Lydd Ranges Spring Survey Analysis Report

Revision: P02

Environment Agency
Lydd Ranges Spring Survey Analysis
5 September 2025



Lydd Ranges Spring Survey Analysis Report

Client name:	Environment Agency		
Project name:	Lydd Ranges Spring Survey Analysis		
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Revision:	P02	**Prepared by:**	Milo Fitzpatrick
Date:	5 September 2025	**File name:**	Lydd Ranges Spring Survey Anaylsis Report P02

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
P01	04/07/25	Draft – WIP	M.Fitzpatrick	J. Eade	E. Pobjoy	-
P02	05/09/2025	Updated for EA comments	M.Fitzpatrick	J. Eade	E. Pobjoy	K. Muniak

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Acronyms and abbreviations

AEP	Annual Exceedance Probability
BMP	Beach Management Plan
MHWS	Mean High Water Springs
MSL	Mean Sea Level
SoP	Standard of Protection
DEM	Digital Elevation Model

1. Introduction

In March 2025 a topographic survey was undertaken by Canterbury City Council for the Lydd Ranges frontage. The survey data has been analysed to compare profile cross-sectional areas (CSAs) and beach volumes against the trigger levels as defined in the Lydd Ranges Beach Management Plan (BMP). Beach volumes from the March 2025 survey have also been estimated. Finally, the ecological triggers for erosion/recession east of the groyne field have been checked.

The analysis in this report focusses on two distinct frontages: the frontage contained within the newly constructed groyne field; and east of the groyne field to Galloways. These extents are indicated in Figure 1-1. The monitoring profile locations and polygons used to analyse beach cross-sectional areas and volumes are presented in Figure 1-2, Figure 1-3, Figure 1-4 and Figure 1-5. It is important to note that the March 2025 survey was not conducted on all monitoring profile locations as was done in the October 2024 survey.

Alongside this, note that Bay 01a and 01b are both in Bay 01. The bay was subdivided either side of the (lower height) emergency works groyne but generally act as a single bay with the emergency works groyne buried unless beach levels are very low.

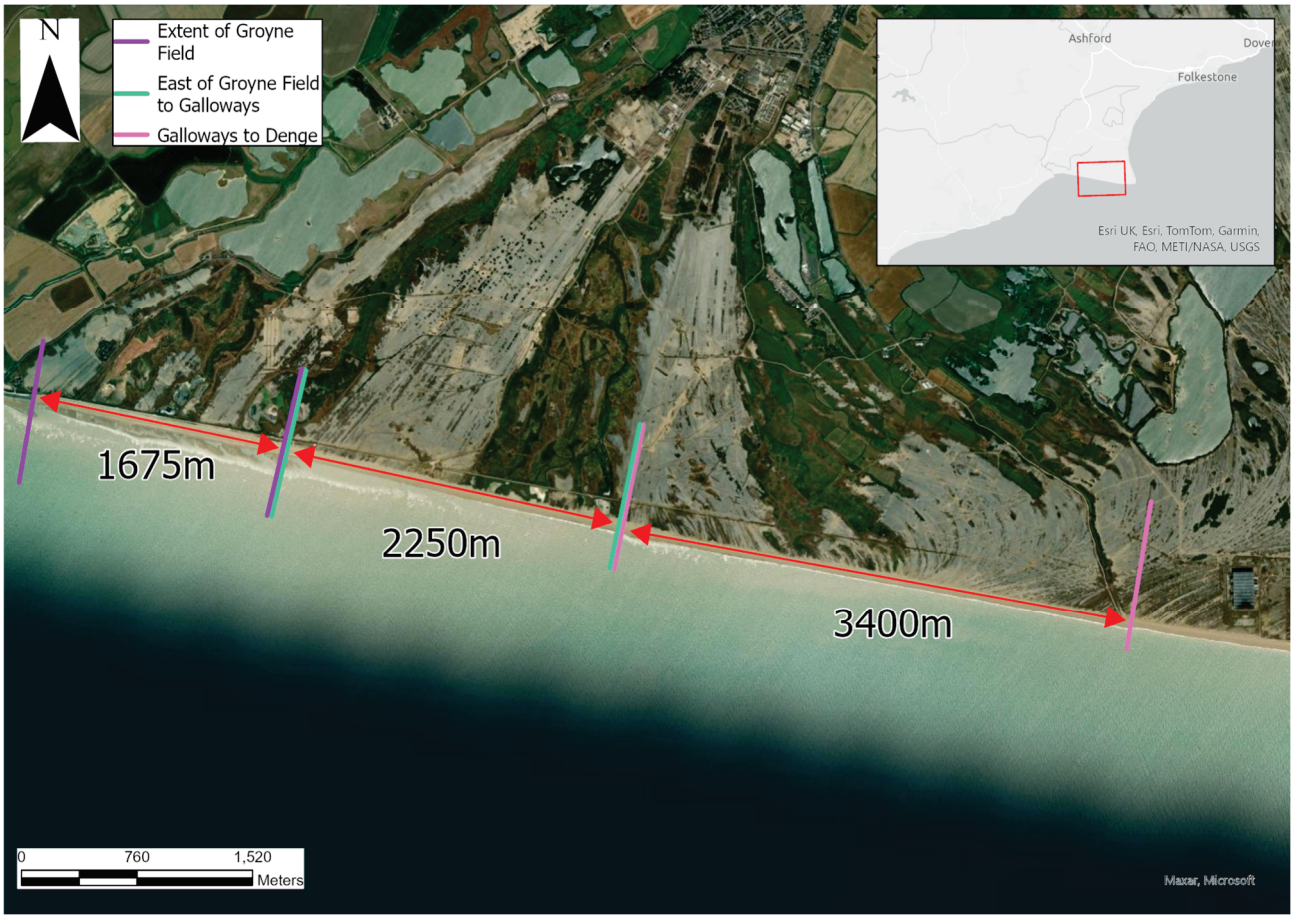


Figure 1-1: Extents of assessed profiles. Magenta lines indicate endpoints of the newly constructed groyne field. Cyan Lines indicate the region between the East of Groyne Field and Galloways.



Figure 1-2. Monitoring profile locations and groyne bay polygons (Bay 00 to 17).



Figure 1-3. Monitoring profile locations and groyne bay polygons (Bay 17 to 33).

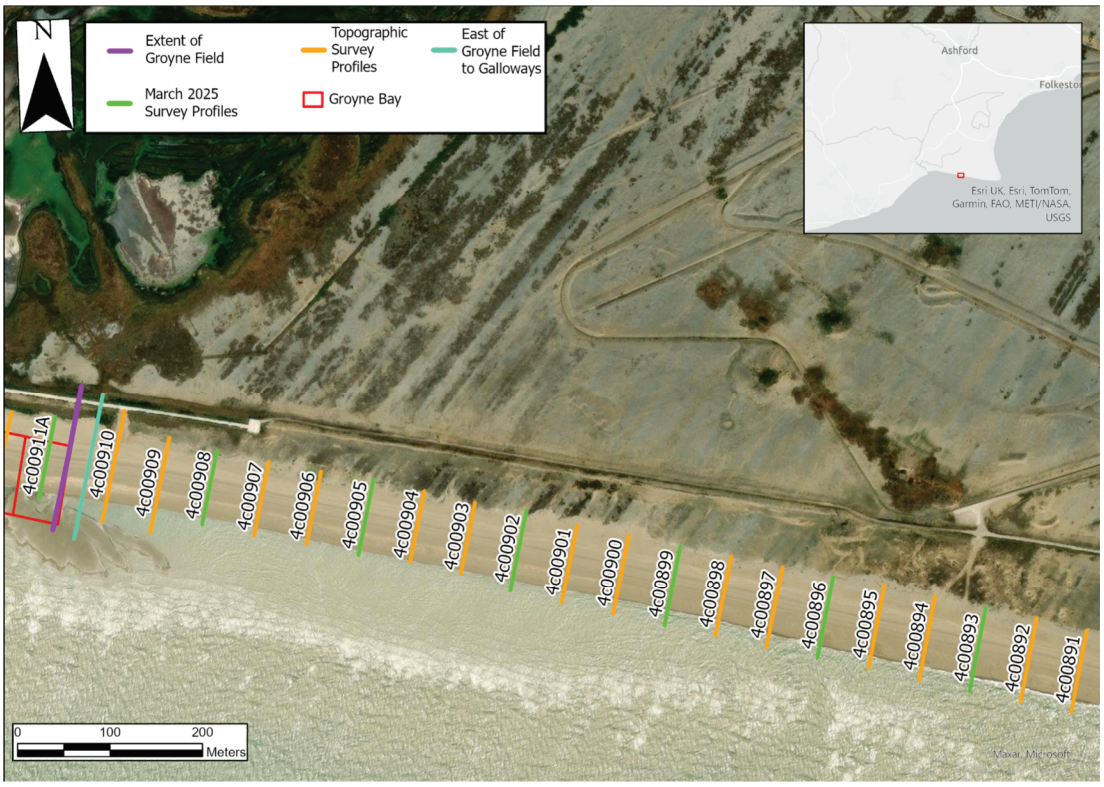


Figure 1-4. Monitoring profile locations east of the groyne field to profile 4c00891.

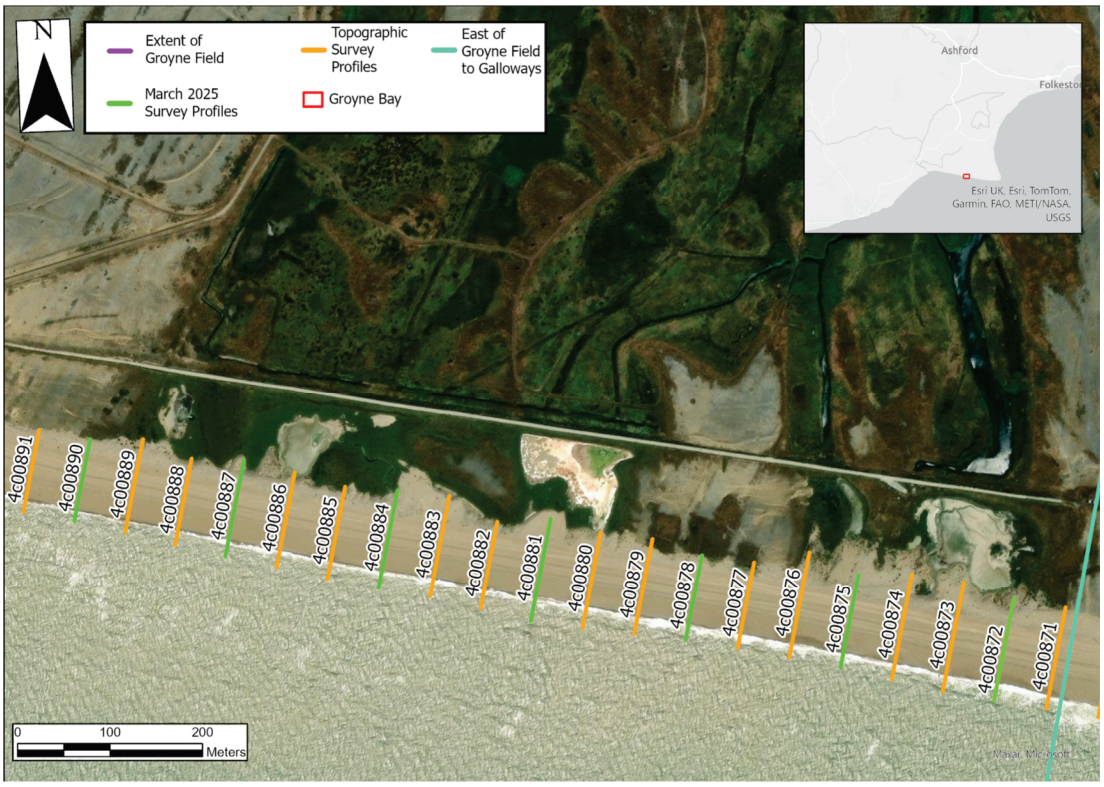


Figure 1-5. Monitoring profiles from 4c00891 to Galloways



Figure 1-6. Monitoring profiles from Galloways to 4c00840

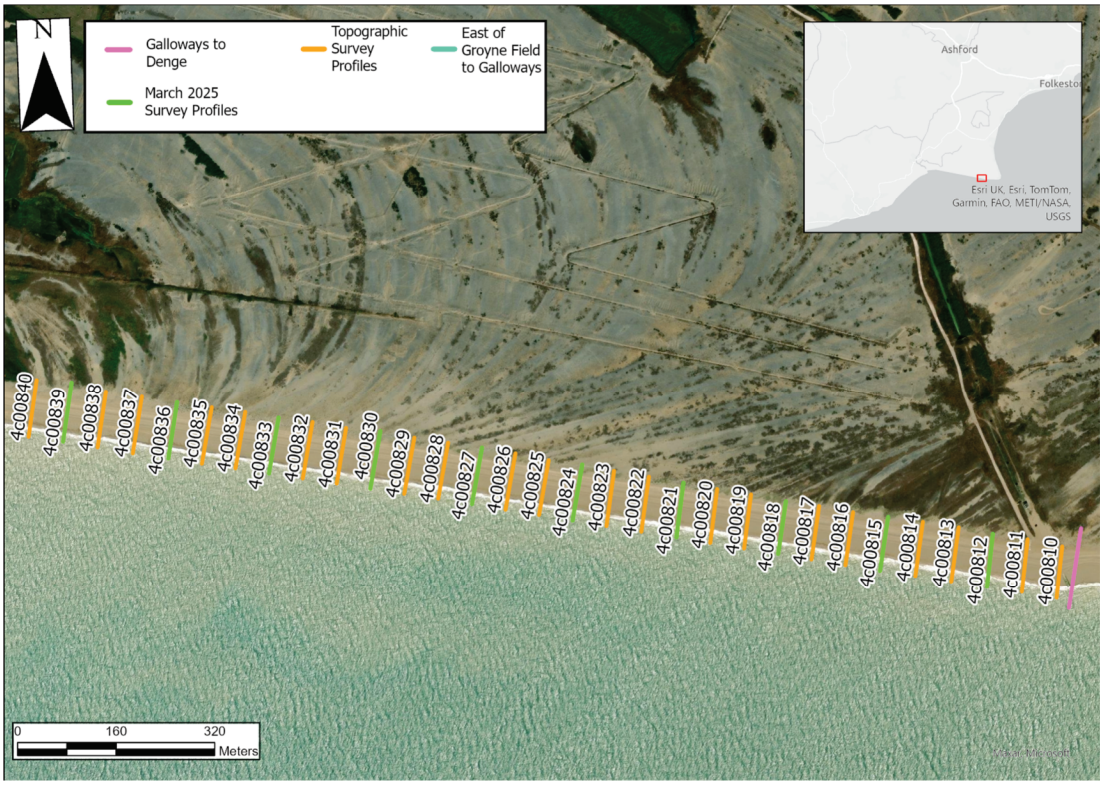


Figure 1-7. Monitoring profiles from 4c00840 to Denge

2. Analysis Outputs

The outputs of this topographic survey/analysis include:

- Lydd Ranges Spring Survey Analysis Report (*this document*)
    - A chart (Figure 4-1) showing the current beach cross-sectional area against both the; October 2024 survey, and trigger values (defined in the BMP) for the groyne field frontage. This figure also indicates the range of cross-sectional areas determined for each profile using survey data from October 2023 to March 2025.
    - A chart (Figure 4-2) showing the current beach performance with regards to beach crest height, relative to the maintenance and critical trigger values (defined in the BMP) for section 1 (see Section 3.1) of the groyne field frontage.
    - Beach profiles comparing the results of the Spring 2025 survey to Design, Maintenance and Critical trigger profiles (Section 5). December 2024 profiles are also shown for reference and are a RCMP post-storm survey performed on 13/12/2024.
    - Difference models (plans) (March 2025 survey to Design levels) for the groyne field (Section 6)
    - Assessment of performance of beach east of the groyne field in terms of ecological triggers for erosion/recession. Analysis carried out in the updated BMP Appendix E4 and discussed in Section 8. Includes latest survey and historic CSA and MSL downdrift of groyne field.

2.1 Data Processing

Topographic survey data was provided by the Environment Agency in a .txt format and was processed using the SANDS software with point data also visualised in QGIS.

Beach profiles were analysed in SANDS using the cross-sectional area analysis tool to compare survey levels against trigger levels for each profile.

Survey profile data was used to generate a Digital Elevation Model (DEM) in Surfer (by Golden Software) for volumetric analysis. The DEM was created by interpolating values in areas lacking data within the groyne field using the nearest neighbour method. With a resolution of 25 cm × 25 cm, the DEM was then compared against a design trigger level surface developed in QGIS. The spatial coverage of the March 2025 survey profiles within the groyne field is illustrated in Figure 2-1. The March 2025 survey DEM is shown in Figure 2-2 and it can be noted that the interpolation between survey lines covers multiple bays.

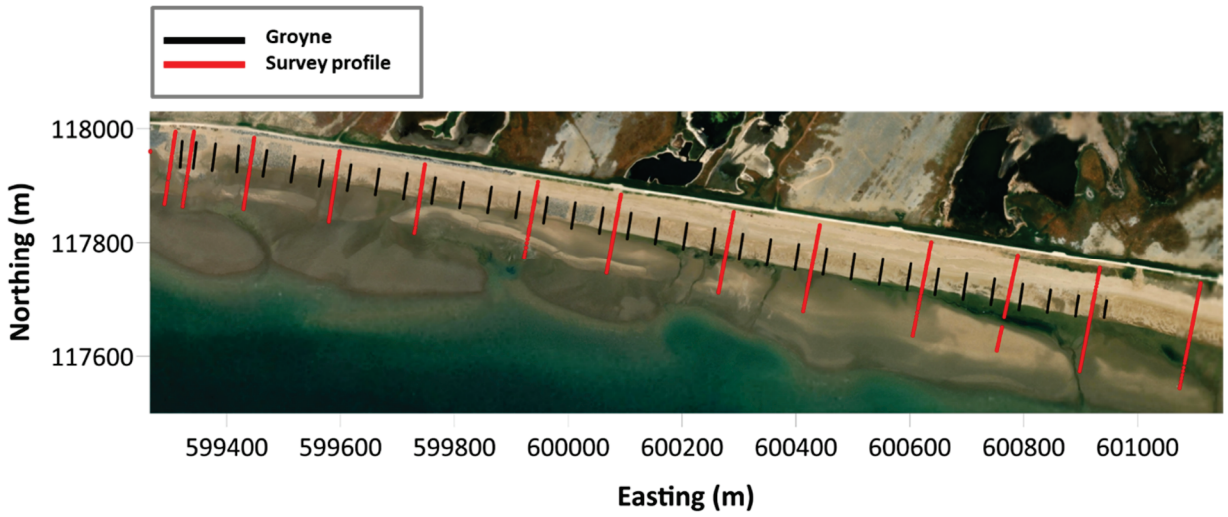


Figure 2-1. March 2025 survey profiles coverage

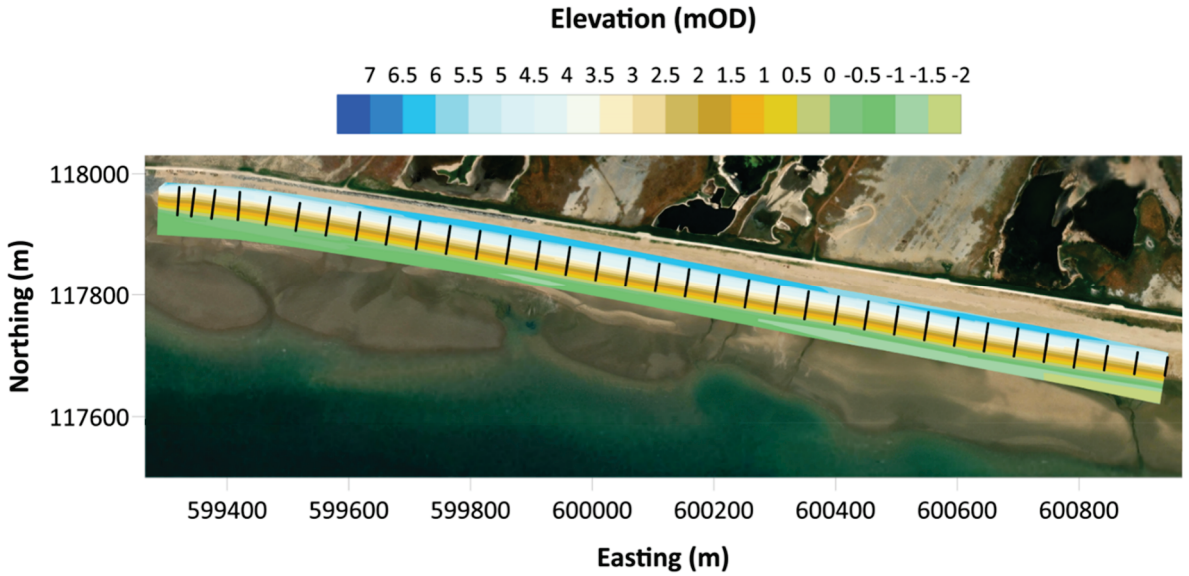


Figure 2-2. March 2025 survey Digital Elevation Model (DEM)

Based on the reference design beach specifications, design profiles were generated for each groyne bay, as shown in the example in Figure 2-3. Using the same interpolation method described earlier, a design DEM was created for the design beach. The design DEM was then subtracted from March 2025 survey DEM using Surfer's grid subtraction tool to produce a difference model. In this model, positive values indicate an increase in sand material, while negative values indicate a loss.

- Difference Elevation ($(\Delta h) = h_{Survey} - h_{Design}$

The groyne field was then divided into distinct zones corresponding to each groyne bay, referred to as volume change area boundaries. Within each of these areas, the volume change was calculated by summing the product of the elevation difference and the area of each DEM cell (25 cm × 25 cm). This calculation was performed for all cells within each boundary, allowing for an accurate estimation of sand loss or surplus in each groyne bay, as expressed in the formula below:

- *Total Volume Change* = $\Sigma\ (\Delta h_i \times A)$

Where:

Δh_i : Elevation difference at cell i.

A : Area of each DEM cell (0.25 cm × 0.25 cm)

n : Total number of cells within the volume change area boundary.

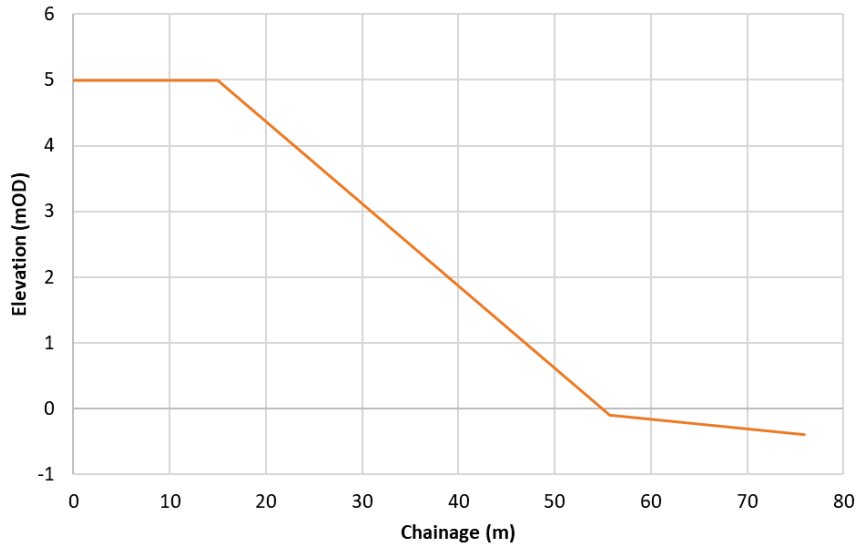


Figure 2-3. Example of a design profile generated in Bay 00

2.1.1 Assessing the Reliability of Volumetric Assessment using Profile Data Compared to Full Surveys

Since the March 2025 survey consisted of elevation profiles within selected bays rather than comprehensive data points covering the entire groyne field, an assessment was carried out to evaluate the reliability of this approach to determine beach volumes and losses.

To understand the range of potential uncertainty, the October 2024 survey (which provided full survey coverage and corresponding beach volume) was re-analysed for comparison. Two comparison scenarios were tested: one using a single profile extracted per groyne bay, and another replicating the coverage pattern of the March 2025 intermittent profiles. For this analysis, Bay 00 and Bay 33 were excluded.

The analysis indicates that when compared to the volumes determined using the full dataset (Figure 2-4):

- using one profile per bay method (Figure 2-5), the analysis shows a slight overall underestimate in volume (less than 2%), with a maximum deviation of 122 m^3 per bay;
- using a reduced set of profiles (March 2025 profiles - Figure 2-6), slightly overestimates the total volume by less than 1% with a more notable variation in volume between individual groyne bays (up to 400 m^3).

This analysis indicates that using intermittent profiles appears to provide a reasonable estimate of overall beach volumes, but is not recommended to indicate the overall status of individual bays. It is noted that this conclusion is based on the analysis of the single October 2024 survey and it may not be consistent across future analyses due to variability within individual bays.

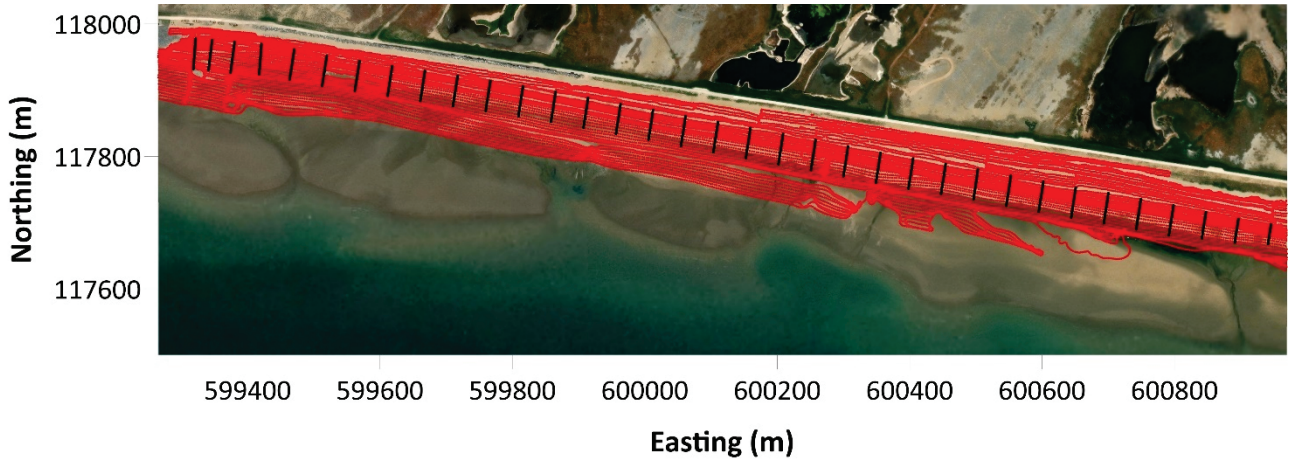


Figure 2-4. October 2024 survey full coverage

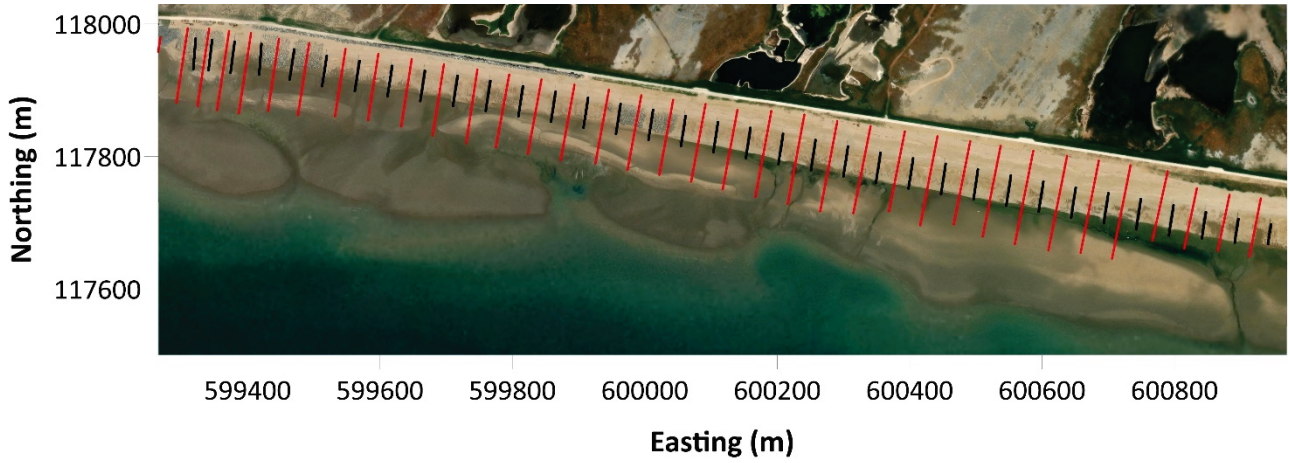


Figure 2-5. October 2024 survey (one profile per groyne bay coverage)

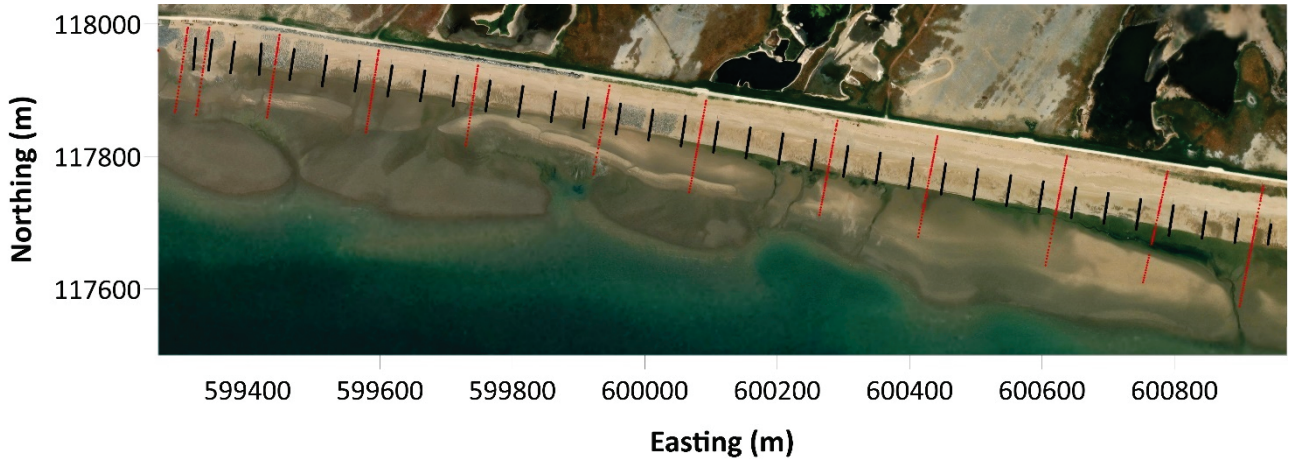


Figure 2-6. October 2024 (replicating the coverage pattern of the March 2025 profiles)

3. Design Beach Levels

3.1 Groyne field

Following the Lydd Ranges trigger profile assessment, undertaken in winter 2024-2025, the groyne field frontage was split into two sections, each with their own respective trigger levels. These varying triggers reflect the increased vulnerability observed at the west of the frontage, Section 1, where the greatest losses in sediment were observed.

