

Irrigation

feature...

WATER MATTERS with Valmont

Whole farm water balance – the key to better management

■ By Jim Purcell, Aquatech Consulting, Narrabri

A SUCCESSFUL and profitable irrigation enterprise is one that manages precious water at both the crop root zone level (soil moisture monitoring and irrigation scheduling) and at the whole farm level (how much water do I have, what are my losses and therefore how much do I have left for crop production?).

Irrigation scheduling and soil moisture monitoring have good adoption in the cotton industry but the whole farm water

KEY POINTS...

- Measure to Manage
- Not only does water need to be managed in the crop root zone but also at the whole farm level.
- Water losses can best be identified and then reduced by completing a whole farm water balance.
- Measuring equipment and easy to use software packages are now commercially available to complete seasonal and even daily whole farm water balances.
- Water balance and improved water use efficiency can be done in stages starting with the very easy.

Important considerations

- Key measurement is needed to complete any water balance.
- Make a start, don't stress about super accuracy. Do the easy things first and work through at your own pace.
- Do not chase accuracy for accuracy's sake. A good estimate is better than nothing and is a good start.

management area is lagging. The tools for whole farm water balance have progressed greatly in the past 10 years. The use of these commercial tools and the water management consulting services has steadily grown as irrigators strive to improve their profitability with less water.

Below is a step by step process to better manage water at the whole farm level. In summary:

Step 1

- Measure and record the basics;
- Complete a simple seasonal whole farm water balance;
- Review the results;
- Fix the easy stuff; and,
- Repeat until happy.

Step 2

You could stop there if you are happy with your WUE, or you can continue to improve measurement and accuracy and routinely complete a whole farm water balance. Why not benchmark against your neighbours?

Step 1 – Seasonal whole farm water balance

Measurement

Measurement is essential for any good management and water management is no different. To achieve good measurement start with the following:

- Ensure all water meters are installed correctly and measuring accurately. Check them with another meter.
- Survey all storages to establish accurate depth to volume to surface area characteristics. Ensure all tailwater and buffer storages are included. Storage surveys can now be done with water in the storages! (call Aquatech Consulting 02 6792 1265).
- Fit storage meters in all storages. Gauge boards are a start



Measurement is essential for good management.

The Leader in Precision Irrigation.



**CENTRE PIVOT and
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but don't really do enough. It is very difficult to measure the volume of a stormwater harvesting event with gauge boards unless the gauge boards are read just before and just after each event and recorded. Aquatech Storage Meters have been developed over the past 10 years. They read and log water level, storage volume and water surface area at any required interval (normally 30 minutes but can be changed). These meters have been approved for use by NSW Water. This not only allows water volume to be accurately monitored in real time but also provides flow rates into or out of the storage. A storage meter also records the water surface area which allows the calculation of water volume loss from seepage and evaporation. Telemetry now means your data is conveniently available by internet (read your storage volume, depth and surface area while on a holiday overseas!).

- Take strategic measurements of soil seepage characteristics and storage and channel evaporation characteristics. This allows calculation of the seepage and evaporation losses

in each storage, channel and drain. Irrigate Seepage and Evaporation Meters can be hired from Aquatech Consulting. These meters measure both seepage and evaporation characteristics. It is not necessary to measure every storage or every channel and drain to get meaningful results. Start with estimates based on soil type and then calculate the actual losses from the storage meters.

