IE CONSULTING
WATER-ENVIRONMENTAL-CIVIL

Technical Note:

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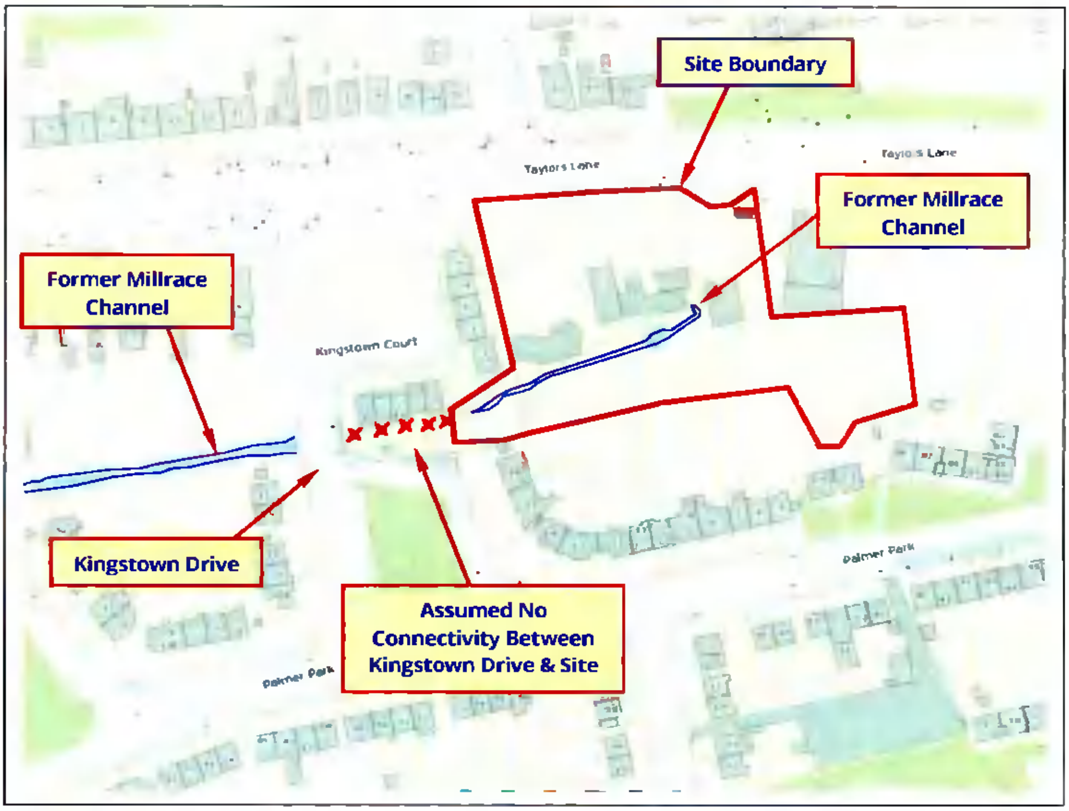
1. Hydrological Assessment - Background

The following sections present an assessment and analysis of the existing catchment area of the former Mill Race channel within the boundary of the proposed development site and the surface water runoff rates that may be expected to discharge to the former Mill Race channel in consideration of the mean annual (Qbar) and the 3.3% AEP (1 in 30 year) and 1% AEP (1 in 100 year) runoff events.

1.1. Assumptions

As illustrated in *Figure 1* below, this assessment and analysis assumes the following:-

1) There is no direct connectivity between the former mill race channel at the location of Kingstown Drive roadway and the western boundary of the proposed development site.
2) Hard-surfacing areas (roof areas, driveways, etc) associated with Kingstown Court house numbers 3-7 drain to the existing public storm sewer in Kingstown Drive, and only the rear garden areas of these properties have the potential to discharge surface water runoff to the area of the proposed development site and subsequently the former mill race channel.
3) Hard-surfacing areas (roof areas, driveways, etc) associated with Palmer Park house numbers 1-16 drain to the existing public storm sewer in Palmer Park road, and only the rear garden areas of these properties have the potential to discharge surface water runoff to the area of the proposed development site and subsequently the former mill race channel.
4) No surface water runoff from Taylors Lane roadway discharges in the direction of the proposed development site.



Site Boundary
Taylors Lane
Former Millrace Channel
Former Millrace Channel
Kingstown Court
Kingstown Drive
Assumed No Connectivity Between Kingstown Drive & Site
Palmer Park
Palmer Park

Figure 1

1.2. Topographical Survey and Contour Mapping

In order to assist in the assessment of the former Mill Race channel catchment area, a Digital Terrain Model (DTM) and contour mapping was developed to encompass the surrounding area of the proposed development site.