For Section 1 (Table 3-1) the new critical trigger profile, is defined as the minimum beach required to provide a 1:200 Standard of Protection (SoP) against overtopping for the year 2045 when accounting for the contribution from both the beach and revetment behind (Jacobs, 2024a). The maintenance trigger level was calculated based on analysis performed in the Lydd Ranges trigger profile assessment and in relation to the critical trigger level defined above. Finally, the design trigger level remained the same.

Note, the cross-sectional area triggers vary for each monitoring profile location due to the varying Master Profiles. The Master Profiles are set based on foreshore levels and back-of-beach structures.

- The Critical trigger is the 1 in 200 SoP (0.5% AEP).
- The Maintenance trigger includes a buffer that allows for the expected losses during a typical winter.
- The Design trigger is the level is the target to reach when carrying out recycling works.

The extents and trigger profiles for the groyne field are summarised in Table 3-1.

Table 3-1. Trigger levels within groyne field

Section	Start Profile	End Profile	Feature	Design Trigger Level	Maintenance Trigger Level	Critical Trigger Level
1	4c00935A	4c00940B	Crest Level	+5.0 mOD	+5.0 mOD	+4.5 mOD
			Crest Width	15 m	-	-
			Beach Slope	1:8	1:8	1:8
2	4c00911A	4c00934A	Crest Level	+5.0 mOD	+5.0 mOD	+5.0 mOD
			Crest Width	15 m	13.5 m	12 m
			Beach Slope	1:8	1:8	1:8

3.2 East of groyne field to Galloways

East of the groyne field to Galloways, the BMP defines only Maintenance and Critical trigger levels. These levels are based on crest height and width as set out in Table 3-2.

Table 3-2. Trigger levels east of groyne field to Galloways

Start Profile	End Profile	Feature	Design Trigger Level	Maintenance Trigger Level	Critical Trigger Level
4c00910	4c00871	Crest Level	N/A	+5.5 mOD	+5.5 mOD
		Crest Width	N/A	6.5 m	5 m
		Beach Slope	N/A	N/A	N/A

4. Groyne Field Performance

4.1 Assessment of Cross-sectional Areas

From analysis of cross-sectional areas relating to monitoring data collected in March 2025, it can be seen that, within section 1, the recently monitored frontages lie within the design trigger level range (so above the maintenance trigger) with the exception of 4c00940B which is in maintenance, whilst those within section 2 tend to lie above the design level (Figure 4-1).

Particular notice should be given to the eastern end of the groyne field (ID 4c00911A) where the cross-sectional area has fallen from the maintenance trigger level in October 2024 to the critical level in March 2025.

Of the 12 profiles that were surveyed in both October 2024 and March 2025 only three exhibited an increase in cross-sectional area over the winter (4c00938A, 4c00923A, 4c00914A) with considerable lowering of CSA in the central area of the frontage e.g., 4c00932A, occurring over the same period.

An additional assessment of cross-sectional area range following the completion of the construction of the groyne field has been performed in this monitoring period. This metric measures all surveys between October 2023 and March 2025 inclusive. In 7 out of 12 profiles surveyed within the groyne field the measured cross-sectional area is the lowest post-construction, indicating an ongoing loss of sediment from the groyne field.

As noted, the March 2025 survey does not include all profiles within the groyne field. For those not resurveyed since October 2024 the conditions have not been reassessed. At the time of the October 2024 survey, all Section 1 profiles not surveyed in March 2025, lay at the lowest recorded. Greater variability was observed in Section 2 where some profiles were the lowest on record (4c00931B) some, towards the highest on record (4c00928A) whilst moving eastwards profiles tend to lay in the middle to lower range observed (4c00915A).

For profiles that were subject to recycling works during the Winter 2024 period (4c00911A, 4c00912A, 4c90037A-4c00940B), a lowering of cross-section area in all profiles surveyed can be discerned. There is, however, some variability in the loss of sediment with the greatest losses (in terms of area) experienced on the western end of the frontage. In particular, as of the March 2025 survey, frontage 4c00940B had lost approximately 76m^2 of sediment, or 54% relative to the design level, since the recycling works were undertaken and, as previously noted, profile 4c00911A now lies within the critical trigger level.

It is important to note that only four of the profiles lying within the recycling works have been surveyed in March 2025, limiting the assessment of beach cross-sectional area that can be performed.

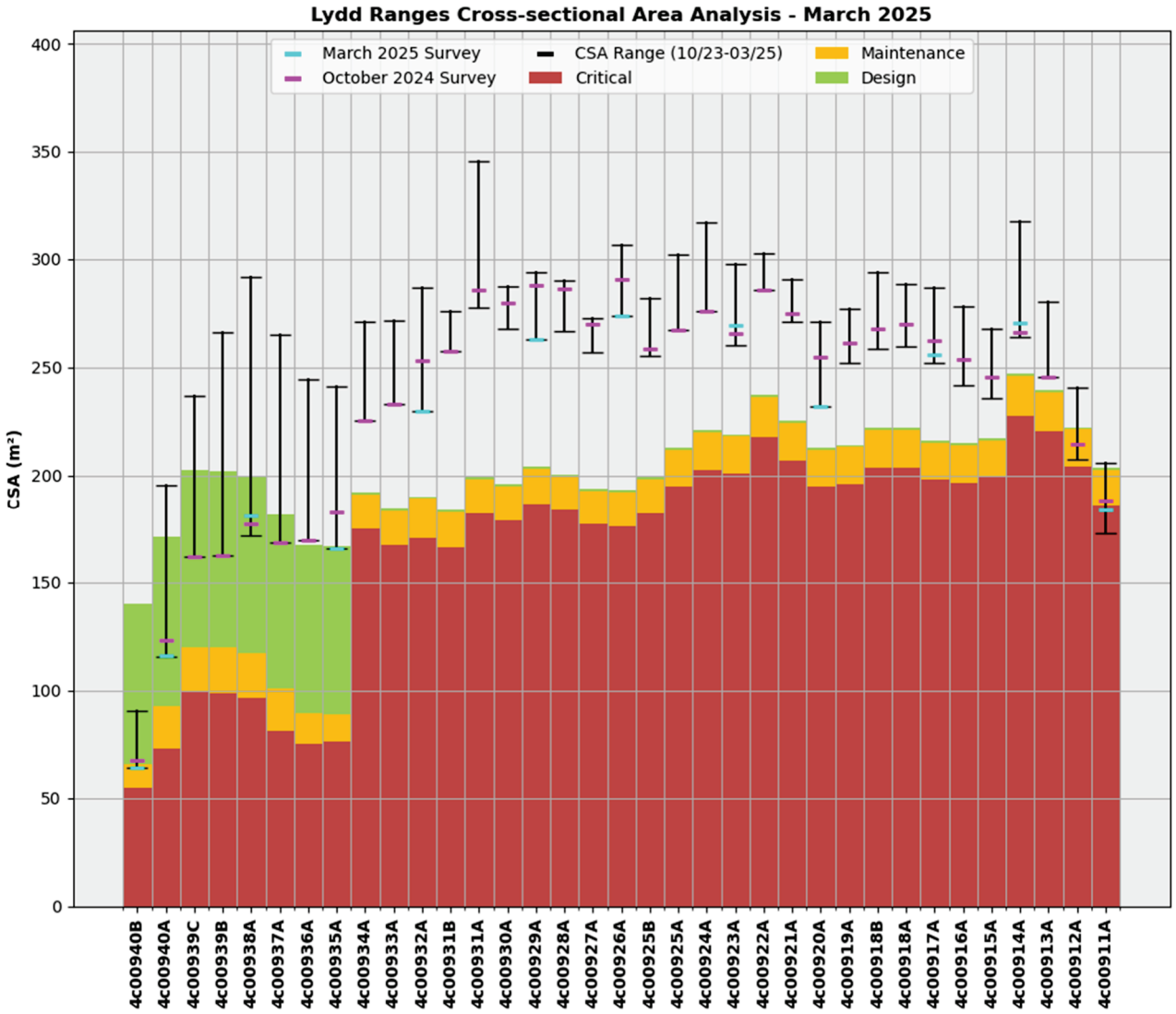


Figure 4-1: Cross-sectional areas for the monitoring locations contained within the Lydd Ranges groyne field.

4.2 Assessment of Section 1 levels

Following the groyne field Maintenance trigger review, performed prior to this report, an assessment of beach crest level at the revetment within section 1 was performed. A continuation of this analysis is shown in Figure 4-2 for the March 2025 survey. Evaluating this data shows that only profile 4c00940B lies within the maintenance trigger level. All other profiles lay above this trigger and, where surveys for both October 2024 and March 2025 have been undertaken, no discernible trend is present.

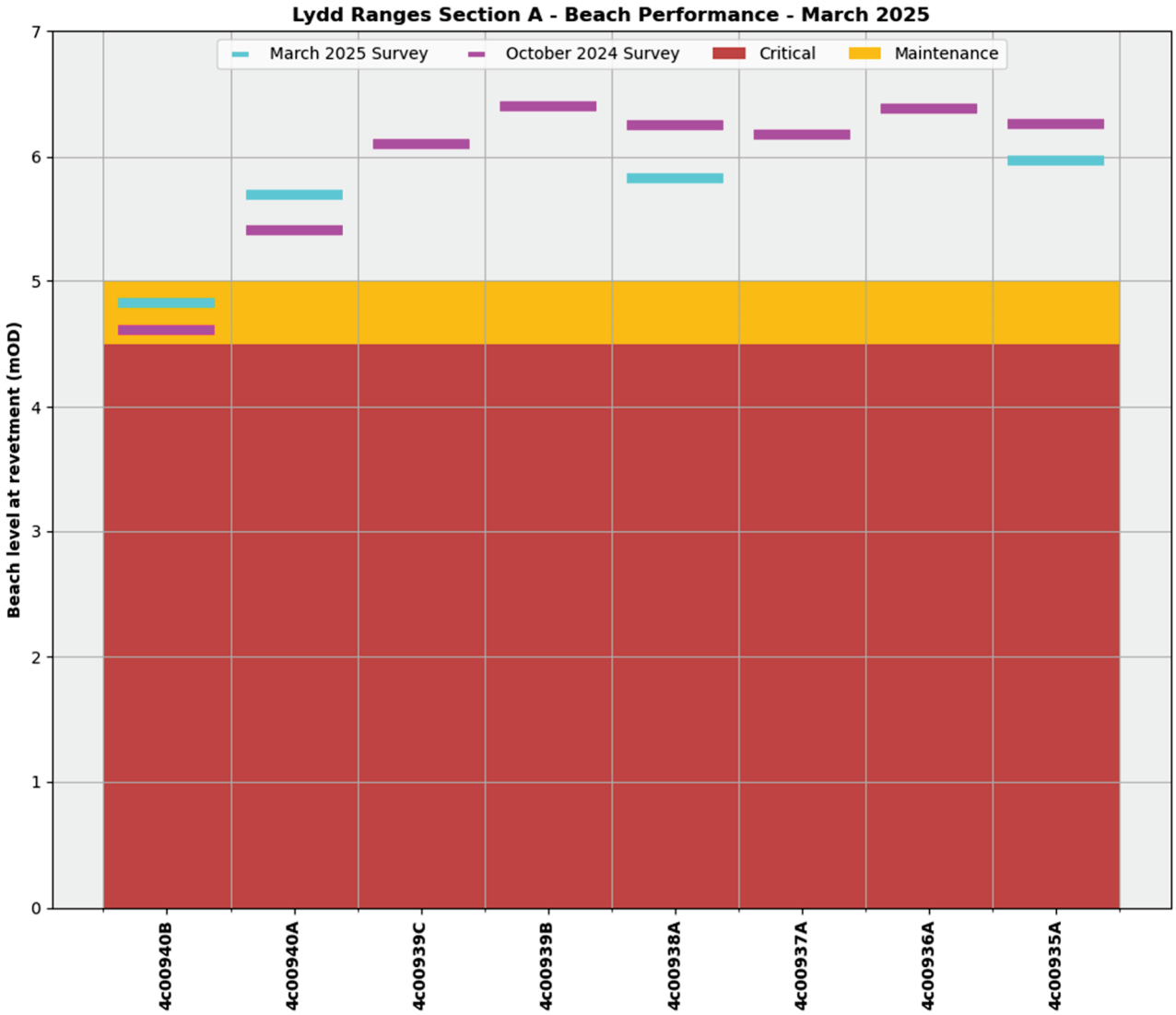
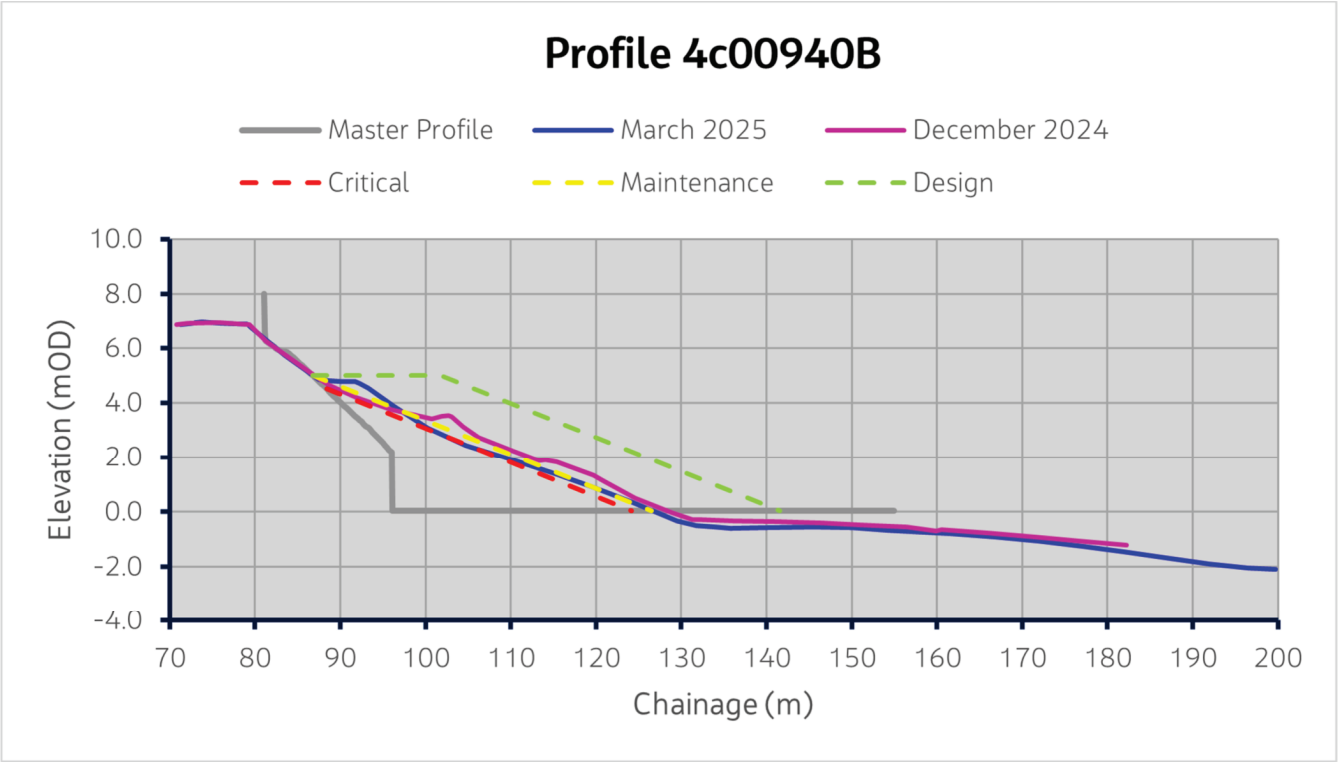
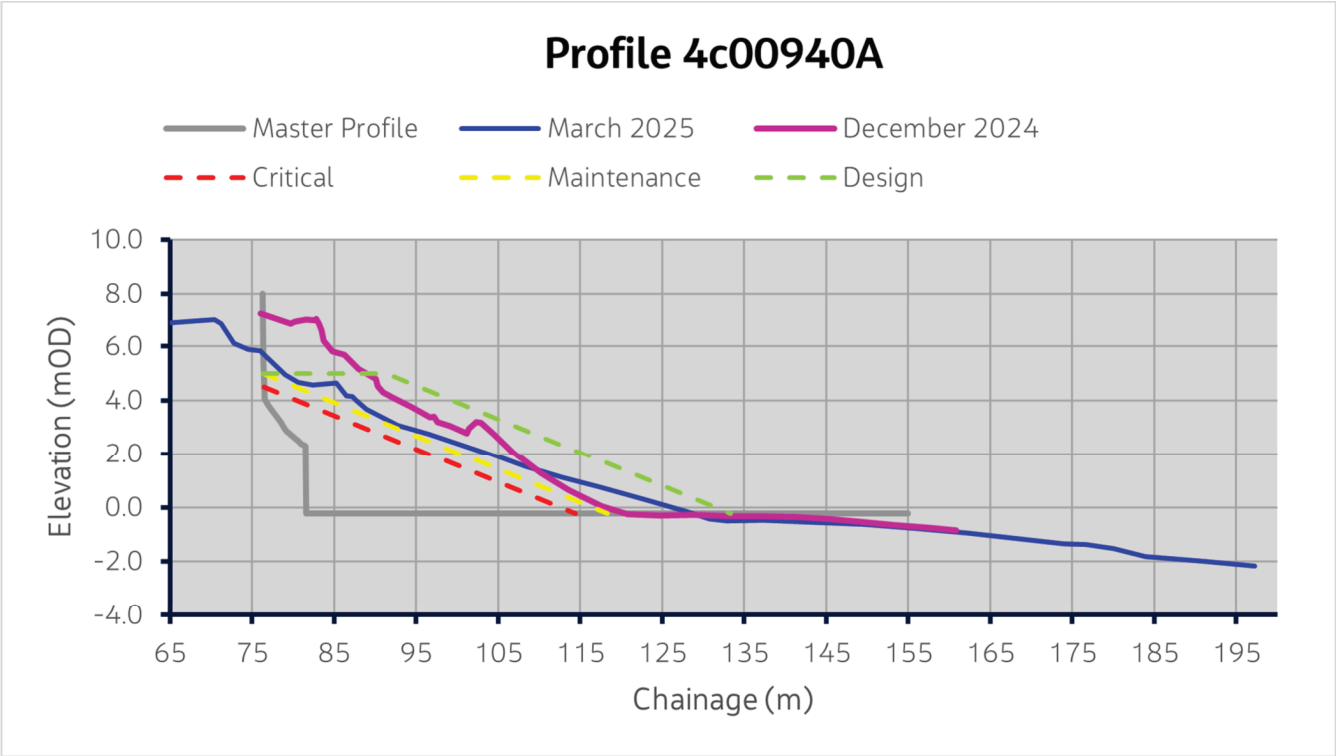


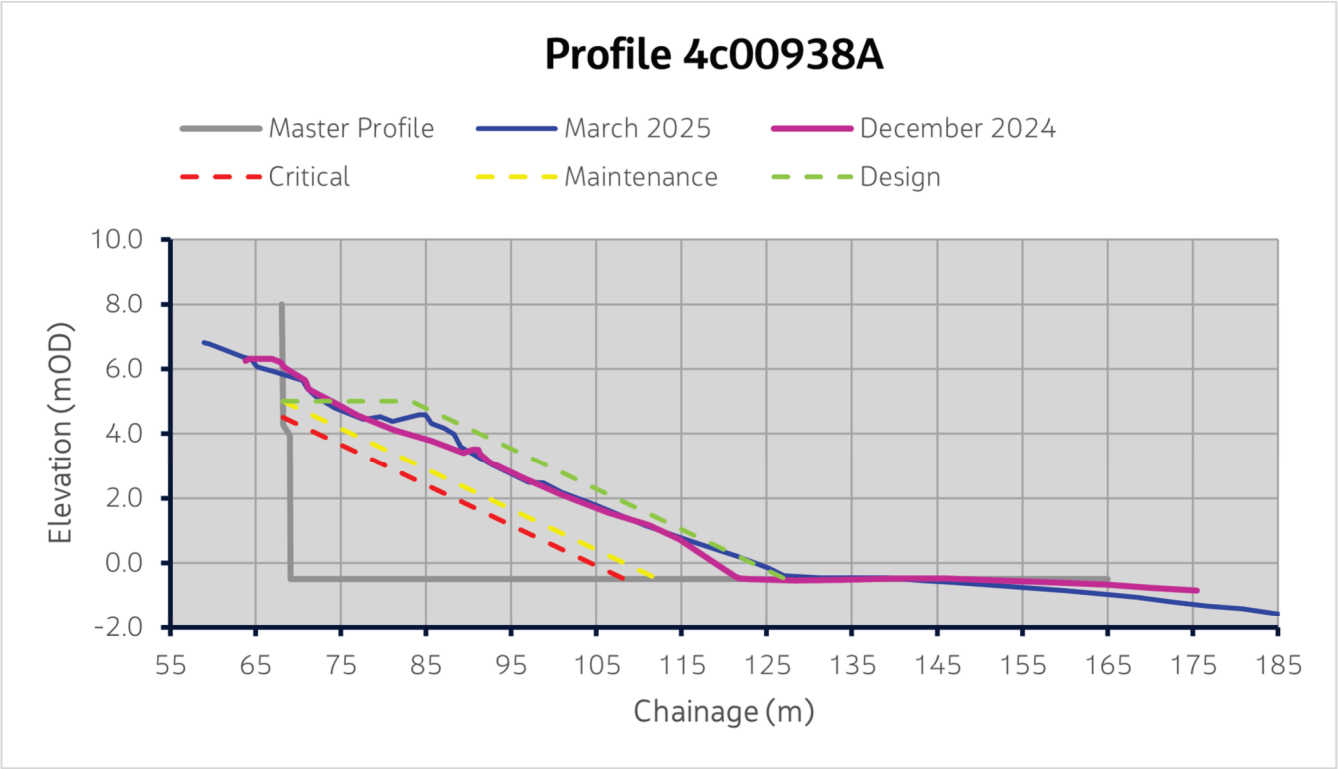
Figure 4-2: Beach level performance within section 1 of the Lydd Ranges groyne field.

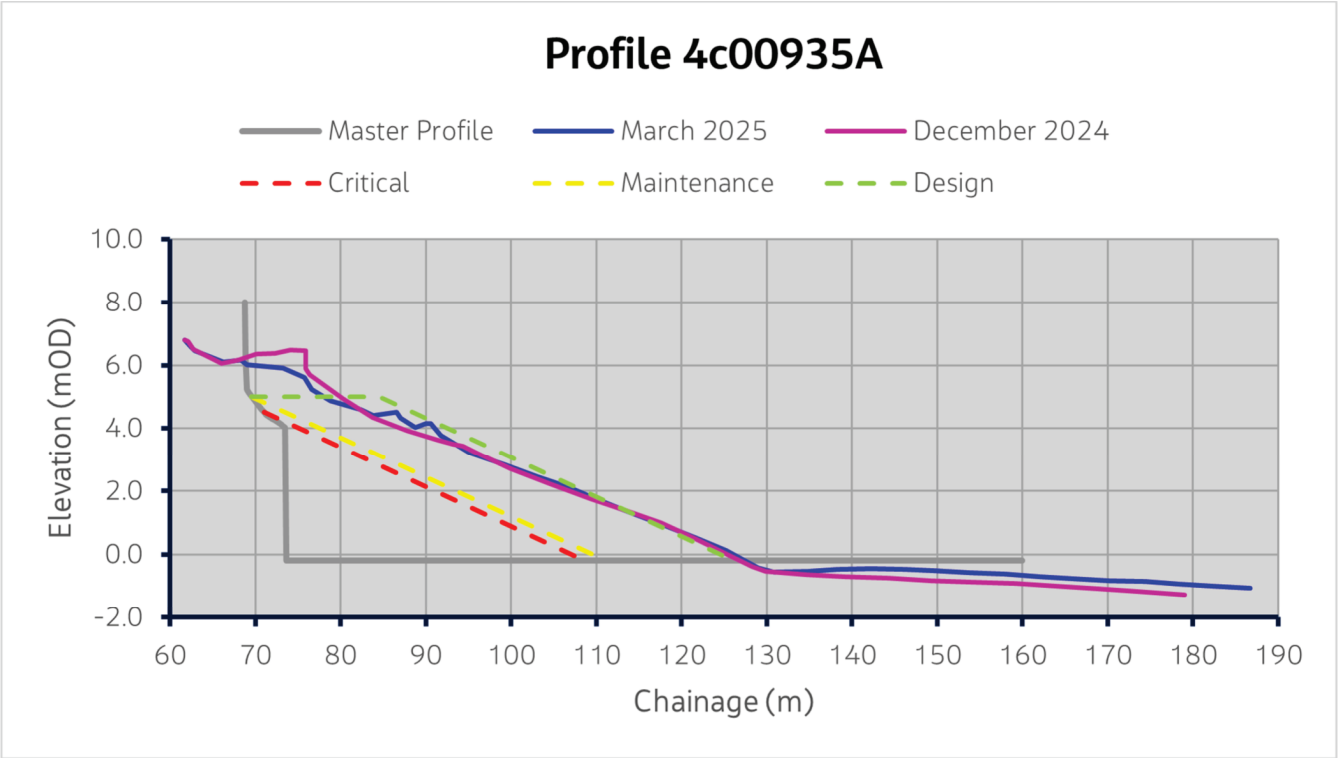
5. Topographic Profiles March 2025

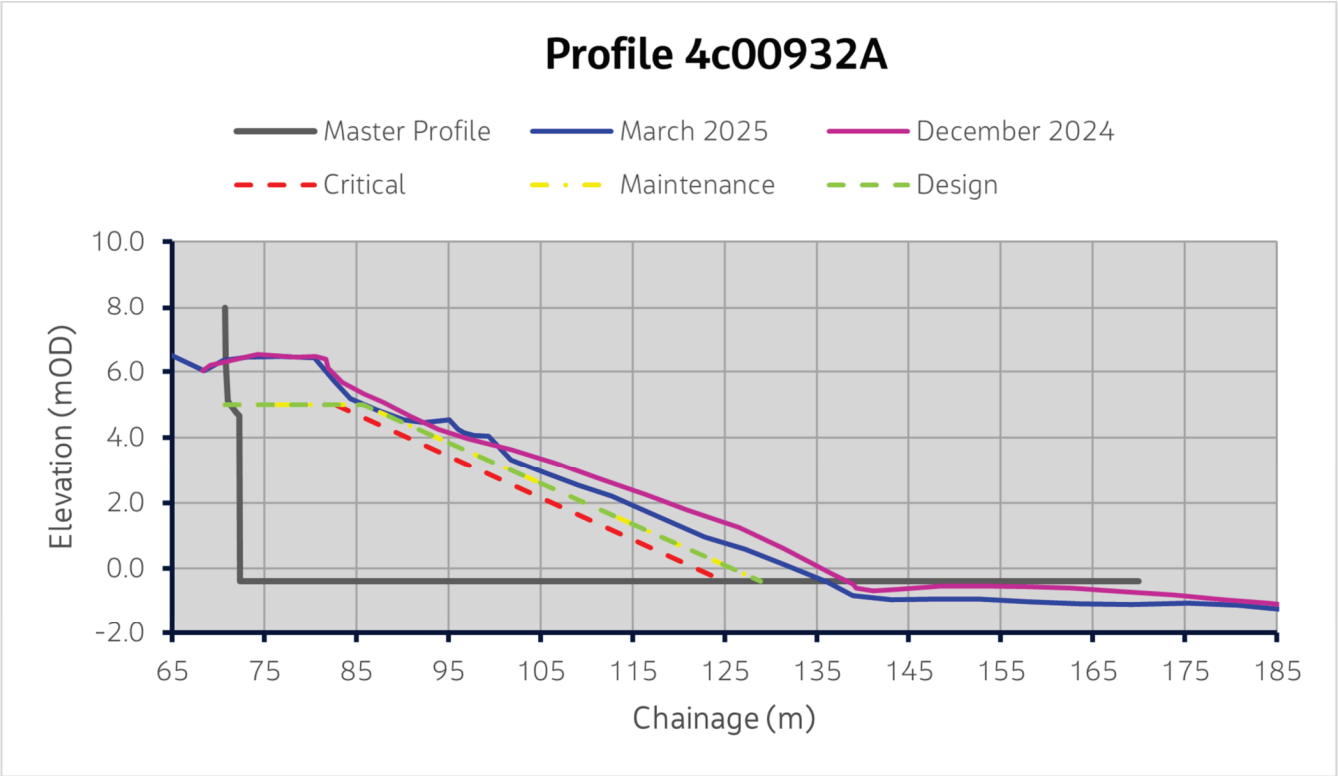
5.1 Groyne field profiles (4c00940B to 4c00911A)

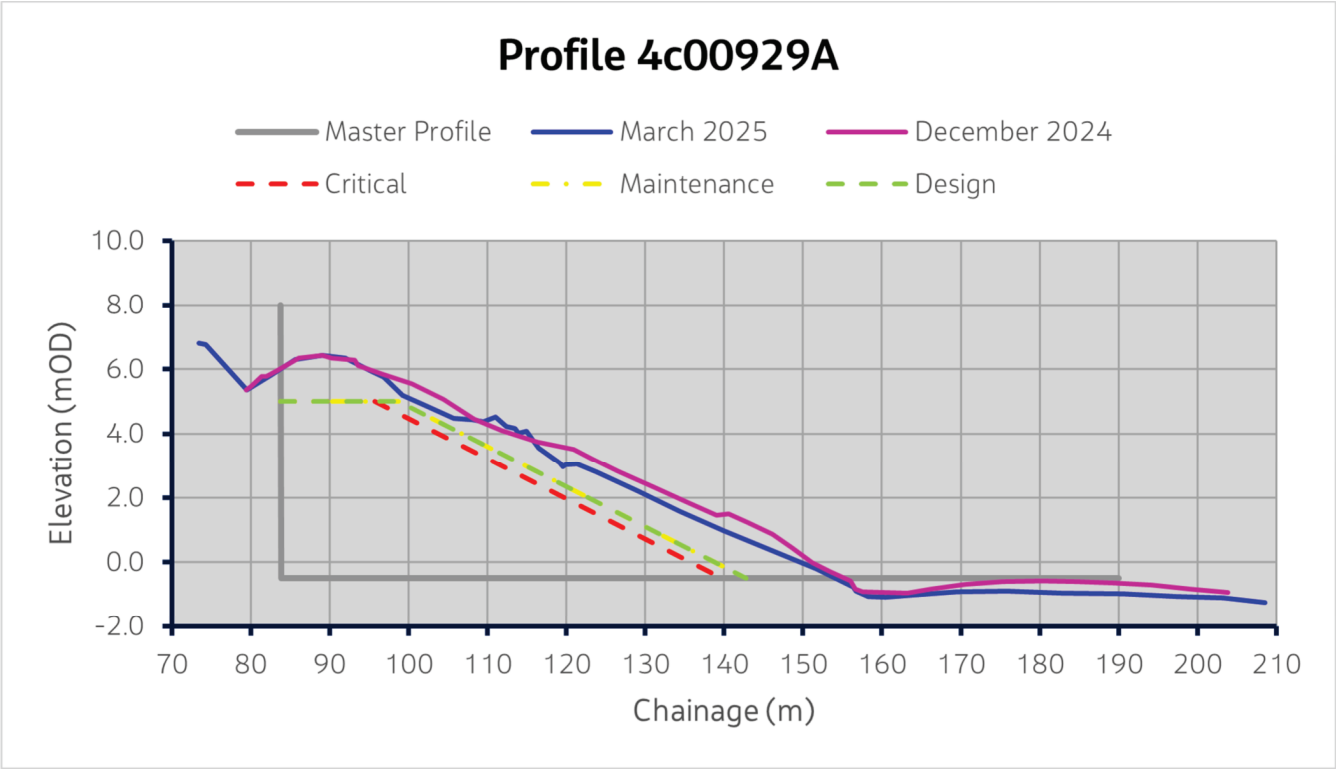

Profile 4c00940B
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
Elevation (mOD)
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
70
80
90
100
110
120
130
140
150
160
170
180
190
200
Chainage (m)

