Appendix 13.7

Witness Statement of Julie Ascoop, Maritime Engineer, Arup (2016)

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STRATEGIC INFRASTRUCTURE DEVELOPMENT

APPLICATION TO AN BORD PLEANÁLA

(REG NO. PL04.PA0045)

ORAL HEARING

RESOURCE RECOVERY CENTRE,
RINGASKIDDY, COUNTY CORK

WITNESS STATEMENT OF JULIE ASCOOP

COASTAL EROSION

1. Qualifications and Experience

My name is Julie Ascoop. I am a Chartered Engineer and a member of the Institute of Engineers of Ireland and the Royal Institute of Engineers in the Netherlands.

I graduated from Delft University in the Netherlands with a Masters degree in Civil Engineering in 1994. I have been working in Ireland since the year 2000. I am currently leader of the Arup maritime engineering team in Dublin, where we have developed a significant number of coastal erosion studies and design of coastal protection works for Ireland and internationally.

Before joining Arup I worked with BAM Civil on various projects around the coast of Ireland and the Netherlands. BAM Civil is a large civil engineering contractor working in numerous European countries and worldwide.

2. Role in the Project

The team of coastal engineers that I manage prepared the 'Coastal study 2015' which is Appendix 13.3 of the Environmental Impact Statement [EIS].

3. Conclusion of the Coastal Erosion Section 13.3.8 of the EIS

Causes of coastal erosion

- A series of studies carried out between 2008 and 2015 found that the coastline which forms the eastern boundary of the Indaver site has eroded over the past 100 years at a varying rate, with the most significant erosion occurring along the south eastern boundary of the site. Some accretion or increase by natural growth of sediment has also occurred along a section in the northern part of the eastern boundary.

- A soil investigation study in 2012 concluded that the ground conditions and water seepage along the eastern coastal boundary of the site make the slope vulnerable to erosion. This is combined with wave action from the sea, which creates turbulence on the beach and at the base of the coastal slope, leading to recession of the glacial till slope line at the toe. It was found that the glacial till slope recedes through a cycle of notching and fissures forming at the base of the glacial till slope due to the wave action, the subsequent slumping of the overhanging material, and the washing away of the slumped material at the base.

- The mechanism of erosion is due to a combination of wave action and geotechnical conditions, which cause cliff collapse and retreat. This conclusion was confirmed in the Coastal Study 2015 by Arup included as Appendix 13.3 of the EIS.

Retreat rates

- The studies, which are included in the EIS Appendix 13.3, determined a predicted conservative maximum rate of erosion of 0.5m/year. Applying this rate results in an expected maximum retreat (of the glacial till face) of 15m in 30 years' time, 20m in 40 years' time and 50m in 100 years' time.

Impact on the proposed Ringaskiddy Resource Recovery Centre

- The study found that the proposed resource recovery building itself will not be impacted by coastal erosion in its lifetime. Even after 40 years the predicted maximum erosion does not reach the boundary fence line. Also, the proposed development will not increase the current rate of erosion of the glacial till face.

- Coastal protection mitigation measures are hence not required for the waste-to-energy facility element of the development. However, coastal protection measures to reduce the rate of erosion have been included in this planning application as a precautionary measure so as to reduce the rate of erosion of the glacial till face. This will also protect the coastal walkway for at least 30 years.

Recommended coastal management measures

- As part of the coastal protection measures to reduce the rate of erosion it is proposed that the Indaver coastal boundary is monitored on an annual basis. In addition, approximately 1100m3 of sacrificial material (shingle) of appropriate size and shape (rounded) will be placed during the construction period. The material will be placed above the foreshore on Gobby beach along the eastern boundary of the Indaver site. Thereafter, it is proposed that the placement of further additional sacrificial material (shingle) is carried out if the glacial till slope erosion rate is more than 0.5m per year measured, over a period of six years, which would indicate some acceleration in the current erosion rate, or when the glacial till slope has retreated by approximately 3m, whichever occurs sooner.

4. Submissions and Responses

In preparing this witness statement, I have considered each of the observations submitted to An Bord Pleanála by various parties in relation to the coastal erosion issues for the Ringaskiddy Resource Recovery Centre. I have addressed each of them below.

4.1 Issue #1: Foreshore

Submission:
Regarding the protection works planned to help slow the natural coastal erosion occurring at the seaside of the site, the submissions from the Cork Harbour Alliance for a Safe Environment (CHASE) and An Taisce have suggested that the high water mark at Gobby beach is moving into the site, so it would be impossible to work without placing materials on the foreshore.

Response:

The Department of Environment (DoE) defines the foreshore as the land and seabed between the high water of ordinary or medium tides (shown as HWM on the Ordnance Survey maps) and the twelve-mile limit (see definition in http://www.environ.ie). The sacrificial material proposed for the Indaver development will be placed above the High Water Mark (HWM) as shown on the latest OSI map and during the placement of this material the construction plant and equipment will also remain above the this HWM.

In reality the HWM changes constantly due to natural variations in the level and slope of the coastal areas. The HWM moves seawards and landwards for example during and between storm events). However, Ordnance Survey Ireland informed us that the HWM on the OSI map remains in the same position on each map revision. We will consult further with DoE before carrying out the works. If it concludes that that the proposed works might affect the foreshore as determined at the relevant time, then then the amount and position of the sacrificial material can be adjusted to remain above the HWM as shown in Appendix 1 of this document.

Appendix 1 shows an estimated current HWM with a reduced amount of sacrificial material above this HWM. The reduced amount would increase the frequency of application slightly, but this still falls within the impacts appraised within the EIS.

