PART I
ANNEX

Annex 2.8.1-1 Mandatory List of Projects that require EIA Study (List A)

1	**Agriculture /Aquaculture Projects**
1.1	Agricultural drainage projects of more than 1 ha.
1.2	Irrigation schemes designed to serve more than 10 ha.
1.3	Land development for the purposes of agriculture on greater than a 20 ha land holding
1.4	Agricultural projects necessitating their resettlement of 20 or more families. Any change form one agricultural land use to another on greater than a 20 ha land holding.
1.5	Use of more than 1 tone of fertiliser per hectare per annum on greater than a 20 ha landholding except for lime applications.
1.6	Use of the following concentrations of pesticides on greater than a 5 ha holding: more than 5 l/ha of ultra low volume pesticides per application; or more than 1 l/ha of aerial application of pesticides; or more than 20kg/ha for each application of granular pesticides.
1.7	Construction of fish-farming or ornamental pond(s) where the capacity is greater than 100 cubic metres or where there is any direct discharge from a fishpond to a receiving water body.
1.8	Any proposal to introduce fish species in an area where they do not presently exist.
2	**Projects in the Food and Beverage Production Industry**
2.1	Construction of new abattoirs or slaughtering houses with a capacity of greater than 100 animals/day and expansions to existing abattoirs or slaughtering houses to a capacity of greater than 100 animals/day.
2.2	Construction of new canning and bottling operation with work space of greater than 5000 square metres or expansion to an existing canning or bottling operation to a work space of greater than 5000 square metres.
2.3	Construction of new breweries and distilleries with a production capacity of greater than 25,000 litres per day, or expansions to existing breweries or distilleries to a production capacity of greater than 25,000 litres per day
2.4	Construction of new sugar production operations or expansions to existing sugar production operations by greater than 10%.
2.5	Construction, or expansions to, tea or coffee processing industries
3	**Water Resources Development**
3.1	Construction, or expansion of, ground water utilisation projects where the utilization will be greater than 15 1/s or where the well is 60 m or deeper.
3.2	Construction of new water pipelines or canals longer than 1 km, or expansion to existing water pipelines or canals by longer than 1 km, where the cross-sectional area is greater than 20 square metres and the volume of water carried will be greater than 50 cubic metres per second.
3.3	Water pumping stations adjacent to lakes, rivers, and reservoirs that withdraw more than 2 cubic meters per second.
3.4	Drinking water supply schemes to serve a population of greater than 10,000 people, or expansions of existing schemes to serve such a population, or water reticulation networks with more than 10 kilometres of pipeline.
3.5	Area of greater than 100 ha, or expansions of existing reservoirs by greater than 500,0001 or greater than 100 ha.
3.6	Construction or expansion of dams with a height of 4.5 m or higher.
4	**Infrastructure Projects**
4.1	Construction of new sanitary sewerage works, or expansion of existing sanitary sewerage works, to serve a population of more than 5,000 people.
4.2	Construction of new storm sewerage works, or expansion of existing storm sewerage works, to drain an area of greater than 10 ha.
4.3	Any new sewerage outfall to a receiving water body or location of sewerage systems or septic tanks within 1 km of a water body.
4.4	Construction or expansion of septic tanks servicing more than 100 people or 20 homes or which receive more than 100 cubic metres per day of waste water.
4.5	Construction of new highways and feeder roads or expansion of existing highways and feeder roads
4.6	Construction of new airport and airstrips or expansion of existing and airstrips and their ancillary facilities
4.7	Construction of hospitals with a bed capacity of greater than 200 beds, or expansions of existing hospitals to a capacity of greater than 200 beds
4.8	Construction of new, or expansions to existing, railway lines.
4.9	Construction of new, or expansions to existing port or harbour facilities
4.10	Establishment or expansion of industrial estates
5	**Waste Management Projects**
5.1	Establishment, or expansion, of any of the following hazardous waste management facilities: incineration plant, off-site recovery plant, off-site waste disposal facility, off-site storage facility, landfill site
5.2	Establishment, or expansion, of any of the following municipal solid waste management facilities serving a population of greater than 1,000 people: landfill site, incineration facility, composting facility, recovery/recycling facility, waste depots/transfer stations.
5.3	Establishment, or expansion of, on-site waste treatment facilities

Annex 2.8.1-1 Mandatory List of Projects that require EIA Study (List A) (cont'd.)

6	**Energy generation, transmission and storage projects**
6.1	Construction or expansion of electrical generating facilities designed to operate at greater than 4 MW or, in the case of hydro-electric generating facilities, where the total head is greater than 20 m or where there is a firm flow of 100 cubic metres per second
6.2	Construction of electrical transmission facilities operating at a voltage of 132 kV or greater
6.3	Construction or expansion of oil and gas pipelines longer than 1 km
6.4	Construction or expansion of storage facilities (excluding services station) for oil, gas, petrol or diesel located within 3 kilometres of commercial, industrial or residential areas and with a storage capacity of 500,000 litres or more
6.5	All activities associated with nuclear power development
7	**Industrial Projects**
7.1	Construction of, and expansions to, industries involving the use, manufacturing, handling storage; transport or disposal of hazardous or toxic chemicals as regulated under the hazardous chemicals regulation under the Environment Management Act
7.2	Construction of, or expansion to, any of the following industrial operations: tanneries, pulp and paper mills, lime plants, cement plants, all types of smelters, soap and detergent plants, fertiliser manufacturing operations
7.3	Construction of textile manufacturing operations (including carpet-making) which consume greater than 5,000 square metres of surface area, or expansions to existing textile manufacturing operations to a capacity of more than 5000 square metres
8	**Mining and Quarrying Projects**
8.1	All mining of minerals, expansions to mines, mining exploration activity, minerals prospecting activity, quarries, gravel pits and removal of sand or gravel from shore lines, except for those activities which have received a project specific exemption under subsection 26 (3) of the Environment Management Act signed by the Director for Environmental Affairs and co-signed by the Director of Mines
8.2	Explosives manufacturing
8.3	Extraction of top soil or the expansion of such an operation, when the operation or the expansion is greater than 0.5 ha or when the depth of a pit to burn bricks from the top soil is deeper than 3 m.
9	**Forestry Projects**
9.1	Establishment or expansion of logging operations covering an area of greater than 50ha.
9.2	Establishment of, or expansions to existing, logging operations on hill sides with a slope of greater than 10% covering an area of greater than 10 ha or any conversion of forested land with a slope of greater than 10% to another land use on greater than 10 ha
9.3	Establishment of logging or conversion of forested land to another land use within the catchment area of reservoirs
9.4	Establishment of forest plantations of greater than 50 ha
10	**Land Development, Housing and Human Settlement Projects**
10.1	Establishment of, or expansion to an existing; housing development of a size greater than 5 ha or where more than 500 people are intended to be housed
10.2	Resettlement programmes for 500 or more people or the creation of refugee camps intended to shelter 500 or more people.
10.3	Filling in water bodies for the purposes of land development where the surface area of gross fill deposit is greater than 50 ha
10.4	Land reclamation projects greater than 100 ha
11	**Remedial Flood and Erosion Control Projects**
11.1	Construction of breakwaters, seawalls, jetties, dikes and groynes of greater than 2 metres in height or 1 km in length to remedy shoreline erosion or flooding
11.2	Construction of dams or weirs with a height of greater than 2 metres, or which divert more than 20 cubic metres per second, or any bypass channels or channel realignments to remedy riverine erosion or flooding.
11.3	Shoreline stabilisation projects where the shoreline involved is greater than 50m
12	**Tourism Development Projects**
12.1	Construction of resort facilities and hotels with a capacity of more than 50 people, or expansions to existing facilities by a factor of greater than 50 people.
12.2	Construction of safari lodges and operations with a capacity of more than 50 people, or expansions to existing facilities by factor of greater than 50 people
12.3	Construction of marine facilities with more than 10 boat slips, or expansion of existing marine facilities by more than 10 boat slips
12.4	Development of tourism master plans which have several projects associated with them.

Annex 2.8.1-1 Mandatory List of Projects that require EIA Study (List A) (cont'd.)

13	**Projects in proximity to or which have the potential to affect:**
13.1	Areas of unique historical, cultural, scientific or geographical significance or which have received some kind of world heritage designation
13.2	National parks, game reserves and protected areas
13.3	Wetlands.
13.4	Water bodies
13.5	Flood zones
13.6	Major sources of drinking water, including communal wells
13.7	Cemeteries or ancestral shrines
13.8	Residential, school and hospital areas, as designed in local planning documents.
14	**Major Policy Reforms**
	For example:
14.1	Degazettement of Forestry Reserves
14.2	Changes to Zoning Plans
14.3	Proposed introduction of exotic species

Source: EIA Guidelines, 1997

Annex 2.8.1-2 List of Projects that may require EIA Study (List B)

1	Agriculture and aquaculture schemes
2	Drainage and irrigation projects
3	Forestry and logging schemes
4	Industrial projects
5	Infrastructure projects
6	Land development projects
7	Mining projects
8	Energy generation, transmission and use projects
9	Tourism projects
10	Waste treatment and disposal projects
11	Water supply projects
12	Health and population projects
13	Projects in areas protected under legislation
14	Projects in areas containing rare or endangered flora and fauna
15	Projects in areas containing unique or outstanding scenery
16	Projects in tribal habitats

Source: EIA Guidelines, 1997

Annex 2.8.1-3 Project Screening Criteria

(1) The project will not substantially use a natural resource in a way that pre-empts the use or potential use of that resource for any other purpose.
(2) Potential residual impacts on the environment are likely to be minor or little significance and easily mitigated.
(3) The type of project, its environmental impacts and measures for managing them are well understood in Malawi.
(4) Reliable means exists for ensuring that impact management measures can and will be adequately planned and implemented.
(5) The project will not displace significant number of people, families or communities.
(6) The project is not located in, and will not affect, any environmentally-sensitive areas such as:

- National parks
- Wet lands
- Productive agricultural land
- Important archaeological, historical and cultural sites
- Areas protected under legislation
- Areas containing rare or endangered flora or fauna
- Areas containing unique or outstanding scenery
- Mountains or developments on or near steep hill-slopes
- Dry tropical forests (e.g. Brachystegia woodlands)
- Development near Lake Malawi or its beaches
- Development providing important resources for vulnerable groups such as fishing communities along the lake-shore
- Development near high population concentrations or industrial activities where further development could create significant environmental problems
- Prime ground-water recharge areas of importance for surface run off of water

(7) The project will not result in and/or:

- Policy initiatives which may affect the environment such as changes in agricultural pricing subsidies or the tobacco liberalization
- Major changes in land tenure
- Changes in water use through irrigation, drainage promotion or dams, changes in fishing practices

(8) The project will not cause:

- Adverse socio-economic impact
- Land degradation
- Water pollution
- Air pollution
- Damage to wildlife and habitat
- Adverse impact on climate and hydrological cycle
- Creation of by-products, residual or waste materials which require handling and disposal in a manner that is not regulated by existing authorities

(9) The project will not cause significant public concern because of potential environmental changes. The following are guiding principles:

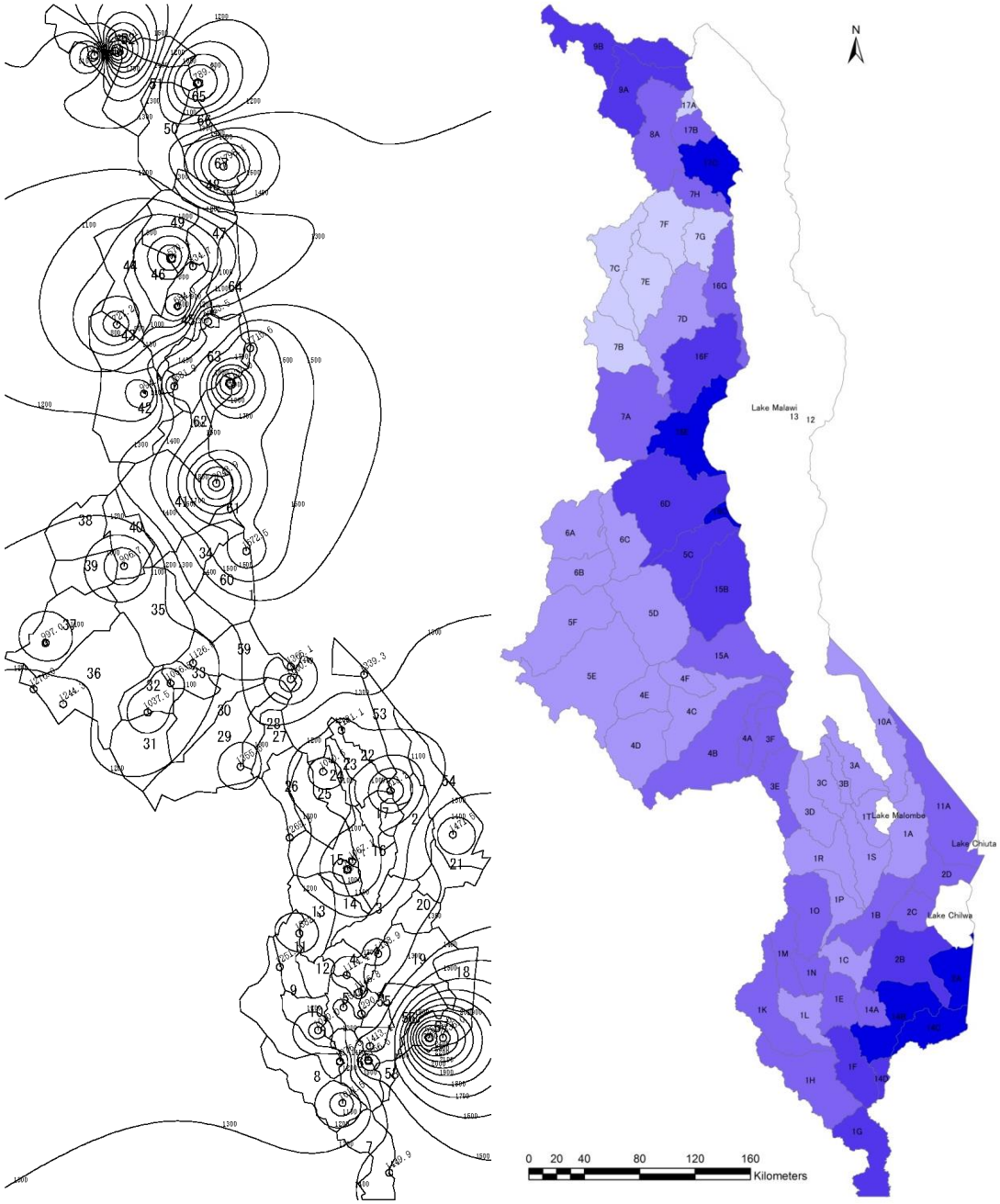
- Is the impact positive, mainly benign or harmful?
- What is the scale of the impact in terms of area affected, number of people or wildlife?
- What is the intensity of the impact?

- Will there be cumulative effects from the impact?
- Are the effects politically controversial?
- Have the main economic, ecological and social costs been quantified?
- Will the impact vary by social group or gender?
- Is there any international impact due to the proposed project?

(10) The project will not necessitate further development activity which is likely to have a significant impact on the environment

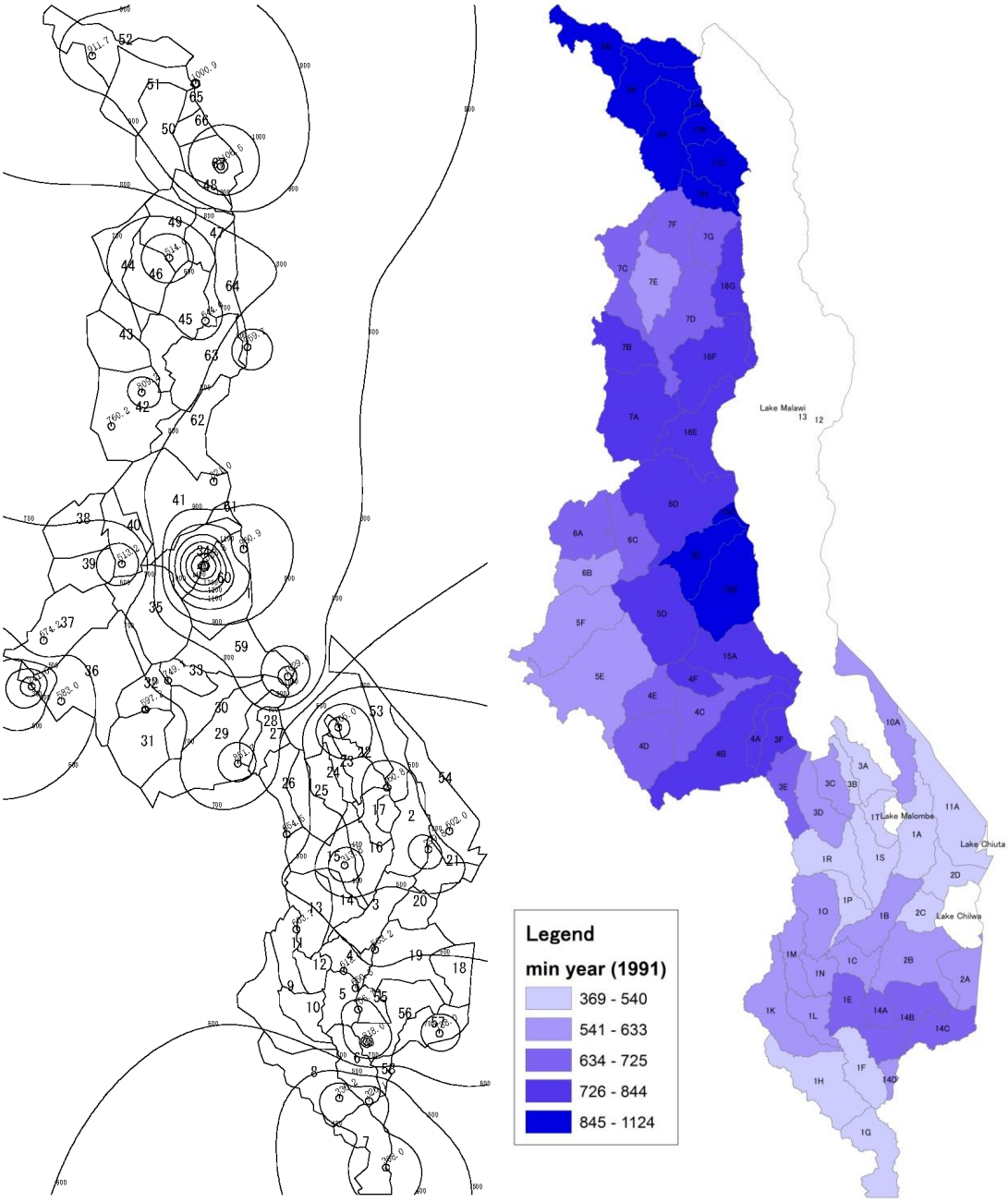
Source: EIA Guidelines, 1997

Annex 3.4.2-1 (1/3)



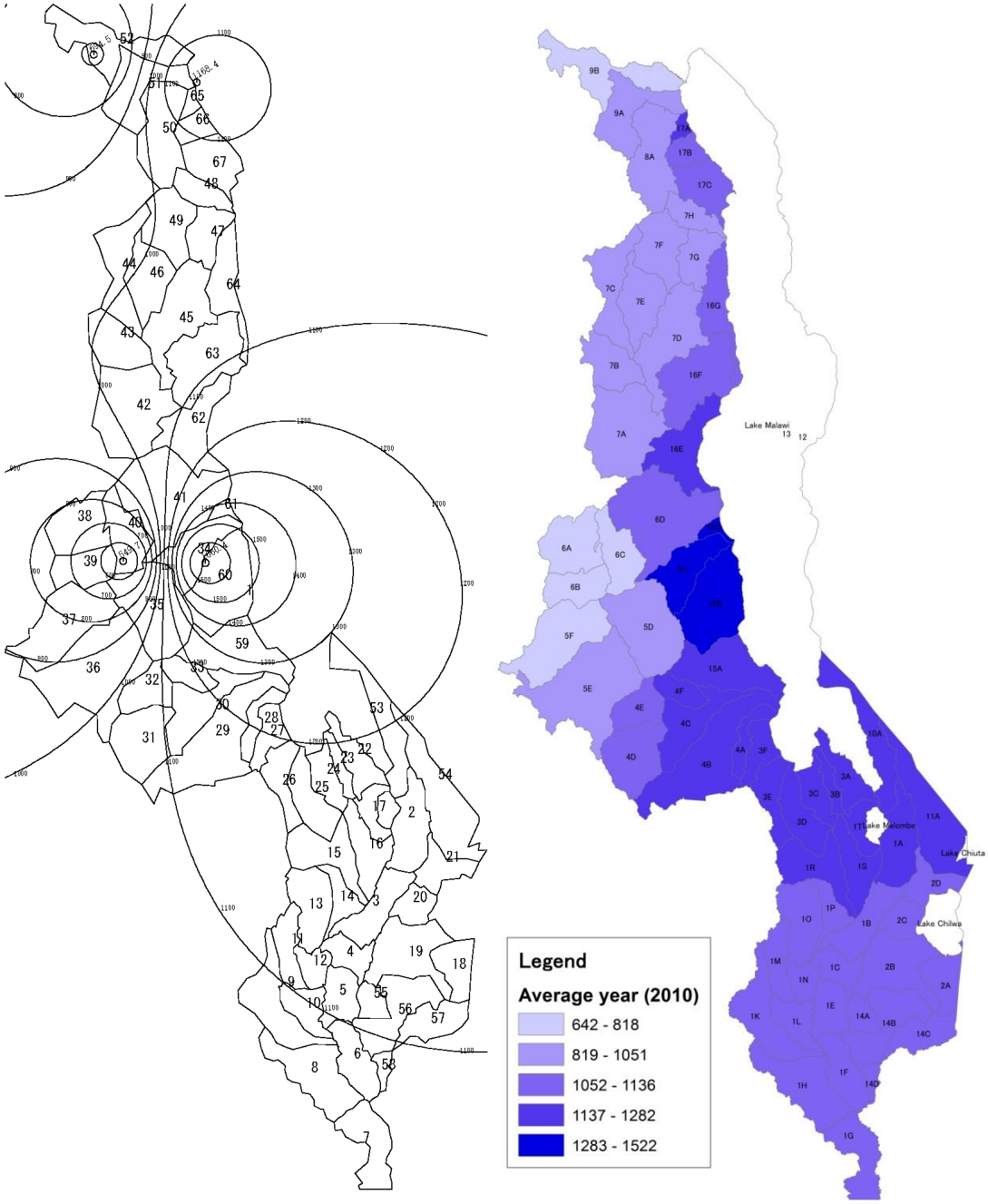
Isohyetal Map and Rainfall Map by WRU in Maximum Year (1988)

Annex 3.4.2-1 (2/3)



Isohyetal Map and Rainfall Map by WRU in Minimum Year (1991)

Annex 3.4.2-1 (3/3)



Isohyetal Map and Rainfall Map by WRU in Normal Year (2010)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
1B1	10201	SHIRE AT LIWONDE	A		1-Nov-89	31-Oct-10	1-Nov	31-Oct		6.31		153.666443	-2.986	1.3	6.31	732
1C1	10301	LIRANGWE AT LIRANGWE	A		4-Dec-79	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 10301	23.9659996	0.169	1.69	4.5	324
1C9	10309	LUNZU AT WHAYO	A		6-Dec-83	25-Jul-90	1-Jan	31-Dec		0.638		9.93013382	-0.116	2.8	0.638	2
1E1	10501	MWAMPHANZI AT MPOKONYOLA	A	Y	1-Nov-81	25-Jul-83	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 10501	18.9189091	0.004	1.847	1.5	40
1E1	10501	MWAMPHANZI AT MPOKONYOLA	B	Y	26-Jul-83	11-Sep-85	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 10501	11.311861	0.031	2.629	1.5	35
1E1	10501	MWAMPHANZI AT MPOKONYOLA	C	Y	12-Sep-85	19-Jan-87	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 10501	28.3470974	-0.393	1.912	1.5	34
1E1	10501	MWAMPHANZI AT MPOKONYOLA	D	Y	20-Jan-87	9-Feb-88	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 10501	25.9015675	-0.117	2.354	1.5	56
1E1	10501	MWAMPHANZI AT MPOKONYOLA	E	Y	10-Feb-88	10-Jul-89	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 10501	24.0799732	-0.038	1.921	1.5	50
1E1	10501	MWAMPHANZI AT MPOKONYOLA	F	Y	11-Jul-89	31-Oct-02	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 10501	1.21839154	0.823	2.8	1.5	13
1E2	10502	LIKHUBULA AT NAMIRA	A	Y	1-Nov-83	31-Oct-87	1-Jan	31-Dec		1.42		6.50484896	-0.041	1.482	1.42	10
1E2	10502	LIKHUBULA AT NAMIRA	B	Y	1-Nov-87	31-Oct-89	1-Jan	31-Dec		0.5		16.556057	0.011	1.503	0.5	6
1E2	10502	LIKHUBULA AT NAMIRA	C	Y	1-Nov-89	31-Dec-90	1-Jan	31-Dec		0.822		3.58697557	0.327	2.8	0.822	5
1E2	10502	LIKHUBULA AT NAMIRA	D	Y	1-Apr-91	30-Sep-91	1-Jan	31-Dec		1.393		25.6966896	-1.005	1.812	1.393	5
1E2	10502	LIKHUBULA AT NAMIRA	E	Y	1-Oct-91	31-Oct-92	1-Jan	31-Dec		1.341		24.9648838	-0.796	2.8	1.341	5
1E2	10502	LIKHUBULA AT NAMIRA	F	Y	1-Nov-92	31-Oct-93	1-Jan	31-Dec		1.624		21.0621529	-1.408	1.316	1.624	3
1E2	10502	LIKHUBULA AT NAMIRA	G	Y	1-Nov-93	31-Dec-94	1-Jan	31-Dec		1.79		12.3756266	-1.24	1.458	1.79	5
1E2	10502	LIKHUBULA AT NAMIRA	H	Y	1-May-98	31-Oct-98	1-Jan	31-Dec		2.05		76.5526199	-1.788	2.8	2.05	2
1E17	10517	NANKHUNDA AT ZINGWANGWA	A	Y	1-Nov-87	31-Jul-95	1-Jan	31-Dec		0.28	DO NOT MODIFY -UKA	0.62098795	-0.044	1.593	0.28	0
1E17	10517	NANKHUNDA AT ZINGWANGWA	B	Y	1-Aug-95	30-Nov-98	1-Jan	31-Dec		0.22		2.18320489	-0.019	2.8	0.22	0
1E19	10519	MUDI AT SUNNYSIDE	A	H	1-Nov-83	31-Oct-02	1-Jan	31-Dec		1.202		1.67656386	-0.37	2.8	0.916	0
1E19	10519	MUDI AT SUNNYSIDE	A	H	1-Nov-83	31-Oct-02	1-Jan	31-Dec		1.202		7.75603819	-0.6	2.8	1.202	2
1F1	10601	MAPELERA AT MAFUMBI	A	Y	1-Nov-86	31-Oct-88	1-Jan	31-Dec		1.42		0.56154639	0.208	2.8	0.624	0
1F1	10601	MAPELERA AT MAFUMBI	A	Y	1-Nov-86	31-Oct-88	1-Jan	31-Dec		1.42		5.71061707	-0.443	1.657	1.42	5
1F1	10601	MAPELERA AT MAFUMBI	B	Y	1-Nov-88	31-Dec-89	1-Jan	31-Dec		0.97		3.58415842	-0.334	1.3	0.97	2
1F1	10601	MAPELERA AT MAFUMBI	C	Y	1-Jan-90	31-Dec-91	1-Jan	31-Dec		0.723		2.61174464	-0.399	1.341	0.723	1
1F1	10601	MAPELERA AT MAFUMBI	D	Y	1-Jan-92	31-Oct-95	1-Jan	31-Dec		1.2		5.3627634	-0.363	2.472	1.2	3
1F1	10601	MAPELERA AT MAFUMBI	E	Y	1-Nov-96	31-Dec-98	1-Jan	31-Dec		4.818		0.07412209	1.121	2.015	4.818	3
1F1	10601	MAPELERA AT MAFUMBI	F	Y	1-Jan-99	28-Feb-01	1-Jan	31-Dec		1.31		26.216217	-0.824	2.791	1.31	3
1F2	10602	THANGADZI EAST AT GOOKE	A	Y	1-Nov-81	9-Feb-86	1-Jan	31-Dec		0.86		19.8092613	-0.53	2.134	0.86	2
1F2	10602	THANGADZI EAST AT GOOKE	B	Y	10-Feb-86	31-Oct-94	1-Jan	31-Dec		0.913		6.9611311	-0.506	1.55	0.913	2
1F2	10602	THANGADZI EAST AT GOOKE	C	Y	1-Nov-94	31-Oct-99	1-Jan	31-Dec		0.85	Difficult Fit	0.60072213	0.292	1.3	0.85	1
1F2	10602	THANGADZI EAST AT GOOKE	D	Y	1-Nov-99	31-May-01	1-Jan	31-Dec		0.609		13.5961123	-0.213	2.8	0.609	1
1F17	10617	LIVUNZU AT MALATA	A	Y	1-Nov-81	31-Oct-83	1-Jan	31-Dec		0.81	DO NOT MODIFY- UKA	15.1998863	-0.439	1.85	0.81	2

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Annex 3.4.4-1 (2/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
1F17	10617	LIVUNZU AT MALATA	B	Y	1-Nov-83	30-Jun-86	1-Jan	31-Dec		0.65		5.36914635	0.035	2.8	0.65	2
1F17	10617	LIVUNZU AT MALATA	C	Y	1-Jul-86	31-Oct-86	1-Jan	31-Dec		0.17		9.21476078	-0.071	1.3	0.17	0
1F17	10617	LIVUNZU AT MALATA	D	Y	1-Nov-86	31-Oct-87	1-Jan	31-Dec		0.6		2.21329165	0.172	2.8	0.6	1
1F17	10617	LIVUNZU AT MALATA	E	Y	1-Nov-87	31-Jul-88	1-Jan	31-Dec		0.491		0.40012148	0.507	2.8	0.491	0
1F17	10617	LIVUNZU AT MALATA	F	Y	1-Aug-88	31-Jan-89	1-Jan	31-Dec		0.342		0.01641843	1.931	2.483	0.342	0
1F17	10617	LIVUNZU AT MALATA	G	Y	1-Feb-89	30-Jun-90	1-Jan	31-Dec		0.33		1.70883238	0.412	2.8	0.33	1
1F17	10617	LIVUNZU AT MALATA	H	Y	1-Jul-90	30-Nov-91	1-Jan	31-Dec		0.28		6.55350256	0.068	2.8	0.28	0
1G1	10701	SHIRE AT CHIROMO	A	Y	1-Dec-83	31-Oct-84	1-Nov	31-Oct		4.931		438.199585	-1.479	1.3	4.931	2194
1G1	10701	SHIRE AT CHIROMO	B	Y	1-Apr-85	31-Oct-10	1-Nov	31-Oct		8.03		114.563133	-1.02	1.3	8.03	1440
1K1	11101	MWANZA AT TOMALI	A		1-Nov-84	31-Oct-93	1-Nov	31-Oct		0.87		127.985413	-0.34	2.8	0.87	22
1K2	11102	NG'ONA AT KALANGA	A	Y	1-Nov-81	31-Mar-85	1-Jan	31-Dec		0.558		0.95249212	-0.295	1.56	0.558	0
1K2	11102	NG'ONA AT KALANGA	B	Y	1-Apr-85	31-Oct-86	1-Jan	31-Dec		1.05		3.80918169	-0.204	2.8	1.05	2
1K2	11102	NG'ONA AT KALANGA	C	Y	1-Nov-86	31-Aug-90	1-Jan	31-Dec		0.72		4.66950226	-0.306	2.164	0.72	1
1K2	11102	NG'ONA AT KALANGA	D	Y	1-Sep-90	30-Apr-91	1-Jan	31-Dec		0.52		6.3848896	-0.431	1.529	0.52	0
1K2	11102	NG'ONA AT KALANGA	E	Y	1-Apr-93	31-Oct-97	1-Jan	31-Dec		0.69		5.41579866	-0.469	1.784	0.69	0
1K2	11102	NG'ONA AT KALANGA	F	Y	1-Nov-97	30-Nov-98	1-Jan	31-Dec		0.74		3.11808634	-0.404	2.195	0.74	0
1K2	11102	NG'ONA AT KALANGA	G	Y	1-Dec-98	31-Oct-02	1-Jan	31-Dec		0.65		1.52928221	-0.349	1.449	0.65	0
1K3	11103	MWANZA AT MWANZA OLD CUSTOMS	A	H	1-Nov-84	31-Oct-88	1-Jan	31-Dec		0.87		0.64174145	0.789	2.8	0.42	1
1K3	11103	MWANZA AT MWANZA OLD CUSTOMS	A	H	1-Nov-84	31-Oct-88	1-Jan	31-Dec		0.87		4.85900831	0.167	2.8	0.87	5
1K3	11103	MWANZA AT MWANZA OLD CUSTOMS	B	Y	1-Nov-88	31-Oct-89	1-Jan	31-Dec		1.101		12.7520676	-0.43	2.532	1.101	5
1K3	11103	MWANZA AT MWANZA OLD CUSTOMS	C	H	1-Nov-89	31-Oct-00	1-Jan	31-Dec		0.945		4.18629551	-0.072	2.8	0.466	0
1K3	11103	MWANZA AT MWANZA OLD CUSTOMS	C	H	1-Nov-89	31-Oct-00	1-Jan	31-Dec		0.945		8.44396019	-0.159	2.8	0.945	4
1K3	11103	MWANZA AT MWANZA OLD CUSTOMS	D	Y	1-Nov-00	31-May-02	1-Jan	31-Dec		0.96		10.9566746	-0.159	2.435	0.96	6
1K8	11108	NG'ONA AT GAGA	A	Y	1-Nov-85	31-Oct-87	1-Jan	31-Dec		0.81		10.0004845	-0.353	1.691	0.81	3
1K8	11108	NG'ONA AT GAGA	B	Y	1-Nov-87	31-Oct-92	1-Jan	31-Dec		0.77		4.73408365	-0.036	2.197	0.77	2
1K8	11108	NG'ONA AT GAGA	C	Y	1-Nov-92	31-Oct-97	1-Jan	31-Dec		0.8		11.6663284	-0.319	1.935	0.8	3
1L12	11212	SHIRE AT CHIKWAWA	A		1-Nov-81	31-Oct-10	1-Nov	31-Oct		3.901		152.430038	-0.025	1.494	3.901	1154
1M1	11301	MKURUMADZI AT MLONGOLA	A	Y	1-Nov-81	31-Oct-86	1-Jan	31-Dec		1.17		9.15292645	0.037	1.395	1.17	12
1M1	11301	MKURUMADZI AT MLONGOLA	B	Y	1-Nov-86	31-Jul-88	1-Jan	31-Dec		0.965		21.1082058	-0.306	1.686	0.965	10
1M1	11301	MKURUMADZI AT MLONGOLA	C	H	1-Aug-88	30-Jun-90	1-Jan	31-Dec		0.93		0.51332116	1.543	2.8	0.556	4
1M1	11301	MKURUMADZI AT MLONGOLA	C	H	1-Aug-88	30-Jun-90	1-Jan	31-Dec		0.93		10.0328341	0.001	1.533	0.93	9
1M1	11301	MKURUMADZI AT MLONGOLA	D	Y	1-Jul-90	31-Dec-92	1-Jan	31-Dec		2.8		14.478056	0.081	2.8	2.8	280
1M1	11301	MKURUMADZI AT MLONGOLA	E	H	1-Jan-93	31-Mar-96	1-Jan	31-Dec		0.86		3.08908153	-0.097	1.3	0.558	1

Column of Application Year or Water Level:
Y shows differences in the application year
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Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
1M1	11301	MKURUMADZI AT MLONGOLA	E	H	1-Jan-93	31-Mar-96	1-Jan	31-Dec		0.86		22.3618164	-0.214	2.8	0.86	7
1M1	11301	MKURUMADZI AT MLONGOLA	F	Y	1-Apr-96	31-Dec-96	1-Jan	31-Dec		1.065		14.2576361	-0.256	2.8	1.065	8
1M1	11301	MKURUMADZI AT MLONGOLA	G	Y	1-Jun-97	30-Nov-98	1-Jan	31-Dec		1.454		0.8816399	0.397	2.8	1.454	5
1M1	11301	MKURUMADZI AT MLONGOLA	H	Y	1-Dec-98	31-Oct-02	1-Jan	1-Jan		0.85		24.5753956	24.575	1.3	0.85	1649
1M4	11304	MKURUMADZI AT MAJETE CAMP	A	Y	1-Oct-81	31-Oct-95	1-Jan	31-Dec		0.93		4.47680283	0.357	2.8	0.93	9
1M4	11304	MKURUMADZI AT MAJETE CAMP	B	Y	1-Nov-95	31-Oct-02	1-Jan	31-Dec		1.1		6.0434742	-0.186	2.8	1.1	5
1P2	11602	SHIRE AT MATOPE	A		1-Jan-86	30-Oct-10	1-Jan	31-Dec		7.54		129.881805	-3.384	1.3	7.54	828
1P6	11606	SHIRE AT ZALEWA	A		13-Jan-88	31-Oct-01	1-Jan	31-Dec		7.5	Rating imported from HDATA DOS database, Station 11606	42.8830795	-2.65	2.013	7.5	1030
1R3	11803	RIVI-RIVI AT BALAKA	A	H	1-Oct-91	31-Oct-07	1-Nov	31-Oct		3.738		3.88639855	-0.12	1.3	0.398	1
1R3	11803	RIVI-RIVI AT BALAKA	A	H	1-Oct-91	31-Oct-07	1-Nov	31-Oct		3.738		48.4417152	-0.174	2.8	3.738	1701
1R18	11818	MPAMADZI AT GUMBU	A		1-Nov-90	31-Oct-08	1-Jan	31-Dec		2		1.20915079	-0.014	2.134	2	5
1R19	11819	MPIRA AT GOMEZA	A	Y	1-Nov-85	31-Oct-87	1-Jan	31-Dec		0.815	DO NOT MODIFY- UKA	5.10133076	-0.297	2.006	0.815	1
1R19	11819	MPIRA AT GOMEZA	B	Y	1-Nov-87	31-Aug-89	1-Jan	31-Dec		0.675	DO NOT MODIFY- UKA	3.57850647	-0.232	1.947	0.675	1
1R19	11819	MPIRA AT GOMEZA	C	Y	1-Sep-89	31-Oct-92	1-Jan	31-Dec		0.75		7.76517868	-0.436	2.156	0.75	1
1R19	11819	MPIRA AT GOMEZA	D	Y	1-Nov-92	30-Jun-94	1-Jan	31-Dec		0.898		7.02393866	-0.46	1.847	0.898	2
1R19	11819	MPIRA AT GOMEZA	E	Y	1-Jul-94	31-Oct-96	1-Jan	31-Dec		0.648		15.4561663	-0.397	2.8	0.648	0
1R19	11819	MPIRA AT GOMEZA	F	Y	1-Nov-96	31-Oct-10	1-Jan	31-Dec		0.805		6.21599436	-0.453	1.836	0.805	1
1R20	11820	RIVI-RIVI AT MANJAWIRA	A		1-Nov-85	30-Nov-87	1-Jan	31-Dec		0.672		12.1315041	0.18	2.8	0.672	8
1S2	11902	SHIRE AT MVERA POINT-MALOMBE OUT	A		1-Nov-45	31-Oct-02	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 11902	1	0	1	10	10
1S7	11907	NKASI AT KALEMBO	A	H	1-Nov-81	30-May-89	1-Jan	31-Dec		1.555		3.09055781	-0.011	2.8	0.436	0
1S7	11907	NKASI AT KALEMBO	A	H	1-Nov-81	30-May-89	1-Jan	31-Dec		1.555		21.3288059	-0.223	2.8	1.555	48
1S7	11907	NKASI AT KALEMBO	B	Y	1-Jun-89	31-Oct-90	1-Jan	31-Dec		0.765		3.27179098	-0.329	1.3	0.765	1
1S7	11907	NKASI AT KALEMBO	C	Y	1-Nov-90	30-Apr-91	1-Jan	31-Dec		1.25		2.79137802	-0.331	1.4	1.25	2
1S7	11907	NKASI AT KALEMBO	D	Y	1-May-91	31-Oct-91	1-Jan	31-Dec		0.67		7.1734581	-0.485	1.787	0.67	0
1S7	11907	NKASI AT KALEMBO	E	Y	1-Nov-91	31-Oct-94	1-Jan	31-Dec		2.356		3.27172542	-0.92	1.3	2.356	5
1S7	11907	NKASI AT KALEMBO	F	Y	1-Nov-95	31-Oct-10	1-Jan	31-Dec		4.285		1.60927176	-2.928	2.412	4.285	3
1T1	12001	SHIRE AT MANGOCHI	A		1-Nov-81	31-Oct-07	1-Nov	31-Oct		8.3		41.4538193	-3.379	1.817	8.3	750
2B6	20206	NAMADZI AT NAMADZI	A	Y	1-Nov-79	31-May-84	1-Jan	31-Dec		1.506		5.48274517	-0.231	2.196	1.506	9
2B6	20206	NAMADZI AT NAMADZI	B	Y	1-Jun-84	30-Jun-87	1-Jan	31-Dec		0.55		11.8652191	-0.167	2.8	0.55	1
2B6	20206	NAMADZI AT NAMADZI	C	Y	1-Jul-87	31-Oct-93	1-Jan	31-Dec		0.582		8.89493275	-0.207	2.491	0.582	1
2B6	20206	NAMADZI AT NAMADZI	D	Y	1-Nov-93	31-Oct-02	1-Jan	31-Dec		0.585		4.72454357	-0.085	2.8	0.585	1
2B8	20208	MULUNGUZI AT ZOMBA PLATEAU	A	Y	1-Jan-91	13-Jul-94	1-Jan	31-Dec		1.315		1.04658186	-0.002	2.182	1.315	2
2B8	20208	MULUNGUZI AT ZOMBA PLATEAU	B	Y	14-Jul-94	31-Dec-96	1-Jan	31-Dec		1.26		0.46505681	0.124	2.8	1.26	1
2B8	20208	MULUNGUZI AT ZOMBA PLATEAU	C	Y	1-Aug-97	31-Oct-98	1-Jan	31-Dec		0.51		7.458148	-0.23	1.3	0.51	1
2B10	20210	PHALOMBE AT PHALOMBI	A	Y	8-Nov-86	7-Apr-93	1-Nov	31-Oct		0.592		7.40816164	-0.015	2.8	0.592	2

Column of Application Year or Water Level:
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Annex 3.4.4-1 (4/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
2B10	20210	PHALOMBE AT PHALOMBI	B	Y	8-Apr-93	8-Mar-96	1-Nov	31-Oct		0.675		17.1424446	-0.402	2.529	0.675	1
2B10	20210	PHALOMBE AT PHALOMBI	C	Y	9-Mar-96	29-Nov-97	1-Nov	31-Oct		0.876		15.6388207	-0.362	1.911	0.876	4
2B11	20211	MULUNGUZI AT WILLIAM FALLS	A	Y	1-Nov-88	30-Sep-91	1-Jan	31-Dec		0.7		1.27943718	0.038	2.8	0.7	1
2B11	20211	MULUNGUZI AT WILLIAM FALLS	B	Y	1-Oct-91	30-Sep-95	1-Jan	31-Dec		0.759		11.6299143	-0.592	-0.592	0.759	34
2B11	20211	MULUNGUZI AT WILLIAM FALLS	C	Y	1-Nov-96	31-Oct-02	1-Jan	31-Dec		0.8		1.08750582	0.043	2.8	2.8	20
2B21	20221	LIKANGALA AT NKOKANGUWO	A	Y	1-Nov-81	30-Apr-83	1-Jan	31-Dec		0.885		5.59203243	-0.096	1.3	0.885	4
2B21	20221	LIKANGALA AT NKOKANGUWO	B	Y	1-May-83	31-Dec-83	1-Jan	31-Dec		0.657		34.3478127	-0.6	1.3	0.657	1
2B21	20221	LIKANGALA AT NKOKANGUWO	C	Y	1-Jan-84	31-Oct-84	1-Jan	31-Dec		0.949		14.1590862	-0.659	1.3	0.949	3
2B21	20221	LIKANGALA AT NKOKANGUWO	D	Y	1-Nov-84	30-Jun-85	1-Jan	31-Dec		1		0.29236534	1.237	2.8	1	3
2B21	20221	LIKANGALA AT NKOKANGUWO	E	Y	1-Jul-85	28-Feb-87	1-Jan	31-Dec		1.05		9.0524559	-0.232	2.8	1.05	5
2B21	20221	LIKANGALA AT NKOKANGUWO	F	Y	1-Mar-87	31-Oct-02	1-Jan	31-Dec		0.885		12.9941177	-0.128	1.737	0.885	8
2B22	20222	THONDWE AT JALI	A		1-Nov-85	31-Oct-10	1-Jan	31-Dec		0.785		22.8863983	-0.05	2.8	0.785	10
2B23	20223	MULUNGUZI AT UPPER DAMBO	A		13-Apr-89	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 20223	1.23214555	0.07	2.8	4.5	87
2B33	20233	NAMADZI AT MATITI	A	Y	1-Nov-82	31-Oct-85	1-Jan	31-Dec		1.96	DO NOT MODIFY- UKA	10.1416636	0.041	2.264	1.96	49
2B33	20233	NAMADZI AT MATITI	B	Y	1-Nov-85	31-Oct-91	1-Jan	31-Dec		0.699		24.5819702	-0.087	2.362	0.699	8
2B33	20233	NAMADZI AT MATITI	C	Y	1-Nov-91	31-Oct-94	1-Jan	31-Dec		0.375		16.8539448	0.056	2.8	0.375	2
2B33	20233	NAMADZI AT MATITI	D	Y	1-Nov-94	31-Oct-97	1-Jan	31-Dec		0.65		12.996562	-0.102	1.919	0.65	4
2B33	20233	NAMADZI AT MATITI	E	Y	1-Nov-97	31-Oct-00	1-Jan	31-Dec		0.53		8.92913818	-0.047	2.8	0.53	1
2B33	20233	NAMADZI AT MATITI	F	Y	1-Nov-00	31-Oct-10	1-Jan	31-Dec		0.685		17.0408592	-0.227	1.3	0.685	6
2C3	20303	DOMASI AT DOMASI T.T.C	A	Y	1-Nov-91	30-Sep-95	1-Jan	31-Dec		0.705		5.17661858	-0.025	1.492	0.705	3
2C3	20303	DOMASI AT DOMASI T.T.C	B	Y	1-Oct-95	31-Oct-97	1-Jan	31-Dec		0.355		0.47430253	-0.152	1.3	0.355	0
2C3	20303	DOMASI AT DOMASI T.T.C	C	Y	1-Nov-97	31-Oct-10	1-Jan	31-Dec		3		4.61941433	0.184	2.503	3	84
2C4	20304	DOMASI BY-PASS AT ZA-LL ROAD	A	H	1-Nov-88	31-Oct-91	1-Jan	31-Dec		0.195		9.01547623	-0.005	2.322	0.156	0
2C4	20304	DOMASI BY-PASS AT ZA-LL ROAD	A	H	1-Nov-88	31-Oct-91	1-Jan	31-Dec		0.195		0.04378125	1.909	1.3	0.195	0
2C4	20304	DOMASI BY-PASS AT ZA-LL ROAD	B	Y	1-Nov-91	31-Aug-92	1-Jan	31-Dec		0.379		0.02930561	0.927	2.8	0.379	0
2C4	20304	DOMASI BY-PASS AT ZA-LL ROAD	C	Y	1-Sep-92	31-Oct-94	1-Jan	31-Dec		0.45		0.79135334	-0.18	1.3	0.45	0
2C4	20304	DOMASI BY-PASS AT ZA-LL ROAD	D	Y	1-Nov-94	31-Aug-96	1-Jan	31-Dec		0.395		1.9799974	-0.006	2.8	0.395	0
2C4	20304	DOMASI BY-PASS AT ZA-LL ROAD	E	Y	1-Sep-96	31-Oct-97	1-Jan	31-Dec		0.415		0.62076068	-0.147	1.452	0.415	0
2C8	20308	NAISI AT MWANDAMA	A	Y	7-Jan-95	18-Aug-98	1-Jan	31-Dec		4.5		1.95453453	0.01	2.8	4.5	133
2C8	20308	NAISI AT MWANDAMA	B	Y	19-Aug-98	16-Aug-06	1-Jan	31-Dec		1.01		2.90103412	0.015	2.631	1.01	3

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Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
3A2	30102	LAKE MALAWI AT MONKEY-BAY	A		1-Nov-52	31-Oct-01	1-Jan	31-Dec		10.5	Rating imported from HYDATA DOS database, Station 30102	1	0	1	10.5	11
3D1	30401	MTEMANKHOKWE at NKUCHILA	A		1-Mar-94	31-Oct-01	1-Jan	31-Dec		10		4.41255045	-0.04	1.925	10	368
3E1	30501	NADZIPOKWE AT MUA MISSION	A	H	1-Nov-86	31-Oct-10	1-Jan	31-Dec		0.632	Do not modify- uka	2.34737444	-0.028	1.738	0.237	0
3E1	30501	NADZIPOKWE AT MUA MISSION	A	H	1-Nov-86	31-Oct-10	1-Jan	31-Dec		0.632	Do not modify- uka	13.0900288	-0.032	2.8	0.632	3
3E2	30502	NAMIKOKWE AT MUA-LIVULEZI F.R.	A		1-Nov-91	31-Oct-02	1-Jan	31-Dec		1.19		8.27434635	-0.473	2.089	1.19	4
3E3	30503	LIVULEZI AT KHWEKHWELELE	A	H	1-Nov-80	19-Nov-81	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 30503	2.58599997	-0.244	1.95	0.58	0
3E3	30503	LIVULEZI AT KHWEKHWELELE	A	H	1-Nov-80	19-Nov-81	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 3003	6	-0.305	2.33	6	346
3E3	30503	LIVULEZI AT KHWEKHWELELE	B	Y	20-Nov-81	10-Nov-86	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 30503	6.22200012	0.05	2.8	6	961
3E3	30503	LIVULEZI AT KHWEKHWELELE	C	Y	11-Nov-86	22-May-89	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 30503	7.89799976	-0.113	1.3	6	79
3E3	30503	LIVULEZI AT KHWEKHWELELE	D	Y	23-May-89	12-Jul-92	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 30503	9.20300007	-0.124	1.3	6	92
3E3	30503	LIVULEZI AT KHWEKHWELELE	E	Y	13-Jul-92	15-Jun-93	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 30503	99.3141632	-0.501	2.228	6	4430
3E3	30503	LIVULEZI AT KHWEKHWELELE	F	Y	16-Jun-93	31-Oct-05	1-Nov	31-Oct		6	Rating imported from HYDATA DOS database, Station 30503	0.90739065	-0.075	1.3	6	9
3E5	30505	NAMIKOKWE AT KAMPANIKIZA	A	Y	1-Nov-83	31-Oct-84	1-Jan	31-Dec		0.895		3.24414396	-0.139	2.712	0.895	2
3E5	30505	NAMIKOKWE AT KAMPANIKIZA	B	Y	1-Nov-86	31-Dec-88	1-Jan	31-Dec		0.58		5.86202002	-0.171	1.896	0.58	1
3E5	30505	NAMIKOKWE AT KAMPANIKIZA	C	Y	1-Jan-89	31-Dec-89	1-Jan	31-Dec		0.635		11.1714993	-0.177	2.8	0.635	1
3E5	30505	NAMIKOKWE AT KAMPANIKIZA	D	Y	1-Jan-90	30-Sep-92	1-Jan	31-Dec		0.71		7.3476119	-0.174	2.208	0.71	2
3E5	30505	NAMIKOKWE AT KAMPANIKIZA	E	Y	1-Oct-92	31-Oct-94	1-Jan	31-Dec		0.612		4.96677542	-0.241	1.729	0.612	1
3E5	30505	NAMIKOKWE AT KAMPANIKIZA	F	Y	1-Nov-94	31-Oct-02	1-Jan	31-Dec		0.721		10.1520081	-0.218	2.8	0.721	1
3E7	30507	NKHANDE AT THOBOLA	A	Y	1-Nov-82	31-Oct-92	1-Nov	31-Oct		0.322	DO NOT MODIFY- UKA	1.73761439	0.013	2.695	0.322	0
3E7	30507	NKHANDE AT THOBOLA	B	Y	1-Nov-92	31-Oct-02	1-Nov	31-Oct		0.38		1.25367272	0.008	2.323	0.38	0
3F2	30602	NAKAINGWA AT SONGWE	A		1-Nov-85	30-Nov-87	1-Jan	31-Dec		1.326		4.09474754	-0.51	2.8	1.326	2
3F3	30603	NADZIPULU AT MTAKATAKA	A		1-Nov-82	31-Oct-03	1-Nov	31-Oct		1.015		4.66838789	0.176	2.8	1.015	8
4A4	40104	MAKANDA AT EDEN ESTATE	A	Y	3-Jan-86	19-Apr-94	1-Nov	31-Oct		0.26		2.76927996	-0.018	2.581	0.26	0
4A4	40104	MAKANDA AT EDEN ESTATE	B	Y	20-Apr-94	20-Apr-08	1-Nov	31-Oct		0.235		3.01098895	-0.012	2.732	0.235	0

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Annex 3.4.4-1 (6/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
4B1	40201	LINTHIPE AT SALIMA RAILBRIDGE	A	Y	1-Jan-82	31-Oct-87	1-Jan	31-Dec		3.13		49.3718147	-1.781	1.724	3.13	83
4B1	40201	LINTHIPE AT SALIMA RAILBRIDGE	B	Y	1-Jun-89	31-Jul-90	1-Jan	31-Dec		3.22		69.2443695	-1.56	2.564	3.22	254
4B1	40201	LINTHIPE AT SALIMA RAILBRIDGE	C	Y	1-Aug-90	30-Apr-91	1-Jan	31-Dec		3.24		21.5230408	-1	2.8	3.24	206
4B1	40201	LINTHIPE AT SALIMA RAILBRIDGE	D	Y	1-May-91	31-Oct-93	1-Jan	31-Dec		3.45		63.3214951	-1.668	2.306	3.45	240
4B1	40201	LINTHIPE AT SALIMA RAILBRIDGE	E	Y	1-Apr-94	9-Nov-01	1-Jan	31-Dec		3.172		53.1893082	-1.444	2.8	3.172	246
4B3	40203	LINTHIPE AT LINTHIPE	A	Y	1-Nov-85	31-Oct-87	1-Nov	1-Oct		3.695	DO NOT MODIFY - UKA	4.80303955	-0.227	2.666	3.695	132
4B3	40203	LINTHIPE AT LINTHIPE	B	Y	1-Nov-87	31-Oct-92	1-Nov	1-Oct		2.764		4.49893713	-0.215	2.754	2.764	59
4B3	40203	LINTHIPE AT LINTHIPE	C	Y	1-Nov-92	30-Oct-10	1-Nov	1-Oct		2.35		4.61239576	-0.235	2.513	2.35	30
4B4	40204	DIAMPHWE AT CHILOWA NEW BRIDGE	A		1-Nov-86	31-Oct-10	1-Jan	31-Dec		2.755		15.6521788	-0.042	1.958	2.755	110
4B9	40209	LINTHIPE AT MALAPA	A	Y	1-Nov-83	31-Oct-85	1-Jan	31-Dec		0.815		28.3967686	0.063	2.8	0.815	20
4B9	40209	LINTHIPE AT MALAPA	B	Y	1-Nov-85	31-Oct-10	1-Jan	31-Dec		3.552		5.9595933	-0.391	2.8	3.552	150
4C2	40302	LILONGWE AT NKWENEMBELA	A	Y	1-Nov-83	31-Oct-84	1-Jan	31-Dec		2.098		4.78729057	-0.781	2.493	2.098	10
4C2	40302	LILONGWE AT NKWENEMBELA	B	Y	1-Nov-84	31-Oct-00	1-Jan	31-Dec		3.4		5.50724554	0.036	2.8	3.4	175
4C11	40311	NANJIRI AT KADZIZILA	A	Y	16-Sep-85	5-May-87	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 40311	7.65941525	-0.11	2.8	6	1098
4C11	40311	NANJIRI AT KADZIZILA	B	Y	6-May-87	30-Aug-93	1-Jan	31-Dec		1.115	Rating imported from HYDATA DOS database, Station 40311	8.54140186	-0.155	2.8	1.115	8
4C11	40311	NANJIRI AT KADZIZILA	C	Y	1-Sep-93	30-Oct-10	1-Jan	31-Dec		0.9		25.9420776	-0.119	2.796	0.9	13
4D4	40404	LILONGWE AT LILONGWE OLD TOWN	A	H	1-Nov-91	31-Oct-10	1-Nov	31-Oct		3.19		0.60420161	-0.05	1.41	0.321	0
4D4	40404	LILONGWE AT LILONGWE OLD TOWN	A	H	1-Nov-91	31-Oct-10	1-Nov	31-Oct		3.19		6.39905977	-0.098	2.8	3.19	151
4D6	40406	LILONGWE AT MALINGUNDE	A		1-Nov-82	31-Oct-01	1-Jan	31-Dec		2.815		13.2288189	-0.297	2.672	2.815	156
4D21	40421	KATETE AT KAWECHE	A	Y	1-Nov-81	31-Jan-84	1-Jan	31-Dec		1.45	DO NOT MODIFY- UKA	13.8153439	-0.889	2.076	1.45	4
4D21	40421	KATETE AT KAWECHE	B	Y	1-Feb-84	31-Oct-92	1-Jan	31-Dec		1.642		6.5675931	-0.804	2.8	1.642	4
4D21	40421	KATETE AT KAWECHE	C	Y	1-Nov-92	31-Oct-93	1-Jan	31-Dec		1.46		3.66654873	-0.543	2.8	1.46	3
4D21	40421	KATETE AT KAWECHE	D	Y	1-Nov-93	31-Oct-98	1-Jan	31-Dec		0.95		6.60048246	-0.552	1.327	0.95	2
4D24	40424	LILONGWE AT MASULA	A	Y	1-Nov-95	31-Dec-96	1-Jan	31-Dec		4.5	DO NOT MODIFY- UKA	2.85861826	0.332	2.8	4.5	235
4D24	40424	LILONGWE AT MASULA	B	Y	1-Jan-97	31-Oct-02	1-Jan	31-Dec		1.4		6.0964818	0.071	2.055	1.4	13
4D27	40427	LIKUNI AT CHIGWIRIZANG	A	Y	1-Nov-91	31-Oct-92	1-Jan	31-Dec		0.184		61.7859383	-0.055	1.8	0.184	2
4D27	40427	LIKUNI AT CHIGWIRIZANG	B	Y	1-Nov-92	31-Oct-93	1-Nov	31-Oct		0.34		14.8863678	0.143	2.626	0.34	2
4D27	40427	LIKUNI AT CHIGWIRIZANG	C	Y	1-Jun-94	31-Oct-94	1-Nov	31-Oct		0.07		43.9014626	0.067	2.8	0.07	0
4D27	40427	LIKUNI AT CHIGWIRIZANG	D	Y	1-Nov-94	31-Oct-98	1-Nov	31-Oct		0.155		49.0184555	-0.021	1.973	0.155	1
4D29	40429	CHAULONGWE AT MAMIN	A		1-Nov-96	31-Oct-02	1-Jan	31-Dec		0.441	O NOT MODIFY RAT- UKA	0.10943031	0.458	1.3	0.441	0
4E1	40501	LINGADZI AT M1 ROADBRIDGE	A		1-Nov-88	31-Oct-02	1-Jan	31-Dec		1.815		10.2725611	-0.109	2.571	1.815	41

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
4E2	40502	LINGADZI AT S11 ROADBRIDGE	A	Y	1-Nov-83	30-Jun-91	1-Nov	1-Oct		2.4		4.94097328	-0.77	1.8	2.4	12
4E2	40502	LINGADZI AT S11 ROADBRIDGE	B	Y	1-Jul-91	31-Oct-92	1-Jan	31-Dec		1.625		1.82990623	-0.286	1.731	1.625	3
4E2	40502	LINGADZI AT S11 ROADBRIDGE	C	Y	1-Nov-92	31-Oct-95	1-Jan	31-Dec		1.685		0.64790773	-0.187	1.66	1.685	1
4E2	40502	LINGADZI AT S11 ROADBRIDGE	D	Y	1-Nov-95	31-Oct-98	1-Jan	31-Dec		0.48		14.8145399	-0.044	2.161	0.48	2
4F6	40606	LUMBADZI AT SIMAKUMI	A	H	1-Nov-83	26-Oct-08	1-Jan	31-Dec		1.22		6.7705245	-0.003	2.8	0.34	0
4F6	40606	LUMBADZI AT SIMAKUMI	A	H	1-Nov-83	26-Oct-08	1-Jan	31-Dec		1.22		24.7461739	-0.128	2.8	1.22	32
5C1	50301	BUA AT S53 ROADBRIDGE	A	H	1-Nov-91	31-Oct-08	1-Jan	31-Dec		15		1.91040492	-1.06	1.3	1.599	1
5C1	50301	BUA AT S53 ROADBRIDGE	A	H	1-Nov-91	31-Oct-08	1-Jan	31-Dec		15		8.80512333	-1.164	2.8	15	13790
5D1	50401	BUA AT BUA DRIFT	A	H	1-Nov-85	31-Oct-02	1-Nov	31-Oct		6.16		13.5932894	-1.008	2.633	2.555	43
5D1	50401	BUA AT BUA DRIFT	A	H	1-Nov-85	31-Oct-02	1-Nov	31-Oct		6.16		20.9152832	-1.059	1.784	6.16	383
5D2	50402	BUA AT OLD BUA BRIDGE	A		1-Nov-91	31-Oct-02	1-Jan	31-Dec		2.64		3.02951455	-0.423	2.663	2.64	25
5D2_01	5E+06	BUA AT OLD BUA BRIDGE - 5D2(A)	A		3-Nov-80	31-Dec-00	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 5040201	3.12879395	0.081	2.041	7.5	195
5D2_02	5E+06	BUA AT M1 ROAD BRIDGE - 5D2(B)	A		11-Sep-86	3-Sep-90	1-Jan	31-Dec		6		9.63495636	-0.844	1.564	6	125
5D3	50403	MTITI AT MTITI	A	Y	1-Nov-87	1-Feb-89	1-Nov	31-Oct		1.07		11.0214768	-0.002	1.384	1.07	12
5D3	50403	MTITI AT MTITI	B	Y	2-Feb-89	3-Jun-90	1-Nov	31-Oct		1.07		31.1485786	-0.475	1.612	1.07	13
5D3	50403	MTITI AT MTITI	C	Y	4-Jun-90	6-May-91	1-Nov	31-Oct		1.07		23.1069813	-0.411	1.63	1.07	12
5D3	50403	MTITI AT MTITI	D	Y	3-Jun-91	21-Apr-94	1-Nov	31-Oct		1.07		3.13561916	-0.03	2.8	1.07	3
5D3	50403	MTITI AT MTITI	E	Y	22-Apr-94	31-May-02	1-Nov	31-Oct		1.07		0.588377	0.16	2.8	1.07	1
5E1	50501	NAMITETE AT NAMITETE TOWN	A	Y	1-Nov-85	31-Oct-87	1-Jan	31-Dec		1.93		3.52951431	-0.584	2.698	1.93	8
5E1	50501	NAMITETE AT NAMITETE TOWN	B	Y	1-Nov-87	31-Oct-88	1-Jan	31-Dec		1.245		4.35116434	-0.816	1.3	1.245	1
5E1	50501	NAMITETE AT NAMITETE TOWN	C	Y	1-Nov-88	31-Oct-90	1-Jan	31-Dec		1.39		5.0835247	-0.914	1.3	1.39	2
5E1	50501	NAMITETE AT NAMITETE TOWN	D	Y	1-Nov-90	31-Oct-91	1-Jan	31-Dec		1.828		5.25291014	-0.869	2.229	1.828	5
5E1	50501	NAMITETE AT NAMITETE TOWN	E	Y	1-Nov-91	31-Oct-92	1-Jan	31-Dec		1.465		5.35058212	-1.063	2.22	1.465	1
5E1	50501	NAMITETE AT NAMITETE TOWN	F	Y	1-Nov-92	31-Oct-93	1-Jan	31-Dec		1.64		4.83368731	-0.828	2.8	1.64	3
5E1	50501	NAMITETE AT NAMITETE TOWN	G	Y	1-Nov-93	31-Oct-96	1-Jan	31-Dec		1.135		11.0362711	-0.795	2.339	1.135	1
5E1	50501	NAMITETE AT NAMITETE TOWN	H	Y	1-Nov-97	31-Oct-98	1-Jan	31-Dec		2.11		5.31414413	-0.81	1.377	2.11	8
5E1	50501	NAMITETE AT NAMITETE TOWN	I	Y	1-Nov-98	31-Oct-10	1-Jan	31-Dec		1.35		10.3542528	-0.862	1.995	1.35	2
5E6	50506	BUA AT MCHINJI	A		1-Nov-81	31-Oct-02	1-Jan	31-Dec		0.85		5.76324177	-0.042	2.8	0.85	3
5F1	50601	RUSA AT KASELA	A	Y	1-Nov-80	19-Mar-81	1-Jan	31-Dec		5.328	Do not modify- Uka	0.77440488	-0.603	1.676	5.328	10
5F1	50601	RUSA AT KASELA	B	Y	20-Mar-81	30-Sep-81	1-Jan	31-Dec		4.45		1.85216713	-0.585	1.3	4.45	11
5F1	50601	RUSA AT KASELA	C	Y	1-Oct-81	30-Sep-82	1-Jan	31-Dec		3.517		4.60267639	-0.743	1.445	3.517	20

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Annex 3.4.4-1 (8/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
5F1	50601	RUSA AT KASELA	D	Y	1-Oct-82	31-Oct-84	1-Jan	31-Dec		3.12		0.28245997	-0.671	1.3	3.12	1
5F1	50601	RUSA AT KASELA	E	Y	1-Nov-85	30-Apr-86	1-Jan	31-Dec		5.49		0.76234257	0.053	2.8	5.49	92
5F1	50601	RUSA AT KASELA	F	Y	1-May-86	31-Oct-86	1-Jan	31-Dec		2.585		9.49152088	-0.964	1.343	2.585	18
5F1	50601	RUSA AT KASELA	G	Y	1-Nov-86	29-Feb-88	1-Jan	31-Dec		4.747		3.74772406	-0.914	1.3	4.747	21
5F1	50601	RUSA AT KASELA	H	H	1-Mar-88	31-Dec-91	1-Jan	31-Dec		5.2		8.89587021	-0.812	1.758	1.627	6
5F1	50601	RUSA AT KASELA	H	H	1-Mar-88	31-Dec-91	1-Jan	31-Dec		5.2		0.81529081	0.864	2.223	5.2	45
5F1	50601	RUSA AT KASELA	I	H	1-Jan-92	31-Dec-95	1-Jan	31-Dec		3.21		15.788064	-0.809	1.985	1.094	1
5F1	50601	RUSA AT KASELA	I	H	1-Jan-92	31-Dec-95	1-Jan	31-Dec		3.21		6.88336372	-0.816	1.3	3.21	21
5F1	50601	RUSA AT KASELA	J	Y	1-Jan-96	31-Oct-02	1-Jan	31-Dec		1.18		12.6107693	-0.979	1.659	1.18	1
5F2	50602	LIWELEZI AT MKANDA	A		1-Nov-80	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 50602	2.40316033	-0.261	1.926	4.5	39
5F3	50603	LIWELEZI AT MATUWAME	A		28-Aug-87	31-Oct-01	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 50603	2.30068445	0.081	1.49	10	72
6C1	60301	DWANGWA AT KHWENGWERE	A	Y	1-May-85	31-Oct-94	1-Nov	31-Oct		4.01	Do not modify rating - Uka	3.82516146	0.037	2.283	4.01	93
6C1	60301	DWANGWA AT KHWENGWERE	B	Y	1-Nov-94	31-Oct-10	1-Jan	31-Dec		3.62		2.5411799	-0.191	2.59	3.62	62
6C5	60305	MPASADZI AT M1 ROADBRIDGE	A	Y	1-Nov-80	31-Oct-81	1-Jan	31-Dec		0.8		12.0833263	-0.236	2.8	0.8	2
6C5	60305	MPASADZI AT M1 ROADBRIDGE	B	Y	1-Nov-81	31-Oct-85	1-Jan	31-Dec		0.469		7.26201153	-0.026	1.897	0.469	2
6C5	60305	MPASADZI AT M1 ROADBRIDGE	C	Y	1-Nov-85	31-Oct-90	1-Jan	31-Dec		1.08		9.4971571	0.084	2.782	1.08	14
6C5	60305	MPASADZI AT M1 ROADBRIDGE	D	Y	1-Nov-90	31-Oct-97	1-Jan	31-Dec		0.765		5.98070431	-0.071	2.8	0.765	2
6D1	60401	MILENJE AT M1 ROADBRIDGE	A	Y	1-Nov-83	31-Mar-85	1-Jan	31-Dec		0.71		3.45414352	-0.241	2.137	0.71	1
6D1	60401	MILENJE AT M1 ROADBRIDGE	B	Y	1-Apr-85	31-Mar-86	1-Jan	31-Dec		1.05		17.1324577	-0.435	2.8	1.05	4
6D1	60401	MILENJE AT M1 ROADBRIDGE	C	Y	1-Apr-86	30-Apr-87	1-Jan	31-Dec		0.876		11.7050772	-0.521	2.8	0.876	1
6D1	60401	MILENJE AT M1 ROADBRIDGE	D	Y	1-May-87	31-Oct-10	1-Jan	31-Dec		1.08		19.1216774	-0.51	2.8	1.08	4
6D5	60405	LUWELEZI AT MATUNDU	A		18-Nov-70	22-Nov-94	1-Jan	31-Dec		2.109		9.21763229	-0.11	2.577	2.109	55
6D7	60407	RUPACHE AT KAMENDE	A	Y	8-Jun-82	6-Dec-89	1-Jan	31-Dec		0.789		4.81923866	0.259	2.8	0.789	5
6D7	60407	RUPACHE AT KAMENDE	B	Y	7-Dec-89	19-Aug-08	1-Jan	31-Dec		1.01		9.82828999	-0.034	2.017	1.01	9
6D10	60410	DWANGWA AT S53 ROADBRIDGE (D/S)	A		1-May-82	31-Oct-10	1-Jan	31-Dec		2.21		61.134491	0.01	1.809	2.21	259
7A3	70103	SOUTH RUKURU AT CHIMSEWEZO	A	H	1-Nov-91	31-Oct-96	1-Jan	31-Dec		2.7		1.97209609	-0.446	1.757	0.992	1
7A3	70103	SOUTH RUKURU AT CHIMSEWEZO	A	H	1-Nov-91	31-Oct-96	1-Jan	31-Dec		2.7		2.64035177	-0.375	2.8	2.7	28
7A3	70103	SOUTH RUKURU AT CHIMSEWEZO	B	Y	1-Nov-96	30-Nov-02	1-Jan	31-Dec		2.173		3.18626571	-0.79	1.3	2.173	5
7A4	70104	MZIMBA AT MUWERU BULUKUTU	A	Y	1-Oct-91	31-Jan-93	1-Jan	31-Dec		0.87		10.3468819	-0.564	1.888	0.87	1

Column of Application Year or Water Level:
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Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
7A4	70104	MZIMBA AT MUWERU BULUKUTU	B	Y	1-Feb-93	31-Oct-93	1-Jan	31-Dec		0.279		3.48619962	0.03	1.3	0.279	1
7A4	70104	MZIMBA AT MUWERU BULUKUTU	C	Y	1-Nov-93	31-Oct-99	1-Jan	31-Dec		0.38		5.57203341	0.037	1.3	0.38	2
7A4	70104	MZIMBA AT MUWERU BULUKUTU	D	Y	1-Nov-99	31-Oct-02	1-Jan	31-Dec		0.74		4.67544746	0.176	2.04	0.74	4
7A11	70111	SOUTH RUKURU AT MAPANJIRA	A	Y	1-Nov-89	31-Oct-91	1-Jan	31-Dec		0.85		3.93566656	-0.358	2.8	0.85	1
7A11	70111	SOUTH RUKURU AT MAPANJIRA	B	Y	1-Nov-91	31-Oct-93	1-Jan	31-Dec		0.59		4.43738747	-0.369	2.8	0.59	0
7A11	70111	SOUTH RUKURU AT MAPANJIRA	C	Y	1-Nov-93	31-Oct-02	1-Jan	31-Dec		1.034	rat fit not so good	4.19313383	-0.384	2.8	1.034	1
7A12	70112	SOUTH RUKURU AT KAMANGADAZI	A		9-Oct-89	31-Dec-00	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 70112	7.57178879	-0.25	1.713	4.5	90
7D4	70404	KASITU AT EDUNDU	A	Y	1-Nov-84	30-Nov-85	1-Jan	1-Jan		0.99	Do not Modify- Uka (12	12.6756258	-0.298	1.598	0.99	7
7D4	70404	KASITU AT EDUNDU	B	Y	1-Dec-85	31-Mar-88	1-Jan	31-Dec		0.676		18.2490807	-0.119	2.064	0.676	5
7D4	70404	KASITU AT EDUNDU	C	Y	1-Apr-88	31-May-91	1-Jan	31-Dec		0.612		14.0845499	-0.012	1.897	0.612	5
7D4	70404	KASITU AT EDUNDU	D	Y	1-Jun-91	31-Jan-93	1-Jan	31-Dec		0.51		25.8562241	-0.024	2.8	0.51	3
7D4	70404	KASITU AT EDUNDU	E	Y	1-Aug-93	4-May-94	1-Jan	31-Dec		0.151		3.73235631	-0.033	1.3	0.151	0
7D7	70407	KASITU AT NJAKWA	A		1-Nov-84	31-Oct-89	1-Jan	31-Dec		5.71		4.95046043	-2.104	2.216	5.71	85
7D8	70408	LUNYANGWA AT ZOMBW	A	Y	1-Nov-84	31-Aug-93	1-Jan	31-Dec		1.218		13.2607222	-0.238	1.857	1.218	13
7D8	70408	LUNYANGWA AT ZOMBW	B	Y	1-Sep-93	30-Nov-97	1-Jan	31-Dec		0.891		11.0156822	-0.277	2.248	0.891	4
7D8	70408	LUNYANGWA AT ZOMBW	C	Y	1-Jan-98	31-Dec-02	1-Jan	31-Dec		1.205		5.00566816	-0.008	2.8	1.205	8
7D16	70416	LUNYANGWA AT MZUZU WATER WORKS	A	Y	1-Nov-81	31-Oct-87	1-Jan	31-Dec		1.784		0.88866872	-0.185	1.784	1.101	1
7D16	70416	LUNYANGWA AT MZUZU WATER WORKS	B	Y	1-Nov-99	31-Dec-02	1-Jan	31-Dec		1.165		0.33892819	-0.643	1.3	1.165	0
7D17	70417	LUSANGAZI AT KAMWEK(	A	H	1-Jan-86	30-Nov-94	1-Jan	31-Dec		0.8	DO Not Modify- Uka	1.11741281	0.002	1.3	0.238	0
7D17	70417	LUSANGAZI AT KAMWEK(	A	H	1-Jan-86	30-Nov-94	1-Jan	31-Dec		0.8	DO Not Modify- Uka	1.58333218	0.044	1.744	0.8	1
7D17	70417	LUSANGAZI AT KAMWEK(	B	Y	1-Dec-94	31-Jul-96	1-Jan	31-Dec		0.867		0.77952969	0.06	1.791	0.867	1
7D17	70417	LUSANGAZI AT KAMWEK(	C	Y	1-Aug-96	31-Oct-02	1-Jan	31-Dec		1.209		0.92690772	-0.17	1.597	1.209	1
7D18	70418	LUNYANGWA AT MOPHO JERE	A	Y	16-May-86	27-Jun-89	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 70418	6.63952637	-0.222	1.492	4.5	58
7D18	70418	LUNYANGWA AT MOPHO JERE	B	Y	28-Jun-89	31-Oct-01	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 70418	7.14840317	-0.354	1.432	10	184
7E2	70502	SOUTH RUKURU AT KAZUNI BRIDGE	B	Y	14-Nov-80	9-Dec-81	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 70502	294.355286	-0.22	1.749	7.5	9479
7E2	70502	SOUTH RUKURU AT KAZUNI BRIDGE	A	Y	10-Dec-81	3-Dec-84	1-Jan	31-Dec		3.62		3.36868715	-0.13	2.421	3.62	69
7E2	70502	SOUTH RUKURU AT KAZUNI BRIDGE	C	Y	4-Dec-84	31-Oct-01	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 70502	4.37753868	0.065	2.104	7.5	309
7F1	70601	RUNYINA AT CHIKWAWA	A		19-Jan-82	31-Oct-94	1-Nov	31-Oct		3		3.51120877	0.282	2.8	3	98
7F2	70602	SOUTH RUMPHI AT RUMPI	A		1-Nov-87	31-Oct-10	1-Jan	31-Dec		3		12.3593683	-0.214	1.596	3	63
7F3	70603	RUNYINA AT MJUMA	A		1-Nov-84	31-Oct-07	1-Nov	31-Oct		2.65		1.5757575	0.338	2.8	2.65	34
7G3	70703	MUHUJU AT MUHUJU	A	Y	1-Nov-84	30-Sep-94	1-Jan	31-Dec		0.66		8.30317307	-0.034	2.719	0.66	2
7G3	70703	MUHUJU AT MUHUJU	B	Y	1-Oct-94	30-Nov-95	1-Jan	31-Dec		0.444		15.7755718	-0.157	2.8	0.444	0

