# CLARA : South Africa Pilot

## - Capacity-linked water supply and sanitation improvement for Africa's peri-urban and rural areas

16th *October 2013*

Valerie Naidoo (Water Research Commission
Marlene vd Merwe-Botha (Watergroup)
Gary Quilling (Watergroup)
Solly Manyaka (Kaleo Consulting)
eThekwini Municipality (Teddy Gounden)

# Outline

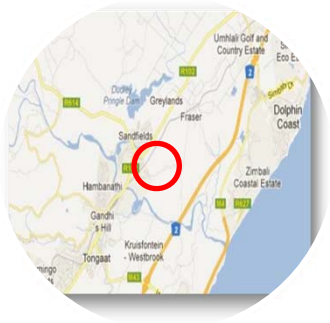
- ✓ Background : Selection of Sites (eThekwini Municipality)
  - ✓ Case study 1: Frasers settlement
  - ✓ Case study 2: Sarasvathi School
- ✓ Input to Simplified Planning Tool
  - ✓ Case study 1: Frasers settlement
  - ✓ Case study 2: Sarasvathi School
- ✓ Results
- ✓ Conclusions



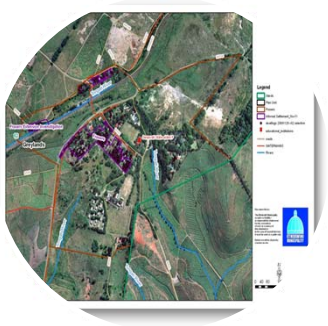


# Background: Site Selection

# Background : Selection of Sites




Fraser (ethekwini