4.2 Issue #2: Maximum expected retreat line

Submission:
The submission from the Cork Harbour Alliance for a Safe Environment (CHASE) states that a maximum of 40 years is predicted before the Gobby beach reaches the site.

Response:
The 40 year recession line provided in Appendix 13.3 of the EIS shows the maximum predicted retreat that the top of the cliff is likely to experience in at the end of the lifetime of the building (plus the 10 year planning permission period). Therefore, the conclusion should be that a **minimum** of 40 years is predicted before the Gobby beach reaches the fencing which surrounds the proposed resource recovery centre facilities and buildings.
However, it is worth noting that the L2545 road to Haulbowline will be impacted in less than 30 years even with the application of sacrificial material. Therefore the road will be affected by erosion before any element of the proposed development.

4.3 Issue #3: Geotechnical aspects affecting cliff erosion

Submission:

The submission from the Cork Harbour Alliance for a Safe Environment (CHASE) has stated that significant 2015/2016 shoreline erosion documented that the groundwater or solifluction effect on landward retreat may be higher than the 50% ascribed in the model. It is suggested that such a change would affect the time-to-site impact downward.

Other submissions have also raised concerns about the effects of storm Frank on the site.

Response:

December 2015 was the wettest month on record in many areas of Ireland. In Cork nearly all meteorological stations reported over 300% of the Long Term Average rainfall. Storm Frank brought high winds and extreme rainfall between 29 December 2015 and 2 January 2016. Significant flooding resulted across much of the country. County Cork was badly affected with major flood events on many rivers.

Immediately following the extreme rainfall associated with storm Frank there were two localised slope failures at Gobby Beach adjacent to the proposed Indaver site. Following these events Arup carried out an assessment of the extent and cause of the failures.

The assessment included a site walkover and assessment, topographic survey and a review of the rate of erosion.

During the site walkover the following were the main items observed:

- Two slope failures. The first one approximately 50m south of the car park was limited in extent. The second slope failure, further south, was larger and V-shaped back landward. A significant amount of material had slumped down in the second failure.
- Water running out of the face of the cliff in the failure zones, even though there had been no recent rain. In the larger failure, a small stream (of fresh water) ran out from the face and flowed into the sea.
- In the larger failure, sand lenses were observed in the mainly clay cliff face.
- There was no evidence of any significant notching at the bottom of the cliffs on either side of the failure zones and the beach shingle was high up on the beach covering the toe of the face.

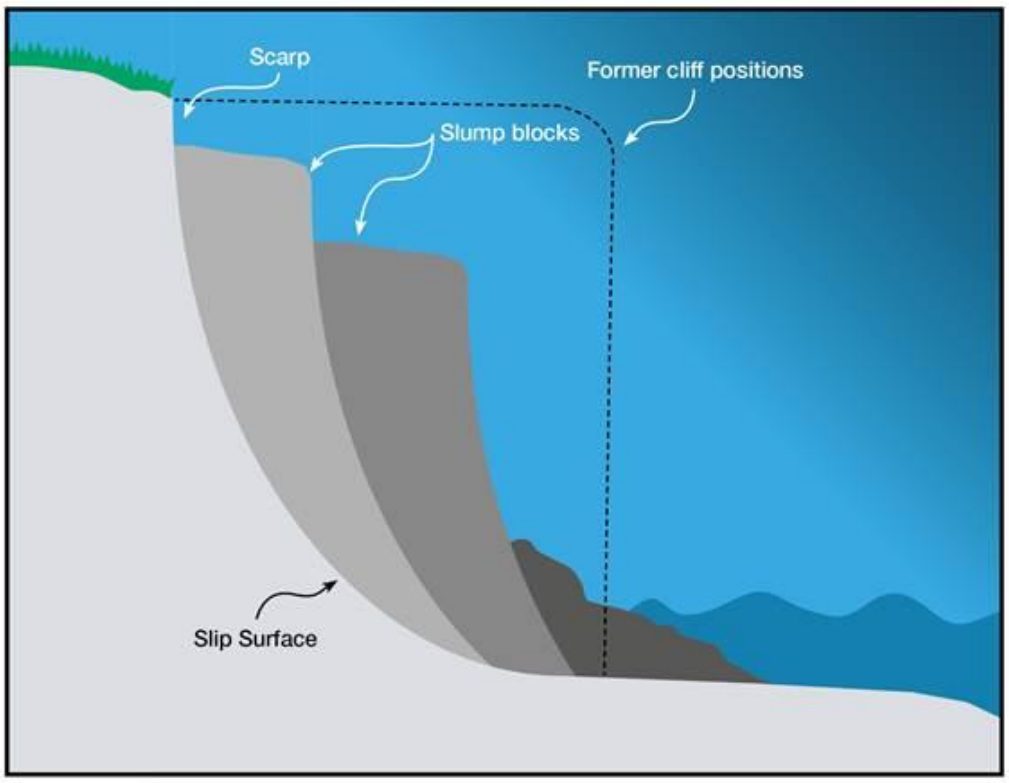


Figure 1: Typical slope failure showing circular slip surface

A topographic survey was carried out in February 2016 and the results were compared to the previous surveys in order to determine the retreat of the face over the period 2008 to 2016. The survey results were then used to estimate an erosion rate for the site and compare it to the retreat rate predicted in the previous studies.

Assessment of the situation on site, and the topographic survey showed that the slope failure was most likely triggered by the significant rainfall causing excessive water pressure and flow within the cliff material, which caused instability and a localised geotechnical failure of the slope.