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Annex 3.4.4-1 (10/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
7G3	70703	MUHUJU AT MUHUJU	C	Y	1-Dec-95	31-Oct-11	1-Jan	31-Dec		0.525		14.3436203	-0.205	2.8	0.525	1
7G13	70713	LUVIRI AT NG'ONGA	A		1-Nov-84	31-Oct-02	1-Jan	31-Dec		0.77		4.69873953	-0.172	2.319	0.77	1
7G14	70714	SOUTH RUKURU AT PHWEZI	A		1-Nov-91	31-Oct-10	1-Nov	31-Oct		10		17.6828518	0.099	2.253	10	3237
7G18	70718	SOUTH RUKURU AT MLOWE	A	Y	1-Nov-85	31-Mar-91	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 70718	49.2000008	-0.575	2.16	10	6258
7G18	70718	SOUTH RUKURU AT MLOWE	B	Y	1-Apr-91	31-Oct-10	1-Jan	31-Dec		10		22.8538399	0.238	2.8	10	15401
7H1	70801	NORTH RUMPHI AT PHOKA COURT	A	H	1-Nov-86	31-Oct-02	1-Jan	31-Dec		0.84		2.27980566	0.649	2.8	0.489	3
7H1	70801	NORTH RUMPHI AT PHOKA COURT	A	H	1-Nov-86	31-Oct-02	1-Jan	31-Dec		0.84		13.2415609	0.06	2.334	0.84	10
7H2	70802	KAZIWIZIWI AT KAZIWIZIV	A		1-Nov-85	31-Oct-02	1-Jan	31-Dec		1.07		14.3214531	-0.322	2.8	1.07	6
7H3	70803	NORTH RUMPHI AT CHIWETA	A	H	1-Nov-91	31-Oct-02	1-Jan	31-Dec		1.48		19.9280186	-0.285	2.8	0.976	7
7H3	70803	NORTH RUMPHI AT CHIWETA	A	H	1-Nov-91	31-Oct-02	1-Jan	31-Oct		1.48		82.7769089	-0.651	2.188	1.48	55
8A5	80105	NORTH RUKURU AT MWAKIMEME	A	H	1-Apr-91	31-Oct-10	1-Nov	31-Oct		2.04	DO NOT MODIFY- UKA	6.90023184	0.384	2.8	0.442	4
8A5	80105	NORTH RUKURU AT MWAKIMEME	A	H	1-Apr-91	31-Oct-10	1-Nov	31-Oct		2.04	DO NOT MODIFY- UKA	19.2593632	0.067	2.316	2.04	108
8A8	80108	NORTH RUKURU AT ULED	A	Y	1-Jan-86	31-Jan-94	1-Nov	31-Oct		1.64		7.11926365	-0.094	2.8	1.64	24
8A8	80108	NORTH RUKURU AT ULED	B	Y	1-Feb-94	31-Oct-06	1-Nov	31-Oct		0.77		9.49684238	0.028	1.497	0.77	7
8A9	80109	MIBANGA AT ULEDI	A		21-Nov-89	16-Aug-94	1-Jan	31-Dec		0.62		1.23492384	-0.01	2.02	0.62	0
9A2	90102	LUFIRA AT NGERENGE	A		1-Nov-84	31-Oct-10	1-Jan	31-Dec		4.5	RATING BY CHAWEZI NGWIRA ON 27 MARC 2005	21.6977844	0.061	2.02	4.5	465
9A3	90103	CHAMBO AT CHIWONA	A		1-Nov-91	31-Dec-04	1-Jan	31-Dec		4		11.6639557	-0.033	2.705	4	485
9A4	90104	LUFIRA AT CHILANGA	A	H	1-Nov-85	31-Oct-94	1-Jan	31-Dec		2		7.65639162	-0.246	1.588	0.737	2
9A4	90104	LUFIRA AT CHILANGA	A	H	1-Nov-85	31-Oct-94	1-Jan	31-Dec		2		7.33506632	-0.084	2.55	2	39
9A4	90104	LUFIRA AT CHILANGA	B	Y	1-Nov-94	31-Oct-97	1-Jan	31-Dec		2		2.21540117	-0.335	1.3	2	4
9A5	90105	KALENJE AT CHIPWERA	A		1-Nov-91	31-Oct-10	1-Jan	31-Dec		0.962		16.0629673	-0.394	2.8	0.962	3
9A7	90107	LUFIRA AT MWAKASANGILA	A	Y	1-Jan-80	11-Dec-85	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 90107	92.0774612	-1.975	2.016	10	6131
9A7	90107	LUFIRA AT MWAKASANGI	B	Y	12-Dec-85	14-Nov-86	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 90107	58.3177223	-1.826	2.216	10	6134
9A7	90107	LUFIRA AT MWAKASANGI	C	Y	15-Nov-86	17-Jan-88	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 90107	19.214325	-1.634	2.616	10	4977
9A7	90107	LUFIRA AT MWAKASANGI	D	Y	18-Jan-88	28-Dec-88	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 90107	29.1887779	-1.67	2.034	10	2177
9A7	90107	LUFIRA AT MWAKASANGI	E	Y	29-Dec-88	7-Dec-89	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 90107	38.3432655	-1.63	1.973	4.5	307
9A7	90107	LUFIRA AT MWAKASANGI	F	Y	8-Dec-89	17-May-95	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 90107	31.7700291	-1.663	1.3	4.5	123
9A7	90107	LUFIRA AT MWAKASANGI	G	Y	18-May-95	29-Jul-96	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 90107	58.3364754	-0.076	2.8	4.5	3752

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
9A7	90107	LUFIRA AT MWAKASANGI	H	Y	30-Jul-96	31-Oct-08	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 90107	22.1736889	-0.112	1.3	4.5	152
9A8	90108	LUFIRA CANAL AT NGERENGE SCHEME	A		19-Sep-79	24-Oct-97	1-Jan	31-Dec		0.318		5.27574253	0.01	1.586	0.318	1
9A9	90109	SEKWA AT WENGA	A	Y	10-Dec-82	29-Nov-85	1-Nov	31-Oct		2.251		2.1770792	-0.308	1.326	2.251	5
9A9	90109	SEKWA AT WENGA	B	Y	30-Nov-85	5-Apr-87	1-Nov	31-Oct		4.5	Rating imported from HYDATA DOS database, Station 90109	2.74582362	-0.377	1.401	4.5	20
9A9	90109	SEKWA AT WENGA	C	Y	6-Apr-87	3-Nov-89	1-Nov	31-Oct		0.77		4.43597126	-0.359	1.69	0.77	1
9A9	90109	SEKWA AT WENGA	D	Y	5-Apr-90	9-Dec-92	1-Nov	31-Oct		0.485		13.870924	13.871	1.853	0.485	1932
9A9	90109	SEKWA AT WENGA	E	Y	10-Dec-92	10-Jun-94	1-Nov	31-Oct		0.385		2.40539408	-0.123	1.631	0.385	0
9A9	90109	SEKWA AT WENGA	F	Y	11-Jun-94	12-Feb-96	1-Nov	31-Oct		0.453		21.9949246	-0.182	2.583	0.453	1
9A9	90109	SEKWA AT WENGA	G	Y	13-Feb-96	27-May-00	1-Nov	31-Oct		0.45		12.2062006	-0.265	1.902	0.45	0
9A10	90110	MBALIZI AT CHILANGA (90110) - [Ratings]	A	Y	1-Nov-80	15-Jul-85	1-Nov	31-Oct		0.812		11.7435598	-0.01	2.317	0.812	7
9A10	90110	MBALIZI AT CHILANGA (90110) - [Ratings]	B	Y	19-Oct-85	2-Dec-86	1-Nov	31-Oct		1.01		13.2087116	-0.056	2.411	1.01	12
9A10	90110	MBALIZI AT CHILANGA (90110) - [Ratings]	C	Y	7-Jan-87	9-Dec-87	1-Nov	31-Oct		1.985		30.5262718	-0.205	1.985	0.629	6
9A10	90110	MBALIZI AT CHILANGA (90110) - [Ratings]	D	Y	3-Feb-88	5-Sep-89	1-Nov	31-Oct		0.676		13.3917656	-0.242	1.3	0.676	5
9B3	90203	KASEYE AT MWENEBWIB/	A		1-Nov-81	31-Oct-10	1-Jan	31-Dec		0.94		17.8307457	-0.186	2.8	0.94	8
9B4	90204	SONGWE AT ICHINGA	A	Y	1-Nov-81	30-Sep-92	1-Nov	31-Oct		0.97	DO NOT MODIFY UKA	27.0220833	-0.123	2.8	0.97	17
9B4	90204	SONGWE AT ICHINGA	B	Y	1-Oct-92	31-Oct-02	1-Nov	31-Oct		4.995		14.641634	-0.412	1.3	4.995	106
9B5	90205	HANGA AT DAVID KAMEME	A	Y	1-Nov-81	31-Aug-87	1-Nov	31-Oct			DO NOT MODIFY- UKA	3.2685132	-0.723	2.584	3.625	51
9B5	90205	HANGA AT DAVID KAMEME	B	Y	1-Sep-87	19-Aug-88	1-Nov	31-Oct		3.625		1.55997205	-0.715	2.778	3.625	30
9B5	90205	HANGA AT DAVID KAMEME	C	Y	20-Aug-88	5-Jun-89	1-Nov	31-Oct		3.625		1.80284035	-0.815	2.713	3.625	30
9B5	90205	HANGA AT DAVID KAMEME	D	Y	6-Jun-89	25-Feb-90	1-Nov	31-Oct		3.625		3.43711424	-1.008	2.418	3.625	35
9B5	90205	HANGA AT DAVID KAMEME	E	Y	26-Feb-90	11-Oct-93	1-Nov	31-Oct		3.625		3.72963643	-1.05	2.379	3.625	35
9B5	90205	HANGA AT DAVID KAMEME	F	Y	12-Oct-93	13-Jan-95	1-Nov	31-Oct		3.625		2.7561729	-1.163	2.667	3.625	30
9B5	90205	HANGA AT DAVID KAMEME	G	Y	14-Jan-95	27-May-02	1-Nov	31-Oct		3.625		2.90332127	-1.369	2.8	3.625	28
9B6	90206	SONGWE AT IPENZA	A	Y	1-Oct-81	14-Jun-84	1-Jan	31-Dec		0.592		5.28555059	-0.239	1.3	0.592	1
9B6	90206	SONGWE AT IPENZA	B	Y	15-Jun-84	7-Dec-88	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 90206	13.6724472	-0.293	2.513	4.5	506
9B6	90206	SONGWE AT IPENZA	C	Y	8-Dec-88	23-Apr-92	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 90206	21.8847961	-0.249	2.54	4.5	864
9B6	90206	SONGWE AT IPENZA	D	Y	24-Apr-92	2-Jul-97	1-Jan	31-Dec		0.832		15.21838	-0.098	2.8	0.832	6
9B6	90206	SONGWE AT IPENZA	E	Y	3-Jul-97	31-Oct-10	1-Jan	31-Dec		3		6.31294918	-0.144	1.3	3	25
9B7	90207	SONGWE AT MWANDENG/	A		1-Sep-85	31-Oct-10	1-Jan	31-Dec		3.642		11.8282299	-0.557	2.454	3.642	188

Column of Application Year or Water Level:
Y shows differences in the application year
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Annex 3.4.4-1 (12/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
11A6	110106	LUSANGWISI AT NAMBANDE ESTATE	A		1-Nov-85	31-Oct-02	1-Jan	31-Dec		0.81		7.31724405	-0.062	2.8	0.81	3
11A7	110107	MASONGOLA AT NAMWEI	A		1-Nov-88	31-Oct-10	1-Nov	31-Oct		3		2.49527264	-0.008	2.694	3	48
14A1	140101	NAMADZI AT HENDERSON ESTATE	A		1-Nov-84	31-Oct-01	1-Jan	31-Dec		0.49		15.0416107	-0.063	2.407	0.49	2
14A2	140102	LUCHENZA AT LUCHENZA	A	Y	14-Apr-92	7-Jan-93	1-Jan	31-Dec		0.55		28.1924	-0.217	1.797	0.55	4
14A2	140102	LUCHENZA AT LUCHENZA	B	Y	2-Apr-93	4-Sep-96	1-Jan	31-Dec		0.87		10.7295113	-0.028	2.8	0.87	7
14A2	140102	LUCHENZA AT LUCHENZA	C	Y	26-Aug-97	17-Jan-02	1-Jan	31-Dec		0.92		20.6843262	-0.345	2.8	0.92	4
14A3	140103	CHISOMBEZI AT MIDIMA ROAD	A		1-Nov-84	31-Oct-02	1-Jan	31-Dec		1.06		15.5643416	-0.243	2.476	1.06	9
14B1	140201	KWAKWASI AT M1 ROADBRIDGE	A	Y	4-Apr-81	5-May-82	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	6.49875879	-0.16	1.823	4.5	94
14B1	140201	KWAKWASI AT M1 ROADBRIDGE	A	Y	6-May-82	31-Oct-01	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	0.40993565	0.064	1.823	4.5	7
14B2	140202	THUCHILA AT CHONDE	A	Y	1-Nov-83	30-Nov-85	1-Jan	31-Dec		2.8		32.2429924	-1.201	2.8	1.876	11
14B2	140202	THUCHILA AT CHONDE	B	H	1-Jan-86	31-Mar-87	1-Jan	31-Dec		1.7		17.7659988	-1.003	1.3	1.7	11
14B2	140202	THUCHILA AT CHONDE	C	H	1-Jan-86	31-Mar-87	1-Jan	31-Dec		1.7		38.6320877	-1.173	1.771	2.6	73
14B2	140202	THUCHILA AT CHONDE	D	Y	1-Apr-87	30-Nov-89	1-Jan	31-Dec		1.7		8.98560047	-0.75	2.662	1.7	8
14B2	140202	THUCHILA AT CHONDE	E	Y	1-Jan-90	31-Mar-91	1-Jan	31-Dec		3.14		40.6995506	-0.889	1.605	3.14	150
14B2	140202	THUCHILA AT CHONDE	F	Y	1-Apr-91	31-Oct-91	1-Jan	31-Dec		0.91		49.1637421	-0.773	1.3	0.91	4
14B2	140202	THUCHILA AT CHONDE	G	Y	1-Nov-91	31-Oct-92	1-Jan	31-Dec		1.12		17.3218803	-0.74	2.8	1.12	1
14B2	140202	THUCHILA AT CHONDE	H	Y	1-Nov-92	31-Jul-94	1-Jan	31-Dec		1.665		19.5217876	-0.832	1.3	1.665	15
14B2	140202	THUCHILA AT CHONDE	I	Y	1-Aug-94	31-Oct-95	1-Jan	31-Dec		1.47		13.1122904	-0.615	2.8	1.47	8
14B3	140203	NSWADZI AT CHIPUNGU	A	Y	2-Feb-83	24-Mar-86	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140203	4.79898596	0.01	2.8	4.5	326
14B3	140203	NSWADZI AT CHIPUNGU	B	Y	25-Mar-86	19-Apr-88	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140203	5.15283585	0.156	2.8	4.5	382
14B3	140203	NSWADZI AT CHIPUNGU	C	Y	20-Apr-88	14-Jan-89	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140203	8.47918797	-0.136	2.8	4.5	525
14B3	140203	NSWADZI AT CHIPUNGU	D	Y	15-Jan-89	1-Mar-93	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140203	3.71123171	0.163	2.8	4.5	277
14B3	140203	NSWADZI AT CHIPUNGU	E	Y	2-Mar-93	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140203	78.7209702	-0.577	2.8	4.5	3616
14B4	140204	NSWADZI AT NAMING'OM	A		18-Nov-80	31-Oct-01	1-Nov	31-Oct		4.5	Rating imported from HYDATA DOS database, Station 140204	1.76695204	0.071	2.683	4.5	104
14B5	140205	NSWADZI AT MAGOMBE ESTATE	A	Y	16-Nov-81	13-Feb-85	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140205	3.82994771	-0.023	1.764	4.5	54
14B5	140205	NSWADZI AT MAGOMBE ESTATE	B	Y	14-Feb-85	13-Apr-86	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140205	6.75653505	-0.192	1.264	4.5	43
14B5	140205	NSWADZI AT MAGOMBE ESTATE	C	Y	14-Apr-86	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140205	3.36392498	-0.101	1.764	4.5	46
14B7	140207	LIKULEZI AT DAUDI	A	Y	21-Feb-79	4-Jan-82	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140207	6.95706415	-0.165	2.778	4.5	409
14B7	140207	LIKULEZI AT DAUDI	B	Y	5-Jan-82	3-Jun-86	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140207	2.50803185	-0.155	2.728	4.5	138

Column of Application Year or Water Level:
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Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
14B7	140207	LIKULEZI AT DAUDI	C	Y	4-Jun-86	18-Mar-88	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140207	11.7605343	-0.1	2.728	4.5	670
14B7	140207	LIKULEZI AT DAUDI	D	Y	19-Mar-88	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 140207	4.75239086	-0.15	2.728	4.5	262
14B8	140208	KWAKWASI AT MANGUNI	A	Y	16-Aug-85	14-Nov-86	1-Jan	31-Dec		3	RATING IMPORTED FROM HYDATA DOS databae, Station	21.6331596	0.01	2.063	3	210
14B8	140208	KWAKWASI AT MANGUNI	B	Y	15-Nov-86	18-Jan-88	1-Jan	31-Dec		3	RATING IMPORTED FROM HYDATA DOS databae, Station	21.5121689	-0.019	1.863	3	165
14B8	140208	KWAKWASI AT MANGUNI	C	Y	19-Jan-88	31-Oct-01	1-Jan	31-Dec		3	RATING IMPORTED FROM HYDATA DOS databae, Station	19.2797203	-0.028	1.663	3	118
14C2	140302	RUO AT M1 ROADBRIDGE	A		1-Nov-91	31-Oct-06	1-Jan	31-Dec		0.73		14.7294817	-0.17	1.3	0.73	7
14C3	140303	LICHENYA AT MINI MINI ESTATE	A	Y	1-Nov-82	6-Nov-85	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 140303	15.7052221	-0.571	1.91	6	398
14C3	140303	LICHENYA AT MINI MINI ESTATE	B	Y	7-Nov-85	31-Oct-01	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 140303	1.90801358	-0.387	2.509	6	145
14C7	140307	MULOZA AT MLELEMBA DRIFT	A		1-Nov-82	31-Oct-02	1-Jan	31-Dec		0.495		53.7786408	-0.034	2.771	0.495	6
14C8	140308	LICHENYA AT MILONDE	A		1-Nov-91	31-Oct-02	1-Jan	31-Dec		0.925		46.1936607	-0.367	2.493	0.925	11
14D1	140401	RUO AT SINOYA SOUT	A	Y	10-Aug-79	3-Nov-81	1-Jan	31-Dec		15	Rating imported from HYDATA DOS database, Station 140401	22.8283215	-2.172	2.8	15	28928
14D1	140401	RUO AT SINOYA SOUT	B	Y	4-Nov-81	15-Sep-86	1-Jan	31-Dec		15	Rating imported from HYDATA DOS database, Station 140401	10.3334732	-2.004	2.8	15	13580
14D1	140401	RUO AT SINOYA SOUT	C	Y	16-Sep-86	31-Oct-01	1-Jan	31-Dec		15	Rating imported from HYDATA DOS database, Station 140401	51.9357033	-3.987	2.8	15	42934
14D3	140403	RUO AT SANDAMA	A		1-Nov-80	31-Oct-01	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 140403	1	0	1	7.5	8
15A4	150104	CHIRUA AT MTAMBE	A	Y	3-Nov-81	4-Oct-82	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	13.7527094	-3.197	2.137	7.5	311
15A4	150104	CHIRUA AT MTAMBE	B	Y	5-Oct-82	12-Jan-84	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	19.2081909	-3.431	2	7.5	318
15A4	150104	CHIRUA AT MTAMBE	C	Y	13-Jan-84	17-Feb-85	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	10.6946392	-3.503	2.281	7.5	252
15A4	150104	CHIRUA AT MTAMBE	D	Y	18-Feb-85	18-Dec-85	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	2.48153663	-3.283	2.382	7.5	76
15A4	150104	CHIRUA AT MTAMBE	E	Y	19-Dec-85	2-Dec-86	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	7.83264303	-2.653	2.247	7.5	272
15A4	150104	CHIRUA AT MTAMBE	F	Y	3-Dec-86	8-May-89	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	4.27321482	-0.481	2.45	7.5	506
15A4	150104	CHIRUA AT MTAMBE	G	Y	9-May-89	9-Jan-90	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	19.1753063	-0.41	2.057	7.5	1078
15A4	150104	CHIRUA AT MTAMBE	H	Y	10-Jan-90	31-Oct-02	1-Jan	31-Dec		7.5	Rating imported from HYDATA DOS database, Station 150104	9.37633514	-0.177	2.453	7.5	1239
15A8	150108	LINGADZI AT KANICHE	A	H	1-Nov-81	31-Oct-10	1-Nov	31-Oct		4		11.0594473	0.024	2.152	0.2	0
15A8	150108	LINGADZI AT KANICHE	A	H	1-Nov-81	31-Oct-10	1-Nov	31-Oct		4		28.3355827	0	2.585	4	1020
15B6	150206	CHIA LAGOON AT MTANG	A		1-Nov-60	31-Oct-01	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 150206	1	0	1	6	6

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Annex 3.4.4-1 (14/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
15B13	150213	KAOMBE AT CHANIKA	A	Y	12-Feb-85	11-Jul-86	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	5.24819374	-0.526	1.301	4.5	32
15B13	150213	KAOMBE AT CHANIKA	B	Y	12-Jul-86	15-Dec-86	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	1.73092759	-0.525	2.408	4.5	48
15B13	150213	KAOMBE AT CHANIKA	C	Y	16-Dec-86	6-Nov-87	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	5.29475307	-0.716	1.401	4.5	34
15B13	150213	KAOMBE AT CHANIKA	D	Y	7-Nov-87	5-Nov-89	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	7.54612017	0.113	2.619	4.5	414
15B13	150213	KAOMBE AT CHANIKA	E	Y	6-Nov-89	31-Oct-10	1-Jan	31-Dec		4.5	RATING IMPORTED FROM HYDATA DOS databae, Station	3.73698187	0.569	2.733	4.5	316
15B14	150214	LIFULIZA AT NYONI	A		1-Apr-85	31-Oct-07	1-Nov	31-Oct		5.055		1.81464303	0.319	2.8	5.055	201
15B15	150215	KAOMBE AT M1 ROADBRIDGE	A		8-Aug-89	31-Oct-01	1-Jan	31-Dec		10	RATING IMPORTED FROM HYDATA DOS databae, Station	6.97882032	-0.162	2.363	10	1549
16E6	160506	DWAMBADZI AT NTHAND	A	Y	1-Nov-85	31-Aug-89	1-Nov	31-Oct		3.91	Do not modify rating - Uka	14.4525557	-0.559	1.311	3.91	71
16E6	160506	DWAMBADZI AT NTHAND	B	Y	1-Sep-89	31-Oct-93	1-Jan	31-Dec		2.75		8.67207336	-0.931	1.3	2.75	19
16E6	160506	DWAMBADZI AT NTHAND	C	Y	1-Nov-93	31-Oct-10	1-Jan	31-Dec		3.372		3.63791108	-0.424	2.214	3.372	40
16E7	160507	AMADZI AT NAMADZI	A	H	1-Nov-80	11-Mar-86	1-Nov	31-Oct		1.69		1.24707377	0.117	2.8	1.096	2
16E7	160507	AMADZI AT NAMADZI	A	H	1-Nov-80	11-Mar-86	1-Nov	31-Oct		1.69		8.23247433	-0.56	2.159	1.69	11
16E7	160507	AMADZI AT NAMADZI	T	Y	12-Mar-86	31-Oct-89	1-Nov	31-Oct		10		6.28319025	-0.554	2.8	10	3380
16E12	160512	MLOWE AT KATAWA	A		12-Nov-89	31-Dec-00	1-Jan	31-Dec		10	Rating imported from HYDATA DOS database, Station 160512	6.92672205	-0.285	1.3	10	133
16F1	160601	LIMPHASA AT TIMBIRI	A	Y	13-Nov-81	1-Dec-82	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 160601	1.45981491	0.652	2.041	6	70
16F1	160601	LIMPHASA AT TIMBIRI	B	Y	2-Dec-82	9-Apr-87	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 160601	3.19004989	0.206	1.641	6	64
16F1	160601	LIMPHASA AT TIMBIRI	C	Y	10-Apr-87	31-Oct-01	1-Jan	31-Dec		6	Rating imported from HYDATA DOS database, Station 160601	1.57995319	0.372	0.372	6	3
16F2	160602	LUWEYA AT ZAYUKA	A		1-Sep-91	31-Jul-93	1-Jan	31-Dec		3.228	DO NOT MODIFY- UKA	16.9298954	-0.604	1.474	3.228	70
16F4	160604	CHIKANGAWA AT VIPHYA	A		23-Mar-87	12-Sep-90	1-Jan	31-Dec		0.362		3.05231524	0.119	2.8	0.362	0
16F5	160605	LUCHELEMU (LOWER) AT MAZAMBA	A		30-Mar-83	31-Oct-10	1-Jan	31-Dec		3		1.9845922	-0.431	2.382	3	19
16F6	160606	LUWAWA AT KAPALAPAT	A	Y	1-Nov-86	31-Oct-91	1-Jan	31-Dec		1.146		4.32456732	-0.161	2.054	1.146	4
16F6	160606	LUWAWA AT KAPALAPAT	B	Y	1-Nov-91	31-Oct-02	1-Jan	31-Dec		1.4		4.0924859	-0.388	1.964	1.4	4
16F10	160610	LUCHELEMU AT MAZAMBA ESTATE	A	Y	1-Nov-80	18-Jun-85	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 160610	1.51499999	-0.399	1.435	4.5	11
16F10	160610	LUCHELEMU AT MAZAMBA ESTATE	B	Y	19-Jun-85	13-Aug-87	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 160610	1.32147014	-0.305	2.007	4.5	23
16F10	160610	LUCHELEMU AT MAZAMBA ESTATE	C	Y	14-Aug-87	10-Oct-90	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 160610	1.83842051	-0.464	1.707	4.5	20
16F10	160610	LUCHELEMU AT MAZAMBA ESTATE	D	Y	11-Oct-90	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 160610	1.26374531	-0.573	1.3	4.5	7
16F13	160613	LIMPHASA AT LIMPHASA SCHEME	A		20-Oct-81	6-Sep-90	1-Jan	31-Dec		1.28		0.46362326	-0.03	1.3	1.28	1
16F15	160615	LUWEYA AT MZENGA	A		1-Nov-87	31-Oct-10	1-Nov	31-Oct		1.944		14.6513176	-0.173	2.434	1.944	59
16F18	160618	LONJOZWA AT KANYOLI	A		14-Feb-92	30-Apr-93	1-Jan	31-Dec		0.68		11.639143	-0.246	2.576	0.68	1

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
16F21	160621	KALWE AT CHIGHA CHANG'OMBE	A	H	1-Feb-94	31-Oct-98	1-Nov	31-Oct		3		10.182	-0.15	7.752	0.65	0
16F21	160621	KALWE AT CHIGHA CHANG'OMBE	A	H	1-Feb-94	31-Oct-98	1-Nov	31-Oct		3		2.247	-0.15	5.491	3	707
16G2	160702	CHIWISI AT BULA	A	Y	1-Nov-86	17-Jul-90	1-Nov	31-Oct		0.67		3.83348012	-0.063	1.746	0.67	2
16G2	160702	CHIWISI AT BULA	B	Y	10-Aug-90	6-Apr-91	1-Nov	31-Oct		0.632		5.92835426	-0.247	1.489	0.632	1
17C1	170301	LAKE MALAWI AT CHILUMBA	A		18-Oct-52	31-Oct-01	1-Jan	31-Dec		10.5	Rating imported from HYDATA DOS database, Station 170301	1	0	1	10.5	11
17C6	170306	WOVWE AT KAPIYIRA	A	H	11-Dec-80	1-Sep-82	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	3.90621781	-0.43	1.3	1	2
17C6	170306	WOVWE AT KAPIYIRA	A	H	11-Dec-80	1-Sep-82	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	0.16438714	1.38	2.8	4.5	23
17C6	170306	WOVWE AT KAPIYIRA	B	H	2-Sep-82	2-Jul-83	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	3.44844198	-0.589	1.343	1.3	2
17C6	170306	WOVWE AT KAPIYIRA	B	H	2-Sep-82	2-Jul-83	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	0.18776152	1.11	2.8	4.5	23
17C6	170306	WOVWE AT KAPIYIRA	C	Y	3-Jul-83	7-May-84	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	3.91360497	-0.918	1.3	4.5	21
17C6	170306	WOVWE AT KAPIYIRA	D	Y	8-May-84	10-Jul-85	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	3.07991529	-1.131	1.58	4.5	21
17C6	170306	WOVWE AT KAPIYIRA	E	Y	11-Jul-85	17-Jun-86	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	5.08033609	-1.799	1.3	4.5	18
17C6	170306	WOVWE AT KAPIYIRA	F	Y	18-Jun-86	1-May-89	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	3.47511888	-1.864	2.121	4.5	27
17C6	170306	WOVWE AT KAPIYIRA	G	Y	2-May-89	11-Feb-90	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	1.09393275	-1.565	2.8	4.5	22
17C6	170306	WOVWE AT KAPIYIRA	T	H	12-Feb-90	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	2.25837612	-1.852	1.3	2.7	2
17C6	170306	WOVWE AT KAPIYIRA	T	H	12-Feb-90	31-Oct-01	1-Jan	31-Dec		4.5	Rating imported from HYDATA DOS database, Station 170306	3.80639839	-1.952	2.577	4.5	42
17C9	170309	NYUNGWE AT NYUNGWE DIP TANK	A	Y	3-May-82	2-Feb-83	1-Jan	31-Dec		1.5		133.168365	-0.128	2.581	1.5	301
17C9	170309	NYUNGWE AT NYUNGWE DIP TANK	B	Y	3-Feb-83	2-Apr-84	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 170309	11.6739016	-0.042	1.3	1.5	19
17C9	170309	NYUNGWE AT NYUNGWE DIP TANK	C	Y	3-Apr-84	6-Jan-86	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 170309	18.7167263	-0.024	1.3	1.5	31
17C9	170309	NYUNGWE AT NYUNGWE DIP TANK	E	Y	7-Jan-86	31-Oct-01	1-Jan	31-Dec		1.5	Rating imported from HYDATA DOS database, Station 170309	0.87193286	0.693	2.8	1.5	8
17C10	170310	HARA AT NTHIPA	A	Y	4-Sep-84	5-May-86	1-Nov	31-Oct		1.43		7.26404428	-0.816	1.306	1.43	4
17C10	170310	HARA AT NTHIPA	B	Y	6-May-86	30-Apr-88	1-Nov	31-Oct		1.745		3.51498842	-1.17	1.311	1.745	2
17C10	170310	HARA AT NTHIPA	C	Y	1-May-88	31-Oct-89	1-Nov	31-Oct		2.492		1.15208483	-1.013	2.8	2.492	3
17C12	170312	HARA INTAKE CANAL AT HARA	A		19-Jan-85	31-Oct-46	1-Jan	31-Dec		1.5	Rating imported HYDATA DOS database, Station 170312	1.42939603	-0.098	1.34	1.5	2
17C15	170315	NYUNGWE AT MCHEKA-CHEKA	A	Y	11-Feb-91	5-Dec-91	1-Jan	31-Dec		1.365		15.4264193	-1.006	1.435	1.365	4

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Annex 3.4.4-1 (16/16)

Historical Rating Curves from HYDATA

Station			Rating	Application Year or Water Level	Period		Season		Stage Range		Comments	Q = A x (h + B) ^ C			hmax	Qmax
Code	Code	Name	No.		Start	End	From	To	From	To		A	B	C		
17C15	170315	NYUNGWE AT MCHEKA-CHEKA	B	Y	19-Mar-92	4-Feb-93	1-Jan	31-Dec		1.53		6.00989723	-1.11	1.346	1.53	2
17C15	170315	NYUNGWE AT MCHEKA-CHEKA	C	Y	15-Mar-93	11-Jan-94	1-Jan	31-Dec		1.725		7.04346704	-1.267	1.75	1.725	2
17C15	170315	NYUNGWE AT MCHEKA-CHEKA	D	Y	24-Apr-94	9-Mar-95	1-Jan	31-Dec		1.69		7.06020594	-0.914	1.649	1.69	5
17C15	170315	NYUNGWE AT MCHEKA-CHEKA	E	Y	2-Jun-95	29-Jan-98	1-Jan	31-Dec		1.26		4.60213852	-0.56	1.343	1.26	3
17C16	170316	WOVWE AT NJALAYANKHUNDA	A		6-Nov-90	31-Oct-01	1-Jan	31-Dec		3	Rating imported from HYDATA DOS database, Station 170316	9.36377811	-0.048	2.8	3	194

Column of Application Year or Water Level:
Y shows differences in the application year
H shows differences in the application water level

Annex 3.6.1-1 (1/6)

DEPARTMENT OF FORESTRY

LAWS OF MALAWI
FORESTRY ACT. CAP. 63.01

LICENCE TO MANAGE AND MAINTAIN CATCHMENT AND TO PRODUCE POTABLE WATER IN KANING'INA FOREST RESERVE

(Forest rules 38 and 54)

1. NAME OF LICENSEE: NORTHERN REGION WATER BOARD

2. FULL ADDRESS
Business: PRIVATE BAG 94, MZUZU
Residential: MZUZU
Telephone No.: 265-334 617/254/255
Telex No. N/A
Facsimile No. 265-332082

3. NATIONALITY: MALAWIAN PARASTATAL ORGANISATION

4. REASONS FOR RESIDING/OPERATING IN FOREST RESERVE:. Operate, manage and maintain Dam Catchment

5. LOCATION:
i. Name of Forest Reserve: KANINGINA
ii. Name of Site: LUNYANGWA DAM
iii. District: MZIMBA/NKHATA BAY (MZUZU CITY)

6. AREA IN HECTARES: 191.243

7. TYPE & NUMBER OF STRUCTURES TO BE ERECTED:

8. DESIRED PERIOD : (DATES) From: 1st JAN 2002 To: 31st DECEMBER 2006

9. OTHER RELEVANT INFORMATION: THE BOARD WITH ASSISTANCE OF THE STAKEHOLDERS WILL CARRYOUT REHABILITATION OF THE CATCHMENT WITH FINANCIAL ASSISTANCE FROM THE WORLD BANK

BOARD	
GM	
MINUTED	EM
DATE	22-4-02
ACTION BY	INITIALS
FC	
OM	
CS	
EM	
FILE	

Annex 3.6.1-1 (2/6)

10. SIGNATURE OF LICENSEE:.....

GENERAL MANAGER
NORTHERN REGION WATER BOARD
18 DEC 2001
P/BAG 84, MZUZU

11. DATE:.....

12. LICENSING OFFICER: K M NYASULU.....

(Director of Forestry or ~~Authorised Representative~~)

13. SIGNATURE OF LICENSING OFFICER:.....

14. REMARKS BY LICENSING OFFICER: (e.g. Rental Fee and Period of Coverage)

This licence is valid for 2yrs up to 20/03/04 after it will be subject to renewal. Special condition 8 is superseded.

For Official use only:

Date Stamp:

DEPARTMENT OF FORESTRY
HEADQUARTERS
2002 -03- 20
P.O. BOX 30048, CAPITAL CITY
LILONGWE 3

Application fee : MK 10,000.00 GR A 851517
Operational fee : MK 25,000.00/year GR 850226
Residential fee : not applicable

GENERAL RECEIPT NO:.....

Note: General conditions and special conditions attached. All fees stipulated in the General and Special Conditions are subject to revision without notice.

Annex 3.6.1-1 (3/6)

GENERAL CONDITIONS

Subject to the provisions of the Forestry Act and to the Forest Rules of the Laws of Malawi thereunder, the following are the general conditions for residing and operating in forest reserves:

CLAUSE 1

The Licensee shall be liable to pay licence fees for operating and residing in the forest reserve. The rate of fees will be stipulated in the special conditions for the activity being undertaken.

CLAUSE 2 This licence is not transferable.

CLAUSE 3

The site authorized under this licence shall be used only for the purpose indicated in the Licence.

CLAUSE 4

The licensee shall not be permitted to undertaken the following activities unless authority is granted by the Licensing Officer.

(a) cut, uproot, fell, work, burn, injure, alter, or remove any tree, shrub, twig, grass, and any other forest produce without written authority.

(b) use any chemicals except those which have been approved by the Licensing Officer.

(c) pursue, kill or capture any animal or bird by shooting, hunting or trapping.

(d) keep any pets and/or hunting animals.

(e) clear, cultivate, or break up soil for any purpose within the forest reserve.

(f) alter or remove any beacon, boundary mark or fence.

(g) camp in the Licensed Area without observing the rules effecting such camping.

CLAUSE 5
The Licensee shall:
(a) be subject at all times to conditions of fire prevention and control.

(b) be liable to pay one and half times the value of damaged property in the Licensed Area and in the forest reserve in which the licensee operates where it is established beyond doubt that the damage has been caused by the licensee employees or clients.

(c) ensure that there are adequate pit latrines toilets, septic tanks, and other hygienic facilities in the Licensed Area for use.

(d) in consultation with The Department of Forestry, undertake measures to prevent and control soil erosion and other environmental degradation.

Annex 3.6.1-1 (4/6)

CLAUSE 6

The Licence may be terminated by the Licensing Officer or the Licensee by giving .written notice prior to the date of termination.

CLAUSE 7

The terms and conditions of this Licence may be varied only by a prior written agreement between the Licensee and the Licensing Officer.

SPECIAL CONDITIONS

1. The Licensee shall be liable to any damage whatsoever done to the forest by any of its employees done deliberately or negligently.

   The Licensee shall pay The Department of Forestry one and a half (1½) times the cost of the damaged property.

2. The Licensee shall ensure that all fire prevention and control measures are taken care of by :

   - Clean hoeing the perimeter or boundary of the Camp by a width of not less than 3 metres to the satisfaction of the Licensing Officer.
   - Calling upon its staff to assist the Department of Forestry in the event of a forest fire.
   - Training its staff in collaboration with the Department of Forestry in forest fire management and in particular forest fire prevention and control.
   - Displaying posters on fire prevention in the licensed area.
   - Reporting any fire to the District Forestry Officer or nearest forestry office in which the Camp is located immediately the fire is spotted.

3. The Licence shall be terminated by the Licensing Officer by giving three month's notice however one (1) month notice shall be given where it is observed that the Licensee is deliberately and negligently not observing the conditions of the licence.

4. The site authorized under this licence shall be used exclusively for, Office and Water Treatment facilities.

5. The Licensee shall be authorised to erect buildings in the licenced area upon approval by the Licensing Officer.

   (a) the purpose of every building shall be specified.

   (b) additional buildings or structures shall only be erected with written approval of the Licensing Officer

Annex 3.6.1-1 (5/6)

6. All buildings in the licensed area shall be kept clean and tidy at all times and shall be removed or handed over to the Department of Forestry following completion of the agreement. One (1) month before final expiry of the licence; all pits, shafts, adits, boles, holes or any other excavations shall be filled and rendered safe and the area rehabilitated by the Licensee to the satisfaction of the Licensing Officer.

7. The Licensing Officer and staff under him/her shall have access at all times to the Licenced area.

8. This Licence is valid for a period of one year from the date it is issued. The conditions of the Licence shall be reviewed on request of either party through exchange of letters and shall become part of the Licence. The Licence shall after expiry be subject to renewal for another one years or alternatively a five year period if there is no violation of conditions.

9. The Licensee shall arrange for the area proposed for the Water Supply Project to be surveyed and mapped and shall meet all costs of the exercise.

10. The Licensee shall submit five copies of the Sketch plan and Locational Map to the Licensing Officer for approval. Construction shall commence upon the approval of the sketch plan by the Licensing Officer.

11. The Licensee shall ensure that the Licensed Area is easily accessible by road, which shall be approved by the Licensing Officer.

    - the intended opening of additional roads or tracks for sightseeing or game viewing has to be submitted on a 1:50,000 map to the Licensing Officer for approval.

12. The Licensee and employees as well as customers shall not be allowed to collect any forest produce without authority issued by the Licensing Officer.

13. Licence fees will be paid as follows:

    - Application fees K10,000 (when applying)
    - Operational fee K25,000/annum and
    - Residential fee K50.00/m^2/annum depending on the extent of area required. The fees shall be payable upon the issuance of the licence in the first year and on the date of the licence renewal in subsequent years.
    - The fees shall be revised by the Licensing Officer when necessary.

14. No structures shall be erected any where other than the licensed area.

15. The Licensee is permitted to carry out the activities as stated on item 4 above within the licensed area described on the 1:50,000 map.

16. The Licensing Officer has authority to prescribe additional conditions to the licence as considered appropriate.

17. The Licensee has to report any illegal activities observed to the District Forestry Officer (Mzuzu (U) in the reserve or the Licensing Officer.

18. The Licensee shall undertake and ensure that in the licensed area there is proper sanitation approved by the Licensing Officer.

Annex 3.6.1-1 (6/6)

20. Any disputes shall be resolved amicably between the Licensee and the Licensing Officer. The Arbitration Act shall be used to resolve disputes where they are not amicably addressed.

DECLARATION

I, (name)..... declare that I shall abide by the above conditions and understand that failure to comply shall oblige the Department of Forestry to exercise its rights and powers as stipulated in this license. I am aware that working in the forest reserve is at my own risk. The property brought in the forest reserve is at owner's risk.

NAME AND ADDRESS OF LICENSEE..... NORTHER REGION WATER BOARD, PRIVATE BAG 94, MZUZU.

SIGNATURE OF LICENSEE.....

DATE..... 18 DEC 2001

SIGNED:.....LICENSING OFFICER

for **DIRECTOR OF FORESTRY**

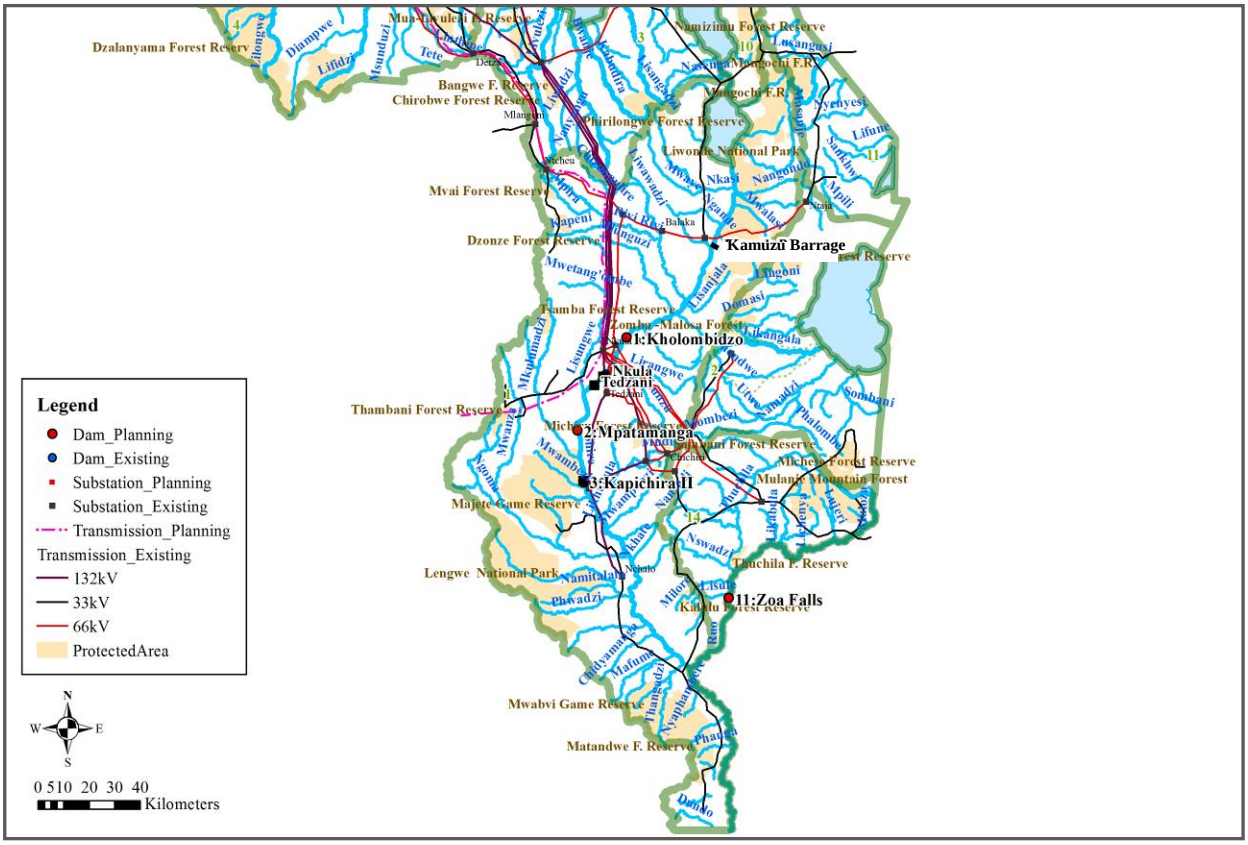
DATE..... 25/3/2002

GENERAL MANAGER NORTHERN REGIONAL WATER BOARD

PRIVATE BAG 94, MZUZU

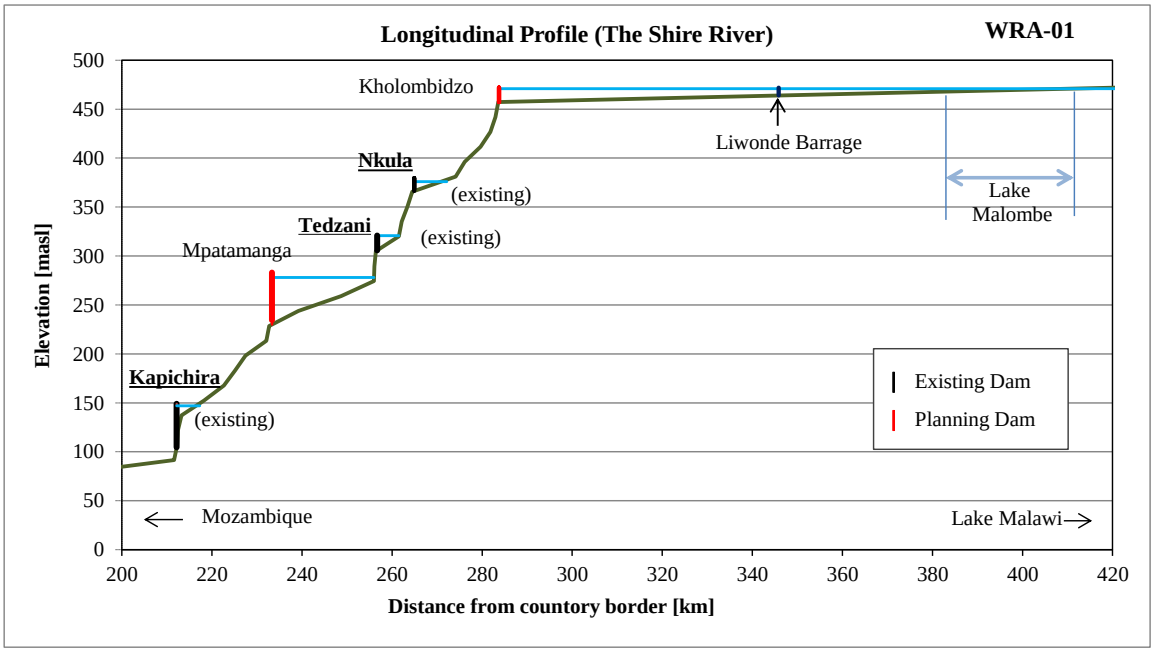
DEPARTMENT OF FORESTRY HEADQUARTERS 2002 -03- 20 P.O. BOX 30048, CAPITAL CITY LILONGWE 3

Annex 5.4.4-1 (1/6)



Source: Project Team based on 1/50,000 topographic map, WB (1998) and MCC (2011)

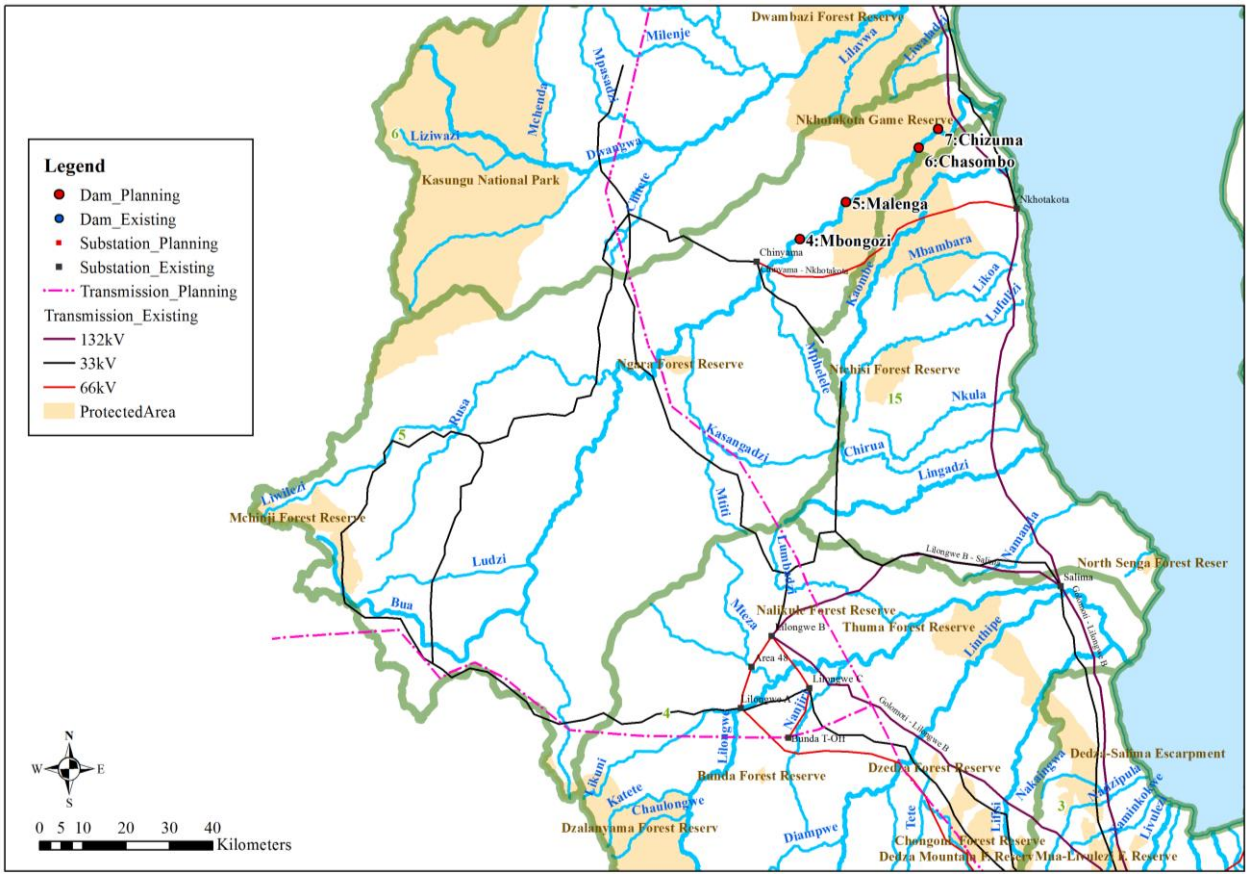
Locations of Hydropower Projects (WRA-01)



Source: Project Team based on 1/50,000 topographic map

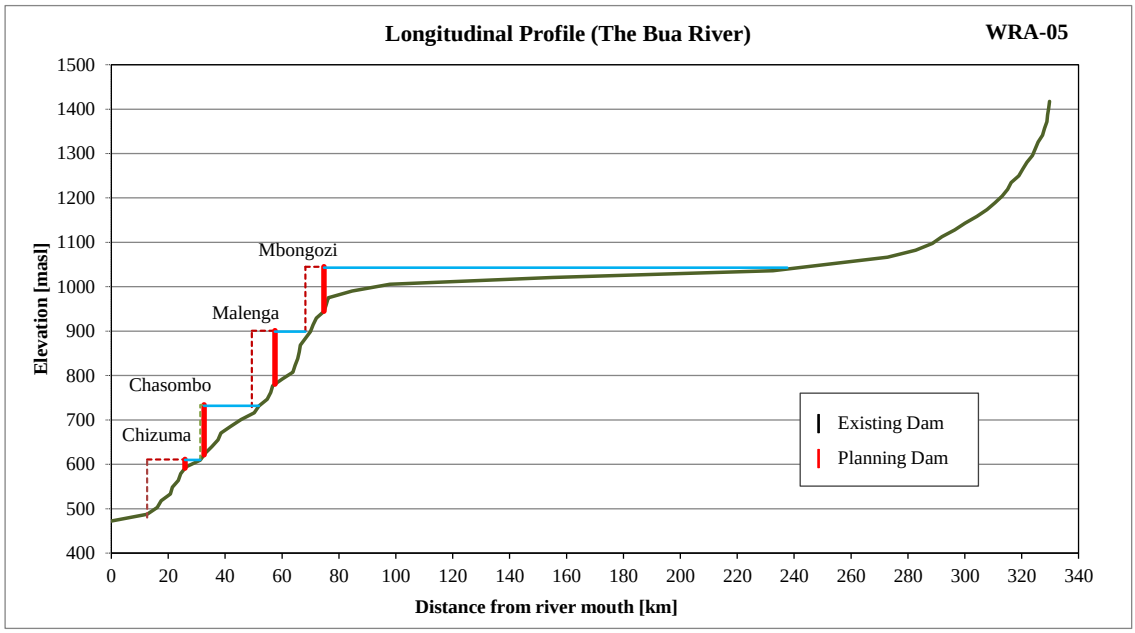
Longitudinal Profiles of the Shire River (WRA-01)

Annex 5.4.4-1 (2/6)



Source: Project Team based on 1/50,000 topographic map, WB (1998) and MCC (2011)

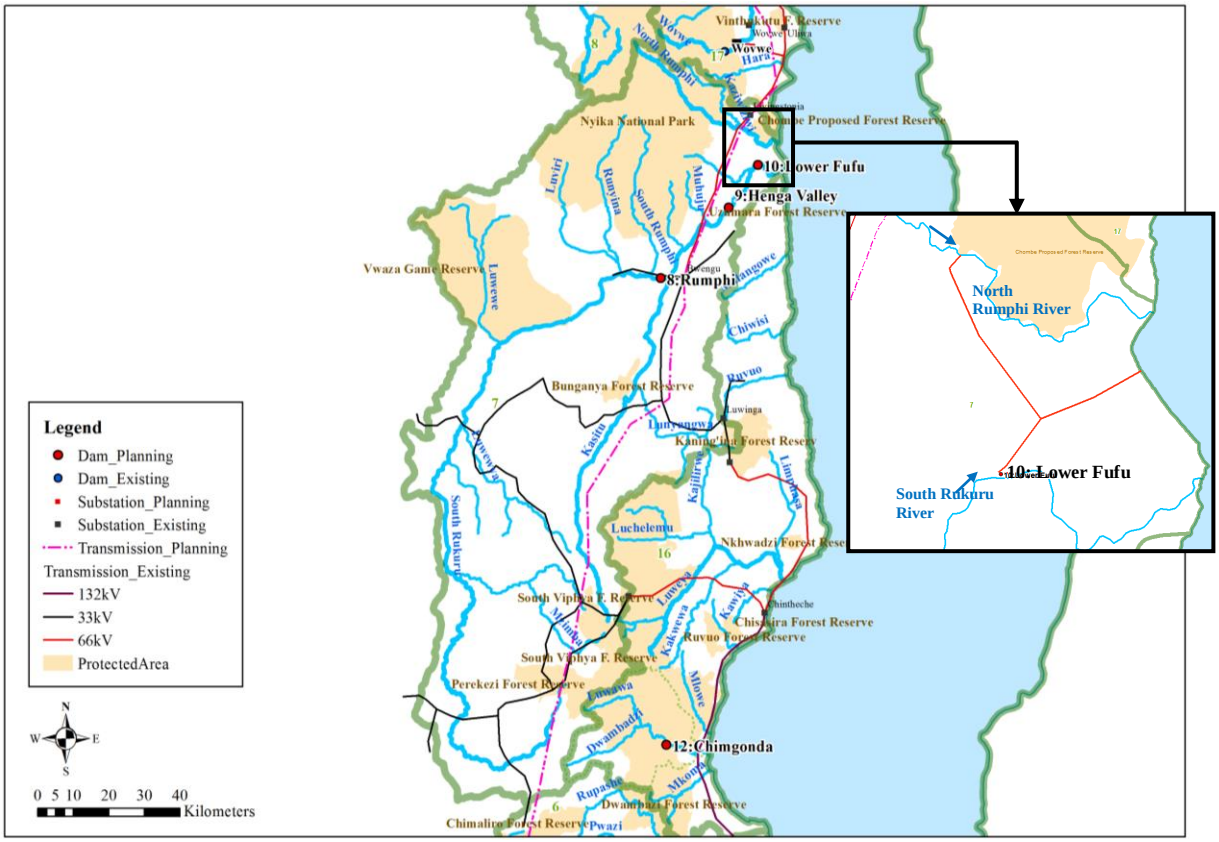
Locations of Hydropower Projects (WRA-05)



Source: Project Team based on 1/50,000 topographic map

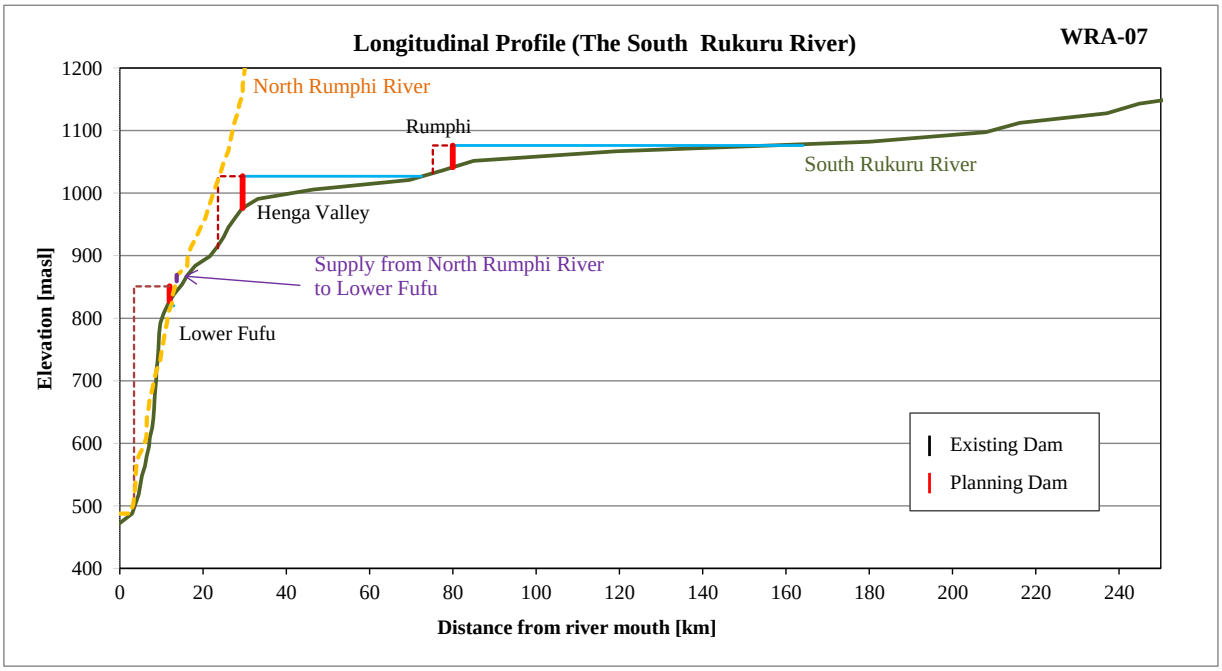
Longitudinal Profiles of the Bua River (WRA-05)

Annex 5.4.4-1 (3/6)



Source: Project Team based on 1/50,000 topographic map, WB (1998) and MCC (2011)

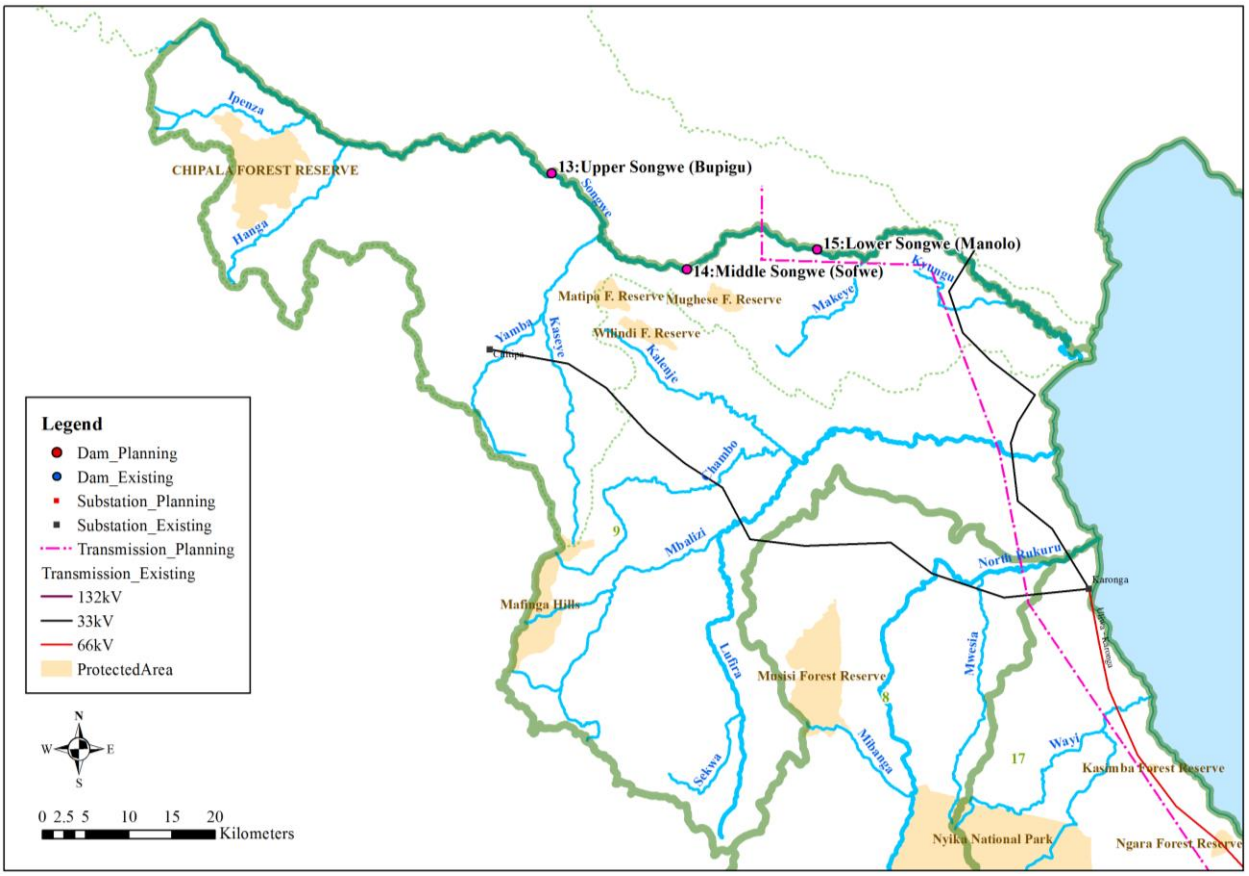
Locations of Hydropower Projects (WRA-07)



Source: Project Team based on 1/50,000 topographic map

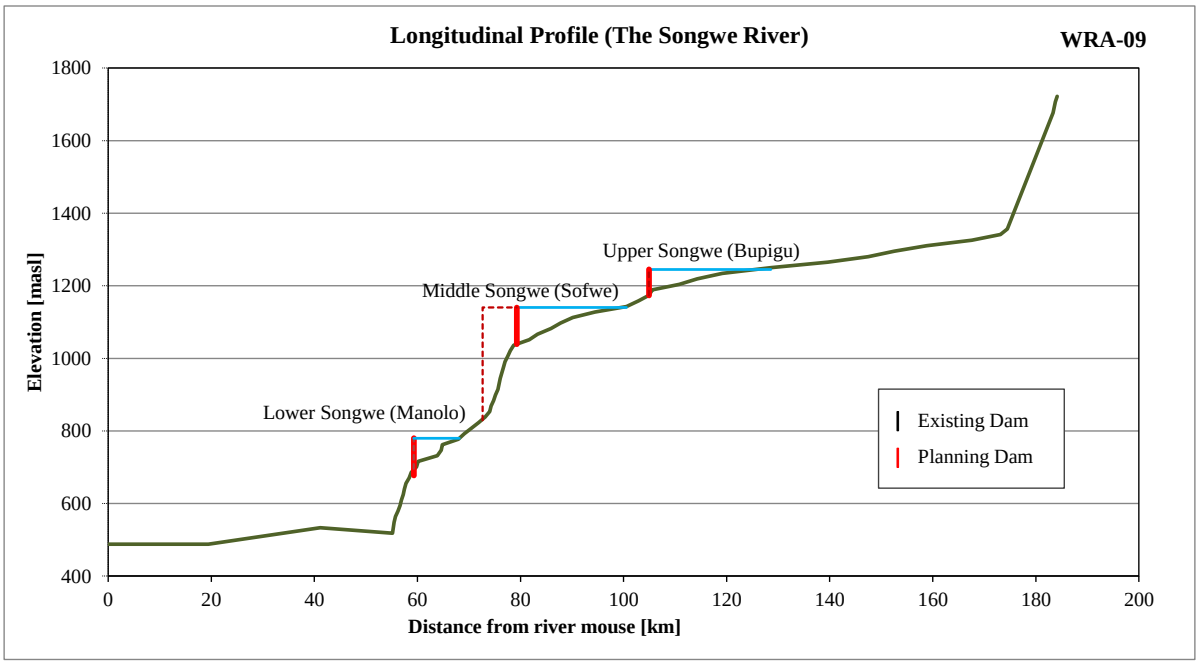
Longitudinal Profiles of the South Rukuru River (WRA-07)

Annex 5.4.4-1 (4/6)



Source: Project Team based on 1/50,000 topographic map, WB (1998) , MCC (2011), and SRBDP (2003)

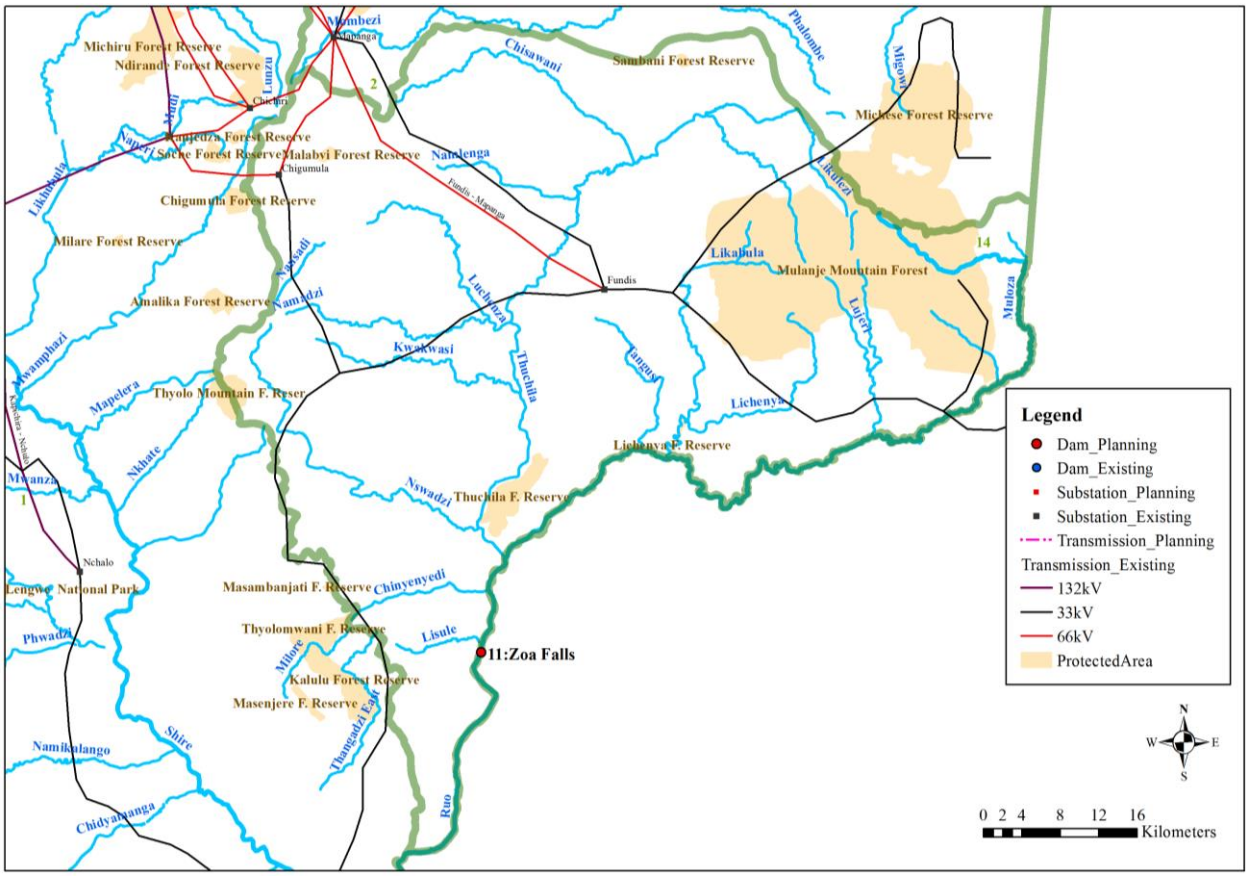
Locations of Hydropower Projects (WRA-09)



Source: Project Team based on 1/50,000 topographic map

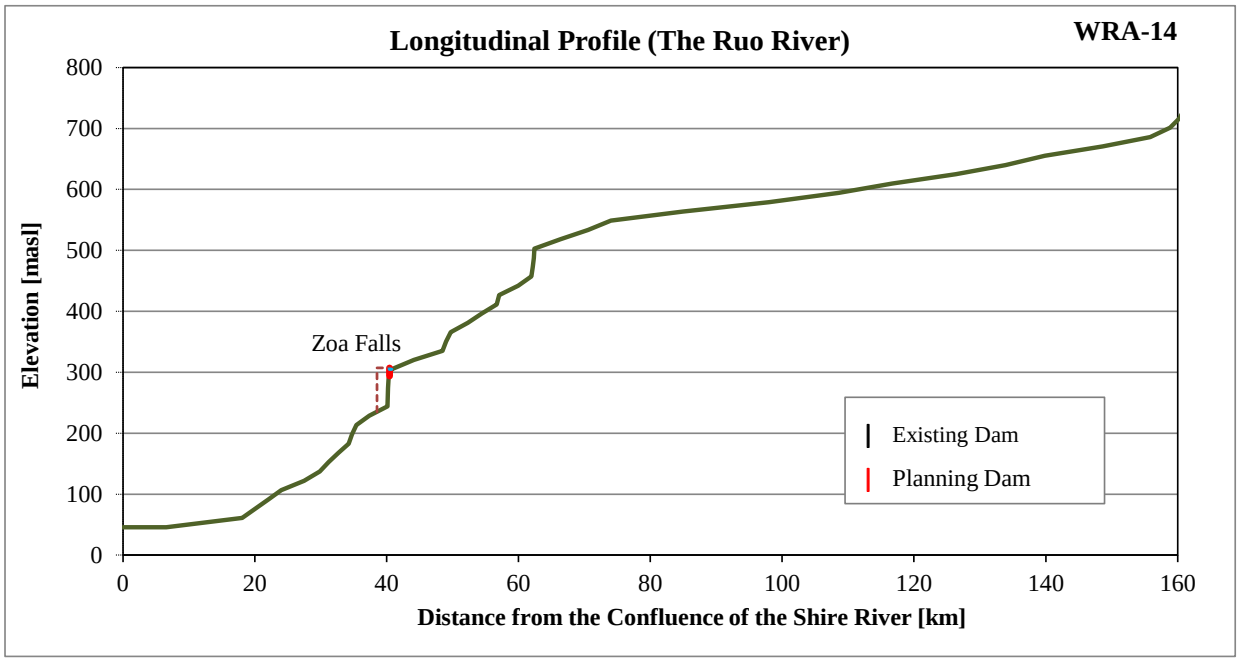
Longitudinal Profiles of the Songwe River (WRA-09)

Annex 5.4.4-1 (5/6)



Source: Project Team based on 1/50,000 topographic map, WB (1998) and MCC (2011)

Locations of Hydropower Projects (WRA-14)