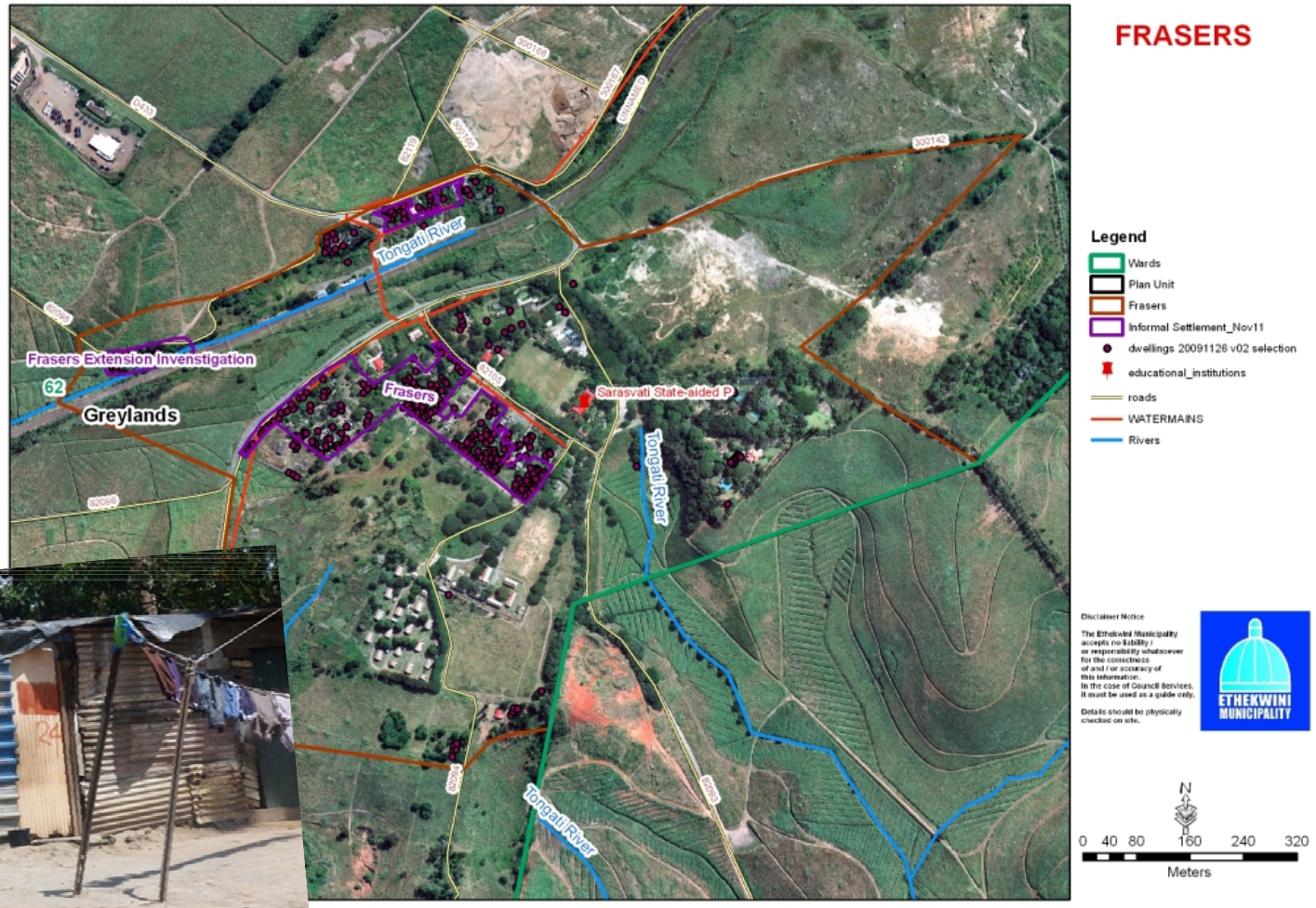


Fraser Informal Settlement

Sarasvati Primary School

# Case study 1: Fraser Settlement (eThekwini)

- ✓ Peri-urban(informal)
- ✓ PE 1000
- ✓ Water supply available
- ✓ Sensitive environment
- ✓ High unemployment (46%)
- ✓ Low income
- ✓ Agriculture based
- ✓ Low education level




# 1. Testing the Tool: Fraser Settlement

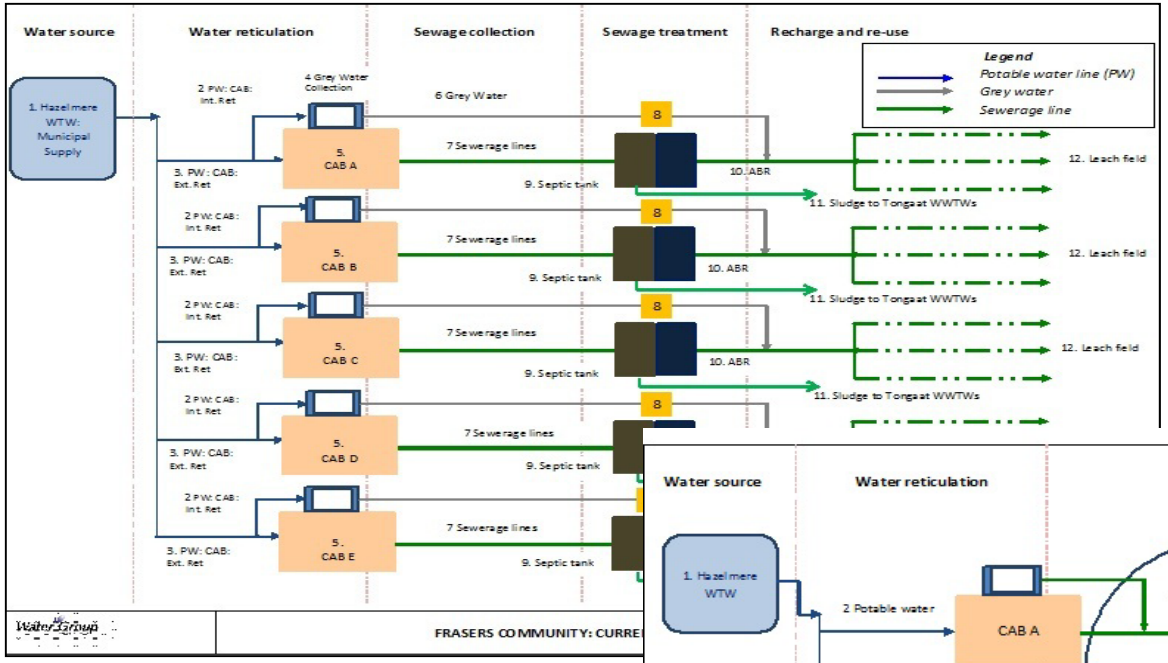
| Existing water services | Alternatives assessed |
|---|---|
| Pressure water supply from Umgeni water scheme from Hazelmere WPW via 300 mm dia pipeline at 6 kPa, gravity line with PRVs. Water offtake vai 75 and 50mm uPVC. Class A quality water | No alternatives assessed. |
| 5 standpipes and 5 CABs services 96.6% of population, boreholes the rest | Umgeni plan to upgrade the 300mm to 1m dia pipe, drawing from WPW. |

