

Bryn Glas, Rhosllannerchrugog

Hydraulic Modelling Advice Note

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1 Introduction

This Hydraulic Modelling Advice Note has been prepared by Weetwood Services Ltd ('Weetwood') to provide advice in respect to fluvial flood risk associated with the proposed development of land of Bryn Glas in Rhosllannerchrugog.

1.1 Site Location

The site is located to the south of Bryn Glas, at Ordnance Survey National Grid Reference SJ 289 458 as shown in **Figure 1**.

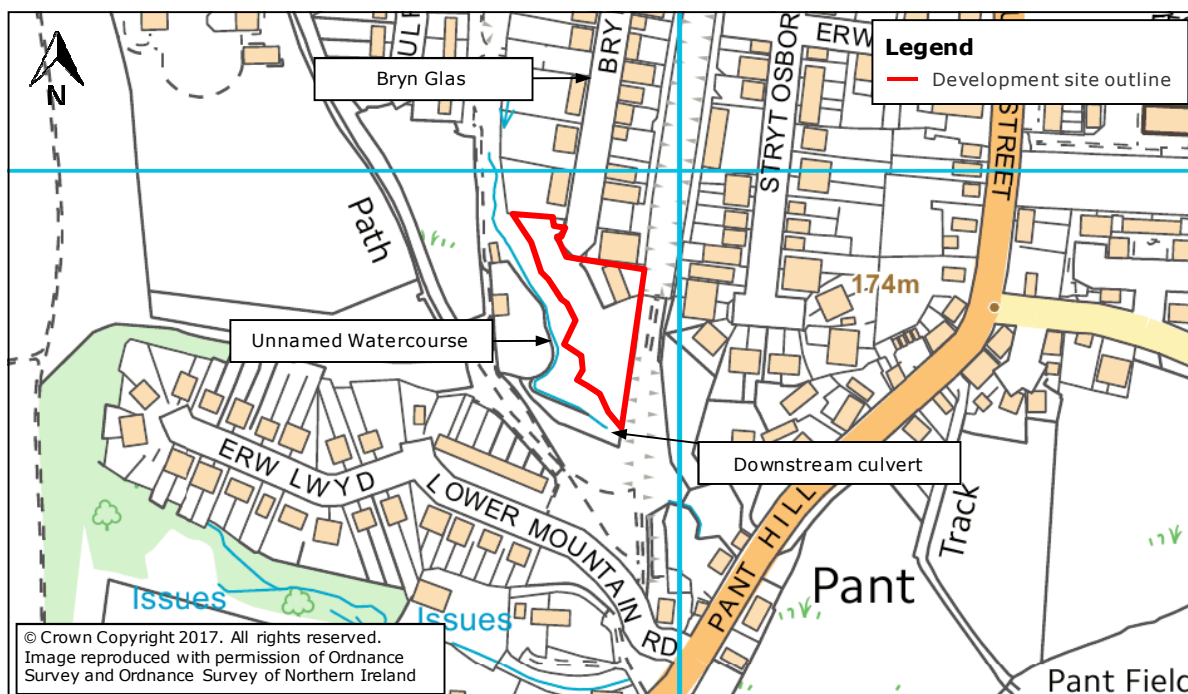


Figure 1: Site Location

1.2 Waterbodies in Vicinity of the Site

There is an unnamed watercourse located adjacent to the site's western boundary (**Figure 1**); this flows in a predominantly southerly direction and is classified as an 'ordinary watercourse'.

The watercourse flows in open channel adjacent to the site, prior to entering a culvert adjacent to the site's southernmost point. The watercourse also flows in culvert upstream of the site, through the residential areas to the north.

According to the Natural Resources Wales (NRW) Flood Risk Map, the site is shown to be located outside the 1 in 1,000 annual probability event flood outline (**Figure 2**).

