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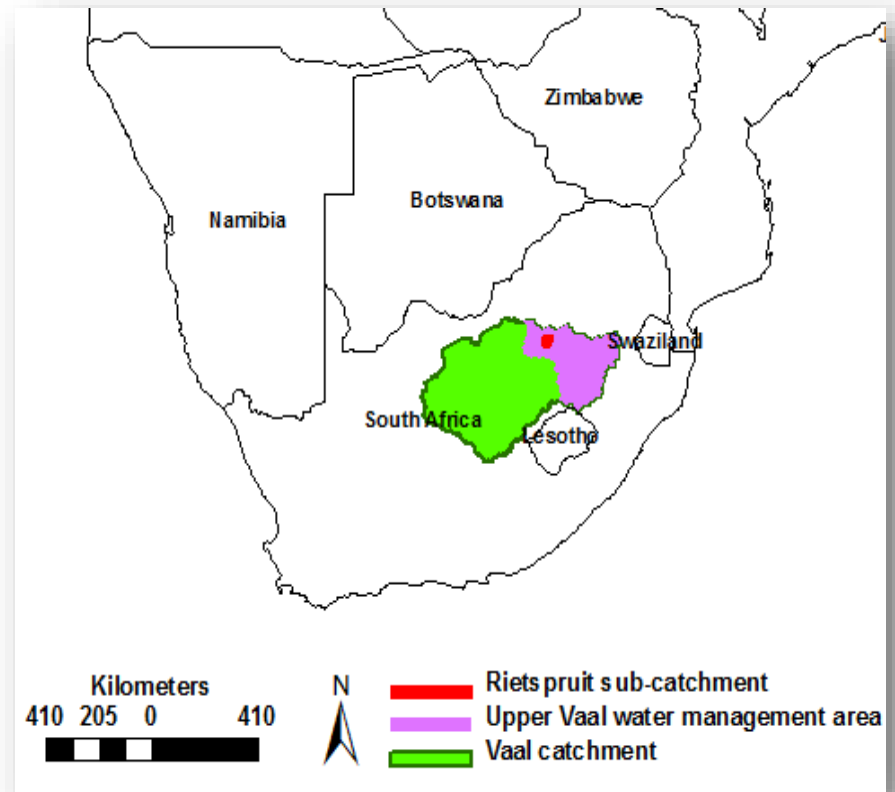
IIT Bombay



# APPLICATION OF SWAT TO WATER QUALITY MODELLING IN THE RIETSPRUIT BASIN OF SOUTH AFRICA

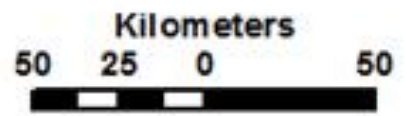
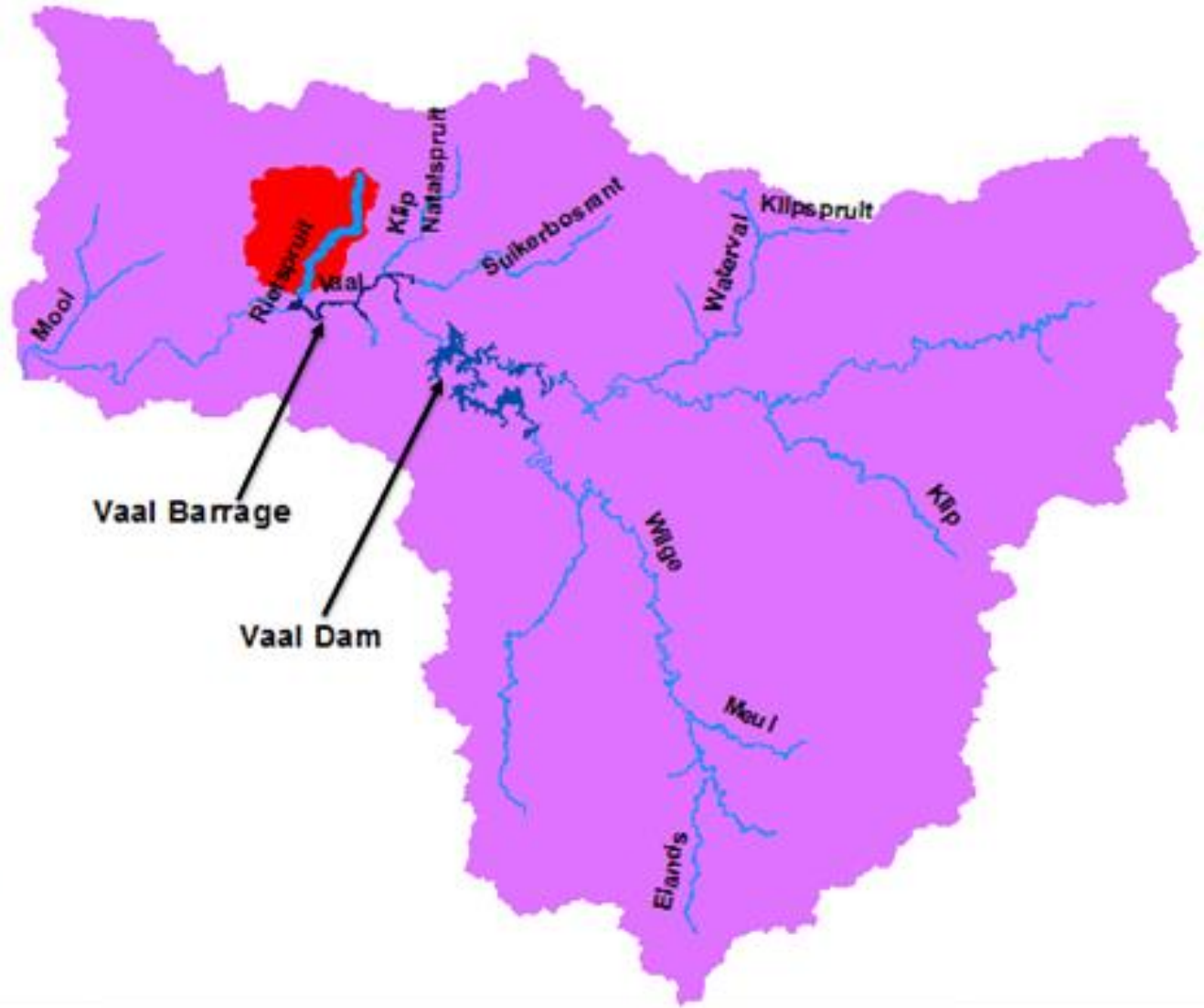
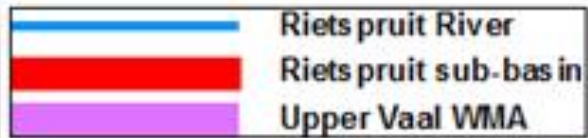
# Rietspruit sub-basin

- Located in the Upper part of the Vaal basin of South Africa
- Occupies approximately 1120 km<sup>2</sup>
- The Upper Vaal WMA is important as it contributes about 20% towards South Africa's GDP
- Pollution from mining activities and wastewater plants
- Rietspruit flows into Vaal River where it exerts chemical and microbial stresses

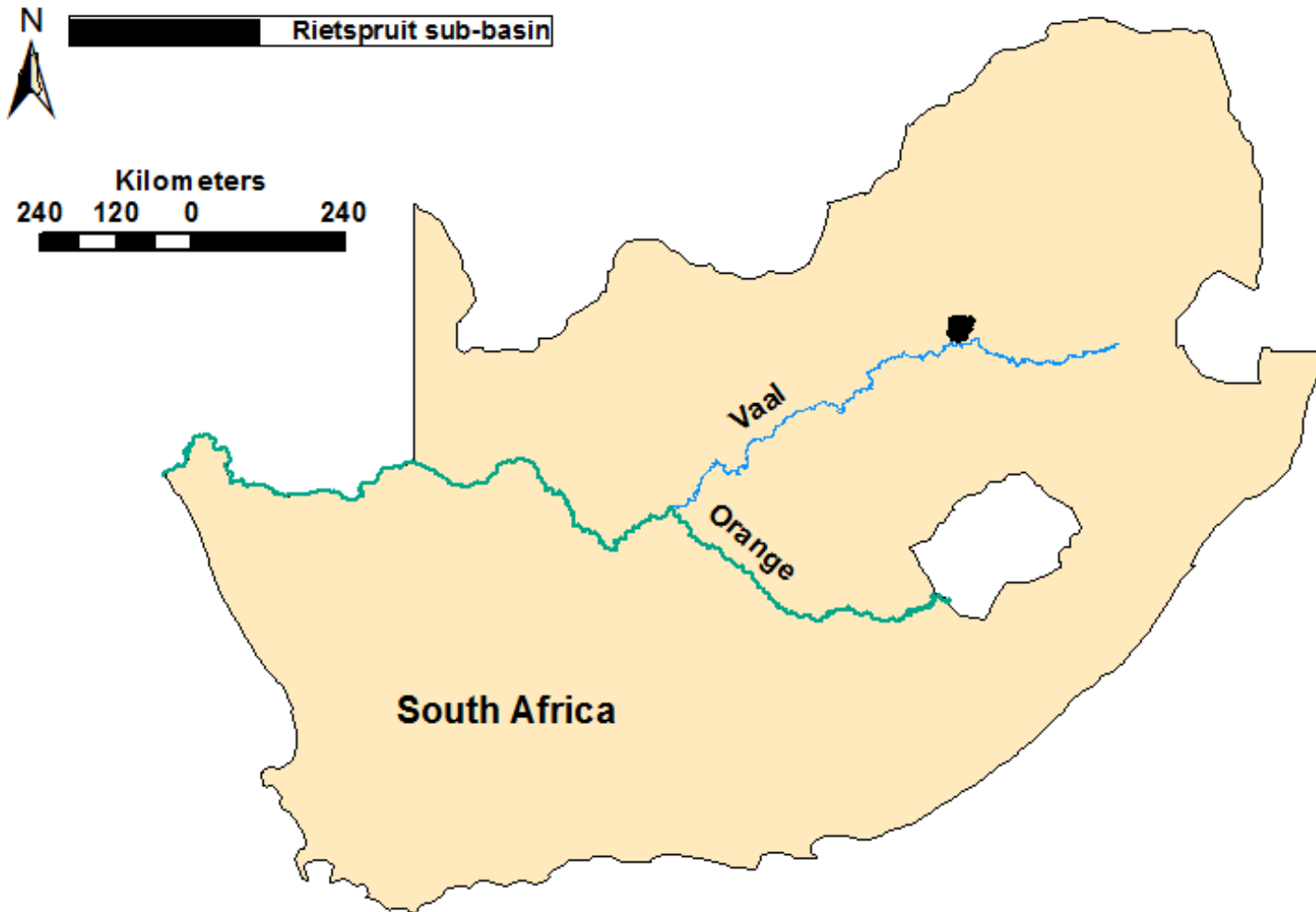


# AIM OF THE RESEARCH

To develop catchment management tools that will support restoration of the Vaal basin to good Health, one sub-basin at a time



