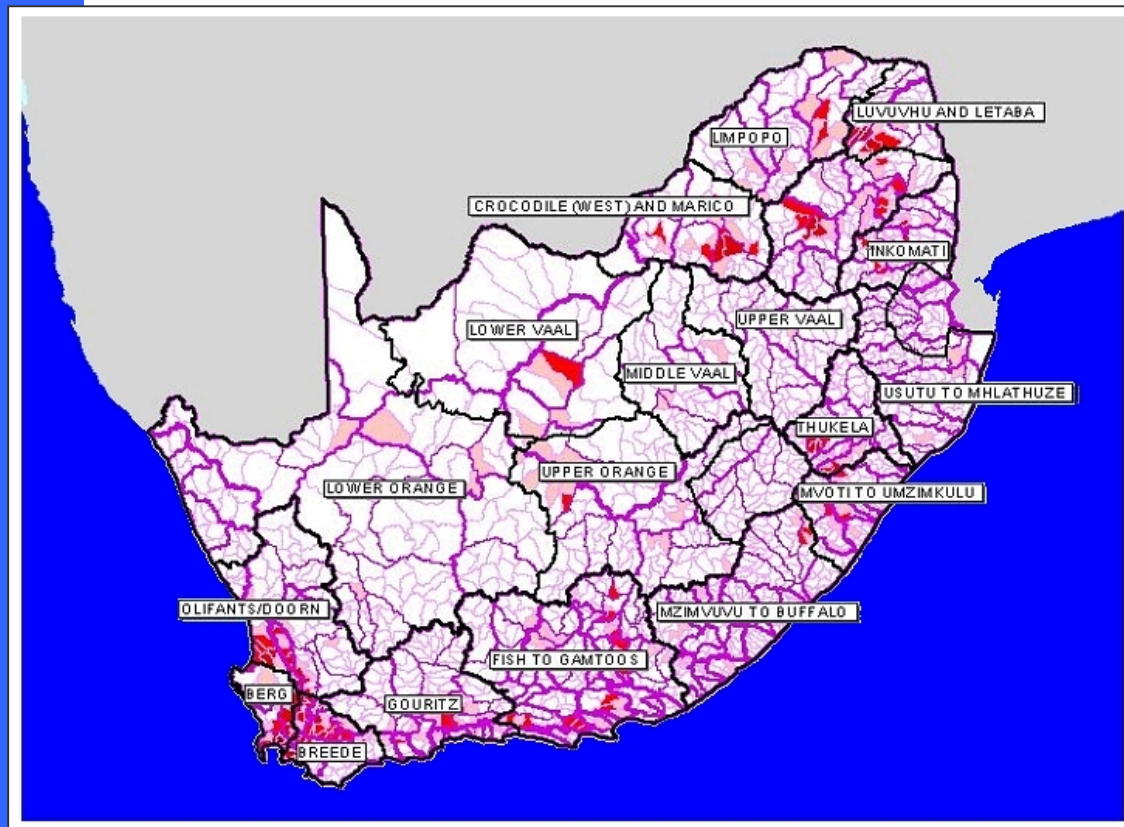


National land cover atlas for the Resource Directed Measures programme

M J Silberbauer and A M Howman
2001-08-31



**INSTITUTE FOR WATER QUALITY STUDIES
DEPARTMENT OF WATER AFFAIRS AND FORESTRY**



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Introduction and background

As a result of the preliminary work done for another project (Aerial Surveillance Data for National Water Act Implementation), the Chief Director of Scientific Services requested additional summaries of the national land cover data in formats that the DWAF Resource Directed Measures office could use. The brief of this project was therefore to summarise data from the National Land Cover database in an electronic atlas for use in the Resource Directed Measures project.

The approach was to consolidate existing maps and develop new maps representing the drainage region hierarchy (primary, secondary, tertiary and quaternary) showing per catchment percentage of afforestation, irrigation and water bodies. A separate set of maps would summarise the desktop provisional reserve (Hughes and Münster, 1999) for flow. The maps should ideally be uncluttered, including only the most basic orientation information, e.g. Water Management Areas, catchments, rivers and dams.

The deliverables were thus an atlas in the form of web pages showing land cover statistics for drainage regions. The raw data scale is 1:250 000, so this is the best possible mapping scale for this project. Technical aspects of presentation meant that most products would be at a coarser scale than 1:250 000. During the course of the project, additional maps became necessary to provide more detail on wetland distribution and surface water quality. Ecological class maps developed earlier were placed on the site for convenience of access, and a set of locality maps was added for orientation.

The sequence of production was according to the priority catchment list and the proposed completion date for the web information was 29 September 2000.

Methods

Segmenting land cover by drainage region

The Department of Water Affairs and Forestry was part of the consortium that funded the National Land Cover project, and therefore has a copy of the GIS coverage of land cover (Fairbanks *et al.*, 2000). An INTERSECT operation on the land cover coverage and quaternary drainage region coverage in Arc/Info

yielded a new coverage containing land cover information "cookie-cut" to drainage region borders. The data table associated with the combined coverage is easily converted to a comma-delimited format readable by other programs, not only ArcView but also other programs, such as spreadsheet packages. Note that scale differences between the two coverages can cause edgematch errors of 100 metres or more. One consequence is that many of the coastal quaternary drainage regions include slivers of marine water.

INTERSECT process (takes several hours)

```
Arc: intersect /hri2/waterm/wmdata/general/landcover
/hri/db/cover/s-africa/hca_4 lc_hca4 poly 1 join
Intersecting /hri2/waterm/wmdata/general/landcover with
/hri/db/cover/s-africa/hca_4 to create lc_hca4
Sorting...
Intersecting...
Assembling polygons...
Creating new labels...
Creating lc_hca4.PAT...
** Item "AREA" duplicated, Join File version dropped **
** Item "PERIMETER" duplicated, Join File version dropped **
** Item "AREA" duplicated, Join File version dropped **
** Item "PERIMETER" duplicated, Join File version dropped **
```

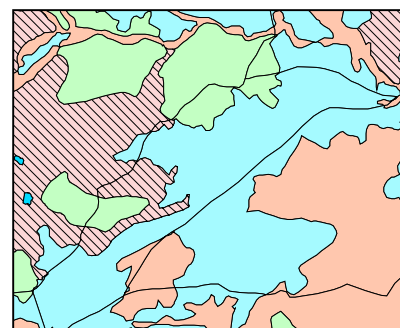
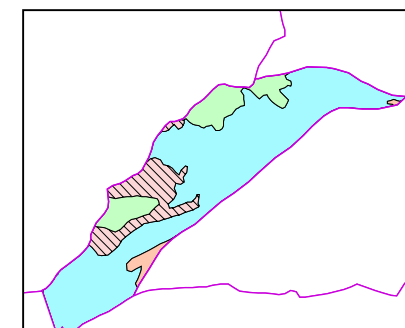


Figure 1 Quaternary B72G,



B72G, "cookie-cut"

Map production

Water Management Areas

At the start of the project, the 1999 Water Management Area boundaries were used for map production, but during the project the 2000 boundaries became available. The 2000 boundaries were much the same as the earlier ones, with a few exceptions. The names for two of the WMAs changed ("Mzimvubu to Buffalo" became "Mzimvubu to Keiskamma" and "Fish to Gamtoos " became "Fish to Tsitsikamma". The boundaries between the Lower Orange, Middle Orange and Lower Vaal WMAs also changed slightly (catchment D33 is now in the Lower Orange). The new names and boundaries appear in some of the updated maps.

An adaptation of the Arc/Info Imapemap Macro (Thomas, 1998) automated the process of generating "clickable" maps for use on the Internet. The adaptation simplifies the process of generating images in Joint Photo Expert Group (JPEG or .jpg format) (Appendix).

Index of base flow

Prof. Dennis Hughes provided the estimated index of base flow (Hughes and Münster, 1999) to Adhishri Singh of the Resource Directed Measures office in spreadsheet form (2000-03-13). The estimates were tabulated by quaternary drainage region, allowing them to be linked to the quaternary drainage region coverage by means of the JOIN function in ArcView. The ArcView legend function shaded quaternary drainage regions using an arbitrary base flow index classification of 0 to 0.81 in steps of 0.09.

A script, WMA_step.ave (Appendix), automated the process of generating output. The script zooms into each water management area in turn and draws a standard map, then exports the map as a JPEG image for use in the Internet environment.

Land cover

A series of maps showing the proportion of each cover type (normalised by area) highlight quaternary drainage regions dominated by forest, irrigation or water body land cover types. While this method produces striking maps on which drainage regions of interest stand out at a glance, it introduces bias into the results. A separate set of maps to illustrate this bias to the casual user, use simple HTML pages to allow the user to scan back and forth between different levels of data consolidation (HTML source in Appendix).

A similar script to the base flow WMA_step.ave utility generated sets of land cover maps for each Water Management Area.

Surface water quality

A criteria table using "cut points" separates the water quality into four classes using the 95th percentile. Note that these classes are based on only a few water quality criteria, and that the algorithm classifies a whole quaternary drainage region on the basis of as few as 5 samples for a minimum of just one station. The algorithm classifies dams separately from the drainage region in which they occur. Such a gross summary means that the user must check the original data before drawing conclusions about individual catchments or dams. For example, coastal lakes may show up as poor quality because of their very high natural salinity.

Table of class definitions

Class	definition
0	ideal water
I	safe water
II	short-term use
III	undrinkable

Most variables have three cut points (and zero which, defines the minimum for Class 0), except pH, which needs six cut points to define acid and base ranges (with 7.0 as the central point).

Only one variable needs to be in a higher class for the algorithm to shift the whole classification to that class.

Units are mg/litre except pH ($-\log [H^+]$) and EC (milliSiemens/m).

Table of concentration ranges used:

Variable	Units	Cut point 1	Cut point 2	Cut point 3	Cut point 4	Cut point 5	Cut point 6
pH	-	4	5	6	9	9.5	10
Fluoride	mg/L	1	1.5	3.5			
Nitrate + nitrite	mg/L	6	10	20			
Sulphate	mg/L	200	400	600			
Chloride	mg/L	100	200	600			
Sodium	mg/L	100	200	400			

Variable	Units	Cut point 1	Cut point 2	Cut point 3	Cut point 4	Cut point 5	Cut point 6
Magnesium	mg/L	30	70	100			
Total dissolved salts	mg/L	450	1000	2450			
Electrical conductivity	mS/m	70	150	370			

The process of generating colour-coded maps of the chemical status of all South African quaternary drainage regions for which sufficient chemical data was available was automated using Arc/Info's macro language (AML). A listing of qatrivhtml.aml is available in Appendix .

Ecological classes

Although not part of the brief of this project, several requests had come in for maps of ecological classifications (Kleynhans 1999).

A manual ArcView procedure for generating ecological class maps was already available, and this was adapted to produce a set of maps on the web site under these headings:

Name	Description
DEMC	default ecological management class or category
PESC	present ecological status class or category
AEMC	(present) attainable ecological management class or category
AEMC	(best) attainable ecological management class or category
EISC	ecological importance and sensitivity class or category

Orientation maps

A set of maps created in ArcView provided orientation information such as river, dam and town names for each water management area.

Web page construction

Web pages were either generated automatically by the methods described above, or created manually with HTML-kit (Chami 2001) using the conventions for HTML 3.2 or 4.0.

Address <http://dwaf-www.pwv.gov.za/IWQS/waterlaw/index.html> Go Lin

WATER MANAGEMENT AREAS

Data mapped per quaternary drainage region. Quaternaries grouped by Water Management Area

report N/0000/00/REQ/0700 (Draft)

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Maps of quaternary drainage characteristics, using available data: note that these maps are not definitive, but are provided as an aid to water resource management. **Please note that the Water Management Area boundaries and names on many of the maps are as they appeared on the 1999 draft WMA map, and the 2000 final map names and boundaries differ slightly.** The correct names for two of the WMAs are "Mzimvubu to Keiskamma" (not "to Buffalo") and "Fish to Tsitsikamma" (not "to Garntoos"). The boundaries between the Lower Orange, Middle Orange and Lower Vaal WMAs have also changed slightly (catchment D33 is now in the Lower Orange). The new names and boundaries will appear in updated maps.

Contact [Adhishri Singh](#), Department of Water Affairs and Forestry, eManzini 437, Tel. (012) 336 8946 for more information about data sources.

- Landcover from the [National Land Cover database](#).
 - Raw landcover data [[screen resolution](#)] [[print resolution](#)]
 - [Cautionary notes](#) on the land cover summaries.
 - Forest (exotic) [[screen resolution](#)] [[print resolution](#)]
 - Irrigation [[screen resolution](#)] [[print resolution](#)]
 - Waterbodies [[screen resolution](#)] [[print resolution](#)]
- [Chemical classifications](#)
- [Wetlands](#)
- [Ecological classes](#)
- [Baseflow index](#)
- Locality (reference) maps
 - Plain background [[screen resolution](#)] [[print resolution](#)]
 - Relief background [[screen resolution](#)] [[print resolution](#)]
- [Reserve status](#)
- Some of these pages mention *high* and *low* resolution or *print* and *screen* resolution. [What does this mean?](#)
- [Why](#) does this site exist?

Figure 2 Main intranet page

Products

Web page

The web pages are located on the Department of Water Affairs and Forestry intranet web site, and are therefore only visible within the government network (Figure 2). A clickable map that allows the user to visually select the water management area of interest is at the head of each set of data.

Land cover

Figure 4 shows the main page for selection of land cover data and Figure 4 shows one of the zoomed-in land cover maps. These are available in "screen" and "print" resolution.