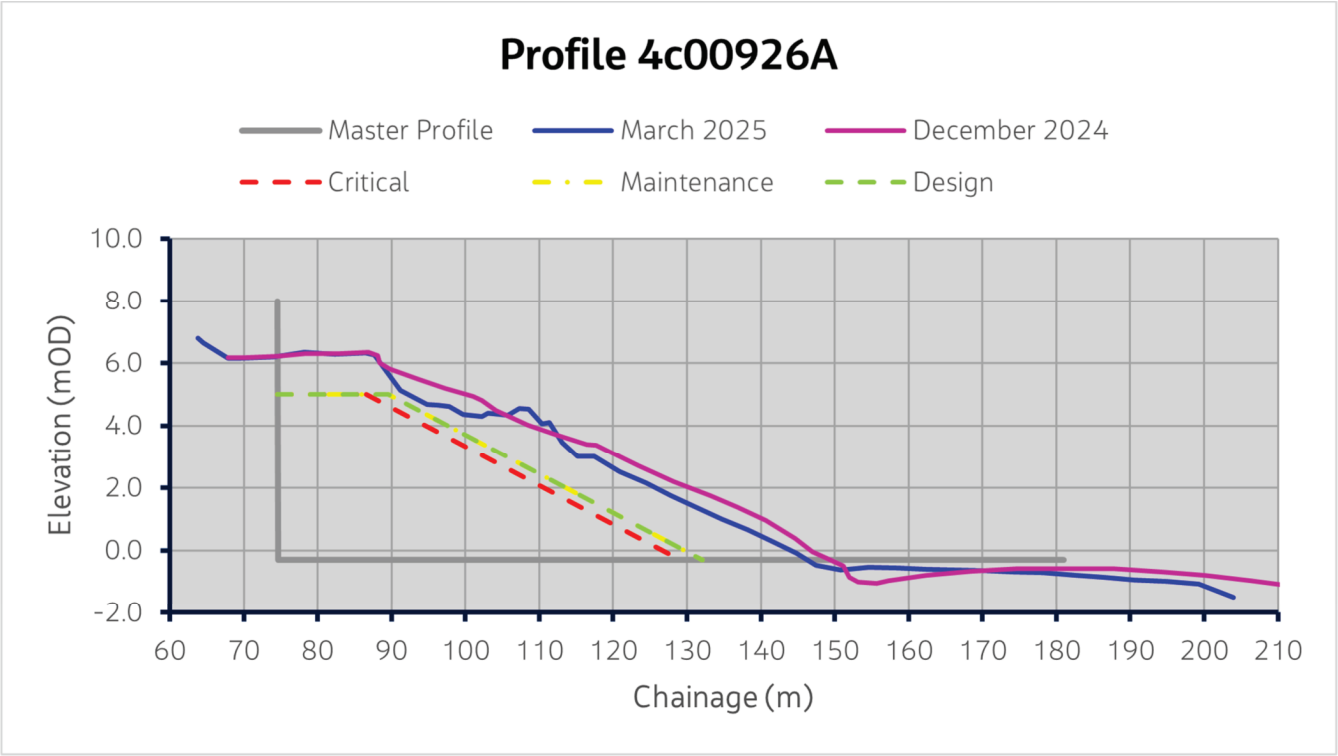

Profile 4c00940A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
Elevation (mOD)
65
75
85
95
105
115
125
135
145
155
165
175
185
195
Chainage (m)

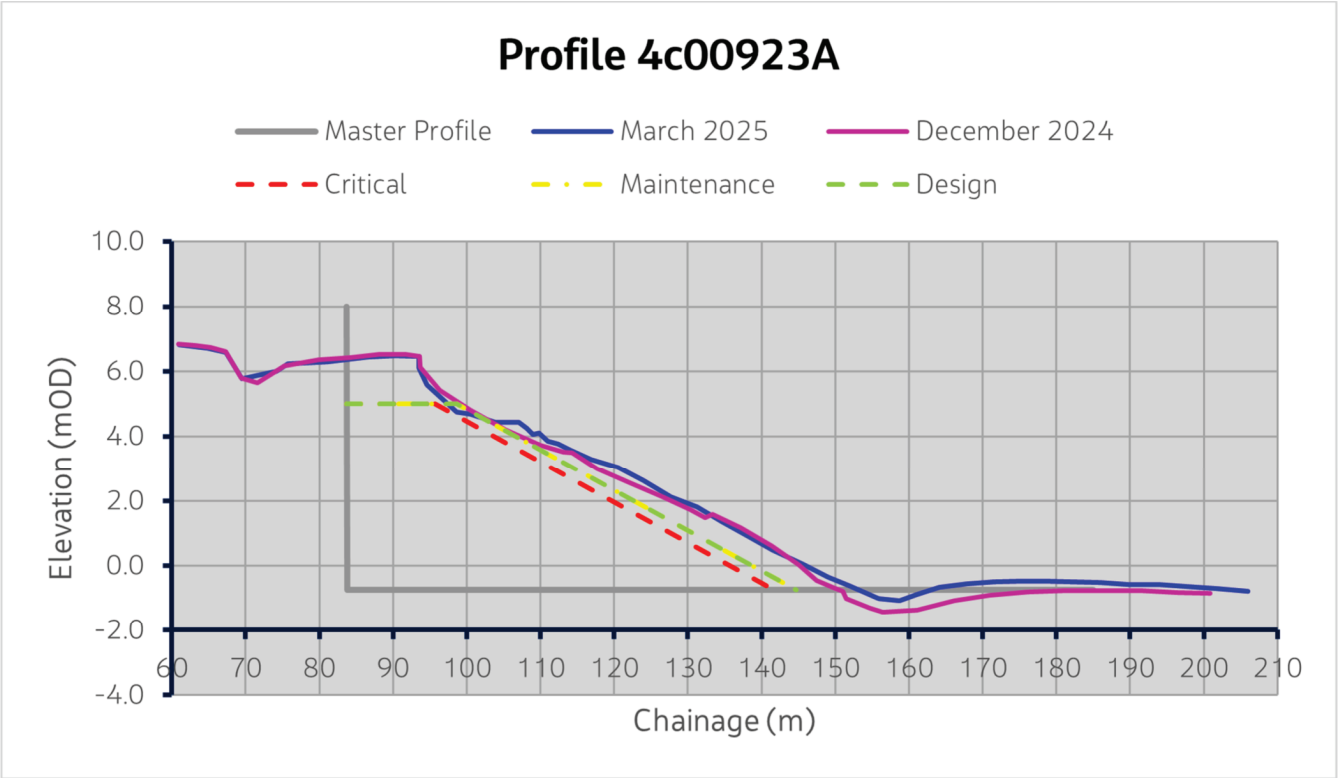

Profile 4c00938A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Elevation (mOD)
55
65
75
85
95
105
115
125
135
145
155
165
175
185
Chainage (m)

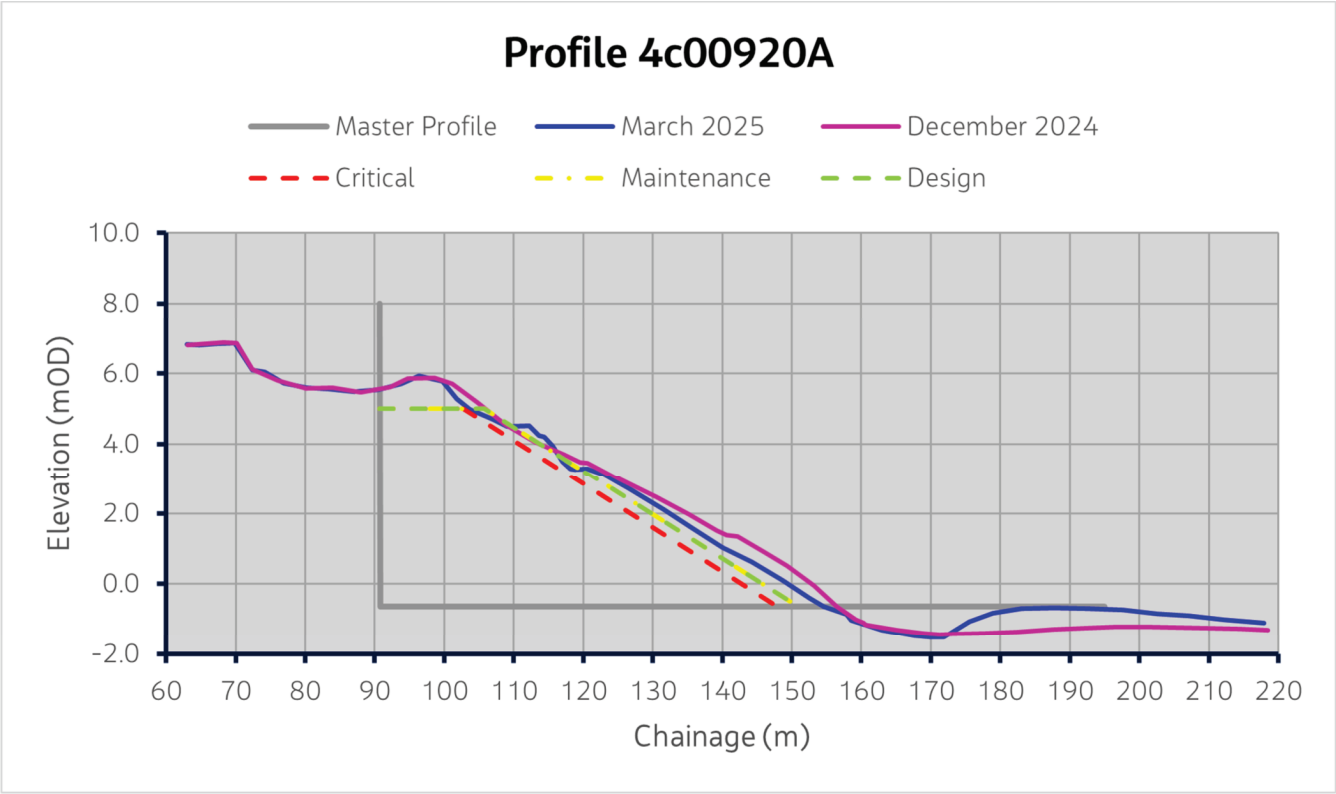

Profile 4c00935A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Elevation (mOD)
60
70
80
90
100
110
120
130
140
150
160
170
180
190
Chainage (m)

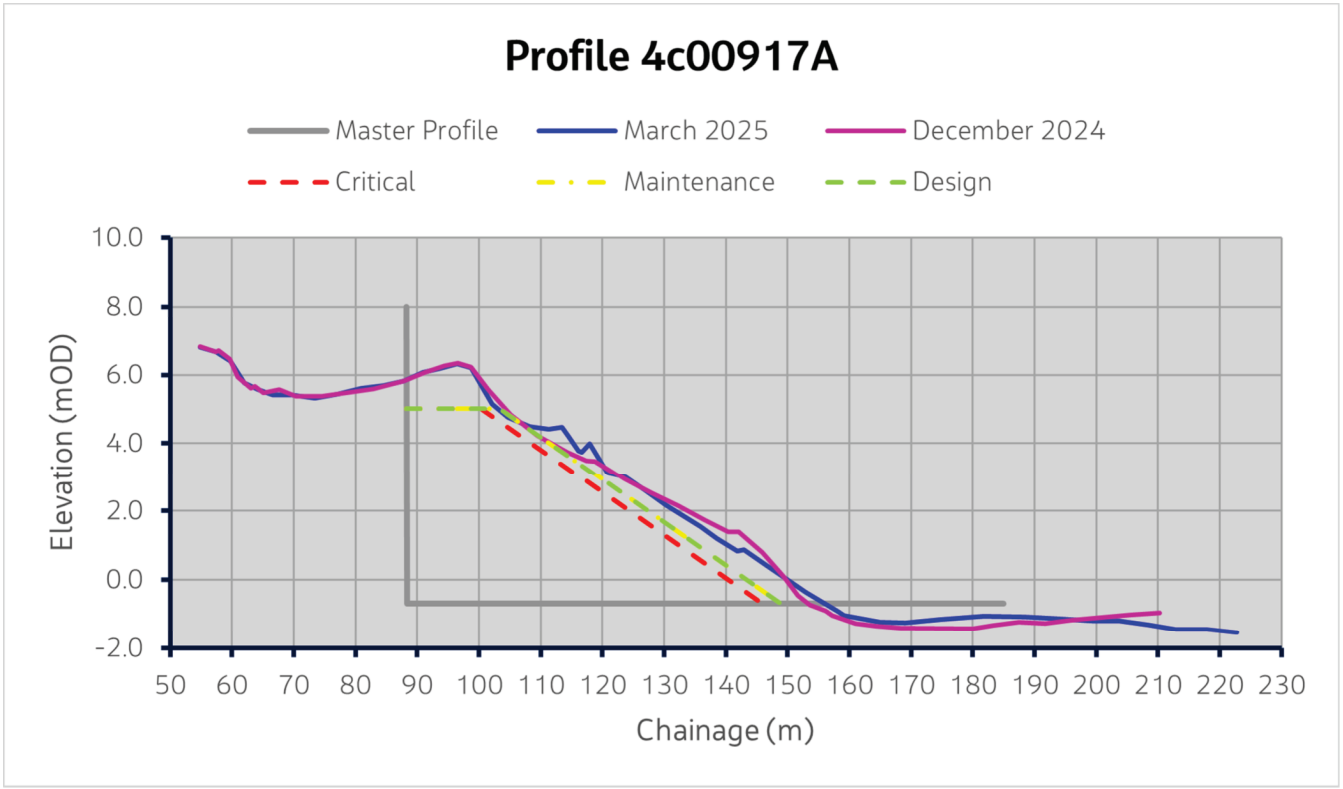

Profile 4c00932A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Elevation (mOD)
65
75
85
95
105
115
125
135
145
155
165
175
185
Chainage (m)

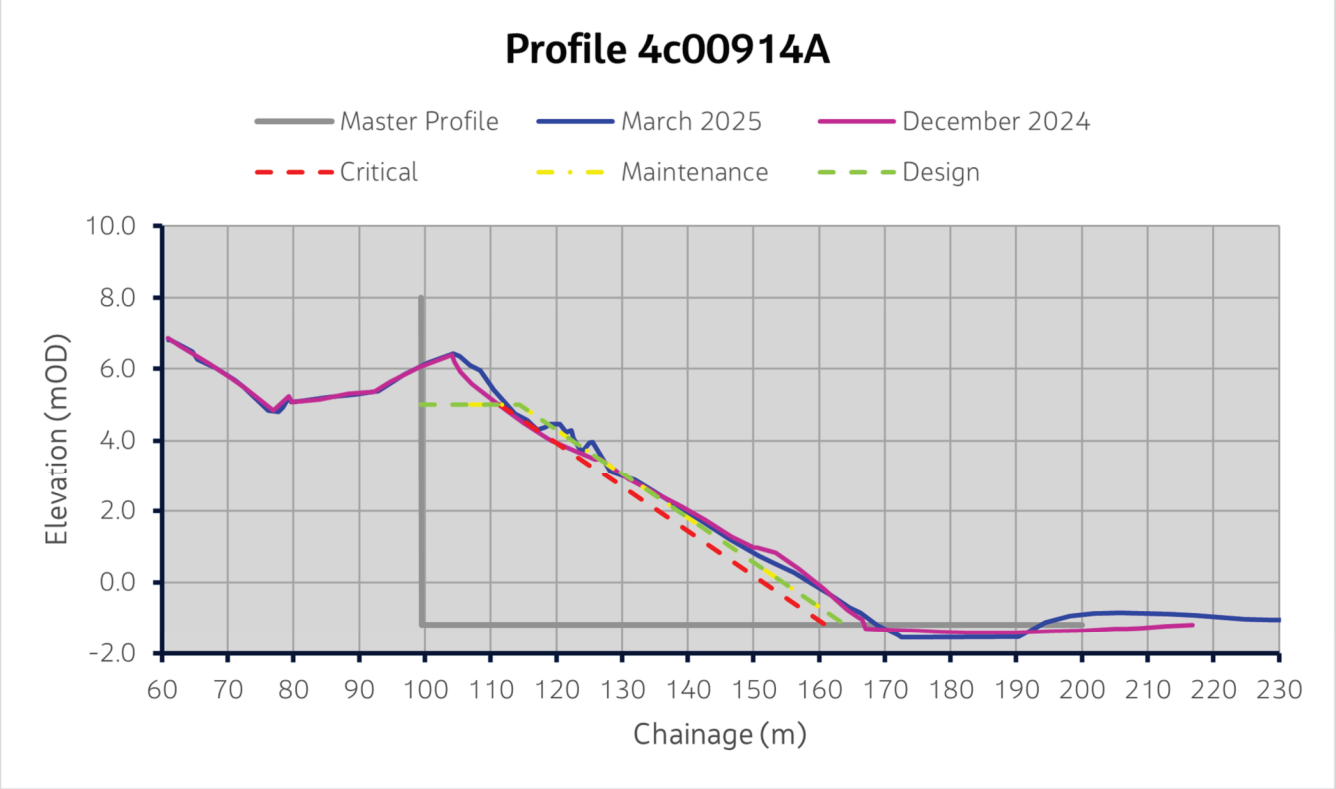

Profile 4c00929A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
Elevation (mOD)
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
Chainage (m)

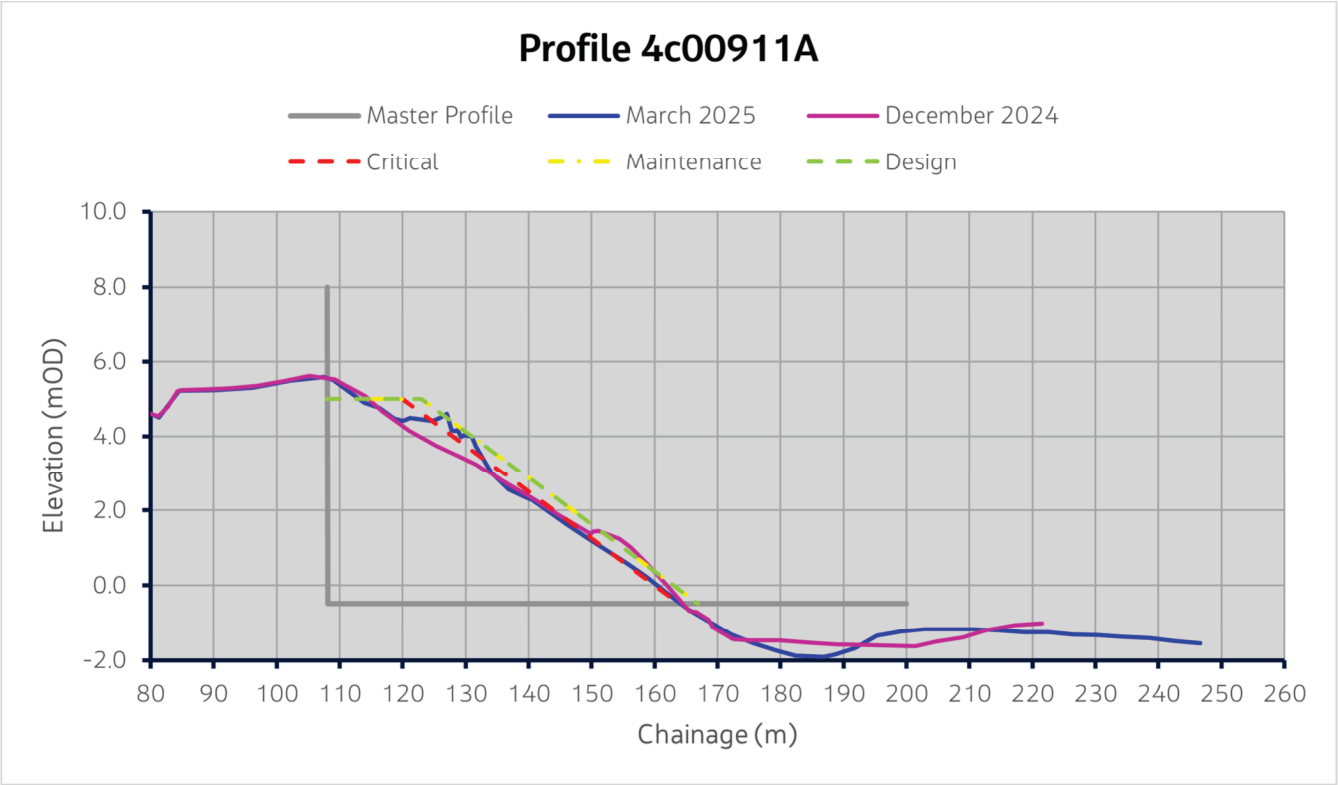

Profile 4c00926A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
Elevation (mOD)
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
Chainage (m)


Profile 4c00923A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
Elevation (mOD)
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
Chainage (m)

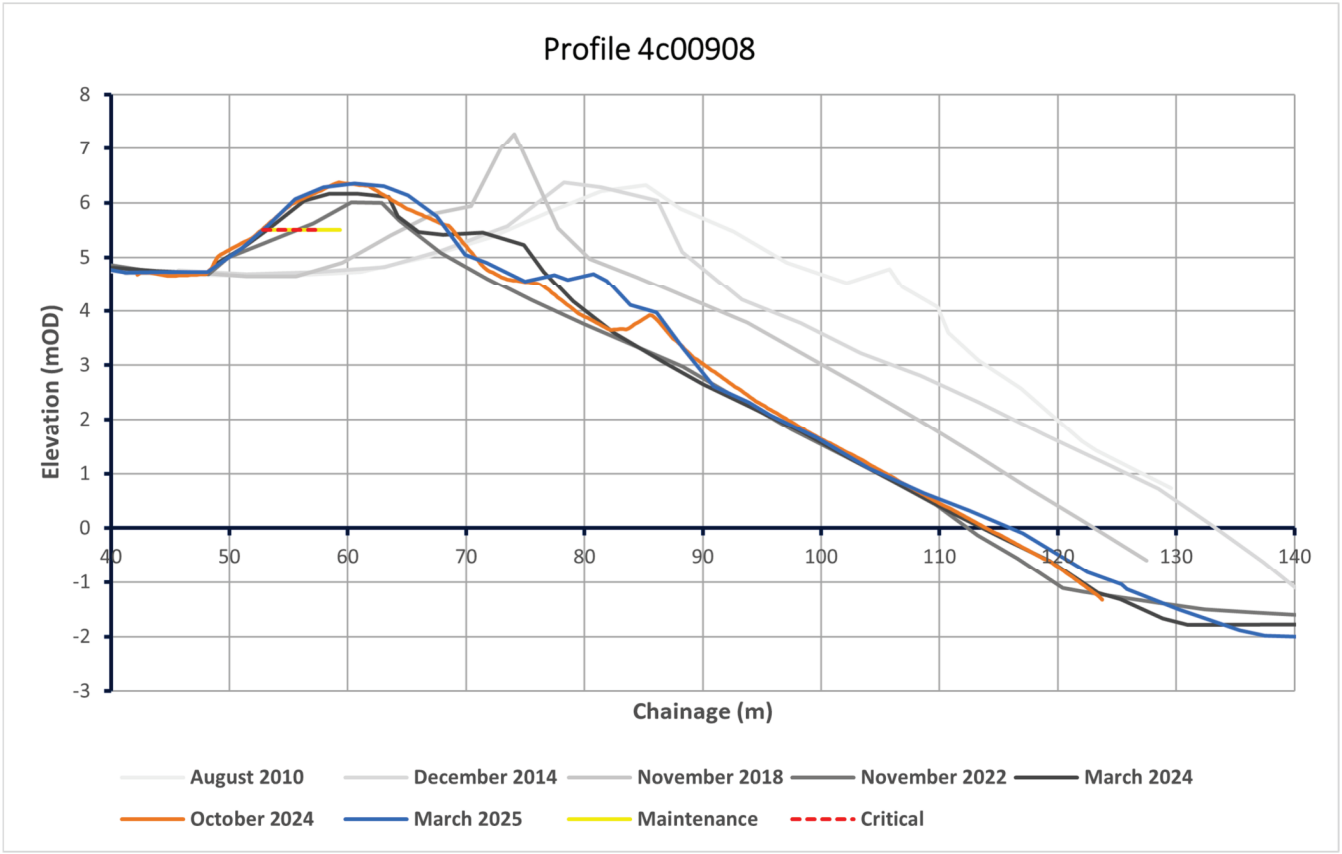

Profile 4c00920A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Elevation (mOD)
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
Chainage (m)

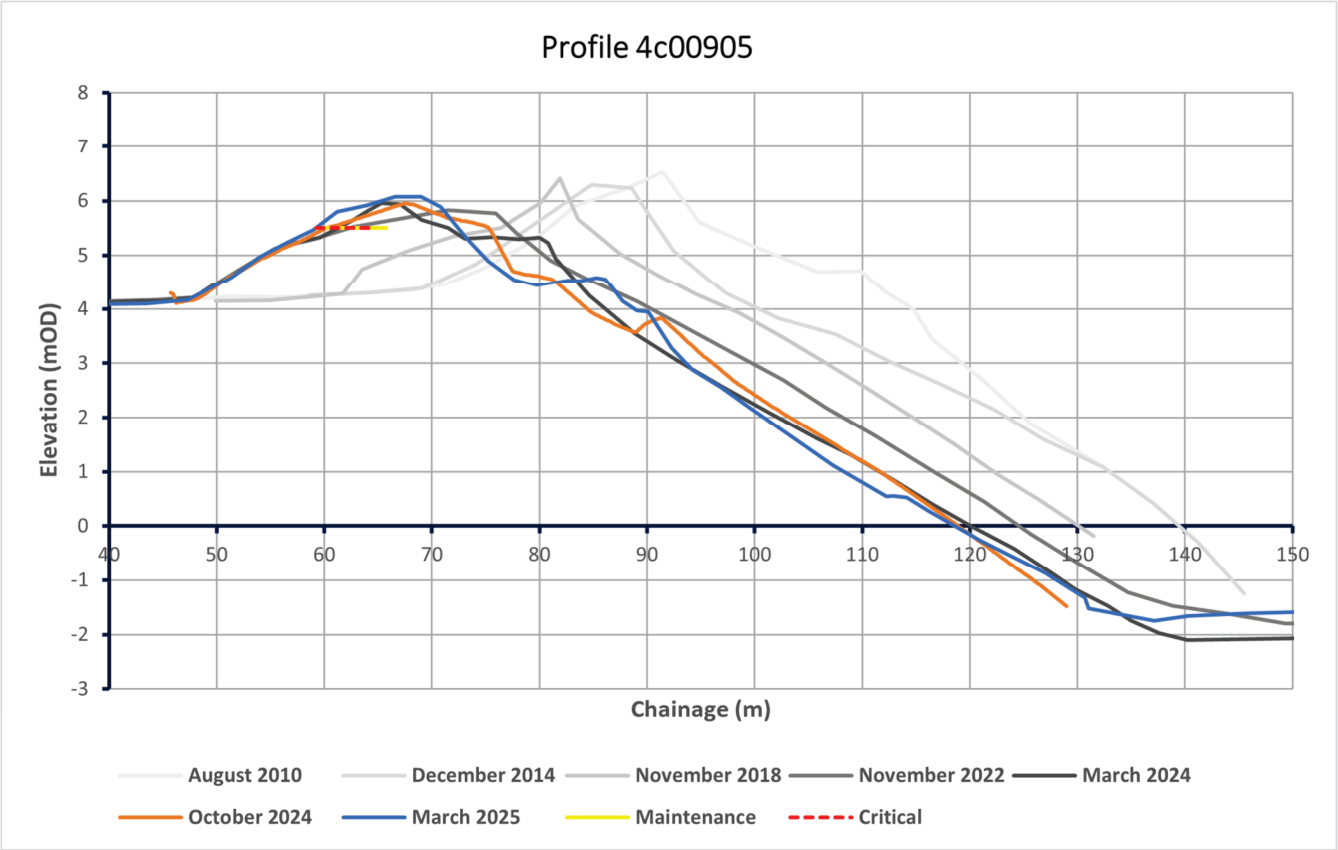

Profile 4c00917A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
Elevation (mOD)
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Chainage (m)