# Vaal River pollution load impacts water quality in the Orange River

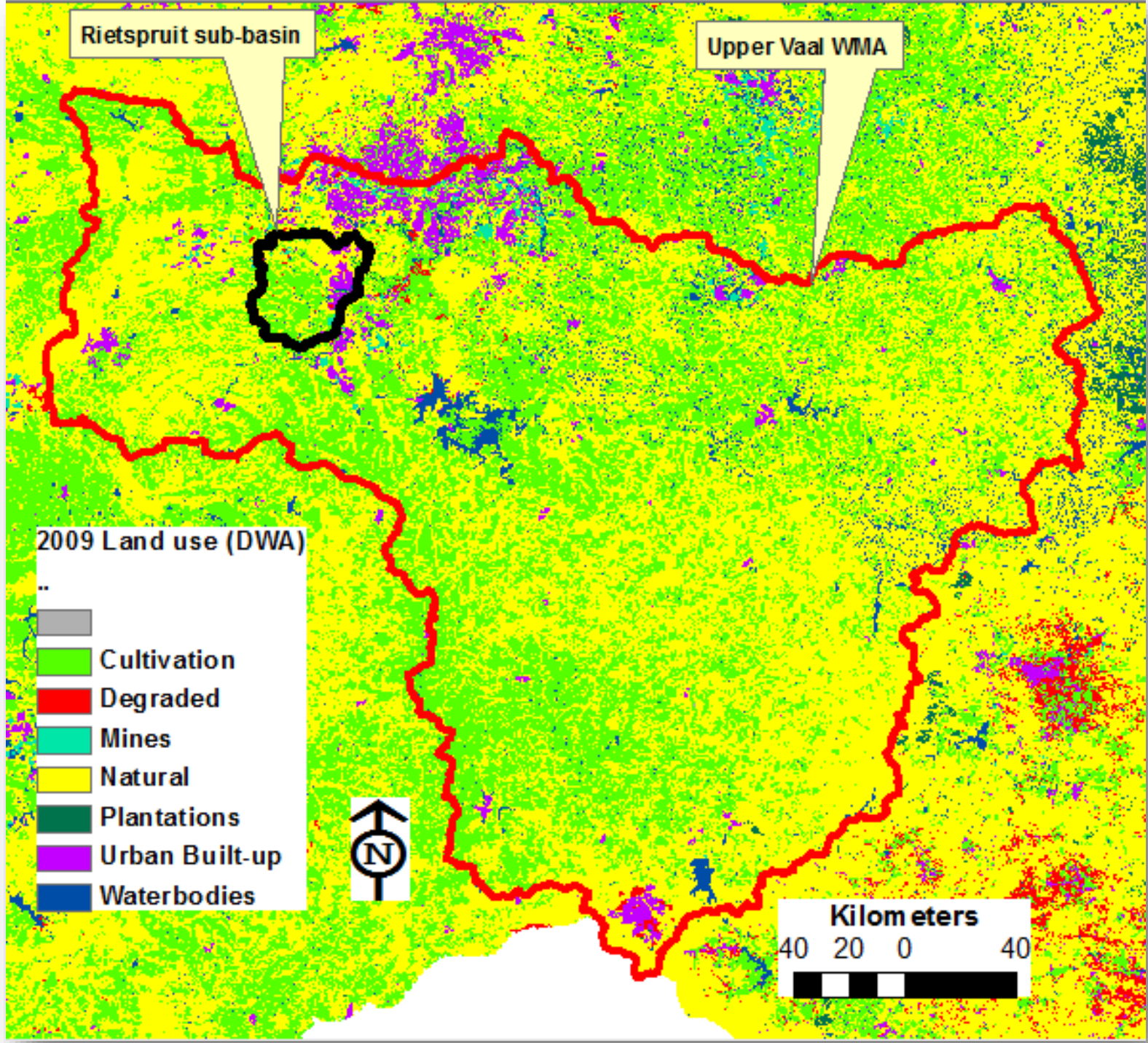
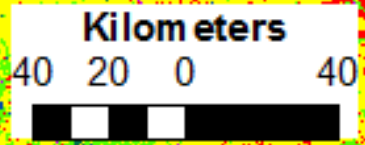


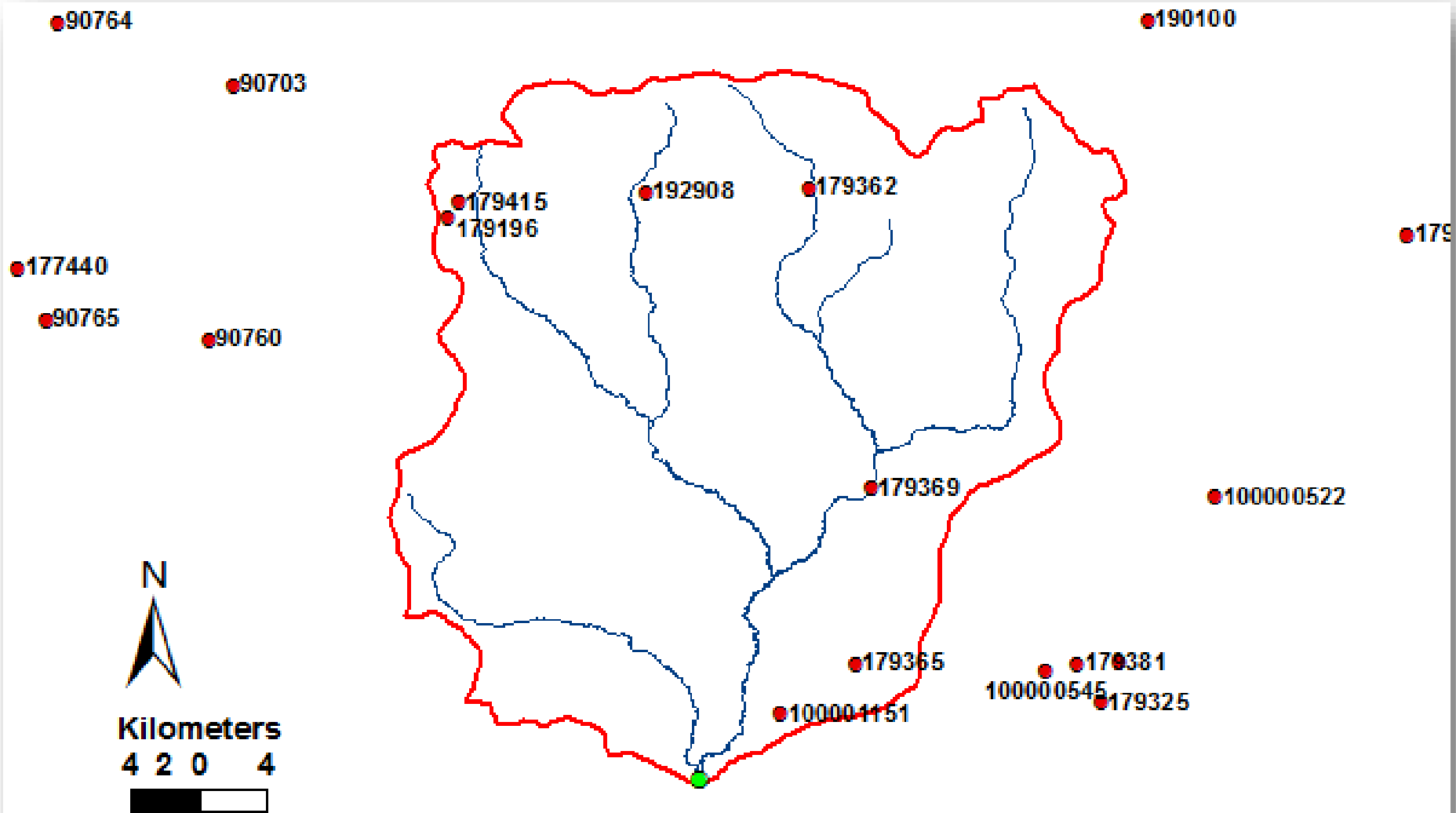
Rietspruit sub-basin

Upper Vaal WMA

2009 Land use (DWA)

- ..
- Cultivation
- Degraded
- Mines
- Natural
- Plantations
- Urban Built-up
- Waterbodies

