Department of Water
Government of Western Australia

ISSN 1835-1573

Rural Water Note RWN 06

Development of Sandplain Seeps for Water Supplies ▫ September 2007

Sandplain seeps may be considered as land degradation hazards, but they are also potential water supplies for agricultural use.

Seeps have been developed into good quality water supplies where water supplies are difficult to obtain.

With appropriate investigation and development techniques, water supplies could be developed from up to 20 per cent of the larger sandplain seeps in the northern and north-eastern Wheatbelt.

Supplies of up to 6,000 DSE (27kL/day) are possible – although most average around 2,000 DSE (9kL/day). In many cases, the water quality is good and often less than 250mS/m, ie fit for human consumption.

Identification and preliminary assessment of potential sites

Ground assessment

It is essential to:

- establish the size of the seep
- how long it has been evident and whether the seepage area is growing
- the size of the likely catchment area
- soil types and their distribution.

The interaction of these features determines whether further investigations are warranted to develop the seep as a water supply.

Seepage area

A large seepage area, more than 0.5ha, indicates a relatively large quantity of water is moving downslope and there may be some potential for development. If the seepage area is small (less than 0.5ha), development potential may be limited because there is not a large enough volume of water moving down the slope.

The importance of the size of the seepage area depends on how long the seep has been noticeable and the rate of expansion.

To determine the reliability and longer-term quality of the supply for livestock or domestic use, it important to determine the sustainable extraction rate by drilling and pump testing.

A seepage that has been discharging for several years and has not changed in size, indicates a relatively stable condition.

When the seepage area is increasing, the seep is in an unstable condition. Seeps in a stable condition with a seepage area less than 0.5ha are unlikely to be suitable for development.

Where the seepage area is more than 0.5ha and the seep is in a stable condition there may be potential for development, depending on the soil type, soil distribution and soil profile.

If seepage is a recent development (within the last year or two) and the seep is in an unstable condition, further investigations are warranted.

The suitability of such a site for development will then depend on the soil types and distribution within the catchment area and the soil profile in the area likely to be developed.

Soil types and distribution

Sandplain seeps with potential for development into water supplies usually consist of deep yellow sandplain, bordered on three sides by a high run-off soil such as heavy red clays or shallow gravel over hardpan. The sandplain is surrounded by high run-off soils and generally contracts to a narrow 'throat' just above where the seepage area is evident.

Catchment area

The area of high infiltration catchment for sandplain seeps with good development potential is usually in excess of 60ha and may be as large of 300ha. Seeps with catchments of less than 60ha of high infiltration sand are usually too small to warrant extensive development. However, development on a small scale can still yield useful supplies of water for livestock.

Aerial photographs, digital elevation models (DEM) and soil landscape mapping

Aerial photographs viewed in stereo are useful to give an overall picture. Changes in soil type, ridgelines and depressions can be identified and the seep catchment area determined. Areas most likely to be carrying most of the water can also be identified.

Overlaying DEMs with landscape and soil maps also assists in identifying suitable areas for investigation on the farm or catchment.

The flow of water downslope in a sandplain seep is both broad scale and confined. Water moves in a broad, average manner downslope. but within this general movement there are areas of higher transmissivity. The areas of higher transmissivity, usually sand seams, are targeted for drilling when detailed investigation begins. Aerial photographs and available mapping can be extremely useful for identifying these potential sites.

Drilling

If preliminary investigations indicate a site is worthy of further investigation, use drilling to assess the soil profile and determine the likely quantity of water available for use as a water supply.

Process

Sand seams identified using aerial photography and mapping should be drilled first. Drill across the suspected seam. Start drilling 100 to 150m upslope of the seepage area and at intervals of 30 to 50m across the seam and up and down slope to find the deepest point.

If no sand seam is readily identifiable, base your drilling on surface features. Then target depressions or slight gullies for initial drilling in the same manner as a sand seam.

Profile

The profile of the seep is usually sand to two to four metres, followed by a gravel layer 0.5 to two metres thick resting on an impermeable layer such as ferricrete or silcrete (Figure 1). The perched water table forms on the impermeable layer. As you move downslope towards the seepage area, the amount of water above the impermeable layer increases and the quality decreases.

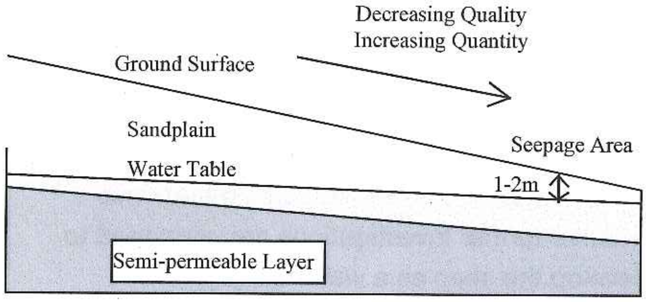

Figure 1. Traditional view of the structure of sandplain seeps.

