# "The water stewardship journey - lessons learnt from case study dairy farms."

**By: Sue Viljoen**

# Who is the World Wide Fund for Nature?

## (*NOT* World Wildlife Fund or the World Wrestling Federation! ☺)

### WWF IN SHORT

**+100**

WWF is in over
100 countries, on
5 continents

**+5,000**

WWF has over
5,000 staff
worldwide

**1961**

WWF was founded
In 1961

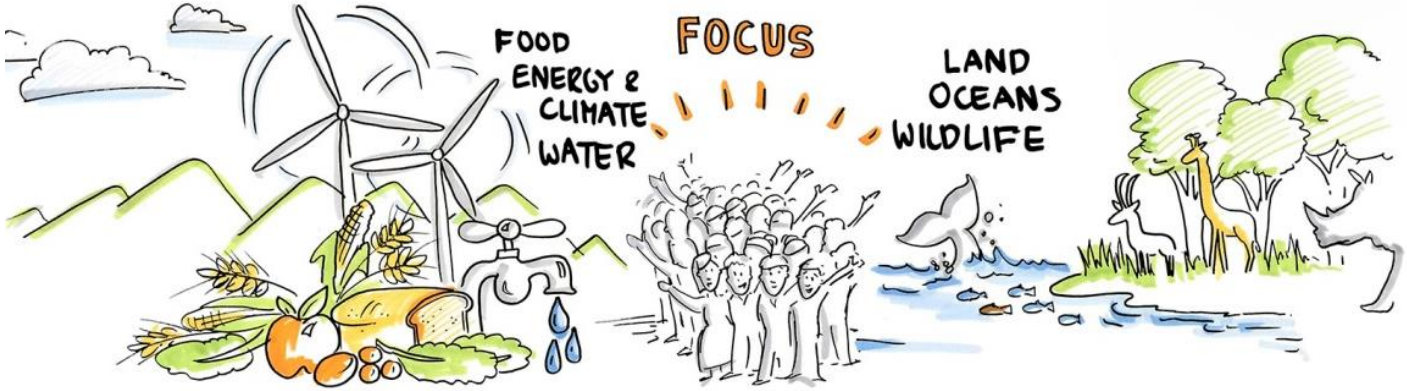
**+5M**

WWF has over
5 million supporters

WWF-SA: About 40 yrs old.
Headoffice: Cape Town, Newlands
Satellite offices: JHB, Hilton, Newcastle, Stellenbosch

## WWF's vision: A future which is sustainable and equitable.

A future were communities and the private sector are earth stewards and where technology enables human wellbeing to be decoupled from environmental degradation.




## WWF's Mission: To be champions of the earth's capacity as a source of inspiration, sustainable food, water and energy for all.

# WWF-SA's Thematic Programmes

SUSTAINING ECOSYSTEMS THROUGH RESPONSIBLE BUSINESS PRACTICES

WOOLWORTHS SOUTH AFRICA

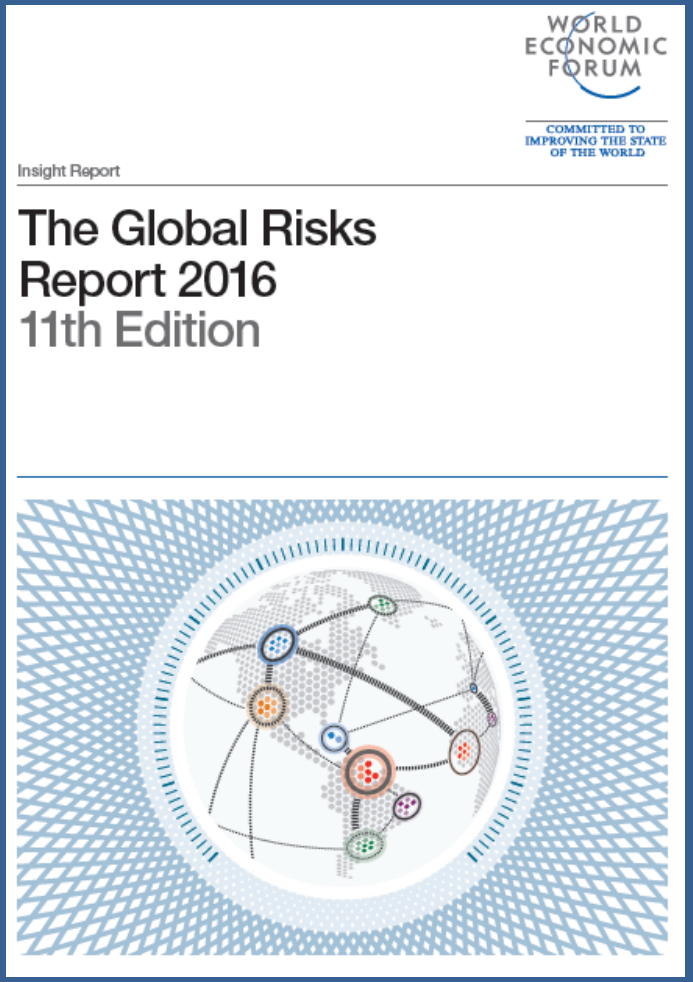
**Current funders**

TOGETHER INVESTING IN THE FUTURE OF SOUTH AFRICA'S FRESHWATER ECOSYSTEMS

1. **Freshwater**
2. Sustainable Agriculture
3. Marine
4. Land and Biodiversity Stewardship
5. Policy & Futures (low carbon economy)
6. Environmental Leaders
7. Species

**Top global risk to industry and society over the next decade is *WATER!***
(World Economic Forum 2016)

**https://www.weforum.org**




*"We never know the worth of water 'til the well runs dry."* – Thomas Fuller

# Water has been a hot topic this year

*"A water constrained environment could become the new normal…."*

*"We need to shift the mindset from one of water usage to **water stewardship**"…*

## Water scarcity forces change in mind-set

AS THE impact of an extended period of drought across much of SA and the southern African region continues to be felt, the realisation is setting in among both commercial and small-scale farmers that a water-constrained environment is no longer a short-term challenge, but could in fact become their new normal.

Zhann Meyer, Head: Agricultural Commodities, Global Commodity Finance at Nedbank CIB, says while this realisation is also dawning among agriculture stakeholders across much of the planet, dealing with this reality is particularly difficult for South African farmers.

