CITIZEN SCIENCE CATCHMENT TOOLKIT

WRC K5 2350:

"Development and Innovative Use of Community-Based Water Resource Monitoring Tools to Research and Mainstream Citizen Science and Improve Trans-Boundary Catchment Management."

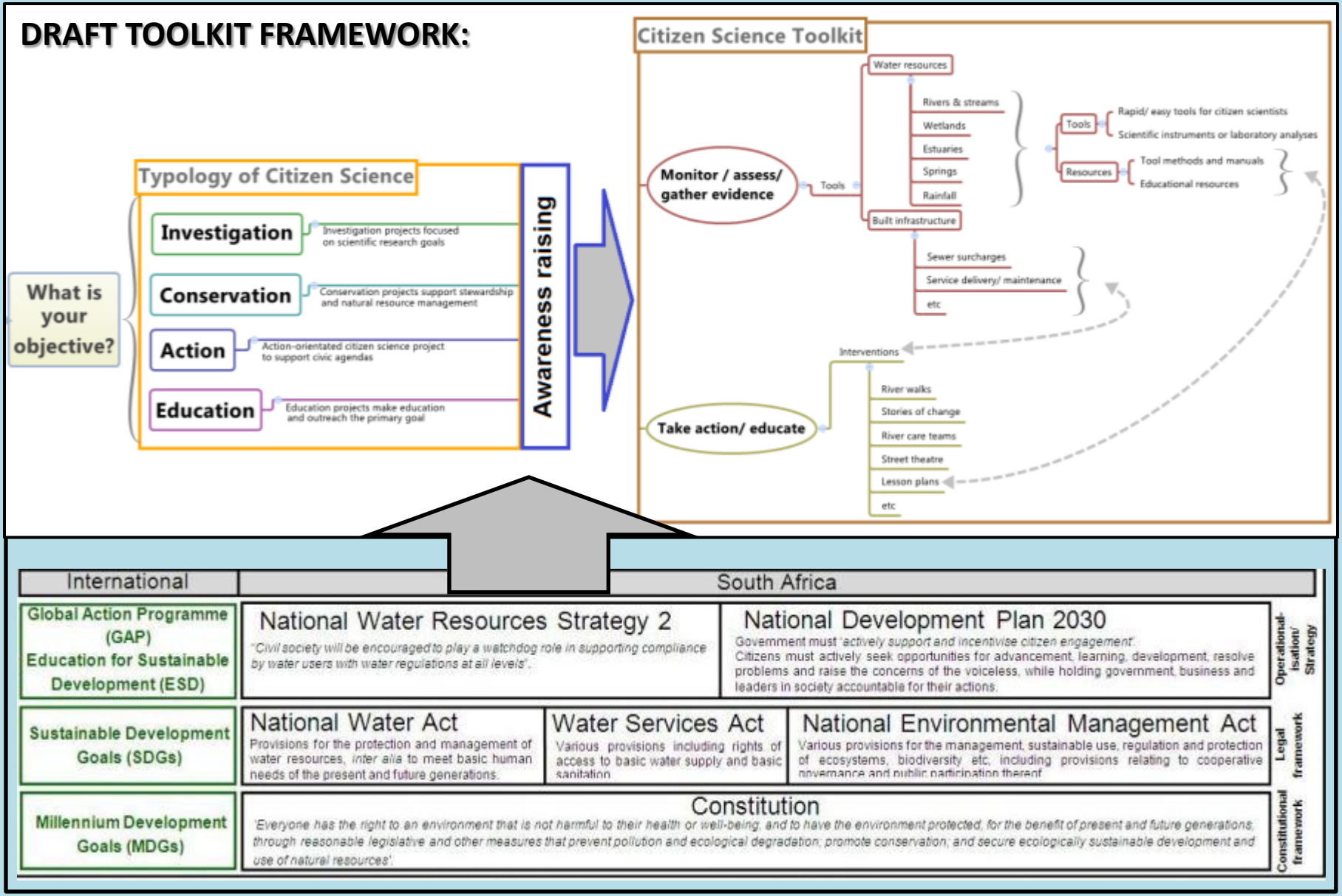
Learning Exchange Matatiele: 24th August 2015

WESSA
PEOPLE CARING FOR THE EARTH

GroundTruth
Water, Wetlands and Environmental Engineering

WATER RESEARCH COMMISSION

DRAFT TOOLKIT FRAMEWORK:



Citizen science rain gauge tool

Develop a rain gauge tool that can be used by a wide range of users that is:

- ❑Low cost
- ❑User friendly
- ❑Robust
- ❑Accurate

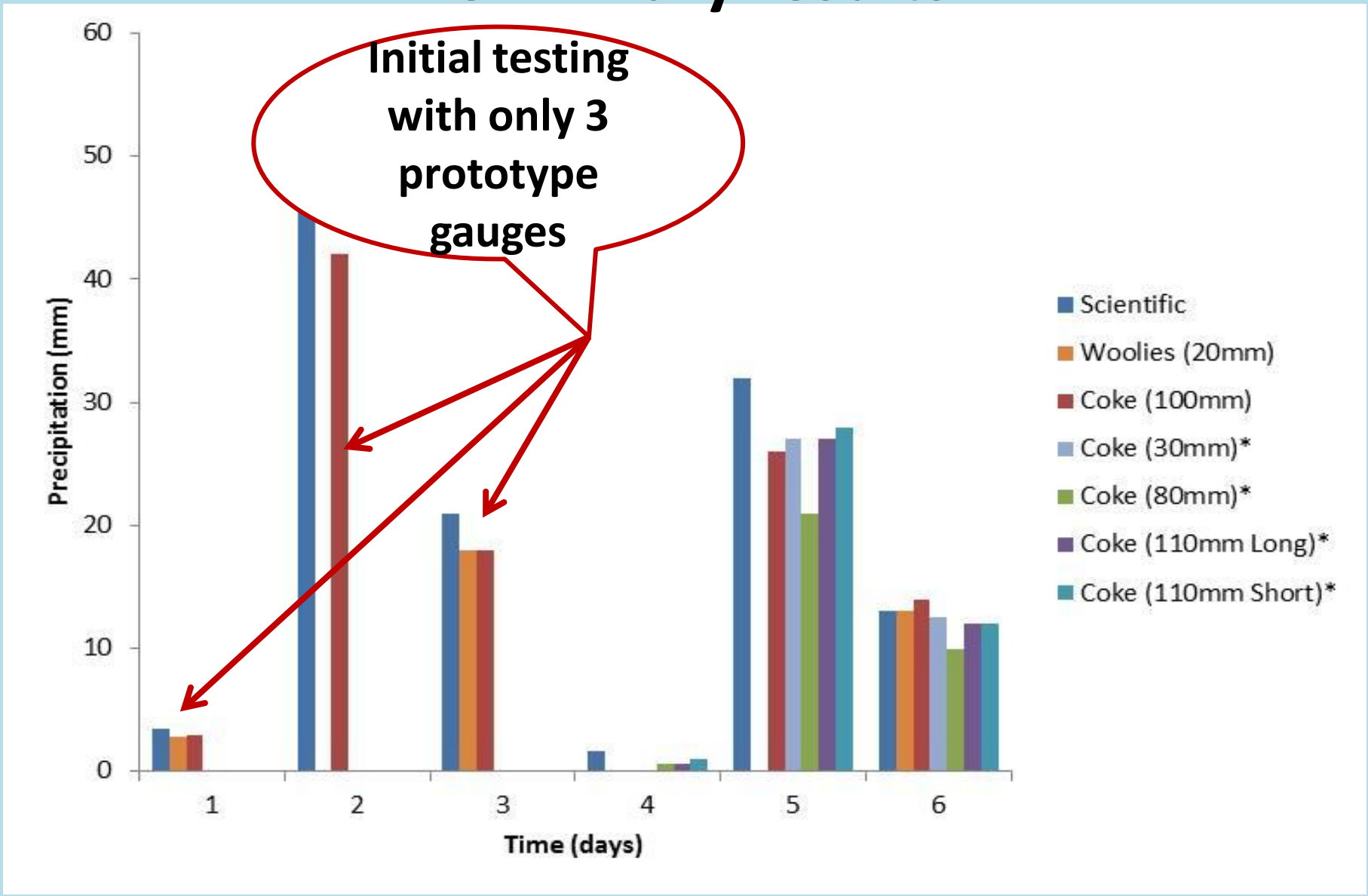
NB - Linking up with ARC and their cheap weather stations

Tool Development

Homemade rain gauges using recycled materials - *Woolworths* 500ml sparkling water and 2L *Coca-Cola* bottles - **calibrated**

In-field testing

Preliminary results



Rainfall (mm) measured by a standard scientific and homemade rain gauges with filled* and unfilled caps.