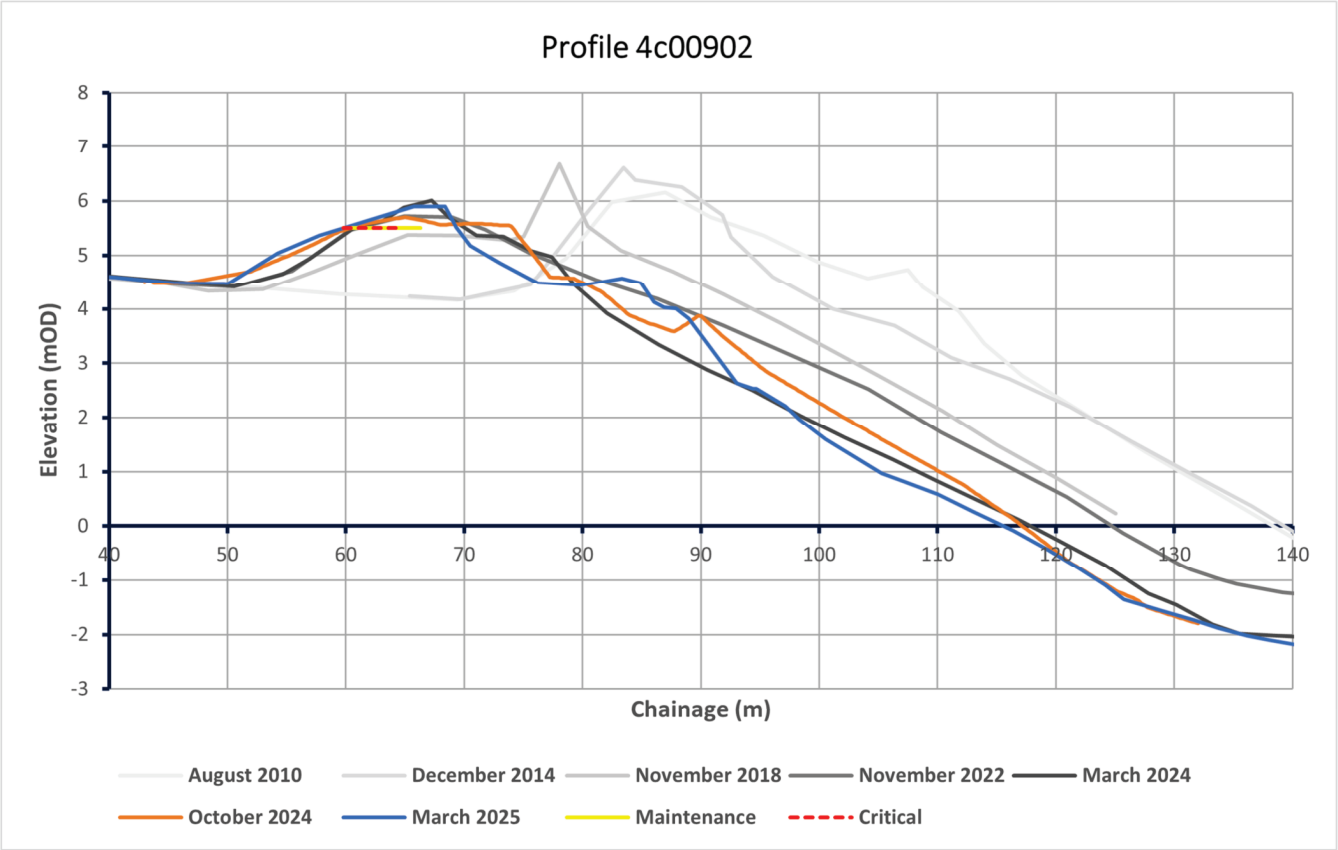

Profile 4c00914A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
Elevation (mOD)
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
Chainage (m)

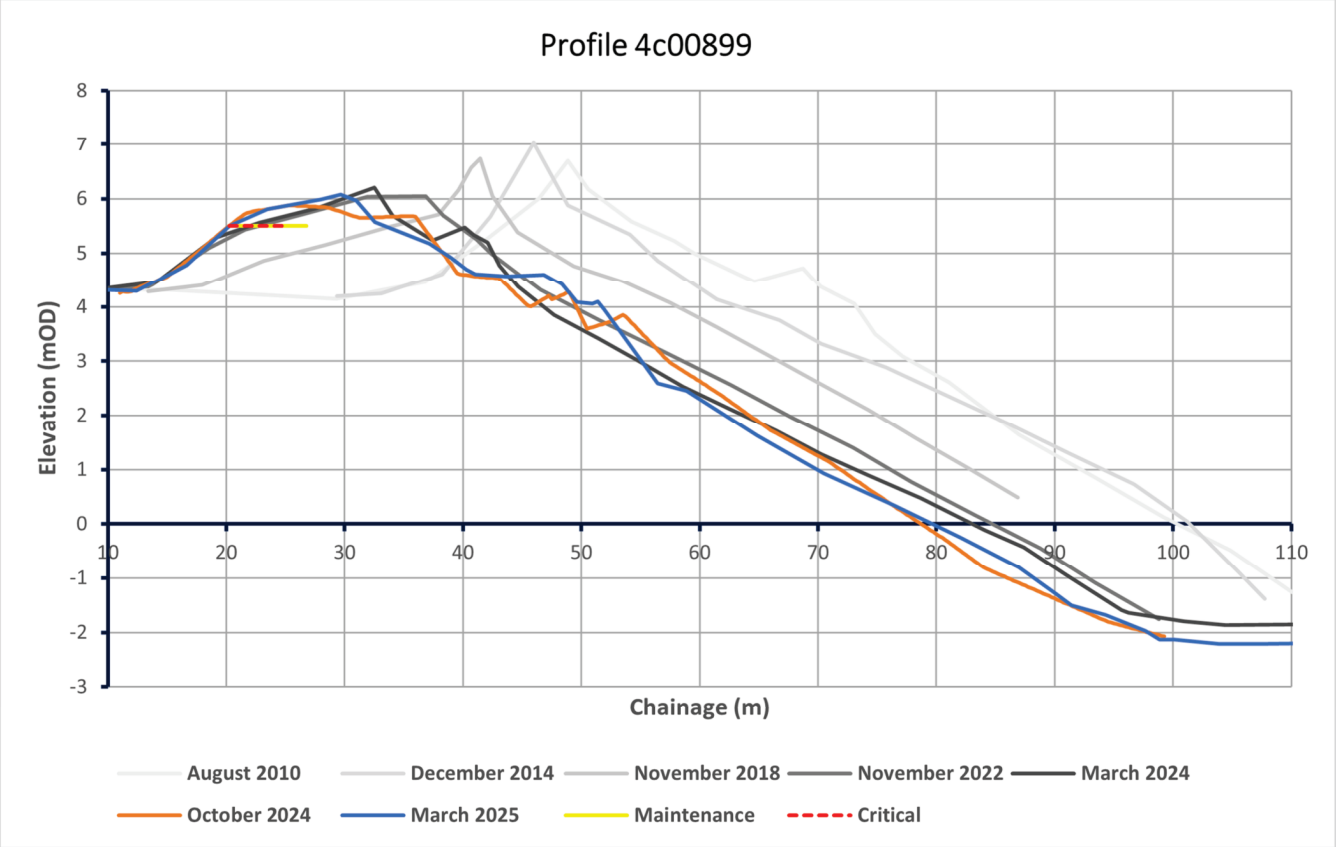

Profile 4c00911A
Master Profile
March 2025
December 2024
Critical
Maintenance
Design
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Elevation (mOD)
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
Chainage (m)

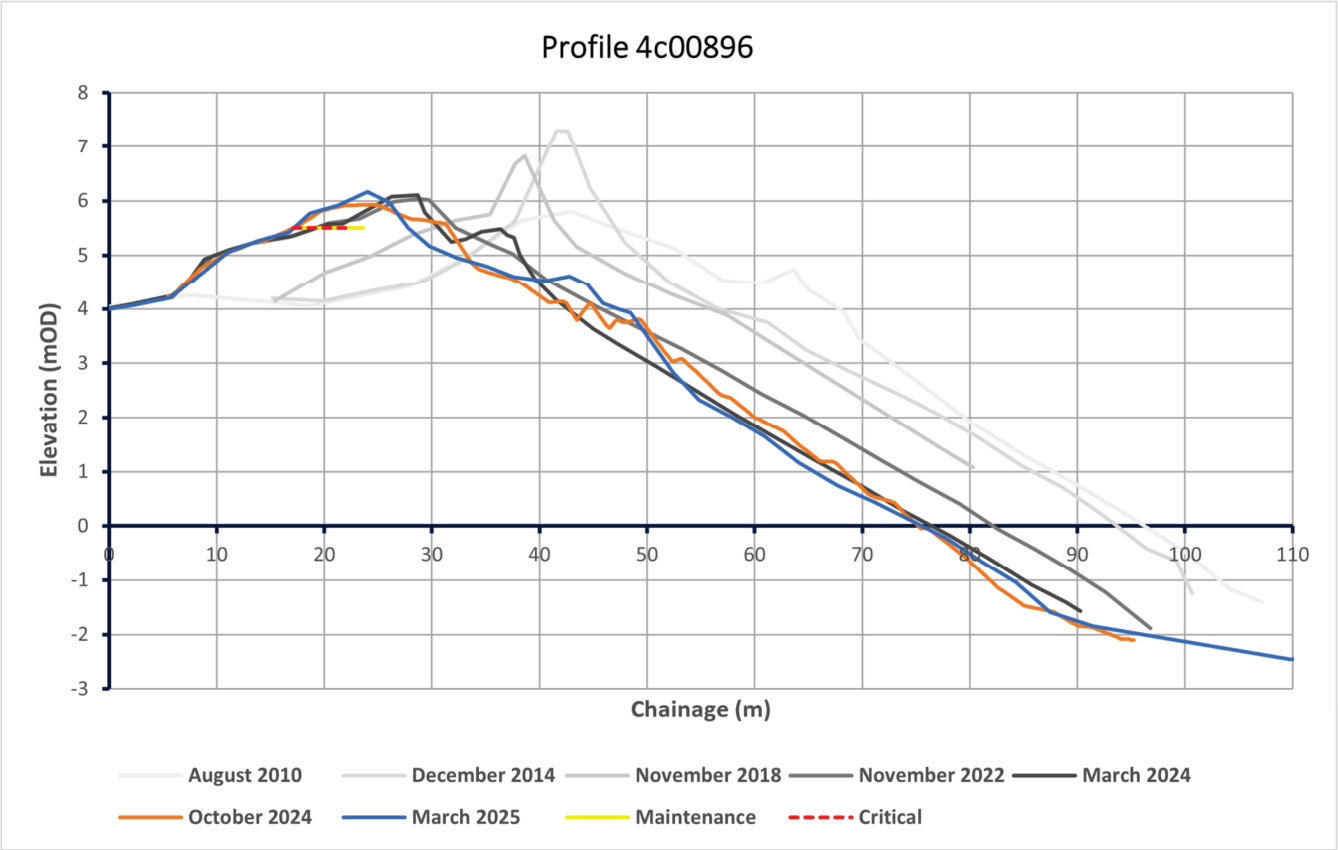
5.2 East of groyne field to Galloways profiles (4c00910 to 4c00871)

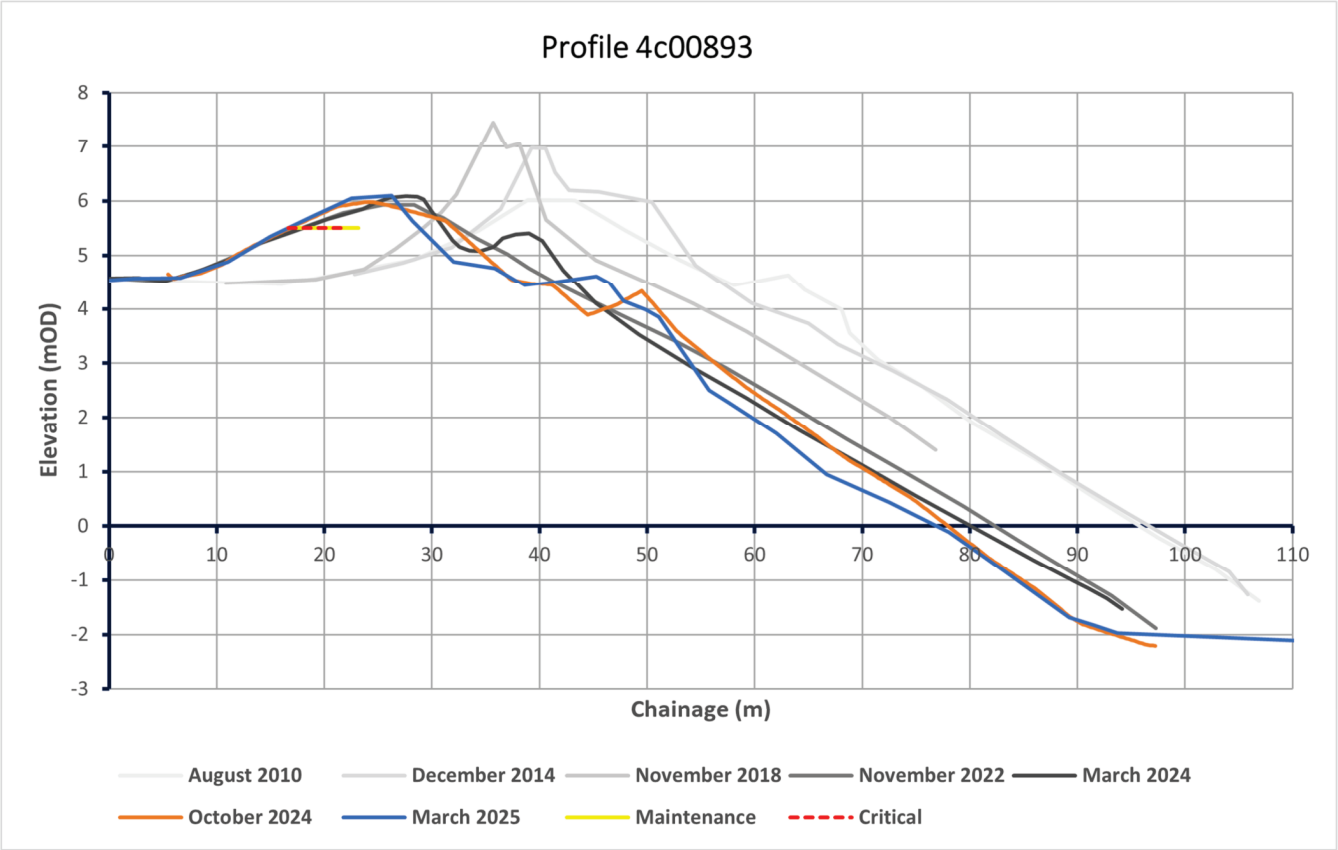

Profile 4c00908
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
40
50
60
70
80
90
100
110
120
130
140
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

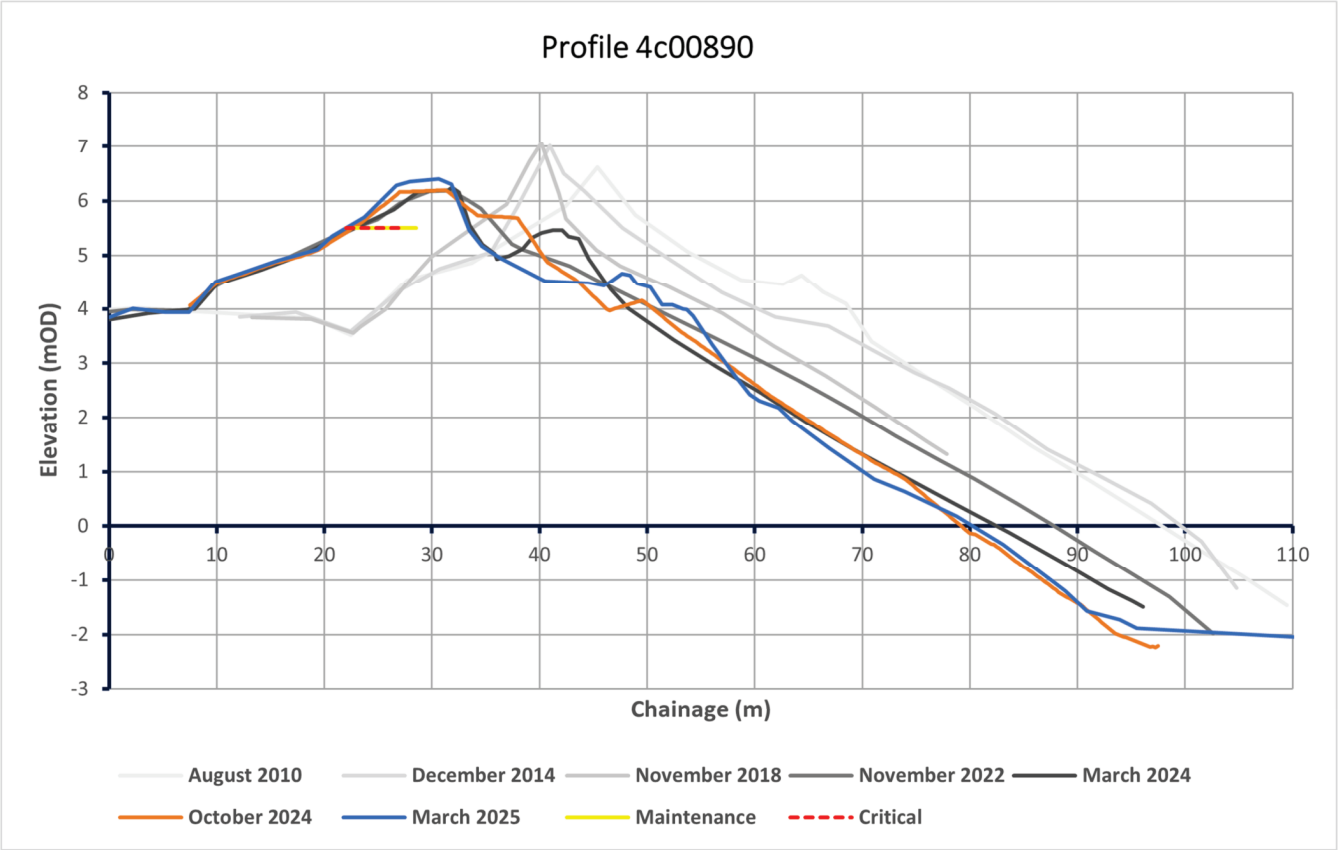

Profile 4c00905
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
40
50
60
70
80
90
100
110
120
130
140
150
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

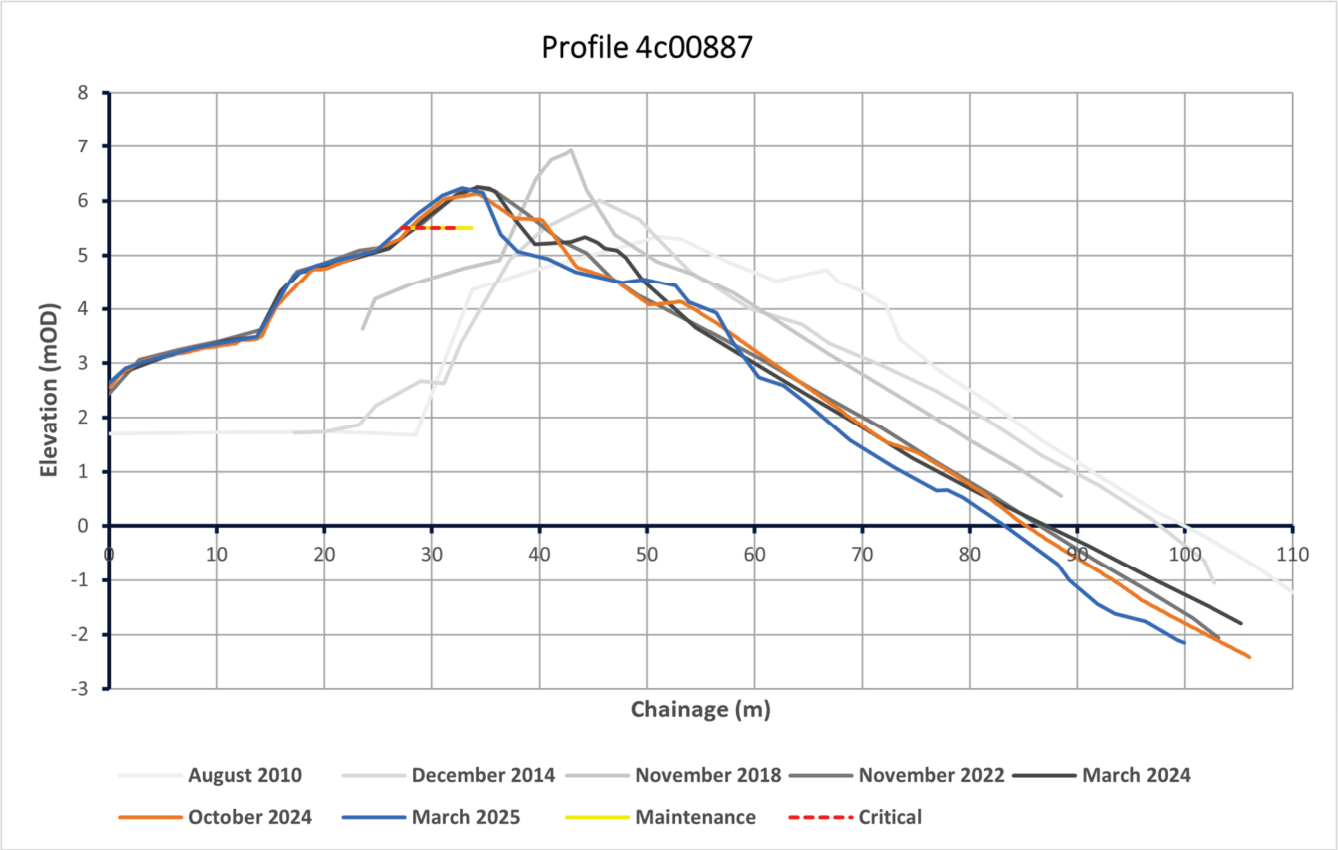

Profile 4c00902
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
40
50
60
70
80
90
100
110
120
130
140
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

