OLIFANTS MANAGEMENT MODEL PROGRAMME: MANAGED CONTROL ROOM SERVICES FOR LEBALELO WATER USER ASSOCIATION

REQUEST FOR INFORMATION

REMOTE / MANAGED CONTROL ROOM SERVICES & SPECIFICATION

CLOSING DATE: 12PM, 20 MARCH 2024 (TENDERS@LEBALELO.CO.ZA)

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Revision 1.0

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Abbreviations

AI	Artificial Intelligence
EPC	Engineering, Procurement and Construction
IoT	Internet of Things
ISP	Internet Service Provider
LWUA	Lebalelo Water User Association
NAS	Network Attached Storage
NDA	Non-Disclosure Agreement
OEM	Original Equipment Manufacturers
OMM Programme	Olifants Management Model Programme
PV	Photovoltaic
QNAP	Quality Network Appliance Provider
RFI	Request for Information
SE2	Southern Extension 2

Contents

1. Background

The Lebalelo Water User Association (LWUA) was established in terms of Section 92(1)(a) of the National Water Act, and in terms of a notice published in Government Gazette No. 89/23053. LWUA is acting on behalf of the still to be established Olifants Management Model (OMM) Programme, being a fully transformed entity (Purchaser) and is thus mandated to invite prospective service providers to submit all the documents requested in the Request for Information (RFI).

LWUA's bulk raw water infrastructure extends for approximately 110km through the Eastern Limb of the Bushveld Igneous Complex in the Sekhukhune District Municipality in Limpopo Province. It includes 5 pump stations, 7 reservoirs and crosses 105 communities. It's planned expansion through the Phase 2B & 2B+ project, which forms part of the greater OMM Programme, will double its pipeline in the Northern Limb, and add 3 pump stations. The third tranche of planned expansion projects will add another 100km of pipeline and more pump stations that will triple LWUA's infrastructure and reach in the Limpopo Province.

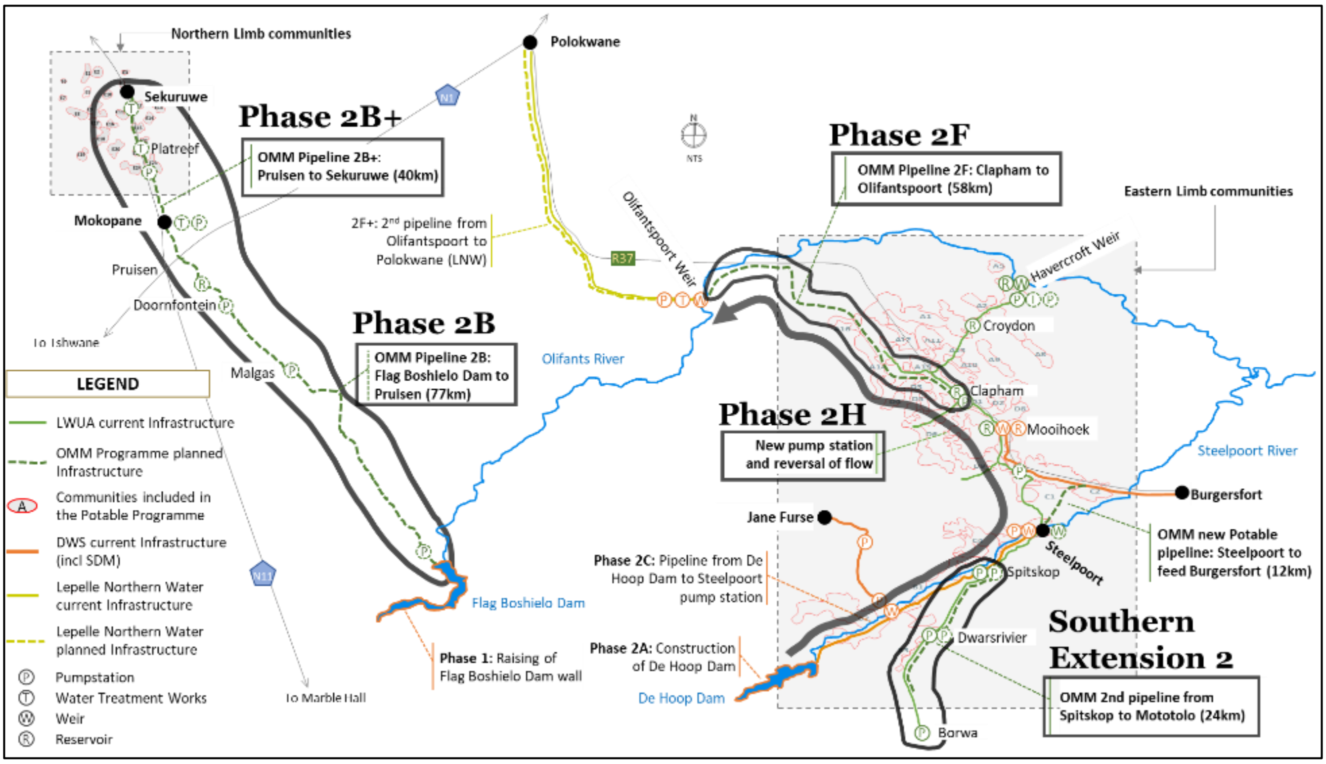
Most communities experience challenges, such as high unemployment, lack of skills and skills development opportunities, high secondary school dropout rates, high rates of HIV and AIDS, electricity supply issues, proximity of shops / food sources and sparse cell phone reception. LWUA understands that to deliver against its mandate it must prioritise the wellness of communities in its areas of operation. LWUA's plan is to leverage its significant asset base and technical expertise in the bulk raw water space to partner with Government, the commercial sector and other Water Services Authorities to help address the water needs of doorstep communities. Our goal is to catalyse the creation of game-changing businesses / initiatives to drive exponential socio-economic growth in the region.