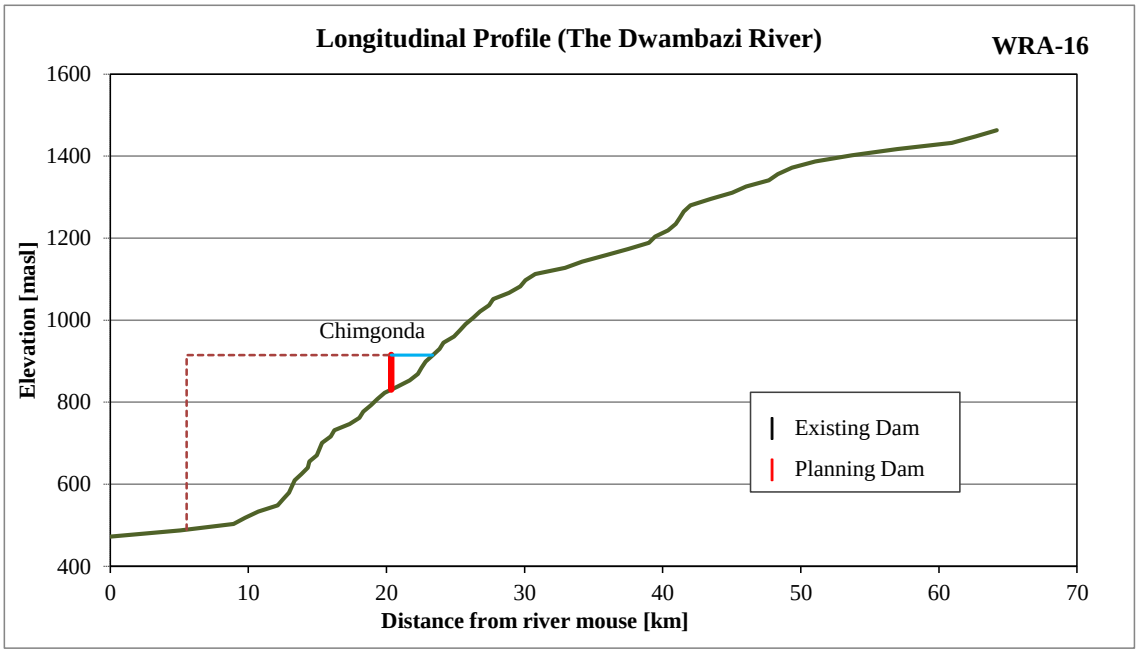
Source: Project Team based on 1/50,000 topographic map

Longitudinal Profiles of the Ruo River (WRA-14)

Annex 5.4.4-1 (6/6)

Source: Project Team based on 1/50,000 topographic map, WB (1998) and MCC (2011)

Locations of Hydropower Projects (WRA-16)

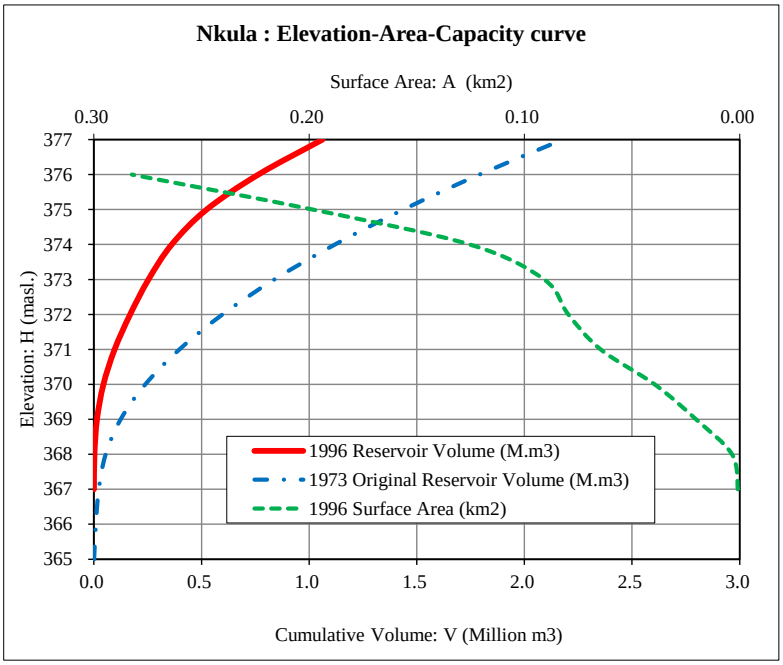


Source: Project Team based on 1/50,000 topographic map

Longitudinal Profiles of the Dwambazi River (WRA-16)

Annex 5.4.4-2 (1/8)

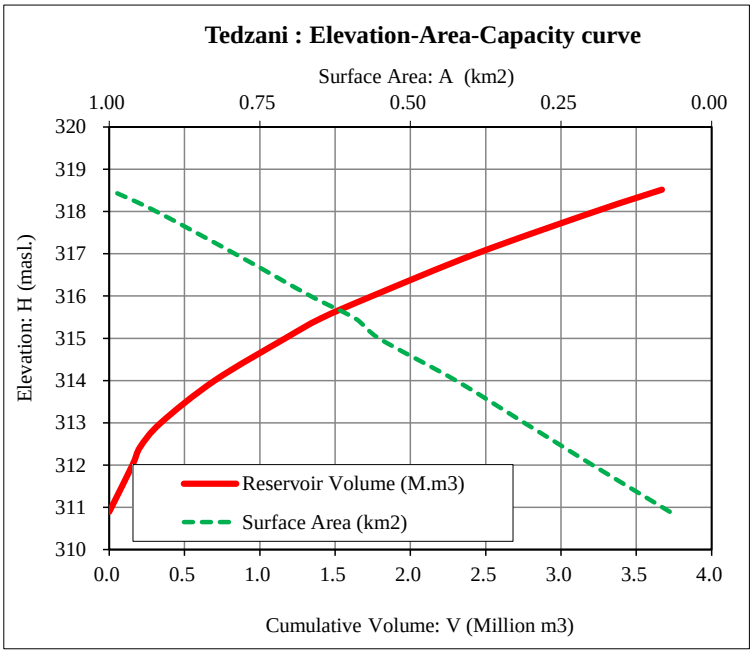
Elevation (masl.)	1973 Original Reservoir Volume ($M.m^3$)	1996 Reservoir Volume ($M.m^3$)	1996 Surface Area (km^2)
365	0.001		
366	0.009		
367	0.023	0.000	0.001
368	0.055	0.003	0.004
369	0.124	0.014	0.020
370	0.239	0.044	0.039
371	0.398	0.096	0.065
372	0.598	0.168	0.080
373	0.839	0.254	0.091
374	1.120	0.362	0.125
375	1.438	0.524	0.198
376	1.791	0.764	0.282
377	2.179	1.062	0.313



Source: Project Team based on data provided by ESCOM

Elevation-Area-Capacity Curve at Nkula (WRA-01)

Elevation (masl.)	Reservoir Volume (M.m3)	Surface Area (km2)
310.9	0.000	0.070
312.0	0.154	0.198
312.4	0.204	0.245
313.0	0.342	0.311
314.0	0.700	0.424
315.0	1.169	0.552
315.5	1.404	0.591
316.0	1.746	0.666
317.0	2.435	0.791
318.0	3.227	0.922
318.5	3.670	1.000

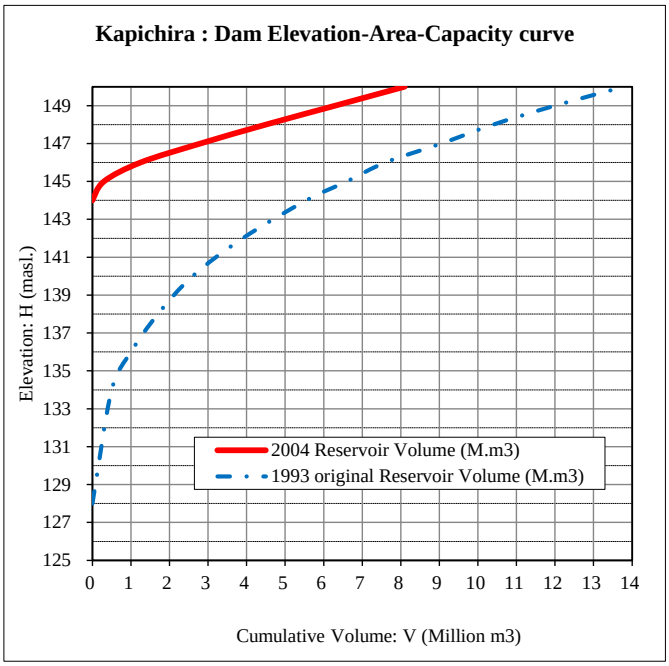


Source: Project Team based on data provided by ESCOM

Elevation-Area-Capacity Curve at Tedzani (WRA-01)

Annex 5.4.4-2 (2/8)

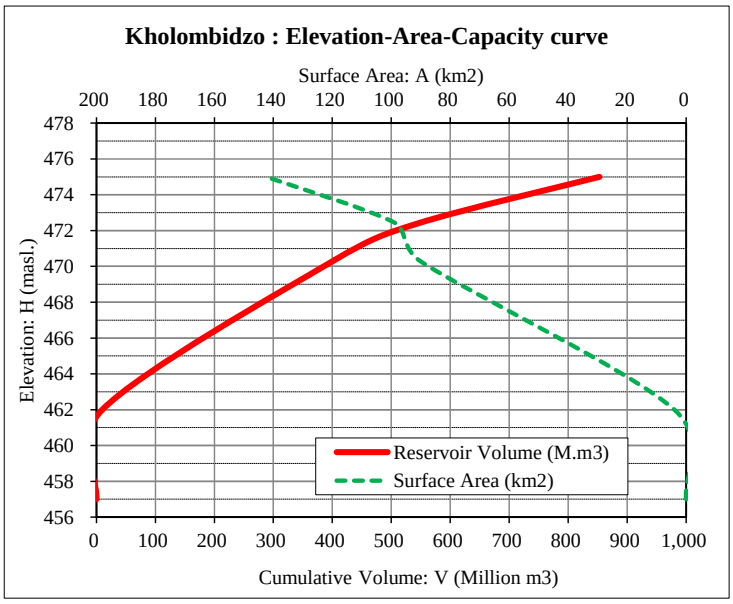
Elevation (masl.)	1993 original Reservoir Volume ($M.m^3$)	2004 Reservoir Volume ($M.m^3$)
128	0.00	-
134	0.50	-
136	1.00	-
138	1.70	-
140	2.60	-
142	3.90	-
144	5.55	0.00
145	6.60	0.30
146	7.60	1.25
147	9.05	2.80
148	10.40	4.50
149	12.00	6.30
150	13.80	8.10



Source: Project Team based on data provided by ESCOM

Elevation-Area-Capacity Curve at Kapichira (WRA-01)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
457.0	0.0	0.0
462.0	10.0	4.0
470.3	401.0	90.0
472.4	545.0	98.0
475.0	853.0	142.0



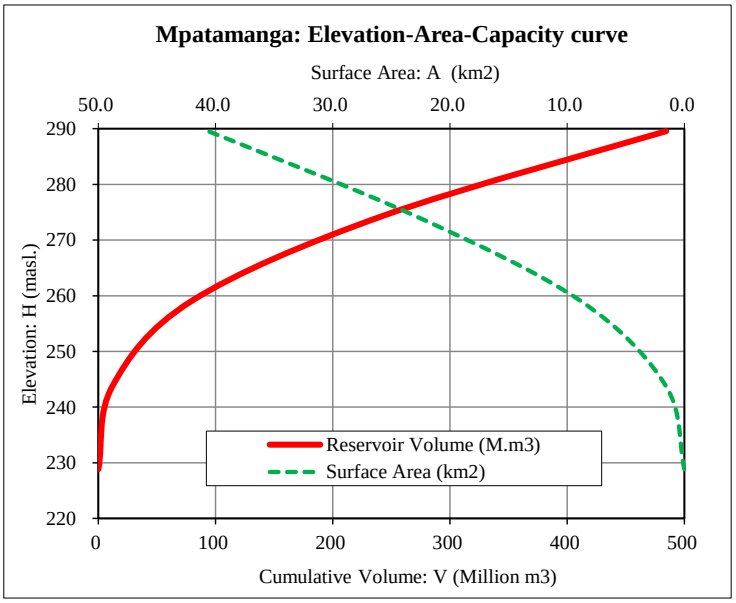
Source: Project Team based on Norconsult (2003)[1]

Elevation-Area-Capacity Curve at Kholombidzo (WRA-01)

[1] Norconsult, The Integrated Water Resources Development Plan for Lake Malawi and Shire River System "Lake Malawi Level Control" – Stage 2, Final Feasibility Report, Volume II-B, 2003, pp.I-B1-11

Annex 5.4.4-2 (3/8)

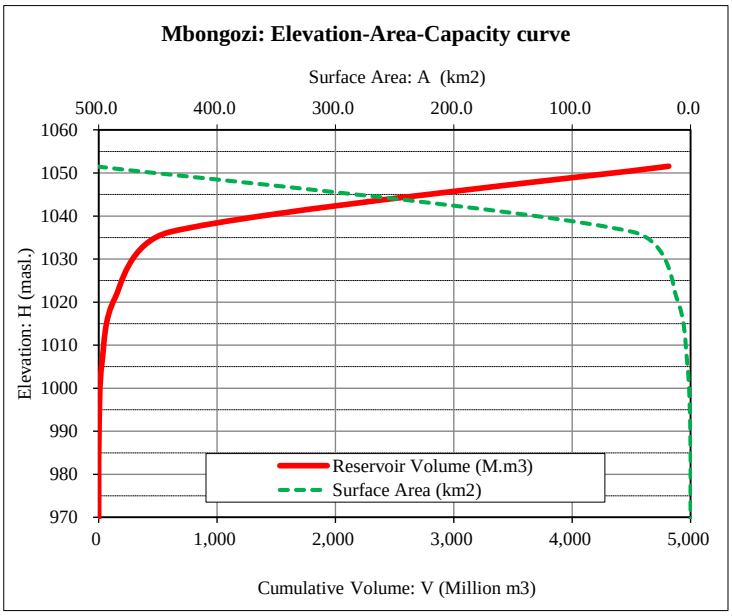
Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
229	0.0	0.0
244	12.2	1.6
259	79.7	8.9
274	242.3	22.9
290	484.5	40.6



Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Mpatamanga (WRA-01)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
960	0.0	0.0
975	0.9	0.1
991	4.0	0.3
1006	28.0	2.9
1021	141.0	12.0
1036	606.2	49.1
1052	4815.1	503.3

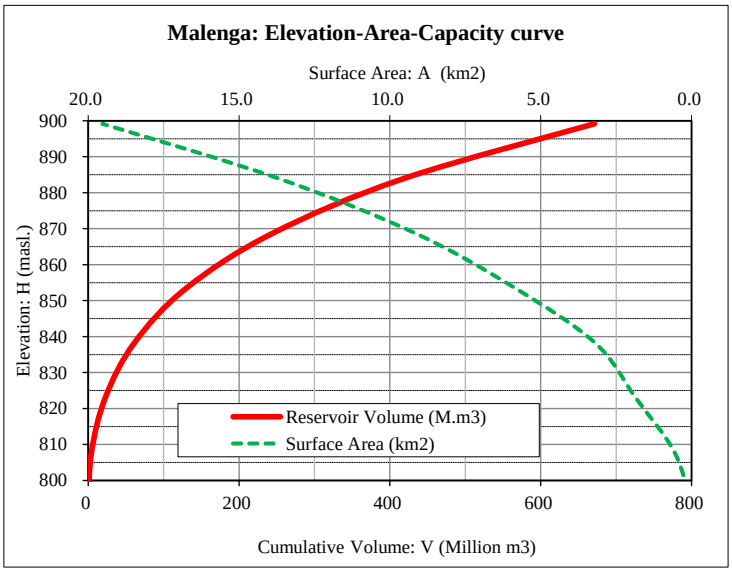


Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Mbongozi (WRA-05)

Annex 5.4.4-2 (4/8)

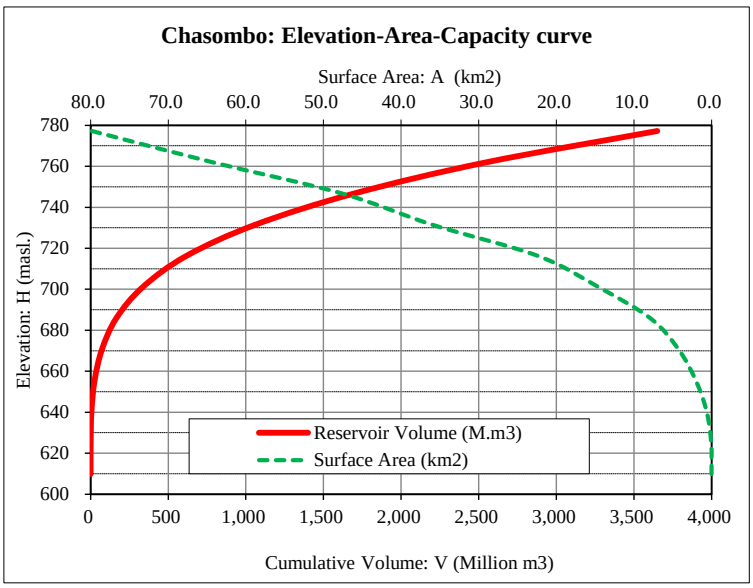
Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
793	0.0	0.0
808	4.3	0.6
823	22.7	1.9
838	61.1	3.2
853	130.0	5.8
869	244.2	9.1
884	418.1	13.7
899	671.2	19.5



Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Malenga (WRA-05)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
610	0.0	0.0
625	0.3	0.0
640	5.3	0.6
655	25.2	2.0
671	72.8	4.2
686	164.9	7.9
701	335.6	14.6
716	617.0	22.4
732	1061.8	36.0
747	1699.1	47.6
762	2552.1	64.3
777	3650.5	79.8

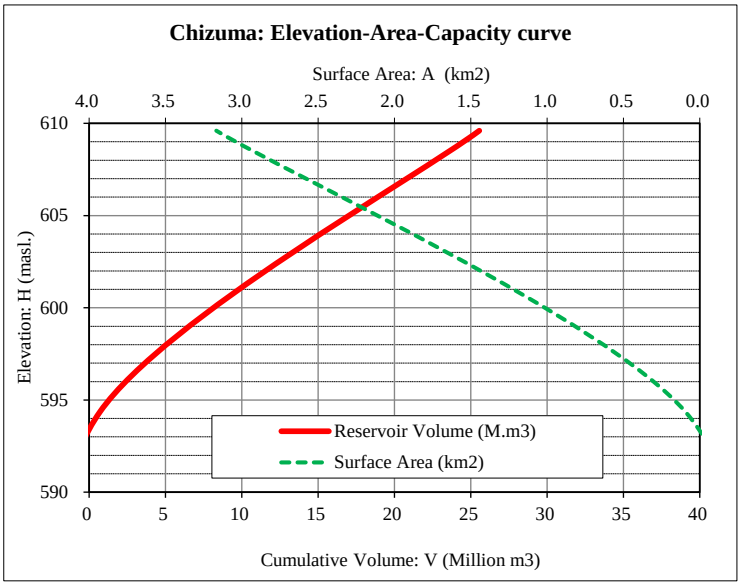


Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Chasombo (WRA-05)

Annex 5.4.4-2 (5/8)

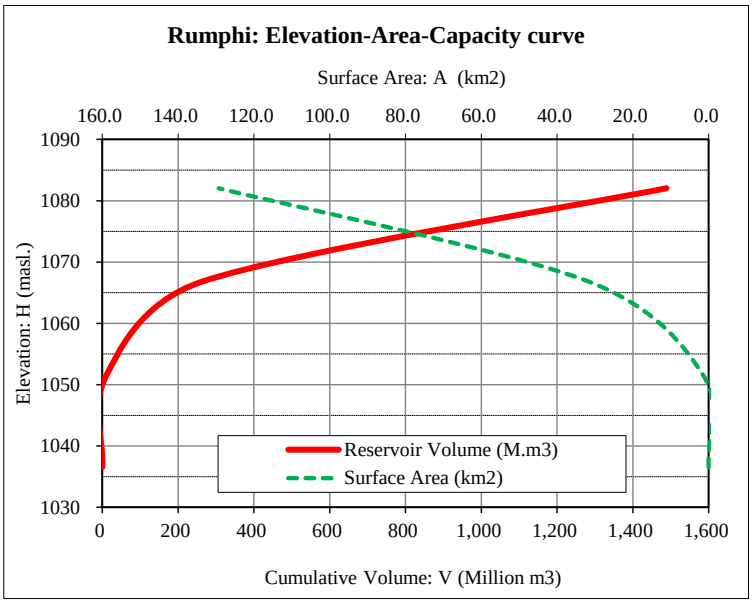
Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
579	0.0	0.0
594	0.7	0.1
610	25.6	3.2



Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Chizuma (WRA-05)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
1037	0.0	0.0
1052	11.1	1.5
1067	262.8	31.6
1082	1488.6	129.3

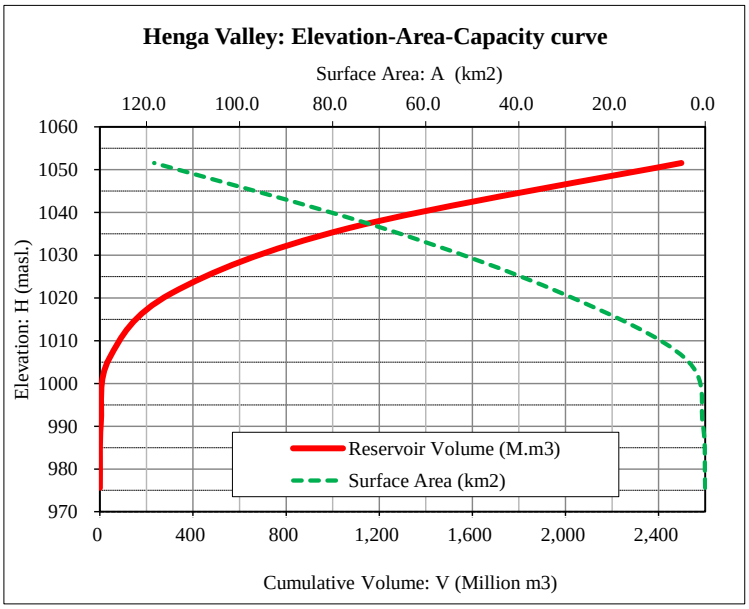


Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Rumphi (WRA-07)

Annex 5.4.4-2 (6/8)

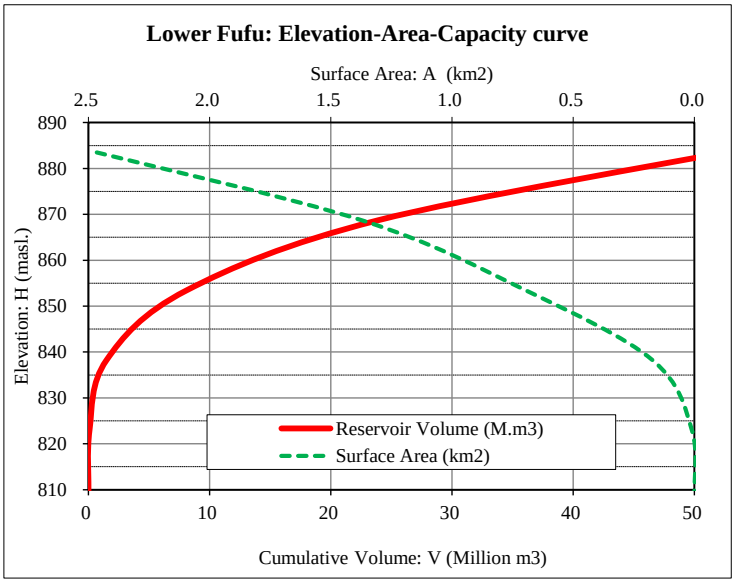
Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
976	0.0	0.0
991	3.9	0.5
1006	40.2	4.3
1021	307.0	30.7
1036	1068.8	69.2
1052	2498.0	118.3



Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Henga Valley (WRA-07)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
808	0.0	0.0
823	0.1	0.01
838	1.5	0.2
853	8.1	0.7
869	23.8	1.4
884	53.3	2.5

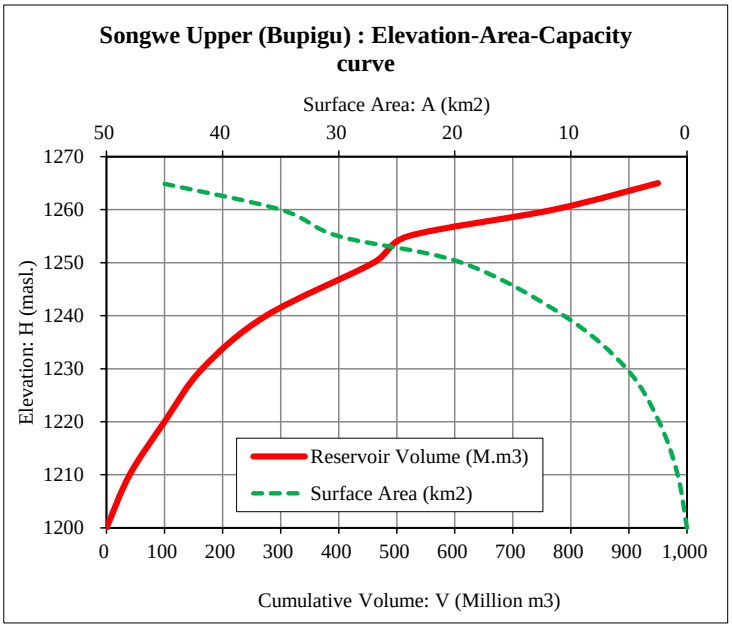


Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Lower Fufu (WRA-07)

Annex 5.4.4-2 (7/8)

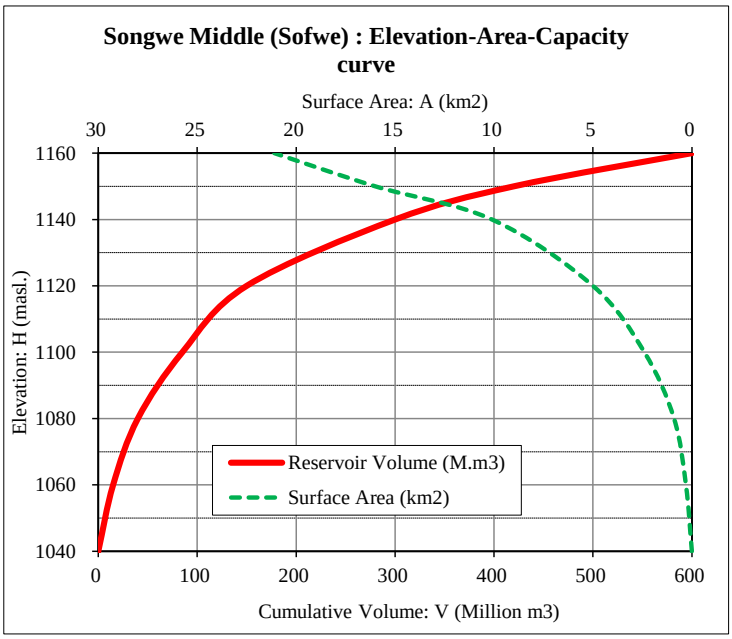
Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
1200	0.0	0.0
1210	40.0	0.8
1220	100.0	2.4
1230	165.0	5.2
1240	275.0	10.6
1250	460.0	19.4
1255	520.0	30.0
1260	770.0	35.0
1265	950.0	45.3



Source: Project Team based on WB (2010) [2]

Elevation-Area-Capacity Curve at Upper Songwe (WRA-09)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
1040	0.0	0.0
1060	15.0	0.3
1080	40.0	0.90
1100	85.0	2.40
1120	150.0	5.00
1140	300.0	10.10
1150	420.0	16.00
1160	600.0	21.10



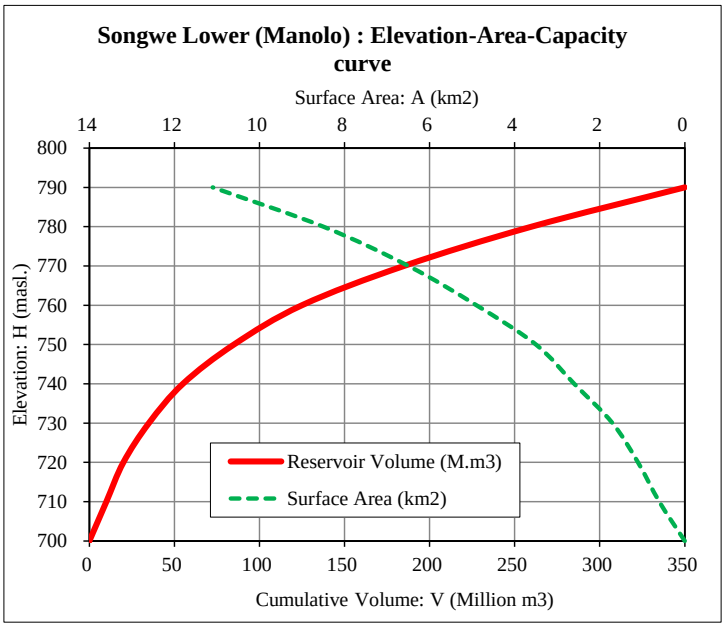
Source: Project Team based on WB (2010)

Elevation-Area-Capacity Curve at Middle Songwe (WRA-09)

[2] World Bank (WB), The Zambezi River Basin A Multi-Sector Investment Opportunity Analysis (MSIOA), Vol.3, 2010

Annex 5.4.4-2 (8/8)

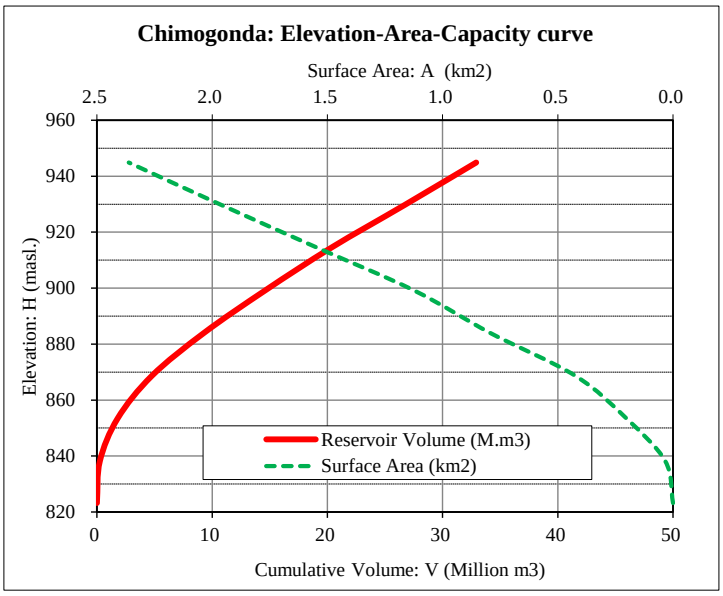
Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
700	0.0	0.0
710	10.0	0.6
720	20.0	1.1
730	35.0	1.7
740	55.0	2.6
750	85.0	3.5
760	125.0	4.9
770	185.0	6.5
780	260.0	8.5
790	350.0	11.1



Source: Project Team based on WB (2010)

Elevation-Area-Capacity Curve at Lower Songwe (WRA-09)

Elevation (masl.)	Reservoir Volume ($M.m^3$)	Surface Area (km^2)
823	0.0	0.0
838	0.3	0.0
853	1.8	0.2
869	4.8	0.4
884	9.3	0.8
899	14.6	1.1
914	20.3	1.5
930	26.7	2.0
945	32.9	2.4



Source: Project Team based on 1/50,000 topographic map

Elevation-Area-Capacity Curve at Chimogonda (WRA-16)

Annex 5.6.1-1 (1/6)

Folder name	File name	CRS	Authority	Remarks
DOF/River Data	RIVN_MW-00000m.shp	Arc1960	Department of Forestry (Japanese Grant for the Forest Preservation Programme to the Republic of Malawi)	Major Rivers
	RIVN_MW-00000s.shp	Arc1960		Sub Rivers
DOF/Road Data	ROAD_MW-00000m.shp	Arc1960		Major Road
	ROAD_MW-00000s.shp	Arc1960		Sub Road
DOF/Village Point Data	VILA_MW-00132.shp	Arc1960		Village
DOF/LU_data_1990-91	LU90_MW-00000.shp	Arc1960		Landuse 1990 by Landsat
DOF/LU_data_2000	LU00_MW-00000.shp	Arc1960		Landuse 2000 by Landsat
DOF/LU_data_2010	LU10_01-45900.shp - LU10_71-65870.shp	Arc1960		Landuse 2010 by ALOS
DOF/Land Cover Map/ Land Cover GIS Data	LC91-MW-91FRI.shp	Arc1960		LandCover 1990 by Landsat
DOF/Land Cover Map/ Georeferenced Tilling 50x50	LC91_01-45900.tif - LC91_71-65870.tif	Arc1960		Land Cover Map
DOF/Land Use and Vegetation Map/Land Use and Vegetation GIS Data	LUVE-MW-00000.shp			
DOF/Land Use and Vegetation Map/Georeferenced Tilling 50x50	LUVE_01-45900.tif - LUVE_71-65870.tif	Arc1960		Land Use and Vegetation Map
DOF/Forest_Resource_Baseline_Map_201	FB10_01-45900.shp - FB10_71-65870.shp	Arc1960		Forest Resourses Base line by ALOS
DOF/Tilling 50X50 TopoMap	TOPO_01-45900.tif - TOPO_71-65870.tif	Arc1960		Exsisting Topographic Map(1:50,000
DOF/Contour	CONT_MW-00000.shp	Arc1960		Contour Line Map by existing topo map digitizing
DOF/Tilling 50X50 SRTM	GDEM_01-45900 - SRTM_71-65870	Arc1960		Digital Elevation Model by SRTM Format: ESRI GRID
DOF/Tilling 50X50 GDEM	GDEM_01-45900 - GDEM_71-65870	Arc1960		Digital Elevation Model by GDEM Format: ESRI GRID
50K	0933.shp, 1033.shp, 1034.shp, 1134.shp, 1535.shp, 1534.shp major_rivers.shp, major_tile.shp, mw_admin_50k_line.shp, mw_admin_50k_poly.shp mw_centres_50k.shp, mw_districts_bnd_50k.shp, mw_intl_bnd.shp, mw_lakes.shp mw_railway_50k.shp, mw_rds_f.shp	Arc1960		1:50,000 scale topographical map
250K	mw_bnd.shp, mw_contours.shp, mw_dist_bnd.shp, mw_dist_mainctr.shp, mw_dist_mainctr.shp mw_lakes.shp	Arc1960		1:250,000 scale topographical map
malawi_general	mw_railway_50k.shp, mw_railways.shp, Mw_river_names.shp, mw_rivers.shp mw_roads.shp, mw_roads_50k.shp, mw_tas_250k.shp, Mw_villages.shp, mw_wetlands.shp mw_wetlands_50k.shp	Arc1960		
spatial_data	mw_cities.shp, mw_district_bnd.shp, mw_district_bnd.shp, mw_district_headquarters.shp, mw_lakes.shp, mw-international_bnd.shp, mw-major_rivers.shp	Arc1960		
WRA from Ministry	wra.shp	Unknown		MoAIWD
Water GIS data	Borehole_Atkins, Meteo_Station_aurecon, Monitoring_Well_aurecon, Rainfall_Station_Atkins, Rainfall_Station_Atkins_with_MAR, Rainfall_Station_aurecon, WL-Q_Station_aurecon	Unknown		MoAIWD
NSO District Maps/Balaka	District_Boundary, main_road.shp, Major_Centre, Major_Centres, major_river, Malawi_TA, minor_road, Other_Schools, River, Road, road_type, Sampled_EAs, Sampled_Schools, School, TA, TA_Boundary, track, Village	WGS84		BALAKA DISTRICT
	(TA Kalembo) Major Centre, Other Schools, River, Road, Sampled Schools, TA_Kalembo, TA_Kalembo_Buffer, Village			
	(TA Nsamala) Major Centre, Other School, River, Road, Sampled Schools, TA_Nsamala, TA_Nsamala_Buffer, Village			
NSO District Maps/Blantyre	Blantyre, Blantyre_City, Blantyre_Rural_Points, District_Boundary, FHWS_Site, IIK_EAs, Kuntaja_TC, Kunthembwe_Vge, Machinjiri_North, Machinjiri_South, Major_Centre, Malaria_Villages, Protected Area, River, Roads, Somba_Vge, south, TA Bound, ta boundary, Village, wetlands			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Chigaru) ADMARC, airstrip enock, Borehole, CDSS, chigaru ea nos, chigaru_ea_boundary, Chigaru_EA_Numbers, Chigaru_Points, Church, Clinics, Dip-Tank, district boundary, ea boundary, Footpath, Gardens, Groceries, hill, IIK_EAs, Lime_Mills, main_river, main_road, Maize_Mills, major_river, major_rivers, minor_roads, Mosque, Office, Police_Unit, Produce_Market, proposed_forestry_reserve, Quarry, rivers, Schools, Staff_Houses, ta boundaries, TA_Boundary, tracks, Trading_Centre, Traditional_Court, Villages, Well			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Kapeni) Borehole, Church, city boundary, Clinic, Compound, Dam, disrict boundary, Ea Nos Kapeni5b, EA_Boundary, ea_bounds, Farm, footpath, forest, Forest_Bou, Forest_Office, Hills, k, main_road, minor_road, Nursery, Points Kapeni5b, rivers, School, ta boundary, TPA_Boundary, tracks, Village			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Kapeni North) Admarc, Borehole, Bottle_Store, Care_Centre, Churches, city boundary, Clinic, Court, dams, Dip_Tank, ea boundaries, ea nos kapeni north, eaboundary, Footpath, Groceries, Hills, IIK_EAs, kapeni north, main road, Maize_Mill, major river, minor road, Mission, Mosque, points kapeni north, Produce_Market, Railway_Line, rivers, roads, School, Staff_Houses, ta boundary, TPA_Boundary, Tracks, Trading_Centre, Village			BLANTYRE RURAL

Annex 5.6.1-1 (2/6)

Folder name	File name	CRS	Authority	Remarks
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Kapeni South) Abbatuor, Borehole, Church, City_Boundary, Clinic, Dip_Tank, ea boundaries, eabounds, EA_Boundary, foot paths, IIK_EAs, kapeni south ea nos, kapeni south, main road, Maize_Mills, Market, minor road, Mosque, points kapeni south, POXF, Private_Clinic, river, School, ta_boundary, trackss, Trading_Centre, Villages, Water_Tap	WGS84		BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Kuntaja) Boreholes, C.D.S.S, Cattle_Farm, Childrens'_Home, Churches, Clinics, Court, DAPP, Dip_Tanks, Dispensary, district boundary, ea_boundaries, EA_Boundary, Farms, foot_paths, Forestry_Reserve, hills, Housing_Estate, kuntaja ea nos, Kuntajaa_Points, main_road, Maize_Mill, major river, minor_roads, Mission, Mosque, nku b, river, Schools, Shire river, Staff_Houses, Sunctuary, ta boundary, TA_Boundary, TPA_Boundary, tracks, Trading_Centre, Villages			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Kunthembwe) ADMARC, Borehole, Church, Clinic, Dip_Tank, district boundary, ea boundary, ea_boundaries, Export_Output, Farm, Foot_Paths, Forest_Camp, Grocery, Health_Centre, Hills, IIK_EAs, kunthembwe ea nos, Kunthembwe_Points, MainRoads, Maize_Mill, major river, Major_River, Maternity_Clinic, minor river, MinorRoads, Mosque, Parish, Produce_Mkt, Rapids, rivers kunthembwe, School, Staff_Houses, ta_bound, ta_boundarry, TDC, Tedzani_Satelite_Stn, Tracks, Trading_Centre, Villages			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Lundu) Agriculture_Houses, Borehole, Churches, Clinic, Dip_Tank, District_Boundary, ea boundaries, ea nos lundu, EA_Boundary, featurepts, foot paths, forest reserve, Health_Centre, Hills, IIK_EAs, lundu, mainroad, Maize_Mill, Marsh, minorroads, Mosque, Produce_Market, Railway_Station, Rail_Way_Line, Rivers, Schools, Staff_Houses, Station, ta boundary, Tax_Office, Tracks, Traditional_Court, traks, Villages			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Machinjili North) Agric, Bar, Borehole, Bottle_Store_&MM, Church, city boundary, Company, Dairy_Farm, district boundary, ea boundaries, ea boundary, ea nos machinjili, Estate, Farm, footpaths, hill, Housing, main road, Maize_Mill, major river, Market, MBC, minor road, Mission, Mosque, Office, Orphan, Point_Machinjili, railways, Railway_Stn, Rest_House, river, School, Staff_House, ta boundary, Tap, track, Trading_Centre, Transport, U5_Clinic			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Machinjili North) Village, ADMARC, Borehole, Church, City_Boundary, District_Boundary, ea boundaries, ea boundary, ea nos machinjili south, ea_bound, Farm, Filling_Stn, footpath, hill, machinjili south points, main road, minor road, Mission, Parish, river, School, Siding, ta bou, ta boundary, track, Village			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Makata) 2 rivers, Borehole, Church, Clinic, Dispensary, District_Boundary, e, ea boundaries, ea_boundary, EA_Numbers, Farm, feature points, foot paths, Health_Centre, Hills, hilly area, Houses, Magistrate_Court, Maize_Mill, major river, makata layer, Market, minor roads, Mosque, river dam, Rivers, School, TA_Boundary, TDC, Tracks, Trading_Centre, Village			BLANTYRE RURAL
NSO District Maps/Blantyre	(Maps\Blantyre\Blantyre Rural\Blantyre Rural\Somba) Admarc, Agricultural_Station, Agriculture_Houses, Borehole, Churches, city boundary, Clinics, Company, dam, district boundarry, ea boundaries, ea boundary, footpaths, Grocery, Health_post, Health_Unit, hill, IIK_EAs, Lines, mainroads, Maize_Mill, majorrivers, minorroads, mirale forest reserve, Mosque, Office, Orphan_Care, Residence, Rivers, Schools, somba ea nos, somba1, Staff_Houses, ta boundaries, ta_bounds, TPA_Boundary, tracks, Trading_Centre, Traditional_Court, Villages			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Blantyre TPA's\Chileka) Borehole, Bottle_Store, BP_Deport, CARGO, Charet, chileka ea nos, Church, Club, Company, Custom_lines, Dambo, dams, ea boundary, eabounds, ea_boundaries, Evans, Filling_Station, foot_paths, Guest_house, Hall, Hanger, Health_Centre, hills, Illovo, Lodge, main_rivers, Main_Roads, Maize_Mill, Martenity_Clinic, Masauli, minor_roads, Mission, Mosque, Offices, Playgroup_Hall, points_chileka_tpa, Police_lines, Police_station, Post_Office, Power_Station, Produce_Market, PTC_Shop, Pump_Station, Rest_House, REUBON, rivers, Road_Camp, runway1, School, sewerage works, Shop, Staff_Houses, Telephone_Exchange, the run way, tpa boundary, tracks, Trading_Centre, Veterinary_Stn, Village, Ware_House			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Blantyre TPA's\Lirangwe) Admarc, Bar, Borehole, Church, Clinic, Dispensary, ea boundaries, ea boundary, Enterprises, Entertainment_Centre, EPA, footpaths, Forest_House, Groceries, lirangwe ea nos, main road, Maize_Mill, major river, minor road, Mosque, Nursery, Office, Old_Filling_Station, Parish, points, Police_Unit, Post_Office, Produce_Market, Quarters, railway line, Residential_House, Rest_House, river, Schools, Stores, ta boundary, tpa boundary, tracks, Trading_Centre, Traditional_Court, Transport_House, Village, Water_Tank			BLANTYRE RURAL

Annex 5.6.1-1 (3/6)

Folder name	File name	CRS	Authority	Remarks
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Blantyre TPA's\Lunzu) Bakery, Bank, Bar, Borehole, Centre, Church, Clinic, ea boundaries, ea boundary, ea nos lunzu, eabounds, Filling_Station, footpath, Garage, Groceries, Hall, Hospital, Houses, J&M_Resturant, Lodge, main rooad, Maize_Mill, major river, Mortuary, Mosque, Motel, Office, Offices, points lunzu, Police_Unit, Post_Office, Produce_Market, Quarters, Restuarant, Rest_House, Rest_Houses, river, RTC, School, Shop, Staff_House, TELECOMS, TPA_Boundary, track, Trading_Centre, Village, Wholesale			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Blantyre TPA's\Mpemba) Borehole, Churches, dam, Dip_Tank, ea nos mpemba, EA_Boundary, Footpath, Health_Centre, main road, Maize_mill, Market, minor road, Mosque, Mpemba_Junior_Staff_Quarters, Mpemba_Staff_Training_College, points mpemba tpa, Post_Office, river, School, Staff_Houses, TAs'_Residencial_House, tpa boundary, tpa ea boundary, tracks, Transmitting_Station, Vertinary_Department, Vertinary_Office, Villages			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Blantyre TPA's\Nkula) Administration, Barage, Church, Club, Club_House, Control_Block, dams, Dispensary, dist, ea boundary, EA_Boundaries, ESCOM_Houses, Exchange, Filling_Station, footpaths, Gate_House, Gest_House, Ground, hill, Houses, Junior_Staff, Main_Gate, Main_Stores, Maize_Mill, major river, Mess, minor road, Mosque, nkula ea nos, nkula falls p, Office, Play_Ground, Police_Unit, Post_Office, Power_Station_A, Power_Station_B, river, School, Social_Club, Staff_Houses, Station, Switch_Yard_A, Switch_Yard_B, TPA_Boundary, track, Trading_Centre, Transformer, Treatment, Valve_House, Village, Water_Intake_A, Water_Intake_B			BLANTYRE RURAL
NSO District Maps/Blantyre	(Blantyre Rural\Blantyre Rural\Blantyre TPA's\Nkula Part B) Church, Club_House, district boundary, ea boundaries, ea boundary, ea nos nkula part b, ESCOM_Houses, footpaths, Gate_House, Ground, hill, Houses, Junior_Staff_Houses, Main_Gate, Maize_Mill, major river, minor road, Mosque, nkb, nkula b boundary, nkula part b points, Office, Play_Group, Post_Office, rivers, School, Staff_Houses, Station, tracks, Trading_Centre, Transformer, Treatment, Village			BLANTYRE RURAL
NSO District Maps/Blantyre City	BT_Landuse, City_Boundary, Educational, Forest, Fuel_Depot, Major River, Mapanga, Open_Space, points, Primary_School, Residential_Area, River, Road, School, Secondary_School, Ward, Ward_Boundary	WGS84		BLANTYRE CITY
NSO District Maps/Chikwawa	Chikwawa_points, District_Boundary, IIK_EAs, International_Boundary, Maj River, Major Centres, Major Roads, Nyala_Park, Protected_Area, River, School, TA Boundary, TA_Boundary, Village	WGS84		CHIKWAWA DISTRICT
NSO District Maps/Chiradzulu	Borehole, Chiradzulu_Points, District, District_Boundary, main_road, Maj River, minor_road, Protected_Area, River, School, TA, TA_Boundary, Trading_Centre, Village	WGS84		CHIRADZULU DISTRICT
NSO District Maps\Chitipa	District_Boundary, International_Boundary, Main_Road, Major River, Minor_Rd, Protected Area, TA Boundary, TA_Bound, Track, Trading_Centre, Village	WGS84		CHITIPA DISTRICT
NSO District Maps\Dedza	District_Boundary, International_Boundary, Main_Road, Major_Centre, Major_River, Minor_Road, Protected Area, River, Roads, Sampled_EAs, TA Boundary, TA_Boundary, Track, Village	WGS84		DEDZA DISTRICT
NSO District Maps\Dowa	district_boundary, Dowa, Dowa_Part, Extra_Bound_Distr, Extra_Bound_TA, Extra_River, Extra_Roads, IIK_EAs, Major_Centres, major_roads, Malawi_TA, Protected_Area, River, ta_boundary	WGS84		DOWA DISTRICT
NSO District Maps\Karonga	International_Boundary, Lake, Main_Road, Major River, Minor_Road, Protected Area, Road, TA Boundary, TAs, TA_Boundary, Trading_Centre, vge, Village	WGS84		KARONGA DISTRICT
NSO District Maps\Kasungu	district_boundary, international_boundary, Kasungu, Major_Centre, Major_Roads, Malawi_TA, Protected Area, River, Sampled_EAs, TA Boundary, ta_boundary, Trading_Centre, Village	WGS84		KASUNGU DISTRICT
NSO District Maps\Lilongwe City	area, Area_Boudary, Area_Buffer, area_Buffer1, city_boundary, Major River, Points, Primary_School, River, road, School, Secondary_School, Trading_Centre (Other Roads) Area, Central_Points, company, Depot, Fuel_Depot, Houses_49, LL_City_Points, Main_Road, Minor_Road, Place, Railway_Line, River, Road, Trading_Centre, vge, vge1	WGS84		LILONGWE CITY
NSO District Maps\Lilongwe Rural	District_Boundary, International_Boundary, Major_Centres, Major_River, Protected Area, River, Roads, Sample_EAs, TA Boundary, TA_Boundary, Village	WGS84	National Statistics Office	LILONGWE RURAL

Annex 5.6.1-1 (4/6)

Folder name	File name	CRS	Authority	Remarks
NSO District Maps\Machinga	(Machinga District) district_boundary, international_boundary, lake, Main_Road, Major River, Major_Centre, Malawi_TAs, minor_road, NP_Camp, Other_Schools, Primary_School, Protected_Area, River, Road_Type, Sampled_EAs, Sampled_Schools, School, Secondary_School, TA, ta_boundary, TA_Buffer, Track, Trig_Station, Village, Ward_Boundary, Wetlands, Wetlands_Clip		2008 Census data	MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Chamba) main road, Market, Other_Schools, Parish, Points, rivers, roads, School, Staff_houses, t a boundaries, t a boundary, TA, Tap, tracks, trig station, T_B_A, T_C, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Chikweo) chikweo, hills, International_Boundary, lake, minor_roads, Rivers, Road Type, School, TA, TA_Boundary, tracks, Trading_Centre, Traditional_Court, T_A_Boundary, Village, Wetlands			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga\Chiwalo) District_Boundary, hills, Main_Road, Maize_Mill, Mapoints, Minor_Roads, River, School, TA_Boundary, Tracks, Trading_Centre, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Kawinga) hills, Intrnational_Boundary, railway line, rivers, roads, School, ta kawinga, TA, TA_Boundary, tracks, Traditional_Court, T_C, Village, Wetlands			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Liwonde) district boundary, forest reserve, Hills, main_roads, minor_roads, rivers, School, TA, ta_boundary, tracks, Trading_Centre, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Liwonde National Park) Camp"district boundary"House"Lodge"national park boundary"national_park"Office_and_Staff_Houses"Points"rivers"shire river"track"trigonometrical station			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Mlomba) forest boundary, forest, hilly area, lake, main road, Maize_Mill, Market, marsh, minor roads, nsanama, rivers, rovers, School, t p a boundary, TA_Boundary, TA_Mlomba, tpa boundary, tracks, Trading_Centre, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(\Machinga\Mposa) forest reserve boundary, forest reserve, Hill, Hills, Marsh, Minor_Roads, Rivers, School, ta mposa, TA_Mposa, Tracks, Trading_Centre, trig, T_A_Boundary, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Nyambi) district boundary, Hill2, hills, hills2, international_boundary, Maize_Mill, minor_roads, rivers, School, ta boundaries, ta boundary, TA_Nyambi, tracks, Trading_Centre, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Sitola) forest reserv, forest reserve boundary, forest_reserve, hills, hills1, main_roads, Minor_Road, minor_roads, rivers, School, shire, t p a boundary, TA_Sitola, tracks, T_C, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\TA Ngokwe) ADMARC, Borehole, Church, Dispensary, ea_boundaries, EA_Nos, Estate, E_A_Boundary, foot_paths, hill, hilly area, Hospital, House, international_boundary, laki, Maize_Mill, Market, marsh, marshe, minor_roads, Mosque, ngokwe, Points, Police, rivers, School, ta_boundary, tracks, Trading_Centre, T_D_C, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Chikweo TPA) ADMARC, Agriculture_Houses, Assembly, Borehole, Council, Dispensary, ea boundaries1, ea_boundaries, EA_Nos, Estate, Footpath, Groceries, Hills, Market, Minor_Road, Points, Rivers, School, t p a boundary, tpa boundary, Tracks, Trading_Centre, Traditional_Court, Village	WGS84		MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Liwonde Town) ADMARC, ARCT_Offices, Bar, Booster_House, Borehole, Central_Government_Store, Centre, Church, Civic_Offices, Clinic, Concrete_Factory, Court, Customs_Office, ea boundaries, EA_Boundary, EA_Nos, Factory, Filling_Station, Footpath, Garage, Groceries, Grocery, Guest_House, Hall, Health_Clinic, Hospital, Hospital_Houses, Hotel, Houses, Junior_Houses, Leisure_Centre, Lines, liwonde, Liwonde_Town, Location, Lodge, Main_Road, Maize_Mill, Major_River, Market, Marlin_Office, marsh, MFC_Depot, Minor_Roads, Mosque, Motel, Office, Offices, Parish, Plots, Points, Produce_Market, PTC_Superate, Railway_Line, Residences, Restaurant, Rest_House, Rivers, School, SC_Stola's_House, Sewage, Sloter_House, Staff_Houses, Store, Stores, Superate, t p a boundary, Tarnery, Telecom_Exchange, Tracks, Trading_Centre, Village, Water_Tank, Water_Tap, WR_Station			MACHINGA DISTRICT

Annex 5.6.1-1 (5/6)

Folder name	File name	CRS	Authority	Remarks
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Machinga Boma) boma, Boma_Boundary, boundary, Church, Council_Lines, Council_Offices, Court, Dispensary, D_C's_Office, D_E_O's_Office, EA_Nos, Foot_Paths, Forestry_Office, Government_Quarters, Hills, hills2, Houses, Labour_Office, machinga_boma, main_road, Maize_Mill, Market, Minor_Roads, Mosque, M_C_P_Office, Office, Points, Police_Lines, Residence, Rest_House, Rivers, School, Telecom, Tracks, Village, Water_House, Water_Tap, Water_Works			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Malosa) Borehole, EA_Nos, footpath, Girls_Hostel, main road, malosa tpa, Points, rivers, School, t p a boundary, tracks, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Nayuchi) Borehole, Church, Dispensary, ea boundaries1, EA_Boundaries, Football_Ground, Footpath, FP_School, Immigration_Office, international boundary, Maize_Mill, Market, marsh1, Minor_Roads, Police_Post, Railway, Railways_Compound, Railways_Station, t p a boundaries, tracks, Village			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Nsanama) Agriculture_House, Borehole, Church, Dispensary, ea boundary, EA_Boundaries, EPA, Export_Output, Footpath, Forestry_House, Groceries, Main_Road, Maize_Mill, Market, Marsh, marsh1, Minor_Road, Mosque, nsanama t, Nsanama_TPA, Numbers, Parish, Points, Post_Office, Railway_Line, Restaurant, Resthouse, Rice_Mill, Rivers, School, Superate, t p a boundary, Tracks, Trading_Centre, Village, Wholesale			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Nselema) ADMARC, Borehole, Church, Depot, district boundary, e a boundary, EA_Nos, footpath, Groceries_Shops, Hall, main road, Maize_Mill, minor road, Mosque, nselema tpa, Points, Police, Post_Office, Rest_House, rivers, School, t p a boundary, tracks, Trading_Centre, Village, Wholesale			MACHINGA DISTRICT
NSO District Maps\Machinga	(Machinga\Machinga TPAs\Ntaja) ADMARC, Agriculture_Station, Agriculture_Station, Borehole, Bottle_Store, Church, Comm, C_D_S_S, EA_Boundaries, ea_nos, Exchange, E_A_Boundary, Filling_Station, Football_Ground, Footpath, Hall, Health_Centre, Hostel, Houses, Main_Roads, Maize_Mill, Market, Minor_Roads, Mosque, Office, Points, Post_Office, P_T_C, Rest_House, Rivers, School, Staff_Houses, Store, Superate, t p a boundary, t pa b, theme5, tpabou, Tracks, T_C, Village			MACHINGA DISTRICT
NSO District Maps\Mangochi	District_Boundary, International_Boundary, lake, Major_Centre, Primary_School, protected_area, River, Road, Sampled_EAs, School, Secondary_School, ta, TA_Boundary, TA_Buffer, Track, Village	WGS84		MANGOCHI DISTRICT
NSO District Maps\Mchinji	Dambe_Tc, district_boundary, internatinal_boundary, Major_Centre, major_roads, Malawi_TA, Mchinji, Mduwa_TC, Mkanda_TC, Protected_Area, River, Sampled_EAs, ta_boundary, TC_Extra, Vge_Dambe, Vge_Mavwere, Vge_Mduwa, Vge_Mkanda, Vge_Mlonyeni, Vge_Zulu	WGS84		MCHINJI DISTRICT
NSO District Maps\Mulanje	Borehole, District, District_Boundary, international_boundary, Mabuka_School, main_road, Major_River, minor_road, Mulanje_Points, Protected_Area, River, Sampled_EAs, School, TA, TA_Boundary, TC_IIK, trading_centre, Village	WGS84		MULANJE DISTRICT
NSO District Maps\Mwanza	District_Boundary, International_Boundary, Main_Road, Major River, Major Roads, Major_Centres, Minor_Road, Protected_Area, River, Study_EAs, TA Boundary, TA_Boundary, Track, Village	WGS84		MWANZA DISTRICT
NSO District Maps\Mzimba	District_Boundary, International_Boundary, Main_Road, Major River, Major_Centre, Minor_Road, Protected Area, River, Roads, Study_EAs, TA Bound, TA Boundary, TA_Boundary, Track, Trading_Centre, Village	WGS84		MZIMBA DISTRICT
NSO District Maps\Mzuzu	Airport, City Boundary, Main_Road, Mzuzu_Stadium, Permanent_Features, Protected_Area, Residential, River, Roads, Ward_bound, Ward_Boundary	WGS84		MZUZU CITY
NSO District Maps\Neno	District_Boundary, Extra_Mlauli, International_Boundary, Major River, Major_Centre, Major_Roads, Neno Boma Boundary, Neno_Boma, Protected Area, River, Sample_EAs, TA Boundary, TA_Boundary, Village	WGS84		NENO DISTRICT
NSO District Maps\Nkhatabay	District_Boundary, Lake, Main_Road, Major River, Major TC, Minor_Road, Protected Area, Road, TA Boundary, TA_Boundary, Track, Village	WGS84		NKHATA-BAY DISTRICT
NSO District Maps\Nkhotakota	Borehole, District Boundary, Forest_Reserve, Health Facility, Lake, Major River, Major_Centres, Protected_Area, River, Roads, Sampled_EAs, TA Boundary, TA_Boundary, Village	WGS84		NKHOTAKOTA DISTRICT
NSO District Maps\Nsanje	District_Boundary, IIK_EAs, International_Boundary, Main_Road, Major Centres, Major Roads, Major_River, Minor_Road, Nsanje_TAs, Protected Area, River, TA_Boundary, Track, Village	WGS84		NSANJE DISTRICT

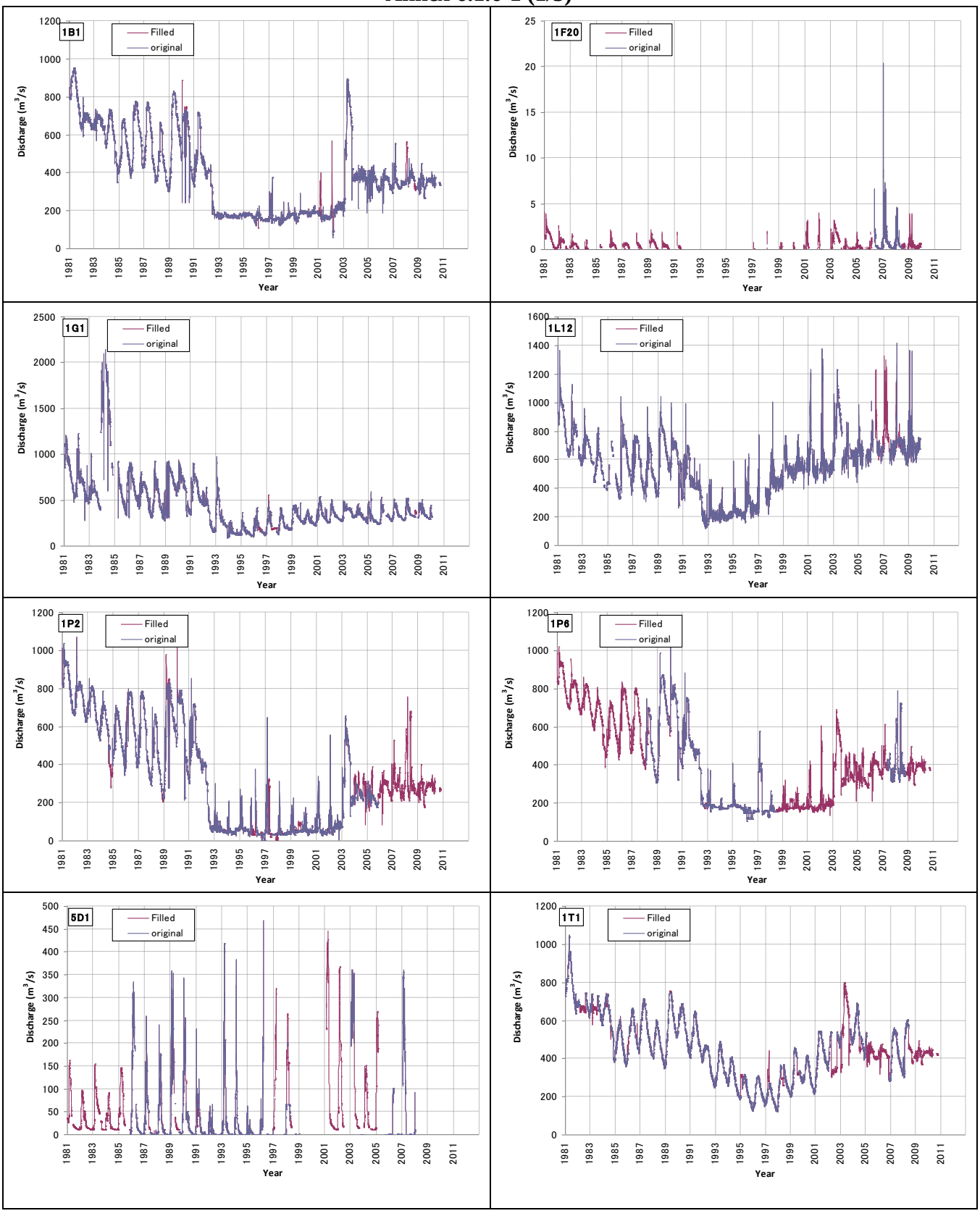
Annex 5.6.1-1 (6/6)

Folder name	File name	CRS	Authority	Remarks
NSO District Maps\Ntcheu	District_Boundary, Export_Output, International_Boundary, Lilongwe points, Main_Road, Major River, Major_Centres, Minor_Road, Protected Area, River, Roads, Sampled_EAs, TA Boundary, TA_Boundary, Track, Village	WGS84		NTCHEU DISTRICT
NSO District Maps\Ntchisi	District_Boundary, Main_Road, Major River, Major_Centre, Minor_Road, Protected_Area, River, Roads, Sampled_EAs, TA Boundary, TA_Boundary, Village	WGS84		NTCHISI DISTRICT
NSO District Maps\Phalombe	Borehole, Communal_Stand_Pipe, District_Boundary, Health_Facility, International_Boundary, Lake_Chilwa, Major_River, Major_Road, PE_Points, Phalombe_District, Phalombe_River, Protected_Area, River, Sampled_EAs, School, TA_Bound, TA_Boundary, TA_Boundary1, TA_Boundary2, TA_Boundary3, Track, Trading_Centre, Village, Wetlands	WGS84		PHALOMBE DISTRICT
NSO District Maps\Rumphi	District, Export_Output, International_Boundary, Lake, Main_Road, Major river, Minor_Road, Protected_area, River, TA Boundary, TA_Boundary, Track, Trading_Centre, Village	WGS84		RUMPHI DISTRICT
NSO District Maps\Salima	district_boundary, lake, Major_Roads, Malawi_TA, Protected Area, River, Salima, ta_boundary	WGS84		SALIMA_DISTRICT
NSO District Maps\South Health Facilities	City, DistBoundCities, District_Boundary, District_Headquarters, Health_Facility, International_Boundary, lake, LakeMalawi, Lake_1, Major_Centre, Major_River, Major_Road, Major_Trading_Centres, Malawi_District_Boundary, Protected_Area, Roads, Salima_EAs, Shire, Shire_1Km_Buffer, TA_Boundary, TA_Polygon	WGS84		
NSO District Maps\Thyolo	District_Boundary, International_Boundary, Maj River, Major Centres, Major River, Major Roads, Nchilamwera_School, Nchilamwera_vge, Protected Area, River, Sampled_EAs, School, TA Boundary, TA_Boundary, Thyolo_Points, Village	WGS84		THYOLO DISTRICT
NSO District Maps\Zomba	Borehole, District_Boundary, Health_Facility, International_Boundary, Lake, main_road, major_river, Malawi_District, Malawi_District_Bound, minor_roads, Protected_Area, River, Sampled_EAs, School, ta_bound, TA_Boundary, Trading_Centre, Village, wetlands, Zomba_Points	WGS84		ZOMBA DISTRICT
NSO District Maps\Zomba City	City_Boundary, Hill, location_dot, main_road, minor_road, Primary_School, River, School, Secondary_School, structure, Track, Trading_Centre, Village, Ward, Ward_Boundary	WGS84		ZOMBA CITY
NSO District Maps\Zomba New	Borehole, District_Boundary, Health_Facility, International_Boundary, Lake, main_road, major_river, Malawi_District, Malawi_District_Bound, minor_roads, Protected_Area, River, Sampled_EAs, School, ta_bound, TA_Boundary, Trading_Centre, Village, wetlands, Zomba_Points	WGS84		

Annex 5.6.2-1

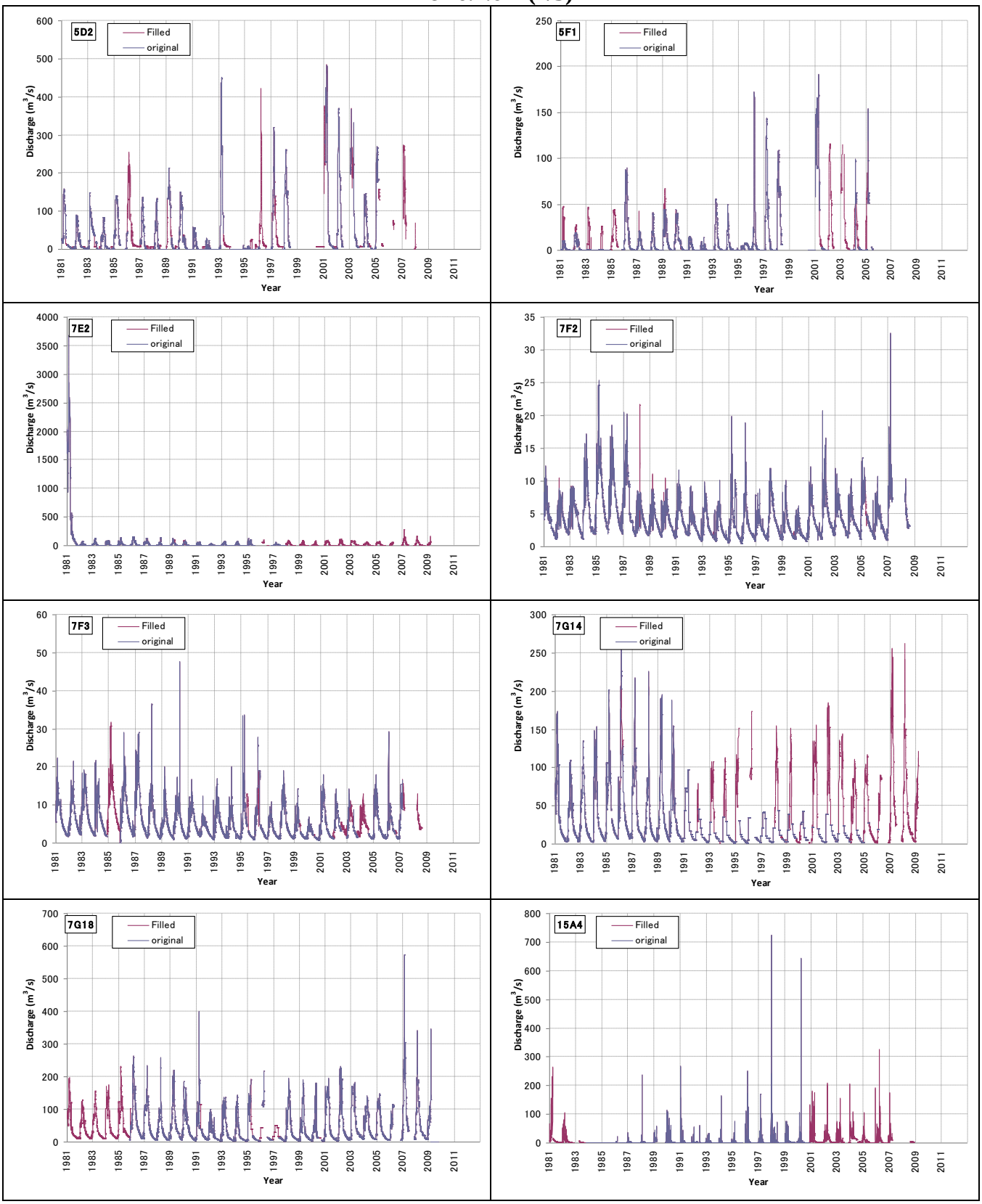
Major Class Name	Sub Class Name	Feature Name	Data Type	Major Annotation	CRS
Administration	District	District Boundary	Polygon	District_Nmae, Area(km2), 2008-2030 Population_density by District	Arc1960
		District Head Office	Point	Name	Arc1960
		Major Centre	Point	Name, Village, TA, District, Region, Easting, Northing	WGS84
		Major Centre Buffer 15km	Polygon	Name, Village, TA, District, Region, Easting, Northing, Buffer_Distance	WGS84
		Major Centre Buffer 25km	Polygon	Name, Village, TA, District, Region, Easting, Northing, Buffer_Distance	WGS84
	Traditional Authority	Traditional Authority Boundary	Polygon	TACode, Area(SqKm), Area(SqM), District_Name, TAName, District_Code, Perimeter, Hectares	Arc1960
		Trading Center Location	Point	ObjectID, Road Type, Road Class, Length, Enabled	WGS84
	Village	Village Location	Point	Serial_No., EA, Village, Name of PL, Feature, Earthing, Northing, Reagion, District, TA,	WGS84
	Water Resources Area	WRA	Polygon	Major_Catch(WRA No.), Name, 2008-2030 Population_density by WRA	Arc1960
		WRU	Polygon	WaterReso(WRU_No.), Area, Perimeter, Major_Catch, Minor_Catch, RiverName, Population Density by WRU	Arc1960
Bacical Features	Roads	Main	Linestring	Main, Mainor, Secondary, Tertiary, District, Other road	Arc1960
	Water Bodies	MajorRiver	Linestring	River Name	Arc1960
		Lake	Polygon	Name, Area, Perimeter	Arc1960
Facilities	Hydrology	Reservoir	point	Name, RiverName, District, WRA, Category, Feature	Arc1960
		Borehole	point	Borehole_ID, Easting, Southing, district, TA_Name, WRA_Code, Aquifercode, WaterLevel, W_Strike, Depth, Yield, Lithology, PH, EC, TDS, CO3, HCO3, CL, SO4, NA, K, CA, MG, FE, MN, F, NO3, SIO2	Arc1960
		observatory	point	Status, Number, Name	Arc1960
	Meteorology	observatory	point	Site, WMO_ID, Name, Start, Latitude, longitude, Elevation	Arc1960
		Rainfall station	point	ID, Name, Longitude, Latitude, Elevation, SFPDP, Glasgow_Un	Arc1960
Vegitation	Land Use 2010	Landuse	Polygon	ObjectID, Major_Catch(WRA_No.), Level1, Level2, length, Area	Arc1960
	Boundary	National Park	Polygon	Type_ID, Type_text, Name, Name_Low, Proteced_Date, Area(sqm,sqkm), Perimetre, Hectares, Gaz_date, Gaz_Decade, Gaz_1964, Add_date, Rational1, R1_code, Rational2, R2_code, Buffer_pop	Arc1960
		ForestReserve and Game	Polygon	Type_ID, Type_text, Name, Name_Low, Proteced_Date, Area(sqm,sqkm), Perimetre, Hectares, Gaz_date, Gaz_Decade, Gaz_1964, Add_date, Rational1, R1_code, Rational2, R2_code, Buffer_pop	Arc1960
Physiognomy	Contour	Index Contour	Linestring	Height(feet), Height(metre), Length, Fnode, Tnode	Arc1960
Raster	1:50,000	Topo_raster_collection	Raster	Name, Length, Area	Arc1960

Annex 6.1.6-1 (1/3)



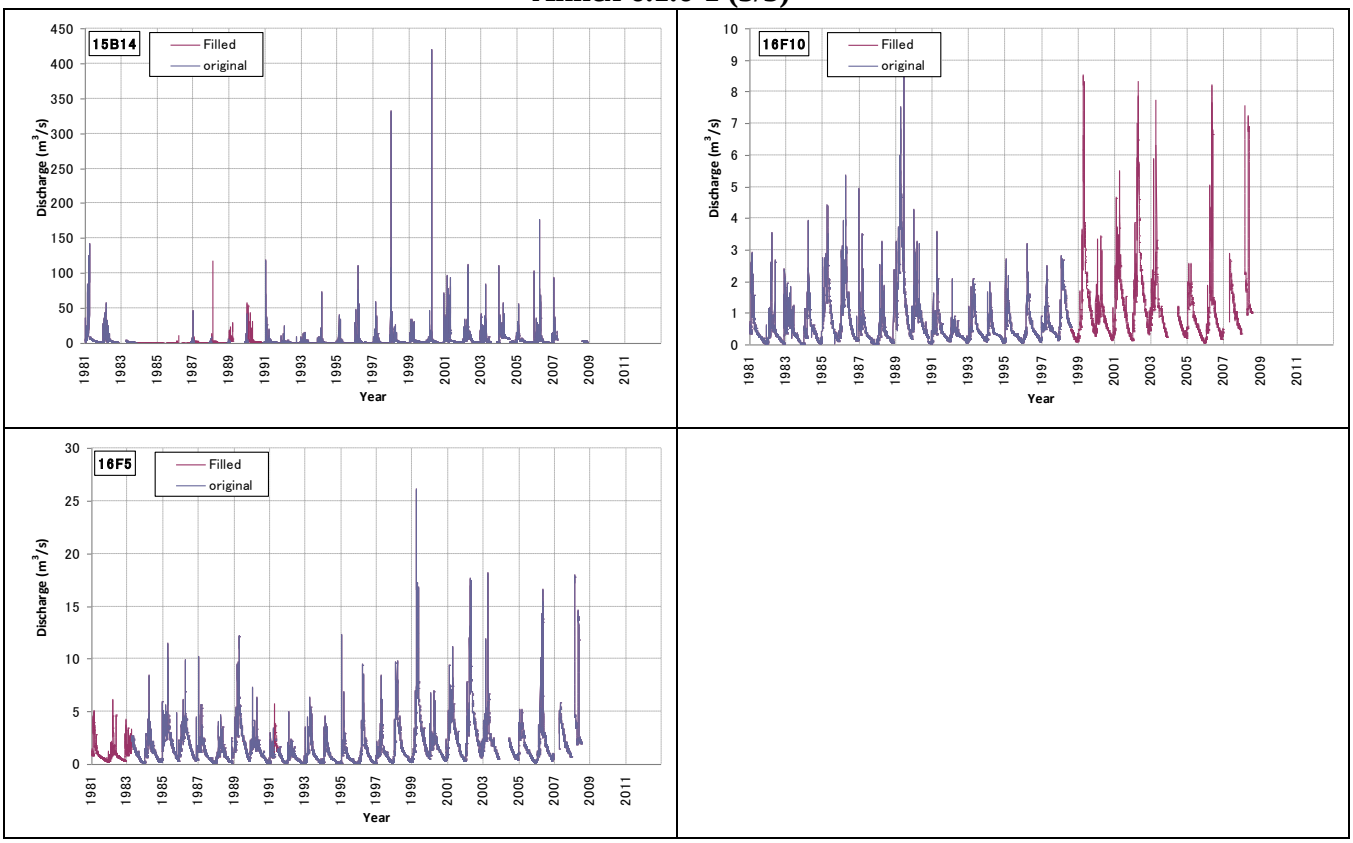
Gap Filling

Annex 6.1.6-1 (2/3)