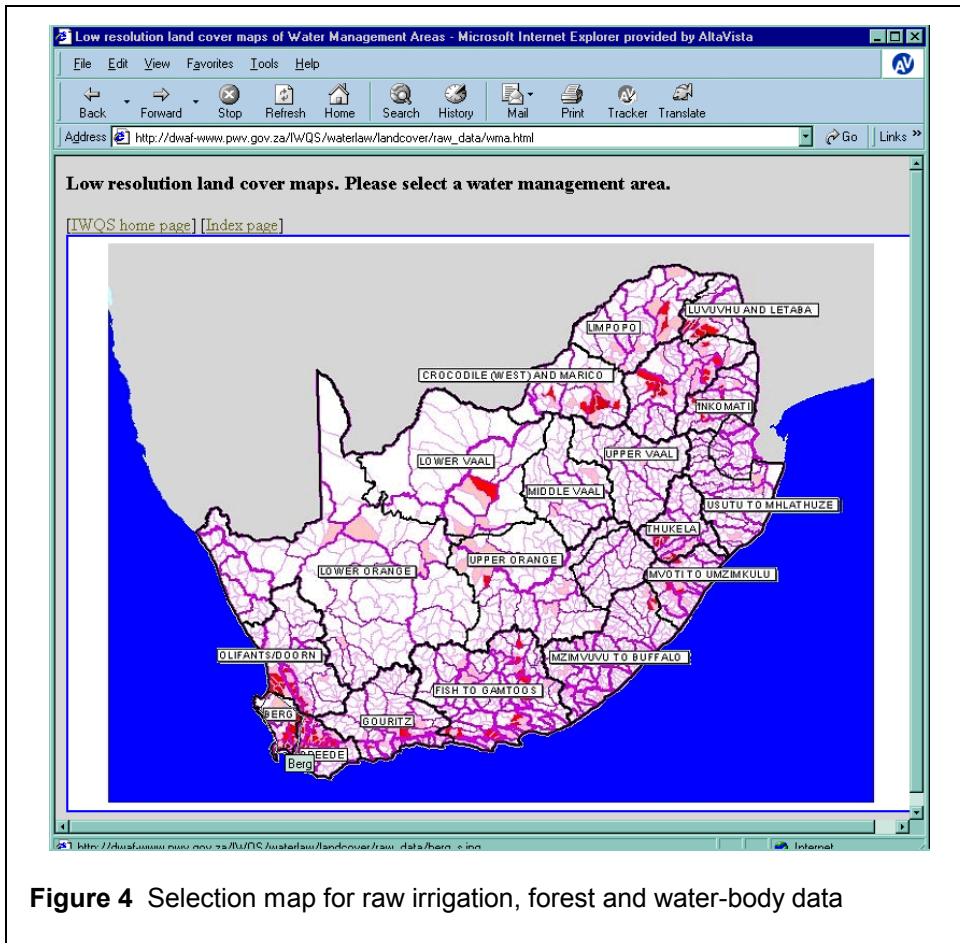


Figure 4 Selection map for raw irrigation, forest and water-body data

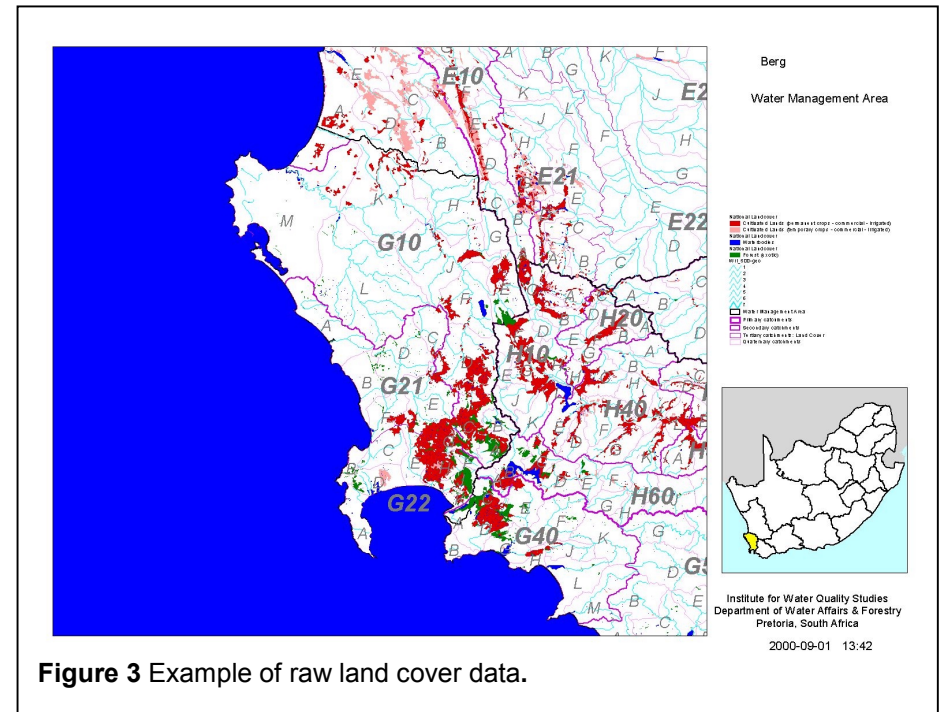


Figure 3 Example of raw land cover data.

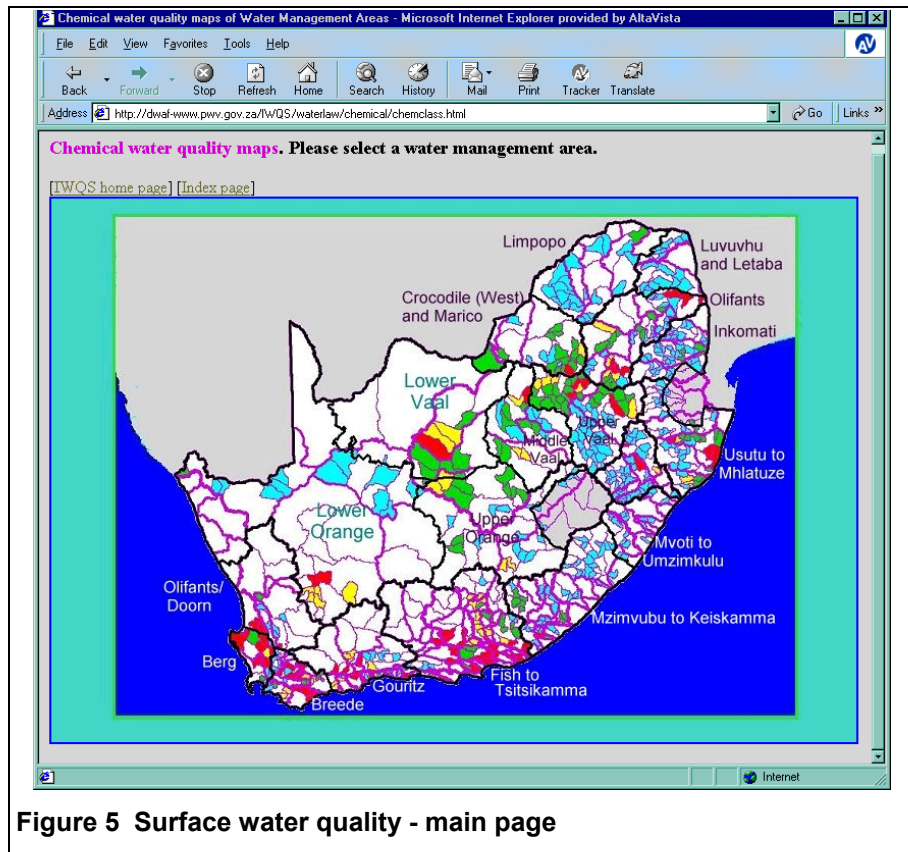


Figure 5 Surface water quality - main page

Surface water quality

A clickable map of South Africa allows the user to select a Water Management Area of interest (Figure 5). The quaternary drainage regions on this map are colour-coded to give an idea of where water quality might be a problem. When the user selects a Water Management Area, a new static HTML page opens, showing a more detailed map and links to information about individual stations (Figure 6).

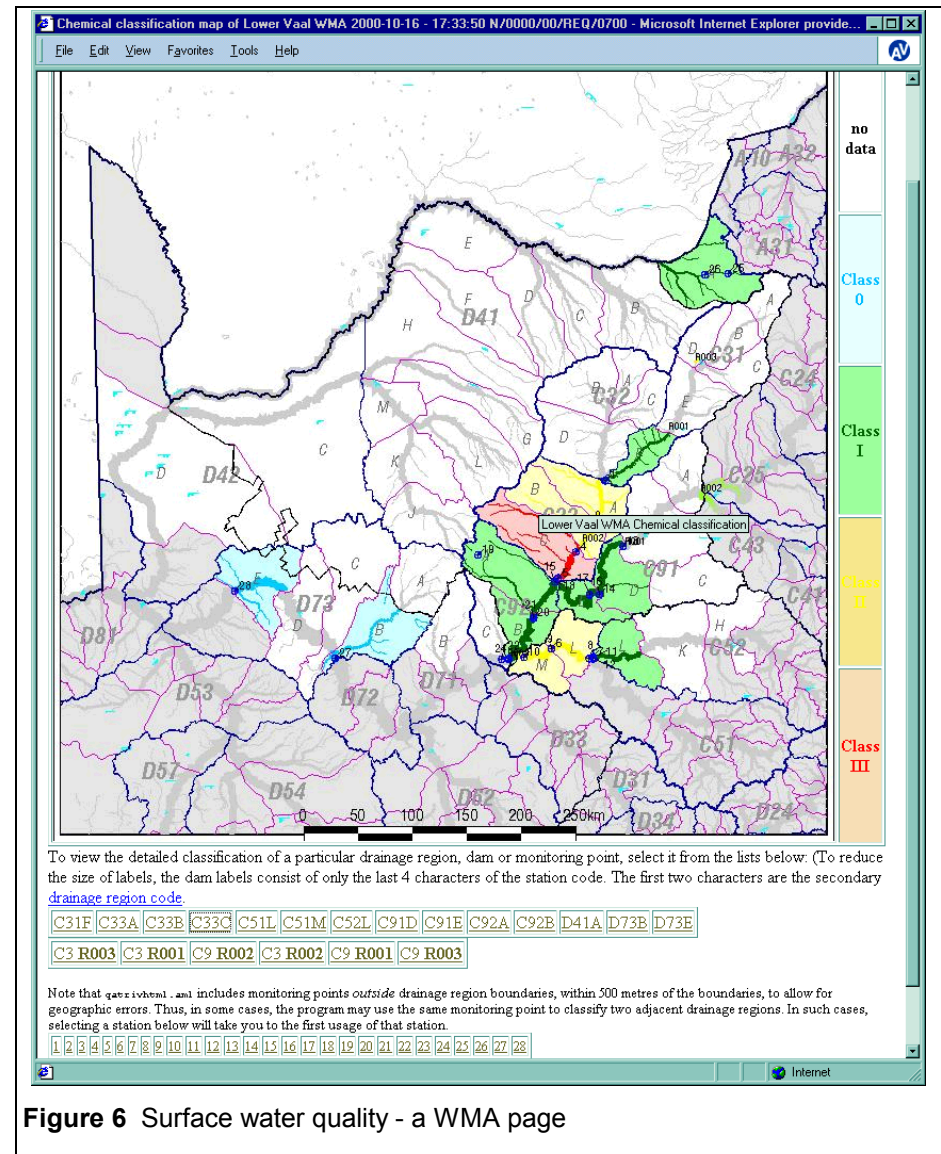


Figure 6 Surface water quality - a WMA page

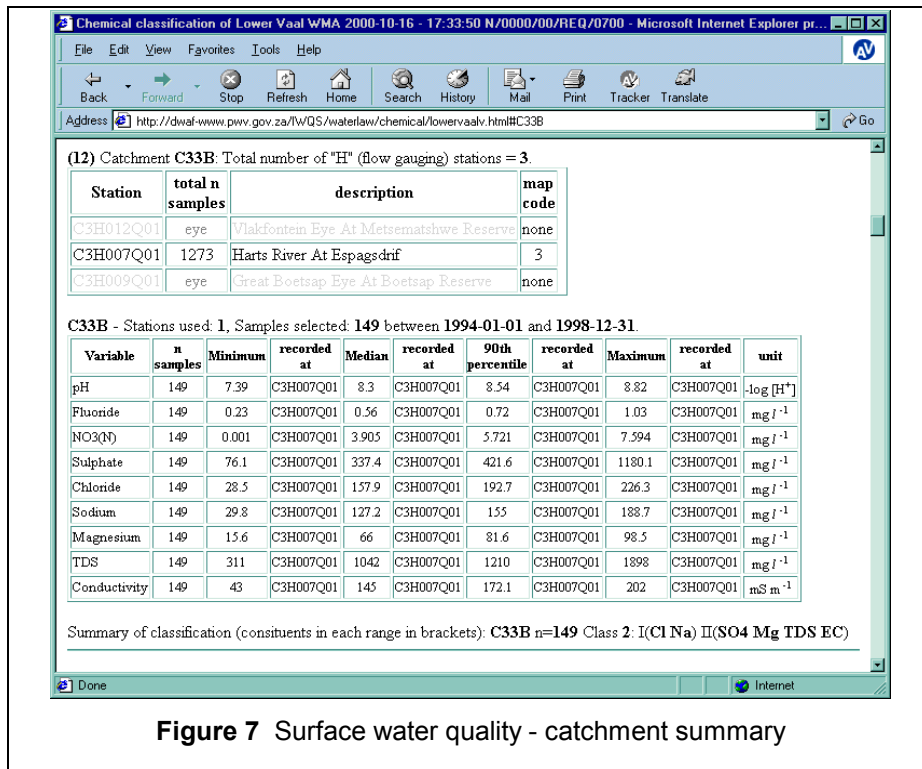


Figure 7 Surface water quality - catchment summary

The page shows the statistics for or each variable and a summary of the classification process, showing which variables, if any, caused the monitoring point to be in a higher class.

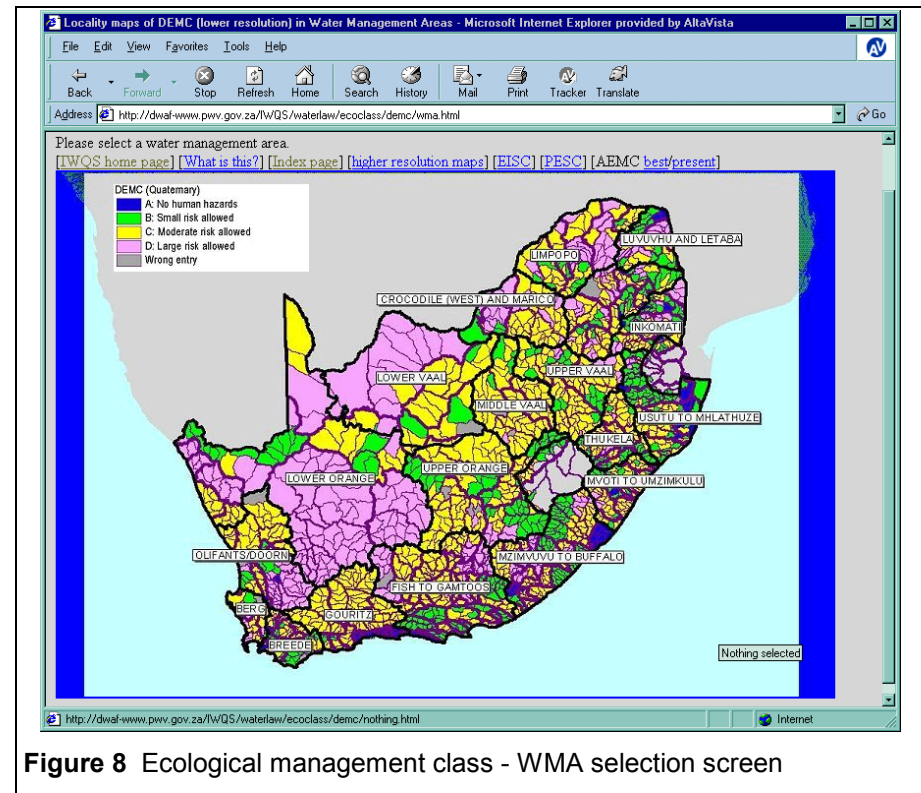


Figure 8 Ecological management class - WMA selection screen

Ecological classes

Figure 8 shows the navigation screen for selecting a water management area and an ecological classification type. Clicking on one of the water management areas brings up a more detailed map of the water management area showing the classification of each quaternary drainage region (e.g. Figure 9). Higher resolution maps (for printing) are also available.

