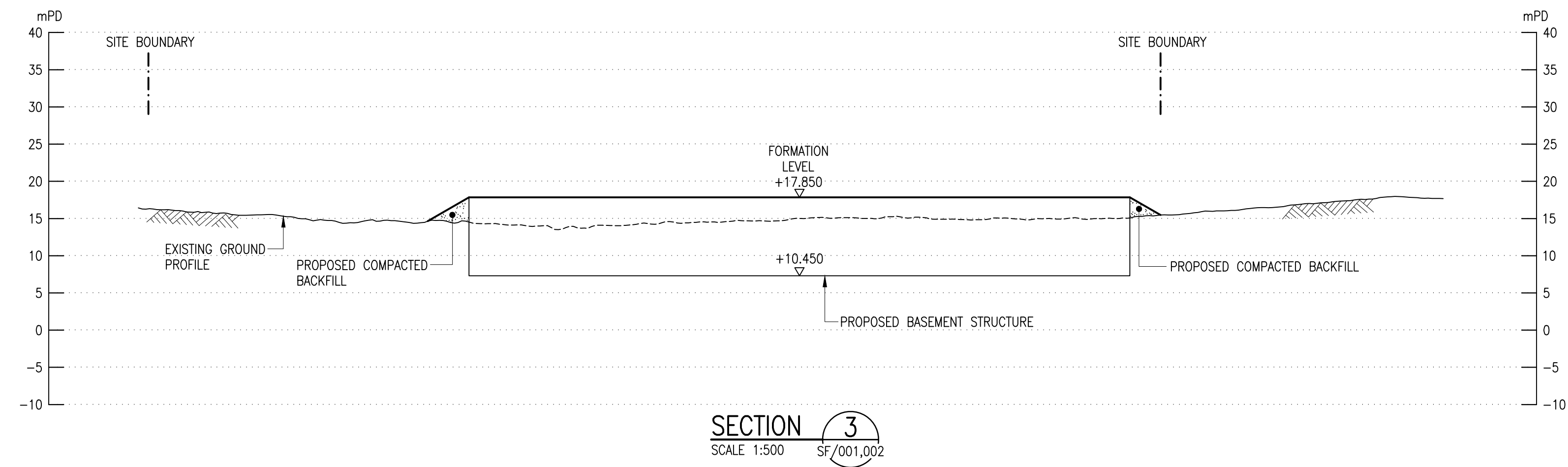
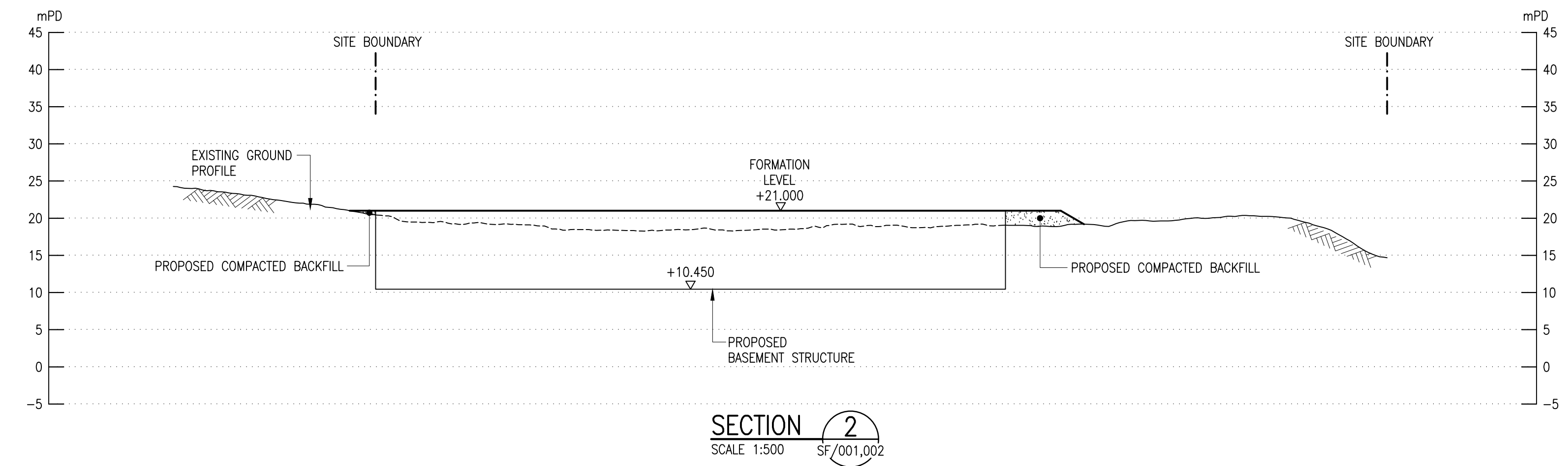