1.1 The OMM Programme

The R27 billion Olifants Management Model Programme ("OMM Programme" and previously known as the Olifants River Resource Development Project) is LWUA's flagship capital expenditure programme that aims to fast-track the construction of bulk raw water and bulk potable water infrastructure to supply targeted communities and commercial water users (such as mining companies, industrial users, etc.) in the Sekhukhune District Municipality and Mogalakwena Local Municipality. The OMM Programme will also enhance water supply to the Polokwane Local Municipality.

Phase 2 of the OMM Programme intends to balance water utilisation in the Middle Olifants River Catchment Area by transferring certain water use licences from Flag Boshielo Dam to the De Hoop Dam for industrial, agricultural and community/social use. The various sub-phases of the OMM Programme are indicated in Figure 1 overleaf and consist of pipeline projects delivering bulk raw water to different areas. The intent is that the bulk raw water would then be treated to become potable water and reticulated to communities.

Figure 1 OMM Programme phases



The provision of potable water to communities in the Eastern Limb will be made possible through new intermediary pump stations and new Water Treatment Works (WTW) near Havercroft, Steelpoort and Ga-Malekana, as well as through the upgrading of the Mooihoek, Steelpoort and Ga-Malekana WTWs, and reticulation up to a yard connection. A potable water connection between Steelpoort WTW (4Ml/day) and the existing Burgersfort pipeline from Mooihoek will be constructed. This approach will reduce current operating costs and make additional water available in the Mooihoek region for reticulation. The provision of potable water to communities in the Northern Limb will be made possible through two new Water Treatment Works near Mokopane and Sekuruwe as well as reticulation up to a yard connection; the bulk raw water will be provided through Phase 2B & 2B+.