That is because they are already challenged by having to operate in an environment of

Zhann Meyer ... there is no excuse.

proactively embrace more water-friendly technologies, practices and attitudes."

impact and dependence on water.

Achieving this requires a willingness to challenge practices that have been passed down for generations. It may also involve some short-term financial investment into water saving technology, but this will almost certainly deliver long-term sustainability returns.

"One example of this change in mind-set is being willing to invest time, effort and capital in converting a farming operation from spray to drip irrigation.

"There is so much information and technology available to farmers today that there really is no excuse for anyone to be practicing farming methods that involve excessive amounts of water usage or wastage.

*"Commercial farmers need to proactively embrace more water friendly technologies, practices & attitudes….*

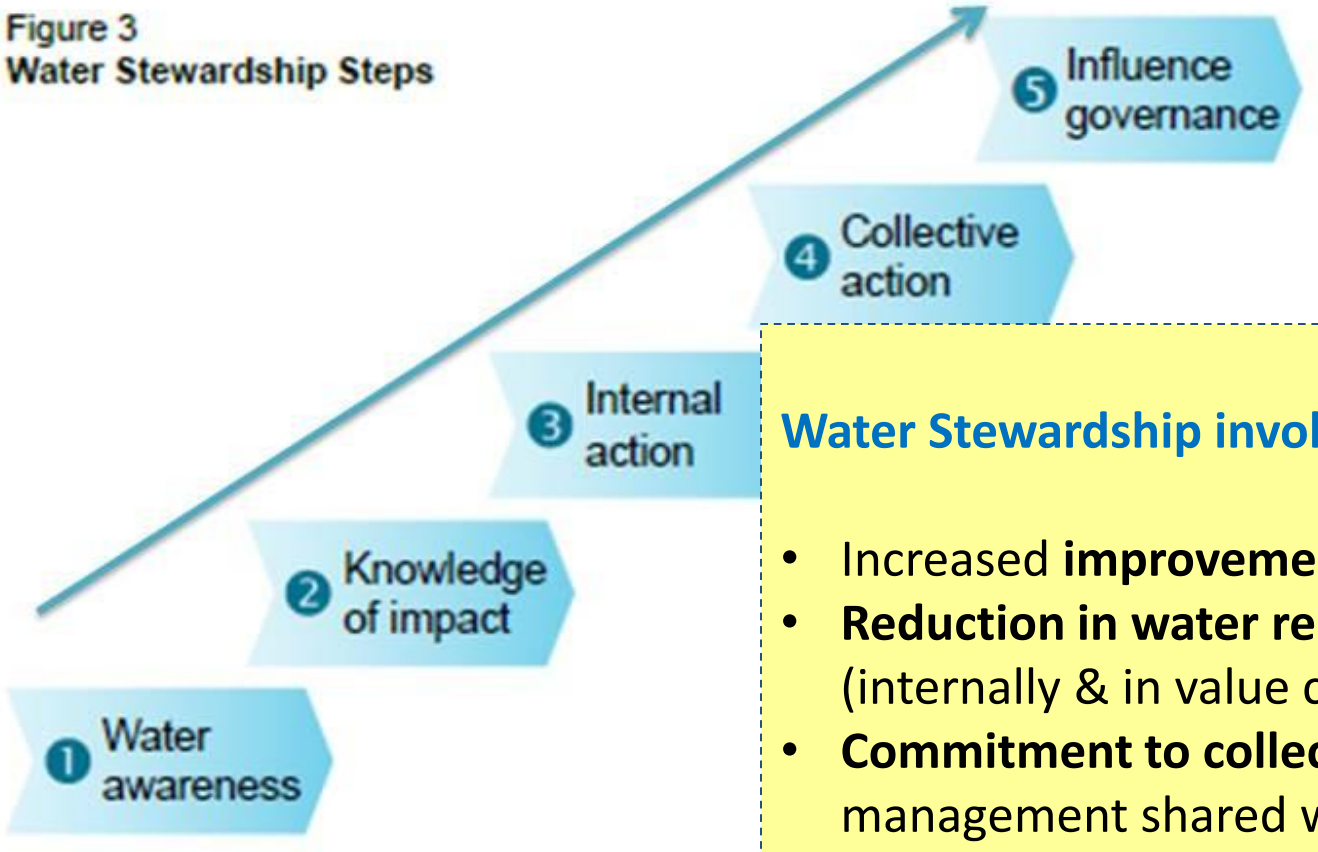
*"this is arguably the most important paradigm shift that has to take place in agriculture for SA to achieve the levels of sustainability required….*

Business Day, 25 Aug 2016

(Zhann Meyer: Head of Agricultural Commodities, Global Commodity Finance, Nedbank CIB)