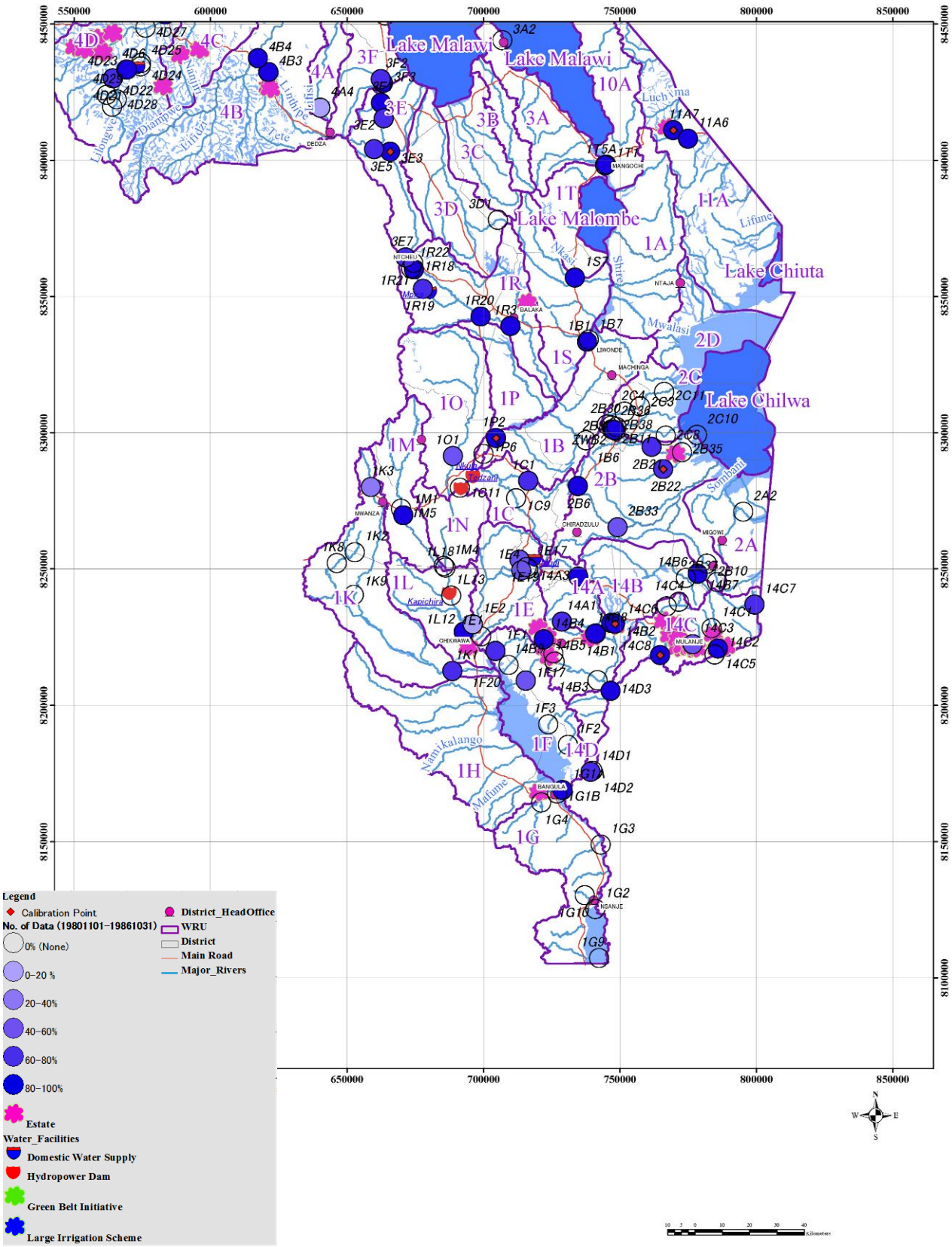
Gap Filling

Annex 6.1.6-1 (3/3)



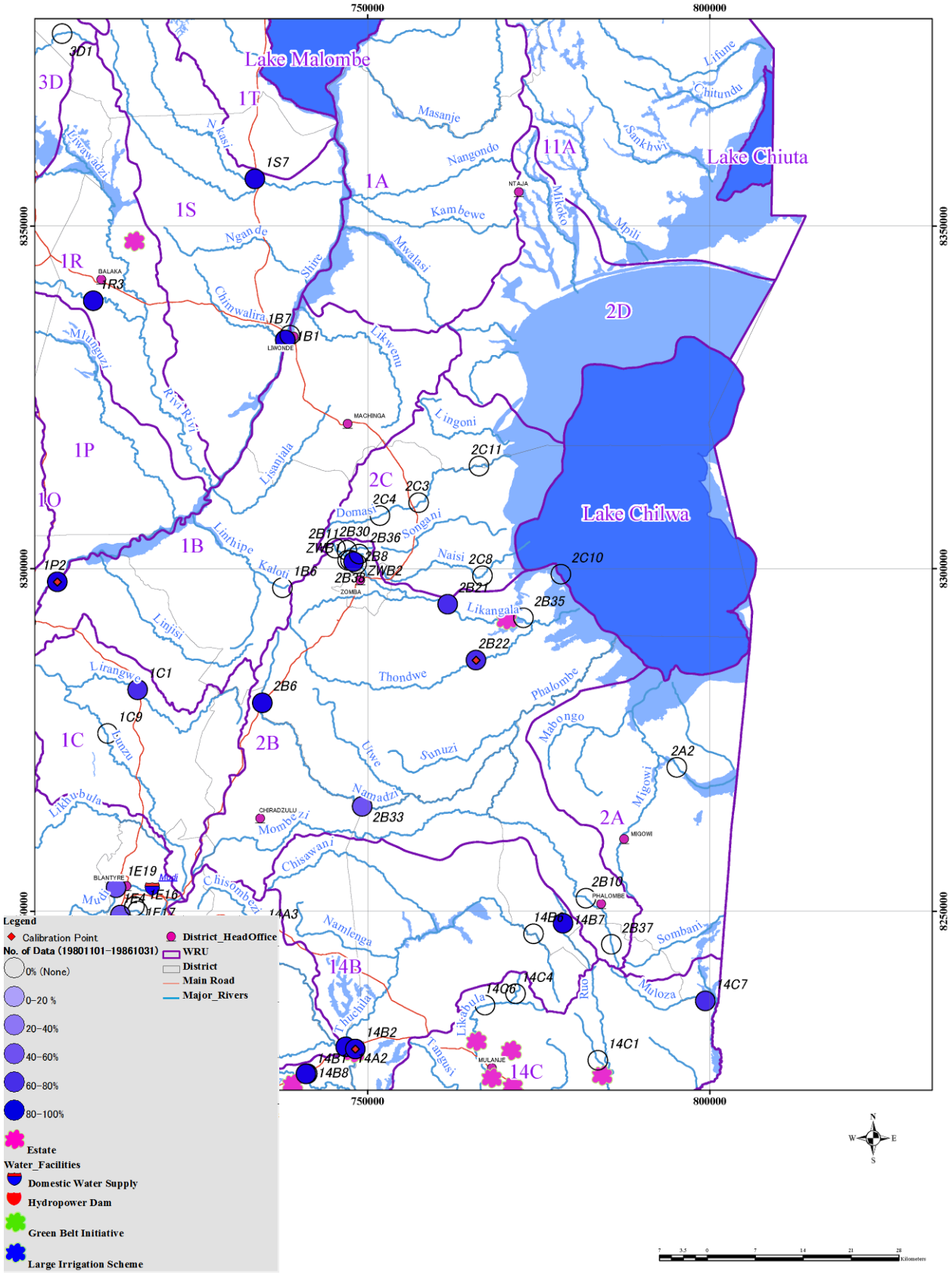
Gap Filling

Annex 6.5.1-1 (1/17)



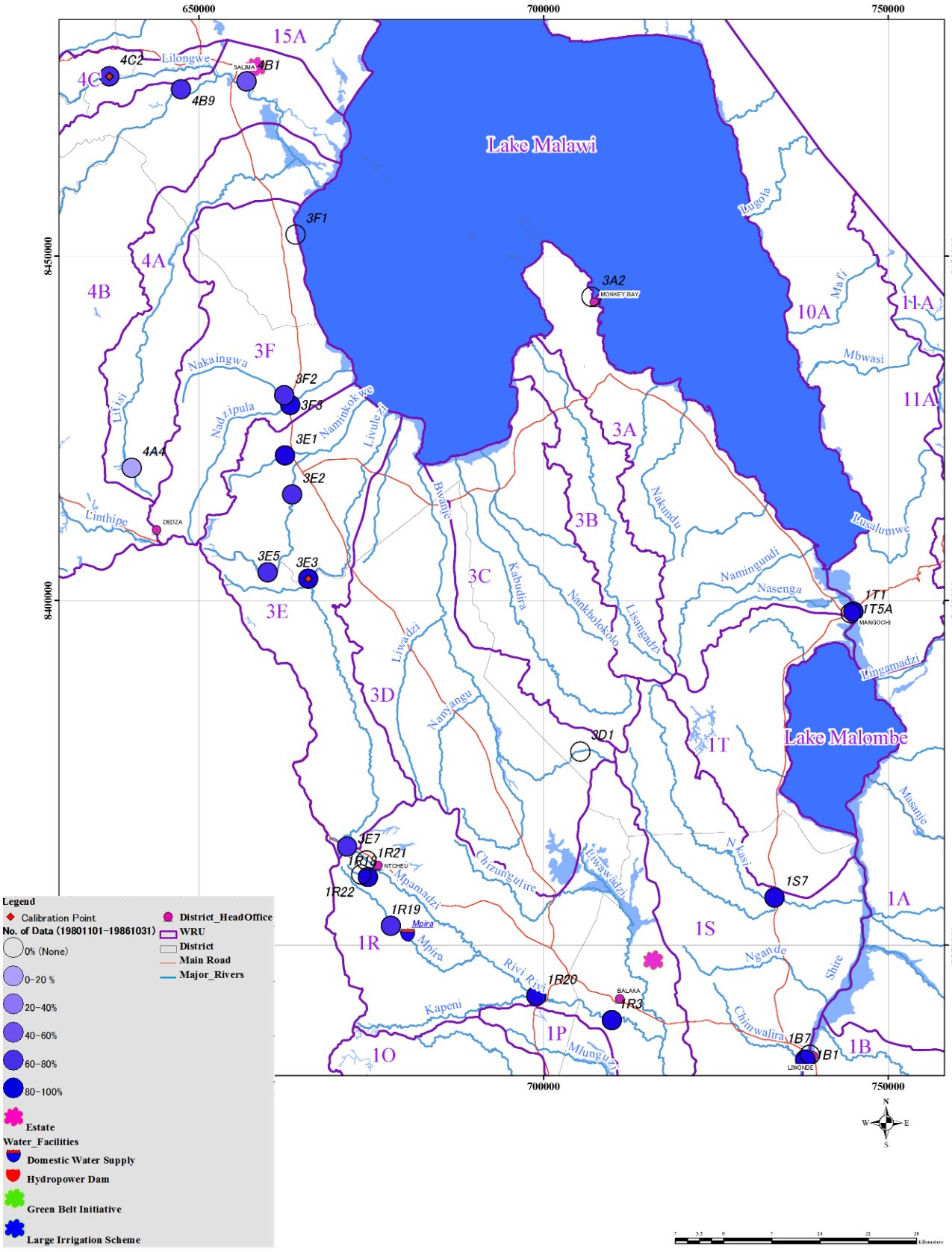
Location of Stations (WRA1)

Annex 6.5.1-1 (2/17)



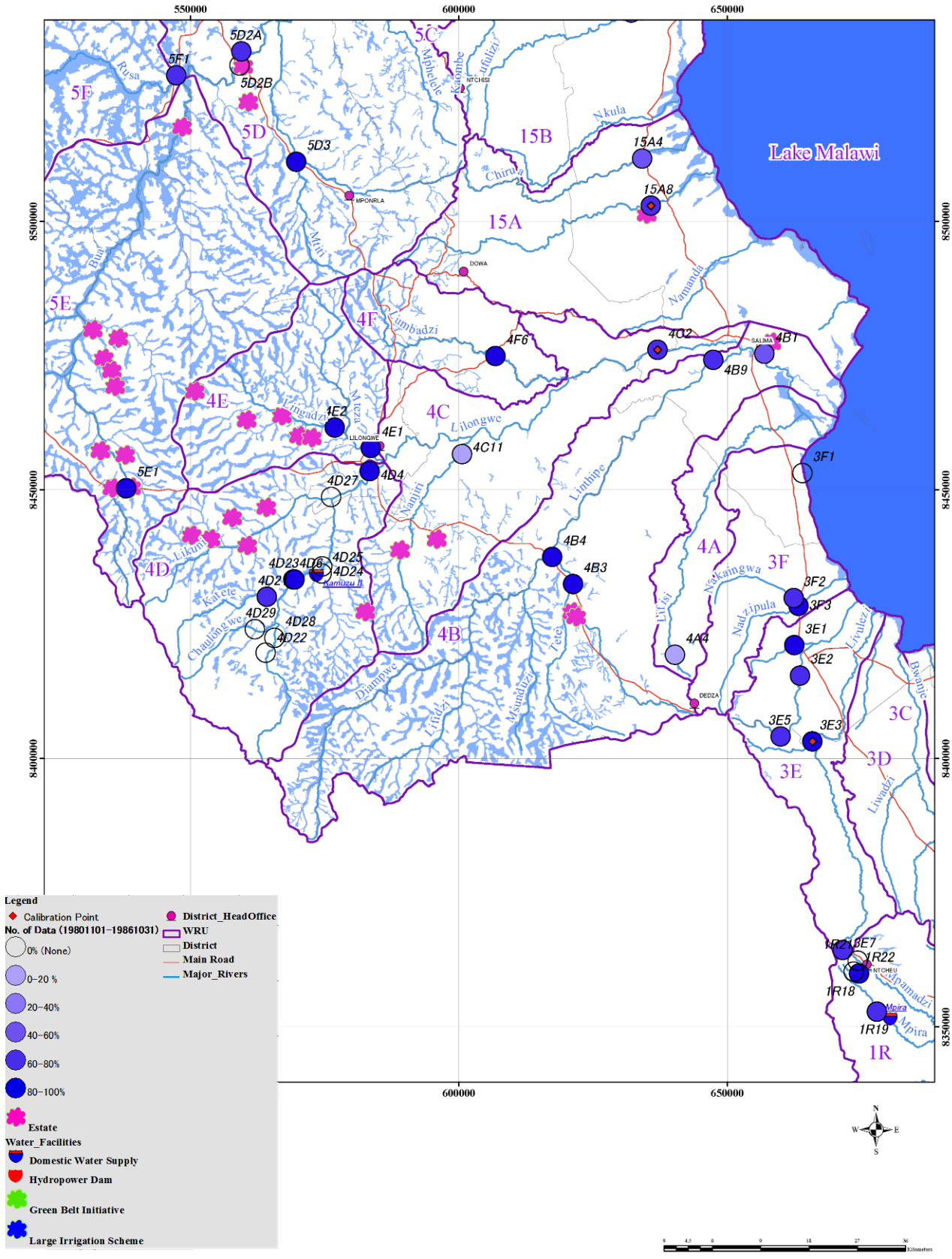
Location of Stations (WRA2)

Annex 6.5.1-1 (3/17)



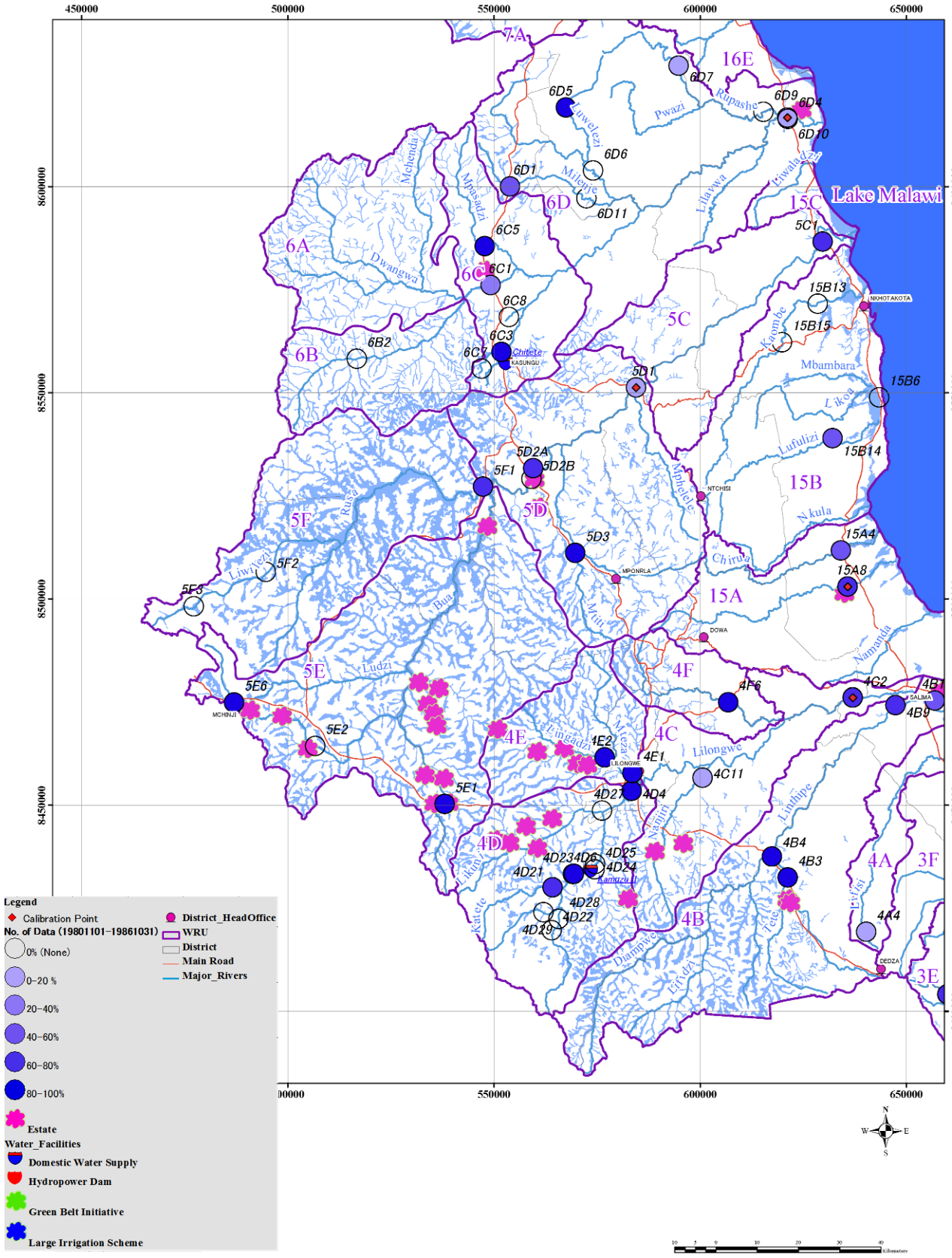
Location of Stations (WRA3)

Annex 6.5.1-1 (4/17)



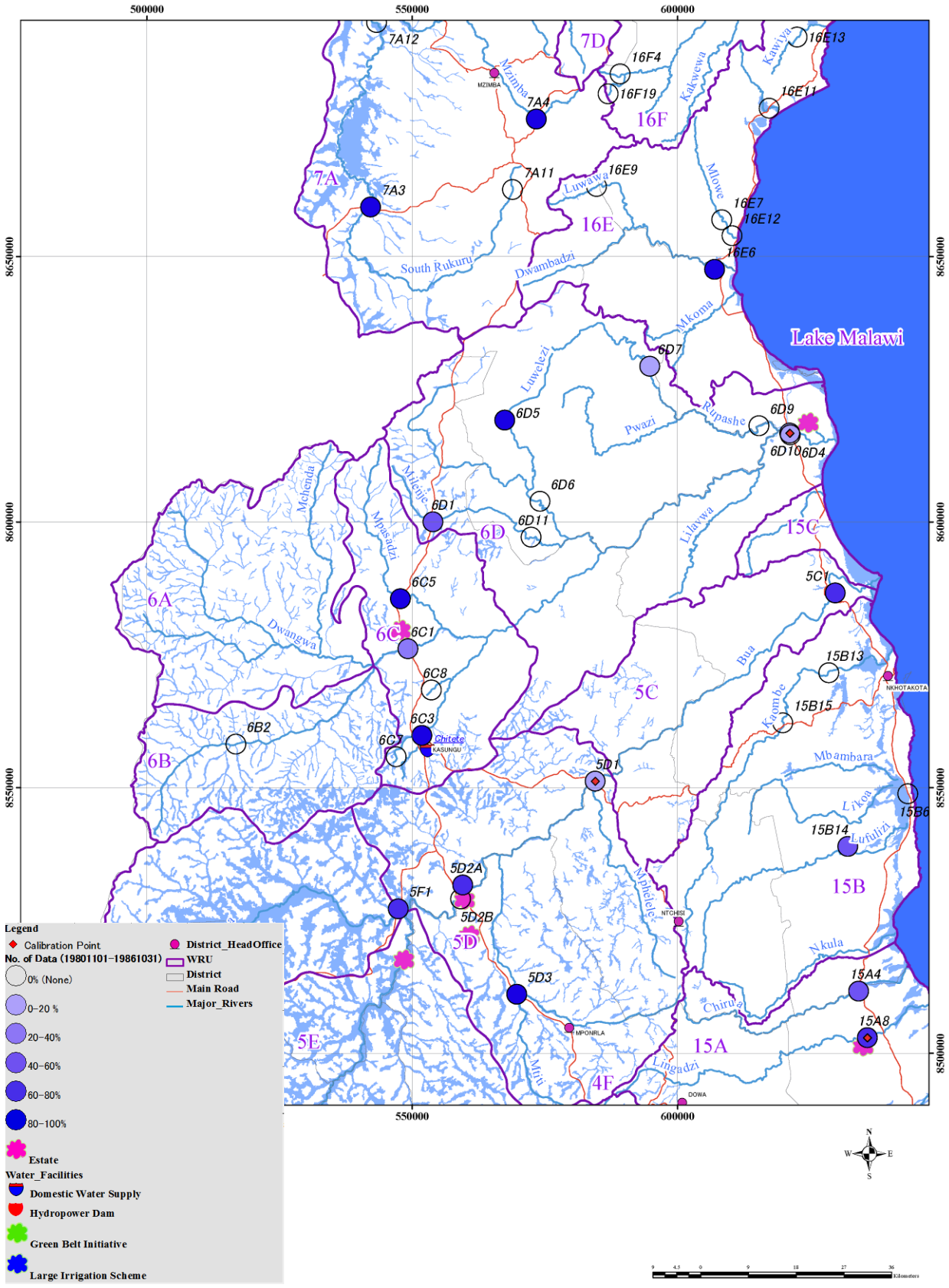
Location of Stations (WRA4)

Annex 6.5.1-1 (5/17)



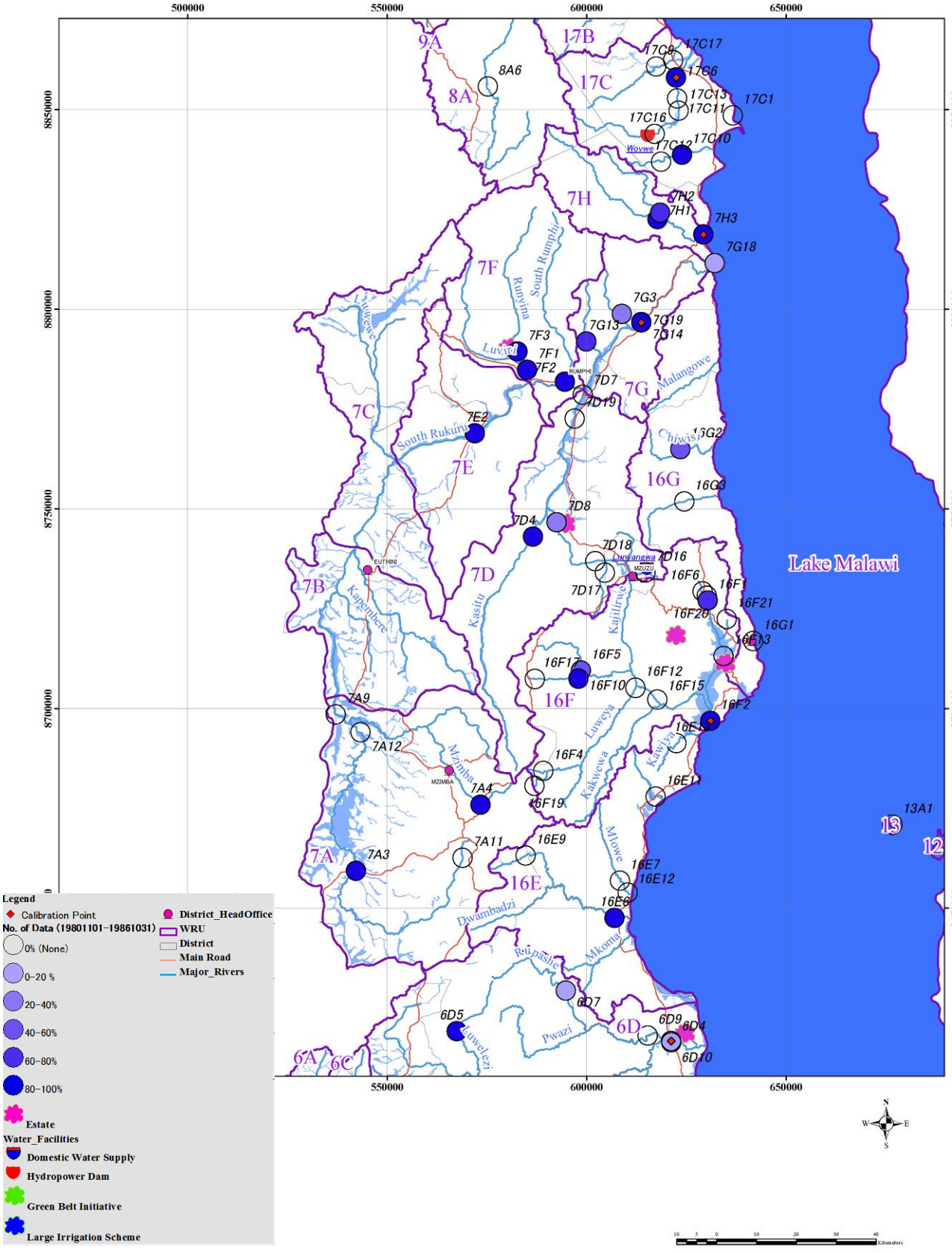
Location of Stations (WRA5)

Annex 6.5.1-1 (6/17)



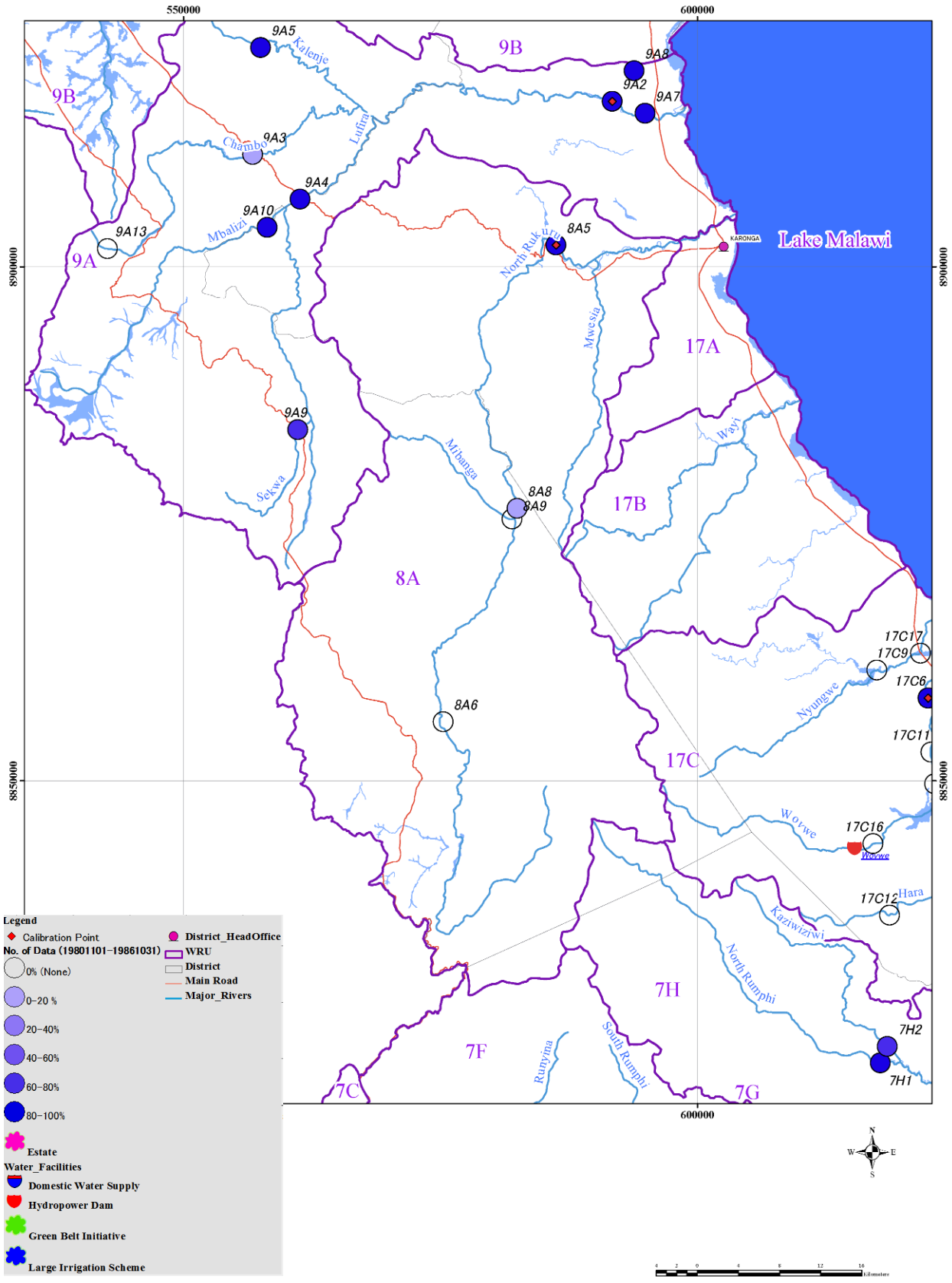
Location of Stations (WRA6)

Annex 6.5.1-1 (7/17)



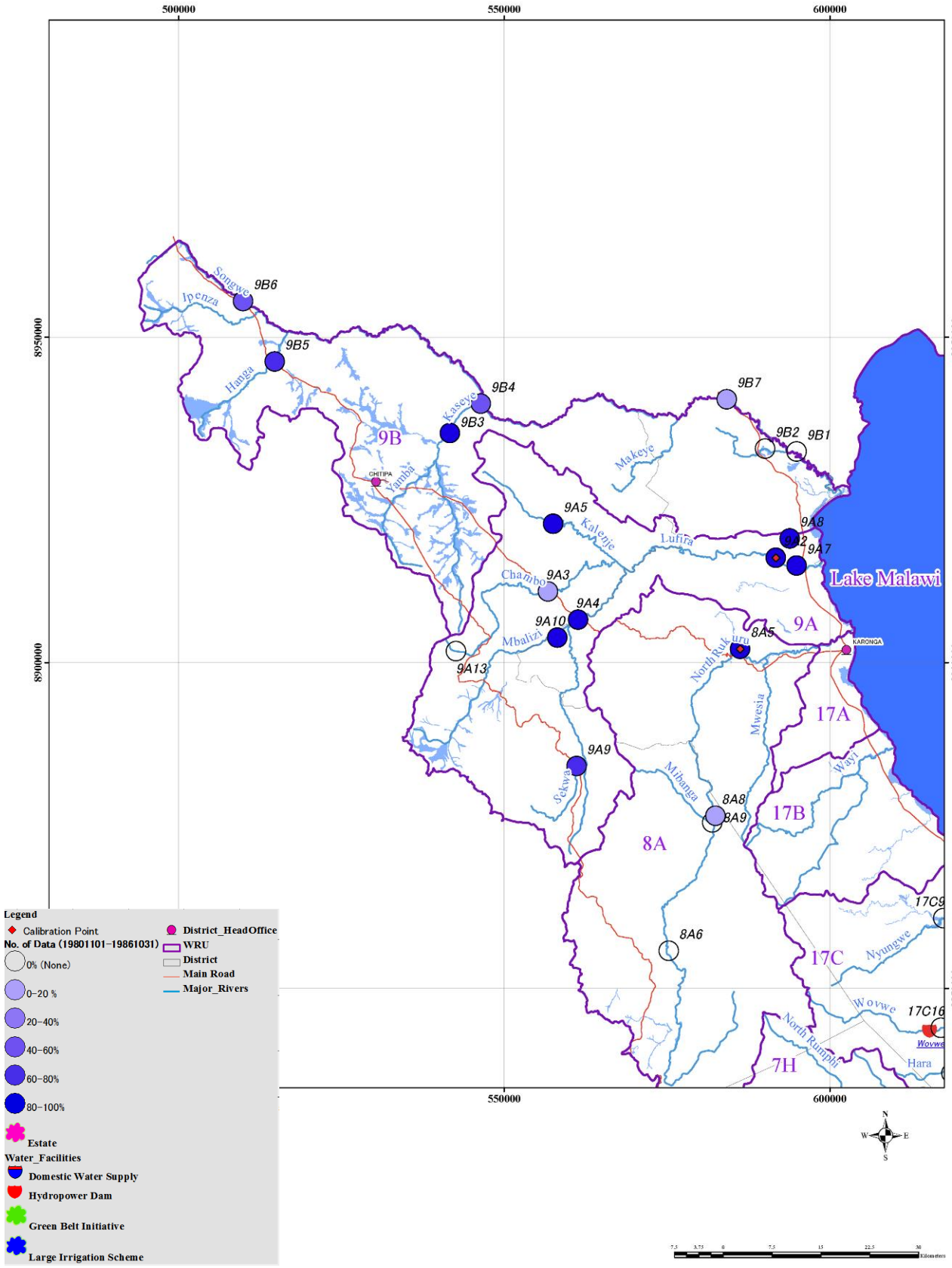
Location of Stations (WRA7)

Annex 6.5.1-1 (8/17)



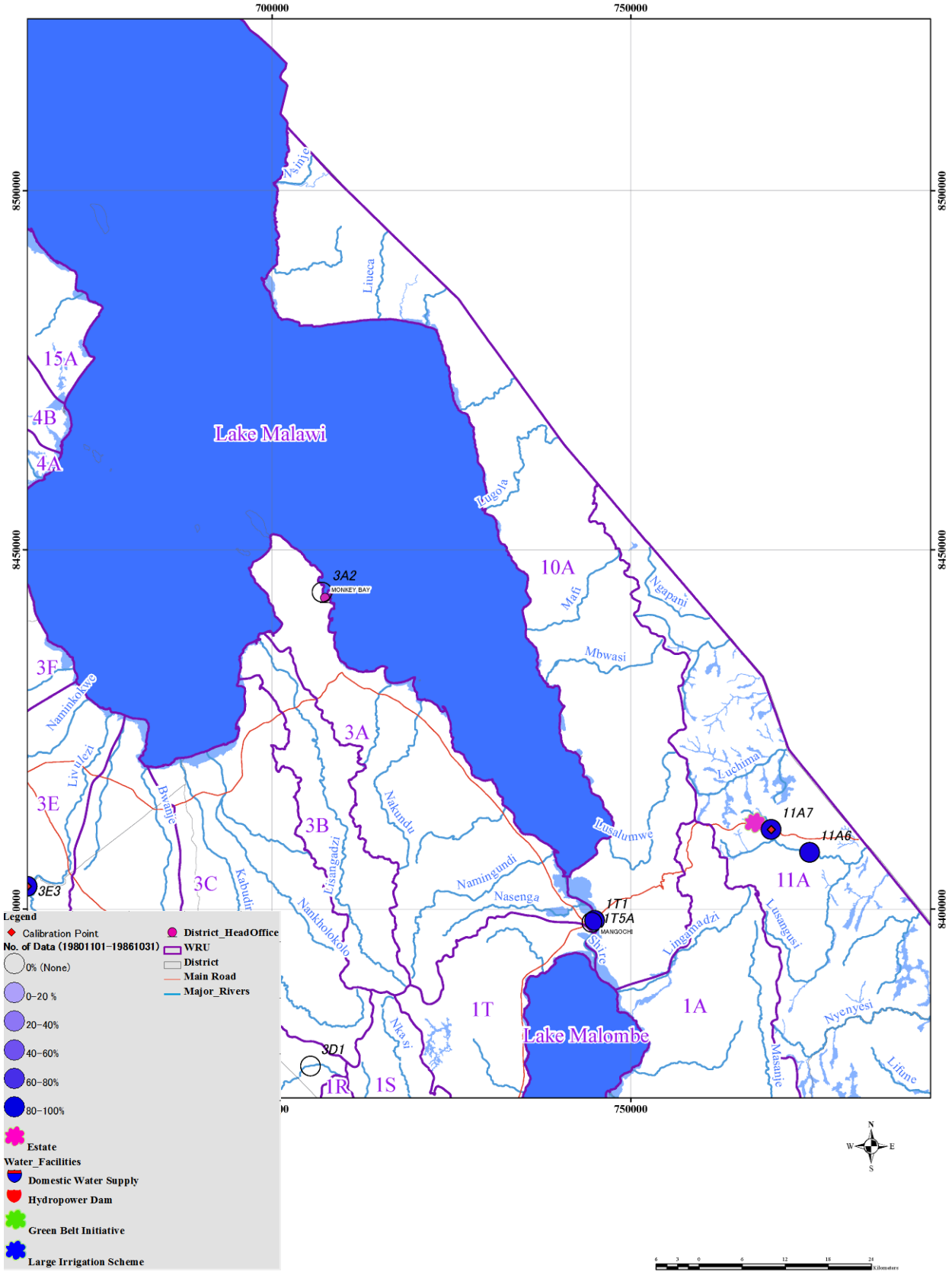
Location of Stations (WRA8)

Annex 6.5.1-1 (9/17)



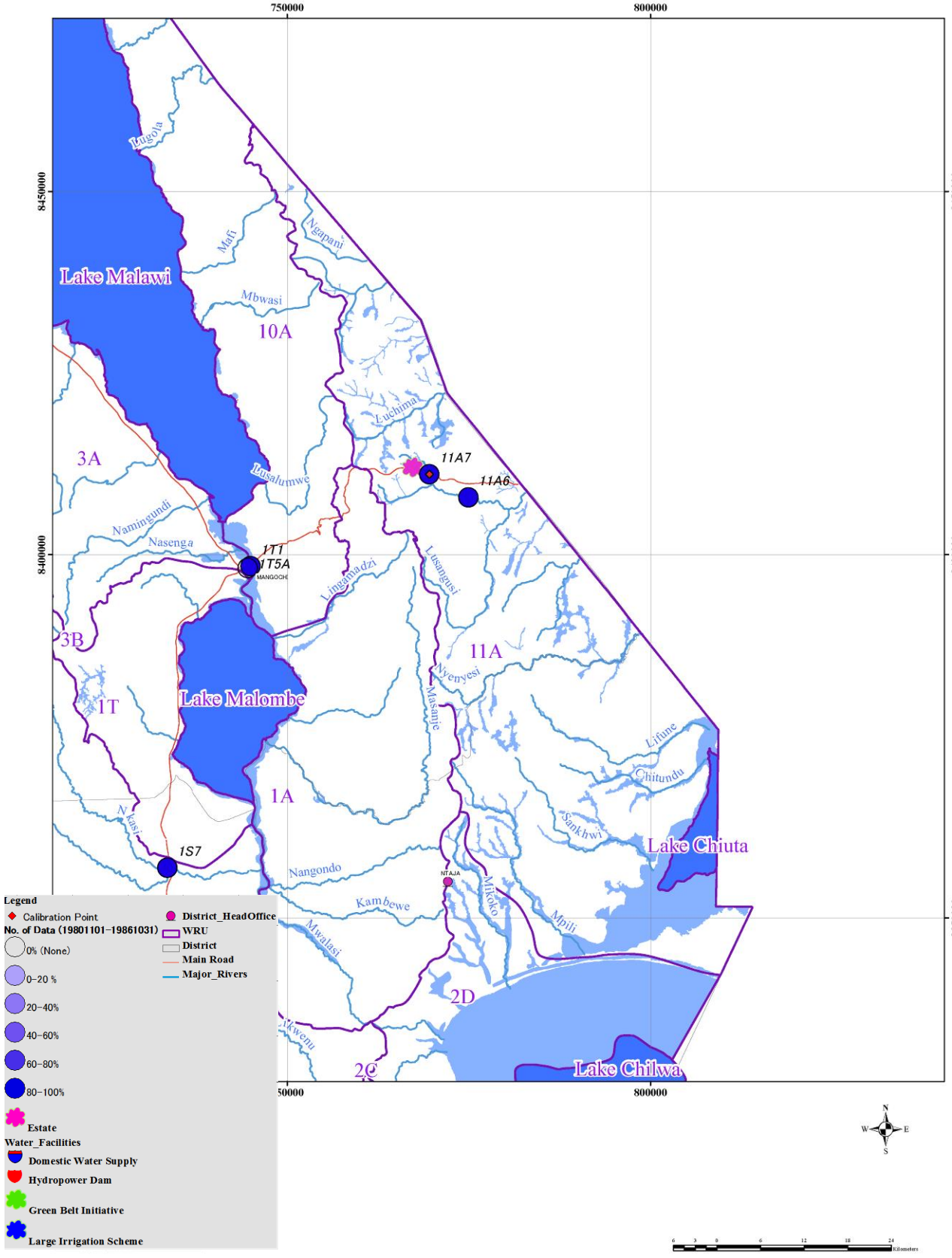
Location of Stations (WRA9)

Annex 6.5.1-1 (10/17)



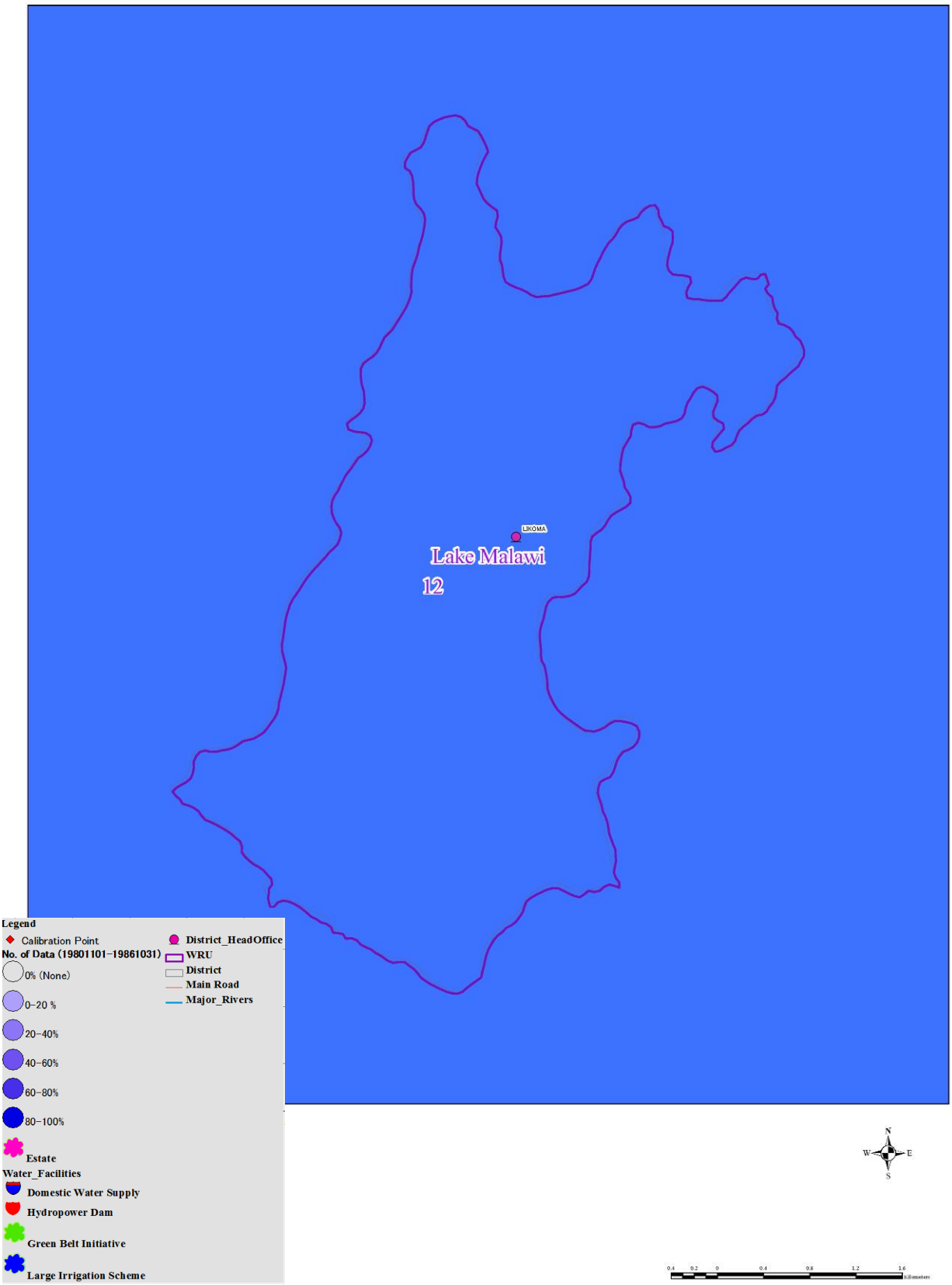
Location of Stations (WRA10)

Annex 6.5.1-1 (11/17)



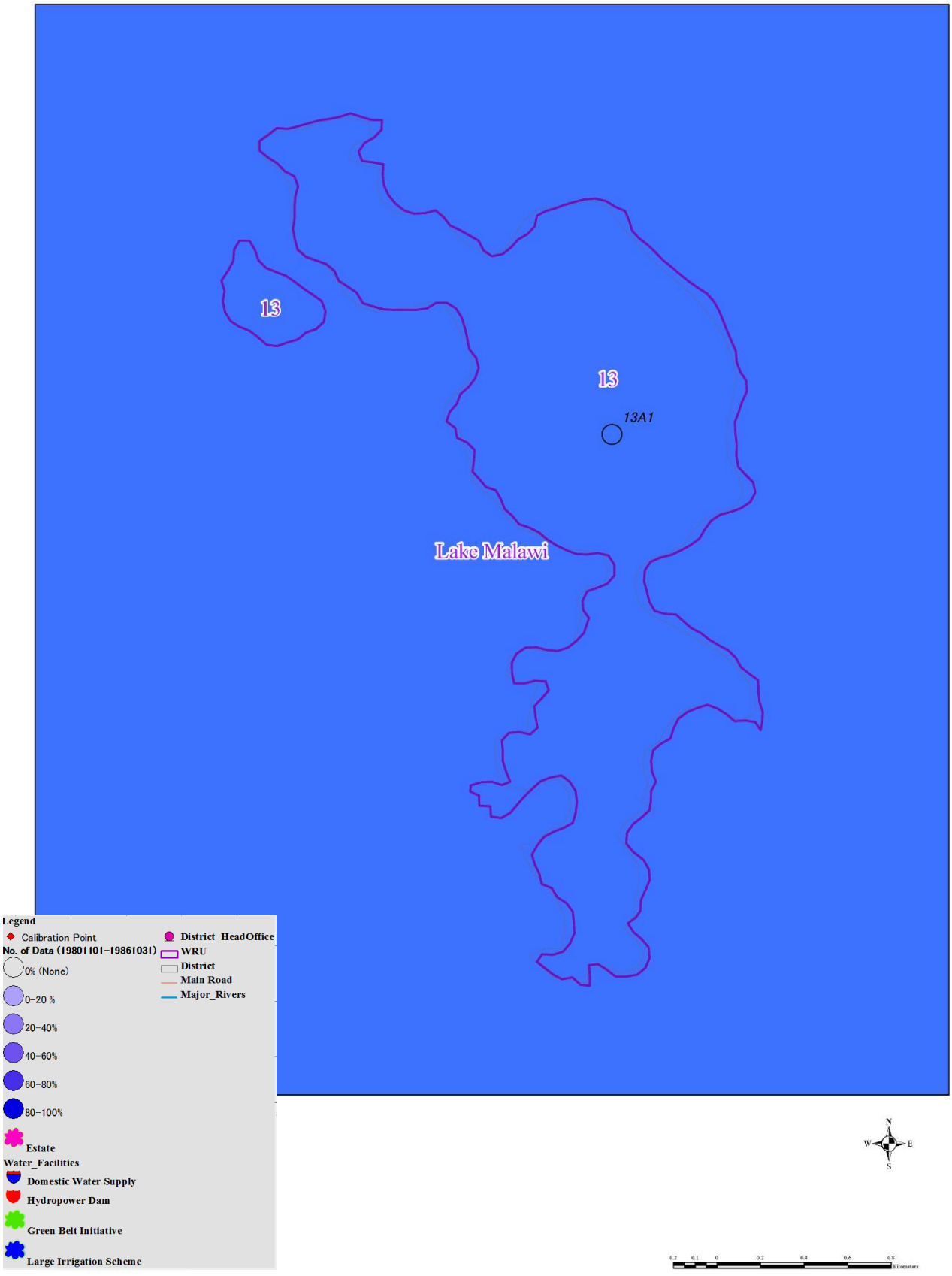
Location of Stations (WRA11)

Annex 6.5.1-1 (12/17)



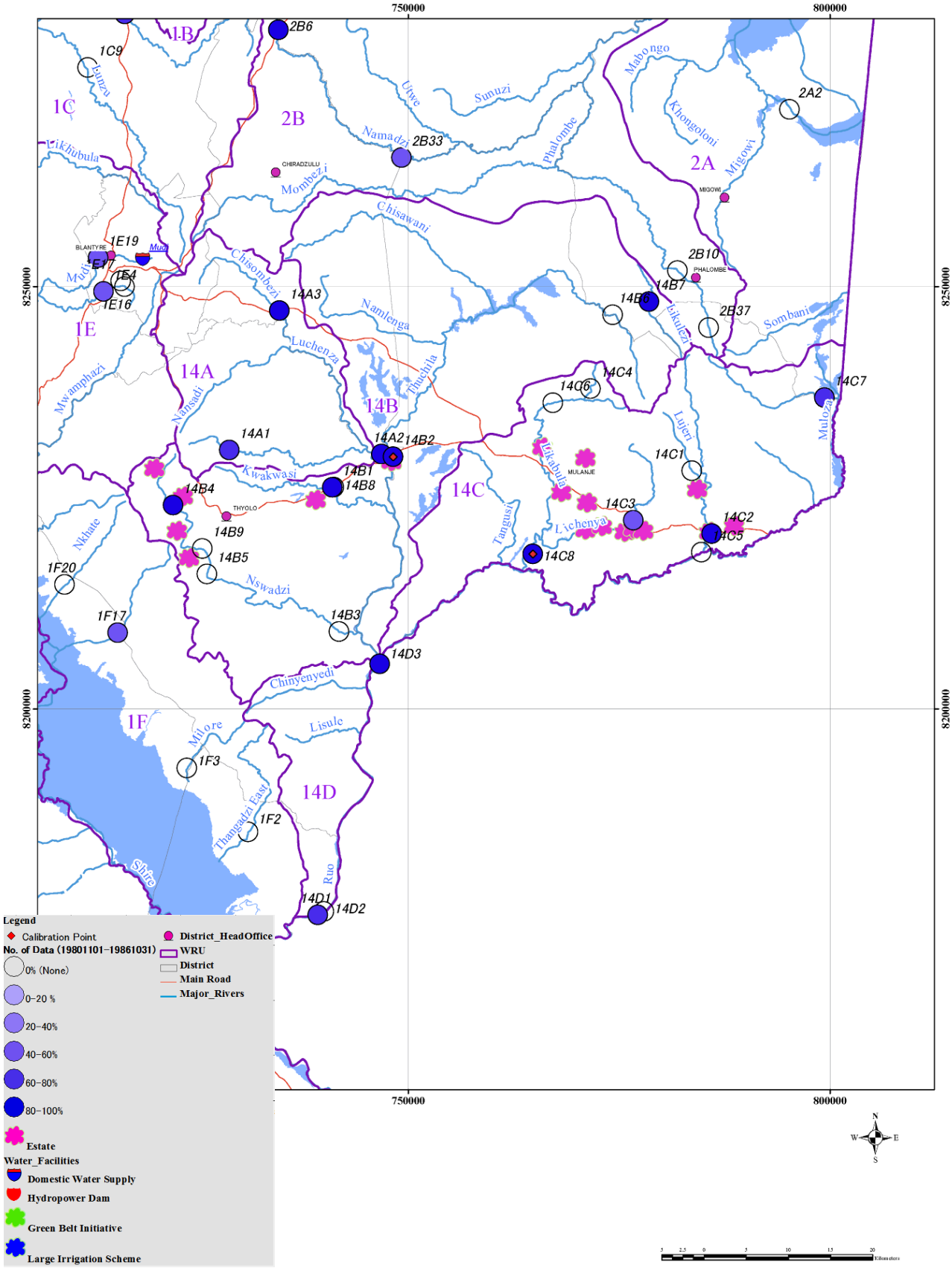
Location of Stations (WRA12)

Annex 6.5.1-1 (13/17)



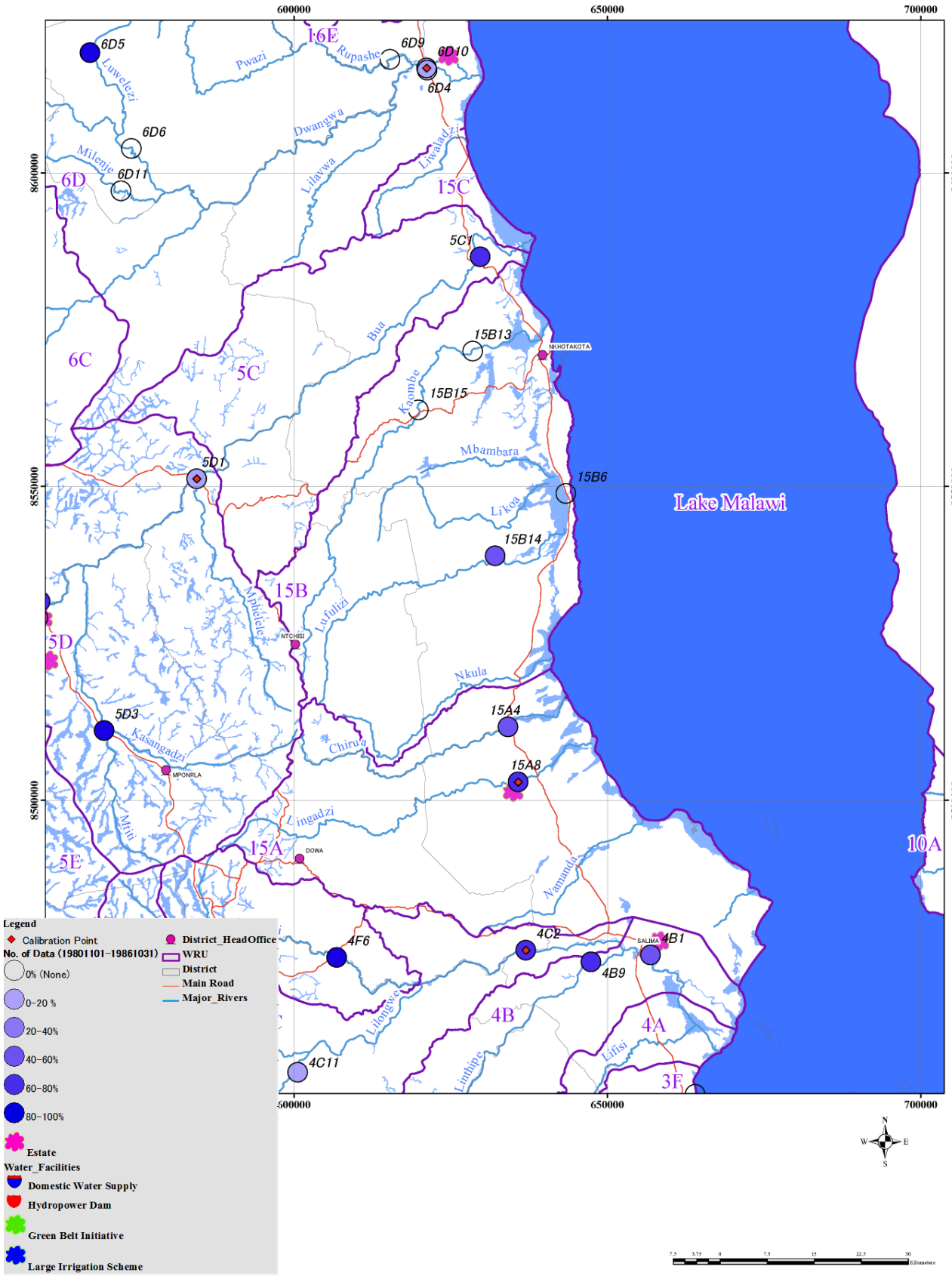
Location of Stations (WRA13)

Annex 6.5.1-1 (14/17)



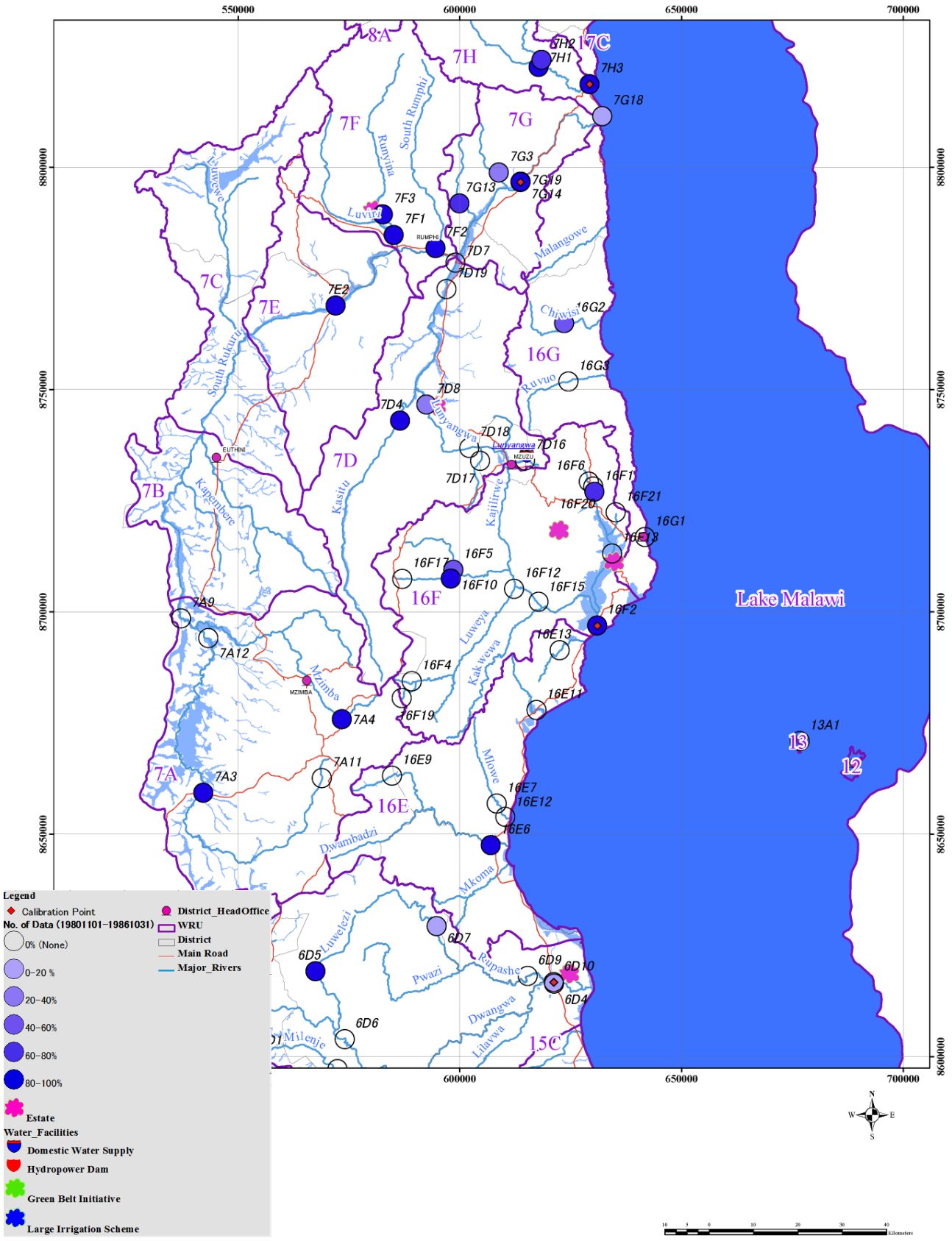
Location of Stations (WRA14)

Annex 6.5.1-1 (15/17)



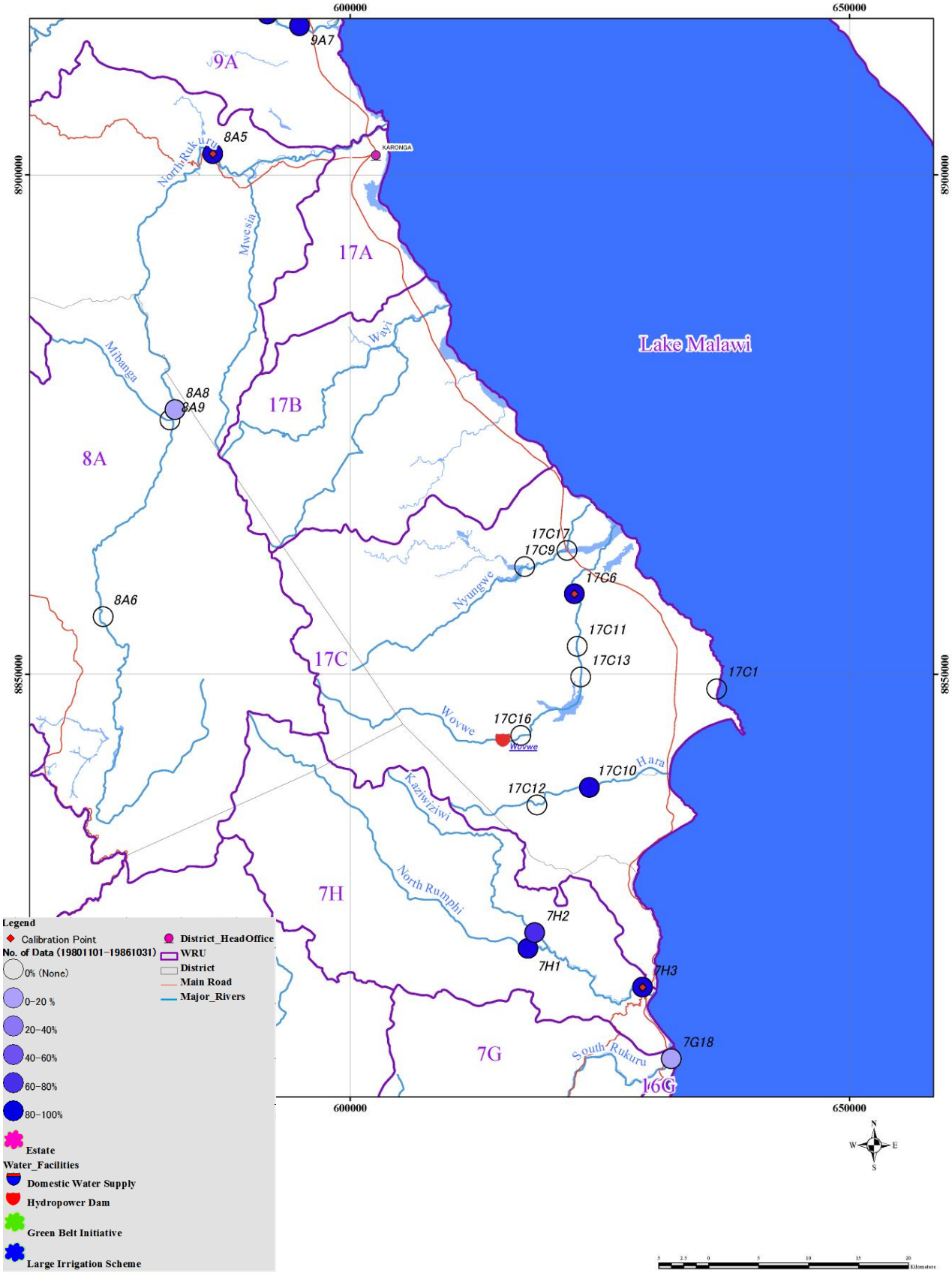
Location of Stations (WRA15)

Annex 6.5.1-1 (16/17)



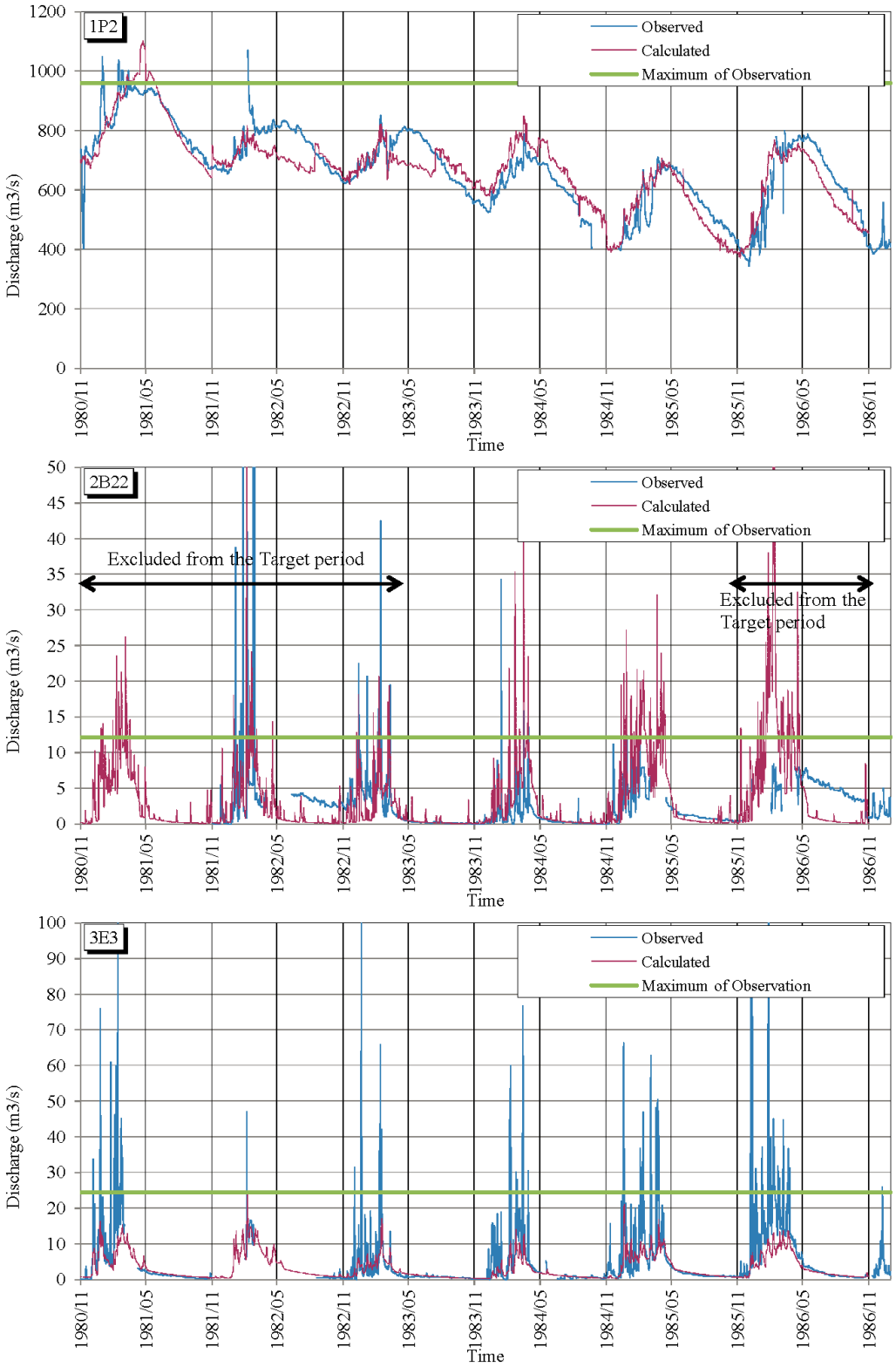
Location of Stations (WRA16)

Annex 6.5.1-1 (17/17)



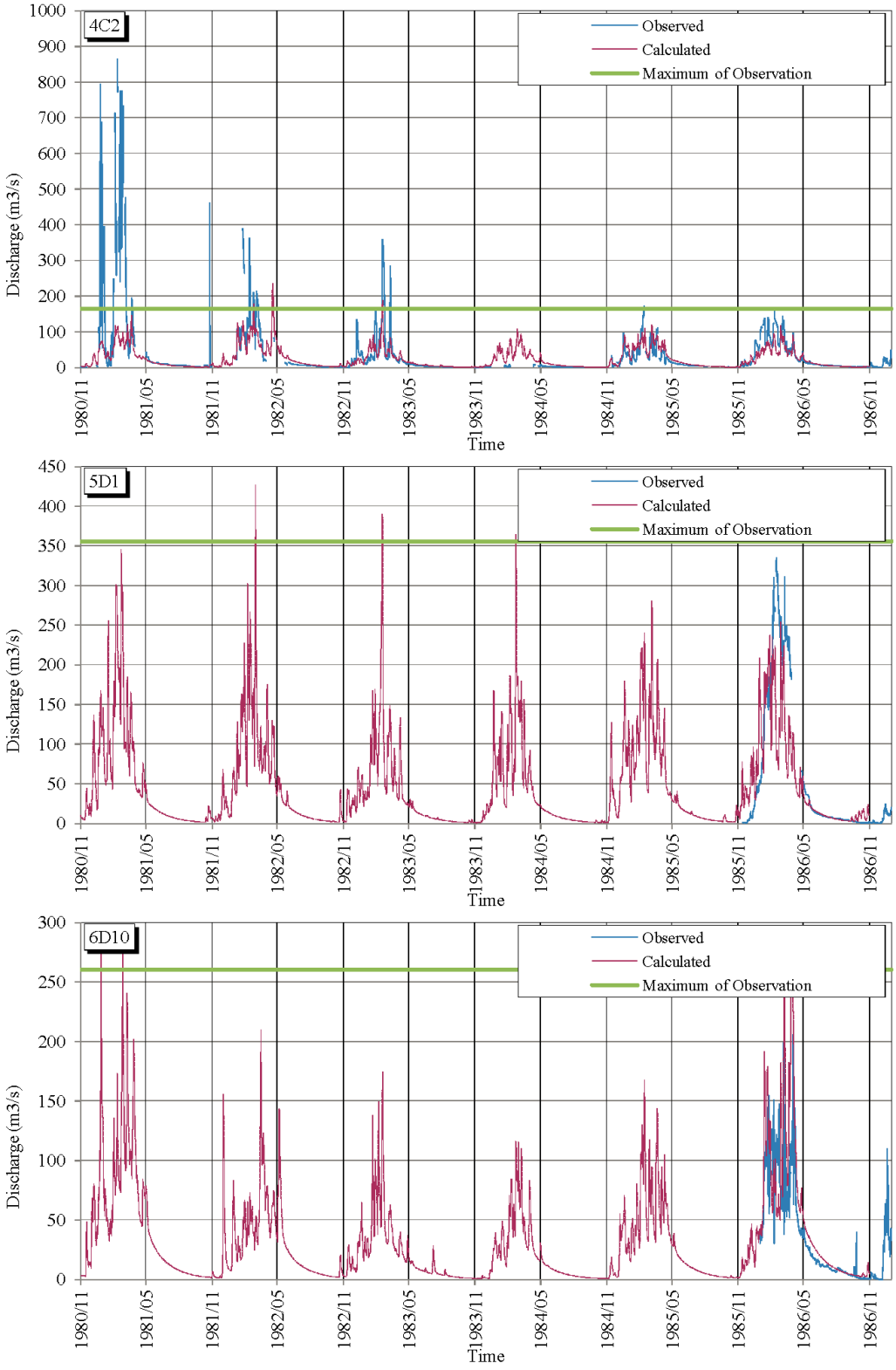
Location of Stations (WRA17)

Annex 6.5.1-2 (1/6)



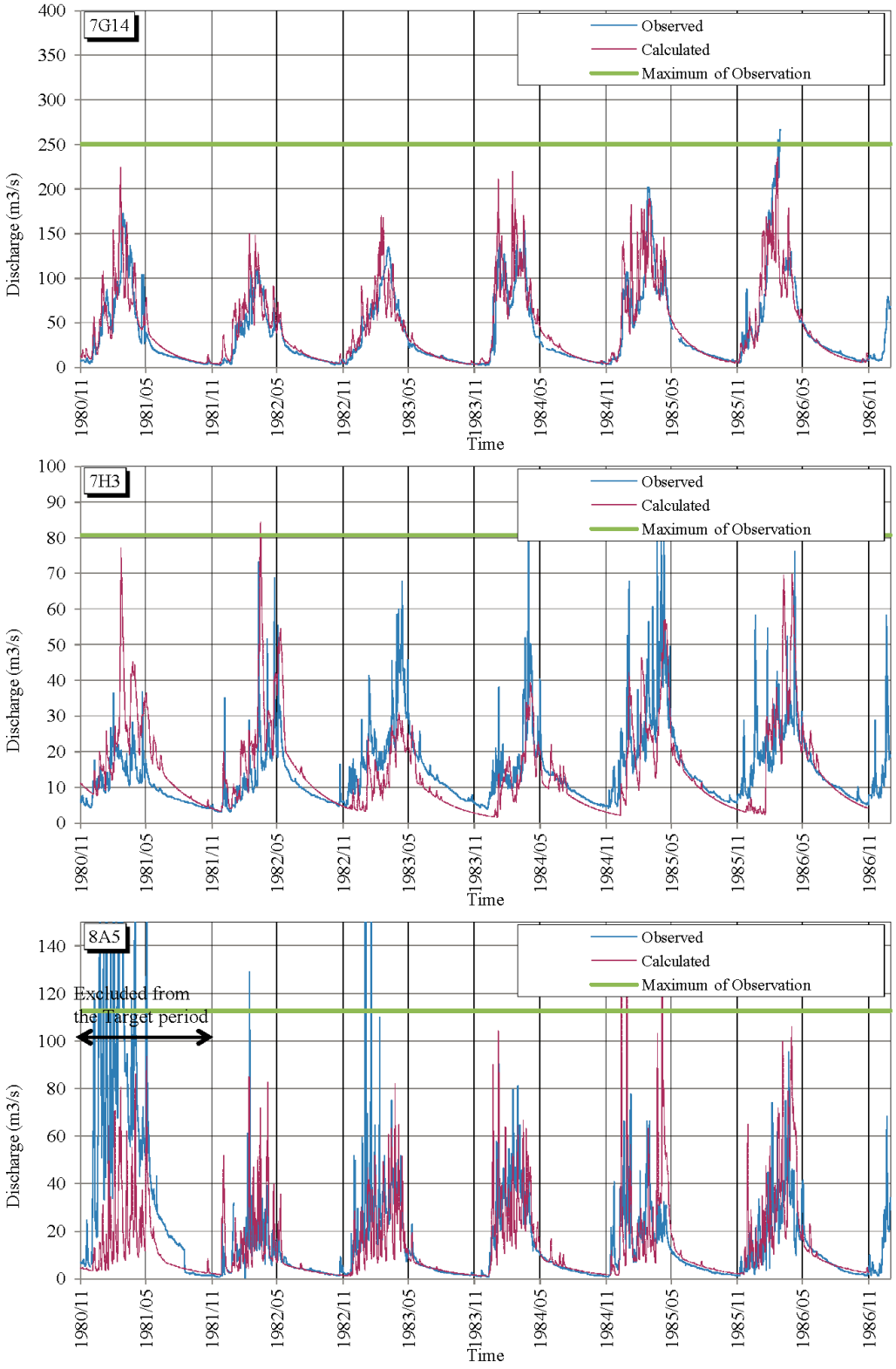
Calibration Result (Hydrograph)

