Innovations of Irrigation technology in South Africa

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INTRODUCTION
IRRIGATION HISTORY
IRRIGATION EFFICIENCY
WATER ADMINISTRATIVE SYSTEM
CONCLUSION
ANNUAL RAINFALL

857 mm
WORLD

10000 mm
HAWAII

470 mm
SOUTH AFRICA

80% in 5 MONTHS

Extensive Water Resource Development

4395 dams on Dam Safety Register
4556 on WSAM
155 DWA owned
359 municipal owned
2598 water supply related (includes irrigation & excludes mines, floods etc.)
2828 for domestic supply
406 for domestic supply
Others (irrigation, waste, flood, pollution control)

DWS WR schemes

• 236 WR schemes
• Incl. transfer schemes

Legend

- Multi-use
- Irrigation only
The purpose of an irrigation system is to apply the desired amount of water, at the correct application rate and uniformly to the whole field, at the right time, with the least amount of non-beneficial water consumption (losses), and as economically as possible.

Irrigation studies and research over many years on the techniques of flood-, sprinkler-, mechanized- and micro-irrigation contributed tremendously to the knowledge base of applying irrigation methods correctly.
IRRIGATION HISTORY

According to history, South African irrigation dates back to Jan van Riebeeck, who in 1652, by being commissioned to provide provisions for passing ships, discovered that the harsh unpredictable South African weather called for more reliable means of supplying adequate water to cultivate plant matter. The first recorded history however goes back to 1875.

Agricultural dams and canals were laboriously hand built, with irrigation comprising of labour intensive bucket and flood methods, followed by the subsequent progression of pumps, pipes and hoses till the 1940’s.

In 1933 Orton Englehart invents the first impact sprinkler to water his orange groves in Glendora, California.

In the late 1940’s, after World War 2, rotating impact sprinklers with portable aluminum and light gauge steel pipes found its way to world wide markets, including the South African agricultural market.
In the meantime agricultural irrigation developments rapidly expanded world wide, and novel products such as drip irrigation, micro sprayers and mechanized irrigation systems also found their way to South Africa.

In 1959, a new technology of drip irrigation was introduced in Israel by Simcha Blass and his son Yeshayahu where they developed and patented the first practical surface drip irrigation emitter.

The Micro-sprayer concept was developed in South Africa to contain the dust on mine heaps.

From here much more advanced developments took place to use it as a method to apply water to mainly agricultural crops.

First centre pivot was invented by a farmer, Mr Zyback from Nebraska in 1949 and the first marketable product was available in 1953.
Cultivated Land Worldwide

- 1,535 Mha – Total world Agriculture Area
- 305 Mha – Currently under Irrigation

20% of total agricultural land area supplies about 40% of the world’s food

- 14 Mha - Drip irrigated

Source: ICID – CIID

World-wide Coverage of Irrigation

Total irrigated area = 305 Mha

- Sprinkler, 38 Mha; 12.5%
- Micro irrigation, 14 Mha; 4.6%
- Flood irrigation, 253 Mha; 82.9%

Efficient use of irrigation water:

Ensuring that most of the water taken from the source reach the intended target – the crop – by minimising losses along the way.

A water balance approach
Water balance framework

Withdrawal for irrigation use:
Water abstracted from streams, groundwater or storage

Storage change:
Flow to or from aquifers, in-system tanks, reservoirs, etc. With no significant change in water quality between the in and out flows

Consumed fraction
Non-consumed fraction

Beneficial consumption
Non-beneficial consumption

Beneficial water
Water that is used as intended – eg. crop transpiration

Non-beneficial water
Water evaporated or transpired for purposes other than the intended – eg. evaporation from dams, riparian vegetation.

Recoverable fraction
Non-recoverable fraction

Recoverable water
Water that can be captured and re-used – eg. drainage water from irrigation fields

Non-recoverable water
Water that is lost to further use – eg. flows to saline groundwater aquifers, flow to the sea.

We have to find ways of reducing the non-beneficial consumptive and non-recoverable fractions of water use within the areas that we control.

Optimising water use

Innovative research funded by the WRC has led to the development and application of the WAS.
An integrated water distribution management system for Irrigation schemes & River systems

that delivers water on demand

**WAS** uses a SQL database that can be deployed in a single or multi-user environment

**Benefits of WAS**

- Improves scheme management
- Improves financial management
- Improves productivity
- Saves water!

**Data flow** (per scheme)

Internet

Scheme

Farm
Data flow (per scheme)

Internet

Scheme → WAS database (scheme 1) → Data capture

Farm

Once off:
- User information
- Addresses
- List of rotatable areas (LRA)
- Distribution sheets
- Canal network
- Dams

Yearly:
- Scheduled areas
- Water quotas & tariffs
- Household & Livestock pipes
- Crops & planted areas

Monthly:
- Measured data
- Meter readings

Weekly:
- Water orders
- Water transfers
- Dam levels
WAS deployment sites
(total area = 182 000 ha)

www.wateradmin.co.za

Water use
Scheme
Irrigation
National

Reports & Graphs
(Regional & National)

Water Administration System (WAS)

The WAS is an integrated information management system for irrigation schemes that deliver water to farmers through canal networks and laterals and is used for water distribution management and for the calculation of canal and lateral operating procedures for a given downstream demand. WAS improves service delivery to farmers and society:

- 100%
- 100%
- 100%

This website is an information and support platform for all irrigation schemes that are using the WAS.

Irrigation Schemes

- Scheme
- Scheme
- Scheme
- Scheme

Lower Olifants River WMA

- Scheme
- Scheme
- Scheme
- Scheme

Water use efficiency reports

- Water use efficiency reports
- Water use efficiency reports
- Water use efficiency reports
- Water use efficiency reports
WAS makes use of nine modules which are fully integrated, making it possible to cross-reference relevant data and information.
Admin

Water order
- Measured data
- Water release

Crop water use

Water order
- Measured data
- Water release

Crop water use

Accounts

Water order
- Measured data
- Water release
- Crop water use

Accounts

Report
Admin

Water order
Measured data
Water release
Crop water use
Accounts
Report
Dam information

Admin

Water order
Measured data
Water release
Crop water use
Accounts
Report
Dam information
Bulk SMS

User lookup

Temporary water transfers
Water orders & Meter readings

Water orders (Day & Night)

Water orders (Flow rate & duration)

Meter readings
### Water use information

<table>
<thead>
<tr>
<th>Measured data</th>
<th>Measured data</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
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</table>

### Measuring stations

<table>
<thead>
<tr>
<th>Cello logger</th>
<th>Zednet Internet platform</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
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</table>
Discharge tables

Water balance sheets

Water use summary report

Distribution sheets
Crop water use module
Calculates . . .
• the total volume needed for the whole scheme
• for a user specified period

Calculate release for a given demand

Water Use Efficiency Accounting Reports

Dam information
Monthly Invoices & Statements
(e-mail invoices in pdf format)

Integrated bulk SMS module

Letters
CONCLUSION

Irrigated agriculture is practised successfully in South-Africa and is based on excellent research, innovation and manufacturing with designers which carefully select, plan and design effective irrigation systems and farmers that manage their systems effectively.

Count every drop because every drop counts.