# What is water stewardship – WWF context

Figure 3
Water Stewardship Steps

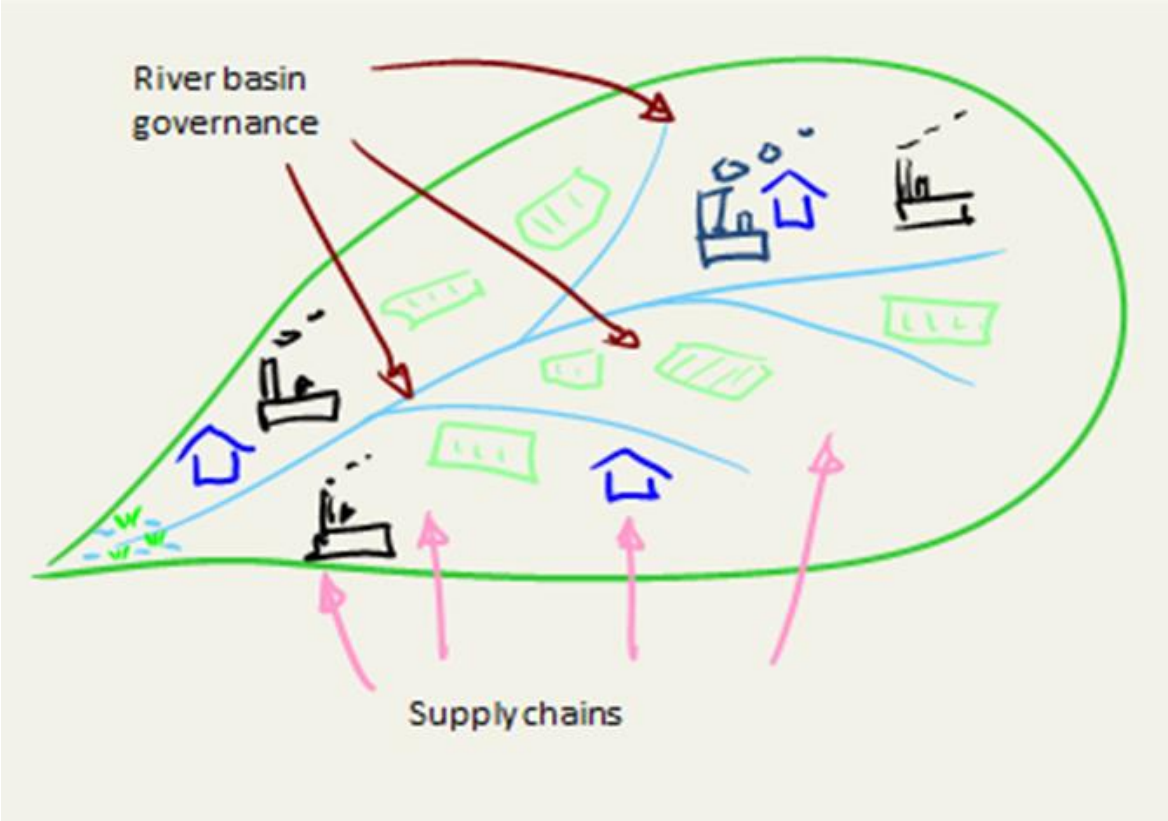



**Water Stewardship involves:**

- Increased **improvement of water use**
- **Reduction in water related impacts** (internally & in value chain operations)
- **Commitment to collective action** in order to management shared water resources (with other business, governments, NGO's & communities)

**WWF definition**

# Water Stewardship means 'beyond efficiency' and looking after what you don't own – i.e. beyond the farm fence

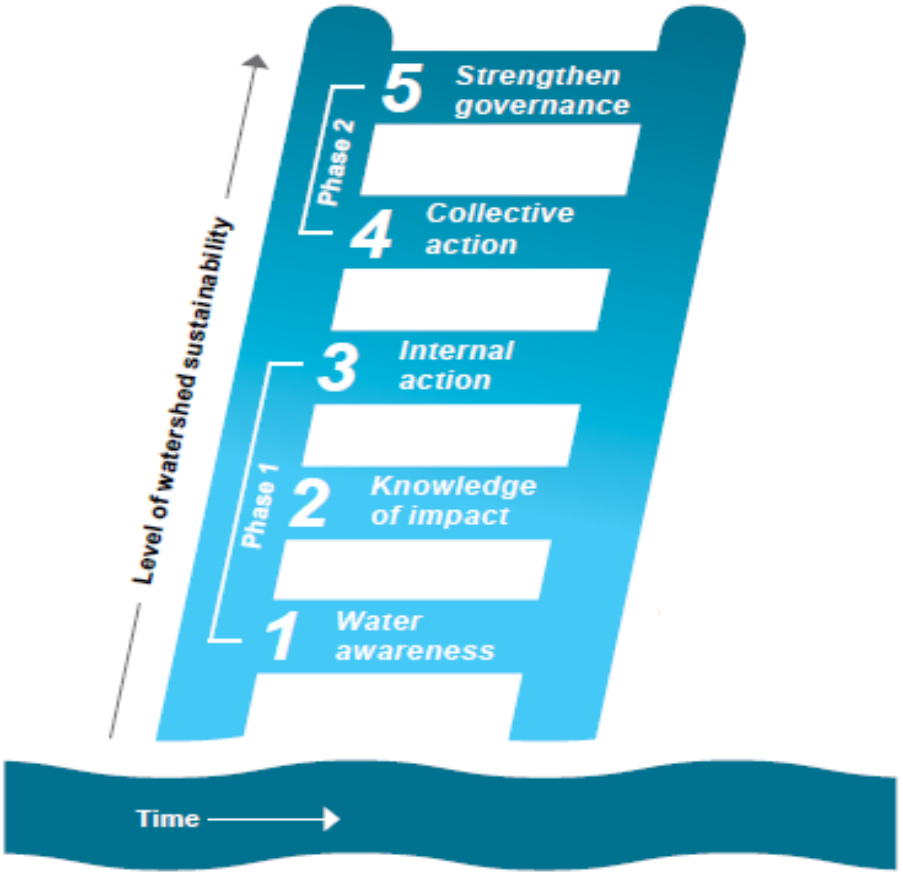



**COLLECTIVE ACTION** with neighbours & other stakeholders within catchments is the only way to achieve this.

Water is the ultimate connector across boundaries & borders

# Water Stewardship requires you to…

- Look at where your water comes from - *look upstream*
- How you use it – *water use efficiency, water footprint, irrigation, waste*
- And where it goes to – *catchment context, downstream water users*



# Water Use Efficiency Assessments

## ("Internal Action" component of Water Stewardship)

Agricultural engineering expertise appointed to look at:

1.) **Irrigation efficiency** (water quantity)
2.) **Waste handling effectiveness** (water quality)

On **14 volunteer farms** assessed in KZN midlands (12 dairies, 2 piggeries), in association with Mooi, Little Mooi & Karkloof Irrigation Boards.

Motivation: Facilitate an improvement in water stewardship practices
Reducing demand on river resources

Funded by WWF Mondi Wetlands Programme

SUSTAINING ECOSYSTEMS THROUGH RESPONSIBLE BUSINESS PRACTICES

**R950 000 investment in providing expertise to guide management decisions and farm operations (avg R67 000 per farm)**

"Water is a key material risk and a common thread. Impacts are felt up and downstream. We need to work together to find solutions to shared water risks."