Annex 6.5.1-2 (2/6)



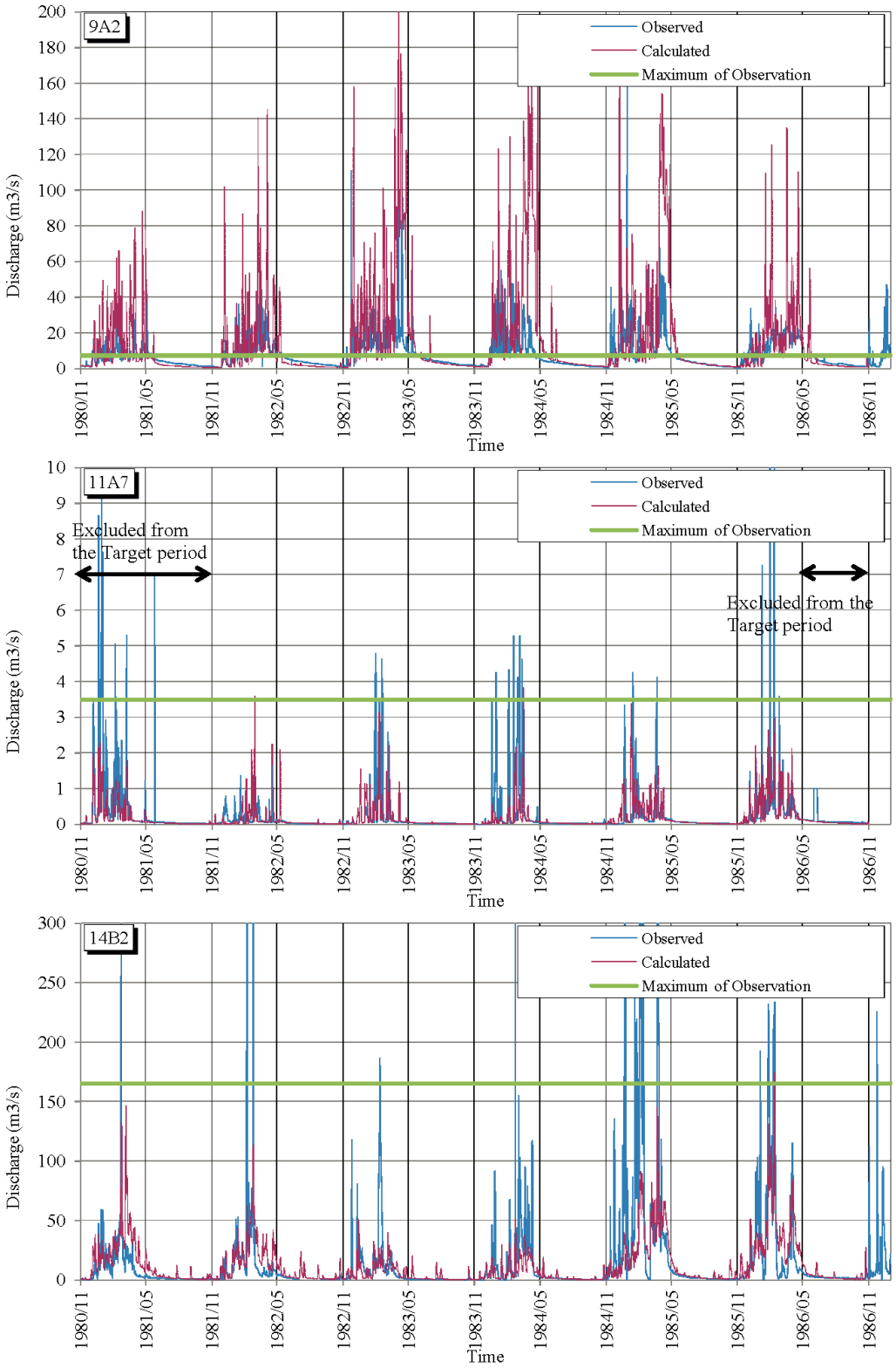
Calibration Result (Hydrograph)

Annex 6.5.1-2 (3/6)



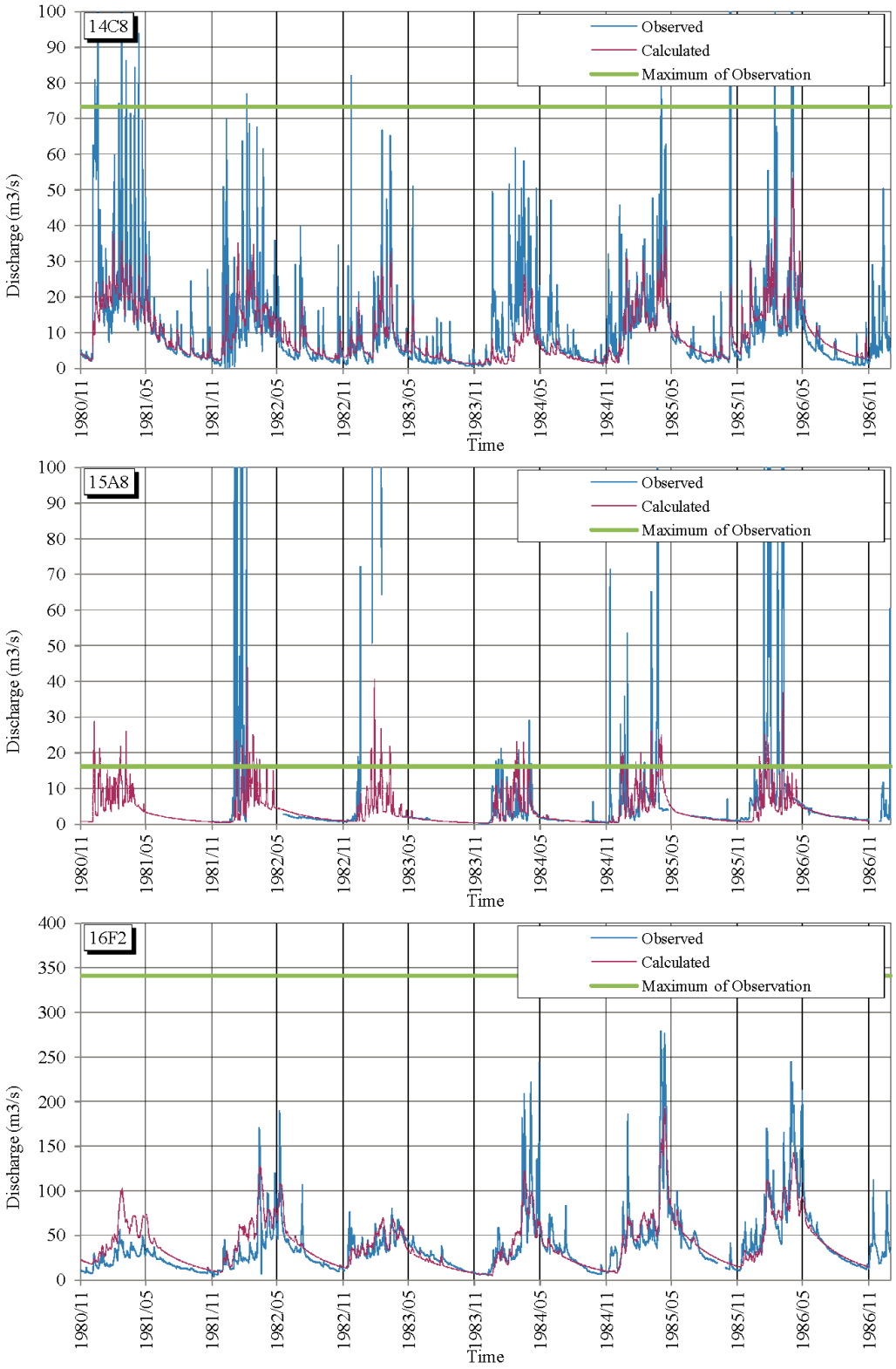
Calibration Result (Hydrograph)

Annex 6.5.1-2 (4/6)



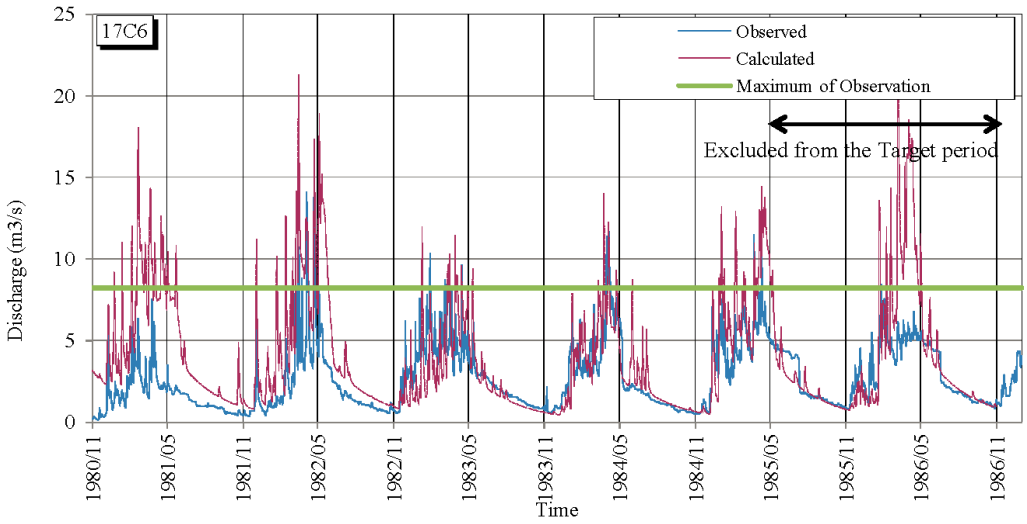
Calibration Result (Hydrograph)

Annex 6.5.1-2 (5/6)



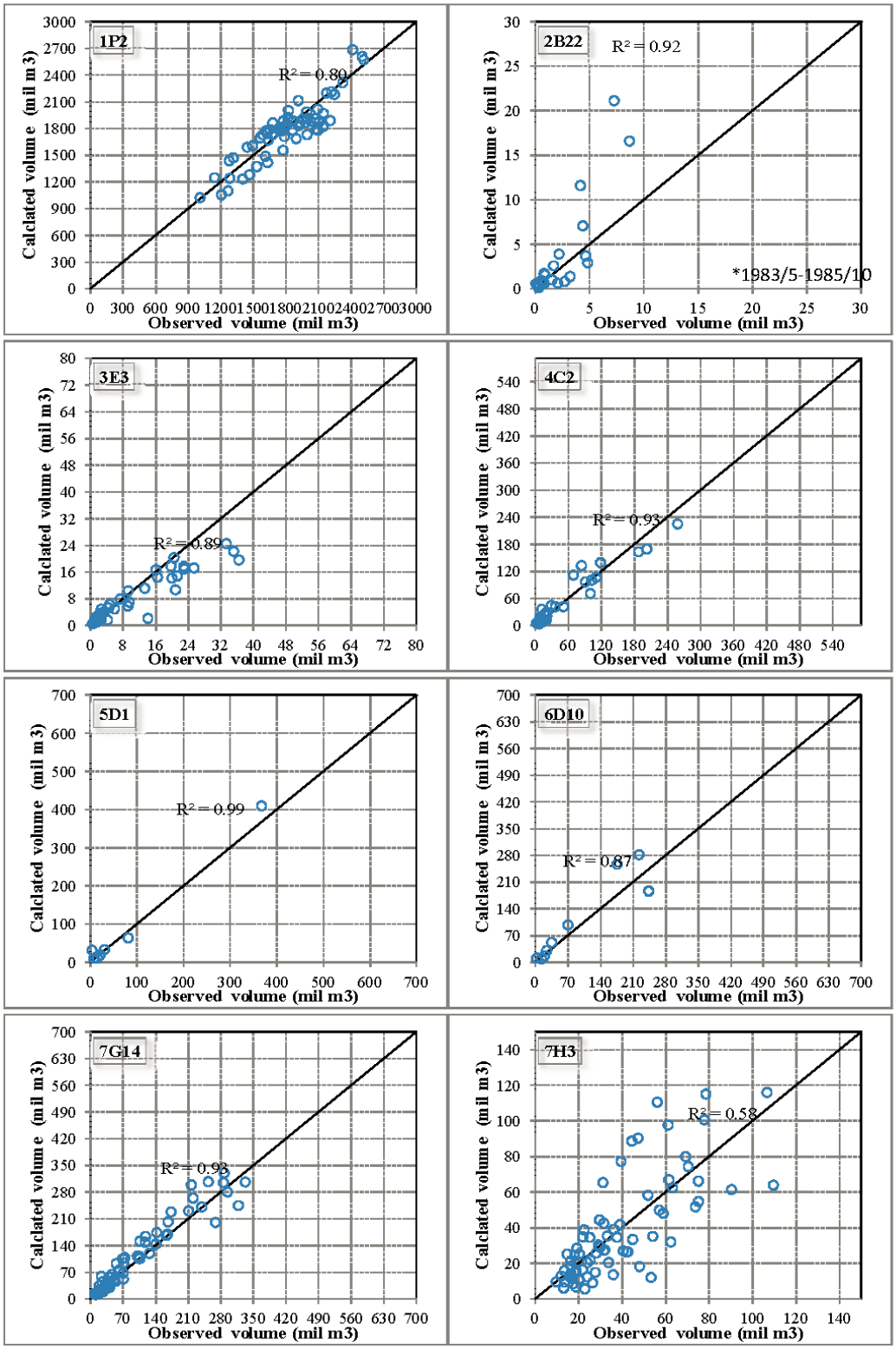
Calibration Result (Hydrograph)

Annex 6.5.1-2 (6/6)



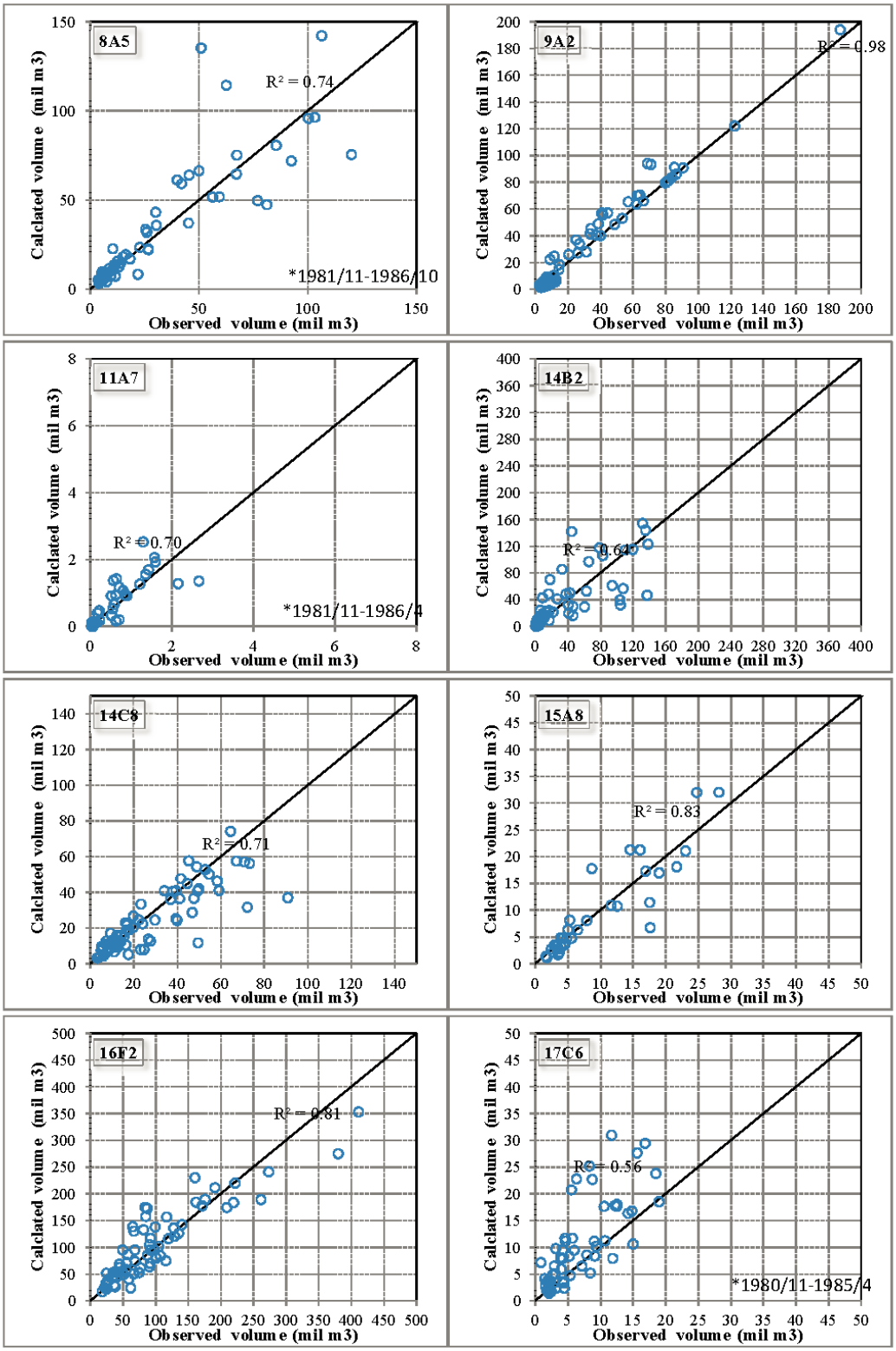
Calibration Result (Hydrograph)

Annex 6.5.1-3 (1/2)



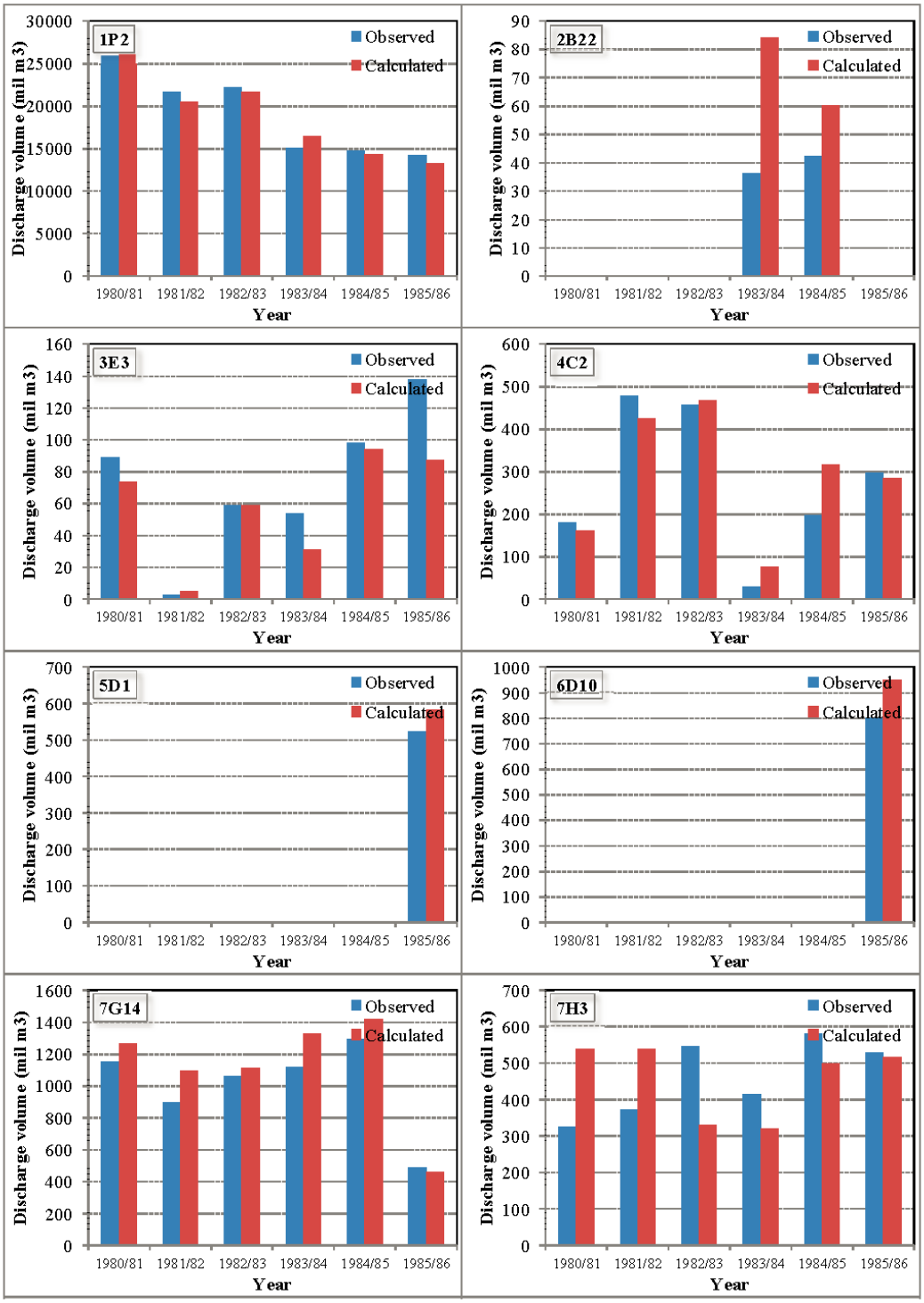
Calibration Result (Correlation between Calculated and Observed Monthly Volume in Year)

Annex 6.5.1-3 (2/2)



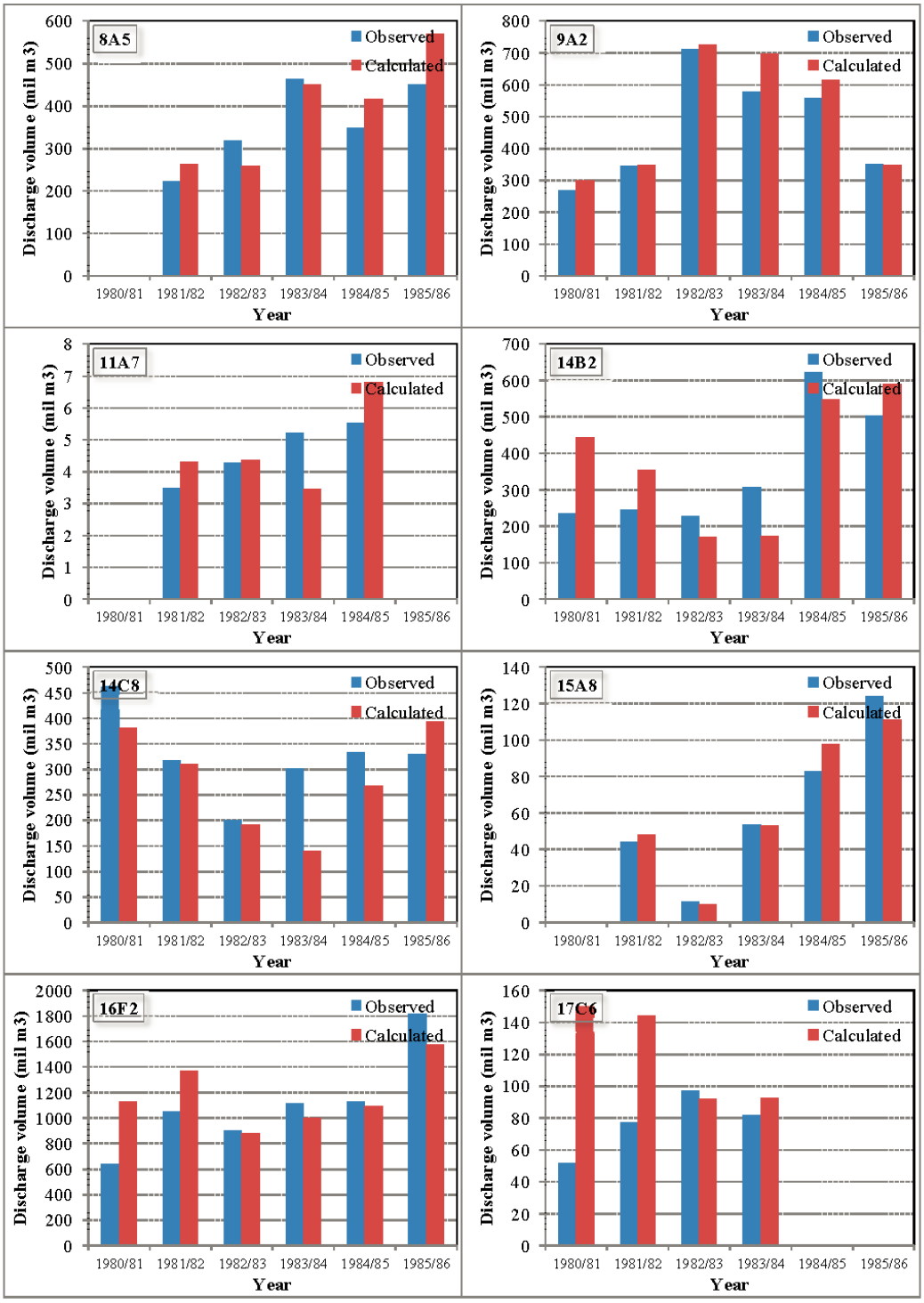
Calibration Result (Correlation between Calculated and Observed Monthly Volume in Year)

Annex 6.5.1-4 (1/2)



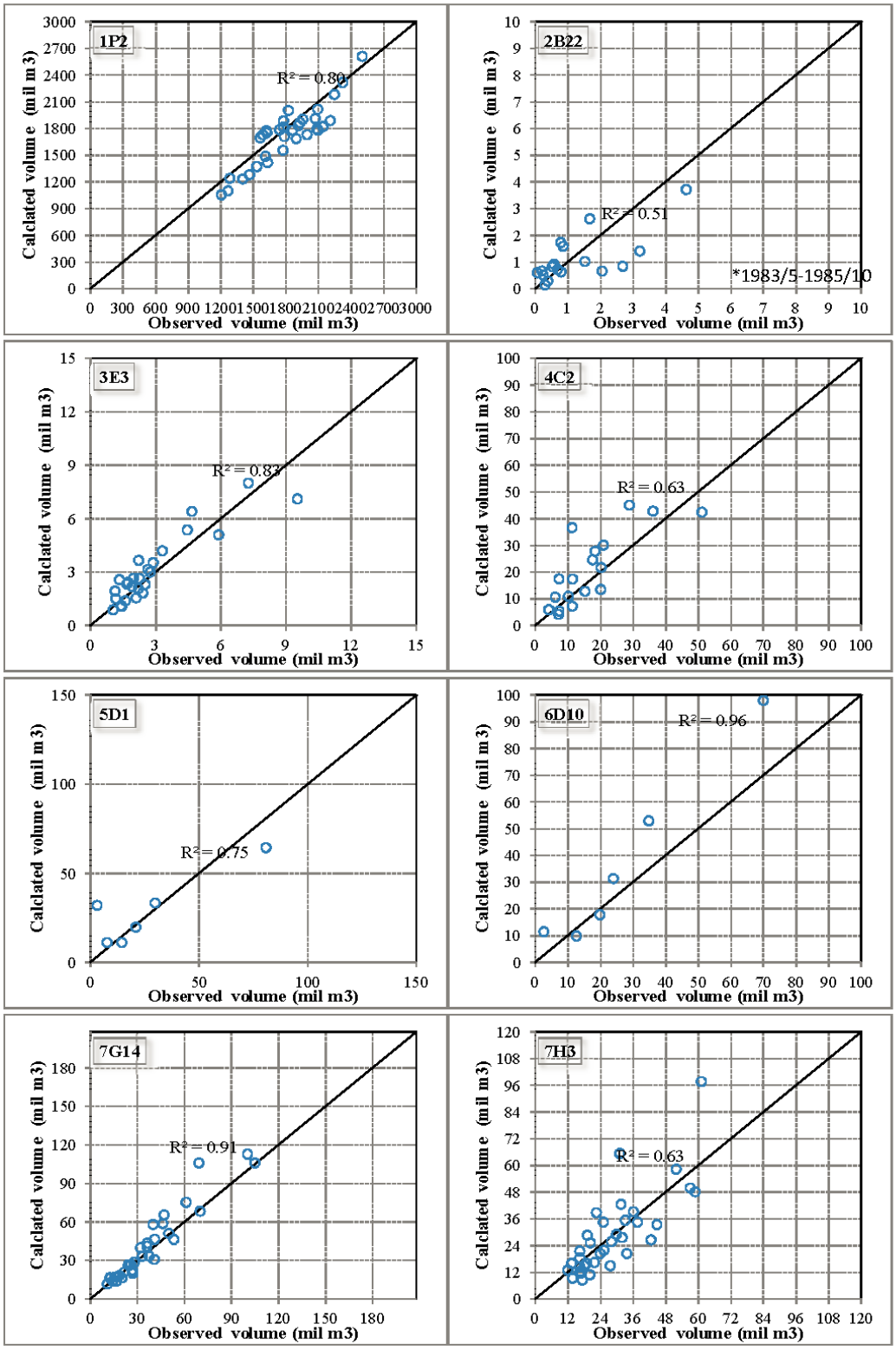
Calibration Result (Yearly Volume)

Annex 6.5.1-4 (2/2)



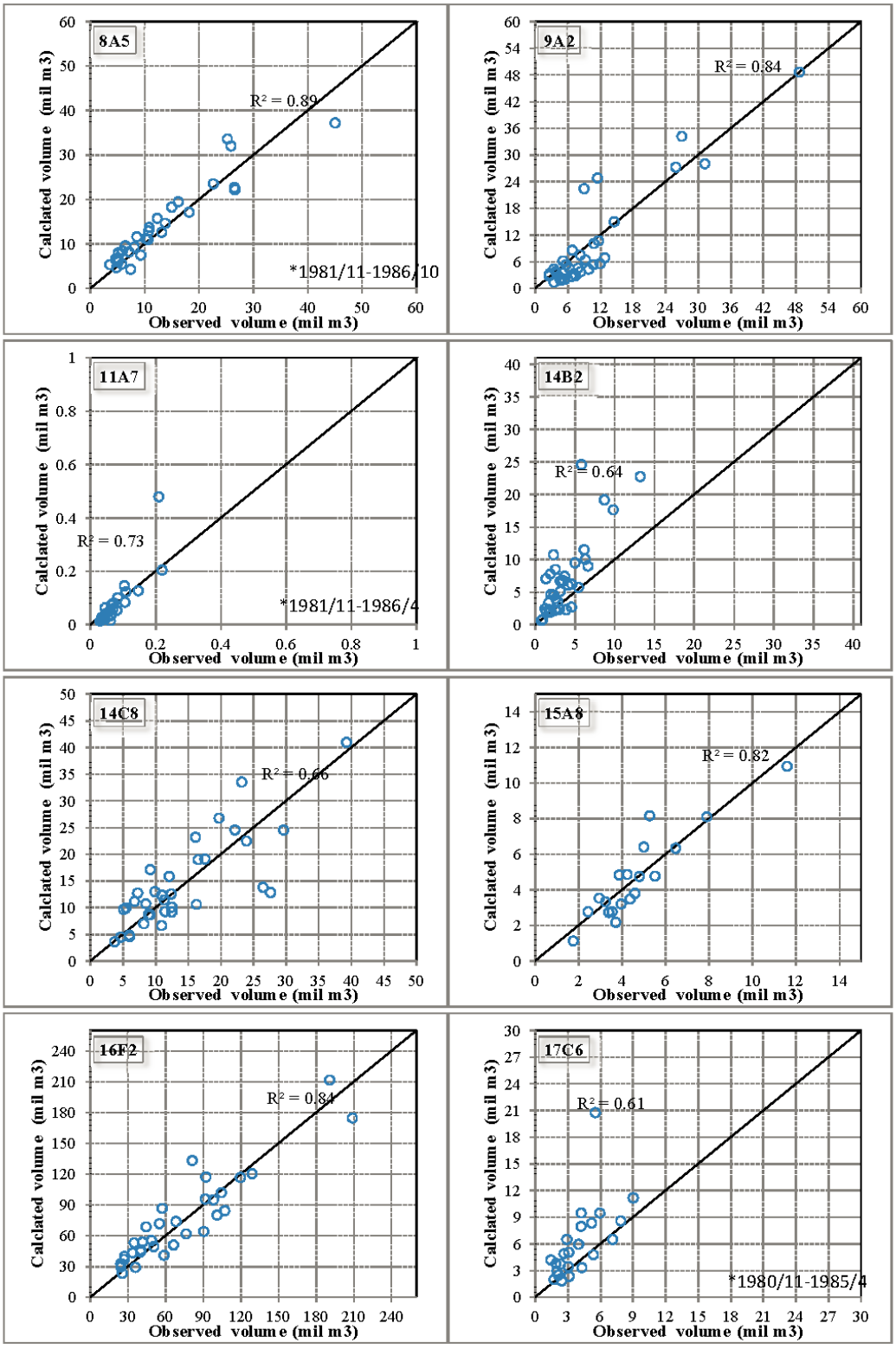
Calibration Result (Yearly Volume)

Annex 6.5.1-5 (1/2)



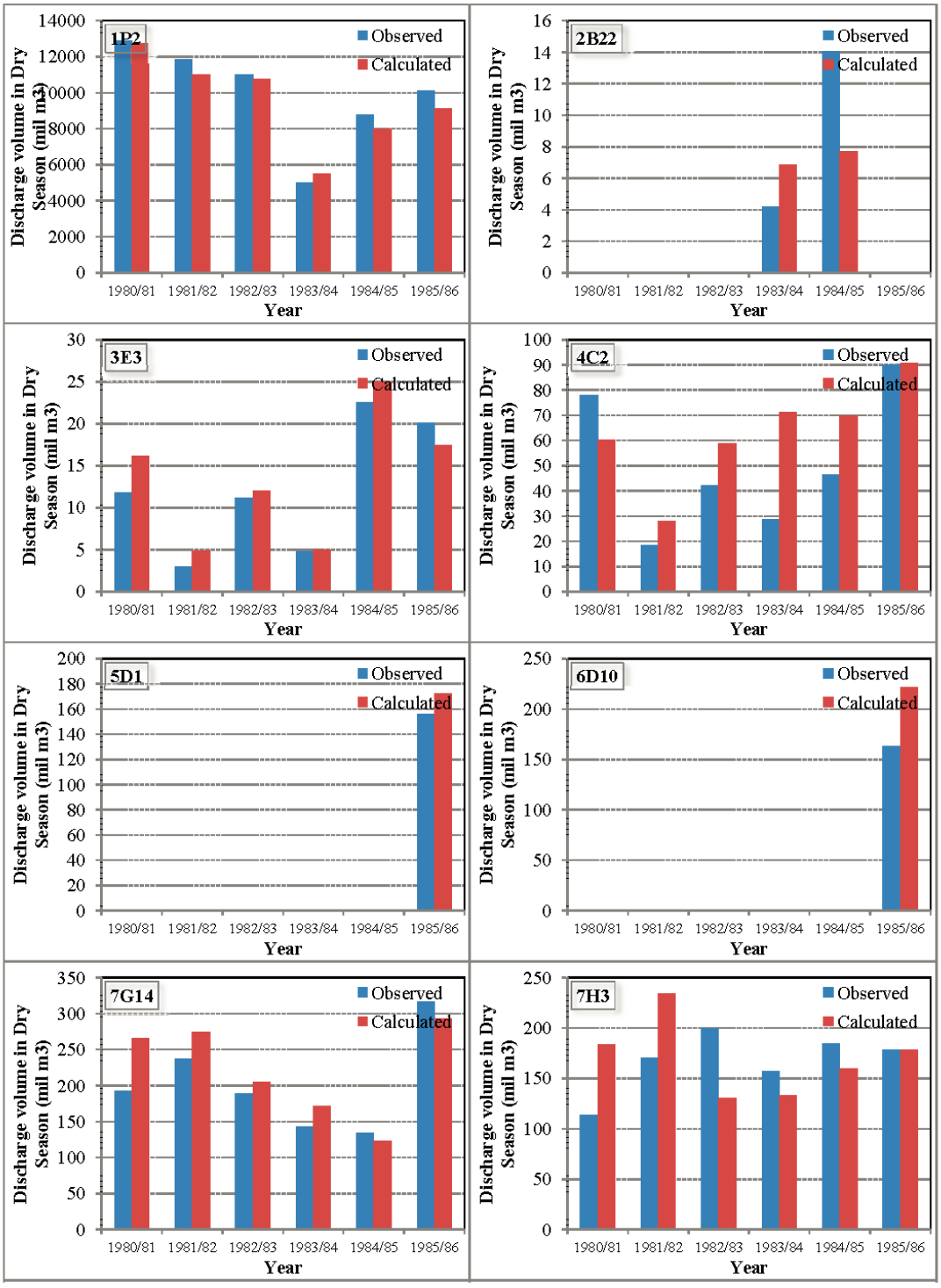
Calibration Result (Correlation between Calculated and Observed Monthly Volume in Dry Season)

Annex 6.5.1-5 (2/2)



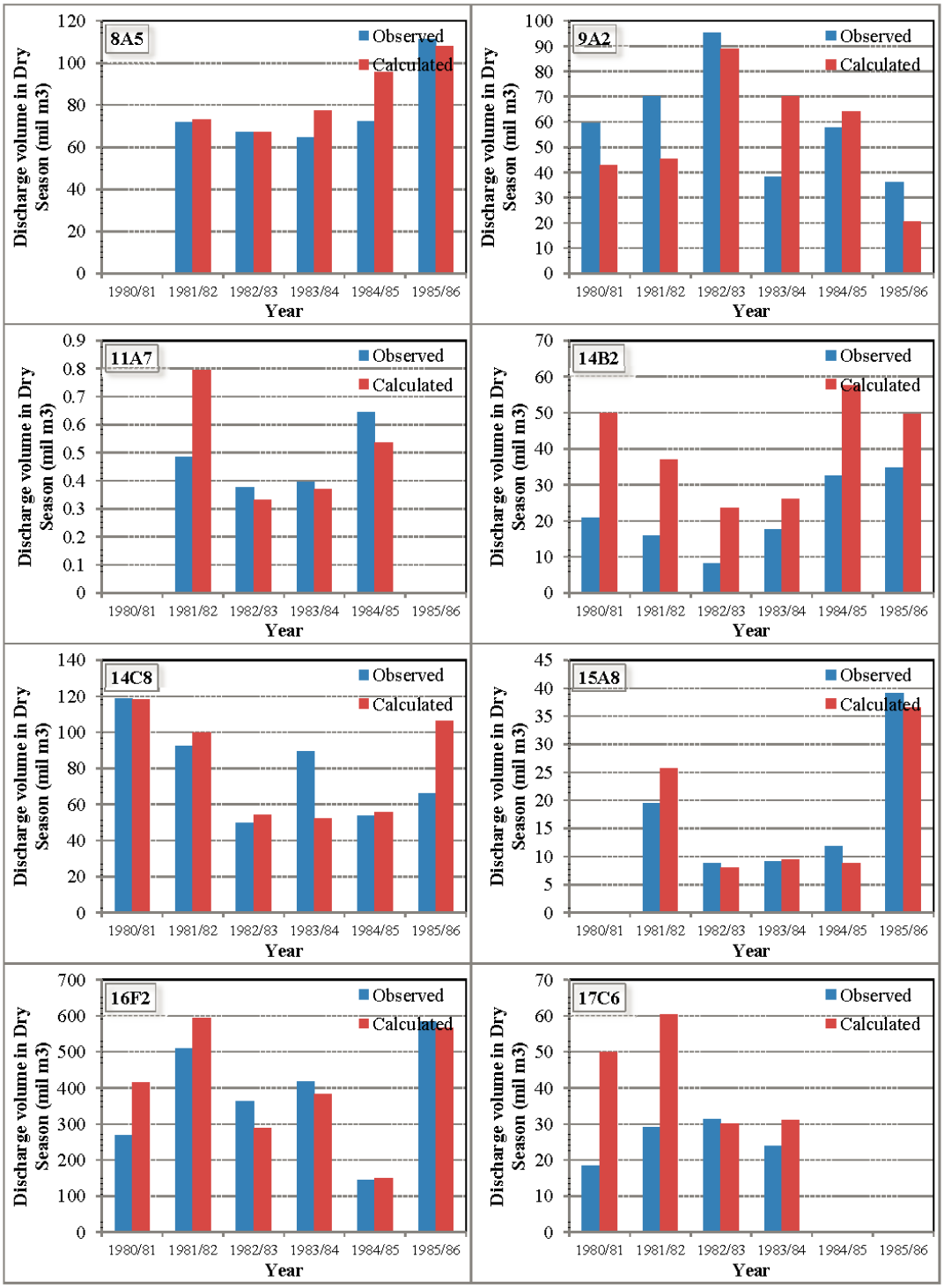
Calibration Result (Correlation between Calculated and Observed Monthly Volume in Dry Season)

Annex 6.5.1-6 (1/2)



Calibration Result (Volume in Dry Season)

Annex 6.5.1-6 (2/2)



Calibration Result (Volume in Dry Season)

Annex 6.5.4-1 (1/12)

(1,000m3)

WRA	Inflow	Demand	Deficit
1A	301,743	64,225	3,090
1B	335,448	61,886	3,138
1C	212,762	43,494	2,559
1E	355,313	77,590	5,598
1F	343,980	71,567	4,739
1G	539,569	109,565	4,680
1H	474,163	375,585	127,240
1K	434,593	71,504	3,005
1L	240,308	46,872	2,293
1M	164,102	28,824	1,710
1N	78,145	13,055	797
1O	222,483	43,140	2,701
1P	176,880	31,788	1,668
1R	341,469	63,369	3,333
1S	241,730	48,535	2,336
1T	86,598	21,855	1,624
1Sub-T	4,549,285	1,172,858	170,512
2A	150,324	7,029	3,408
2B	319,485	37,264	18,265
2C	149,007	7,442	3,068
2D	74,646	3,811	1,931
2Sub-T	693,462	55,545	26,672
3A	63,633	30,773	3,496
3B	61,291	21,195	1,342
3C	160,133	47,499	3,323
3D	148,447	45,778	7,696
3E	144,851	53,465	6,219
3F	86,590	27,703	5,123
3Sub-T	664,945	226,413	27,200
4A	54,505	11,696	5,096
4B	882,787	113,933	27,506
4C	496,819	58,527	15,352
4D	205,098	62,027	11,154
4E	119,359	16,434	5,478
4F	37,802	9,795	4,517
4Sub-T	1,796,368	272,412	69,104
5C	989,242	132,886	16,439
5D	706,259	118,776	32,641
5E	286,768	77,762	34,535
5F	255,074	42,006	15,035
5Sub-T	2,237,343	371,430	98,650

(1,000m3)

WRA	Inflow	Demand	Deficit
6A	56,162	9,785	2,662
6B	60,750	8,287	2,099
6C	161,349	30,802	10,901
6D	689,662	192,836	68,432
6Sub-T	967,923	241,710	84,094
7A	224,352	52,727	6,121
7B	322,745	66,265	4,525
7C	400,911	85,568	6,321
7D	325,938	67,257	765
7E	440,234	96,834	7,886
7F	519,409	112,654	8,086
7G	890,473	186,622	8,641
7H	72,590	100,100	49,844
7Sub-T	3,196,652	768,027	92,189
8A	463,782	91,146	3,940
8Sub-T	463,782	91,146	3,940
9A	239,013	28,711	8,829
9B	277,369	36,088	13,433
9Sub-T	516,383	64,799	22,262
10A	54,655	12,332	6,881
10Sub-T	54,655	12,332	6,881
11A	286,257	33,597	16,337
11Sub-T	286,257	33,597	16,337
12+13A	-	-	-
12+14Sub-	-	-	-
14A	43,582	14,756	9,083
14B	436,774	80,110	40,202
14C	577,492	246,592	47,774
14D	1,037,137	281,654	42,334
14Sub-T	2,094,986	623,112	139,393
15A	301,611	80,912	12,500
15B	464,478	117,079	24,807
15C	39,139	11,667	1,701
15Sub-T	805,228	209,657	39,008
16E	578,756	281,793	12,027
16F	701,248	304,500	22,178
16G	327,843	154,765	6,806
16Sub-T	1,607,847	741,059	41,011
17A	4,603	4,358	1,500
17B	73,844	38,735	2,078
17C	195,396	87,492	8,743
17Sub-T	273,843	130,585	12,322
Blantyre	5,655,914	39,284	0

Present by WRU (10-Drought Year)

Annex 6.5.4-1 (2/12)

(1,000m^3/month)

WRA	11			12			1		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	38,507	110,799	74,204	236,728	92,141	16,963	546,168	83,015	0
2	10,808	3,625	1,596	29,105	3,674	642	257,743	3,169	18
3	21,548	16,683	38	18,775	17,088	668	104,271	16,992	1
4	29,067	12,838	1,775	68,279	12,583	258	356,261	11,454	0
5	43,195	12,774	464	137,614	11,967	0	174,376	12,007	0
6	7,863	25,861	22,074	66,856	12,041	5	193,942	7,854	0
7	21,920	24,926	9,362	32,144	25,486	10,914	96,944	25,466	6,118
8	13,359	7,451	0	45,076	7,565	0	121,135	7,394	0
9	4,618	5,234	2,891	52,020	4,874	594	120,121	3,692	0
10	1,792	620	78	9,827	468	26	19,322	531	0
11	1,425	1,928	1,390	28,428	1,934	60	112,494	1,679	0
14	30,480	24,824	10,880	68,708	24,301	1,075	346,924	24,200	0
15	12,695	19,279	7,106	18,877	16,025	1,533	137,413	14,765	0
16	67,366	59,376	176	108,753	60,360	197	216,838	59,716	0
17	10,012	10,709	902	19,803	11,030	417	27,176	9,793	0
Blantyre	189,084	3,220	0	186,828	3,327	0	307,842	3,327	0

(1,000m^3/month)

WRA	2			3			4		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	855,132	71,102	0	1,043,034	87,431	0	660,978	111,482	0
2	258,445	2,905	0	73,783	3,169	0	35,467	3,070	326
3	218,997	15,359	0	101,554	16,705	0	62,063	16,073	0
4	235,306	10,296	0	135,734	12,379	0	69,943	10,780	0
5	159,873	10,640	0	224,501	13,252	0	136,361	11,514	0
6	151,690	6,389	0	131,928	12,948	0	64,412	20,102	0
7	193,748	23,044	405	250,927	25,466	0	157,433	24,659	282
8	70,591	6,680	0	54,558	7,394	0	87,004	7,155	0
9	127,758	3,340	0	170,618	3,689	0	17,017	3,570	0
10	4,751	490	0	28,994	499	0	5,050	571	0
11	90,411	1,516	0	35,235	1,561	0	8,128	1,512	0
14	252,449	21,882	0	98,425	24,200	0	79,646	23,423	0
15	212,730	13,601	0	222,881	14,750	0	93,448	14,279	0
16	206,187	54,018	0	311,079	59,714	0	182,803	57,794	0
17	28,472	8,877	0	39,591	9,793	0	59,912	9,477	0
Blantyre	436,647	3,113	0	704,506	3,327	0	683,904	3,220	0

Present by WRA (10-Drought Year) (Monthly) (1)

Annex 6.5.4-1 (3/12)

(1,000m^3/month)

WRA	5			6			7		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	434,896	125,649	15,309	308,894	114,992	17,058	238,816	91,040	210
2	16,196	3,784	551	6,792	3,760	704	4,546	6,556	3,836
3	41,443	18,025	0	30,346	19,640	7	23,773	22,553	1,352
4	36,249	13,851	0	20,115	18,723	401	12,350	25,138	11,048
5	65,913	14,053	0	31,937	18,762	455	18,709	29,773	14,276
6	37,953	25,315	0	18,547	25,085	6,494	10,990	17,962	6,927
7	82,098	25,606	1,989	55,116	25,532	3,469	38,292	28,769	4,824
8	22,792	7,652	0	15,650	7,705	0	12,273	7,867	0
9	7,839	5,235	0	5,520	6,844	1,330	4,153	6,032	1,879
10	1,006	808	10	610	1,097	487	383	1,773	1,390
11	3,507	2,382	0	2,799	3,507	1,122	1,693	4,320	2,642
14	61,526	27,019	26	42,990	25,462	193	30,859	36,221	10,671
15	33,163	16,946	0	23,146	20,862	832	18,309	18,535	1,105
16	150,305	60,546	0	110,782	61,924	0	90,754	66,205	0
17	28,698	11,014	0	17,310	12,589	215	17,590	11,536	100
Blantyre	659,927	3,327	0	599,640	3,220	0	562,306	3,327	0

(1,000m^3/month)

WRA	8			9			10		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	163,507	83,983	294	109,640	94,992	13,443	87,360	106,229	33,031
2	1,713	8,438	6,835	740	9,230	8,490	507	4,164	3,674
3	18,014	25,505	7,507	13,135	24,209	11,073	11,027	17,581	6,554
4	7,796	30,322	21,621	4,138	29,465	26,017	7,109	13,233	7,985
5	10,658	36,294	28,534	5,904	34,703	35,690	3,504	13,129	19,231
6	6,246	15,426	9,349	3,465	20,143	17,730	2,081	21,902	21,515
7	25,575	31,369	8,358	16,670	30,544	19,230	12,861	26,345	27,237
8	9,226	8,238	14	6,801	8,140	1,339	5,317	7,903	2,586
9	3,007	7,841	4,833	2,118	8,427	6,309	1,594	6,019	4,426
10	274	2,402	2,128	166	2,229	2,063	145	844	698
11	1,044	5,715	4,670	701	5,400	4,699	391	2,145	1,754
14	18,516	42,080	28,628	11,781	47,759	45,989	9,106	37,594	41,931
15	13,724	19,139	5,495	9,973	20,573	10,600	8,872	20,903	12,337
16	69,296	70,700	3,619	52,004	68,240	16,236	41,681	62,465	20,784
17	10,966	12,628	1,863	8,031	12,442	4,411	6,283	10,697	4,414
Blantyre	512,799	3,327	0	438,252	3,220	0	374,179	3,327	0

Present by WRA (10-Drought Year) (Monthly) (2)

Annex 6.5.4-1 (4/12)

(1,000m3)

WRA	Inflow	Demand	Deficit
1A	155,786	64,225	6,245
1B	157,726	61,886	5,340
1C	111,910	43,494	3,235
1E	171,626	77,590	10,470
1F	145,088	71,567	11,286
1G	234,981	109,565	9,809
1H	190,819	375,585	218,097
1K	172,351	71,504	6,240
1L	105,773	46,872	3,467
1M	86,227	28,824	2,013
1N	43,646	13,055	875
1O	101,431	43,140	4,738
1P	85,899	31,788	2,403
1R	138,664	63,369	5,962
1S	122,099	48,535	4,364
1T	52,369	21,855	4,102
1Sub-T	2,076,397	1,172,858	298,648
2A	631,458	7,029	1,522
2B	1,658,942	37,264	4,762
2C	481,076	7,442	871
2D	241,582	3,811	834
2Sub-T	3,013,058	55,545	7,988
3A	139,857	30,773	314
3B	105,017	21,195	0
3C	244,638	47,499	10
3D	281,879	45,778	2,050
3E	290,716	53,465	664
3F	132,226	27,703	1,834
3Sub-T	1,194,332	226,413	4,873
4A	74,786	11,696	3,893
4B	1,183,434	113,933	16,530
4C	639,174	58,527	8,118
4D	282,183	62,027	7,679
4E	91,025	16,434	4,431
4F	54,223	9,795	3,287
4Sub-T	2,324,825	272,412	43,939
5C	1,618,457	132,886	10,528
5D	1,427,933	118,776	18,734
5E	641,278	77,762	19,451
5F	406,249	42,006	7,436
5Sub-T	4,093,918	371,430	56,149

(1,000m3)

WRA	Inflow	Demand	Deficit
6A	135,237	9,785	849
6B	117,001	8,287	655
6C	364,955	30,802	5,542
6D	720,338	192,836	57,250
6Sub-T	1,337,532	241,710	64,296
7A	476,873	52,727	924
7B	700,281	66,265	118
7C	846,061	85,568	736
7D	376,124	67,257	770
7E	922,129	96,834	1,337
7F	1,057,209	112,654	1,302
7G	1,513,088	186,622	2,438
7H	147,028	100,100	32,292
7Sub-T	6,038,793	768,027	39,918
8A	620,525	91,146	2,006
8Sub-T	620,525	91,146	2,006
9A	303,656	28,711	6,346
9B	349,001	36,088	9,879
9Sub-T	652,657	64,799	16,225
10A	139,294	12,332	4,838
10Sub-T	139,294	12,332	4,838
11A	515,485	33,597	9,374
11Sub-T	515,485	33,597	9,374
12+13A	-	-	-
12+14Sub-	-	-	-
14A	116,039	14,756	6,600
14B	921,231	80,110	26,182
14C	923,521	246,592	26,382
14D	1,875,544	281,654	21,659
14Sub-T	3,836,335	623,112	80,822
15A	624,108	80,912	1,378
15B	897,180	117,079	8,988
15C	67,070	11,667	540
15Sub-T	1,588,358	209,657	10,905
16E	1,183,779	281,793	5,270
16F	1,128,644	304,500	7,833
16G	555,784	154,765	3,273
16Sub-T	2,868,208	741,059	16,376
17A	10,801	4,358	800
17B	148,640	38,735	2,147
17C	355,089	87,492	5,701
17Sub-T	514,530	130,585	8,648
Blantyre	15,070,486	39,284	0

Present by WRU (2-Drought Year)

Annex 6.5.4-1 (5/12)

(1,000m^3/year)

WRA	11			12			1		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	67,865	110,799	51,301	127,011	92,141	19,375	161,956	83,015	8,889
2	178,872	3,625	98	413,279	3,674	0	393,187	3,169	0
3	30,756	16,683	0	74,933	17,088	0	362,808	16,992	0
4	40,299	12,838	559	107,211	12,583	2	261,894	11,454	0
5	21,771	12,774	4,654	82,355	11,967	0	221,646	12,007	0
6	5,294	25,861	21,487	24,904	12,041	2,720	41,074	7,854	0
7	49,554	24,926	7,419	93,539	25,486	6,010	436,736	25,466	0
8	9,001	7,451	1,326	108,448	7,565	371	63,887	7,394	0
9	2,568	5,234	3,458	59,914	4,874	271	113,653	3,692	0
10	1,516	620	49	2,841	468	62	18,441	531	0
11	9,993	1,928	421	51,878	1,934	0	85,868	1,679	0
14	15,585	24,824	19,528	37,014	24,301	12,678	539,575	24,200	0
15	22,194	19,279	1,401	100,078	16,025	0	404,154	14,765	0
16	45,047	59,376	14,329	223,497	60,360	2,046	417,691	59,716	0
17	5,978	10,709	4,731	12,239	11,030	3,463	44,504	9,793	0
Blantyre	1,024,673	3,220	0	1,016,748	3,327	0	1,072,504	3,327	0

(1,000m^3/year)

WRA	2			3			4		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	347,122	71,102	17	487,617	87,431	0	335,046	111,482	18,928
2	794,189	2,905	0	848,592	3,169	0	317,331	3,070	0
3	243,941	15,359	0	140,880	16,705	0	98,553	16,073	0
4	351,668	10,296	0	250,015	12,379	0	138,017	10,780	0
5	407,234	10,640	0	509,880	13,252	0	186,612	11,514	0
6	121,544	6,389	0	288,948	12,948	0	129,470	20,102	0
7	290,895	23,044	0	319,870	25,466	0	178,869	24,659	0
8	60,023	6,680	0	90,985	7,394	0	173,453	7,155	0
9	117,666	3,340	0	167,386	3,689	0	151,865	3,570	0
10	79,662	490	0	60,609	499	0	18,072	571	0
11	115,847	1,516	0	170,124	1,561	0	56,700	1,512	0
14	461,587	21,882	0	341,312	24,200	0	178,737	23,423	0
15	360,166	13,601	0	378,824	14,750	0	130,059	14,279	0
16	415,110	54,018	0	427,602	59,714	0	401,721	57,794	0
17	58,098	8,877	0	135,467	9,793	0	95,820	9,477	0
Blantyre	1,114,288	3,113	0	1,490,518	3,327	0	1,513,534	3,220	0

Present by WRA (2-Drought Year) (Monthly) (1)

Annex 6.5.4-1 (6/12)

(1,000m^3/year)

WRA	5			6			7		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	212,586	125,649	36,681	145,388	114,992	32,801	106,071	91,040	10,952
2	30,464	3,784	0	15,212	3,760	0	10,378	6,556	117
3	81,770	18,025	0	50,762	19,640	0	39,709	22,553	0
4	65,079	13,851	0	38,857	18,723	0	24,278	25,138	2,519
5	98,674	14,053	0	48,878	18,762	0	29,986	29,773	2,312
6	54,963	25,315	0	29,859	25,085	277	17,794	17,962	1,272
7	115,580	25,606	0	71,977	25,532	911	51,070	28,769	2,821
8	41,253	7,652	0	23,154	7,705	0	18,674	7,867	0
9	15,025	5,235	0	8,248	6,844	27	6,288	6,032	224
10	2,593	808	0	1,535	1,097	0	1,104	1,773	694
11	8,662	2,382	0	5,290	3,507	0	5,571	4,320	527
14	112,195	27,019	0	75,240	25,462	0	54,537	36,221	2,374
15	62,878	16,946	0	41,795	20,862	0	31,961	18,535	0
16	270,150	60,546	0	203,237	61,924	0	163,877	66,205	0
17	50,683	11,014	0	35,574	12,589	0	27,828	11,536	0
Blantyre	1,543,644	3,327	0	1,424,915	3,220	0	1,395,425	3,327	0

(1,000m^3/year)

WRA	8			9			10		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	82,371	83,983	9,037	51,761	94,992	45,400	42,548	106,229	65,267
2	7,606	8,438	2,092	7,259	9,230	4,430	4,145	4,164	1,251
3	30,159	25,505	790	22,739	24,209	2,890	17,324	17,581	1,194
4	14,982	30,322	13,594	7,683	29,465	20,465	7,392	13,233	6,800
5	17,201	36,294	19,088	9,246	34,703	26,090	28,553	13,129	4,006
6	10,109	15,426	5,286	5,599	20,143	14,500	3,339	21,902	18,753
7	39,449	31,369	4,295	23,706	30,544	7,343	17,199	26,345	11,119
8	13,786	8,238	0	10,021	8,140	0	7,839	7,903	310
9	4,495	7,841	3,345	3,166	8,427	5,262	2,382	6,019	3,637
10	661	2,402	1,741	413	2,229	1,816	1,182	844	475
11	2,289	5,715	3,425	1,424	5,400	3,976	1,839	2,145	1,025
14	40,891	42,080	8,125	22,129	47,759	26,504	32,952	37,594	11,614
15	24,068	19,139	0	17,672	20,573	3,004	14,507	20,903	6,499
16	128,109	70,700	0	95,561	68,240	0	76,606	62,465	1
17	20,967	12,628	103	15,359	12,442	233	12,013	10,697	118
Blantyre	1,296,300	3,327	0	1,139,546	3,220	0	1,038,391	3,327	0

Present by WRA (2-Drought Year) (Monthly) (2)

Annex 6.5.4-1 (7/12)

(1,000m3)

WRA	Inflow	Demand	Deficit
1A	301,743	68,439	3,308
1B	335,448	65,493	3,197
1C	212,762	45,213	2,608
1E	355,313	84,649	6,882
1F	343,980	85,690	10,285
1G	539,569	122,677	7,098
1H	474,163	638,720	331,495
1K	434,593	76,280	3,103
1L	240,308	47,958	2,304
1M	164,102	30,239	1,734
1N	78,145	13,324	794
1O	222,483	45,344	2,682
1P	176,880	33,311	1,705
1R	341,078	66,591	3,353
1S	241,730	51,641	2,469
1T	86,598	26,181	3,363
1Sub-T	4,548,894	1,501,749	386,381
2A	150,324	10,752	6,136
2B	319,485	57,166	36,714
2C	149,007	9,855	5,140
2D	74,646	5,567	3,507
2Sub-T	693,462	83,340	51,497
3A	63,633	35,295	6,773
3B	61,291	23,468	2,669
3C	160,133	51,913	5,916
3D	148,447	53,878	14,091
3E	144,851	62,044	12,021
3F	86,590	34,802	10,748
3Sub-T	664,945	261,401	52,218
4A	54,505	11,830	5,271
4B	848,226	114,774	28,576
4C	463,221	60,602	16,591
4D	172,514	102,569	21,034
4E	119,359	18,029	6,139
4F	37,802	10,268	4,819
4Sub-T	1,695,626	318,072	82,431
5C	979,402	145,127	22,653
5D	699,991	146,550	56,823
5E	286,768	112,723	65,813
5F	255,074	58,320	28,735
5Sub-T	2,221,236	462,720	174,024

2025 by WRU (10-Drought Year)

(1,000m3)

WRA	Inflow	Demand	Deficit
6A	56,162	10,766	3,597
6B	60,750	9,297	2,968
6C	160,652	37,759	16,206
6D	687,928	271,625	120,897
6Sub-T	965,492	329,448	143,668
7A	224,352	62,742	10,902
7B	317,510	70,421	6,478
7C	393,474	87,927	7,554
7D	322,561	84,801	8,682
7E	431,633	100,365	9,825
7F	509,169	113,697	8,602
7G	871,179	187,867	9,907
7H	72,590	100,506	50,238
7Sub-T	3,142,468	808,326	112,189
8A	463,782	94,523	5,325
8Sub-T	463,782	94,523	5,325
9A	239,013	32,621	12,236
9B	277,369	43,658	19,821
9Sub-T	516,383	76,279	32,058
10A	54,655	16,241	10,251
10Sub-T	54,655	16,241	10,251
11A	286,257	64,803	43,145
11Sub-T	286,257	64,803	43,145
12+13A	-	-	-
12+14Sub-	-	-	-
14A	43,582	19,845	13,804
14B	436,407	103,821	61,985
14C	577,492	261,271	60,650
14D	1,033,053	284,718	45,193
14Sub-T	2,090,535	669,656	181,633
15A	301,611	82,414	13,686
15B	464,478	122,571	29,434
15C	39,139	12,040	1,910
15Sub-T	805,228	217,025	45,030
16E	578,756	288,837	15,512
16F	701,248	320,180	32,192
16G	327,843	158,635	8,698
16Sub-T	1,607,847	767,653	56,403
17A	4,603	14,529	11,504
17B	73,844	51,031	8,770
17C	195,396	149,749	56,933
17Sub-T	273,843	215,309	77,207
Blantyre	5,552,790	54,301	0

Annex 6.5.4-1 (8/12)

(1,000m^3/year)

WRA	11			12			1		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	38,507	150,852	113,823	236,728	113,326	31,880	546,168	95,951	141
2	10,808	5,038	2,678	29,105	5,068	1,458	257,743	4,095	374
3	21,548	17,582	114	18,775	17,861	1,013	104,271	17,666	7
4	29,067	16,415	4,918	68,279	16,248	1,552	356,261	15,068	0
5	43,195	14,724	624	137,614	12,670	0	174,376	12,751	0
6	7,863	38,295	34,047	66,856	15,888	12	193,942	9,133	0
7	21,920	27,444	10,296	32,144	27,901	11,505	96,944	27,867	6,643
8	13,359	7,697	0	45,076	7,711	0	121,135	7,404	0
9	4,618	6,131	3,666	52,020	5,529	725	120,121	3,743	0
10	1,792	742	104	9,827	507	31	19,322	602	0
11	1,425	3,028	2,306	28,428	2,967	127	112,494	2,265	0
14	30,480	25,717	11,540	68,708	24,377	1,093	346,924	24,214	0
15	12,695	20,323	8,063	18,877	16,270	1,585	137,413	14,740	0
16	67,366	60,552	473	108,753	60,861	278	216,838	59,729	0
17	10,012	17,539	7,527	19,803	17,895	3,415	27,176	9,831	1
Blantyre	183,996	4,451	0	181,947	4,599	0	302,411	4,599	0

(1,000m^3/year)

WRA	2			3			4		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	855,132	79,221	0	1,043,034	104,360	0	660,978	152,151	21,239
2	258,445	3,770	627	73,783	4,095	1,200	35,467	3,969	1,187
3	218,997	15,963	0	101,554	17,085	0	62,063	16,345	0
4	235,306	13,668	0	135,734	16,035	0	69,943	14,264	0
5	159,873	11,058	0	224,501	15,324	0	136,361	12,124	0
6	151,690	7,101	0	131,928	17,350	0	64,412	29,005	0
7	193,748	25,290	910	250,927	27,867	218	157,433	26,993	285
8	70,591	6,690	0	54,558	7,404	0	87,004	7,165	0
9	127,758	3,386	0	170,618	3,739	0	17,017	3,619	0
10	4,751	558	0	28,994	554	0	5,050	668	0
11	90,411	2,029	0	35,235	1,938	0	8,128	1,881	0
14	252,449	21,894	0	98,425	24,213	0	79,646	23,438	0
15	212,730	13,631	0	222,881	14,722	0	93,448	14,253	0
16	206,187	54,080	0	311,079	59,726	0	182,803	57,809	0
17	28,472	9,069	0	39,591	9,831	0	59,912	9,516	0
Blantyre	430,642	4,303	0	696,333	4,599	0	674,607	4,451	0

2025 by WRA (10-Drought Year) (Monthly) (1)

Annex 6.5.4-1 (9/12)

(1,000m^3/year)

WRA	5			6			7		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	434,896	177,121	60,508	308,894	158,835	53,300	238,816	111,231	8,341
2	16,196	5,280	1,412	6,792	5,299	1,782	4,546	10,623	7,569
3	41,443	19,760	0	30,346	23,575	738	23,773	28,940	5,899
4	36,249	17,574	0	20,115	22,566	729	12,350	29,372	12,200
5	65,913	16,979	0	31,937	27,091	4,155	18,709	49,443	31,958
6	37,953	37,300	3,682	18,547	37,043	18,386	10,990	25,438	14,353
7	82,098	28,103	2,261	55,116	28,467	4,182	38,292	33,448	5,930
8	22,792	7,869	0	15,650	8,153	0	12,273	8,254	0
9	7,839	6,074	0	5,520	8,562	3,042	4,153	7,278	3,124
10	1,006	1,019	102	610	1,461	851	383	2,473	2,089
11	3,507	4,205	730	2,799	7,384	4,705	1,693	9,551	7,858
14	61,526	28,799	98	42,990	26,755	474	30,859	43,769	16,980
15	33,163	17,387	0	23,146	22,245	1,765	18,309	19,317	1,691
16	150,305	61,166	0	110,782	64,907	0	90,754	70,747	0
17	28,698	17,790	690	17,310	29,789	12,580	17,590	21,190	5,414
Blantyre	649,908	4,599	0	589,187	4,451	0	550,796	4,599	0

(1,000m^3/year)

WRA	8			9			10		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	163,507	97,795	934	109,640	120,757	30,842	87,360	140,148	65,374
2	1,713	14,250	12,592	740	15,842	15,102	507	6,012	5,517
3	18,014	34,924	16,910	13,135	32,838	19,703	11,027	18,861	7,834
4	7,796	34,789	22,982	4,138	33,795	27,076	7,109	16,928	12,973
5	10,658	62,911	55,115	5,904	60,013	61,000	3,504	15,070	21,171
6	6,246	21,347	15,220	3,465	29,072	26,610	2,081	31,795	31,357
7	25,575	37,842	13,548	16,670	36,938	25,878	12,861	29,353	30,533
8	9,226	8,922	188	6,801	8,935	2,134	5,317	8,320	3,003
9	3,007	10,008	7,001	2,118	10,953	8,835	1,594	7,258	5,664
10	274	3,420	3,146	166	3,166	3,000	145	1,073	927
11	1,044	13,398	12,354	701	12,606	11,905	391	3,551	3,160
14	18,516	53,301	39,849	11,781	63,028	61,258	9,106	46,003	50,340
15	13,724	20,051	6,391	9,973	21,894	11,921	8,872	22,192	13,614
16	69,296	78,203	9,463	52,004	75,382	23,378	41,681	64,491	22,810
17	10,966	28,304	17,338	8,031	28,835	20,805	6,283	15,720	9,437
Blantyre	500,470	4,599	0	426,871	4,451	0	365,622	4,599	0

2025 by WRA (10-Drought Year) (Monthly) (2)

Annex 6.5.4-1 (10/12)

(1,000m3)

WRA	Inflow	Demand	Deficit
1A	301,743	71,819	3,639
1B	335,448	68,311	3,337
1C	212,762	46,696	2,679
1E	355,313	89,729	8,389
1F	343,980	95,460	15,261
1G	539,569	131,648	9,274
1H	474,163	812,460	481,836
1K	434,593	79,837	3,346
1L	240,308	48,834	2,331
1M	164,102	31,389	1,775
1N	78,145	13,641	808
1O	222,483	47,812	2,928
1P	176,880	34,522	1,752
1R	340,696	69,548	3,457
1S	241,730	54,001	2,626
1T	86,598	29,218	4,845
1Sub-T	4,548,512	1,724,923	548,282
2A	150,324	13,430	8,078
2B	319,485	69,355	47,563
2C	149,007	11,659	6,622
2D	74,646	6,963	4,712
2Sub-T	693,462	101,407	66,975
3A	63,633	38,358	9,058
3B	61,291	24,988	3,635
3C	160,133	54,893	7,802
3D	148,447	59,518	18,481
3E	144,851	67,843	16,106
3F	86,590	39,498	14,630
3Sub-T	664,945	285,097	69,712
4A	54,505	11,974	5,345
4B	834,713	115,763	29,037
4C	450,739	62,304	17,291
4D	161,869	135,013	42,089
4E	119,359	19,363	6,592
4F	37,802	10,839	5,086
4Sub-T	1,658,985	355,257	105,439
5C	970,764	155,753	28,924
5D	694,111	171,359	78,862
5E	286,768	143,672	93,124
5F	255,074	73,025	41,177
5Sub-T	2,206,717	543,809	242,087

2035 by WRU (10-Drought Year)

(1,000m3)

WRA	Inflow	Demand	Deficit
6A	56,162	12,107	4,602
6B	60,750	10,475	3,850
6C	159,532	44,065	21,042
6D	685,917	337,604	169,499
6Sub-T	962,362	404,252	198,993
7A	224,352	68,605	14,248
7B	314,993	72,772	7,765
7C	389,893	89,384	8,386
7D	322,561	97,702	20,827
7E	427,416	102,529	11,300
7F	504,250	114,605	9,082
7G	863,123	188,843	10,790
7H	72,590	100,856	50,571
7Sub-T	3,119,178	835,297	132,968
8A	463,782	97,112	6,458
8Sub-T	463,782	97,112	6,458
9A	239,013	34,753	13,982
9B	277,369	47,613	23,023
9Sub-T	516,383	82,366	37,006
10A	54,655	20,294	13,703
10Sub-T	54,655	20,294	13,703
11A	286,257	81,214	57,494
11Sub-T	286,257	81,214	57,494
12+13A	-	-	-
12+14Sub-	-	-	-
14A	43,582	22,567	16,198
14B	436,082	115,267	72,161
14C	577,492	268,181	66,569
14D	1,030,477	286,244	46,587
14Sub-T	2,087,633	692,258	201,514
15A	301,611	91,236	20,099
15B	464,478	145,815	49,943
15C	39,139	13,628	2,848
15Sub-T	805,228	250,679	72,890
16E	578,756	294,797	18,812
16F	701,248	332,869	40,430
16G	327,843	161,847	10,489
16Sub-T	1,607,847	789,513	69,731
17A	4,603	18,350	15,292
17B	73,844	55,657	12,486
17C	195,396	173,064	77,051
17Sub-T	273,843	247,070	104,829
Blantyre	5,491,590	73,580	0

Annex 6.5.4-1 (11/12)

(1,000m^3/year)

WRA	11			12			1		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	38,507	177,764	140,630	236,728	127,838	43,105	546,168	105,032	2,365
2	10,808	5,957	3,318	29,105	5,974	1,860	257,743	4,697	747
3	21,548	18,309	249	18,775	18,517	1,372	104,271	18,261	14
4	29,067	19,452	7,648	68,279	19,385	2,420	356,261	18,202	0
5	43,195	16,744	970	137,614	13,660	0	174,376	13,776	0
6	7,863	48,736	44,096	66,856	19,276	42	193,942	10,410	0
7	21,920	29,053	12,538	32,144	29,421	13,509	96,944	29,376	7,465
8	13,359	7,887	0	45,076	7,832	0	121,135	7,429	0
9	4,618	6,610	4,081	52,020	5,897	801	120,121	3,832	0
10	1,792	889	159	9,827	578	40	19,322	703	0
11	1,425	3,659	2,832	28,428	3,568	166	112,494	2,646	0
14	30,480	26,274	11,960	68,708	24,577	1,145	346,924	24,386	0
15	12,695	24,922	12,439	18,877	17,533	1,990	137,413	14,876	0
16	67,366	61,593	821	108,753	61,402	360	216,838	59,795	0
17	10,012	20,100	10,088	19,803	20,470	5,044	27,176	9,886	2
Blantyre	181,192	6,031	0	179,160	6,232	0	299,090	6,232	0

(1,000m^3/year)

WRA	2			3			4		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	855,132	85,095	0	1,043,034	116,069	0	660,978	179,470	44,952
2	258,445	4,333	964	73,783	4,697	1,573	35,467	4,553	1,548
3	218,997	16,504	0	101,554	17,499	0	62,063	16,686	0
4	235,306	16,599	0	135,734	19,171	0	69,943	17,296	0
5	159,873	11,783	0	224,501	17,459	0	136,361	13,022	0
6	151,690	7,897	0	131,928	21,195	0	64,412	36,543	0
7	193,748	26,702	1,636	250,927	29,376	831	157,433	28,461	1,009
8	70,591	6,713	0	54,558	7,428	0	87,004	7,189	0
9	127,758	3,469	0	170,618	3,828	0	17,017	3,705	0
10	4,751	654	0	28,994	640	0	5,050	793	0
11	90,411	2,369	0	35,235	2,218	0	8,128	2,153	0
14	252,449	22,055	0	98,425	24,384	0	79,646	23,606	0
15	212,730	13,984	0	222,881	14,845	0	93,448	14,376	0
16	206,187	54,181	0	311,079	59,791	0	182,803	57,876	0
17	28,472	9,178	0	39,591	9,886	0	59,912	9,570	0
Blantyre	427,074	5,830	0	691,538	6,232	0	669,109	6,031	0

2035 by WRA (10-Drought Year) (Monthly) (1/2)

Annex 6.5.4-1 (12/12)

(1,000m^3/year)

WRA	5			6			7		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	434,896	211,568	90,305	308,894	188,242	77,200	238,816	125,087	16,168
2	16,196	6,252	1,914	6,792	6,299	2,546	4,546	13,266	10,044
3	41,443	21,010	0	30,346	26,176	1,663	23,773	33,058	9,515
4	36,249	20,715	0	20,115	25,620	928	12,350	32,544	12,725
5	65,913	19,827	0	31,937	34,446	9,697	18,709	66,295	47,891
6	37,953	47,380	11,737	18,547	47,094	28,381	10,990	31,811	20,679
7	82,098	29,686	3,241	55,116	30,397	4,955	38,292	36,701	7,354
8	22,792	8,039	0	15,650	8,486	0	12,273	8,545	0
9	7,839	6,528	18	5,520	9,420	3,900	4,153	7,919	3,766
10	1,006	1,250	296	610	1,834	1,224	383	3,159	2,775
11	3,507	5,193	1,686	2,799	9,376	6,607	1,693	12,209	10,517
14	61,526	29,755	216	42,990	27,489	706	30,859	47,283	20,069
15	33,163	19,475	0	23,146	28,261	6,290	18,309	22,828	4,893
16	150,305	61,802	0	110,782	67,309	0	90,754	74,378	111
17	28,698	20,332	1,054	17,310	36,179	18,869	17,590	24,795	8,378
Blantyre	643,946	6,232	0	582,899	6,031	0	543,847	6,232	0