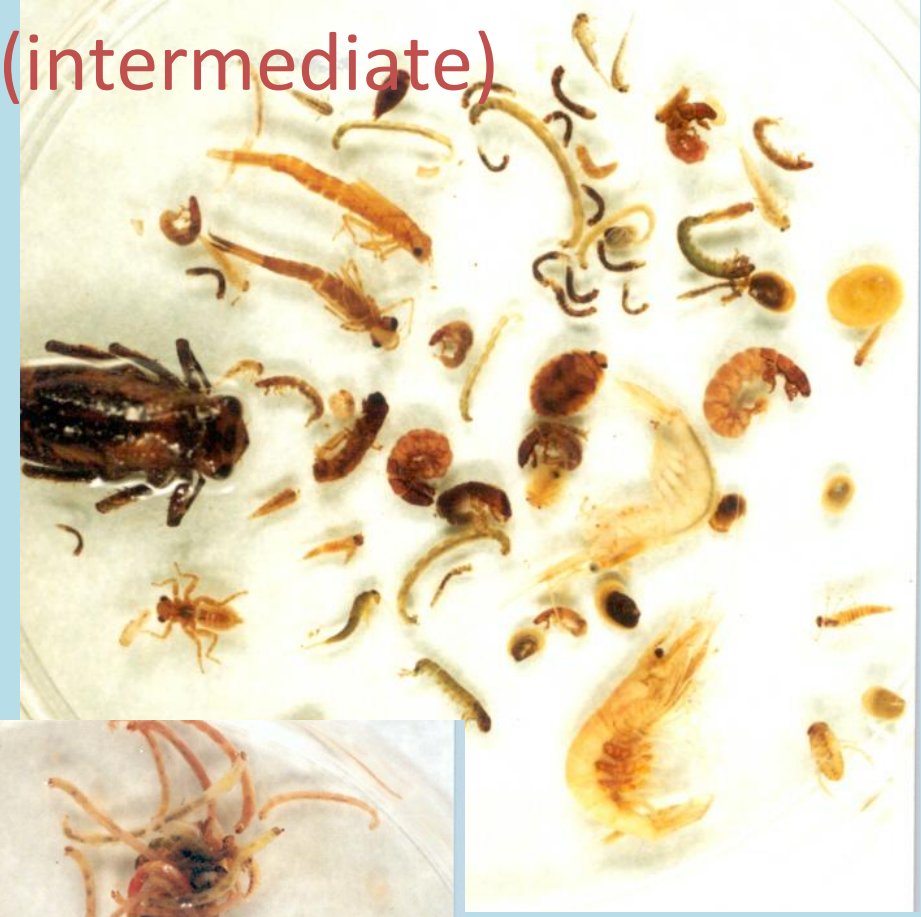
Spring Health Index Tool

Tools or method to assess, monitor, manage and protect South African springs

miniSASS Background

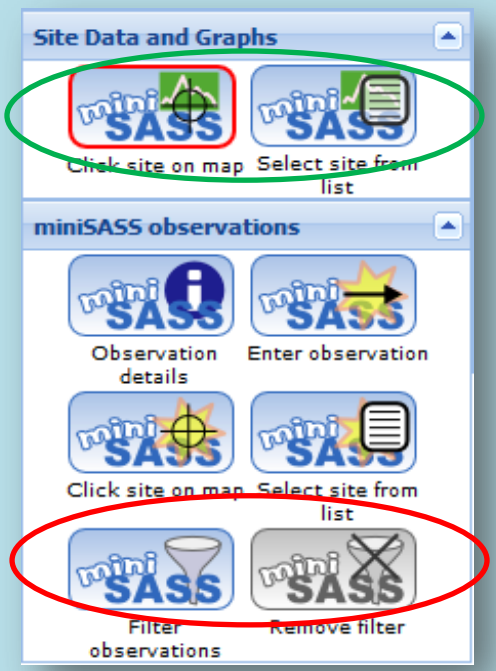
Good (sensitive taxa)

Fair (intermediate)

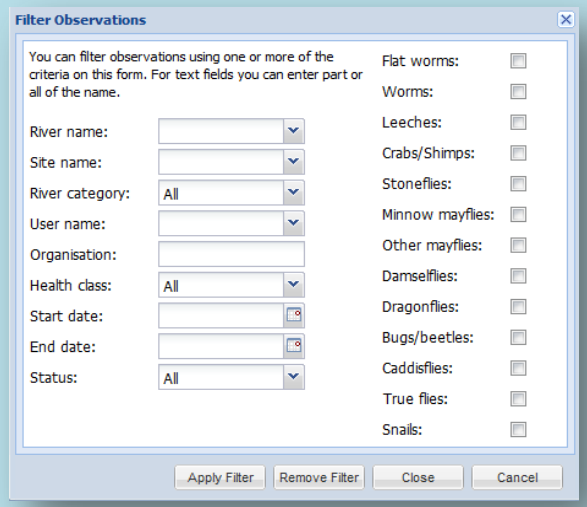


Poor (tolerant taxa)

