Pre-feasibility Study for the Ruhuhu Irrigation Project Update

Presentation to Stakeholders

Landmark Hotel, Ubungo, Dar es Salaam

12th September 2014

CRIDF

An Introduction to the Climate Resilient Infrastructure Development Facility

CRIDF

What is CRIDF

- DFID-funded water infrastructure programme for southern Africa
- Aimed at catalysing delivery of sustainable small-scale infrastructure
- Working through local networks and integrating into regional decision making
- Mainstreaming climate resilience into infrastructure planning
- Leaving behind sustainable solutions

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The CRIDF Logical Framework

Output

Prepare **small scale water infrastructure** projects
Facilitate **access to finance** for the implementation of these projects
Engaging with river basin **organisation** and national **stakeholders**
Using **CRIDF principles** to ensure that investments align with strategic objectives

Outcome

- Poor people will benefit from **climate resilient water infrastructure**
- Conditions for **cooperation** between stakeholders in shared river basins will be improved

Impact

- Contribution to **peaceful**, **climate resilient** and sustainable planning and management of shared waters in SADC for current and future benefits to the poor.

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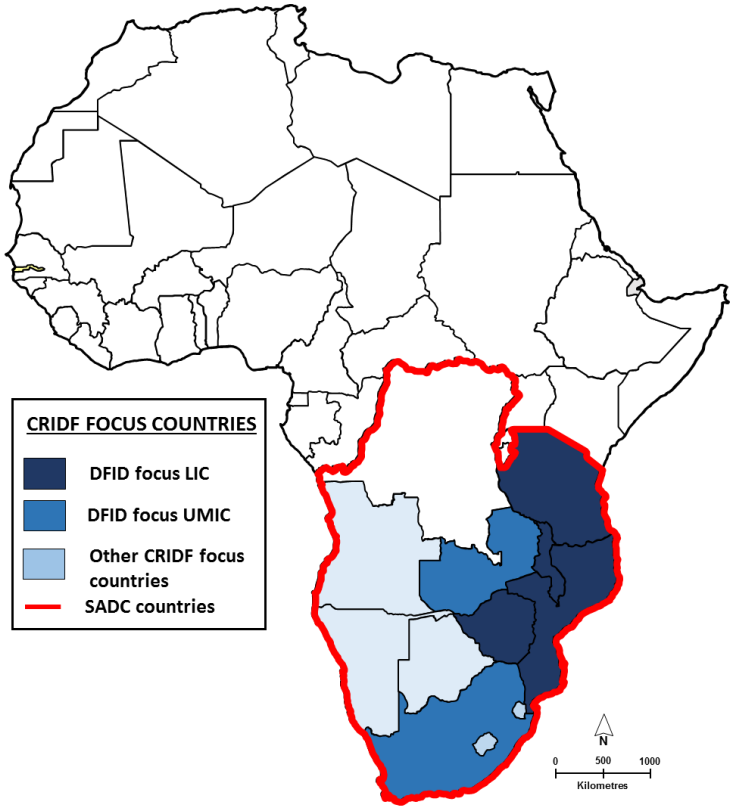
What Are the CRIDF Countries?

- Working in 11 mainland SADC countries
- Focusing on DFID countries: Malawi, Mozambique, South Africa, **Tanzania**, Zambia and Zimbabwe
- With special attention on the low income countries: Malawi, Mozambique, **Tanzania** and Zimbabwe



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Demand Driven and within a Climate Change Context

- Working with SADC and RBOs to respond to demand for investments
- Differentiating between well watered (northern) basins and water stressed (southern) basins
- Pursuing a specific strategy in each basin – different means of improving climate resilience according to context

CRIDF focus transboundary River Basins in SADC

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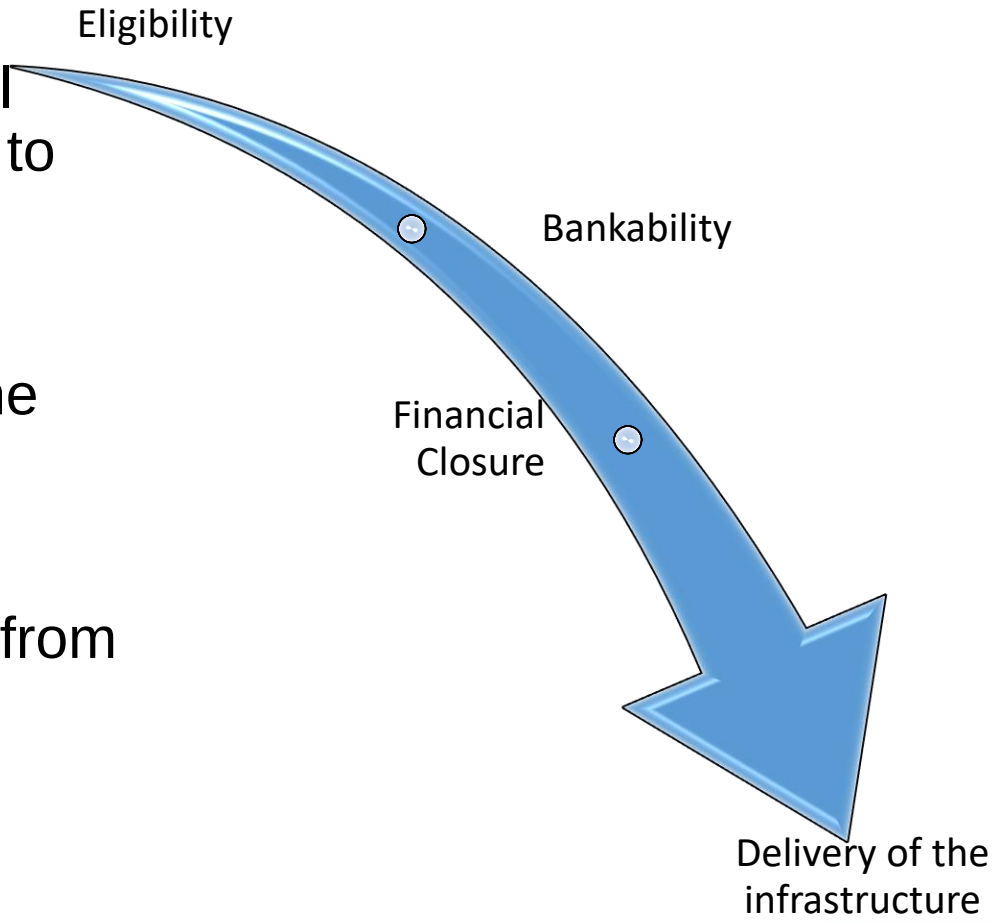
Support to a Range of Investments and Activities

- Entry Projects (**Quick Wins**) to engage with key stakeholders, deliver on the ground and demonstrate specific concepts more widely
- **Focal Projects** to deliver climate resilient investments to Bankability and Implementation
- **Strategic Projects**, engaging in longer-term concepts that last beyond the CRIDF timeframe
- **Stakeholder Engagement** (TA) to assist RBOs and widen as well as deepen Project influence

How Does the ‘Facility’ Work?