Pumping large volumes of water requires high amounts of energy. Up to 30% of the water tariff (excluding capital repayment) is made up of the electricity cost component. LWUA will be installing renewable energy solutions at all its pump stations, starting with the new ones in the Northern Limb. The bulk raw water network and associated pump stations in the Northern Limb are not close to any Eskom electricity supply network. Providing access to the new pump stations using the Eskom electricity distribution network is costly and will not meet the required project or overall OMM Programme timelines. The Eastern Limb has access to Eskom grid connections with current pump stations operating fully on Eskom supplied electricity. However, Eskom is no longer reliable, with continuous load shedding and power failures experienced in the past couple of years. In addition, the unpredictable and high annual escalation in electricity tariffs has led LWUA to investigate and consider alternative and more reliable and predictable energy solutions.

1.2 Current LWUA Operations

LWUA is currently operating the following pump stations:

Table 1: Eastern Limb pump stations

EASTERN LIMB Pump Stations		Havercroft	Clapham	Spitskop	Dwarsrivier	Borwa
Power Demand	MW	4.2	1.0	1.6	1.6	0.6
Nominal Flow Rate	L/s	1065	490	167	167	49

LWUA is in the process of commissioning a second pumpstation at the Spitskop site. The max flow will be limited to 275 l/s for two new 355kW pumps. As part of Phase 2B & 2B+, LWUA will be building the following new pump stations between 2024 and 2026:

Table 2: Northern Limb pump stations

NORTHERN LIMB Pump station		Flag Boshielo	Malgas	Doornfontein
Pump Station load demand	MW	6.234	6.506	6.449
Nominal Flow Rate	L/s	2108	2108	2108

Each pump station's information is available online on the current Zednet water demand management system.

2. Scope of Specialist Services

Lebalelo is looking for a Specialist in the Control & Instrumentation environment that can assist in defining the needs and functionalities of a future-proof, clever and predictive remote control system (or virtual control room) that will be able to monitor and control all its operations across all its sites and pipelines, old and new, in the Eastern and Northern limbs.

The scope of the specialist services includes, at the least, the following:

- Provide an understanding of all the current limitations and operating scenarios, including new system architecture and advise on upgrades, enhancements and future-proofing of operations;
- Plot out the path to fully remote controlled and autonomous operations;
- Increase predictability and preventative measures using the latest technologies;
- Define the next level of control system, using Artificial Intelligence and Neural Networks;
- Propose world-class, state-of-the-art software and equipment to take LWUA beyond its 50-year operation horizon;
- Define the physical interfaces and instrumentation needs for the current EPC contractor(s) that is currently engineering the new pump stations and water treatment works; and
- Prepare an operational and maintenance budget for the envisioned world-class control system.

LWUA is open to considering new ideas. As a guideline for what we think is possible, we have captured the minimum requirements (or functionality) below, but expect the service provider to come up with a software and hardware solution that meets our needs in a creative and intuitive manner.

3. Remote Control Room Functionality

Remote monitoring and control systems are designed to automate the control of large and complex processes. They are usually composed of a combination of digital and mechanical parts that together can capture, analyse, and act upon a higher volume of information faster than a human staff component could safely or effectively manage. Monitoring and control systems are usually comprised of a combination of:

- Sensors;
- Network connections;
- Central computer systems;
- Interfaces for human input; and
- Actuators, which are mechanical or electronic devices that take an action based on user or system feedback.

These systems are important for complying with a number of different industrial standards, such as ISO 9001. They are used across industries for a variety of functions including industrial automation, IT network security, public transit controls, patient monitoring in healthcare and physical asset management and distribution.

LWUA has identified the following core requirement for a Remote Monitoring System:

1. Improved operational efficiency & predictability;
2. Detailed data collection;
3. More uptime;
4. Minimise problem response time; and
5. Effective change management.

3.1 Functional Needs

The remote control system provider needs to consider two things in developing its proposed solution:

1. LWUA's way of business in the sense that the operation of bulk raw water is different than operation of, for example, a single water treatment plant; and
2. Local knowledge of both the raw and potable water businesses, in the public and private spaces.