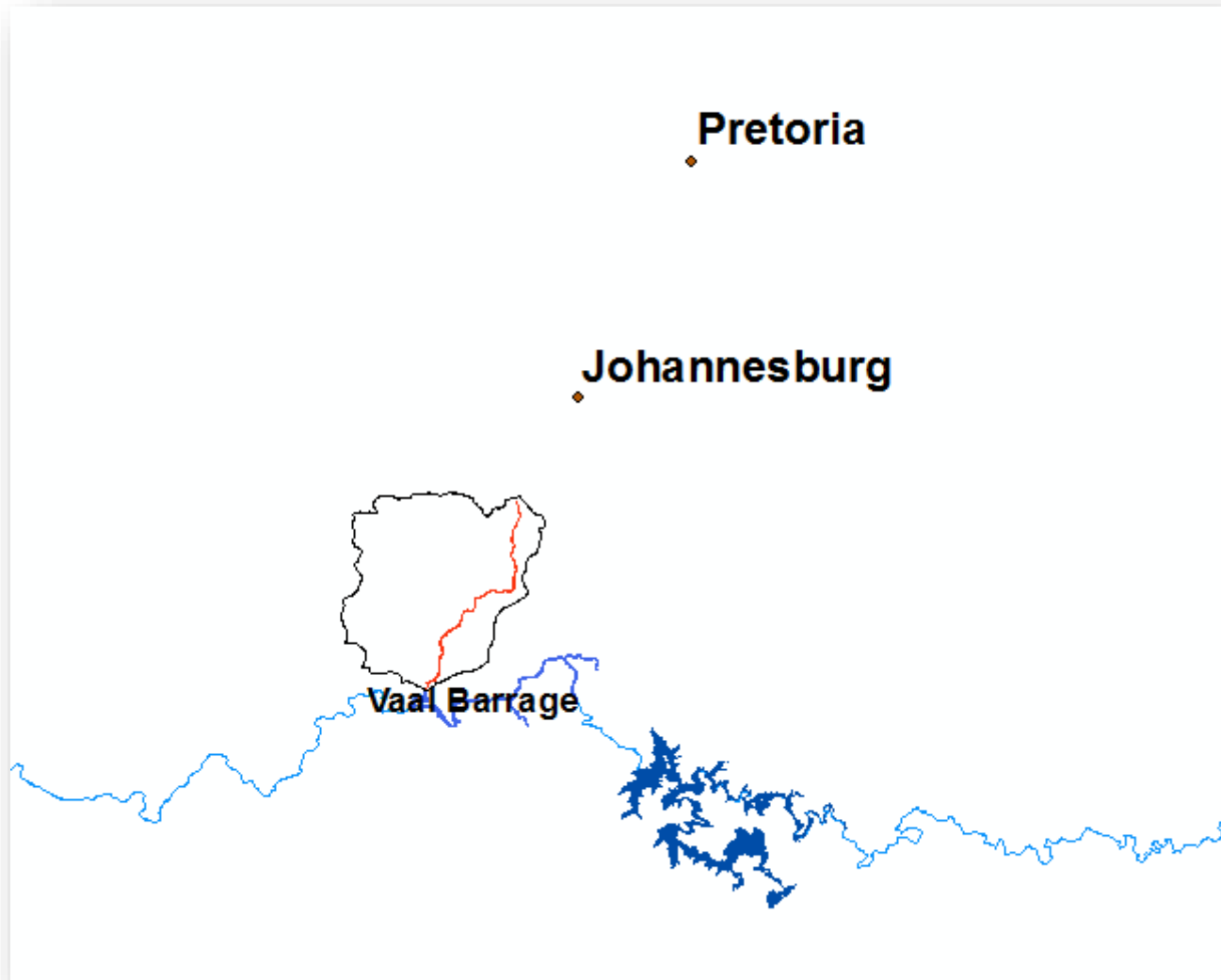


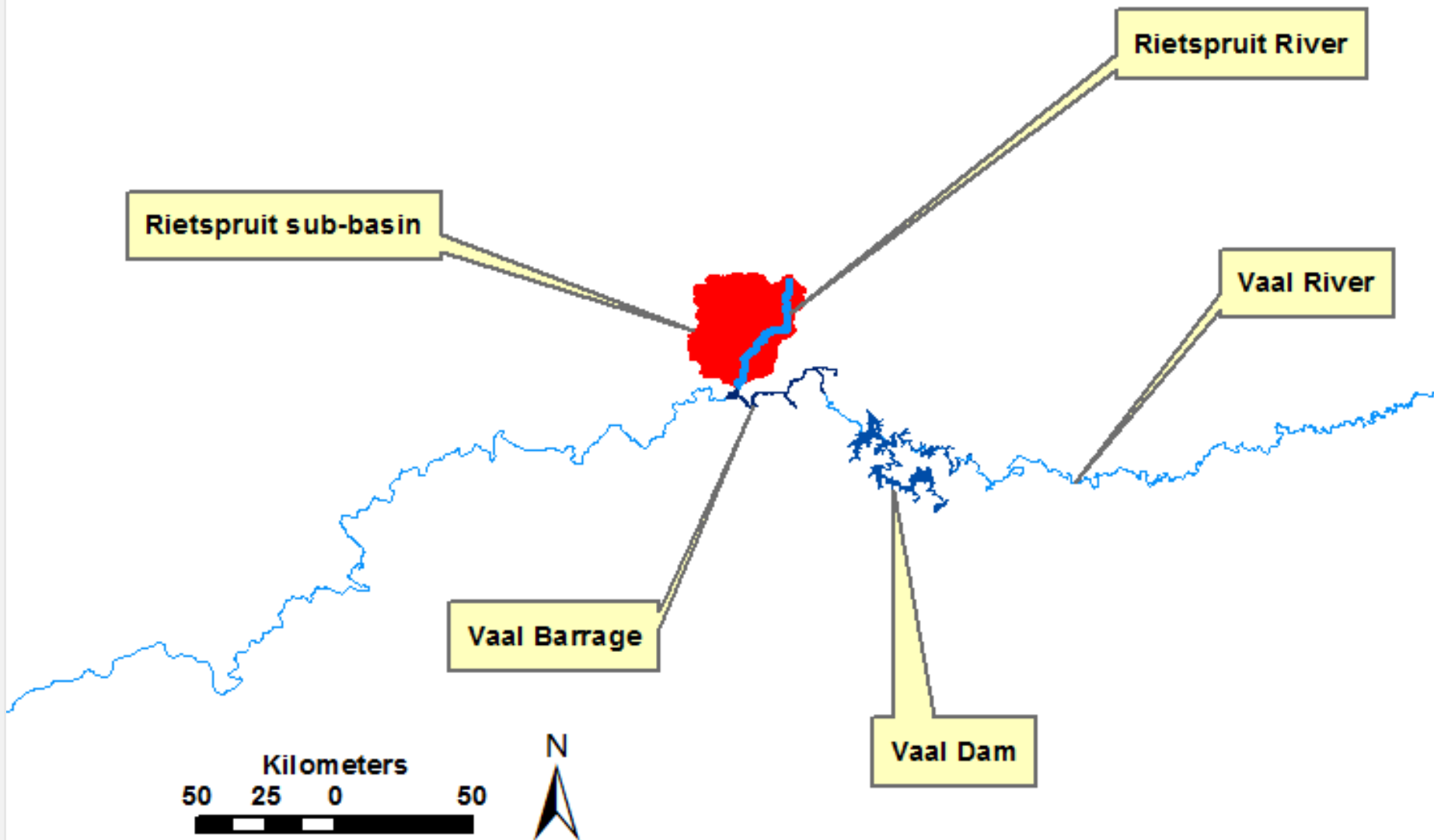


- R2 water quality site
- Wastewater plants
- Rietspruit sub-catchment rivers
- Rietspruit sub-catchment