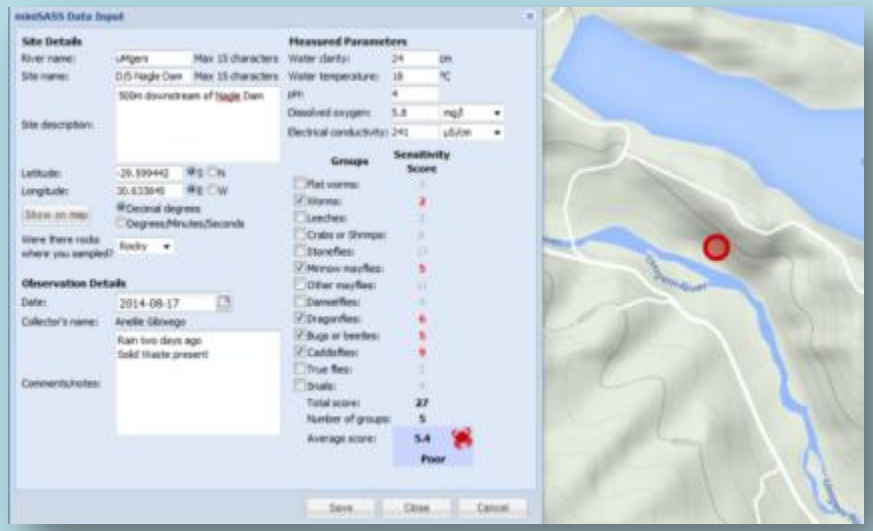
Enhancements to the website



Filter observations



The "View on Map" tool

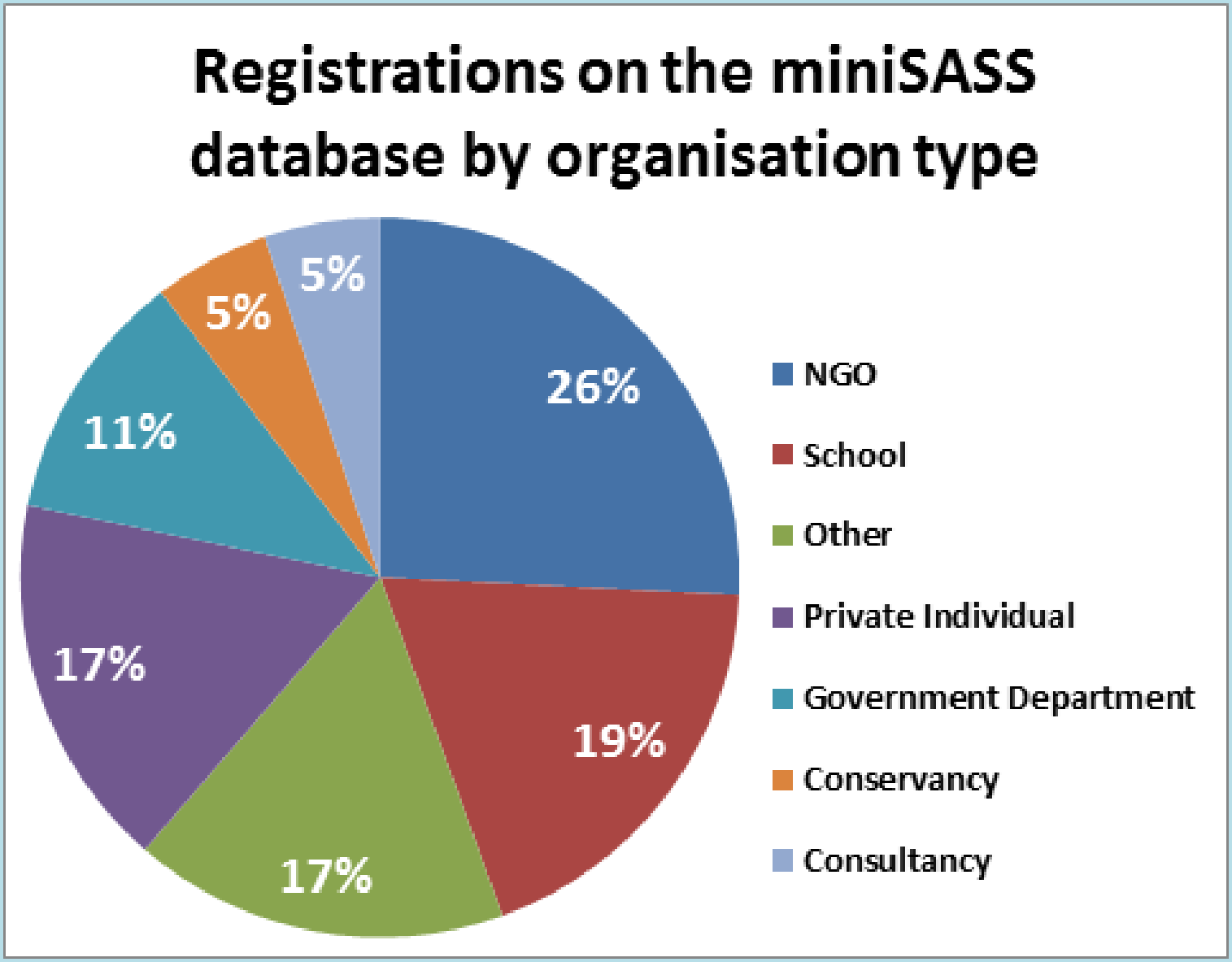


Additional measured parameters:

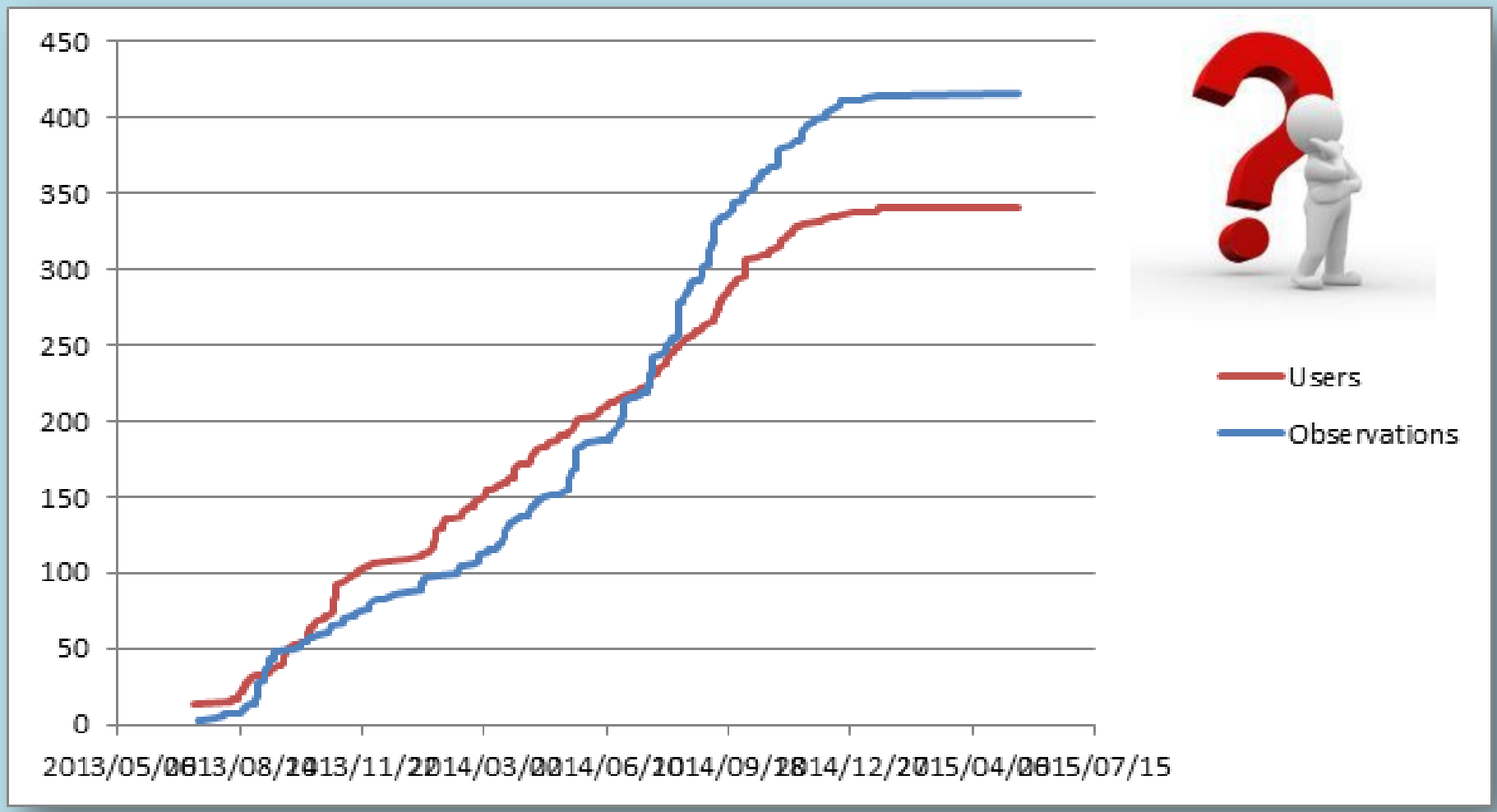
Measured Parameters

Water clarity:	cm
Water temperature:	°C
pH:	pH units
Dissolved oxygen:	
Electrical conductivity:	

miniSASS website statistics



miniSASS website statistics



Riparian Health Audit Tool

AIM: Develop an easy-to-use citizen science tool for determining the ecological health of Riparian Ecosystems.

Which system is healthier?

Riparian Health Audit - Method

8 principle impacts identified to form the basis of the RHA:

1. Alien Invasive Plants

2. Rubbish dumping

3. Bank erosion

4. Inundation

5. Flow modification

6. Physico-chemical modification

7. Vegetation removal

8. Channel modification

Riparian Health Audit - Outputs

- Field data entered into a model & the EC (Ecological Condition) is generated as an output.

- The EC is based on the percentage change in the riparian system from natural and/or pre-anthropogenic conditions.

Score	Percentage Change	Ecological Condition
0-4.5	0-10	Natural
5-11.5	11-29	Good
12-19.5	30-49	Fair
20-27.5	50-69	Poor
28-35.5	70-89	Very Poor
36-40	90-100	Critical

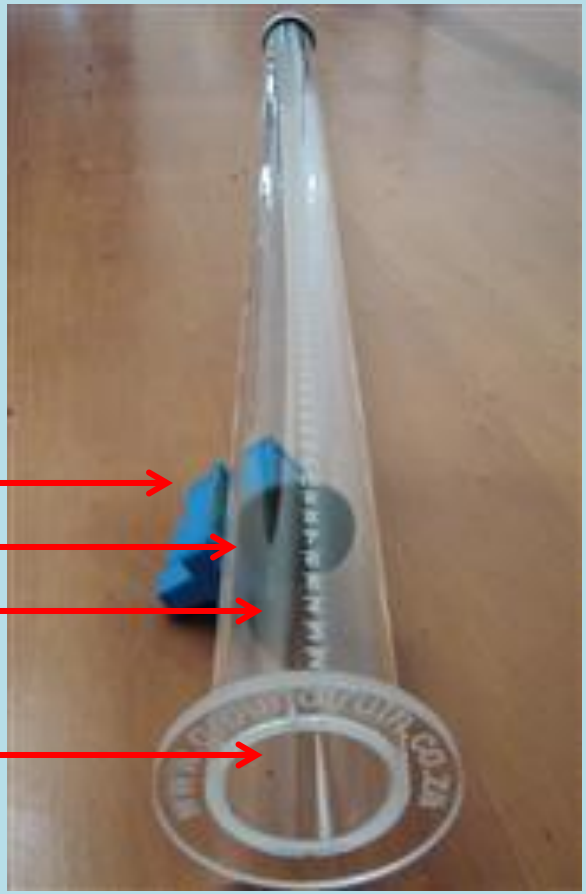
Water Clarity Tube

- Monitoring rivers, streams and WWTW:
  1. Stream/river, wetland and dam water clarity
  2. Monitoring performance (discharge WQ) of WWTW to GLVs and SLVs

The Water Clarity Tube Tool

- Clarity Tube: 1 m long, 50 mm external diameter tube constructed of 3 mm thick clear Perspex.