References

- Chami (2001) HTML-kit editor. <http://www.chami.com/html-kit/>
- Fairbanks DHK, Thompson MW, Vink DE, Newby TS, van den Berg HM, Everard DA (2000) The South African Land-cover Characteristics Database: a synopsis of the landscape. South African Journal of Science, 96:69-82. <http://www.nrf.ac.za/sajs/abfeb00e.stm>
- Kleynhans, CJ (1999) Desktop Present Ecological Status Assessment for Use in the National Water Balance Model. In: Resource Directed Measures for Protection of Water Resources: River Ecosystems. <http://www-dwaf.pwv.gov.za/docs/water%20resource%20protection%20policy/river%20ecosystems/riv%5Fappr3%5Fversion1.0.doc>
- D A Hughes & F Münster (1999) A Decision Support System for an Initial 'Low-Confidence' Estimate of the Quantity Component of the Reserve for Rivers. Institute For Water Research, Rhodes University. http://www.ru.ac.za/institutes/iwr/reserve/plan_idx.html
- I Thomas (1998) Arc/Info Imagemap Macro, Version 1.0. GIS & Remote Sensing Unit, Biological Resources Division, USGS Patuxent Wildlife Research Center, Laurel, MD, USA. <http://www.mbr-pwrc.usgs.gov/geotech/imagemap/home.html>
- M W Thompson (1999) South African National Land-Cover Database Project Data Users Manual Final Report (Phase1, 2 And 3). (ENV/P/C 98136 version 3.1.) Division of Water, Environment and Forest Science, CSIR, PO Box 395, Pretoria 0001. http://www.sac.co.za/geoinfo/nlc_report.htm

Appendices

Appendix : Baseflow scripts in ArcView

```
' Name: Layout.WMAmap
'
' Title: Steps through each WMA and draws a map
'
' Topics: Views, Layouts
'
' Description: Steps through each Water Management Area and
```

```
' asks the user whether to draw a map using the current
' layout.
'
' Requires: Locality map (a script that draws a locality
' map of South Africa)
' View with the required themes
' Layout with the required graphics objects already created
'
' Michael Silberbauer 2000-03-23
'
```

```
av.GetProject.SetModified( true )
```

```
theView = av.GetProject.FindDoc( "Baseflow" )
'myLayout = av.GetProject.FindDoc( "Baseflow layout" )
myLayout = av.GetProject.FindDoc( "A1 baseflow" )
myLayout.GetWin.Open
myTheme = theView.FindTheme( "Water Management Area" )
```

```
'MsgBox.Info( myTheme.asString,"My theme" )
```

```
if( myTheme.HasTable ) then
    myFTab = myTheme.GetFTab
    theField = myFTab.FindField( "Dwaf-region" )
else
    exit
end
```

```
num = 0
for each rec in myFTab
    num = num + 1
end
```

```
nowDate = Date.Now
nowDate.SetFormat( "yyyy-MM-dd" )
av.ShowStopButton
```

```
for each rec in myFTab
    wma = myFTab.ReturnValue( theField, rec )
    'MsgBox.Info( wma, myTheme.asString++"record"++rec.AsString )
    myTheme.ClearSelection
    if( wma.asString.Count > 0 ) then
        'Please_print = MsgBox.YesNo( "Print?", wma.asString, TRUE )
        Please_print = TRUE
        if( Please_print ) then
            nowTime = Date.Now
            nowTime.SetFormat( "hhhh:m" )
            dtStamp = nowDate.asString++ "++nowTime.AsString
            av.ShowMsg( wma.asString++"record"++rec.AsString++dtStamp )
            'more = av.SetStatus( rec/num * 100 )
            'myFTab = myTheme.GetFTab
```

```

myFTab.SetDefinition( "[Dwaf-region] = wma" )
myFTab.UpdateDefBitmap
myFTab.GetSelection.Set( rec )
'theView.GetDisplay.Flush
myTheme.Invalidate( true )
av.ShowMsg( wma.asString++"record"++rec.AsString++dtStamp )

av.Run( "Locality map", {rec, wma} )

r = Rect.MakeEmpty
r = myTheme.GetSelectedExtent
'MsgBox.Info( r.asString,"Sel Rect" )
if( r.ReturnSize = (0@0) ) then
  theView.GetDisplay.PanTo( r.ReturnOrigin )
else
  theView.GetDisplay.SetExtent( r.Scale( 1.1 ) )
end
theView.Invalidate
theView.GetWin.Activate
theView.GetDisplay.Flush
av.ShowMsg( wma.asString++"record"++rec.AsString++dtStamp )

theFills = av.GetProject.GetDocs.Clone
theList = { wma, dtStamp }
theFills.Merge( theList )

myLayout.GetGraphics.FillFrames( theFills )
myLayout.Invalidate
myLayout.GetWin.Activate
myLayout.GetDisplay.ZoomToPage
myLayout.GetDisplay.Flush
if( Please_print ) then
  'myLayout.Print
  myLayout.Export
end

av.ShowMsg(
wma.asString++dtStamp++r.asString++"record"++rec.AsString )
'more = av.SetStatus( rec/num * 100 )
end

end
myTheme.ClearSelection

end

' Name: Layout.LocalityMap
'
' Title: Locality map of South Africa
'
' Topics: Views, Layouts

```

```

'
' Description: Draws a locality map of South Africa on the layout
' with the WMA highlighted.
'
' Requires: View "WMA SA" with the map of South Africa
' Layout "Baseflow layout"
'
' Michael Silberbauer 2000-03-23
'

rec = self.Get( 0 )
wma = self.Get( 1 )
theView = av.GetProject.FindDoc( "WMA SA" )
myLayout = av.GetProject.FindDoc( "Baseflow layout" )
myLayout.GetWin.Open
myTheme = theView.FindTheme( "WMA" )

'MsgBox.Info( myTheme.asString,"My theme" )

if( myTheme.HasTable ) then
  myFTab = myTheme.GetFTab
  theField = myFTab.FindField( "Dwaf-region" )
else
  exit
end

myTheme.ClearSelection
myFTab.SetDefinition( "[Dwaf-region] = wma" )
myFTab.UpdateDefBitmap
myFTab.GetSelection.Set( rec )
myTheme.Invalidate( true )
theView.Invalidate
theView.GetWin.Activate
theView.GetDisplay.Flush

return 0

```

Appendix : Landcover comparison in HTML

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
```

```
<html>
<head><title>Land cover: Water Management Areas</title></head>
<body>
```

```
<h3 align="center">
Summarising land cover data by catchment
</h3>
<p>This page illustrates how summarising land cover data per catchment
area
```

```

is less meaningful for larger catchment areas than smaller ones.</p>
<p>Click on the various maps to compare the raw
<b><font color="#009900">forest (exotic)</font></b>,
<b><font color="#0066ff">waterbody</font></b>
and
<b><font color="#cc0000">irrigation (commercial, permanent +
temporary)</font></b>
data with the output created
at primary, secondary, tertiary and quaternary level.</p>
<table summary="Land cover progressive summary by catchment" border>
<tr>
<th>LC</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
<th>Quaternary</th>
<th>Raw data</th>
</tr>
<tr align="center">
<td><b><font size="-1">F<br>O<br>R</font></b></td>
<td><a href="for_1.htm"></a></td>
<td><a href="for_2.htm"></a></td>
<td><a href="for_3.htm"></a></td>
<td><a href="for_4.htm"></a></td>
<td><a href="for_lc.htm"></a></td>
</tr>
<tr align="center">
<td><b><font size="-1">W<br>A<br>T</font></b></td>
<td><a href="wat_1.htm"></a></td>
<td><a href="wat_2.htm"></a></td>
<td><a href="wat_3.htm"></a></td>
<td><a href="wat_4.htm"></a></td>
<td><a href="wat_lc.htm"></a></td>
</tr>
<tr align="center">
<td><b><font size="-1">I<br>R<br>R</font></b></td>
<td><a href="irr_1.htm"></a></td>
<td><a href="irr_2.htm"></a></td>

```

```

<td><a href="irr_3.htm"></a></td>
<td><a href="irr_4.htm"></a></td>
<td><a href="irr_lc.htm"></a></td>
</tr>
</table>

<p align="center"><font size="-1">
[<a href=" ../index.html">Index Page</a> ]</font></td>
<font size="-1"><p align="center">Please send comments on
these pages to
<a href="mailto:eck@dwaf-hri.pwv.gov.za">Michael Silberbauer</a>
at the Institute for Water Quality Studies.</font>
</body>
</html>

```

Appendix : Landcover script in ArcView

```

' Name: Layout.WMAmap_lc
'
' Title: Steps through each WMA and draws a map
'
' Topics: Views, Layouts
'
' Description: Steps through each Water Management Area and
' asks the user whether to draw a map using the current
' layout.
'
' Requires: Locality map (a script that draws a locality
' map of South Africa)
' View with the required themes
' Layout with the required graphics objects already created
' and tagged with SetObjectTag
' (to avoid using the confusing command .FillFrames)
' myTheme should be a filled polygon theme, set to transparent shading
'
' Michael Silberbauer 2000-03-23
' - modified 2001-01-17
' - pies 2001-02-05
' - adapted for land cover (again) 2001-02-12

av.GetProject.SetModified( true )
av.GetProject.SetSelColor ( color.GetGray )

theView = av.GetProject.FindDoc( "Quaternary" )
myLayout = av.GetProject.FindDoc( "Quaternary layout" )
myLayout.GetWin.Open

```

```

myTheme = theView.FindTheme( "Water Management Area" )

map = "Quaternary layout"

myLayout = av.GetProject.FindDoc( map )
myLayout.GetWin.Open
theViewLoc = av.GetProject.FindDoc( "WMA locality" )
myTheme = theView.FindTheme( "Water Management Area" )
myLegend = myTheme.GetLegend

if( myTheme.HasTable ) then
  myFTab = myTheme.GetFTab
  theField = myFTab.FindField( "Name" )
else
  MsgBox.Info( myTheme.asString,"No table - exit" )
  exit
end

output_type = MsgBox.ListAsString(
  { "image on disk" , "print to default printer" , "no
  idea" } ,
  "Please select the output type" , "Output Selection" )
'redraw_symbol = MsgBox.YesNo( "Redraw symbols for each WMA",
'
  "MAUCHA", FALSE )
auto_mode = MsgBox.YesNo( "Run in automatic mode?", "AUTO MODE",
FALSE )

num = 0
for each rec in myFTab
  num = num + 1
end

myTheme.ClearSelection
av.ShowStopButton

for each rec in myFTab
  wma = myFTab.ReturnValue( theField, rec )
  if( wma.asString.Count > 0 ) then
    if( auto_mode ) then
      Please_print = true
    else
      Please_print = MsgBox.YesNoCancel( "Process"++wma.asString++"?",
        "Water Management Area Map",
TRUE )
    end

    if( Please_print = nil ) then
      exit
    end

    if( Please_print ) then

```

```

myTheme.ClearSelection
myFTab.SetDefinition( "[Name] = wma" )
myFTab.UpdateDefBitmap
myFTab.GetSelection.Set( rec )
myTheme.Invalidate( true )
theNumField = myFTab.FindField( "Number" )
wmanumber = myFTab.ReturnValue( theNumField, rec )

av.Run( "Locality map", { rec, wma, map } )

r = Rect.MakeEmpty
r = myTheme.GetSelectedExtent

if( r.ReturnSize = (0@0) ) then
  theView.GetDisplay.PanTo( r.ReturnOrigin )
else
  theView.GetDisplay.SetExtent( r.Scale( 0.97 ) )
end

theTable = myFTab
theTable.GetSelection.Not
theTable.UpdateSelection
myTheme.Invalidate( true )

theView.GetWin.Activate

theView.GetDisplay.Flush

'Frame 1 is the main map View:

theGraphics = myLayout.GetGraphics
theGraphicsList = theGraphics.FindAllByObjectTag( "Frame1" )
theGraphics.UnselectAll
g = 0
for each g in theGraphicsList
  g.SetView( theView, true )
  ViewScale = g.ReturnScale
end

'MsgBox.Info( "1:"++ ViewScale.asString, "View Scale" )

'Frame 2 is the locality map View:

theGraphics = myLayout.GetGraphics
theGraphicsList = theGraphics.FindAllByObjectTag( "Frame2" )
theGraphics.UnselectAll
g = 0
for each g in theGraphicsList
  g.SetView( theViewLoc, true )
end

```

```

'Frame 3 is the maucha key View:

'ISOdate is the datestamp and scale text string:

nowDate = Date.Now
nowDate.SetFormat( "yyyy-MM-dd" )
nowTime = Date.Now
nowTime.SetFormat( "hhhh:m" )
dtStamp = nowDate.asString++ "++nowTime.AsString
av.ShowMsg( wma.asString++"record"++rec.AsString++dtStamp )

theGraphics = myLayout.GetGraphics
theGraphicsList = theGraphics.FindAllByObjectTag( "ISOdate" )
theGraphics.UnselectAll
g = 0
for each g in theGraphicsList
  g.SetText( dtStamp++" Scale of original print =
1:++ViewScale.SetFormat( "d" ).AsString )
end

'Title is the Water Management Area text:

theGraphicsList = theGraphics.FindAllByObjectTag( "Title" )
theGraphics.UnselectAll
g = 0
for each g in theGraphicsList
  g.SetText( wma ++ "Water Management Area" )
end

'Number is the Water Management Area number on the 1:2 000 000 map
(Year 2000):

theGraphics.ClearSelected
theGraphicsList = theGraphics.FindAllByObjectTag( "Number" )
theGraphics.UnselectAll
g = 0
for each g in theGraphicsList
  g.SetText( wmanumber.SetFormat( "d" ).AsString )
end
theGraphics.ClearSelected

av.ShowMsg( wmanumber.SetFormat( "d"
).AsString++wma.asString++dtStamp++r.asString++"record"++rec.AsString )

myLayout.Invalidate
myLayout.GetWin.Activate
myLayout.GetDisplay.ZoomToPage
myLayout.GetDisplay.Flush

```

```

'theView.Invalidate

if( Please_print ) then
  if( output_type = "print to default printer" ) then
    'printer.The.SetFileName("s:\temp\wma.prt")
    myLayout.Print
  elseif( output_type = "image on disk" ) then
    myLayout.Export
  else
    'nothing
  end
end

end

end

'myTheme.ClearSelection
end

```

Appendix : Chemical classification macro in Arc/Info

```

/* plot the quaternary catchments of South Africa.
/* - select each province in turn...
/* - select the quat catchments within the province...
/* - for each quat catchment with monitoring points, calc the status..
/* - draw quat rivers in colours according to chemical status...
/* Michael Silberbauer Thu Mar 21 16:15:20 GMT 1996
/* - 1999-06-23 Dusted off for water law...
/* - 2000-08-22 Plucked from the mire for the
Internet...
/* used for report N/0000/00/REQ/0700
/* - 2000-09-04 Median added, and advanced percentile
/* - 2000-10-12 Year 2000 regions used

&args Region_Type Date1 Date2 Percentile minChem Debug
&if [null %Region_Type%] &then &sv Region_Type = WMA
  &sv RegionType = [substr [locase %Region_Type%] 1 1]
&if [null %Date1%] &then &sv Date1 = 19940101
&if [null %Date2%] &then &sv Date2 = 19981231
&sv yyyy1 [unquote [substr [quote %Date1%] 1 4]]
&sv yyyy2 [unquote [substr [quote %Date2%] 1 4]]
&sv mm1 [unquote [substr [quote %Date1%] 5 2]]
&sv mm2 [unquote [substr [quote %Date2%] 5 2]]
&sv dd1 [unquote [substr [quote %Date1%] 7 2]]
&sv dd2 [unquote [substr [quote %Date2%] 7 2]]
&if [null %Percentile%] &then &sv Percentile = 90
&if [null %minChem%] &then &sv minChem = 5

```

```

&if ^ [null %Debug%] &then &sv Debug = .true.
  &else &sv Debug = .false.