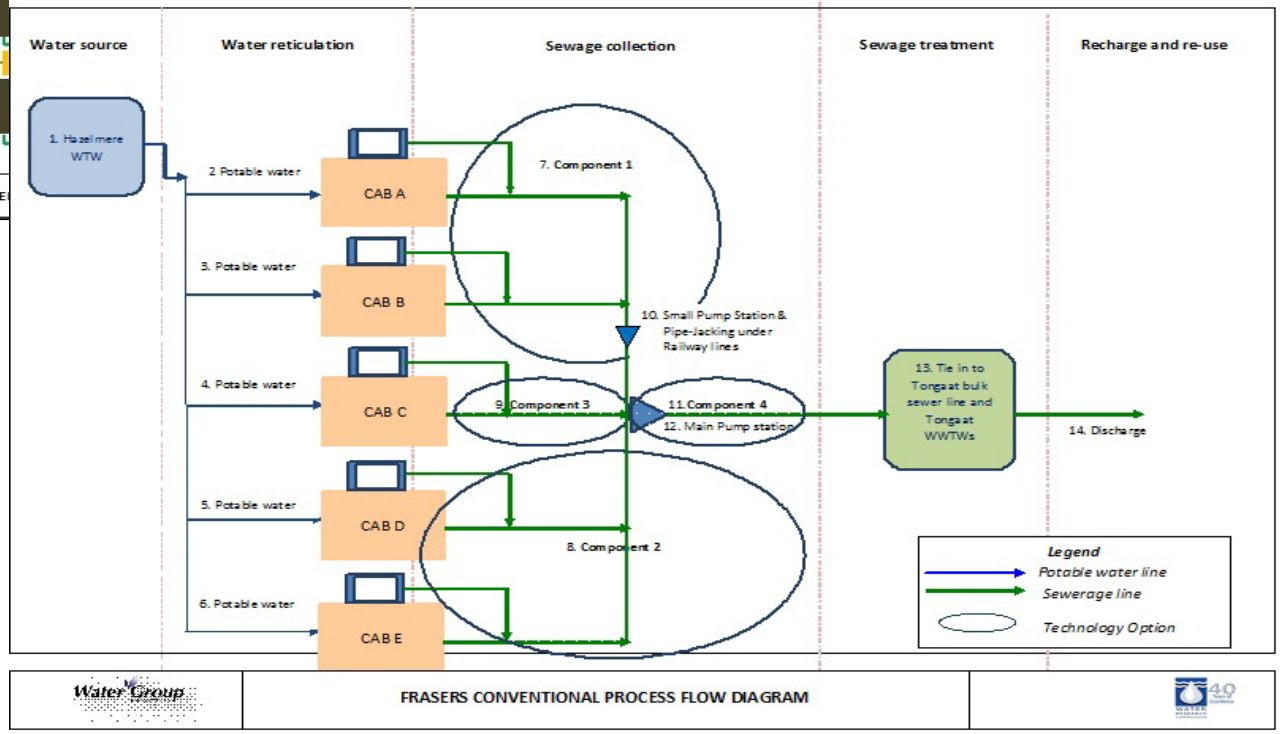
| Existing sanitation services | Alternatives assessed |
|---|---|
| 1 = CABs and onsite waterborne septic tank &ABR | 2 = CAB linked to offsite centralised waterborne sewer system |

**Input constants for Alternative 1 & 2:**

- Period of consideration: 50 years
- Net interest rate: should be 8.5%
- Expected annual growth: 1.8%

# Example of process flow diagram : ALT 1 & ALT 2



# FRASER TECHNOLOGIES INVESTIGATED

## ALTERNATIVE 1 = CABs and onsite waterborne sanitation (CABS + SepticTank + ABR)

### Wastewater collection:

- **Technology 1: Sewer for CAB A-B**
  - PE 200, trench depth 0.8m, sewer length 66 – 78 m, depending in CAB
- **Technology 2: collection of faecal sludge**
  - 5 pick up points, 1x annum, 5 $m^3$/a

### Wastewater treatment:

- **Technology 1: Septic tank for CAB A-E**
  - PE 200, 1x tank 6mx3mx2m
- **Technology 2: ABR for CAB A-E**
  - 1x ABR 6mx3mx2m

# FRASER TECHNOLOGIES INVESTIGATED

## ALTERNATIVE 2 = CABs and centralised waterborne sanitation (CAB's + sewer (to existing WWTP)

## Wastewater collection:

- **Technology 1: Sewer for CAB A-B**
  - PE 200, trench depth 1.2m, sewer length 283 – 560 - 700m, depending in CAB