- Measures visibility of water column in aquatic ecosystems (cm).



Wastewater Monitoring: A Case Study

Shiyabazali & Howick
WWTW final effluent

Wastewater Monitoring: A Case Study

Eutrophication!

Possible TSS bonded nutrients accumulate at Albert Falls Dam

Howick Wastewater Treatment Works
(final effluent often non-compliant with TSS discharge limits and associated nutrients TN, TP, etc.)

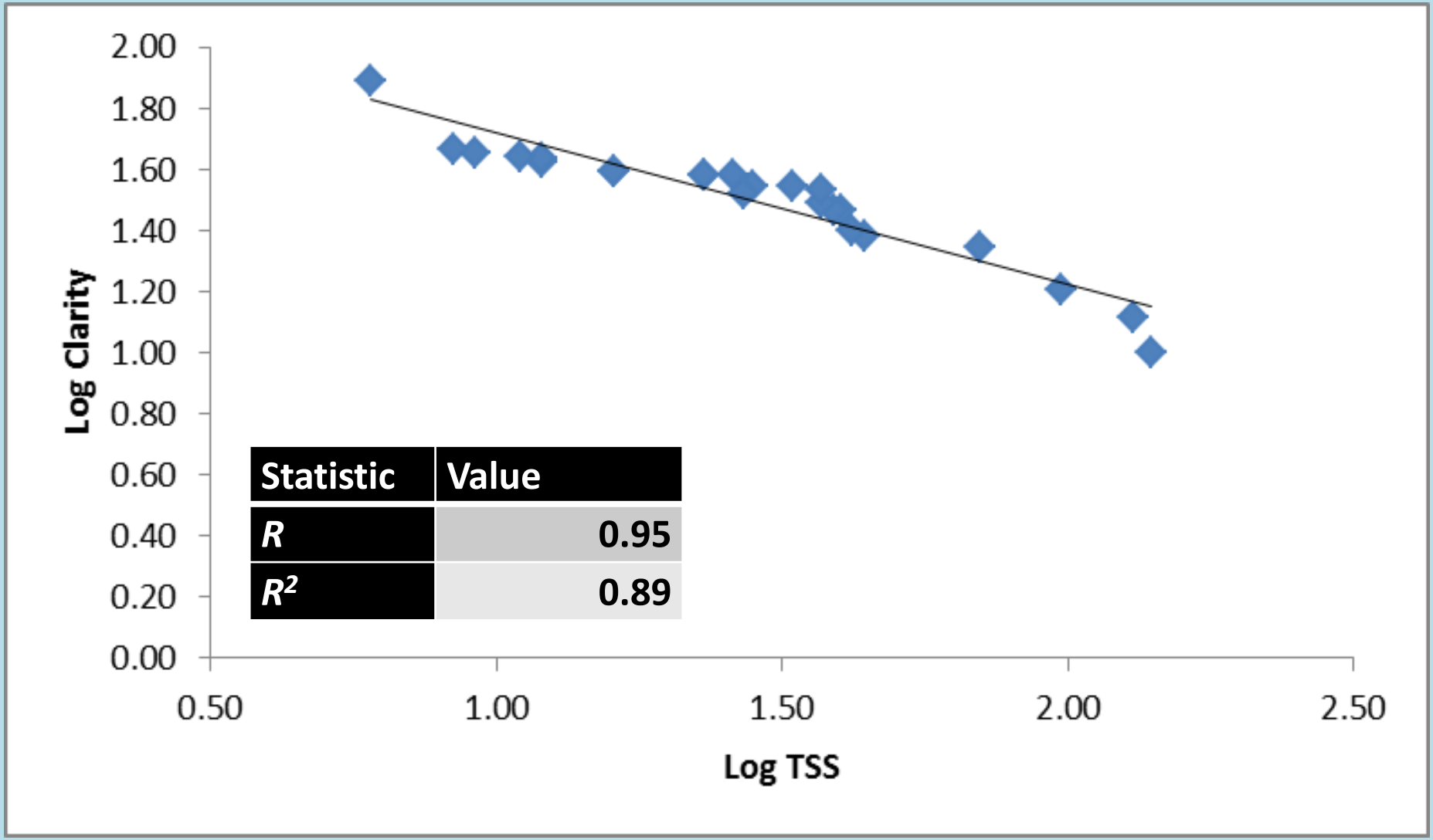
0 10 20 30 40 50 Km

Wastewater Monitoring: A Case Study

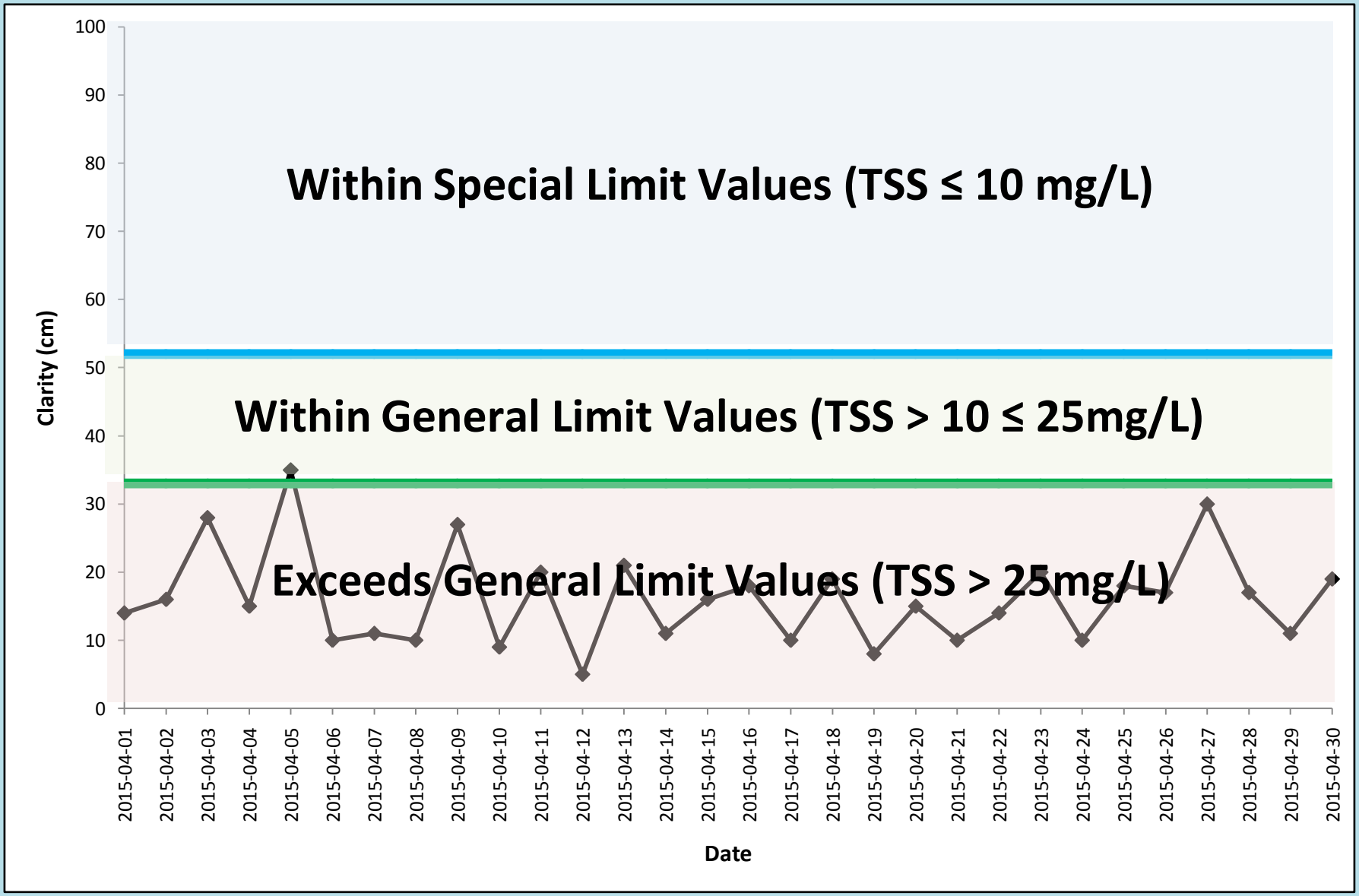
- Zongile Ngubane monitors the Howick WWTW final effluent 3Xdaily
- Consistent monitoring determines quality of the final effluent- quality is based on DWS discharge limits.
- However: no limits established for water clarity!