(1,000m^3/year)

WRA	8			9			10		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	163,507	107,453	2,503	109,640	138,265	43,703	87,360	163,041	87,349
2	1,713	18,027	16,347	740	20,138	19,399	507	7,213	6,714
3	18,014	40,913	22,899	13,135	38,333	25,198	11,027	19,829	8,803
4	7,796	37,976	29,287	4,138	36,879	35,802	7,109	20,067	16,630
5	10,658	85,573	77,777	5,904	81,569	82,556	3,504	17,095	23,196
6	6,246	26,442	20,267	3,465	36,631	34,123	2,081	40,154	39,669
7	25,575	42,469	17,490	16,670	41,514	30,454	12,861	31,327	32,487
8	9,226	9,421	433	6,801	9,512	2,712	5,317	8,631	3,314
9	3,007	11,077	8,069	2,118	12,185	10,067	1,594	7,896	6,303
10	274	4,402	4,128	166	4,071	3,905	145	1,321	1,176
11	1,044	17,259	16,215	701	16,230	15,529	391	4,334	3,943
14	18,516	58,444	44,992	11,781	69,960	68,191	9,106	49,899	54,235
15	13,724	24,103	10,407	9,973	27,652	17,679	8,872	27,823	19,193
16	69,296	84,164	14,900	52,004	81,057	29,053	41,681	66,167	24,486
17	10,966	34,133	23,167	8,031	34,927	26,896	6,283	17,615	11,332
Blantyre	493,018	6,232	0	420,102	6,031	0	360,616	6,232	0

2035 by WRA (10-Drought Year) (Monthly) (2/2)

Annex 6.7.2-1 (1/6)

(1,000m3)

WRA	Inflow	Demand	Deficit
1A	297,226	68,439	3,503
1B	329,593	65,493	3,361
1C	208,744	45,213	2,714
1E	341,300	84,649	7,405
1F	338,692	85,690	10,993
1G	537,529	122,677	7,740
1H	464,440	638,720	336,836
1K	424,788	76,280	3,420
1L	236,571	47,958	2,506
1M	161,719	30,239	1,786
1N	76,830	13,324	827
1O	218,439	45,344	2,797
1P	173,819	33,311	1,783
1R	332,955	66,591	3,506
1S	238,272	51,641	2,602
1T	85,375	26,181	3,456
1Sub-T	4,466,291	1,501,749	395,234
2A	149,209	10,752	6,052
2B	321,991	57,166	36,656
2C	150,341	9,855	5,155
2D	76,036	5,567	3,517
2Sub-T	697,577	83,340	51,381
3A	60,770	35,295	7,300
3B	58,905	23,468	3,013
3C	154,106	51,913	6,661
3D	142,023	53,878	14,788
3E	135,559	62,044	12,980
3F	82,362	34,802	11,407
3Sub-T	633,726	261,401	56,147
4A	51,911	11,830	5,464
4B	840,843	114,774	28,785
4C	459,563	60,602	16,792
4D	171,850	102,569	21,694
4E	119,794	18,029	6,150
4F	37,315	10,268	4,867
4Sub-T	1,681,275	318,072	83,753
5C	915,828	145,127	25,304
5D	656,517	146,550	59,099
5E	274,396	112,723	66,883
5F	240,506	58,320	29,369
5Sub-T	2,087,247	462,720	180,654

(1,000m3)

WRA	Inflow	Demand	Deficit
6A	53,197	10,766	3,722
6B	57,227	9,297	3,071
6C	151,198	37,759	16,518
6D	659,932	271,625	122,992
6Sub-T	921,554	329,448	146,302
7A	226,945	62,742	10,670
7B	320,929	70,421	6,287
7C	398,071	87,927	7,334
7D	326,718	84,801	8,417
7E	436,767	100,365	9,575
7F	515,891	113,697	8,313
7G	882,775	187,867	9,774
7H	72,892	100,506	50,120
7Sub-T	3,180,986	808,326	110,489
8A	470,105	94,523	5,114
8Sub-T	470,105	94,523	5,114
9A	248,295	32,621	11,949
9B	290,341	43,658	19,382
9Sub-T	538,636	76,279	31,331
10A	53,227	16,241	10,299
10Sub-T	53,227	16,241	10,299
11A	285,600	64,803	43,143
11Sub-T	285,600	64,803	43,143
12+13A	-	-	-
12+14Sub-	-	-	-
14A	44,060	19,845	13,803
14B	432,347	103,821	61,651
14C	553,308	261,271	62,617
14D	1,004,471	284,718	47,165
14Sub-T	2,034,187	669,656	185,237
15A	290,050	82,414	14,817
15B	451,251	122,571	31,444
15C	37,941	12,040	1,991
15Sub-T	779,243	217,025	48,252
16E	559,778	288,837	17,408
16F	679,762	320,180	34,758
16G	317,892	158,635	9,790
16Sub-T	1,557,432	767,653	61,957
17A	4,646	14,529	11,501
17B	74,327	51,031	8,720
17C	195,824	149,749	56,861
17Sub-T	274,797	215,309	77,082
Blantyre	5,125,327	54,301	0

A1B 2025 by WRU (10-Drought Year)

Annex 6.7.2-1 (2/6)

(1,000m^3/year)

WRA	11			12			1		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	38,507	150,852	116,021	236,728	113,326	32,850	546,168	95,951	143
2	10,808	5,038	2,823	29,105	5,068	1,459	257,743	4,095	347
3	21,548	17,582	312	18,775	17,861	1,871	104,271	17,666	32
4	29,067	16,415	5,463	68,279	16,248	1,730	356,261	15,068	0
5	43,195	14,724	783	137,614	12,670	0	174,376	12,751	0
6	7,863	38,295	34,477	66,856	15,888	31	193,942	9,133	0
7	21,920	27,444	10,189	32,144	27,901	11,492	96,944	27,867	6,491
8	13,359	7,697	0	45,076	7,711	0	121,135	7,404	0
9	4,618	6,131	3,655	52,020	5,529	738	120,121	3,743	0
10	1,792	742	108	9,827	507	32	19,322	602	0
11	1,425	3,028	2,315	28,428	2,967	130	112,494	2,265	0
14	30,480	25,717	13,422	68,708	24,377	1,353	346,924	24,214	0
15	12,695	20,323	8,844	18,877	16,270	1,867	137,413	14,740	0
16	67,366	60,552	564	108,753	60,861	662	216,838	59,729	0
17	10,012	17,539	7,473	19,803	17,895	3,454	27,176	9,831	0
Blantyre	159,836	4,451	0	159,451	4,599	0	278,362	4,599	0

(1,000m^3/year)

WRA	2			3			4		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	855,132	79,221	0	1,043,034	104,360	0	660,978	152,151	23,479
2	258,445	3,770	611	73,783	4,095	1,205	35,467	3,969	1,192
3	218,997	15,963	0	101,554	17,085	0	62,063	16,345	0
4	235,306	13,668	0	135,734	16,035	0	69,943	14,264	0
5	159,873	11,058	0	224,501	15,324	0	136,361	12,124	0
6	151,690	7,101	0	131,928	17,350	0	64,412	29,005	0
7	193,748	25,290	919	250,927	27,867	214	157,433	26,993	267
8	70,591	6,690	0	54,558	7,404	0	87,004	7,165	0
9	127,758	3,386	0	170,618	3,739	0	17,017	3,619	0
10	4,751	558	0	28,994	554	0	5,050	668	0
11	90,411	2,029	0	35,235	1,938	0	8,128	1,881	0
14	252,449	21,894	0	98,425	24,213	0	79,646	23,438	0
15	212,730	13,631	0	222,881	14,722	0	93,448	14,253	0
16	206,187	54,080	0	311,079	59,726	0	182,803	57,809	0
17	28,472	9,069	0	39,591	9,831	0	59,912	9,516	0
Blantyre	402,806	4,303	0	654,234	4,599	0	628,392	4,451	0

A1B 2025 by WRA (10-Drought Year) (Monthly) (1/2)

Annex 6.7.2-1 (3/6)

(1,000m^3/year)

WRA	5			6			7		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	434,896	177,121	61,861	308,894	158,835	53,826	238,816	111,231	8,296
2	16,196	5,280	1,417	6,792	5,299	1,769	4,546	10,623	7,432
3	41,443	19,760	0	30,346	23,575	922	23,773	28,940	6,665
4	36,249	17,574	0	20,115	22,566	806	12,350	29,372	12,312
5	65,913	16,979	0	31,937	27,091	5,415	18,709	49,443	33,427
6	37,953	37,300	4,358	18,547	37,043	18,970	10,990	25,438	14,700
7	82,098	28,103	2,210	55,116	28,467	4,164	38,292	33,448	5,879
8	22,792	7,869	0	15,650	8,153	0	12,273	8,254	0
9	7,839	6,074	0	5,520	8,562	2,796	4,153	7,278	2,940
10	1,006	1,019	115	610	1,461	860	383	2,473	2,097
11	3,507	4,205	742	2,799	7,384	4,694	1,693	9,551	7,841
14	61,526	28,799	98	42,990	26,755	468	30,859	43,769	17,150
15	33,163	17,387	0	23,146	22,245	2,212	18,309	19,317	2,220
16	150,305	61,166	0	110,782	64,907	0	90,754	70,747	9
17	28,698	17,790	687	17,310	29,789	12,495	17,590	21,190	5,426
Blantyre	603,258	4,599	0	545,635	4,451	0	508,979	4,599	0

(1,000m^3/year)

WRA	8			9			10		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	163,507	97,795	911	109,640	120,757	31,195	87,360	140,148	66,653
2	1,713	14,250	12,517	740	15,842	15,093	507	6,012	5,515
3	18,014	34,924	17,695	13,135	32,838	20,276	11,027	18,861	8,374
4	7,796	34,789	23,010	4,138	33,795	27,125	7,109	16,928	13,308
5	10,658	62,911	57,066	5,904	60,013	62,124	3,504	15,070	21,838
6	6,246	21,347	15,498	3,465	29,072	26,798	2,081	31,795	31,472
7	25,575	37,842	13,288	16,670	36,938	25,202	12,861	29,353	30,175
8	9,226	8,922	141	6,801	8,935	2,047	5,317	8,320	2,925
9	3,007	10,008	6,867	2,118	10,953	8,741	1,594	7,258	5,593
10	274	3,420	3,149	166	3,166	3,004	145	1,073	933
11	1,044	13,398	12,346	701	12,606	11,916	391	3,551	3,160
14	18,516	53,301	40,048	11,781	63,028	61,848	9,106	46,003	50,848
15	13,724	20,051	6,879	9,973	21,894	12,293	8,872	22,192	13,937
16	69,296	78,203	11,400	52,004	75,382	25,117	41,681	64,491	24,204
17	10,966	28,304	17,325	8,031	28,835	20,794	6,283	15,720	9,429
Blantyre	461,227	4,599	0	391,318	4,451	0	331,830	4,599	0

A1B 2025 by WRA (10-Drought Year) (Monthly) (2/2)

Annex 6.7.2-1 (4/6)

(1,000m3)

WRA	Inflow	Demand	Deficit
1A	297,226	71,819	3,860
1B	329,593	68,311	3,516
1C	208,744	46,696	2,787
1E	341,300	89,729	8,956
1F	338,692	95,460	15,945
1G	537,529	131,648	9,960
1H	464,440	812,460	487,168
1K	424,788	79,837	3,677
1L	236,571	48,834	2,536
1M	161,719	31,389	1,827
1N	76,830	13,641	841
1O	218,439	47,812	3,053
1P	173,819	34,522	1,832
1R	332,574	69,548	3,619
1S	238,272	54,001	2,769
1T	85,375	29,218	4,945
1Sub-T	4,465,910	1,724,923	557,293
2A	149,209	13,430	7,984
2B	321,991	69,355	47,491
2C	150,341	11,659	6,641
2D	76,036	6,963	4,720
2Sub-T	697,577	101,407	66,836
3A	60,770	38,358	9,600
3B	58,905	24,988	4,034
3C	154,106	54,893	8,661
3D	142,023	59,518	19,308
3E	135,559	67,843	17,246
3F	82,362	39,498	15,371
3Sub-T	633,726	285,097	74,219
4A	51,911	11,974	5,545
4B	827,368	115,763	29,238
4C	447,104	62,304	17,507
4D	161,218	135,013	42,763
4E	119,794	19,363	6,607
4F	37,315	10,839	5,138
4Sub-T	1,644,710	355,257	106,799
5C	907,646	155,753	32,070
5D	650,850	171,359	81,382
5E	274,396	143,672	94,234
5F	240,506	73,025	41,986
5Sub-T	2,073,399	543,809	249,672

A1B 2035 by WRU (10-Drought Year)

(1,000m3)

WRA	Inflow	Demand	Deficit
6A	53,197	12,107	4,728
6B	57,227	10,475	3,955
6C	150,085	44,065	21,448
6D	658,020	337,604	171,760
6Sub-T	918,528	404,252	201,891
7A	226,945	68,605	13,981
7B	318,377	72,772	7,560
7C	394,441	89,384	8,163
7D	326,718	97,702	20,672
7E	432,497	102,529	11,031
7F	510,898	114,605	8,787
7G	874,601	188,843	10,672
7H	72,892	100,856	50,453
7Sub-T	3,157,367	835,297	131,319
8A	470,105	97,112	6,220
8Sub-T	470,105	97,112	6,220
9A	248,295	34,753	13,695
9B	290,341	47,613	22,566
9Sub-T	538,636	82,366	36,262
10A	53,227	20,294	13,759
10Sub-T	53,227	20,294	13,759
11A	285,600	81,214	57,476
11Sub-T	285,600	81,214	57,476
12+13A	-	-	-
12+14Sub-	-	-	-
14A	44,060	22,567	16,180
14B	432,006	115,267	71,810
14C	553,308	268,181	68,517
14D	1,001,843	286,244	48,496
14Sub-T	2,031,217	692,258	205,004
15A	290,050	91,236	21,409
15B	451,251	145,815	52,067
15C	37,941	13,628	2,961
15Sub-T	779,243	250,679	76,436
16E	559,778	294,797	20,933
16F	679,762	332,869	43,308
16G	317,892	161,847	11,710
16Sub-T	1,557,432	789,513	75,951
17A	4,646	18,350	15,290
17B	74,327	55,657	12,421
17C	195,824	173,064	76,979
17Sub-T	274,797	247,070	104,689
Blantyre	5,066,856	73,580	0

Annex 6.7.2-1 (5/6)

(1,000m^3/year)

WRA	11			12			1		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	38,507	177,764	142,892	236,728	127,838	44,117	546,168	105,032	2,332
2	10,808	5,957	3,491	29,105	5,974	1,860	257,743	4,697	720
3	21,548	18,309	572	18,775	18,517	2,356	104,271	18,261	45
4	29,067	19,452	8,206	68,279	19,385	2,604	356,261	18,202	0
5	43,195	16,744	1,210	137,614	13,660	0	174,376	13,776	0
6	7,863	48,736	44,526	66,856	19,276	67	193,942	10,410	0
7	21,920	29,053	12,456	32,144	29,421	13,484	96,944	29,376	7,456
8	13,359	7,887	0	45,076	7,832	0	121,135	7,429	0
9	4,618	6,610	4,070	52,020	5,897	814	120,121	3,832	0
10	1,792	889	167	9,827	578	41	19,322	703	0
11	1,425	3,659	2,840	28,428	3,568	168	112,494	2,646	0
14	30,480	26,274	13,862	68,708	24,577	1,406	346,924	24,386	0
15	12,695	24,922	13,297	18,877	17,533	2,336	137,413	14,876	0
16	67,366	61,593	938	108,753	61,402	806	216,838	59,795	0
17	10,012	20,100	10,034	19,803	20,470	5,082	27,176	9,886	2
Blantyre	157,242	6,031	0	156,879	6,232	0	275,255	6,232	0

(1,000m^3/year)

WRA	2			3			4		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	855,132	85,095	0	1,043,034	116,069	0	660,978	179,470	47,192
2	258,445	4,333	948	73,783	4,697	1,578	35,467	4,553	1,553
3	218,997	16,504	0	101,554	17,499	0	62,063	16,686	0
4	235,306	16,599	0	135,734	19,171	0	69,943	17,296	0
5	159,873	11,783	0	224,501	17,459	0	136,361	13,022	0
6	151,690	7,897	0	131,928	21,195	0	64,412	36,543	0
7	193,748	26,702	1,645	250,927	29,376	815	157,433	28,461	977
8	70,591	6,713	0	54,558	7,428	0	87,004	7,189	0
9	127,758	3,469	0	170,618	3,828	0	17,017	3,705	0
10	4,751	654	0	28,994	640	0	5,050	793	0
11	90,411	2,369	0	35,235	2,218	0	8,128	2,153	0
14	252,449	22,055	0	98,425	24,384	0	79,646	23,606	0
15	212,730	13,984	0	222,881	14,845	0	93,448	14,376	0
16	206,187	54,181	0	311,079	59,791	0	182,803	57,876	0
17	28,472	9,178	0	39,591	9,886	0	59,912	9,570	0
Blantyre	399,440	5,830	0	649,659	6,232	0	623,109	6,031	0

A1B 2035 by WRA (10-Drought Year) (Monthly) (1/2)

Annex 6.7.2-1 (6/6)

(1,000m^3/year)

WRA	5			6			7		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	434,896	211,568	91,658	308,894	188,242	77,726	238,816	125,087	16,123
2	16,196	6,252	1,919	6,792	6,299	2,526	4,546	13,266	9,868
3	41,443	21,010	0	30,346	26,176	2,036	23,773	33,058	10,414
4	36,249	20,715	0	20,115	25,620	1,013	12,350	32,544	12,837
5	65,913	19,827	0	31,937	34,446	11,375	18,709	66,295	49,815
6	37,953	47,380	12,667	18,547	47,094	28,966	10,990	31,811	21,025
7	82,098	29,686	3,214	55,116	30,397	4,937	38,292	36,701	7,230
8	22,792	8,039	0	15,650	8,486	0	12,273	8,545	0
9	7,839	6,528	0	5,520	9,420	3,655	4,153	7,919	3,582
10	1,006	1,250	313	610	1,834	1,233	383	3,159	2,783
11	3,507	5,193	1,696	2,799	9,376	6,582	1,693	12,209	10,500
14	61,526	29,755	224	42,990	27,489	666	30,859	47,283	20,131
15	33,163	19,475	0	23,146	28,261	6,801	18,309	22,828	5,528
16	150,305	61,802	0	110,782	67,309	0	90,754	74,378	354
17	28,698	20,332	1,037	17,310	36,179	18,771	17,590	24,795	8,401
Blantyre	597,522	6,232	0	539,573	6,031	0	502,271	6,232	0

(1,000m^3/year)

WRA	8			9			10		
	Inflow	Demand	Deficit	Inflow	Demand	Deficit	Inflow	Demand	Deficit
1	163,507	107,453	2,392	109,640	138,265	44,125	87,360	163,041	88,736
2	1,713	18,027	16,270	740	20,138	19,390	507	7,213	6,713
3	18,014	40,913	23,684	13,135	38,333	25,772	11,027	19,829	9,342
4	7,796	37,976	29,367	4,138	36,879	35,853	7,109	20,067	16,919
5	10,658	85,573	79,728	5,904	81,569	83,680	3,504	17,095	23,863
6	6,246	26,442	20,545	3,465	36,631	34,311	2,081	40,154	39,783
7	25,575	42,469	17,188	16,670	41,514	29,779	12,861	31,327	32,138
8	9,226	9,421	359	6,801	9,512	2,625	5,317	8,631	3,236
9	3,007	11,077	7,936	2,118	12,185	9,973	1,594	7,896	6,232
10	274	4,402	4,131	166	4,071	3,909	145	1,321	1,182
11	1,044	17,259	16,207	701	16,230	15,540	391	4,334	3,944
14	18,516	58,444	45,191	11,781	69,960	68,781	9,106	49,899	54,744
15	13,724	24,103	10,905	9,973	27,652	18,051	8,872	27,823	19,519
16	69,296	84,164	17,181	52,004	81,057	30,792	41,681	66,167	25,880
17	10,966	34,133	23,153	8,031	34,927	26,886	6,283	17,615	11,324
Blantyre	454,019	6,232	0	384,800	6,031	0	327,087	6,232	0

A1B 2035 by WRA (10-Drought Year) (Monthly) (2/2)

ANNEX Fact Sheet for WRA

Fact Sheet for WRA 1 (1A-1T)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Shire (Shire River Bain)
2	WRA (WRU)		WRA1 (1A, 1B, 1C, 1E, 1F, 1G, 1H, 1K, 1L, 1M, 1N, 1O, 1P, 1R, 1S,1T)
3	Catchment Area(km^2)		Total 18,945
			1A 1,632 / 1B 1,374 / 1C 753 / 1E 946
			1F 1,160 / 1G 1,460 / 1H 2,110 / 1K 1,790
			1L 861 / 1M 870 / 1N 550 / 1O 1,440
			1P 674 / 1R 1,570 / 1S 1,230 / 1T 525
4	Topography		
5	Annual Rainfall		WRA1 888mm
			1A 851 mm / 1B 928 mm / 1C 922 mm / 1E 1025 mm
			1F 870 mm / 1G 905 mm / 1H 740 mm / 1K 866 mm
			1L 801 mm / 1M 1028 mm / 1N 948 mm / 1O 1020 mm
			1P 844 mm / 1R 922 mm / 1S 863 mm / 1T 763mm
6	Land Use in 2010 I.A = Irrigation Area	WRA1	Forest: 4,580.8km^2 (24.6%), Bush/Grassland: 8.7km^2 (0.1%), Wetland: 942.6km^2 (5.1%), Rain fed Farmland: 13,090.7km^2 (70.3%), Total: 18,622.8km^2 I.A = 29,564 ha
		1A	Forest: 729.7km^2 (47.2%), Bush/Grassland: 2.7km^2 (0.2%), Wetland: 67.5km^2 (4.4%), Rain fed Farmland: 744.8km^2 (48.2%), Total: 1,544.6km^2 I.A = 29,564 ha
		1B	Forest: 361.9km^2 (26.7%), Bush/Grassland: 2.3km^2 (0.2%), Wetland: 34.0km^2 (2.5%), Rain fed Farmland: 957.2km^2 (70.6%), Total: 1,355.3km^2 I.A = 516 ha
		1C	Forest: 54.1km^2 (7.5%), Bush/Grassland: 3.6km^2 (0.5%), Wetland: 1.3km^2 (0.2%), Rain fed Farmland: 663.8km^2 (91.8%), Total: 722.8km^2 I.A = 302 ha
		1E	Forest: 171.5km^2 (19.6%), Bush/Grassland: 0.1km^2 (0.0%), Wetland: 9.1km^2 (1.0%), Rain fed Farmland: 693.0km^2 (79.3%), Total: 873.8km^2 I.A = 658 ha
		1F	Forest: 62.7km^2 (5.3%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 419.3km^2 (35.6%), Rain fed Farmland: 694.8km^2 (59.0%), Total: 1,176.9km^2 I.A = 1,133 ha
		1G	Forest: 482.9km^2 (34.3%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 176.6km^2 (12.5%), Rain fed Farmland: 750.3km^2 (53.2%), Total: 1,409.8km^2 I.A = 1,205 ha
		1H	Forest: 398.0km^2 (19.3%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 61.4km^2 (3.0%), Rain fed Farmland: 1,605.7km^2 (77.8%), Total: 2,065.1km^2 I.A = 21,730 ha
		1K	Forest: 510.3km^2 (28.1%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 31.2km^2 (1.7%), Rain fed Farmland: 1,271.8km^2 (70.1%), Total: 1,813.2km^2 I.A = 658 ha

		1L	Forest: 544.1km^2 (64.5%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 24.2km^2 (2.9%), Rain fed Farmland: 274.8km^2 (32.6%), Total: 843.1km^2 I.A = 148 ha
		1M	Forest: 251.4km^2 (28.6%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 2.9km^2 (0.3%), Rain fed Farmland: 623.6km^2 (71.0%), Total: 877.9km^2 I.A = 311 ha
		1N	Forest: 415.3km^2 (72.4%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 2.3km^2 (0.4%), Rain fed Farmland: 155.9km^2 (27.2%), Total: 573.4km^2 I.A = 73 ha
		1O	Forest: 220.7km^2 (14.9%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 6.5km^2 (0.4%), Rain fed Farmland: 1,252.5km^2 (84.7%), Total: 1,479.6km^2 I.A = 615 ha
		1P	Forest: 9.5km^2 (1.4%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 26.3km^2 (4.0%), Rain fed Farmland: 620.4km^2 (94.6%), Total: 656.2km^2 I.A = 284 ha
		1R	Forest: 139.4km^2 (9.4%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 34.5km^2 (2.3%), Rain fed Farmland: 1,313.5km^2 (88.3%), Total: 1,487.5km^2 I.A = 612 ha
		1S	Forest: 113.9km^2 (20.0%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 21.0km^2 (3.7%), Rain fed Farmland: 433.8km^2 (76.3%), Total: 568.6km^2 I.A = 485 ha
		1T	Forest: 128.9km^2 (13.7%), Bush/Grassland: 7.3km^2 (0.8%), Wetland: 108.5km^2 (11.6%), Rain fed Farmland: 695.1km^2 (74.0%), Total: 939.7km^2 I.A = 383 ha

7	Population in 2008	WRA1	2,927,994 persons			
		1A	136,473 persons	1B	193,265 persons	
		1C	255,096 persons	1E	685,485 persons	
		1F	215,129 persons	1G	164,984 persons	
		1H	227,484 persons	1K	190,216 persons	
		1L	37,147 persons	1M	57,798 persons	
		1N	26,415 persons	1O	101,284 persons	
		1P	59,024 persons	1R	286,782 persons	
		1S	186,049 persons	1T	105,363 persons	
8	Major Cities/Towns	1A: Nsanama (Rural MC) 1B: Liwonde (Sub Regional Centre), Machinga (District MC, Population: 488,996 in 2008) 1C: Lirangwe (Rural MC) 1E: Blantyre (National Centre, City Population: 661,444 in 2008, Rural Population: 338,047 in 2008) 1F: - 1G: Bangula (Sub Regional Centre), Nsanje (District MC) 1H: Nchalo (Rural MC), Ngabu (Rural MC) 1K: Thambani (Rural MC), Chapananga (Rural MC) 1L: Chikwawa (District MC, Population: 438,895 in 2008) 1M: Neno (District MC, Population: 108,897 in 2008), Mwanza (District MC, Population: 94,476 in 2008) 1N: - 1O: - 1P: Phalula (Rural MC) 1R: Ntcheu (District MC, Population: 474,464 in 2008), Balaka (District MC, Population: 316,748 in 2008) 1S: Ulongwe (Rural MC), Chilipa (Rural MC) 1T: -				
9.	Existing Water	1A				

	Supply System and Scheme	1B	
		1C	Limbe Zone of BWB (Blantyre City, Blantyre Rural)
		1E	Kabula, Soche and Limbe Zone of BWB (Blantyre City, Blantyre Rural)
		1F	
		1G	
		1H	
		1K	
		1L	
		1M	
		1N	
		1O	
		1P	
		1R	
		1S	
		1T	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	1A	GBI Pilot-Lake Malombe (500 ha) ; rice 50%
		1B	Umodzi motorised pump scheme was surveyed.
		1C	
		1E	
		1F	GBI Pilot-Chikhwawa/Chilengo (240 ha) ; maize 100%
		1G	
		1H	
		1K	
		1L	
		1M	
		1N	
		1O	
		1P	
		1R	
		1S	
		1T	
11.	Existing Hydropower Plant & Electric Supply	1A	No hydropower plant Transmission lines from Liwonde to Ntaja passes No substation
		1B	No hydropower plant Transmission lines from Nkula No substation
		1C	Transmission lines from Nkula and Tedzani No substation
		1E	No hydropower plant Transmission lines from Nkula, Tedzani, and Kapichira to Blabtyre and its suburbs 2 substations (Blantyre West, Chichiri)
		1F	No hydropower plant Transmission line from Blantyre to Bangula No substation
		1G	No hydropower plant Transmission line from Blantyre to Bangula and Nsanje No substation
		1H	No hydropower plant Transmission line from Kapichira to Nchalo substation which leads to Bangula
		1K	No hydropower plant Transmission lines passes

			No substation
		1L	Kapichira I hydropower plant Transmission from and to Kapichira substation
		1M	No hydropower plant Transmission lines passes No substation
		1N	Tedzani (I, II, II) hydropower plant Transmission lines from/to Tedzani substation
		1O	Nkula (A, B) hydropower plant Transmission lines from/to Nkula B substation
		1P	Transmission lines from/to Nkula A substation
		1R	No hydropower plant Transmission lines from Nkula to Chigeni and Ntcheu substations
		1S	No hydropower plant Transmission lines from/to Liwonde substation
		1T	No hydropower plant Transmission line from Liwonde to Mangochi passes No substation
12.	Industrial Areas		
13.	Estate/Village	1A	
		1B	MPOYA & MPOTOLA (MACHINGA) Villages were surveyed.
		1C	MASAMBA & MALOYA (BLANTYRE) Villages were surveyed.
		1E	
		1F	MAFUMBE, DZIPHUTSI & KWATAINE (CHIKHWAWA) Villages were surveyed
		1G	KAOMBE (NSANJE) Estate was surveyed. CHINGWE & NYAMULA (NSANJE) Villages were surveyed.
		1H	KASINTHULA CANE GROWERS & ILLOVO-NCHALO (CHIKHWAWA) Estates.
		1K	DICKSON (MWANZA) Ville. was surveyed.
		1L	
		1M	AMOS (MWANZA) Ville. was surveyed.
		1N	
		1O	
		1P	
		1R	DAVITE (NTCHEU) & CHISINKHA (BALAKA) Villages were surveyed.
		1S	TOLEZA (BALAKA) Estate. Water source is borehole. SILIKA (BALAKA) Ville. was surveyed.
		1T	MACHENJE (MANGOCHI) Ville. was surveyed.
14.	Water Supply Development	1A	
		1B	
		1C	Rehabilitation of Walker's Ferry Treatment Plant
		1E	・Construction and supervision of three storage reservoirs, ・Rehabilitation and renewal of Chileka pumping station, ・Mudi Rehabilitation Works.
		1F	
		1G	
		1H	
		1K	
		1L	
		1M	
		1N	

		1O	
		1P	
		1R	
		1S	
		1T	
15.	Hydropower Development	1A	No project
		1B	Kholombidzo hydropower plant
		1C	No project
		1E	No project
		1F	No project
		1G	No project
		1H	No project
		1K	No project (New transmission line will pass)
		1L	Kapichira II and III project (Extension)
		1M	No project (New transmission line will pass)
		1N	Tedzani IV project (Extension) Mpatamanga hydropower project
		1O	Upgrading Nkula A hydropower plant New transmission lines from/to Nkula B substation
		1P	Kholombidzo hydropower plant
		1R	No project (New transmission line will pass)
		1S	No project
		1T	No project
16	Monitoring System		
	Rainfall Gauge	1A	No rainfall gauge
		1B	Chingale (monitored period: 1952-1990, 1994-2010)
		1C	Chileka (monitored period:1949-2011)
		1E	Chichiri (monitored period:1965-2011) Bvumbwe (monitored period:1945-2010) Mpemba (monitored period:1948-1964, 1966-1990)
		1F	Masambanjati (monitored period:1935-1990) Makhanga (monitored period:1941-1988, 1990-2011)
		1G	Nsanje (monitored period:1939-1961, 1973-2003, 2005-2011)
		1H	Ngabu (monitored period:1960-2011) Nchalo (monitored period:1971-2010)
		1K	Mwanza (monitored period:1935-1990, 2000-2006)
		1L	Chikwawa (monitored period:1920-2010)
		1M	Neno (monitored period:1947-2009)
		1N	No rainfall gauge
		1O	No rainfall gauge
		1P	Phalula (monitored period:1982-1987, 1989-1992, 1994-1998, 2000-2008)
		1R	Balaka(monitored period:1976-2010) Toleza(monitored period:1941-1989, 2002-2006) Balaka(monitored period:1976-2008)
		1S	Liwonde(monitored period:1900-1944, 1951-1968, 1971-1989, 1993-1996, 1998-2005)
		1T	No rainfall gauge
	Stream Gauge	1A	No representative stream gauge
		1B	1B1 (Shire at Liwonde): monitored period; 63 years, drainage area; 3,700 km^2, average dry-season flows: Q_{75} = 308.159 m^3/s & Q_{97} = 255.442 m^3/s
		1C	1C1 (Lirangwe at Lirangwe): monitored period; 43 years, drainage area;

			198 km^2, average dry-season flows: Q_{75} = 2.240 m^3/s & Q_{97} = 1.740 m^3/s 1C9 (Lunzu at Whayo): monitored period; 4 years, drainage area; 163 km^2, average dry-season flows: Q_{75} = 0.009 m^3/s & Q_{97} = 0.000 m^3/s
		1E	1E1 (Mwamphanzi at Mpokonyola): monitored period; 0 year, drainage area; 311 km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s 1E2 (Likhubula at Namira): monitored period; 7 year, drainage area; 594 km^2, average dry-season flows: Q_{75} = 0.756 m^3/s & Q_{97} = 0.440 m^3/s 1E4 (Naperi at Stella Maris School): monitored period; 32 year, drainage area; 594 km^2, average dry-season flows: Q_{75} = 0.039 m^3/s & Q_{97} = 0.021 m^3/s 1E19 (Mudi at Sunnyside): monitored period; 27 year, drainage area; 594 km^2, average dry-season flows: Q_{75} = 0.032 m^3/s & Q_{97} =0.014 m^3/s
		1F	1F1 (Mapelera at Mafumbi): monitored period; 20 years, drainage area; 61.5 km^2, average dry-season flows: Q_{75} = 0.248 m^3/s & Q_{97} = 0.189 m^3/s 1F2 (Thangadzi East at Gooke): monitored period; 25 years, drainage area; 45.5 km^2, average dry-season flows: Q_{75} = 0.231 m^3/s & Q_{97} = 0.130 m^3/s 1F17 (Livunzu at Malata): monitored period; 9 years, drainage area; 57.4 km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s
		1G	1G1 (Shire at Chiromo (Left Bank)): monitored period; 57 years, drainage area; 18,240 km^2, average dry-season flows: Q_{75} = 409.933 m^3/s & Q_{97} = 339.837 m^3/s 1G3 (Shire at Tengani): monitored period; 0 years, drainage area; 150,000 km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s
		1H	No representative stream gauge
		1K	1K1 (Mwanza at Tomali): monitored period; 42years, drainage area; 1,650km^2, average dry-season flows: Q_{75} = 0.075 m^3/s & Q_{97} = 0.000 m^3/s 1K3 (Mwanza at Mwanza Old Customs): monitored period; 17years, drainage area;86.8km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s
		1L	1L12 (Shire at Chikwawa): monitored period; 33 years, drainage area; 138,600 km^2, average dry-season flows: Q_{75} = 464.894 m^3/s & Q_{97} = 390.158 m^3/s
		1M	1M1 (Mkurumadzi at Mlongola): monitored period; 15 years, drainage area; 586 km^2, average dry-season flows: Q_{75} = 1.699 m^3/s & Q_{97} = 1.030 m^3/s 1M5 (Mkurumadzi at Mlongola): monitored period; 0 years, drainage area; - km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s
		1N	No representative stream gauge
		1O	1O1 (Lisungwe at Moffat): monitored period; 16 years, drainage area; 1,190 km^2, average dry-season flows: Q_{75} = 1.322 m^3/s & Q_{97} =0.702 m^3/s
		1P	1P2 (Shire at Matope): monitored period; 45 years, drainage area; 7,200 km^2, average dry-season flows: Q_{75} = 318.978 m^3/s & Q_{97} = 256.527 m^3/s
		1R	1R3 (Rivi-Rivi at Balaka): monitored period; 53 years, drainage area; 775 km^2, average dry-season flows: Q_{75} = 0.608 m^3/s & Q_{97} = 0.206 m^3/s 1R18 (Mpamadzi at Gumbu): monitored period; 45 years, drainage area; 7.03 km^2, average dry-season flows: Q_{75} = 0.010 m^3/s & Q_{97} = 0.003 m^3/s 1R19 (Mpira at Gomeza): monitored period; 28 years, drainage area; 38.9 km^2, average dry-season flows: Q_{75} = 0.029 m^3/s & Q_{97} = 0.007 m^3/s
		1S	No representative stream gauge
		1T	1T1 (Shire at Mangochi): monitored period; 30 years, drainage area; 126,500 km^2, average dry-season flows: Q_{75} = 443.454 m^3/s & Q_{97} = 388.140 m^3/s
	Monitoring Well	1A	GN205(Kawombe Dam): monitored period; 4 years, the highest G.W.L; 15.88m, the lowest G.W.L; 24.10m, the range of periodic fluctuation is 8.22m. The groundwater table may be influenced by impounding of dam.
		1B	No monitoring well

		1C	No monitoring well
		1E	No monitoring well
		1F	No monitoring well
		1G	DM149 (Nsanje W/Office): monitored period; 3 years, the highest G.W.L; 13.40m, the lowest G.W.L; 15.80m, the range of periodic fluctuation is unclear. The groundwater table had decreased in May-2010 to Dec-2012.
		1H	GN166 (Ngabu W/Office): monitored period; 4 years, the highest G.W.L; 6.10m, the lowest G.W.L; 16.32m, the range of periodic fluctuation is 1 to 3m. The groundwater table has decreased with periodic cycle since the monitoring began.
		1K	DM152(Mwanza Prison): monitored period; within 1 year, the groundwater trend is unclear due to very few monitoring data.
		1L	DM138(Chikhwawa W/office): monitored period; 3 years, the highest G.W.L; 35.17m, the lowest G.W.L; 36.20m, the range of periodic fluctuation is within 1m.
		1M	No monitoring well
		1N	No monitoring well
		1O	No monitoring well
		1P	No monitoring well
		1R	DM136(Balaka W/Office): monitored period; 4 years, the highest G.W.L; 1.14m, the lowest G.W.L; 6.17m, the range of periodic fluctuation is 2 to 5m.
		1S	GN165(M'manga CDSS: monitored period; 4 years, the highest G.W.L; 7.50m, the lowest G.W.L; 14.70m, the range of periodic fluctuation is unclear.
		1T	No monitoring well
	Water Quality	1A	<Surface Water> No monitoring <Groundwater> GN205(Kawombe Dam): Monitored date in rainy season; 15-Mar-2013, in dry season; 31-Jul-2013 pH=[7.9](6.52), Temp=[25.7](25.4)°C, EC=[261](286)µs/cm, TDS=[117](158)mg/l, CO_3^{2-}=[180](0.00)mg/l, HCO_3^{2-}=[19](154)mg/l, Cl^-=[95](11)mg/l, SO_4^{2-}=[8.6](3.94) mg/l, NO_3^-=[0.1](<0.001)mg/l, F^-=[0.035](1)mg/l, Na^+=[8](8)mg/l, K^+=[2.1](1.6)mg/l, Ca^{2+}=[20](29.8)mg/l, Mg^{2+}=[12.6](13.1)mg/l, Fe^{2+}=[0.007](<0.001)mg/l, Mn^{2+}=[0.001](<0.001)mg/l, Hardness=[101](128)mg/l, Alkalinity=[109](125)mg/l, Turbidity=[5](3.2)NTU, SS=[4](1)mg/l, Cu^{2+}=[0.005](0.003)mg/l, DO=[7.5](1.9)mg/l, BOD=[3](27.5)mg/l, COD=[9](98)mg/l, F.Coliform=[12](0)nos./100ml, , F.Steptococci=[121](8)nos.100ml note: [ ]; rainy season, ( ); dry season
		1B	<Surface Water> 1B1(Shire River): Monitored date in rainy season; 15-Apr-2013, in dry season; 31-Jul-2013 pH=[7.9](8.55), Temp=[25.5](26.5)°C, EC=[260](277)µs/cm, TDS=[120](141)mg/l, CO_3^{2-}=[19](14.4)mg/l, HCO_3^{2-}=[53](98)mg/l, Cl^-=[25.4](12)mg/l, SO_4^{2-}=[3.1](5.38)mg/l, NO_3^-=[0.017](0.001)mg/l, F^-=[0.74](1.28)mg/l, Na^+=[26](21)mg/l, K^+=[5.7](57)mg/l, Ca^{2+}=[11](16)mg/l, Mg^{2+}=[5.2](9.6)mg/l, Fe^{2+}=[0.002](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[48](79)mg/l, Alkalinity=[75](108)mg/l, Turbidity=[14](22)NTU, SS=[13](18)mg/l, PO_4^{3-}=[0.001](0.001)mg/l, Cu^{2+}=[0.006](0.001)mg/l, DO=[6.2](6)mg/l, BOD=[1](9.15)mg/l, COD=[4](29.4)mg/l, F.Coliform=[60](48)nos./100ml, , F.Steptococci=[4](28)nos.100ml <Groundwater>

			No monitoring note: [ ]; rainy season, ( ); dry season
		1C	<Surface Water> 1C9(Lunzu River): Monitored date in rainy season; 16-Mar-2013, in dry season; 2-Aug-2013 pH=[7.47](8.36), Temp=[21.4](24.2)°C, EC=[376](546)µs/cm, TDS=[195](270)mg/l, CO_3^{2-}=[0](28.8)mg/l, HCO_3^{2-}=[214](202)mg/l, Cl^-=[8.5](20.6)mg/l, SO_4^{2-}=[6.2](11.9)mg/l, NO_3^-=[0.381](0.001)mg/l, F^-=[0.48](1.34)mg/l, Na^+=[23](25)mg/l, K^+=[1.8](1.2)mg/l, Ca^{2+}=[35.1](47.2)mg/l, Mg^{2+}=[13.5](20.6)mg/l, Fe^{2+}=[0.006](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[143](202)mg/l, Alkalinity=[175](214)mg/l, Turbidity=[17](4)NTU, SS=[15](2)mg/l, PO_4^{3-}=[0.081](0.02)mg/l, Cu^{2+}=[0.01](0.001)mg/l, DO=[8.7](6.2)mg/l, BOD=[5](6.7)mg/l, COD=[45](25.1)mg/l, F.Coliform=[90](872)nos./100ml, , F.Steptococci=[42](480)nos.100ml <Groundwater> No monitoring note: [ ]; rainy season, ( ); dry season
		1E	No monitoring
		1F	No monitoring
		1G	<Surface Water> No monitoring <Groundwater> DM149(Nsanje W/Office): Monitored date in rainy season; 16-Mar-2013, in dry season; 2-Aug-2013 pH=[7.8](7.22), Temp=[27.2](26.3)°C, EC=[383](363)µs/cm, TDS=[180](201)mg/l, CO_3^{2-}=[19](0)mg/l, HCO_3^{2-}=[125](159)mg/l, Cl^-=[27.1](27.5)mg/l, SO_4^{2-}=[3.2](8.83)mg/l, NO_3^-=[0.188](0.083)mg/l, F^-=[0.68](1.41)mg/l, Na^+=[24](22)mg/l, K^+=[1.4](1.7)mg/l, Ca^{2+}=[30.6](29.8)mg/l, Mg^{2+}=[11.9](13)mg/l, Fe^{2+}=[0.008](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[123](127)mg/l, Alkalinity=[134](130)mg/l, Turbidity=[14](10)NTU, SS=[13](7)mg/l, Cu^{2+}=[0.007](0.001)mg/l, DO=[3.9](3.1)mg/l, BOD=[3](32.1)mg/l, COD=[12](87.8)mg/l, F.Coliform=[60](1,608)nos./100ml, , F.Steptococci=[12](404)nos.100ml note: [ ]; rainy season, ( ); dry season
		1H	No monitoring
		1K	<Surface Water> No monitoring <Groundwater> DM152(Mwanza Prison): Monitored date in rainy season; 17-Mar-2013, in dry season; 3-Aug-2013 pH=[7.5](7.14), Temp=[28.9](29.9)°C, EC=[152](143)µs/cm, TDS=[76](83)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[52](55)mg/l, Cl^-=[17.5](11.6)mg/l, SO_4^{2-}=[3.5](6.15)mg/l, NO_3^-=[0.295](0.055)mg/l, F^-=[0.04](0.31)mg/l, Na^+=[16](11)mg/l, K^+=[3.6](3.4)mg/l, Ca^{2+}=[9.3](8.6)mg/l, Mg^{2+}=[3](4.5)mg/l, Fe^{2+}=[0.009](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[35](39)mg/l, Alkalinity=[42](45)mg/l, Turbidity=[1](1.4)NTU, SS=[0.1](0.1)mg/l, Cu^{2+}=[0.012](0.001)mg/l, DO=[4.9](3.9)mg/l, BOD=[5](20.6)mg/l, COD=[42](86.2)mg/l, F.Coliform=[50](12)nos./100ml, , F.Steptococci=[103](28)nos.100ml note: [ ]; rainy season, ( ); dry season
		1L	No monitoring
		1M	<Surface Water> 1M1(Wankurumadzi River): Monitored date in rainy season; 16-Mar-2013, in dry season; 2-Aug-2013

			pH=[7.46](8.06), Temp=[23.1](21.1)°C, EC=[136](118)μs/cm, TDS=[68](70)mg/l, CO_3^{2-}=[0](4.8)mg/l, HCO_3^{2-}=[54](38)mg/l, Cl^-=[15](6.1)mg/l, SO_4^{2-}=[0.002](6.19)mg/l, NO_3^-=[0.013](0.006)mg/l, F^-=[0.01](0.65)mg/l, Na^+=[14](8)mg/l, K^+=[2.1](1.4)mg/l, Ca^{2+}=[9](8)mg/l, Mg^{2+}=[2.2](3.6)mg/l, Fe^{2+}=[0.057](0.727)mg/l, Mn^{2+}=[0.001](0.205)mg/l, Hardness=[31](36)mg/l, Alkalinity=[44](39)mg/l, Turbidity=[230](24)NTU, SS=[200](20)mg/l, PO_4^{3-}=[0.113](0.011)mg/l, Cu^{2+}=[0.01](0.001)mg/l, DO=[6.2](5.3)mg/l, BOD=[5](8.9)mg/l, COD=[37](21.6)mg/l, F.Coliform=[42](908)nos./100ml, , F.Steptococci=[20](100)nos.100ml <Groundwater> No monitoring note: [ ]; rainy season, ( ); dry season
		1N	No monitoring
		1O	<Surface Water> 1O1(Shire River): Monitored date in rainy season; 16-Mar-2013, in dry season; 3-Aug-2013 pH=[7.45](7.92), Temp=[22.5](21.2)°C, EC=[138](187)μs/cm, TDS=[69](98)mg/l, CO_3^{2-}=[0](9.6)mg/l, HCO_3^{2-}=[60](50)mg/l, Cl^-=[12.6](12.2)mg/l, SO_4^{2-}=[1.1](8.31)mg/l, NO_3^-=[0.043](0.001)mg/l, F^-=[0.1](0.59)mg/l, Na^+=[12](13)mg/l, K^+=[2.1](1.8)mg/l, Ca^{2+}=[10.1](11.6)mg/l, Mg^{2+}=[3.2](6.1)mg/l, Fe^{2+}=[0.032](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[38](54)mg/l, Alkalinity=[49](57)mg/l, Turbidity=[500](22)NTU, SS=[489](20)mg/l, PO_4^{3-}=[0.197](0.051)mg/l, Cu^{2+}=[0.011](0.001)mg/l, DO=[5.2](6.8)mg/l, BOD=[8](6.85)mg/l, COD=[63](15.2)mg/l, F.Coliform=[12](556)nos./100ml, , F.Steptococci=[90](408)nos.100ml <Groundwater> No monitoring note: [ ]; rainy season, ( ); dry season
		1P	No monitoring
		1R	<Surface Water> No monitoring <Groundwater> DM136(Balaka W/Office): Monitored date in rainy season; 17-Mar-2013, in dry season; 3-Aug-2013 pH=[7.5](7.46), Temp=[27.2](27.8)°C, EC=[418](438)μs/cm, TDS=[202](245)mg/l, CO_3^{2-}=[20](0)mg/l, HCO_3^{2-}=[84](184)mg/l, Cl^-=[32.1](25.8)mg/l, SO_4^{2-}=[32.4](24.4)mg/l, NO_3^-=[0.817](0.502)mg/l, F^-=[0.47](0.98)mg/l, Na^+=[44](38)mg/l, K^+=[3.7](3.4)mg/l, Ca^{2+}=[20](30)mg/l, Mg^{2+}=[7.9](12.7)mg/l, Fe^{2+}=[0.003](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[82](127)mg/l, Alkalinity=[102](150)mg/l, Turbidity=[5](0.8)NTU, SS=[3](0.1)mg/l, Cu^{2+}=[0.01](0.001)mg/l, DO=[5.1](1.3)mg/l, BOD=[4](25.5)mg/l, COD=[29](110)mg/l, F.Coliform=[25](4)nos./100ml, , F.Steptococci=[10](12)nos.100ml note: [ ]; rainy season, ( ); dry season
		1S	No monitoring

		1T	<Surface Water> 1T1(Shire River): Monitored date in rainy season; 15-Mar-2013, in dry season; 31-Jul-2013 pH=[7.7](8.32), Temp=[28.2](26.2)°C, EC=[252](256)µs/cm, TDS=[117](131)mg/l, CO_3^{2-}=[14](19.2)mg/l, HCO_3^{2-}=[58](72)mg/l, Cl^-=[27.1](10.3)mg/l, SO_4^{2-}=[2.3](7.91)mg/l, NO_3^-=[0.023](0.001)mg/l, F^-=[0.55](1.14)mg/l, Na^+=[20](20)mg/l, K^+=[6.2](5.9)mg/l, Ca^{2+}=[13.2](15)mg/l, Mg^{2+}=[6.5](6.8)mg/l, Fe^{2+}=[0.11](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[59](65)mg/l, Alkalinity=[70](90)mg/l, Turbidity=[4](1.8)NTU, SS=[2.5](0.1)mg/l, PO_4^{3-}=[0.001](0.001)mg/l, Cu^{2+}=[0.005](0.001)mg/l, DO=[6.6](5.9)mg/l, BOD=[2](8.45)mg/l, COD=[10](13.3)mg/l, F.Coliform=[20](48)nos./100ml, , F.Steptococci=[4](0)nos.100ml <Groundwater> No monitoring note: [ ]; rainy season, ( ); dry season
17.	Water Demand	1A	(Present) Irrigation 4,208,476m^3/year, Water Supply 1,620,494 m^3/year, Live Stock 369,254m^3/year (2035) Irrigation 10,516,214 m^3/year, Water Supply 2,444,305 m^3/year, Live Stock 827,684 m^3/year GBI-Lake Malombe (21,000 ha)
		1B	(Present) Irrigation 3,950,310m^3/year, Water Supply 870,094 m^3/year, Live Stock 742,861m^3/year (2035) Irrigation 9,871,104m^3/year, Water Supply 819,414 m^3/year, Live Stock 1,295,746 m^3/year
		1C	(Present) Irrigation 1,640,804m^3/year, Water Supply 384,066 m^3/year, Live Stock 970,775m^3/year (2035) Irrigation 4,100,069m^3/year, Water Supply 284,581 m^3/year, Live Stock 1,810,301 m^3/year
		1E	(Present) Irrigation 7,559,329m^3/year, Water Supply 4,951,147 m^3/year, Live Stock 1,044,230m^3/year (2035) Irrigation 18,889,384m^3/year, Water Supply 4,755,297 m^3/year, Live Stock 2,046,089 m^3/year
		1F	(Present) Irrigation 15,800,749m^3/year, Water Supply 720,751 m^3/year, Live Stock 687,087m^3/year (2035) Irrigation 39,483,193m^3/year, Water Supply 392,308 m^3/year, Live Stock 1,226,110 m^3/year GBI-Chikhwawa/Chilengo (63,506 ha), 1F/1G GBI- Muona/Ruo (53,037 ha)
		1G	(Present) Irrigation 14,458,852m^3/year, Water Supply 376,705 m^3/year, Live Stock 699,207m^3/year (2035) Irrigation 36,130,036m^3/year, Water Supply 165,920 m^3/year, Live Stock 1,320,734 m^3/year GBI- Nyachipere (14,665 ha)
		1H	(Present) Irrigation 290,613,581m^3/year, Water Supply 665,561 m^3/year, Live

			Stock 1,305,047m^3/year (2035) Irrigation 726,190,372m^3/year, Water Supply 613,330 m^3/year, Live Stock 2,651,801 m^3/year GBI- Phwadzi (21,179 ha), GBI- Nchalo (21,179 ha)
		1K	(Present) Irrigation 4,858,266m^3/year, Water Supply 901,106 m^3/year, Live Stock 1,119,854m^3/year (2035) Irrigation 12,139,920m^3/year, Water Supply 983,788 m^3/year, Live Stock 2,084,912 m^3/year
		1L	(Present) Irrigation 1,170,652m^3/year, Water Supply 274,231 m^3/year, Live Stock 228,056m^3/year (2035) Irrigation 2,925,246m^3/year, Water Supply 253,685 m^3/year, Live Stock 454,800 m^3/year
		1M	(Present) Irrigation 1,410,351m^3/year, Water Supply 254,777 m^3/year, Live Stock 506,441m^3/year (2035) Irrigation 3,524,211m^3/year, Water Supply 92,242 m^3/year, Live Stock 1,118,067 m^3/year
		1N	(Present) Irrigation 351,640m^3/year, Water Supply 254,983 m^3/year, Live Stock 150,448m^3/year (2035) Irrigation 878,683m^3/year, Water Supply 163,870 m^3/year, Live Stock 300,357 m^3/year
		1O	(Present) Irrigation 3,008,496m^3/year, Water Supply 40,544,577 m^3/year, Live Stock 1,076,909m^3/year (2035) Irrigation 7,517,684m^3/year, Water Supply 74,404,845 m^3/year, Live Stock 1,580,716 m^3/year GBI- Lisungwi (43,180 ha)
		1P	(Present) Irrigation 1,417,754m^3/year, Water Supply 358,522 m^3/year, Live Stock 397,118m^3/year (2035) Irrigation 3,542,709m^3/year, Water Supply 603,053 m^3/year, Live Stock 760,396 m^3/year 1P/1R GBI- Liviridzi (15,958 ha)
		1R	(Present) Irrigation 3,321,182m^3/year, Water Supply 1,547,543 m^3/year, Live Stock 1,144,385m^3/year (2035) Irrigation 8,299,028m^3/year, Water Supply 2,671,500 m^3/year, Live Stock 1,217,797 m^3/year
		1S	(Present) Irrigation 2,836,531m^3/year, Water Supply 643,471 m^3/year, Live Stock 609,773m^3/year (2035) Irrigation 7,087,973m^3/year, Water Supply 1,139,979 m^3/year, Live Stock 1,324,288 m^3/year
		1T	(Present) Irrigation 4,654,317m^3/year, Water Supply 284,977 m^3/year, Live Stock 280,767m^3/year

			(2035) Irrigation 11,630,289m^3/year, Water Supply 316,170 m^3/year, Live Stock 634,972 m^3/year
18.	Water Balance	1A	Water Resources 301,742,734 m^3/year (Present) Deficit 3,021,883 m^3/year (Irrigation 2,395,480 m^3/year, Water Supply 498,934 m^3/year, Live Stock 247,512 m^3/year) (2035) Deficit 7,477,226 m^3/year (Irrigation 6,388,592 m^3/year, Water Supply 761,833 m^3/year, Live Stock 326,801 m^3/year)
		1B	Water Resources 335,448,075 m^3/year (Present) Deficit 2,702,696 m^3/year (Irrigation 2,195,098 m^3/year, Water Supply 260,085 m^3/year, Live Stock 247,512 m^3/year) (2035) Deficit 6,561,939m^3/year (Irrigation 5,836,171 m^3/year, Water Supply 244,728 m^3/year, Live Stock 481,040 m^3/year)
		1C	Water Resources 212,761,610 m^3/year (Present) Deficit 1,466,055 m^3/year (Irrigation 911,409 m^3/year, Water Supply 149,840 m^3/year, Live Stock 404,806 m^3/year) (2035) Deficit 3,299,856 m^3/year (Irrigation 2,378,664 m^3/year, Water Supply 110,592 m^3/year, Live Stock 810,600 m^3/year)
		1E	Water Resources 355,312,519 m^3/year (Present) Deficit 8,082,238 m^3/year (Irrigation 4,462,149 m^3/year, Water Supply 3,213,886 m^3/year, Live Stock 406,203 m^3/year) (2035) Deficit 16,100,250 m^3/year (Irrigation 12,043,320 m^3/year, Water Supply 3,150,033 m^3/year, Live Stock 906,897 m^3/year)
		1F	Water Resources 343,979,862 m^3/year (Present) Deficit 10,092,385 m^3/year (Irrigation 9,617,577 m^3/year, Water Supply 208,849 m^3/year, Live Stock 265,959 m^3/year) (2035) Deficit 27,460,476 m^3/year (Irrigation 26,757,874 m^3/year, Water Supply 112,952 m^3/year, Live Stock 589,650 m^3/year)
		1G	Water Resources 539,568,770 m^3/year (Present) Deficit 5,285,822 m^3/year (Irrigation 4,918,368 m^3/year, Water Supply 112,495 m^3/year, Live Stock 254,958 m^3/year) (2035) Deficit 15,609,138 m^3/year (Irrigation 14,944,453 m^3/year, Water Supply 49,549 m^3/year, Live Stock 615,136 m^3/year)
		1H	Water Resources 474,163,105 m^3/year (Present) Deficit 226,364,347 m^3/year (Irrigation 225,093,524 m^3/year, Water Supply 198,180 m^3/year, Live Stock 1,072,642 m^3/year) (2035) Deficit 640,649,152 m^3/year (Irrigation 638,047,254 m^3/year, Water Supply 182,583 m^3/year, Live Stock 2,419,316 m^3/year)
		1K	Water Resources 434,593,233 m^3/year (Present) Deficit 3,327,362 m^3/year (Irrigation 2,703,702 m^3/year, Water Supply 258,325 m^3/year, Live Stock 365,335 m^3/year) (2035)

			Deficit 8,377,740 m^3/year (Irrigation 7,312,751 m^3/year, Water Supply 282,449 m^3/year, Live Stock 782,540 m^3/year)
		1L	Water Resources 240,307,638 m^3/year (Present) Deficit 755,930 m^3/year (Irrigation 613,192 m^3/year, Water Supply 75,883 m^3/year, Live Stock 66,855 m^3/year) (2035) Deficit 1,789,399 m^3/year (Irrigation 1,580,213 m^3/year, Water Supply 70,198 m^3/year, Live Stock 138,989 m^3/year)
		1M	Water Resources 164,102,285 m^3/year (Present) Deficit 1,017,630 m^3/year (Irrigation 728,703 m^3/year, Water Supply 90,140 m^3/year, Live Stock 198,787m^3/year) (2035) Deficit 2,444,397 m^3/year (Irrigation 1,938,404 m^3/year, Water Supply 32,339 m^3/year, Live Stock 473,654 m^3/year)
		1N	Water Resources 78,145,217 m^3/year (Present) Deficit 342,687 m^3/year (Irrigation 188,079 m^3/year, Water Supply 94,543 m^3/year, Live Stock 60,066 m^3/year) (2035) Deficit 669,165 m^3/year (Irrigation 484,115 m^3/year, Water Supply 60,063 m^3/year, Live Stock 124,987 m^3/year)
		1O	Water Resources 222,482,540 m^3/year (Present) Deficit 2,950,857 m^3/year (Irrigation 1,830,868 m^3/year, Water Supply 592,435 m^3/year, Live Stock 527,554 m^3/year) (2035) Deficit 6,138,725 m^3/year (Irrigation 4,886,906 m^3/year, Water Supply 441,972 m^3/year, Live Stock 809,847 m^3/year)
		1P	Water Resources 176,879,751 m^3/year (Present) Deficit 1,046,970 m^3/year (Irrigation 796,308 m^3/year, Water Supply 113,725 m^3/year, Live Stock 136,937 m^3/year) (2035) Deficit 2,610,919 m^3/year (Irrigation 2,118,832 m^3/year, Water Supply 192,108 m^3/year, Live Stock 299,978 m^3/year)
		1R	Water Resources 341,468,802 m^3/year (Present) Deficit 2,521,330 m^3/year (Irrigation 1,889,994 m^3/year, Water Supply 263,078 m^3/year, Live Stock 368,259m^3/year) (2035) Deficit 5,934,216 m^3/year (Irrigation 5,109,057 m^3/year, Water Supply 387,079 m^3/year, Live Stock 438,080 m^3/year)
		1S	Water Resources 241,730,315 m^3/year (Present) Deficit 2,016,337 m^3/year (Irrigation 1,615,988 m^3/year, Water Supply 194,405 m^3/year, Live Stock 205,944 m^3/year) (2035) Deficit 5,195,906 m^3/year (Irrigation 4,335,682 m^3/year, Water Supply 347,664 m^3/year, Live Stock 512,559 m^3/year)
		1T	Water Resources 86,598,060 m^3/year (Present) Deficit 3,111,068 m^3/year (Irrigation 2,914,416 m^3/year, Water Supply 85,883 m^3/year, Live Stock 110,768 m^3/year) (2035)

			Deficit 8,531,602 m^3/year (Irrigation 8,114,836 m^3/year, Water Supply 95,284 m^3/year, Live Stock 321,481 m^3/year)
19.	Water Resources Development Facilities	1A	S.Dams+Weir+Canal +I.Res.
		1B	1B/1P Kholombidzo P. Damsite (L/R)→H.P→S.Dams+Weir+Canal +I.Res.
		1C	P. Damsite (U/R) →S.Dams+Weir+Canal +I.Res.
		1E	S.Dams+Weir+Canal +I.Res.
		1F	S.Dams+Weir+Canal +I.Res., P. Stn.+Canal+C.Pivot
		1G	S.Dams+Weir+Canal +I.Res., P. Stn.+Canal+C.Pivot
		1H	S.Dams+Weir+Canal +I.Res., P. Stn.+Canal+C.Pivot
		1K	Mwanza P. Damsite (U/R)→Dam+Weir+Canal +I.Res.
		1L	Weir+Canal +I.Res., P. Stn.+Canal+C.Pivot
		1M	Weir+Canal +I.Res
		1N	Mpatamanga P. Damsite (L/R) →Weir+Canal +I.Res.
		1O	S.Dams+Weir+Canal +I.Res.
		1P	1B/1P Kholombidzo P. Damsite (L/R)→H.P→Weir+Canal +I.Res.
		1R	6 P. Damsites (U/R)→S.Dams+Weir+Canal +I.Res.
		1S	S.Dams+Weir+Canal +I.Res.
		1T	P. Stn.+Canal

Fact Sheet for WRA 2 (2A-2D)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Lake Chilwa (4 major river basins)
2	WRA (WRU)		WRA2 (2A, 2B, 2C, 2D)
3	Catchment Area(km^2)		Total 4,981 2A 980 2B 2,050 2C 898 2D 1,053
4	Topography		
5	Annual Rainfall		WRA2 1086mm 2A 1392mm 2B 1092mm 2C 918mm 2D 867mm
6	Land Use in 2010 I.A = Irrigation Area	WRA2	Forest: 390.8km^2 (8.6%), Bush/Grassland: 34.4km^2 (0.8%), Wetland: 834.4km^2 (18.4%), Rain fed Farmland: 3,278.5km^2 (72.3%), Total: 4,537.2km^2 , I.A = 3,320 ha,
		2A	Forest: 128.9km^2 (13.7%), Bush/Grassland: 7.3km^2 (0.8%), Wetland: 108.5km^2 (11.6%), Rain fed Farmland: 695.1km^2 (74.0%), Total: 939.7km^2 , I.A = 574 ha,
		2B	Forest: 134.5km^2 (6.5%), Bush/Grassland: 4.5km^2 (0.2%), Wetland: 84.0km^2 (4.1%), Rain fed Farmland: 1,841.3km^2 (89.2%), Total: 2,064.3km^2 , I.A = 2,021 ha,
		2C	Forest: 89.4km^2 (13.3%), Bush/Grassland: 22.6km^2 (3.4%), Wetland: 102.1km^2 (15.1%), Rain fed Farmland: 460.1km^2 (68.2%), Total: 674.2km^2 , I.A = 437 ha,
		2D	Forest: 37.3km^2 (4.3%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 539.8km^2 (62.8%), Rain fed Farmland: 282.0km^2 (32.8%), Total: 859.0km^2 , I.A = 288 ha,
7	Population in 2008		WRA2 1,160,274 persons 2A 193,224 persons 2B 701,979 persons 2C 165,262 persons 2D 99,809 persons
8	Major Cities/Towns		2A: Migowi (District MC) 2B: Zomba (District MC, City Population: 87,366 in 2008, Rural Population: 583,167 in 2008), Chiradzulu (District MC, Population: 290,946 in 2008), Namadzi (Rural MC), Mayaka TC (Rural MC), Namwera (Rural MC), Kachulu TC (Rural MC) 2C: Malosa (Rural MC) 2D: Ntaja (District MC)
9.	Existing Water Supply System and Scheme	2A	
		2B	Limbe Zone of BWB (Blantyre City, Blantyre Rural), Zomba Sub Scheme of SRWB (Zomba city)
		2C	
		2D	Zomba Sub Scheme of SRWB (Zomba city)
10.	Existing irrigation System→Only the schemes with GIS data are shown here.	2A	
		2B	Mkanga (0.5ha) & Likangala (397ha) gravity fed schemes. The former is not operational and the latter sometimes dry- up the river.
		2C	Msenjere (9ha), Mifumo (12ha),Makongolo Kalino (2.5ha) & Chigumukile (1.2ha) schemes. The former is tredle pump and the latter three are gravity fed. Water is not adequate.
		2D	Chanyungu (1.1ha) & Namose (5ha) schemes. The former is motorised pump and the latter is gravity fed.
11.	Existing Hydropower Plant & Electric Supply	2A	No hydropower plant A transmission line to Migowi of Phalombe district
		2B	No hydropower plant Transmission lines to Zomba through Chiradzulu, and a transmission line to Phalombe Changalume substation Mapanga substation

		2C	No hydropower plant, No transmission line, No substation
		2D	No hydropower plant A transmission line to Ntaja of Machinga district Ntaja substation
12.	Industrial Areas		
13.	Estate/Village	2A	NKHULAMBE, HORO & MISOMALI (PHALOMBE) Villages were surveyed.
		2B	NJULI, SABLE (CHILADZULU), MAKOKA, KAPNO (ZOMBA) Estates are identified. RAMUSI 1(ZOMBA) Ville.was surveyed
		2C	
		2D	DAUDA (MACHINGA) Ville. was surveyed.
14.	Water Supply Development	2A	
		2B	・Upgrading of Zomba Water Supply.
		2C	
		2D	
15.	Hydropower Development	2A	No project
		2B	No project
		2C	No project
		2D	No project
16	Monitoring System		
	Rainfall Gauge	2A	Makoka (monitored period:1964-2011)
		2B	No rainfall gauge
		2C	No rainfall gauge
		2D	Ntaja (monitored period:1970-1988, 1990-2010)
	Stream Gauge	2A	No representative stream gauge
		2B	2B6 (Namadzi at Namadzi): monitored period; 21 years, drainage area; 26.7 km^2, average dry-season flows: Q_{75} = 0.121 m^3/s & Q_{97} = 0.085 m^3/s 2B8 (Mulunguzi at Zomba Plateau): monitored period; 43 years, drainage area; 18.1 km^2, average dry-season flows: Q_{75} = 0.177 m^3/s & Q_{97} = 0.094 m^3/s 2B10 (Phalombe at Phalombe): monitored period; 30 years, drainage area; 55.8 km^2, average dry-season flows: Q_{75} = 0.096 m^3/s & Q_{97} = 0.027 m^3/s 2B11 (Mulunguzi at William Falls): monitored period; 13 years, drainage area; 7.02 km^2, average dry-season flows: Q_{75} = 0.072 m^3/s & Q_{97} = 0.042 m^3/s 2B21 (Likangala at Nkokanguwo): monitored period; 39 years, drainage area; 144 km^2, average dry-season flows: Q_{75} = 0.330 m^3/s & Q_{97} = 0.079 m^3/s 2B33 (Namadzi at Matiti): monitored period; 41 years, drainage area; 266 km^2, average dry-season flows: Q_{75} = 0.070 m^3/s & Q_{97} = 0.015 m^3/s
		2C	No representative stream gauge
		2D	No representative stream gauge
	Monitoring Well	2A	No monitoring well
		2B	DM158(Nasomba School); not started (at present, August, 2013)
		2C	DM147(Songani W/Office); monitored period; 3 years, the highest G.W.L; 3.04m, the lowest G.W.L; 8.56m, the range of periodic fluctuation is about 5m.
		2D	GN204(Ntaja W/Office); monitored period; 3 years, the highest G.W.L; 10.09m, the lowest G.W.L; 14.84m, the range of periodic fluctuation is unclear due to lack of monitoring.
	Water Quality	2A	No monitoring
		2B	<Surface Water> 2C10(Likangala River): Monitored date in rainy season; 16-Mar-2013, in dry season;31-Jul-2013 pH=[7.54](7.53), Temp=[22.4](20.4)°C, EC=[105](134)μs/cm,

			TDS=[51](76)mg/l, CO_3^{2-}=[4](4.8)mg/l, HCO_3^{2-}=[36](42)mg/l, Cl^-=[8.6](8.8)mg/l, SO_4^{2-}=[1.2](5.96)mg/l, NO_3^-=[0.013](0.008)mg/l, F^-=[0.52](0.68)mg/l, Na^+=[10](9)mg/l, K^+=[0.8](1.9)mg/l, Ca^{2+}=[5.8](8.4)mg/l, Mg^{2+}=[3.1](4.6)mg/l, Fe^{2+}=[0.003](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[27](39)mg/l, Alkalinity=[36](42)mg/l, Turbidity=[58](18)NTU, SS=[55](15)mg/l, PO_4^{3-}=[0.001](0.061)mg/l, Cu^{2+}=[0.009](0.001)mg/l, DO=[8.3](6.5)mg/l, BOD=[3](10.4)mg/l, COD=[10](33.7)mg/l, F.Coliform=[2,055](1,620)nos./100ml, , F.Steptococci=[1,380](672)nos.100ml 2B21(Kujabgaka River): Monitored date in rainy season; 16-Mar-2013, in dry season;31-Jul-2013 pH=[7.2](7.45), Temp=[21.4](20.4)°C, EC=[73](96)µs/cm, TDS=[37](60)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[28](42)mg/l, Cl^-=[8.6](5)mg/l, SO_4^{2-}=[0.78](5.14)mg/l, NO_3^-=[0.001](0.001)mg/l, F^-=[0.04](0.71)mg/l, Na^+=[8](6)mg/l, K^+=[0.7](1)mg/l, Ca^{2+}=[4.2](6.6)mg/l, Mg^{2+}=[1.4](4.2)mg/l, Fe^{2+}=[0.483](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[17](33)mg/l, Alkalinity=[22](34)mg/l, Turbidity=[24](12)NTU, SS=[20](8)mg/l, PO_4^{3-}=[0.001](0.01)mg/l, Cu^{2+}=[0.005](0.041)mg/l, DO=[8.7](8.2)mg/l, BOD=[5](9.7)mg/l, COD=[28](27.1)mg/l, F.Coliform=[4,680](1,620)nos./100ml, , F.Steptococci=[1,060](672)nos.100ml <Groundwater> DM158(Nasomba School): Monitored date in rainy season; 16-Mar-2013, in dry season; 31-Jul-2013 pH=[7.9](7.92), Temp=[28.9](27)°C, EC=[220](227)µs/cm, TDS=[110](120)mg/l, CO_3^{2-}=[0](7.2)mg/l, HCO_3^{2-}=[104](52)mg/l, Cl^-=[16.9](20)mg/l, SO_4^{2-}=[0.1](14.8)mg/l, NO_3^-=[0.114](0.291)mg/l, F^-=[0.31](0.9)mg/l, Na^+=[22](16)mg/l, K^+=[0.7](5.3)mg/l, Ca^{2+}=[13](17)mg/l, Mg^{2+}=[7.2](4.5)mg/l, Fe^{2+}=[0.004](0.001)mg/l, Mn^{2+}=[-](0.001)mg/l, Hardness=[62](61)mg/l, Alkalinity=[85](55)mg/l, Turbidity=[4](1.2)NTU, SS=[205](0.1)mg/l, Cu^{2+}=[0.006](0.013)mg/l, DO=[4.6](4.4)mg/l, BOD=[4](24.4)mg/l, COD=[36](78.4)mg/l, F.Coliform=[41](0)nos./100ml, , F.Steptococci=[3](132)nos.100ml note: [ ]; Rainy season, ( ); dry season
		2C	<Surface Water> No monitoring <Groundwater> DM147(Songani W/Office): Monitored date in rainy season; 16-Mar-2013, in dry season; 31-Jul-2013 pH=[7.4](6.62), Temp=[25.1](24.2)°C, EC=[115](119)µs/cm, TDS=[58](73)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[50](37)mg/l, Cl^-=[10.4](12.9)mg/l, SO_4^{2-}=[0.1](5.56)mg/l, NO_3^-=[0.127](0.097)mg/l, F^-=[0.34](0.64)mg/l, Na^+=[10](9)mg/l, K^+=[2.4](2.4)mg/l, Ca^{2+}=[7.6](7.2)mg/l, Mg^{2+}=[3](3.8)mg/l, Fe^{2+}=[0.069](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[31](33)mg/l, Alkalinity=[41](30)mg/l, Turbidity=[5](1.8)NTU, SS=[3](0.1)mg/l, Cu^{2+}=[0.008](0.001)mg/l, DO=[7.2](3.9)mg/l, BOD=[1](30.6)mg/l, COD=[7](94.1)mg/l, F.Coliform=[10](4)nos./100ml, , F.Steptococci=[80](4)nos.100ml note: [ ]; Rainy season, ( ); dry season
		2D	No monitoring
17.	Water Demand	2A	(Present) Irrigation 2,922,133m^3/year, Water Supply 1,225,009 m^3/year, Live Stock 605,320m^3/year (2035) Irrigation 7,394,035m^3/year, Water Supply 2,587,921 m^3/year, Live