- **Technology 2: Sewage pump station**
  - Flow 1.2 $m^3$/h, 56 pressure head (actual is 6m but tool require +50 factor)

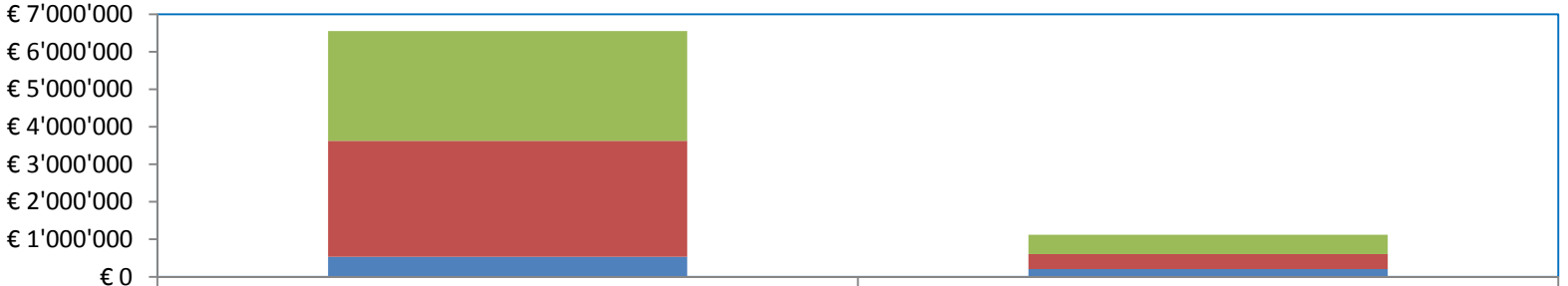
- **Technology 3: Sewer**
  - PE 400 for 2 CAB inputs, trench depth 1.2m, length 700m

*etc up to* **Technology 6.**

# Results from SPT: Fraser Settlement

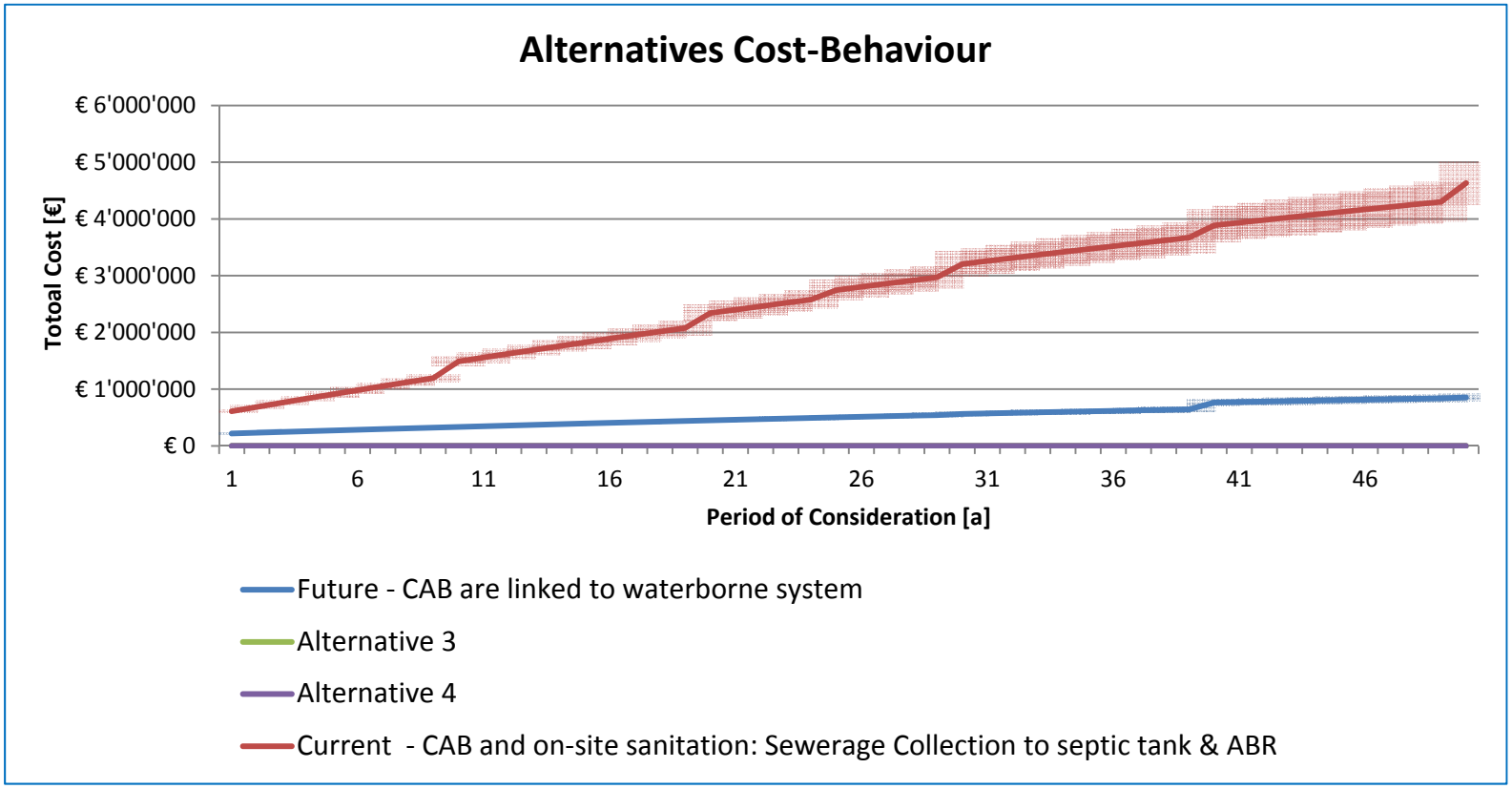
| | Alternative Name | Investment Costs | Σ Reinvestment Costs | Σ O/M Costs | Σ Revenues | Total Costs/Profits | Final Residual Values |
|---|---|---|---|---|---|---|---|
| 1 | Current - CAB and on-site sanitation: Sewerage Collection to septic tank & ABR | € 533 773 | € 3 093 346 | € 2 925 743 | € 0 | € 4 631 573 | € 293 589 |
| 2 | Future - CAB are linked to waterborne system | € 204 812 | € 403 278 | € 512 387 | € 0 | € 851 048 | € 71 428 |