The DTM and contour mapping was developed utilising acquired LiDAR data for the area. The contour mapping and DTM developed for the area is illustrated in *Figure 2* and *Figure 3* below.

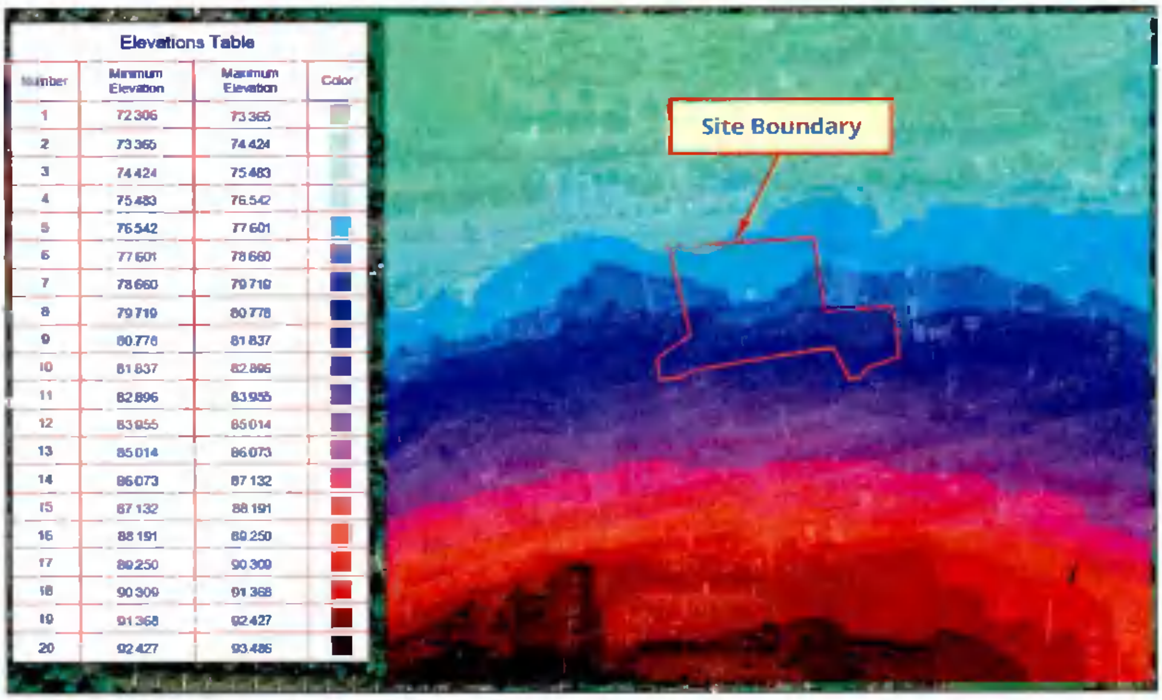


Figure 2 – DTM

Figure 3 – Contour Mapping

1.3. Catchment Area Delineation

The catchment area of the former Mill Race channel has been delineated utilising the constructed DTM detailed in *Section 1.2* above and has been estimated to be 0.009069 km^2 to a point at the downstream extent of the channel as illustrated in *Figure 4* below.