			Stock 1,166,033 m^3/year GBI- Phalombe Plain (28,279 ha)
		2B	(Present) Irrigation 10,764,323m^3/year, Water Supply 9,522,031 m^3 /year, Live Stock 2,195,002m^3/year (2035) Irrigation 27,237,561m^3/year, Water Supply 23,518,886 m^3/year, Live Stock 3,773,099 m^3/year
		2C	(Present) Irrigation 2,547,568m^3/year, Water Supply 721,610 m^3/year, Live Stock 355,135m^3/year (2035) Irrigation 6,446,251m^3/year, Water Supply 765,213 m^3/year, Live Stock 629,213 m^3/year 2C/2D/11A GBI- Lake Chirwa/Chiuta (86,100 ha)
		2D	(Present) Irrigation 1,951,149m^3/year, Water Supply 537,574 m^3/year, Live Stock 95,456m^3/year , (2035) Irrigation 4,937,099m^3/year, Water Supply 594,616 m^3/year, Live Stock 204,555 m^3/year
18.	Water Balance W.L of Lake Chilwa is decreasing	2A	Water Resources 150,324,415 m^3/year (Present) Deficit 3,039,326 m^3/year (Irrigation 2,474,166 m^3/year, Water Supply 362,232 m^3/year, Live Stock 202,929 m^3/year) (2035) Deficit 7,709,314 m^3/year (Irrigation 6,455,656 m^3/year, Water Supply 797,228 m^3/year, Live Stock 456,430m^3/year)
		2B	Water Resources319,484,884 m^3/year (Present) Deficit 15,909,279 m^3/year (Irrigation 9,256,079 m^3/year, Water Supply 5,807,671 m^3/year, Live Stock 845,529 m^3/year) (2035) Deficit 45,207,318 m^3/year (Irrigation 24,007,201 m^3/year, Water Supply 19,574,652 m^3/year, Live Stock 1,625,464 m^3/year)
		2C	Water Resources 149,006,778 m^3/year (Present) Deficit 2,496,591 m^3/year (Irrigation 2,127,349 m^3/year, Water Supply 229,285 m^3/year, Live Stock 139,957 m^3/year) (2035) Deficit 6,049,808 m^3/year (Irrigation 5,519,598 m^3/year, Water Supply 243,825 m^3/year, Live Stock 286,385 m^3/year)
		2D	Water Resources 74,645,575 m^3/year (Present) Deficit 1,774,788 m^3/year (Irrigation 1,562,319 m^3/year, Water Supply 166,198 m^3/year, Live Stock 46,270 m^3/year) (2035) Deficit 4,556,378 m^3/year (Irrigation 4,253,842 m^3/year, Water Supply 185,968 m^3/year, Live Stock 116,568 m^3/year)
19.	Water Resources Development Facilities	2A	S.Dam+Weir+Canal+ I.Res.
		2B	Three P. Damsites (U/R)→M.Dams+Weir+Canal+ I.Res.
		2C	Upper/Lower Domasi P. Damsites (U/R)→S.Dam+Weir+Canal+ I.Res.
		2D	Weir+Canal+ I.Res., Sallow well

Fact Sheet WRA 3 (3A-3F)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		South West Lakeshore (6 major river basins)
2	WRA (WRU)		WRA3 (3A, 3B, 3C, 3D, 3E, 3F)
3	Catchment Area (km^2)		Total: 4,958 3A: 895 / 3B: 364 / 3C: 813 / 3D: 1,010 3E: 1,080 / 3F: 796
4	Topography		
5	Annual Rainfall		WRA3: 910mm 3A: 791 mm / 3B: 859 mm / 3C: 895 mm / 3D: 933 mm 3E: 950 mm / 3F: 1006mm
6	Land Use in 2010 I.A = Irrigation Area	WRA3	Forest: 1,114.5km^2 (22.4%), Bush/Grassland: 187.8km^2 (3.8%), Wetland: 75.6km^2 (1.5%), Rain fed Farmland: 3,592.8km^2 (72.3%), Total: 4,970.8km^2 , I.A = 2,368 ha
		3A	Forest: 300.4km^2 (33.5%), Bush/Grassland: 12.7km^2 (1.4%), Wetland: 20.6km^2 (2.3%), Rain fed Farmland: 562.9km^2 (62.8%), Total: 896.5km^2 , I.A = 323 ha
		3B	Forest: 126.7km^2 (32.8%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 2.2km^2 (0.6%), Rain fed Farmland: 257.1km^2 (66.6%), Total: 386.0km^2 , I.A = 163 ha
		3C	Forest: 177.1km^2 (22.6%), Bush/Grassland: 53.1km^2 (6.8%), Wetland: 13.4km^2 (1.7%), Rain fed Farmland: 540.5km^2 (68.9%), Total: 784.1km^2 I.A = 315 ha
		3D	Forest: 65.2km^2 (5.6%), Bush/Grassland: 109.0km^2 (9.3%), Wetland: 25.1km^2 (2.2%), Rain fed Farmland: 969.3km^2 (82.9%), Total: 1,168.6km^2 , I.A = 601 ha
		3E	Forest: 219.4km^2 (22.2%), Bush/Grassland: 13.1km^2 (1.3%), Wetland: 5.9km^2 (0.6%), Rain fed Farmland: 749.7km^2 (75.9%), Total: 988.1km^2, I.A = 549 ha
		3F	Forest: 225.6km^2 (30.2%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 8.4km^2 (1.1%), Rain fed Farmland: 513.5km^2 (68.7%), Total: 747.5km^2, I.A = 418 ha
7	Population in 2008		WRA3: 561,399 persons 3A: 97,731 persons / 3B: 37,589 persons 3C: 57,165 persons / 3D: 118,279 persons 3E: 172,160 persons / 3F: 78,475 persons
8	Major Cities/Towns		3A: Mangochi (Sub-Regional Centre, Population: 803,602 in 2008), Monkey-Bay (District MC) 3B: - 3C: Namkumba (Rural MC) 3D: Golomoti (Rural MC), Bwanje (Rural MC), Bilila (Rural MC) 3E: Lizulu (Rural MC), Tsangano (Rural MC) 3F: Dedza District MC, Population: 623,789 in 2008), Chipoka (Rural MC), Mtakataka (Rural MC)
9.	Existing Water Supply System and Scheme	3A	
		3B	
		3C	
		3D	
		3E	
		3F	
10.	Existing irrigation System→Only the schemes with GIS data are shown here	3A	
		3B	
		3C	
		3D	
		3E	

		3F	
11.	Existing Hydropower Plant & Electric Supply	3A	No hydropower plant Transmission lines from Mangochi to Monkey Bay Monkey-Bay substation
		3B	No hydropower plant Transmission line from Monkey-Bay to Golomoti passes
		3C	No hydropower plant A transmission line passes
		3D	No hydropower plant Transmission lines from Monkey Bay to Golomoti and from Nkula to Golomoti passes
		3E	No hydropower plant Transmission line from Golomoti to Lilongwe, Golomoti to Salima,, and Ntcheu to Detza Golomiti substation and Mlangeni substation
		3F	No hydropower plant Transmission lines from Golomoti to Salima, Golomoti to Lilongwe, and Detza to Lilongwe Detza substation
12.	Industrial Areas		
13.	Estate/Village	3A	
		3B	FUNWE (MANGOCHI) Estate was surveyed.
		3C	
		3D	
		3E	CHAPITA (NTCHEU) & KACHINDAMOTO (DEDZA) Villages were surveyed.
		3F	PEACOCK 1 (SALIMA) Estate was surveyed.
14.	Water Supply Development	3A	
		3B	
		3C	
		3D	
		3E	
		3F	
15.	Hydropower Development	3A	No project
		3B	No project
		3C	No project
		3D	No project
		3E	New transmission line from Nkula to Lilongwe will pass
		3F	New transmission line from Nkula to Lilongwe will pass
16	Monitoring System		
	Rainfall Gauge	3A	Mangochi (monitored period:1961-2010) Monkey Bay (monitored period:1979-2010)
		3B	No rainfall gauge
		3C	Nankumba (monitored period:1953-1997)
		3D	No rainfall gauge
		3E	Mlangeni (monitored period:1950-1979, 1982-1990) Ntcheu-nkhande (monitored period:1957-2010)
		3F	No rainfall gauge
	Stream Gauge	3A	No representative stream gauge
		3B	No representative stream gauge
		3C	No representative stream gauge
		3D	No representative stream gauge
		3E	3E3 (Livulezi at Khwekhwelele): monitored period; 49 years, drainage area; 452 km^2, average dry-season flows: Q_{75} = 0.562 m^3/s & Q_{97} = 0.204 m^3/s
		3F	No representative stream gauge

	Monitoring Well	3A	DM134(Monkey Bay PVT School): monitored period; 4 years, the highest G.W.L; 1.92m, the lowest G.W.L; 2.77m, the range of periodic fluctuation is within 1m. DM135(Mangochi W/Office): monitored period; 4 years, the highest G.W.L; 2.00m, the lowest G.W.L; 3.37m, the range of periodic fluctuation is about 1m.
		3B	No monitoring well
		3C	No monitoring well
		3D	No monitoring well
		3E	No monitoring well
		3F	GN202(Mtongola Dam): monitored period; 4 years, the highest G.W.L; 3.70m, the lowest G.W.L; 5.32m, the range of periodic fluctuation is unclear due to lack of monitoring.
	Water Quality	3A	<Surface Water> 3A2(Lake Malawi): Monitored date in rainy season; 15-Mar-2013, in dry season;30-Jul-2013 pH=[8.2](8.78), Temp=[28.3](27.4)°C, EC=[249](250)µs/cm, TDS=[120](126)mg/l, CO_3^{2-}=[9](14.4)mg/l, HCO_3^{2-}=[80](90)mg/l, Cl^-=[22](11.5)mg/l, SO_4^{2-}=[1.2](1.34)mg/l, NO_3^-=[0.001](0.001)mg/l, F^-=[0.48](0.82)mg/l, Na^+=[22](17)mg/l, K^+=[6.1](5.9)mg/l, Ca^{2+}=[14](14.9)mg/l, Mg^{2+}=[6.5](9.1)mg/l, Fe^{2+}=[0.001](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[61](73)mg/l, Alkalinity=[80](90)mg/l, Turbidity=[6](2.8)NTU, SS=[6](2)mg/l, PO_4^{3-}=[0.001](0.001)mg/l, Cu^{2+}=[0.004](0.011)mg/l, DO=[7.4](5.9)mg/l, BOD=[4](4.5)mg/l, COD=[27](12.9)mg/l, F.Coliform=[100](56)nos./100ml, , F.Steptococci=[4](8)nos.100ml <Groundwater> DM134(Monkey Bay PVT School): Monitored date in rainy season; 15-Mar-2013, in dry season; 30-Jul-2013 pH=[7.91](6.91), Temp=[31.7](30)°C, EC=[3120](5,510)µs/cm, TDS=[1401](2,568)mg/l, CO_3^{2-}=[19](0)mg/l, HCO_3^{2-}=[144](870)mg/l, Cl^-=[753](1,170)mg/l, SO_4^{2-}=[39.7](4.33)mg/l, NO_3^-=[0.094](0.001)mg/l, F^-=[0.65](1.32)mg/l, Na^+=[174](360)mg/l, K^+=[14.8](59)mg/l, Ca^{2+}=[300](387)mg/l, Mg^{2+}=[30.1](130)mg/l, Fe^{2+}=[0.013](3.430)mg/l, Mn^{2+}=[0.001](2.850)mg/l, Hardness=[871](1,507)mg/l, Alkalinity=[149](713)mg/l, Turbidity=[7](180)NTU, SS=[6](140)mg/l, Cu^{2+}=[0.005](0.001)mg/l, DO=[0.8](1.3)mg/l, BOD=[4](63)mg/l, COD=[55](12.9)mg/l, F.Coliform=[552](110)nos./100ml, , F.Steptococci=[12](120)nos.100ml note: [ ]; Rainy season, ( ); dry season
		3B	No monitoring
		3C	No monitoring
		3D	No monitoring
		3E	No monitoring
		3F	No monitoring
17.	Water Demand	3A	(Present) Irrigation 4,207,680m^3/year, Water Supply 369,422 m^3/year, Live Stock 379,477m^3/year (2035) Irrigation 11,412,213m^3/year, Water Supply 337,386 m^3/year, Live Stock 872,018 m^3/year
		3B	(Present) Irrigation 2,155,154m^3/year, Water Supply 154,958 m^3/year, Live Stock 174,014m^3/year, (2035) Irrigation 5,734,354m^3/year, Water Supply 142,296 m^3/year, Live Stock 399,876 m^3/year GBI- Lisangadzi (13,510 ha)

		3C	(Present) Irrigation 4,215,368m^3/year, Water Supply 323,901 m^3/year, Live Stock 379,460m^3/year , (2035) Irrigation 11,216,094m^3/year, Water Supply 297,803 m^3/year, Live Stock 797,656 m^3/year 3C/3D/3E/3F GBI- Bwanje/Malembo (44,860 ha)
		3D	(Present) Irrigation 8,292,013m^3/year, Water Supply 690,035 m^3/year, Live Stock 954,760m^3/year , (2035) Irrigation 22,063,079m^3/year, Water Supply 789,402 m^3/year, Live Stock 823,997 m^3/year
		3E	(Present) Irrigation 8,699,173m^3/year, Water Supply 652,773 m^3/year, Live Stock 671,278m^3/year , (2035) Irrigation 23,146,435m^3/year, Water Supply 542,214 m^3/year, Live Stock 712,621 m^3/year
		3F	(Present) Irrigation 7,083,229m^3/year, Water Supply 476,790 m^3/year, Live Stock 323,428m^3/year , (2035) Irrigation 19,035,202m^3/year, Water Supply 214,070 m^3/year, Live Stock 499,927 m^3/year
18.	Water Balance	3A	Water Resources 63,632,515 m^3/year (present) Deficit 2,418,302 m^3/year (Irrigation 2,210,334 m^3/year, Water Supply 80,506 m^3/year, Live Stock 127,462 m^3/year) (2035) Deficit 7,980,474 m^3/year (Irrigation 7,551,246 m^3/year, Water Supply 73,485 m^3/year, Live Stock 355,744 m^3/year)
		3B	Water Resources 61,290,867 m^3/year (present) Deficit 860,795 m^3/year (Irrigation 784,140 m^3/year, Water Supply 26,644 m^3/year, Live Stock 50,011 m^3/year) (2035) Deficit 3,153,079 m^3/year (Irrigation 2,984,051 m^3/year, Water Supply 24,389 m^3/year, Live Stock 144,639 m^3/year)
		3C	Water Resources 160,132,982 m^3/year (present) Deficit 1,901,591 m^3/year (Irrigation 1,726,712 m^3/year, Water Supply 64,015 m^3/year, Live Stock 110,863 m^3/year) (2035) Deficit 6,380,714 m^3/year (Irrigation 6,037,790 m^3/year, Water Supply 58,796 m^3/year, Live Stock 284,128 m^3/year)
		3D	Water Resources 148,447,441 m^3/year (present) Deficit 5,840,300 m^3/year (Irrigation 5,323,735 m^3/year, Water Supply 162,501 m^3/year, Live Stock 354,064 m^3/year) (2035) Deficit 16,625,601 m^3/year (Irrigation 16,088,523 m^3/year, Water Supply 186,185 m^3/year, Live Stock 350,892m^3/year)
		3E	Water Resources144,851,355 m^3/year

			(present) Deficit 4,511,212 m^3/year (Irrigation 4,187,538 m^3/year, Water Supply 119,370 m^3/year, Live Stock204,304 m^3/year) (2035) Deficit 14,397,969 m^3/year (Irrigation 14,003,792 m^3/year, Water Supply 99,068 m^3/year, Live Stock 295,109 m^3/year)
		3F	Water Resources 86,590,267 m^3/year (present) Deficit 4,179,926 m^3/year (Irrigation 3,963,849 m^3/year, Water Supply 92,763 m^3/year, Live Stock 123,314 m^3/year) (2035) Deficit 13,686,119 m^3/year (Irrigation 13,389,615 m^3/year, Water Supply 41,157 m^3/year, Live Stock 255,347 m^3/year)
19.	Water Resources Development Facilities	3A	S.Dam+Weir+Canal+ I.Res.
		3B	Weir+Canal + I.Res.
		3C	S.Dam+Weir+Canal + I.Res.
		3D	Bwanje P. Damsite (L/R)→L.Dam+Weir+Canal + I.Res.
		3E	Dams+Weir+Canal + I.Res.
		3F	Dams+Weir+Canal + I.Res.

Fact Sheet WRA 4 (4A-4F)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Linthipe (Lilongwe and Lifisi River Basins)
2	WRA (WRU)		WRA4 (4A, 4B, 4C, 4D, 4E, 4F)
3	Catchment Area (km^2)		Total 8,641 4A 463 / 4B 3,190 / 4C 1,572 / 4D 1,854 4E 937 / 4F 625
4	Topography	Lifisi R.(4A)	
		Lilongwe R. – Upper	
		Lilongwe R. – Middle	
		Lilongwe R. – Lower	
5	Annual Rainfall		WRA4 929mm 4A 1056mm / 4B 971mm / 4C 885mm / 4D 913mm 4E 857mm / 4F 862mm
6	Land Use in 2010 I.A = Irrigation Area	WRA4	Forest: 1,540.4km^2 (17.7%), Bush/Grassland: 0.9km^2 (0.0%), Wetland: 997.0km^2 (11.5%), Rain fed Farmland: 6,170.9km^2 (70.9%), Total: 8,709.2km^2, I.A = 4,668 ha
		4A	Forest: 132.7km^2 (23.1%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 22.6km^2 (3.9%), Rain fed Farmland: 418.3km^2 (72.9%), Total: 573.6km^2, I.A = 384 ha
		4B	Forest: 693.5km^2 (21.4%), Bush/Grassland: 0.6km^2 (0.0%), Wetland: 419.6km^2 (13.0%), Rain fed Farmland: 2,121.4km^2 (65.6%), Total: 3,235.1km^2, I.A = 1,890 ha
		4C	Forest: 138.7km^2 (8.8%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 67.9km^2 (4.3%), Rain fed Farmland: 1,378.2km^2 (87.0%), Total: 1,584.8km^2, I.A = 912 ha
		4D	Forest: 549.5km^2 (30.6%), Bush/Grassland: 0.3km^2 (0.0%), Wetland: 251.3km^2 (14.0%), Rain fed Farmland: 995.2km^2 (55.4%), Total: 1,796.3km^2, I.A = 912 ha
		4E	Forest: 4.3km^2 (0.5%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 188.2km^2 (20.7%), Rain fed Farmland: 718.22km^2 (78.9%), Total: 910.7km^2, I.A = 472 ha
		4F	Forest: 21.7km^2 (3.6%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 47.4km^2 (7.8%), Rain fed Farmland: 539.6km^2 (88.6%), Total: 608.8km^2, I.A = 355 ha
7	Population in 2008		WRA3 2,507,441 persons 4A 98,189 persons / 4B 700,982 persons 4C 580,306 persons / 4D 586,061 persons 4E 388,956 persons / 4F 152,947 persons
8	Major Cities/Towns		4A: - 4B: Salima (Sub-Regional Centre, Population: 340,327 in 2008), Lobi (Rural MC), Linthipe (Rural MC), Mayani (Rural MC) 4C: Lilongwe (National Centre, City Population: 669,021 in 2008, Rural Population: 1,228,146 in 2008), Mvera (Rural MC), Chimutu (Rural MC), Nathenje (Rural MC), Mitundu (Rural MC) 4D: Sinyala (Rural MC) 4E: Nsaru (Rural MC) 4F: Lumbazi (Rural MC)
9.	Existing Water Supply System and Scheme	4A	
		4B	
		4C	Northern, Central and Southern Zone of LWB (Lilongwe City, Lilongwe Rural)
		4D	Central and Southern Zone of LWB (Lilongwe City, Lilongwe Rural)
		4E	Northern and Central Zone of LWB (Lilongwe City, Lilongwe Rural)

		4F	Northern Zone of LWB (Lilongwe City, Lilongwe Rural)
10.	Existing irrigation System→Only the schemes with GIS data are shown here.	4A	Katumba (2ha) & Windu (42ha) gravity fed schemes. The former is borehole and the latter is 2 springs.
		4B	
		4C	Kambwirisele (6.6ha) gravity fed scheme. The water source is borehole.
		4D	
		4E	
		4F	Ndalama (2ha) & Jonasi (7.6ha) gravity fed scheme. The former is good water supply and the latter is poor.
11.	Existing Hydropower Plant & Electric Supply	4A	No hydropower plant Transmission line from Golomoti to Salima, Golomoti to Lilongwe No substation,
		4B	No hydropower plant Transmission lines from Golomoti to Lilongwe, Detza to Lilongwe, and Golomoti to Salima Detza and Salima substation
		4C	No hydropower plant Transmission lines from/to Lilongwe and Salima Lilongwe C and Bunda T-Off substation,
		4D	No hydropower plant Transmission line from/to Lilongwe Lilongwe A substation
		4E	No hydropower plant Transmission linse from/to Lilongwe Lilongwe B and Area 48 substation
		4F	No hydropower plant Transmission line from Lilongwe to Dowa and Salima No substation,
12.	Industrial Areas		
13.	Estate/Village	4A	KUMPHIRA & KASANKHA (DEDZA)Villages were surveyed
		4B	DUDU & KATENGEZA (DEDZA) Estates were surveyed. The water source of the latter is borehole. KATUMBA (SALIMA) & MSAKO (LILONGWE) Villages were surveyed.
		4C	NAMITETE & MALOWA (LILONGWE) Estates were surveyed. The latter one is rain fed cultivation. KAMBWILISELE (SALIMA) Ville. was surveyed.
		4D	NSAGWA, KACHAWA, MUDI, MCHEZA, KAKOMA & GHINGANGA (LILONGWE) Estates were surveyed. The latter one is rain fed cultivation. The water sources of the others were reservoir/river. KUDZODZI, CHALA & POJOKAISI (LILONGWE) Villages were surveyed.
		4E	GWILIZE, MBABZI, MACPHERSON, NSUNGA & DAMINGA (LILONGWE) Estates were surveyed. The water source of the latter is borehole and the others are reservoirs. MLAWA (MZIMBA) Ville. was surveyed.
		4F	
14.	Water Supply Development	4A	
		4B	
		4C	
		4D	・Supply and installation of penstock for (TW2), Cone Valves for Kamuzu Dam 2 and Bunda Plant, and Piezometers for KD 1 to reduce NRW. ・Chikungu-Construction of 2000m3 area 9 tower and 5000 m3 storage tank; Supply of pipes and fitting for Chikungu and area 9 water supplies.
		4E	
		4F	
15	Hydropower	4A	No project
		4B	New transmission line from Nkula to Lilongwe will pass

.	Development	4C	New transmission line from Nkula to northwards (to Songwe) and to western country boundary (Zambia) via Lilongwe New Lilongwe substation
		4D	New transmission line from Lilongwe to western country boundary (Zambia) will pass
		4E	No project
		4F	New transmission line from Lilongwe to Songwe will pass
16	Monitoring System		
	Rainfall Gauge	4A	No rainfall gauge
		4B	Dedza (monitored period:1961-2011) Thiwi (monitored period:1945-1990)
		4C	Nathenje (monitored period:1955-1956, 1958-1975, 1978-1988)
		4D	Dzalanyama (monitored period:1956-1990)
		4E	Chitedze (monitored period:1950-2011)
		4F	KIA (monitored period:1961-2010)
	Stream Gauge	4A	No representative stream gauge
		4B	4B1 (Linthipe at Salima Railbridge): monitored period; 46 years, drainage area; 8,070 km^2, average dry-season flows: Q_{75} = 2.328 m^3/s & Q_{97} = 0.384 m^3/s 4B3 (Linthipe at Linthipe): monitored period; 35 years, drainage area; 600 km^2, average dry-season flows: Q_{75} = 0.209 m^3/s & Q_{97} = 0.043 m^3/s 4B4 (Diamphwe at Chilowa New Bridge): monitored period; 37 years, drainage area; 1,460 km^2, average dry-season flows: Q_{75} = 0.484 m^3/s & Q_{97} = 0.075 m^3/s 4B9 (Linthipe at Malapa): monitored period; 37 years, drainage area; 2,930 km^2, average dry-season flows: Q_{75} = 1.242 m^3/s & Q_{97} = 0.378 m^3/s
		4C	4C2 (Lilongwe at Nkwenembela): monitored period; 44 years, drainage area; 4,940 km^2, average dry-season flows: Q_{75} = 1.954 m^3/s & Q_{97} = 0.515 m^3/s
		4D	4D4 (Lilongwe at Lilongwe Old Town): monitored period; 56 years, drainage area; 1,870 km^2, average dry-season flows: Q_{75} = 0.900 m^3/s & Q_{97} = 0.260 m^3/s 4D24 (Lilongwe at Masula): monitored period; 11 years, drainage area; - km^2, average dry-season flows: Q_{75} = 1.069 m^3/s & Q_{97} = 0.594 m^3/s
		4E	No representative stream gauge
		4F	No representative stream gauge
	Monitoring Well	4A	No monitoring well
		4B	GN164(Katelera School):not monitored because of vandalizing. GN176(Linthipe W/Office): monitored period; within 1 year, the groundwater trend is unclear due to very few monitoring data.
		4C	GN214(Kambwiri Sele W/Field): monitoring data have not been submitted GN215(Kuti Plant): monitored period; within 1 year, the highest G.W.L; 5.87m, the lowest G.W.L; 7.28m, the range of periodic is unclear.
		4D	No monitoring well
		4E	GN171(Mlezi School): monitored period; 4 years, the highest G.W.L; 2.65m, the lowest G.W.L; 10.20m, the range of periodic is unclear due to few monitoring.
		4F	No monitoring data
	Water Quality	4A	No monitoring
		4B	<Surface Water> 4B1(Lithipe River): Monitored date in rainy season; 13-Mar-2013, in dry season; 8-Aug-2013 pH=[8.2](7.74), Temp=[27.3](25.2)°C, EC=[307](779)µs/cm, TDS=[150](383)mg/l, CO_3^{2-}=[12](36)mg/l, HCO_3^{2-}=[70](99)mg/l, Cl^-=[15.5](54.3)mg/l, SO_4^{2-}=[33.9](104)mg/l, NO_3^-=[0.024](0.155)mg/l, F^-=[0.31](0.81)mg/l, Na^+=[14](80)mg/l, K^+=[2.2](9.6)mg/l, Ca^{2+}=[27.3](40)mg/l, Mg^{2+}=[8.6](10.2)mg/l, Fe^{2+}=[0.026](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[104](141)mg/l,

			Alkalinity=[57](141)mg/l, Turbidity=[62](12)NTU, SS=[60](6)mg/l, PO_4^{3-}=[0.071](0.706)mg/l, Cu^{2+}=[0.003](0.002)mg/l, DO=[4.5](9.1)mg/l, BOD=[5](6.6)mg/l, COD=[31](19.6)mg/l, F.Coliform=[250](2,355)nos./100ml, , F.Steptococci=[40](1,420)nos.100ml 4B4(Diamphwe River): Monitored date in rainy season; 1-Mar-2013, in dry season; 5-Aug-2013 pH=[7.3](7.89), Temp=[24.9](26.2)°C, EC=[100](226)µs/cm, TDS=[52](113)mg/l, CO_3^{2-}=[0](9)mg/l, HCO_3^{2-}=[42](55)mg/l, Cl^-=[6](1.8)mg/l, SO_4^{2-}=[4](37.9)mg/l, NO_3^-=[0.44](0.101)mg/l, F^-=[1.69](0.27)mg/l, Na^+=[5](8)mg/l, K^+=[1.1](0.4)mg/l, Ca^{2+}=[9](20)mg/l, Mg^{2+}=[4.3](7.7)mg/l, Fe^{2+}=[0.293](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[40](81)mg/l, Alkalinity=[34](60)mg/l, Turbidity=[50](2.5)NTU, SS=[47](0.1)mg/l, PO_4^{3-}=[0.74](0.848)mg/l, Cu^{2+}=[0.001](0.001)mg/l, DO=[5.1](9.3)mg/l, BOD=[5](0.9)mg/l, COD=[113](4.4)mg/l, F.Coliform=[760](40)nos./100ml, F.Steptococci=[105](8)nos.100ml <Groundwater> GN176(Linthipe W/Office): Monitored date in rainy season; 1-Mar-2013, in dry season;5-Aug-2013 pH=[7.1](6.94), Temp=[25.2](26.8)°C, EC=[90](99)µs/cm, TDS=[48](50)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[35](18)mg/l, Cl^-=[6.8](9)mg/l, SO_4^{2-}=[3.3](16.1)mg/l, NO_3^-=[0.137](0.069)mg/l, F^-=[1.57](0.27)mg/l, Na^+=[9](7)mg/l, K^+=[1.2](1.5)mg/l, Ca^{2+}=[6](5)mg/l, Mg^{2+}=[2.3](3)mg/l, Fe^{2+}=[0.258](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[24](24)mg/l, Alkalinity=[28](14)mg/l, Turbidity=[1.2](4)NTU, SS=[1](2)mg/l, Cu^{2+}=[0.002](0.024)mg/l, DO=[4.5](8.9)mg/l, BOD=[4](1.3)mg/l, COD=[14](8.6)mg/l, F.Coliform=[0](0)nos./100ml, , F.Steptococci=[10](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
		4C	<Surface Water> 4C11(Nanjiri River): Monitored date in rainy season; 1-Mar-2013, in dry season;5-Aug-2013 pH=[7.45](7.75), Temp=[25.2](24.3)°C, EC=[300](680)µs/cm, TDS=[150](340)mg/l, CO_3^{2-}=[0](18)mg/l, HCO_3^{2-}=[86](255)mg/l, Cl^-=[32.1](18.1)mg/l, SO_4^{2-}=[19.2](53.3)mg/l, NO_3^-=[0.032](0.057)mg/l, F^-=[1.64](0.66)mg/l, Na^+=[15](33)mg/l, K^+=[2.3](1.3)mg/l, Ca^{2+}=[26](77)mg/l, Mg^{2+}=[9.72](14)mg/l, Fe^{2+}=[0.408](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[105](249)mg/l, Alkalinity=[70](239)mg/l, Turbidity=[120](4)NTU, SS=[117](3)mg/l, PO_4^{3-}=[0.145](0.89)mg/l, Cu^{2+}=[-9](0.02)mg/l, DO=[7.3](10.1)mg/l, BOD=[5](8.2)mg/l, COD=[72](49.4)mg/l, F.Coliform=[1020](300)nos./100ml, , F.Steptococci=[40](156)nos.100ml <Groundwater> GN214(Kambwiri Sele W/Field): Monitored date in rainy season; 27-Feb-2013, in dry season; 8-Aug-2013 pH=[7.9](6.95), Temp=[28.5](25.7)°C, EC=[1209](1,164)µs/cm, TDS=[624](597)mg/l, CO_3^{2-}=[29](0)mg/l, HCO_3^{2-}=[405](638)mg/l, Cl^-=[45.7](36.2)mg/l, SO_4^{2-}=[97.5](17.2)mg/l, NO_3^-=[0.154](0.061)mg/l, F^-=[0.86](0.74)mg/l, Na^+=[100](41)mg/l, K^+=[39.8](3.4)mg/l, Ca^{2+}=[100](62.5)mg/l, Mg^{2+}=[11.4](23)mg/l, Fe^{2+}=[0.115](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[296](500)mg/l, Alkalinity=[380](523)mg/l, Turbidity=[5](4)NTU, SS=[3](2)mg/l, Cu^{2+}=[0.006](0.002)mg/l, DO=[5.6](9.1)mg/l, BOD=[3](10.9)mg/l, COD=[45](43.1)mg/l, F.Coliform=[10](0)nos./100ml, , F.Steptococci=[0](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
		4D	<Surface Water> 4D23(Lilongwe River): Monitored date in rainy season; 1-Mar-2013, in dry season; 5-Aug-2013 pH=[7.4](7.6), Temp=[26.3](27.4)°C, EC=[70](77)µs/cm,

			TDS=[37](45)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[27](15)mg/l, Cl^-=[3.5](5.2)mg/l, SO_4^{2-}=[4.1](12)mg/l, NO_3^-=[0.052](0.054)mg/l, F^-=[1.93](1.8)mg/l, Na^+=[4](3.2)mg/l, K^+=[1.3](0.7)mg/l, Ca^{2+}=[7](7.6)mg/l, Mg^{2+}=[2](2)mg/l, Fe^{2+}=[0.374](0.001)mg/l, Mn^{2+}=[0.002](0.001)mg/l, Hardness=[26](27)mg/l, Alkalinity=[22](12)mg/l, Turbidity=[18](6)NTU, SS=[16](2.5)mg/l, PO_4^{3-}=[0.081](0.845)mg/l, Cu^{2+}=[0.001](0.001)mg/l, DO=[5.3](8.6)mg/l, BOD=[5](2.1)mg/l, COD=[14](7.8)mg/l, F.Coliform=[1050](55)nos./100ml, , F.Steptococci=[420](8)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		4E	<Surface Water> No monitoring <Groundwater> GN171(Mlezi School): Monitored date in rainy season; 4-May-2013, in dry season; not sampled due to vandalism pH=[8.1](-), Temp=[25.9](-)°C, EC=[500](-)µs/cm, TDS=[254](-)mg/l, CO_3^{2-}=[19](-)mg/l, HCO_3^{2-}=[150](-)mg/l, Cl^-=[15.2](-)mg/l, SO_4^{2-}=[51](-)mg/l, NO_3^-=[0.046](-)mg/l, F^-=[1.77](-)mg/l, Na^+=[37](-)mg/l, K^+=[8.8](-)mg/l, Ca^{2+}=[36.8](-)mg/l, Mg^{2+}=[10.6](-)mg/l, Fe^{2+}=[0.001](-)mg/l, Mn^{2+}=[0.001](-)mg/l, Hardness=[133](-)mg/l, Alkalinity=[134](-)mg/l, Turbidity=[0.8](-)NTU, SS=[0.1](-)mg/l, Cu^{2+}=[0.001](-)mg/l, DO=[3.6](-)mg/l, BOD=[4](-)mg/l, COD=[13](-)mg/l, F.Coliform=[25](-)nos./100ml, , F.Steptococci=[5](-)nos.100ml note: [ ]; Rainy season, ( ); dry season
		4F	<Surface Water> 4F6(Lumbadzi River): Monitored date in rainy season; 1-Mar-2013, in dry season;8-Aug-2013 pH=[7.47](8.98), Temp=[24.5](27.2)°C, EC=[300](674)µs/cm, TDS=[155](318)mg/l, CO_3^{2-}=[0](54)mg/l, HCO_3^{2-}=[102](131)mg/l, Cl^-=[18.6](12.7)mg/l, SO_4^{2-}=[29.2](70.2)mg/l, NO_3^-=[0.001](0.085)mg/l, F^-=[1.42](0.59)mg/l, Na^+=[20](42)mg/l, K^+=[3.2](2.8)mg/l, Ca^{2+}=[23.2](60)mg/l, Mg^{2+}=[8.7](11.2)mg/l, Fe^{2+}=[0.555](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[94](195)mg/l, Alkalinity=[83](197)mg/l, Turbidity=[200](4.2)NTU, SS=[195](2)mg/l, PO_4^{3-}=[0.062](0.589)mg/l, Cu^{2+}=[0.002](0.001)mg/l, DO=[8.5](9.6)mg/l, BOD=[5](4.8)mg/l, COD=[20](16.5)mg/l, F.Coliform=[1100](1,065)nos./100ml, , F.Steptococci=[150](955)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
17.	Water Demand	4A	(Present) Irrigation 6,599,712m^3/year, Water Supply 309,516m^3/year, Live Stock 266,334m^3/year, (2035) Irrigation 6,916,749m^3/year, Water Supply 118,457 m^3/year, Live Stock 418,457 m^3/year
		4B	(Present) Irrigation 32,180,476m^3/year, Water Supply 2,080,724m^3/year, Live Stock 1,459,319m^3/year, (2035) Irrigation 33,726,360m^3/year, Water Supply 647,970 m^3/year, Live Stock 3,175,934 m^3/year
		4C	(Present) Irrigation 12,309,736m^3/year, Water Supply 1,302,418m^3/year, Live Stock 1,693,805m^3/year (2035) Irrigation 12,901,070m^3/year, Water Supply 313,503 m^3/year, Live Stock

			5,859,450 m^3/year
		4D	(Present) Irrigation 8,802,657m^3/year, Water Supply 35,720,091m^3/year, Live Stock 1,129,217m^3/year (2035) Irrigation 9,225,518m^3/year, Water Supply 105,041,641 m^3/year, Live Stock 4,172,525 m^3/year
		4E	(Present) Irrigation 6,353,210m^3/year, Water Supply 744,756m^3/year, Live Stock 1,291,797m^3/year, (2035) Irrigation 6,658,405m^3/year, Water Supply 159,827 m^3/year, Live Stock 4,493,515 m^3/year
		4F	(Present) Irrigation 4,775,867m^3/year, Water Supply 573,149m^3/year, Live Stock 617,862m^3/year (2035) Irrigation 5,005,290m^3/year, Water Supply 154,572 m^3/year, Live Stock 1,849,041 m^3/year
18.	Water Balance	4A	Water Resources 54,504,590 m^3/year (Present) Deficit 4,731,999 m^3/year (Irrigation 4,547,884 m^3/year, Water Supply 61,862 m^3/year, Live Stock 122,253 m^3/year) (2035) Deficit 4,980,832 m^3/year (Irrigation 4,763,090 m^3/year, Water Supply 23,249 m^3/year, Live Stock 194,493 m^3/year)
		4B	Water Resources 882,786,716 m^3/year (Present) Deficit 21,407,753 m^3/year (Irrigation 20,458,143 m^3/year, Water Supply 443,082 m^3/year, Live Stock 506,527 m^3/year) (2035) Deficit 22,847,135 m^3/year (Irrigation 21,574,049 m^3/year, Water Supply 139,903 m^3/year, Live Stock 1,133,183 m^3/year)
		4C	Water Resources 496,818,595 m^3/year (Present) Deficit 10,746,558 m^3/year (Irrigation 9,791,959 m^3/year, Water Supply 346,685 m^3/year, Live Stock 607,914 m^3/year) (2035) Deficit 12,519,676 m^3/year (Irrigation 10,278,406 m^3/year, Water Supply 91,327 m^3/year, Live Stock 2,149,943 m^3/year)
		4D	Water Resources 205,097,831 m^3/year (Present) Deficit 8,461,025 m^3/year (Irrigation 7,367,508 m^3/year, Water Supply 630,924 m^3/year, Live Stock 462,592 m^3/year) (2035) Deficit 39,219,081 m^3/year (Irrigation 7,829,697 m^3/year, Water Supply 29,590,916 m^3/year, Live Stock 1,798,468 m^3/year)
		4E	Water Resources 119,358,644 m^3/year (Present) Deficit 5,060,205 m^3/year (Irrigation 4,513,740 m^3/year, Water Supply 129,783 m^3/year, Live Stock 416,682 m^3/year) (2035) Deficit 6,174,121 m^3/year (Irrigation 4,682,974 m^3/year, Water Supply 26,902 m^3/year, Live Stock 1,464,246 m^3/year)
		4F	Water Resources 37,801,853 m^3/year (Present) Deficit 4,204,331 m^3/year (Irrigation 3,787,408 m^3/year, Water Supply 149,497 m^3/year, Live Stock 267,426 m^3/year)

			(2035) Deficit 4,773,281 m^3/year (Irrigation 3,922,425 m^3/year, Water Supply 36,978 m^3/year, Live Stock 813,878 m^3/year)
19.	Water Resources Development Facilities	4A	Lifidizi P. Damsite (L/R)→Weir+Canal +I.Res.
		4B	Diamphwe (U/R & M/L), Linthipe (Dedza & Salima) P. Damsites (L/R) →Dams+Weir+Canal/ M.Pumps +I.Res.
		4C	(Likuni /Lilongwe III) Dam+ Weir+Canal +I.Res.
		4D	Likuni & Lilongwe III P. Damsites (L/R)→Weir+M.Pumps/Canal +I.Res
		4E	Likuni & Lilongwe III P. Damsites (L/R)→Weir+M.Pumps/Canal +I.Res
		4F	Notofu & Lumbabadzi P. Damsite (M/R) →S.Dam+Weir+Canal +I.Res.

Fact Sheet WRA 5 (5C-5F)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Bua (Bua River Basin)
2	WRA (WRU)		WRA2 (5C, 5D, 5E, 5F)
3	Catchment Area (km^2)		WRA5 10,654 5C 1,388 5D 2,770 5E 3,916 5F 2,580
4	Topography	Upper	
		Middle	
		Lower	
5	Annual Rainfall		WRA5 944mm 5C 1232 mm 5D 864mm 5E 921mm 5F 901mm
6	Land Use in 2010 I.A = Irrigation Area	WRA5	Forest: 1,300.6km^2 (12.2%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 2,038.3km^2 (19.2%), Rain fed Farmland: 7,284.0km^2 (68.6%), Total: 10,622.9km^2, I.A = 6,159 ha
		5C	Forest: 689.4km^2 (47.9%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 21.6km^2 (1.5%), Rain fed Farmland: 727.5km^2 (50.6%), Total: 1,438.4km^2, I.A = 840 ha
		5D	Forest: 53.9km^2 (2.0%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 325.8km^2 (11.9%), Rain fed Farmland: 2,349.9km^2 (86.1%), Total: 2,729.5km^2, I.A = 1,910 ha
		5E	Forest: 118.7km^2 (3.0%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 936.9km^2 (24.0%), Rain fed Farmland: 2,852.0km^2 (73.0%), Total: 3,907.6km^2, I.A = 2,311 ha
		5F	Forest: 438.6km^2 (17.2%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 754.1km^2 (29.6%), Rain fed Farmland: 1,354.7km^2 (53.2%), Total: 2,547.4km^2, I.A = 1,098 ha
7	Population in 2008		WRA5 1,388,377 persons 5C 110,251persons 5D 416,743 persons 5E 617,414 persons 5F 243,969 persons
8	Major Cities/Towns		5C: Mlomo (Rural MC) 5D: Mponela (District MC), Madisi (Rural MC) 5E: Mchinji (District MC, Population: 456,558 in 2008), Santhe (Rural MC), Mkanda (Rural MC), Kamwendo (Rural MC), Kasiya (Rural MC), Mambuma (Rural MC), Mamitete (Rural MC) 5F: Kapiri (Rural MC)
9.	Existing Water Supply System and Scheme	5C	
		5D	
		5E	
		5F	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	5C	Chilangamwale 1 (12ha) & 2 (8ha) schemes. The former is motorised pump and the latter is gravity fed. Water is adequate.
		5D	Chipuka (3ha), Chitwala 1 (6ha) & 2 (0.7ha), Mphamba (1.1ha), Mkalalo (2ha) & Chanombo (4ha) schemes. The former is gravity fed and the others are motorised pump and/or tredle pump or watering can. Bvitchetche (7.5ha) motorised pump scheme.
		5E	Chidowola (8ha) & Khamalathu (43.6ha) schemes. The former is motorised pump and the latter is gravity fed.
		5F	
11.	Existing Hydropower Plant & Electric Supply	5C	No hydropower plant Transmission line from Nkhotakota to Dwanga and Chintheche, and from Nkhotakota to Chinyama No substation
		5D	No hydropower plant Transmission line from Lilongwe to Kasungu

			Chinyama substation
		5E	No hydropower plant Transmission lines from Lilongwe to Mchinji and from Mchinji to Kasungu No substation
		5F	No hydropower plant Transmission lines from Mchinji to Kasungu No substation
12.	Industrial Areas		
13.	Estate/Village	5C	
		5D	NGALA (DOWA) Estate was surveyed. CHIMWENDO & CHIMUNGU (DOWA) Villages were surveyed.
		5E	KWEZA, CHICHERE (MCHINJI), LISOKA, KHASU, CHIPALA, ZAZI, KASONJORA, NSUNGUZA, CHILIKHANDA, LINGADZI & LUSUNGWI Estates were surveyed. KACHAMBA (MCHINJI) Ville. was surveyed.
		5F	KALULU & JONI (MCHINJI) Villages were surveyed.
14.	Water Supply Development	5C	
		5D	
		5E	
		5F	
15.	Hydropower Development	5C	4 hydropower project (Mbongozi, Malenga, Chasombo, and Chizuma hydropower project)
		5D	New transmission line from Lilongwe to Songwe will pass
		5E	New transmission line from Lilongwe to western country boundary (Zambia) will pass
		5F	No project
16	Monitoring System		
	Rainfall Gauge	5C	No rainfall gauge
		5D	Madisi (monitored period:1959-1988) Mponela (monitored period:1945-1993)
		5E	Tembwe (monitored period:1966-2010) Mchinji (monitored period:1922-2007) Kasiya (monitored period:1952-1981, 1983-1990)
		5F	Mkanda (monitored period:1982-2008)
	Stream Gauge	5C	5C1 (Bua at S53 Roadbridge): monitored period; 49 years, drainage area; 10,600 km^2, average dry-season flows: Q_{75} = 16.362 m^3/s & Q_{97} = 5.108 m^3/s
		5D	5D1 (Bua at Bua Drift): monitored period; 35 years, drainage area; 9,410 km^2, average dry-season flows: Q_{75} = 1.198 m^3/s & Q_{97} = 0.095 m^3/s 5D2 (Bua at M1 Road Bridge - 5D2(B)): monitored period; 46 years, drainage area; 6,790 km^2, average dry-season flows: Q_{75} = 0.776 m^3/s & Q_{97} = 0.066 m^3/s
		5E	5E6 (Bua at Mchinji): monitored period; 23 years, drainage area; 126 km^2, average dry-season flows: Q_{75} = 0.098 m^3/s & Q_{97} = 0.019 m^3/s
		5F	5F1 (Rusa at Kasela): monitored period; 30 years, drainage area; 2,580 km^2, average dry-season flows: Q_{75} = 0.055 m^3/s & Q_{97} = 0.004 m^3/s 5F3 (Liwelezi at Matuwamba): monitored period; 11 years, drainage area; - km^2, average dry-season flows: Q_{75} = 0.237 m^3/s & Q_{97} = 0.104 m^3/s
	Monitoring Well	5C	No monitoring well
		5D	No monitoring well
		5E	GN196(Mchinji W/Office): monitored period; 4 years, the highest G.W.L; 0.98m, the lowest G.W.L; 7.67m, the range of periodic fluctuation is 5 to 6m. Surface water may directly flow into the well.
		5F	GN200(Lusa/Kalulu Dam): not started (at present, August, 2013)
	Water Quality	5C	<Surface Water> 5C1(Bua River): Monitored date in rainy season; 27-Feb-2013, in dry

			season;7-Aug-2013 pH=[7.5](7.37), Temp=[28.6](29.7)°C, EC=[244](297)µs/cm, TDS=[127](153)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[70](109)mg/l, Cl^-=[10.1](10.9)mg/l, SO_4^{2-}=[39.4](34.6)mg/l, NO_3^-=[0.053](0.074)mg/l, F^-=[0.41](0.37)mg/l, Na^+=[15](10)mg/l, K^+=[2](1.9)mg/l, Ca^{2+}=[16.3](33)mg/l, Mg^{2+}=[8.8](8.4)mg/l, Fe^{2+}=[0.298](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[77](116)mg/l, Alkalinity=[57](89)mg/l, Turbidity=[60](6)NTU, SS=[56](3)mg/l, PO_4^{3-}=[0.051](0.789)mg/l, Cu^{2+}=[0.003](0.013)mg/l, DO=[6.8](8.9)mg/l, BOD=[4](5.2)mg/l, COD=[125](31.4)mg/l, F.Coliform=[820](125)nos./100ml, , F.Steptococci=[105](25)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		5D	Surface Water> 5D1(Bua River): Monitored date in rainy season; 27-Feb-2013, in dry season; 6-Aug-2013 pH=[8.25](8.94), Temp=[28.3](24.6)°C, EC=[198](346)µs/cm, TDS=[94](168)mg/l, CO_3^{2-}=[10](12)mg/l, HCO_3^{2-}=[66](62)mg/l, Cl^-=[10.4](23.5)mg/l, SO_4^{2-}=[6.2](45.7)mg/l, NO_3^-=[0.001](0.083)mg/l, F^-=[0.12](0.11)mg/l, Na^+=[11](18)mg/l, K^+=[1.7](1.5)mg/l, Ca^{2+}=[13.5](26)mg/l, Mg^{2+}=[7.6](11)mg/l, Fe^{2+}=[0.193](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[65](110)mg/l, Alkalinity=[70](70)mg/l, Turbidity=[38](4)NTU, SS=[37](3)mg/l, PO_4^{3-}=[0.031](0.833)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[5.2](9.3)mg/l, BOD=[4](7.6)mg/l, COD=[90](61.2)mg/l, F.Coliform=[200](500)nos./100ml, , F.Steptococci=[75](130)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		5E	<Surface Water> 5E6(Bua River): Monitored date in rainy season; 10-Feb-2013, in dry season; 6-Aug-2013 pH=[7.49](7.72), Temp=[22.9](22.7)°C, EC=[69](120)µs/cm, TDS=[36](58)mg/l, CO_3^{2-}=[0](4)mg/l, HCO_3^{2-}=[14](30)mg/l, Cl^-=[8](3.7)mg/l, SO_4^{2-}=[6.09](16.3)mg/l, NO_3^-=[0.047](0.061)mg/l, F^-=[0.49](0.1)mg/l, Na^+=[8](4)mg/l, K^+=[0.7](1)mg/l, Ca^{2+}=[4](10)mg/l, Mg^{2+}=[1](4.7)mg/l, Fe^{2+}=[0.047](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[14](44)mg/l, Alkalinity=[11](31)mg/l, Turbidity=[1.1](8)NTU, SS=[0.1](5)mg/l, PO_4^{3-}=[0.035](0.623)mg/l, Cu^{2+}=[0.001](0.001)mg/l, DO=[10.2](8.3)mg/l, BOD=[5](5.4)mg/l, COD=[97](27.4)mg/l, F.Coliform=[1520](1,980)nos./100ml, , F.Steptococci=[500](1,220)nos.100ml <Groundwater> GN196(Mchinji W/Office): Monitored date in rainy season; 10-Feb-2013, in dry season; 6-Aug-2013 pH=[8.1](6.77), Temp=[26.3](23.1)°C, EC=[220](238)µs/cm, TDS=[106](130)mg/l, CO_3^{2-}=[11](0)mg/l, HCO_3^{2-}=[40](67)mg/l, Cl^-=[13.5](9)mg/l, SO_4^{2-}=[23.5](38.7)mg/l, NO_3^-=[0.001](0.099)mg/l, F^-=[0.41](0.14)mg/l, Na^+=[10](10)mg/l, K^+=[1.4](5.9)mg/l, Ca^{2+}=[18](19)mg/l, Mg^{2+}=[6.7](8)mg/l, Fe^{2+}=[0.342](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[73](80)mg/l, Alkalinity=[51](54)mg/l, Turbidity=[54](6.1)NTU, SS=[20](4)mg/l, Cu^{2+}=[0.001](0.023)mg/l, DO=[1.4](9)mg/l, BOD=[3](10.6)mg/l, COD=[99](65.1)mg/l, F.Coliform=[16](0)nos./100ml, , F.Steptococci=[2](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
		5F	<Surface Water>

			5F2(Liwerezi River): Monitored date in rainy season; 10-Feb-2013, in dry season;6-Aug-2013 pH=[7.4](6.68), Temp=[24.1](26.9)°C, EC=[70](99)µs/cm, TDS=[36](50)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[15](27.8)mg/l, Cl^-=[8](7.2)mg/l, SO_4^{2-}=[6.51](12.2)mg/l, NO_3^-=[0.001](0.068)mg/l, F^-=[0.41](0.62)mg/l, Na^+=[7](4)mg/l, K^+=[1.7](0.3)mg/l, Ca^{2+}=[3.7](8)mg/l, Mg^{2+}=[1](3.8)mg/l, Fe^{2+}=[0.372](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[14](35)mg/l, Alkalinity=[12](22)mg/l, Turbidity=[28](4.2)NTU, SS=[26](2)mg/l, PO_4^{3-}=[0.039](0.791)mg/l, Cu^{2+}=[0.002](0.008)mg/l, DO=[8.3](9.2)mg/l, BOD=[5](7.1)mg/l, COD=[46](25.9)mg/l, F.Coliform=[1400](75)nos./100ml, , F.Steptococci=[1160](60)nos.100ml <Groundwater> GN200(Lusa/Kalulu Dam): Monitored date in rainy season; 10-Feb-2013, in dry season; not sampled due to vandalism pH=[8.3](-), Temp=[25.7](-)°C, EC=[640](-)µs/cm, TDS=[296](-)mg/l, CO_3^{2-}=[52](-)mg/l, HCO_3^{2-}=[212](-)mg/l, Cl^-=[152](-)mg/l, SO_4^{2-}=[9.7](-)mg/l, NO_3^-=[0.001](-)mg/l, F^-=[0.54](-)mg/l, Na^+=[16](-)mg/l, K^+=[3.3](-)mg/l, Ca^{2+}=[84](-)mg/l, Mg^{2+}=[9.7](-)mg/l, Fe^{2+}=[0.618](-)mg/l, Mn^{2+}=[0.004](-)mg/l, Hardness=[250](-)mg/l, Alkalinity=[260](-)mg/l, Turbidity=[140](-)NTU, SS=[136](-)mg/l, Cu^{2+}=[0.001](-)mg/l, DO=[0.3](-)mg/l, BOD=[70](-)mg/l, COD=[549](-)mg/l, F.Coliform=[2300](-)nos./100ml, , F.Steptococci=[700](-)nos.100ml note: [ ]; Rainy season, ( ); dry season
17.	Water Demand	5C	(Present) Irrigation 11,487,041m^3/year, Water Supply 563,761m^3/year, Live Stock 440,981m^3/year (2035) Irrigation 33,957,331m^3/year, Water Supply 381,460 m^3/year, Live Stock 1,019,085 m^3/year 5C/15B/15C GBI-Bua/Lozi (42,100 ha)
		5D	(Present) Irrigation 26,180,897m^3/year, Water Supply 1,988,588m^3/year, Live Stock 1,868,017m^3/year (2035) Irrigation 77,394,463m^3/year, Water Supply 767,734 m^3/year, Live Stock 4,453,995 , m^3/year GBI-Kantungu (54,651 ha)
		5E	(Present) Irrigation 31,705,848m^3/year, Water Supply 2,976,257m^3/year, Live Stock, 3,172,026m^3/year, (2035) Irrigation 93,727,006m^3/year, Water Supply 1,565,207 m^3/year, Live Stock 8,460,996 m^3/year GBI-Bua Dambos (137,731 ha)
		5F	(Present) Irrigation 15,069,982m^3/year, Water Supply 1,488,222m^3/year, Live Stock 1,497,100m^3/year, (2035) Irrigation 44,549,015m^3/year, Water Supply 1,095,977 m^3/year, Live Stock 3,425,908 m^3/year
18.	Water Balance	5C	Water Resources989,242,362 m^3/year (Present) Deficit 5,088,690 m^3/year (Irrigation 4,861,025 m^3/year, Water Supply 118,930 m^3/year, Live Stock 108,735 m^3/year) (2035) Deficit 17,573,761 m^3/year (Irrigation 17,160,522 m^3/year, Water Supply

			80,472 m^3/year, Live Stock 332,766 m^3/year)
		5D	Water Resources 706,258,769 m^3/year (Present) Deficit 21,709,536 m^3/year (Irrigation 20,560,443 m^3/year, Water Supply 509,361 m^3/year, Live Stock 639,732 m^3/year) (2035) Deficit 67,931,128 m^3/year (Irrigation 65,868,500 m^3/year, Water Supply 195,615 m^3/year, Live Stock 1,867,014 m^3/year)
		5E	Water Resources 286,767,902 m^3/year (Present) Deficit 28,524,215 m^3/year (Irrigation 26,442,852 m^3/year, Water Supply 859,825 m^3/year, Live Stock 1,221,539 m^3/year) (2035) Deficit 87,112,878 m^3/year (Irrigation 83,032,597 m^3/year, Water Supply 448,144 m^3/year, Live Stock 3,632,137 m^3/year)
		5F	Water Resources 255,074,271 m^3/year (Present) Deficit 12,386,798 m^3/year (Irrigation 11,530,664 m^3/year, Water Supply 346,980 m^3/year, Live Stock 509,154 m^3/year) (2035) Deficit 38,528,668 m^3/year (Irrigation 36,887,349 m^3/year, Water Supply 253,617 m^3/year, Live Stock 1,387,703 m^3/year)
19.	Water Resources Development Facilities	5C	Mbongozi (U/R), Malenga (M/R) & Chasombo (L/R) P. Damsites→Dams+Weir+Canal+I.Res.
		5D	Dams+Weir+Canal +I.Res.
		5E	Dam/Weir+M. Pumps+I.Res
		5F	Dam/Weir+M. Pumps+I.Res

Fact Sheet WRA 6 (6A-6D)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Dwangwa (Dwangwa River Basin)
2	WRA (WRU)		WRA6 (6A, 6B, 6C, 6D)
3	Catchment Area (km^2)		WRA6 7,768 6A 1,690 6B 1,066 6C 1,287 6D 3,725
4	Topography	Upper	
		Middle	
		Lower	
5	Annual Rainfall		WRA6 931mm 6A 776mm 6B 784mm 6C 776mm 6D 1100mm
6	Land Use in 2010 I.A = Irrigation Area	WRA6	Forest: 3,143.2km^2 (40.8%), Bush/Grassland: 86.3km^2 (1.1%), Wetland: 414.9km^2 (5.4%), Rain fed Farmland: 4,065.5km^2 (52.7%), Total: 7,709.9km^2, I.A = 9,918 ha
		6A	Forest: 1,253.8km^2 (76.1%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 126.5km^2 (7.7%), Rain fed Farmland: 266.4km^2 (16.2%), Total: 1,646.6km^2, Mainly Forest Land, I.A = 169 ha
		6B	Forest: 665.5km^2 (62.0%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 168.4km^2 (15.7%), Rain fed Farmland: 240.2km^2 (22.4%), Total: 1,074.1km^2, Mainly Forest Land, I.A = 152 ha
		6C	Forest: 20.7km^2 (1.6%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 58.9km^2 (4.5%), Rain fed Farmland: 1,233.0km^2 (93.9%), Total: 1,312.5km^2, I.A = 782 ha
		6D	Forest: 1,203.3km^2 (32.7%), Bush/Grassland: 86.3km^2 (2.4%), Wetland: 61.1km^2 (1.7%), Rain fed Farmland: 2,326.0km^2 (63.3%), Total: 3,676.6km^2, I.A = 8,815 ha
7	Population in 2008		WRA6 487,339 persons 6A 34,871 persons 6B 34,390 persons 6C 156,078 persons 6D 262,000 persons
8	Major Cities/Towns		6A: - 6B: - 6C: Kasungu (Sub-Regional Centre, Population: 616,085 in 2008) 6D: Dwangwa (Rural MC), Chisemphere (Rural MC), Chamama (Rural MC)
9.	Existing Water Supply System and Scheme	6A	
		6B	
		6C	
		6D	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	6A	
		6B	
		6C	Jalo (2.2ha) motorised pump scheme.
		6D	
11.	Existing Hydropower Plant & Electric Supply	6A	No hydropower plant No transmission line No substation
		6B	No hydropower plant No transmission line No substation
		6C	No hydropower plant Transmission lines to Kasungu and its suburbs No substation
		6D	No hydropower plant

			Transmission lines to Dwanga, and from Nkhotakota to Chintheche Dwanga substation
12.	Industrial Areas		
13.	Estate/Village	6A	CHISANU & CHIOZA (KASUNGU) Villages were surveyed.
		6B	
		6C	CHIBWAZI 1 & ESTATE 81 (KASUNGU) Estates were surveyed. KANYENDA, KANSIMJENI & MBILA (KASUNGU) Villages were surveyed.
		6D	DWANGWA CANE GROWERS & DWANGWA (NKHOTAKOTA) Estates were surveyed.
14.	Water Supply Development	6A	
		6B	
		6C	
		6D	
15.	Hydropower Development	6A	No project
		6B	No project
		6C	New transmission line from Lilongwe to Songwe will pass
		6D	New transmission line from Lilongwe to Songwe will pass
16	Monitoring System		
	Rainfall Gauge	6A	No rainfall gauge
		6B	No rainfall gauge
		6C	Kasungu (monitored period:1961-2011) KFCTA (monitored period:1984-1990)
		6D	Dwangwa (monitored period:1972-2010)
	Stream Gauge	6A	No representative stream gauge
		6B	6B2 (Lingadzi at Lifupa): monitored period; 0 years, drainage area; - km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s
		6C	6C1 (Dwangwa at Khwengwere): monitored period; 50 years, drainage area; 2,980 km^2, average dry-season flows: Q_{75} = 0.013 m^3/s & Q_{97} = 0.001 m^3/s
		6D	6D10 (Dwangwa at S53 Roadbridge (D/S)): monitored period; 25 years, drainage area; 7,610 km^2, average dry-season flows: Q_{75} = 1.260 m^3/s & Q_{97} = 0.130 m^3/s
	Monitoring Well	6A	No monitoring data
		6B	No monitoring data
		6C	GN177(Mwalawanyenje School): monitored period; 4 years, the highest G.W.L; 2.10m, the lowest G.W.L; 7.90m, the range of periodic fluctuation is unclear due to few monitoring data.
		6D	No monitoring data
	Water Quality	6A	No monitoring
		6B	No monitoring
		6C	<Surface Water> 6C1(Dwangwa River): Monitored date in rainy season; 27-Feb-2013, in dry season;7-Aug-2013 pH=[7.85](6.92), Temp=[27.2](29.3)°C, EC=[196](93)µs/cm, TDS=[92](47)mg/l, CO_3^{2-}=[12](0)mg/l, HCO_3^{2-}=[62](20)mg/l, Cl^-=[10.8](9)mg/l, SO_4^{2-}=[5.2](11.9)mg/l, NO_3^-=[0.001](0.079)mg/l, F^-=[0.22](0.18)mg/l, Na^+=[8](6)mg/l, K^+=[2.9](2)mg/l, Ca^{2+}=[21](6)mg/l, Mg^{2+}=[6.4](2.6)mg/l, Fe^{2+}=[0.507](0.155)mg/l, Mn^{2+}=[0.002](0.001)mg/l, Hardness=[80](25)mg/l, Alkalinity=[71](16)mg/l, Turbidity=[160](8)NTU, SS=[156](4)mg/l, PO_4^{3-}=[0.157](0.498)mg/l, Cu^{2+}=[0.007](0.011)mg/l, DO=[4.6](8.9)mg/l, BOD=[5](0.9)mg/l, COD=[135](2.9)mg/l, F.Coliform=[1760](120)nos./100ml, , F.Steptococci=[575](20)nos.100ml <Groundwater> GN177(Mwalawanyenje School): Monitored date in rainy season; 14-Mar-2013, in dry season; 6-Aug-2013 pH=[8.46](7.71), Temp=[25.1](25.8)°C, EC=[280](349)µs/cm, TDS=[140](179)mg/l, CO_3^{2-}=[15](11)mg/l, HCO_3^{2-}=[81](109)mg/l,

			Cl^-=[20.7](7.2)mg/l, SO_4^{2-}=[4.78](34.3)mg/l, NO_3^-=[0.128](0.027)mg/l, F^-=[1.23](0.55)mg/l, Na^+=[19](33)mg/l, K^+=[5.1](10.2)mg/l, Ca^{2+}=[17](20)mg/l, Mg^{2+}=[9](7.6)mg/l, Fe^{2+}=[0.001](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[79](81)mg/l, Alkalinity=[91](109)mg/l, Turbidity=[1.2](4)NTU, SS=[0.1](2)mg/l, Cu^{2+}=[0.002](0.015)mg/l, DO=[8.5](8.8)mg/l, BOD=[9](4.5)mg/l, COD=[15](11.7)mg/l, F.Coliform=[20](0)nos./100ml, , F.Steptococci=[5](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
		6D	<Surface Water> 6D10(Dwangwa River): Monitored date in rainy season; 10-Feb-2013, in dry season; 6-Aug-2013 pH=[7.1](8.72), Temp=[24.8](25.3)°C, EC=[190](649)µs/cm, TDS=[92](320)mg/l, CO_3^{2-}=[0](20)mg/l, HCO_3^{2-}=[81](142)mg/l, Cl^-=[8.8](61.5)mg/l, SO_4^{2-}=[6.31](46.3)mg/l, NO_3^-=[0.004](0.079)mg/l, F^-=[0.46](0.5)mg/l, Na^+=[7](71)mg/l, K^+=[2.8](4.7)mg/l, Ca^{2+}=[20](38)mg/l, Mg^{2+}=[6.4](7.8)mg/l, Fe^{2+}=[0.562](0.001)mg/l, Mn^{2+}=[0.003](0.001)mg/l, Hardness=[77](126)mg/l, Alkalinity=[66](149)mg/l, Turbidity=[50](6)NTU, SS=[46](4)mg/l, PO_4^{3-}=[0.103](0.751)mg/l, Cu^{2+}=[0.001](0.001)mg/l, DO=[5.4](4.7)mg/l, BOD=[5](6.1)mg/l, COD=[82](111)mg/l, F.Coliform=[1120](1,850)nos./100ml, , F.Steptococci=[660](125)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
17.	Water Demand	6A	(Present) Irrigation 2,203,640m^3/year, Water Supply 754,768m^3/year, Live Stock 153,546m^3/year (2035) Irrigation 4,665,710m^3/year, Water Supply 401,786 m^3/year, Live Stock 366,980 m^3/year
		6B	(Present) Irrigation 1,989,678m^3/year, Water Supply 486,245m^3/year, Live Stock 138,637m^3/year (2035) Irrigation 4,212,694m^3/year, Water Supply 258,843 m^3/year, Live Stock 331,349 m^3/year
		6C	(Present) Irrigation 10,215,437m^3/year, Water Supply 1,529,031m^3/year, Live Stock 711,794m^3/year, (2035) Irrigation 21,628,883m^3/year, Water Supply 2,384,725 m^3/year, Live Stock 1,701,215 m^3/year 6C/6D GBI- Upper Dwangwa (63,256 ha)
		6D	(Present) Irrigation 129,529,959m^3/year, Water Supply 1,199,841m^3/year, Live Stock 1,205,771m^3/year, (2035) Irrigation 274,250,469m^3/year, Water Supply 882,475m^3/year, Live Stock 1,571,141 m^3/year
18.	Water Balance	6A	Water Resources56,162,403 m^3/year (Present) Deficit1,770,983 m^3/year (Irrigation 1,491,009 m^3/year, Water Supply 219,749 m^3/year, Live Stock 60,224 m^3/year) (2035) Deficit 3,710,866 m^3/year (Irrigation 3,442,038 m^3/year, Water Supply 114,998 m^3/year, Live Stock 153,831 m^3/year)
		6B	Water Resources60,749,949 m^3/year (Present)

			Deficit 1,446,993 m^3/year (Irrigation 1,267,349 m^3/year, Water Supply 129,408 m^3/year, Live Stock 50,236 m^3/year) (2035) Deficit 3,198,152 m^3/year (Irrigation 2,999,215 m^3/year, Water Supply 68,131 m^3/year, Live Stock 130,807m^3/year)
		6C	Water Resources 161,349,175 m^3/year (Present) Deficit 8,490,875 m^3/year (Irrigation 8,017,437 m^3/year, Water Supply 188,721 m^3/year, Live Stock 284,717 m^3/year) (2035) Deficit 18,629,043 m^3/year (Irrigation 17,736,400 m^3/year, Water Supply 100,003 m^3/year, Live Stock 792,641m^3/year)
		6D	Water Resources 689,661,729 m^3/year (Present) Deficit 61,426,588 m^3/year (Irrigation 60,520,963 m^3/year, Water Supply 304,392 m^3/year, Live Stock 601,233 m^3/year) (2035) Deficit 162,472,274 m^3/year (Irrigation 161,349,107 m^3/year, Water Supply 223,529 m^3/year, Live Stock 899,639 m^3/year)
19.	Water Resources Development Facilities	6A	Mainly Forest Land ~~Weir+M. Pumps+I.Res~~
		6B	Mainly Forest Land ~~Weir+M. Pumps+I.Res~~
		6C	Dam+ Weir+M. Pumps+I.Res
		6D	Dam+ Weir+M. Pumps+I.Res

Fact Sheet WRA 7 (7A-7H)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		South Rukuru/North Rumphi (Rukuru and Rumphi River Basins)
2	WRA (WRU)		WRA7 (7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H)
3	Catchment Area (km^2)	Total	12,705
		Rukuru R.B.	11,993
		N. Rumphi R.B.	712
		WRUs	7A 2,897 / 7B 1,302 / 7C 1,648 / 7D 2,258 / 7E 1,456 / 7F 1,482 / 7G 950 / 7H 712
4	Topography	N. Rumphi.	
		Rukuru – Upper	
		Rukuru – Middle	
		Rukuru – Lower	
5	Annual Rainfall		WRA7 807mm / 7A 842mm / 7B 818mm / 7C 657mm / 7D 976mm / 7E 677mm / 7F 661mm / 7G 710mm / 7H 1167mm
6	Land Use in 2010 I.A = Irrigation Area	WRA7	Forest: 3,523.1km^2 (27.8%), Bush/Grassland: 1,174.8km^2 (9.3%), Wetland: 615.9km^2 (4.9%), Rain fed Farmland: 7,342.9km^2 (58.0%), Total: 12,656.7km^2, I.A = 2,840 ha
		7A	Forest: 325.0km^2 (11.1%), Bush/Grassland: 24.9km^2 (0.9%), Wetland: 247.9km^2 (8.5%), Rain fed Farmland: 2,332.2km^2 (79.6%), Total: 2,930.0km^2, I.A = 856 ha
		7B	Forest: 116.1km^2 (9.4%), Bush/Grassland: 0.7km^2 (0.1%), Wetland: 102.4km^2 (8.3%), Rain fed Farmland: 1,022.1km^2 (82.3%), Total: 1,241.3km^2, I.A = 363 ha
		7C	Forest: 879.4km^2 (54.0%), Bush/Grassland: 26.2km^2 (1.6%), Wetland: 112.3km^2 (6.9%), Rain fed Farmland: 610.4km^2 (37.5%), Total: 1,628.3km^2, I.A = 235 ha
		7D	Forest: 562.5km^2 (25.0%), Bush/Grassland: 18.2km^2 (0.8%), Wetland: 65.4km^2 (2.9%), Rain fed Farmland: 1,601.9km^2 (71.3%), Total: 2,247.9km^2, I.A = 597 ha
		7E	Forest: 458.1km^2 (31.3%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 53.2km^2 (3.6%), Rain fed Farmland: 952.4km^2 (65.1%), Total: 1,463.6km^2, I.A = 374 ha
		7F	Forest: 662.3km^2 (44.6%), Bush/Grassland: 576.1km^2 (38.8%), Wetland: 8.8km^2 (0.6%), Rain fed Farmland: 238.3km^2 (16.0%), Total: 1,485.6km^2, I.A = 119 ha
		7G	Forest: 341.8km^2 (35.7%), Bush/Grassland: 150.6km^2 (15.7%), Wetland: 24.5km^2 (2.6%), Rain fed Farmland: 439.9km^2 (46.0%), Total: 956.8km^2, I.A = 221 ha
		7H	Forest: 177.9km^2 (25.3%), Bush/Grassland: 378.3km^2 (53.8%), Wetland: 1.32km^2 (0.2%), Rain fed Farmland: 145.7km^2 (20.7%), Total: 703.2km^2, I.A = 76 ha
7	Population in 2008		WRA7 854,518 persons / 7A 210,562 persons / 7B 138,995 persons / 7C 73,974 persons / 7D 236,765 persons / 7E 65,672 persons / 7F 43,763 persons / 7G 68,412 persons / 7H 16,375 persons
8	Major Cities/Towns		7A: Mzimba (Distric MC, Population: 724,873 in 2008), Edingeni (Rural MC), Embangweni (Rural MC) 7B: Euthini (District MC), Bulala (Rural MC) 7C: Mbalachanda (Rural MC) 7D: Ekwendeni (Rural MC), Chikangawa (Rural MC)

			7E: - 7F: Rumphi (District MC, Population: 169,112 in 2008), Bolero (Rural MC), Living stonia (Rural MC) 7G: Mphompha (Rural MC) 7H: -
9.	Existing Water Supply System and Scheme	7A	
		7B	
		7C	
		7D	Mzuzu Zone of NRWB (Mzuzu Scheme, Ekwendeni Scheme)
		7E	
		7F	
		7G	
		7H	
10.	Existing irrigation System Only the schemes with GIS data are shown here	7A	
		7B	
		7C	
		7D	
		7E	
		7F	
		7G	Mzokoto (2.5ha) tredle pump scheme.
		7H	
11.	Existing Hydropower Plant & Electric Supply	7A	No hydropower plant Transmission lines around Mzimba and its suburbs, and to country boundary No substation
		7B	No hydropower plant Transmission lines to Euthini and its suburbsm and to country boundary No substation
		7C	No hydropower plant Transmission line from Euthini to Mzuzu No substation
		7D	No hydropower plant Transmission lines from Mzuzu to Rumphi and from Euthini to Rumphi No substation
		7E	No hydropower plant Transmission linesfrom Euthini to Rumphi No substation
		7F	No hydropower plant Transmission lines to Rumphi and its suburbs No substation
		7G	No hydropower plant Transmission lines from Mzuzu to Livingstonia and to Rumphi A substation near Rumphi (Bwengu substation)
		7H	No hydropower plant Transmission lines from Rumphi to Karonga via Livingstonia Livingstonia substation
12	Industrial Areas		
13.	Estate/Village	7A	JACOMA (MZIMBA) Estate was surveyed. MPONDA MVULA, KATAMBALALA, ZEBEDIA & JENDA Villages were surveyed.
		7B	
		7C	CHATUMBWA & NKHUTAMAJI, & NTHAWATAWA (RUMPHI) Villages were surveyed.
		7D	
		7E	
		7F	BONGOLOLO (RUMPHI) Ville. was surveyed.
		7G	MGOMAKHANDA & VWALAKO (RUMPHI) Villages were surveyed
		7H	NKHOZO (RUMPHI) Estate was surveyed.
14	Water Supply	7A	

.	Development	7B	
		7C	
		7D	・Water Supply Consultancy/Supervision, and Distribution pipelines for Mzuzu Town.
		7E	
		7F	
		7G	
		7H	
15 .	Hydropower Development	7A	New transmission line from Lilongwe to Songwe will pass
		7B	No project
		7C	No project
		7D	No project
		7E	No project
		7F	Rumphi hydropower project
		7G	Henga Valley and Lower Fufu hydropower project New transmission line from Lilongwe to Songwe will pass
		7H	Intake for Lower Fufu hydropower project on the North Rumphi River New transmission line from Lilongwe to Songwe will pass
16	Monitoring System		
	Rainfall Gauge	7A	Mzimba (monitored period:1933-2010) Embangweni (monitored period:1943-1953, 1978-1990) Mbawa (monitored period:1952-2004, 2007, 2009)
		7B	M'mbelwa (monitored period:1949-1960, 1971-1990) Euthini (monitored period:1969-1990)
		7C	No rainfall gauge
		7D	Mzuzu (monitored period:1961-2010) Bwengu (monitored period:1978-1990) Zombwe (monitored period:1945-1990) Chikangawa (monitored period:1953-1990, 2000-2005)
		7E	Bolero (monitored period:1962-2010)
		7F	Rumphi (monitored period:1952-1969, 1972-1990, 1996-1997)
		7G	No rainfall gauge
		7H	No rainfall gauge
	Stream Gauge	7A	7A3 (South Rukuru at Chimsewezo): monitored period; 30 years, drainage area; 958 km^2, average dry-season flows: Q_{75} = 0.295 m^3/s & Q_{97} = 0.056 m^3/s
		7B	No representative stream gauge
		7C	No representative stream gauge
		7D	7D4 (Kasitu at Edundu): monitored period; 43 years, drainage area; 766 km^2, average dry-season flows: Q_{75} = 0.169 m^3/s & Q_{97} = 0.012 m^3/s 7D8 (Lunyangwa at Zombwe): monitored period; 42 years, drainage area; 513 km^2, average dry-season flows: Q_{75} = 1.667 m^3/s & Q_{97} = 0.775 m^3/s
		7E	No representative stream gauge
		7F	7F2 (South Rumphi at Rumphi): monitored period; 50 years, drainage area; 476 km^2, average dry-season flows: Q_{75} = 2.985 m^3/s & Q_{97} = 1.896 m^3/s
		7G	7G14 (South Rukuru at Phwezi): monitored period; 51 years, drainage area; 11,800 km^2, average dry-season flows: Q_{75} = 8.084 m^3/s & Q_{97} = 3.491 m^3/s 7G18 (South Rukuru at Mlowe): monitored period; 25 years, drainage area; 12,088 km^2, average dry-season flows: Q_{75} = 11.134 m^3/s & Q_{97} = 5.338 m^3/s
		7H	7H1 (North Rumphi at Phoka Court): monitored period; 44 years, drainage area; 419 km^2, average dry-season flows: Q_{75} = 4.639 m^3/s & Q_{97} = 3.005 m^3/s 7H3 (North Rumphi at Chiweta): monitored period; 30 years, drainage area; 683 km^2, average dry-season flows: Q_{75} =7.336 m^3/s & Q_{97} = 4.695 m^3/s
	Monitoring Well	7A	No monitoring well
		7B	No monitoring well
		7C	No monitoring well
		7D	GN167(Endongolweni School): monitored period; 4 years, the highest G.W.L;