- **Component 1: Irrigation (& energy) efficiency**

  ***Expertise: Agreplan (Marc Mulder)***

- **Component 2: Wastewater & stormwater handling management effectiveness**

  ***Expertise: EVN Africa***

***Objective: Seek to understand the obstacles & opportunities for strengthening water stewardship at farm scale. Case study material for engaging value chain roleplayers.***

OUTPUTS:

- Report for each farm
- feedback meetings with each farmer
- Aggregated results for each Irrigation Board

# Objectives: Irrigation Efficiency Assessments

- Assess irrigation system **efficiency** against **manufacturer design & operation** (not system type)
- Identify possible **design and/or management improvements**. (i.e. within acceptable design norms)
- Model **potential savings** through implementation of identified infrastructure changes (e.g. correct pump, pipe size & system application)

***(2nd phase: 5 more farms in the Mooi & potentially 3 farms in the uMvoti catchment)***

# Overall results

| | | |
|---|---|---|
| **Hectares assessed** | **1850ha** | |
| **Pumps** | **64** | (80% pivot, 20% sprinklers) |

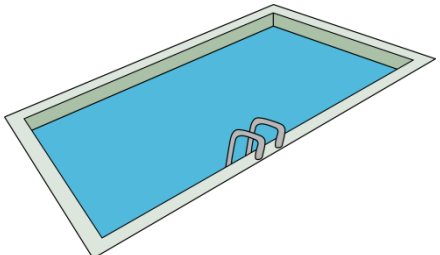
| | | | |
|---|---|---|---|
| **Water and energy Saving** | **Water** | **Energy** | **Application** |
| | $m^3$/annum | KWh/annum | mm |
| | 314 369 | 921 779 | 18 |

| | | | |
|---|---|---|---|
| **Financial Saving** | **Energy Cost saving** | **Cost/ha saving** | **Capital Req** |
| | R/annum | R/ha/annum | R |
| | R 1 013 333 | R 439 | R 1 926 100 |

**( = 2 yr payback)**

Water Saving equates to:

**125 olympic size swimming pools**



**Or: water consumption of 3400 households for a year (av 250 litres/day)!**

# Key learnings: Irrigation Efficiency

1. **Record keeping & correct climate-based irrigation scheduling is key!** - know your soils TAM & local weather data (invest in weather station/soil moisture probes)
2. **Be careful of relying solely on technology** - nothing replaces field verification
3. **Flow meters are essential - measure to manage** - correctly installed & calibrated

   *Only 14% (9 out of 64) of pumps had flow meters*

   *Of the 9, only 2 were installed acc to manufacturer specs*

   *Meter error varied from 1 to 80%.*

- **Irrigation Boards** – consider flow meter installation guidelines, policy on calibration tests & maximum accuracy deviation.
- ***Reminder: Vibration and resonance affect metering accuracy! (avoid proximity to valves & diffusers)***

Flow meter installation guideline:

**Agric Mechanical (not clean water), insertion and ultrasonic** - need a straight pipe run of :

- **10 x** diameter upstream and
- **5 x** downstream to achieve stated accuracy

**Magflow meters** need a pipe run of:

- **3 - 5** x diameter upstream and
- **2 - 3** x downstream

**4. Avoid low cycle applications -** these result in lower rainfall efficiency

**Irrigation Demands** : (assuming a medium soil with TAM of 120mm & rooting depth of 400mm)

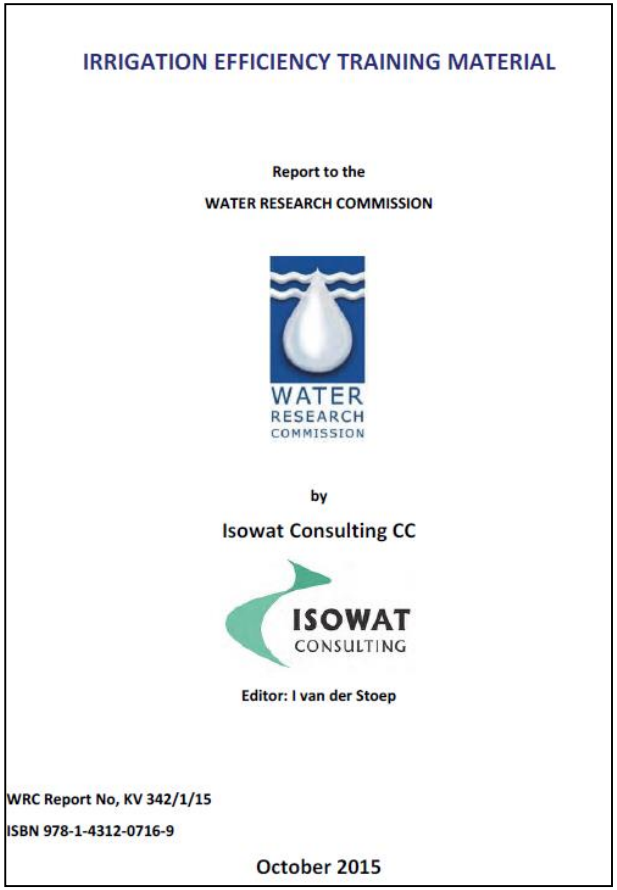
| Description | unit | 5mm | 15mm | 25mm |
|---|---|---|---|---|
| Gross demand | mm/ann | 1422 | 1106 | 891 |
| Nett demand | mm/ann | 1137 | 885 | 712 |
| **Rainfall Efficiency** | | **7.7%** | **42%** | **65%** |

**5. Assess pump efficiency** – annually check pressure, amperage, flow, shaft wear & impellor cavitation & efficiency ring wear when serviced

**6. Do regular maintenance checks** – see www.wrc.org.za for guidelines

(check nozzle wear, hose leaks, hydrant leaks)

www.wrc.org.za


IRRIGATION EFFICIENCY TRAINING MATERIAL

Report to the

WATER RESEARCH COMMISSION

WATER RESEARCH COMMISSION

by

Isowat Consulting CC

ISOWAT CONSULTING

Editor: I van der Stoep

WRC Report No, KV 342/1/15

ISBN 978-1-4312-0716-9

October 2015

Table 5 Maintenance schedule of centre pivots

| Action | After each revolution | After each 4th revolution | Seasonal |
|---|---|---|---|
| **Electrical** | | | |
| Switch on pivot and listen to each motor and starter. If any abnormal sound is heard, remove and service. | | | X |
| Replace end tower's electric bulb (if out) and remove dust, insects and water where necessary. | | | X |
| Check tower panel and main control cabinet. Clean panels, remove dust, insects, e.g. wasps, etc. | | | X |
| Inspect condition of wiring of pivot | | | X |
| Inspect electrical motor cable condition, earth conductor and connections | | | X |
| **Structure** | | | |
| Tighten all bolts and nuts where necessary. Ensure that earth conductors are clean. | | | X |
| Grease pivot | | X | X |
| Grease pin that holds swing mechanism of towable pivots to prevent rusting | | X | X |
| Check system for leakages. Repair if necessary | | | X |

