GROUNDWATER AVAILABILITY IN THE HAWKESBURY / NEPEAN CATCHMENT.

The following discussion of groundwater characteristics is based on information contained in the "Groundwater in New South Wales" 1984 report and knowledge from experienced hydrogeologists.

Unconsolidated Sediments

The unconsolidated sediments of the Hawkesbury /Nepean Catchment are mostly confined to the alluvium of the Penrith - Windsor area. These can be divided into Quaternary alluvial aquifers and Tertiary alluvial aquifers. The Quaternary alluvial aquifers are generally high yielding. The sediments here range to about 20 metres in thickness. Yields of 10 to 25 litres per second (L/s) and occasionally as high as 50 L/s are obtained from wells usually not exceeding 12 metres in depth. Groundwater yields are poorer around Windsor. There are also localised areas of alluvium in some of the extreme upstream tributaries such as in the Capertree Valley, where irrigation supplies are obtained, and in the Mulwaree Ponds, near Goulburn, but the latter are low yielding.

The Tertiary alluvial aquifers are found around Windsor and have poor groundwater yields and poor groundwater quality. The reason for this is that they are more consolidated than the Quaternary alluvial aquifers and contain a high clay content.

Porous Rocks

The porous rock aquifers of the Hawkesbury / Nepean Catchment occur primarily in the Sydney Sedimentary Basin. The sedimentary rocks of sandstone, sandy shale, and shale in these basins have only been slightly disturbed by earth movements and as such often the original intergranular porosity is still present usually associated with bedding / layering characteristics. Secondary porosity in the form of joints, particularly along the bedding planes, is also developed in some strata. Where the Mesozoic rocks are underlain by the older Permian strata, forming part of the basin structure, secondary porosity is usually dominant.

Sydney Basin

The Sydney Basin has a roughly triangular shape, extending from Batemans Bay in the south coast to the Goulburn and Hunter Rivers in the north. It is traversed by the Hawkesbury and Shoalhaven Rivers. Its basal formations are of Permian age (230 to 280 million years ago) and comprise both marine and coal measure sequences as well as some volcanic rocks.

The Permian rocks outcrop around the margins of the Basin. Groundwater occurs in them, both in porous zones and fracture systems, but because of their depositional environment it is mostly brackish and sometimes too salty for stock. As a result of this salinity, the baseflow of streams draining these rocks tends to markedly increase in salinity in drought periods; the quality of groundwater in alluvium flanked by Permian rocks may also be adversely affected. Bores usually obtain water of stock quality at depths between 30 and 100 metres, and yields are mostly between 0.25 and 2 L/s.

Overlying the Permian formations, and occupying the centre of the Basin, are strata of Triassic age (180 to 230 million years ago). These are sub-divided into the Narrabeen Group, the Hawkesbury Sandstone, and the Wianamatta Group, the latter being the youngest. The Narrabeen Group outcrops mainly in the northern half of the Basin. Bores 40 to 100 metres deep in these strata near the Gosford area usually yield groundwater of household and garden quality. Yields are mostly low, in the range of 0.2 to 2 L/s.

The Hawkesbury Sandstone, which occurs extensively in the Hawkesbury / Nepean Catchment, is the most favourable of the porous rocks in the Sydney Basin. It forms most of the deeply - eroded plateau area around Sydney, and in these areas its groundwater is mainly in fracture systems and bedding associated structures. If not overlain by Wiannamatta shales, the groundwater is usually of low salinity, though iron content is a common problem. Bore yields tend to be low, between 0.1 and 2 L/s.

The uppermost of the Triassic rocks, the Wiannamatta Group, mainly occurs in the Cumberland Plain, west and southwest of Sydney, and also often capping ridges of Hawkesbury Sandstone around Sydney. It has poor groundwater potential, the water usually being brackish to saline, particularly in the low relief areas of western Sydney. Where it caps Hawkesbury Sandstone, it commonly adversely affects the salinity of the water in the sandstone. In marginal sloping areas, the water in the Wiannamatta Group may be suitable for stock, and occasionally other uses. Yields of bores are mostly low, between 0.1 and 1 L/s.