&call SetConstants

&call KeyHeader
&do ProvName &list %ProvList%
  &call NameGen
  &call ReportHeader
  &call MapHeader
  &call ProvMap
  &call MapFooter
  &call ReportFooter
&end
&call KeyFooter
&sv cQ [close -all]

&return

/* -----
&routine ProvMap

ArcPlot

/*disp 1040
  /*%PlotFile%
/*&type %PlotFile%

disp 9999 size 800 800

pagesize %xp% %yp%
pageunits cm
library aqces
shadeset colornames
lineset plotter
lineset carto
markerset mineral
textset font
&sv yt %yp% - ( 2 * %ym% )

linesymbol 69
box 0 0 [show pagesize]
maplimits %xm% %ym% %yl% %yl%
box [show maplimits]
Linesymbol 1

clipmapextent off

clearsel %Prov% poly

&if %ProvName% = 'South Africa' &then
  reselect %Prov% poly class cn 'Province'
&else
&do
  &if %RegionType% = p &then
    reselect %Prov% poly province = %ProvName%
  &if %RegionType% = w &then
    reselect %Prov% poly name = %ProvName%
&end

&sv nSelProv = [extract 1 [show select %Prov% poly]]
&type Number of polygons selected for %ProvName% = %nSelProv%
&if %nSelProv% = 0 &then &stop Error selecting %ProvName%!

move %xt% %yt%
textsymbol 5
textsize [calc 3 * %ym%]
text %ProvName% cc
&sv yt %yt% - ( 3.9 * %ym% )
move %xt% %yt%
textsize %ym%
text [quote %Date1% to %Date2%] cc
&sv yt %yt% - ( 1 * %ym% )

clearsel %Catch_Qat% poly
reselect %Catch_Qat% poly overlap %prov% poly # passthru
writeselect %PlotFile%.sel %Catch_Qat% poly
/*readselect %PlotFile%.sel clear
mapextent poly %Catch_Qat%
mapposition cen cen
mapunits meters
nselect %Catch_Qat% poly
polygonshade %Catch_Qat% 3
nselect %Catch_Qat% poly

clearselect .ponet poly
reselect .ponet poly popytype = 2
polygonshade .ponet 57

&sv nQcats = [extract 1 [show select %Catch_Qat% poly]]
&sv w = [write %ru% [quote <p>%nQcats% quaternary drainage regions
overlap [unquote %ProvName%] %Region_Type%]]
&type %nQcats% quaternary catchments in %ProvName%
infofile %Catch_Qat% poly qatriv.tmp quaternary init
sort qatriv.tmp info quaternary ascending
/*list qatriv.tmp info
&sv nSmpIs = 0

&call PlotHydro

&if ^ %Debug% &then &message &off

```



```

&call ProcessStreams
&message &on

&call PlotCat
textsymbol 10
textsize [calc %xm% * 1.5 ]
overpost 0.05 1.0 0.1
overpost text moveable
overpost on
leaders on
leadersymbol 1
leadertolerance 0.05
textalignment automatic

readselect %PlotFile%.sel
&call ProcessDams
overpost off
leaders off
textsymbol 1
/*textscale 1

&call PlotProv

textsymbol 10
textsize [calc %xm% * 1.5 ]
overpost 0.05 1.0 0.1
overpost text moveable
overpost on
leaders on
leadersymbol 1
leadertolerance 0.05
textalignment automatic

&call PlotStations
overpost off
leaders off
textsymbol 1
/*textscale 1

/*&call PlotInset
&call PlotScale

&if [exists %PlotFile%.ras] &then &sv delras [delete %PlotFile%.ras -
file]
&if [exists %PlotFile%.rsw] &then &sv delrsw [delete %PlotFile%.rsw -
file]
screensave %PlotFile%.ras

quit

&if [exists %PlotFile%.jpg] &then &sv deljpg [delete %PlotFile%.jpg -
file]
&if [exists %PlotFile%.jgw] &then &sv deljgw [delete %PlotFile%.jgw -
file]
&if [exists %PlotFile%.jpgw] &then &sv deljpgw [delete %PlotFile%.jpgw -
file]
convertimage %PlotFile%.ras %PlotFile%.jpg jfif
&if [exists %PlotFile%.ras] &then &sv delras [delete %PlotFile%.ras -
file]
&if [exists %PlotFile%.rsw] &then &sv delrsw [delete %PlotFile%.rsw -
file]

/*draw %PlotFile% 9999 4
/*[unquote ' ' ] /* quit screen display

/*&if [exists %PlotFile%.cgm -file] &then &ty [delete %PlotFile%.cgm -
file]
/*cgm %PlotFile% %PlotFile%.cgm # binary # # opaque
/*&if [exists %PlotFile%.rtl -file] &then &ty [delete %PlotFile%.rtl -
file]
/*rtl %PlotFile% %PlotFile%.rtl # # opaque

&return

/* -----
&routine QatPlot

clearsel %Catch_Qat% poly
reselect %Catch_Qat% poly quaternary = [quote %QatCat%]
&type Catchment %QatCat%: %nQcat% of %nQcats%
&call SetChemValue
&call SetChemClass

&if %Class% = 0 &then
&do
&type %QatCat% %n%: %nChems%: Class%Class%
&sv w [write %ru% [quote <br>Summary of classification: ]]
&sv w [write %ru% [quote <b>%QatCat%</b> n=<b>%nChems%</b> Class
<b>%Class%</b>]]]
&end

&if %Class% = 1 &then
&do
&type %QatCat% %n%: %nChems%: Class%Class% I(%badvar1%)
&sv w [write %ru% [quote <br>Summary of classification (consituents in
each range in brackets): ]]
&sv w [write %ru% [quote <b>%QatCat%</b> n=<b>%nChems%</b> Class
<b>%Class%</b>: I(<b>%badvar1%</b>))]
&end

&if %Class% = 2 &then

```

```

&do
  &sv w [write %ru% [quote <br>Summary of classification (constituents in
each range in brackets): ]]
  &type %QatCat% %n%: %nChems%: Class%Class% I(%badvar1%) II(%badvar2%)
  &sv w [write %ru% [quote <b>%QatCat%</b> n=<b>%nChems%</b> Class
<b>%Class%</b>: I(<b>%badvar1%</b>) II(<b>%badvar2%</b>)]]
&end

&if %Class% = 3 &then
&do
  &sv w [write %ru% [quote <br>Summary of classification (constituents in
each range in brackets): ]]
  &type %QatCat% %n%: %nChems%: Class%Class% I(%badvar1%) II(%badvar2%)
III(%badvar3%)
  &sv w [write %ru% [quote <b>%QatCat%</b> n=<b>%nChems%</b> Class
<b>%Class%</b>: I(<b>%badvar1%</b>) II(<b>%badvar2%</b>)
III(<b>%badvar3%</b>)]]
&end

&if %Class% = 0 &then &sv shd = 57 /*light cyan, E0FFFF
&if %Class% = 1 &then &sv shd = 67 /*pale green, 98FB98
&if %Class% = 2 &then &sv shd = 79 /*khaki, F0E68C
&if %Class% = 3 &then &sv shd = 95 /*wheat, F5DEB3
polygonshade %Catch_Qat% %shd%

&if %Class% = 0 &then &sv cnam = 'deep sky blue' /*00BFFF
&if %Class% = 1 &then &sv cnam = 'dark green' /*006400
&if %Class% = 2 &then &sv cnam = 'yellow' /*FFFF00
&if %Class% = 3 &then &sv cnam = 'red' /*FF0000

linesymbol 1
linecolor %cnam%

&do nOrder = 1 &to 7
  &sv width = %nOrder% / 21
  clearsel %rivqat% arc
  reselect %rivqat% arc quaternary = [quote %QatCat%]
  reselect %rivqat% arc order = %nOrder%
  linesize %width%
  arcs %rivqat%
&end

&return

/* -----
&routine PlotProv

linesymbol 137
arcs %prov%
line [calc %xt% - ( 4 * %xm% )] %yt% [calc %xt% - %xm%] %yt%
move %xt% %yt%

textsymbol 1
textsize [calc 1.5 * %ym%]
text [quote Provincial boundaries] c1
&sv yt %yt% - ( 2 * %ym% )

linesymbol 138
line [calc %xt% - ( 4 * %xm% )] %yt% [calc %xt% - %xm%] %yt%
move %xt% %yt%
text [quote [unquote %ProvName%] boundaries] c1
&sv yt %yt% - ( 3 * %ym% )
polygons %prov%

&return

/* -----
&routine PlotTown

polygonshade %townpol% 83

&return

/* -----
&routine PlotHydro

textsymbol 1
textsize [calc 1.5 * %ym%]
linesymbol 4
linecolor 'light grey'
arcs %afivers%

&do nOrder = 1 &to 7
  &sv width = %nOrder% / 14
  &type Rivers of order %nOrder% being drawn with a width of ~
[calc [round [calc 100 * %width%]] / 100]cm:
  clearselect %rivers% arc
  reselect %rivers% arc order = %nOrder%
  linesize %width%
  arcs %rivers%
  &sv x11 = %xt% - %xm% - ( 3 * %xm% * %nOrder% / 7 )
  &sv x12 = %xt% - %xm% - ( 3 * %xm% * ( %nOrder% - 1 ) / 7 )
  line %x11% %yt% %x12% %yt%
&end

linesymbol 1
linesize 0.01
move %xt% %yt%
text [quote Rivers order 7 to 1] c1
&sv yt %yt% - ( 2 * %ym% )

clearselect %dams% poly
reselect %dams% poly name <> 'Island'

```

```

polygonshade %dams% 33

shadesymbol 33
patch [calc %xt% - ( 4 * %xm% )] [calc %yt% - ( 1 * %ym% )] [calc %xt% -
%xm%] [calc %yt% + ( 1 * %ym% )]
move %xt% %yt%
text [quote Lakes] c1
&sv yt %yt% - ( 2 * %ym% )

textsymbol 22 /* DCW annotation for rivers
textcolor cyan
textput 4
textsymbol 13
textcolor cyan
textput 76
/*textscale 1.8
annotext .dnnet
/*textscale 0.9

&return

/* -----
&routine PlotCat

linesymbol 1
linecolor 'magenta 3'
arcs %Catch_Qat%
line [calc %xt% - ( 4 * %xm% )] %yt% [calc %xt% - %xm%] %yt%
textsymbol 1
textsize [calc 1.5 * %ym%]
move %xt% %yt%
text [quote Quaternary catchments] c1
&sv yt %yt% - ( 2 * %ym% )

linesymbol 5
linecolor 'blue 4'
arcs %Catch_Ter%
/*line [calc %xt% - ( 4 * %xm% )] %yt% [calc %xt% - %xm%] %yt%
/*textsymbol 1
/*textsize [calc 1.5 * %ym%]
/*move %xt% %yt%
/*text [quote Tertiary catchments] c1
&sv yt %yt% - ( 2 * %ym% )

linesymbol 9
linecolor 'blue 4'
arcs %Catch_Sec%
/*line [calc %xt% - ( 4 * %xm% )] %yt% [calc %xt% - %xm%] %yt%
/*textsymbol 1
/*textsize [calc 1.5 * %ym%]

/*move %xt% %yt%
/*text [quote Secondary catchments] c1
&sv yt %yt% - ( 2 * %ym% )

linesymbol 13
linecolor 'blue 4'
arcs %Catch_Pri%
line [calc %xt% - ( 4 * %xm% )] %yt% [calc %xt% - %xm%] %yt%
textsymbol 1
textsize [calc 1.5 * %ym%]
move %xt% %yt%
text [quote Primary catchments] c1
&sv yt %yt% - ( 2 * %ym% )

textsymbol 13
textsize [calc %xm% * 3]
textcolor gray60
polygontext %Catch_Ter% tertiary

textsymbol 11
textsize [calc %xm% * 2]
textcolor gray40
clearselect %Catch_Qat% poly
readselect %PlotFile%.sel
polygontext %Catch_Qat% qat_letter
/*polygontext %Catch_Qat% quaternary
/*clearselect %Catch_Qat% poly
textcolor 1
textsymbol 1

&return

/* -----
&routine PlotInset

shadesymbol 61
textsymbol 1
textcolor 1
/*textscale 0.75
linesymbol 1

textsize [calc 1.5 * %ym%]

move %xt% %yt%
text [quote Surface resource classification] cc
&sv yt %yt% - ( 2 * %ym% )

move %xt% %yt%
text [quote (quality of surface water at monitoring points)] cc
&sv yt %yt% - ( 2 * %ym% )

```

```

move %xt% %yt%
text [quote extrapolated to whole quaternary catchments] cc
&sv yt %yt% - ( 2 * %ym% )

/*textscale 0.7

move %xt% %yt%
text [quote %Percentile%%suffix% percentile - potability:] cl
&sv yt %yt% - ( 2 * %ym% )

shadesymbol 33
patch [calc %xt% - ( 4 * %xm% )] [calc %yt% - ( 0.1 * %ym% )] [calc %xt%
- %xm%] [calc %yt% + ( 0.1 * %ym% )]
move %xt% %yt%
text [quote Insufficient data] cl
&sv yt %yt% - ( 2 * %ym% )

shadesymbol 45
patch [calc %xt% - ( 4 * %xm% )] [calc %yt% - ( 0.1 * %ym% )] [calc %xt%
- %xm%] [calc %yt% + ( 0.1 * %ym% )]
move %xt% %yt%
text [quote Class 0 (ideal water)] cl
&sv yt %yt% - ( 2 * %ym% )

shadesymbol 73
patch [calc %xt% - ( 4 * %xm% )] [calc %yt% - ( 0.1 * %ym% )] [calc %xt%
- %xm%] [calc %yt% + ( 0.1 * %ym% )]
move %xt% %yt%
text [quote Class I (safe water)] cl
&sv yt %yt% - ( 2 * %ym% )

shadesymbol 83
patch [calc %xt% - ( 4 * %xm% )] [calc %yt% - ( 0.1 * %ym% )] [calc %xt%
- %xm%] [calc %yt% + ( 0.1 * %ym% )]
move %xt% %yt%
text [quote Class II (short-term use)] cl
&sv yt %yt% - ( 2 * %ym% )

shadesymbol 110
patch [calc %xt% - ( 4 * %xm% )] [calc %yt% - ( 0.1 * %ym% )] [calc %xt%
- %xm%] [calc %yt% + ( 0.1 * %ym% )]
move %xt% %yt%
text [quote Class III (undrinkable)] cl
&sv yt %yt% - ( 2 * %ym% )

markersymbol 432
marker [calc %xt% - %xm%] %yt%
move %xt% %yt%
text [quote Monitoring point] cl
&sv yt %yt% - ( 2 * %ym% )

markersymbol 432
marker [calc %xt% - %xm%] %yt%
markersymbol 401
marker [calc %xt% - %xm%] %yt%
move %xt% %yt%
text [quote Mon. pt. <= %FuzzyEdge% from catchment edge] cl
&sv yt %yt% - ( 2 * %ym% )

/*textscale 1.0

&call ScaleBarCalc
&sv yt %yt% - ( 8 * %ym% )
scalebar automatic %bar% %xt% %yt% width %xm% big_blocks 5 small_block 0
~
bar_text %xm% scale_text no north_arrow no
chartext
&sv yt %yt% - ( 3 * %ym% )

maplimits [calc %xt% - ( 2 * %xm% )] [calc %yt% - ( 2 * %ym% )] ~
[calc %xt% + ( 2 * %xm% )] [calc %yt% + ( 2 * %ym% )]

mapextent /hri/db/clip/dwaf
mapposition cen cen
polygonshades /hri/db/clip/dwaf dwaf-id
&sv yt %yt% - ( 3 * %ym% )

textsize [calc %xm% / 2]

move %xt% %yt%
text 'Please read this map with its tabular printout' cc
&sv yt %yt% - ( 2 * %ym% )
move %xt% %yt%

text 'Institute for Water Quality Studies, DWAF, P/Bag X313, PRETORIA
0001\Tel (012) 8080374 Fax (012) 8082702 eck@dwaf-hri.pwv.gov.za' cc
&sv yt %yt% - ( 2 * %ym% )

move %xt% %yt%
text %ISOdate% cc
&sv yt %yt% - ( 2 * %ym% )
move %xt% %yt%
text [quote AML: %AML$FULLFILE%\STN: %StnPnts%\QUAL: %ChemFile%] cc
&sv yt %yt% - ( 4 * %ym% )
textjustification uc
textfile %CriteriaT% block
textjustification cc
&sv yt %yt% - ( 3 * %ym% )

maplimits [calc %xl% + %xm%] [calc %ym% + %ym%] ~
[calc %xp% - %xm%] [calc %yp% / 4.0 ]
mapextent -759000,-3853000,942000,-2316000

```