## 8. Are you on the optimal electricity tarriff? Assess Ruraflex vs Landrate.

**Ruraflex *is a viable option*** if <u>automation</u> & system capacity is sufficient to avoid peak tariff periods

*(Ruraflex: 12 out of 14 farms could benefit, potential total electricity saving of **R1 810 835**)*

## 7. Consider Variable Speed Drives (VSD's) -esp. for multiple duty systems

| Tariff | hours/week | % Week | High Demand rate | % Cost | Low demand rate | % Cost |
|---|---|---|---|---|---|---|
| High | 25 | 15% | 200.35 | 44% | 84.92 | 26% |
| Med | 62 | 37% | 78.87 | 33% | 58.45 | 41% |
| Low | 81 | 48% | 42.83 | 23% | 37.09 | 34% |

Low demand season

High demand season

# VSD trial: Triandra Farm, Karkloof - 30 March to 15 Aug 2016

- 42,020 $m^3$ used to irrigate **17ha** (1 small pivot & sprinklers) over 4 mnths applying 2471$m^3$ per hectare)
- Pump curves indicate the operating energy reduced from around **17KW** to **8KW** to operate these individually.
- Running sprinkler and pivot together reduced energy from **20KW** to around 1**0KW**.


- **This = 8900 KWH calculated saving, or a cost saving of around R10 350 for the 4 months of operation.**
- Assuming full operation based on long term crop demand irrigation requirements, the saving could be **R23 463 per annum**

- **Conclusion: the savings are higher than anticipated and provided significant flexibility on both systems.**

*Note: Motor efficiency improvement achieved depends on the power factor of the motor and transformer.*

# Key learnings: Waste Handling

1. **Separate storm water from waste water** – reduces strain on waste storage facilities.

2. **Check on slurry dam capacity & freeboard** – should have min. **3 months storage & 30cm freeboard** (*Fauke et al, 1984*). Have slurry dams surveyed to verify depths and capacities. Dams might need resizing to accommodate the herd size.

3. **For self-disposal of slurry volumes - consider better separation of solids & liquids** – e.g. weeping wall / mechanical separator


**4. Consider rainwater harvesting options** from roofed surfaces –

large potential for water saving!

Water harvesting example:

- Feed pad: 18 x 84m
- Calculate: rainfall mm/yr x roofed surface area $m^2$ = saving $m^3$/year

e.g. 1005 mm/year x 1500 $m^2$ = 1508 $m^3$/year

- Could provide **85%** of the feedpad wash down requirements

  (assuming avg wash down uses 6.4 litres/$m^2$ per wash.)

## 3. **Check location of slurry dams & outlets** in relation to proximity to water courses. (``***watercourse''*** defined as a river or spring; a natural channel, wetland, lake or dam)

**In order to comply with provisions for a General Authorisation (National Water Act, GN 665)**

**Slurry dams & irrigation with wastewater must be located –**

- **100 metres** from a **water resource**
- **500m radius** from a **borehole** that is utilised for drinking water or stock watering;
- Outside a **500m radius** from the boundary of a **wetland,**
- on land that is not, or does not, overlie, a **major aquifer.**

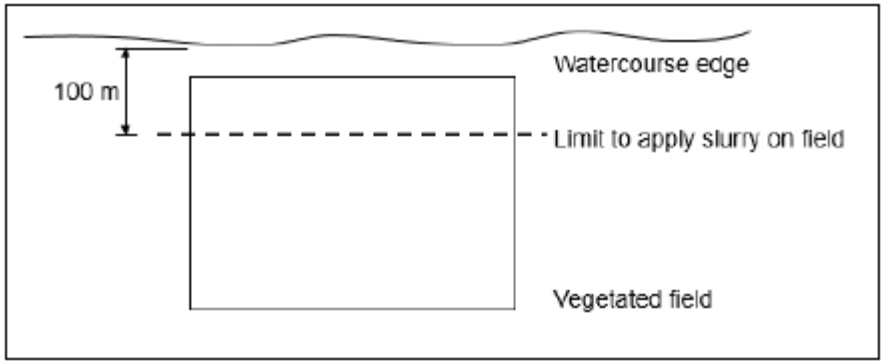
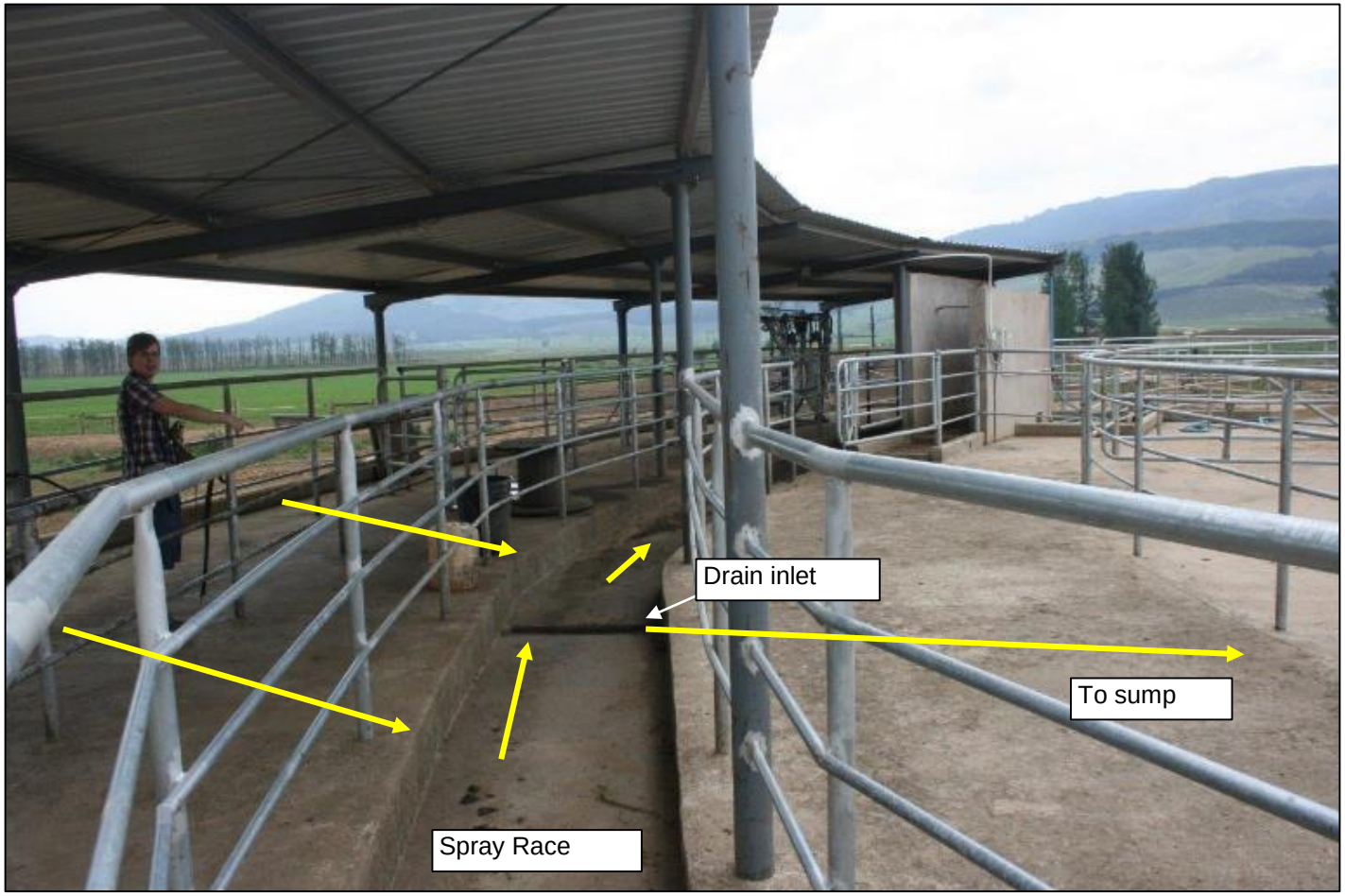