- One-stop shop, linking to all the components necessary to deliver sustainable, climate resilient infrastructure
- Initial screening to determine eligibility (consistency with CRIDF mandate)
- Secure financing (could be from CRIDF); and
- Deliver infrastructure



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The Ruhuhu Irrigation Scheme

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Introduction

- Project initiated in 2006 by the Ministry of Agriculture, Food Security and Fisheries.
- Identified as a SADC Regional priority project, under the SADC Regional Indicative Development Masterplan.

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CRIDF Eligibility Assessment

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Regional and Trans-boundary Context

- Project identified from the RIDMP (Maseru 23); adopted as a priority irrigation project (scope expanded after CRIDF intervention)
- Can significantly contribute towards clean energy supply to the region
- May foster cooperation in national water infrastructure development in a transboundary basin

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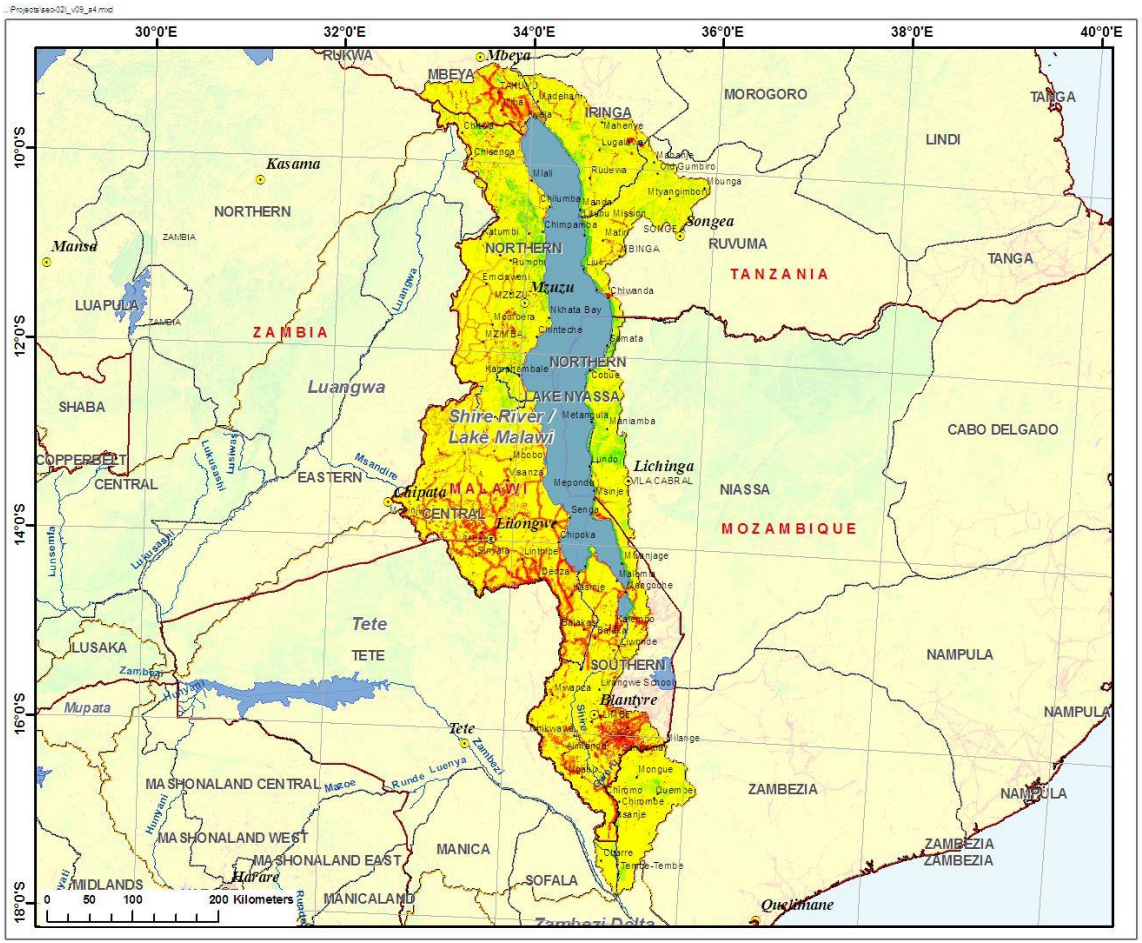
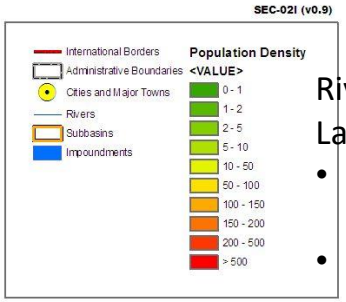
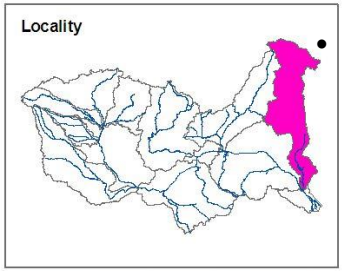
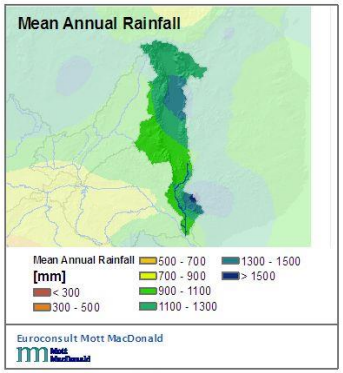
Lake Nyasa Sub-basin Characteristics









River inflow into the Lake

- Tanzania – 44% (27,623km2)
- Malawi – 46% (62,906km2)
- Mozambique – 10% (8,182km2)

IWRM Strategy for the Zambezi River Basin

Map 24 - Subbasin Characteristics - Shire River / Lake Malawi

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Climate Change Resilience Context

- Possible climate change impacts identified:
  - Increased occurrence of floods and droughts
  - High projected population growth will increase demand for food
  - Intensification and Diversification of crop production: higher temps may favour some crops eg rice
- Possible mitigation
  - Increase productivity per ha; per m3
  - Rain-fed converted to irrigation (vulnerability to drought is shifted to a regional issues) Farmers become less vulnerable.
  - Exploitation of underground water. After hydro-geological studies
  - Reservoirs for hydropower production store more flood water for an even power production and flood control
  - Irrigation designs should cater for possible increase in irrigation peak requirements.
- Need to diversify sources of livelihoods for households in the project area through provision of energy

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Project Components

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Component Descriptions

- **Irrigation development:** About 3,200ha of irrigation on the left and right banks of the Ruhuhu River in the Manda and Lituhi Wards.
- **Transportation link across the Ruhuhu River:** The construction of a bridge across the Ruhuhu River, to serve the left and right bank communities in the Njombe and Ruvuma Regions.
- **Water supply and sanitation:** The provision of safe and reliable domestic water supply and sanitation for about 12,000 inhabitants in the Manda (now Ruhuhu and Manda) and Lituhi Wards.
- **Hydropower generation and distribution:** The generation of electricity (medium- to large-scale for feeding into the national grid, or small-scale for local use).
- **Flood control on the Ruhuhu delta:** The management of high-water flows, to help protect the communities and fields on the Ruhuhu delta from floods from the Ruhuhu River.