# RIETSPRUIT SUB-BASIN IS STRATEGIC TO SOUTH AFRICA'S GROWTH

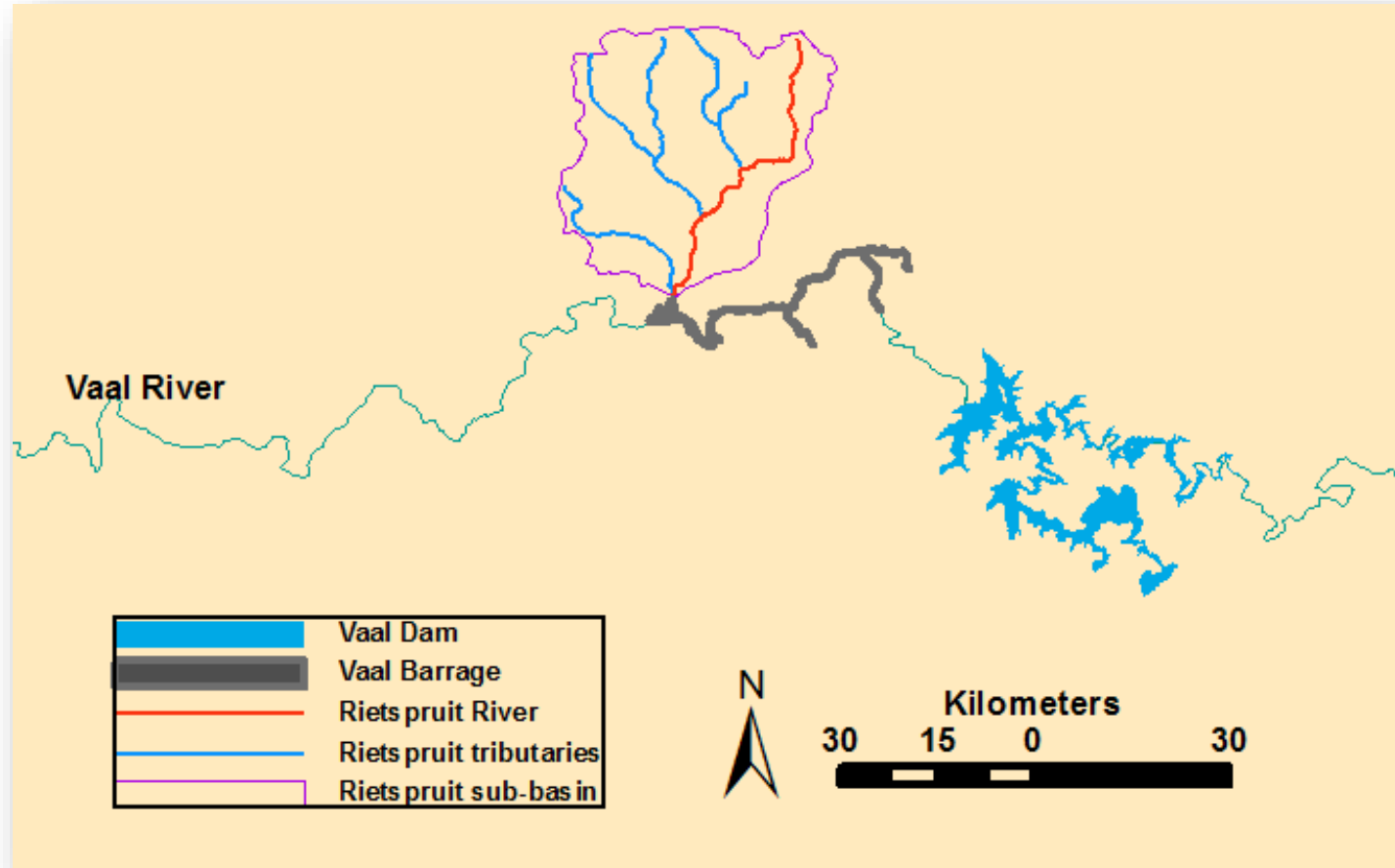




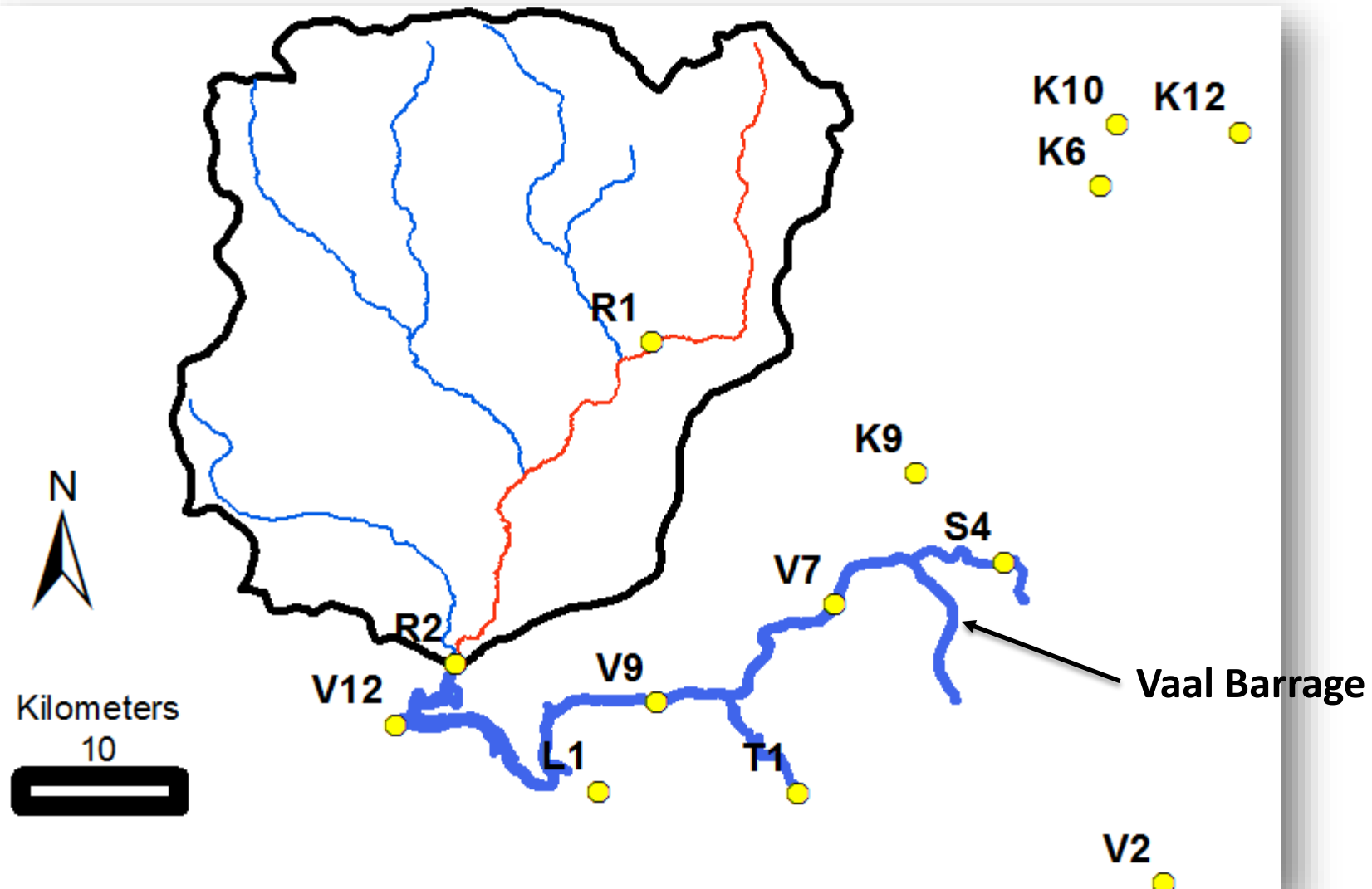
- Vaal Dam has good quality water
- Vaal Barrage is polluted
- Downstream stakeholders eg. potable water treatment plants use polluted water

- Management of the polluting activities could assist the downstream users

- using good quality raw water
- plants treating less polluted raw water

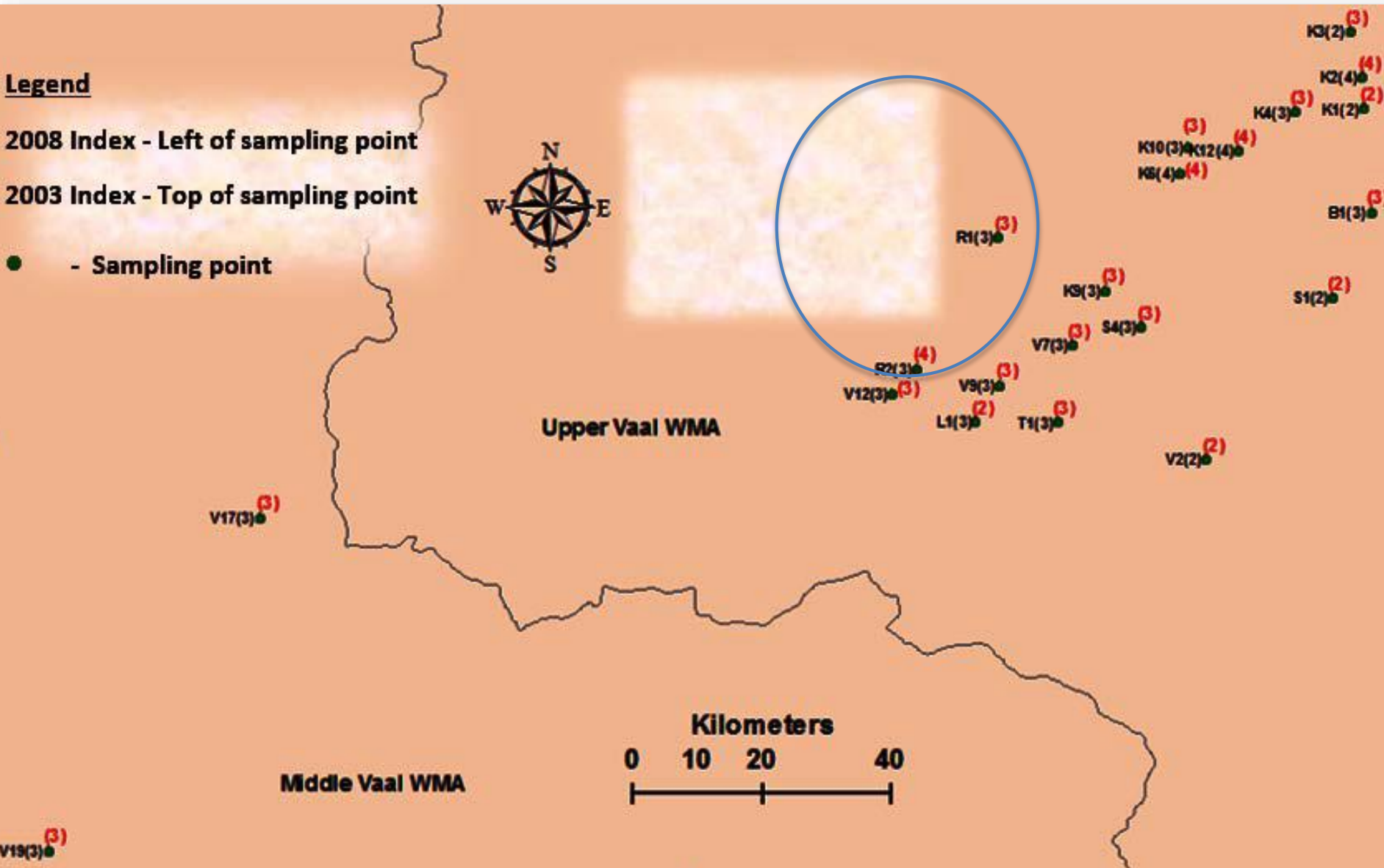


# Rietspruit sub-basin's water quality points of interest



B. Dzwaairo and F.A.O Otieno. 2014. Chemical pollution assessment and prioritisation model for the Upper and Middle Vaal water management areas of South Africa. *Journal of Water and Health*. Accepted for publication. (USED NINE PARAMETERS INCLUDING N AND P)

**Legend**  
2008 Index - Left of sampling point  
2003 Index - Top of sampling point  
● - Sampling point

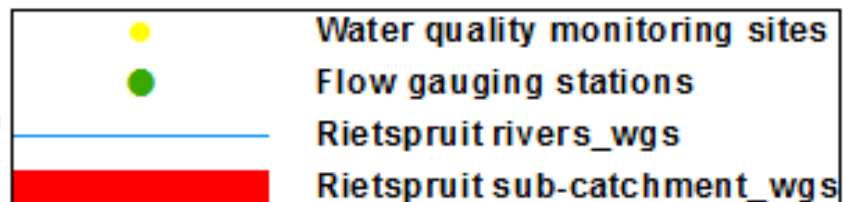
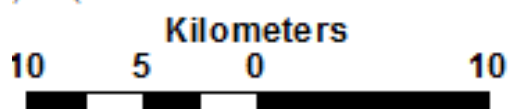
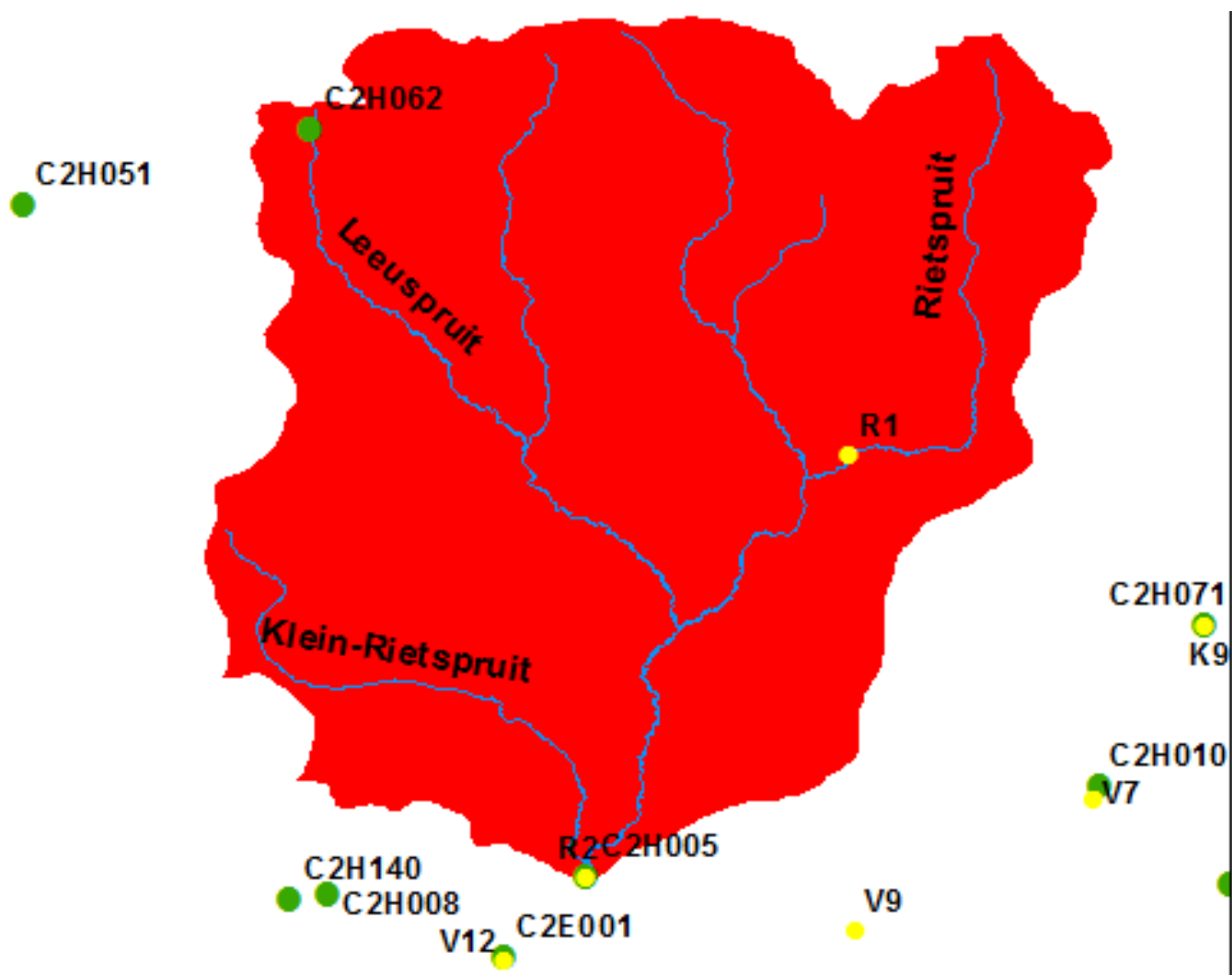