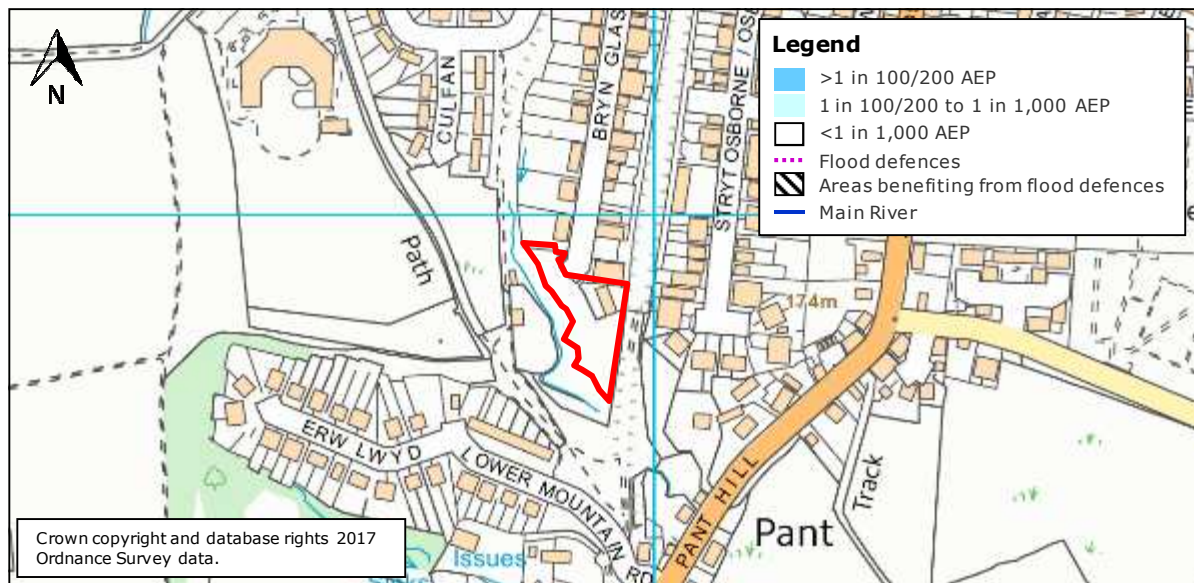


Figure 2: NRW Flood Risk Map
(Source: NRW website)

In addition, the site is shown to be located within Zone A on the Development Advice Map¹, which is defined as an area that is considered to be at little or no risk of fluvial flooding.

However, the flood risk posed by the unnamed watercourse is not accurately represented on the NRW Flood Risk Map, nor on the Development Advice Map, due to its small catchment size.

In light of this, Weetwood has developed a detailed 1D-2D ESTRY-TUFLOW hydraulic model of the unnamed watercourse, in order to quantify the flood risk posed to the site from this source. This has considered a range of both free flowing and culvert blockage events. Some preliminary results from the modelling exercise are presented below.

¹ Source: NRW Website

2 Model Runs and Results

Table 1 details the flood events that have been assessed for the purposes of this Advice Note.

Table 1: Model Runs

Annual Probability Event	Scenario
1 in 1,000	Free flowing
1 in 100 +20% climate change	100% blockage of the downstream culvert inlet structure
1 in 100 +45% climate change	100% blockage of the downstream culvert inlet structure
1 in 1,000	100% blockage of the downstream culvert inlet structure

The 1 in 1,000 annual probability event is used by NRW to define the Zone C2 designation on the Development Advice Map. Welsh Government guidance stipulates that 'highly vulnerable' land use (i.e. residential land use) should not be permitted within the Zone C2 outline. The 1 in 1,000 annual probability event should therefore normally be utilised to inform residential development proposals.

The model output plot for the 1 in 1,000 annual probability event is provided within **Appendix A**. This indicates that the southern and south-western parts of the site would be expected to flood during this event as a result of the downstream culvert becoming overwhelmed, causing water to back up behind the culvert inlet. As shown in **Table 2** flood levels on site during this scenario appear to be in the region of 163.20 m AOD.

In light of the current development proposals, flooding in the vicinity of the two southernmost plots would be expected. As such, we would advise that the proposals are amended accordingly, also taking consideration of our further comments below.

Table 2: Modelled Flood Levels

Annual Probability Event	Max Level (m AOD)
1 in 1,000	163.20
1 in 100 +20% climate change & blockage	163.59
1 in 100 +45% climate change & blockage	163.67
1 in 1,000 & blockage	163.70

In accordance with NRW guidance² culvert blockage scenarios should also be assessed to consider compliance with Technical Advice Note (TAN) 15; Development and Flood Risk. This scenario is used to inform mitigation measures that may be required for the site to ensure the future occupiers of the site remain safe and to minimise any impacts of the development on third parties.

