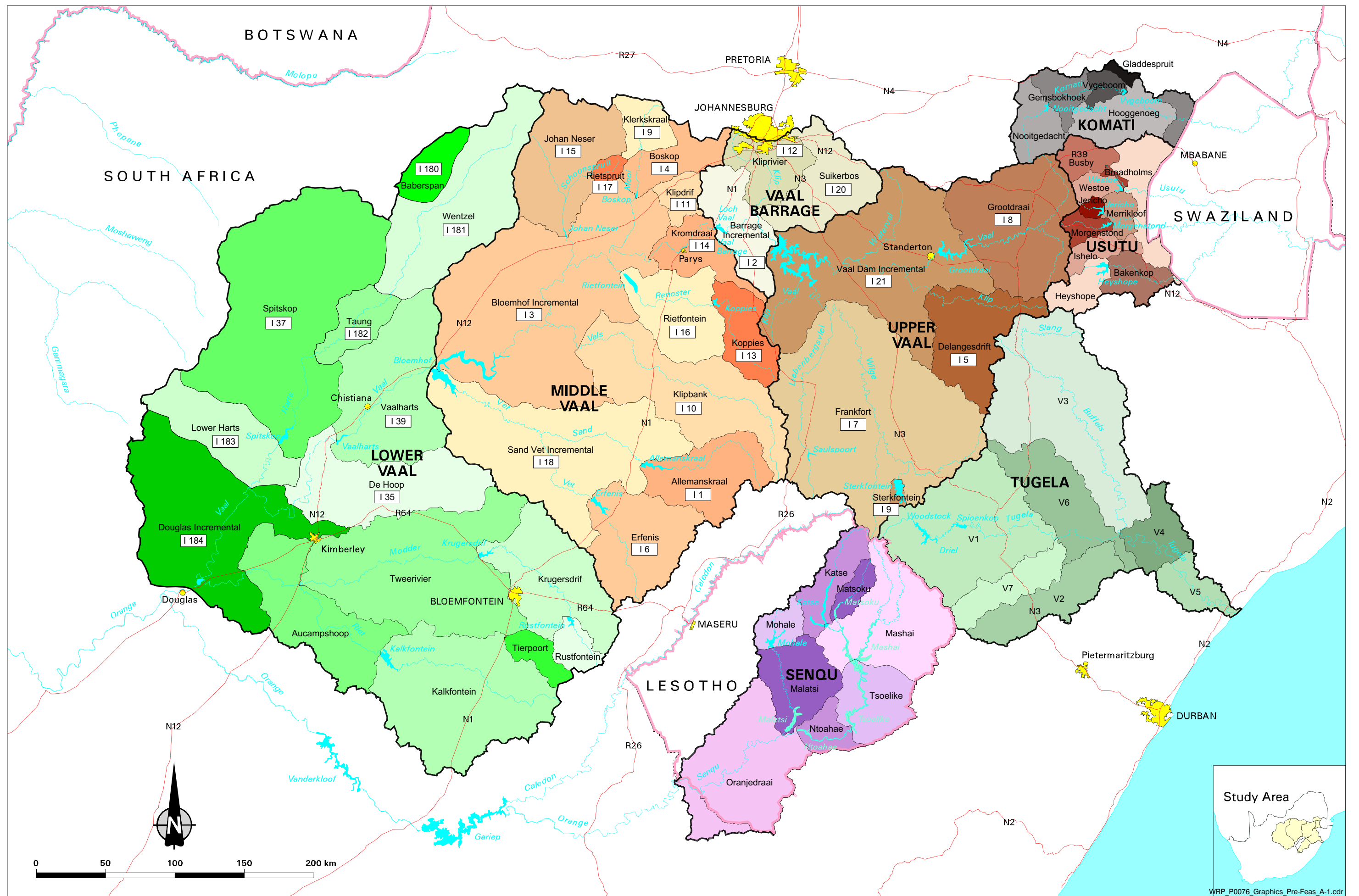


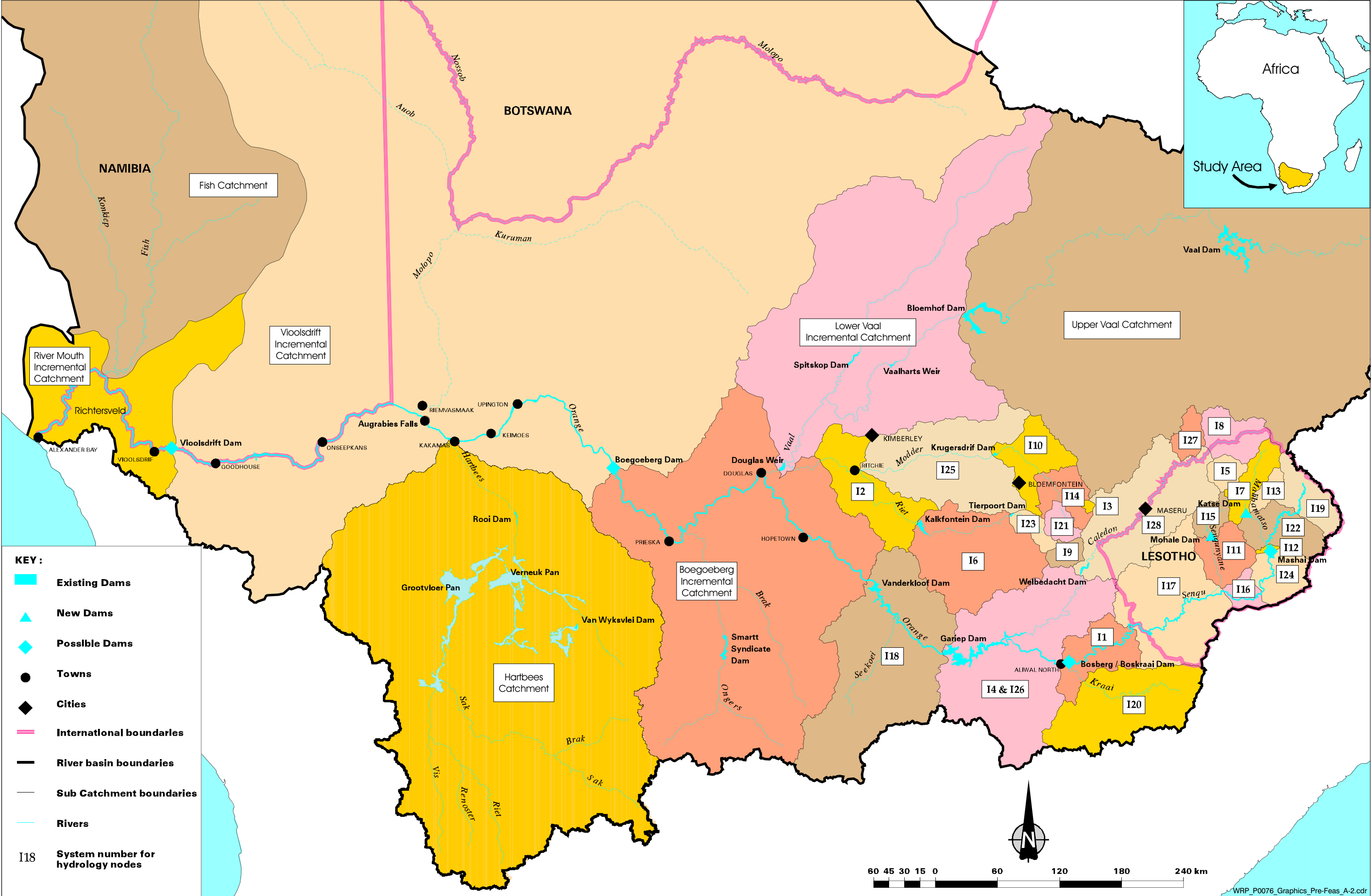
# ***Appendix A***

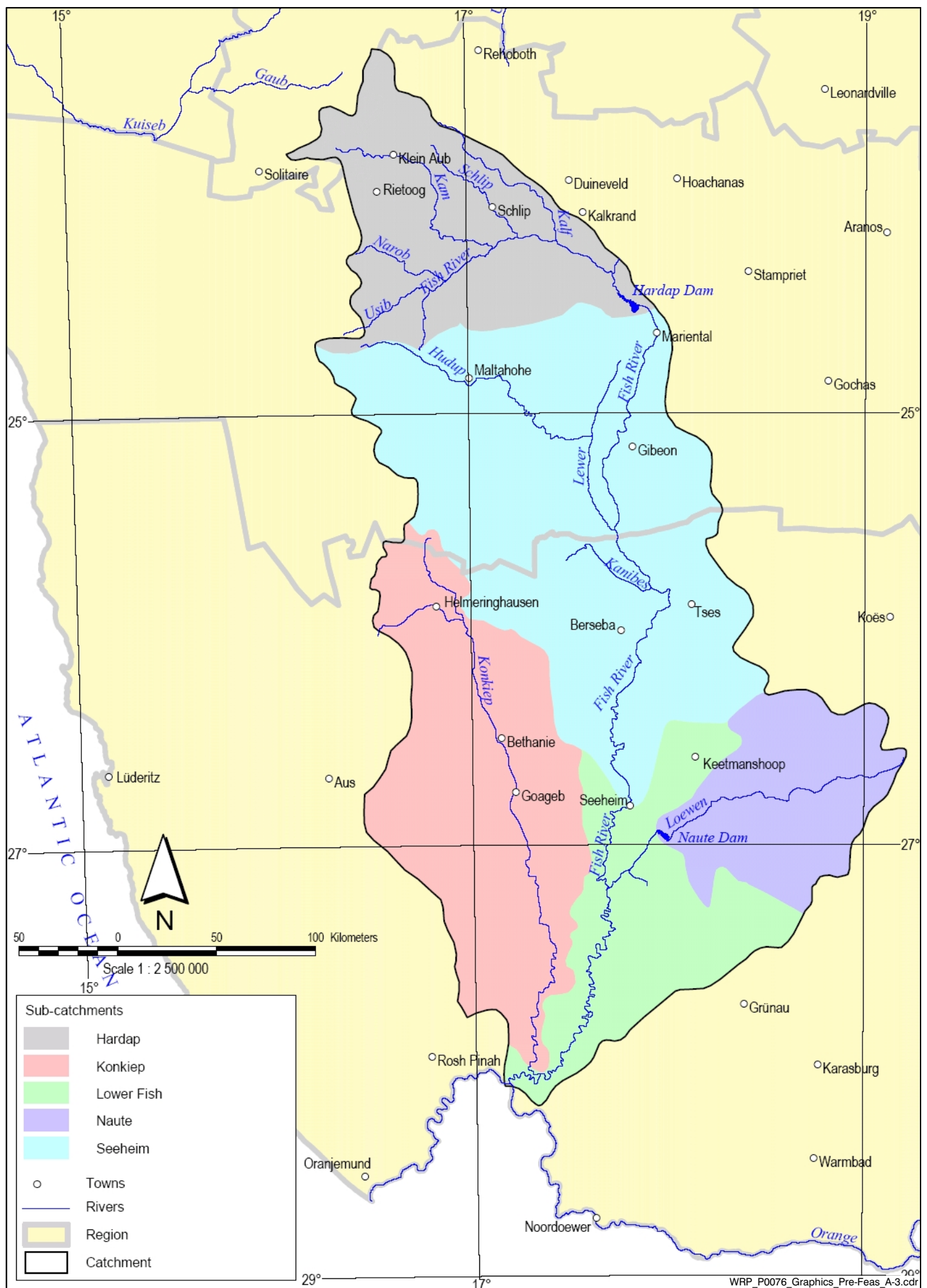
## ***Figures***

<b><i>Description</i></b>	<b><i>Figure no.</i></b>
<b><i>1) Vaal River Basin sub-catchments</i></b>	<b><i>A-1</i></b>
<b><i>2) Orange River Basin sub-catchments</i></b>	<b><i>A-2</i></b>
<b><i>3) Fish River Basin (Namibia) sub-catchments</i></b>	<b><i>A-3</i></b>
<b><i>4) Integrated Vaal River Water Supply System</i></b>	<b><i>A-4</i></b>
<b><i>5) Larger Orange River Water Supply System</i></b>	<b><i>A-5</i></b>



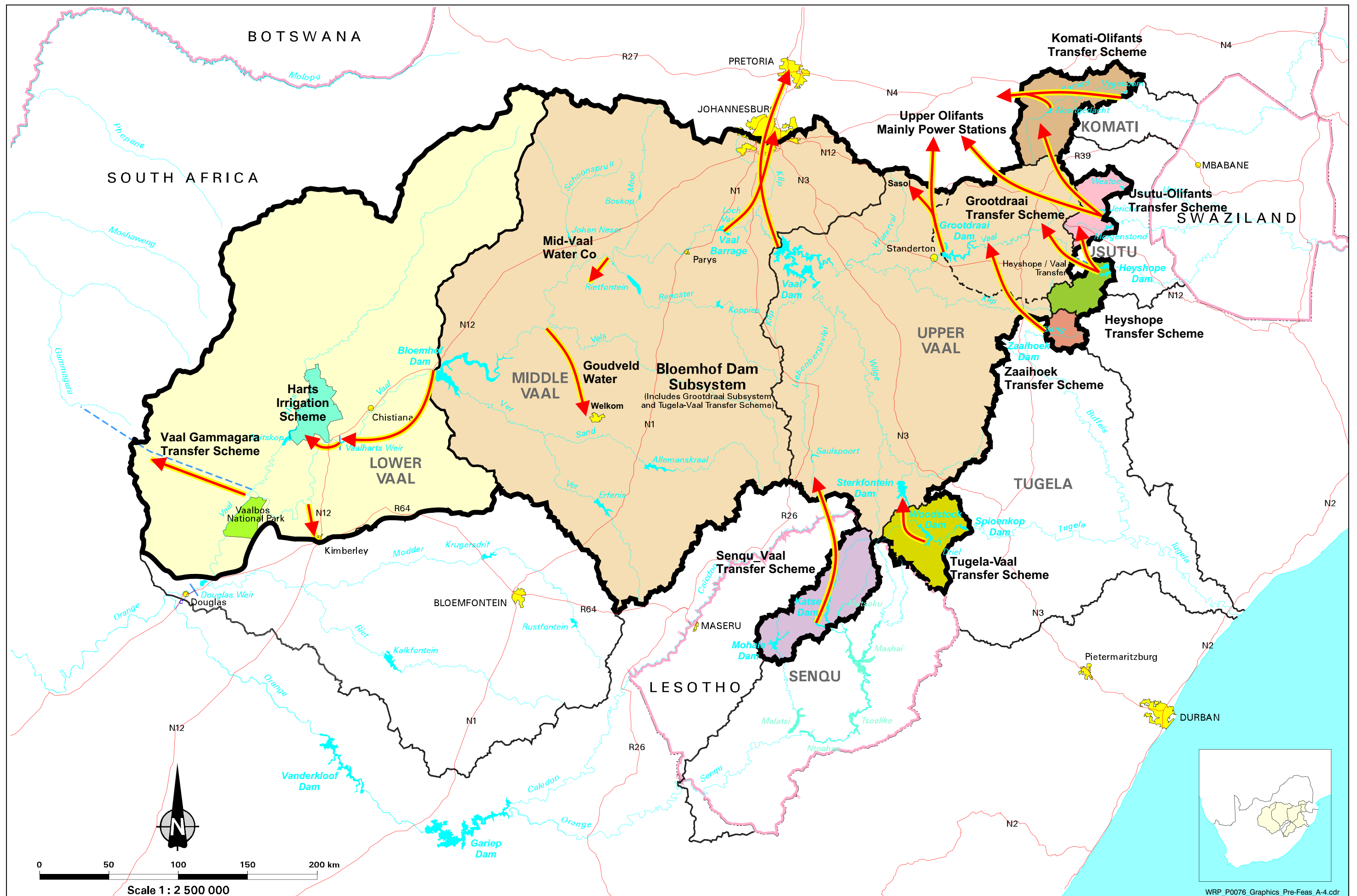
WRP\_P0076\_Graphics\_Pre-Feas\_A-1.cdr





WRP\_P0076\_Graphics\_Pre-Feas\_A-3.cdr





WRP\_P0076\_Graphics\_Pre-Feas\_A-4.cdr



## ***Appendix B***

### ***Sizing of Re-regulation Dams***

<b><i>Description</i></b>	<b><i>Table no.</i></b>
<b><i>1) Boegoeberg Re-regulating Dam</i></b>	<b><i>B-1</i></b>
<b><i>2) Komsberg Re-regulating Dam</i></b>	<b><i>B-3</i></b>
<b><i>3) Vioolsdrift Re-regulating Dam</i></b>	<b><i>B-4</i></b>

## Boegoeberg (LORMS distribution)

B-1

	October	November	December	January	February	March	April	May	June	July	August	September	Max	Annual data
Demand: Downstream of Boegoeberg	1.413E+08	1.605E+08	1.829E+08	1.898E+08	1.276E+08	1.070E+08	7.793E+07	5.116E+07	4.365E+07	4.430E+07	5.899E+07	8.794E+07		1.273E+09
Modelled flow	1.517E+08	1.738E+08	1.959E+08	2.035E+08	1.558E+08	1.420E+08	1.025E+08	7.273E+07	5.388E+07	6.014E+07	7.619E+07	1.130E+08		1.501E+09
Difference = Gross saving	1.041E+07	1.327E+07	1.307E+07	1.369E+07	2.816E+07	3.506E+07	2.460E+07	2.156E+07	1.023E+07	1.585E+07	1.721E+07	2.507E+07	3.506E+07	2.282E+08
Saving not required downstream as requirement	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%		
Difference = Gross saving	3.563E+06	4.542E+06	4.473E+06	4.686E+06	9.639E+06	1.200E+07	8.422E+06	7.381E+06	3.501E+06	5.424E+06	5.889E+06	8.581E+06	1.200E+07	7.810E+07
Lag time	11	11	11	11	11	11	13	15	15	13	11	11		
Upper zone lag water	1.306E+06	1.665E+06	1.640E+06	1.718E+06	3.534E+06	4.400E+06	3.649E+06	3.691E+06	1.750E+06	2.351E+06	2.159E+06	3.146E+06	4.400E+06	3.101E+07
Lower zone lag water	5.181E+07	5.885E+07	6.705E+07	6.960E+07	4.680E+07	3.923E+07	3.377E+07	2.558E+07	2.183E+07	1.920E+07	2.163E+07	3.224E+07	6.900E+07	4.876E+08
Gross storage required (calc)	5.688E+07	6.506E+07	7.316E+07	7.601E+07	5.997E+07	5.563E+07	4.584E+07	3.665E+07	2.708E+07	2.697E+07	2.988E+07	4.397E+07	8.600E+07	
Gross storage required (used)	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	8.600E+07	
Evaporation from ORPS	1.47E+06	1.78E+06	2.04E+06	2.11E+06	1.85E+06	1.72E+06	1.21E+06	8.00E+05	5.90E+05	5.80E+05	7.90E+05	1.09E+06	2.11E+06	1.601E+07
Net storage required	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07	8.389E+07		
Net difference	2.093E+06	2.782E+06	2.433E+06	2.576E+06	7.789E+06	1.028E+07	7.212E+06	6.581E+06	2.911E+06	4.844E+06	5.099E+06	7.491E+06		6.209E+07

Storage @ Boegoeberg =  $86 \times 10^6 \text{ m}^3$

Net saving =  $62 \times 10^6 \text{ m}^3$

Does not take into account releases by region as well as hydropower releases



## Boegoeberg (ORRS distribution)

B-2

	October	November	December	January	February	March	April	May	June	July	August	September	Max	Annual data
Demand: Downstream of Boegoeberg	1.668E+08	1.471E+08	1.078E+08	7.519E+07	5.379E+07	4.090E+07	4.206E+07	6.218E+07	1.037E+08	1.477E+08	1.738E+08	1.767E+08		1.298E+09
Modelled flow	1.484E+08	1.278E+08	1.164E+08	1.012E+08	7.827E+07	6.980E+07	8.136E+07	1.133E+08	1.458E+08	1.689E+08	1.694E+08	1.702E+08		1.491E+09
Difference = Gross saving	-1.840E+07	-1.936E+07	8.604E+06	2.609E+07	2.447E+07	2.891E+07	3.930E+07	5.119E+07	4.206E+07	2.119E+07	-4.380E+06	-6.486E+06	5.119E+07	1.932E+08
Saving not required downstream as requirement	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%	34%		
Difference = Gross saving	-6.298E+06	-6.627E+06	2.945E+06	8.929E+06	8.377E+06	9.895E+06	1.345E+07	1.752E+07	1.440E+07	7.253E+06	-1.499E+06	-2.220E+06	1.752E+07	6.613E+07
Lag time	11	11	11	11	11	11	13	15	15	13	11	11		
Upper zone lag water	-2.309E+06	-2.430E+06	1.080E+06	3.274E+06	3.072E+06	3.628E+06	5.829E+06	8.761E+06	7.199E+06	3.143E+06	-5.498E+05	-8.139E+05	8.761E+06	2.988E+07
Lower zone lag water	6.117E+07	5.394E+07	3.951E+07	2.755E+07	1.972E+07	1.500E+07	1.823E+07	3.108E+07	5.185E+07	6.401E+07	6.372E+07	6.479E+07	6.479E+07	5.106E+08
Gross storage required (calc)	5.256E+07	4.488E+07	4.354E+07	3.975E+07	3.117E+07	2.852E+07	3.751E+07	5.738E+07	7.345E+07	7.441E+07	6.167E+07	6.76E+07	9.108E+07	
Gross storage required (used)	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	9.108E+07	
Evaporation from ORRS	1.47E+06	1.76E+06	2.04E+06	2.11E+06	1.85E+06	1.72E+06	1.21E+06	8.00E+05	5.90E+05	5.80E+05	7.90E+05	1.09E+06	2.11E+06	
Net storage required	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07	8.897E+07		
Net difference	-7.768E+06	-8.387E+06	9.052E+05	6.819E+06	6.527E+06	8.175E+06	1.224E+07	1.672E+07	1.381E+07	6.673E+06	2.289E+06	-3.310E+06		5.012E+07

Storage @ Boegoeberg =  $91 \times 10^6 \text{ m}^3$

Net saving =  $50 \times 10^6 \text{ m}^3$

Does not take into account releases by region as well as hydropower releases

# Komsberg (LORMS distribution)

B-3

	October	November	December	January	February	March	April	May	June	July	August	September	Max	Annual data
Demand: Downstream of Komsberg	6.842E+07	7.452E+07	8.257E+07	8.519E+07	6.567E+07	6.067E+07	4.895E+07	3.586E+07	2.544E+07	2.221E+07	2.730E+07	4.048E+07		6.373E+08
Modelled flow	7.941E+07	8.824E+07	9.767E+07	9.554E+07	9.710E+07	9.429E+07	7.653E+07	6.278E+07	3.797E+07	3.728E+07	4.194E+07	6.045E+07		8.692E+08
Difference = Gross saving	1.099E+07	1.372E+07	1.510E+07	1.035E+07	3.143E+07	3.362E+07	2.758E+07	2.692E+07	1.254E+07	1.508E+07	1.464E+07	1.999E+07	3.362E+07	2.320E+08
Saving not required downstream as requirement	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%		
Difference = Gross saving	6.739E+06	8.414E+06	9.261E+06	6.348E+06	1.928E+07	2.062E+07	1.691E+07	1.651E+07	7.689E+06	9.248E+06	8.982E+06	1.226E+07	2.062E+07	1.423E+08
Lag time	15	15	15	15	15	15	17	19	19	17	15	15		
Upper zone lag water	3.370E+06	4.207E+06	4.830E+06	3.174E+06	9.639E+06	1.031E+07	9.585E+06	1.046E+07	4.870E+06	5.240E+06	4.491E+06	6.130E+06	1.046E+07	7.611E+07
Lower zone lag water	3.421E+07	3.728E+07	4.128E+07	4.260E+07	3.283E+07	3.033E+07	2.774E+07	2.271E+07	1.611E+07	1.258E+07	1.365E+07	2.023E+07	4.260E+07	3.315E+08
Gross storage required (calc)	4.432E+07	4.988E+07	5.518E+07	5.212E+07	6.175E+07	6.127E+07	5.424E+07	4.969E+07	2.867E+07	2.707E+07	2.712E+07	3.862E+07	7.368E+07	
Gross storage required (used)	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	7.368E+07	
Evaporation from ORRS	1.47E+06	1.78E+06	2.04E+06	2.11E+06	1.85E+06	1.72E+06	1.21E+06	8.00E+05	5.90E+05	5.80E+05	7.90E+05	1.09E+06	2.11E+06	1.601E+07
Net storage required	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07	7.157E+07		
Net difference	5.269E+06	6.654E+06	7.221E+06	4.238E+06	1.743E+07	1.890E+07	1.570E+07	1.571E+07	7.099E+06	8.668E+06	8.192E+06	1.117E+07		1.263E+08