```

mapposition      cen cen
clipmapextent    off

clearselect      .ponet poly
reselect         .ponet poly popytype = 1
polygonshade     .ponet 80
box              [show maplimits]
linesymbol       1
polygons         .ponet

clearsel         %Prov% poly
&if %ProvName% = 'South Africa' &then
  reselect %Prov% poly class cn 'Province'
&else
&do
  &if %RegionType% = p &then
    reselect %Prov% poly province = %ProvName%
  &if %RegionType% = w &then
    reselect %Prov% poly name = %ProvName%
&end

polygonshade %Prov% 119
arcs             %Catch_Pri%
/*textscale     0.7
polygontext      %Catch_Pri% primary
/*textscale     0.9

&return

/* -----
&routine ScaleBarCalc

&sv mape [show mape]
&sv barxmin [extract 1 %mape%]
&sv barxmax [extract 3 %mape%]
&sv barxlen [round [calc ( %barxmax% - %barxmin% ) / 1000 ]]
&sv barlen [calc %barxlen% * 0.25]
&sv logbar [calc ln %barlen% / ln 10 ]
&sv ilogbar [truncate %logbar%]
&sv flogbar [calc %logbar% - %ilogbar%]
&if %flogbar% < 0.39794 &then
  &sv blogbar %ilogbar%
&if %flogbar% >= 0.39794 and %flogbar% < 0.69897 &then
  &sv blogbar [calc %ilogbar% + 0.39794]
&if %flogbar% >= 0.69897 &then
  &sv blogbar [calc %ilogbar% + 0.69897]
&sv bar [round [calc 10 ** %blogbar%]]

&return

/* -----
&routine SetChemValue

&sv ChemList = pH Fluoride NO3(N) Sulphate Chloride Sodium Magnesium
TDS Conductivity
&sv ChemUnit1 = -logH+
&sv ChemUnit1 = -log [unquote '[']H<sup>+</sup>[unquote ']']
&sv ChemUnit2 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit3 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit4 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit5 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit6 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit7 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit8 = mg <i>1</i><sup>-1</sup>
&sv ChemUnit9 = mS m<sup>-1</sup>
&sv ChemRndv1 = 100
&sv ChemRndv2 = 100
&sv ChemRndv3 = 1000
&sv ChemRndv4 = 10
&sv ChemRndv5 = 10
&sv ChemRndv6 = 10
&sv ChemRndv7 = 10
&sv ChemRndv8 = 1
&sv ChemRndv9 = 10

&sv TempFile = tempsortriv.tmp
&if [exists %TempFile% -info] &then &sv di [delete %TempFile% -info]
infofile %ChemFile% info %TempFile% %ChemList% station init
reselect %TempFile% info $RECNO > 0
&sv nC = [extract 1 [show select %TempFile% info]]

/* Calculate nth percentile. Algorithm supplied by John Carter.
/* Only calculate the record once, then sort the data for each variable
/* and select the nth percentile.
/* First calculate the (possibly) theoretical ExactRecord for the
percentile,
/* then find the two integers surrounding this value:

&sv PcntRec = [round [max 1 [calc %Percentile% / 100 * %nC%]]]
&if %PcntRec% > %nC% &then &sv PcntRec = %nC%
&sv ExactRec = [calc ( %Percentile% * %nC% ) / 100 ]
&sv Recd1 [truncate %ExactRec%]
&if %Recd1% < 1 &then &sv Recd1 = 1
&sv Recd2 = [calc %Recd1% + 1]
&if %Recd2% > %nC% &then &sv Recd2 = %nC%

/* also select record for the 50th percentile (median):

&sv MedRec = [max 1 [trunc [calc %nC% / 2]]]

```

```

&sv ChemHdr Variable      Number  Minimum  min stn   %Percentile%th
pctl  at stn      MAXIMUM  MAX STN
&type [quote [unquote %ChemHdr%]]

&sv w [write %ru% [quote <table border summary="%QatCat% classification
triggers">]]
&sv w [write %ru% [quote <tr>]]
&sv w [write %ru% [quote <th><small>Variable</small></th>]]
&sv w [write %ru% [quote <th><small>n<br>samples</small></th>]]
&sv w [write %ru% [quote <th><small>Minimum</small></th>]]
&sv w [write %ru% [quote <th><small>recorded<br>at</small></th>]]
&sv w [write %ru% [quote <th><small>Median</small></th>]]
&sv w [write %ru% [quote <th><small>recorded<br>at</small></th>]]
&sv w [write %ru% [quote
<th><small>%Percentile%th<br>percentile</small></th>]]
&sv w [write %ru% [quote <th><small>recorded<br>at</small></th>]]
&sv w [write %ru% [quote <th><small>Maximum</small></th>]]
&sv w [write %ru% [quote <th><small>recorded<br>at</small></th>]]
&sv w [write %ru% [quote <th><small>unit</small></th>]]
&sv w [write %ru% [quote </tr>]]

&sv ChemN = 0

&do ChemVar &list %ChemList%

  &sv ChemN = %ChemN% + 1
  &data ARC INFO > /dev/null
  ARC
  SELECT [translate [entryname %TempFile%]]
  SORT ON [translate %ChemVar%]
  Q STOP
  q
  &end

  &sv FirstValue = [show select %TempFile% INFO %Recd1% item %ChemVar%]
  &sv SecondValue = [show select %TempFile% INFO %Recd2% item %ChemVar%]

  /* Interpolate between these two records, by the cunning method of
  finding out
  /* the exact percentile of the two records surrounding the percentile
  we want:

  &sv Val2-1 = [calc %SecondValue% - %FirstValue%]
  &sv Pcntile1 = [calc ( %Recd1% / %nC% ) * 100]
  &sv Pcntile2 = [calc ( %Recd2% / %nC% ) * 100]
  &sv PcntRatio = [calc ( %Percentile% - %Pcntile1% ) / ( %Pcntile2% -
  %Pcntile1% ) ]
  &sv cv%ChemN% = [calc ( %PcntRatio% * %Val2-1% ) + %FirstValue%]

  /* Calculate the median in a more mundane way (for (1) odd or (2) even
  nC):

  &if [mod %nC% 2] = 1 &then
  &do
    &sv medSTATION [show select %TempFile% info %MedRec% item station]
    &sv cvmd%ChemN% [show select %TempFile% info %MedRec% item
  %ChemVar%]
  &end
  &else
  &do
    &sv MedRec2 [min %MedRec% %nC%]
    &sv medSTATION [show select %TempFile% info %MedRec2% item station]
    &sv median1 [show select %TempFile% info %MedRec% item
  %ChemVar%]
    &sv median2 [show select %TempFile% info %MedRec2% item
  %ChemVar%]
    &sv cvmd%ChemN% [calc ( %median1% + %median2% ) / 2]
  &end

  &sv minStation [show select %TempFile% info 1 item station]
  &sv pctSTATION [show select %TempFile% info %Recd2% item station]
  &sv MAXStation [show select %TempFile% info %nC% item station]
  &sv cvmn%ChemN% [show select %TempFile% info 1 item %ChemVar%]
  /*&sv cv%ChemN% = [show select %TempFile% info %PcntRec% item
  %ChemVar%]
  &sv cvmx%ChemN% [show select %TempFile% info %nC% item %ChemVar%]

  &format 2
  &sv ChemString ~
  [format '%1,12% %2,-7% %3,-9% (%4,-9%) %5,-9% (%6,-9%) %7,-9% (%8,-
  9%)' ~
  %ChemVar% %nC% [value cvmn%ChemN%] %minStation% [value cv%ChemN%]
  %pctSTATION% [value cvmx%ChemN%] %MAXStation%]
  &type [quote [unquote %ChemString%]]

  /* round values to required number of decimals (must be an easier
  way!):
  &sv val_min = [calc [round [calc [value ChemRndv%ChemN%] * [value
  cvmn%ChemN%]]] / [value ChemRndv%ChemN%]]
  &sv val_med = [calc [round [calc [value ChemRndv%ChemN%] * [value
  cvmd%ChemN%]]] / [value ChemRndv%ChemN%]]
  &sv val_pct = [calc [round [calc [value ChemRndv%ChemN%] * [value
  cv%ChemN%]]] / [value ChemRndv%ChemN%]]
  &sv val_max = [calc [round [calc [value ChemRndv%ChemN%] * [value
  cvmx%ChemN%]]] / [value ChemRndv%ChemN%]]
  &sv w [write %ru% [quote <tr>]]
  &sv w [write %ru% [quote <td align="left"
  ><small>%ChemVar%</small></td>]]
  &sv w [write %ru% [quote <td align="center"><small>%nC%</small></td>]]
  &sv w [write %ru% [quote <td
  align="center"><small>%val_min%</small></td>]]
  &sv w [write %ru% [quote <td align="left"
  ><small>%minStation%</small></td>]]

```

```

    &sv w [write %ru% [quote <td
align="center"><small>%val_med%</small></td>]]
    &sv w [write %ru% [quote <td align="left"
><small>%medSTATION%</small></td>]]
    &sv w [write %ru% [quote <td
align="center"><small>%val_pct%</small></td>]]
    &sv w [write %ru% [quote <td align="left"
><small>%pctSTATION%</small></td>]]
    &sv w [write %ru% [quote <td
align="center"><small>%val_max%</small></td>]]
    &sv w [write %ru% [quote <td align="left"
><small>%MAXStation%</small></td>]]
    &sv w [write %ru% [quote <td align="center"><small>[value
ChemUnit%ChemN%]</small></td>]]
    &sv w [write %ru% [quote </tr>]]

&end
&sv w [write %ru% [quote </table>]]

    &if ^ %Debug% &then &sv di [delete %TempFile% -info]
&return

/* -----
&routine SetChemClass
/* start with no class:
&sv Class = 0
&sv BadVar1 = [unquote ' ']
&sv BadVar2 = [unquote ' ']
&sv BadVar3 = [unquote ' ']

/* step through the variables: the class of the water sample is
dependent
/* on the WORST chemical class, so check each time that the class has
not
/* already been raised by a previous variable...

&do n = 1 &to 9

    &sv type = [value t%n%]
    &sv val = [value cv%n%]
    &sv c1 = [value c%n%-1]
    &sv c2 = [value c%n%-2]
    &sv c3 = [value c%n%-3]
    &sv c4 = [value c%n%-4]

    &if %type% = 1 &then
    &do
        &if %val% > %c1% and %val% <= %c2% &then &sv BadVar1 = %BadVar1%
[value v%n%]

```

```

        &if %val% > %c2% and %val% <= %c3% &then &sv BadVar2 = %BadVar2%
[value v%n%]
        &if %val% > %c3% &then &sv BadVar3 = %BadVar3%
[value v%n%]

    &if %val% <= %c1% and %Class% <= 0 &then &sv Class
0
    &if %val% > %c1% and %val% <= %c2% and %Class% <= 1 &then &sv Class
1
    &if %val% > %c2% and %val% <= %c3% and %Class% <= 2 &then &sv Class
2
    &if %val% > %c3% &then &sv Class
3

    &if %Debug% &then
        &type [value v%n%] [substr %val% 1 6] (%c1%-%c2%-%c3%)
Class%Class% %badvar1% %badvar2% %badvar3%

    &end

    &if %type% = 2 &then /* this is the case of pH:
    &do

        &sv c5 = [value c%n%-5]
        &sv c6 = [value c%n%-6]

    &if %val% >= %c3% and %val% <= %c4% and %Class% <= 0 &then &sv Class
0

    &if ( ( %val% < %c3% and %val% >= %c2% ) or ~
        ( %val% > %c4% and %val% <= %c5% ) ) and %Class% <= 1 &then
    &do
        &sv Class 1
        &sv badvar1 %badvar1% [value v%n%]
    &end

    &if ( ( %val% < %c2% and %val% >= %c1% ) or ~
        ( %val% > %c5% and %val% <= %c6% ) ) and %Class% <= 2 &then
    &do
        &sv Class 2
        &sv badvar2 %badvar2% [value v%n%]
    &end

    &if %val% < %c1% or %val% > %c6% &then
    &do
        &sv Class 3
        &sv badvar3 %badvar3% [value v%n%]
    &end

    &if %Debug% &then

```

```

&type [value v%n%] [substr %val% 1 6] (%c1%-&c2%-&c3%-&c4%-&c5%-
&c6%) Class%Class% %badvar1% %badvar2% %badvar3%

&end

&end

&return

/* -----
&routine SetConstants

&if %RegionType% = w &then
&do
&sv Reg_name = name
&sv prov = /hri/db/cover/s-africa/hrg_2000
&sv Provlist = 'Limpopo' 'Luvuvhu and Letaba' 'Olifants'
'Crocodile(West) and Marico' 'Inkomati' 'Upper Vaal' 'Middle Vaal'
'Lower Vaal' 'Upper Orange' 'Lower Orange' 'Usutu to Mhlathuze'
'Thukela' 'Mvoti to Umzimkulu' 'Mzimvubu to Keiskamma' 'Olifants/Doorn'
'Fish to Tsitsikamma' 'Gouritz' 'Berg' 'Breede'
&end
&else
&if %RegionType% = p &then
&do
&sv Reg_name = province
&sv ProvList = 'Gauteng' 'Northern Province' 'Western Cape' 'Northern
Cape' 'Eastern Cape' 'Free State' 'KwaZulu/Natal' 'North-West'
'Mpumalanga'
&sv prov = /hri/db/cover/s-africa/spr_500
&end

&sv townpol = /hri/db/cover/s-africa/smu_500
/*&sv StnPnts = /hri/db/cover/s-africa/stations2.alb
&sv StnPnts = /hri/db/cover/s-africa/nms_his
&sv Catch_Pri = /hri/db/cover/s-africa/hca_1
&sv Catch_Sec = /hri/db/cover/s-africa/hca_2
&sv Catch_Ter = /hri/db/cover/s-africa/hca_3
&sv Catch_Qat = /hri/db/cover/s-africa/hca_4
&sv ChemFile = $WMSYS/wmdata/wq/inorganic.dat
&sv rivers = /hri/db/cover/s-africa/wri_500
&sv afrivers = /hri/db/cover/s-africa/wri_not_sa
&sv rivqat = /hri/db/cover/s-africa/wri_500q
&sv dams = /hri/db/cover/s-africa/wla_500
&sv Report = qr[substr [username] 1 5].tmp
&sv SList = qstn[substr [username] 1 5].tmp
&sv CriteriaT = chemcriteria.html

&if [exists %Report%r -file] &then &sys \rm %Report%r
&sv closeall [close -all]
&sv ct = [open %CriteriaT% openstatus -write]

```

```

&call ISOdate
&type %ISOdate%

&sv number = %Percentile%
&call SetSuffix
&type %Percentile%%suffix% percentile

&sv FuzzyEdge = 500 /* width in metres of catchment boundaries

/* set shades for unclassified, and classes 0 to 3:
&sv shdx = "#ffffff" /*26 /*white , FFFFFFFF
&sv shd0 = "#e0ffff" /*57 /*light cyan, E0FFFF
&sv shd1 = "#98fb98" /*67 /*pale green, 98FB98
&sv shd2 = "#f0e68c" /*79 /*khaki, F0E68C
&sv shd3 = "#f5deb3" /*95 /*wheat, F5DEB3

&sv cnmx = "#000000" /*'black' /*000000
&sv cnm0 = "#00bfff" /*'deep sky blue' /*00BFFF
&sv cnm1 = "#006400" /*'dark green' /*006400
&sv cnm2 = "#ffff00" /*'yellow' /*FFFF00
&sv cnm3 = "#ff0000" /*'red' /*FF0000