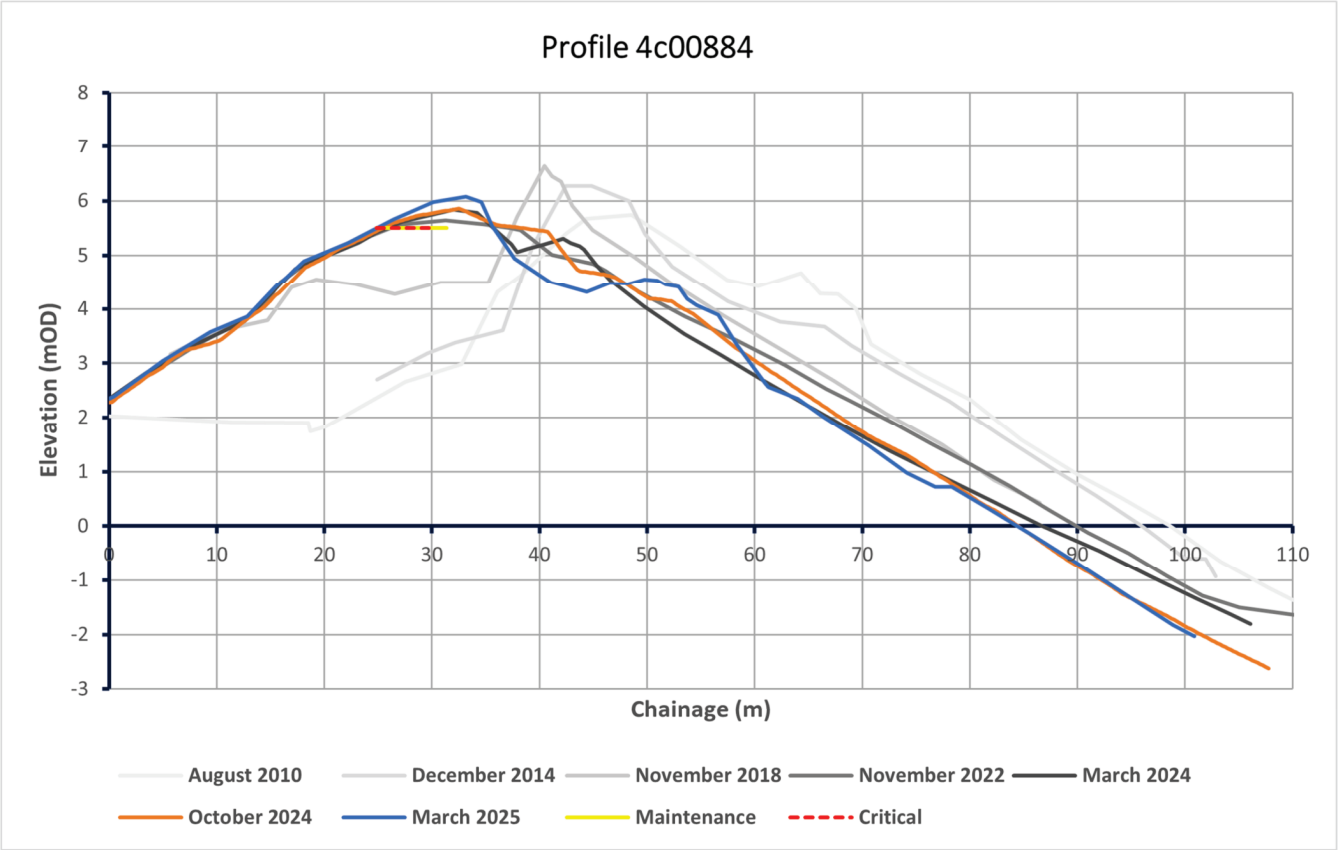

Profile 4c00899
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

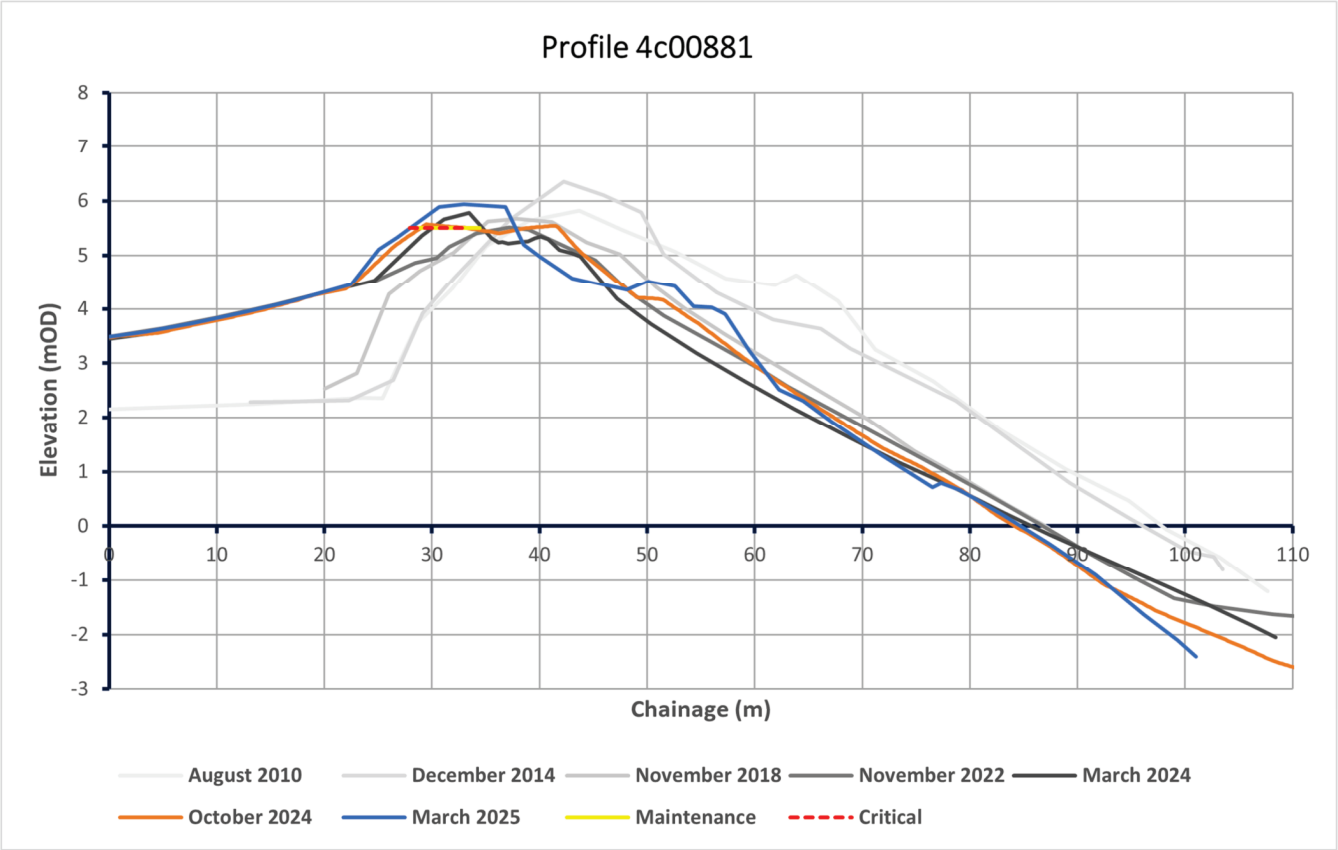

Profile 4c00896
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

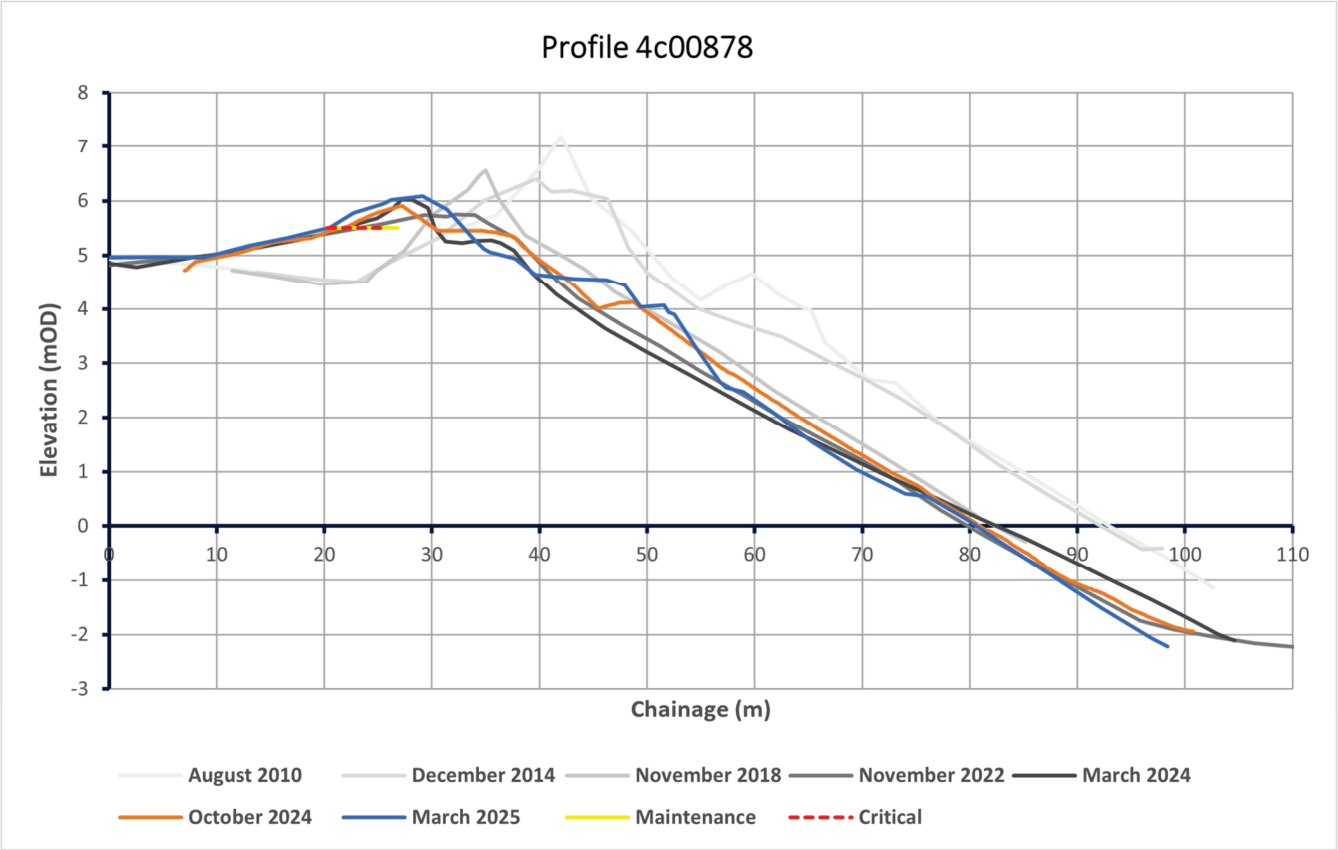

Profile 4c00893
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

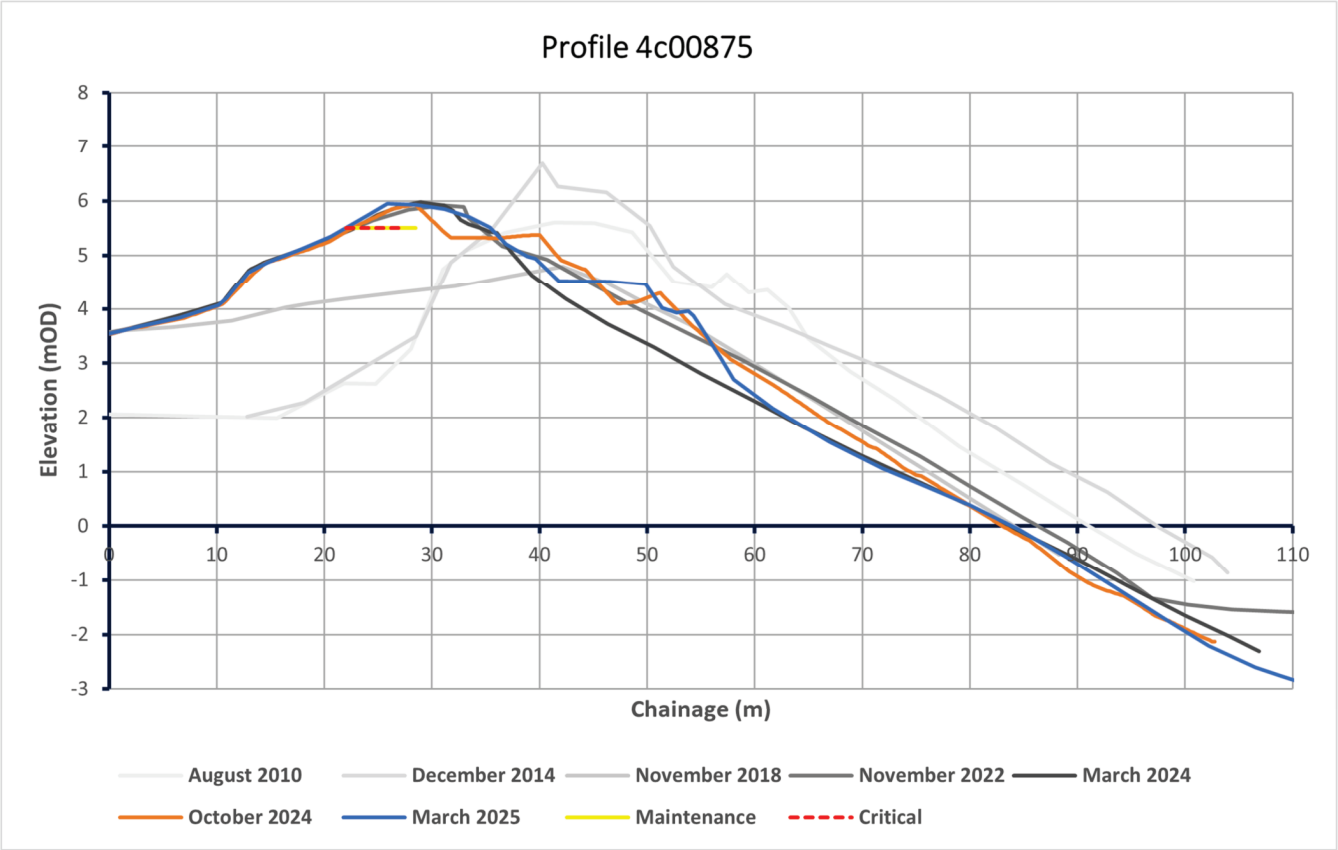

Profile 4c00890
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

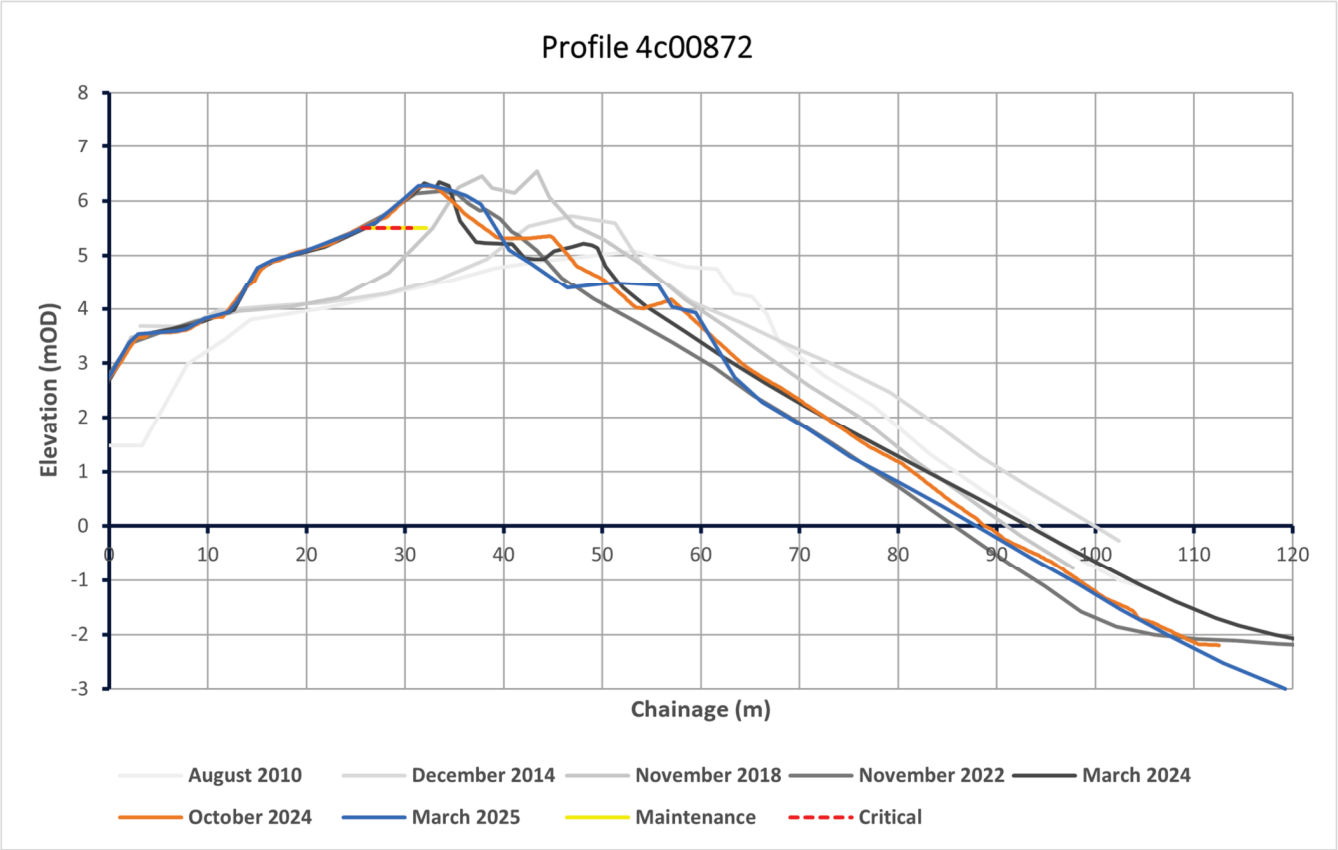

Profile 4c00887
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical


Profile 4c00884
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

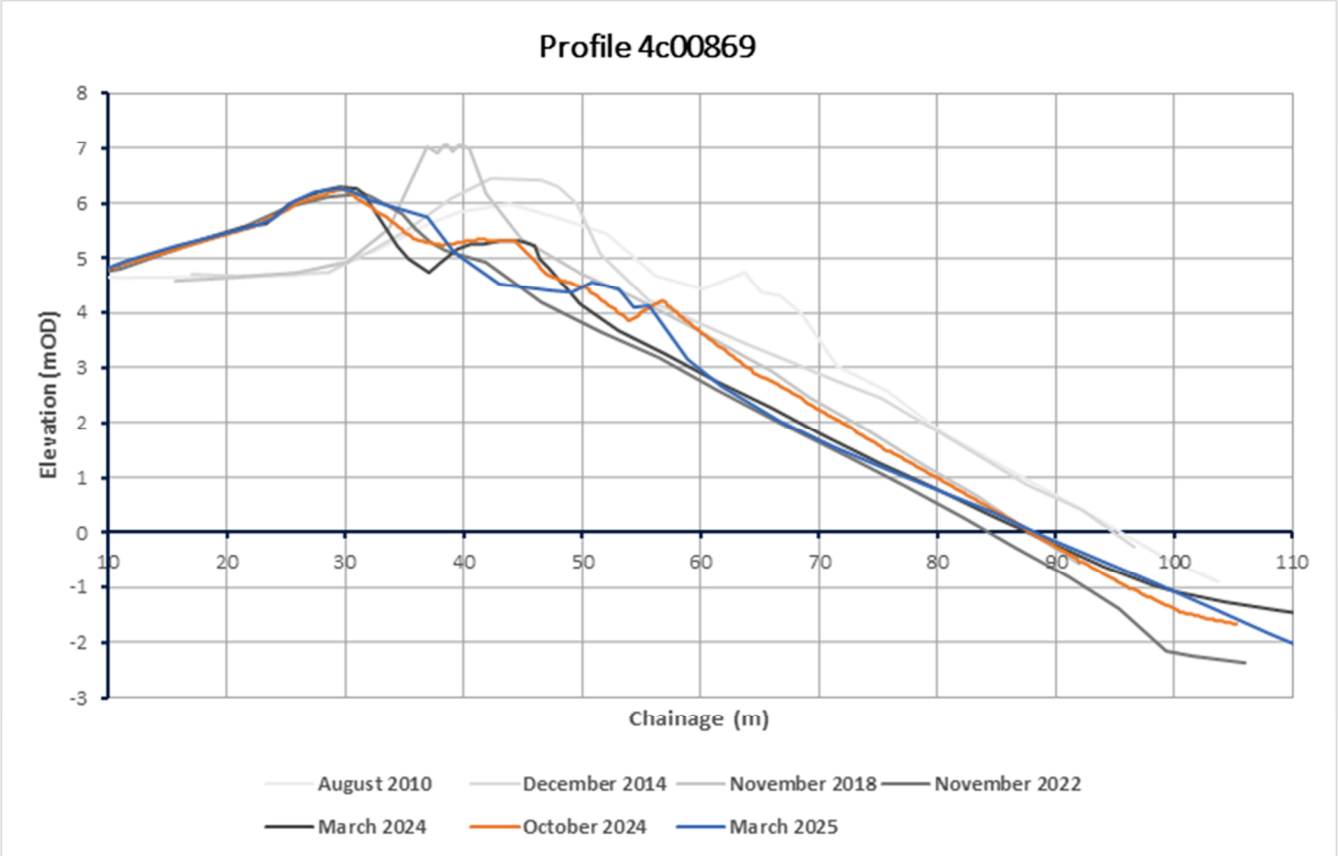

Profile 4c00881
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

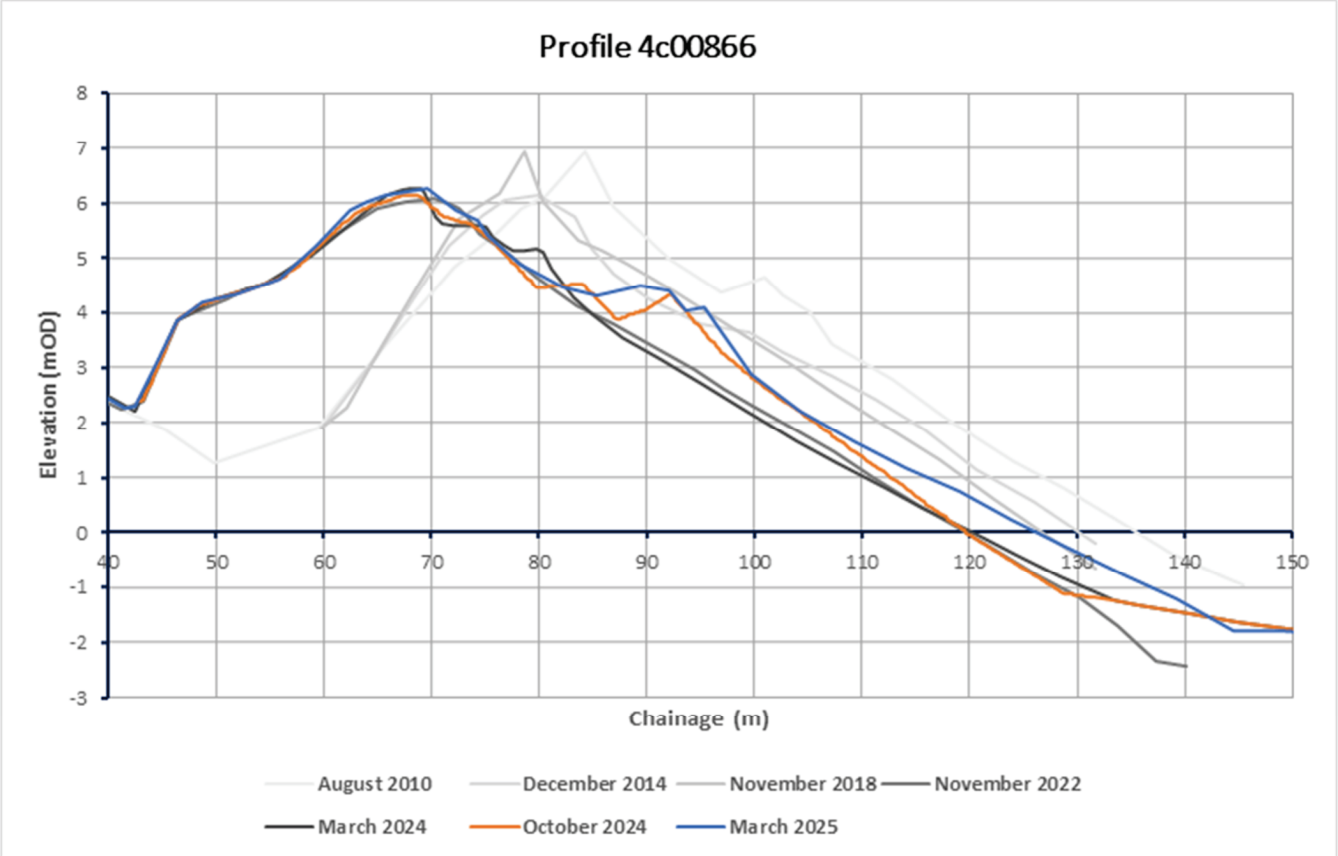

Profile 4c00878
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

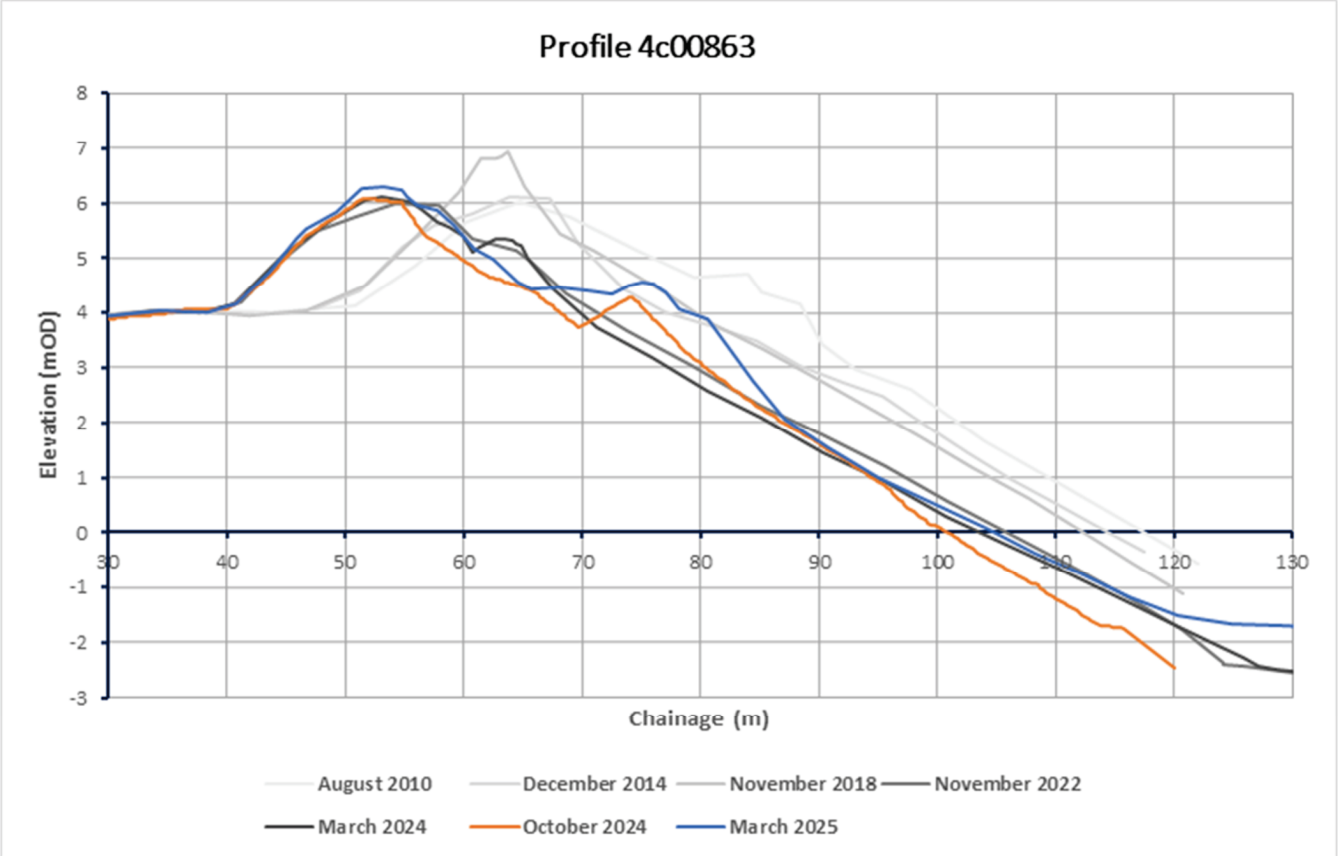

Profile 4c00875
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

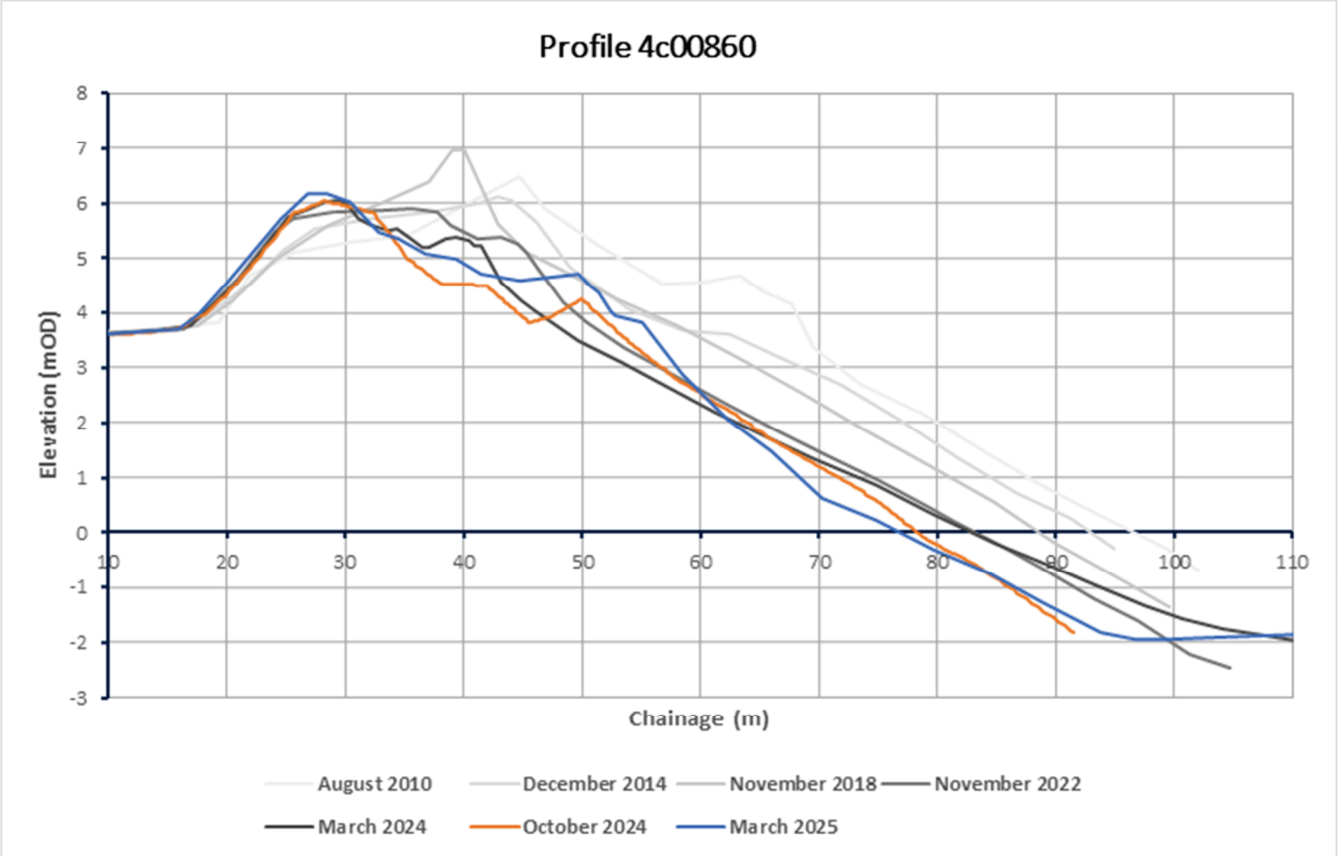

Profile 4c00872
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
110
120
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025
Maintenance
Critical

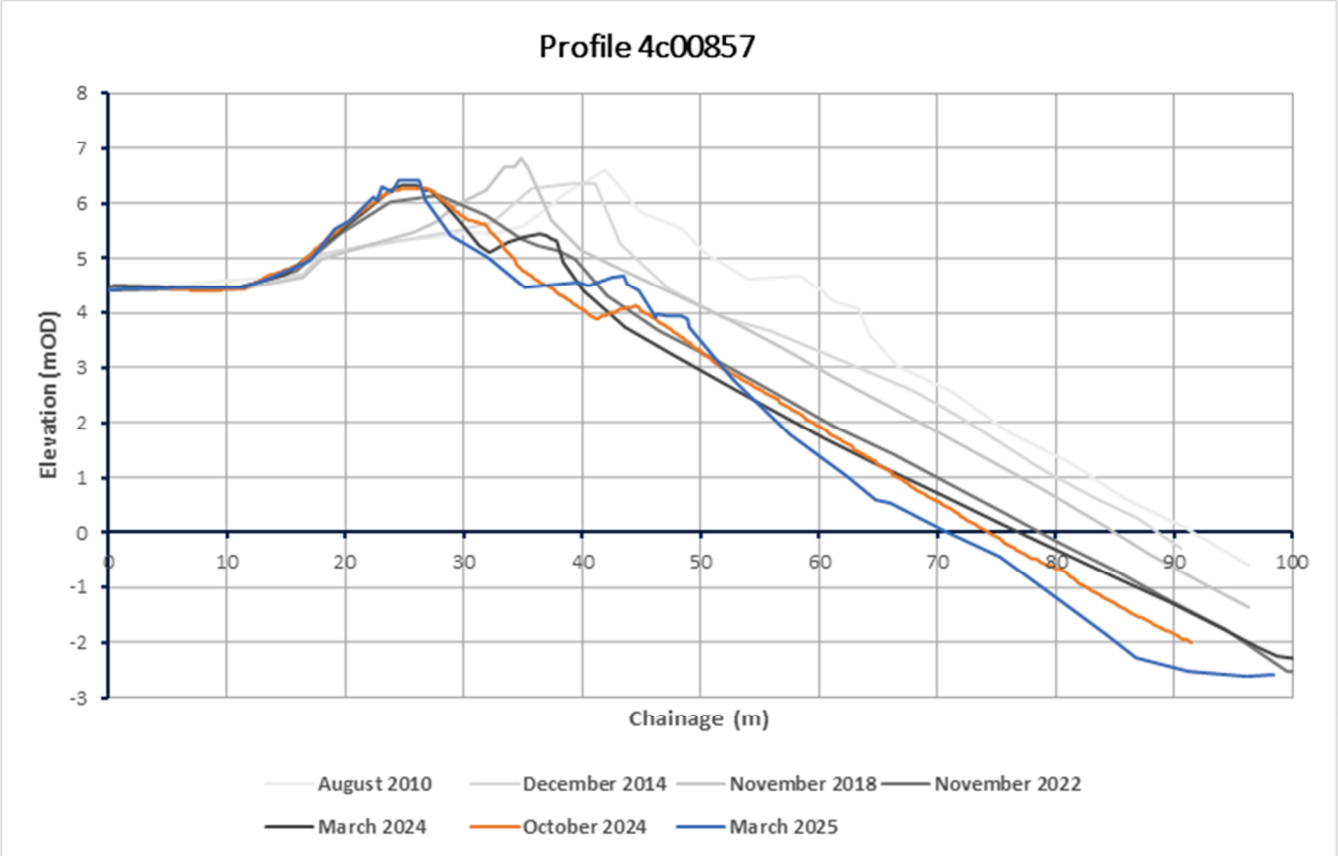
5.3 Galloways to Dungeness B Power Station profiles (4c00870 to 4c00812)

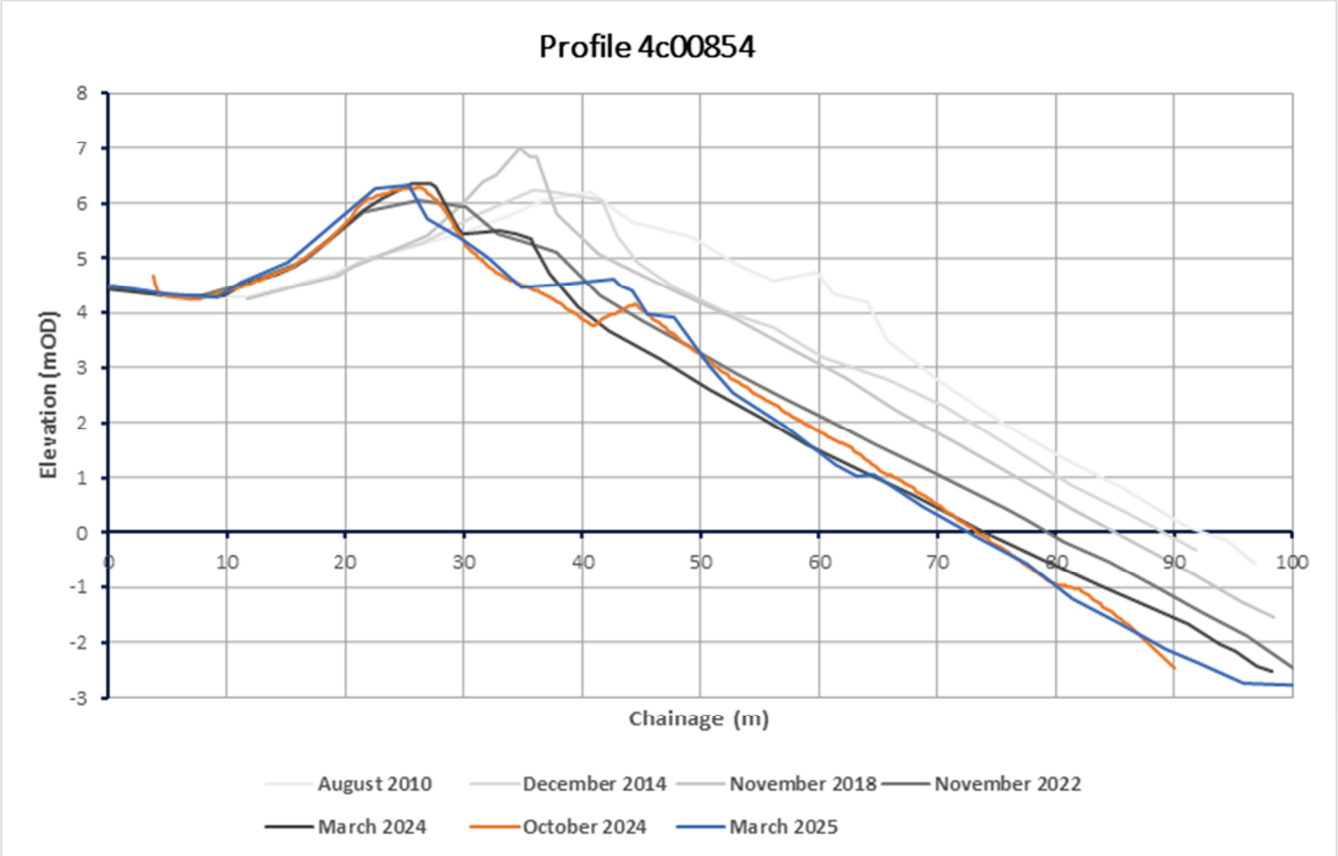

Profile 4c00869
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

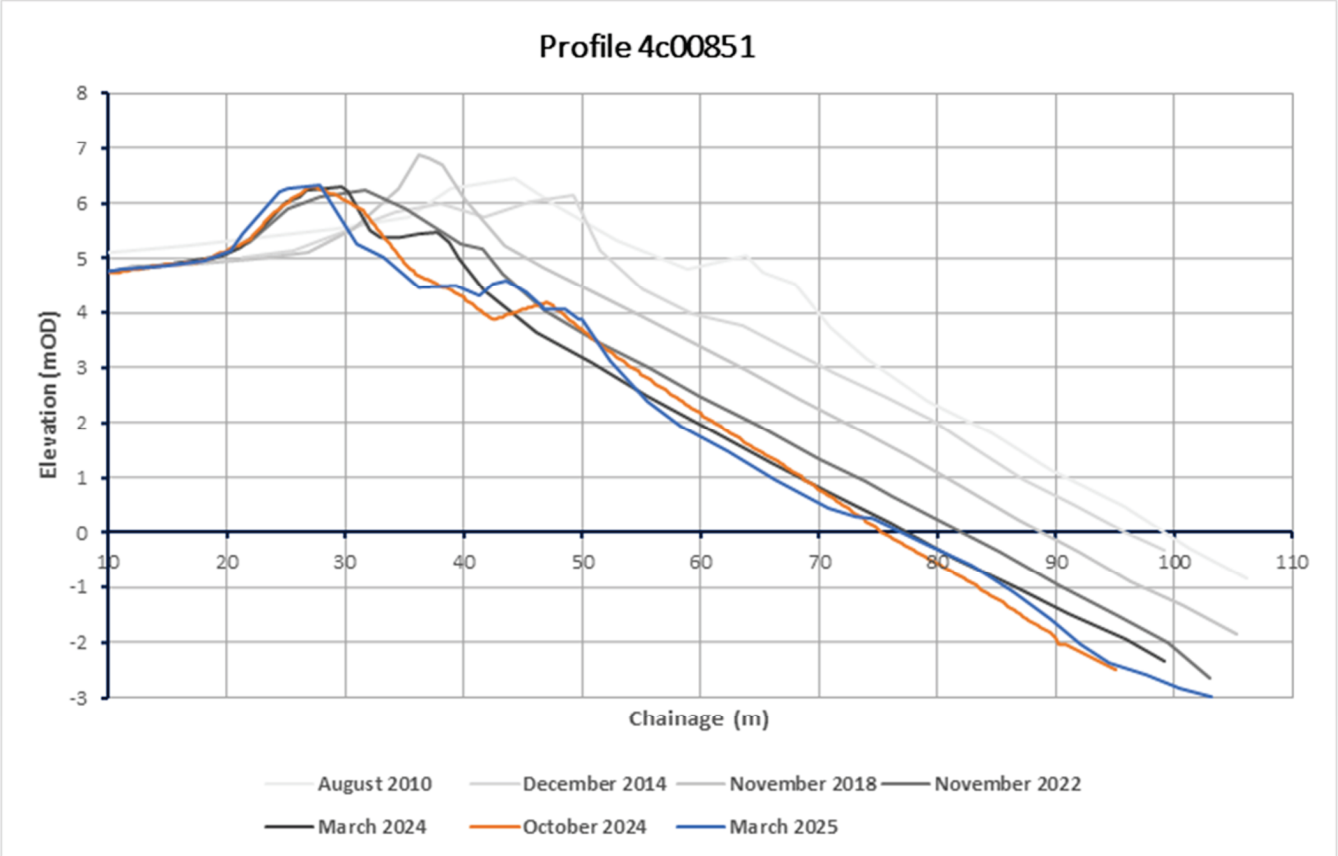

Profile 4c00866
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
40
50
60
70
80
90
100
110
120
130
140
150
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