Storage @ Komsberg =  $74 \times 10^6 \text{ m}^3$

Net saving =  $126 \times 10^6 \text{ m}^3$

Does not take into account releases by region as well as hydropower releases

## Vioolsdrift (LORMS distribution)

B-4

	October	November	December	January	February	March	April	May	June	July	August	September	Max	Annual data
Demand: Downstream of Boegoeberg	4.198E+07	4.200E+07	4.416E+07	4.511E+07	3.992E+07	4.246E+07	3.684E+07	2.749E+07	1.843E+07	1.419E+07	1.590E+07	2.344E+07		3.919E+08
Modelled flow	5.270E+07	5.347E+07	5.970E+07	5.284E+07	6.689E+07	7.438E+07	7.058E+07	5.829E+07	3.682E+07	2.924E+07	2.932E+07	3.606E+07		6.203E+08
Difference = Gross saving	1.072E+07	1.147E+07	1.554E+07	7.732E+06	2.697E+07	3.192E+07	3.373E+07	3.080E+07	1.839E+07	1.504E+07	1.342E+07	1.261E+07	3.373E+07	2.284E+08
Saving not required downstream as requirement	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
Difference = Gross saving	1.072E+07	1.147E+07	1.554E+07	7.732E+06	2.697E+07	3.192E+07	3.373E+07	3.080E+07	1.839E+07	1.504E+07	1.342E+07	1.261E+07	3.373E+07	2.284E+08
Lag time	25	25	25	25	25	25	27	30	30	30	27	25		
Upper zone lag water	8.936E+06	9.557E+06	1.295E+07	6.443E+06	2.247E+07	2.660E+07	3.038E+07	3.080E+07	1.839E+07	1.504E+07	1.208E+07	1.051E+07	3.080E+07	2.041E+08
Lower zone lag water	3.498E+07	3.500E+07	3.680E+07	3.759E+07	3.327E+07	3.538E+07	3.316E+07	2.749E+07	1.843E+07	1.419E+07	1.431E+07	1.953E+07	3.759E+07	3.401E+08
Gross storage required (calc)	5.464E+07	5.603E+07	6.529E+07	5.177E+07	8.271E+07	9.391E+07	9.725E+07	8.909E+07	5.521E+07	4.428E+07	3.981E+07	4.265E+07	1.021E+08	
Gross storage required (used)	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	1.021E+08	
Evaporation from ORRS	1.47E+06	1.76E+06	2.04E+06	2.11E+06	1.85E+06	1.72E+06	1.21E+06	8.00E+05	5.90E+05	5.80E+05	7.90E+05	1.09E+06	2.11E+06	1.601E+07
Net storage required	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08	1.000E+08		
Net difference	9.253E+06	9.709E+06	1.350E+07	5.622E+06	2.512E+07	3.020E+07	3.252E+07	3.000E+07	1.780E+07	1.446E+07	1.263E+07	1.152E+07		2.123E+08

Storage @ Vioolsdrift =  $102 \times 10^6 \text{ m}^3$

Net saving =  $212 \times 10^6 \text{ m}^3$

Does not take into account releases by region as well as hydropower releases

## Vioolsdrift (ORRS distribution)

B-5

	October	November	December	January	February	March	April	May	June	July	August	September	Max	Annual data
Demand: Downstream of Vioolsdrift	4.328E+07	4.620E+07	4.519E+07	4.160E+07	4.160E+07	3.978E+07	3.520E+07	2.525E+07	1.708E+07	1.254E+07	1.462E+07	2.541E+07		3.877E+08
Modelled flow	6.201E+07	4.882E+07	3.834E+07	3.059E+07	2.452E+07	4.023E+07	6.323E+07	6.038E+07	4.837E+07	4.594E+07	5.165E+07	6.060E+07		5.747E+08
Difference = Gross saving	1.873E+07	2.622E+06	-6.846E+06	-1.101E+07	-1.707E+07	4.648E+05	2.803E+07	3.511E+07	3.130E+07	3.340E+07	3.702E+07	3.519E+07	3.702E+07	1.869E+08
Lag time	25	25	25	25	25	25	27	30	30	27	25	25		
Upper zone lag water	1.561E+07	2.185E+06	-5.705E+06	-9.178E+06	-1.423E+07	3.873E+05	2.522E+07	3.511E+07	3.130E+07	3.008E+07	3.085E+07	2.933E+07	3.511E+07	1.709E+08
Lower zone lag water	3.608E+07	3.850E+07	3.766E+07	3.467E+07	3.467E+07	3.314E+07	3.168E+07	2.525E+07	1.708E+07	1.129E+07	1.219E+07	2.118E+07	3.850E+07	3.334E+08
Gross storage required (calc)	7.041E+07	4.331E+07	2.511E+07	1.448E+07	3.362E+06	3.399E+07	8.493E+07	9.548E+07	7.967E+07	7.474E+07	8.006E+07	8.569E+07	1.106E+08	
Gross storage required (used)	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	1.106E+08	
Evaporation from ORRS	1.47E+06	1.76E+06	2.04E+06	2.11E+06	1.85E+06	1.72E+06	1.21E+06	8.00E+05	5.90E+05	5.80E+05	7.90E+05	1.09E+06	2.11E+06	1.601E+07
Net storage required	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08	1.085E+08		
Net difference	1.728E+07	8.623E+05	-8.886E+06	-1.312E+07	-1.892E+07	-1.255E+06	2.682E+07	3.431E+07	3.071E+07	3.282E+07	3.623E+07	3.410E+07		1.709E+08

Storage @ Vioolsdrift =  $110 \times 10^6 \text{ m}^3$

Net saving =  $171 \times 10^6 \text{ m}^3$

Does not take into account releases by region as well as hydropower releases

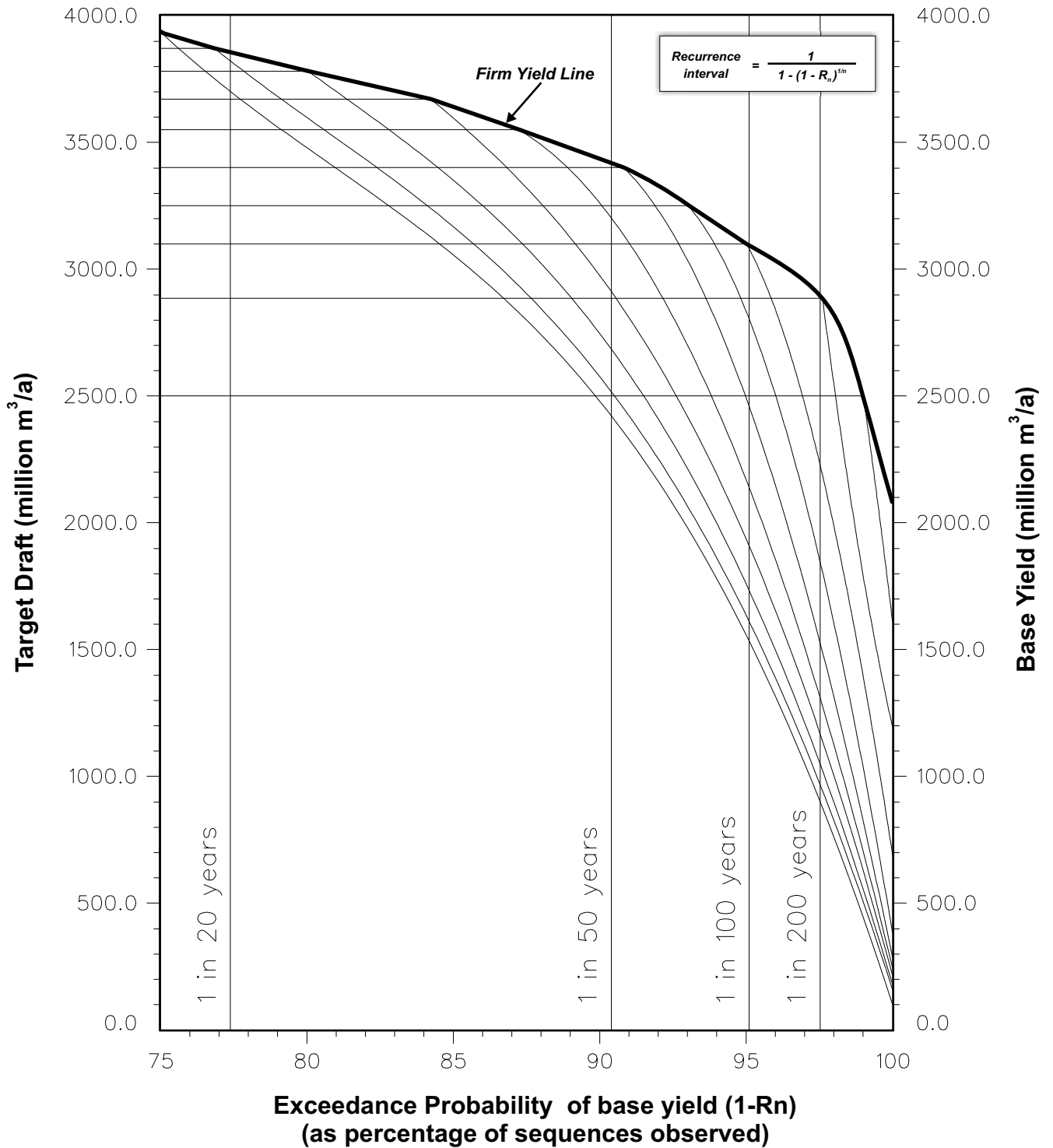


## **Appendix C**

### **Short-term Stochastic Yield Characteristics for the Current Orange River system 2005 Development Level**

<i>Description</i>	<i>Graph no.</i>
<b>1) Short-term stochastic yield curves 100% start storage</b>	<b>C-1</b>
<b>2) Short-term stochastic yield curves 80% start storage</b>	<b>C-2</b>
<b>3) Short-term stochastic yield curves 60% start storage</b>	<b>C-3</b>
<b>4) Short-term stochastic yield curves 40% start storage</b>	<b>C-4</b>
<b>5) Short-term stochastic yield curves 20% start storage</b>	<b>C-5</b>
<b>6) Short-term stochastic yield curves 10% start storage</b>	<b>C-6</b>
<b>7) Short-term stochastic firm yield lines</b>	<b>C-7</b>

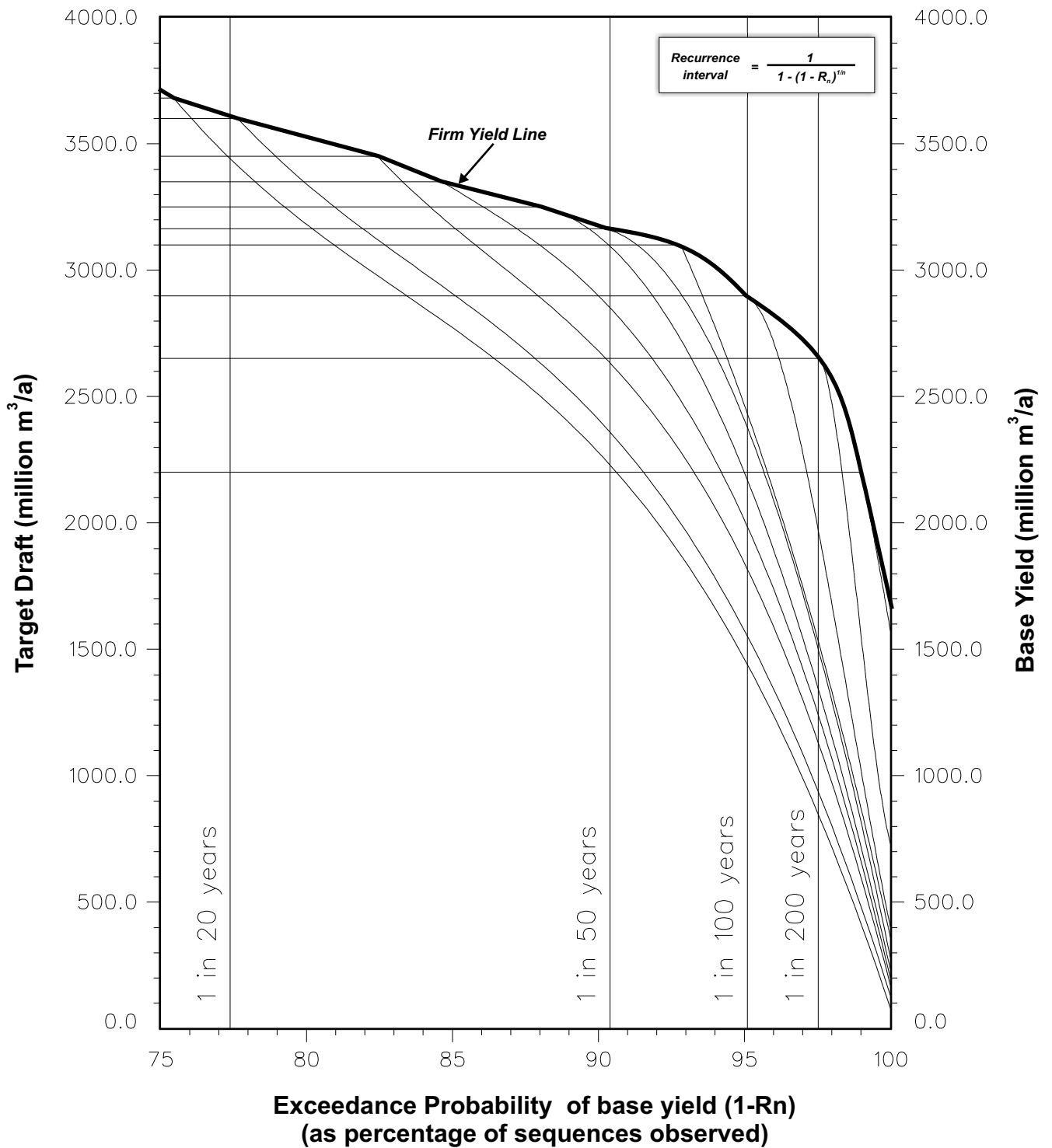
**Reliability of base yield derived from  
501 5-year generated sequences**



Gariep net FSC = 4 587 million m<sup>3</sup>  
 Vanderkloof net FSC = 2 173 million m<sup>3</sup>  
 Total contribution FSC = 6 760 million m<sup>3</sup>

WRP\_P0076\_Graphics\_Pre-Feas\_C-1.cdr

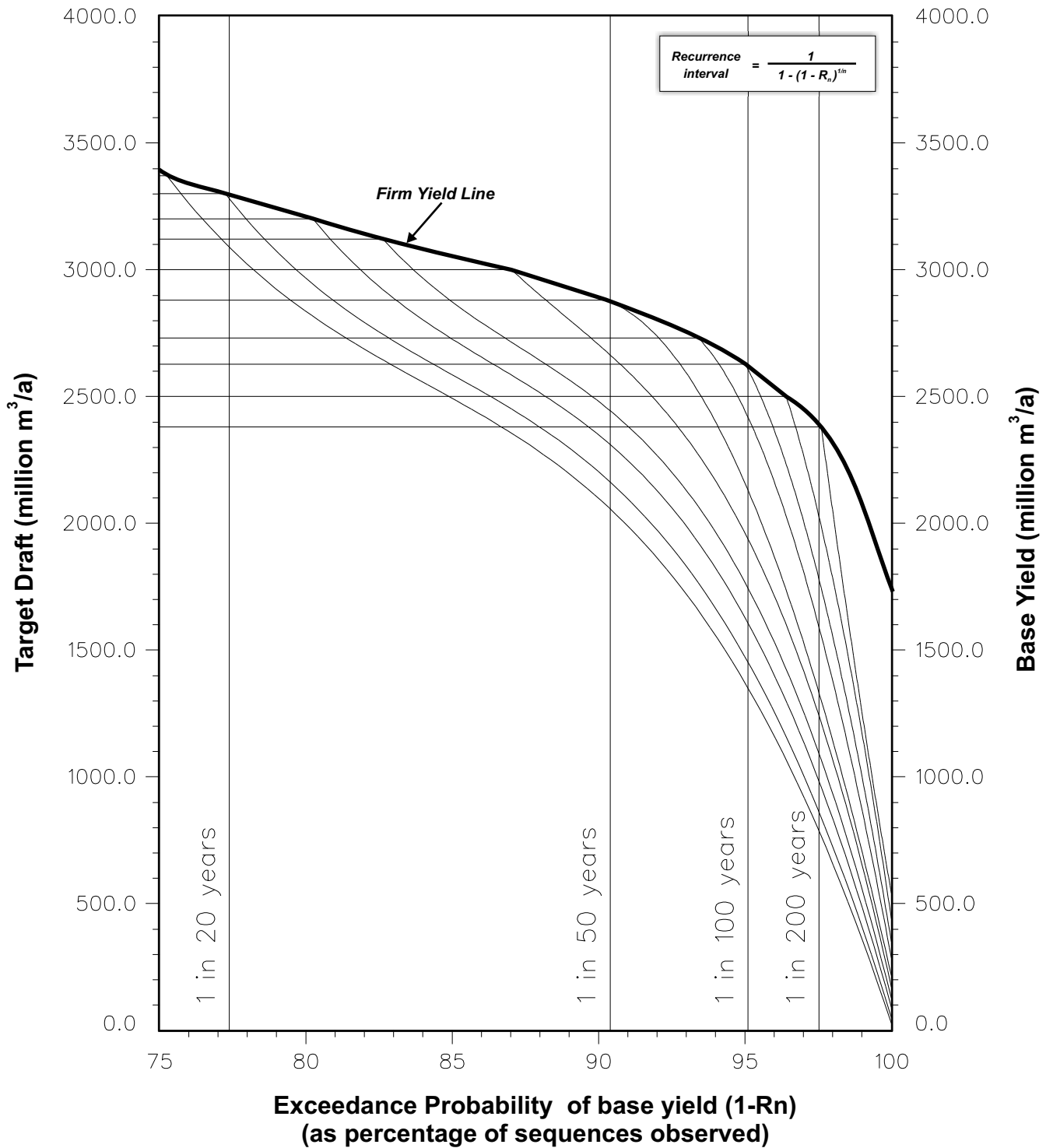
**Reliability of base yield derived from  
501 5-year generated sequences**



Gariep net FSC = 3 670 million m<sup>3</sup>  
Vanderkloof net FSC = 1 739 million m<sup>3</sup>  
Total contribution FSC = 5 408 million m<sup>3</sup>

WRP\_P0076\_Graphics\_Pre-Feas\_C-2.cdr

**Reliability of base yield derived from  
501 5-year generated sequences**

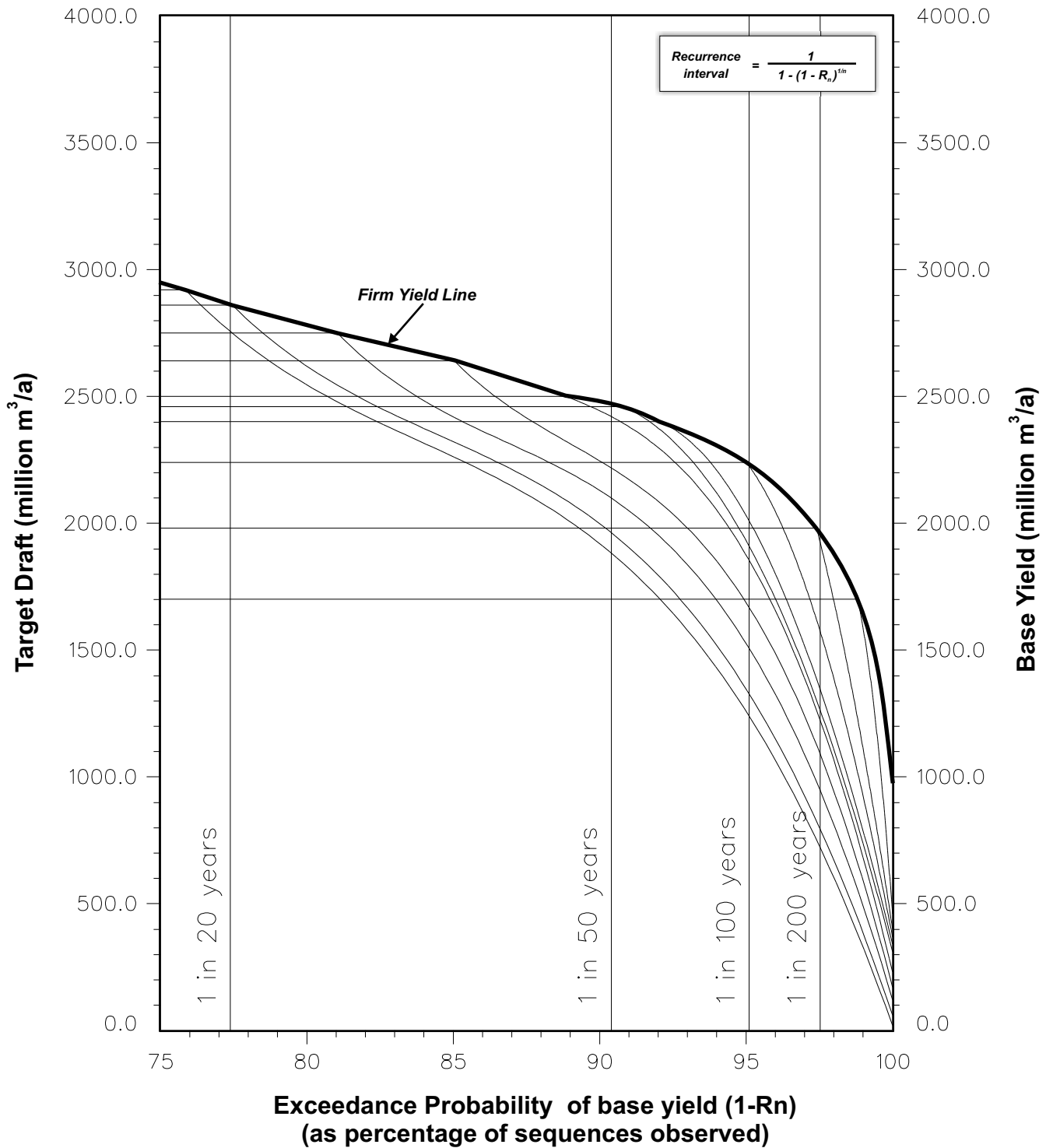


Gariep net FSC = 2 752 million m<sup>3</sup>  
 Vanderkloof net FSC = 1 304 million m<sup>3</sup>  
 Total contribution FSC = 4 056 million m<sup>3</sup>

WRP\_P0076\_Graphics\_Pre-Feas\_C-3.cdr



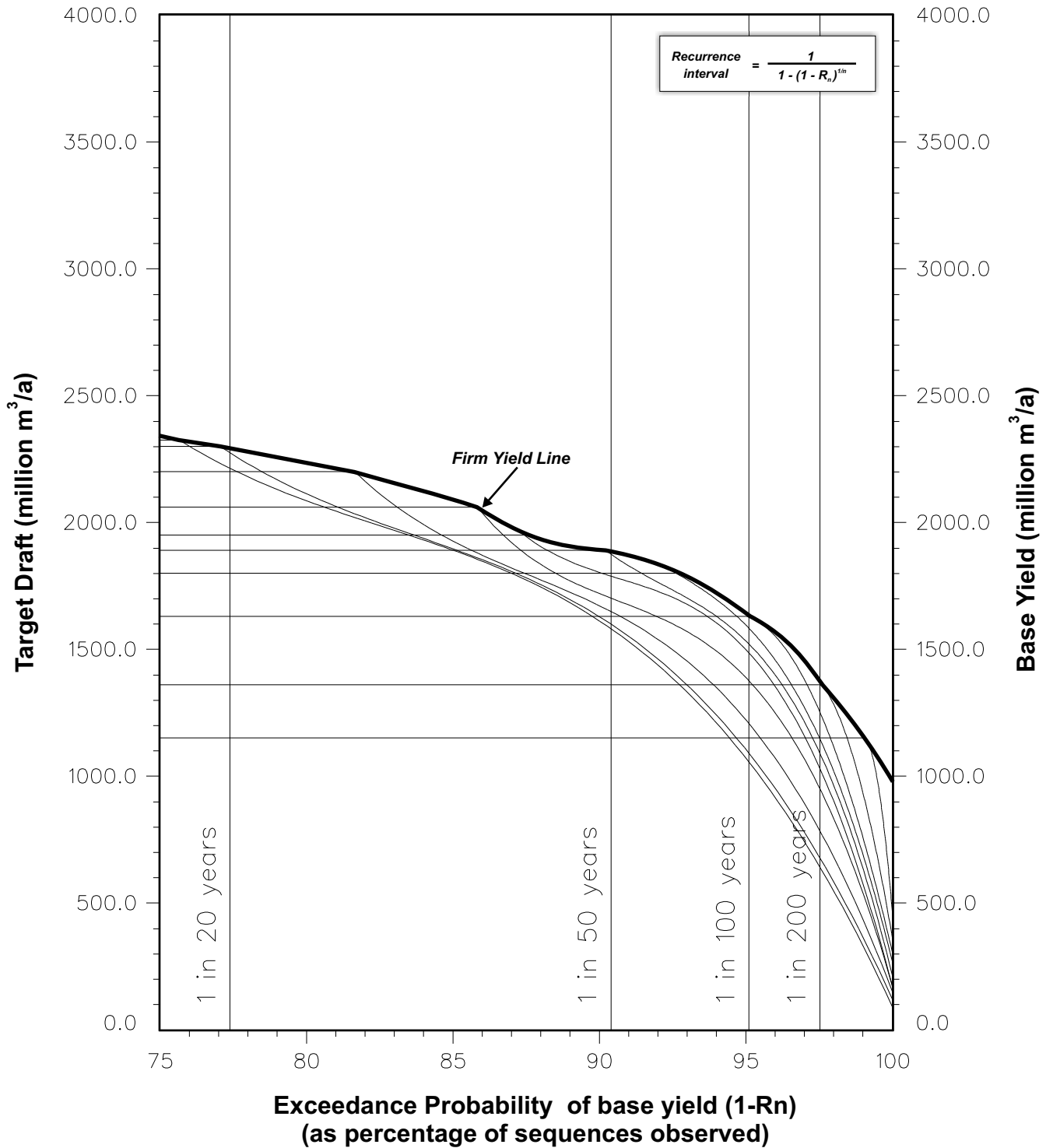
**Reliability of base yield derived from  
501 5-year generated sequences**