			7.85m, the lowest G.W.L; 11.97m, the range of periodic fluctuation is within 1m. The groundwater table has decreased with little periodic cycle since the monitoring began.
		7E	No monitoring well
		7F	No monitoring well
		7G	No monitoring well
		7H	No monitoring well
	Water Quality	7A	<Surface Water> 7A3(South Rukuku River): Monitored date in rainy season; 7-Mar-2013, in dry season; 16-Aug-2013 pH=[7.27](8.03), Temp=[24](17)°C, EC=[154](201)µs/cm, TDS=[79](97)mg/l, CO_3^{2-}=[0](9)mg/l, HCO_3^{2-}=[69](71)mg/l, Cl^-=[8.9](9.9)mg/l, SO_4^{2-}=[5.81](5.86)mg/l, NO_3^-=[0.03](0.001)mg/l, F^-=[0.63](0.57)mg/l, Na^+=[12](14)mg/l, K^+=[4](2.9)mg/l, Ca^{2+}=[11.2](13)mg/l, Mg^{2+}=[4](6.8)mg/l, Fe^{2+}=[0.843](0.87)mg/l, Mn^{2+}=[0.003](0.001)mg/l, Hardness=[45](62)mg/l, Alkalinity=[56](73)mg/l, Turbidity=[2](0.6)NTU, SS=[0.1](1)mg/l, PO_4^{3-}=[0.042](0.569)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[4.1](6.9)mg/l, BOD=[2.2](3)mg/l, COD=[43](44.7)mg/l, F.Coliform=[900](1,700)nos./100ml, , F.Steptococci=[80](0)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		7B	No monitoring
		7C	No monitoring
		7D	<Surface Water> 7D4(Kasitu River): Monitored date in rainy season; 7-Mar-2013, in dry season; not sampled due to dry up pH=[8.03](-), Temp=[29.3](-)°C, EC=[198](-)µs/cm, TDS=[99](-)mg/l, CO_3^{2-}=[10](-)mg/l, HCO_3^{2-}=[77](-)mg/l, Cl^-=[6](-)mg/l, SO_4^{2-}=[4.01](-)mg/l, NO_3^-=[0.017](-)mg/l, F^-=[0.57](-)mg/l, Na^+=[12](-)mg/l, K^+=[4](-)mg/l, Ca^{2+}=[15](-)mg/l, Mg^{2+}=[6.3](-)mg/l, Fe^{2+}=[0.367](-)mg/l, Mn^{2+}=[0.001](-)mg/l, Hardness=[64](-)mg/l, Alkalinity=[79](-)mg/l, Turbidity=[20](-)NTU, SS=[13](-)mg/l, PO_4^{3-}=[0.035](-)mg/l, Cu^{2+}=[0.003](-)mg/l, DO=[5.1](-)mg/l, BOD=[2.2](-)mg/l, COD=[29](-)mg/l, F.Coliform=[1060](-)nos./100ml, , F.Steptococci=[990](-)nos.100ml <Groundwater> GN167(Endongolweni School): Monitored date in rainy season; 14-Mar-2013, in dry season; 7-Aug-2013 pH=[6.8](7.12), Temp=[26.3](23.6)°C, EC=[2300](2,157)µs/cm, TDS=[1160](1,015)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[550](500)mg/l, Cl^-=[397](376)mg/l, SO_4^{2-}=[11.5](11.5)mg/l, NO_3^-=[1.348](1.88)mg/l, F^-=[0.75](0.32)mg/l, Na^+=[77](68)mg/l, K^+=[9.8](9.6)mg/l, Ca^{2+}=[238](267)mg/l, Mg^{2+}=[62.2](31)mg/l, Fe^{2+}=[0.003](0.072)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[850](794)mg/l, Alkalinity=[451](410)mg/l, Turbidity=[2](1)NTU, SS=[0.1](6)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[2.2](6.1)mg/l, BOD=[6.5](4.1)mg/l, COD=[31](14.1)mg/l, F.Coliform=[0](0)nos./100ml, , F.Steptococci=[0](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
		7E	No monitoring
		7F	No monitoring
		7G	<Surface Water> 7G14(South Rukuku River): Monitored date in rainy season; 7-Mar-2013, in dry season; 14-Aug-2013 pH=[7.68](7.38), Temp=[27.2](16.1)°C, EC=[109](87)µs/cm, TDS=[55](44)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[38](17)mg/l, Cl^-=[12.5](9.9)mg/l, SO_4^{2-}=[2.19](12.2)mg/l, NO_3^-=[0.001](0.063)mg/l,

			F^-=[0.38](0.15)mg/l, Na^+=[11](7)mg/l, K^+=[2.9](1.4)mg/l, Ca^{2+}=[6](5.1)mg/l, Mg^{2+}=[2.1](2)mg/l, Fe^{2+}=[0.787](0.31)mg/l, Mn^{2+}=[0.006](0.001)mg/l, Hardness=[25](22)mg/l, Alkalinity=[31](13)mg/l, Turbidity=[120](15)NTU, SS=[50](14)mg/l, PO_4^{3-}=[0.136](0.57)mg/l, Cu^{2+}=[0.002](0.001)mg/l, DO=[6.2](7)mg/l, BOD=[1.9](5.8)mg/l, COD=[11](14.1)mg/l, F.Coliform=[270](2,350)nos./100ml, , F.Steptococci=[100](0)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		7H	<Surface Water> 7H3(North Rumphi River): Monitored date in rainy season; 7-Mar-2013, in dry season; 14-Aug-2013 pH=[7.69](7.34), Temp=[25.1](16.4)°C, EC=[51](32)µs/cm, TDS=[25](16)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[11](7)mg/l, Cl^-=[5.4](3.3)mg/l, SO_4^{2-}=[5.41](3.84)mg/l, NO_3^-=[0.035](0.001)mg/l, F^-=[0.6](0.14)mg/l, Na^+=[5](2)mg/l, K^+=[1](0.9)mg/l, Ca^{2+}=[3](2.2)mg/l, Mg^{2+}=[1](0.9)mg/l, Fe^{2+}=[0.291](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[12](9)mg/l, Alkalinity=[9](5)mg/l, Turbidity=[10](0.8)NTU, SS=[5](6)mg/l, PO_4^{3-}=[0.007](0.755)mg/l, Cu^{2+}=[0.003](0.001)mg/l, DO=[7.1](7.1)mg/l, BOD=[1.9](3.6)mg/l, COD=[60](8.6)mg/l, F.Coliform=[1240](0)nos./100ml, , F.Steptococci=[250](200)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
17.	Water Demand	7A	(Present) Irrigation 5,140,580m^3/year, Water Supply 1,635,257m^3/year, Live Stock 1,207,613m^3/year, (2035) Irrigation 11,401,184m^3/year, Water Supply 2,322,408 m^3/year, Live Stock 10,112,549 m^3/year 7A/7B/7C GBI- South Rukuru (95,298 ha)
		7B	(Present) Irrigation 2,156,585m^3/year, Water Supply 319,873m^3/year, Live Stock 530,735m^3/year, (2035) Irrigation 4,783,044m^3/year, Water Supply 275,751 m^3/year, Live Stock 4,444,368 m^3/year
		7C	(Present) Irrigation 1,428,583m^3/year, Water Supply 382,605m^3/year, Live Stock 307,016m^3/year, (2035) Irrigation 3,168,425m^3/year, Water Supply 486,469 m^3/year, Live Stock 2,274,066 m^3/year
		7D	(Present) Irrigation 3,601,147m^3/year, Water Supply 7,876,084m^3/year, Live Stock 812,176m^3/year, (2035) Irrigation 7,986,907m^3/year, Water Supply 27,970,199 m^3/year, Live Stock 6,706,054 m^3/year
		7E	(Present) Irrigation 2,291,854m^3/year, Water Supply 358,465m^3/year, Live Stock 472,424m^3/year, (2035) Irrigation 5,083,053m^3/year, Water Supply 369,330 m^3/year, Live Stock 3,357,800 m^3/year GBI- Mpherembe (29,273 ha)
		7F	(Present) Irrigation 775,155m^3/year, Water Supply 1,049,305m^3/year, Live Stock

			104,157m^3/year, (2035) Irrigation 1,719,199m^3/year, Water Supply 1,863,554 m^3/year, Live Stock 294,083 m^3/year
		7G	(Present) Irrigation 1,441,472m^3/year, Water Supply 206,886m^3/year, Live Stock 193,681m^3/year, (2035) Irrigation 3,197,011m^3/year, Water Supply 330,800 m^3/year, Live Stock 533,656 m^3/year
		7H	(Present) Irrigation 495,596m^3/year, Water Supply 149,452m^3/year, Live Stock 61,794m^3/year (2035) Irrigation 1,099,172m^3/year, Water Supply 248,997 m^3/year, Live Stock 114,199 m^3/year
18.	Water Balance	7A	Water Resources 224,351,962 m^3/year (Present) Deficit 3,741,177 m^3/year (Irrigation 3,008,707 m^3/year, Water Supply 355,733 m^3/year, Live Stock 376,737 m^3/year) (2035) Deficit 11,868,302 m^3/year (Irrigation 7,741,725 m^3/year, Water Supply 513,615 m^3/year, Live Stock 3,612,963 m^3/year)
		7B	Water Resources 322,744,877 m^3/year (Present) Deficit 1,303,487 m^3/year (Irrigation 1,073,914 m^3/year, Water Supply 70,653 m^3/year, Live Stock 158,920 m^3/year) (2035) Deficit 4,543,345 m^3/year (Irrigation 2,988,384 m^3/year, Water Supply 60,861 m^3/year, Live Stock 1,494,099 m^3/year)
		7C	Water Resources 400,910,912 m^3/year (Present) Deficit 1,081,148 m^3/year (Irrigation 881,839 m^3/year, Water Supply 102,578 m^3/year, Live Stock 96,731 m^3/year) (2035) Deficit 3,096,222 m^3/year (Irrigation 2,180,374 m^3/year, Water Supply 133,415 m^3/year, Live Stock 782,433 m^3/year)
		7D	Water Resources 325,938,354 m^3/year (Present) Deficit 487,515 m^3/year (Irrigation 355,395 m^3/year, Water Supply 40,936 m^3/year, Live Stock 91,184 m^3/year) (2035) Deficit 20,549,330 m^3/year (Irrigation 1,660,223 m^3/year, Water Supply 17,749,510 m^3/year, Live Stock 1,139,597 m^3/year)
		7E	Water Resources 440,234,468 m^3/year (Present) Deficit 1,795,235 m^3/year (Irrigation 1,544,805 m^3/year, Water Supply 95,112 m^3/year, Live Stock 155,318 m^3/year) (2035) Deficit 5,150,400 m^3/year (Irrigation 3,791,302 m^3/year, Water Supply 100,023 m^3/year, Live Stock 1,259,075 m^3/year)
		7F	Water Resources 519,409,018 m^3/year (Present) Deficit 673,943 m^3/year (Irrigation 379,404 m^3/year, Water Supply 266,573 m^3/year, Live Stock 27,965 m^3/year) (2035) Deficit 1,557,471 m^3/year (Irrigation 960,742 m^3/year, Water Supply 502,407 m^3/year, Live Stock 94,322 m^3/year)

		7G	Water Resources 890,473,088 m^3/year (Present) Deficit 653,539 m^3/year (Irrigation 573,462 m^3/year, Water Supply 40,810 m^3/year, Live Stock 39,267 m^3/year) (2035) Deficit 1,967,639 m^3/year (Irrigation 1,750,144 m^3/year, Water Supply 79,755 m^3/year, Live Stock 137,741 m^3/year)
		7H	Water Resources 72,589,801 m^3/year (Present) Deficit 667,948 m^3/year (Irrigation 495,478 m^3/year, Water Supply 122,018 m^3/year, Live Stock 50,451 m^3/year) (2035) Deficit 1,395,438 m^3/year (Irrigation 1,098,911 m^3/year, Water Supply 203,291 m^3/year, Live Stock 93,236 m^3/year)
19.	Water Resources Development Facilities	7A	Karuwela, Thanthe, Mzimba & Munjiri P. Damsites→Dam+Weir+M.Pump/Canal+I.Res
		7B	S.Dam+Weir+M.Pump/Canal+I.Res
		7C	Weir+M.Pump/Canal+I.Res
		7D	Weir+M.Pump/Canal+I.Res
		7E	S.Dam+Weir+M Pump/Canal+I.Res
		7F	Rumphi P. Damsite→S.Dam+Weir+M.Pump/Canal+I.Res
		7G	Henga & Lower Fufu P. Damsites→Weir+M.Pump/Canal+I.Res
		7H	Nil

Fact Sheet for WRA 8 (8A)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		North Rukuru (North Rukuru River Bain)
2	WRA (WRU)		WRA8 (8A)
3	Catchment Area(km^2)		2,091
4	Topography	Upper	
		Middle	
		Lower	
5	Annual Rainfall		1285mm
6	Land Use in 2010 I.A = Irrigation Area		Forest: 1,233.6km^2 (59.2%), Bush/Grassland: 341.0km^2 (16.4%), Wetland: 5.4km^2 (0.3%), Rain fed Farmland: 502.3km^2 (24.1%), Total: 2,082.3km^2, I.A = 445 ha
7	Population in 2008		72,540 persons
8	Major Cities/Towns		Nthalire TC (Rural MC)
9.	Existing Water Supply System and Scheme		
10.	Existing irrigation System		
11.	Existing Hydropower Plant & Electric Supply		No hydropower plant Transmission lines from Karonga to Chitipa No substation
12.	Industrial Areas		
13.	Estate/Village		KAYEREKELA (KARONGA) Ville. was surveyed.
14.	Water Supply Development		
15.	Hydropower Development		No project (New transmission line from Lilongwe to Songwe will pass)
16	Monitoring System		
	Rainfall Gauge		No rainfall gauge
	Stream Gauge		8A5 (North Rukuru at Mwakimeme): monitored period; 40 years, drainage area; 1,860 km^2, average dry-season flows: Q_{75} = 4.297 m^3/s & Q_{97} = 2.729 m^3/s 8A8 (North Rukuru at Uledi): monitored period; 16 years, drainage area; 1,244 km^2, average dry-season flows: Q_{75} = 2.450 m^3/s & Q_{97} = 1.535 m^3/s
	Monitoring Well		GN168 (Karonga Well Field): not monitored because of vandalizing.
	Water Quality		<Surface Water> 8A8(North Rukuru River): Monitored date in rainy season; 6-Mar-2013, in dry season; 14-Aug-2013 pH=[7.69](7.29), Temp=[25.7](22.2)°C, EC=[47](38)µs/cm, TDS=[24](19)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[9](12)mg/l, Cl^-=[7](3.6)mg/l, SO_4^{2-}=[3.1](2.98)mg/l, NO_3^-=[0.001](0.001)mg/l, F^-=[0.32](0.9)mg/l, Na^+=[3](2)mg/l, K^+=[1](0.7)mg/l, Ca^{2+}=[3.4](3.2)mg/l, Mg^{2+}=[1](1)mg/l, Fe^{2+}=[0.413](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[13](12)mg/l, Alkalinity=[7](9)mg/l, Turbidity=[60](0.4)NTU, SS=[25](6)mg/l, PO_4^{3-}=[0.049](1.089)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[5.7](7.2)mg/l, BOD=[2.6](9.5)mg/l, COD=[86](22.7)mg/l, F.Coliform=[2220](150)nos./100ml, , F.Steptococci=[960](50)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
17.	Water Demand		(Present) Irrigation 4,088,837m^3/year, Water Supply 444,747m^3/year, Live Stock 388,793m^3/year,

		(2035) Irrigation 9,647,253m^3/year, Water Supply 484,070 m^3/year, Live Stock 755,841 m^3/year
18.	Water Balance	Water Resources 463,782,084 m^3/year (Present) Deficit 1,546,958 m^3/year (Irrigation 1,417,089 m^3/year, Water Supply 61,696 m^3/year, Live Stock 68,172 m^3/year) (2035) Deficit 4,065,491 m^3/year (Irrigation 3,834,971 m^3/year, Water Supply 67,191 m^3/year, Live Stock 163,330 m^3/year)
19.	Water Resources Development Facilities	North Rukuru P. Damsite (L/R)→S.Dam+Weir+M. Pumps+I.Res

Fact Sheet for WRA 9

No	Basin Parameters	Sub-Areas		Particular Features of Basin/Sub-Basin
1	Name of Catchment			Songwe/Lufira (Songwe and Lufira River Basin)
2	WRA (WRU)			WRA9 (9A, 9B)
3	Catchment Area	Songwe R.B. (9B)		4,215 km^2 (45 % in Malawi, 55 % in Tanzania)
		Lufira R.B.(9A)		1,790
4	Topography	9B	Upper	The Songwe headwaters is composed of Hills and Plateau of which elevation ranges from 1,200 m to 1,600 m with the highest point of 1,970 m. There are numerous wetlands in the flatter areas. The Northeastern areas are sub-catchments of the Itumba and Mwati river basins located in Tanzania. Their elevation ranges from 1,200 m to 2,300 m.
			Middle	On the right bank, there are sub-catchment of the Kaseya River and lies mainly between 1,200 m and 1,350 m. The plain is very flat and extends in the form of wetlands (dambos). On the left bank and on the right bank after confluence of the Kaseya River, hilly areas extends with an elevation ranging from 750 m to 1,800 m. There are numerous steep streams draining directly into the Songwe River.
			Lower	After escarpment with an elevation of 600 m to 1,000 m, the Songwe River enters the floodplain with flat to very gentle slopes, ranging in elevation from 475 m to 550 m. There are well-developed natural levee on the alluvium.
		9A	Upper –Mid.	
			Lower	
5	Annual Rainfall	Songwe(9B)		1033mm
		Lufira(9A)		1101mm
6	Land Use in 2000 (under estimation of land use changes) I.A = Irrigation Area	WRA9		Forest: 1,106.2km^2 (30.2%), Bush/Grassland: 187.3km^2 (5.1%), Wetland: 144.5km^2 (3.9%), Rain fed Farmland: 2,225.6km^2 (60.8%), Total: 3,663.6km^2
		9A		Forest: 745.1km^2 (42.8%), Bush/Grassland: 176.5km^2 (10.2%), Wetland: 27.3km^2 (1.6%), Rain fed Farmland: 790.3km^2 (45.4%), Total: 1,739.0km^2 LA=1,367 ha
		9B		Forest: 361.2km^2 (18.8%), Bush/Grassland: 10.9km^2 (0.6%), Wetland: 117.2km^2 (6.1%), Rain fed Farmland: 1,435.4km^2 (74.6%), Total: 1,924.6km^2 LA=752 ha
7	Population in 2002			WRA9: 247,659 persons 9A: 110,021 persons; 9B: 137,638 persons
8	Major Cities/Towns			9A: - 9B: Citipa (District MC, Population: 179,072 in 2008), Misuku (Rural MC), Kaporo (Rural MC)
9	Existing Water Supply	9B	Upper	Lacking reliable and safe water sources for domestic water use
			Middle	Piped water system in 46 villages of Mwenechendo TA utilizing Mafinga hills as water source
			Lower	Gravity and natural water for their domestic water sources
		9A	Upper-Mid.	
			Lower	
10	Existing	9B	Upper	Maize as the main crop for irrigation Operational three small-scale schemes in Chitipa district using motorized

	Irrigation System			pumps under the supervision of farmers' group
			Middle	Pumped water irrigation from rivers in most part of Chitipa Small-scale irrigation scheme in Ibanda village covering 62 households
			Lower	Mainly rainfed cultivation
		9A	Upper-Mid.	
			Lower	
11	Existing Hydropower Plant & Electric Supply		9B	No hydropower plant Two electric transmission lines to Chitipa town and to the lakeshore Chipita Substation
			9A	No hydropower plant Two electric transmission lines to Chitipa town and to the lakeshore No substation
12	Industrial Areas		9B	No industrial areas
			9A	
13	Estate/Village		9B	NJENGA, NANDUNDA & CHINUKHA (CHITIPA) Villages were surveyed. Two GBI projects: Chitipa and Karonga/Kaporo, total area of 53,165 ha
			9A	MWANJASI (KARONGA) & CHENDO (CHITIPA) Villages were surveyed.
14	Water Supply Development		9B	under studying
			9A	
15	Hydropower Development		9B	Manolo (Lower Songwe), Sofwe (Middle Songwe), Bupigu (Upper Songwe) multi-purpose dam project New transmission line from Lilongwe to new substation near the Manolo (Lower Songwe substation) which will extend to Tanzania
			9A	New transmission line from Lilongwe to Songwe will pass
16	Monitoring System			
	9B	Rainfall Gauge	Upper	Upper: Kameme
			Middle	Middle: Chipta (monitored period: 1957 – 2011)
			Lower	Lower: Misuku (monitored period: 1946 – 1957, 1976 – 1989)
		Stream Gauge	Upper	9B6 (Ipenza): monitored period; 28 years, drainage are; 815 km^2, average dry-season flows: Q_{75} = 0.705 m^3/s & Q_{97} = 0.325 m^3/s
			Middle	9B4 (Ichinga): monitored period; 21 years, drainage are; 3,140 km^2, average dry-season flows: Q_{75} = 0.000 m^3/s & Q_{97} = 0.000 m^3/s
			Lower	9B7 (Mwandenga): monitored period; 25 years, drainage are; 3,864 km^2, average dry-season flows: Q_{75} = 12.185 m^3/s & Q_{97} = 8.656 m^3/s
		Monitoring Well	Upper	GN174(Chitipa W/Office): monitored period; 4 years, the highest G.W.L; 4.94m, the lowest G.W.L; 7.12m, the range of periodic fluctuation is about 2m. GN175 (Chitipa Well Field): not monitored because of vandalizing.
			Lower	No monitoring well
			Middle	No monitoring well
		Water Quality	Upper	<Surface Water> 9B4(Songwe River): Monitored date in rainy season; 6-Mar-2013, in dry season; 15-Aug-2013 pH=[7.43](7.31), Temp=[28.5](17.4)°C, EC=[83](97)µs/cm, TDS=[42](50)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[13](33)mg/l, Cl^-=[10](6.6)mg/l, SO_4^{2-}=[10.3](8.45)mg/l, NO_3^-=[0.038](0.001)mg/l, F^-=[0.41](0.69)mg/l, Na^+=[8](7)mg/l, K^+=[2.8](2.3)mg/l, Ca^{2+}=[4](7)mg/l, Mg^{2+}=[1](2.5)mg/l, Fe^{2+}=[1.19](0.038)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[16](27)mg/l, Alkalinity=[11](27)mg/l, Turbidity=[120](14)NTU, SS=[59](24)mg/l, PO_4^{3-}=[0.111](1.185)mg/l, Cu^{2+}=[0.003](0.001)mg/l, DO=[6](6.6)mg/l,

				BOD=[2.2](0.8)mg/l, COD=[70](2.4)mg/l, F.Coliform=[3450](520)nos./100ml, , F.Steptococci=[370](80)nos.100ml <Groundwater> GN175(Chitipa Well Field): Monitored date in rainy season; 6-Mar-2013, in dry season; 15-Aug-2013 pH=[6](6.94), Temp=[25.6](24.2)°C, EC=[78](99)µs/cm, TDS=[39](53)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[17](32)mg/l, Cl^-=[10.8](9.9)mg/l, SO_4^{2-}=[5.05](5.07)mg/l, NO_3^-=[0.092](0.001)mg/l, F^-=[0.58](0.6)mg/l, Na^+=[9](9)mg/l, K^+=[0.4](5.8)mg/l, Ca^{2+}=[4](5)mg/l, Mg^{2+}=[1.2](1)mg/l, Fe^{2+}=[0.026](1.43)mg/l, Mn^{2+}=[0.001](0.42)mg/l, Hardness=[14](19)mg/l, Alkalinity=[13](16)mg/l, Turbidity=[2](1)NTU, SS=[0.1](14)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[4.8](6.8)mg/l, BOD=[3.1](5.1)mg/l, COD=[9](19.6)mg/l, F.Coliform=[98](2)nos./100ml, , F.Steptococci=[50](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
			Lower	No monitoring
			Middle	No monitoring
	9A	Rainfall Gauze	Upper-Mid	No rainfall gauge
			Lower	Karonga (monitored period: 1961-2011)
		Stream gauge	Upper-Mid.	9A9 (Sekwa at Wenga): monitored period; 18 years, drainage are; 84 km^2, average dry-season flows: Q_{75} = 0.173 m^3/s & Q_{97} = 0.091 m^3/s 9A4 (Lufira at Chilanga): monitored period; 18 years, drainage are; 774 km^2, average dry-season flows: Q_{75} = 0.912 m^3/s & Q_{97} = 0.333 m^3/s
			Lower	9A2 (Lufira at Ngerenge): monitored period; 30 years, drainage are; 1,410 km^2, average dry-season flows: Q_{75} = 2.134 m^3/s & Q_{97} = 0.882 m^3/s
		Monitoring Well	Upper-Mid.	No monitoring well
			Lower	No monitoring well
		Water Quality	Upper-Mid.	No monitoring
			Lower	No monitoring
17	Water Demand	Irrigation	9B	(Present) 13,779,900 m^3/year, (2035) 24,061,743 m^3/year GBI-Chitipa (19,833 ha), 9A/9 B/17A GBI-Karonga/Kaporo (36,451 ha)
			9A	(Present) 7,573,930 m^3/year, (2035) 13,225,201 m^3/year
		Water Supply	9B	(Present) 425,746 m^3/year (2035) 456,291 m^3/year
			9A	(Present) 386,058 m^3/year (2035) 406,368 m^3/year
		Live Stock	9B	(Present) 1,245,224 m^3/year (2035) 2,454,139 m^3/year
			9A	(Present) 684,835 m^3/year (2035)

				1,054,352 m^3/year
		Hydropower	9B	
			9A	
18	Water Balance		9B	Water Resources 277,369,222 m^3/year (Present) Deficit 11,079,318 m^3/year (Irrigation 10,319,098 m^3/year, Water Supply 135,902 m^3/year, Live Stock 624,318 m^3/year) (2035) Deficit 20,669,459 m^3/year (Irrigation 19,268,446 m^3/year, Water Supply 145,776 m^3/year, Live Stock 1,255,236 m^3/year)
			9A	Water Resources 239,013,390 m^3/year (Present) Deficit 5,975,102 m^3/year (Irrigation 5,501,317 m^3/year, Water Supply 133,652 m^3/year, Live Stock 340,132 m^3/year) (2035) Deficit 11,128,497 m^3/year (Irrigation 10,444,714 m^3/year, Water Supply 140,720 m^3/year, Live Stock 543,064 m^3/year)
19	Water resources Development Facilities		9B	Bupigu (U. Songwe), Sofwe (M. Songwe), Manolo (L. Songwe) & Kyungu P. Damsites→ Dams+Weir+M Pump/Canal+I.Res
			9A	Lufilya P. Damsite→ Dams+Weir+M.Pump/Canal+I.Res

Fact Sheet for WRA 10 (10A)

No	Basin Parameters	Particular Features of Basin/Sub-Basin
1	Name of Catchment	South East Lakeshore (7 major river basins)
2	WRA (WRU)	WRA10 (10A)
3	Catchment Area(km^2)	1,540
4	Topography	
5	Annual Rainfall	874mm
6	Land Use in 2010 I.A = Irrigation Area	Forest: 763.2km^2 (46.1%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 43.1km^2 (2.6%), Rain fed Farmland: 848.1km^2 (51.3%), Total: 1,654.4km^2 , I.A = 531 ha
7	Population in 2008	172,909 persons
8	Major Cities/Towns	Makanjila (Rural MC), Malindi (Rural MC)
9.	Existing Water Supply System and Scheme	
10.	Existing irrigation System	
11.	Existing Hydropower Plant & Electric Supply	No hydropower plant Transmission lines from Mangochi No substation
12.	Industrial Areas	
13.	Estate/Village	
14.	Water Supply Development	
15.	Hydropower Development	No project
16	Monitoring System	
	Rainfall Gauge	Makanjila (monitored period: 1957-1989)
	Stream Gauge	No representative stream gauge
	Monitoring Well	No monitoring well
	Water Quality	No monitoring
17.	Water Demand	(Present) Irrigation 7,607,614 m^3/year, Water Supply 666,321 m^3/year, Livestock 448,055m^3/year, (2035) Irrigation 15,040,500m^3/year, Water Supply 611,872 m^3/year, Live Stock 1,029,607 m^3/year
18.	Water Balance	Water Resources 54,654,646 m^3/year (Present) Deficit 6,490,039 m^3/year (Irrigation 6,099,818 m^3/year, Water Supply 183,292 m^3/year, Livestock 206,929 m^3/year) (2035) Deficit 13,312,054 m^3/year (Irrigation 12,590,345 m^3/year, Water Supply 167,159 m^3/year, Livestock 554,549 m^3/year)
19.	Water Resources Development Facilities	Weir+M. Pumps+I.Res

Fact Sheet for WRA 11 (11A)

No	Basin Parameters	Particular Features of Basin/Sub-Basin
1	Name of Catchment	Lake Chiuta
2	WRA (WRU)	WRA11 (11A)
3	Catchment Area(km^2)	2,462
4	Topography	
5	Annual Rainfall	941mm
6	Land Use in 2010 I.A = Irrigation Area	Forest: 464.0km^2 (19.1%), Bush/Grassland: 7.7km^2 (0.3%), Wetland: 301.9km^2 (12.4%), Rainfed Farmland: 1,657.6km^2 (68.2%), Total: 2,431.2km^2, I.A = 1,160 ha
7	Population in 2008	451,701 persons
8	Major Cities/Towns	Namwera (Rural MC), Chikweo (Rural MC), Nayuchi (Rural MC)
9.	Existing Water Supply System and Scheme	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	Namankhandwe (1.6ha) & Salimu 1 (2.1ha) schemes. The former is tredle pump and the latter is gravity fed
11.	Existing Hydropower Plant & Electric Supply	No hydropower plant Transmission lines from Mangochi and Ntaja to country boudary No substation
12.	Industrial Areas	
13.	Estate/Village	NAMANGADWE (MANGOCHI) Estate was surveyed. CHIKOJA, MACHEMBA & SABILI (MANGOCHI) Villages were surveyed.
14.	Water Supply Development	
15.	Hydropower Development	No project
16	Monitoring System	
	Rainfall Gauge	Namwera (monitored period: 1927-1941, 1943-1990,) Chikweo (monitored period: 1982-2010)
	Stream Gauge	11A6 (Lusangwisi at Nambande Estate): monitored period; 21 years, drainage area; 86.5 km^2, average dry-season flows: Q_{75} = 0.152 m^3/s & Q_{97} = 0.034 m^3/s 11A7 (Masongola at Namwera): monitored period; 22 years, drainage area; 16.2 km^2, average dry-season flows: Q_{75} = 0.046 m^3/s & Q_{97} = 0.017 m^3/s
	Monitoring Well	GN203(Namwera Well Field): monitored period; 4 years, the highest G.W.L; 2.30m, the lowest G.W.L; 10.50m, the range of periodic fluctuation is unclear. The groundwater table is strongly influenced by pumping.
	Water Quality	<Surface Water> No monitoring <Groundwater> GN203(Namwera Well Field): Monitored date in rainy season; 15-Mar-2013, in dry season; 31-Jul-2013 pH=[7.4](7.63), Temp=[25.6](24.9)°C, EC=[113](126)µs/cm, TDS=[59](70)mg/l, CO_3^{2-}=[0](7.2)mg/l, HCO_3^{2-}=[55](44)mg/l, Cl^-=[6.9](3.4)mg/l, SO_4^{2-}=[0.1](3.51)mg/l, NO_3^-=[0.065](0.001)mg/l, F^-=[0.12](0.64)mg/l, Na^+=[3](4)mg/l, K^+=[8.5](8.4)mg/l, Ca^{2+}=[9.3](8.8)mg/l, Mg^{2+}=[3.5](4.2)mg/l, Fe^{2+}=[0.001](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[37](39)mg/l, Alkalinity=[45](47)mg/l, Turbidity=[4](0.7)NTU, SS=[3](0.1)mg/l, Cu^{2+}=[0.006](0.001)mg/l, DO=[4.8](3.2)mg/l, BOD=[2](21)mg/l, COD=[9](74.5)mg/l, F.Coliform=[212](0)nos./100ml, , F.Steptococci=[9](0)nos.100ml note: [ ]; Rainy season, ( ); dry season

17.	Water Demand	(Present) Irrigation 18,003,753m^3/year, Water Supply 1,264,529m^3/year, Live Stock 1,480,764m^3/year (2035) Irrigation 65,188,924m^3/year, Water Supply 1,308,240 m^3/year, Live Stock 1,867,380 m^3/year 2C/2D/11A GBI- Lake Chirwa/Chiuta (86,100 ha)
18.	Water Balance	Water Resources 286,257,031 m^3/year (Present) Deficit 14,398,240 m^3/year (Irrigation 13,302,074 m^3/year, Water Supply 387,610 m^3/year, Live Stock 708,556 m^3/year) (2035) Deficit 55,555,922 m^3/year (Irrigation 54,080,038 m^3/year, Water Supply 401,501 m^3/year, Live Stock 1,074,382 m^3/year)
19.	Water Resources Development Facilities	S.Dams+Weir+M.Pump/Canal+I.Res

Fact Sheet WRA 14 (14A-14D)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Ruo (Ruo River Basin)
2	WRA (WRU)		WRA14 (14A, 14B, 14C, 14D)
3	Catchment Area (km^2)		WRA14: 3,494 — 14A: 513; 14B: 1,645; 14C: 1,066; 14D: 270
4	Topography	Upper	
		Middle	
		Lower	
5	Annual Rainfall		WRA14: 1436mm — 14A: 1145mm; 14B: 1306mm; 14C: 1878mm; 14D: 1060mm
6	Land Use in 2010 I.A = Irrigation Area	WRA14	Forest: 312.7km^2 (9.2%), Bush/Grassland: 128.8km^2 (3.8%), Wetland: 62.0km^2 (1.8%), Rain fed Farmland: 2,910.0km^2 (85.3%), Total: 3,413.5km^2, I.A = 14,749 ha
		14A	Forest: 17.2km^2 (3.6%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 0.0km^2 (0.0%), Rain fed Farmland: 463.0km^2 (96.4%), Total: 480.2km^2, I.A = 1,580 ha
		14B	Forest: 85.7km^2 (5.0%), Bush/Grassland: 30.2km^2 (1.8%), Wetland: 45.5km^2 (2.7%), Rain fed Farmland: 1,541.0km^2 (90.5%), Total: 1,702.5km^2, I.A = 7,577 ha
		14C	Forest: 209.1km^2 (21.2%), Bush/Grassland: 98.7km^2 (10.0%), Wetland: 13.5km^2 (1.4%), Rain fed Farmland: 666.5km^2 (67.5%), Total: 987.8km^2, I.A = 4,570 ha
		14D	Forest: 0.7km^2 (0.3%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 2.9km^2 (1.2%), Rain fed Farmland: 239.5km^2 (98.5%), Total: 243.0km^2, I.A = 1,021 ha
7	Population in 2008		WRA14: 1,175,500 persons — 14A: 288,017 persons; 14B: 506,634 persons; 14C: 307,931 persons; 14D: 72,918 persons
8	Major Cities/Towns		14A: - 14B: Thyolo (District MC, Population: 587,455 in 2008), Luchenza (Rural MC) 14C: Mulanje (District MC, Population: 5255,429 in 2008), Muloza (Rural MC) 14D: Thekerani (Rural MC)
9.	Existing Water Supply System and Scheme	14A	Limbe Zone of BWB (Blantyre City, Blantyre Rural)
		14B	
		14C	
		14D	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	14A	
		14B	
		14C	
		14D	
11.	Existing Hydropower Plant & Electric Supply	14A	No hydropower plant Transmission lines from Blantyre to Chiradzulu town and to Mulanje town Chigumula substation
		14B	No hydropower plant Transmission lines from Blantyre to Thyolo town and to Mulanje town Fundis substation
		14C	No hydropower plant Transmission lines from Blantyre to Mulanje town and country boundary No substation

		14D	No hydropower plant Transmission lines from Thyolo to Bangula No substation
12.	Industrial Areas		
13.	Estate/Village	14A	MULEVISA (THYOLO) Ville. was surveyed.
		14B	More than 30 Estates were surveyed. NKOLOKOSA (THYOLO) Ville. was surveyed.
		14C	More than 20 Estates were surveyed. MWANAMVULA & NAMWERA (MULANJE) Villages were surveyed.
		14D	PRESS AGRICULTURE has two Estates.
14.	Water Supply Development	14A	
		14B	
		14C	
		14D	
15.	Hydropower Development	14A	No project
		14B	No project
		14C	No project
		14D	Zoa Falls hydropower project
16	Monitoring System		
	Rainfall Gauge	14A	No rainfall gauge
		14B	Thyolo (monitored period: 1960-2011) Luchenza (monitored period: 1959-1965, 1967-1990)
		14C	Mimosa (monitored period: 1958-2011) Mulanje (monitored period: 1923-1944, 1980-1990)
		14D	No rainfall gauge
	Stream Gauge	14A	No representative stream gauge
		14B	14B2 (Thuchila at Chonde): monitored period; 45 years, drainage area; 1,440 km^2, average dry-season flows: Q_{75} = 0.971 m^3/s & Q_{97} = 0.391 m^3/s
		14C	14C2 (Ruo at M1 Roadbridge (Nsuwadzi)): monitored period; 50 years, drainage area; 193 km^2, average dry-season flows: Q_{75} = 2.876 m^3/s & Q_{97} = 0.930 m^3/s 14C8 (Lichenya at Milonde): monitored period; 35 years, drainage area; 325 km^2, average dry-season flows: Q_{75} = 4.050 m^3/s & Q_{97} = 2.029 m^3/s
		14D	14D1 (Ruo at Sinoya South): monitored period; 11 years, drainage area; 4,640 km^2, average dry-season flows: Q_{75} = 13.616 m^3/s & Q_{97} = 7.204 m^3/s 14D2 (Ruo at Sinoya): monitored period; 0 years, drainage area; 4,640 km^2, average dry-season flows: Q_{75} = - m^3/s & Q_{97} = - m^3/s 14D3 (Ruo at Sandama): monitored period; 11 years, drainage area; 3,710 km^2, average dry-season flows: Q_{75} = 0.751 m^3/s & Q_{97} = 0.535 m^3/s
	Monitoring Well	14A	DM131 (Mzedi Dumping Site): not monitored because of vandalizing.
		14B	No monitoring well
		14C	DM148(Mulanje W/Office): monitored period; 2 years, the highest G.W.L; 4.50m, the lowest G.W.L; 8.35m, the range of periodic fluctuation is about 3m.
		14D	No monitoring well
	Water Quality	14A	No monitoring
		14B	<Surface Water> 14B4(Nsuwadzi River): Monitored date in rainy season; 16-Mar-2013, in dry season; 1-Aug-2013 pH=[7.4](7.23), Temp=[24.1](23.4)°C, EC=[150](144)µs/cm, TDS=[74](84)mg/l, CO_3^{2-}=[0](7.2)mg/l, HCO_3^{2-}=[52](48)mg/l, Cl^-=[20.3](6)mg/l, SO_4^{2-}=[1.6](6.41)mg/l, NO_3^-=[0.006](0.001)mg/l, F^-=[0.01](0.49)mg/l, Na^+=[12](8)mg/l, K^+=[1.4](1.3)mg/l, Ca^{2+}=[10](11.4)mg/l, Mg^{2+}=[4](5)mg/l, Fe^{2+}=[1.42](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[43](49)mg/l, Alkalinity=[42](51)mg/l, Turbidity=[270](18)NTU, SS=[267](12)mg/l, PO_4^{3-}=[0.077](0.001)mg/l, Cu^{2+}=[0.007](0.001)mg/l, DO=[8](7.2)mg/l, BOD=[6](8.2)mg/l, COD=[60](27.8)mg/l, F.Coliform=[1020](1,132)nos./100ml, , F.Steptococci=[520](120)nos.100ml

			<Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		14C	<Surface Water> 14C2(Ruo River): Monitored date in rainy season; 16-Mar-2013, in dry season; 1-Aug-2013 pH=[7](7.8), Temp=[24.9](21.2)°C, EC=[27](29)µs/cm, TDS=[14](18)mg/l, CO_3^{2-}=[0](1.2)mg/l, HCO_3^{2-}=[9](4)mg/l, Cl^-=[3.5](3.2)mg/l, SO_4^{2-}=[0.56](2.1)mg/l, NO_3^-=[0.001](0.28)mg/l, F^-=[0.1](0.19)mg/l, Na^+=[2](1.8)mg/l, K^+=[0.4](0.8)mg/l, Ca^{2+}=[2](2.6)mg/l, Mg^{2+}=[0.8](0.2)mg/l, Fe^{2+}=[0.018](0.56)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[8](8.8)mg/l, Alkalinity=[7](6.1)mg/l, Turbidity=[8](2)NTU, SS=[7](1)mg/l, PO_4^{3-}=[0.001](0.068)mg/l, Cu^{2+}=[0.007](0.001)mg/l, DO=[7.3](6.8)mg/l, BOD=[3](6.35)mg/l, COD=[11](18.8)mg/l, F.Coliform=[2400](432)nos./100ml, , F.Steptococci=[170](176)nos.100ml 14C8(Lichenya River): Monitored date in rainy season; 16-Mar-2013, in dry season; 1-Aug-2013 pH=[7.4](8.44), Temp=[23.8](20.2)°C, EC=[48](51)µs/cm, TDS=[24](26)mg/l, CO_3^{2-}=[0](1.8)mg/l, HCO_3^{2-}=[14](10)mg/l, Cl^-=[7.2](7.8)mg/l, SO_4^{2-}=[0.38](0.7)mg/l, NO_3^-=[0.012](0.001)mg/l, F^-=[0.44](0.15)mg/l, Na^+=[6](4.3)mg/l, K^+=[0.3](0.58)mg/l, Ca^{2+}=[2.5](3.9)mg/l, Mg^{2+}=[0.8](1)mg/l, Fe^{2+}=[0.063](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[9](14)mg/l, Alkalinity=[11](11)mg/l, Turbidity=[6](0.8)NTU, SS=[5](0.1)mg/l, PO_4^{3-}=[0.001](0.001)mg/l, Cu^{2+}=[0.007](0.001)mg/l, DO=[6](8.6)mg/l, BOD=[3](6.25)mg/l, COD=[10](14.9)mg/l, F.Coliform=[1480](28)nos./100ml, , F.Steptococci=[225](4)nos.100ml <Groundwater> DM148(Mulanje W/Office): Monitored date in rainy season; 16-Mar-2013, in dry season; 1-Aug-2013 pH=[7.4](6.9), Temp=[24.7](26.3)°C, EC=[130](134)µs/cm, TDS=[67](83)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[58](49)mg/l, Cl^-=[11.8](6.9)mg/l, SO_4^{2-}=[0.1](11.7)mg/l, NO_3^-=[0.083](0.001)mg/l, F^-=[0.18](1.21)mg/l, Na^+=[10](8)mg/l, K^+=[3.4](3)mg/l, Ca^{2+}=[8.1](10.8)mg/l, Mg^{2+}=[4](4.2)mg/l, Fe^{2+}=[0.036](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[36](44)mg/l, Alkalinity=[47](40)mg/l, Turbidity=[3](2)NTU, SS=[2](2)mg/l, Cu^{2+}=[0.005](0.001)mg/l, DO=[4.2](2.5)mg/l, BOD=[1](45)mg/l, COD=[8](110)mg/l, F.Coliform=[89](172)nos./100ml, , F.Steptococci=[5](16)nos.100ml note: [ ]; Rainy season, ( ); dry season
		14D	No monitoring
17.	Water Demand	14A	(Present) Irrigation 7,951,499m^3/year, Water Supply 963,280m^3/year, Live Stock 882,411m^3/year, (2035) Irrigation 15,146,026 m^3/year, Water Supply851,066 m^3/year, Live Stock 1,609,115 m^3/year
		14B	(Present) Irrigation 37,998,350m^3/year, Water Supply 1,910,856m^3/year, Live Stock 1,965,546m^3/year, (2035) Irrigation 72,379,307m^3/year, Water Supply 1,569,640 m^3/year, Live Stock 3,080,727 m^3/year
		14C	(Present) Irrigation 22,998,383m^3/year, Water Supply 1,878,853m^3/year, Live Stock 738,721m^3/year, (2035) Irrigation 43,807,350m^3/year, Water Supply 2,273,218 m^3/year, Live Stock 1,122,014 m^3/year

		14D	(Present) Irrigation 5,061,614m^3/year, Water Supply 290,840m^3/year, Live Stock 259,548m^3/year, (2035) Irrigation 9,641,368m^3/year, Water Supply 124,350 m^3/year, Live Stock 435,441 m^3/year
18.	Water Balance	14A	Water Resources 43,582,371 m^3/year (Present) Deficit 7,996,787 m^3/year (Irrigation 7,141,324 m^3/year, Water Supply 401,855 m^3/year, Live Stock 453,608 m^3/year) (2035) Deficit 15,111,447 m^3/year (Irrigation 13,852,827 m^3/year, Water Supply 353,083 m^3/year, Live Stock 905,537 m^3/year)
		14B	Water Resources 436,774,044 m^3/year (Present) Deficit 34,348,177 m^3/year (Irrigation 32,978,119 m^3/year, Water Supply 593,974 m^3/year, Live Stock 776,085 m^3/year) (2035) Deficit 66,306,304 m^3/year (Irrigation 64,470,615 m^3/year, Water Supply 485,833 m^3/year, Live Stock 1,349,856 m^3/year)
		14C	Water Resources 577,492,318 m^3/year (Present) Deficit 20,643,003 m^3/year (Irrigation 19,702,410 m^3/year, Water Supply 653,200 m^3/year, Live Stock 287,393 m^3/year) (2035) Deficit 39,438,092 m^3/year (Irrigation 38,203,935 m^3/year, Water Supply 791,499 m^3/year, Live Stock 442,657 m^3/year)
		14D	Water Resources 1,037,137,218 m^3/year (Present) Deficit 4,729,712 m^3/year (Irrigation 4,515,588 m^3/year, Water Supply 113,149 m^3/year, Live Stock 100,975 m^3/year) (2035) Deficit 8,931,098 m^3/year (Irrigation 8,709,057 m^3/year, Water Supply 49,059 m^3/year, Live Stock 172,983 m^3/year)
19.	Water Resources Development Facilities	14A	Dams+Weir+Canal+I.Res
		14B	Tuchila & Nswadzi P. Damsites→Dams+Weir+Canal+I.Res
		14C	Dams+Weir+Canal+I.Res
		14D	Dams+Weir+Canal+I.Res

Fact Sheet WRA 15 (15A-15C)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Nkhata-kota Lakeshore (3 major river basins)
2	WRA (WRU)		WRA15 (15A, 15B, 15C)
3	Catchment Area (km^2)		WRA15: 4,949 / 15A: 2,293 / 15B: 2,458 / 15C: 198
4	Topography	15A	Lower: Upper
		15B	Lower: Upper
		15C	
5	Annual Rainfall		WRA15: 1139mm / 15A: 1004mm / 15B: 1243mm / 15C: 1305mm
6	Land Use in 2010 I.A = Irrigation Area	WRA15	Forest: 900.7km^2 (18.8%), Bush/Grassland: 54.1km^2 (1.1%), Wetland: 244.0km^2 (5.1%), Rain fed Farmland: 3,605.0km^2 (75.1%), Total: 4,803.8km^2 I.A = 6,589 ha
		15A	Forest: 61.7km^2 (2.9%), Bush/Grassland: 54.1km^2 (2.5%), Wetland: 94.9km^2 (4.4%), Rain fed Farmland: 1,934.0km^2 (90.2%), Total: 2,144.7km^2 I.A = 1,241 ha
		15B	Forest: 735.5km^2 (30.0%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 125.1km^2 (5.1%), Rain fed Farmland: 1,590.5km^2 (64.9%), Total: 2,451.1km^2 I.A = 4,996 ha
		15C	Forest: 103.5km^2 (49.8%), Bush/Grassland: 0.0km^2 (0.0%), Wetland: 24.0km^2 (11.5%), Rain fed Farmland: 80.5km^2 (38.7%), Total: 208.0km^2 I.A = 351 ha
7	Population in 2008		WRA15: 614,635 persons / 15A: 326,867 persons / 15B: 255,865 persons / 15C: 31,903 persons
8	Major Cities/Towns		15A: Dowa (District MC, Population: 556,678 in 2008), Khombeza (Rural MC) 15B: Nkhotakota (District MC, Population: 301,868 in 2008), Ntchisi (District MC, Population: 224,098 in 2008), Mwansambo (Rural MC) 15C: -
9.	Existing Water Supply System and Scheme	15A	GBI Pilot-Lingadzi/lipimbi (530 ha) ; Sugar cane
		15B	Nango (0.8ha) & Kaombe (43.6ha) gravity fed schemes. Chimbetete (7ha) & Mpamantha (150ha) schemes. Both are adequate water supply. The latter is gravity fed.
		15C	Chikazo (5ha) treadle pump scheme.
10.	Existing irrigation System Only the schemes with GIS data are shown here.	15A	
		15B	
		15C	
11.	Existing Hydropower Plant & Electric Supply	15A	No hydropower plant Transmission lines from Salima to Nkhotakota, from Lilongwe to Salima, and from Lilongwe to Ntchisi via Dowa town No substation
		15B	No hydropower plant Transmission lines from Salima to Nkhota Bay via Nkhotakota and from Nkhotakota to Kasungu town Nkhotakota substation
		15C	No hydropower plant Transmission lines from Nkhotakota to Nkhota Bay and from Nkhotakota to

			Dwanga. No substation
12.	Industrial Areas		
13.	Estate/Village	15A	NIAGARA (DOWA) & MPATSANJOKA (SALIMA) Estates were surveyed. NYANGULU, NYANGULU (SALIMA) & JONAS (DOWA) Villages were surveyed.
		15B	NTANGA (NTCHISI) & MPAMANTHA (NKHOTAKOTA) Villages were surveyed.
		15C	CHIPELESA (NTCHISI) & MGOWA (NKHOTAKOTA) Villages were surveyed.
14.	Water Supply Development	15A	
		15B	
		15C	
15.	Hydropower Development	15A	No project
		15B	No project
		15C	No project
16	Monitoring System		
	Rainfall Gauge	15A	Salima (monitored period: 1954-2010) Lifuwu (monitored period: 1978-1990, 2000-2009) Dowa (monitored period: 1960-1976, 1978-2009)
		15B	Nkhota Kota (monitored period: 1922-1931, 1933-2010) Ntchisi (monitored period: 1954-1989)
		15C	No rainfall gauge
	Stream Gauge	15A	15A8 (Lingadzi at Kaniche): monitored period; 48 years, drainage area; 450 km^2, average dry-season flows: Q_{75} = 0.721 m^3/s & Q_{97} = 0.264 m^3/s
		15B	15B13 (Kaombe at Chanika): monitored period; 11 years, drainage area; 470 km^2, average dry-season flows: Q_{75} = 4.975 m^3/s & Q_{97} = 2.764 m^3/s
		15C	No representative stream gauge
	Monitoring Well	15A	GN201 (Chaliwa Dam): monitored period; 4 years, the highest G.W.L; 0.00m, the lowest G.W.L; 2.42m, the range of periodic fluctuation is about 2m. Surface water may directly flow into the well.
		15B	GN216 (Nkhotakota W/Office): monitoring data has not been submitted. GN219(Nkhotakota Well Field): not started (at present, August, 2013)
		15C	No monitoring well
	Water Quality	15A	<Surface Water> 15A8(Lingadzi River): Monitored date in rainy season; 27-Mar-2013, in dry season; 7-Aug-2013 pH=[7.37](7.85), Temp=[27.8](26.8)°C, EC=[203](273)µs/cm, TDS=[102](127)mg/l, CO_3^{2-}=[0](16)mg/l, HCO_3^{2-}=[86](83.1)mg/l, Cl^-=[10.6](14.9)mg/l, SO_4^{2-}=[12.5](8.63)mg/l, NO_3^-=[0.013](0.157)mg/l, F^-=[0.37](0.59)mg/l, Na^+=[10](13)mg/l, K^+=[2.8](2.3)mg/l, Ca^{2+}=[17](23)mg/l, Mg^{2+}=[7.6](8.8)mg/l, Fe^{2+}=[0.647](0.001)mg/l, Mn^{2+}=[0.004](0.001)mg/l, Hardness=[74](93)mg/l, Alkalinity=[70](94)mg/l, Turbidity=[120](6)NTU, SS=[117](3.1)mg/l, PO_4^{3-}=[0.085](0.7)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[5.6](8.1)mg/l, BOD=[4](9)mg/l, COD=[111](22.7)mg/l, F.Coliform=[160](150)nos./100ml, , F.Steptococci=[48](45)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		15B	<Surface Water> 15B6(Chia Lagoon): Monitored date in rainy season; 27-Mar-2013, in dry season; pH=[7.39](8.04), Temp=[29.4](29.1)°C, EC=[121](192)µs/cm, TDS=[61](90)mg/l, CO_3^{2-}=[0](13)mg/l, HCO_3^{2-}=[50](50)mg/l, Cl^-=[8.6](11.7)mg/l, SO_4^{2-}=[0.8](4.2)mg/l, NO_3^-=[0.001](0.169)mg/l, F^-=[0.17](0.53)mg/l, Na^+=[7](13)mg/l, K^+=[3.8](3.8)mg/l, Ca^{2+}=[9](12)mg/l, Mg^{2+}=[4](6)mg/l, Fe^{2+}=[0.399](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l,

			Hardness=[39](54)mg/l, Alkalinity=[41](62)mg/l, Turbidity=[100](12)NTU, SS=[96](7)mg/l, PO_4^{3-}=[0.189](0.632)mg/l, Cu^{2+}=[0.005](0.009)mg/l, DO=[3.9](11.2)mg/l, BOD=[4](5.9)mg/l, COD=[91](16.5)mg/l, F.Coliform=[105](1,600)nos./100ml, , F.Steptococci=[10](100)nos.100ml 15B15(Kaombe River): Monitored date in rainy season; 27-Mar-2013, in dry season;7-Aug-2013 pH=[7.47](6.94), Temp=[20.3](24.2)°C, EC=[156](154)μs/cm, TDS=[93](77)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[92](46)mg/l, Cl^-=[12.1](9.9)mg/l, SO_4^{2-}=[0.61](18.9)mg/l, NO_3^-=[0.006](0.071)mg/l, F^-=[0.01](0.42)mg/l, Na^+=[8](5)mg/l, K^+=[1.3](1)mg/l, Ca^{2+}=[17.1](12.4)mg/l, Mg^{2+}=[7.7](6.8)mg/l, Fe^{2+}=[0.418](0.819)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[75](60)mg/l, Alkalinity=[75](37)mg/l, Turbidity=[10](20)NTU, SS=[8](13)mg/l, PO_4^{3-}=[0.016](0.325)mg/l, Cu^{2+}=[0.004](0.001)mg/l, DO=[5.8](9.8)mg/l, BOD=[3](0.7)mg/l, COD=[44](3.8)mg/l, F.Coliform=[200](120)nos./100ml, , F.Steptococci=[25](115)nos.100ml <Groundwater> GN216 (Nkhotakota W/Office): Monitored date in rainy season; 27-Mar-2013, in dry season;7-Aug-2013 pH=[6.3](5.95), Temp=[28.1](28.9)°C, EC=[130](88)μs/cm, TDS=[67](46)mg/l, CO_3^{2-}=[0](0)mg/l, HCO_3^{2-}=[68](25)mg/l, Cl^-=[7.1](8.1)mg/l, SO_4^{2-}=[0.1](8.03)mg/l, NO_3^-=[0.044](0.221)mg/l, F^-=[0.54](0.36)mg/l, Na^+=[8](8)mg/l, K^+=[0.8](0.6)mg/l, Ca^{2+}=[10.2](6)mg/l, Mg^{2+}=[5.6](2)mg/l, Fe^{2+}=[0.056](0.001)mg/l, Mn^{2+}=[0.001](0.001)mg/l, Hardness=[48](23)mg/l, Alkalinity=[56](20)mg/l, Turbidity=[6](2.1)NTU, SS=[6](2)mg/l, Cu^{2+}=[0.005](0.001)mg/l, DO=[4](8.9)mg/l, BOD=[3](3.8)mg/l, COD=[11](11.8)mg/l, F.Coliform=[200](0)nos./100ml, , F.Steptococci=[70](0)nos.100ml note: [ ]; Rainy season, ( ); dry season
		15C	
17.	Water Demand	15A	(Present) Irrigation 8,973,332m^3/year, Water Supply 1,218,443m^3/year, Live Stock 1,278,480m^3/year (2035) Irrigation 18,929,004m^3/year, Water Supply 542,632 m^3/year, Live Stock 2,322,489 m^3/year GBI-Lingadzi/lipimbi (43,040 ha), GBI-Lingadzi (21,520 ha)
		15B	(Present) Irrigation 25,259,551 m^3/year, Water Supply 932,043m^3/year, Live Stock 692,591m^3/year (2035) Irrigation 53,283,860m^3/year, Water Supply 696,100 m^3/year, Live Stock 1,640,513 m^3/year GBI-Chia (24,592 ha), 5C/15B/15C GBI-Bua/Lozi (42,100 ha)
		15C	(Present) Irrigation 1,738,121m^3/year, Water Supply 62,793m^3/year, Live Stock 24,997m^3/year (2035) Irrigation 3,666,220m^3/year, Water Supply 56,820 m^3/year, Live Stock 63,798 m^3/year
18.	Water Balance	15A	Water Resources 301,611,480 m^3/year (Present) Deficit 6,511,802 m^3/year (Irrigation 5,631,875 m^3/year, Water Supply 379,553 m^3/year, Live Stock 500,374 m^3/year) (2035) Deficit 14,110,267 m^3/year (Irrigation 12,896,473 m^3/year, Water Supply 167,993 m^3/year, Live Stock 1,045,801 m^3/year)
		15B	Water Resources 464,478,051 m^3/year (Present)

			Deficit 16,799,159 m^3/year (Irrigation 16,190,619 m^3/year, Water Supply 289,080 m^3/year, Live Stock 319,460 m^3/year) (2035) Deficit 41,935,970 m^3/year (Irrigation 40,856,002 m^3/year, Water Supply 215,505 m^3/year, Live Stock 864,463 m^3/year)
		15C	Water Resources 39,138,701 m^3/year (Present) Deficit 963,771 m^3/year (Irrigation 939,409 m^3/year, Water Supply 16,676 m^3/year, Live Stock 7,686 m^3/year) (2035) Deficit 2,110,561 m^3/year (Irrigation 2,071,527 m^3/year, Water Supply 15,089 m^3/year, Live Stock 23,946 m^3/year)
19.	Water Resources Development Facilities	15A	Dams+Weir+Canal+I.Res,
		15B	Navikoko & Chilingali P. Damsites (L/R)→Dams+Weir+Canal+I.Res
		15C	Weir+Canal+I.Res

Fact Sheet WRA 16 (16E-16G)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Nkhata-Bay Lakeshore (3 major river basins)
2	WRA (WRU)		WRA16 (16E, 16F, 16G)
3	Catchment Area (km^2)		WRA16 5,458 16E 1,770 16F 2,346 16G 1,342
4	Topography	16E	Lower: Upper
		16F	Lower: Upper
		16G	Lower: Upper:
5	Annual Rainfall		WRA16 1222mm 16E 1259mm 16F 1230mm 16G 1156mm
6	Land Use in 2010 I.A = Irrigation Area	WRA16	Forest: 2,577.4km^2 (46.7%), Bush/Grassland: 838.7km^2 (15.2%), Wetland: 149.9km^2 (2.7%), Rain fed Farmland: 1,957.7km^2 (35.4%), Total: 5,523.7km^2 I.A = 4,823 ha
		16E	Forest: 872.5km^2 (47.6%), Bush/Grassland: 262.6km^2 (14.3%), Wetland: 38.7km^2 (2.1%), Rain fed Farmland: 661.0km^2 (36.0%), Total: 1,834.7km^2 I.A = 1,210 ha
		16F	Forest: 1,150.8km^2 (48.6%), Bush/Grassland: 171.0km^2 (7.2%), Wetland: 103.5km^2 (4.4%), Rain fed Farmland: 943.6km^2 (39.8%), Total: 2,369.0km^2 I.A = 2,967 ha
		16G	Forest: 554.1km^2 (42.0%), Bush/Grassland: 405.1km^2 (30.7%), Wetland: 7.8km^2 (0.6%), Rain fed Farmland: 353.2km^2 (26.8%), Total: 1,320.1km^2 I.A = 647 ha
7	Population in 2008		WRA16 328,246 persons 16E 97,452 persons 16F 157,559 persons 16G 73,235 persons
8	Major Cities/Towns		16E: Chintheche (Rural MC) 16F: Mzuzu (Region Centre, Population: 128,482 in 2008), Chikwina (Rural MC) 16G: Nkhata-Bay (District MC, Population: 213,779 in 2008), Usiya (Rural MC)
9.	Existing Water Supply System and Scheme	16E	
		16F	Mzuzu Zone of NRWB (Mzuzu Scheme, Ekwendeni Scheme)
		16G	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	16E	Kasitu (55ha) gravity fed-rice scheme.
		16F	
		16G	
11.	Existing Hydropower Plant & Electric Supply	16E	No hydropower plant Transmission lines from Nkhotakota to Nkhata-Bay and Chikangawa via Chintheche Chintheche substation
		16F	No hydropower plant Transmission lines from Chintheche to Khata-Bay and Chikangawa Chikangawa substation and Telegraph Hill substation
		16G	No hydropower plant Transmission lines from Nkhotakota to Mzuzu No substation
12.	Industrial Areas		
13.	Estate/Village	16E	

		16F	LIMPASA SUGAR CORP. EST. & KAWALAZI (NKHATABAY) Estates were surveyed. LIMPHASA (NKHATABAY) Ville. was surveyed.
		16G	NTHETA (NKHATABAY) Ville. was surveyed.
14.	Water Supply Development	16E	
		16F	
		16G	
15.	Hydropower Development	16E	No project
		16F	No project
		16G	No project
16	Monitoring System		
	Rainfall Gauge	16E	Chintheche (monitored period: 1921-1989)
		16F	No rainfall gauge
		16G	Nkhata Bay (monitored period: 1951-2010)
	Stream Gauge	16E	16E6 (Dwambadzi at Nthanda): monitored period; 29 years, drainage area; 778 km^2, average dry-season flows: Q_{75} = 6.942 m^3/s & Q_{97} = 4.325 m^3/s
		16F	16F2 (Luweya at Zayuka): monitored period; 43 years, drainage area; 2,334 km^2, average dry-season flows: Q_{75} = 16.608 m^3/s & Q_{97} = 9.353 m^3/s 16F5 (Luchelemu (Lower) at Mazamba): monitored period; 47 years, drainage area; 297 km^2, average dry-season flows: Q_{75} = 1.091 m^3/s & Q_{97} = 0.537 m^3/s 16F15 (Luweya at Mzenga): monitored period; 22 years, drainage area; 1,425 km^2, average dry-season flows: Q_{75} = 5.549 m^3/s & Q_{97} = 2.838 m^3/s
		16G	16G2 (Chiwisi at Bula): monitored period; 3 years, drainage area; 96 km^2, average dry-season flows: Q_{75} = 0.652 m^3/s & Q_{97} = 0.380 m^3/s
	Monitoring Well	16E	No monitoring well
		16F	No monitoring well
		16G	GN173(Msani School): monitored period; 4 years, the highest G.W.L; 9.74m, the lowest G.W.L; 15.83m, the range of periodic fluctuation is unclear due to few monitoring data.
	Water Quality	16E	<Surface Water> 16E6(Dwambazi River): Monitored date in rainy season; 5-Mar-2013, in dry season; 13-Aug-2013 pH=[7.94](7.28), Temp=[22.4](18.1)°C, EC=[65](62)µs/cm, TDS=[33](31)mg/l, CO_3^{2-}=[2.4](0)mg/l, HCO_3^{2-}=[14](16)mg/l, Cl^-=[6.1](6.6)mg/l, SO_4^{2-}=[5.04](5.08)mg/l, NO_3^-=[0.001](0.001)mg/l, F^-=[0.47](0.14)mg/l, Na^+=[4](5)mg/l, K^+=[1.4](1.1)mg/l, Ca^{2+}=[5](4)mg/l, Mg^{2+}=[1.2](1.2)mg/l, Fe^{2+}=[0.585](0.026)mg/l, Mn^{2+}=[0.003](0.001)mg/l, Hardness=[18](14)mg/l, Alkalinity=[14](13)mg/l, Turbidity=[4](0.6)NTU, SS=[1](4)mg/l, PO_4^{3-}=[0.006](0.311)mg/l, Cu^{2+}=[0.002](0.001)mg/l, DO=[5.6](9.2)mg/l, BOD=[4.1](3.4)mg/l, COD=[89](14.9)mg/l, F.Coliform=[1660](250)nos./100ml, , F.Steptococci=[350](100)nos.100ml <Groundwater> No monitoring note: [ ]; Rainy season, ( ); dry season
		16F	<Surface Water> 16F15 (Luweya River): Monitored date in rainy season; 5-Mar-2013, in dry season; 13-Aug-2013 pH=[7.87](8.16), Temp=[25.4](20)°C, EC=[76](82)µs/cm, TDS=[40](43)mg/l, CO_3^{2-}=[2.4](4)mg/l, HCO_3^{2-}=[17](23)mg/l, Cl^-=[1.7](3.3)mg/l, SO_4^{2-}=[6.4](6.31)mg/l, NO_3^-=[0.005](0.001)mg/l, F^-=[0.52](0.16)mg/l, Na^+=[6](7)mg/l, K^+=[2.2](1.1)mg/l, Ca^{2+}=[5](6)mg/l, Mg^{2+}=[1.1](1.2)mg/l, Fe^{2+}=[1.22](0.001)mg/l, Mn^{2+}=[0.345](0.001)mg/l, Hardness=[19](19)mg/l, Alkalinity=[17](25)mg/l, Turbidity=[40](6)NTU, SS=[19](6)mg/l, PO_4^{3-}=[0.063](0.685)mg/l, Cu^{2+}=[0.002](0.001)mg/l, DO=[5.8](9.4)mg/l, BOD=[5.8](3.5)mg/l, COD=[129](11.8)mg/l, F. Coliform=[1990](150)nos./100ml, , F.Steptococci=[1140](100)nos.100ml <Groundwater> No monitoring

			Note: [ ]; Rainy season, ( ); dry season
		16G	No monitoring
17.	Water Demand	16E	(Present) Irrigation 6,305,498m^3/year, Water Supply 536,634m^3/year, Live Stock 206,407m^3/year (2035) Irrigation 23,651,250m^3/year, Water Supply 478,463 m^3/year, Live Stock 855,432 m^3/year GBI- Limphasa (36,771 ha)
		16F	(Present) Irrigation 23,929,466m^3/year, Water Supply 693,406m^3/year, Live Stock 226,912m^3/year (2035) Irrigation 52,093,488m^3/year, Water Supply 615,699 m^3/year, Live Stock 509,595 m^3/year
		16G	(Present) Irrigation 5,920,215m^3/year, Water Supply 373,570m^3/year, Live Stock 89,172m^3/year (2035) Irrigation 12,888,070m^3/year, Water Supply 389,632 m^3/year, Live Stock 186,451 m^3/year
18.	Water Balance	16E	Water Resources 578,755,716 m^3/year (Present) Deficit 3,240,237 m^3/year (Irrigation 3,115,283 m^3/year, Water Supply 84,239 m^3/year, Live Stock 40,716 m^3/year) (2035) Deficit 10,024,899 m^3/year (Irrigation 9,739,821 m^3/year, Water Supply 74,996 m^3/year, Live Stock 210,082 m^3/year)
		16F	Water Resources 701,247,915 m^3/year (Present) Deficit 11,956,799 m^3/year (Irrigation 11,769,296 m^3/year, Water Supply 123,470 m^3/year, Live Stock 64,033 m^3/year) (2035) Deficit 30,208,620 m^3/year (Irrigation 29,929,154 m^3/year, Water Supply 109,632 m^3/year, Live Stock 169,834 m^3/year)
		16G	Water Resources 327,843,095 m^3/year (Present) Deficit 2,186,180 m^3/year (Irrigation 2,110,334 m^3/year, Water Supply 57,768 m^3/year, Live Stock 18,079 m^3/year) (2035) Deficit 5,868,836 m^3/year (Irrigation 5,761,053 m^3/year, Water Supply 60,276 m^3/year, Live Stock 47,507 m^3/year)
19.	Water Resources Development Facilities	16E	Chimugonda P. Damsite (L/R)→S. Dam+Weir+Canal+I.Res
		16F	Dams+Weir+Canal+I.Res
		16G	Weir+Canal+I.Res

Fact Sheet WRA 17 (17A-17C)

No	Basin Parameters	Sub-Areas	Particular Features of Basin/Sub-Basin
1	Name of Catchment		Karonga lakeshore (3 major river basins)
2	WRA (WRU)		WRA17 (17A, 17B, 17C)
3	Catchment Area (km^2)		WRA17: 1,928 17A: 178 / 17B: 556 / 17C: 1,194
4	Topography	17A	Lower: Upper
		17B	Lower: Upper
		17C	Lower: Upper:
5	Annual Rainfall		WRA17: 1153mm 17A: 920mm / 17B: 1036mm / 17C: 1240mm
6	Land Use in 2010 I.A = Irrigation Area	WRA17	Forest: 1,145.9km^2 (59.1%), Bush/Grassland: 116.0km^2 (6.0%), Wetland: 32.5km^2 (1.7%), Rain fed Farmland: 644.2km^2 (33.2%), Total: 1,938.6km^2 I.A = 982 ha
		17A	Forest: 97.4km^2 (54.8%), Bush/Grassland: 0.3km^2 (0.2%), Wetland: 6.1km^2 (3.4%), Rain fed Farmland: 73.8km^2 (41.6%), Total: 177.7km^2 I.A = 117 ha
		17B	Forest: 429.8km^2 (79.3%), Bush/Grassland: 12.6km^2 (2.3%), Wetland: 9.9km^2 (1.8%), Rain fed Farmland: 89.6km^2 (16.5%), Total: 541.9km^2 I.A = 141 ha
		17C	Forest: 618.6km^2 (50.8%), Bush/Grassland: 103.1km^2 (8.5%), Wetland: 16.5km^2 (1.4%), Rain fed Farmland: 480.7km^2 (39.4%), Total: 1,219.0km^2 I.A = 725 ha
7	Population in 2008		WRA17: 135,498 persons 17A: 20,204 persons / 17B: 16,530 persons 17C: 98,764 persons
8	Major Cities/Towns		17A: Karonga (Sub-Regional Centre, Population: 272,789 in 2008) 17B: - 17C: Chilumba (Rural MC)
9.	Existing Water Supply System and Scheme	17A	
		17B	
		17C	
10.	Existing irrigation System Only the schemes with GIS data are shown here.	17A	GBI Pilot-Nthola-Ilora-Ngosi (1,000 ha) ; rice
		17B	
		17C	
11.	Existing Hydropower Plant & Electric Supply	17A	No hydropower plant Transmission lines from /to Karonga Karongra substation
		17B	No hydropower plant Transmission lines from /to Karonga No substation
		17C	Wovwe hydropower plant Transmission lines from /to Karonga and Wovwe Wovwe substation and Uliwa substation
12.	Industrial Areas		
13.	Estate/Village	17A	
		17B	MWENELUPEMBE (KARONGA) Ville. was surveyed.
		17C	
14.	Water Supply	17A	
		17B	

	Development	17C	
15.	Hydropower Development	17A	No project (New transmission line from Lilongwe to Songwe will pass)
		17B	No project (New transmission line from Lilongwe to Songwe will pass)
		17C	No project (New transmission line from Lilongwe to Songwe will pass)
16	Monitoring System		
	Rainfall Gauge	17A	No rainfall gauge
		17B	Lupembe (monitored period: 1949-1990)
		17C	Vinthukutu (monitored period: 1969-1998, 2005-2009)
	Stream Gauge	17A	No representative stream gauge
		17B	No representative stream gauge
		17C	17C6 (Wovwe at Kapiyira): monitored period; 14 years, drainage area; 313 km^2, average dry-season flows: Q_{75} = 1.051 m^3/s & Q_{97} = 0.531 m^3/s 17C10 (Hara at Nthipa): monitored period; 15 years, drainage area; 75.5 km^2, average dry-season flows: Q_{75} = 0.614 m^3/s & Q_{97} = 0.384 m^3/s 17C16 (Wovwe at Njalayankhunda): monitored period; 5 years, drainage area; 235.8 km^2, average dry-season flows: Q_{75} = 1.461 m^3/s & Q_{97} =1.010 m^3/s
	Monitoring Well	17A	GN169(Karonga W/Office): monitored period; 3 years, the highest G.W.L; 0.63m, the lowest G.W.L; 4.90m, the range of periodic fluctuation is 2 to 3m.
		17B	No monitoring well
		17C	No monitoring well
	Water Quality	17A	No monitoring
		17B	No monitoring
		17C	No monitoring
17.	Water Demand	17A	(Present) Irrigation: 1,837,513m^3/year, Water Supply 72,663m^3/year, Livestock 119,558m^3/year (2035) Irrigation: 15,714,958m^3/year, Water Supply 58,530 m^3/year, Livestock 247,931 m^3/year 9A/9 B/17A GBI-Karonga/Kaporo (36,451 ha)
		17B	(Present) Irrigation: 2,218,420m^3/year, Water Supply 110,445m^3/year, Livestock 145,158m^3/year (2035) Irrigation: 18,972,590m^3/year, Water Supply 121,614 m^3/year, Livestock 301,018 m^3/year 17B/17C GBI-Hara (17,625 ha)
		17C	(Present) Irrigation: 11,222,227m^3/year, Water Supply 260,905m^3/year, Livestock 730,914m^3/year (2035) Irrigation: 95,975,847m^3/year, Water Supply 295,443 m^3/year, Livestock 1,512,358 m^3/year
18.	Water Balance	17A	Water Resources: 4,603,149 m^3/year (Present) Deficit: 1,415,216 m^3/year (Irrigation 1,331,455 m^3/year, Water Supply 14,433 m^3/year, Live Stock 69,328 m^3/year) (2035) Deficit: 15,207,210 m^3/year (Irrigation 15,027,426 m^3/year, Water Supply 11,486 m^3/year, Live Stock 168,298 m^3/year)
		17B	Water Resources: 73,843,862 m^3/year (Present) Deficit: 742,634 m^3/year (Irrigation 687,608 m^3/year, Water Supply 20,273 m^3/year, Live Stock 34,752 m^3/year) (2035) Deficit: 11,149,814 m^3/year (Irrigation 10,969,310 m^3/year, Water Supply 22,324 m^3/year, Live Stock 158,180 m^3/year)

		17C	Water Resources: 195,395,661 m^3/year (Present) Deficit: 5,215,201 m^3/year (Irrigation 4,909,366 m^3/year, Water Supply 57,525 m^3/year, Live Stock 248,310 m^3/year) (2035) Deficit: 73,523,720 m^3/year (Irrigation 72,617,411 m^3/year, Water Supply 65,189 m^3/year, Live Stock 841,120 m^3/year)
19.	Water Resources Development Facilities	17A	Dams+Weir+Canal+I.Res
		17B	Dam+Weir+Canal+I.Res
		17C	Dams+Weir+Canal+I.Res