Wastewater Monitoring: A Case Study

- How do we determine if Howick WWTW is really compliant?
- Linear regression between TSS and Clarity.

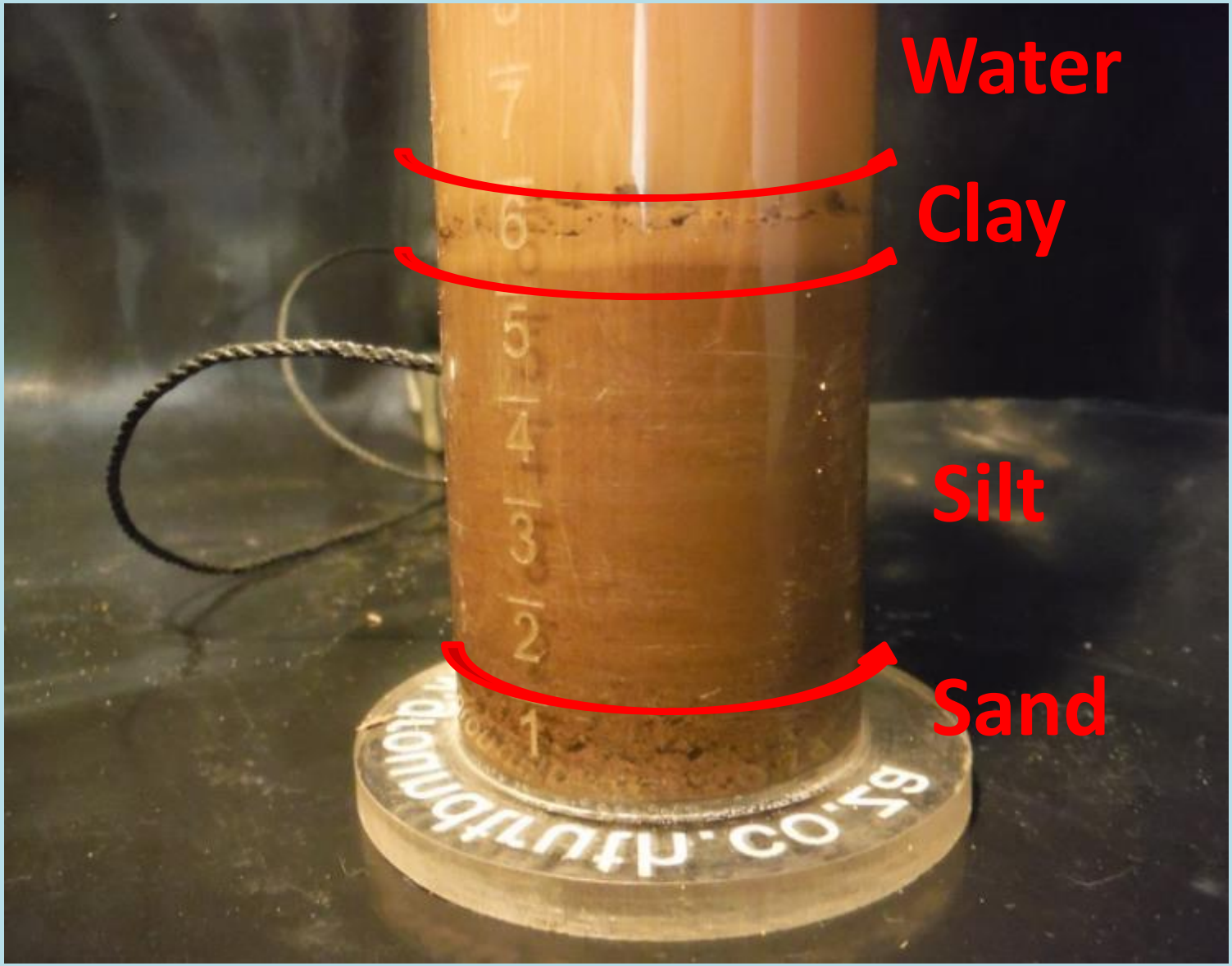


Wastewater Monitoring: A Case Study



Future Possibility: Sediment Profiling

Sediments - How much and from where in the catchment?



Citizen Science: Sediment Sampling & Profiling

- **How may citizen scientists assist with understanding more about the sediment dynamics of our rivers ?**

IFR 5 (Summer)

IFR 5 (Winter)

Nutrient Enrichment : Eutrophication
Streams/rivers, wetlands & dams

Inanda Dam – 13 March 2015

Inanda Dam – 14 Dec 2014

Mshazi Rd

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Google earth

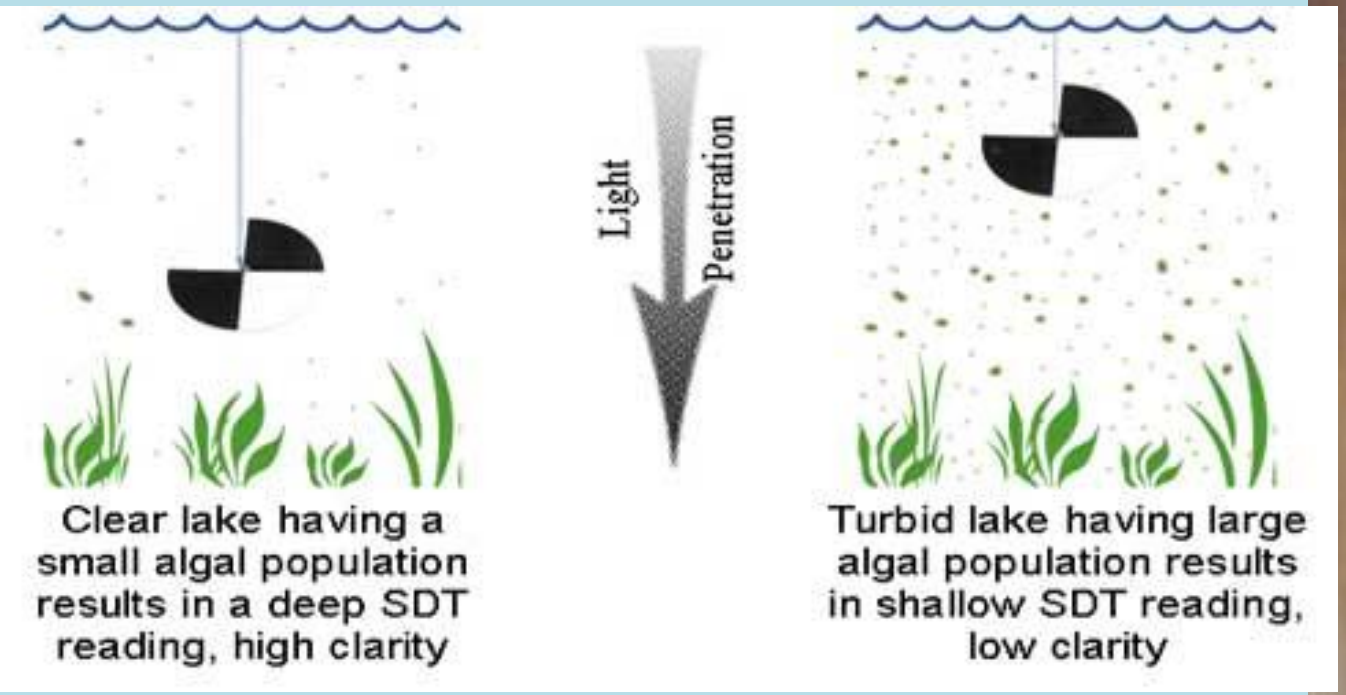
2004

Imagery Date: 12/14/2014 lat -29.676623° lon 30.806319° elev 210 m eye alt 1.48 km