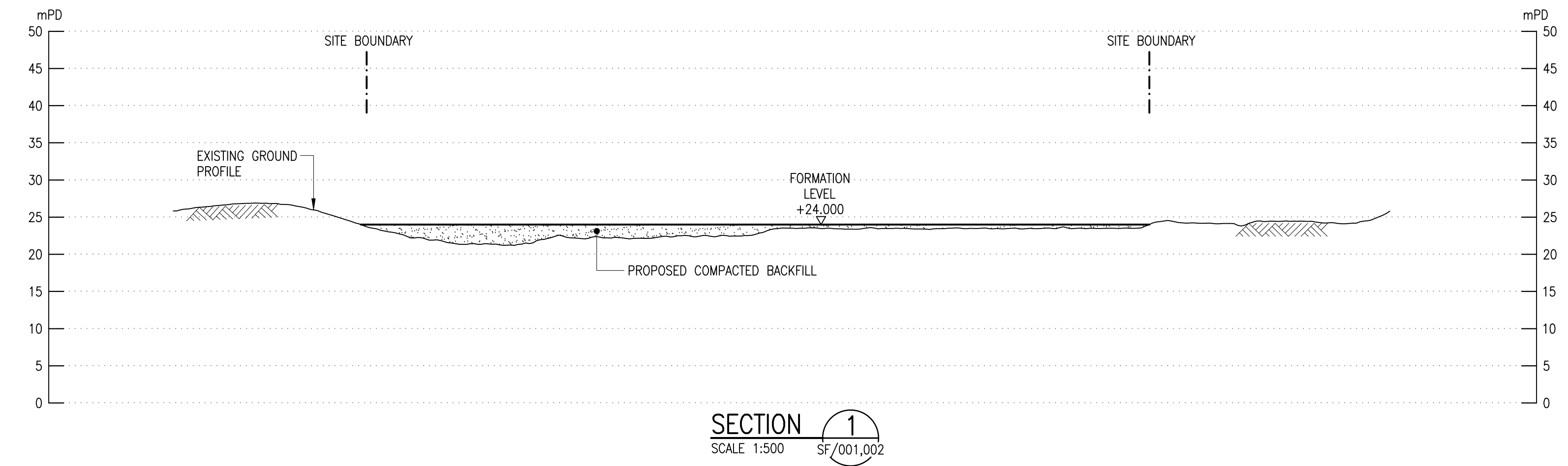
DRAFT