Figure 3.12: Guideline of distance to apply slurry from watercourse edge

**Building of slurry dams and all dairy infrastructure (feedpad, holding yard, parlour), should be –**

- More than **32m away** from a **watercourse** (NEMA, GN 983)
- More than **500m** from a **wetland** (unless deemed to be low risk according to risk matrix) (NWA, GN 509)

**Should any of the above-mentioned thresholds NOT be met, a Water Use License and / or Environmental Authorization would be required.**




**Good design and layout of holding yards can save wash down water requirements & slurry storage volume**

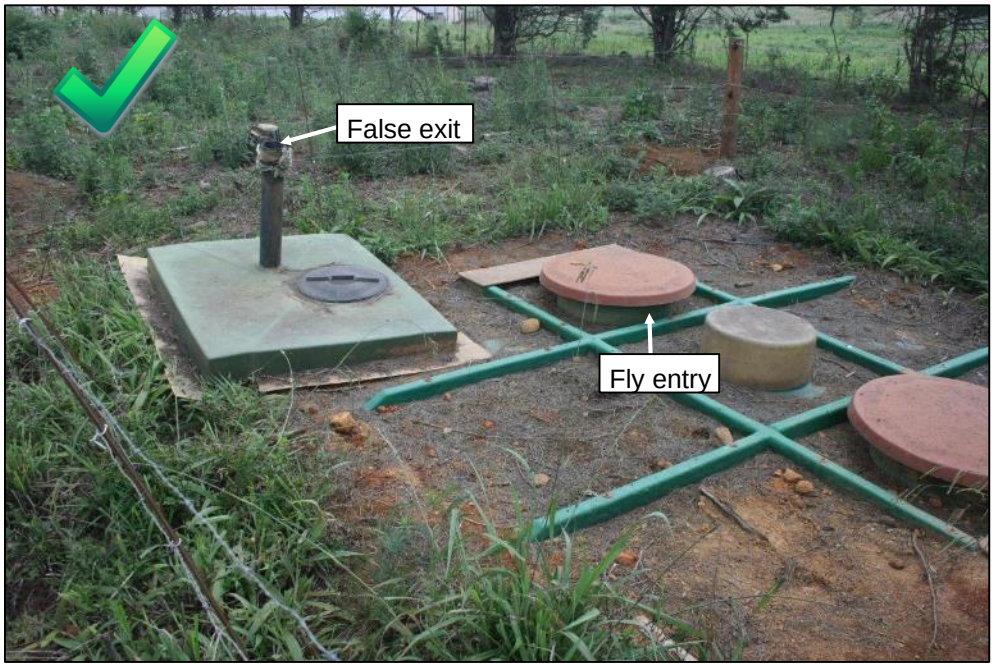
Using the spray race as an inlet point for wastewater means that the surface flow from the exit yard is only pushed 5 m to the spray race instead of 25 m to the main inlet at the circular holding yard.