Gariep net FSC = 1 835 million m<sup>3</sup>  
 Vanderkloof net FSC = 869 million m<sup>3</sup>  
 Total contribution FSC = 2 704 million m<sup>3</sup>

WRP\_P0076\_Graphics\_Pre-Feas\_C-4.cdr

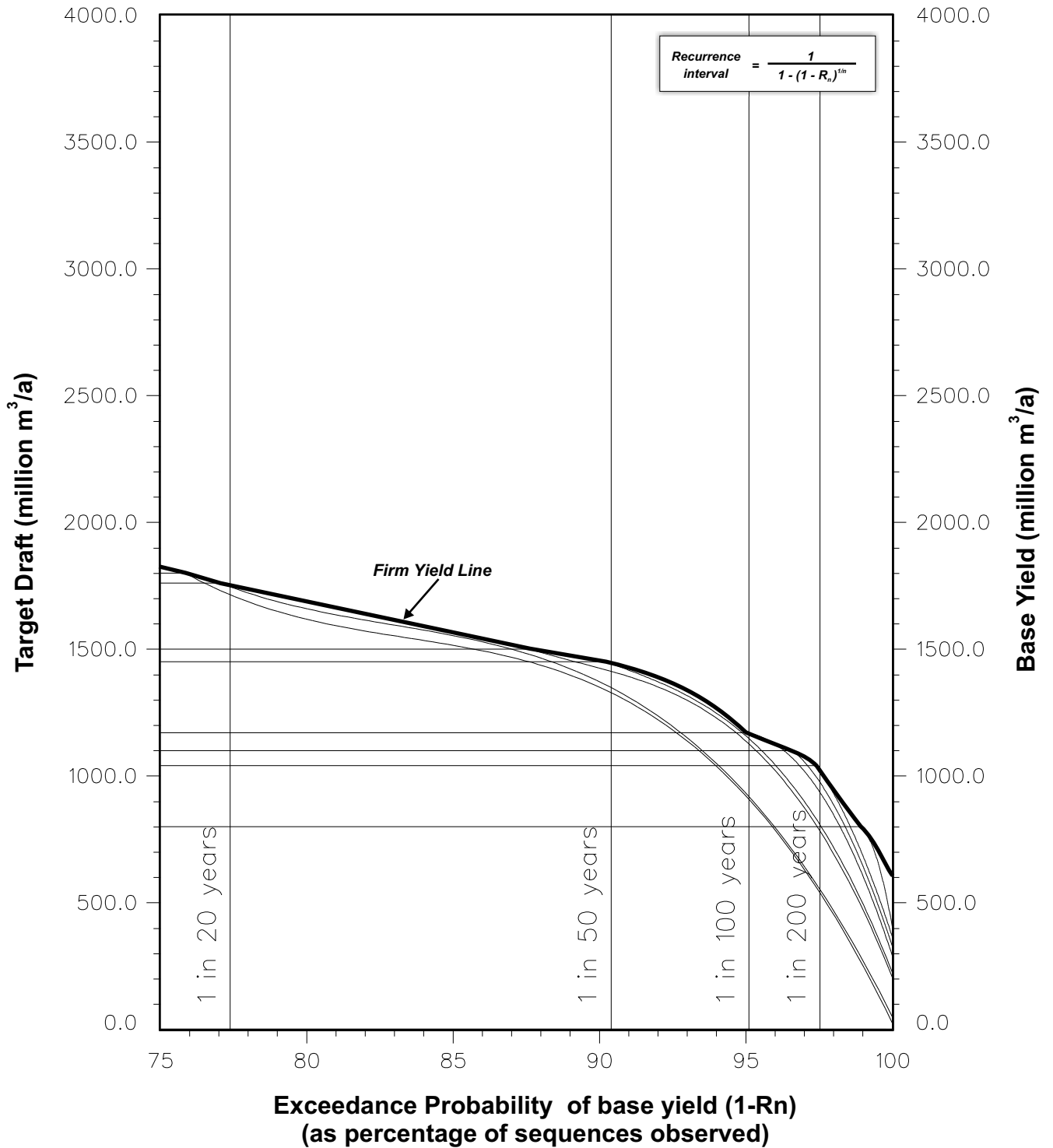
**Reliability of base yield derived from  
501 5-year generated sequences**



Gariep net FSC = 917 million m<sup>3</sup>  
Vanderkloof net FSC = 435 million m<sup>3</sup>  
Total contribution FSC = 1 352 million m<sup>3</sup>

WRP\_P0076\_Graphics\_Pre-Feas\_C-5.cdr

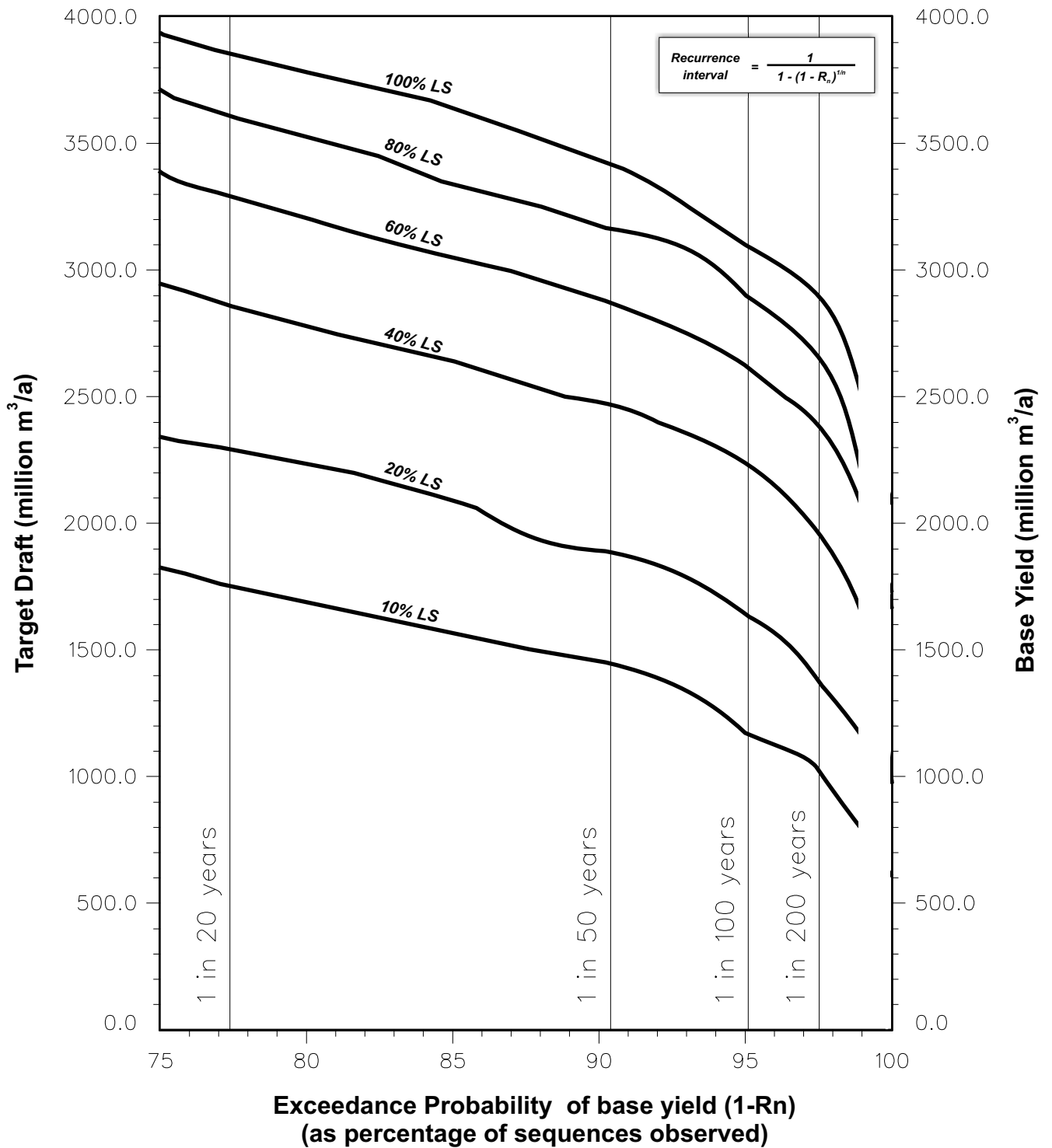
**Reliability of base yield derived from  
501 5-year generated sequences**



Gariep net FSC = 459 million m³  
Vanderkloof net FSC = 217 million m³  
Total contribution FSC = 676 million m³

WRP\_P0076\_Graphics\_Pre-Feas\_C-6.cdr

**Reliability of base yield derived from  
501 5-year generated sequences**



Gariep net FSC = 4 587 million m<sup>3</sup>  
 Vanderkloof net FSC = 2 173 million m<sup>3</sup>  
 Total contribution FSC = 6 760 million m<sup>3</sup>

WRP\_P0076\_Graphics\_Pre-Feas\_C-7.cdr



# **Appendix D**

## **System Schematics**

### **Description**

### **Schematic no.**

#### **Reference Scenario 1**

- |   |     |
|---|-----|
| 1) Upper Orange schematic with penalty structures | D-1 |
| 2) Lower Orange schematic with penalty structures | D-2 |
| 3) Fish River sub-system with penalty structures  | D-3 |
| 4) Upper Orange schematic with water balance      | D-4 |
| 5) Lower Orange schematic with water balance      | D-5 |
| 6) Fish River sub-system with water balance       | D-6 |

#### **Reference Scenario 2**

- |   |      |
|---|------|
| 7) Upper Orange schematic with penalty structures | D-7  |
| 8) Lower Orange schematic with penalty structures | D-8  |
| 9) Fish River sub-system with penalty structures  | D-9  |
| 10) Upper Orange schematic with water balance     | D-10 |
| 11) Lower Orange schematic with water balance     | D-11 |
| 12) Fish River sub-system with water balance      | D-12 |

#### **Reference Scenario 3**

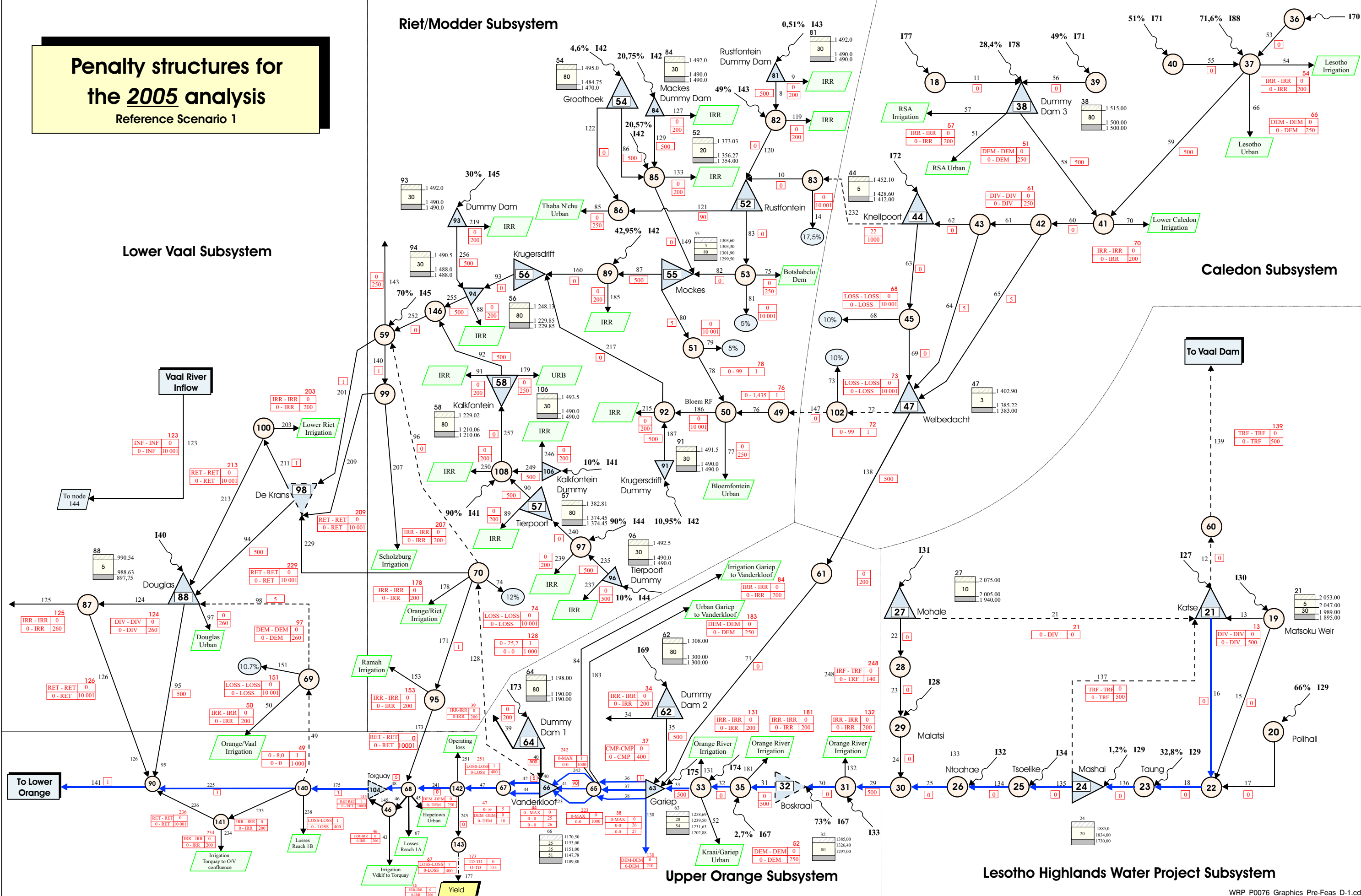
- |  |      |
|--|------|
| 13) Upper Orange schematic with penalty structures | D-13 |
| 14) Lower Orange schematic with penalty structures | D-14 |
| 15) Fish River sub-system with penalty structures  | D-15 |
| 16) Upper Orange schematic with water balance      | D-16 |
| 17) Lower Orange schematic with water balance      | D-17 |
| 18) Fish River sub-system with water balance       | D-18 |

# Penalty structures for the **2005** analysis Reference Scenario 1

## Lower Vaal Subsystem

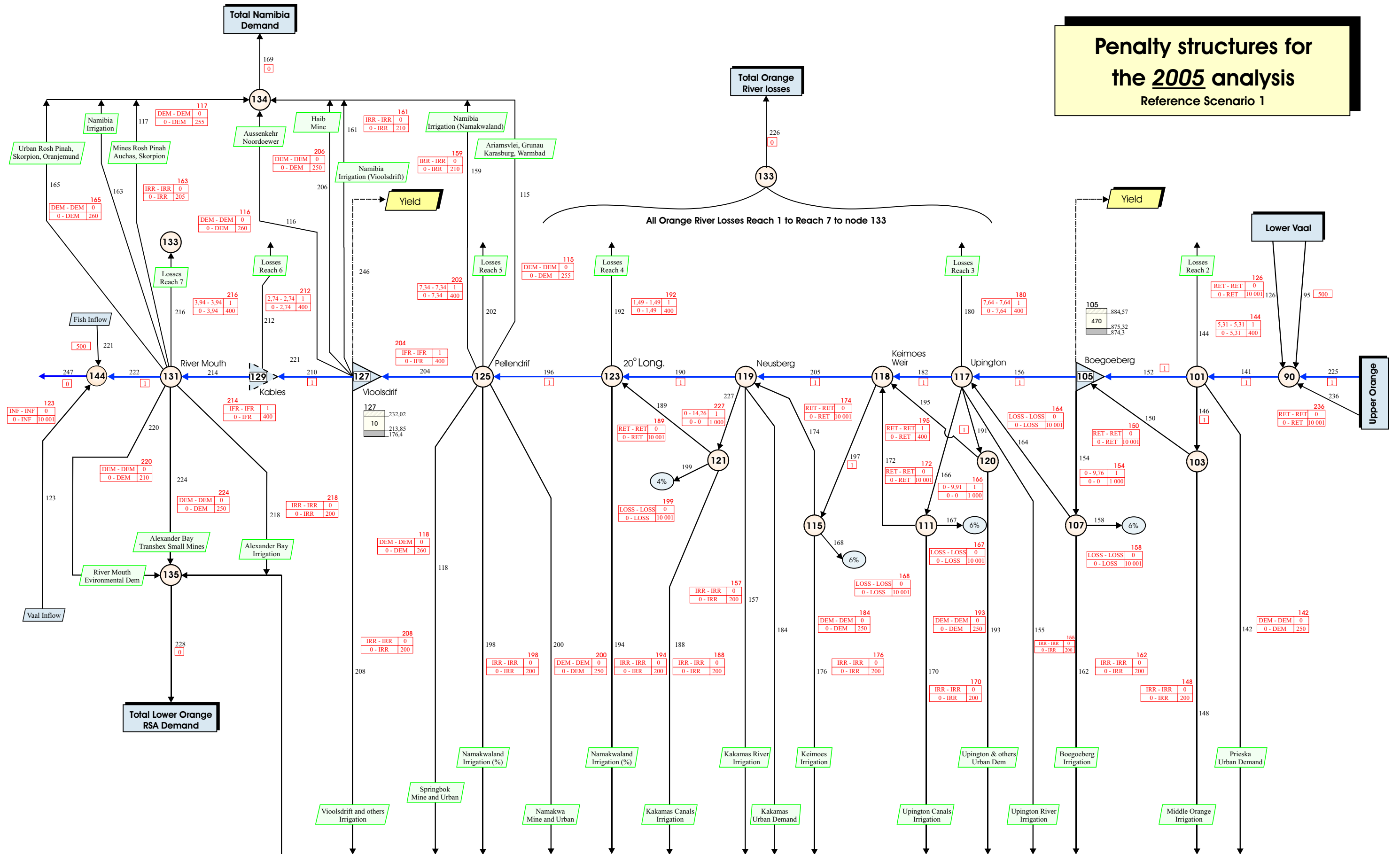
## Riet/Modder Subsystem

## Caledon Subsystem



WRP\_PO076\_Graphics\_Pre-Feas\_D-1.cdr

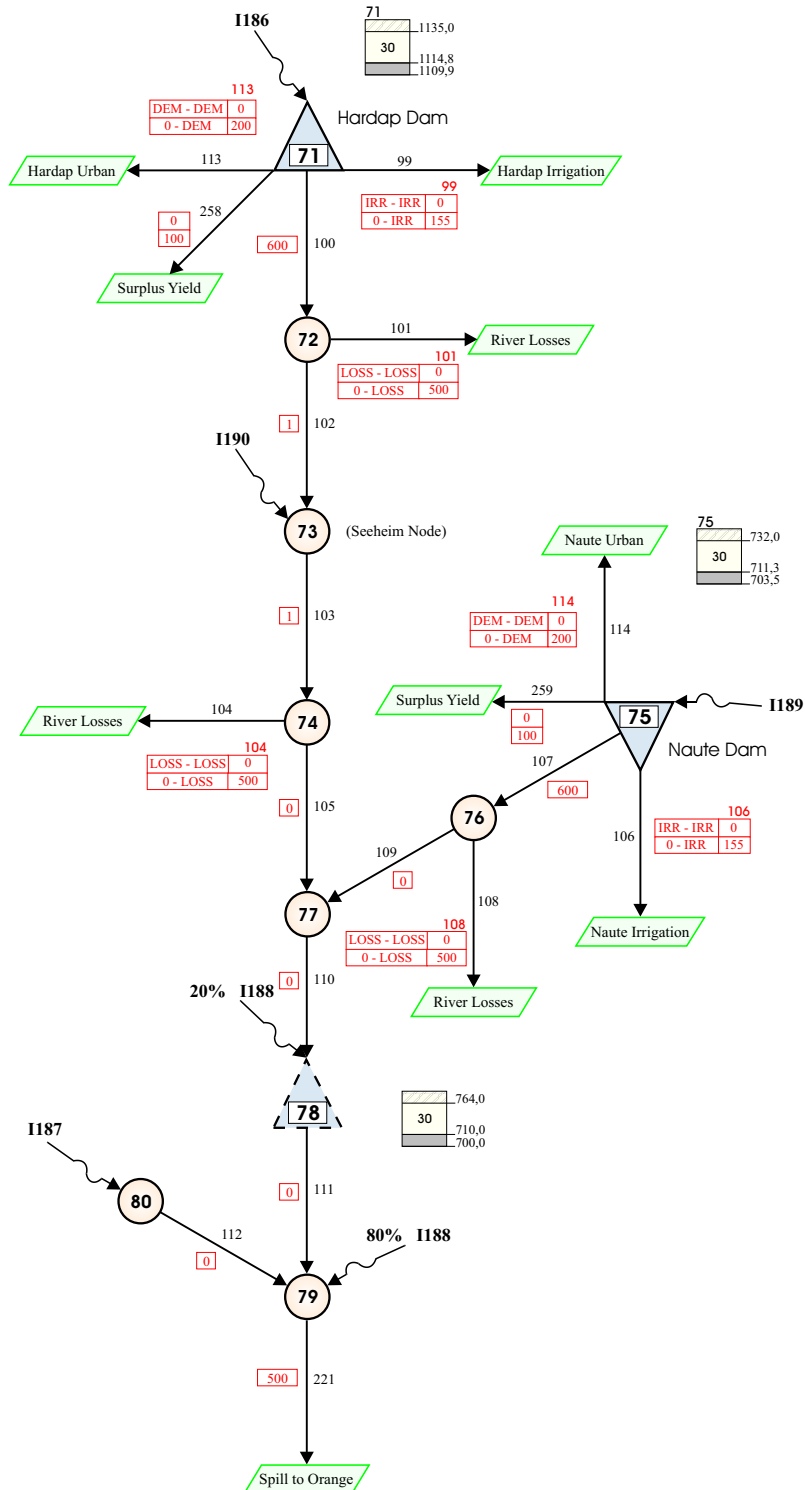
# Penalty structures for the 2005 analysis Reference Scenario 1