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Status of each component

Component	Stage in Development Cycle
Hydropower generation and distribution	Reconnaissance study for the proposed Kikonge Hydropower Project
Water Supply and Sanitation	Reconnaissance stage but will only proceed if the irrigation component is developed
Transportation link across the Ruhuhu River	Dropped from CRIDF funding
Flood control on the Ruhuhu delta	To included in the development of the dam for hydropower
Irrigation development	Prefeasibility stage – subject of today's workshop.

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Irrigation Development Component

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Ruhuhu Irrigation Project Results Chain

Main tasks- by CRIDF

Agriculture and Irrigation

Desk study and literature review; Reconnaissance study for project indentification and assess eligibility; Prefeasibility study or preliminary viability assessment; Feasibility analysis to assess viability, sustainability & bankability; Source implementation funding and close financing deal; Prepare detailed designs and BoQ; Procure contractors; Supervise construction (CRIDF with MoAFS); Construction works (CRIDF with MoAFS); and Commissioning the scheme and handover (CRIDF with MoAFS)

Agricultural Marketing

Conduct market feasibility study

Feasibility analysis to assess viability, sustainability and bankability; Source implementation funding and close financing deal (CRIDF with REA); Prepare detailed designs and BoQs (CRIDF with REA); Procure constractors (CRIDF with REA); Supervise Construction (CRIDF with REA); Construction of works (CRIDF with REA); and Commissioning the plant and handover (CRIDF with REA)

Main Tasks - by others

Agricultural Support

Facilitate the development and implementation of farm business (MoAFS) ; Capacity building of farmers to implement farm business plan (MoAFS); and Developing institutions for irrigation scheme maintenance (MoAFS)

Agricultural Marketing

Develop agro-processing industry (MoAFS); and Link farmers to existing value chains (MoAFS & Pvt Sector)

Institutional Development

Developing institutions for operation and maintenance of irrigation scheme (MoAFS & Pvt Sector); Capacity building and resourcing of extension staff and other service providers at all levels (MoAFS); Developing institutions for mini hydropower generation operation and maintenance (REA & Pvt Sector); and Developing institutions for operation and maintenance of water supply

Output 1
Irrigation infrastructure for targeted smallholder farmers in the Ruhuhu and Lituhi wards developed
(CRIDF, GoT and Pvt Sector)

Output 2
Markets for crops produced by targeted smallholder farmers developed
(CRIDF, GoT and Pvt Sector)

Output 3
Capacity of private and public institutions supporting the irrigation schemes improved
(CRIDF, GoT & Pvt Sector)

Output 4:
Mini-hydropower infrastructure developed
(CRIDF, TANESCO, Pvt Sector & REA)

Output 6
Production and Productivity of targeted crops under smallholder farming improved
(GoT)

Project Outcome 1
Improved irrigation water management practices adopted by smallholder farmers in the irrigable areas of Lituhi and Ruhuhu wards

Project Outcome 2
Increased agricultural production and productivity for participating farmers in the Lituhi and Ruhuhu wards

Project Outcome 3
Access to clean electricity for the rural community in the Lituhi ward improved)

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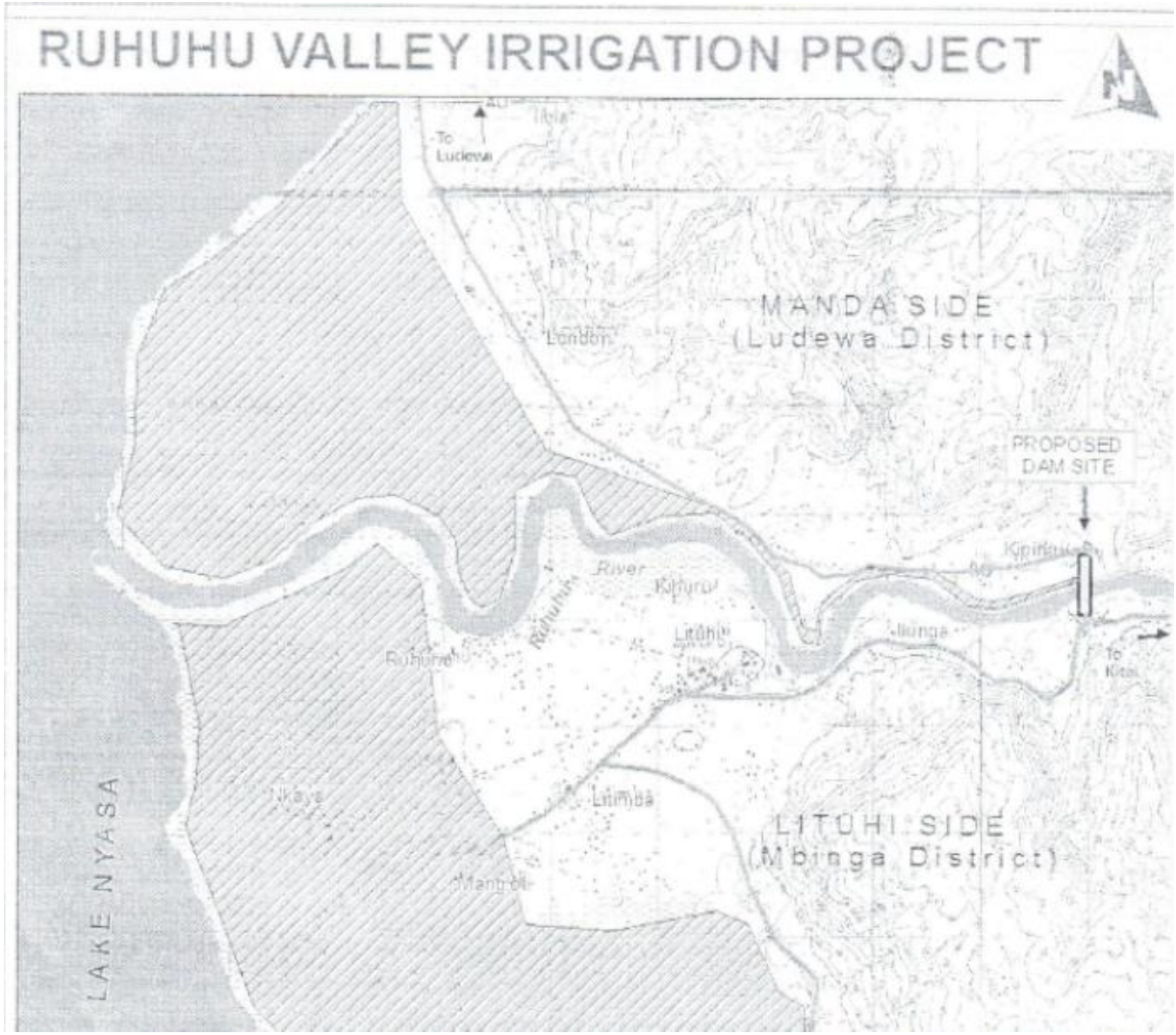
Ruhuhu Valley Irrigation Project