The presence of sand deposits, and the less steeper angle (compared to the slope of the face where failure had not occurred) or more circular slip surface (see image below), with significant flow of water through the face of the slips observed at the failure zones, all point in this direction.

The 2016 topographical data shows that the erosion rates for all the sections are below the maximum estimated retreat of 0.5m per year, except in the short length of cliff where the localised larger slide had occurred. The average erosion rate along the length of the retreated study area over the eight year period from 2008 to 2016 (including the effects from storm Frank) is conservatively estimated at 0.4m per year, which is below the previously predicted maximum erosion retreat of 0.5m per year. Therefore, the two recent slope failures do not change the previous estimates for the maximum coastal erosion retreat.

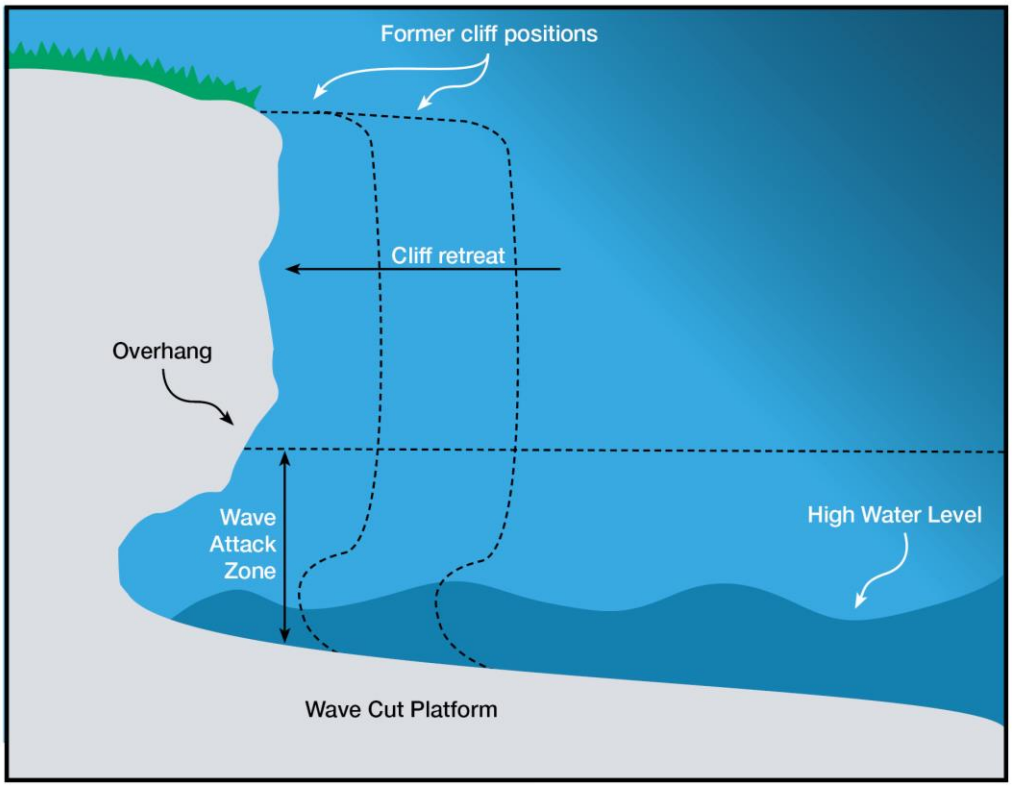


Figure 2. Typical steepened cliffs eroded by wave action

The December 2015 failure confirms the assessment (see Appendix 13.3 of the EIS) that the cliff recession has both a geotechnical and a coastal element. The coastal impact was confirmed by our numerical wave modelling studies and wave run- up assessment which show that waves reach the bottom of the cliffs. We also have seen evidence on site of typical 'notching' of the cliffs caused by wave attack (see figure 2 and 3 below).

There is no evidence that one mechanism makes a greater contribution than the other. As shown in the image above, Figure 1, the geotechnical slope failure is likely to cause a bigger slip circle but would occur less frequently than the smaller slides caused by the 'notching' of the cliffs due to wave action.

The December 2015 failure showed that the water flow in the cliff face plays a significant role in the geotechnical cause of the cliff erosion. This water flow to the shoreline will be reduced over a large section of the shoreline (in particular in the area of the buildings) by the proposed development of the site, as the lowering of ground levels and the installation of drainage systems, will collect surface water, which currently infiltrates into the ground and

flows to the cliff face. The cliff erosion, due to wave action, will be managed by placing of sacrificial material on the beach at the toe of the cliff face. Hence, both causes of retreat will be reduced ensuring that the future rate of erosion is lower than the maximum 0.5m per year estimated in the Appendix 13.3 of the EIS.

We have conservatively estimated that the placement of the sacrificial material would reduce the maximum rate of erosion to 0.4m per year. The improved drainage will reduce this figure further again.



Figure 3. Pocket of notching undermining the coastal slope face at Indaver site (2012).

4.4 Issue #4: Sea level rise effects

Submission:
Regarding the potential impact of sea level rise on risk of erosion, An Taisce has suggested that the impact of sea level rise on water tables is inadequately assessed and that the exposure of groundwater on the site to increase seawater ingress and risk of erosion will, accordingly increase.

Response:
The erosion study (included as Appendix 13.3 of the EIS) takes into account the sea level rise effects by following the guidance from the OPW which advises on future sea level scenarios and allowances for climate change. This guidance identifies two scenarios: the Mid-Range Future Scenario; and the High-End Future Scenario with an allowance for mean sea level in 2100 for both of +0.5m and +1m respectively. These scenarios have been included in our assessment.