The criteria for selecting a remote control programme to be used should ensure that all the information that is gathered from LWUA's sites across Limpopo is available in one place or uses a single system. The data needs to be filtered and analysed in such a manner to enable our operators to understand the movement of the water across many kilometres.

LWUA prides itself in its ability to essentially put rivers in pipes over a more than 200 km pipeline network operating at its maximum velocity. Our members' usage is irregular and we cannot predict when we need to start and stop pumps.

The selection criteria for an artificial intelligence (AI) system, and an intelligent remote control system, should be based on experience in developing a system like this on both a hardware and software level, plus experience in working with multiple OEMs to conduct a generic system that can be integrated with old and new equipment, instruments, control systems, valves and sensors. One of the criteria for selection is the flexibility and agility of the company developing the software and hardware to cater for changing needs.

LWUA's operations include bulk raw water infrastructure and, in future, will include potable water distribution. The infrastructure includes big raw water pump stations and raw water storage dams that need to be monitored. Raw water pipelines are normally buried and thus are not prone to any sabotage, however security on our system must be monitored in order to safeguard LWUA's manual valves within an integrated security system. The potable water distribution system will run from existing and new water treatment plants all the way to command reservoirs, and then from command reservoir to a community or municipality. This infrastructure needs to be monitored for leaks and the flow rates need to be monitored too. Custody meters will be installed at every single user/offtaker which will also need to be measured and monitored, and ultimately connected to a billing system to ensure that LWUA is paid for all water used by its various off-takers.

Maximo (provided by IBM) has been implemented as LWUA's maintenance system programme, and the remote control system will need to integrate with Maximo so that any problems picked up on any equipment can be communicated and actioned through to the maintenance system for early detection. The response time to any incidents is critical and the system must ensure that the intelligence of the remote control system can cater for any maintenance predictions and assist in timeous maintenance solutions.

The selection of monitoring equipment should also consider the large pumps and motors utilised by LWUA to ensure that any vibrations or cavitation on those pumps and motors is identified and also communicated with the system operators who may be working across various locations. The system should also be able to track and monitor LWUA's fleet of maintenance vehicles and operators to ensure that they are deployed in the most efficient manner.

The water treatment works will be developed with remote control capabilities which will be maintained by the municipalities supporting the operating system. To ensure that the water inventory in the reservoir is accurate and that the reservoir is used optimally, the system will need to ensure that all level meters and flow meters are integrated to enable a real-time confirmation of the water balance.

3.1.1 Energy Needs

As the energy requirement at LWUA's pump stations is very high, LWUA is planning to integrate solar PV power plants at all its pump stations. The remote control system needs to be able to interface with the solar PV power plants to ensure oversight on how much energy is available in battery storage and how much of that energy can be dispatched to the pump station. Most of the pump stations are in rural areas, and LWUA may not export any excess electricity; LWUA therefore needs to be as efficient as possible in its energy usage.

The remote control system and intelligence will need to ensure that water is pumped at the most critical times to utilise energy efficiently. In the Northern Limb, three pump stations will be connected across a distance of almost 70 km. To utilise the pumps efficiently, a system that can assist in predicting when the sun shines and when it rains on different sections of the same pipeline is needed. Predictability is very important to ensure there is enough power in the system to use it optimally.

3.2 Predictability Needs

The Monitoring and Control Room system will need to predict scenarios, based on received and processed data, and generate outputs accordingly.

Tangible examples would be measuring flow, outputs and quality at various sources of water. The expectation then would be that the system should be able to display a digital twin with live measurements at each point, be able to raise an alarm wherever a measurement is out of range and be able to provide business intelligence reports based on the measurements as per below examples.

- Percentage water quality report across all measurement points;
- Percentage water quality report not within acceptable levels; and
- Percentage water loss or non-revenue water.

The system should include warnings for potential end-of-life on specific infrastructure based on operational hours and manufacturers' specifications, as well as routine maintenance notifications based on operational hours.