ARUP

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Dm. AC Date 06/2022 Chd. DL Passed JS
Job No. 287082 Drawing No. SF/005 Rev. -

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6/XXXX/XX



DWG Name : V:\287082\Arup\Geo\287082_SF_011.dwg

Plot by : Andy Chee
Plot Time : 8/7/2022 3:51 PM

—	07/22	KC	DRAFT	
Mark	Date	By	Rev.	

Job Title
PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D. 82 AND D.D.86
AND ADJOINING GOVERNMENT LAND,
MAN KAM TO, NEW TERRITORIES

Drawing Title
SITE FORMATION
SECTIONS

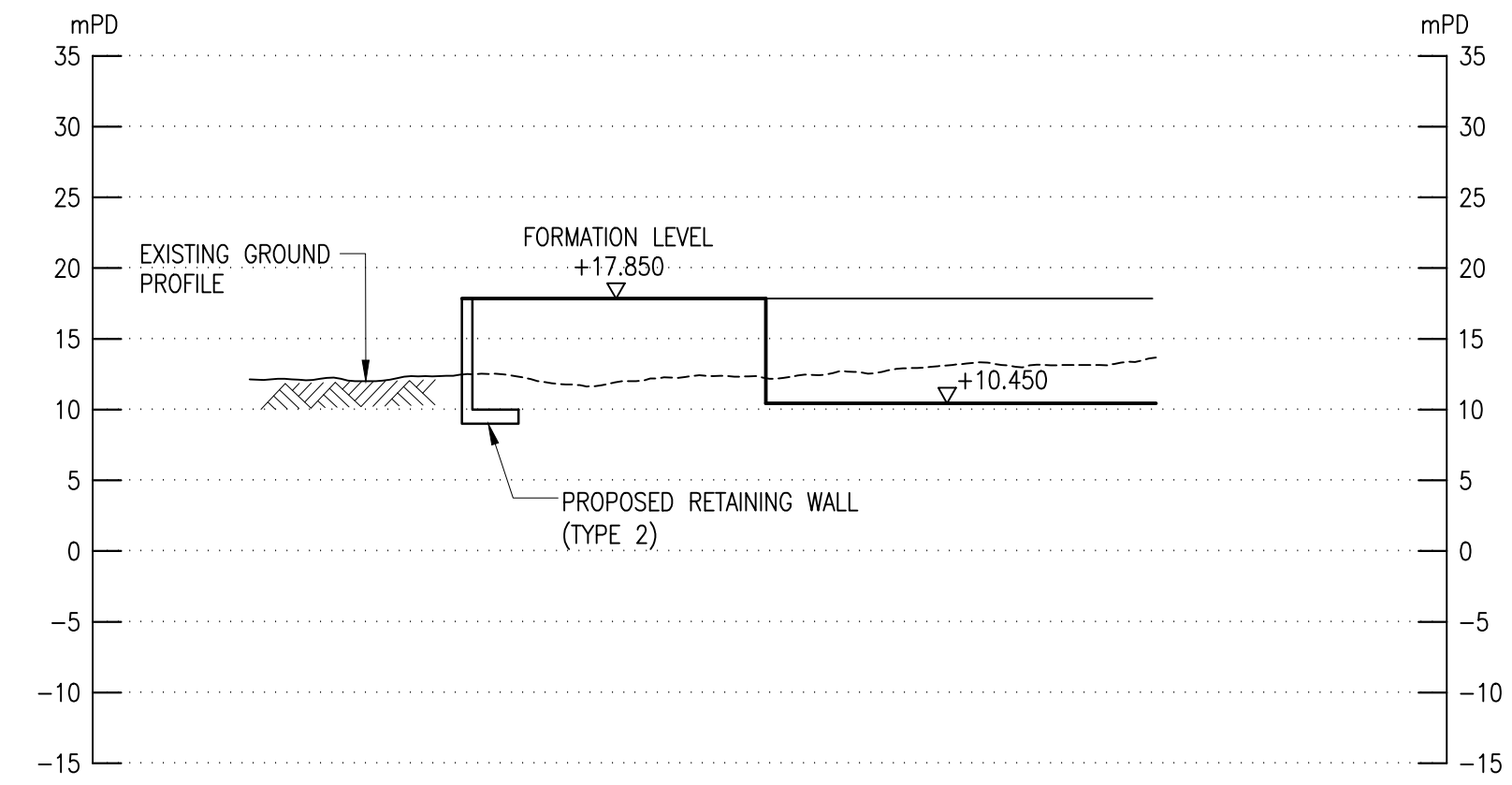
(SHEET 1 OF 4)