However, sandplain seeps used as water supplies do not usually fit this description. The maximum depth of aquifer is frequently located up to 150m upslope of the seepage area. The depth of the aquifer upslope and downslope of this location is frequently less than at this point (see Figure 2). When bores are installed into the seep, this location invariably gives the maximum flow rate.

This is contrary to the generally accepted behaviour of flow rates from a sandplain seep. Water quality behaviour is the same as for the generally accepted model of a sandplain seep.

The impermeable layer that is normally considered the bottom of the traditional sandplain seep may only be a thin confining or semi-confining layer as little as 0.2m thick. If you continue drilling through this layer, you will often find a fractured hardpan layer ranging from one to four metres thick (as illustrated in Figure 2). Frequently, this fractured hardpan layer is where the bulk of the water is encountered and determines the appropriate method of development.

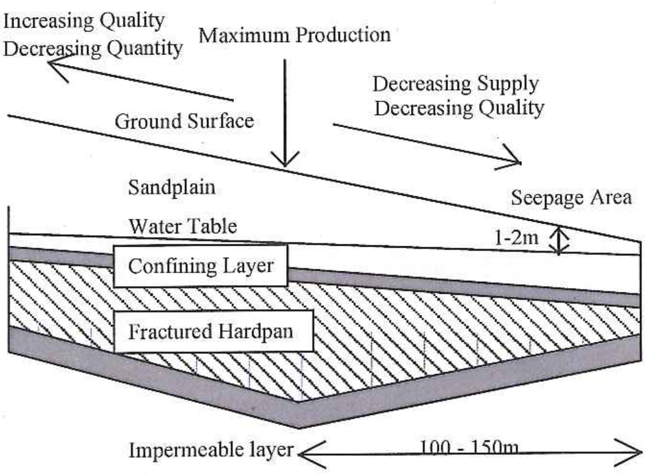

Figure 2. Profile of sandplain seeps with maximum potential for development into water supplies.

Drilling across slope usually results in a profile similar to that illustrated in Figure 3. A deep section of aquifer is readily identifiable from the drill logs.

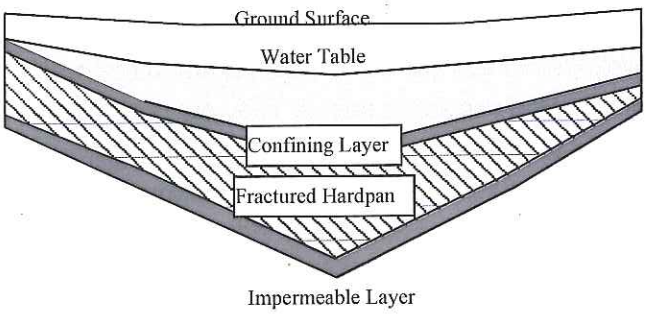

Figure 3. Cross-section across the face of a sandplain seep developed for a water supply.

Development

There are several options you can use to develop sandplain seeps as water supplies. These include using a bore or series of bores, well-liners, well-liners with feeder drains, or excavating a soak.

The method of development will depend on the type of profile encountered and the thickness of the various layers.

Bores

Bores are probably the simplest method of development and are the preferred option where the total depth is more than six metres. However, they are limited to a relatively small number of seeps.

For a single bore to be considered a good option, there needs to be minimum of three metres of fractured hardpan. If the fractured hardpan is less than three metres thick, the thickness of water bearing material and available drawdown are frequently insufficient for a bore. Sites have been developed using multiple bores where the fractured hardpan is thinner than three metres but not usually less than one metre.

Sites have been equipped using solar pumps with pumping rates of up to 9kL/day over summer.

Department of Water
Government of Western Australia

Well-liners

Well-liners have been the most common method of developing sandplain seeps. They are particularly suited to sites with little or no fractured hardpan, but with a thick layer of gravel. The conductivity of the gravel is not as high as that of the fractured hardpan but the large storage capacity of the well-liners makes development an option for low demand systems (less than 9kL per day).

Well-liners with feeder drains

To enhance the production from the well-liners, you can include feeder drains. Excavate the drains are to the bottom of the gravel layer on either side of the well-liners and fill them with slotted pipe and gravel. Anecdotal evidence suggests production may be increased by up to a factor of five by using this technique.

Soaks

Soaks, or excavations intercepting the water table, are commonly used. However, soaks must be located where the water is close to the surface and hence closer to the seepage area. As a result, the water quality tends to be lower. By their nature, soaks have a surface open to the atmosphere. The relatively large surface area results in high evaporation per unit of water stored compared with the evaporation from well-liners. Consequently, salts tend to concentrate reasonably quickly if the initial quality of the water is too low.

Further information

George, RJ (1992). *Groundwater processes, sandplain seeps and interactions with regional aquifer systems in South-Western Australia.* Journal of Hydrology, 134:247–271.

Horwood, WN (1994). *Identification and Development of Sandplain Seeps as Water Supplies in the Wheatbelt of Western Australia.* International Hydrology and Water Resources Conference, Adelaide, November 1994.

Contact details

Rural Water Planning
Department of Water
www.water.wa.gov.au
ruralwater@water.wa.gov.au
Tel: 1800 780 300 (freecall)