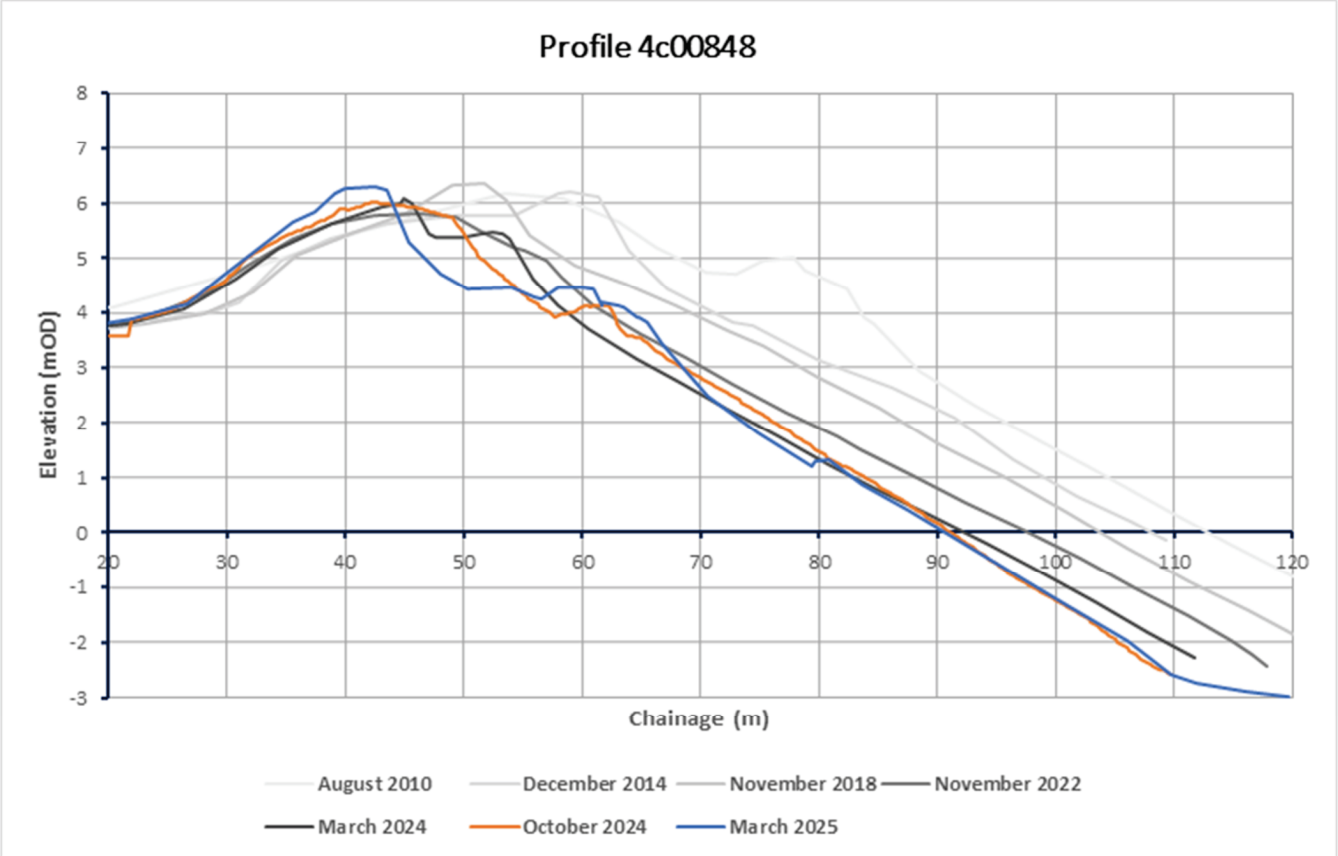

Profile 4c00863
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
30
40
50
60
70
80
90
100
110
120
130
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

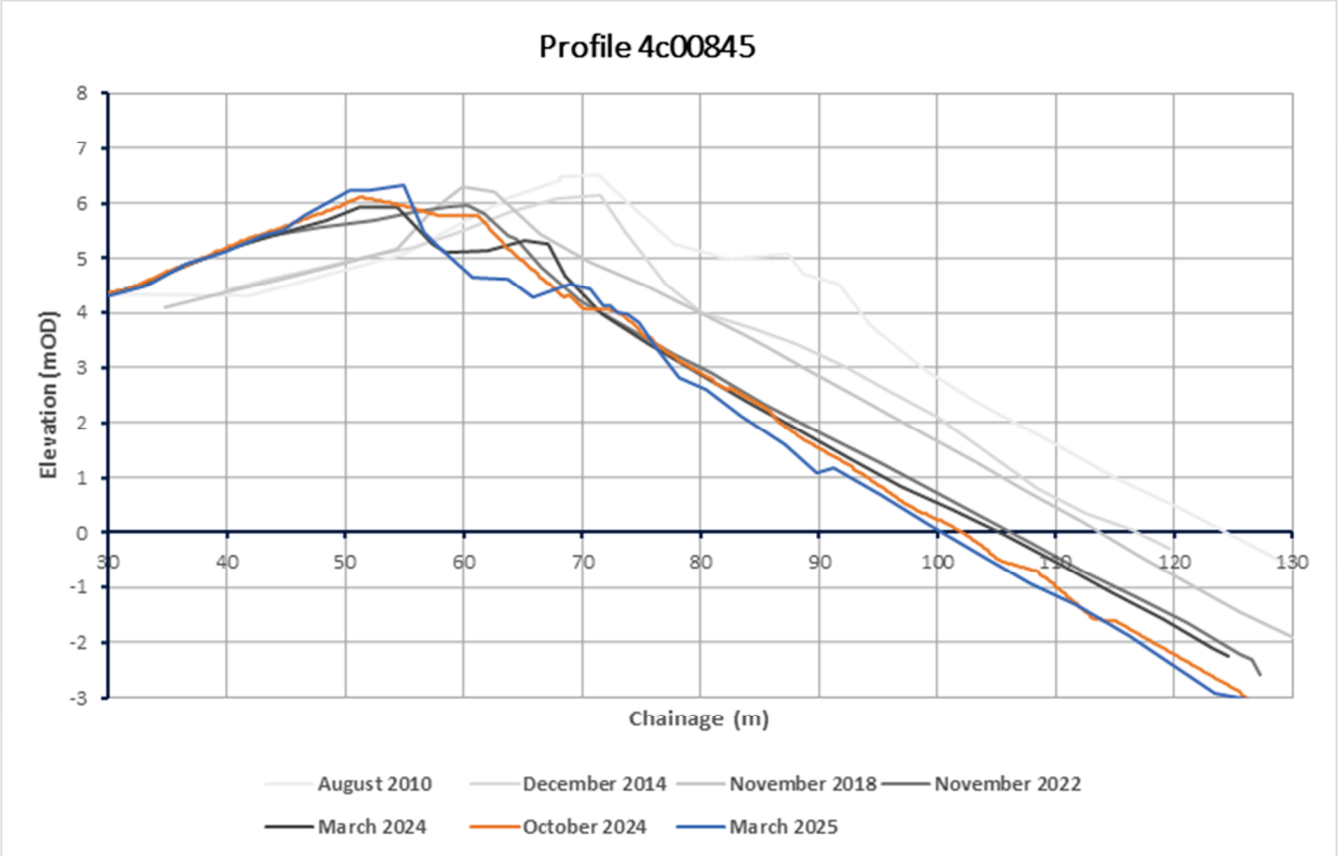

Profile 4c00860
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

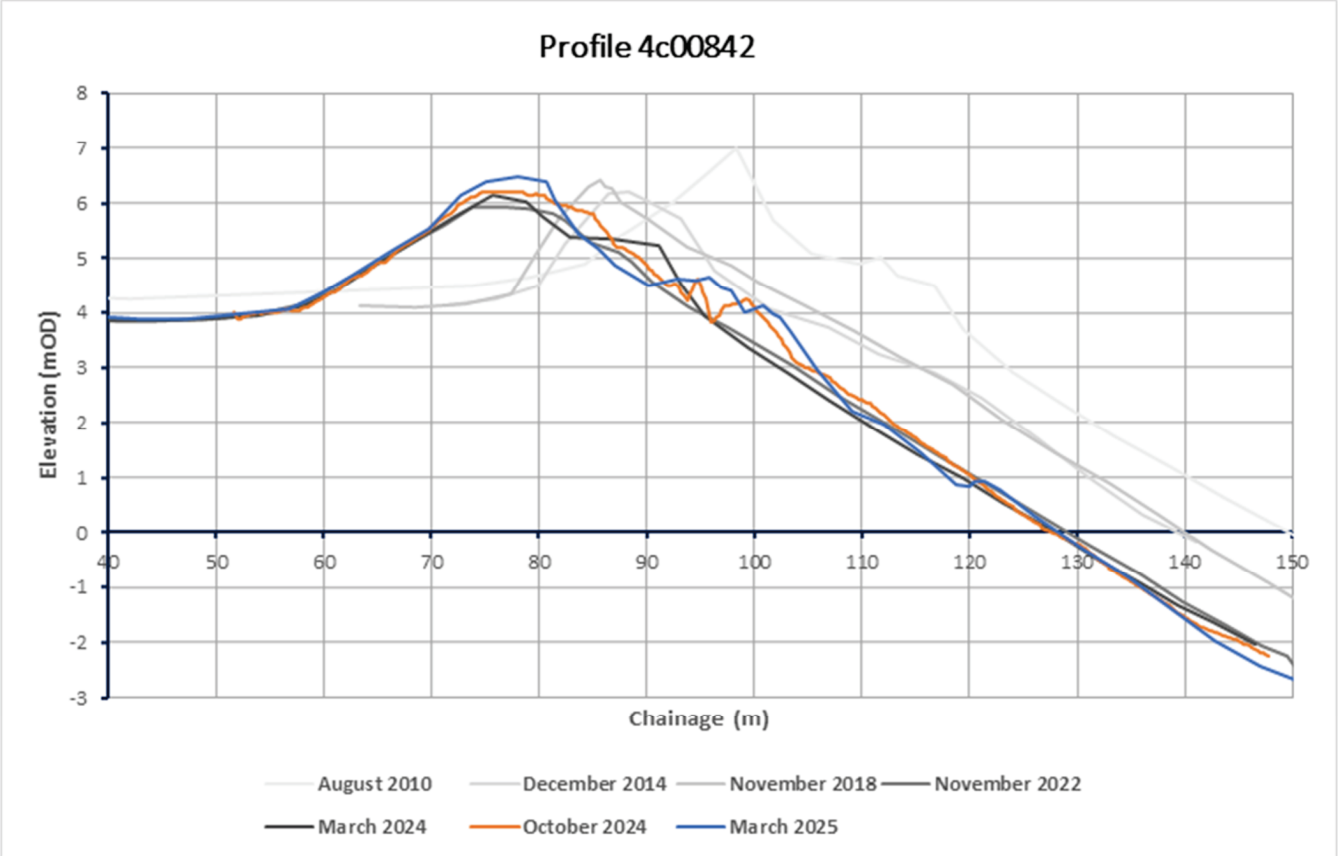

Profile 4c00857
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

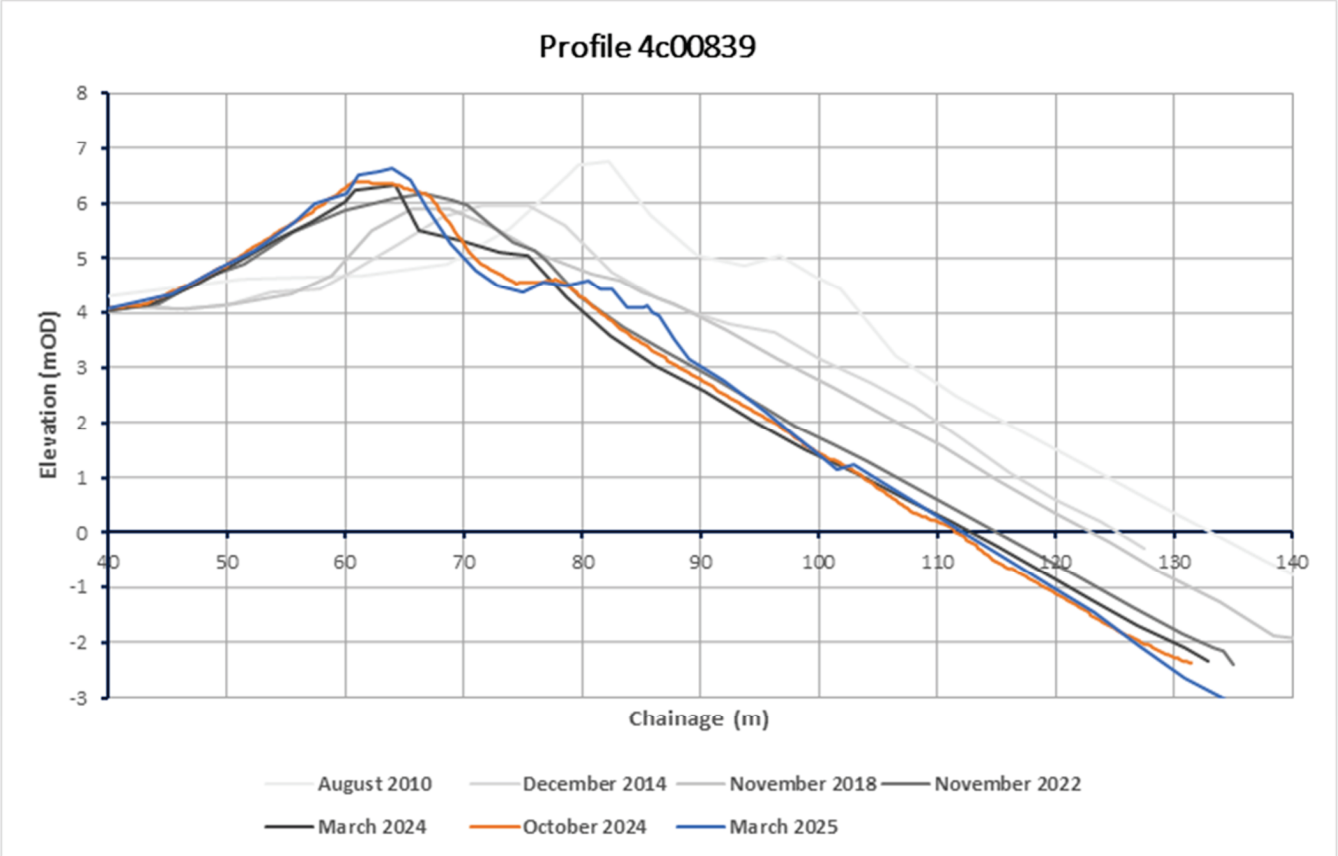

Profile 4c00854
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
0
10
20
30
40
50
60
70
80
90
100
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

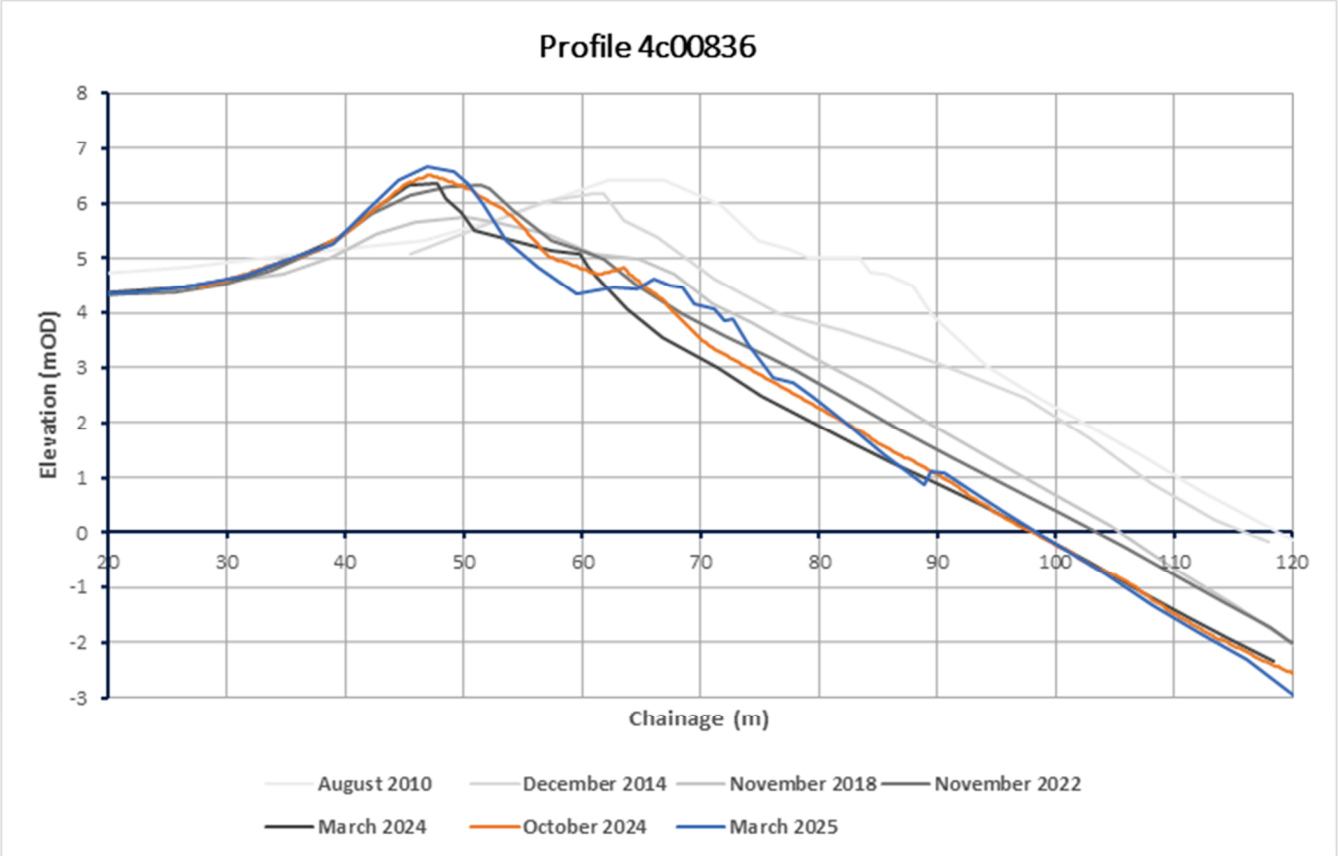

Profile 4c00851
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

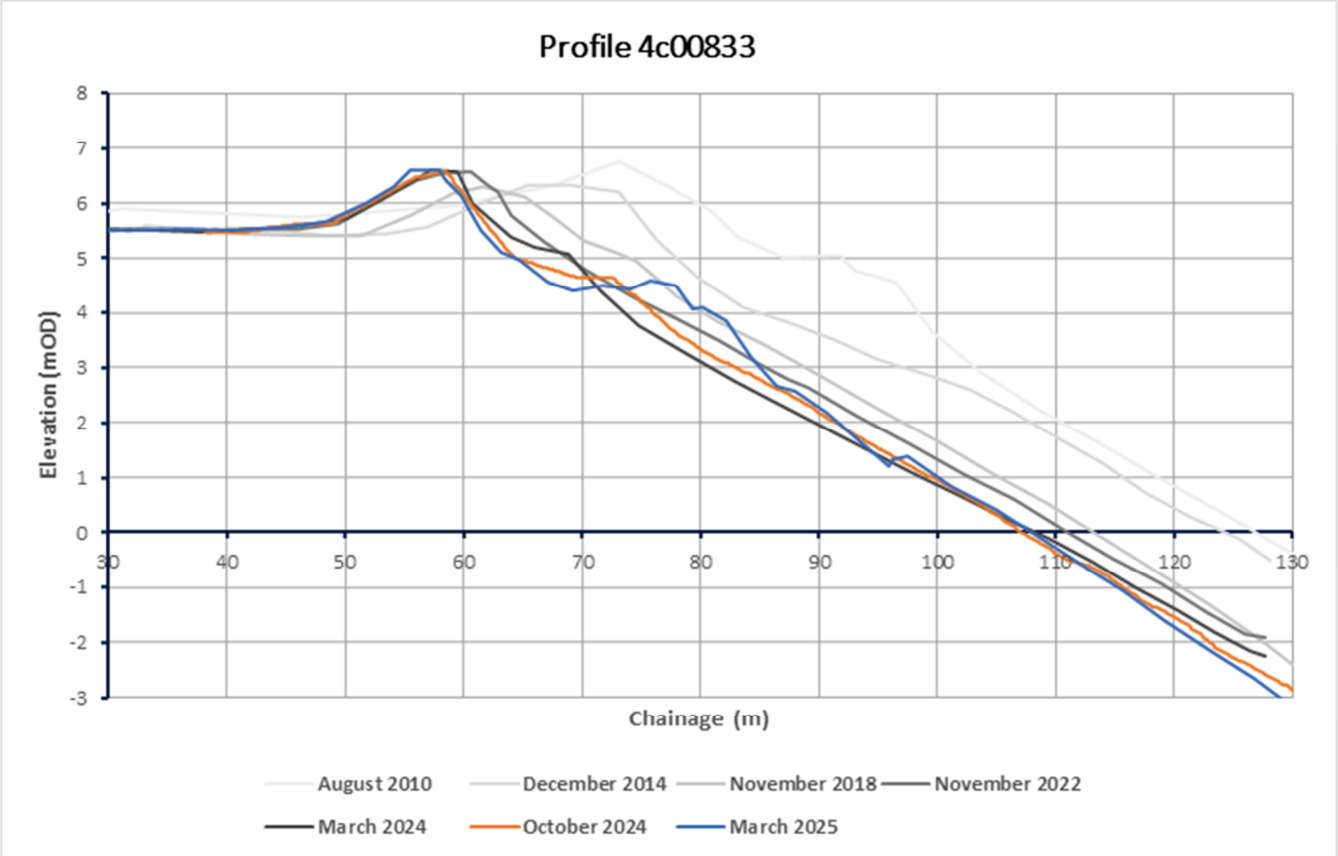

Profile 4c00848
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
20
30
40
50
60
70
80
90
100
110
120
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

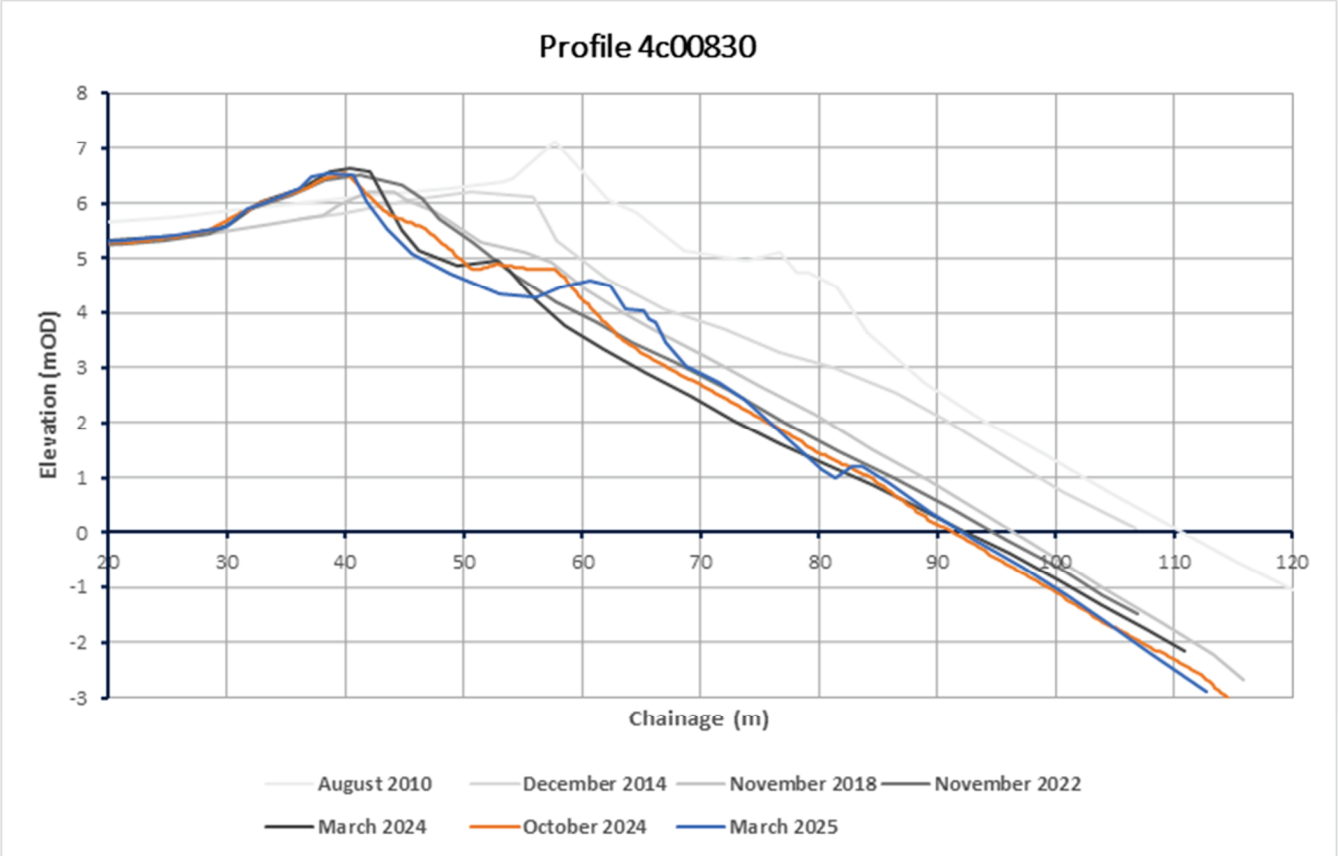

Profile 4c00845
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
30
40
50
60
70
80
90
100
110
120
130
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

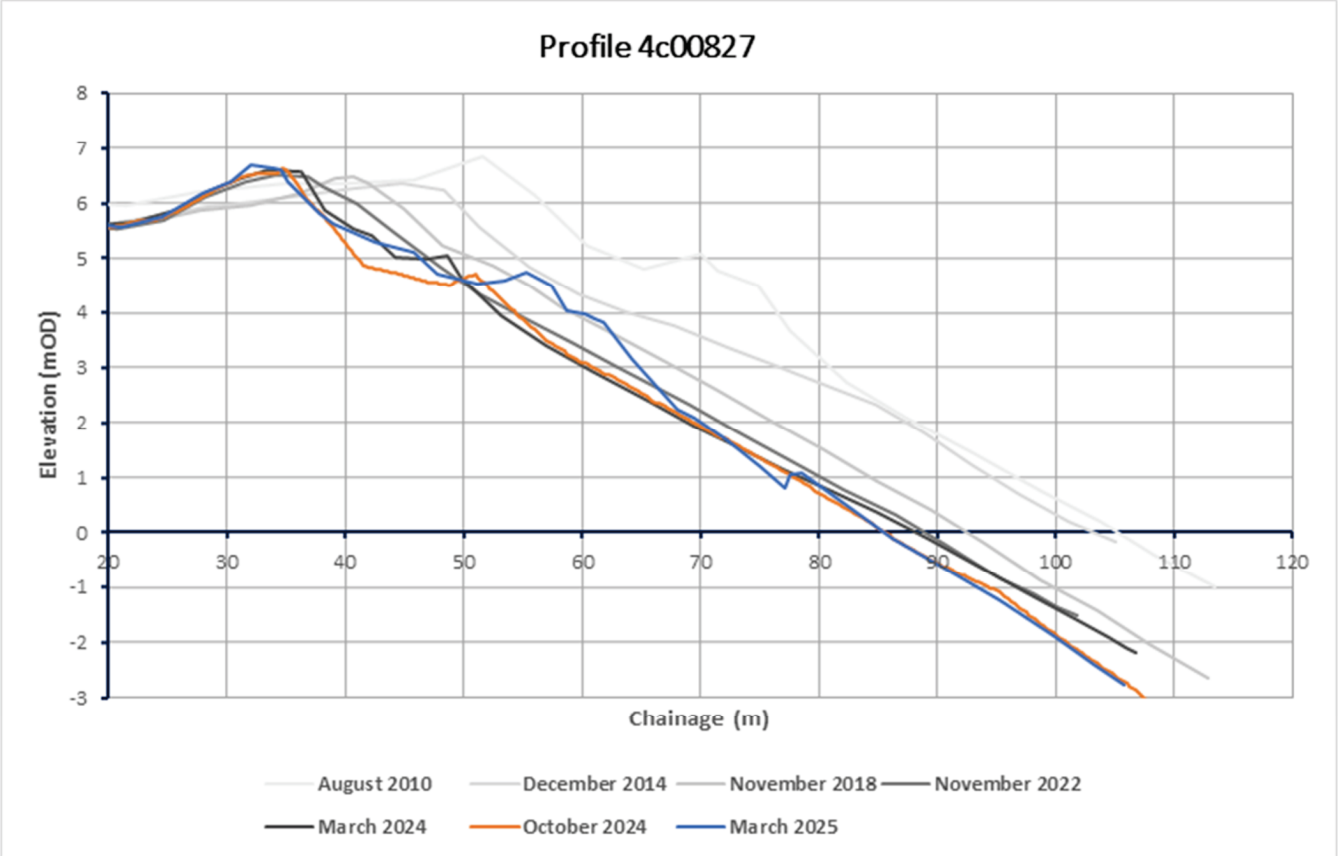

Profile 4c00842
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
40
50
60
70
80
90
100
110
120
130
140
150
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

