Dewatering and the Quarrying Industry

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Objectives

1) *To present a summary of water management within the extractive industry.*

2) *To discuss potential impacts of extraction below the water table and the mitigation options thereof.*

3) *To present tools used to determine the extent of dewatering impacts.*

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Presentation Outline

This presentation is divided into 3 sections:

1) the Irish context,
2) management of water in quarries, and
3) the hydrogeology of dewatering associated with quarrying.

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1. The Extractive Industry in Ireland

- The GSI 2001 'Directory of Active Quarries, Pits and Mines' tallys 415 sites in Ireland (Doyle *et al*., 2001).
- Combined aggregate production from rock quarries and sand & gravel pits is estimated to 135 million tpa.
- The majority of quarries exceed 200,000 tpa and many exceed 500,000 tpa.
- Limestone, various sandstone and volcanics are the main rock types used as aggregates.

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1.1 Characteristics of Irish Geology

- Approximately 50% of Ireland's rock topography is limestone.

- Bedrock strata are indurated but the upper part of the bedrock has been significantly weathered.

- Faulting and fracturing are abundant.

- Bedrock is overlain by Quaternary subsoils. The lithology, thickness and permeability of these are very variable.

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1.2 Characteristics of Irish Hydrogeology

- Rainfall is plentiful and well-distributed throughout the year. A significant amount of the winter recharge is “rejected”.

- Fissure flow predominate. Storage is relatively low but through flow can be quite rapid, particularly near the surface.

- Hydraulic conditions are variable over short distances and flow paths tend to be shallow and short.

- Water table tends to within 10m of the surface although there are a few areas that are notable exceptions.

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1.3 Irish Aquifers

Aquifer Classification	Strata	Flow Regime
Major Aquifer (Regionally Important)	Karst fractured limestones and dolomites	Mainly unconfined strata. Major contribution to baseflow. Large springs. Large flows can be induced
	Sandstones and volcanics	Often confined strata. Limited contribution to baseflow. Few significant springs. Significant flows can be induced
Minor Aquifer (Locally Important)	Small areas karstified / fractured limestones. Sandstones	
	Moderately productive only in local zones.	Little contribution to baseflow. Few springs, many shallow seeps. Relatively small flows can be induced
Aquitard (Poorly productive aquifer)	Shales / mudstones, argillaceous limestones and granites	

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1.3 Irish Aquifers (cont.)

- The Geological Survey of Ireland has collated extensive hydrogeological datasets so that aquifer maps are available nationally.

- Local variations in structure and lithology mean that these maps, although excellent for desk study and site selection, should not be used as a substitute for site investigation.

- Hydrogeological characterisation should be completed on all dewatering assessments.

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Groundwater Discharge from a Regionally Important Aquifer