In addition to allowing for sea level rise, we have allowed for increased storminess due to climate change by an increase of 10% in the present storm conditions, in accordance with UK DEFRA recommendations.

3.5 *Issue #5: Assessment of coastal erosion following import placement of beach nourishment shingle and in relation with existing elements of the development*

Submission:
The submission from Cork County Council asks for clarification on the coastal retreat rate estimation following import placing of beach nourishment shingle.
Cork County Council suggests the applicant should be requested to outline the distance of the proposed facility from the current cliff face, amenity walk and diverted gas line.

Response:
The estimation of coastal retreat following import placement of beach nourishment shingle has been provided in the EIS (see Appendix A of Appendix 13.3 of the EIS).
The minimum distance from the worst section of the current top of the cliff to the building is 46m. Distances to all other key elements are provided in the Appendix 2 of this document.

4.6 Issue #6: Coastal erosion risks

Submission:
The submissions from the Alliance for a Safe Environment (CHASE), An Taisce and others express their concerns regarding the coastal erosions risks of the site.

Response:

Coastal erosion is a feature of many coastlines worldwide. In order to allow for development near these shores the recognised practice is to assess the rate of retreat and establish safe

distances for construction. Arup coastal and geotechnical engineers have assessed the coastal retreat at the Indaver site, as detailed in Appendix 13.3 of the EIS, and established that the predicted maximum retreat will not reach the Resource Recovery Centre building in its lifetime.

We recommend beach nourishment in order to reduce the maximum predicted rate of erosion.

5. CONDITIONS RECOMMENDED BY CORK COUNTY COUNCIL

Cork County Council has recommended the attachment of a number of indicative conditions which are contained in its report received. The applicant is generally in agreement with the approach taken by the Council in relation to the monitoring of coastal erosion.

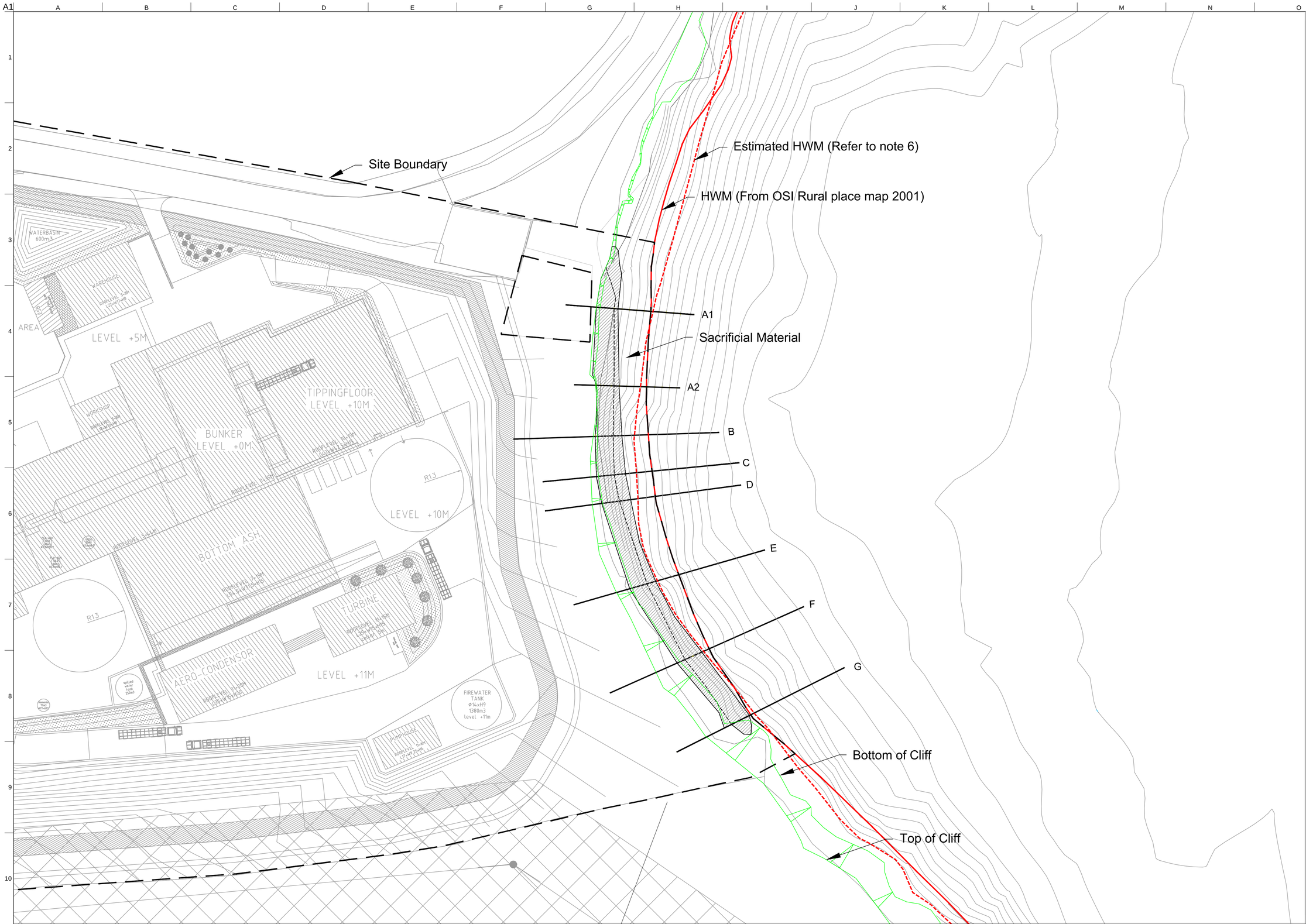
QUOTE CONDITIONS

In relation to condition 22, it may be useful to clarify that a monitoring plan has already been provided in the EIS. Monitoring will take place after winter storms every year, so it is proposed that the yearly survey takes place in April.

