Ardee GWB: Summary of Initial Characterisation.

<table>
<thead>
<tr>
<th>Hydrometric Area 06</th>
<th>Associated surface water features</th>
<th>Associated terrestrial ecosystem(s)</th>
<th>Area (km²)</th>
</tr>
</thead>
</table>

Located around Ardee and Nobber (Figure 1), this approximately triangular-shaped GWB is bounded by less productive rocks to the east and west, karst aquifer to the north and a topographic divide to the southwest (Hydrometric Area 07). Elevations generally increase westwards (inland), ranging from c.40 mAOD in the flatter eastern area, to c.120 mAOD in the west, where drumlins are a topographic feature. Surface water generally flows eastwards, to eventually discharge into Dundalk Bay.

**Topography**

**Aquifer categories**
The vast majority (c.98%) of the GWB comprises **LI**: Locally important aquifer which is moderately productive only in local zones, with the remainder categorised as **Lm**: Locally important aquifer which is moderately productive.

**Main aquifer lithologies**
The main rock group in this GWB is the Dinantian Upper Impure Limestones (47.39%). The remaining groups flanking these are also of Dinantian age: Lower Impure Limestones (27.46%), early Sandstones, Shales and Limestones (22.79%) and a small area of Sandstones (2.35%). These are detailed in Table 1.

**Key structures**
Deformation in this part of the county has resulted in these rocks forming part of a syncline feature, and predominantly dipping by 10-40° to a NW. There are a large number of faults throughout the GWB trending NE-SE over the eastern portion of the body and NW-SE over the western area.

**Key properties**
Yields from 12 wells in this GWB range from 12-1636 m³/d, averaging c.350 m³/d. Well yields may be influenced by the high degree of faulting in this body or by their close proximity with the more productive Carrickmacross GWB (e.g. the highest yielding well). The 8 available specific capacity values range from 1.5-38 m³/d/m with an average of 11 m³/d/m. Generally, these rocks are expected to have relatively low transmissivity (<20 m³/d). However a transmissivity of 30 m³/d was estimated for the Nobber PWS*. This higher values may be influenced by faulted zones, especially in the coarser-grained rocks. The specific dry weather flow value is considered to be relatively low (0.4 l/s/km²), although it is higher than the down-gradient flows across less productive rocks (0.1-0.32 l/s/km²). Such values suggest that this aquifer does not make a significant baseflow contribution to streamflow. Storativity is also expected to be low.

Just under half of the 21 available groundwater levels are <6 m below ground level, with the deepest level recorded at c.35 m bgl. The occurrence of deeper flows may be related to the faulting in the GWB. The fluctuation in one available water level record is limited – between 3.2 m and 5.5 m below ground.

*The two Nobber PWS boreholes straddle the Carrickmacross/Ardee GWB boundary. However, due to the dip of the rocks, the Carrickmacross GWB borehole actually abstracts water from the underlying Upper Impure Limestones, which are a continuum of the Ardee GWB.

(Dinantian Aquifer Chapters; Nobber Source Report)

**Thickness**
Most groundwater flux is likely to be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3 m thick, a zone of interconnected fissuring 15-20 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m. Water strikes are noted between 19-45 m bgl in 3 borehole although 2 of these may be influenced by their close proximity with the more productive Carrickmacross GWB.

**Lithologies**
Till covers the majority of this GWB (c.78%), with small proportions of other subsoil types, such as peat (8%), alluvium (7%) and sand/gravel (7%).

**Thickness**
The available outcrop borehole data indicate that the subsoil is generally thicker (>3 m thick) throughout the GWB, with a few sporadic areas of outcrop/thin subsoil (<3 m thick). The thickest subsoil (>10 m) appears to be in the central region of the body.

**% area aquifer near surface**
[Information will be added at a later date]

**Vulnerability**
From the Meath GWPS, the vulnerability is predominantly Moderate around the centre of the GWB and High to the south. Smaller zones of Low vulnerability occur along the western and eastern boundary, where Low permeability material has been mapped. The areas of Extreme vulnerability are limited due to the generally thicker subsoil. This pattern is likely to continue into Louth.