## Cost distribution of alternatives




| | Current - CAB and on-site sanitation: Sewerage Collection to septic tank & ABR | Future - CAB are linked to waterborne system |
|---|---|---|
| Σ Revenues | € 0 | € 0 |
| Σ O/M Costs | € 2'925'743 | € 512'387 |
| Σ Reinvestment Costs | € 3'093'346 | € 403'278 |
| Investment Costs | € 533'773 | € 204'812 |

# Results from SPT: Fraser Settlement




- ✓ Current selected option of on-site sanitation not feasible as a permanent service option over 50 year lifespan : conventional service provision more feasible and one has to make the decision with the following considerations:
  - ✓ Informal
  - ✓ Private land
  - ✓ Subsidised service

# Case study 2: SARASVATHI SCHOOL (eThekwini)

- ✓ Primary school
- ✓ 325 learners, 10 educators
- ✓ Public school on private land
- ✓ No agreement.
- ✓ School serves impoverished community (mainly of migrant labourers,
- ✓ Have basic water and sanitation services.

# Site 2: Testing the Tool: SARASVATHI

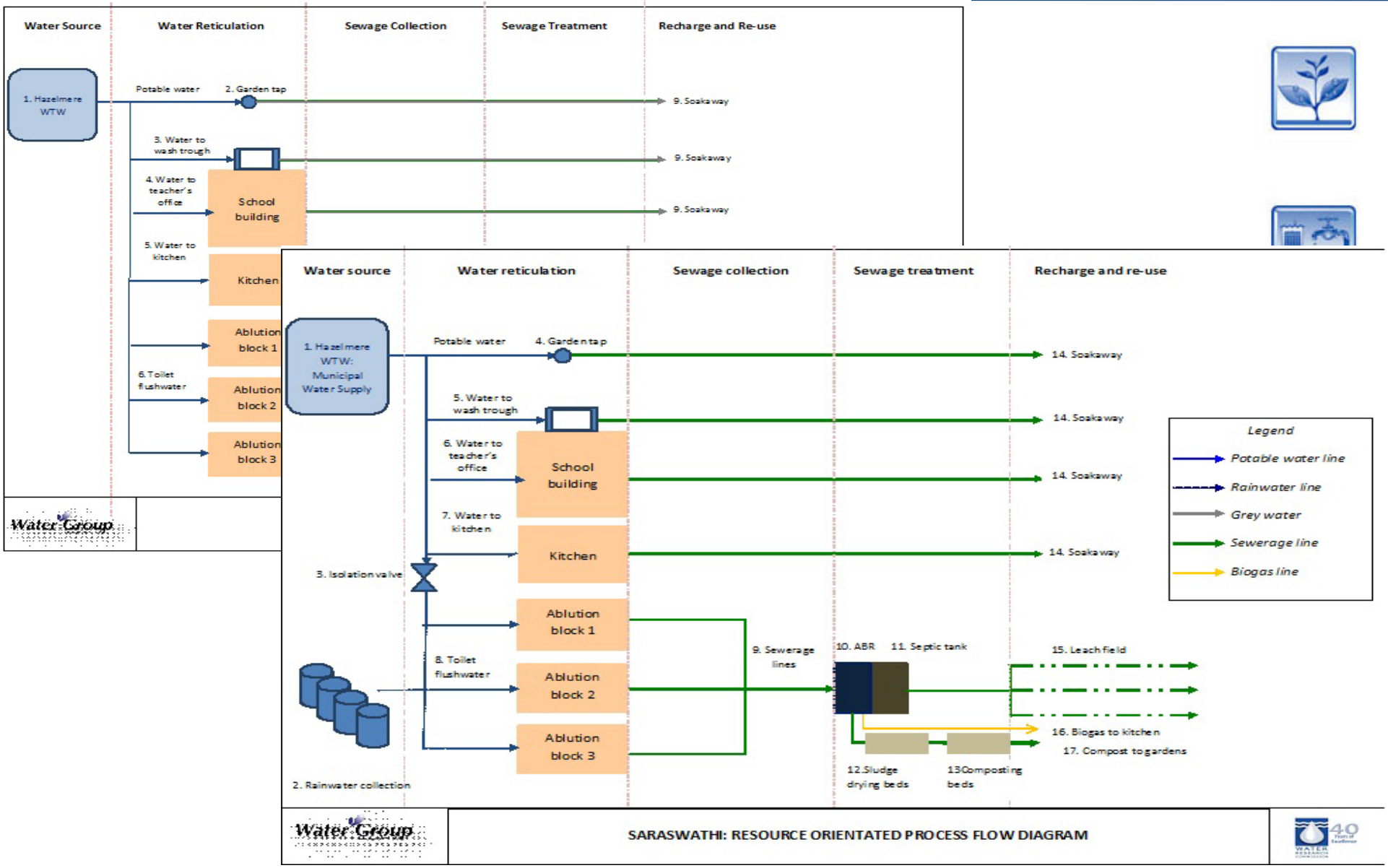
| Existing water services | Alternatives assessed |
|---|---|
| 1 = Same pressured, unmetered supply ; Two standpipes, 4 taps at water troughs supply at 10l/day (9 kl/month). Supply 350 people with Class 0 water. | 2 = Equip rainwater harvesting tanks to augment existing service. (possibility) |

| Existing sanitation services | Alternatives assessed |
|---|---|