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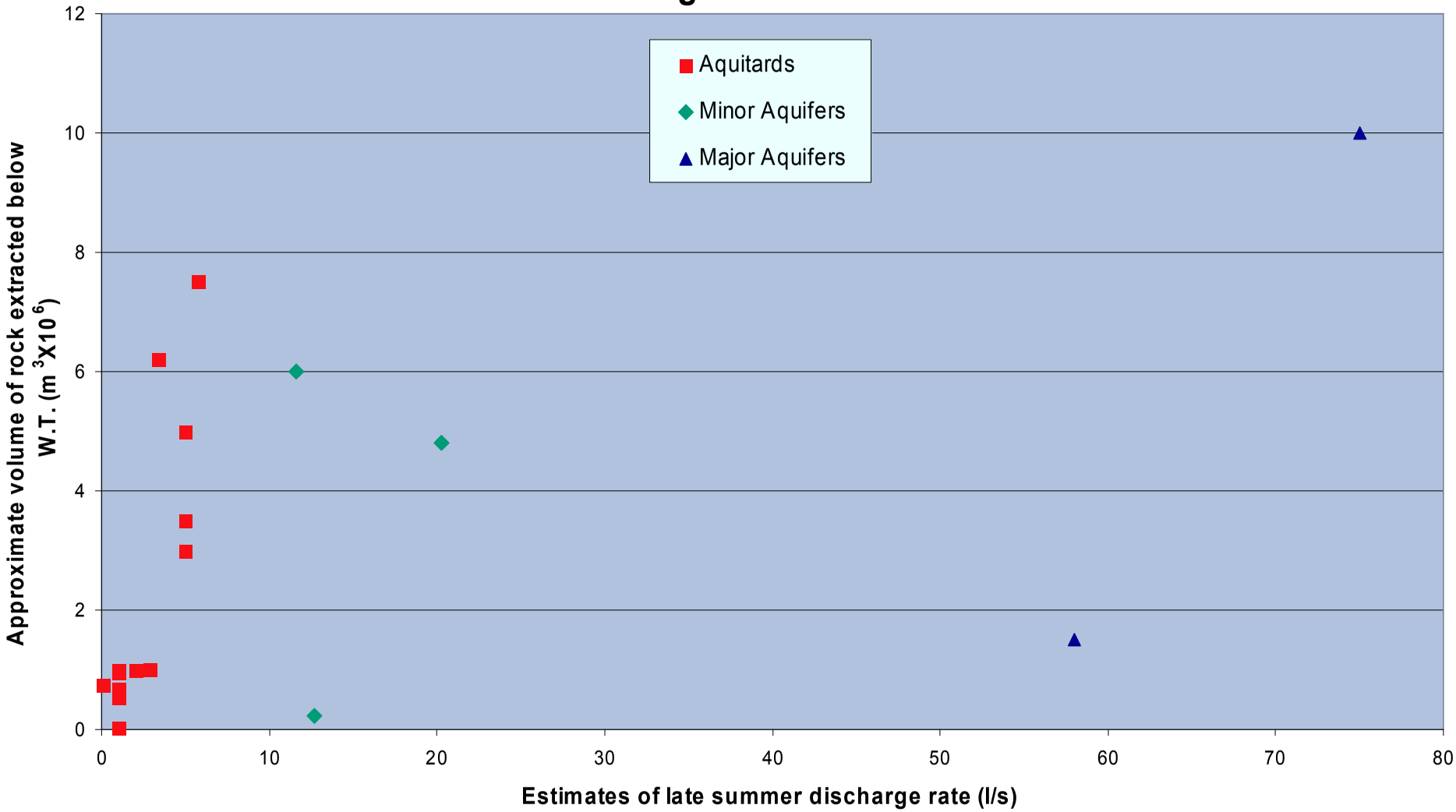
Estimates of groundwater inflows to a number of rock quarries throughout Ireland.



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2. Management of Water in Quarries

Water management falls into 3 catagories:

1) supply of potable and process water,
2) management of rainfall incident with the site, and
3) management of groundwater inflows to excavation

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2.1 Water Supply

- The volumes required for potable water are of the order 5-10m^3/day and can be supplied via mains or private source.
- Process waters are required for aggregate washing and dust suppression measures as well as ancillary facilities such as readymix plant. Volumes required tend to be 300-600m^3/day depending on quarry output.
- The process waters are unlikely to be provided by mains and must be either abstracted from groundwater or recycled from run-off.

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2.2 Water Management

- It is a requirement both from the planning authourity but also for operational efficiency that all run-off from site is controlled.

- Rainfall allowed to run-off must be attenuated to remove fines and contaminents prior to discharge. This is normally achieved using settlement lagoons and hydrocarbon interceptors.

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2.2 Water Management (continued)

- A 25-year rainfall event will equate to 80-100mm rainfall falling over a 48hr period. For a typical medium sized quarry of 20ha this will generate run-off of c.7,000m^3/day.

- The quarry void can be used as storage to retain waters incident with it. However, run-off from yard and process areas tend to be discharged during the event. This can equate to 1,000m^3/day, which must be attenuated.

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Cut off drain to reduce surface water ingress to quarry void

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