Therefore SWAT is being used to model the sub-basin processes in order to understand the basin processes specifically NUTRIENTS LOAD (water quality) and the WATER BALANCE

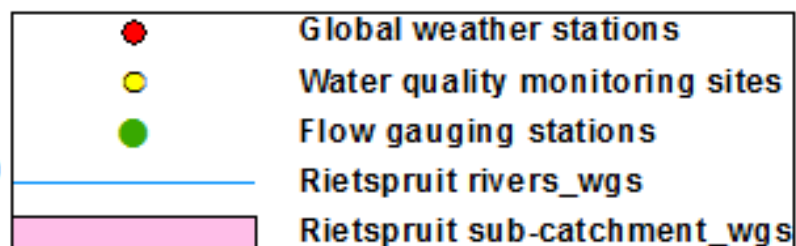
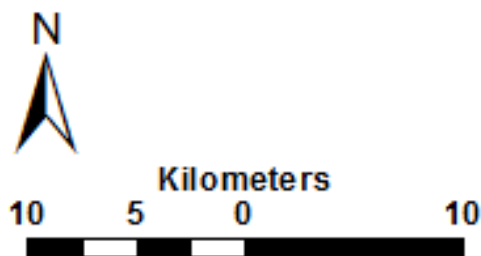
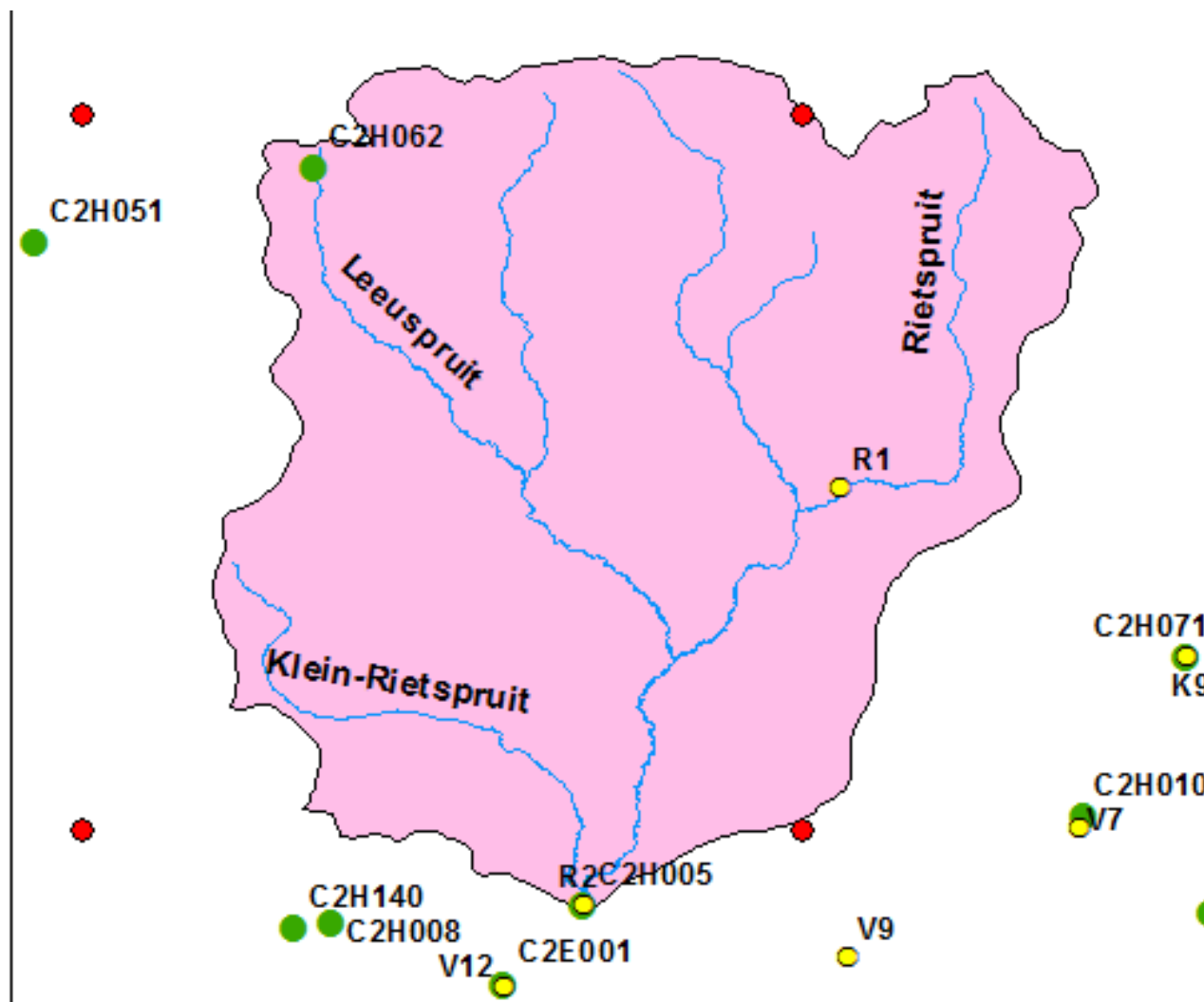
These processes have a major impact on sustainability of the water resource and the environment

# Data Sources

- Flow, weather and water quality data ranges from 2005 to 2010.
- It is split for calibration (2005 to 2007) and validation (2008 to 2010).
- Sources were the global weather data website and SA's DWA
- SOTERSAF and SA's DAFF soil data were used to construct user soil data for the study area
- 2009 landuse map from the DWA
- LibreOffice 4.1 was used to format, edit and/or save dbf files
- ArcGIS 10 and ArcSWAT 2012