| 1 = 3 ablution buildings, 8 toilets, uPVC pipe of 12m 110mm feeds to 2 septic tanks which are emptied every 2-18months, 30 learners/toilet | 2 = Tamper resistant ablution with 12 toilets, network to ABR // septic tank / leach fields<br><br>3 = Sludge drying & reuse, compost, biogas |

**Input constants for alternatives:**

- Period of consideration: 30 years
- Net interest rate: should be 8.5%
- Expected annual growth: 0% (no plan to expand school)

# Example of process flow diagram : ALT 1, & 3



# SARASVATHI TECHNOLOGIES INVESTIGATED

## ALTERNATIVE 1 = ablution and septic tanks

### Wastewater collection:

- **Technology 1: Sewer**
  - PE 350, trench depth 0.8m, sewer length 12m

- **Technology 2: Cesspit**
  - PE 350, discharge black & grey water from ablution facilities only

- **Technology 3: Collection of faecal sludge**
  - 1x 5000l tanker used, discharge to Tongaat WWTW every 12-24months, 5m$^3$/pick up, 12km distance

### Wastewater treatment:

- **Technology 1: Septic tank**
  - PE 350, 2x tanks (6mx3mx2m)

# SARASVATHI TECHNOLOGIES INVESTIGATED

## ALTERNATIVE 2 = ablution and septic tanks/ABR

### Wastewater collection:

- **Technology 1: Sewer**
  - PE 350, trench depth 0.8m, sewer length 140m

- **Technology 2: Cesspit**
  - PE 350, discharge black & grey

- **Technology 3: Collection of faecal sludge**
  - 1x 5000l tanker, discharge to Tongaat WWTW every 12-24months, 5m$^3$/pick up, 12km distance