The model output plot for the 1 in 1,000 annual probability 100% culvert blockage event is provided within **Appendix B**. The model results indicate an additional 0.5 m of floodwater accumulating behind the culvert (**Table 2**), affording a flood level of 163.70 m AOD at the site; however, this additional floodwater appears to be comfortably accommodated within the natural 'bowl' that resides within the vicinity of the site. As such, there is little difference shown in the flood extents expected during both free-flowing and 100% blockage scenarios.

² Flood Risk Management: Modelling blockage and breach scenarios, NRW, February 2015

Given the similarity in flood extents between the aforementioned scenarios, it would be prudent to utilise the blockage scenario (**Appendix B**) as a basis to inform further iterations of the development proposals in order to help avoid complications when dealing with NRW during the planning process with respect to impacts to third parties. All residential development should therefore be located outside this modelled flood outline.

3 Mitigation

3.1 Development Platform Area

It is recommended that the proposed development plan is amended to ensure that there is no residential development within the 1 in 1,000 annual probability 100% culvert blockage event flood outline (**Appendix B**).

It *may* be possible to locate some of the garden areas within the areas shown to flood (assuming that this would require no land-raising); however, it would be worth checking with the local planning authority whether it would consider this to be acceptable in light the potential concerns regarding '*highly vulnerable*' development being located in Zone C2.

3.2 Finished Floor Levels

It is recommended that finished floor levels should be set at a minimum of 163.89 m AOD. This provides a freeboard of 300 mm above the 1 in 100 annual probability + 20% climate change water level expected at the site in the event of a 100% culvert blockage. This level would also be above the anticipated water level during more extreme events as outlined in **Table 2**.

APPENDIX A:

Model Plot – 1 in 1,000 annual probability

Notes:

1. Do not scale from this drawing.

2. Map backdrop reproduced from Ordnance Survey digital map data. Crown Copyright under licence.

KEY:

Site Location

Depth (metres)

0.0 to 0.2

0.2 to 0.4

0.4 to 0.6

0.6 to 0.8

0.8 to 1.0

1.0 to 1.2

1.2 to 1.4

1.4 to 1.6

1.6 to 1.8

1.8 to 2.0

> 2.0

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Client:

Dave Cottle Civil Engineering Ltd

Project Title:

Bryn Glas, Rhosllannerchrugog

Drawing Title:

Maximum Flood Depths: 1 in 1,000 Annual Probability Event

Map Orientation:

Scale:

Drawn:

Checked:

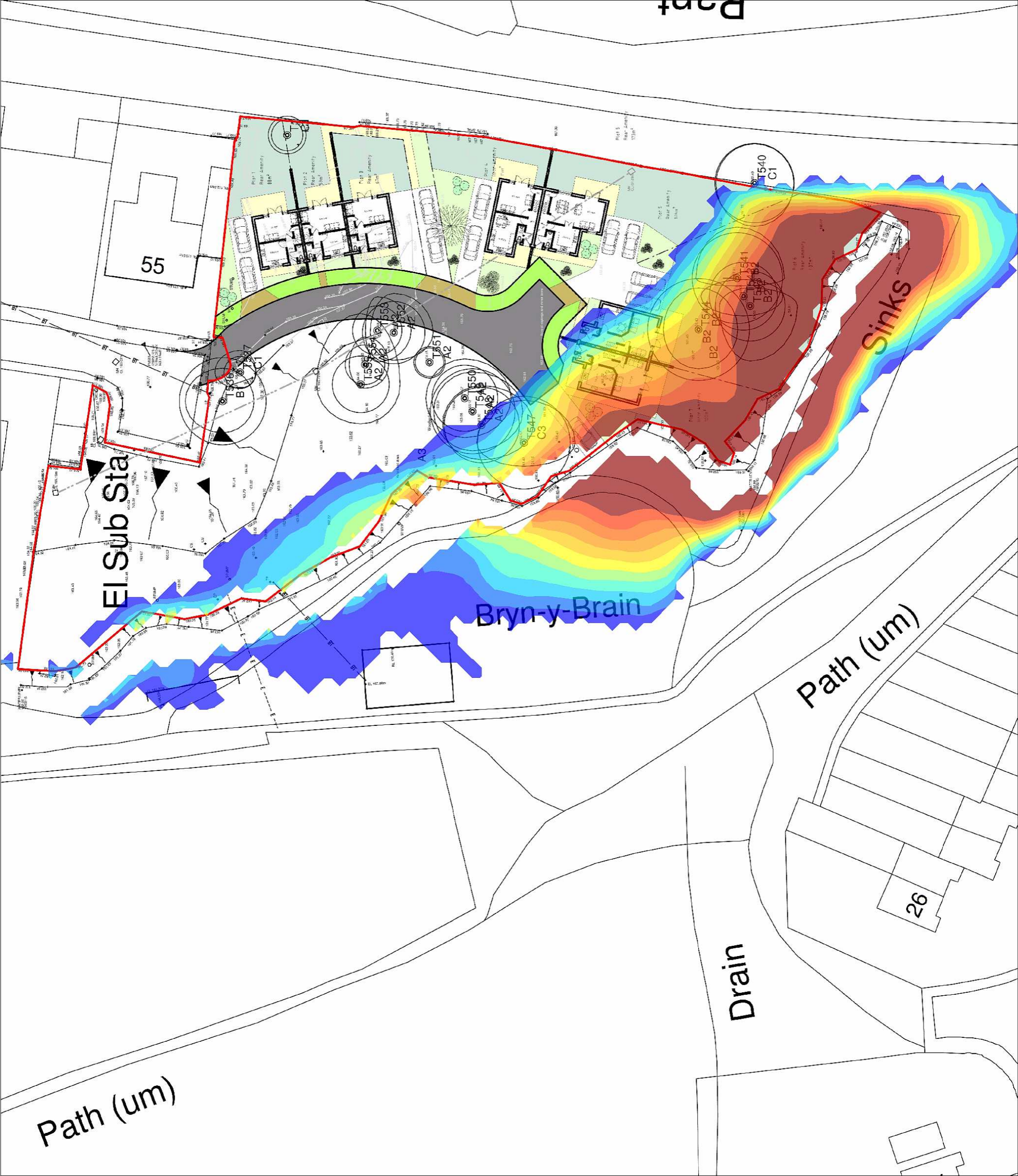
Date:

Drawing No:

Rev:

3494_002_Q1000_d_g001_Max

A



APPENDIX B:

Model Plot – 1 in 1,000 annual probability 100% culvert blockage

Notes:

1. Do not scale from this drawing.

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KEY:

Site Location

Depth (metres)

0.0 to 0.2

0.2 to 0.4

0.4 to 0.6

0.6 to 0.8

0.8 to 1.0

1.0 to 1.2

1.2 to 1.4

1.4 to 1.6

1.6 to 1.8

1.8 to 2.0

> 2.0

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Project Title:

Bryn Glas, Rhosllannerchrugog

Drawing Title:

Maximum Flood Depths; 1 in 1,000 Annual Probability Event 100% Culvert Blockage

Map Orientation:

Scale:

Drawn:

Checked:

Date:

Drawing No:

Rev:

This figure is a technical flood depth map for a site in Rhosllannerchrugog. The map displays the site's layout, including buildings, roads, and a railway line. A color-coded contour map is overlaid, representing flood depths in metres for a 1 in 1,000 annual probability event with 100% culvert blockage. The colors range from blue (0.0 to 0.2m) to red (> 2.0m). Key features include:

- Site Location:** Indicated by a red line.
- Depth (metres):** Color-coded contours showing varying flood depths across the site.
- Labels:** 'El Sub Sta' (Electric Sub Station), 'Bryn-y-Brain', 'Sinks', 'Path (um)', and 'Drain' are labeled on the map.
- Contours:** Concentric circles around specific points, likely representing culverts or drains, with labels such as 'T547 C3', 'T548 A2', 'T549 A2', 'T550 A2', 'T551 A2', 'T552 A2', 'T553 A2', 'T554 A2', 'T555 A2', 'T556 A2', 'T557 A2', 'T558 A2', 'T559 A2', 'T560 A2', 'T561 A2', 'T562 A2', 'T563 A2', 'T564 A2', 'T565 A2', 'T566 A2', 'T567 A2', 'T568 A2', 'T569 A2', 'T570 A2', 'T571 A2', 'T572 A2', 'T573 A2', 'T574 A2', 'T575 A2', 'T576 A2', 'T577 A2', 'T578 A2', 'T579 A2', 'T580 A2', 'T581 A2', 'T582 A2', 'T583 A2', 'T584 A2', 'T585 A2', 'T586 A2', 'T587 A2', 'T588 A2', 'T589 A2', 'T590 A2', 'T591 A2', 'T592 A2', 'T593 A2', 'T594 A2', 'T595 A2', 'T596 A2', 'T597 A2', 'T598 A2', 'T599 A2', 'T600 A2'.



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