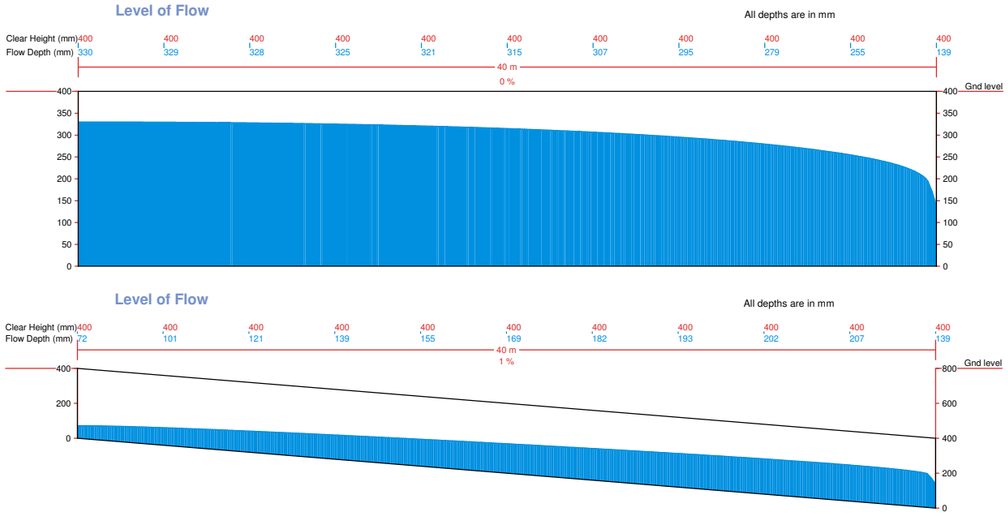
Effect of slope on trench drain hydraulics

Hydraulic capacity

Slope increases the hydraulic capacity of the trench drain because flow velocity is increased. This increase in capacity may result in larger areas being drained, outlets spaced further apart or a narrower and/or shallower trench system being specified that will result in product and installation cost savings.The drawings below highlight the water profile in the trench. The channel and flows are the same in both examples except the lower image has a 1% slope added. Note the difference in flow depth.

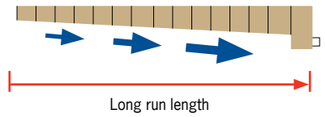


Position of outlet

Trench drains connect to underground pipes and the outlet position can dramatically affect the size and length of the trench drain required.

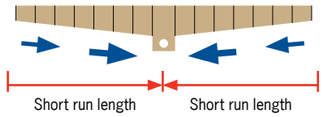
End outlet

With a single end outlet, water may build up along the trench and cause ponding before reaching the outlet.



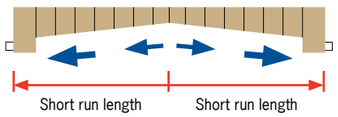
Central outlet – two directions

A central outlet enables a smaller trench drain as the central outlet reduces the build up of water, reducing the risk of ponding.



Double end outlet – two directions

An outlet at either end of the trench run enables a smaller trench drain but requires more outlets and additional pipework.



Size and type of outlet

Designers need to ensure the outlet and pipe infrastructure is not undersized restricting the outflow of the trench drain.

Horizontal end outlet

A pipe is connected horizontally at the end of the trench. This minimises excavation but offers the lowest outlet capacity.

Vertical end outlet

A pipe is connected vertically at the bottom of the trench. This option improves the outlet capacity due to gravity.

In-line pit

The pit is the same width as the trench, but deeper. It offers superior outlet capacity as large pipes can be connected and the increased depth gives increased head of water pressure.

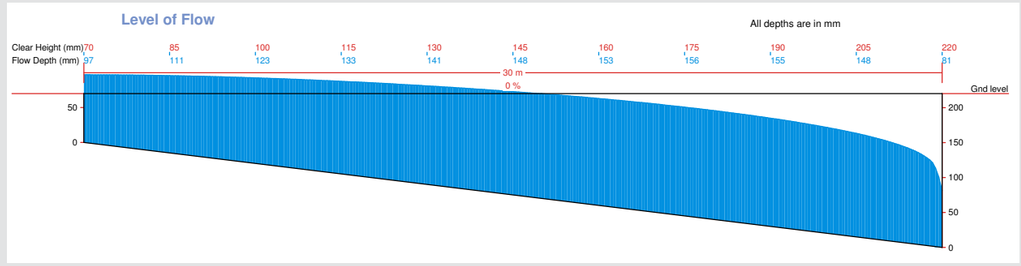
ACO Technical Services – Modelling catchment hydraulics

Temporary ponding refers to a brief flood situation that is acceptable with an undersized trench drain to enable a more cost effective drainage solution. The drain is designed to work effectively under average weather conditions, but will be slightly undersized during heavy storms.

Temporary ponding should only be considered where buildings and property are not in close proximity to the drainage system to minimise risk of damage. It is an ideal option for outer areas such as large car parks and distribution yards. A risk analysis should be carried out when temporary ponding is considered.

In order to produce a ponding analysis map, the following information is required:

- The same information required for the **'Hydro'** program, see page 117.
- Plan of site showing elevations.
- Location of buildings near the drain.



The **'Hydro'** result above indicates that flooding and ponding will occur and the situation requires a re-evaluation of the drainage size (width, depth, run length) or if temporary ponding can be tolerated, a ponding analysis, see below.

Ponding analysis results

The ponding analysis map shows the size and location of the ponding.

Key

1. Run-off scenario.
2. Catchment geometry showing width and depth of temporary ponding.
3. Visual map of worst ponding scenario.
4. Trench drain length an length of temporary ponding.
5. Project notes.

Ponding Analysis

Based on the results from ACO's 'Hydro' hydraulic design program

PROJECT: Resort Facility
Contact: James Smith
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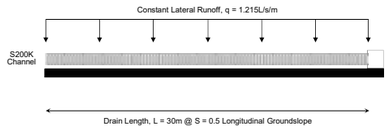
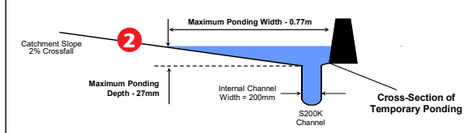
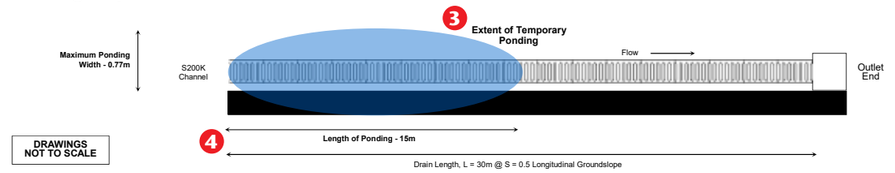
Runoff Scenario 1



Catchment Geometry (Cross Section)



Ponding Map



General Information

Date: 22/01/19 **ACO Contact:** Jarred Taylor **Ref. No:** NSW/19/10

Note: 5
1. The hydraulics of the ACO Drain System were calculated based on the assumed Runoff Scenario above.
2. The extent of ponding, depth and width, were determined from the Catchment Geometry (Cross-Section).

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