&sv A4P 21.0 29.7
&sv A3P 29.7 42.0
&sv A2P 42.0 59.4
&sv A1P 59.4 84.1
&sv A0P 84.1 118.9

&sv A4L 29.7 21.0
&sv A3L 42.0 29.7
&sv A2L 59.4 42.0
&sv A1L 84.1 59.4
&sv A0L 118.9 84.1

&sv xp [extract 1 %A1L%]
&sv yp [extract 2 %A1L%]

&sv xp 29.7
&sv yp 29.7

&sv xm %xp% / 100
&sv ym %yp% / 100

&sv yl %yp% - %ym%
&sv xl %yl%

&sv xt ( %xp% + %xl% ) * 2.0 /* for now, write all the text off the
page...
/*&sv xt ( %xp% + %xl% ) / 2.0

```



```

/* write criteria explanation table:
&sv w [write %ct% '<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.0
Transitional//EN">']
&sv w [write %ct% '<html><head><title>Criteria table by '%aml$fullfile%'
N/0000/00/REQ/0700</title></head><body bgcolor="#ffffff">']
&sv w [write %ct% '<h2>Criteria table</h2>']
&sv w [write %ct% '"Cutpoints" separate the water quality into four
classes using the ']
&sv w [write %ct% [quote %Percentile%%suffix% ]]
&sv w [write %ct% 'percentile. ']
&sv w [write %ct% '<br>Please note that these classes are based on only
a few water quality criteria, ']
&sv w [write %ct% 'and that the algorithm classifies a whole quaternary
drainage region ']
&sv w [write %ct% 'on the basis of as few as '%minChem%' samples for a
minimum of just one station! ']
&sv w [write %ct% 'Also be aware that the algorithm classifies dams
separately from the drainage region in which they occur. ']
&sv w [write %ct% '<br>Checking the original data is essential before
drawing conclusions ']
&sv w [write %ct% 'about individual catchments or dams. ']
&sv w [write %ct% 'For example, coastal lakes may have a very high
natural salinity. ']
&sv w [write %ct% '<table summary="class definitions">']

&sv w [write %ct% '<tr><th>Class</th><th>definition</th></tr>']
&sv w [write %ct% '<tr><td align="center">0</td><td>ideal water</td>']
&sv w [write %ct% '<tr><td align="center">I</td><td>safe water</td>']
&sv w [write %ct% '<tr><td align="center">II</td><td>short-term
use</td>']
&sv w [write %ct% '<tr><td align="center">III</td><td>undrinkable</td>']
&sv w [write %ct% '</table>']
&sv w [write %ct% '<p>Most variables have three cutpoints (and zero
defining the minimum for Class 0),']
&sv w [write %ct% 'except pH, which needs six cutpoints to define acid
and base ranges. ']
&sv w [write %ct% '<p>Only one variable needs to be in a higher class
for the whole classification to be bumped up ']
&sv w [write %ct% 'into that class. ']
&sv w [write %ct% [quote <p>Units are mg/litre except pH (-log [unquote
'[]H<sup>+</sup></sup>[unquote ']]) and EC (milliSiemens/m).]]

&sv w [write %ct% '<table border summary="table of class cutpoints">']
&sv w [write %ct% '<tr>']
&sv w [write %ct%
'<th>Variable</th><th>Type</th><th>Cutpoint<br>1</th><th>Cutpoint<br>2</
th><th>Cutpoint<br>3</th><th>Cutpoint<br>4</th><th>Cutpoint<br>5</th><th>
Cutpoint<br>6</th>']
/*Variable Type Cutpoint1 Cutpoint2 Cutpoint3
Cutpoint4 Cutpoint5 Cutpoint6

&sv v1 pH ; &sv t1 2; &sv c1-1 4; &sv c1-2 5 ; &sv c1-3 6; &sv
c1-4 9; &sv c1-5 9.5; &sv c1-6 10
&sv v2 F ; &sv t2 1; &sv c2-1 1; &sv c2-2 1.5; &sv c2-3 3.5
&sv v3 NO3; &sv t3 1; &sv c3-1 6; &sv c3-2 10 ; &sv c3-3 20
&sv v4 SO4; &sv t4 1; &sv c4-1 200; &sv c4-2 400 ; &sv c4-3 600
&sv v5 Cl ; &sv t5 1; &sv c5-1 100; &sv c5-2 200 ; &sv c5-3 600
&sv v6 Na ; &sv t6 1; &sv c6-1 100; &sv c6-2 200 ; &sv c6-3 400
&sv v7 Mg ; &sv t7 1; &sv c7-1 30; &sv c7-2 70 ; &sv c7-3 100
&sv v8 TDS; &sv t8 1; &sv c8-1 450; &sv c8-2 1000 ; &sv c8-3 2450
&sv v9 EC ; &sv t9 1; &sv c9-1 70; &sv c9-2 150 ; &sv c9-3 370

&do n = 1 &to 9
&if [value t%n%] = 2 &then
&do
&sv w [write %ct% [quote <tr align="center">]]
&sv w [write %ct% [quote <td>[value v%n%]</td>]]
&sv w [write %ct% [quote <td>[value t%n%]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-1]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-2]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-3]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-4]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-5]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-6]</td>]]
&sv w [write %ct% [quote </tr>]]
&end
&else
&do
&sv w [write %ct% [quote <tr align="center">]]
&sv w [write %ct% [quote <td>[value v%n%]</td>]]
&sv w [write %ct% [quote <td>[value t%n%]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-1]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-2]</td>]]
&sv w [write %ct% [quote <td>[value c%n%-3]</td>]]
&sv w [write %ct% [quote </tr>]]
&end
&end

&sv w [write %ct% '</table>']
&sv w [write %ct% '<font size="-1">Table of concentration ranges used by
<tt>']
&sv w [write %ct% %aml$fullfile%]
&sv w [write %ct% '</tt><br>to generate colour-coded maps of chemical
status ']
&sv w [write %ct% 'of South African catchments.</font>']
&sv rl %ct%; &call RefLink
&sv w [write %ct% '</body></html>']
&sv cct [close %ct%]
&return

/* -----
&routine ProcessStreams

```

```

&sv nStnTags = 0
&do nQcat = 1 &to %nQcats%
  &sv QatCat = [extract 1 [show select qatriv.tmp info %nQcat% item
    quaternary]]
  &type %QatCat% processed at [date -vmstime]

  clearsel %StnPnts% point
/* select points by making an overlap with the quaternary coverage.
/* also do the overlap within FuzzyEdge metres of the edge of the
quaternary
/* to allow for misalignment between the coverages:
clearselect %Catch_Qat% poly
reselect %Catch_Qat% poly quaternary = [quote %QatCat%]
clearselect %Catch_Qat% line
reselect %Catch_Qat% line overlap %Catch_Qat% poly # passthru

reselect %StnPnts% point overlap %Catch_Qat% poly # passthru
aselect %StnPnts% point overlap %Catch_Qat% line %FuzzyEdge%
reselect %StnPnts% point stntype = 'H'

clearselect %Catch_Qat% line

&sv nQstns = [extract 1 [show select %StnPnts% point]]

&sv Samples = 0

&if %nQstns% > 0 &then
&do
  &sv w [write %ru% [quote <hr>]]
  &sv w [write %ru% [quote <p><a name="%QatCat%"></a>]]
  &sv w [write %ru% [quote <b>(%nQcat%)</b> Catchment <b>%QatCat%</b>:
]]
  &sv w [write %ru% [quote Total number of "H" (flow gauging) stations
= <b>%nQstns%</b>]]
  &sv w [write %ru% [quote <table border summary="monitoring
statistics">]]
  &sv w [write %ru% [quote <tr><th>Station</th><th>total
n<br>samples</th><th>description</th><th>map<br>code</th></tr>]]

  clearsel %ChemFile% info
  nsel %ChemFile% info

  &sv nStns = 0
  &do n = 1 &to %nQstns%
    &sv st [show select %StnPnts% point %n% item station]
    &sv sx [show select %StnPnts% point %n% item x-coord]
    &sv sy [show select %StnPnts% point %n% item y-coord]

&sv ds [show select %StnPnts% point %n% item description]
&sv ds [unquote [subst [quote %ds%] ' ' `]]
/* remove derogatory place names:
&sv ds [unquote [subst [quote %ds%] 'Kaffer' 'XX']]
&sv ds [unquote [subst [quote %ds%] 'Kaffir' 'XX']]

&sv PriQat = [substr [quote %st%] 1 1]

&sv Status = OK
&if [index [locase [quote [unquote ' ]%ds%]] ' eye' ] > 0
&then &sv Status = eye
&if [index [locase [quote [unquote ' ]%ds%]] ' furrow' ] > 0
&then &sv Status = furrow
&if [index [locase [quote [unquote ' ]%ds%]] ' canal' ] > 0
&then &sv Status = canal
&if [index [locase [quote [unquote ' ]%ds%]] ' boreh' ] > 0
&then &sv Status = borehole
&if [index [locase [quote [unquote ' ]%ds%]] ' pipe l' ] > 0
&then &sv Status = pipe
&if [index [locase [quote [unquote ' ]%ds%]] ' pump ' ] > 0
&then &sv Status = pump
&if [index [locase [quote [unquote ' ]%ds%]] ' drain' ] > 0
&then &sv Status = drain
&if [index [locase [quote [unquote ' ]%ds%]] ' tunnel' ] > 0
&then &sv Status = tunnel
&if [index [locase [quote [unquote ' ]%ds%]] ' power' ] > 0
&then &sv Status = power
&if [index [locase [quote [unquote ' ]%ds%]] ' plant ' ] > 0
&then &sv Status = plant
&if [index [locase [quote [unquote ' ]%ds%]] ' pond' ] > 0
&then &sv Status = pond
&if [index [locase [quote [unquote ' ]%ds%]] ' treatm' ] > 0
&then &sv Status = treatment
&if [index [locase [quote [unquote ' ]%ds%]] ' treated' ] > 0
&then &sv Status = treatment
&if [index [locase [quote [unquote ' ]%ds%]] ' dam' ] > 0
&then &sv Status = dam
&if [index [locase [quote [unquote ' ]%ds%]] ' effl' ] > 0
&then &sv Status = effluent
&if [index [locase [quote [unquote ' ]%ds%]] ' maturat' ] > 0
&then &sv Status = pond
&if [index [locase [quote [unquote ' ]%ds%]] ' sewage' ] > 0
&then &sv Status = sewage
&if [index [locase [quote [unquote ' ]%ds%]] ' sewer' ] > 0
&then &sv Status = sewage
&if [index [locase [quote [unquote ' ]%ds%]] ' sew.' ] > 0
&then &sv Status = sewage
&if [index [locase [quote [unquote ' ]%ds%]] ' swg' ] > 0
&then &sv Status = sewage
&if [index [locase [quote [unquote ' ]%ds%]] ' stw' ] > 0
&then &sv Status = sewage

```

```

&if %PriQat% <> 'Z' and ~
( %PriQat% <> [substr [quote %QatCat%] 1 1] ) &then
&do
  &sv Status = coord<br>error
  &type %Status%! %n% %st% - %ds%
  &sv w [write %ru% [quote
<tr><td>%st%</td><td>%Status%</td><td><font color="#ff0000">Drainage
region error for %ds%:<br>Secondary=[substr [quote %QatCat%] 1 2] but
station=[substr [quote %st%] 1 2]</font><td>!</td></tr>]]
  &end

&if %Status% = OK &then
&do
  &select %ChemFile% info station = [quote %st%]
  &sv nSmpls = [extract 1 [show select %ChemFile% info]]
  &sv StnSmpls = %nSmpls% - %Samples% /* check if nSmpls
incremented
  &sv Samples = %nSmpls%
  &type %ChemFile% stn = [quote %st%], samples = %StnSmpls%
  &sv w [write %ru% [quote <tr><td>%st%</td><td>
align="center">%StnSmpls%</td><td>%ds%</td>]]
  &sv nStns = %nStns% + 1
  &if %StnSmpls% > 0 &then
  &do
    &sv nStnTags = %nStnTags% + 1
    &sv w [write %lu% [quote %nStnTags%, %st%, %sx%, %sy%]]
    &sv w [write %ru% [quote <td align="center"><a
name="%nStnTags%"></a>%nStnTags%</td></tr>]]
    &end
  &else
    &sv w [write %ru% [quote <td align="center">none</td></tr>]]
  &end
&else
  &sv w [write %ru% [quote <tr><td><font
color="#d3d3d3">%st%</font></td><td align="center"><font
color="#808080">%Status%</font></td><td><font
color="#d3d3d3">%ds%</font></td><td>none</td></tr>]]

&end
&sv w [write %ru% [quote </table>]]

&if %nSmpls% > 0 &then
&do
  reselect %ChemFile% info date >= %Date1% & date <= %Date2%
  &sv nChDat = [extract 1 [show select %ChemFile% info]]

  reselect %ChemFile% info ~
  pH >= 0 and ~

```

```

FLUORIDE >= 0 and ~
NO3 (N) >= 0 and ~
SULPHATE >= 0 and ~
CHLORIDE >= 0 and ~
SODIUM >= 0 and ~
MAGNESIUM >= 0 and ~
TDS >= 0 and ~
CONDUCTIVITY >= 0
&sv nChems = [extract 1 [show select %ChemFile% info]]

&if %nChems% >= %minChem% &then
&do
  &type Catchment %QatCat% - %nChems% valid samples in %nStns%
stations from %Date1% to %Date2%.
  &sv trc = %trc% + 1
  &sv w [write %cm% [quote <td><a
href="%PlotFile%.html#%QatCat%">%QatCat%</a></td>]]
  &if [mod %trc% 15] = 0 &then &sv w [write %cm% [quote
</tr><tr>]] /* new line every 15 catchments
  &sv w [write %ru% [quote <p><b>%QatCat%</b> - Stations used:
<b>%nStns%</b>, Samples selected: <b>%nChems%</b> between <b>%yyyy1%-
%mm1%-%dd1%</b> and <b>%yyyy2%-%mm2%-%dd2%</b>.]
  &call QatPlot
  &end
&else
  &sv w [write %ru% [quote <p><b>%QatCat%</b> - not classified:
<b>%nChems%</b> samples between <b>%yyyy1%-%mm1%-%dd1%</b> and
<b>%yyyy2%-%mm2%-%dd2%</b>, <b>%nChems%</b> valid samples. Require at
least %minChem%.]]
  &end
&end
&return

/* -----
&routine DamPlot

&sv w [write %ru% [quote <tr><td><a href="%DamStn%">%DamStn%</a></td>]]

&if %Class% = 0 &then
&do
  &type %DamStn% %nChems%: Class%Class%
  &sv w [write %ru% [quote <td>%nChems%</td><td>%Class%</td></tr>]]
&end

&if %Class% = 1 &then
&do
  &type %DamStn% %nChems%: Class%Class% I(%badvar1%)
  &sv w [write %ru% [quote
<td>%nChems%</td><td>%Class%</td><td>%badvar1%</td></tr>]]

```

```

&end

&if %Class% = 2 &then
&do
  &type %DamStn% %nChems%: Class%Class% I(%badvar1%) II(%badvar2%)
  &sv w [write %ru% [quote
<td>%nChems%</td><td>%Class%</td><td>%badvar1%</td><td>%badvar2%</td></tr>]]]
&end

&if %Class% = 3 &then
&do
  &type %DamStn% %nChems%: Class%Class% I(%badvar1%) II(%badvar2%)
  III(%badvar3%)
  &sv w [write %ru% [quote
<td>%nChems%</td><td>%Class%</td><td>%badvar1%</td><td>%badvar2%</td><td>
>%badvar3%</td></tr>]]]
&end

&if %Class% = 0 &then &sv cnam = 'deep sky blue'
&if %Class% = 1 &then &sv cnam = 'green yellow'
&if %Class% = 2 &then &sv cnam = 'yellow'
&if %Class% = 3 &then &sv cnam = 'red'

shadesymbol 1
shadecolor %cnam%
polygonshade %dams% 1000
textsize [calc %xm% * 1.25]
polygontext %dams% stntype|monptnum

&return

/* -----
&routine ProcessDams
&sv w [write %ru% [quote <hr>]]
&sv w [write %ru% [quote <p>Processing dam monitoring points:]]

&if %ProvName% = 'South Africa' &then
  reselect %Prov% poly class cn 'Province'
&else
&do
  &if %RegionType% = p &then
    reselect %Prov% poly province = %ProvName%
  &if %RegionType% = w &then
    reselect %Prov% poly name = %ProvName%
&end

clearselect %dams% poly
reselect %dams% poly station <> ''
reselect %dams% poly overlap %prov% poly # passthru
&sv nDams = [extract 1 [show select %dams% poly]]

&sv nDamsOK = 0

&sv w [write %cm% [quote </tr></table>]] /* new table for dams
&sv w [write %cm% [quote <table border summary="dam matrix of [unquote
%ProvName%] %Region_Type% Chemical classifications">]]
&sv w [write %cm% [quote <tr>]]
&do nDam = 1 &to %nDams%

  &sv DamStn = [show select %dams% poly %nDam% item station]
  &sv DamNam = [show select %dams% poly %nDam% item name ]
  clearselect %ChemFile% info
  reselect %ChemFile% info station = [quote %DamStn%]
  &sv nSmpls = [extract 1 [show select %ChemFile% info]]
  &type %ChemFile% stn = [quote %DamStn%], samples = %nSmpls%
  &sv w [write %ru% [quote <hr>]]
  &sv w [write %ru% [quote <br><b>%nDam%</b>) Checked %DamStn%
(%DamNam%) for valid samples...]]