Drawing Status
DRAFT

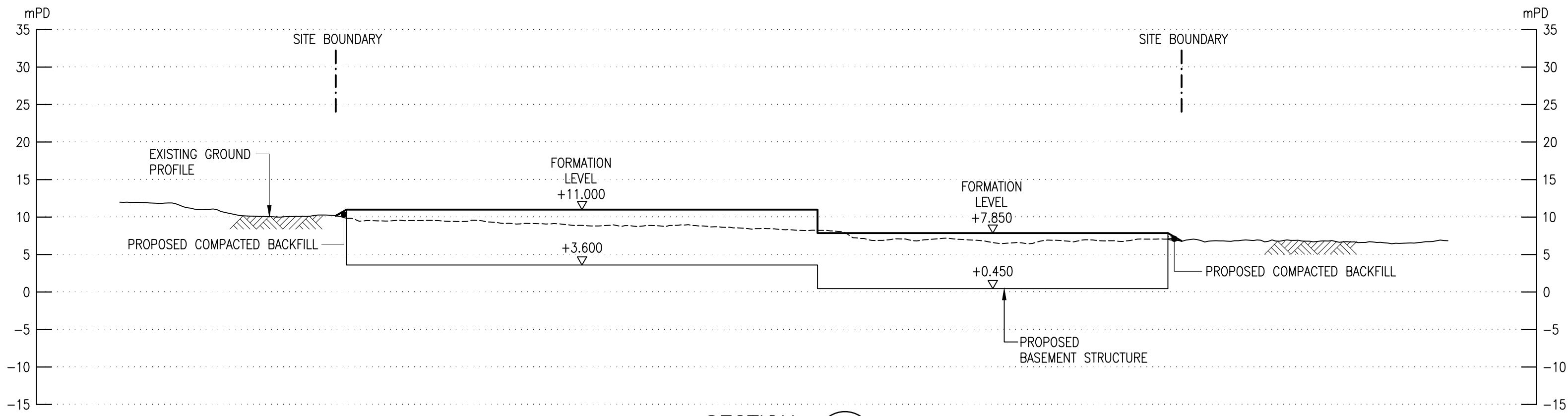
ARUP			
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Dwn. AC	Date 07/2022	Chd. DL	Passed JS
Job No. 287082	Drawing No. SF/011	Rev. —	

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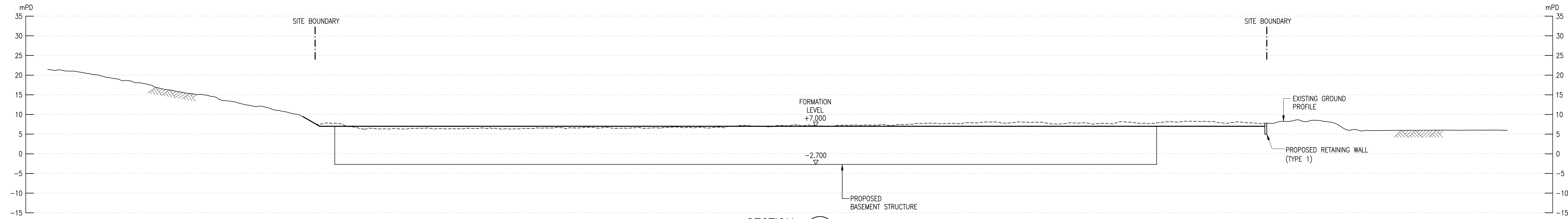
B.D. REFERENCE No.
6/XXXX/XX



SECTION 4
SCALE 1:500 SF/001,002



SECTION 5
SCALE 1:500 SF/001,004



SECTION 6
SCALE 1:500 SF/001,004

DWG Name : V:\287082\Arup\Geo\287082_SF_012.dwg

Plot by : Andy Chee
Plot Time : 8/7/2022 4:42 PM

—	07/22	KC	DRAFT	
Mark	Date	By	Rev.	

Job Title
PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D. 82 AND D.D.86
AND ADJOINING GOVERNMENT LAND,
MAN KAM TO, NEW TERRITORIES

Drawing Title
SITE FORMATION
SECTIONS

(SHEET 2 OF 4)

