Optimisation of water measurement and management in the Vaalharts Irrigation Scheme
Introduction

• The importance of water measurement

• Overview of the Vaalharts Irrigation Scheme

• Water Administration System

• Zednet

• Savings achieved
Why do we need to measure?

- Know where water is used and how much is used
  
  “om te meet is om te weet”

- Establish if and where there are physical and/or operational losses in the system

- Maintain a balance between the water supply and the water demand

- Ensure an equitable water supply to different user sectors

- Billing purposes among different user sectors

- Improved planning and water management

- Government regulation
SAVE
Example

24 Rivers canal to IB in the Berg River Reach requires 24.5 million m³/a @ 1.52 c/m³

If 1 million m³/a water can be saved it is equal to a monetary value of R 15 200

The approved 2017/18 water charges for raw water from Voëlvlei Dam to the CoCT = 62.05 c/m³

If 1 million m³/a water can be saved it is equal to a monetary value of R 620 500

For this same volume of water a revenue of R 4.56M can be generated
### Water tariffs

<table>
<thead>
<tr>
<th>Water (domestic full) steps (1kl = 1 000 litres)</th>
<th>2017/18 Level 4 tariffs Rands (incl. VAT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 (0 &lt; 6kl)</td>
<td>R4,56 (free for indigent households) per kl</td>
</tr>
<tr>
<td>Step 2 (&gt;6 &lt; 10,5kl)</td>
<td>R17,75 per kl</td>
</tr>
<tr>
<td>Step 3 (&gt;10,5 &lt; 20kl)</td>
<td>R25,97 per kl</td>
</tr>
<tr>
<td>Step 4 (&gt;20 &lt; 35kl)</td>
<td>R43,69 per kl</td>
</tr>
<tr>
<td>Step 5 (&gt;35 &lt; 50kl)</td>
<td>R113,99 per kl</td>
</tr>
<tr>
<td>Step 6 (&gt;50kl)</td>
<td>R302,24 per kl</td>
</tr>
</tbody>
</table>

For indigent HH using up to 6 m³/month free of charge (72 m³/a) an additional 13 888 HH can be supplied with water.
Vaalharts Irrigation Scheme

We are here
Vaalharts Irrigation Scheme

9 140 m³/ha/annum

29 181 ha

266.7 million m³/annum
Vaalharts Irrigation Scheme
Vaalharts Irrigation Scheme
Crops produced in the Vaalharts Irrigation Scheme

![Barley, Wheat, Oats, Lucerne (1yr), Lucerne (>1yr), Cotton, Ground nuts, Maize, Pecans (1-5yrs), Pecans (6-15yrs), Other]

Figure 2
Relative crop distribution of the Vaalharts Irrigation Scheme for 2015 as a percentage of the total cultivated area (Adapted from Erasmus, 2015)
An integrated water distribution management system for Irrigation schemes & River systems

**ULTIMATE AIM**

Optimise irrigation water management and minimise management-related distribution losses in irrigation canals
Why implement WAS?

- Improves scheme management
- Improves financial management
- Improves productivity
- Saves water!
WAS interface
How does it work?

Admin

- Water order
- Measured Data
- Water Release
- Crop water use
- Accounts
- Report
- Dam information
- Bulk sms
What is Zednet?

Zednet is a web based software service designed to collect, process and display information related to water resource and water supply systems.

It is aimed at assisting both Water Authorities and Water Users to monitor river and canal flows and abstractions, dam levels, borehole levels, rainfall and pump status (on/off).
How it works

Data **loggers** installed in the field **upload** data to Zednet via cellular telephone (**GSM**) networks.

Data can also be **uploaded** to and **downloaded** from Zednet directly via its **web based interfaces**.
With Zednet’s web based interfaces you can view, manage and export your up-to-date data.

You can access your data from anywhere in the world, without having to install anything. All you need is an internet connection.
Flow and pressure monitoring

- **Flow Profile**
  - Site: Industry 2
  - Data type: Flow
  - Reference: MNF/Avg: 9%
  - Notes:
  - Latest Import: 2013-12-10 00:00...
  - Value: 176,000 m³/h
  - Meter reading: 8,000 m³/h
  - Min: 160,000 m³/h
  - Max: 180,000 m³/h
  - Sum: 93,486 m³/h
  - Avg: 93,486 m³/h