  &if %nSmpls% > 0 &then
  &do
    reselect %ChemFile% info date >= %Date1% & date <= %Date2%
    /*reselect %ChemFile% info gauge1 <= 1.0
    /*reselect %ChemFile% info flow <= 1.0
    reselect %ChemFile% info ~
    pH >= 0 and ~
    FLUORIDE >= 0 and ~
    NO3 (N) >= 0 and ~
    SULPHATE >= 0 and ~
    CHLORIDE >= 0 and ~
    SODIUM >= 0 and ~
    MAGNESIUM >= 0 and ~
    TDS >= 0 and ~
    CONDUCTIVITY >= 0
    &sv nChems = [extract 1 [show select %ChemFile% info]]

    &if %nChems% >= %minChem% &then
    &do
      &sv nDamsOK = %nDamsOK% + 1
      &type (%nDam%) %DamNam% %DamStn% station - %nChems% valid samples
      from %Date1% to %Date2%.
      /*&sv w [write %ru% [quote <br>Samples selected: <b>%nChems%</b>
      between <b>%yyyy1%-&mm1%-%dd1%</b> and <b>%yyyy2%-&mm2%-%dd2%</b>
      (<b>%DamNam%</b>).]]
      &sv w [write %ru% [quote <a name="%DamStn%"></a>]]
      &sv w [write %ru% [quote <p>Quaternary %QatCat%, dam station:
      <b>%DamStn%</b>, Samples selected: <b>%nChems%</b> between <b>%yyyy1%-
      %mm1%-%dd1%</b> and <b>%yyyy2%-&mm2%-%dd2%</b>].]]
      &sv w [write %ru% [quote <br>[unquote '['<a
      href="#damsum">Summary of classification</a>[unquote '']]]]
      &sv w [write %cm% [quote <td><a href="%PlotFile%.html#%DamStn%">]]]

```

```

    &sv w [write %cm% [quote [unquote [substr [quote %DamStn%] 1 2]
<b>[substr [quote %DamStn%] 3 4]</b></a></td>]]]
    &if [mod %nDamsOK% 9] = 0 &then &sv w [write %cm% [quote
</tr><tr>]] /* new line every 9 dams
    &call SetChemValue
    &call SetChemClass
    &sv DamClass%nDamsOK% = %Class%
    &sv DamStation%nDamsOK% = %DamStn%
    &sv badvar1%nDamsOK% = %badvar1%
    &sv badvar2%nDamsOK% = %badvar2%
    &sv badvar3%nDamsOK% = %badvar3%
    &sv nChems%nDamsOK% = %nChems%

    &end
    &else
    &sv w [write %ru% [quote <br>Number of samples found = %nChems%:
less than the %minChem% required, so not classified.]]
    &end
    &else
    &sv w [write %ru% [quote <br>No data: not classified.]]

&end

&sv w [write %ru% [quote <p>Summary of dam (or lake) classifications,
with classification variables, if any.]]
&sv w [write %ru% [quote Click on a dam station to go to the
classification data.]]
&sv w [write %ru% [quote <a name="damsum"></a>]]
&sv w [write %ru% [quote <table border summary="dam results">]]
&sv w [write %ru% [quote
<tr><th>Dam<br>station</th><th>number</th><th>class</th>]]
&sv w [write %ru% [quote <th>Class I<br>variable</th><th>Class
II<br>variable</th><th>Class III<br>variable</th></tr>]]
&do nDam = 1 &to %nDamsOK%
    &sv nChems = [value nChems%nDam%]
    &sv badvar1 = [value badvar1%nDam%]
    &sv badvar2 = [value badvar2%nDam%]
    &sv badvar3 = [value badvar3%nDam%]
    &sv Class = [value DamClass%nDam%]
    &sv DamStn = [value DamStation%nDam%]
    clearselect %dams% poly
    reselect %dams% poly station = [quote %DamStn%]
    &call DamPlot
&end
&sv w [write %ru% [quote </table>]]

&return

/* -----
&routine PlotStations
/* plot monitoring stations at end to avoid being blanked by polygons

```

```

&sv clu [close %lu%]
&sv lu [open %SList% openstatus -read]
&sv Old_StnText = ' '
&sv w [write %cm% [quote </table>]]
&sv w [write %cm% [quote <font size="-1">]]
&sv w [write %cm% [quote <br>Note that <tt>%aml$file%</tt> includes
monitoring points <i>outside</i> drainage region boundaries, within
%FuzzyEdge% metres of the boundaries, to allow for geographic errors.]]
&sv w [write %cm% [quote Thus, in some cases, the program may use the
same monitoring point to classify two adjacent drainage regions.]]
&sv w [write %cm% [quote In such cases, selecting a station below will
take you to the first usage of that station.]]
&sv w [write %cm% [quote </font>]]
&sv w [write %cm% [quote <table border summary="point matrix of [unquote
%ProvName%] %Region_Type% Chemical classifications">]]
&sv w [write %cm% [quote <tr>]]
/* set table row counter:
&sv trc = 0

&do StnTag = 1 &to %nStnTags%
    &sv tag [read %lu% ReadStatus]
    /*&if [unquote [extract 1 %tag%]] <> %StnTag% &then &stop %tag%
    &type [unquote [extract 1 %tag%]] %StnTag%
    &sv StnText = [extract 2 %tag%]
    &sv sx = [unquote [extract 3 %tag%]]
    &sv sy = [unquote [extract 4 %tag%]]
    &sv w [write %cm% [quote <td><a
href="%PlotFile%.html#%StnTag%"><small>%StnTag%</small></a></td>]]
    &if [mod %StnTag% 35] = 0 &then &sv w [write %cm% [quote </tr><tr>]]
/* new line every 35 points

/* this doesnt't really work...
&if %StnText% = %Old_StnText% &then
&do
    &type %StnText% lies on the boundary of two drainage regions.
    markersymbol 401
    units map
    marker %sx% %sy%
    units page
&end
&else
&do
    markersymbol 432
    units map
    marker %sx% %sy%
    move %sx% %sy%
    text %StnTag%
    units page
&end
&sv Old_StnText = %StnText%
&end

```

```

/*&sv w [write %cm% [quote </tr></table>]]
&sv clu [close %lu%]
&return

/* -----
&routine ReportHeader

&sv PlotF %PlotFile%.html
&if [exists %PlotF% -file] &then &sv dpf [delete %PlotF% -file]
&sv ru = [open %PlotF% openstatus -write]
&call ISOdate
&sv w [write %ru% [quote <!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.0
Transitional//EN">]]
&sv w [write %ru% [quote <html><head><title>]]
&sv w [write %ru% [quote Chemical classification of [unquote %ProvName%
%Region_Type% %ISOdate%] N/0000/00/REQ/0700]]
&sv w [write %ru% [quote </title></head>]]
&sv w [write %ru% [quote <body bgcolor="#ffffff">]]
&sv w [write %ru% [quote <h2>[unquote %ProvName% %Region_Type%</h2>]]]
&sv w [write %ru% [quote <h3>[unquote Chemical classification run on
%ISOdate%</h3>]]]
&sv w [write %ru% [quote Program <tt>%aml$fullfile%</tt> ]]
&sv w [write %ru% [quote <br>Data file <tt>%ChemFile%</tt> ]]
&sv w [write %ru% [quote <br>Data selection dates %yyy1%-&mm1%-&dd1% to
%yyy2%-&mm2%-&dd2%]]
&sv w [write %ru% [quote <font size="-1">]]
&sv w [write %ru% [quote <br>Programmer <a href="mailto:eck@dwarf-
hri.pwv.gov.za">Michael Silberbauer</a>]]
&sv w [write %ru% [quote <br>Institute for Water Quality Studies,]]
&sv w [write %ru% [quote <br>Department of Water Affairs and Forestry,
Private Bag X313,]]
&sv w [write %ru% [quote <br>PRETORIA, South Africa 0001 - eck@dwarf-
hri.pwv.gov.za ]]
&sv w [write %ru% [quote </font>]]
&sv w [write %ru% [quote <hr> ]]
&sv w [write %ru% [quote <br>Note that <tt>%aml$file%</tt> includes
monitoring points <i>outside</i> drainage region boundaries, within
%FuzzyEdge% metres of the boundaries, to allow for geographic errors.]]
&sv w [write %ru% [quote Thus, in some cases, the program may use the
same monitoring point to classify two adjacent drainage regions.]]
&sv w [write %ru% [quote <br>Minimum number of samples used per
classification = %minChem%.]]
&sv w [write %ru% [quote <br>[unquote '']<a
href="%CriteriaT%">explanation</a> of classification process[unquote
']] ]]]
&sv w [write %ru% [quote [unquote '']<a
href="%PlotFile%map.html">map</a>[unquote '']] ]]]
&sv w [write %ru% [quote [unquote '']<a href="chemclass.html">chemical
index page</a>[unquote '']] ]]]

```

```

&sv w [write %ru% [quote [unquote '']<a href="http://www-
dwaf.pwv.gov.za/directorates/iwqs/">IWQS home page</a>[unquote '']]
&sv w [write %ru% [quote <hr> ]]

```

```

/* make entry in key file:
&sv w [write %cc% [quote <tr><td>[unquote %ProvName%]</td><td><a
href="%PlotFile%map.html">class map</a></td>]]
&sv w [write %cc% [quote <td><a
href="%PlotFile%.html">calculations</a></td></tr>]]

```

```
&return
```

```

/* -----
&routine NameGen
/* remove funny characters and make lower case:

```

```

&sv PlotFile = [subst %ProvName% ' ' '']
&sv PlotFile = [subst %PlotFile% '/' '']
&sv PlotFile = [subst %PlotFile% '(' '']
&sv PlotFile = [subst %PlotFile% ')' '']
&sv PlotFile = [subst %PlotFile% '.' '']
&sv PlotFile = [substr %PlotFile% 1 11]
&sv PlotFile = [locase %PlotFile%]v

```

```

&sv %SList% %PlotFile% Stn_list.tmp
&if [exists %SList% -file] &then &sv dsl [delete %SList% -file]
&sv lu = [open %SList% openstatus -write]

```

```
&return
```

```

/* -----
&routine ReportFooter

```

```

&call ISOdate
&sv w = [write %ru% [quote <p><tt>[unquote Finished calculations for
%ProvName% %Region_Type% at [unquote %ISOdate%]</tt>]]]
&sv rl %ru%; &call RefLink
&sv w = [write %ru% [quote </body></html> ]]
&sv closeru [close %ru%]

```

```
&return
```

```

/* -----
&routine PlotScale
/* uses the ultimate scalebar from http://www.eykamp.com/scalebar
&sv .scalebar$justification = center
/* scalebar_u <xpos> <ypos> <width> <height>
scalebar_u [calc %yl% / 2] [calc %ym% * 2] [calc %yl% / 2] [calc %ym% *
2]

```

```
&return
```

```

/* -----
&routine KeyHeader

&sv ChemClass chemclass.html
&if [exists %ChemClass% -file] &then &sv dcc [delete %ChemClass% -file]
&sv cc = [open %ChemClass% openstatus -write]
&call ISOdate
&sv w [write %cc% [quote <!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.0
Transitional//EN">]]
&sv w [write %cc% [quote <html><head><title>]]
&sv w [write %cc% [quote Chemical classification of [unquote
%Region_Type% %ISOdate%] N/0000/00/REQ/0700]]
&sv w [write %cc% [quote </title></head>]]
&sv w [write %cc% [quote <body bgcolor="#ffffff">]]
&sv w [write %cc% [quote <h3>[unquote %Region_Type% Chemical
classification run on %ISOdate%</h3>]]]
&sv w [write %cc% [quote <table border summary="%Region_Type% Chemical
classification">]]

&return

/* -----
&routine KeyFooter

&sv w [write %cc% [quote </table>]]
&sv w [write %cc% [quote <hr>]]
&sv w [write %cc% [quote <p align="center">]]
&sv w [write %cc% [quote <font size="-1">]]
&sv w [write %cc% [quote <a href=" ../index.html">Index page</a>]]
&sv w [write %cc% [quote <a href="http://www-
dwaf.pwv.gov.za/directorates/iwqs/">IWQS home page</a>]]
&sv w [write %cc% [quote </font></p>]]
&sv w [write %cc% [quote </body></html>]]
&sv closeru [close %cc%]

&return

/* -----
&routine ISOdate
/* date in ISO format
&sv ISOdate = [quote [date -year]-[substr[date -usa] 1 2]-[substr[date -
vmsdate] 1 2] - [before[date -vmstime] .] ]

&return

/* -----
&routine MapHeader

&sv ClassMap %PlotFile%map.html
&if [exists %ClassMap% -file] &then &sv dcm [delete %ClassMap% -file]

```