WRP\_P0076\_Graphics\_Pre-Feas\_D-2.cdr

# Penalty structures for the 2005 analysis

Reference Scenario 1



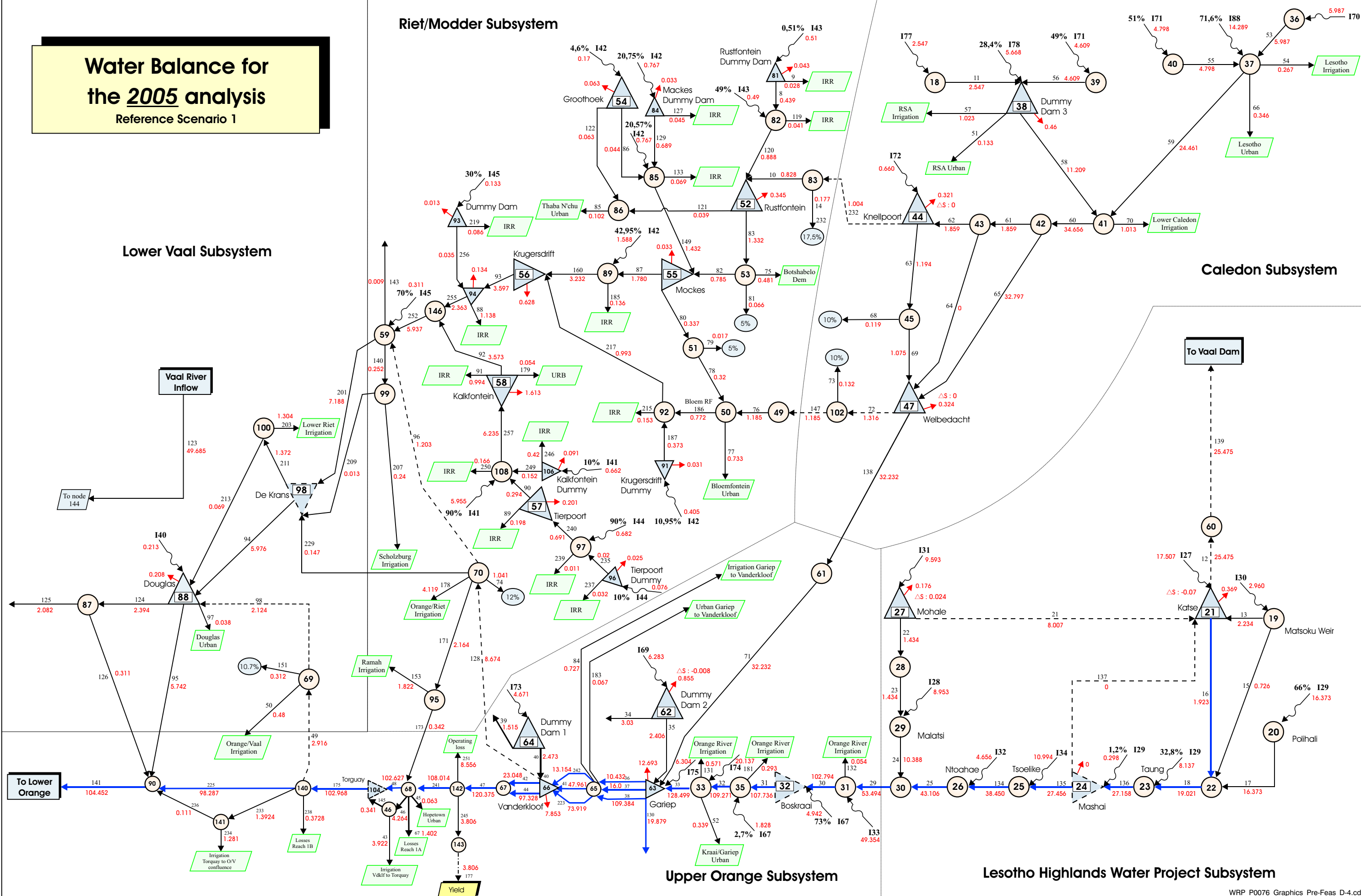
WRP\_P0076\_Graphics\_Pre-Feas\_D-3.cdr

# Water Balance for the 2005 analysis Reference Scenario 1

## Lower Vaal Subsystem

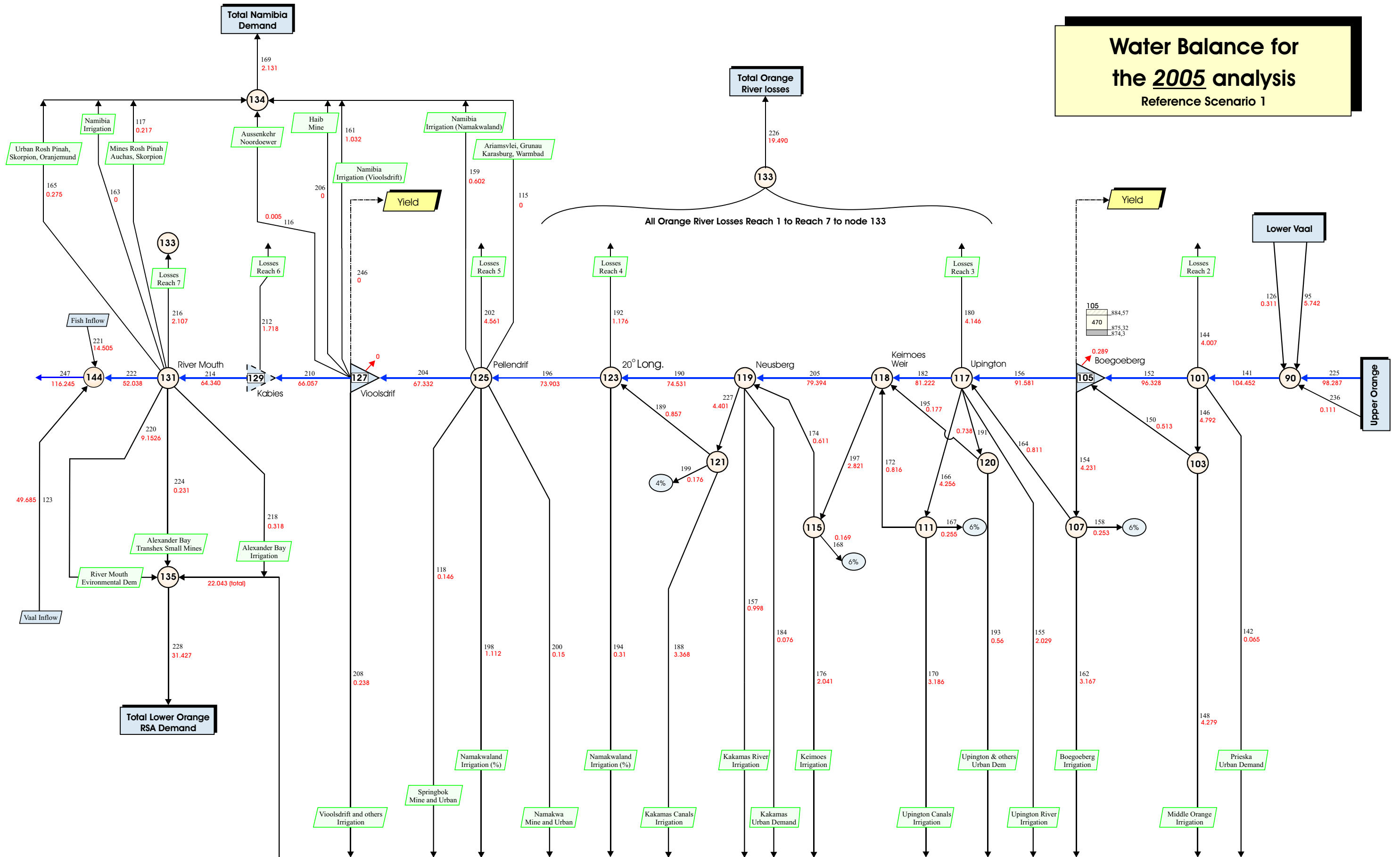
## Riet/Modder Subsystem

## Caledon Subsystem



WRP\_PO076\_Graphics\_Pre-Feas\_D-4.cdr

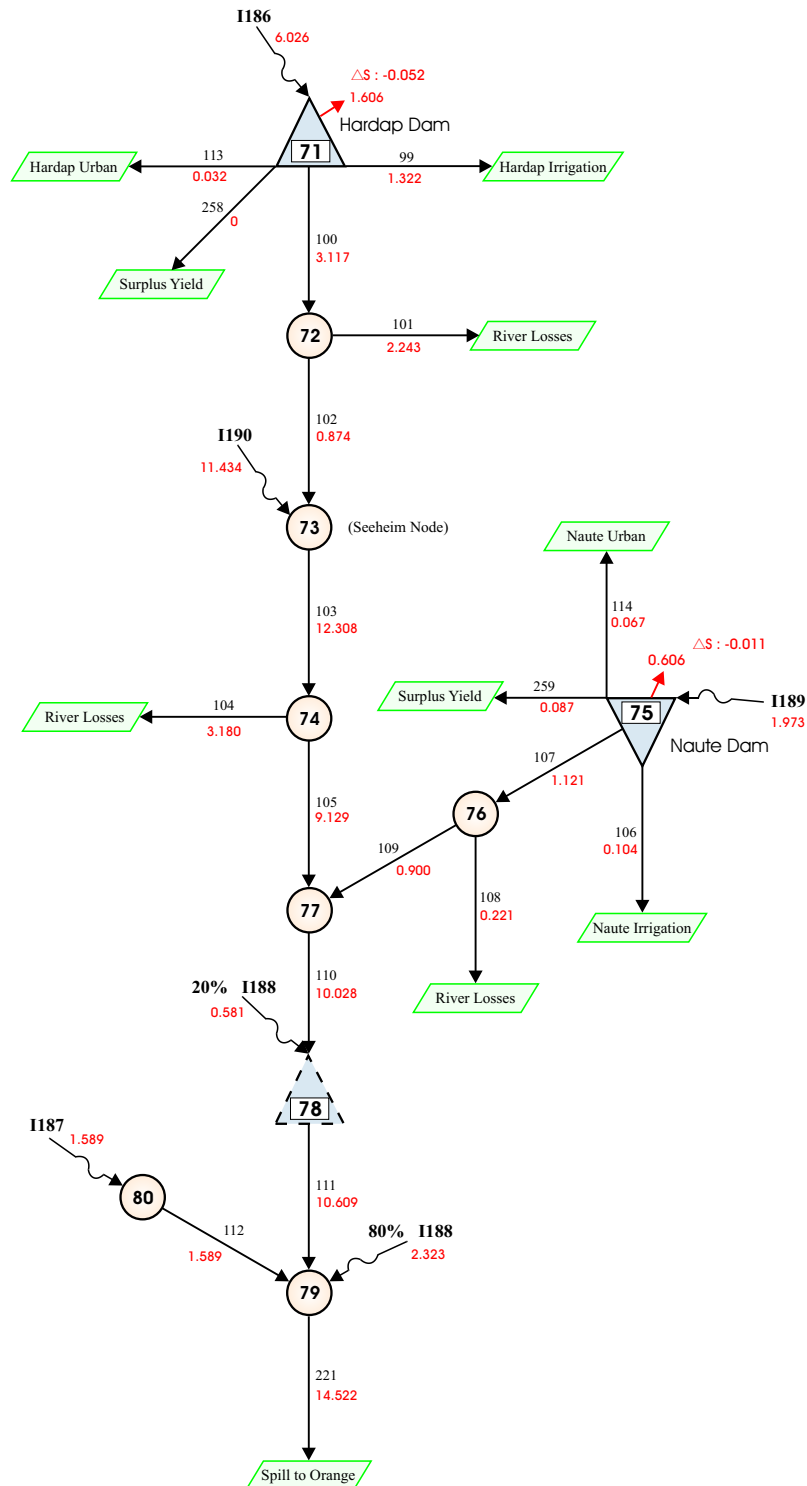
# Water Balance for the 2005 analysis Reference Scenario 1



