Improving water runoff into dams

Reduced water runoff into dam storages has been experienced by many Barossa Ranges farmers in recent years. Various strategies have been used across South Australia to increase runoff into dams. This fact sheets outlines these strategies.

Understanding runoff into storages

Runoff events in the Barossa Ranges occur during seasons where catchments become saturated or from one large rainfall event. Figure 1 demonstrates how run-off increases as annual rainfall increases past 500mm for the top of the Torrens catchment at Mt Pleasant. Steeper rockier catchments will follow a similar pattern but with a lower threshold where saturation is reached and runoff commences. One-off rainfall events can also lead to runoff however these can also be associated with flash flooding and damage to infrastructure.

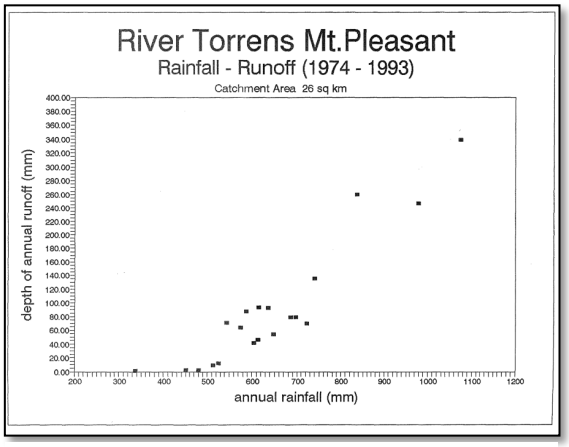

Figure 1. Runoff amount by annual rainfall at Mt Pleasant

Capturing and increasing runoff for dam storage

Water runoff can be calculated by the area of runoff multiplied by a runoff coefficient (from Table 1) using the following formula:

Runoff (ML) = (Rainfall (mm) x Catchment Area (ha) x Runoff Coefficient (%/100) /100

For example: 500mm rainfall, 1 ha catchment, 20% coefficient = (500mm x 1ha x 20/100)/100 = 1ML

Table 1. Runoff yield assuming 500mm rainfall by catchment size and runoff coefficient (in ML)

Catchment area (ha)	*Runoff coefficient – 500mm annual rainfall		
	20%	40%	95%
0.1	0.1	0.2	0.48
0.4	0.4	0.8	1.9
1.0	1.0	2.0	4.75
5.0	5.0	10.0	24.0

**Runoff coefficient is determined by slope, surface condition and surface hardness.*

Various strategies may be implemented to increase runoff and consequently dam capture, including:

1. Tracks and roads
2. Houses, sheds, and built-up areas
3. Diversion drains or banks
4. Graded and roaded catchments and scrapes
5. Plastic sheeted catchments

1. Tracks and roads

Historically roads (both public and farm roads) have been used as catchments to collect and divert water into dams, which can be quite significant if it enters the storage area quickly. For example, assuming 500mm rainfall, a track runoff of 400m x 2.5m wide (0.1ha) and 40% runoff, will catch approximately 0.2ML of water (Table 1).

2. Houses, sheds, and built-up areas

Capture from infrastructure can be quite significant given higher rates of runoff, including up to 95% from roofs (Figure 2).

Figure 2. Farm sheds and built-up areas can provide significant runoff

3. Diversion drains or banks

Diversion areas can be used to increase the catchment area for an existing dam by collecting runoff water from areas which would normally bypass the dam. Slope of around 0.8 to 1.0% is required in the banks to prevent erosion. While diversion drains or banks can be used to extend the catchment area, they are sometimes positioned high in the catchment, which avoids potential saline seepage.

4. Graded and roaded catchments and scrapes

Historically graded and roaded catchments and scrapes have been used in some regions of South Australia to provide water for stock and domestic supplies. These rely on exposing and rolling less permeable clay layers to enhance runoff. The feasibility of these options is determined by the presence of suitable soils and the cost of earthworks. It is recommended that sub-soil clay needs to be within around 20cm of the surface to be cost effective.
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An example of a scraped/graded catchment for a farm water supply is shown near Mangalo (Figure 3). Topsoil is scraped away to enable better runoff along the clay subsoils. Some ground cover is necessary on erodible soils, but controlling weeds helps to optimise runoff.