DRAFT

ARUP

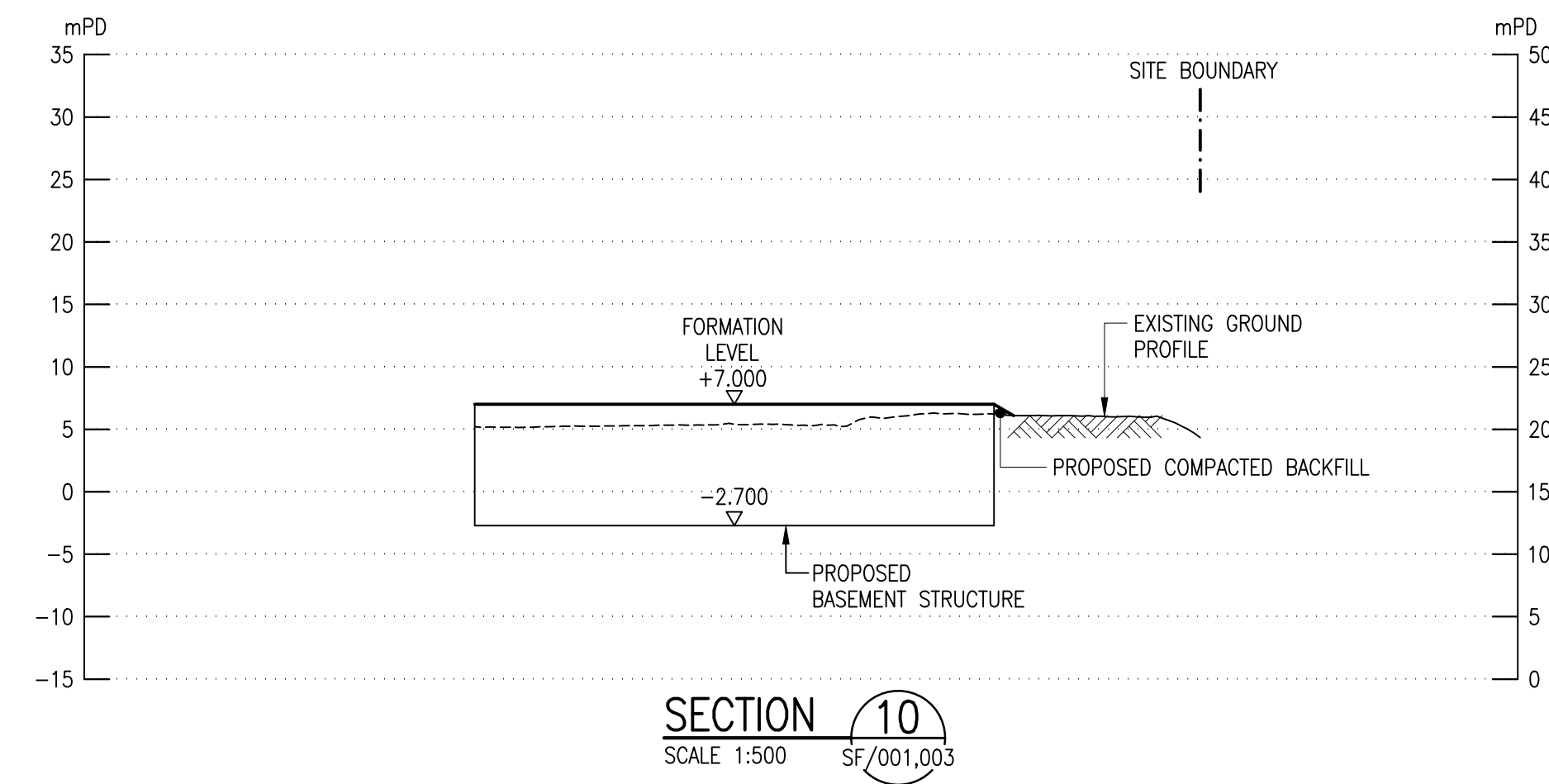
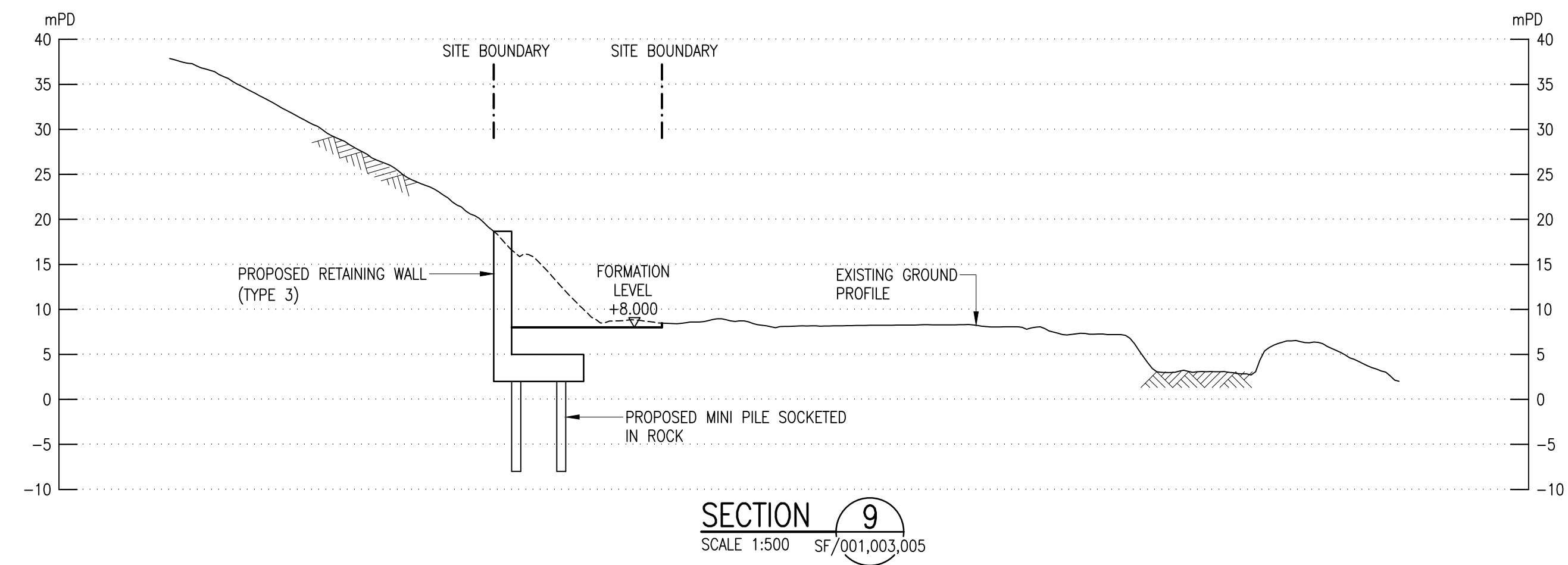
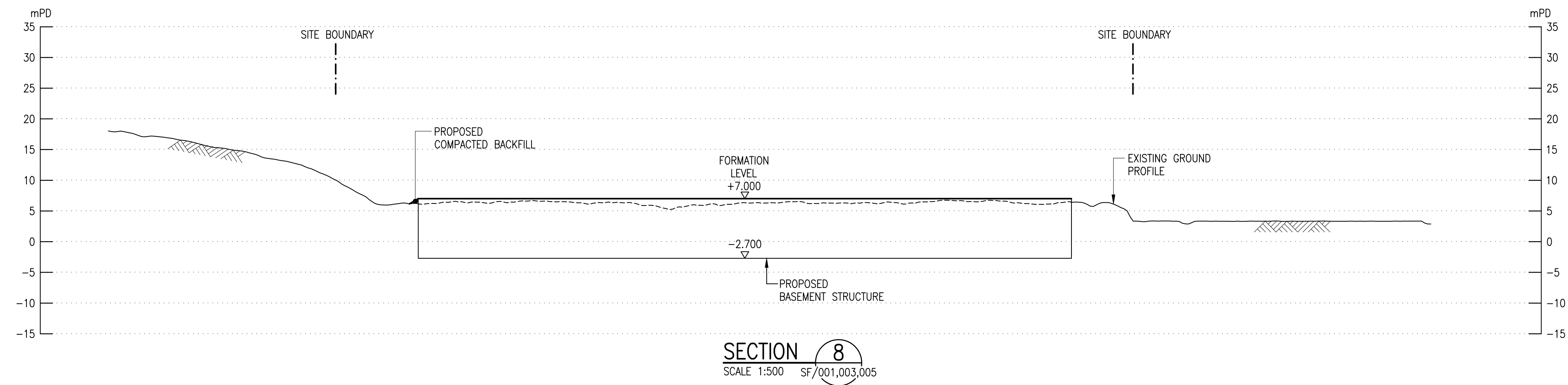