- **Supply Pressure**
  - Latest Import: 2013-12-10 00:00...
  - Value: 44,000 m
  - Min: 25,000 m
  - Max: 68,000 m
  - Sum: 45,961 m
  - Avg: 45,961 m
Water quality monitoring

```
<table>
<thead>
<tr>
<th>Name</th>
<th>Latest import</th>
<th>Value</th>
<th>Meter reading</th>
<th>Min</th>
<th>Max</th>
<th>Sum</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHLOROPHYLL A</td>
<td>2015-06-22 16:00</td>
<td>1.470 RPV</td>
<td>0.800 RPV</td>
<td>2.960 RPV</td>
<td>1.465 RPV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISSOLVED OXYGEN %</td>
<td>2015-06-22 16:00</td>
<td>112.100 %</td>
<td>98.600 %</td>
<td>121.000 %</td>
<td>107.842 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>2015-06-22 16:00</td>
<td>8.220 pH</td>
<td>8.150 pH</td>
<td>8.300 pH</td>
<td>8.219 pH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Rainfall and river level monitoring

Channel data

Start date: 2014-02-06 00:00:00  End date: 2014-02-09 00:00:00

Rainfall and River Level

Raw values, at device native intervals, between 2014-02-06 00:00:00 and 2014-02-09 00:00:00

Generated on 2014-07-23 @ 10:37:45 by ZEDNET, Copyright
River Level converted to River Flow

Channel data

start date: 2014-02-01 00:00:00
end date: 2014-03-01 00:00:00

River Level
Flow

Raw values, at device native intervals, between 2014-02-01 00:00:00 and 2014-03-01 00:00:00

Generated on 2014-07-23 @ 10:28:55 by ZEDNET, Copyright
Dam Levels

Average values, at daily intervals, between 2015-01-20 and 2016-01-20

Generated on 2016-01-20 @ 09:10 by ZEDNET, Copyright
**Canal Level, Flow and Volume**

**Average values, at daily intervals, between 2017-07-22 and 2017-07-29**

<table>
<thead>
<tr>
<th>Name</th>
<th>Latest import</th>
<th>Value</th>
<th>Meter reading</th>
<th>Min</th>
<th>Max</th>
<th>Sum</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>2017-07-29 18:00:00</td>
<td>2.536 m³/s</td>
<td>1.283 m³/s</td>
<td>2.574 m³/s</td>
<td></td>
<td></td>
<td>1.738 m³/s</td>
</tr>
<tr>
<td>Volume</td>
<td>2017-07-29 18:00:00</td>
<td>1825.92 m³</td>
<td>923.76 m³</td>
<td>1853.28 m³</td>
<td>1047551.04 m³</td>
<td>150215.908 m³/day</td>
<td></td>
</tr>
<tr>
<td>Upstream Water Level</td>
<td>2017-07-29 18:00:00</td>
<td>0.420 m</td>
<td>0.270 m</td>
<td>0.424 m</td>
<td></td>
<td></td>
<td>0.327 m</td>
</tr>
</tbody>
</table>
Monitoring Pump status
(On/Off)

Pump Status Demo: Status

Raw values, at device native intervals, between 2014-05-05 07:19 and 2014-05-12 07:19
### Geographic map interface

**Zednet**  SA: Live data map

<table>
<thead>
<tr>
<th>Channel</th>
<th>Type</th>
<th>Value</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Water Level</td>
<td>River level</td>
<td>0.427</td>
<td>2017-07-29 14:00</td>
</tr>
<tr>
<td>Stuwel Kortloos lesion</td>
<td>Canal Level</td>
<td>0</td>
<td>2015-12-01 08:00</td>
</tr>
<tr>
<td>CSH001</td>
<td>River level</td>
<td>0.473</td>
<td>2016-08-24 15:00</td>
</tr>
<tr>
<td>CSH002</td>
<td>Dam level</td>
<td>6.409</td>
<td>2016-08-25 09:00</td>
</tr>
<tr>
<td>CSH003</td>
<td>Dam level</td>
<td>12.178</td>
<td>2016-08-23 14:12</td>
</tr>
<tr>
<td>Site: Dam 7 Ultrasat</td>
<td>Canal Level</td>
<td>0.254</td>
<td>2017-07-29 16:00</td>
</tr>
<tr>
<td>Site: Invoci Dam 6</td>
<td>Canal Level</td>
<td>0.384</td>
<td>2017-07-28 16:00</td>
</tr>
<tr>
<td>Site: Invoci Dam 7</td>
<td>Canal Level</td>
<td>0.391</td>
<td>2017-07-29 16:00</td>
</tr>
<tr>
<td>Hooge</td>
<td>Canal Level</td>
<td>0.466</td>
<td>2017-07-29 16:00</td>
</tr>
<tr>
<td>Site: KB Ultrasat</td>
<td>Canal Level</td>
<td>0</td>
<td>2017-07-29 16:00</td>
</tr>
<tr>
<td>KU Kortloos lesion</td>
<td>Canal Level</td>
<td>0.557</td>
<td>2017-07-25 16:00</td>
</tr>
<tr>
<td>Noord Kanaal Crump</td>
<td>Canal Level</td>