Results of the Prefeasibility Study

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Methodology

- Hydrological and sedimentation study
- Geological and geo-technical investigations (not yet done)
- Irrigation study
  - Engineering
  - Soils
  - Agronomy
- Project cost estimation and economic analysis
- Climate resilience assessment (not yet done)
- Environmental and social scoping
- Project Evaluation
- Training in notification requirements (not done – notification advisory prepared)

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Siting of Intake Structure

- The ferry site rejected as dam and intake site
- Intake site selected 15km upstream of ferry site.
  - Narrow river bed width, about 100m
  - Substantial exposure to rock
  - Allow command of greater potential irrigable area
  - Diversion works impoundment will not result in displacement of people
  - Potential for development of a mini-hydropower of up to 500kW capacity.

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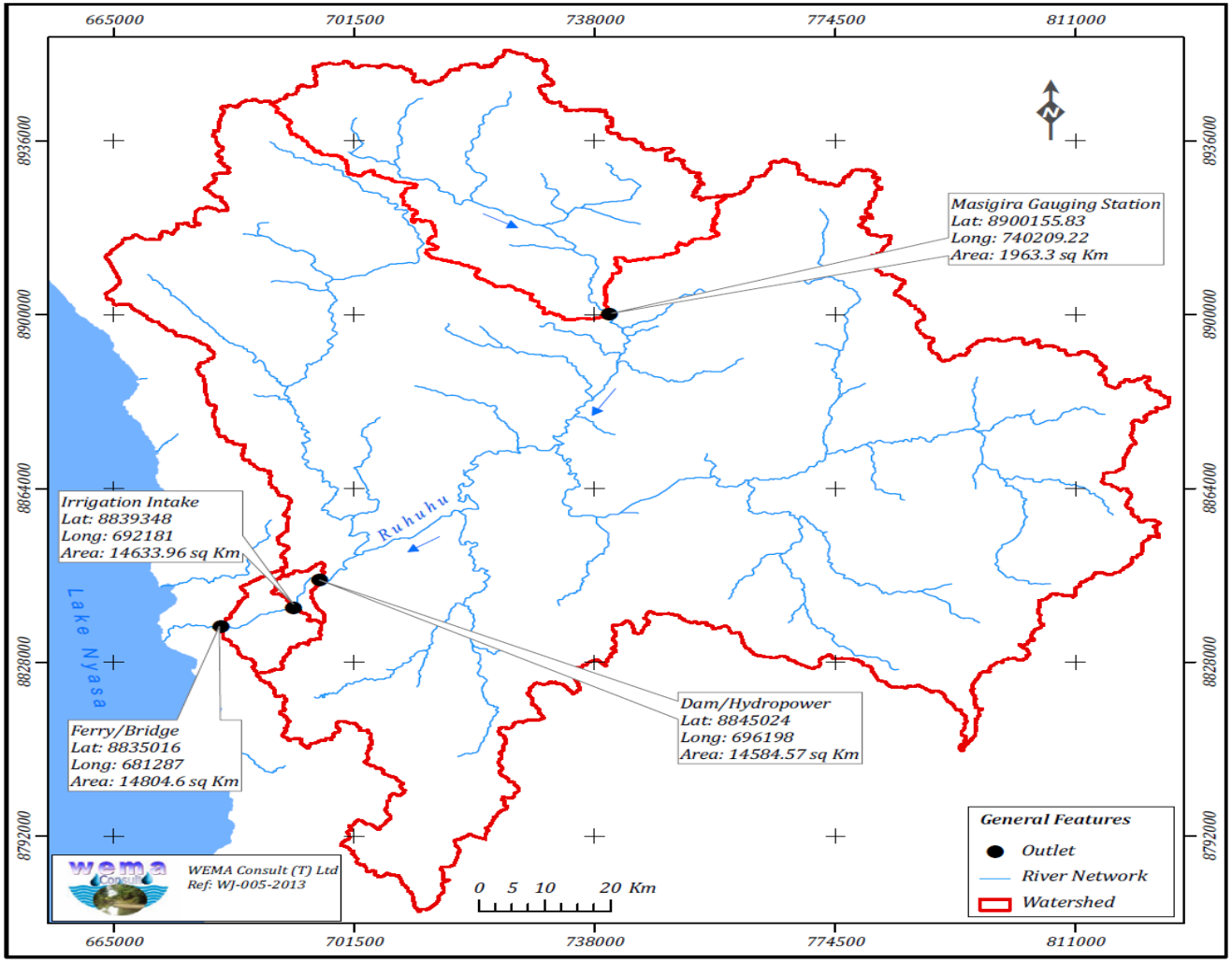
Intake Sites for the Irrigation Scheme



Ruhuhu Irrigation and Hydropower Dam Sites

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Hydrology and Sedimentation

- 100 - 80% dependability flow at the intake site is about 20 – 26m^3/s.
- The flow potentially available for irrigation is about 16m^3/s (60% of 80% dependable flow)
- No sedimentation studies carried out for the weir.
- Recommendations
  - Detailed hydrological data, including reliable rainfall data, required for further analysis
  - Full understanding of existing and planned water abstraction licences.
  - Assess potential impact of climate change