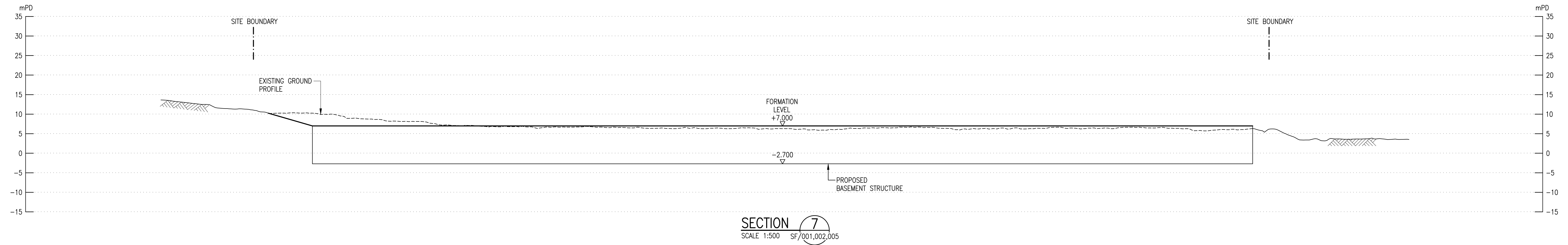
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Dwn. AC Date 07/2022 Chd. DL Passed JS