<td>0</td>
<td>2017-07-25 16:00</td>
</tr>
</tbody>
</table>

**Channel Data Table**

<table>
<thead>
<tr>
<th>Channel</th>
<th>Last Import</th>
<th>Value</th>
<th>Min</th>
<th>Max</th>
<th>Avg</th>
<th>Sum ^</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Water Level</td>
<td>Sat 2017-07-23 14:00:00</td>
<td>0.407</td>
<td>0.217</td>
<td>0.849</td>
<td>0.67</td>
<td>0.00</td>
<td>m</td>
</tr>
<tr>
<td>Stuwel Kortloos lesion</td>
<td>Tue 2015-12-01 00:00:00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>m</td>
</tr>
</tbody>
</table>

^ min, max, avg and sum are for latest 7 days' data available.

Main features

- Web based interfaces
- Dynamic charts and graphs
- Raw data grids and data summaries
- Data import and export
- Data backups
- Alarms
- Automated reporting
- Interactive geographic maps
- Administration of users, hardware assets and geographic data
Benefits of using Zednet

• Track river and canal levels and flows.
• Track dam and borehole levels
• Track rainfall
• Track Pump Status (On/Off)
• Receive alarms
• Potential reduction in pumping cost or spillage – when an alarm is received when a dam is full.
• Reduce cost of meter reading and managing data.
• Track water usage to verify water usage estimates and corresponding water usage charges.
• Access to a dedicated technical support team.
C9H018 A01
(Right canal Vaalharts weir)

**Average values, at hourly intervals, between 2017-05-29 00:00 and 2017-07-29 07:16**
Noord kanaal Tvv10 Crump

- **Noord Kanaal Tvv10 Crump:** Hoogte
- **Noord Kanaal Crump:** Noord Kanaal Crump

**Legend:**
- Red line: Noord Kanaal Tvv10 Crump
- Yellow line: Noord Kanaal Crump

**Graph Details:**
- X-axis: Dates from 9th to 16th July
- Y-axis: Canal Level (m)

**Annotations:**
- Lag
- Downstream use

**Note:**
- Raw values, between 2017-07-09 00:00 and 2017-07-16 00:00

Generated on 2017-07-29 @ 07:16 by ZEDNET, Copyright
Savings improvement

### Avg water loss 23%: Vaalharts WUA 2016/2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Agriculture</th>
<th>Industry</th>
<th>Municipality</th>
<th>Household</th>
<th>Downstream</th>
<th>Other</th>
<th>Total</th>
<th>Released</th>
<th>Total loss</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>198.42</td>
<td>0.361</td>
<td>11.96</td>
<td>0.617</td>
<td>78.87</td>
<td>0.714</td>
<td>290.9</td>
<td>412.91</td>
<td>122.0</td>
<td>29.5</td>
</tr>
<tr>
<td>2015</td>
<td>262.24</td>
<td>0.262</td>
<td>14.11</td>
<td>0.459</td>
<td>83.52</td>
<td>0.907</td>
<td>361.5</td>
<td>494.22</td>
<td>132.7</td>
<td>26.9</td>
</tr>
<tr>
<td>2016</td>
<td>221.97</td>
<td>0.154</td>
<td>14.95</td>
<td>0.468</td>
<td>63.14</td>
<td>0.903</td>
<td>301.6</td>
<td>395.52</td>
<td>93.94</td>
<td>23.8</td>
</tr>
</tbody>
</table>

Loss %: 3.1%
Avg. loss among schemes
## Savings achieved

- Quota = 9 140 m³/ha @ 29 181 ha

### Description of Savings

<table>
<thead>
<tr>
<th>Description</th>
<th>Released m³/ha</th>
<th>Difference</th>
<th>Losses %</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before WAS</td>
<td>12 064.8</td>
<td>-</td>
<td>32.0</td>
<td>-</td>
</tr>
<tr>
<td>With WAS</td>
<td>11 580.4</td>
<td>484.4</td>
<td>26.7</td>
<td>5.3</td>
</tr>
<tr>
<td>With Zednet</td>
<td>11 315.3</td>
<td>265.1</td>
<td>23.8</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>749.5</strong></td>
<td></td>
<td><strong>8.2 %</strong></td>
<td></td>
</tr>
</tbody>
</table>

- 21.87 million m³ saved

- The theoretical water requirement of Kimberley in 2015 = 24.12 million m³/a
Conclusion

The optimisation of water measurement and management is an ongoing process whereby the latest technology and expert minds engage in order for sustainable water saving products to be developed.
THE END