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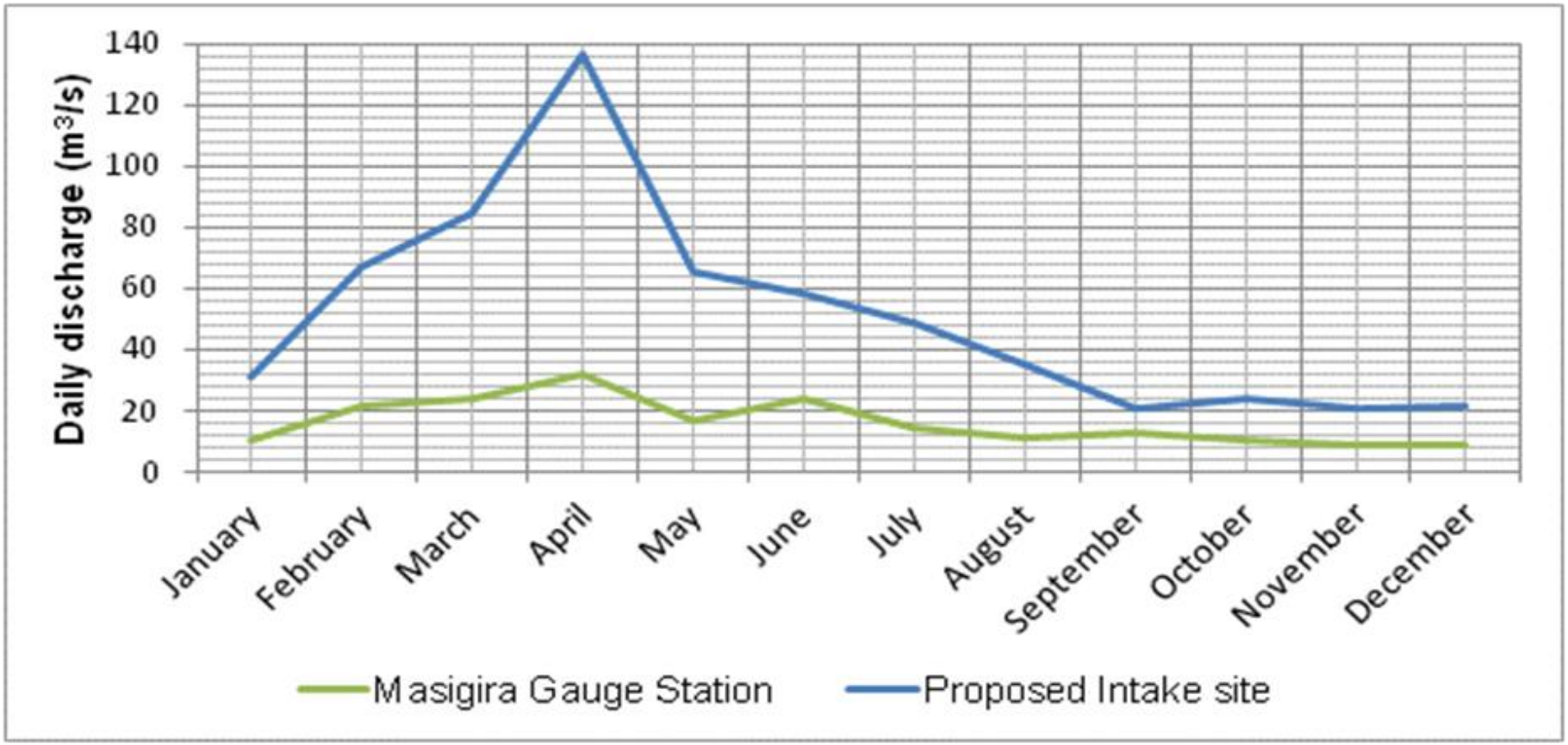
Minimum Daily Mean Flow at the Proposed Intake Site



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Soil Analysis

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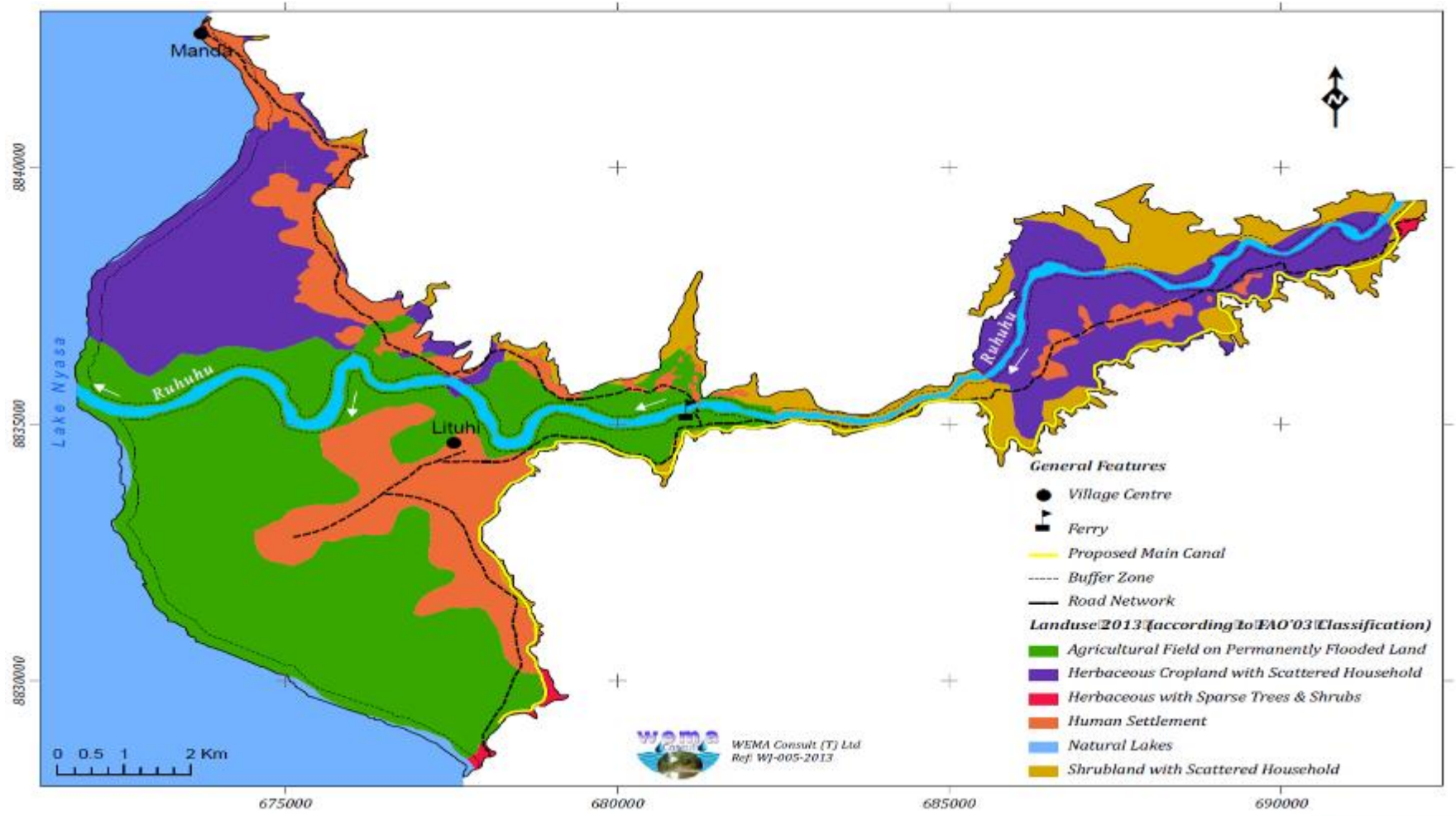
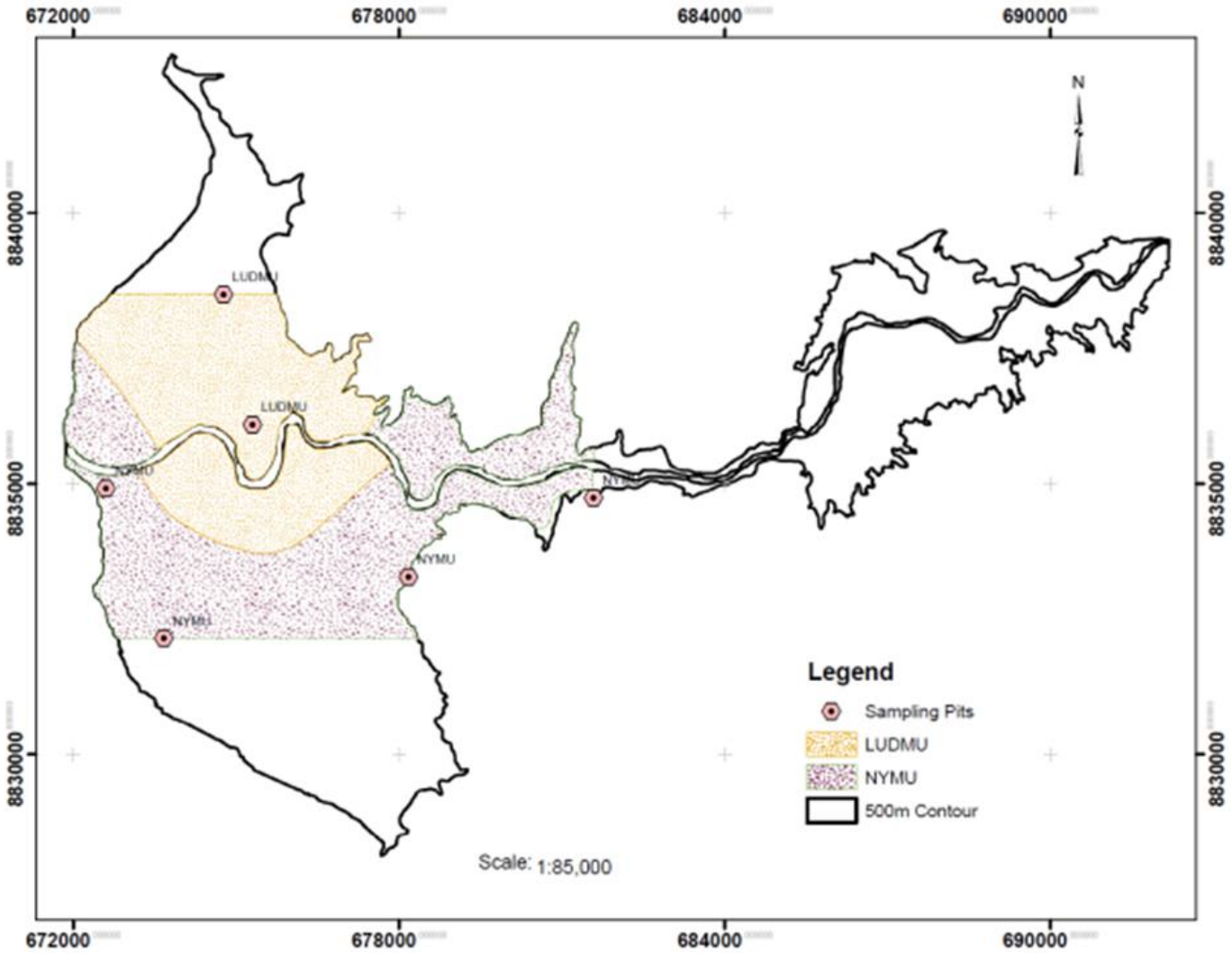
Land Use Classes (FAO)