WRP\_P0076\_Graphics\_Pre-Feas\_D-5.cdr



# Water Balance for the 2005 analysis Reference Scenario 1



WRP\_P0076\_Graphics\_Pre-Feas\_D-6.cdr

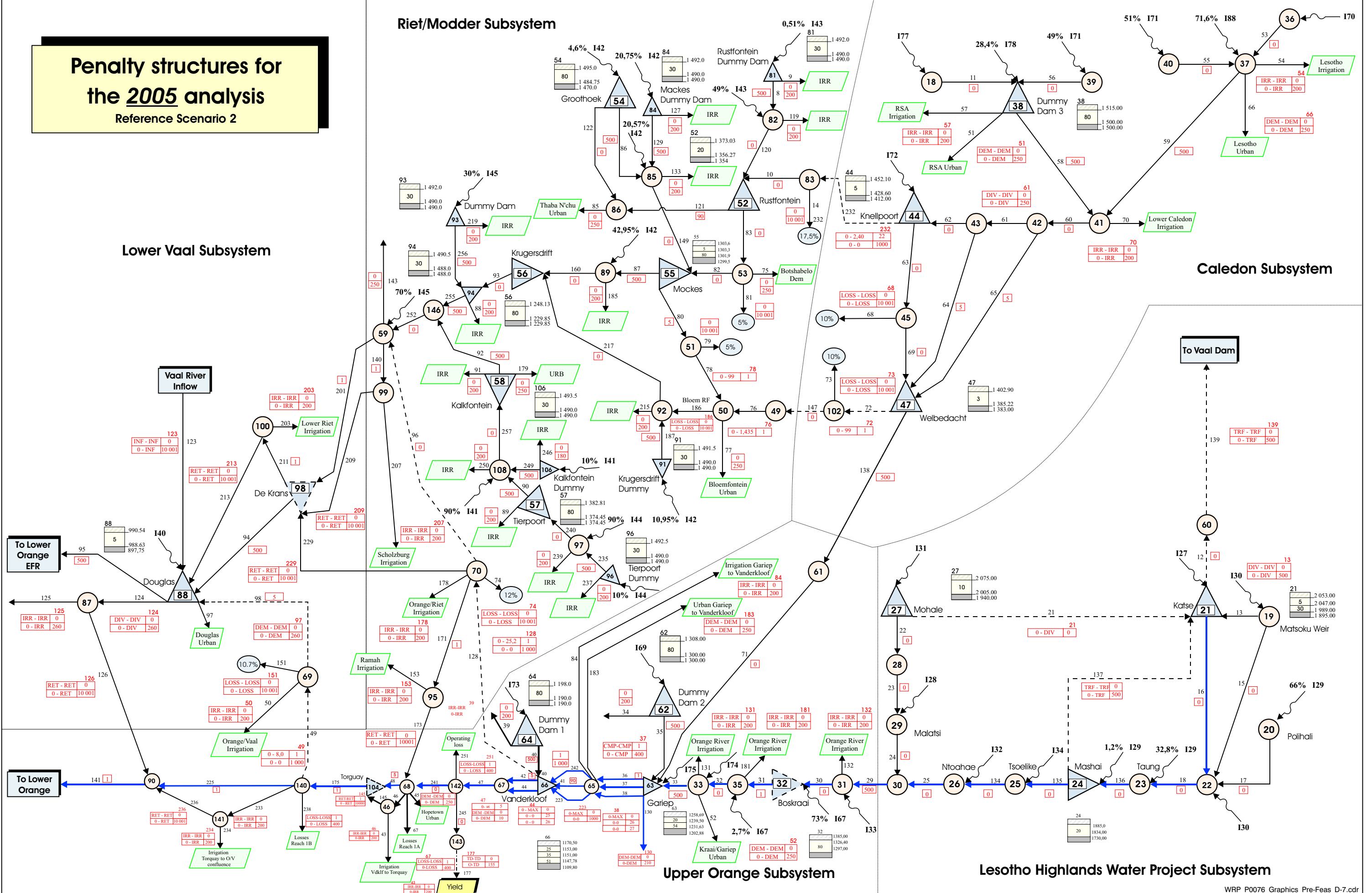


# Penalty structures for the **2005** analysis Reference Scenario 2

## Lower Vaal Subsystem

## Riet/Modder Subsystem

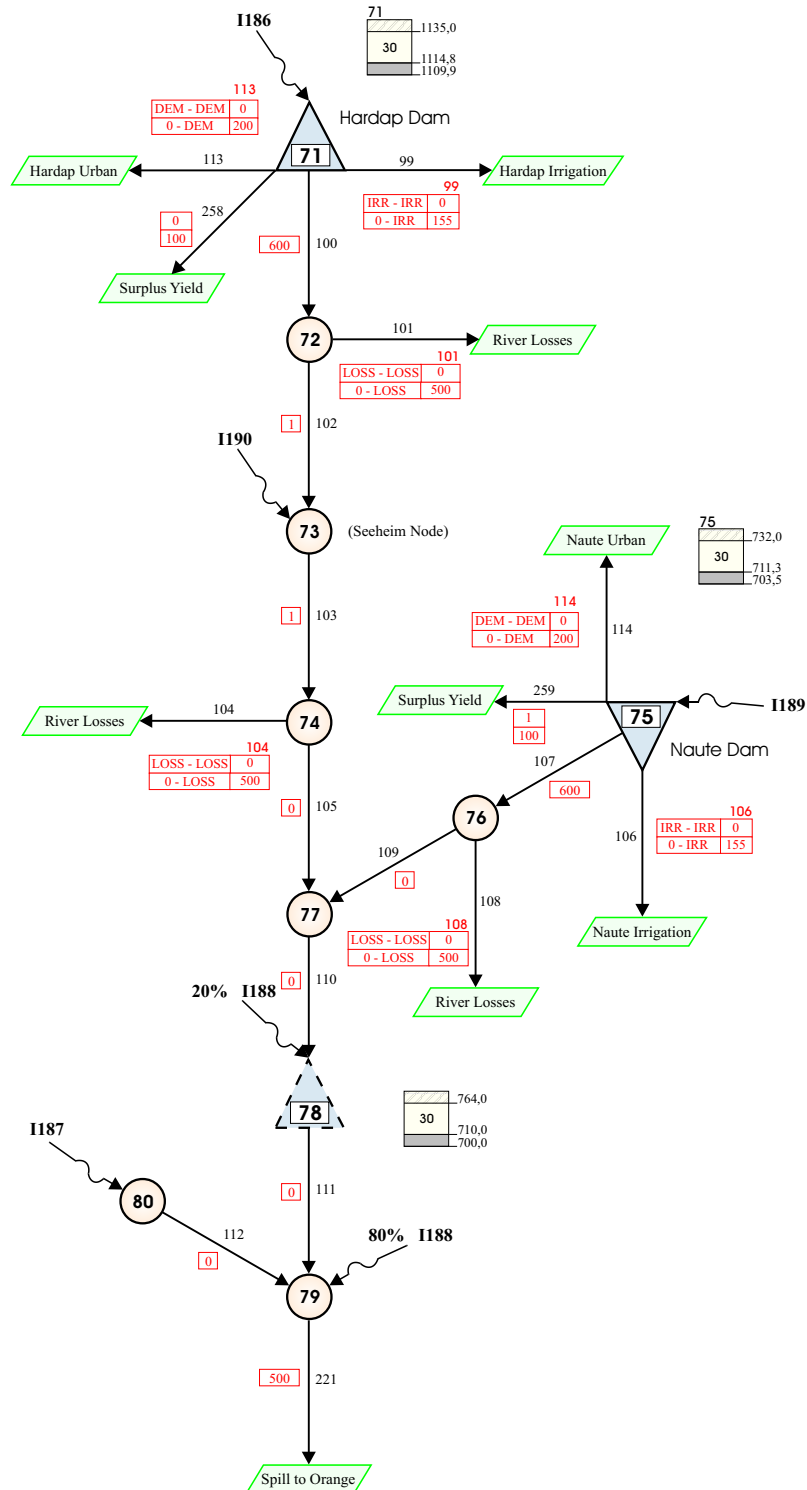
## Caledon Subsystem





# Penalty structures for the 2005 analysis

Reference Scenario 2



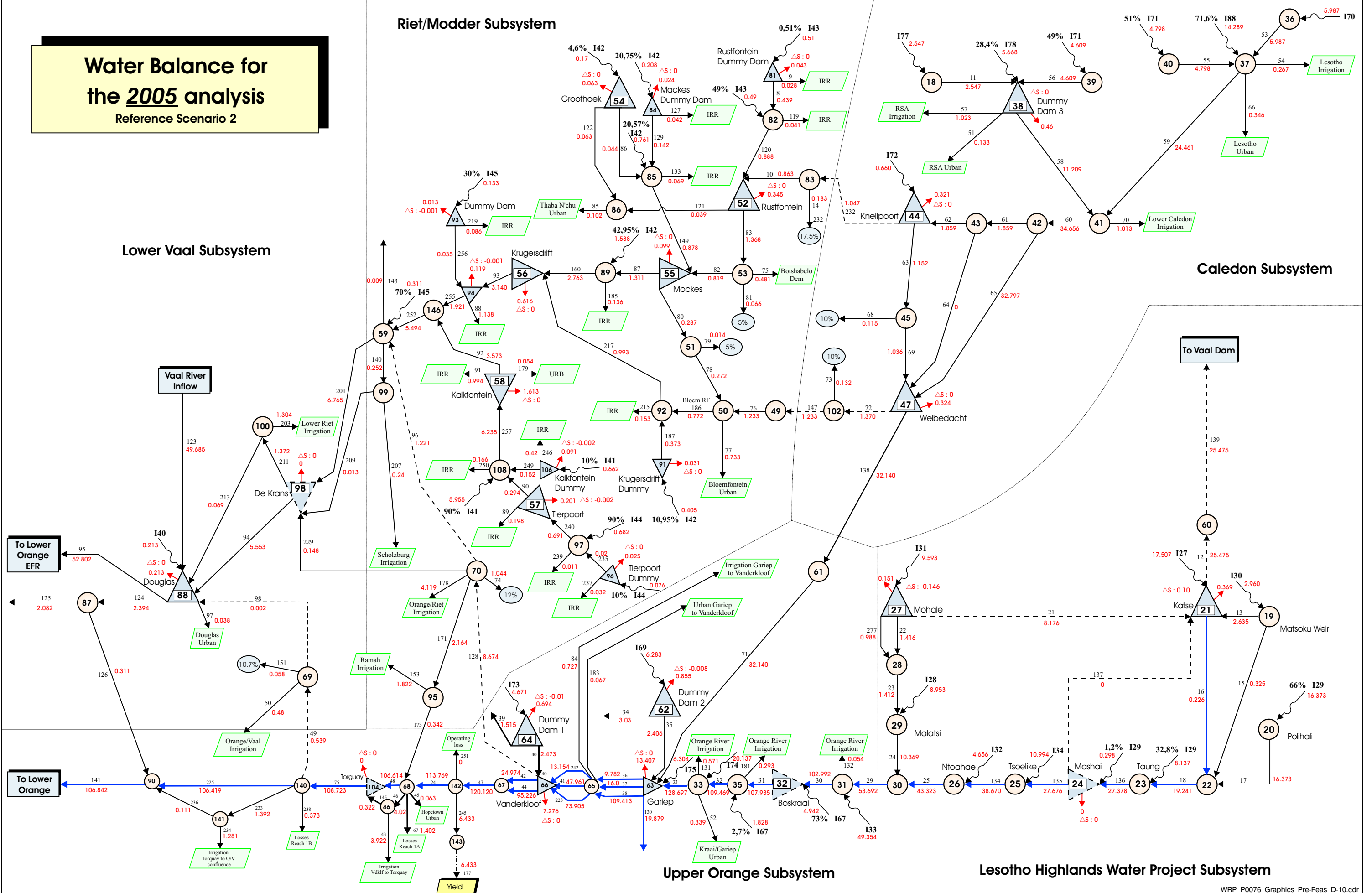
WRP\_P0076\_Graphics\_Pre-Feas\_D-9.cdr

# Water Balance for the **2005** analysis Reference Scenario 2

## Lower Vaal Subsystem

## Riet/Modder Subsystem

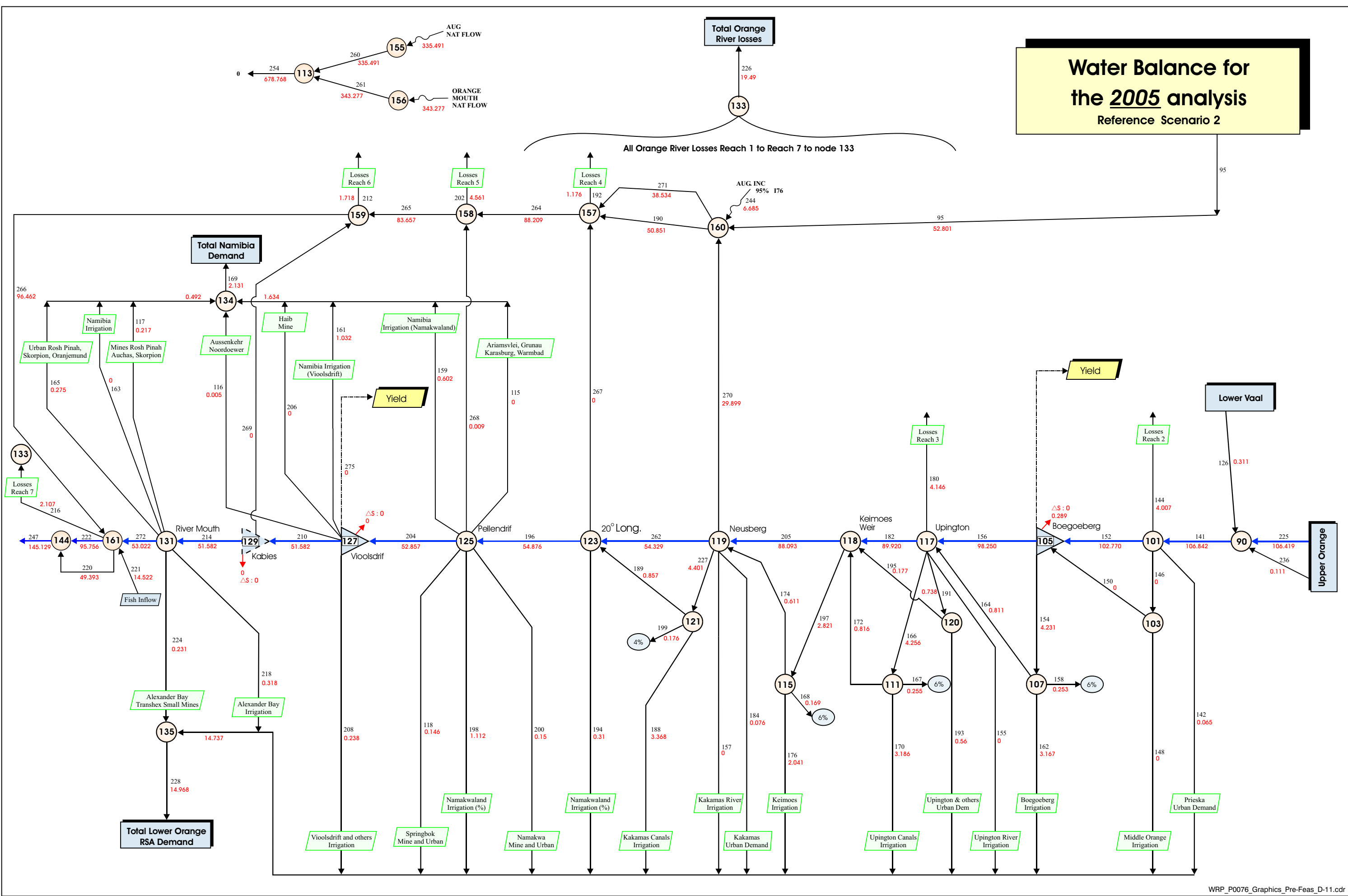
## Caledon Subsystem



WRP\_P0076\_Graphics\_Pre-Feas\_D-10.cdr

# Water Balance for the 2005 analysis

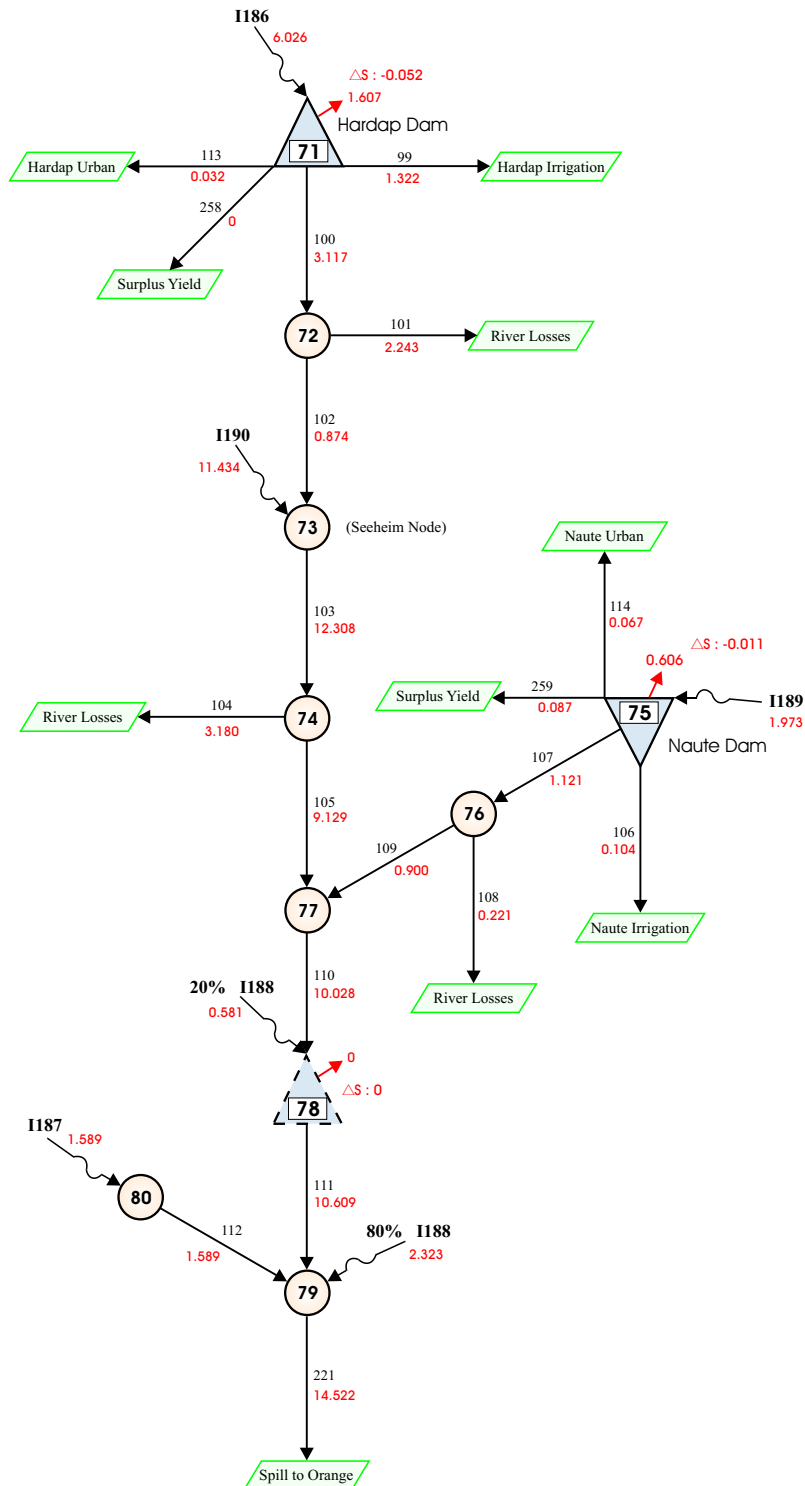
Reference Scenario 2





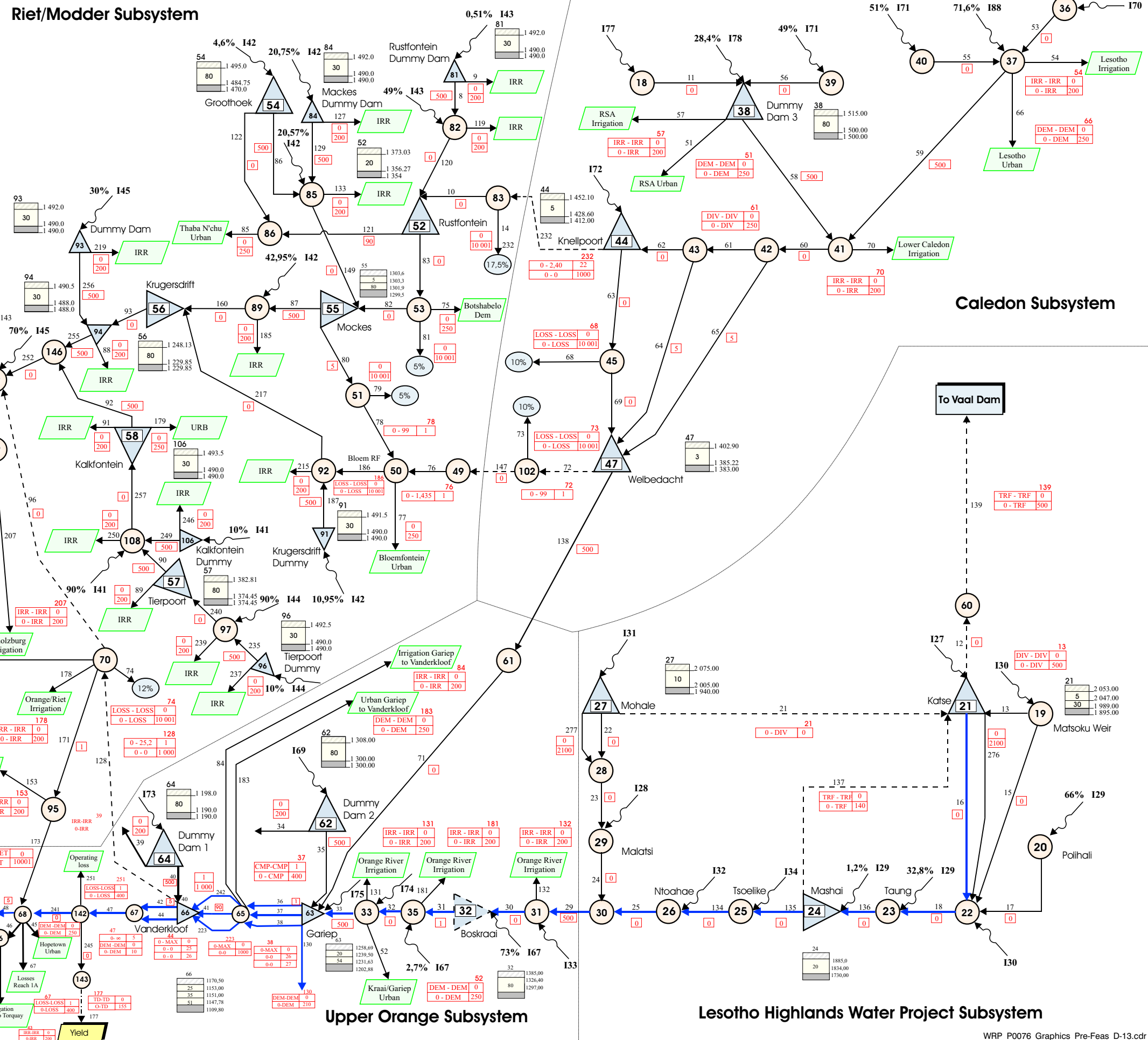
# Water Balance for the 2005 analysis

Reference Scenario 2



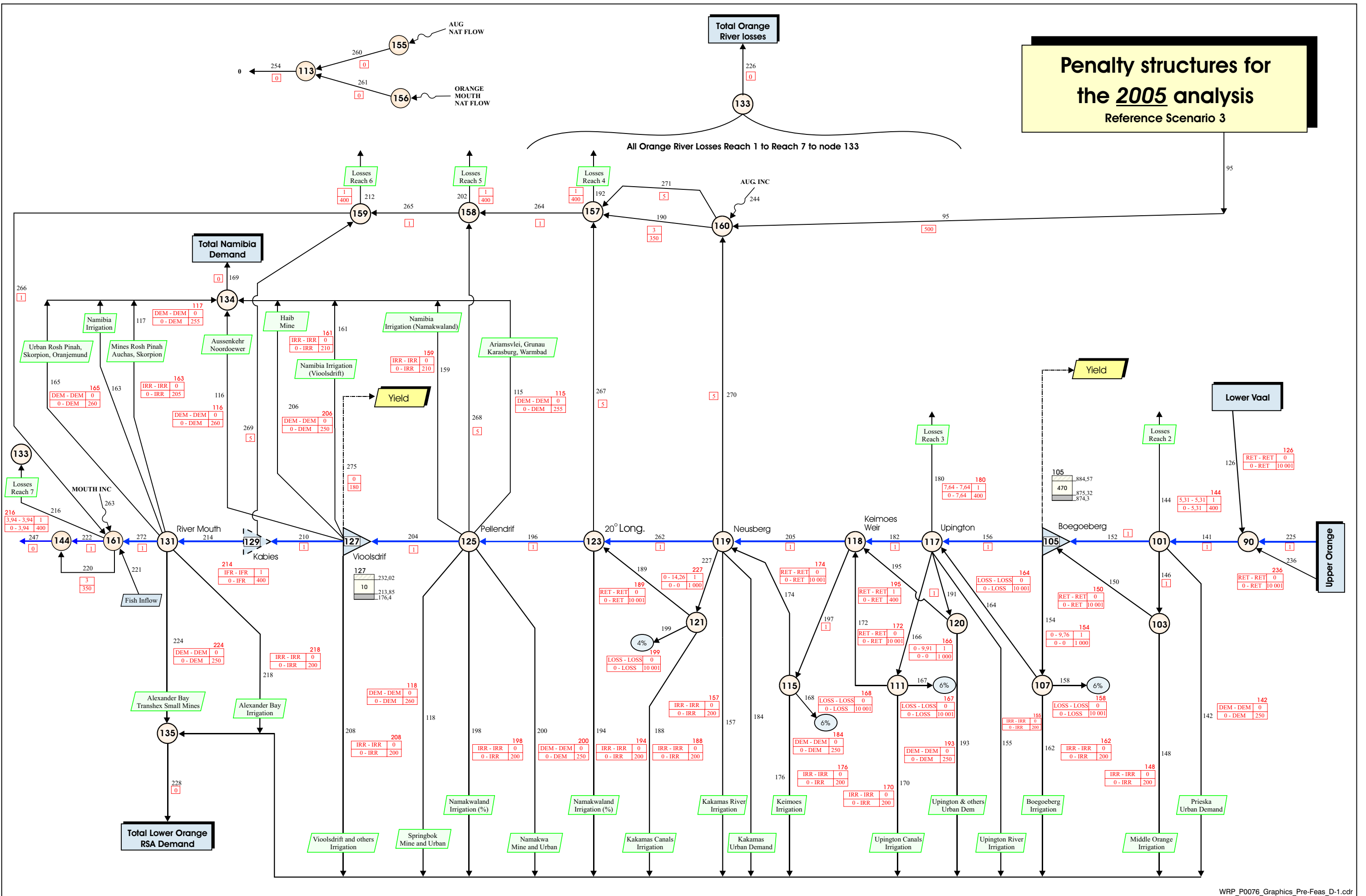
WRP\_P0076\_Graphics\_Pre-Feas\_D-12.cdr

### Reference Scenario 3



WRP\_P0076\_Graphics\_Pre-Feas\_D-13.cdr

# Penalty structures for the 2005 analysis Reference Scenario 3

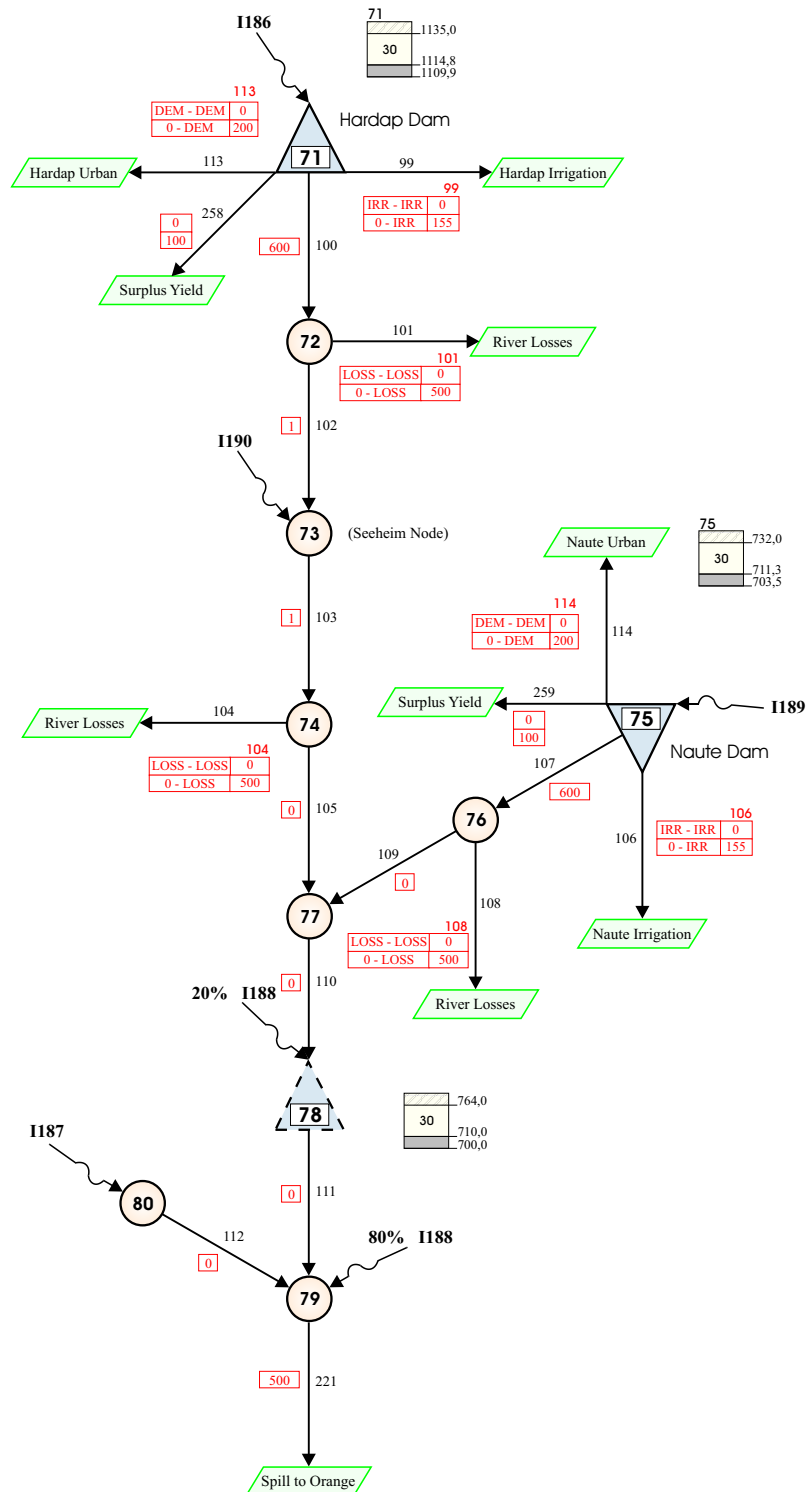


WRP\_P0076\_Graphics\_Pre-Feas\_D-1.cdr



# Penalty structures for the **2005** analysis

Reference Scenario 3



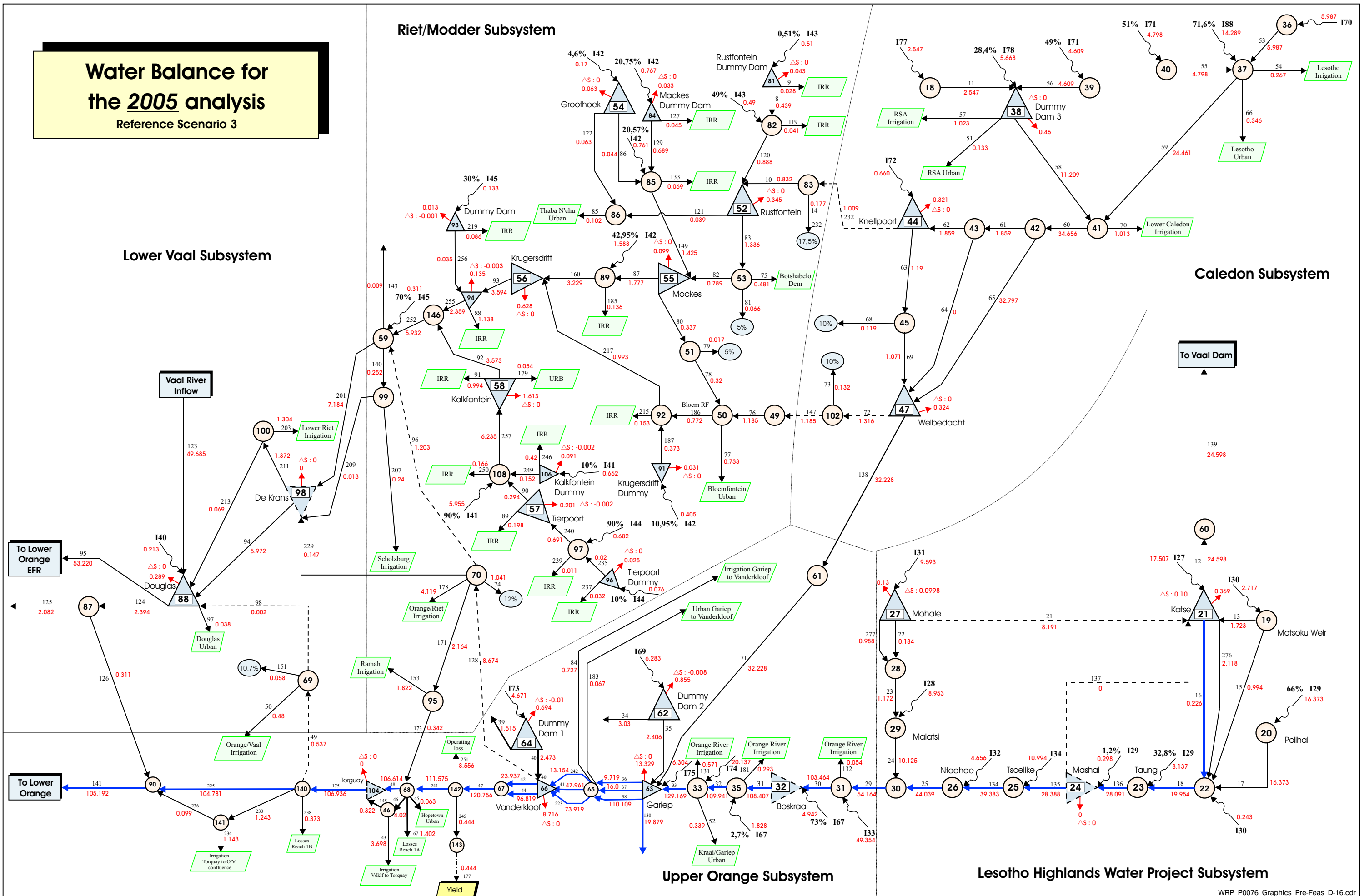
WRP\_P0076\_Graphics\_Pre-Feas\_D-15.cdr