Nutrient Enrichment : Eutrophication Streams/rivers, wetlands & dams

Nonkululeko Mokoena (DWS – M.Tech - TUT)

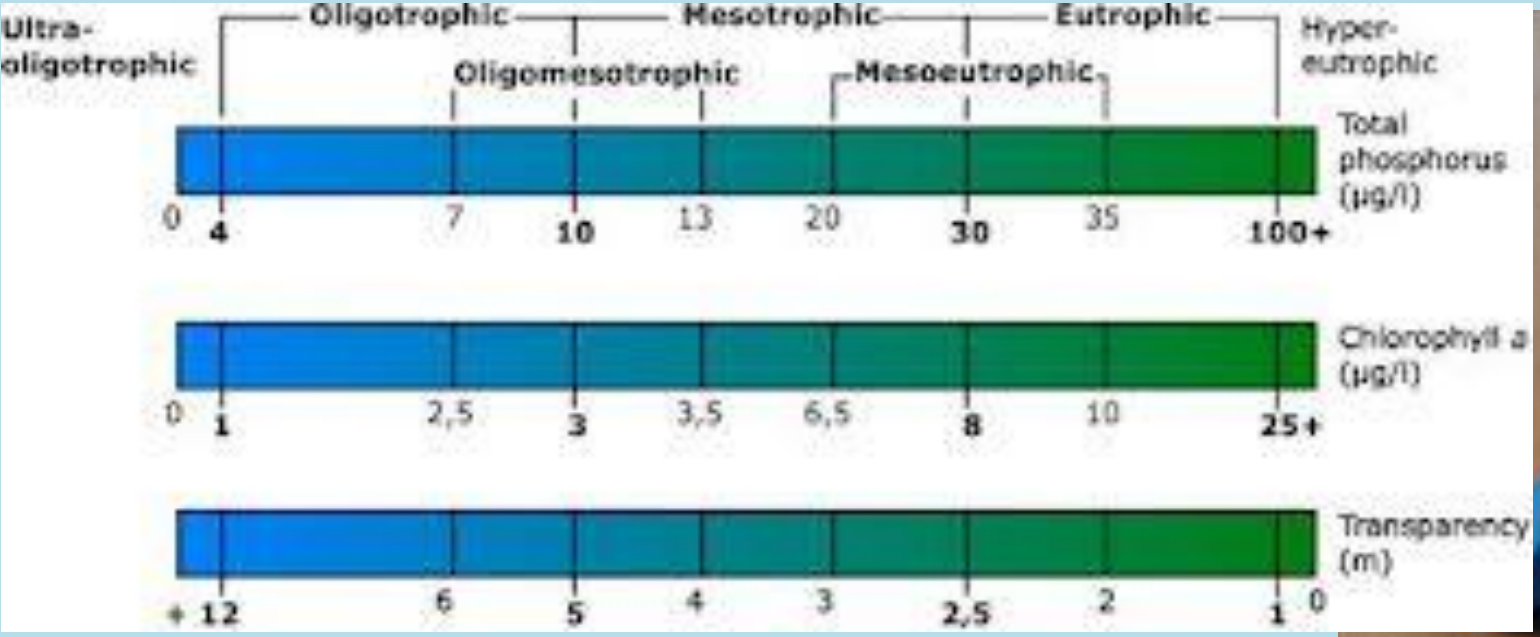
Streams, dams, wetlands



Nutrient Enrichment : Eutrophication Streams/rivers, wetlands & dams

Nonkululeko Mokoena (DWS) M.Tech (TUT) studies

Direct measures of algal concentrations – correlated to Chlorophyll “a”
Indirect measures of nutrient concentrations *in situ*



Transparent Velocity Head Rod (TVHR)

A tool for measuring water velocity and stream/river discharge:

Equation: $Q = A*V$ ($m^3.s$)

So you need:

- ❑ A: Area

Make a cross section of the river, then calculate the area measuring the depth along the stream

- ❑ V: Velocity

For each interval, you need to measure the velocity and then take an average.

Transparent Velocity Head Rod (TVHR)

INTERVENTIONS

Working with local NGOs (DUCT and WESSA), a number of intervention initiatives are being developed:

- Ecological Infrastructure & Leadership Seminars
- Street Theatre
- EnviroChamps
- River Walks
- River Care Teams
- Accredited Training (level 2 & 5)
- Non-accredited Training (1 day)
- EnviroPicture Building

EI & Leadership Seminars

amaKhosi, iziNduna, Municipal planners & authorities, etc.

Street Theatre

Communicating current environmental crises & bridging the gap between science and society.

EnviroChamps

Develop a community monitoring model to

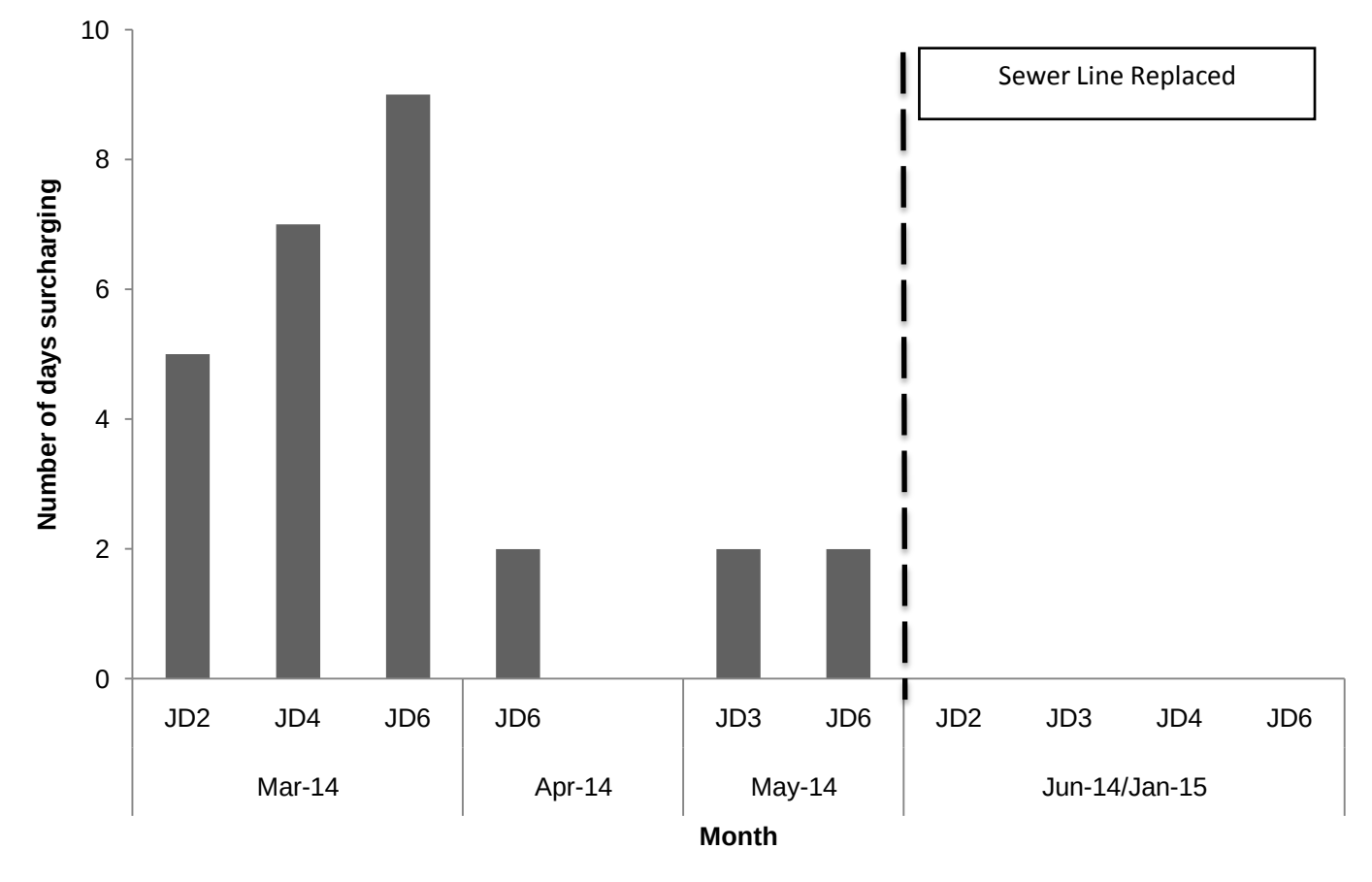
- ❑ record
- ❑ report on and
- ❑ respond to environmental problems.

