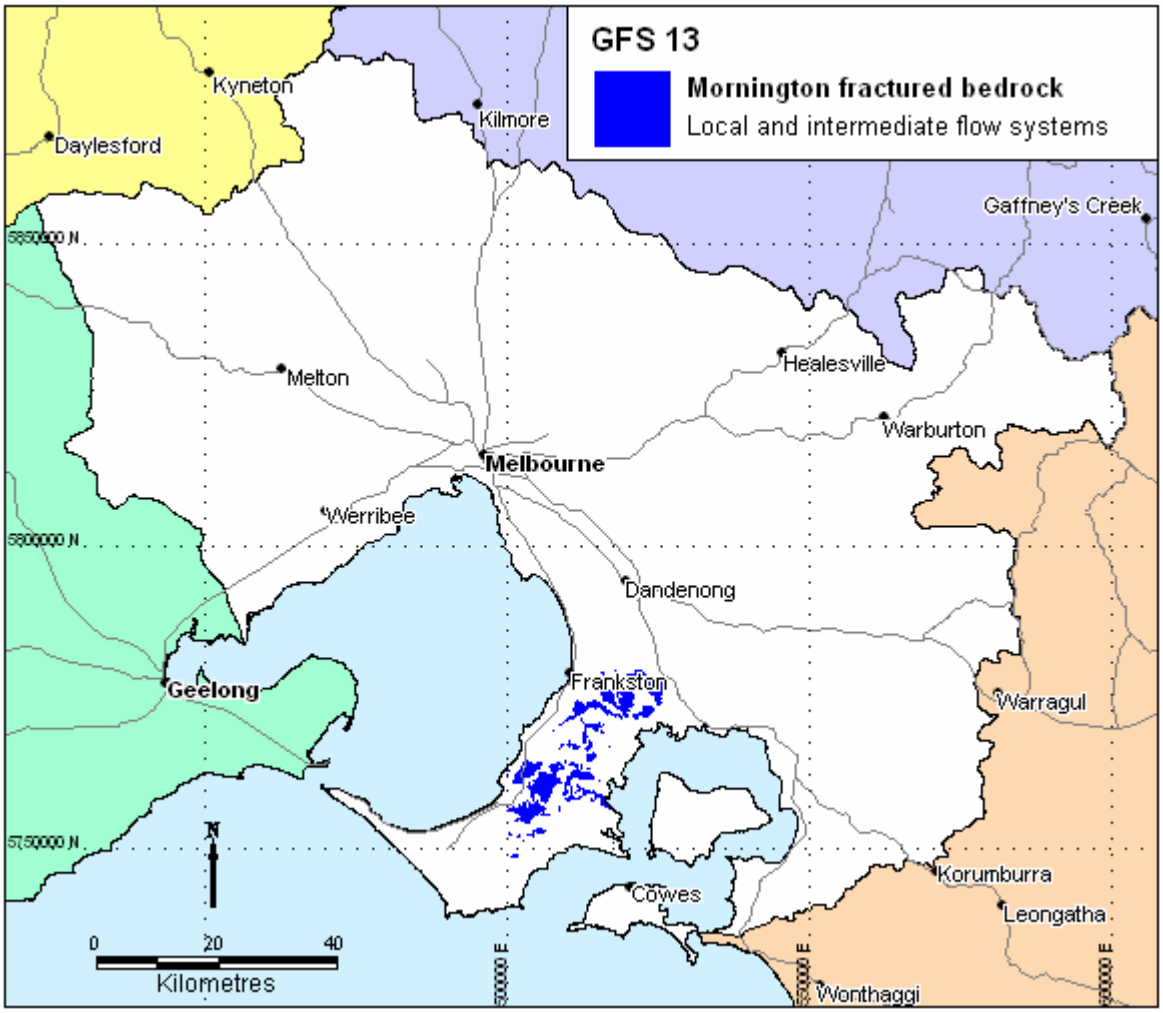
Local and intermediate flow systems of the Mornington fractured bedrock

Region: South central PPWP CMA (Mornington Peninsula)

Type areas: Bittern, Devon Meadows, Moorooduc South

Brief description: The underlying bedrock of the Mornington Peninsula comprises Ordovician and Silurian age sedimentary rocks (~ 480 – 420 Ma). Groundwater moves through the fractures in these sandstones and mudstones in local and possibly intermediate systems. The rock underlies the Brighton Group sediments (GFS 10) over most of the central Mornington Peninsula.



Problem statement: Small areas of salinity associated with this GFS have been mapped in the Devon Meadows, Langwarrin - Cranbourne South, and the Mount Martha – Safety Beach – Red Hill areas. In other areas, salinity in the Brighton Group sediments (GFS 10) and the Quaternary sediment (GFS 1) occur very close to the boundary with the bedrock. The salinity is probably associated with the altered hydrology following the massive changes in land use over the past century or more.