The system should be able to display any statistical data in a dashboard format and should allow an optional report on a listed legible format for potential distribution. The system should be capable of utilising several different sources of measurement and be able to react/respond should a combination or cluster of inputs be activated.

For example, if a political instability map were to be overlayed with existing system information on a specific day and a sensor alarm had to go off in the exact vicinity of the instability, then a high-level alert should then be raised, based on the overlap of information from two different sources that indicate that there is an increased risk and that a high-level of attention is required.

The system should also allow for manual entry of data where devices or sensors are not yet available for the automation cycle.

All activity on the system must be securely stored including feedback and input notes to ensure an audit trail and reporting on system integrity.

3.3 Cognitive Control System

This section contains LWUA's expectations of a functional description of a Cognitive Control System:

Sensory Input:

- *Data Acquisition:* The system collects data from various sensors and sources. This data can include inputs from the environment, such as temperature, pressure, images, sounds, or any other relevant information.

Data Processing:

- *Sensor Fusion:* The system integrates and fuses data from multiple sensors to create a comprehensive and coherent representation of the environment; and
- *Feature Extraction:* Relevant features are extracted from the raw data to identify patterns, trends, and key elements.

Contextual Understanding:

- *Contextual Analysis:* The system analyses the data in context, considering historical information and understanding the relationships between different elements; and
- *Semantic Understanding:* The system interprets the meaning of data, recognising objects, events, or situations within the given context.

Learning and Adaptation:

- *Machine Learning:* The system employs machine learning algorithms to recognise patterns, make predictions, and adapt to changing conditions over time; and
- *Training and Feedback:* It continually learns from new data and user feedback, refining its models and improving its decision-making capabilities.

Decision-Making:

- *Probabilistic Reasoning:* The system makes decisions based on probabilistic reasoning, taking into account uncertainties and probabilities associated with different outcomes; and
- *Goal-Oriented Decision Making:* It aligns decisions with predefined goals and objectives.

Action Planning:

- *Action Generation:* The system generates a set of actions or responses based on its decisions and goals; and
- *Resource Allocation:* It optimises the allocation of resources to execute actions efficiently.

Execution and Monitoring:

- *Control Execution:* The system implements the selected actions in the physical or digital environment; and
- *Real-Time Monitoring:* It monitors the effects of its actions in real-time and adjusts its strategies if needed.

Human Interaction:

- *Natural Language Processing:* The system may interact with users through natural language interfaces, understanding and generating human-like language; and
- *User Collaboration:* It allows for collaboration with human operators, incorporating their inputs and feedback.

Self-Awareness:

- *Self-Monitoring:* The system can monitor its own performance and detect anomalies; and
- *Self-Optimisation:* It can adapt its own algorithms and parameters to optimise performance.

4. Deliverables

In reply to this RFI, we request that the Interested Party submit the following:

1. Company brochure, background documents and the necessary registration forms;
2. A Non-Disclosure Agreement (NDA) – The criteria for selecting a company is based on the company's know-how and intellectual property. We will protect the intellectual property by signing a reciprocal non-disclosure agreement with each company that is replying to the request for information. At least five examples of your experience and knowledge in respect of development and design of remote monitoring and control systems is required;
3. A list of 3rd party technologies, service providers and/or preferred OEM;
4. A typical signal list required for monitoring purposes;
5. A typical architecture (see example of LWUA's architecture below);
6. An indication of the typical key performance indicators for a system like this; and
7. An indication of what would be included in a service level agreement to ensure a quick turnaround on any system failure.

If you are interested in submitting a response to this RFI, please return the signed NDA together with your contact details to tenders@lebalelo.co.za. A SharePoint site will be created to enable you to upload your response, with access limited to only your specified e-mail addresses. After the submission date, access to these SharePoint sites will be revoked.

To be considered for this RFI, please respond by no later than **12:00** on **20 March 2024**.

Figure 2: Referenced architecture