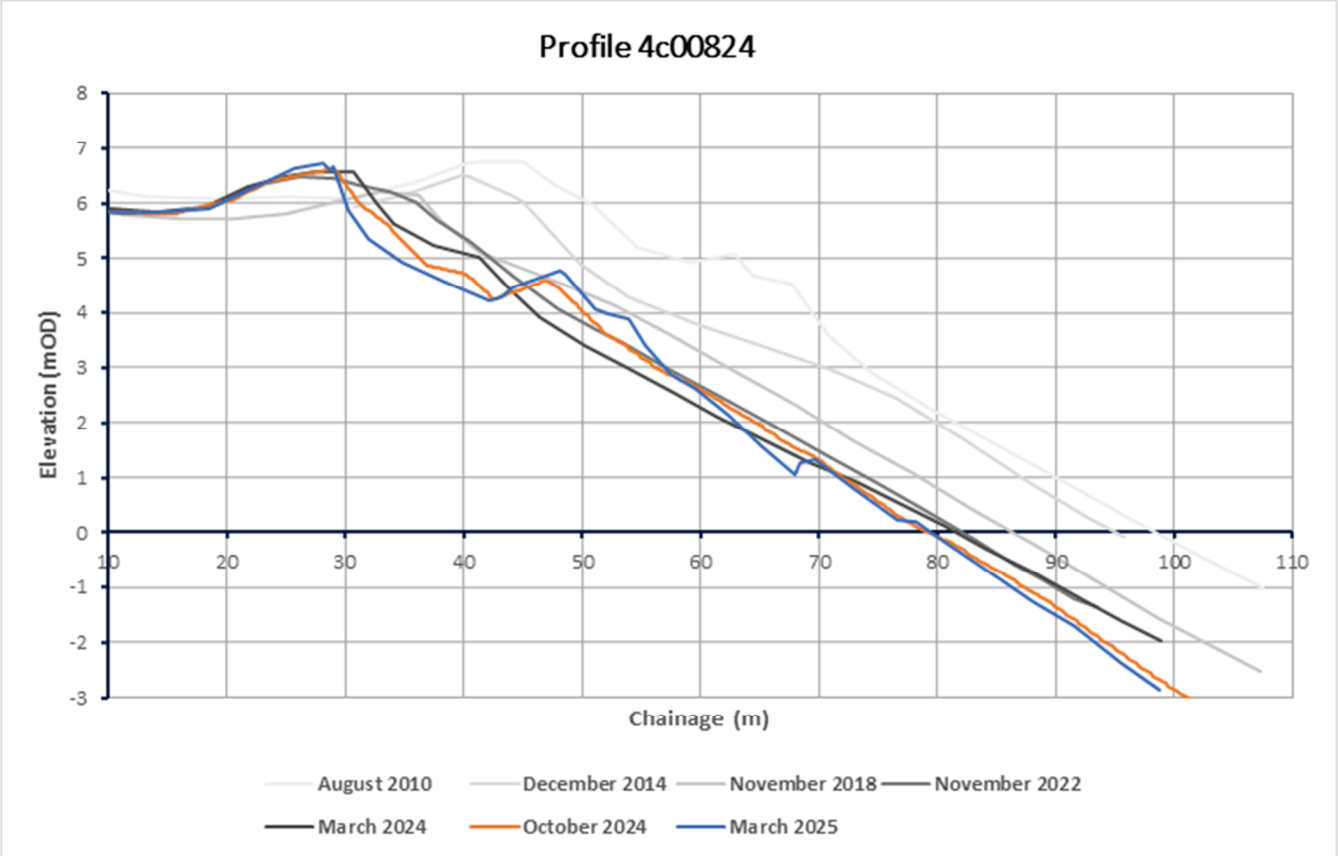

Profile 4c00839
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
40
50
60
70
80
90
100
110
120
130
140
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

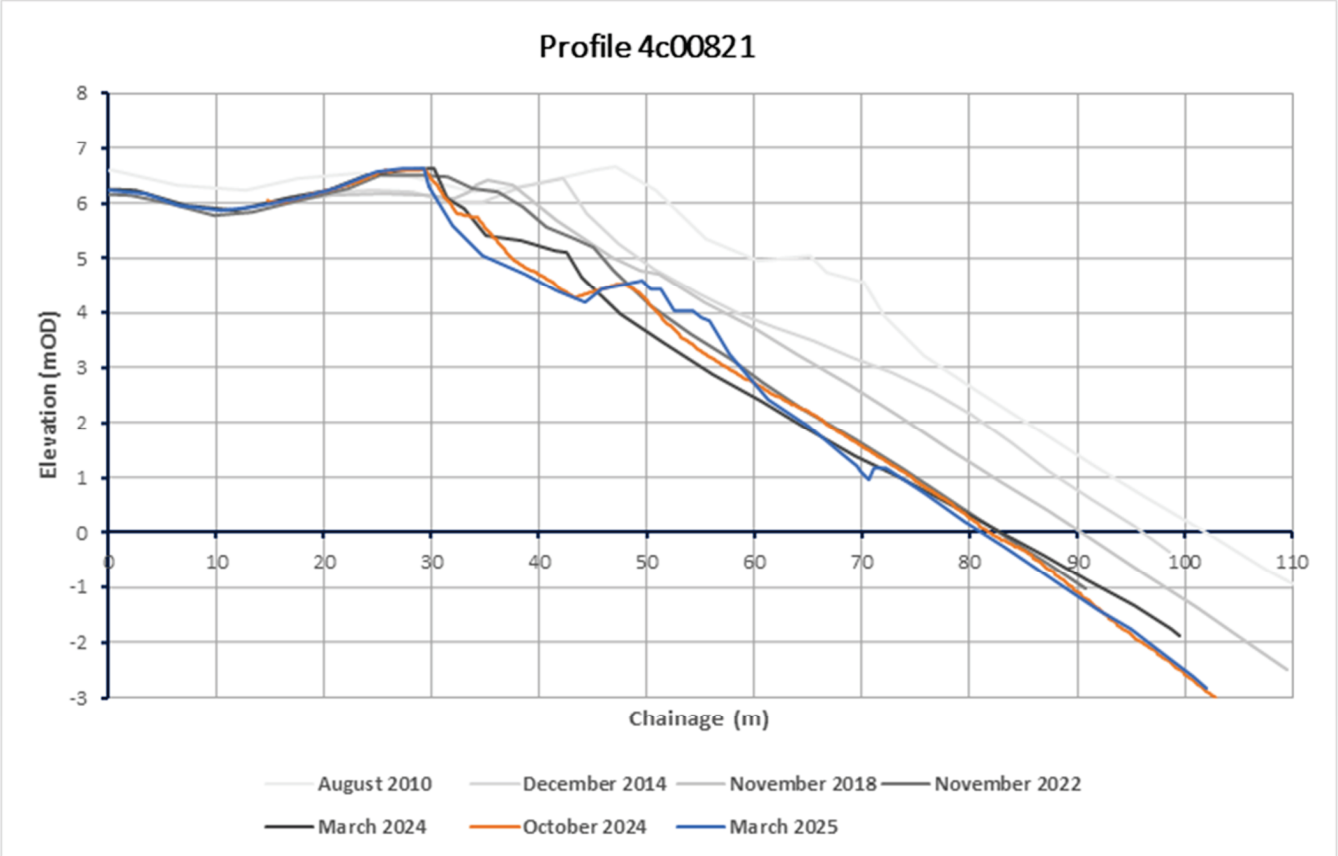

Profile 4c00836
Elevation (mOD)
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4
3
2
1
0
-1
-2
-3
20
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120
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

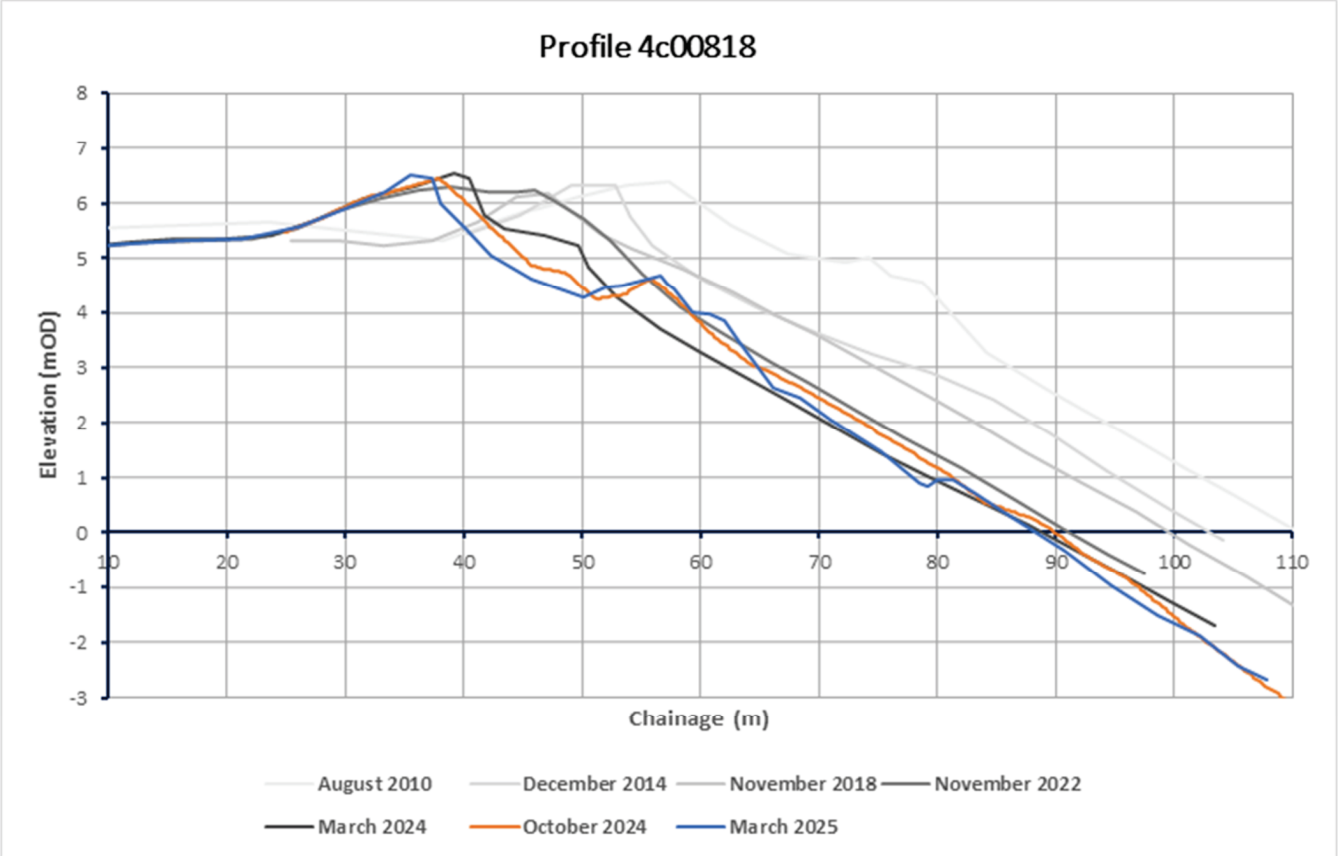

Profile 4c00833
Elevation (mOD)
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-1
-2
-3
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130
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

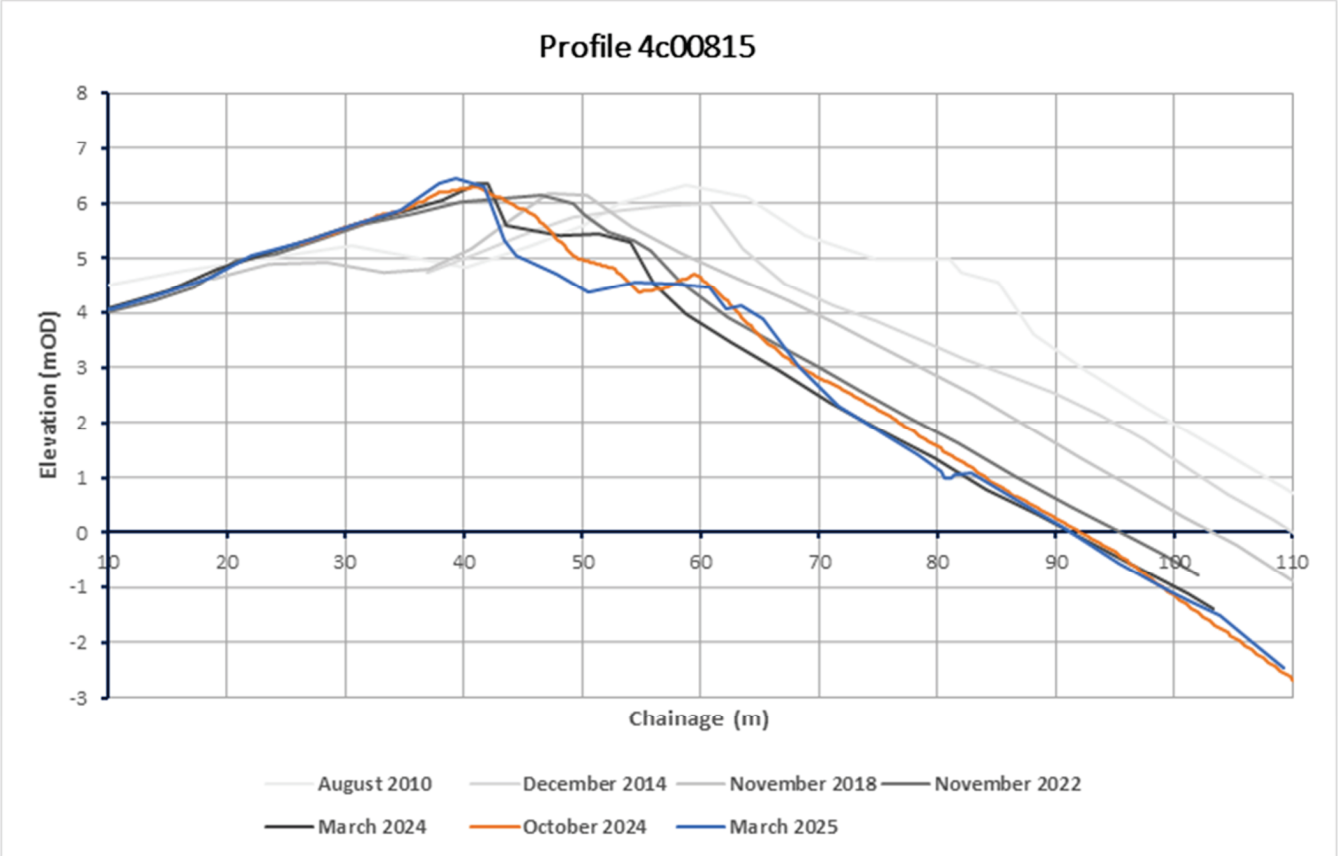

Profile 4c00830
Elevation (mOD)
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5
4
3
2
1
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-3
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Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

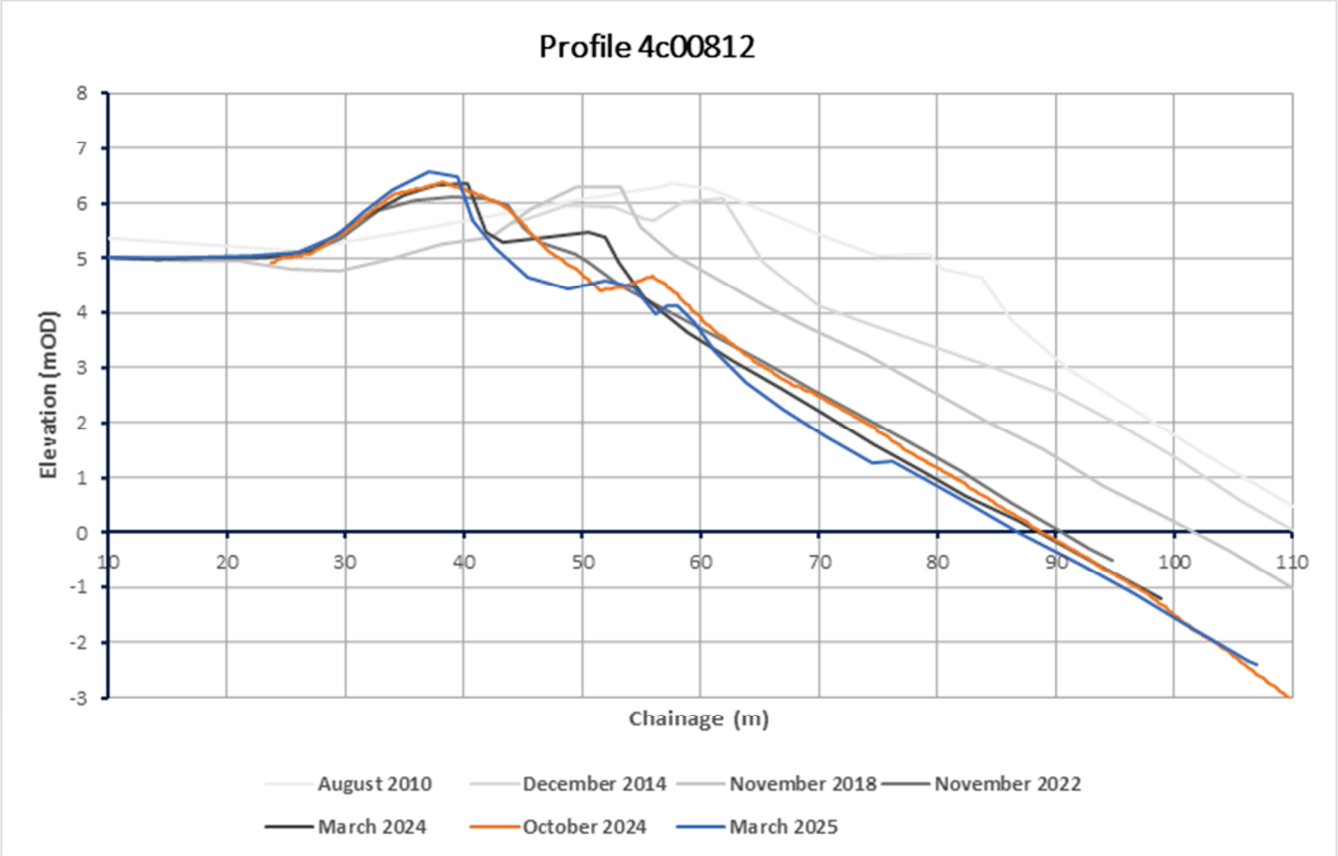

Profile 4c00827
Elevation (mOD)
8
7
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5
4
3
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-1
-2
-3
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50
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70
80
90
100
110
120
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025


Profile 4c00824
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
10
20
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40
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60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025


Profile 4c00821
Elevation (mOD)
8
7
6
5
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1
0
-1
-2
-3
0
10
20
30
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80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025


Profile 4c00818
Elevation (mOD)
8
7
6
5
4
3
2
1
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-1
-2
-3
10
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70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025


Profile 4c00815
Elevation (mOD)
8
7
6
5
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1
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-1
-2
-3
10
20
30
40
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60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025


Profile 4c00812
Elevation (mOD)
8
7
6
5
4
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
80
90
100
110
Chainage (m)
August 2010
December 2014
November 2018
November 2022
March 2024
October 2024
March 2025

6. Difference models – March 2025 to Design Level

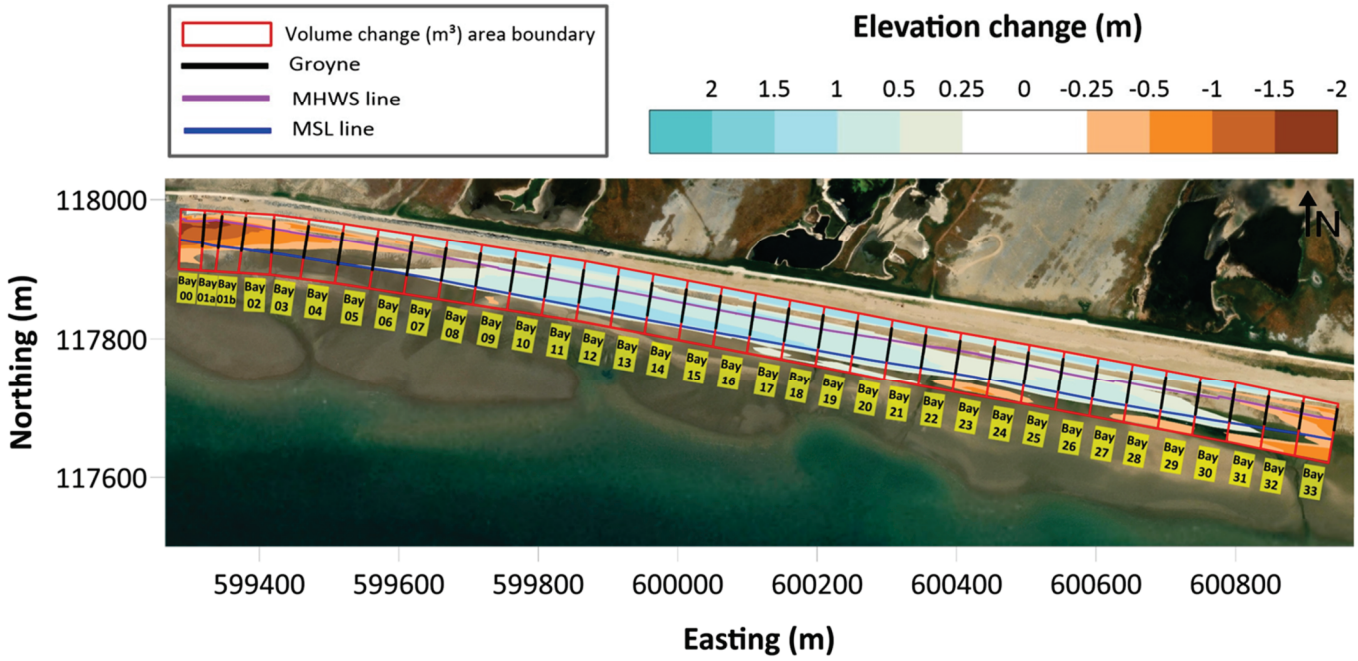


Figure 6-1: Difference model – March 2025 to Design Level within groyne field.

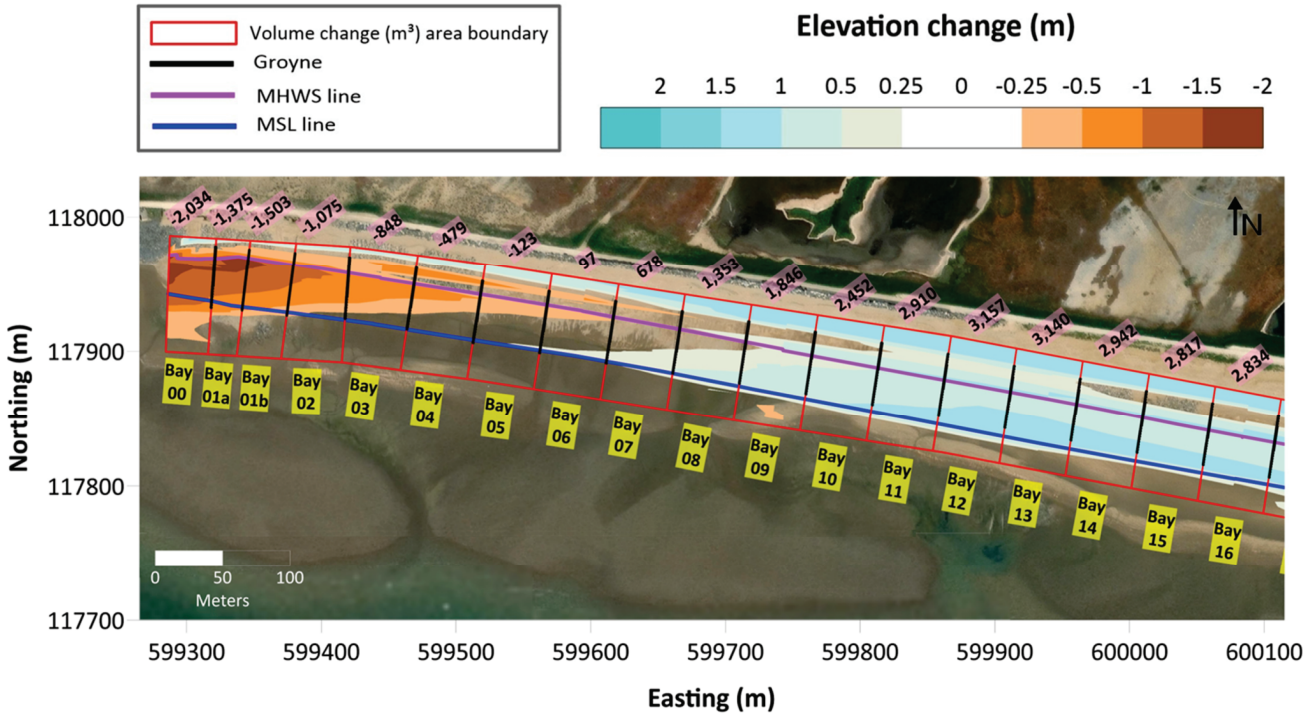


Figure 6-2: Difference model – March 2025 to Design Level groyne bays 00 to 16. Net volume values provided for each bay in m³.

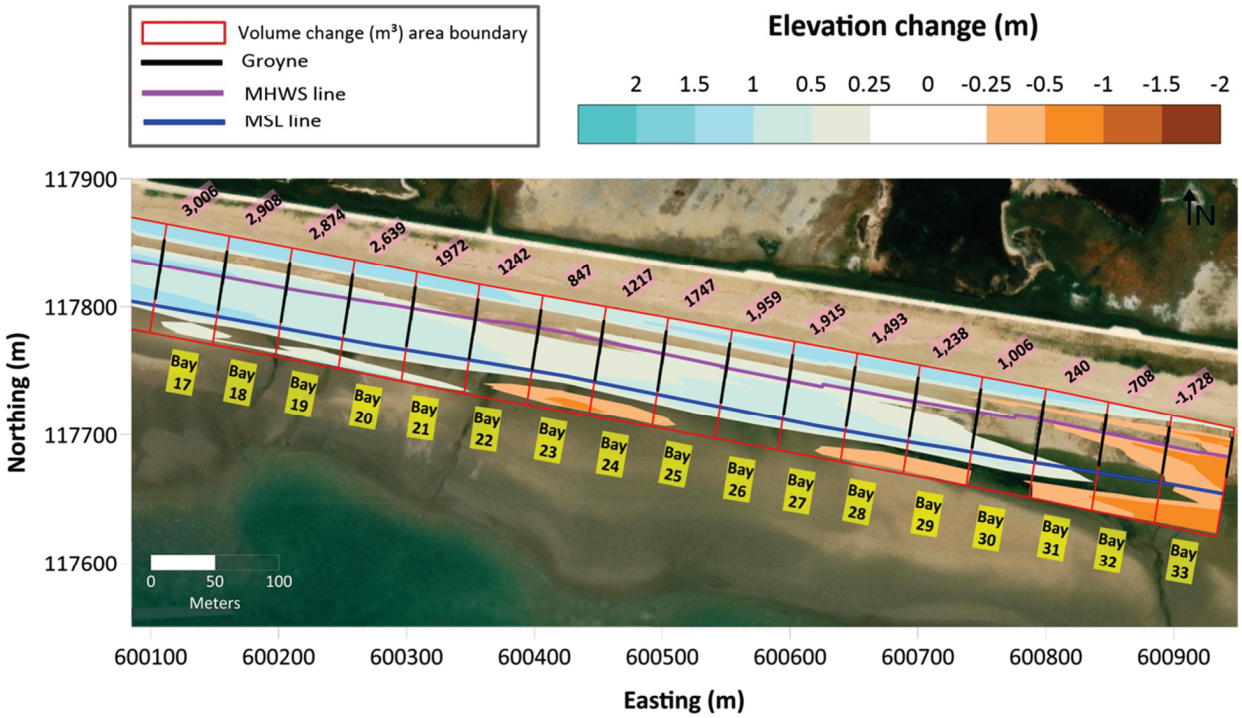


Figure 6-3: Difference model – March 2025 to Design Level groyne bays 17 to 33. Net volume values provided for each bay in m³.

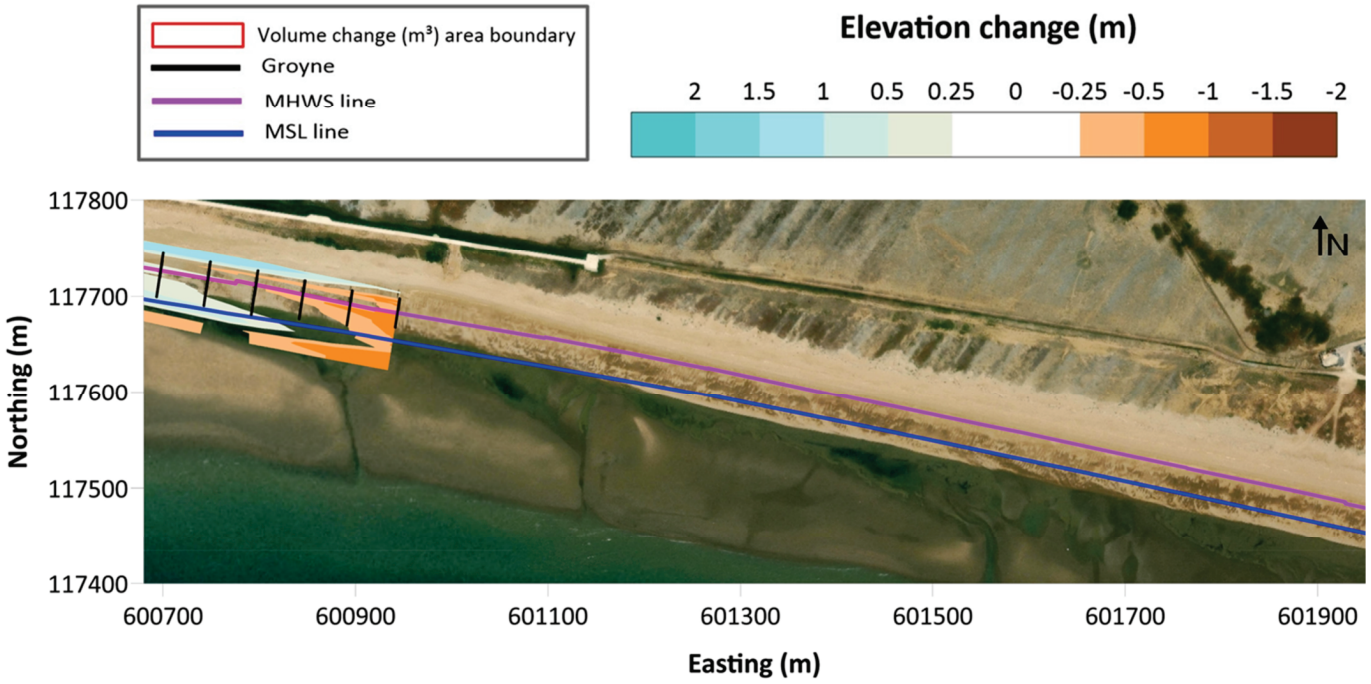


Figure 6-4: MHWS and MSL contours east of the groyne field for March 2025 (interpolated based on designated profiles).