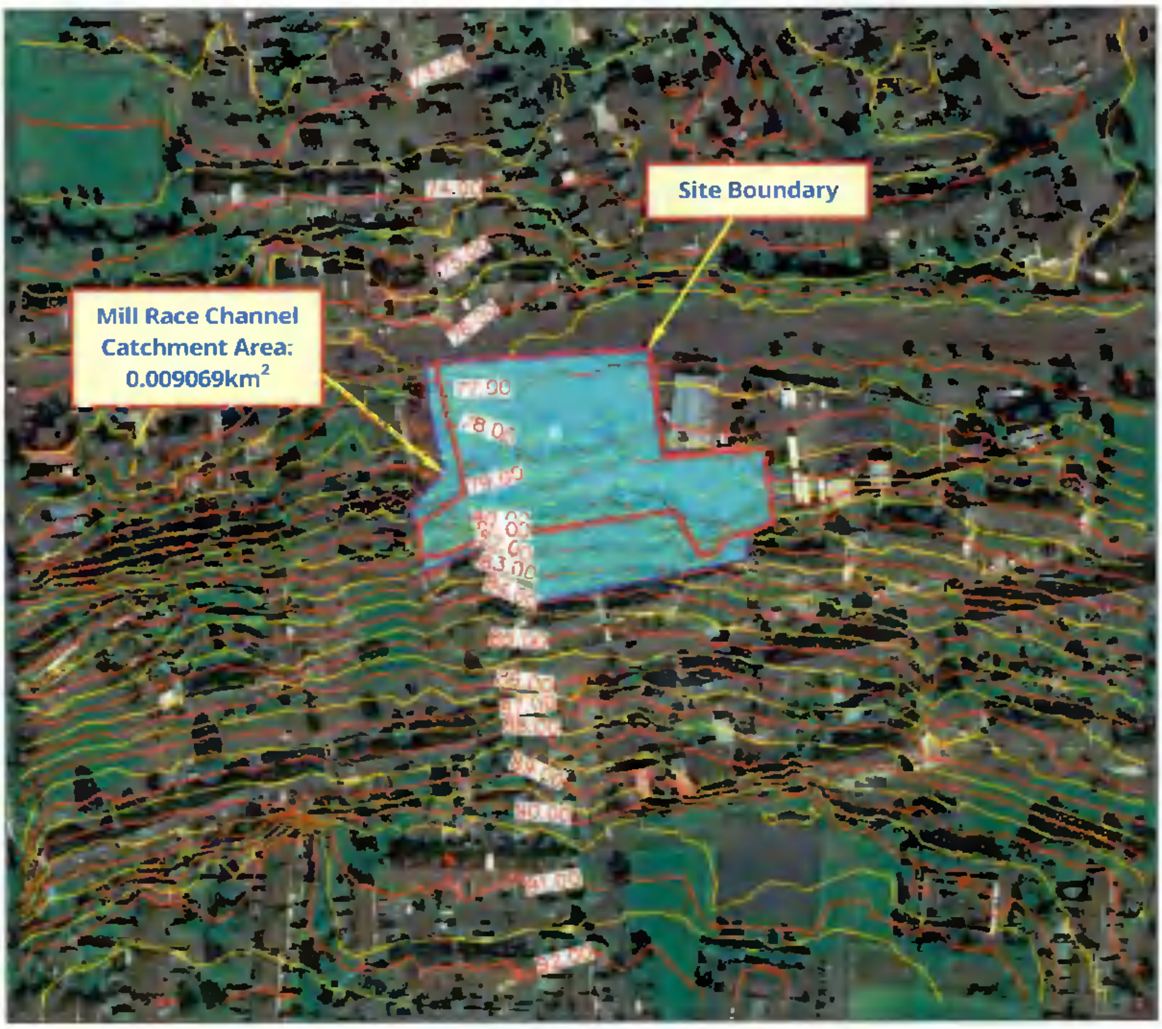


Figure 4 – Mill Race Catchment

1.4. Mean Annual Flow Estimation

No suitable historical flow data, hydrometric gauging station data or anecdotal information is available from the OPW, EPA or local authority for the former Mill Race channel or catchment area from which an estimation of design flows can be extrapolated or correlated.

Given the small size of the catchment area of the former Mill Race channel, the FSU portal software is not considered appropriate to estimate the mean or median annual flow. The mean annual flow, Q_{BAR} *(m^3/s)*, is therefore estimated by utilising the Institute of Hydrology Report (IH) No. 124 'Flow Estimation for Small Catchments' regression equation.

For catchment areas less than 50 hectares (0.5 km^2) in area it is recommended that the mean annual flow is calculated for a 50 hectare area and the flow for the actual catchment is then estimated through linear interpolation. The Hydrology Report (IH) No. 124 'Flow Estimation for Small Catchments' regression equation is listed below:-

$$Qbar\ Rural = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times SOIL^{2.17} \qquad \text{EQN 7.1 (IH124)}$$

where:

AREA = the topographic catchment area

Area = 0.009069 Km²

SAAR = Standard Annual Average Rainfall

***SAAR = 890.11 mm** (from Met Éireann data)*

SOIL = A number depending on the soil type and relating to the winter rain acceptance potential of the soils in the catchment. Values for SOIL are obtained from *Figure 5* and *Figure 6* below, which are replicated from map I. 4.18 (I) in the FSR.