```

&sv cm = [open %ClassMap% openstatus -write]
&call ISOdate

&sv w [write %cm% [quote <!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.0
Transitional//EN">]]
&sv w [write %cm% [quote <html><head><title>]]
&sv w [write %cm% [quote Chemical classification map of [unquote
%ProvName% %Region_Type% %ISOdate%] N/0000/00/REQ/0700]]
&sv w [write %cm% [quote </title></head>]]
&sv w [write %cm% [quote <body bgcolor="#ffffff">]]
&sv w [write %cm% [quote <h3>[unquote %ProvName% %Region_Type% chemical
classification map created on %ISOdate%</h3>]]]
&sv w [write %cm% [quote Classified using %Percentile% suffix%
percentile and at least %minChem% samples.]]
&sv w [write %cm% [quote Please scroll to the right for the key and down
for the station list.]]
&sv w [write %cm% [quote <br>[unquote '['<a
href="%CriteriaT%">explanation</a> of classification process[unquote
'']]]]
&sv w [write %cm% [quote [unquote '['<a href="#">quaternary drainage region</a>[unquote ']]]]
&sv w [write %cm% [quote [unquote '['<a href="chemclass.html">return to
chemical index</a>[unquote ']]]]
&sv w [write %cm% [quote <table border summary="map of %ProvName%
%Region_Type% Chemical classification">]]
&sv w [write %cm% [quote <tr><td rowspan="6">]]
&sv w [write %cm% [quote </td></tr>]]
&sv w [write %cm% [quote <tr><td bgcolor=%shdx% align="center"><font
color=%cnmx%><b>no<br>data</b></font></td></tr>]]
&sv w [write %cm% [quote <tr><td bgcolor=%shd0% align="center"><font
color=%cnm0%><b>Class<br>0</b></font></td></tr>]]
&sv w [write %cm% [quote <tr><td bgcolor=%shd1% align="center"><font
color=%cnm1%><b>Class<br>I</b></font></td></tr>]]
&sv w [write %cm% [quote <tr><td bgcolor=%shd2% align="center"><font
color=%cnm2%><b>Class<br>II</b></font></td></tr>]]
&sv w [write %cm% [quote <tr><td bgcolor=%shd3% align="center"><font
color=%cnm3%><b>Class<br>III</b></font></td></tr>]]
&sv w [write %cm% [quote </table>]]
&sv w [write %cm% [quote To view the detailed classification of a
particular drainage region,]]
&sv w [write %cm% [quote dam or monitoring point, select it from the <a
name="list">lists</a> below:]]
&sv w [write %cm% [quote (To reduce the size of labels, the dam labels
consist of only the last 4 characters )]]
&sv w [write %cm% [quote of the station code. The first two characters
are the secondary )]]
&sv w [write %cm% [quote <a href="http://www-
dwaf.pwv.gov.za/directorates/iwqs/gis_apps/drain2/index.htm">]]
&sv w [write %cm% [quote drainage region code</a>. ]]]

```

```

&sv w [write %cm% [quote <table border summary="quaternary matrix of
[unquote %ProvName%] %Region_Type% Chemical classifications">]]
&sv w [write %cm% [quote <tr>]]
/* set table row counter:
&sv trc = 0

&return

/* -----
&routine MapFooter

&sv w [write %cm% [quote </tr>]]
&sv w [write %cm% [quote </table>]]
&sv rl %cm%; &call RefLink
&sv w [write %cm% [quote </body></html>]]
&sv closeru [close %cm%]

&return

/* -----
&routine RefLink

&sv w [write %rl% [quote <hr>]]
&sv w [write %rl% [quote <p align="center">]]
&sv w [write %rl% [quote <font size="-1">]]
&sv w [write %rl% [quote [unquote '[']<a href="chemclass.html">Chemical
index page</a>[unquote '']] ]]
&sv w [write %rl% [quote [unquote '[']<a href="http://www-
dwaf.pwv.gov.za/directorates/iwqs/">IWQS home page</a>[unquote ']]]]
&sv w [write %rl% [quote </font></p>]]

&return

/* -----
&routine SetSuffix
/* 1st 2nd 3rd 4th ... 20th 21st 22nd 23rd 24th ... 30th 31st 32nd 33rd
.... 100th

&select %number%
  &when 1,21,31,41,51,61,71,81,91
    &do
      &sv suffix = st
    &end
  &when 2,22,32,42,52,62,72,82,92
    &do
      &sv suffix = nd
    &end
  &when 3,23,33,43,53,63,73,83,93
    &do
      &sv suffix = rd
    &end
&end

```

```

&otherwise
  &do
    &sv suffix = th
  &end
&end

&return

```

Appendix : Clickable map macro in Arc/Info

```

/*ArcInfo Imagemap Macro
/*Version 1.0
/*
/*Developed by Ian L ThomasWRC
/*GIS & Remote Sensing Unit,
/*Biological Resources Division
/*USGS Patuxent Wildlife Research Center,
/*Laurel, MD 20708-4017.
/*Tel:      (301) 497-5636
/*Fax:      (301) 497-5666
/*email:    ian_thomas@usgs.gov,
/*WWW:      http://www.mbr-pwrc.usgs.gov/geotech
/* Hacked by Michael Silberbauer, IWQS May 1998
/* Relief added by M Silberbauer, June 1998
/* Adapted for satellite images by M Silberbauer, May 1999
/* Adapted for water management areas by M Silberbauer, March 2000
/* Adapted for water management areas (version 2000) by M Silberbauer,
October 2000

&args amls cover cover2 jpg codeitem thedir theurl

&echo &on
&terminal 9999
display 9999 size 800 600
ap

mapposition cen cen
clipmape off

/* YOU HAVE TO CHANGE THIS BIT

/*%amls% is the directory where you should place the rasttopnm and
ppmtogif executibles eg.
&if [null %amls%] &then &sv amls /prjws8/users/michael/aml

/*%cover% is the name of the polygon cover that defines the different
clickable areas on the imagemap eg.
&if [null %cover%] &then &sv cover = /hri/db/cover/s-africa/hrg_2000

```



```

/*%cover2% is the name of the polygon cover that the different clickable
areas on the imagemap point to, e.g.:
&if [null %cover2%] &then &sv cover2 = dummy

/*%jpg% is the name of the jpg and map file that will be created on your
web server eg.
&if [null %jpg%] &then &sv jpg = wma

/*%codeitem% is the name of an item in the polygon coverage that will be
used to name the link file eg.
&if [null %codeitem%] &then &sv codeitem = name
/*          &sv codeitem2 = wrsl
/*          &sv codeitem3 = wrs2

&sv title = Water Management Areas

/*%thedir% is the Unix directory path of the root directory where
everything will be created eg.
&if [null %thedir%] &then &sv thedir = /hri/db/cover/html/wma
&sv www = %thedir%

/*%theurl% is the WWW address of the root directory where everything
will be created eg.
&if [null %theurl%] &then &sv theurl = http://dwaf-
www.pwv.gov.za/Directorates/iwqs/waterlaw/

/*END OF REQUIRED CHANGES

&sv hue = /plots/db/dem/hue_5km
&sv sat = /plots/db/dem/sat_5km
&sv val = /plots/db/dem/val_5km
&sv prv = /hri/db/cover/s-africa/spr_500
&sv primary = /hri/db/cover/s-africa/hca_1
&sv wma_list = %thedir%wma.lis
&sv themap = %thedir%/%jpg%.map
&sv thehtml = %thedir%/%jpg%.html

&sv rivers = /hri/db/cover/s-africa/wri_500
&sv afrivers = /hri/db/cover/s-africa/wri_not_sa
shadeset colornames
textset font
&if [exists %thedir% -directory] &then &sys \rm -r %thedir%
&sys mkdir %thedir%

mape %cover%
/* = -812450.653125,-3887324.590625,957341.340625,-2319499.659375
/* for whole of South Africa WMAs
gridcomposite hsv %hue% %sat% %val%
&call river
linesymbol 6
linecolor white

```

```

arcs %cover%
clearselect %prv% poly
reselect %prv% poly name = 'SEA'
polygonshade %prv% 43
textset font
textsymboll 8
textcolor white
textscale 0.7
labeltext %cover% %codeitem% cc
textscale 1.0

&sv raster = %www%/%jpg%2.ras
&sv rsw = %www%/%jpg%2.rsw
&sv pbm = %jpg%.pbm
&sv jpg2 = %www%/%jpg%.jpg
&if [exists %raster% -file] &then &sys \rm %raster%
screensave %raster%
&sys arc convertimage %raster% %jpg2% jfif
&sys \rm %raster%
&sys \rm %rsw%

```

```

/*Find the View's Display window extent and size in Map units
&sv map_extent = [show maplimits map]
&sv Xmin = [extract 1 %map_extent%]
&sv Ymin = [extract 2 %map_extent%]
&sv Xmax = [extract 3 %map_extent%]
&sv Ymax = [extract 4 %map_extent%]
&sv Xdiff = %Xmax% - %Xmin%
&sv Ydiff = %Ymax% - %Ymin%

```

```

/*THIS PAGEUNIT NUMBER WORKS FOR OUR SUN SPARC: YOU MAY HAVE TO CHANGE

```

```

pageunits 81.28

```

```

&sv page_extent = [show maplimits page]
&sv pXmax = [extract 3 %page_extent%]
&sv pYmax = [extract 4 %page_extent%]
&sv sfx = %pXmax% / %Xdiff%
&sv sfy = %pYmax% / %Ydiff%

```

```

/* Create the HTML files
&if [exists %thehtml% -file] ~
    &then &sys echo '<HTML>' >> %thehtml%
    &else &sys echo '<HTML>' > %thehtml%

```

```

/*&sys echo '<HEAD></HEAD>' >> %thehtml%
&sys echo '<TITLE>' >> %thehtml%
&sys echo %title% >> %thehtml%
&sys echo '</TITLE>' >> %thehtml%

```

```

&sys echo '<BODY BGCOLOR=AAAAFF>' >> %thehtml%
/*&sv oneline = <A HREF = "/cgi-
bin/imagemap/geotech/imagemap/%jpg%/%jpg%.map">
/*&sys echo [quote %oneline%] >> %thehtml%
&sv oneline = <IMG SRC="[entryname %jpg2%]" ALT="%title%"
USEMAP="#%jpg2%-%cover%" ISMAP>
&sys echo [quote %oneline%] >> %thehtml%
/*&sys echo '</A>' >> %thehtml%
&sv oneline = <MAP NAME = %jpg2%-%cover%>
&sys echo [quote %oneline%] >> %thehtml%

&if [exists %themap% -file] ~
  &then &sys echo 'default /clickable_map/miss.html' >> %themap%
  &else &sys echo 'default /clickable_map/miss.html' > %themap%
q

&if [exists xxtmp -cover] &then kill xxtmp all
&if [exists xxtmp2 -cover] &then kill xxtmp2 all
&sv weed = 10 * %Xdif% / %pXmax%
&sv weedarea = %weed% * %weed%

ae
ec %cover%
ef poly
sel all
res area gt %weedarea%
put xxtmp
q

&if [exists xxtmp2 -cover] &then kill xxtmp2 all
generalize xxtmp xxtmp2 %weed%
&if [exists xxtmp -cover] &then kill xxtmp all

clean xxtmp2
build xxtmp2 line
&sv cover = xxtmp2

&echo &on
&severity &error &ignore
cursor sites remove
&severity &error &fail

&sv n = 2

cursor sites declare %cover%.pat info ro
cursor sites open
cursor sites 2

&do &while %:sites.aml$next%
  &sv outputline =

```

```

&type %codeitem%
/*&sv polyhtml = [locase [subst [quote [value :sites.%codeitem%]] ' '
' _]]
&sv polyhtml = [subst [quote [value :sites.%codeitem%]] ' ' '_']
&sv polyhtml = [subst %polyhtml% '/' '-']
&sv polyhtml = [subst %polyhtml% '(' '-']
&sv polyhtml = [subst %polyhtml% ')' '-']
&sv polyhtml = [subst %polyhtml% '.' '-']
&sv polyhtml = [subst %polyhtml% '-.' '-']
&type %polyhtml%
&if [exists %wma_list% -file] ~
  &then &sys echo %polyhtml% >> %wma_list%
  &else &sys echo %polyhtml% > %wma_list%

arcedit
drawenv all
ec %cover%
ef line

&if [exists linetmp -cover] &then kill linetmp y
sel all
res LPOLY# EQ %n% OR RPOLY# EQ %n%
put linetmp
ec linetmp
ef line
draw
additem num 4 5 i
sel all
calc num = 1
save
sel all
unsplit num
clear
draw
save
quit
build linetmp line

arcplot
aselect linetmp line
&sv narcs [extract 1 [show select linetmp line]]

/*get and convert the map coords of the point to jpg coords

&do na = 1 &to %narcs%
  &sv nverts [show select linetmp line %na% XY]

&do nv = 1 &to %nverts%
  &sv vertxy = [show select linetmp line %na% XY %nv%]
  &sv vertex = [extract 1 %vertxy%]
  &sv verty = [extract 2 %vertxy%]

```

```

    &sv x = ( %vertx% - %Xmin% ) * %sfx%
    &sv y = %pYmax% - ( %verty% - %Ymin% ) * %sfy%
    &sv x = [truncate %x%]
    &sv y = [truncate %y%]
    &sv outputline = %outputline% %x%,%y%
  &end
&end
quit
&sv outputline = %outputline% %x%,%y%

/*Write to the html
/*&sv oneline = <AREA SHAPE = polygon COORDS = %outputline% HREF =
"%theurl%/%polyhtml%.html">
  &sv oneline = <AREA HREF="%polyhtml%.html" ALT="%polyhtml%"
SHAPE="POLYGON" COORDS="%outputline%">
  &sys echo [quote %oneline%] >> %thehtml%

/*Write to the map file
/*&sv oneline = poly %theurl%/%polyhtml%.html %outputline%
&sv oneline = poly %polyhtml%.html %outputline%
&sys echo [quote %oneline%] >> %themap%

/*Write to the link file
&if [exists %thedir%/%polyhtml%.html -file] ~
  &then &sys echo '<HTML>' >> %thedir%/%polyhtml%.html
  &else &sys echo '<HTML>' > %thedir%/%polyhtml%.html

&sys echo '<TITLE>' >> %thedir%/%polyhtml%.html
&sv oneline = %polyhtml% %title%
&sys echo [quote %oneline%] >> %thedir%/%polyhtml%.html
&sys echo '</TITLE>' >> %thedir%/%polyhtml%.html
&sys echo '<BODY BGCOLOR=AAAAFF>' >> %thedir%/%polyhtml%.html
&sv oneline = <H2>Maps for %polyhtml% </H2>
&sys echo [quote %oneline%] >> %thedir%/%polyhtml%.html
&sv oneline = <UL>
&sys echo [quote %oneline%] >> %thedir%/%polyhtml%.html
/*&sv oneline = <IMG SRC=%polyhtml%.jpg ALT=%title% WMA>
&sv oneline = <LI><A HREF=%polyhtml%.jpg>%polyhtml%</A>
&sys echo [quote %oneline%] >> %thedir%/%polyhtml%.html
&sv oneline = </UL>
&sys echo [quote %oneline%] >> %thedir%/%polyhtml%.html
&sys echo '</BODY>' >> %thedir%/%polyhtml%.html
&sys echo '</HTML>' >> %thedir%/%polyhtml%.html

/*Empty the outputline for the next polygon
&sv outputline = ""
&sv n = %n% + 1

  cursor sites next
&end

```

```

/*Write to the "nothing selected" file
&if [exists %thedir%/nothing.html -file] &then &sv del_nothing [delete
%thedir%/nothing.html -file]
  &else &sys echo '<HTML>' > %thedir%/nothing.html

&sv oneline = Sorry - you have clicked outside the selection area.
&sys echo [quote %oneline%] >> %thedir%/nothing.html
&sys echo '</HTML>' >> %thedir%/nothing.html

/* End off the HTML file:
&sys echo '<AREA HREF="nothing.html" ALT="Nothing selected" SHAPE=RECT
COORDS="0,0,1000,1000">' >> %thehtml%
&sys echo '</MAP>' >> %thehtml%
&sys echo '</BODY>' >> %thehtml%
&sys echo '</HTML>' >> %thehtml%
&if [exists xxtmp2 -cover] &then kill xxtmp2 all

&return

&routine river

linesymbol 2
/*arcs %primary%

linesymbol 4
arcs %afrivers%

&do nOrder = 3 &to 7
  &sv width = %nOrder% / 200
  &type Rivers of order %nOrder% being drawn with a width of ~
    [calc [round [calc 100 * %width%]] / 100]cm:
  clearselect %rivers% arc
  reselect %rivers% arc order = %nOrder%
  linesize %width%
  arcs %rivers%
&end

linesymbol 1
linesize 0.01
&return

```