Map of Potential Irrigable Soils



NYMU – 2100ha

- profile is deep, moderately well drained non calcareous with very dark grey-brown (10YR4/2) sand clay loam in topsoil and light brownish grey (10YR6/2) clay loam in sub soil. When moist the soil is firm in top soil to extremely firm in sub soil, while when wet the consistence is slightly sticky and non-plastic in top soil.

LUDMU – 1690ha

Land Suitability for Upland Crops and Paddy

Land quality/characteristics	Mapping units	
	NYMU	LDMU
Infiltration/permeability (i)	1	2
Capacity to maintain surface water (c)	1	1
Possibility for mechanization (m)	1	1
Soil workability (s)	1	2
Drainage (d)	1	2
Soil fertility (f)	3	3
Sodicity/Salinity (a)	1	2
Suitability class	S2f	S2isfda

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Soil Analysis Results

- All the mapping units NYMU (2,117.13ha) and LUDMU (1,695.41ha) were rated as moderately suitable for paddy, maize and vegetables (tomatoes).
- If the soil fertility (f) is corrected, decantation basin (NYMU) will be highly suitable (S1) for the production of irrigated upland crops.
- Sodicity may pose a threat to irrigated crops, especially to maize and legume crops, which have low tolerance to the effect of sodium and high soil pH (FAO, 1986). Thus adequate provision of farm drainage to keep the sodicity condition below the root zone is recommended.
- The potential area for irrigation agriculture is estimated to be greater than 5,947.7ha. However the area which this soil survey has covered is only about 3,812.54ha.

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Marketing and Agronomic Studies

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Current Crops, with Typical 1ha Cropping Model

- In dry season, cassava is the main crop >60%, using residual soil moisture
- In wet season rice is the main crop.
- Other crops: maize and leafy vegetables.

Crop type	Rain season	Dry season
	% area cropped	% area cropped
Paddy	50	-
Maize	10	2
Cassava	-	60
Vegetable	10	3
Fallow	30	35
Total	100	100

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Typical Irrigated cropping 1ha model

Crop type	Rainy season (% area covered)	Dry season (% area covered)
Paddy	80	50
Maize	10	15
Vegetable/tomatoes	10	15
Cassava	-	20
Total	100	100

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Marketing

- Explore the following:
  - Establishment of warehouses
  - Links to SACOGT
- More needs to be done to understand marketing for the new irrigation scheme.

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Crop Water Requirements

- The peak net monthly irrigation requirement for the mapping unit NYMU is 1,736m^3/ha occurring in the month of August. The peak net irrigation duty requirement for the same mapping unit is 1.78l/s/ha, occurring in September
- The peak net monthly irrigation requirement for the mapping unit LUDMU is 1,823m^3/ha occurring in the month of August. The peak net irrigation duty requirement for the same mapping unit is 1.86l/s/ha, occurring in September