Landscape attributes

Geology: Ordovician and Silurian marine sediments: mudstones and sandstones (Ol, Ou, S).

Topography: Low hills and undulating plains.

Land Systems:

South Victorian Uplands

3.3 Moderate Ridge – Mornington Peninsula

Regolith: Highly weathered to completely weathered sandstones and mudstones.

Annual rainfall: 750 mm to 1000 mm

Dominant mid-1800s vegetation type: Forest, Scrub and Woodland

Current dominant land uses: Urban development, grazing, water supply catchment (Devilbend Reservoir), conservation area.

Mapping method: Outcrop geology

Salinity (S1) along a drainage line adjacent to the Nepean Highway, Mount Martha

Hydrogeology

Aquifer type (porosity): Fractured rock and saprolite (secondary porosity)

Aquifer type (conditions): Unconfined and semi-confined

Hydraulic Conductivity (lateral permeability): Highly variable. The saprolite varies from approximately 10^{-5} m/d to 10^{-1} m/d and the rock varies from 10^{-5} m/d to 1 m/d

Aquifer Transmissivity: Highly variable in the low to moderate range. Estimated to be generally less than 50 m^2/d.

Aquifer Storativity: Variable. Estimated to be less than 0.03 for saprolite and 0.02 to 0.05 for the fractured rock.

Hydraulic gradient: Estimated to be low in intermediate systems and locally moderate in local systems.

Flow length: Generally <15 km for intermediate systems and <5 km for local systems.

Catchment size: Small (~<500 Ha) for local systems and moderate (>1000 Ha) for intermediate systems.

Recharge estimate: Unknown. Probably 40 mm to 50 mm annually.

Temporal distribution of recharge: Seasonal (winter and spring), with more recharge in wetter years.

Spatial distribution of recharge: Catchment wide but varies with the depth of regolith, slope and wet areas in the landscape. Where covered by the Brighton Group sediments, continuous recharge would occur.

Aquifer uses: Minor use, mainly for stock water.

Salinity

Groundwater salinity (TDS): Generally in the range of 1000 mg/L to 8000 mg/L

Salt store: Moderate to high.

Salinity occurrence: Some within this GFS, but may contribute to salinity in the adjacent units (GFS 1 & GFS 12).

Soil Salinity Rating: S1 to S3.

Salt export: Both baseflow to streams and wash-off from surface.

Salt impacts: Both on-site and off-site.

Risk

Soil salinity hazard: Low

Water salinity hazard: Moderate

Assets at risk: Streams and rivers, engineering and urban infrastructure, conservation areas, agricultural land.

Responsiveness to land management: Largely unknown, but thought to be moderate for intermediate flow systems and high for local flow systems.

Management Options

High rainfall (in excess of 750 mm/yr), urbanisation and the relatively isolated instances of salinity will likely result in an emphasis on discharge treatment rather than significant recharge reduction. Salinity adjacent to the margins of this GFS appears more likely to be associated with groundwater flows terminating in neighbouring GFSs (GFS1 and GFS10).

Dryland agriculture options for managing salinity in local and intermediate flows in the **Mornington bedrock**.

Salinity focus: numerous occurrences across Mornington Peninsula

Options	Treatments	Comments
Biological Management of recharge	Perennial pastures	Low to moderate impact– rainfall too high for significant impact. Offers some level of run-off and waterlogging control.
	Crop management	Low impact– cropping is generally absent in these landscapes
	Trees/woody vegetation	Moderate impact– in local systems where they can be incorporated into existing land uses. Plantations and belts will reduce gross recharge, run-off, waterlogging
Engineering intervention	Surface drainage	Low impact– disposal issues
	Groundwater pumping	Low impact– low hydraulic conductivities make pumping expensive. Disposal issues
Productive uses of saline land and water	Salt tolerant pastures	High impact– to stabilise and aesthetically improve salt affected areas
	Halophytic vegetation	Low impact– climate and environs not likely to be conducive
	Saline aquaculture	Low impact– discharge sites only minor in extent
	Salt harvesting	Low impact– groundwater is not sufficiently saline
	Others	See OPUS database (NDSP)

Management implications given projected land use

On the Mornington Peninsula there are projected increases in urbanisation and intensive horticultural industries (e.g. vineyards) that will have significant implications for landscape hydrology. Under these circumstances, and given the nature of the salinity processes in the GFS, planning may preclude such developments in hazardous areas, and institute specific engineering standards for infrastructure to limit degradation potential.