Figure 3. Farm scrape near Mangalo, Eyre Peninsula

Roaded catchments (Figure 4) are specifically designed to capture runoff from a dedicated area. They are usually constructed with a grader where earth banks and channels are built to collect, concentrate, and generate flows. South Australian case studies have shown that runoff from roaded catchments capture about 20-25% of rainfall, with a higher proportion in wetter seasons. Roaded catchments:

- Require a soil type that can be compacted to reduce permeability (usually a proportion of clay)
- A design that enables water to run off at velocities that do not erode the soil (i.e., surveying is required to ensure fall of banks and channels are not too steep)
- A structure at the base to intercept silt and direct runoff into a storage facility (dam or tank)
- Regular maintenance to ensure that banks and channels remain sound and have not eroded or filled in; and there is no plant growth on them (i.e., herbicide control required)
- Preferably are fenced off to stop stock walking or camping on them

Figure 4. Roaded catchment at the Nuriootpa Research Centre (1988)

5. Plastic sheeted catchments

Sheeted catchments have soil surfaces covered by an impervious material, such as plastic used to line dams. Sheeted (and roaded) catchments are usually built on sites with some slope so that water runs off. Welded plastic sheets provide maximum runoff and good quality water. The volume of water that can be generated from an impermeable surface is far greater than a semi-permeable surface, particularly during low intensity rainfall. Sheeted catchments:

- Require material that will last for long periods of time as is exposed to sunlight and weather
- Needs to be laid on an even surface without any underlying sticks, stones or gravel that can puncture or abrade sheeting
- Require a sump at the foot of the catchment to collect and direct runoff into a dam or tank.
- Require fencing to keep wildlife off the plastic sheet to prevent tearing or puncturing it
- Require weighting to keep the plastic sheeting flat on the ground and to minimise movement and abrasion. Used tyres can be effective unless slope is too steep as tyres can be washed downslope
- Will shed at least 95% of any rainfall
- Key costs: Plastic sheeting, laying of sheeting, earthworks (bed levelling and construction of sump)

Plastic lined catchments have been constructed in various areas of South Australia, including the Coorong and Eyre Peninsula (Figure 5).

Source: Eyre Peninsula Natural Resources Management Board

Figure 5. Sheeted catchment at Wharminda, Eyre Peninsula

Legal aspects

Important water resources in South Australia are protected and managed by being 'prescribed' under the Landscape South Australia Act 2019. This enables sustainable management of the water resource to provide security for all water users, including the environment. Once a water resource is prescribed, all people who take water from that prescribed resource need a licence or approval from the Minister for Environment and Water. Smaller broadacre stock and domestic uses are often exempt in some catchments/water resource areas although taking water for intensive stock production such as feedlots, piggeries, chicken farms etc require licensing requirements (contact your local SA Landscape Board for further information). Water for firefighting is also currently exempt.

There are several prescribed water resources areas in this region including: Barossa, Marne River and Saunders Creek, Western Mount Lofty Ranges and Eastern Mount Lofty Ranges. The Landscape Boards are the relevant authority for surface and watercourse water. For the Northern and Yorke Landscape region visit the Boards webpage, 'Water Affecting Activities' https://www.landscape.sa.gov.au/ny/water/water-affecting-activities.

References

- Farm dams – A guide to siting, design, construction and management on Eyre Peninsula (Eyre Peninsula Natural Natural Resource Management Board, 2011). https://www.sheepconnectsa.com.au/downloads/farm-dams-fact.pdf
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- Water harvesting and lined catchments (Coorong District Council website). https://www.coorong.sa.gov.au/council-services/coorong-tatiara-local-action-plan/water-security/water-harvesting-and-lined-catchments

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