**Recharge mechanisms**
Diffuse recharge occurs via rainfall percolating through the subsoil and rock outcrops. Due to the low permeability of some subsoil deposits (e.g. thicker till) and the aquifers, a high proportion of the effective rainfall will quickly discharge to the streams in the GWB. In addition, steeper slopes in the drumlin areas will promote surface runoff. The relatively high stream density is likely to be influenced by both the lower permeability aquifers and subsoil.
Groundwater & Surface water interactions

Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is relatively low.

Conceptual model

- Western, northern and eastern boundaries are differing aquifer types. The southwest boundary is marked by a topographic divide (Hydrometric Area 07). Drumlins occur in the central and western area although the topography flattens out the east. Surface water flows eastwards to eventually discharge into Dundalk Bay.
- The GWB is composed primarily of low transmissivity rocks. Most of the groundwater flux is likely to be in the uppermost part of the aquifer comprising: a broken and weathered zone typically less than 3m thick; a zone of interconnected fissuring typically less than 20 m, and a possible zone of isolated fissuring typically less than 150m.
- Recharge occurs diffusely through the subsoil and rock outcrops, although can be limited by thicker peat or till, and the low permeability bedrock. Therefore, most of the effective rainfall is not expected to recharge the aquifers.
- Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to nearby streams and small springs. Water strikes deeper than the estimated interconnected fissure zone are limited suggesting that relatively shallow groundwater flow is dominant. Groundwater flow directions are expected to follow topography – overall in a easterly direction.
- A proportion of the Nobber PWS source protection area occurs in this GWB.

Hydrochemical Signature

National classification: Dinantian Rocks (excluding Sandstones)
- Calcareous. Generally Ca-HCO₃ signature.
- Alkalinity (mg/l as CaCO₃): range of 10-990; mean of 283 (2454 data points)
- Total Hardness (mg/l): range of 10-1940; mean of 339 (2163 data points)
- Conductivity (µS/cm): range of 76-2999; mean of 691 (2663 data points)

Groundwater Flow Paths

In the absence of inter-granular permeability, groundwater flow is expected to be concentrated in upper fractured and weathered zones and in the vicinity of fault zones. Available groundwater levels are mainly less than 15-20 m below ground level (c.50% <6 mbgl). Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to nearby streams and small springs. Water strikes deeper than the estimated interconnected fissure zone are limited suggesting that relatively shallow groundwater flow is dominant. Groundwater flow directions are expected to follow topography – overall in a easterly direction.

Information Sources


Disclaimer

Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae.
Figure 1. Location and Boundaries of GWB.

Table 1. List of Rock units in Ardee GWB

<table>
<thead>
<tr>
<th>Rock Unit Name</th>
<th>Code</th>
<th>Description</th>
<th>Rock Unit Group</th>
<th>Aquifer Class.</th>
<th>% Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fingal Group (undiff.)</td>
<td>FNG</td>
<td>Dark limestone, shale and micrite</td>
<td>Dinantian Upper Impure Limestones</td>
<td>Ll</td>
<td>47.39%</td>
</tr>
<tr>
<td>Cruicetown Group</td>
<td>CRT</td>
<td>Argillaceous bioclastic limestone</td>
<td>Dinantian Lower Impure Limestones</td>
<td>Ll</td>
<td>27.46%</td>
</tr>
<tr>
<td>Navan Group (undiff.)</td>
<td>NAV</td>
<td>Limestone, mudstone and sandstone</td>
<td>Dinantian (early) Sandstones, Shales and Limestones</td>
<td>Ll</td>
<td>22.79%</td>
</tr>
<tr>
<td>Sandstone</td>
<td>sd</td>
<td>Rockfield Sdst. Mbr in undif. Navan Gp</td>
<td>Dinantian Sandstones</td>
<td>Lm</td>
<td>2.35%</td>
</tr>
</tbody>
</table>

Figure 2: Groundwater hydrographs (EPA Groundwater Level Monitoring)

Variation in water level in the Ardee GWB
EPA Monitoring Point MEA149 Nobber Observation Well