# Water Balance for the 2005 analysis

Reference Scenario 3

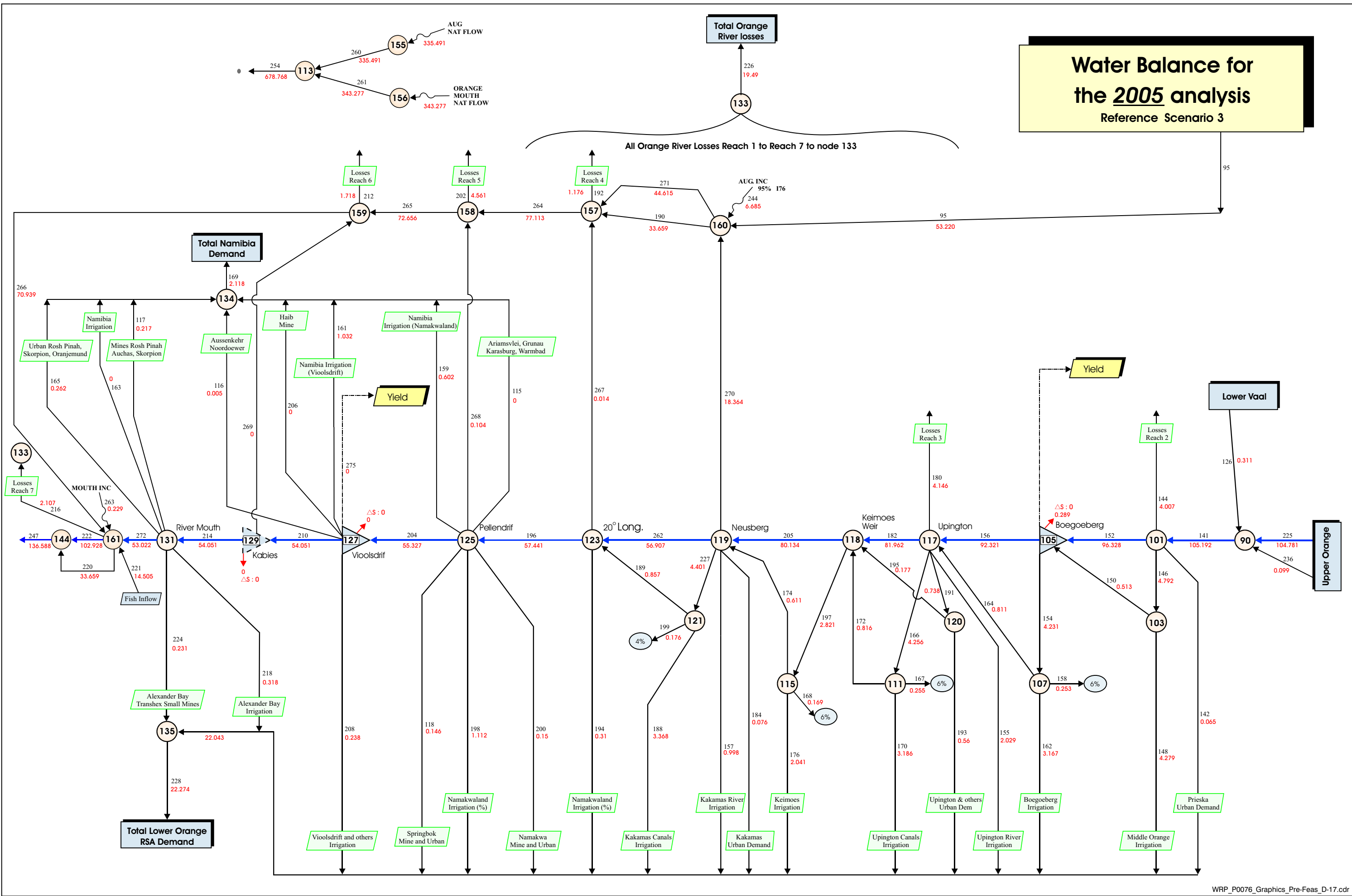
## Lower Vaal Subsystem

## Riet/Modder Subsystem



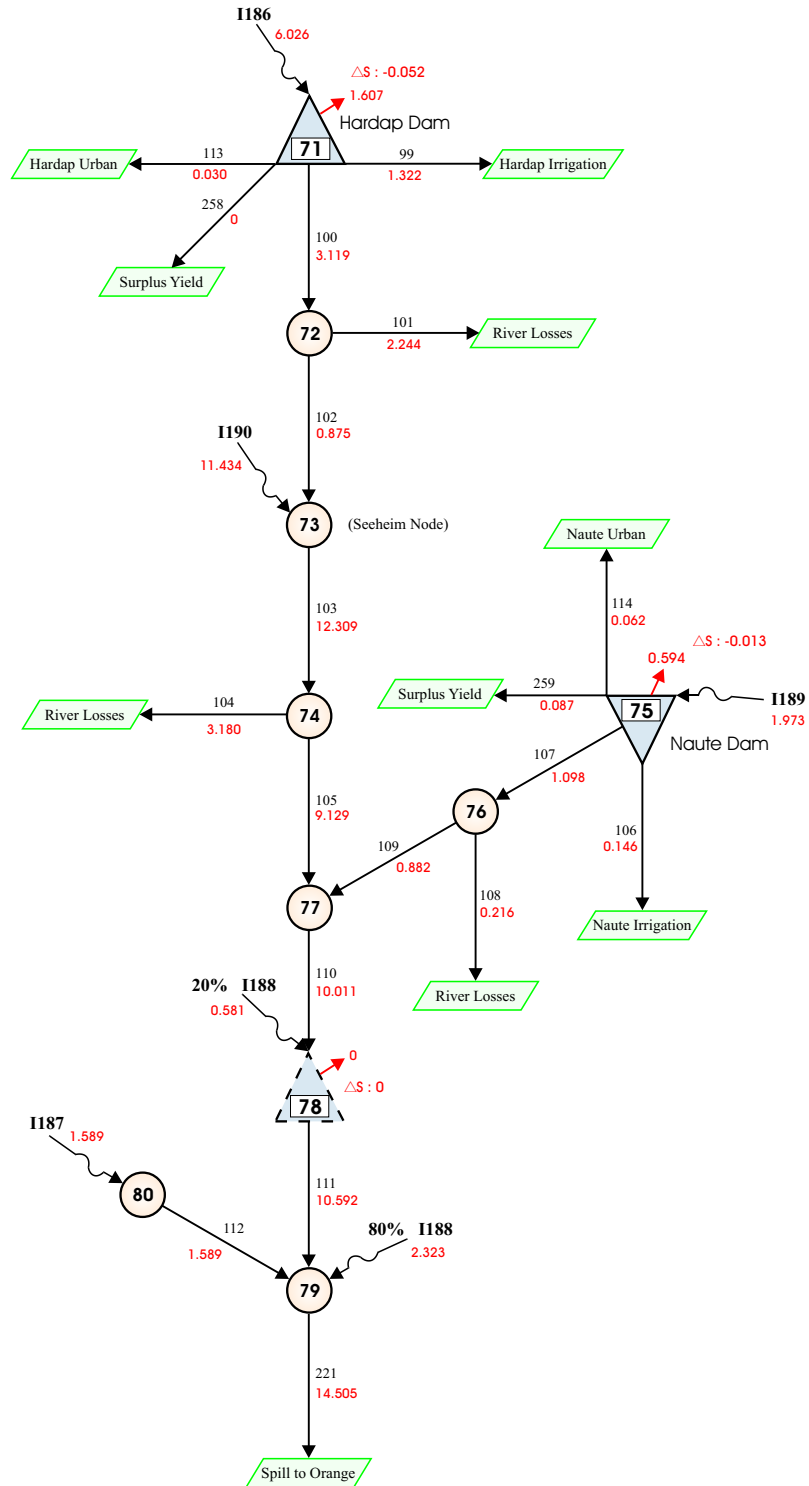
# Water Balance for the 2005 analysis

Reference Scenario 3



WRP\_P0076\_Graphics\_Pre-Feas\_D-17.cdr

# Water Balance for the 2005 analysis Reference Scenario 3

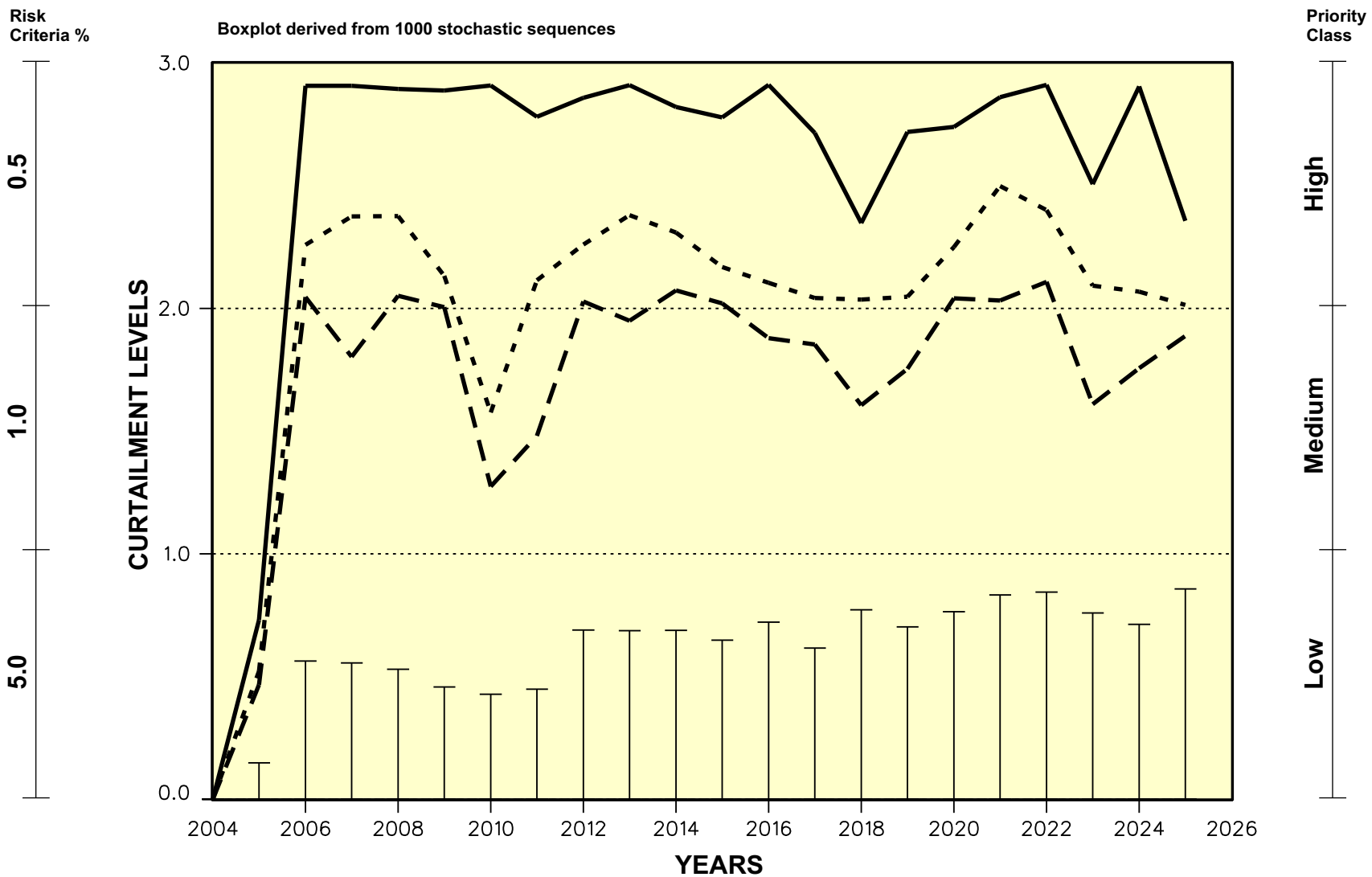


WRP\_P0076\_Graphics\_Pre-Feas\_D-18.cdr

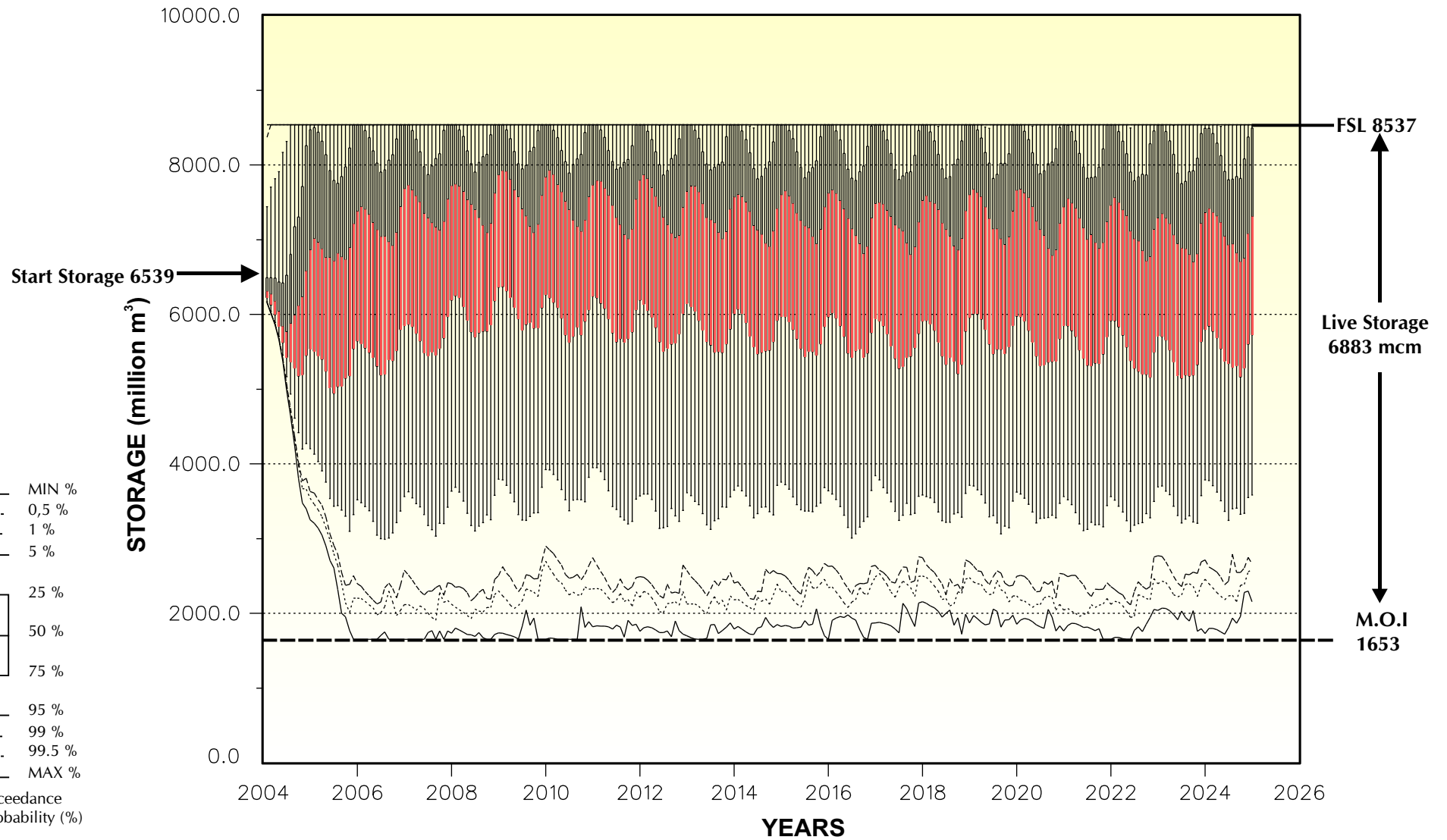
## **Appendix E**

### **WRPM Results**

<b>Description</b>	<b>Schematic no.</b>
<b>1) Reference Scenario P3 Curtailment level plot</b>	<b>E-1</b>
<b>2) Reference Scenario P3 Storage projection plot</b>	<b>E-2</b>
<b>3) Scenario P3a (Full starting level) Curtailment level plot</b>	<b>E-3</b>
<b>4) Scenario P3b (Limited irrigation growth) Curtailment level plot</b>	<b>E-4</b>
<b>5) Scenario P3c (Vioolsdrift re-regulating dam) Curtailment level plot</b>	<b>E-5</b>
<b>6) Scenario P3d (Vioolsdrift re-regulating dam full starting storage level) Curtailment level plot</b>	<b>E-6</b>
<b>7) Scenario P3e (ORRS EFR) Curtailment level plot</b>	<b>E-7</b>
<b>8) Scenario P3f (ORRS EFR &amp; real time modelling) Curtailment level plot</b>	<b>E-8</b>
<b>9) Scenario P3g (ORRS EFR &amp; real time modelling &amp; Vanderkloof Lower Level Storage</b>	<b>E-9</b>
<b>10) Required intervention time for various options versus the most probable demand growth</b>	<b>E-10</b>