For clarity we suggest to reword condition 22 as follows:

“The applicant should submit and agree in writing with the Planning Authority a monitoring regime for the proposed coastal protection measures which should include surveys following any significant coastal storm event which causes any significant erosion or following any unexpected retreat of the coastline.”

Appendix 1



Notes:

1. Information shown on this drawing is to be considered indicative only.
2. All dimensions are shown in metres unless noted otherwise.
3. All levels are shown in metres above ordnance datum.
4. All levels shown are based on most recent Bathymetric and Topographical Survey.
5. Material type and dimensions are assumed based on visual inspection and site investigation works.
6. The estimated HWM has been calculated as the average of mean high water springs (MHWS) and mean high water neaps (MHWN).

Legend:

- Sacrificial material
- Site boundary
- High water mark
- Top/ bottom of cliff
- Estimated High water mark

PRELIMINARY

Issue	Date	By	Chkd	Appd
I03	10/09/15	JR	SL	SL
I02	02/07/15	JR	SL	SL
I01	10/03/15	JR	SL	SL

ARUP

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Client: INDAVER

Job Title: Indaver Ringaskiddy Development

Coastal Study
Proposed Solution Plan

Scale at A1: 1:500
Discipline: Civil
Job No: 238129-00
Drawing Status: For Information
Drawing No: 238129-M-006
Issue: I03

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A0 A B C D E F G H I J

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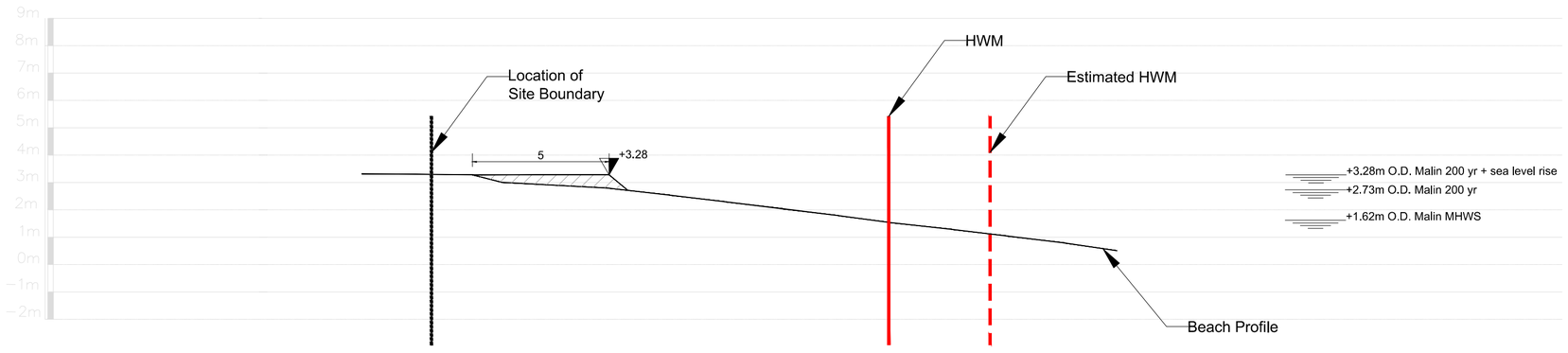
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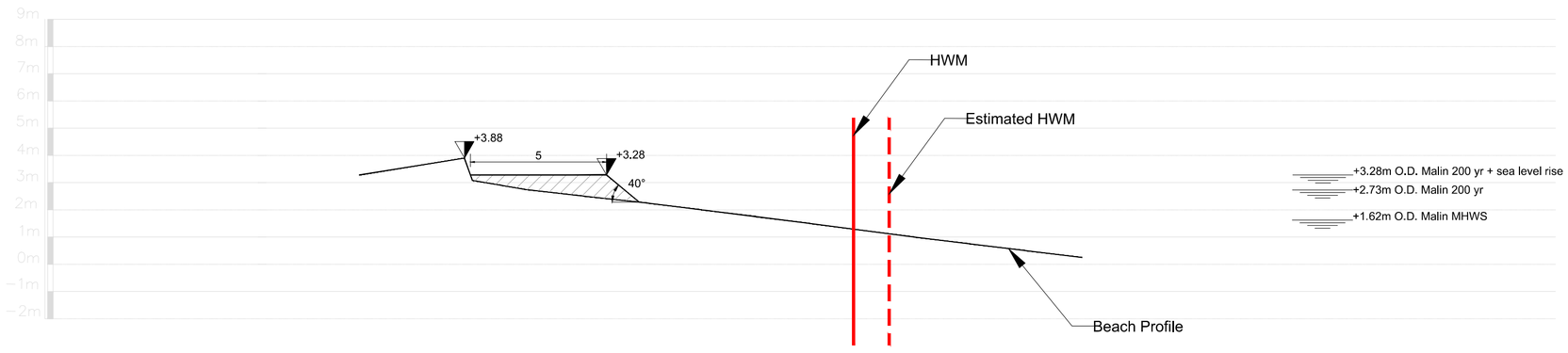
Legend:

- High water mark
- Estimated High water mark

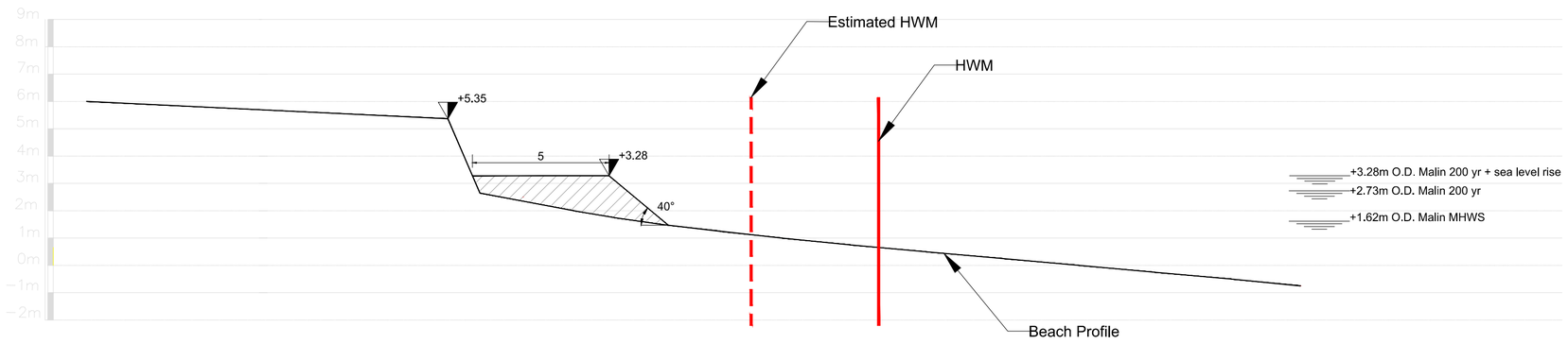
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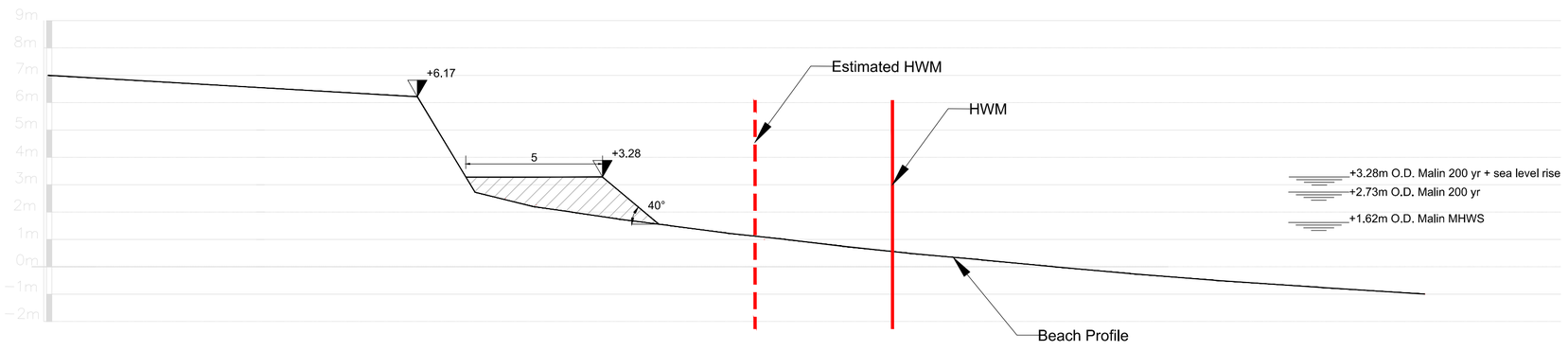
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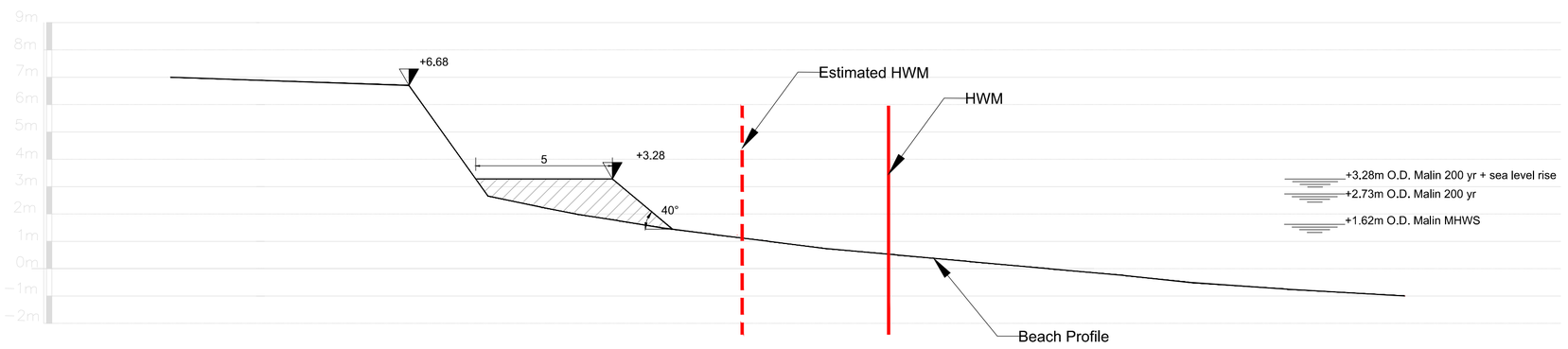
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C



D



PRELIMINARY

Issue	Date	By	Chkd	Appd
I03	10/09/15	JR	SL	SL
I02	02/07/15	JR	SL	SL
I01	26/02/15	JR	SL	SL