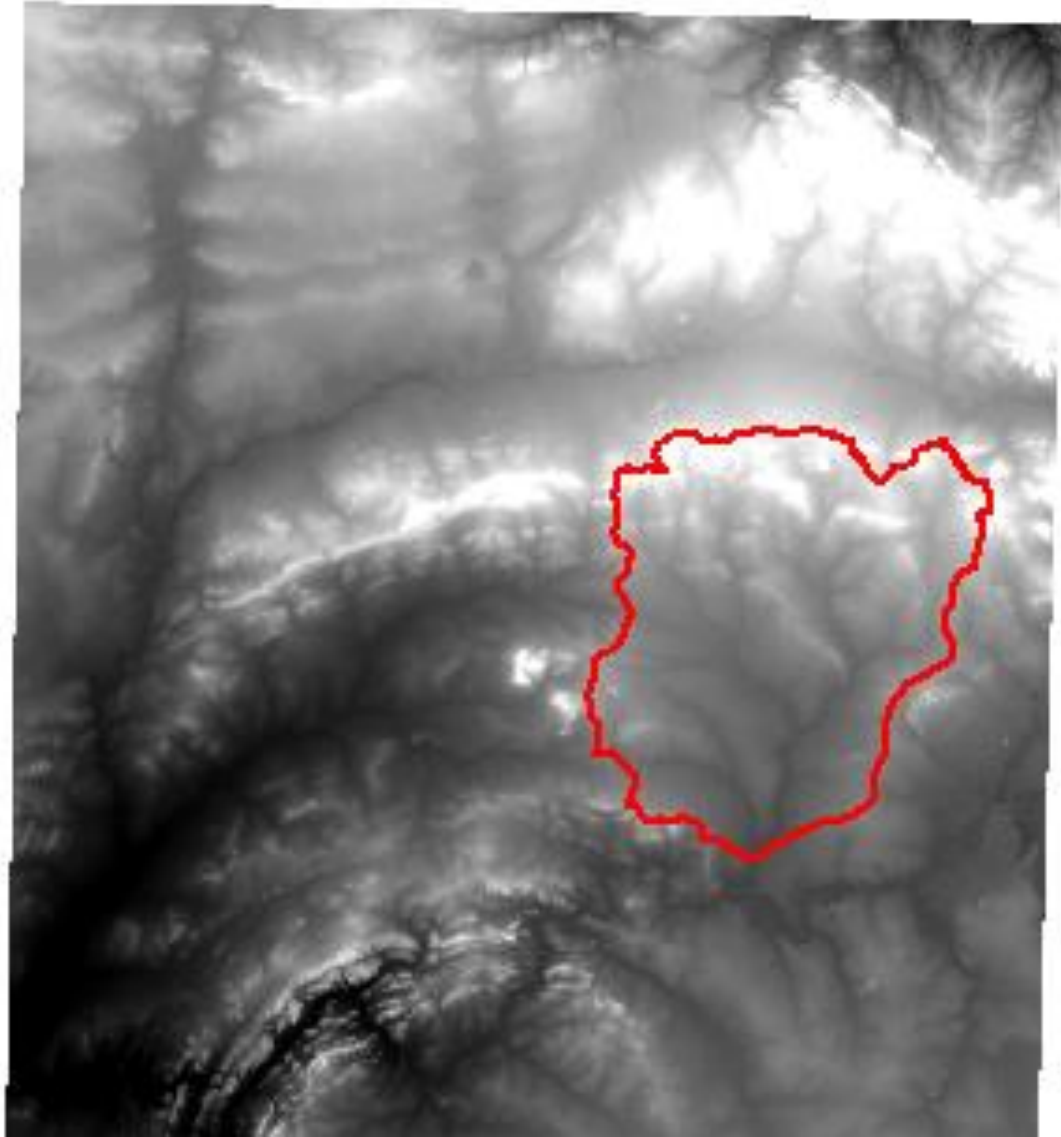




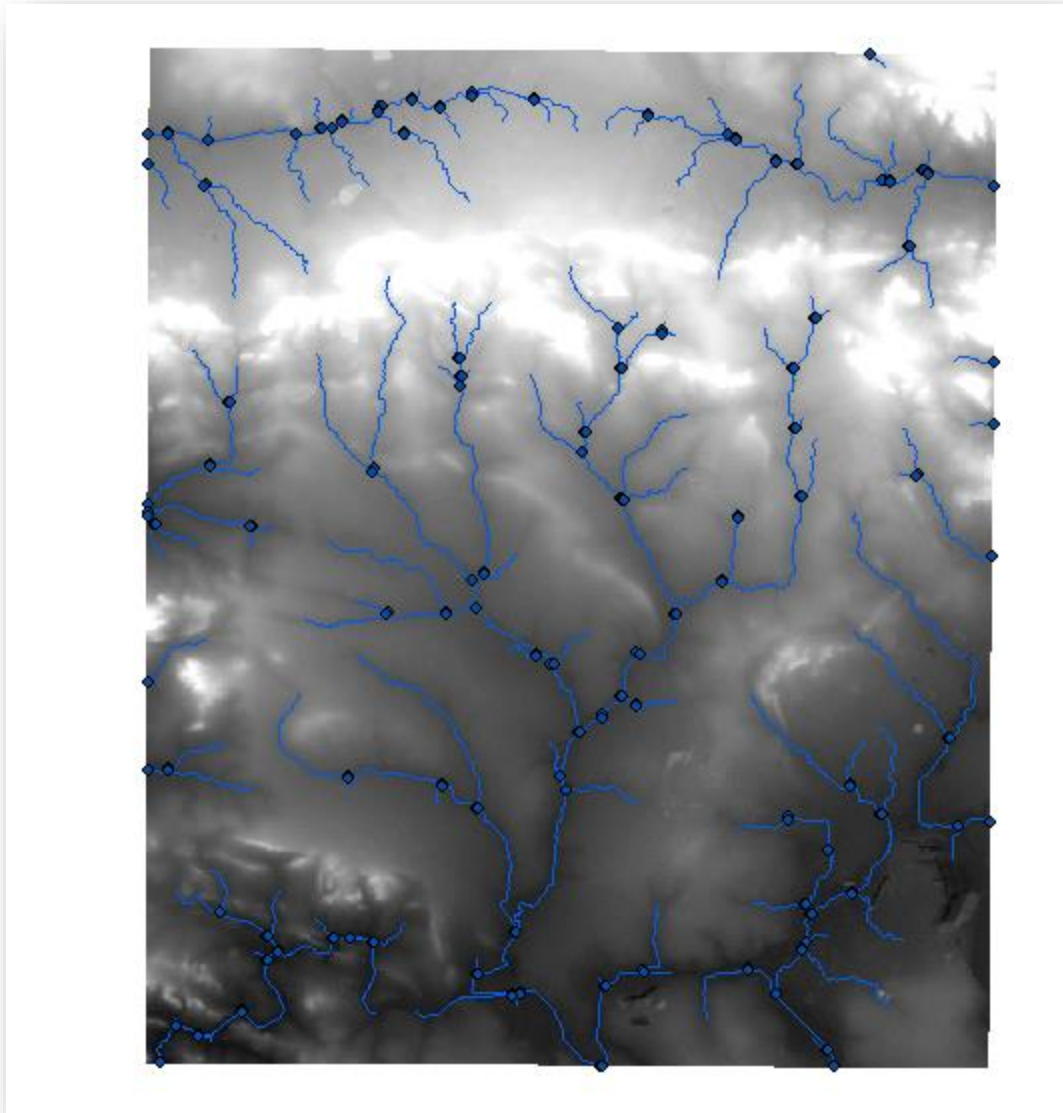


**DEM**

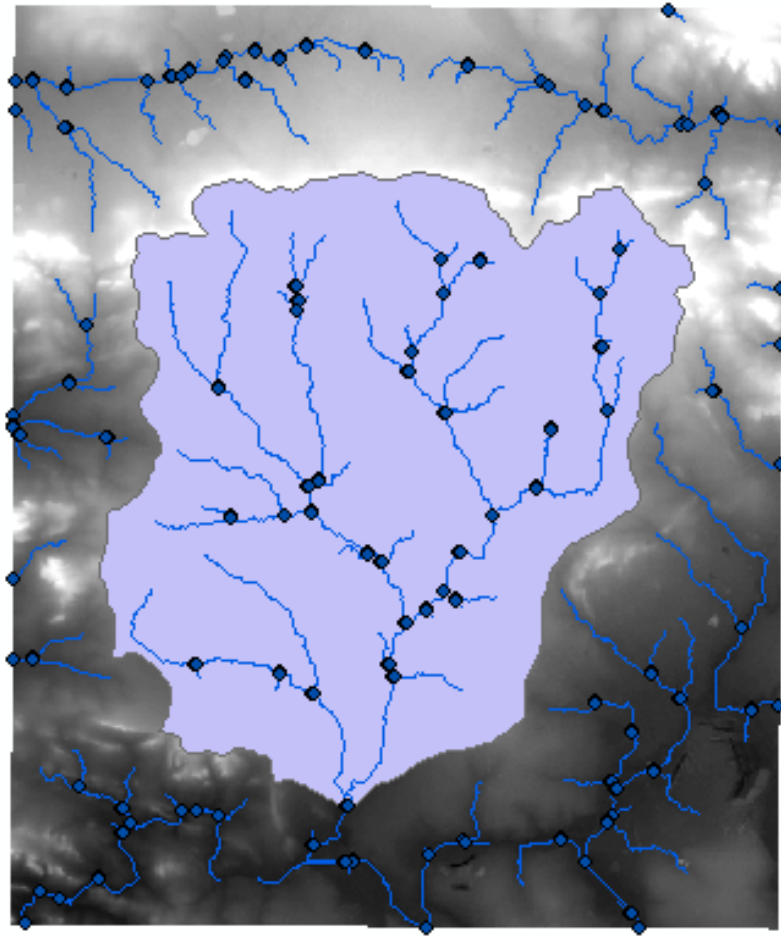
**SRTM 90**



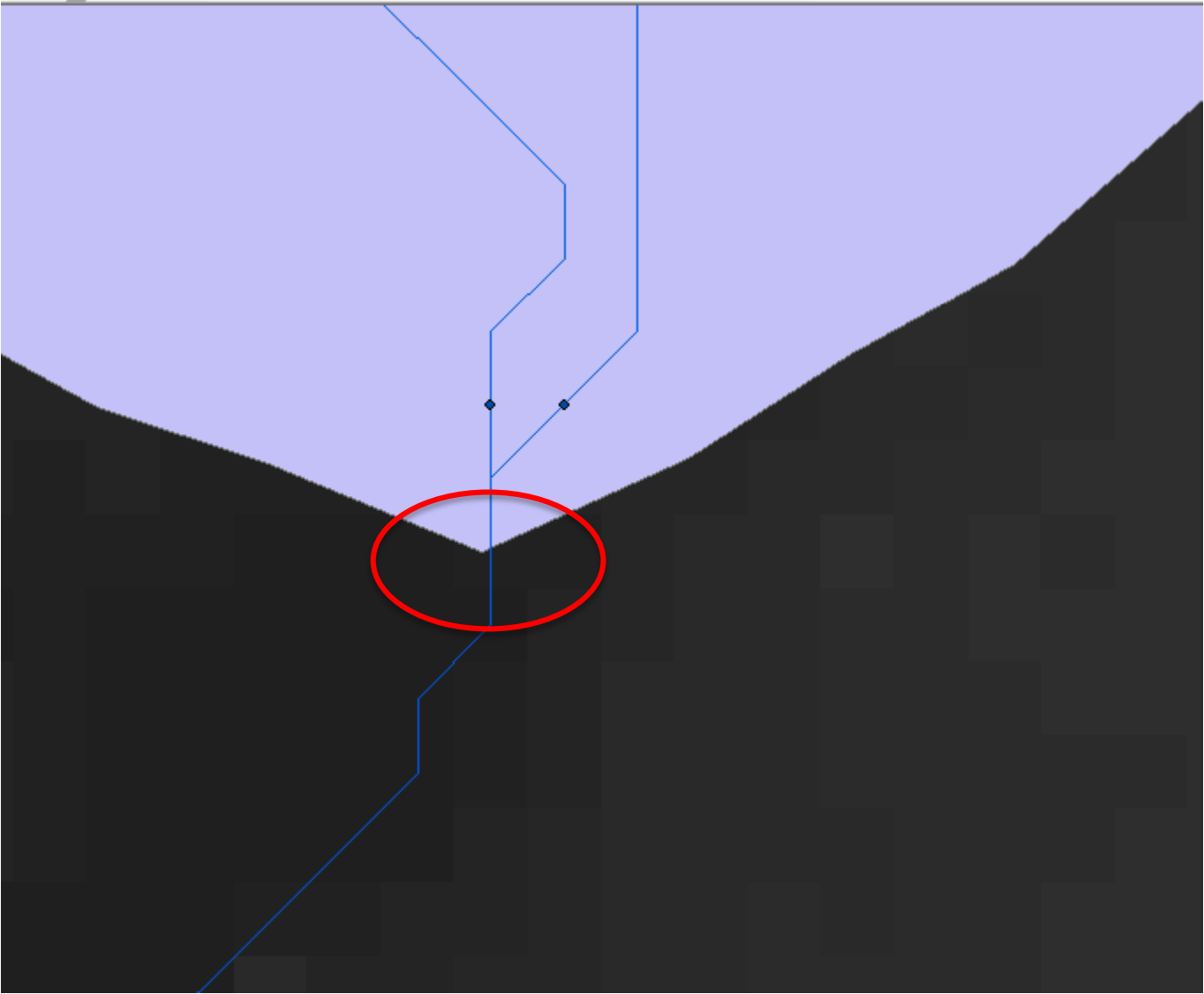