### Wastewater treatment:

- **Technology 1: ABR**
  - PE 350, 1x reactor (6mx3mx2m)

- **Technology 2: Septic tank**
  - PE 350, 1x reactor (6mx3mx2m)

# SARASVATHI TECHNOLOGIES INVESTIGATED

## ALTERNATIVE 3 = resource-oriented

### Wastewater collection:

- **Technology 1, 2, 3** same as per Altern. 2: **Sewer/Cesspit/Sludge**

### Wastewater treatment:

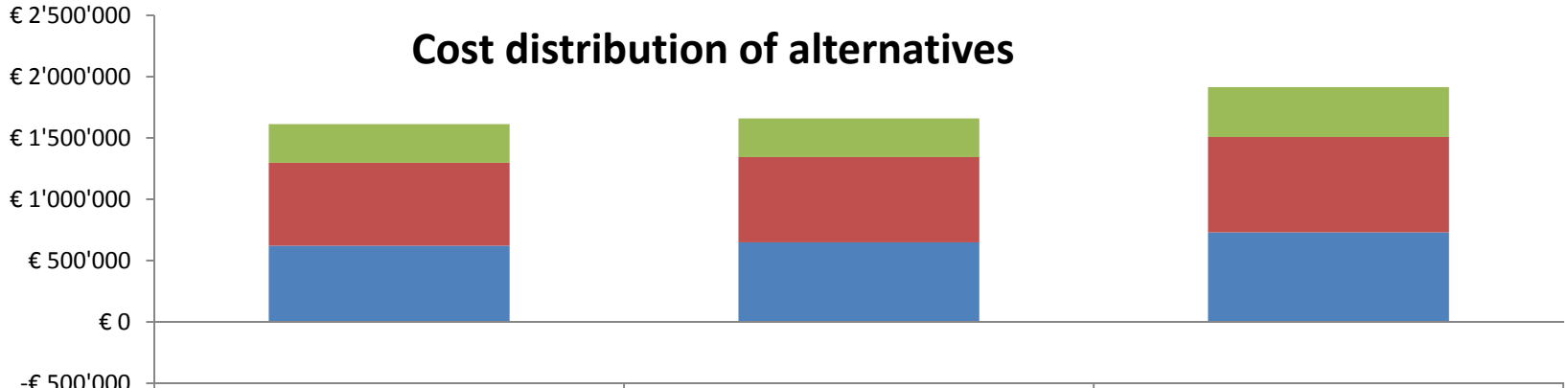
- **Technology 1: ABR**
  - PE 350, 1x reactor (6mx3mx2m), 80% removal rate

- **Technology 2: Septic tank**
  - PE 350, 1x reactor (6mx3mx2m), emptied 1x/24months
- **Technology 3: Sludge dewatering**
  - Sludge volume 4.2m$^3$/d, TS 5%, anaerobically stabilised, sludge volume 1540m$^3$/a

- **Technology 4: Composting beds**
  - Faeces from UDDTs 0 (N/A), 0.84m$^3$/d dewatered sludge, biowaste N/A