In both the Permian and Triassic rocks, where structural and topographic conditions are favourable, artesian flows have sometimes been obtained in the Sydney Basin.

Fractured Rocks

Fractured rock aquifers occupy much of the western and southern regions of the Hawkesbury /Nepean Catchment. They are generally considered to be basement rocks of the Central and Southern Tablelands underlying the Sydney Basin. These rocks form high relief, having been uplifted in the late Tertiary time. Groundwater usage from these aquifers is generally moderate, and is usually obtained to supplement surface water supplies. For the most part it is of sufficiently low salinity to be used in homes as well as for stock.

About half the area is underlain by granite and although this commonly means hard drilling, bores on topographically favourable sites usually yield between 0.2 and 1.5 L/s. Bores are mostly between 20 to 75 metres in depth.

Most of the remainder of the zone is underlain by a considerable variety of metamorphic rocks such as slate, phyllite, schist, quartzite, and altered volcanics, Bores in these rocks mostly yield between 0.1 to 1 L/s, and occasionally up to 3 L/s, but in some areas it is difficult to obtain useful supplies. Boring in the Yass region, just outside the southwestern boundary of the Hawkesbury / Nepean Catchment, has shown that good results can be obtained by drilling even in relatively elevated areas. In the metamorphic rocks, bore depths are usually within the range of 15 to 75 metres.

Basalt cappings occur in some areas. They are generally favourable for bores and also often give rise to useful springs. The smaller the extent of basalts and the higher their relief, the more yields of bores and springs are likely to decrease in dry seasons. Bore depths vary considerably, from 10 to 75 metres depending on the area and the topography.

Potential for Land Salinisation

There is the potential for land salinisation to occur on the lower lying areas of the Hawkesbury / Nepean Catchment. Land salinisation occurs when salty groundwaters rise to or near the ground surface. The rise of groundwaters is caused by the modification of native vegetation by activities such as clearing, grazing, or by cropping to vegetation that uses much less water than the natural vegetation. This results in a more significant amount of surface water recharge to the groundwater. As the water table rises due to excessive recharge, it dissolves and accumulates naturally occurring salts in the soil and brings them towards the surface where the salt is concentrated by soil moisture evaporation. This concentration causes devegetation of the land of all but the most salt resistant plants.

It is recommended that a Dryland Salinity Hazard Map be produced for the Hawkesbury / Nepean Catchment. These maps show areas that have the potential to be affected by land salinisation as well as those that already have been.

Potential Acid Sulfate Soils

Coastal areas such as the lower reaches of the Hawkesbury / Nepean River and the associated areas contain vast amounts of potential and actual acid sulfate soils due to their close relationship with marine environments.

Acid sulfate soils are acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulphides, mainly pyrite. When drainage or excavation brings oxygen into these previously water logged soils (potential acid sulfate soils), the pyrite is oxidised to sulfuric acid. Should the production of acid exceed the neutralising capacity of the soil so that the pH falls below 4, these soils are known as actual acid sulfate soils.

Potential acid sulfate soils are waterlogged soils rich in pyrite that have not been oxidised. Any disturbance which admits oxygen will lead to the development of actual acid sulfate soil layers. Potential acid sulfate soils are completely innocuous to the environment if kept under water (Soil Conservation Service of NSW, 1995).

Acid sulfate soil risk maps have been produced for the coastal and inland areas (up to Penrith) of the Hawkesbury River by the Soil Conservation Service of NSW. These maps show there is high potential for acid sulfate soil development within the soils associated with alluvial flats and river banks of the Hawkesbury / Nepean River and its tributaries. The occurrence of these potential acid sulfate soils means that certain groundwaters that have been classed favourably on the availability map could be destroyed by the formation of actual acid sulfate soils by lowering of the watertable through, for example, pumping from bores or construction of surface water diversions.

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