Record keeping

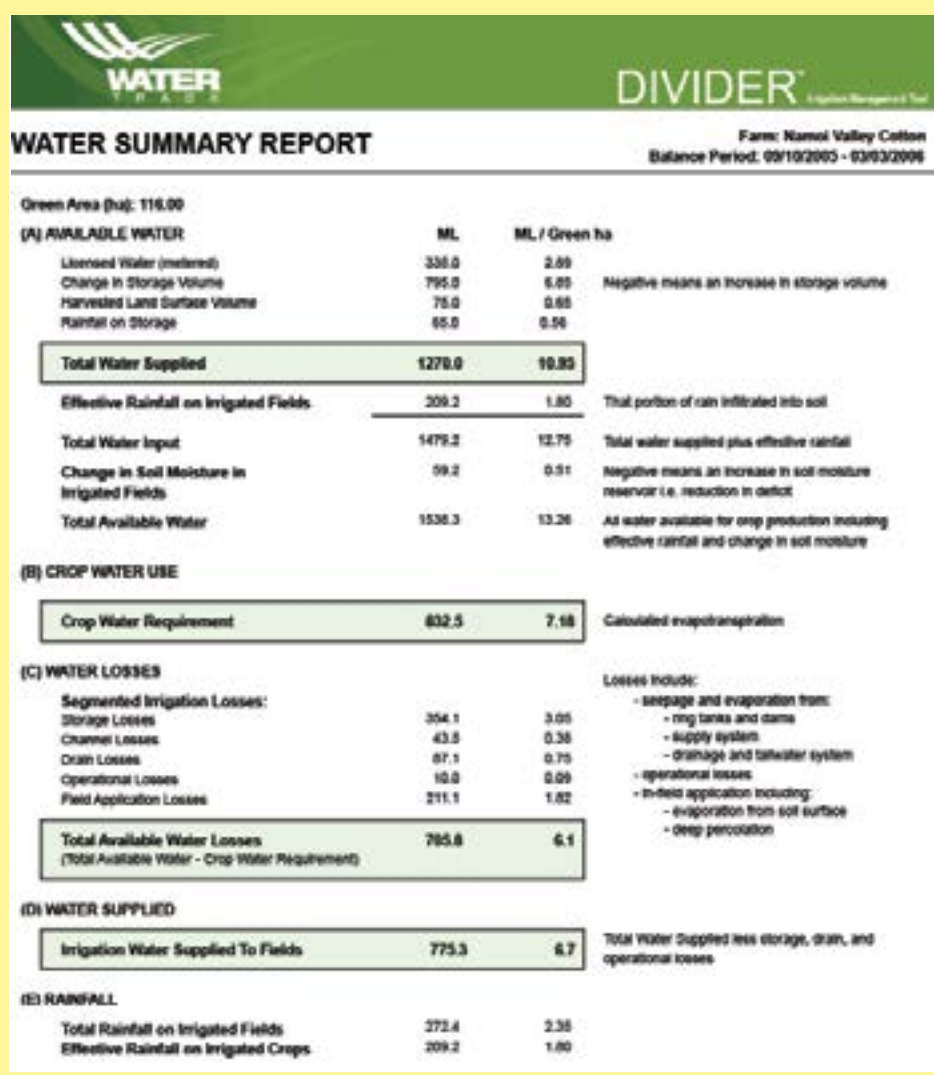
The next step is basic record keeping. The aim is to provide enough information to be able to complete a seasonal water balance. Enough basic information is required to calculate accurately how much water the crop actually needed during the particular season and how much water was made available to grow that crop.

In simple terms, the total measured available water, less the calculated actual crop water requirements for the season, equals the water lost to production. It should always be remembered that it is impossible to produce an irrigated crop without some losses. The real question is "How much lost water can be saved and used to increase production and profit?"

To establish this, it is necessary to be able to split up the total water lost to production into components:

- Storages losses (wet-up, seepage and evaporation);
 - Channel system losses;
 - Drainage system losses;
 - In-field losses; and,
 - Operational losses (stuff-ups resulting in water lost out of the system).
- The records needed for a seasonal whole farm water balance include:
- Meter readings from all inflows – (river, scheme channel and/or bores);
 - Storage volumes at the start of the season;
 - Storage volumes at the end of the season;
 - Floodplain harvested water volumes;
 - Rainfall runoff captured from your fields and farm;
 - Rainfall on fields;
 - Field number or name and area;
 - Crop yield;
 - Reference evapotranspiration for each day during season (automatically provided in WaterTrack);
 - Field soil type (menus provided);
 - Field soil moisture deficits (mm) at the start of the season and end of season (estimated or from soil probes if available);
 - Crop emergence date and end date (when crop stops transpiring eg. cotton defoliation); and,
 - Dates of each field irrigation.
- While these records or similar are currently noted in some form or another by most irrigators, Aquatech Consulting provides record sheets and/or spreadsheets for easy record keeping.