WRP\_P0076\_Graphics\_Fig50b.cdr

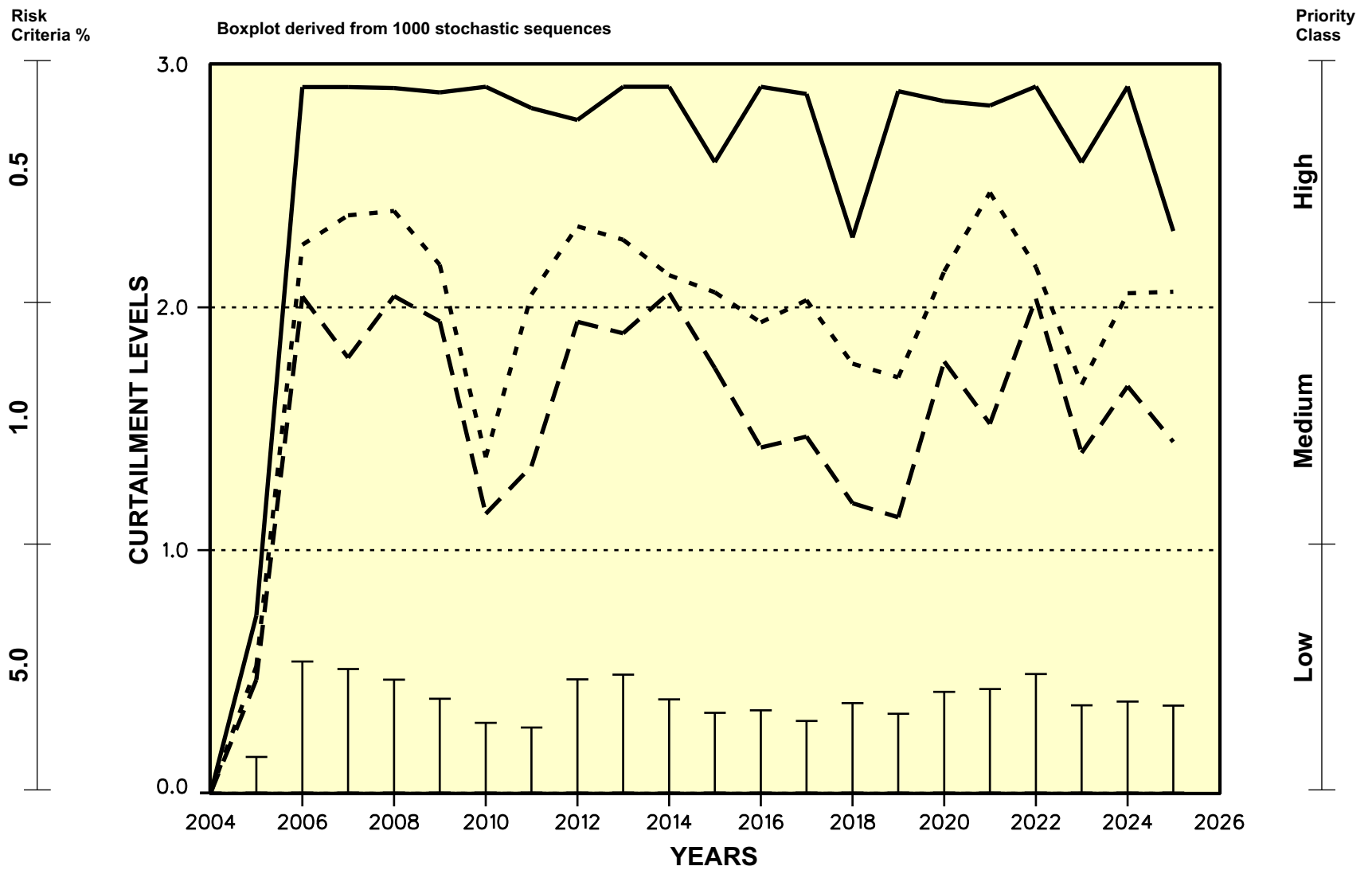


WRP\_P0076\_Graphics\_Fig51b.cdr



WRP\_P0076\_Graphics\_Fig47b.cdr



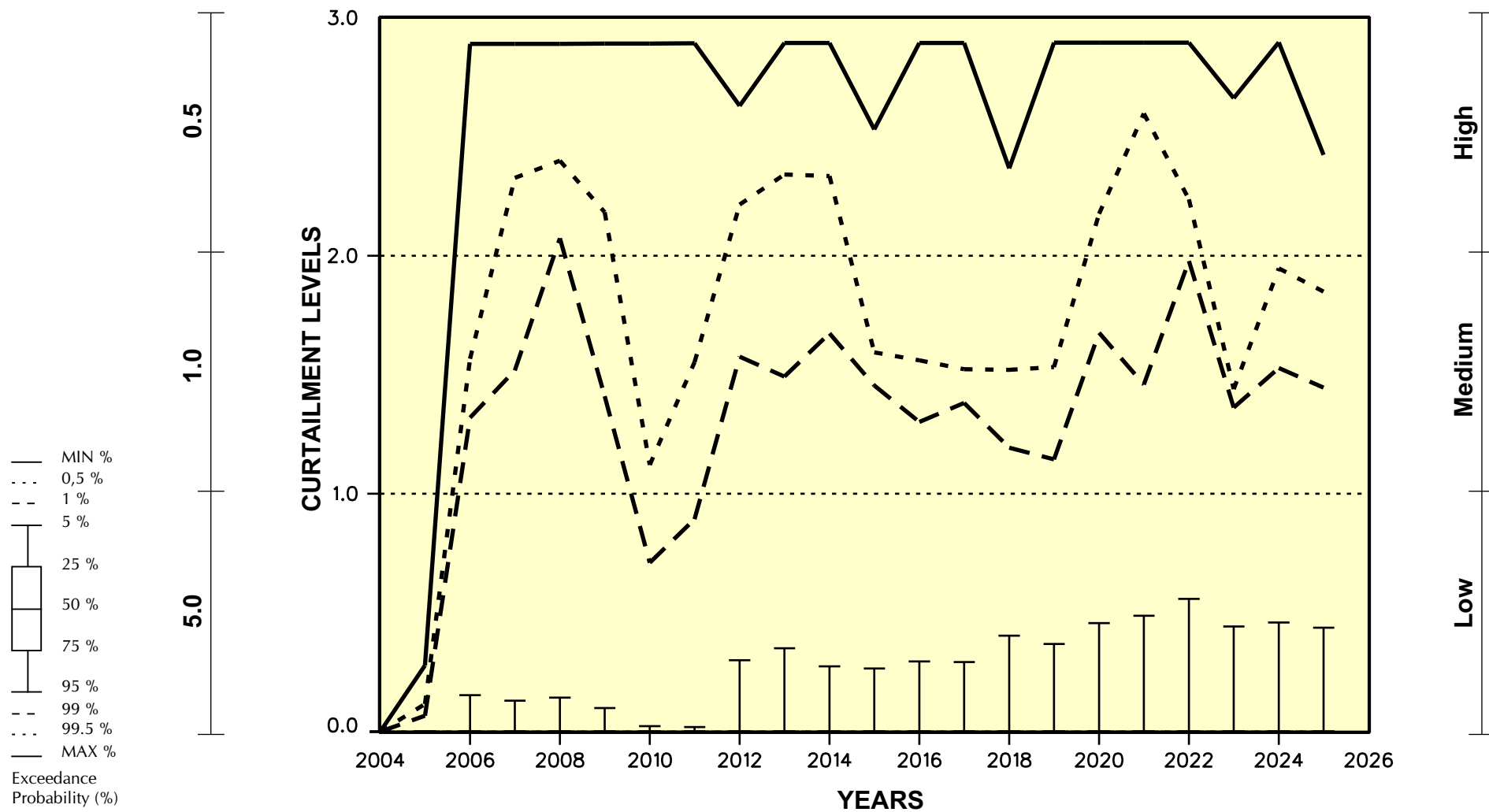


WRP\_P0076\_Graphics\_Fig47b.cdr

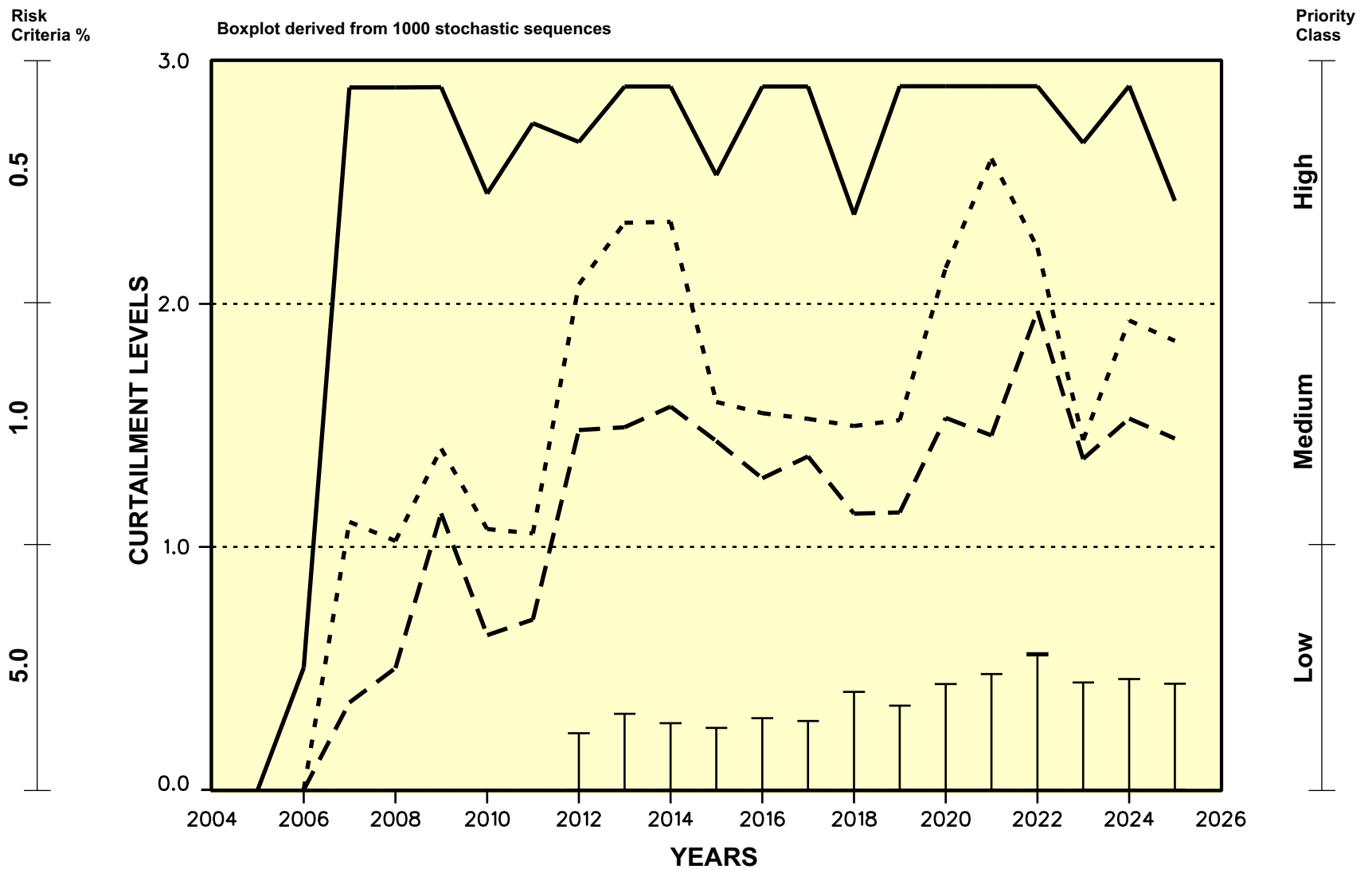
Risk  
Criteria %

Boxplot derived from 1000 stochastic sequences

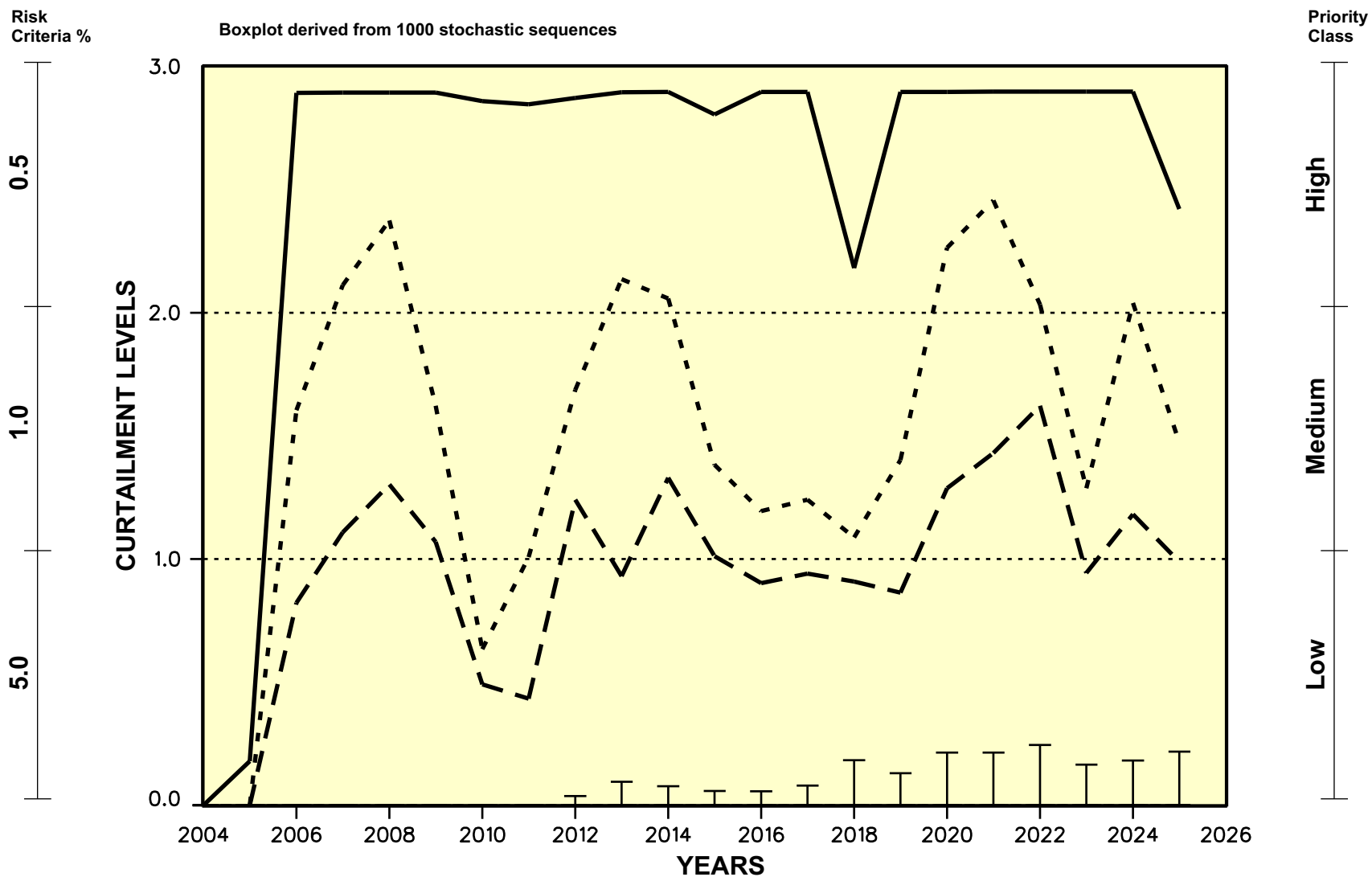
Priority  
Class



WRP\_P0076\_Graphics\_Fig48b.cdr



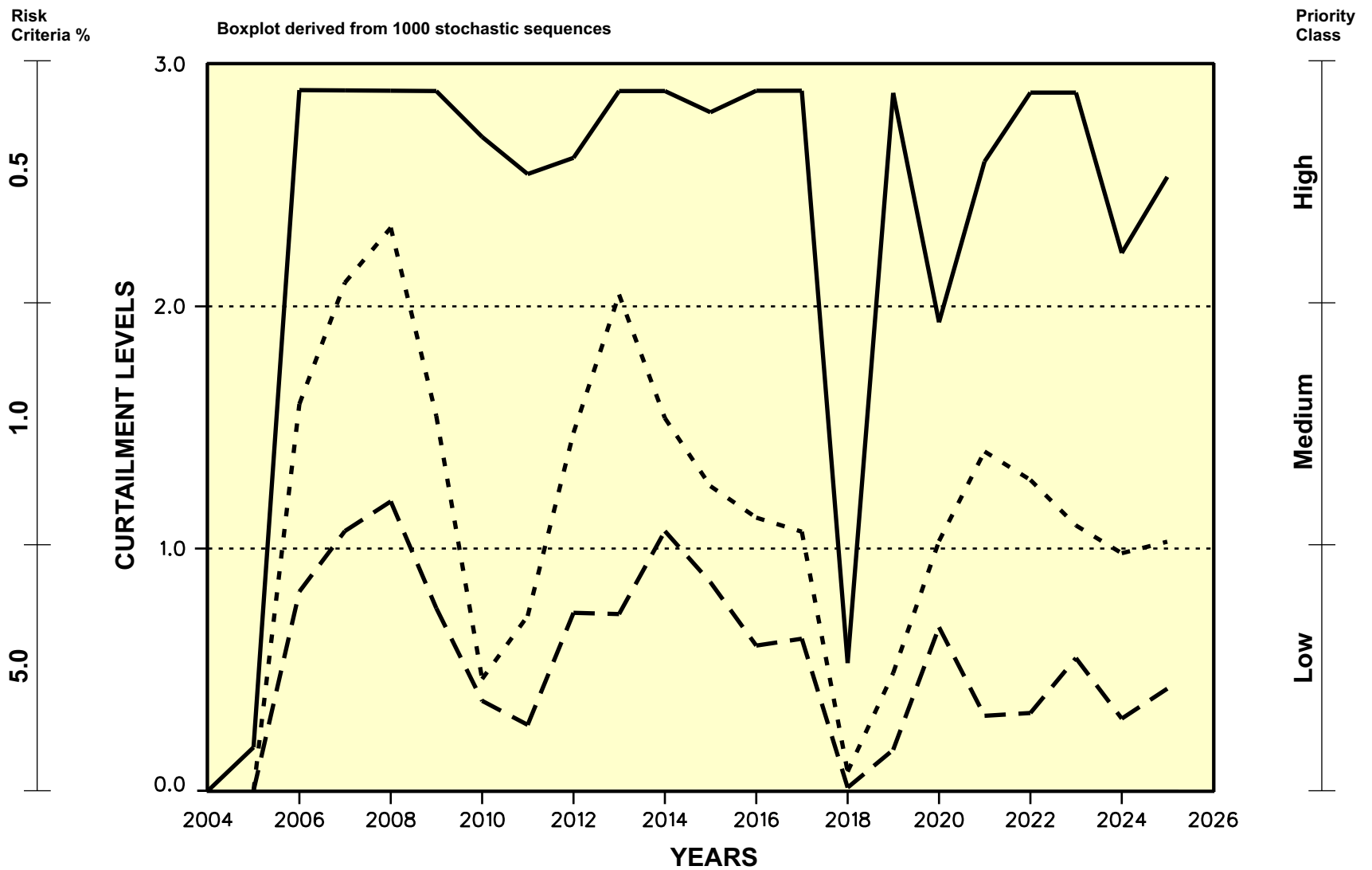
WRP\_P0076\_Graphics\_Fig48b.cdr



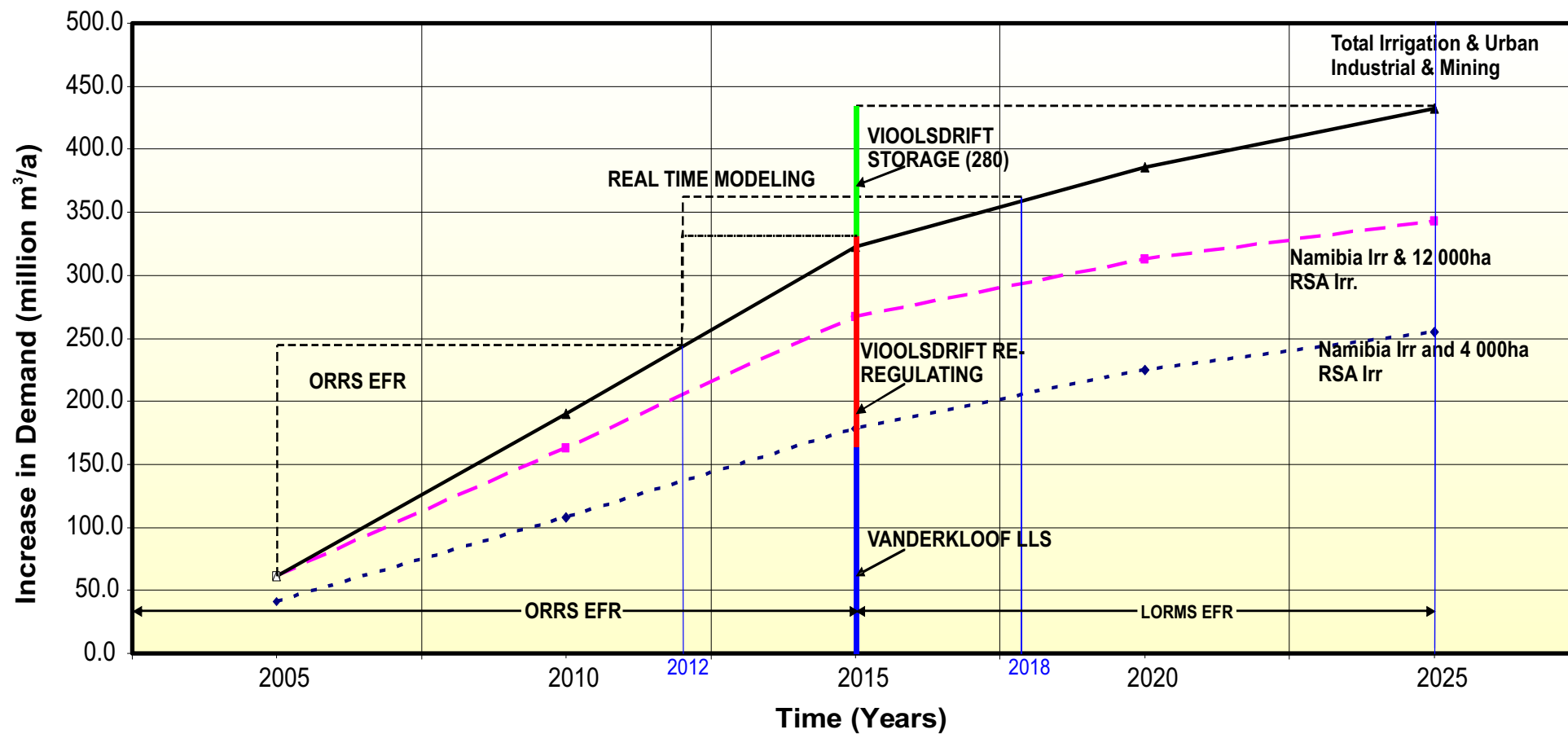
WRP\_P0076\_Graphics\_Fig54b.cdr



WRP\_P0076\_Graphics\_Fig54b.cdr



WRP\_P0076\_Graphics\_Fig54b.cdr



WRP\_P0076\_Graphics\_Fig58b.cdr



## **Appendix F**

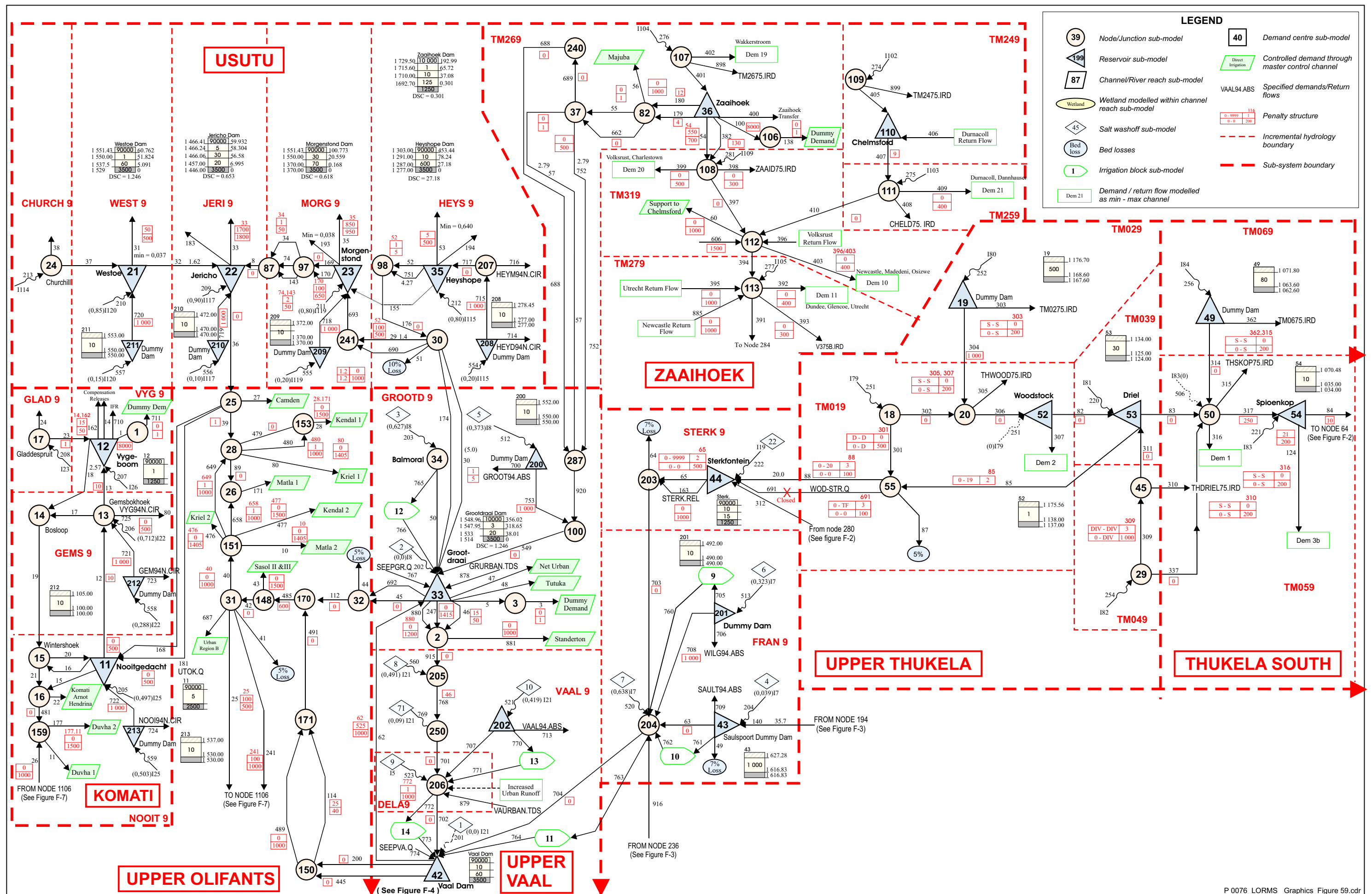
### **WRPM System Schematics**

#### **Description**

#### **Schematic no.**

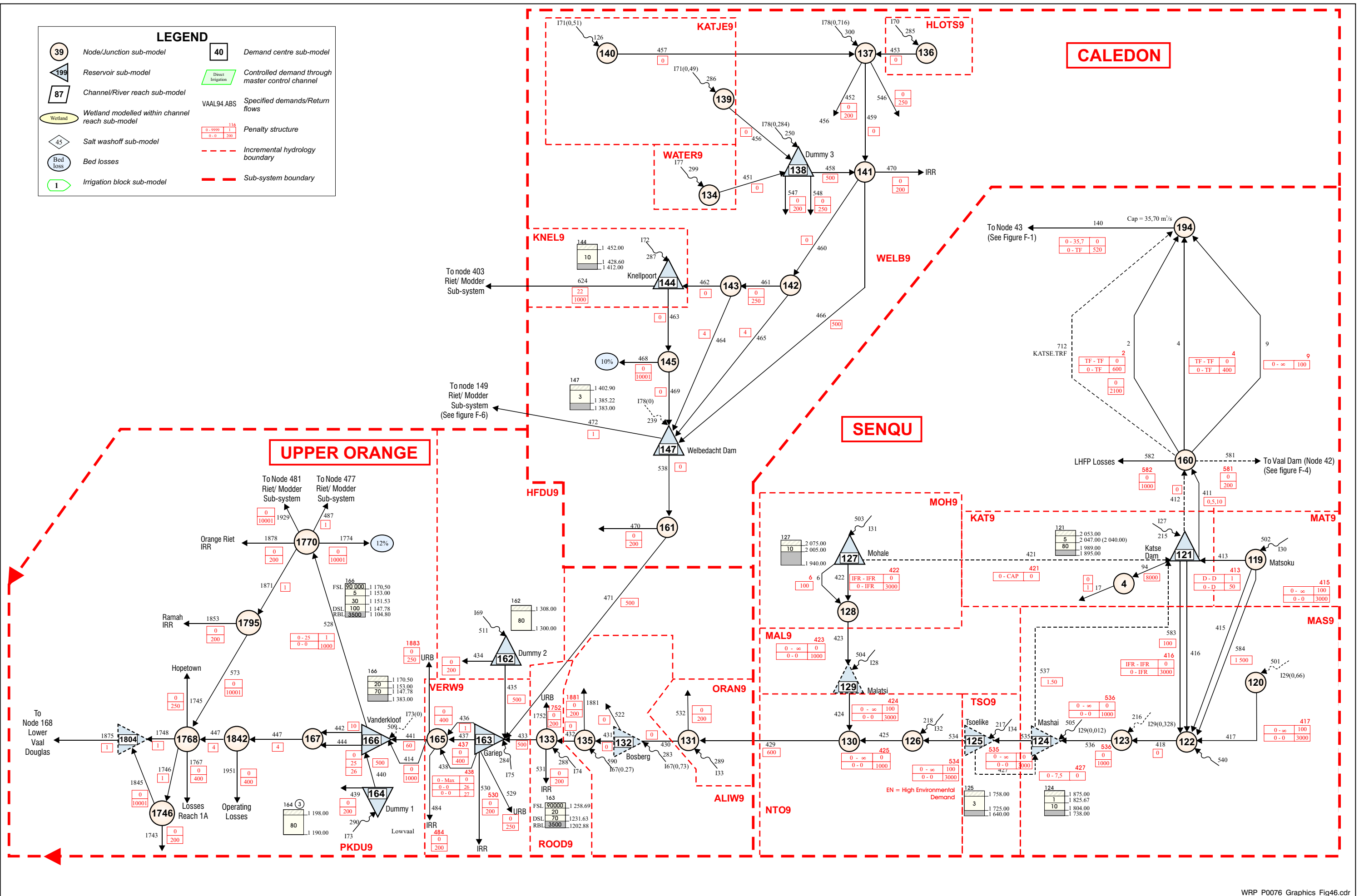
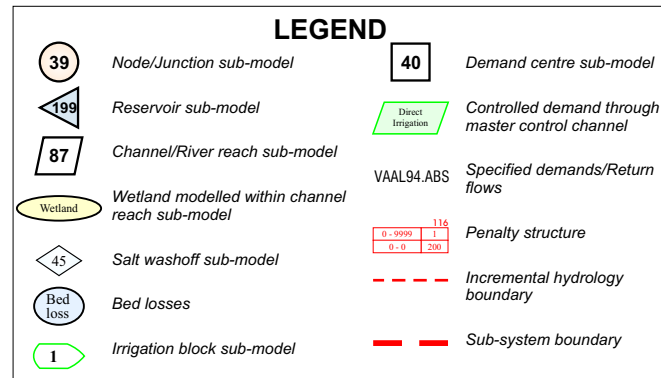
#### **Reference Scenario P3**

- |  |      |
|--|------|
| 1) Upper Vaal, Komati, Usutu, Thukela North, Upper Thukela South sub-systems | F-1  |
| 2) Thukela sub-system  | F-2  |
| 3) Senqu, Caledon and Upper Orange sub-systems                               | F-3  |
| 4) Vaal Dam to Vaal Barrage sub-system                                       | F-4  |
| 5) Middle Vaal sub-system  | F-5  |
| 6) Lower Vaal and Riet Modder sub-systems                                    | F-6  |
| 7) Witbank Dam Sub-system  | F-7  |
| 8) Middelburg Dam Sub-system   | F-8  |
| 9) Loskop Dam incremental sub-system   | F-9  |
| 10) Lower Orange sub-system  | F-10 |
| 11) Fish River sub-system  | F-11 |