Wastewater Monitoring: A Case Study

- Zongile Ngubane monitors the Howick WWTW final effluent 3 X daily.

Interventions – success story

- EnviroChamp Jabulani Dladla repeatedly reported surcharging manholes within his area.
- Municipality replaced the sewer line in June 2014.
- Constantly surcharging manholes improved – significant reduction in water pollution from this area.



River Walks

Legend

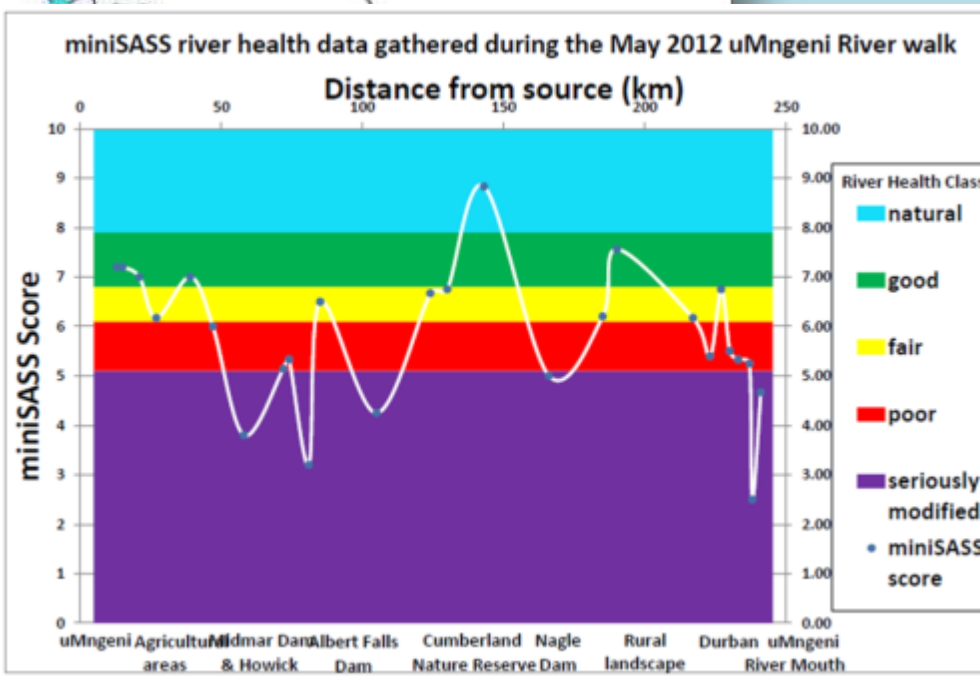
Minisass

- Natural->7.9
- Good- 6.8-7.9
- Fair- 6.1-6.8
- Poor- 5.1-6.1
- Very Poor- <5.1

Howick

Hilton

Pietermaritzburg



Where Tools & Interventions come together

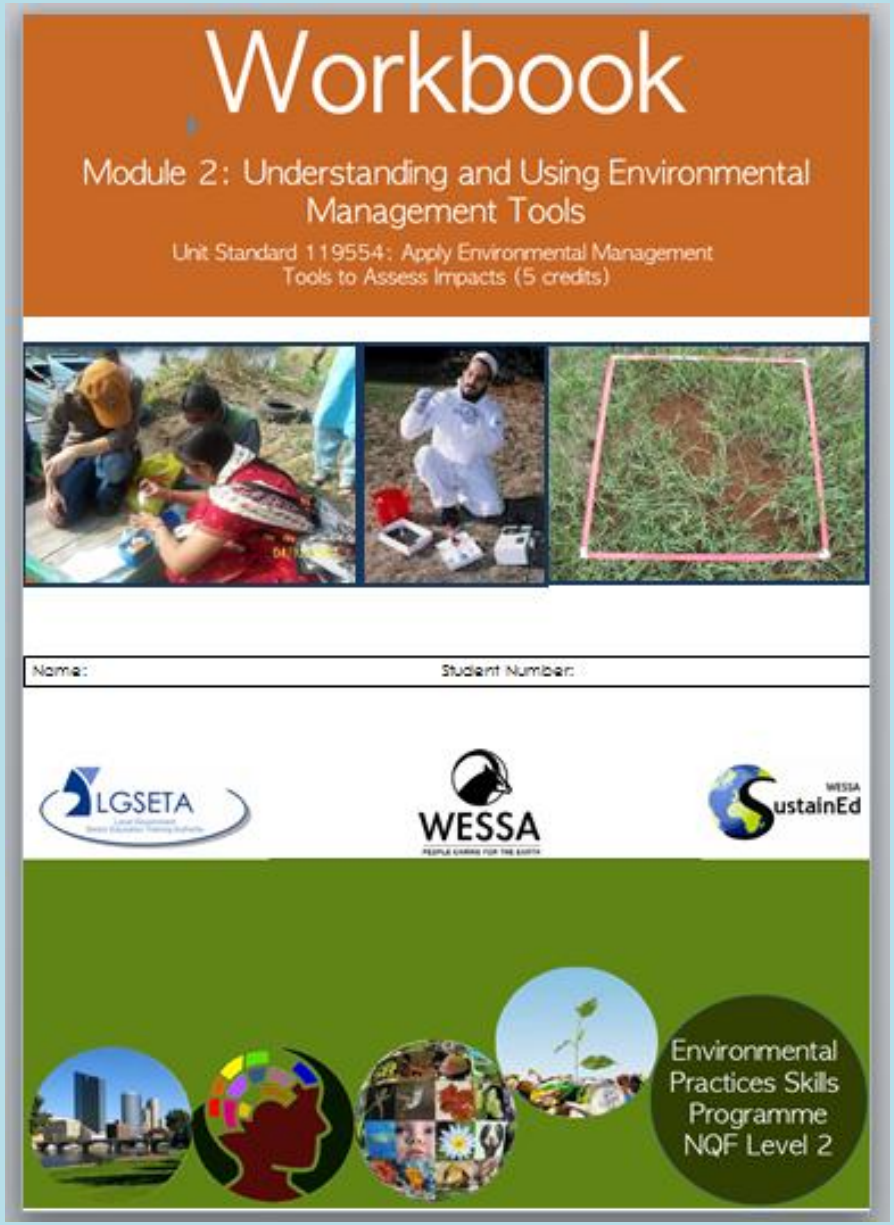
River walks hosted by Ayanda Lipheyana – DUCT EnviroChamp in Mpophomeni:

Date	River Walk	Materials used	No. of participants
10/10/2014	UMthunzima stream	none	unknown
15/12/2014	UMthunzima River walk	miniSASS kit and Turbidity tube	20 school learners
20/12/2014	Nguga River Walk	miniSASS kit and Turbidity tube	12 school learners & 1 adult
15/01/2015	UMthunzima River walk	miniSASS kit	22 school learners & 4 adults
17/01/2015	UMthunzima River walk	miniSASS tool kit, Share net picture building & turbidity tube	38 school learners & 4 adult
08/04/2015	Nguga River Walk	miniSASS kit	26 school learners & 2 adults
11/04/2015	UMthunzima River walk	miniSASS kit	24 school learners
18/04/2015	Nguga River Walk	miniSASS kit	21 Participants
25/04/2015	UMthunzima River walk	miniSASS kit	7 school learners

Non-accredited training

Accredited training

NQF Levels 2 & 5



School Lesson Plans

The *Fundisa For Change* Toolkit initiative:

Established to update and add to fieldwork lesson plans for:

- Senior Primary phase – Grade 5-7 (Natural Science)
- Further Education and Training phase - Grade 10 (Geography)