# Elevation 1842 – 1388 m



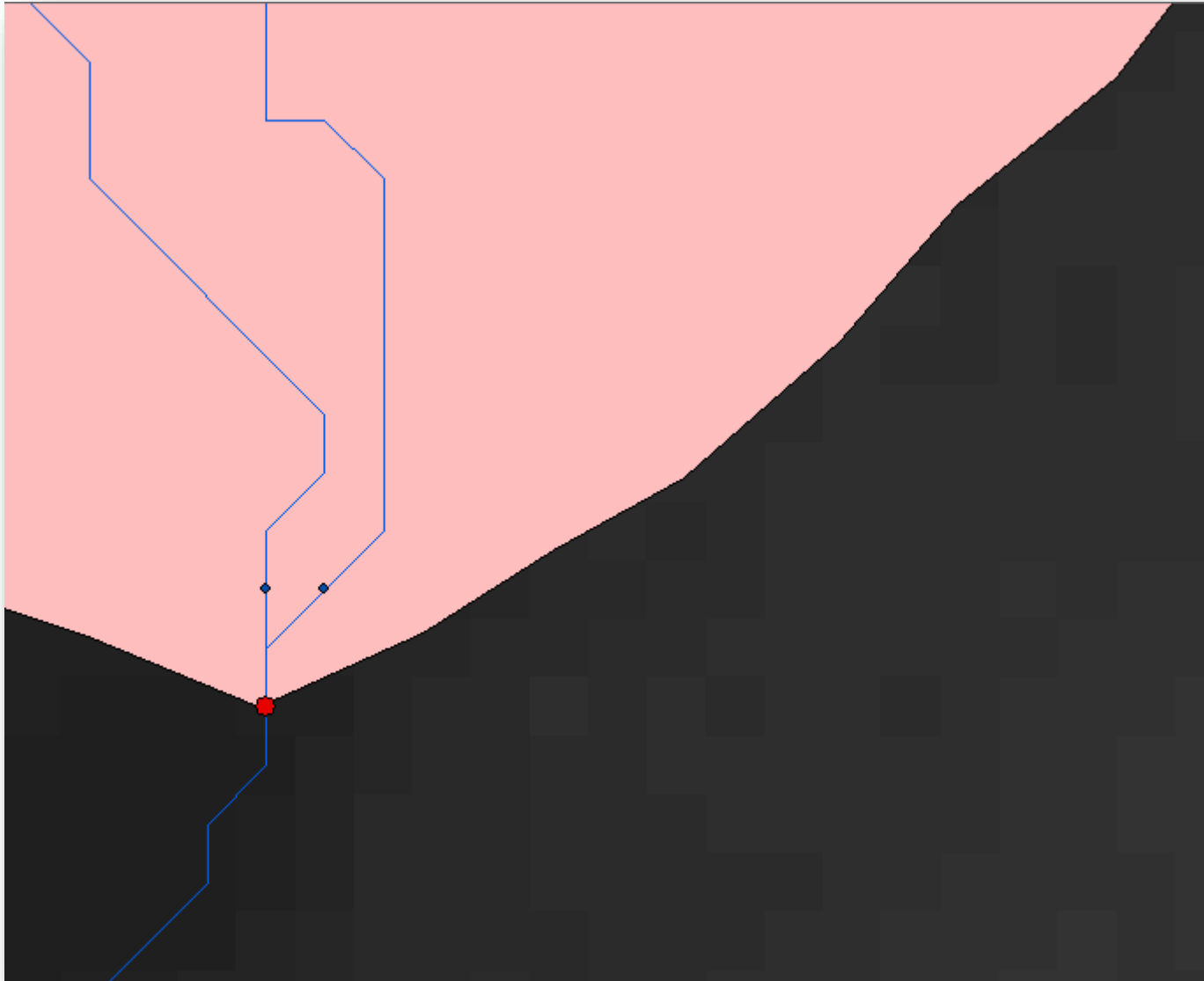
**Superimposed shape file shows that there is no defined outlet at the basin outlet**