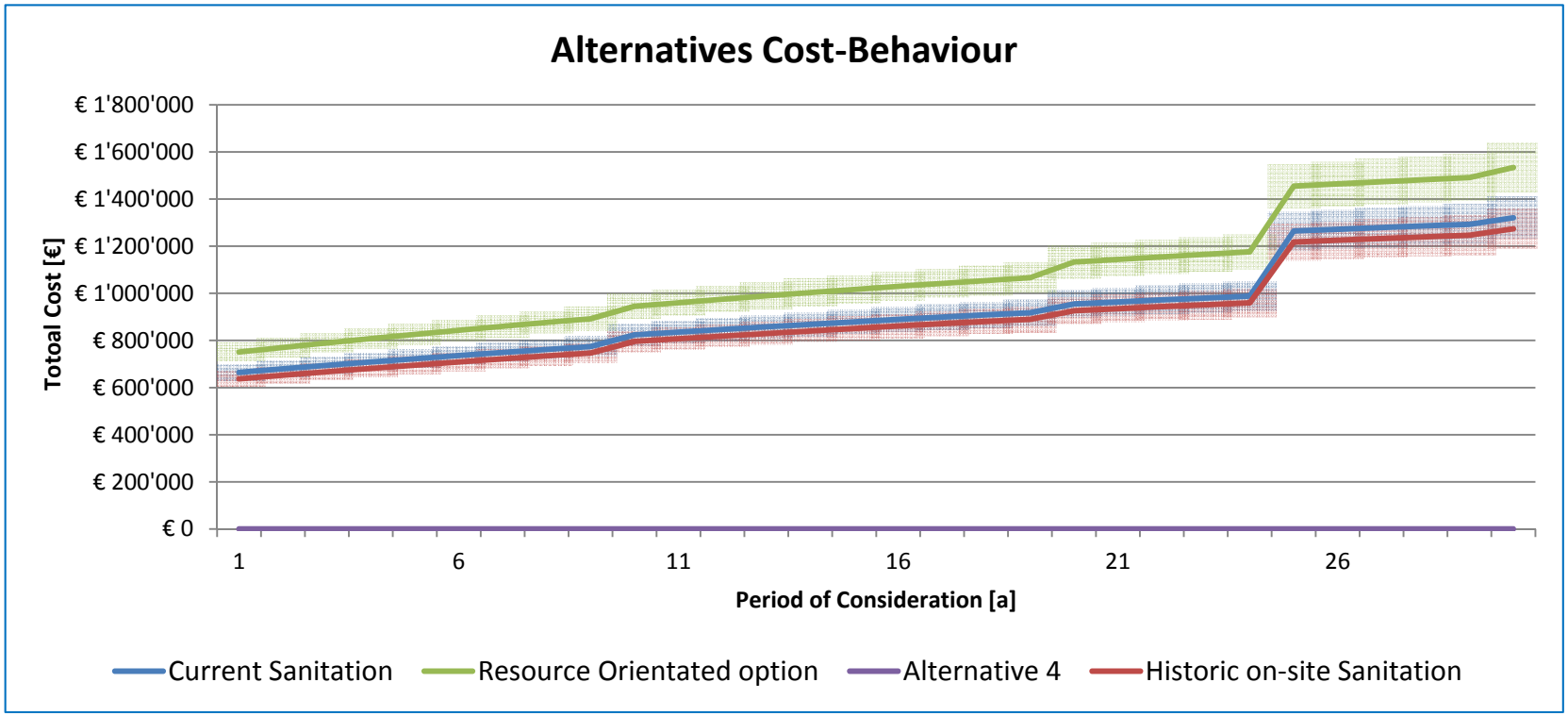
# Results from SPT: Sarasvati School

| | Alternative Name | Investment Costs | Σ Reinvestment Costs | Σ O/M Costs | Σ Revenues | Total Costs/Profit | Final Residual Values |
|---|---|---|---|---|---|---|---|
| 1 | Historic on-site Sanitation | € 621 455 | € 676 519 | € 314 533 | € 0 | € 1 273 559 | € 201 585 |
| 2 | Current Sanitation | € 648 786 | € 695 130 | € 315 900 | € 0 | € 1 320 301 | € 211 972 |
| 3 | Resource Orientated option | € 730 657 | € 777 619 | € 406 392 | € 86 | € 1 533 745 | € 235 466 |




| | Historic on-site Sanitation | Current Sanitation | Resource Orientated option |
|---|---|---|---|
| Σ Revenues | € 0 | € 0 | -€ 86 |
| Σ O/M Costs | € 314'533 | € 315'900 | € 406'392 |
| Σ Reinvestment Costs | € 676'519 | € 695'130 | € 777'619 |
| Investment Costs | € 621'455 | € 648'786 | € 730'657 |

# Results from SPT: Sarasvati School




- ✓ cost progressively increases with adding of additional service options
- ✓ historical situation had deteriorated and needs to be upgraded to comply
- ✓ resource orientated option does not generate substantial revenue:
  - ✓ Impact negligible
  - ✓ If risks managed could have value around “living lab” concept
  - ✓ Linking to biogas and crop production

# Conclusions

- Tool is ambitious, but will give good 1st order base to inform decisions on system options
- Gives clear difference for distinctive system options:
  - Decentralised waterborne
  - Centralised waterborne options
- For on-site systems – where changes are incremental due to addition of unit processes to meet specific performance improvements and services, the additional cost may be less significant over the life-cycle.
- Finally, by testing the following options, it allows one to think about the options tested under the specific assumptions and refine and test further.





# THANK YOU

## Acknowledgements

The work is carried out within the project CLARA (Capacity-Linked water supply and sanitation improvement for Africa's peri-urban and Rural Areas; Contract # 265676; duration: 1.3.2011 – 28.2.2014; http://clara.boku.ac.at/), a Collaborative Project funded within the EU 7th Framework Programme, Theme "Environment"

Capacity-Linked water and sanitation for Africa's peri-urban and Rural Areas