7. Beach Triggers and Actions

7.1 Shingle Recycling - General

The BMP action for reaching the Critical trigger is "undertake urgent works (see section 5.5 and section 7)" with the stated risk of "Expected excessive overtopping/lowering of the shingle ridge which could lead to breach and/or flooding of the low-lying land behind the beach." The urgent works include reprofiling or recycling.

Analysis of beach volumes has been undertaken using interpolated beach levels from the March 2025 surveyed beach profiles. This gives an indication of overall volumetric change within the groyne field and likely areas of surplus and deficit, but caution should be used in making any detailed shingle recycling plans using this data (refer to Section 2.1.1).

When recycling material it is important that only shingle is recycled, therefore taking material from the lower slope where it may be mixed with sand should be avoided.

The rear crest is the most stable area within the shingle profile and hence most likely to have vegetation present. This should also be avoided where feasible.

7.2 Groyne field

7.2.1 Volumes below design beach

Table 7-1 below summarises the volume changes in each groyne bay (as interpolated from the surveyed profiles) relative to the Design level. Table 7-2 summarises the sum of volume changes in bays 00 to 07, 08 to 12, 13 to 28, and 29 to 33. The positive and negative volumes are the total volume above and below the Design level respectively. The net volume indicates if there is an overall surplus or deficit within a bay.

Bays 09–16 in the western half of the groyne field, as well as Bays 17–21 and 25–27 in the eastern half, appear to contain the highest volumes of material exceeding the design beach level, with surpluses greater than 1,500 m^3.

Groyne trigger levels set out in the BMP and the risk of outflanking should be considered even for bays in net surplus. This is because whilst the CSA may indicate there is sufficient material to provide the required SoP, all bays have some locations below Design levels. On inspection of the difference plots generated from the March 2025 survey data, there do not appear to be any bays in surplus where levels at the groynes suggest they would be at risk. However, the survey profiles are located mid-bay and alignment of the beach within the bays may mean that the beach at the groyne locations are higher or lower than assumed.

Where there are large deficits, recycling may be required to address beach trigger levels set out in the BMP. Reprofiling to move material from the top of the beach seawards to bring beach levels up to approximately the top of groyne level may also be required by groyne triggers. Losses in Bays 32 and 33 and bay volume deficits suggest the beach crest is close to the root of the groyne and hence Groynes 33 and 34 may be close to being outflanked. This and the cross-sectional analysis in Section 4.1 suggests this area requires recycling and reprofiling.

The sediment volume analysis within the groyne field indicates that the surplus of 63,550 m^3 determined from the October 2024 survey is now reduced to a surplus of 40,659 m^3 using the March 2025 survey.

Table 7-1. Groyne bay volumes relative to design profile (interpolated from surveyed profiles)

Groyne Bay	Positive volume (m^3)	Negative volume (m^3)	Net volume (m^3)	Action
00	85	2119	-2034	Top up bay and reprofile.
01a	29	1405	-1375	Top up bay and reprofile.
01b	68	1570	-1503	Top up bay and reprofile.
02	234	1309	-1075	Top up bay and reprofile.
03	219	1067	-848	Top up bay and reprofile.
04	264	743	-479	Top up bay and reprofile.
05	372	494	-123	Top up bay and reprofile.
06	475	378	97	No action required.
07	835	156	678	No action required.
08	1439	85	1353	No action required.
09	1984	137	1846	No action required.
10	2517	64	2452	No action required.
11	2961	51	2910	No action required.
12	3199	43	3157	No action required.
13	3201	61	3140	No action required.
14	3014	71	2942	No action required.
15	2845	27	2817	No action required.
16	2853	19	2834	No action required.
17	3015	9	3006	No action required.
18	2914	6	2908	No action required.
19	2880	6	2874	No action required.
20	2658	19	2639	No action required.
21	2022	50	1972	No action required.

Groyne Bay	Positive volume (m^3)	Negative volume (m^3)	Net volume (m^3)	Action
22	1413	170	1242	No action required.
23	1149	303	847	No action required.
24	1462	245	1217	No action required.
25	1859	112	1747	No action required.
26	2030	70	1959	No action required.
27	2032	117	1915	No action required.
28	1709	216	1493	No action required.
29	1472	234	1238	No action required.
30	1241	235	1006	No action required.
31	700	460	240	No action required.
32	268	975	-708	Top up bay and reprofile.
33	81	1808	-1728	Top up bay and reprofile.

Table 7-2. Groyne bay grouped volumes relative to design profile (interpolated from surveyed profiles)

Groyne Bay	Positive volume (m^3)	Negative volume (m^3)	Net volume (m^3)	Action
00 to 07	2581	9241	-6662	Top up bay and reprofile.
08 to 12	12100	380	11718	No action required.
13 to 28	37056	1256	35552	No action required.
29 to 33	3762	3712	48	No action required.

7.3 East of groyne field

It can be seen in the profile graphs in section 5.2 that no profiles surveyed between the groyne field and Galloways reached the Maintenance Trigger level for these locations.

These triggers east of the groyne field are taken from the previous BMP and are understood to have been based on experience of past breaches on site. It is therefore recommended that these are periodically reviewed with the area team who have past experience of this frontage and considered in light of any observations from the site walkover and actions agreed with NE.

Note there are no triggers for the Galloways to Denge frontage.

8. Ecological trigger check for erosion/recession

As part of the Lydd Ranges survey analysis, the beach performance east of the groyne field has been assessed against the erosion/recession ecological triggers in Table 3.4.3.1 of the BMP (see updated appendix E4). The extent of this analysis is from profile 4c00910 to 4c00893, located 1km east of the end of the groyne field. Additional profiles 4c00875, and 4c00857 which are located 1km and 2km east of 4c00893 respectively have been assessed to indicate natural response beyond influence of groyne field.

Two trigger levels are defined; these consider analysis on both cross-sectional area and mean sea level changes. For annual reviews as recommended in the BMP the ecological erosion triggers are as follows:

Trigger 1 – Is met if 3 (or more) consecutive surveying points are below the identified trendline at a given profile. The trendline is defined as a linear fit from data points prior to 2020.

Trigger 2 – Is met if a survey data point lies further below the trendline than measured pre-scheme (2020). I.e., when the trendline is lowered to the lowest lying point pre-2020 do any post-scheme points lie below this.

For mid-yearly reviews, such as this report, these trigger levels are adjusted as follows:

Trigger 1 – If the three most recent surveys fall below the erosion trendline. The trendline is defined as a linear fit from data points prior to 2020.

Trigger 2 – If one survey from the current year falls further below the erosion trendline than measured pre-scheme (2020). I.e., when the trendline is lowered to the lowest lying point pre-2020, do any post-scheme points lie below this.

From assessing data against the noted triggers for the March 2025 survey the following triggers were met.

Table 8-1: Ecological triggers met during Spring 2025 survey analysis.

		Cross-sectional Area		Mean Sea Level	
Profile	Distance East of groyne field (m)	Trigger 1	Trigger 2	Trigger 1	Trigger 2
4c00857*	3,000	X	X	X	X
4c00875*	2,000				
4c00893	1,000	X	X	X	X
4c00896	850	X		X	X
4c00899	675	X	X	X	X
4c00902	500	X		X	X
4c00905	325			X	X
4c00908	150			X	

* The BMP states that these ecological triggers only apply to profiles up to 1 km east of the groyne field. Profiles 2 and 3 km east have been included for reference to indicate natural response beyond influence of groyne field.

This analysis suggests at least one of the triggers have been met on 7 of the 8 sections assessed, suggesting that rates of downdrift erosion and change is exceeding historic values. Of the triggers, the most prevalent was for the chainage of the mean sea level elevation lying below the historical trend line for the three most recent surveys extending back to August 2024. Only three of the profiles had a cross-sectional area which lay below the erosion trendline measured pre-scheme. Triggers being met in profiles 4c00893 at 1km and 4c00857 at 3km east of the groyne field, but not in the profile 4c00875 which is 2km east or those closer to the groyne field where the zone of influence is expected to be significantly greater suggests that natural processes including large storm events and variability in beach response to these events may be influential in these observations.

In addition, as previously noted, some profiles exhibit an apparent offset in CSA between pre-construction and post-construction profiles. More details can be found in Appendix E4. Taking into account the observed offset in CSA, the spring survey results generally show change and variability typical of the pre-construction period.

9. Performance of frontage

9.1 Comparison of wave conditions post-construction

Initial analysis of the offshore wave conditions was completed to help provide context for any differences between measured and modelled results. This analysis shows whether the actual storminess was higher or lower than assumed in the model, which can affect how well the model output is expected to match reality.

Post-works survey data is available from October 2023 to March 2025. To understand the wave conditions during this period, actual wave data was extracted from Cefas Wavenet sites at Pevensey and Hastings. Rye was excluded from the analysis, even though it is geographically closer, because its data was less consistent with large gaps. Further, UK Met Office wave location 441 was selected over 462. While 462 is slightly closer to the site, point 441 was used in the wave modelling setup as it lies on the model boundary, making it more suitable for model comparison. In contrast, point 462 falls within the model domain and was not used as a boundary condition. The location of these wave extraction points is shown in Figure 9-1

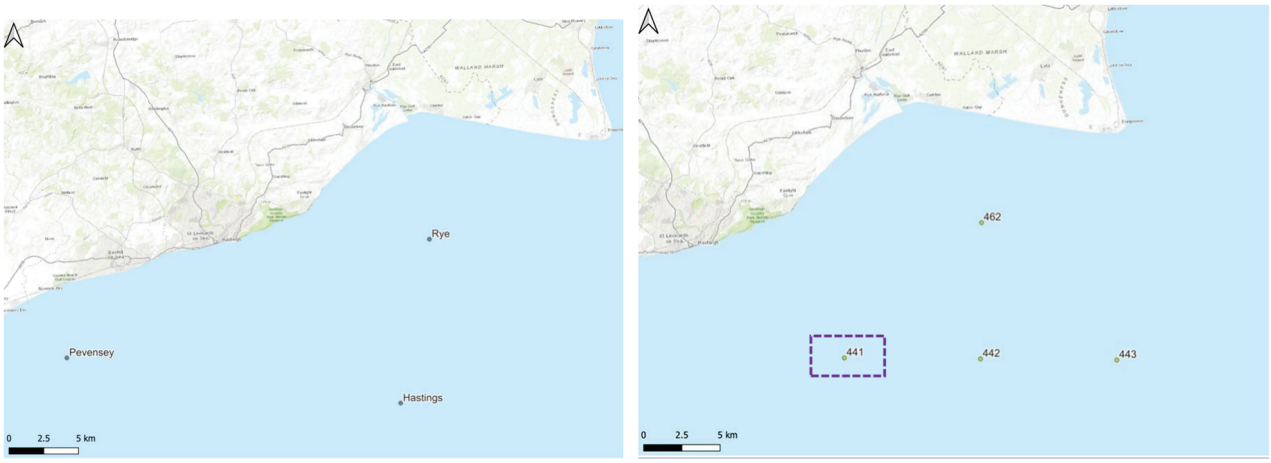


Figure 9-1: Cefas Wavenet locations (left) and UKMO locations (right) extraction locations for waves

Proxy wave energy flux (calculated as E=Hm0^2 * Tp) has been summed and analysed by direction for each wave point, and compared against the 2019 wave climate used in the model simulations. This approach helps to understand how the actual wave conditions differ from those assumed in the modelling. Energy flux is used as a comparison metric because it combines both wave height and period, giving a better indication of the total energy delivered by waves from different directions—something that is more relevant to coastal impacts than wave height alone. Flux plots are shown below in Figure 9-2 and Figure 9-3.

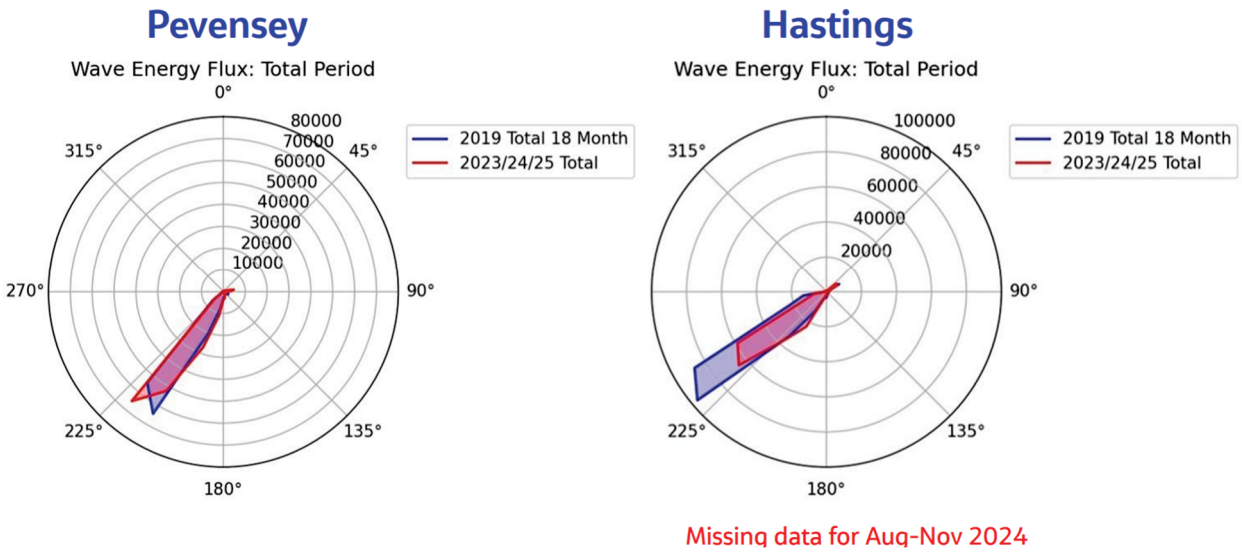


Figure 9-2: Pevensey (left) and Hastings (right) flux comparisons for period Oct/2023-Mar/2025

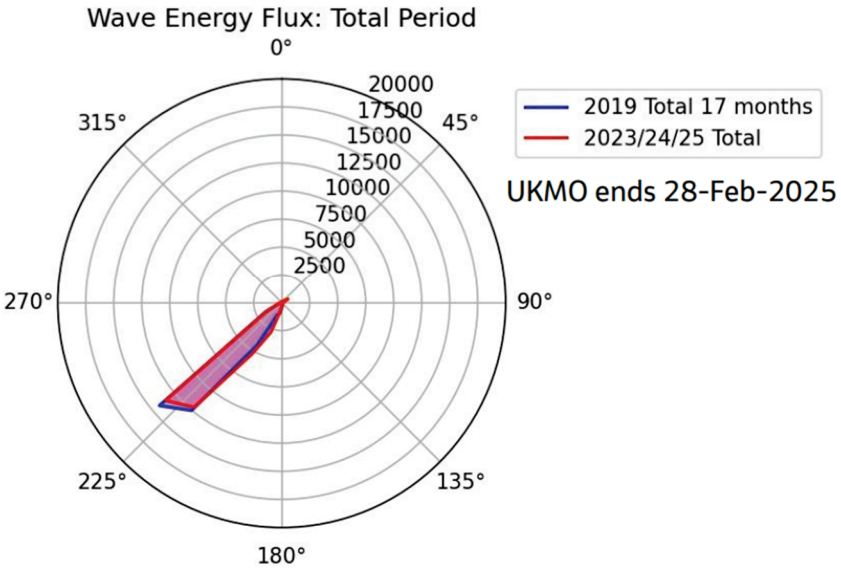


Figure 9-3: UKMO location 441 flux comparisons for period Oct/2023-Feb/2025

The analysis shows that wave conditions between October 2023 and March 2024 were more extreme than those during the same periods in 2019, while conditions between October 2024 and March 2025 were less extreme. Despite these differences, the overall directional pattern of offshore proxy wave energy flux during the full survey period (October 2023 to March 2025) closely matches that of the 2019 design wave year, with the prevailing energy flux direction being from the southwest. The magnitude of energy flux from this southwest direction is also similar between the two periods. Offshore hindcast data confirms that the first survey year was more energetic and the second less so, effectively balancing out to produce a comparable total energy flux across the full survey period. As a result, shoreline change during 2023/24 is expected to be more rapid than predicted using the 2019 wave climate, followed by a slower rate of change during 2024/25. However, the overall shoreline loss across the entire survey period is anticipated to be similar to that predicted using the 2019 design conditions.

9.2 Comparison of surveyed MHWS shorelines against model

A comparison was carried out between the actual shoreline changes and the modelled predictions. Four shoreline survey dates were analysed: October 2023 (one month post-construction, used as the baseline), February 2024 (five months post-construction), October 2024 (12 months), and March 2025 (18 months). The October 2023 and March 2025 shoreline positions were based on surveys which consisted of every ~third profile, providing lower spatial resolution and interpolated shoreline positions. The February and October 2024 surveys were full 3D surface surveys, offering higher detail and measured shoreline positions within each bay. This variation in survey resolution means that some finer-scale changes may not be captured in the lower-resolution datasets, which should be considered when comparing observed shoreline evolution with modelled outputs. Comparisons between the measured and modelled shorelines is shown below in Figure 9-4, Figure 9-5 and Figure **9-6**.



Figure 9-4: Shoreline results for period 1/Oct'23-28/Feb'24 (5months)



Figure 9-5: Shoreline results for period 28/Feb'24-1/Oct'24 (7months)



Figure 9-6: Shoreline results for period 1/Oct'24-31/March'25 (6months)

The analysis of shoreline change reveals that during the winter periods (October 2023 to February 2024 and October 2024 to March 2025), the observed rate of shoreline retreat was generally faster than predicted by the model using the 2019 design wave conditions. In contrast, during the summer period (February to October 2024), the observed changes were slower than those predicted by the model, with actual shoreline accretion occurring where the model had forecast erosion.

Measured results for the period Oct/2023 to March/2025 are shown in Figure 9-7 and compared with the model results from "Groynes + VAST1" scenario - including groyne field and modified recharge as placed by Van Oord. Overall, from October 2023 to March 2025, the measured shoreline change exceeded the modelled change between chainage 150 (groyne 4) chainage 1380 (near Groyne 28).

It is important to note that additional VAST material was placed east of Groyne 28, which contributed to higher change rates in the model in that area. This placement explains the discrepancy between measured and modelled changes east of Groyne 28, where the model reflects the influence of the added material more strongly than the measured data.

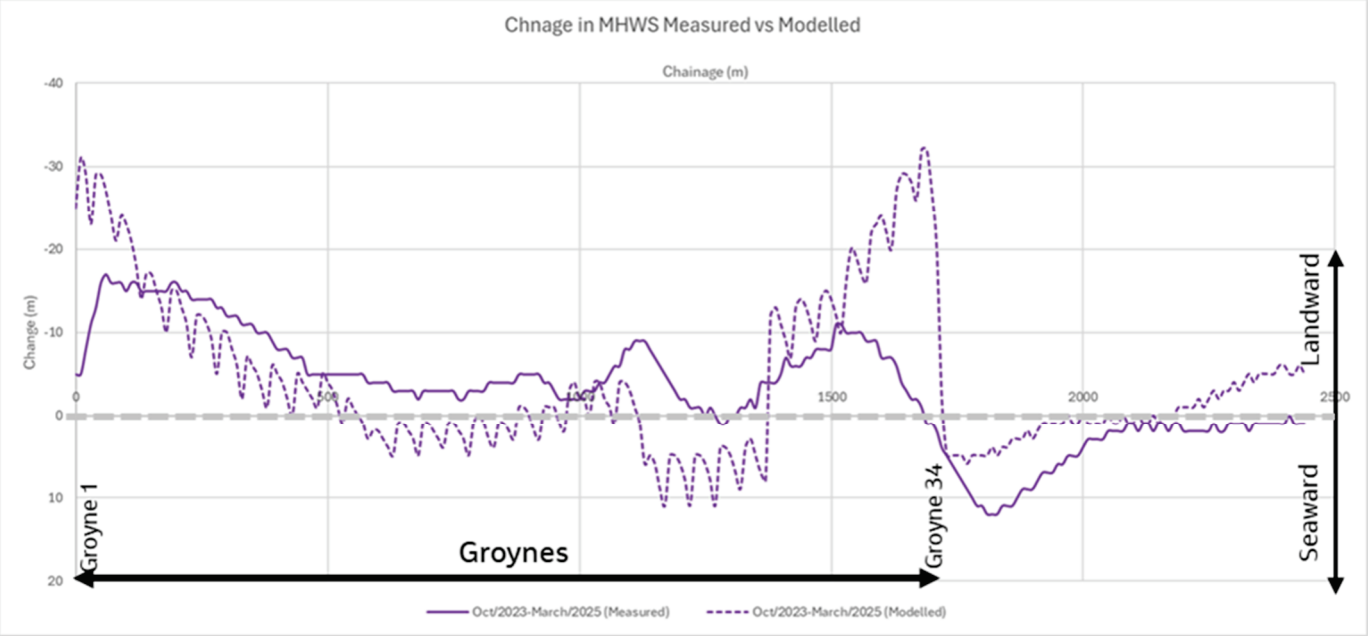


Figure 9-7: Change in MHWS measured (solid) vs modelled (dashed) for period Oct/2023-March/2025 Model run for (all) Groynes +VAST1

Additional analysis was undertaken as presented in Jacobs, 2024c to account for the fact that the groynes were likely to be buried initially by the placed material. To explore this, a model run including only groynes 1–12 was analysed (Groynes 1-12 +VAST1). This model run output is compared to the measured shoreline positions (Figure 9-8), and the results show a closer match. It is important to note that as the shoreline retreats over time, the groynes will become increasingly exposed, which will begin to influence shoreline behaviour. Therefore, whilst the model output shown in Figure 9-8 is most likely to be representative initially, over time the MHWS position will fall somewhere between the two modelled outcomes shown in Figure 9-7 and Figure 9-8.

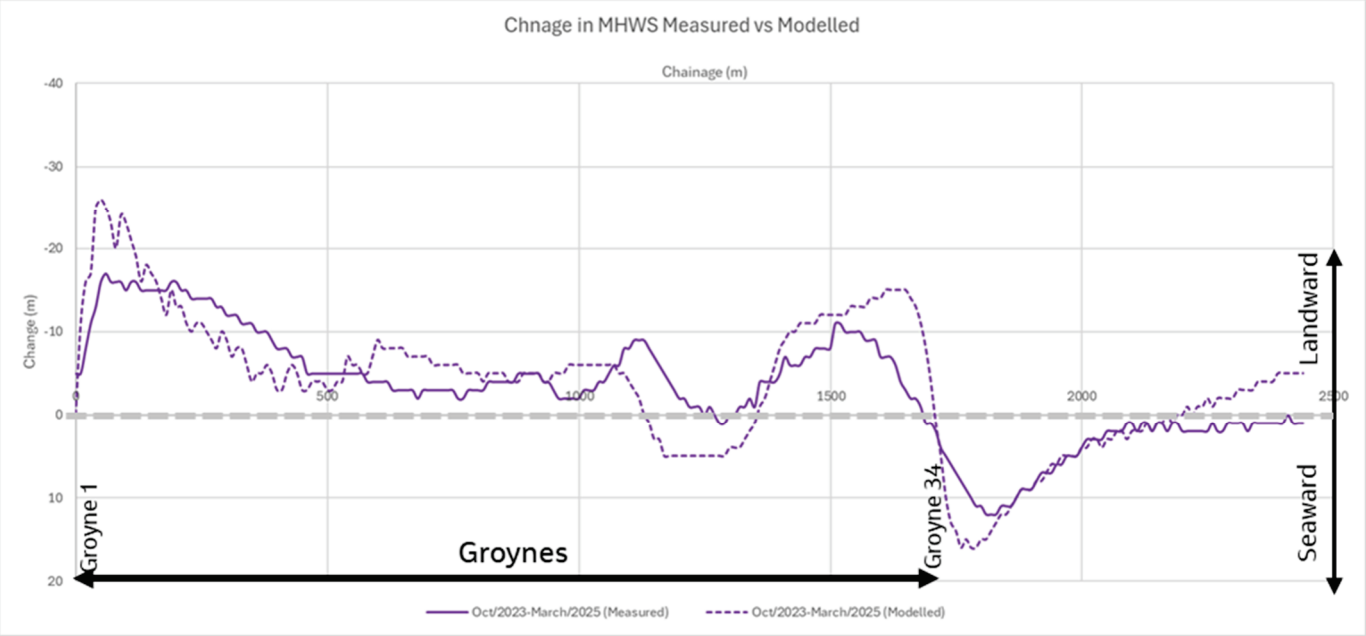


Figure 9-8: Change in MHWS measured (solid) vs modelled (dashed) for period Oct/2023-March/2025 with Model run for Groynes 1-12 +VAST1

Table 9-1 presents the sediment volume changes for both the survey data and modelled outputs. The model results are based on an active beach height of 7.8 m and assume a constant beach profile as the shoreline retreats within the one-line model. Overall, the volume changes across the groyne field are broadly comparable in magnitude, though some discrepancies are evident between the surveyed and modelled values. Modelled results for Groynes 1-12 + VAST1 results are more representative of surveyed values (both shoreline position and volume); volumes are compared below.

- Groyne Bays 00–07 show a large net loss in both the survey and modelled volumes. The modelled loss is greater than the surveyed (-45,010 m^3 compared to -37,210 m^3 surveyed) suggesting losses in this area may be overestimated in the model runs.
- Groyne Bays 08–12 have a survey loss of (-11,030 m^3), which is a close match to the modelled volume for groynes 1–12 (-11,000 m^3).
- Groyne Bays 13–28 the survey indicates a loss (-22,120 m^3); the modelled volume for groynes 1–12 only is reasonably well aligned (-20,750 m^3).
- Groyne Bays 29–33 show consistent losses across all datasets, with the modelled volumes suggesting a larger loss (-31,280 m^3) than the survey (-19,010 m^3) suggesting losses in this area may be overestimated in the model runs.

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Table 9-1: Difference model – Volume difference between March 2025 and October 2023 based on survey analysis and model results

Groyne Bay	Survey net volume (m^3)	Model run including all groynes net volume (m^3)	Model run including groynes 1-12 only net volume (m^3)
00-07	-37,210	-43,210	-45,010
08-12	-11,030	-5,230	-11,000
13-28	-22,120	13,960	-20,750
29-33	-19,010	-41,650	-31,280
SUM	-89,370	-76,130	-108,040

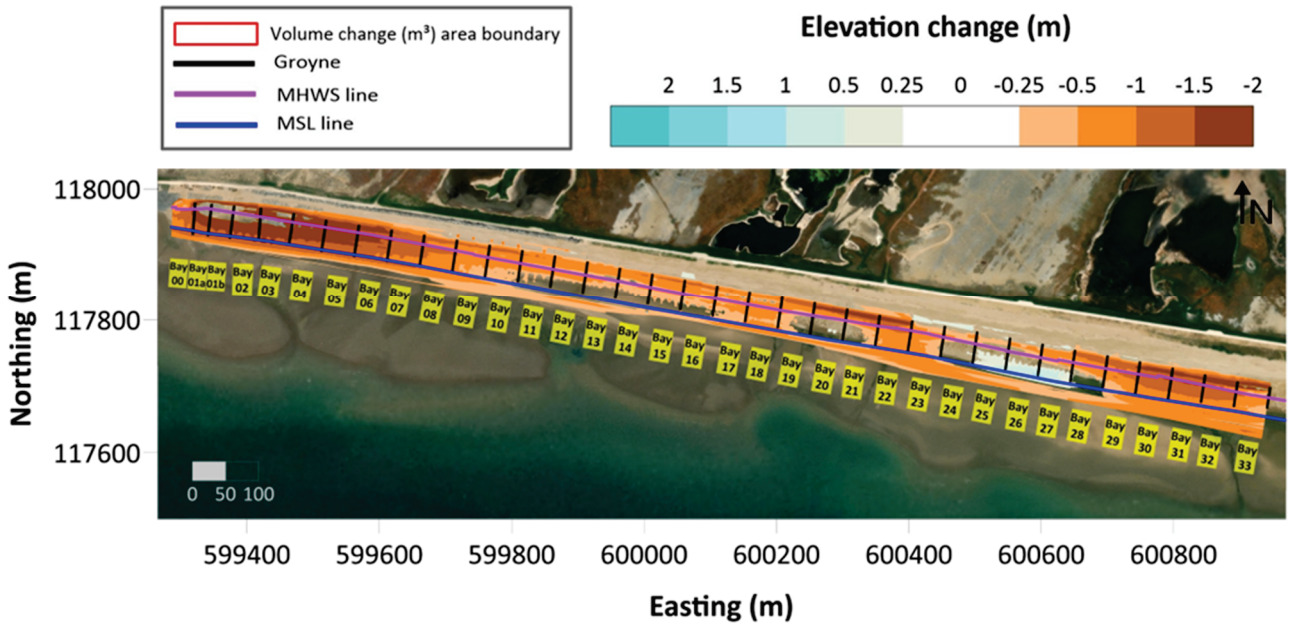


Figure 9-9: Difference model – Volume difference between March 2025 and October 2023 surveys (MHWS and MSL contours derived from March 2025 survey)

9.3 Future recycling and recharge

As noted in section 7.2.1, there was a surplus volume of 40,659 m^3 (above design beach) when the March 2025 survey was carried out, down from 63,550 m^3 in October 2024. The comparison between modelled and measured performance indicates that the frontage tends to perform worse than expected over the winter months and better over the summer months. As such, there is still anticipated to be plenty of material available for recycling in winter 2025/26 to bring all bays back up to Design level. There may still be sufficient material in winter 2026/27 but by this time the need to recycle smaller amounts from a larger number of bays in surplus would make this operationally difficult and time consuming.

As noted within section 4.1, the profile 4c00911A, contained within bay 33, was at the critical trigger level in the March 2025 survey. As per section 3.4.2 of the BMP (Jacobs, 2024b), urgent works should be undertaken upon triggering the critical level.

10. References

Jacobs, 2024a. Year 2045 Standard of Protection - Jury's Gap. ENVIMSO000702-VAO-00-L00-TN-C-106

Jacobs, 2024b. Lydd Ranges Beach Management Plan 2023-2028. ENVIMSO000702-VAO-ZZ-RP-C-0004-S3

Jacobs 2024c. Lydd Ranges Coastal Modelling Report – 2023 update. ENVIMSO000702-VAO-00 L00-RP-C-005_P03, 3 May 2024