Job No.
287082

Drawing No.
SF/012

Rev.
—



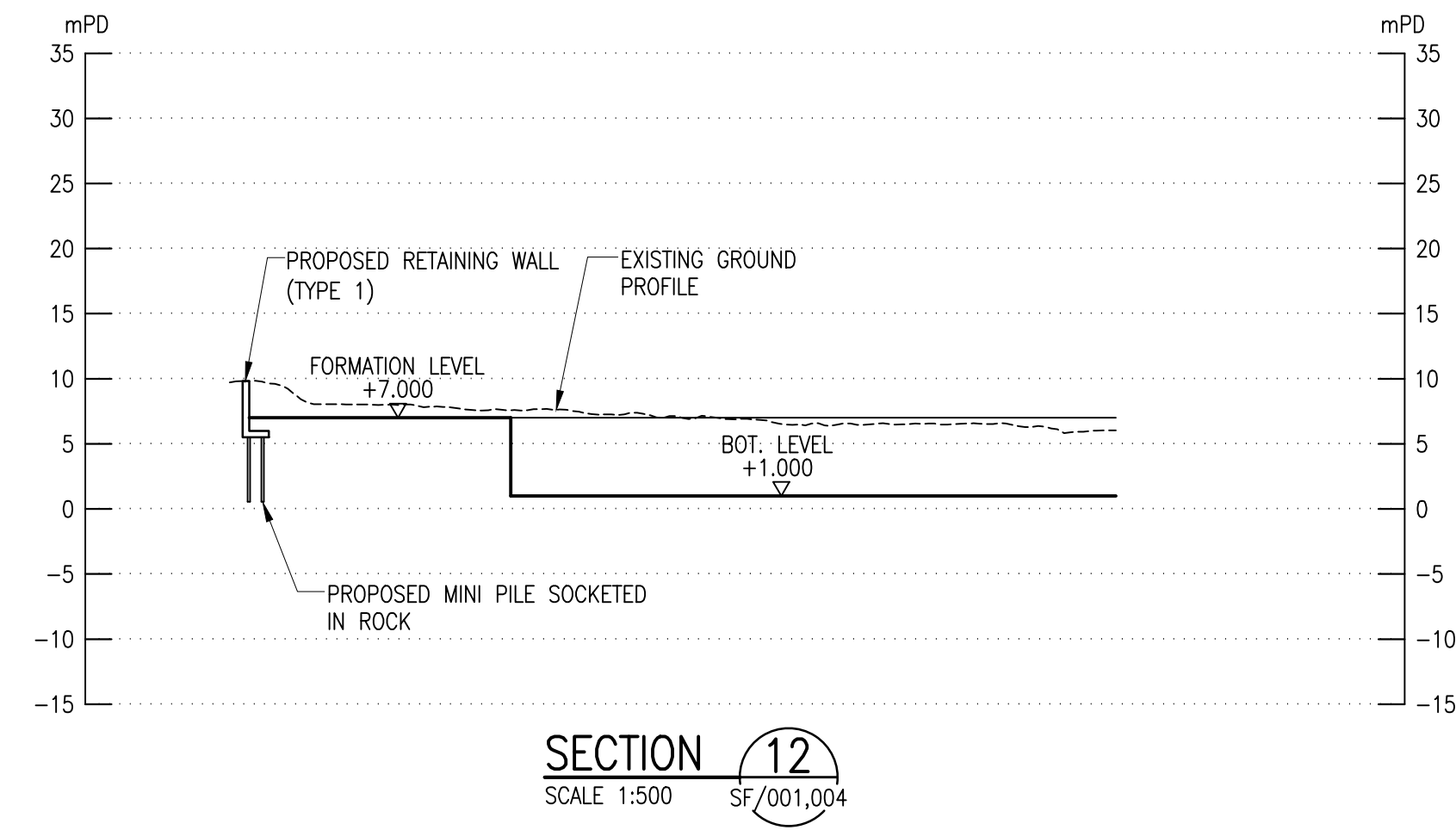
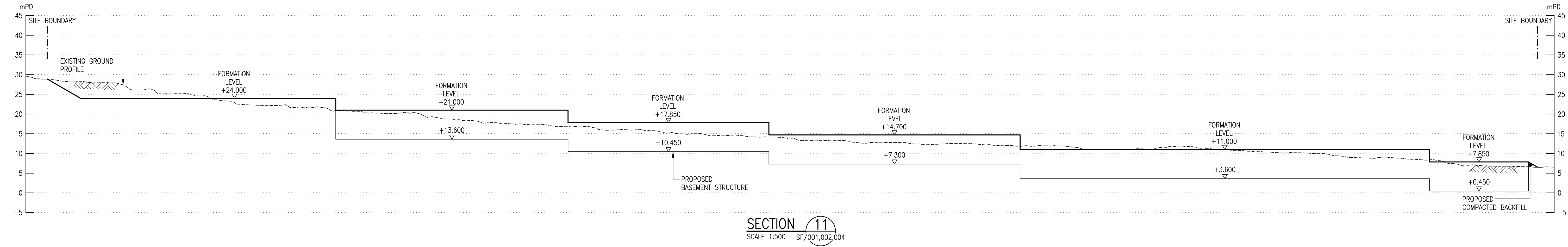
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	-	07/22	KC	DRAFT
	Mark	Date	By	Rev.

Job Title PROPOSED INNOVATION AND TECHNOLOGY HUB AT VARIOUS LOTS IN D.D. 82 AND D.D.86 AND ADJOINING GOVERNMENT LAND, MAN KAM TO, NEW TERRITORIES	Drawing Title SITE FORMATION SECTIONS		ARUP	
	Scale 1:500 @A1, 1:1000 @A3			
	Drn. AC	Date 07/2022	Chd. DL	Passed JS
	Drawing Status DRAFT		Job No. 287082	Drawing No. SF/013

(SHEET 3 OF 4)

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6/XXXX/XX



DWG Name : V:\287082\Arup\Geo\287082_SF_014.dwg

Plot by : Andy Chee
Plot Time : 8/7/2022 3:51 PM

—	07/22	KC	DRAFT	
Mark	Date	By	Rev.	

Job Title
PROPOSED INNOVATION AND
TECHNOLOGY HUB AT VARIOUS
LOTS IN D.D. 82 AND D.D.86
AND ADJOINING GOVERNMENT LAND,
MAN KAM TO, NEW TERRITORIES

Drawing Title
SITE FORMATION
SECTIONS

(SHEET 4 OF 4)

Drawing Status
DRAFT

ARUP

Scale 1:500 @A1, 1:1000 @A3

Dwn. AC Date 07/2022 Chd. DL Passed JS

Job No.
287082

Drawing No.
SF/014

Rev.
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