FIGURE 1:



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It is impossible to produce an irrigated crop without some losses.

WaterTrack Divider (www.watertrack.com.au) and the whole farm water balance is completed for the season. See Figure 1.

The seepage and evaporation characteristics for channels, drains and storages can be calculated from nearby storage meters or estimated initially from soil types (menus provided).

Calculation of actual crop water requirements is based on daily reference evapotranspiration (Eto) values for your particular farm and season and crop factors. Eto can be sourced from a weather station on the farm or normally from the Bureau of Meteorology SILO database. If WaterTrack is used for the whole farm water balance, the program automatically obtains and updates daily Eto from the Bureau of Meteorology. All that is required is the farm latitude and longitude from Google Earth.

Review the results

All irrigation farms will lose water – it is inevitable. The question is “Where are the losses and are they OK?”

WaterTrack Divider will complete a simple seasonal water balance and provide water use efficiency indices required for myBMP and water management plans.

Step 2 – Improve measurement and routinely complete whole farm water balance

WaterTrack Divider is a low cost and easy way to continue to complete a whole farm water balance. The first couple of times may rely on estimates of seepage and evaporation, for instance, but these characteristics can be calculated directly from the data from the Aquatech Storage Meters. If the farm is already setup in WaterTrack, each subsequent year is easy. Whole farm water balance is ideal for benchmarking WUE performance with your neighbours.

Where to go

Consultants like Aquatech Consulting and others can run your whole farm water balance as a service and advise whether the losses are typical, good or bad and can then advise on the type of works and cost to reduce losses. WaterTrack Divider even provides a basic economic calculator. This can determine if the

proposed capital works are economic for the water savings and how long the pay back period is from the extra production.

Aquatech Consulting currently supports other consultants to provide the equipment, software and support to their clients. Most growers prefer this work done by their consultant as a service but others can be trained to do it themselves if required.

ON-FARM WATER STORAGE: DO YOU KNOW HOW MUCH YOUR STORAGE REALLY HOLDS?

Having an accurate measurement of the water in your storage is a critical tool for effective farm management.

“When you get towards the end of the season, you really need to know whether you’ve got enough water to finish each field.” That’s the message from Jim Purcell of Aquatech Consulting, who features in a new You Tube video, ‘On-farm storages: surveying to determine accurate volumes’ (<https://www.youtube.com/watch?v=sBEI-1jWRXI>).

However many irrigators don’t have an accurate measurement of the volume of water in their farm storage, and often storages are not built accurately to the original ‘design’, making estimates unreliable. In Jim’s experience, actual volumes frequently differ by up to 20 per cent compared to the original design. A build-up of silt or slumping of dam walls can also reduce storage dimensions.

The video and an accompanying fact sheet available on the CottonInfo website have been produced by the North West NSW Irrigation Australia Limited (NWIAL) Regional Committee in collaboration with Sustaining the Basin Irrigated Farm Modernisation (STBIFM), CottonInfo, and North West Local Land Services.

The video and fact sheet give practical advice on how to measure storage volume using a GPS survey, and explain why an accurate depth-to-volume and surface area measurement is so important.

“Not only can you measure what you’ve got left to use, you can predict what the evaporation losses will be till the end of the season. That’s water in the dam that you can’t use,” Jim says in the video.

A GPS survey can be used to measure volume, whether the storage is full or empty, while installing a gauge board or, even better, an electronic storage meter, enables you to know how much water remains in storage at any point in the season.

The key message is that you can’t manage what you don’t measure!

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