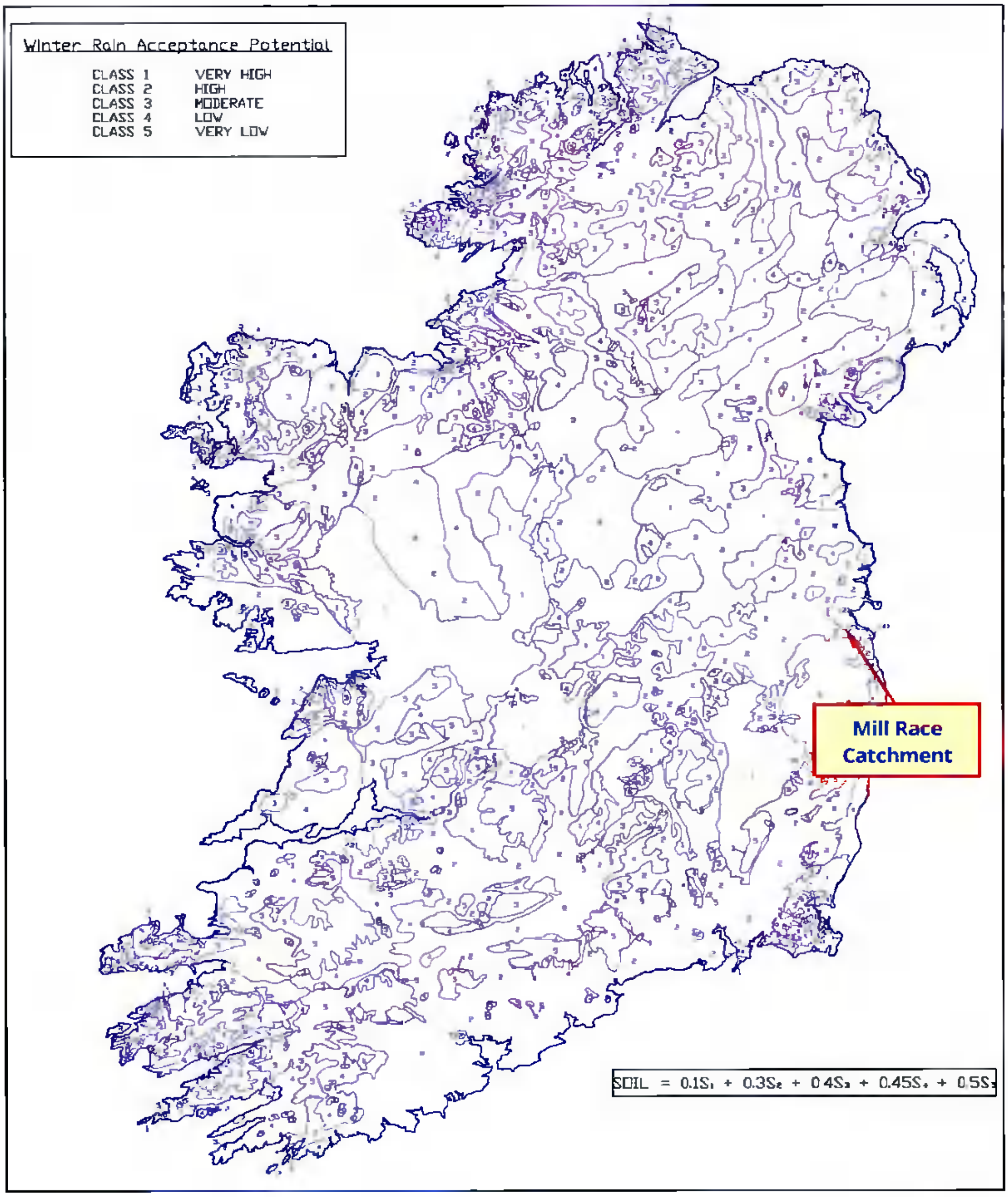


Figure 5 – Winter Rainfall Acceptance Potential

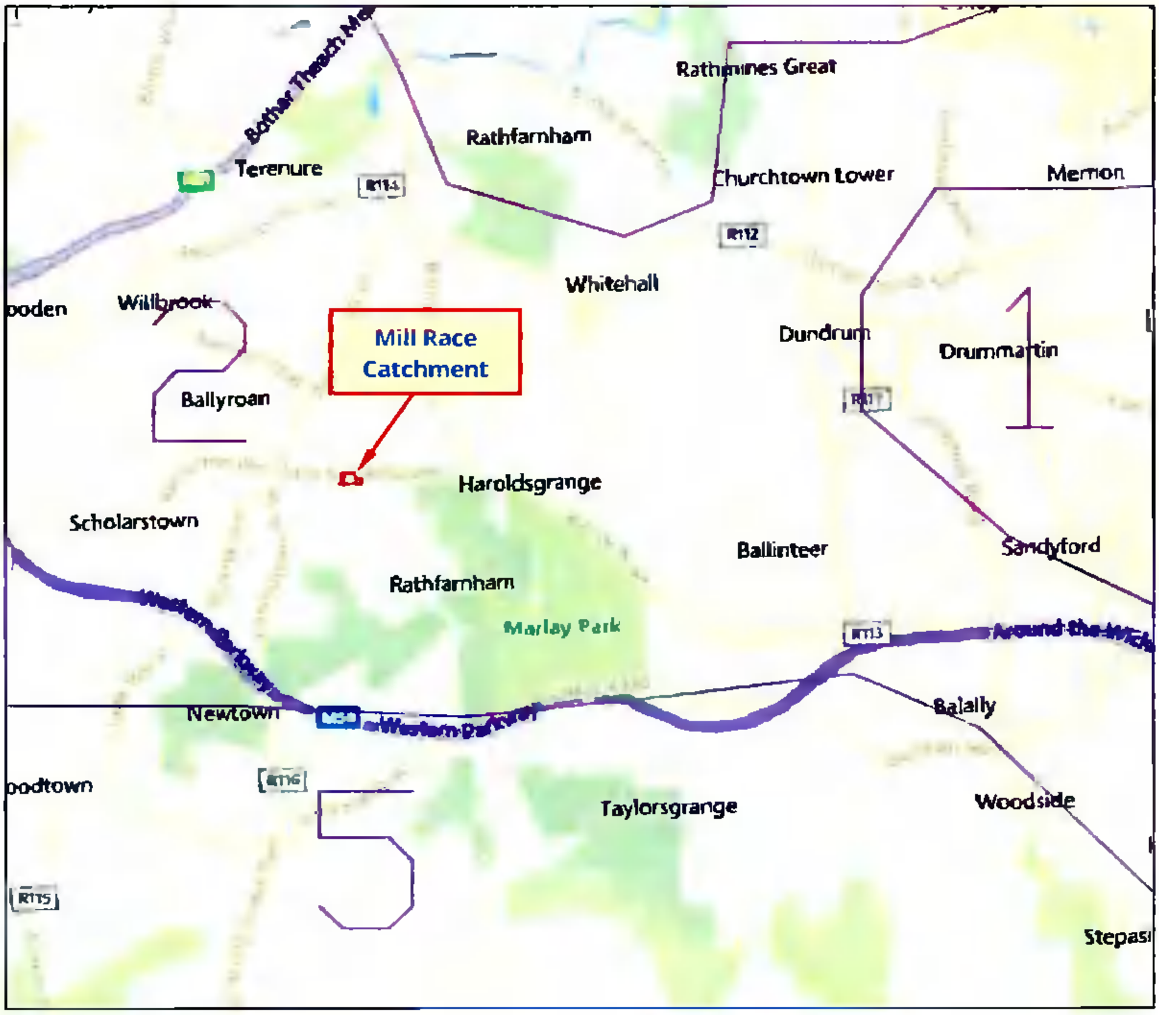


Figure 6 – Winter Rainfall Acceptance Potential

From *Figure 5* and *Figure 6* above (not to scale) the Mill Race catchment area comprises 100% SOIL Type 2.

Therefore:

SOIL = 0.15(S1) + 0.3(S2) + 0.40(S3) + 0.45(S4) + 0.5(S5)

SOIL = 0.15(0) + 0.3(1.0) + 0.40(0) + 0.45(0) + 0.5(0)

SOIL = 0.3

Therefore:

$Qbar = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$ *EQN 7.1 (IH124)*

$Qbar = 0.00108 \times 0.5^{0.89} \times 890.11^{1.17} \times 0.3^{2.17}$ = ***121 l/s (<u>0.121 m³/s)</u>*** *(for 50 hectare catchment area)*

The IH Report 124 Flood estimation for small catchments equation has a standard factorial error of 1.65, therefore the design Q_{BAR} is:-

121 l/s x 1.65 = ***<u>199.65 l/s</u>***

The Qbar flow for the actual former Mill Race channel is estimated using linear interpolation as shown below:-

$$Qbar\ Rural = \frac{Qbar\ Design}{0.5} \times Site\ Area$$

Therefore:-

$$Qbar\ Rural = \frac{199.65}{0.5} \times 0.009069$$

$\Rightarrow \mathbf{Q_{BAR} = 3.62\ l/s}$

1.5. Estimated Flows for Different Return Periods

The return period flows 'Q_T' are estimated using the index method and multiplying the annual maximum flow by the appropriate growth factor 'X_T' using the FSR (1975) national growth curve for Ireland, as shown in *Figure 7* below: -