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Client: INDAVER

Job Title:
Indaver
Ringaskiddy Development

Coastal Study
Sacrificial Material
Section Details

Scale at A0: 1:150

Discipline: Civil

Job No: **238129-00**

Drawing Status: **For Information**

Drawing No: **238129-M-003**

Issue: **I03**

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A0

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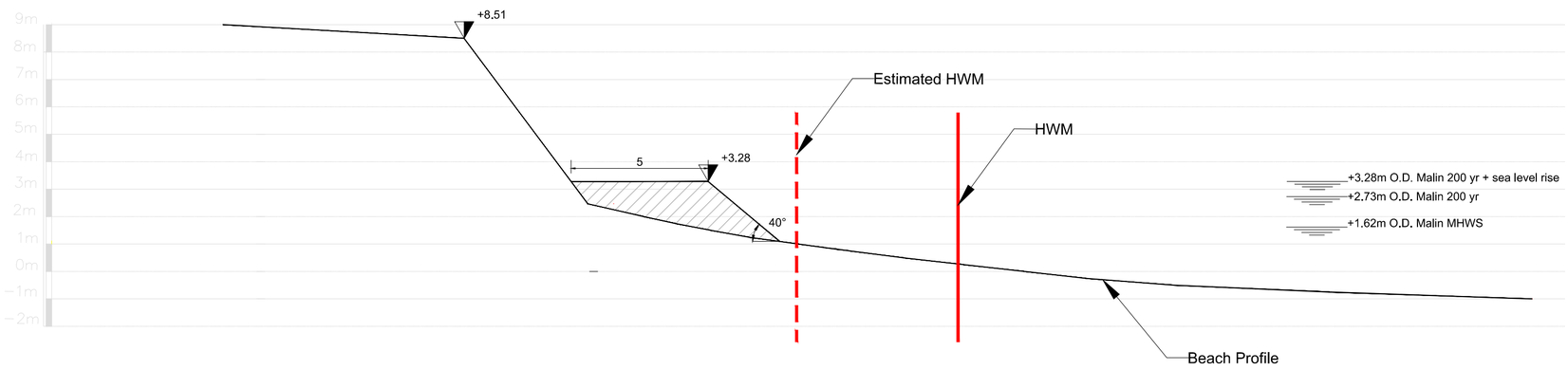
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Legend:

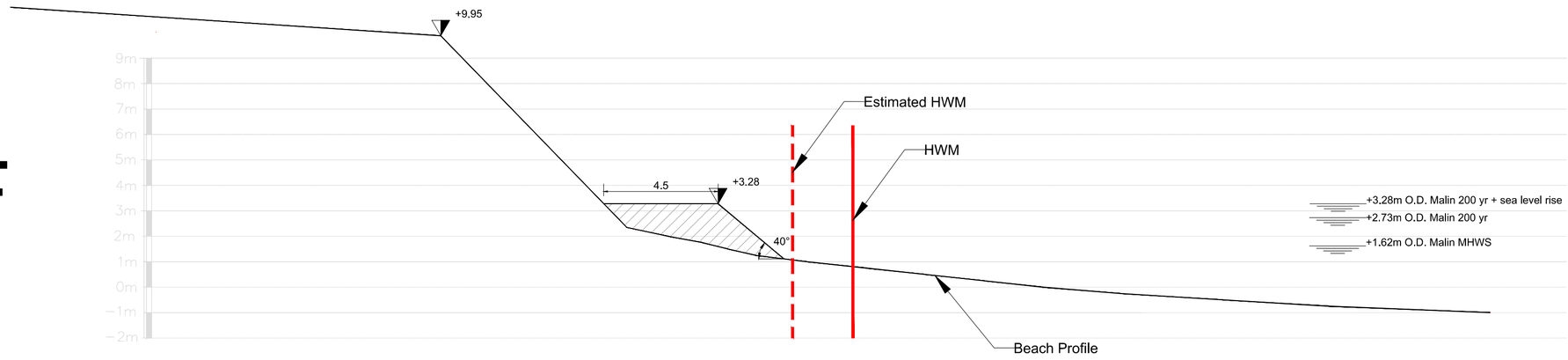
High water mark

Estimated High water mark

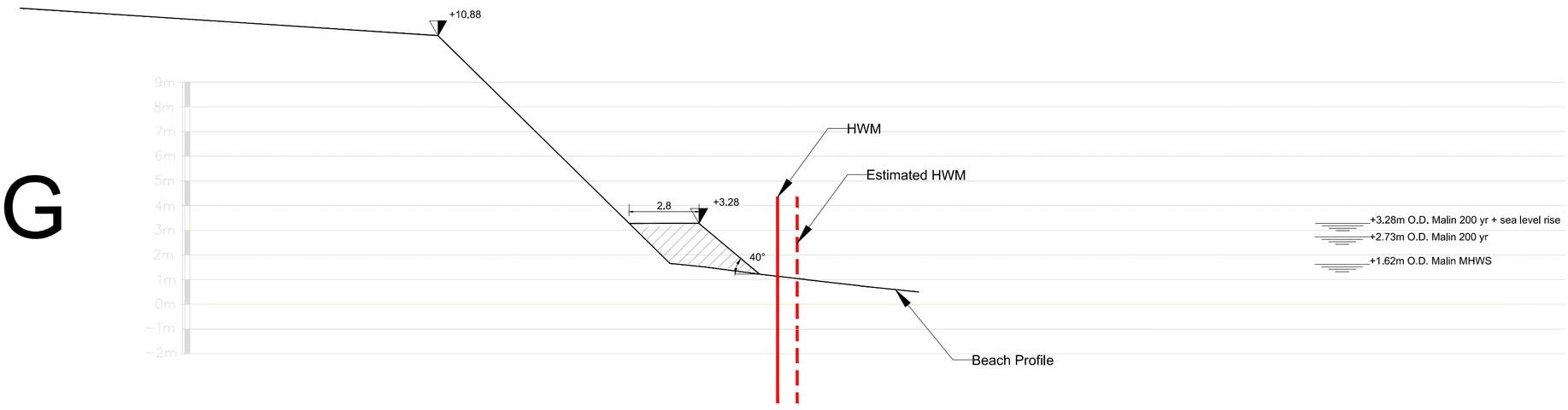
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F