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Irrigation Systems

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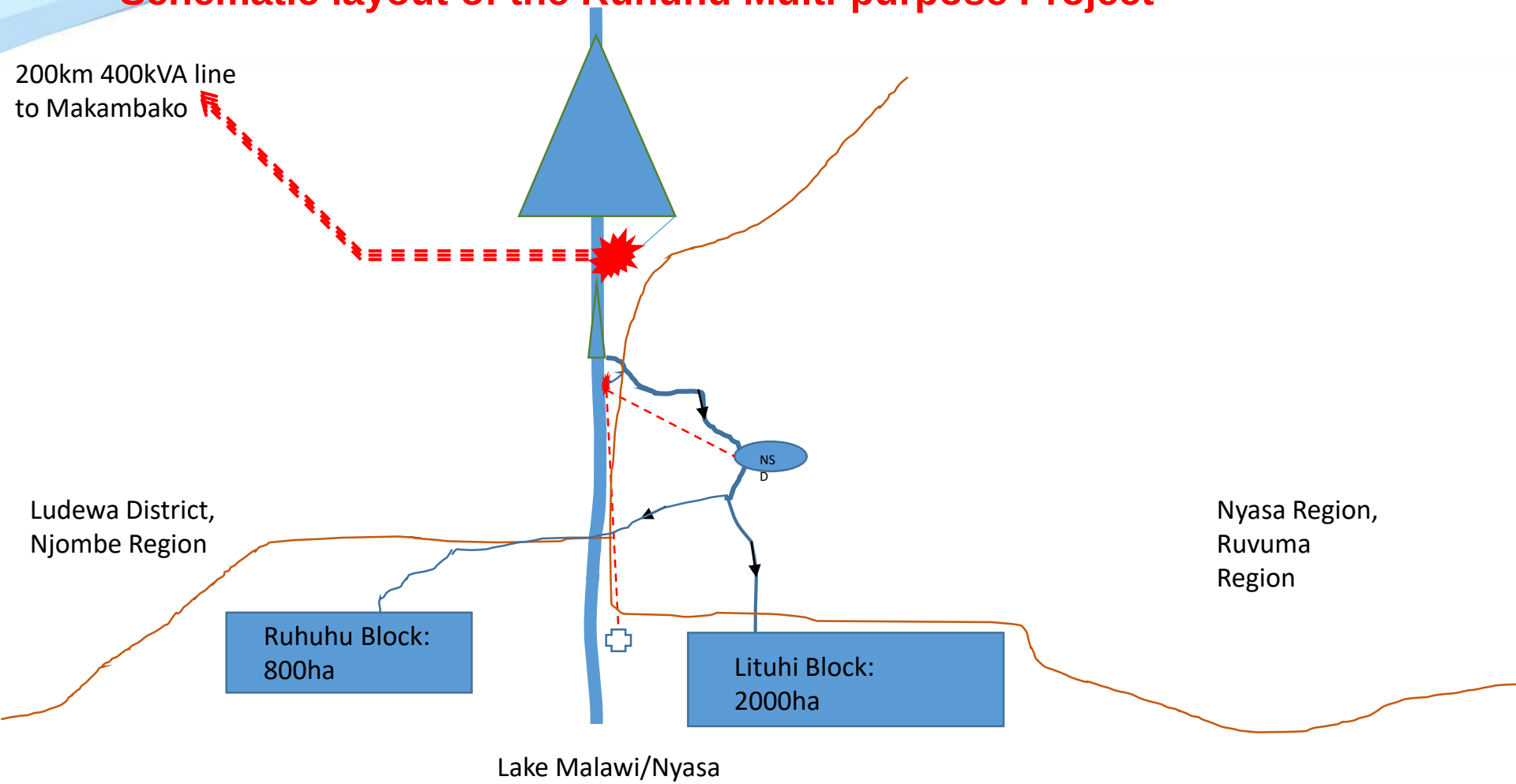
Schematic layout of the Ruhuhu Multi-purpose Project



Component Descriptions

- Irrigation development:
  - Area: Approx. 4000ha
  - No. potential direct beneficiaries: 4,000 hh (20,000 pax)
  - Indirect beneficiaries: 6,000hh
  - Cost: GBP21 million
  - Main crops: Rice, vegetables, maize
- Kikonge Hydropower Plant
  - Dam height: 120m
  - Potential installed capacity: 330 MW
  - No. beneficiaries: National
  - Potential Cost: GBP400 million
  - Main advantage: Year round electricity production

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Irrigation Headworks and Main Canals

- Diversion weir:
  - Mass concrete
  - Height: 10m
  - Width: 15m
  - Control gate: 1.5 x 1.5m
- Main canal:
  - Trapezoidal section
  - Length: 10km