Developing a mobile phone app for miniSASS

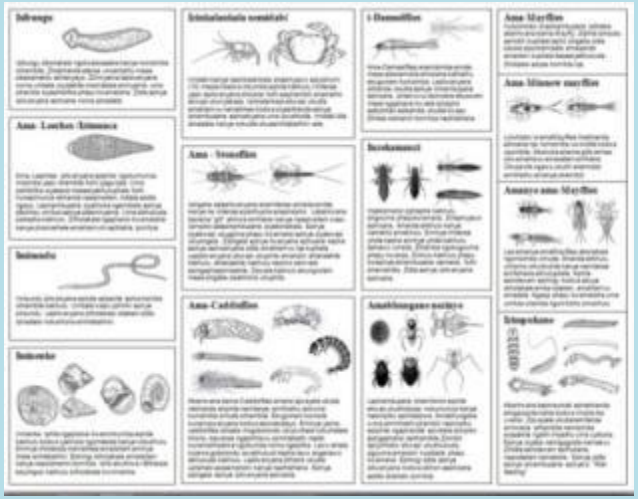
Working with MLab and DST

Information & knowledge dissemination

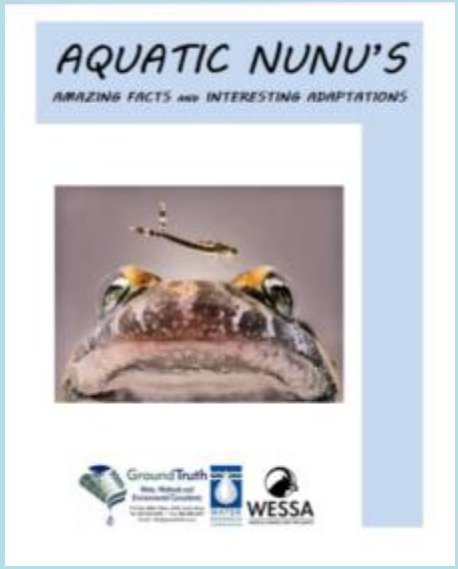
miniSASS poster

miniSASS field pamphlet

miniSASS field and identification sheets
(English, Afrikaans and isiZulu versions)



miniSASS Nunu book (draft)



Student capacity development & involvement

Student involvement:

- bursary funded students with a research topic contributing directly to the project; or
- non-bursary funded students whose research topic aligns with the project, receiving necessary mentorship;
- students seeking interesting research topics using other/own funding;
- vac students contributing to the testing of various citizen science tools;
- foreign students on study or internship programmes; and
- student research support group meetings.

Summary: Projected number of students

1 PhD student	▪ Mr Tichaona Pesanayi	
5 Masters students	▪ Ms Louine Boothway ▪ Ms Marilyn Govender ▪ Ms Pamella Magida	▪ Ms Abulele Qulu ▪ Mr Denis Radebe
0 Honours students		

Actual: Number of students supported

3 PhD students	▪ Mr Tichaona Pesanayi ▪ Ms Morakane Madiba	▪ Mr Thobani Khomo
9 Masters students	▪ Ms Louine Boothway ▪ Mr Luvuyo Dlamini ▪ Mr Richard Ndou ▪ Ms Nondumiso Dumakude	▪ Ms Xolile Nkomo ▪ Ms Hlengiwe Cele (thesis) ▪ Ms Andrea Kolbe (thesis) ▪ Mr Andreas Johnsson and Ms Karolina Klasander (thesis)
4 Honours students	▪ Ms Samiksha Singh (thesis) ▪ Mr Bryan Paul	▪ Ms Sarah-Lynn Williams ▪ Ms Nokwanda Ndebele
5 students providing research support	▪ Mr Baptiste Lelong ▪ Ms Melissa Aurelle	▪ Mr Rudzani Tshiswaise ▪ Mr Roger van Tonder ▪ Ms Adwoa Awuha

Palmiet River Watch

30th August 2013

Activity:

- miniSASS presentation and practical
- Introduction to the clarity tube

Included:

- Local residents along the Palmiet River
- GroundTruth
- 17 attendees

miniSASS day with Pelham Prep School

10th October 2013

Activity:

- miniSASS presentation and practical

Included:

- 23 school children from Pelham School- PMB (grade 7)

Groen Sebenza Provincial River Health Day

7th March 2014

Activity:

- Discussions surrounding water resources
- Intro to citizen science tools- miniSASS and clarity tube

Included:

- Groen Sebenza pioneers
- WESSA
- UKZN students
- GroundTruth
- 49 attendees

International Day of Action for Rivers

14th March 2014

Activity:

miniSASS training

Included:

- Alexander High School EnviroClub
- DUCT EcoClub
- Teachers
- 30 attendees

National Water Week

17th – 20th March 2014

South Africa's National Water Week

Activity:
miniSASS day with the the Deputy Minister, Miss Rejoice Mabudafhasi

Included:

- Department of Water & Sanitation
- Water Research Commission
- GroundTruth
- Department of Science & Technology
- WESSA's Eco-schools

WRC Youth Summit

29th June – 4th July 2014

Activity:

- Included workshops & training sessions in citizen science tools - such as miniSASS, clarity tube and EnviroPicture building
- Deputy Minister Pam Tshwete conducting a miniSASS assessment

Included:

- Students and teachers from across the country
- Delegates from DWS
- WRC
- GroundTruth

Student Water Symposium

30th July 2014

Included:

- GroundTruth
- WESSA
- DUCT
- Students & lecturers from UKZN
- 26 attendees

Activity:

Students presented on research topics associated with water resources

Youth Water Workshop

Mphophomeni Sanitation Education Project (MSEP)

6th Sept 2014

Activity:

- miniSASS training
- Teaching about water resources

Included:

- DUCT EcoClub
- EnviroChampions
- 45 attendees

SADC Citizen Science Network Training Symposium

30th Sept – 2nd Oct 2014

Activity:

- miniSASS training
- Clarity tube
- EnviroPicture Building etc.

Included:

- Delegates representing different SADC countries
- GroundTruth & WESSA
- 55 attendees

Cata Cultural Village Community Workshop

4th October 2014

Activity:

- miniSASS training
- Introduction to Stream Ecology

Included:

- Local community members of the Cata Cultural Village, Eastern Cape
- GroundTruth & WESSA
- 10 attendees

Centre for Environmental Rights (CER) Workshop

20-21th October 2014

Activity:
miniSASS training
Sannieshof
community

Included:
- CER staff
- GroundTruth
- 30 attendees

Ecological Infrastructure Workshop

28th October 2014

Included:

- Traditional Leaders from the uMgungundlovu district municipality
- WESSA
- GroundTruth
- 34 attendees

Activity:

Introduction and training with citizen science tools- miniSASS, clarity tube and EnviroPicture Building etc.

New Generations Plantations Study & Tour

October 2014

Activity:

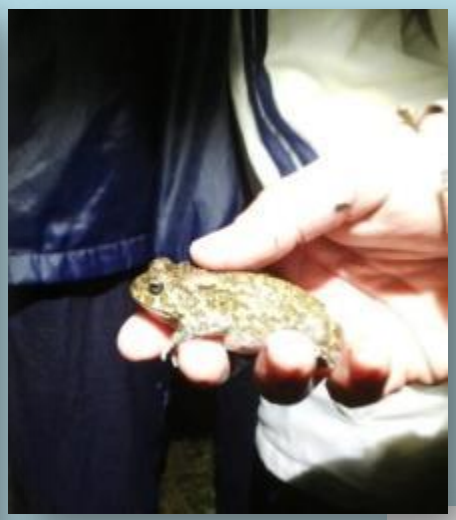
- miniSASS training

Included:

- International foresters; WWF – local & international; Mondi; local farmers, GroundTruth

St Anne's school biodiversity study & frogging evening

November 2014



Activity:
Assessing the various plants and animals present within the local wetland

Included:
- St Anne's EnviroClub
- Teachers
- GroundTruth
- 25 attendees

TriWaters Tour

January - March 2015

Included:

Triwaters adventurers Franz Fuls and Brett Merchant

The team paddled for about 2,500 kilometers, from the source of the Vaal River to the mouth of the Orange River in Alexander Bay – March to May 2015.

Activity:

River Talks

These informed local residents and schools surrounding the Vaal and Orange River on how to use miniSASS.

Ecological Infrastructure Workshop

5th February 2015

Included:

- Local Msunduzi Municipality officials
- GroundTruth
- WESSA
- 15 attendees

Activity:

Introduction and training with citizen science tools- miniSASS, clarity tube and EnviroPicture Building

World Water Forum (Korea)

April 2015

Activity:

Simon Bruton (GroundTruth) facilitated two miniSASS field assessments and training in Korea.

Presented on miniSASS at the conference

Included:

- International delegates
- Youth
- Citizens
- media
- 35 attendees attended two training sessions

“WWF Journey of Water”

13th May 2015

Included:

- Rapper “ProVerb” and other celebrities
- Miss Earth of 2015, Ilze Saunders
- Dusi King, Andrew Birkett

Activity:

- miniSASS practical
- Clarity Tube demo