G



PRELIMINARY

Issue	Date	By	Chkd	Appd
I03	10/09/15	JR	SL	SL
I02	02/07/15	JR	SL	SL
I01	26/02/15	JR	SL	SL

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Client

INDAVER

Job Title

Indaver
Ringaskiddy Development

Coastal Study
Sacrificial Material
Section Details

Scale at A0 1:150

Discipline Civil

Job No **238129-00**

Drawing Status **For Information**

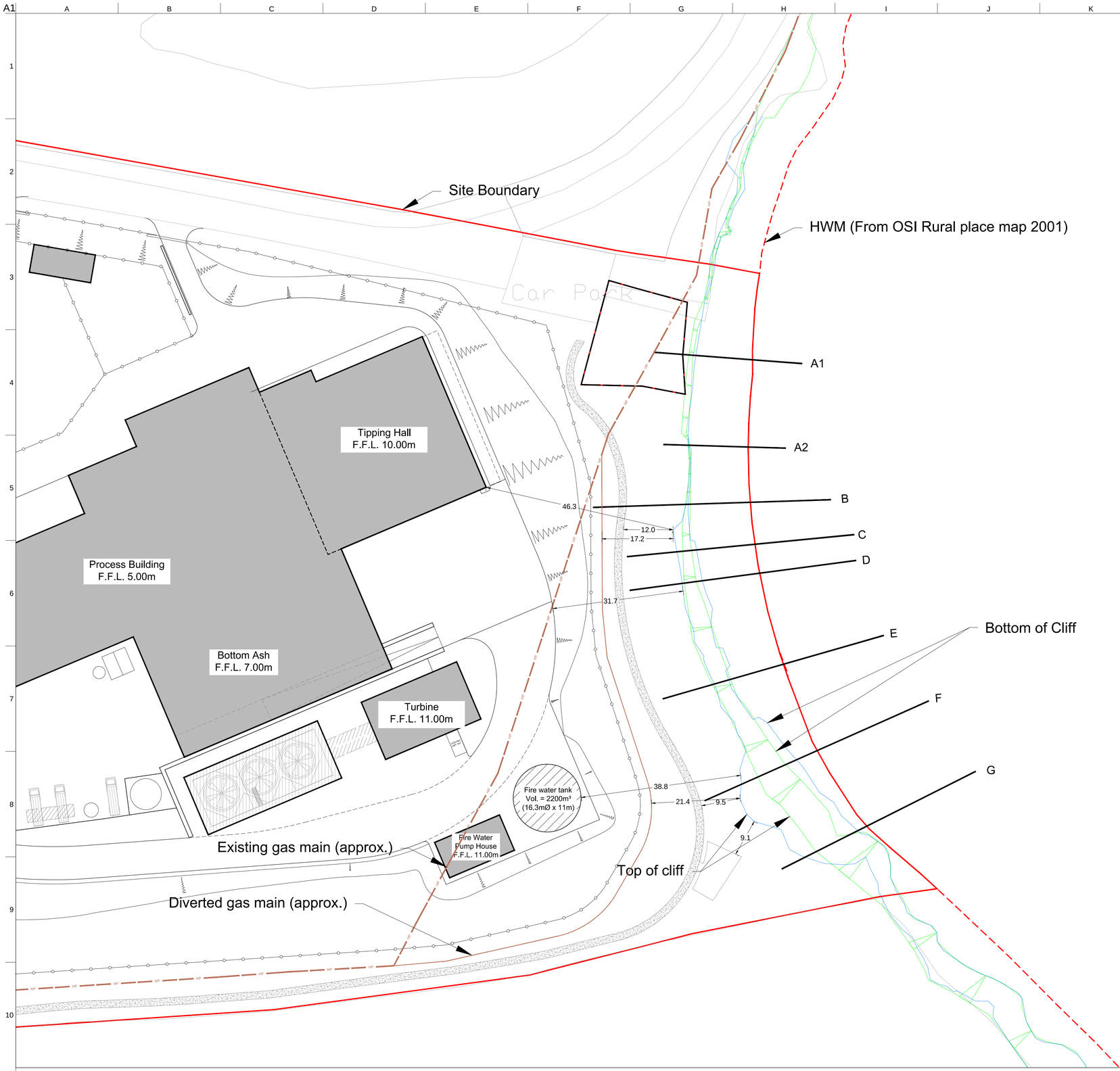
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Issue **I02**

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Appendix 2



Notes:

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5. Material type and dimensions are assumed based on visual inspection and site investigation works.

Legend:

- Site boundary
- High water mark
- Top/ bottom of cliff 2014
- Top/ bottom of cliff 2016

Issue	Date	By	Chkd	Appd
I01	31/03/2016	JR	SL	SL
Issued for Information				

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Client: INDAVER

Job Title: Ringaskiddy Resource Recovery Centre

Coastal Study
Comparative Plan

Scale at A1	1:500
Discipline	Civil
Job No	238129-00
Drawing Status	For Information
Drawing No	C-000-064
Issue	I01

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