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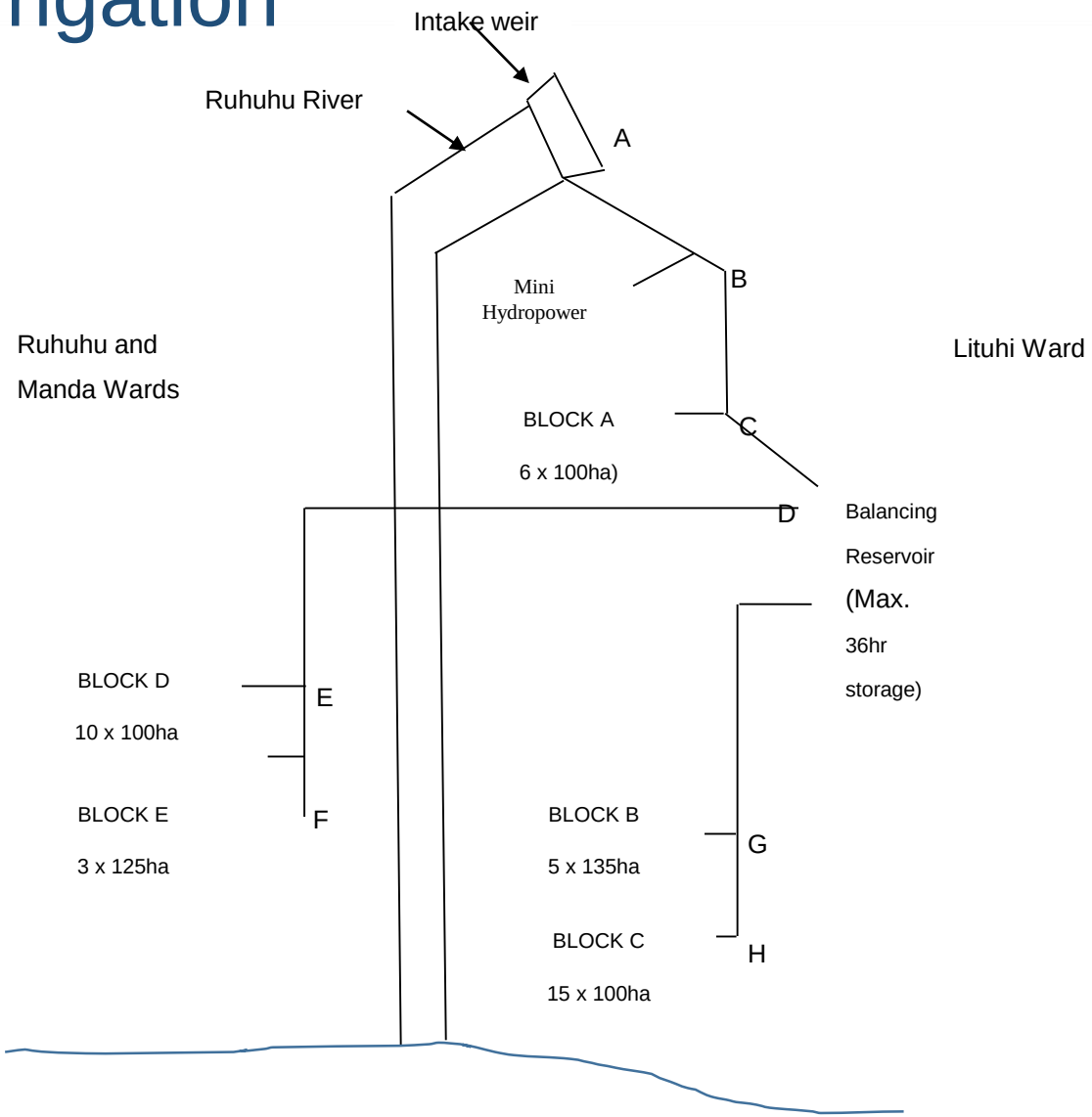
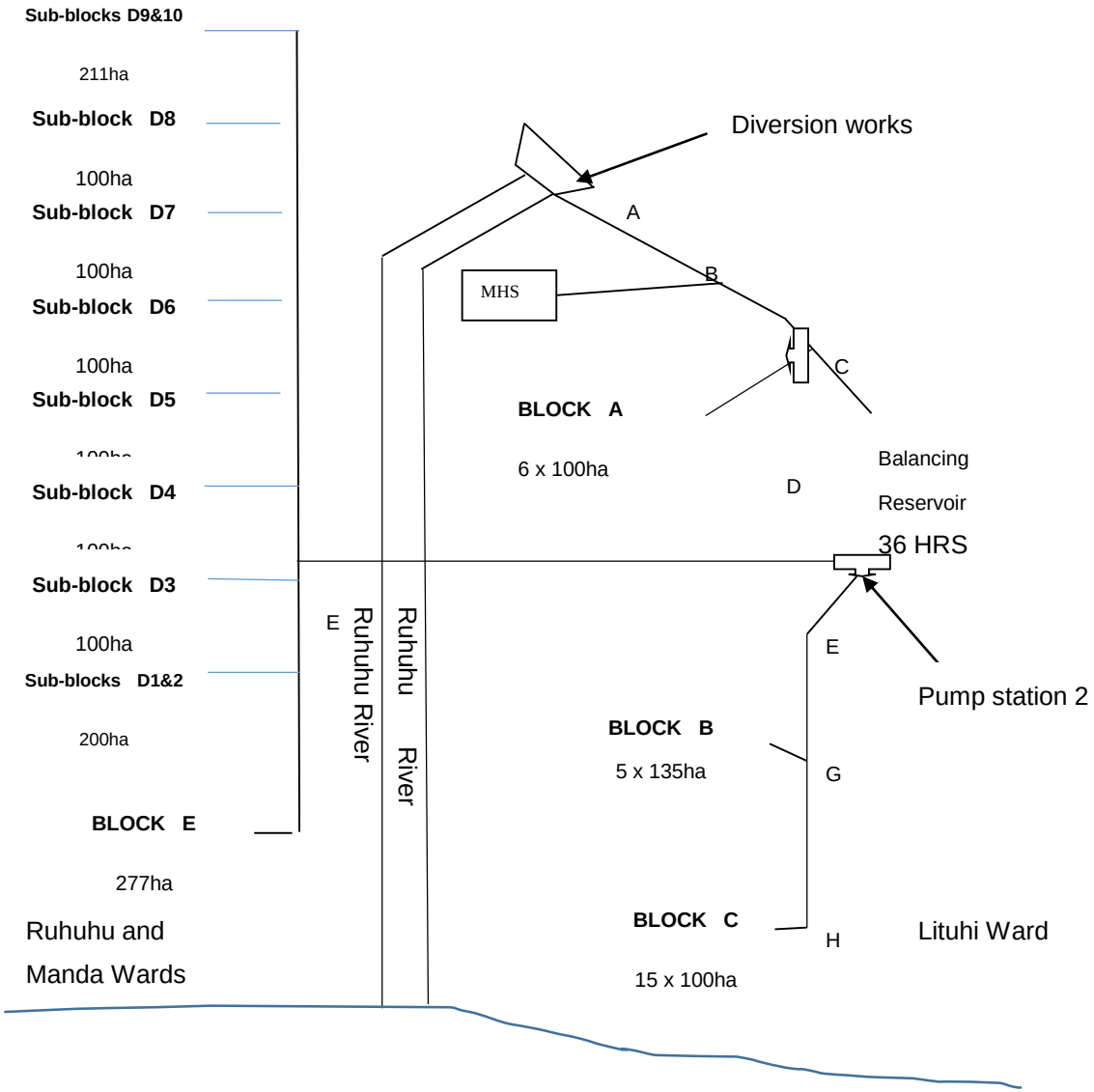
Schematic Layout of Irrigation Blocks – Flood Irrigation



Schematic Layout of Irrigation Blocks – Pumped Option



Cost Estimates

- Flood irrigation option: USD14,350,000 (3,590/ha)
- Pumped irrigation scheme: USD28,925,000(7,230/ha)

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Economic Analysis

Parameters	Value
EIRR - Economic Internal rate of Return (%)	13.3
NPV – Net Present Value (million US$)	3.846
B/C – Benefit Cost ratio	1.16
Average water Unit Cost (US$/ m3)	0.150

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Conclusion

- The scheme is viable from an economic point of view

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Way forward

- Develop scenarios for possible multiplier impacts from irrigation scheme
- Decision from CRIDF and DFID on funding of feasibility study
- If approved, develop terms of reference for the feasibility study, with DITS.
- Consider possibility to seek funding to develop a masterplan for the Ruhuhu Valley, so as to better integrate irrigation development with other developments, especially mining activities.

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Kikonge Hydropower Project

Dam Height	FSL	NMOL	TWL	Ave Head	Active Storage	Ave Annual Dam inflow	Active Storage/ inflow	Station Capacity	Capacity Factor	Spill	Annual Generation
m	masl	masl	masl	m	MCM	m^3/s	vol/vol	MW		%	**GWh**
140	680	640	520	140	11000	120	2.90	285	0.5	5%	**1187**
120	660	620	520	120	6200	120	1.64	240	0.5	10%	**947**
100	640	610	520	105	3000	120	0.79	210	0.5	15%	**782**

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Advantages of Kikonge Hydropower Project

- Large storage – high energy security year round
- Can be flexibly dispatched to meet seasonal or peaking requirements of the system
- Cost of supply likely to be highly competitive with alternatives

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Component description: Water supply and sanitation

- No. of households: 12,000
- Possible Cost: GBP530,000
- Project area: Ruhuhu, Manda and Lituhi wards in Tanzania
- Immediate response
  - Utilise potential ground water sources with simple technology
- Medium term response
  - Rehabilitate existing water systems (e.g. Lituhi water scheme) to determine requirements to improve services

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