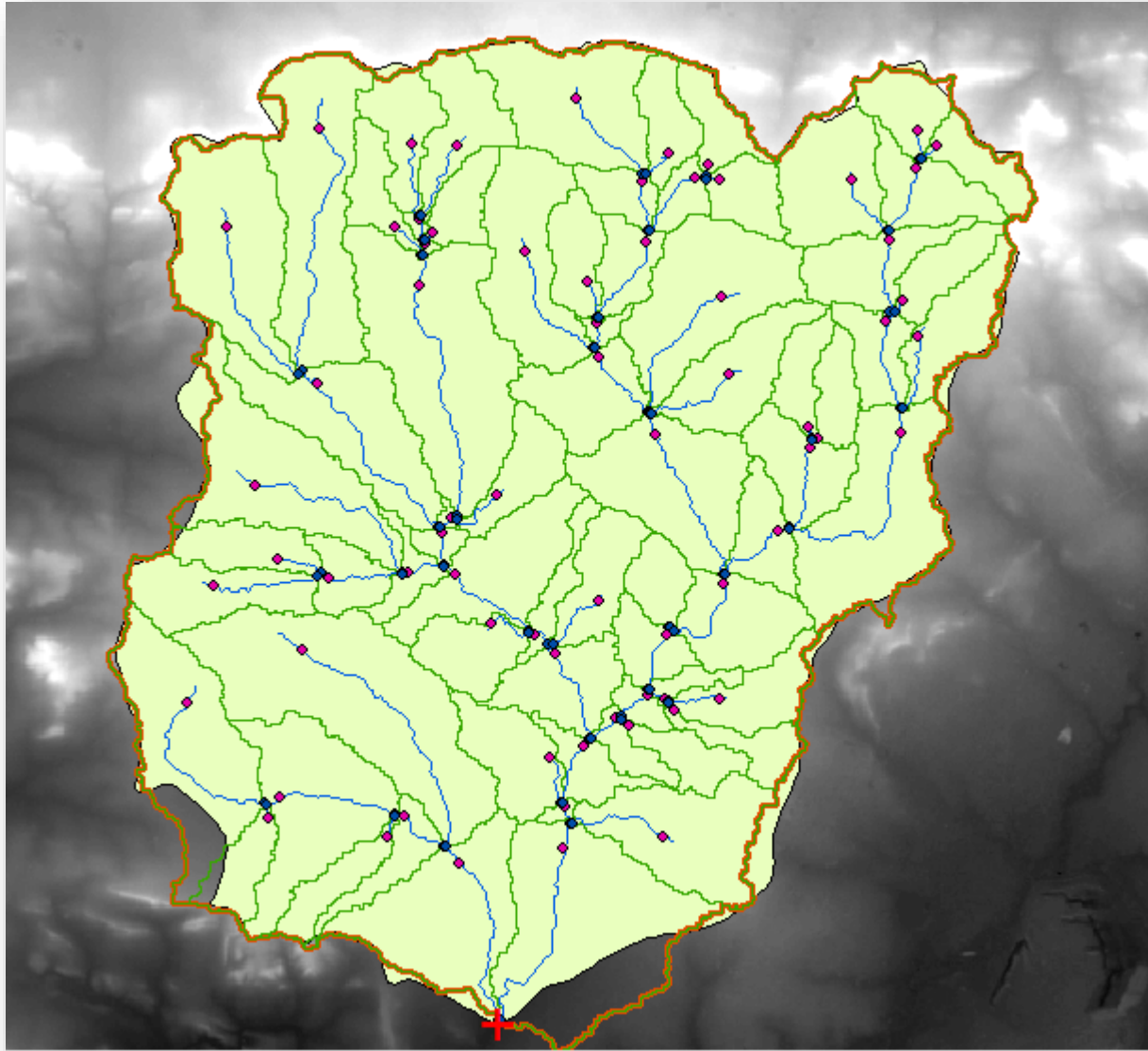
# NO OUTLET



# NEW OUTLET ADDED



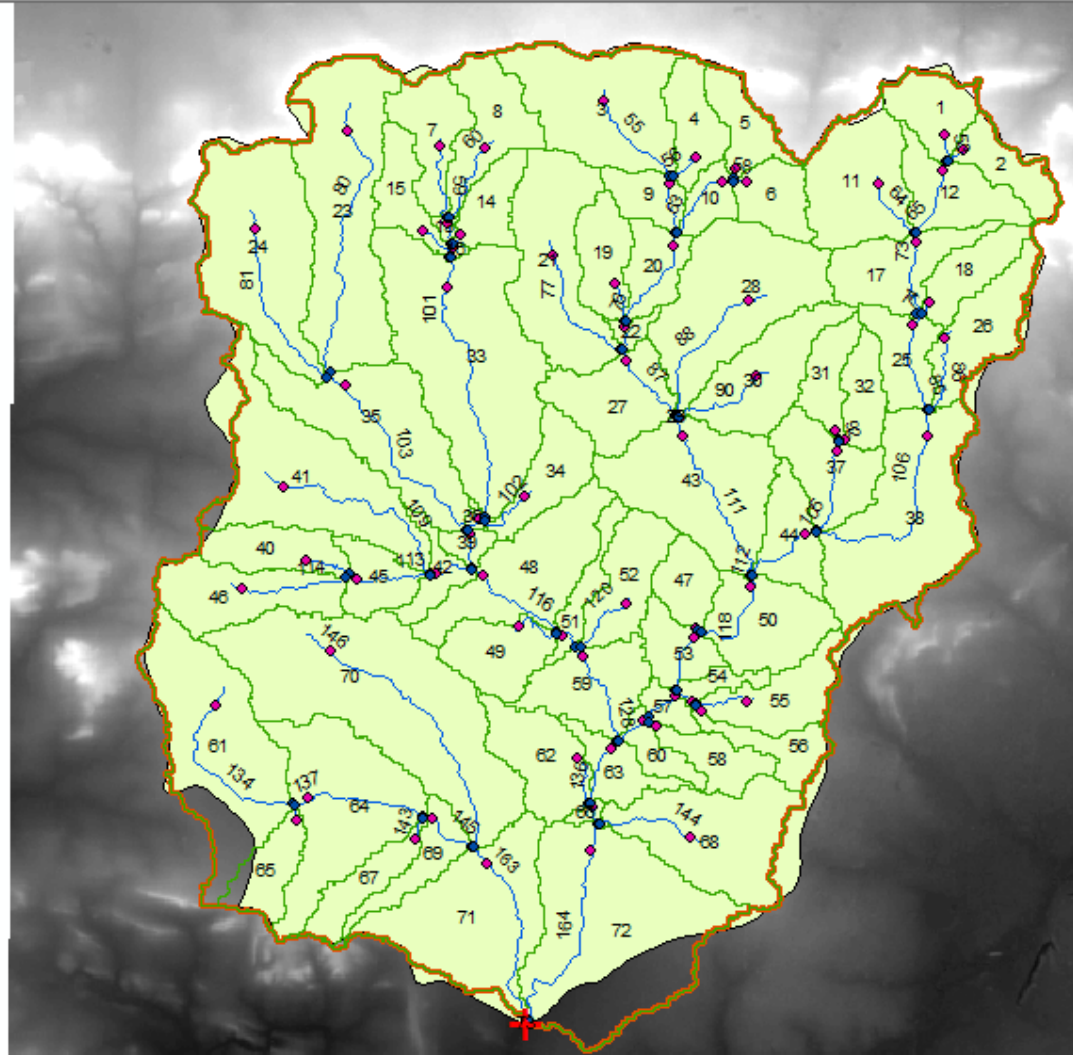
# DELINEATED WATERSHED



# REACHES

Table Of Contents

- < all other values >  
Type
- Linking stream added Outlet
- Manually added Outlet
- Manually added Point Source
- Reach
- Watershed
- C:\Clean shape file downloads\Flowgstns.xlsx
  - Sheet1\$ Events
  - Sheet1\$
- C:\Clean shape file downloads\RV2.xlsx
  - Sheet1\$ Events
  - Sheet1\$
- C:\Clean shape file downloads
  - RTMPWutm35
- C:\Clean shape file downloads\Braz1\Watershe
  - SourceDEM
    - Value
    - High : 1842
    - Low : 1388

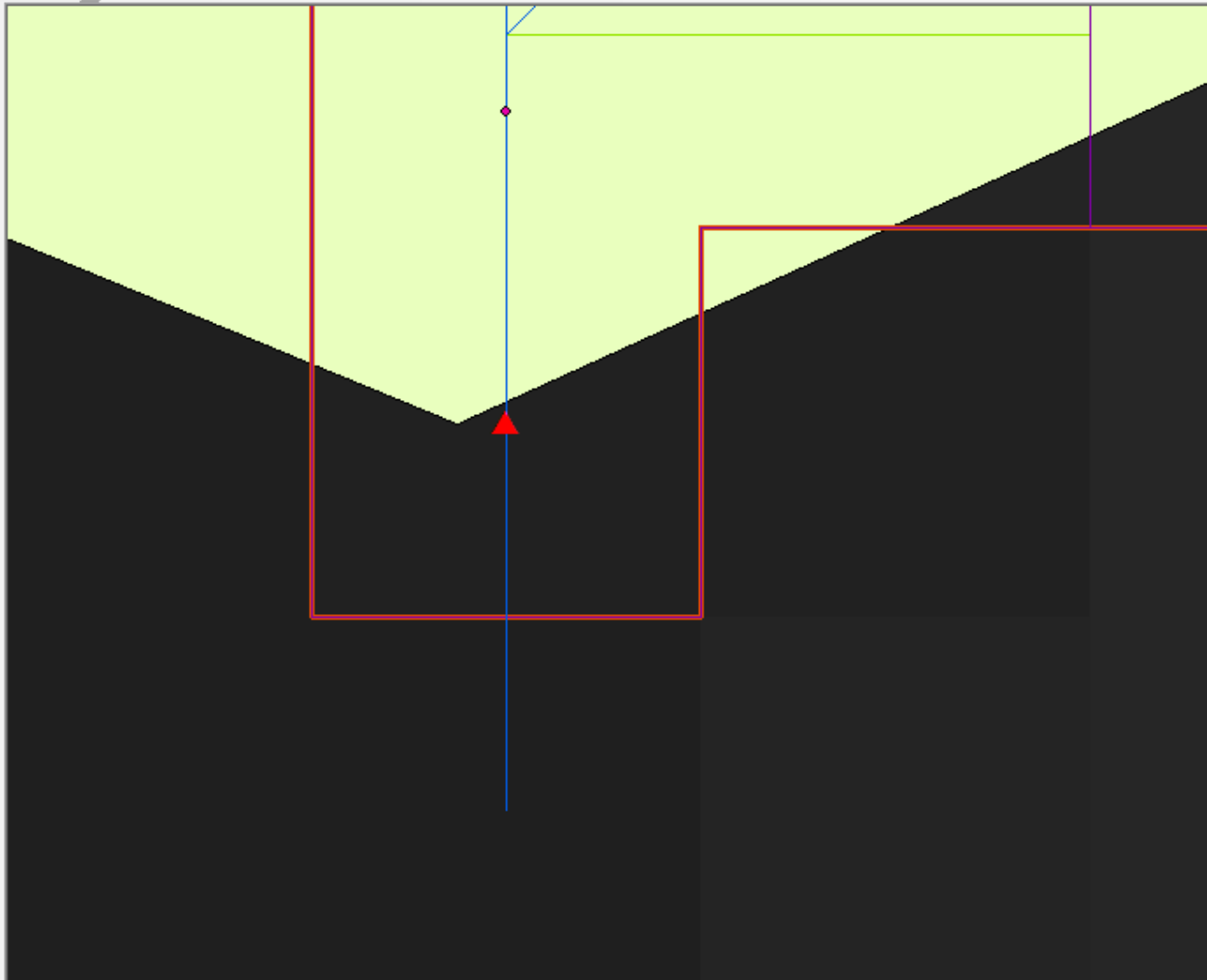




# MANUALLY ADDED OUTLET

Table Of Contents

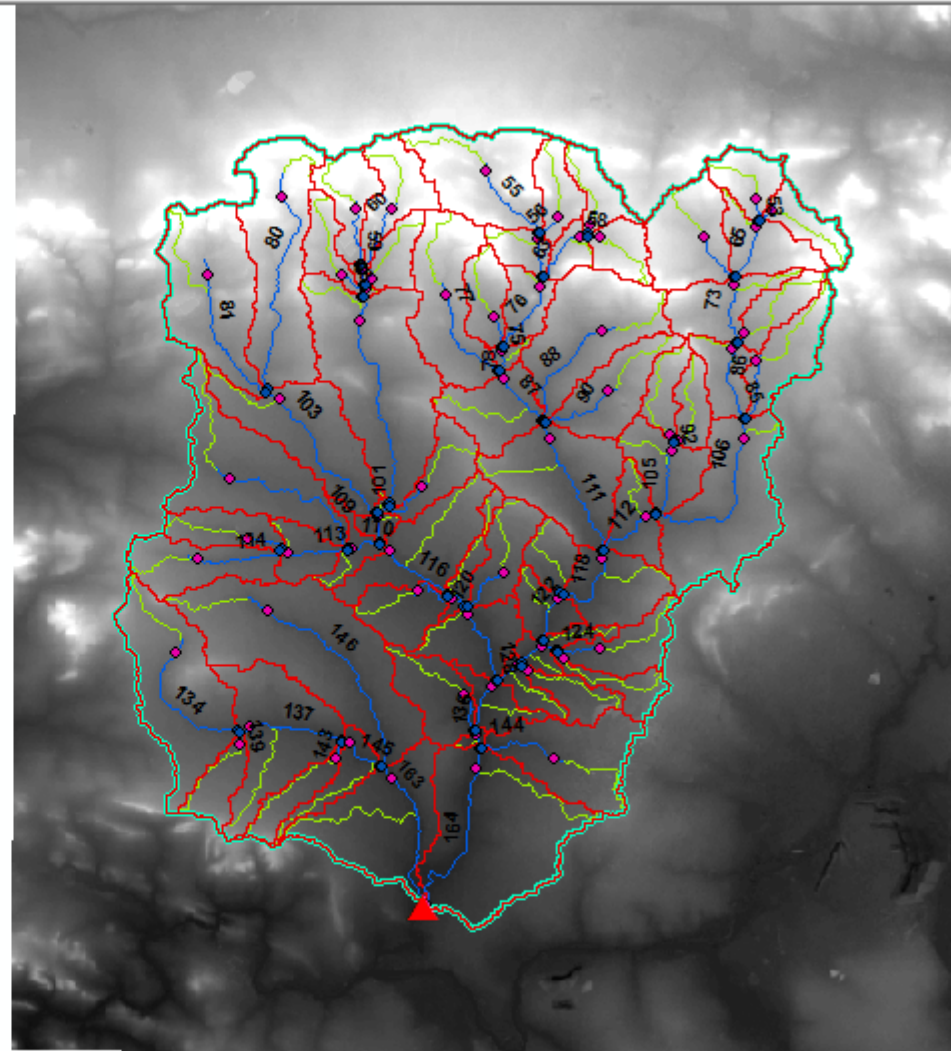
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  - [x] MonitoringPoint
    - <all other values>  
Type
    - ◆ Linking stream added Outlet
    - ▲ **Manually added Outlet**
    - ◆ Manually added Point Source
  - [x] Outlet
    - <all other values>  
Type
    - ◆ Linking stream added Outlet
    - ◆ Manually added Outlet
  - [x] Reach
    -
  - [x] Watershed
    -
  - [x] LongestPath
    -
  - [x] Basin
    -
- [+] C:\Clean shape file downloads\Flowgstns.xlsx
  - [x] Sheet1\$ Events
    -
  - Sheet1\$
- [+] C:\Clean shape file downloads\RV2.xlsx
  - [x] Sheet1\$ Events
    -
  - Sheet1\$



# 73 sub-basins and 164 reaches created

Table Of Contents

- Manually added Outlet
  - Reach
  - Watershed
  - LongestPath
  - Basin
- C:\Clean shape file downloads\Flowgtns.xlsx
  - Sheet1\$ Events
  - Sheet1\$
- C:\Clean shape file downloads\RV2.xlsx
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- C:\Clean shape file downloads
  - RTMPWutm35
- C:\Clean shape file downloads\Braz1\Watersh
  - SourceDEM
    - Value
    - High : 1842
    - Low : 1388





**The research is in its initial stages and is on-going**

# ACKNOWLEDGEMENTS

- Durban University of Technology, South Africa for hosting and co-funding the Post-Doc Fellowship
- South Africa's Department of Water Affairs
- South Africa's Department of Agriculture, Forestry and Fisheries
- Funding of Post-Doc through the SA's DST/NRF
- CV Raman Visiting Fellowship for 2013 to IIT-Bombay, India, Civil Engineering Department
- Global Weather Data

<http://srtm.csi.cgiar.org/SELECTION/inputCoord.aspp>



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NGIYABONGA  
I THANK YOU**