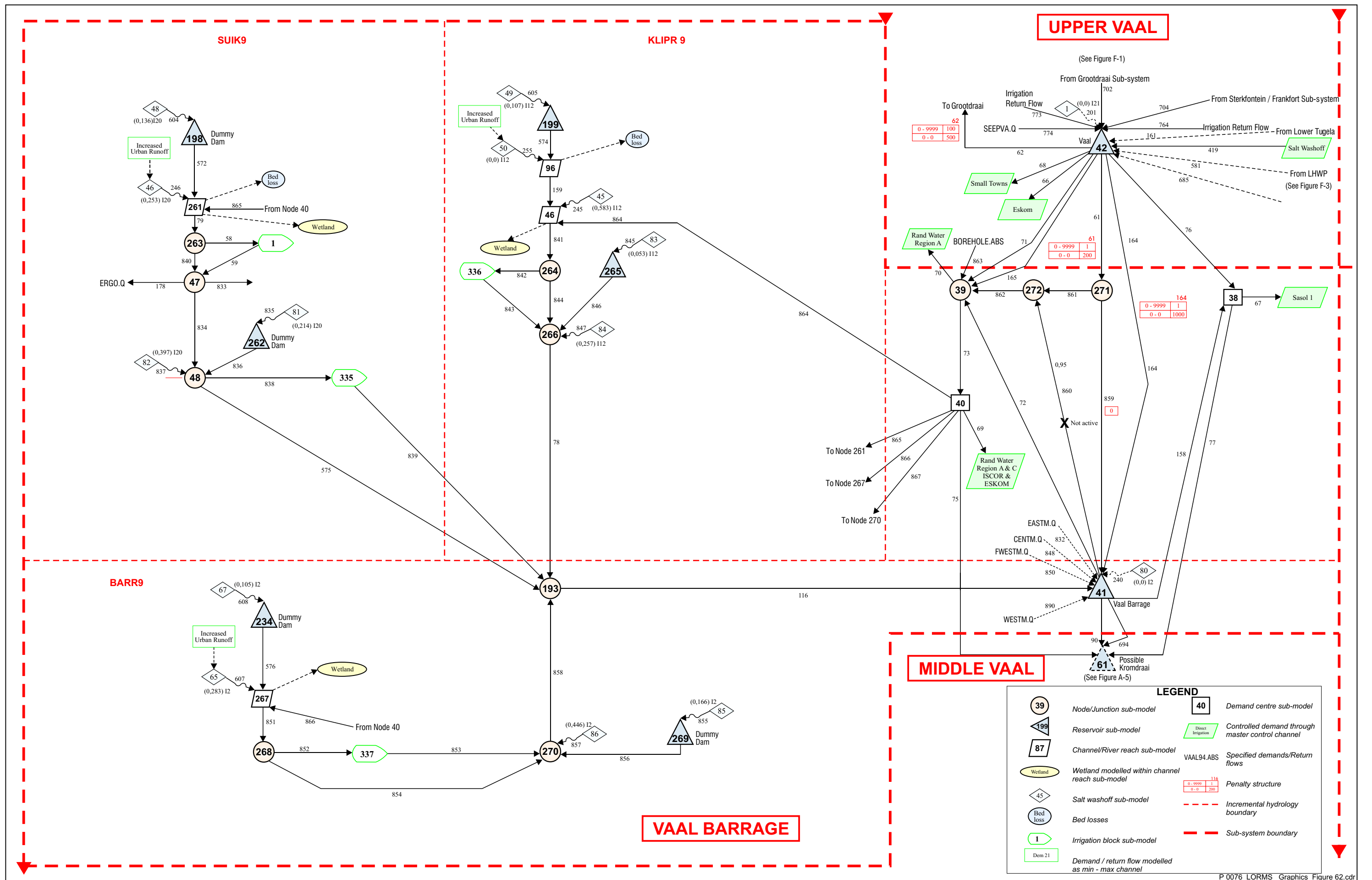


P 0076\_LORMS\_Graphics\_Figure 59.cdr

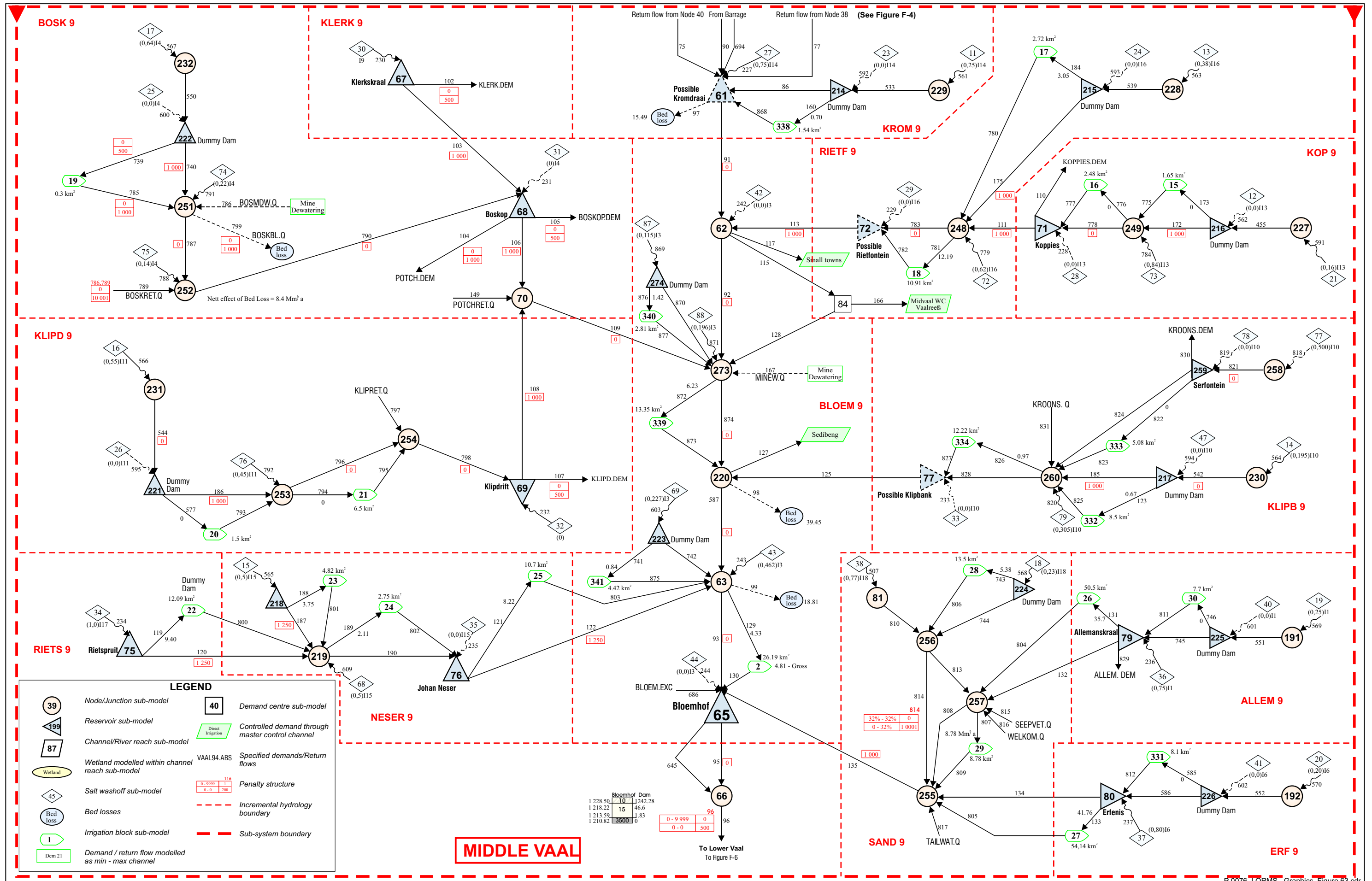




WRP\_P0076\_Graphics\_Fig46.cdr







P 0076 LORMS Graphics Figure 63.cdr

## LOWER VAAL SUBSYSTEM

## RIET/MODDER SUBSYSTEM

USWENTZD

BARBERS

DSWENZD

VHARTS9

DEHOOP9

SPITS9

C3H013

C9H007

## UPPER ORANGE SUBSYSTEM

### LEGEND



Node number



Reservoir node



Natural runoff



Salt Washoff



Penalty structure



Reservoir storage penalties



Total loss node



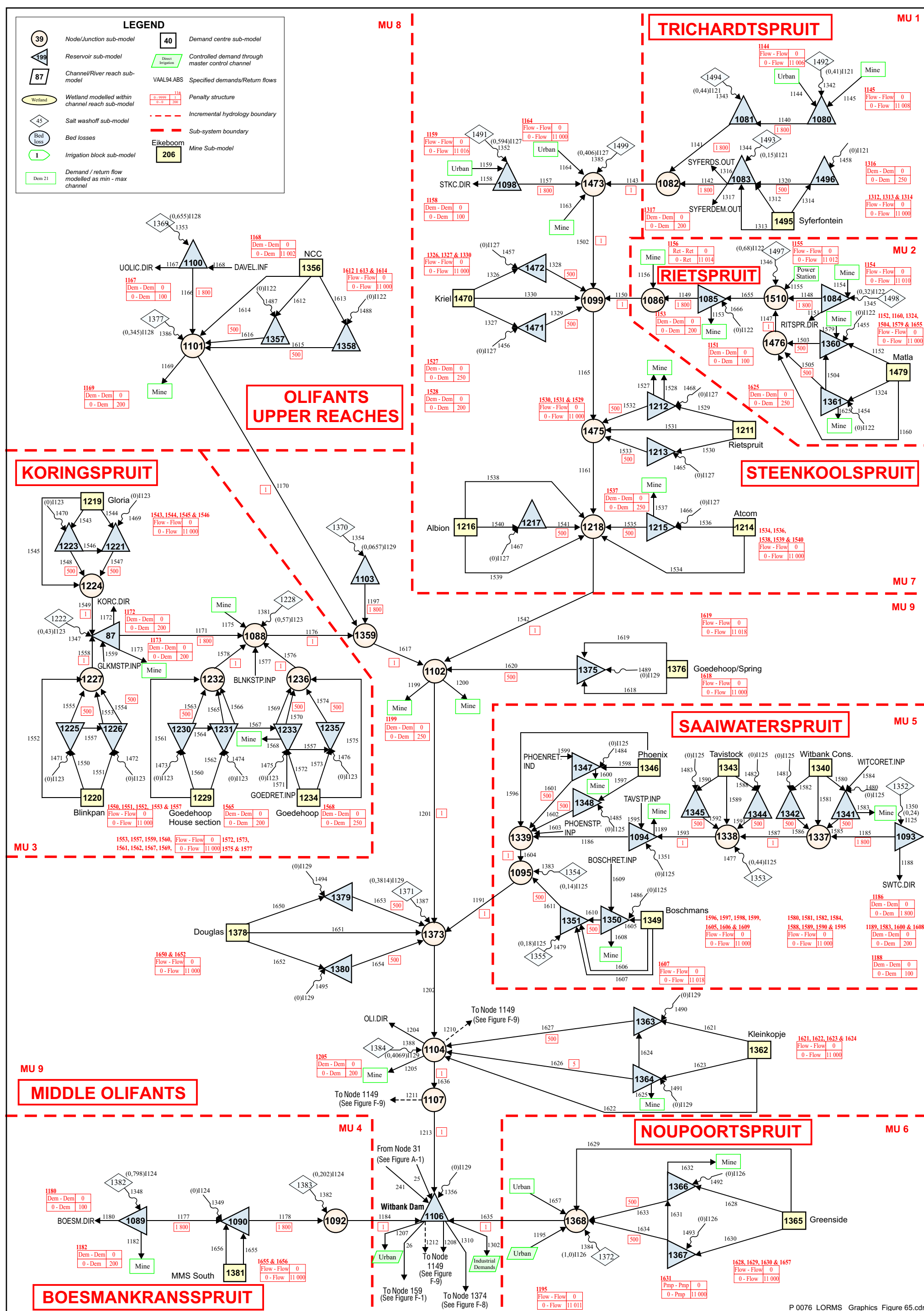
Irrigation Block



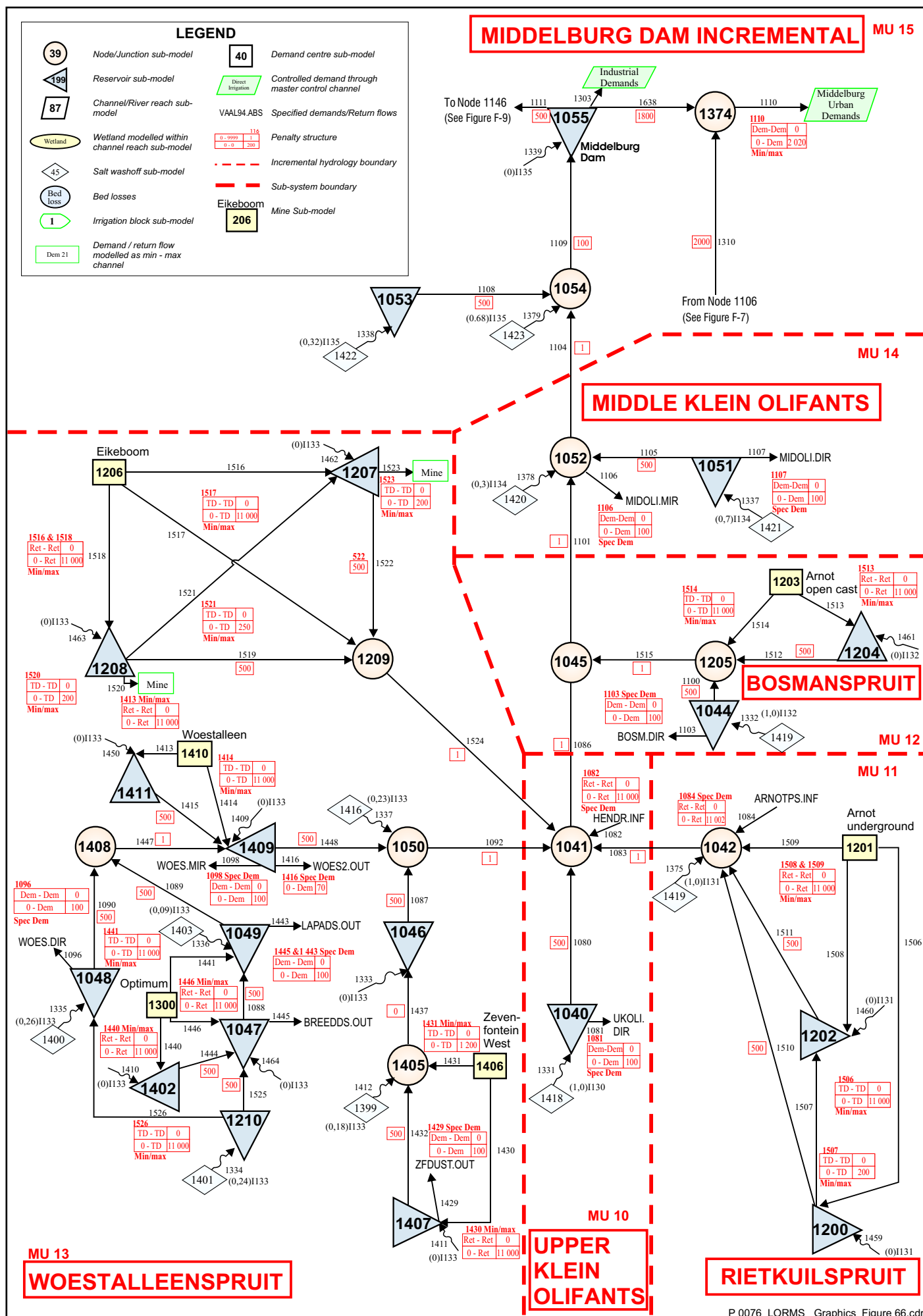
Incremental hydrology boundary



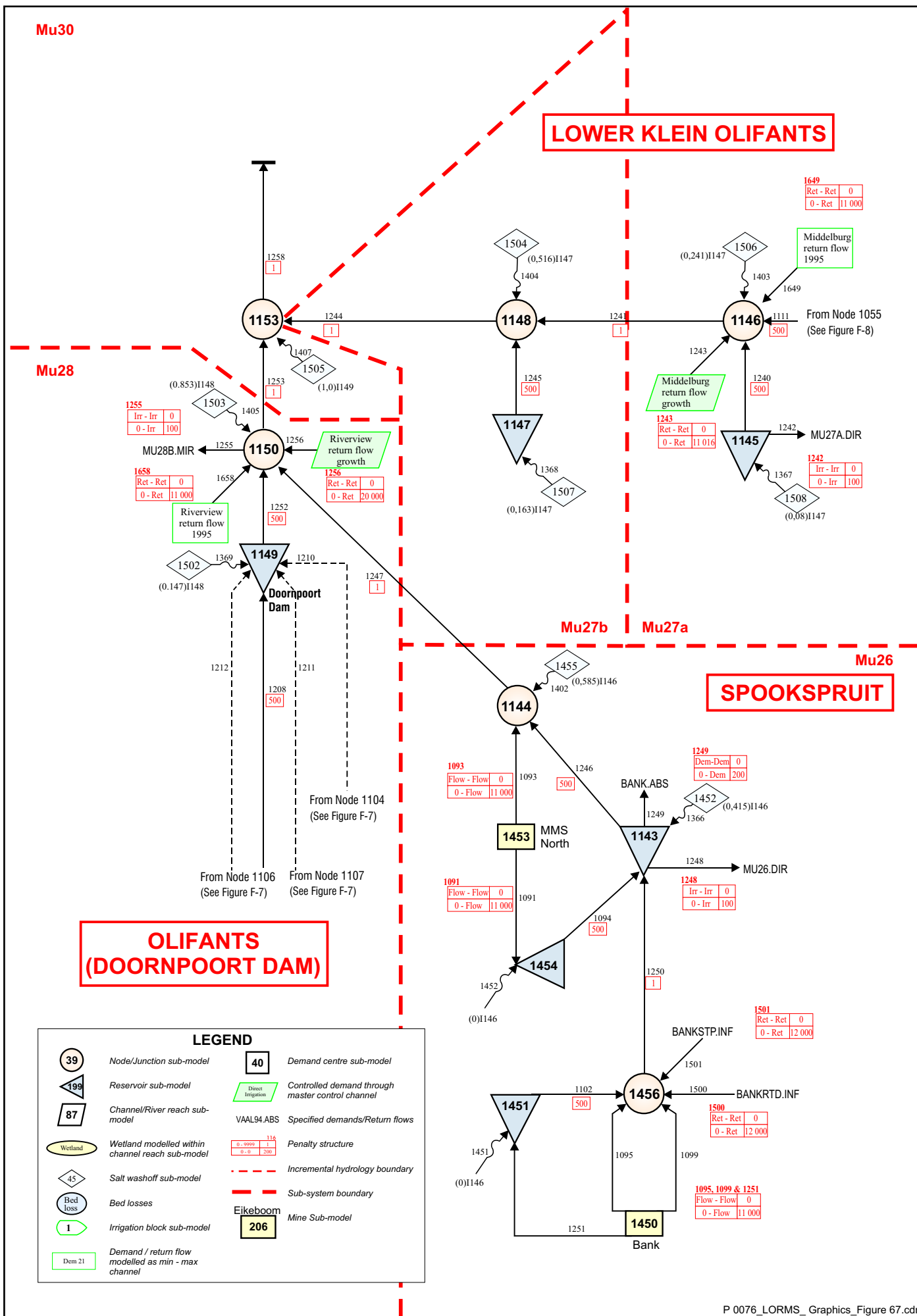
Sub-system boundary





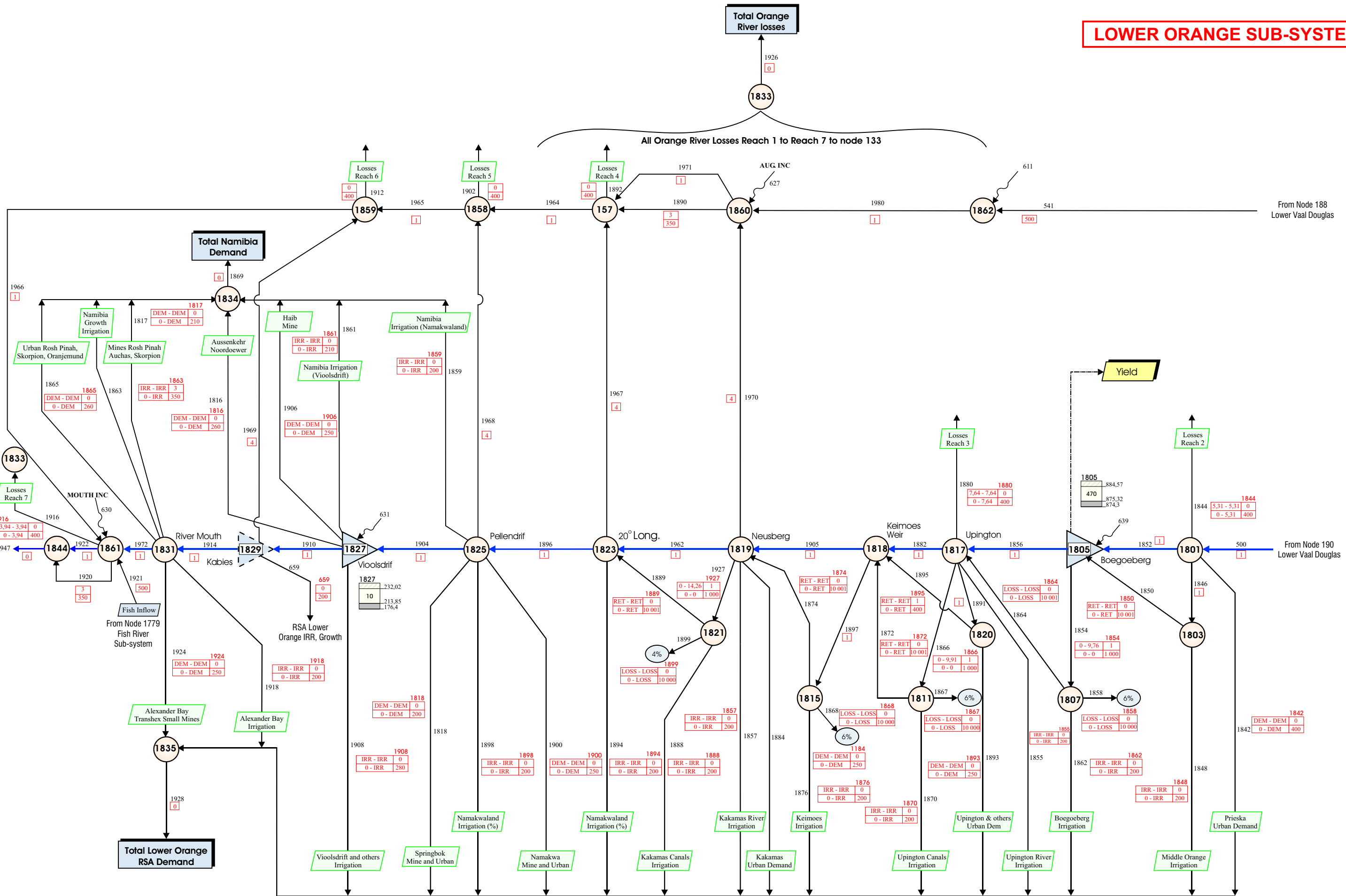


## Mu30



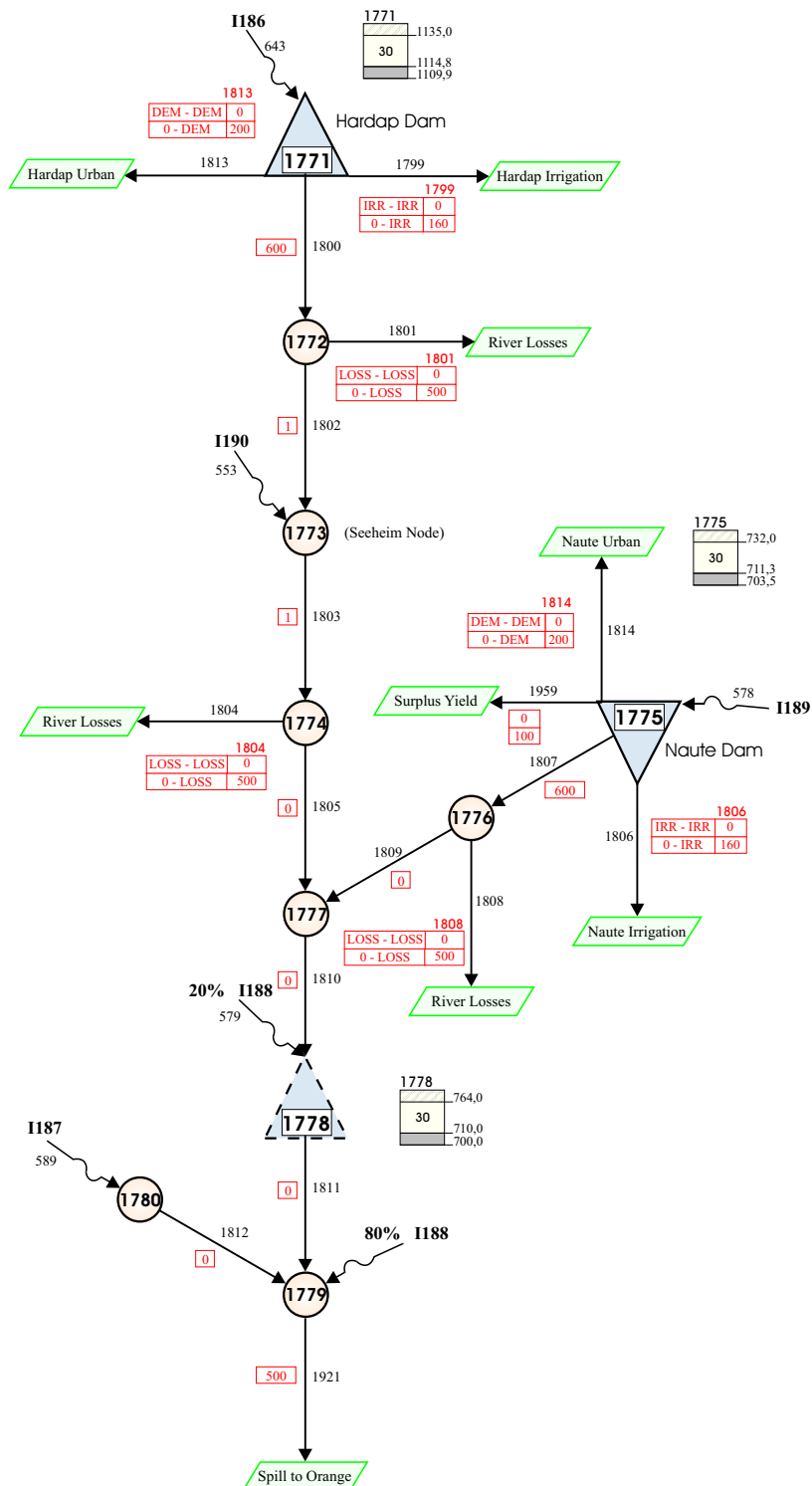
P 0076\_LORMS\_Graphics\_Figure 67.cdr

# LOWER ORANGE SUB-SYSTEM



WRP\_P0076\_Graphics\_Fig42.cdr

# NAMIBIA: FISH RIVER SUB-SYSTEM



WRP\_P0076\_Graphics\_Fig41.cdr