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Memo

To	Kerry Watson (OGL NZ)	Date	4 February 2025
From	Chris Simpson	**Project No**	WWLA1280
Copy	Polly Smith (Mitchell Daysh)		
Subject	**Wharekirauponga Shallow and Deep Groundwater Movement**		

1. Background

During recent consultation with iwi groups there was some discussion about shallow and deep groundwater systems and how the technical interpretation fits with the cultural interpretation of waters. While the conversation was initiated through the WNP project, this discussion is not specific to the Wharekirauponga catchment and is more broadly applicable to other locations in New Zealand.

There are effectively three realms of groundwater that exist at different depths being:

- Shallow groundwater system
- Deep groundwater system
- Basement groundwater system

Each of these are discussed in detail below.

2. Shallow Groundwater System

The shallow groundwater system exists in the near surface, it is recharged directly from rainfall and the movement of groundwater is largely determined by the topographic expression of the surrounds. Groundwater discharges as springs and stream baseflow at topographic lows and inflection points. This is illustrated on the attached regional conceptual hydrogeology schematic. As that figure shows, the movement and discharge of shallow groundwater is at a catchment scale and entirely constrained to being within the land-based watershed.

3. Deep Groundwater System

The deep groundwater system is not constrained to the land-based water shed with discharges occurring both on land and in the submarine environment. Groundwater flow in the deep system occurs at a regional scale rather than a catchment scale and is less influenced by localized topographic divides. Deep groundwater has longer flow paths and is therefore typically older than shallow groundwaters. Deep groundwater flow is driven by recharge from the shallow groundwater system and regional throughflow.

4. Basement Groundwater system

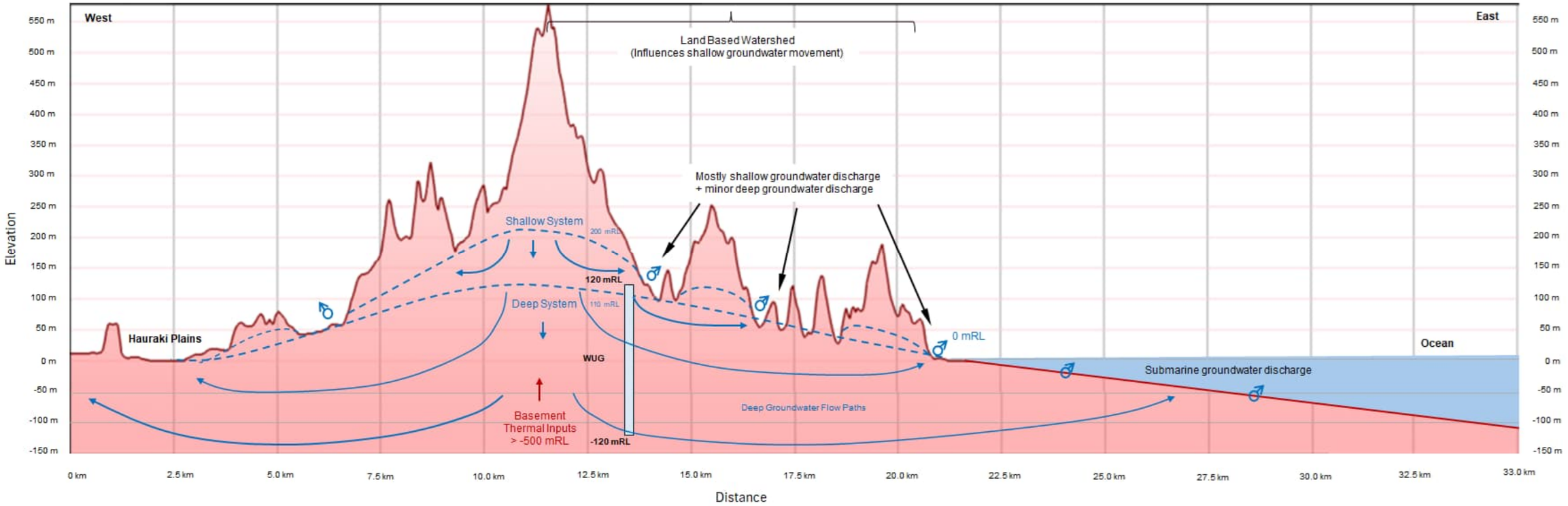
The basement rocks have limited groundwater movement due to the low permeability. The groundwater present typically moves along fractured zones and faults and commonly flows upwards via convective circulation as the water is heated by the earth's natural geothermal gradient. The flow paths in the basement groundwater are in the order of 2-4 km deep and are much older than the other water types. Where discharges occur at the surface thermal springs are

often present and the water chemistry often reflects the water's interaction with rock deep beneath the surface.

5. Applicability to Wharekirauponga

The relative elevation of the proposed Wharekirauponga underground mine (WUG) is shown on the attached schematic. The top level of the proposed mine is approximately level with the upper elevation of the deep groundwater system. In summary, the underground mining will not extend to an elevation that significantly intercepts shallow groundwater flow paths. Rather, the mining will intercept some flow paths within the deep groundwater system. While a small portion of those flow paths would normally discharge within the land-based watershed, the majority of those intercepted by the proposed mine would be expected to discharge at the coast and in the submarine environment.

In effect, the groundwater taken during mining will not result in any significant loss of shallow or deep groundwater inputs within the Wharekirauponga catchment. Most of the deep groundwater intercepted as a result of the mine dewatering would otherwise be lost as coastal or offshore discharge.



Conceptual Regional Hydrogeologic Groundwater Movement