# Carcass disposal

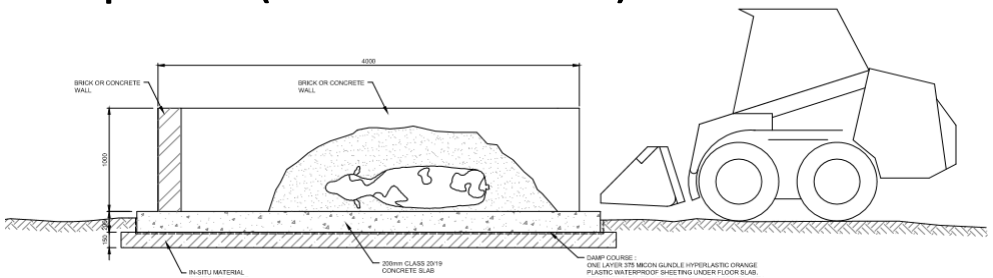
Too close to wetland

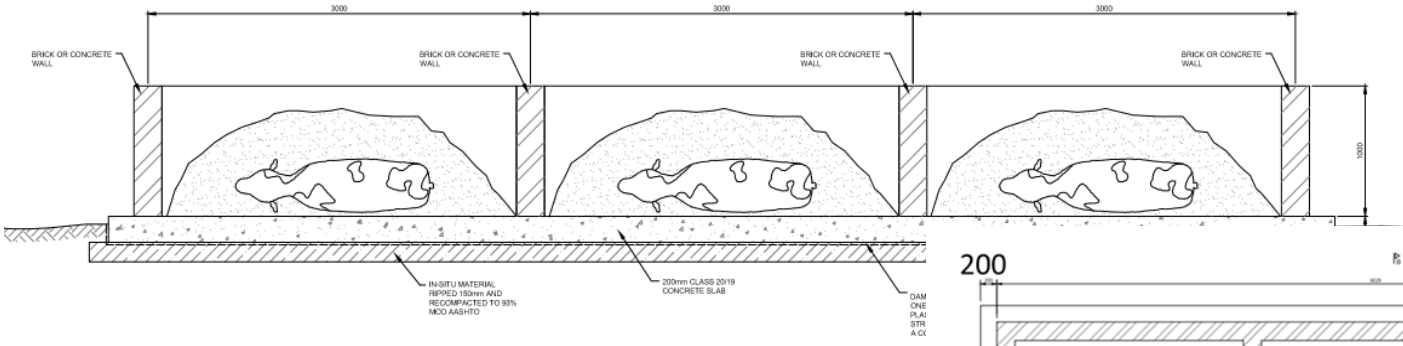
Animal health hazard

Fly trap mortality pit

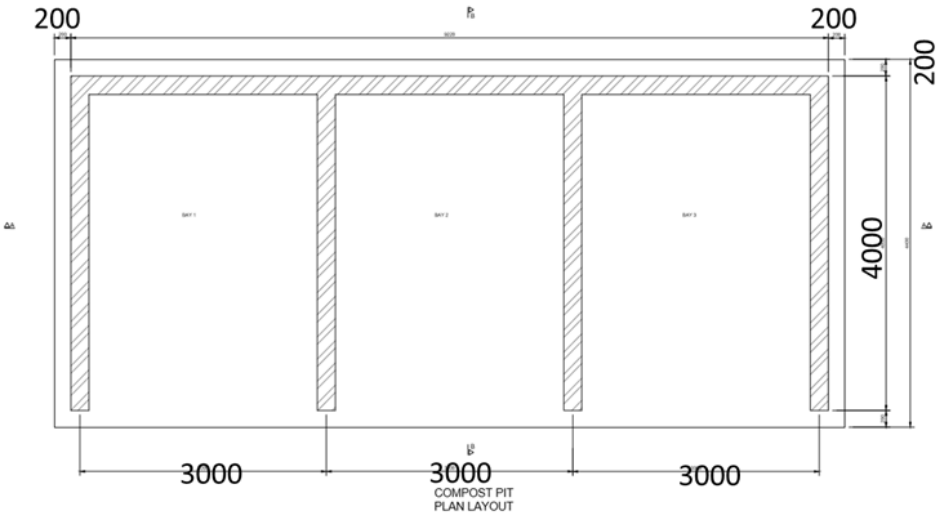


# **Composting** - good option for carcass disposal (if no vultures)




SECTION A-A

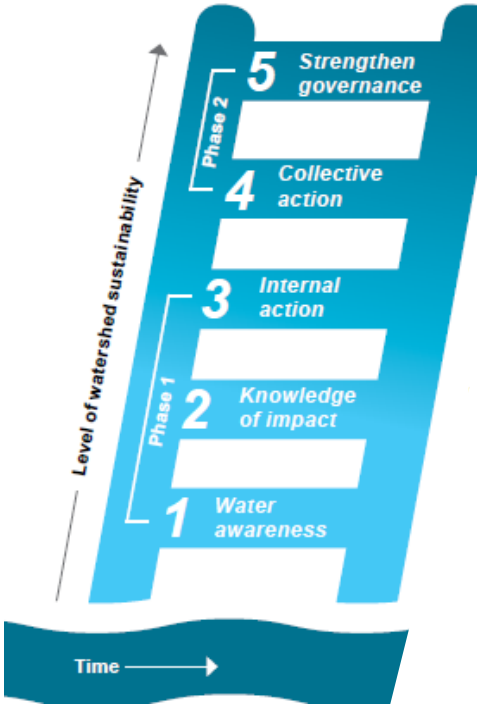


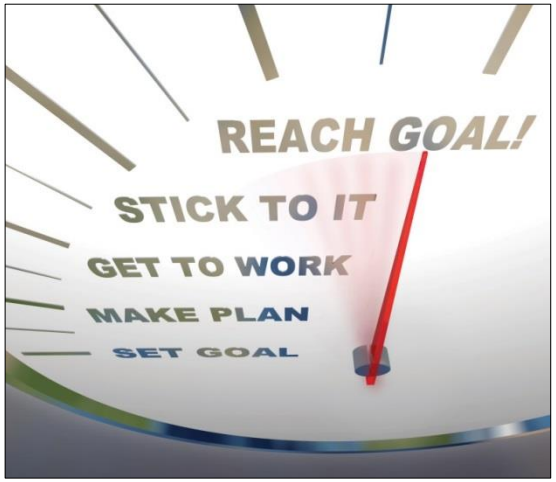

Cover carcasses in organic material such as **saw dust, wood chips, hay or garden refuse.** Takes 6 – 8 weeks to break down.

Compost site <u>location</u> is important – avoid proximity to wetlands & river courses.