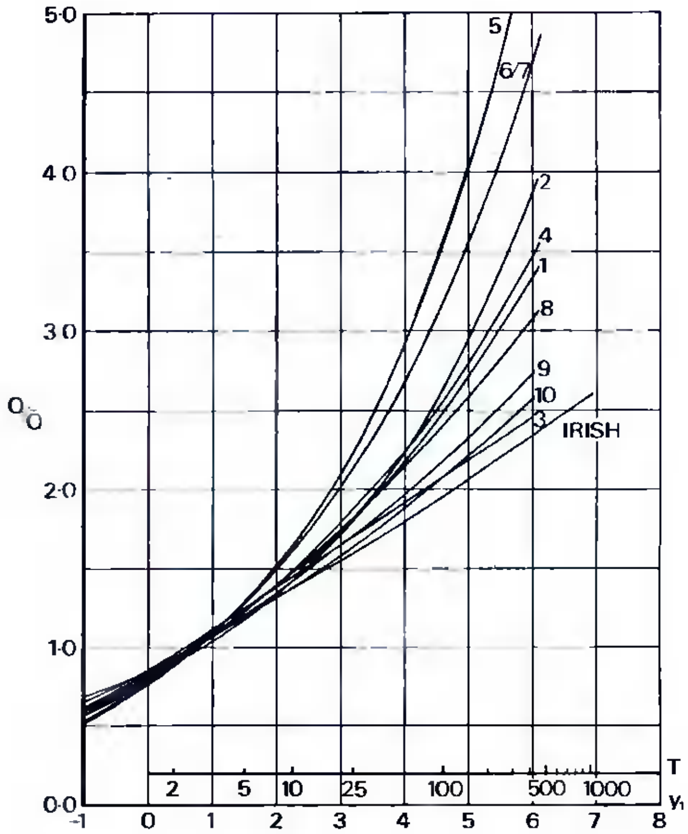


Figure 7 – Regional Growth Factors

For return periods 2, 5, 10, 20, 30. 50 and 100years the growth factors determined from *Figure 6* are listed in *Table 1* below: -

Flood Return Period (Yrs)	2	5	10	20	30	50	100
Growth Curve Factor (Q_T/Q_{BAR})	0.95	1.2	1.37	1.54	1.63	1.77	1.96

Table 1: Growth Factors Applied to Irish Catchments for Q_{BAR} Discharge Prediction

Table 2 below lists the estimated peak flow in the former Mill Race channel at the point of interest for different return periods: -

Flood Return Period (Yrs)	2	5	10	20	30	50	100
Mill Race Estimated Peak Flow (l/s)	3.43	4.34	4.95	5.57	5.90	6.40	7.09

Table 2: Estimated Peak Flows in the Mill Race Channel for Different Return Periods

The estimated 3.3% AEP (1 in 30 year) and 1% AEP (1 in 100 year) flows for the former Mill Race channel along the reach under consideration are therefore:-

Q_{30} = **5.90 l/s**

Q_{100} = **7.09 l/s**

1.6. Climate Change

It is generally acknowledged that future climate change will cumulate in decreases in summer rainfall amounts and increases in winter rainfall amounts. The levels or percentages of increase or decrease are still subjective and dependant on future studies and analysis.

The recently published Greater Dublin Strategic Drainage Study (GDSDS) suggests that by the year 2100 summer rainfall depths will have decreased by 35-45%, with a corresponding increase in winter rainfall depths by 20%. The suggested increase in winter rainfall depth will inevitability result in higher catchment run-off and therefore greater flood peaks.

It is therefore prudent to include a climate change factor in any estimation of flood peak volumes. In this instance a 20% increase in estimated flood peaks is provided for in this assessment. Therefore, the predicted 1% AEP (1 in 100-year) flood flows are increased to reflect the climate change factor.

The estimated 3.3% AEP + climate change (1 in 30 year + CC) and 1% AEP plus climate change (1 in 100 year + CC) flow in the former Mill Race watercourse along the reach under consideration is therefore:-

$\Rightarrow Q_{30+cc} = 5.90 \times 1.20 =$ ***7.08 l/s***

$\Rightarrow Q_{100+cc} = 7.09 \times 1.20 =$ ***8.50 l/s***