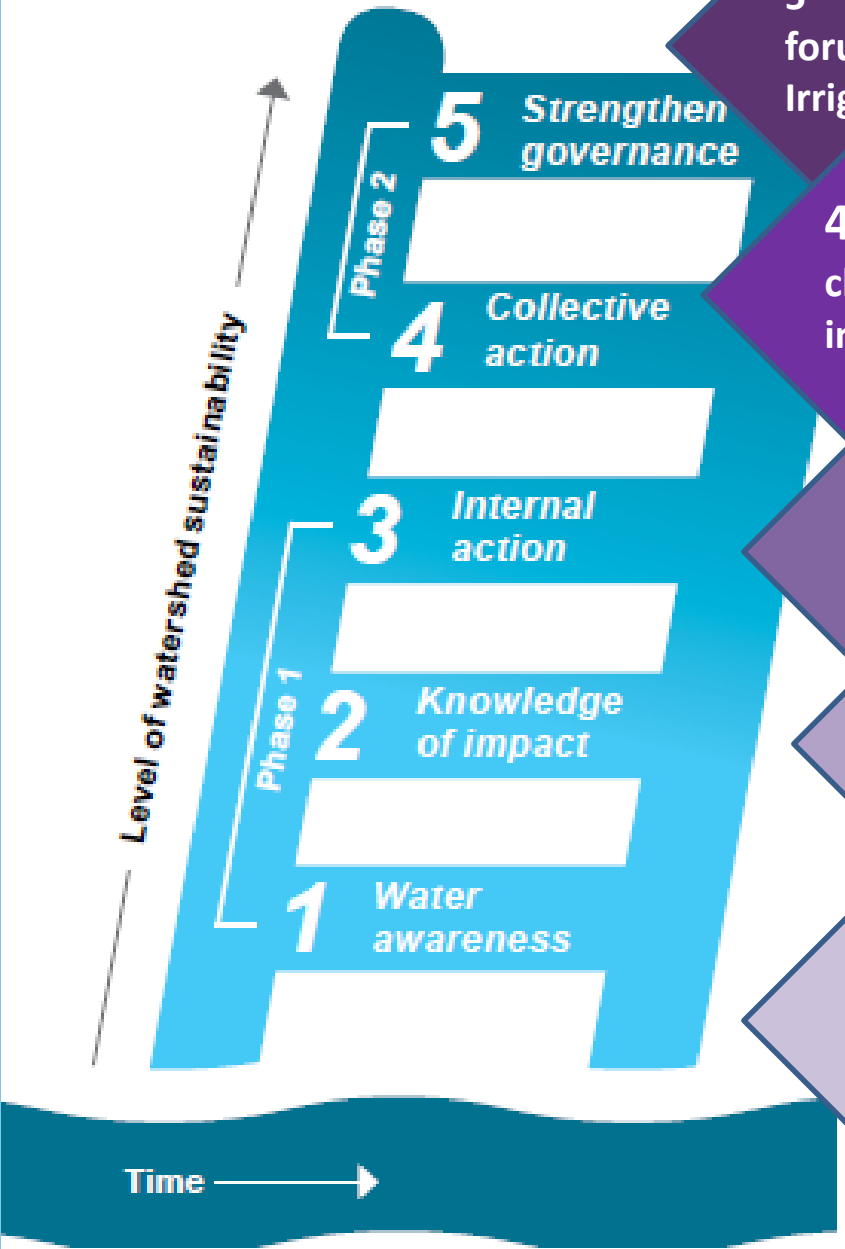
HEIGHT = 1000
Wall thickness = 200

- Where are you on your water stewardship journey?
- Set a goal – what would you like to achieve 1 year & 5 yrs from now?



# What could Water Stewardship look like for Dairy Producers?



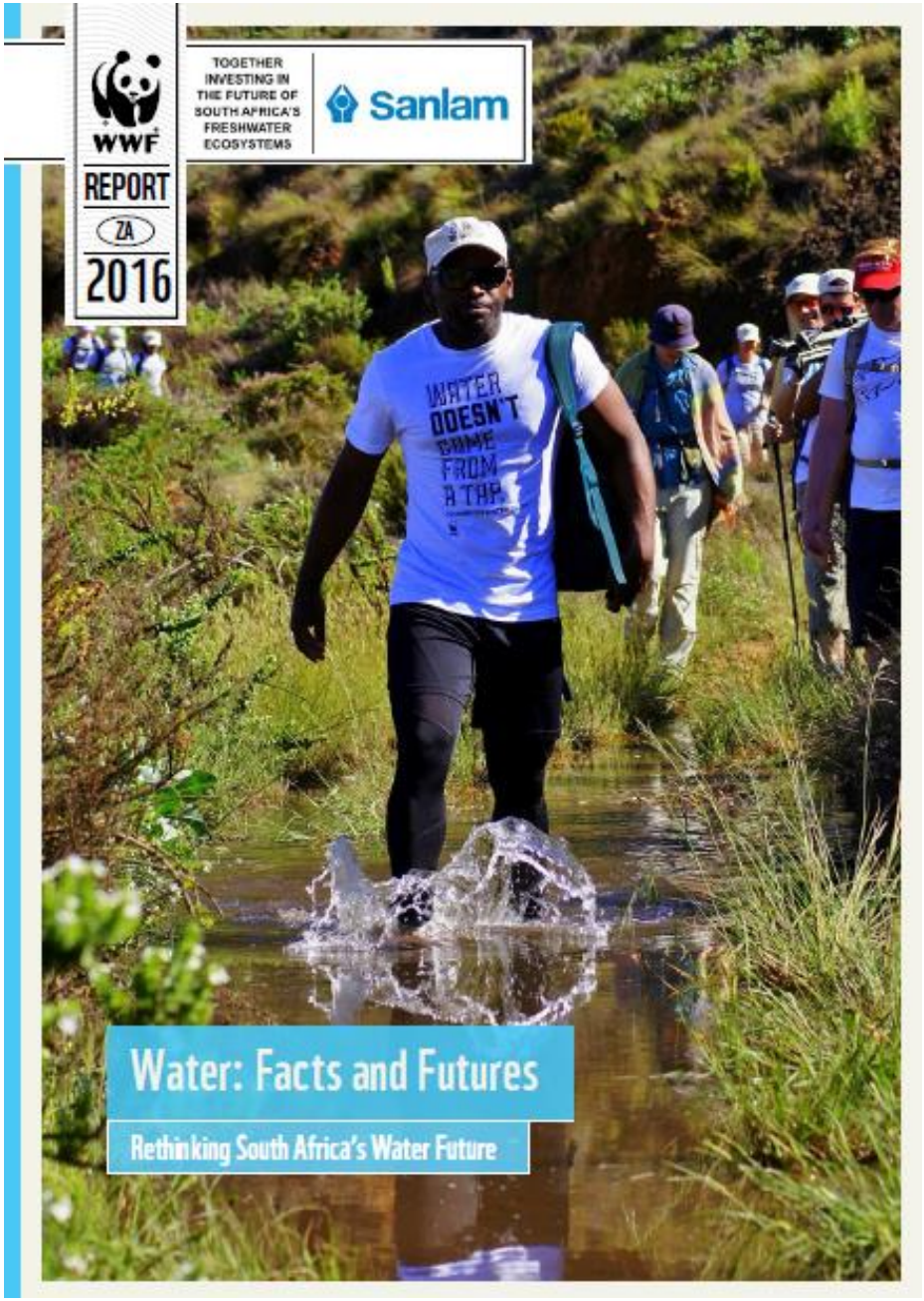

5 – Can you become involved catchment/multi-stakeholder forums to improve catchment governance? E.g. CMF's, Irrigation Boards, Farmers Associations.

4 – What are your biggest water risks & common challenges in your catchment? Can you partner with others in the catchment to do more together?

3 – What water use efficiency improvements could be made?

2 – How big is your farm water footprint? Do you measure water use / have flow meters?

1 – Where does your water come from? Who are your downstream recipients? What are the dam levels like and state of water resources in your catchment?




# *THANK YOU!*

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**(WWF Water Facts & Futures Report -** available for download on wwf.org.za)