**SAFE WATER SUPPLY MASTER PLAN UKHIA SUB-REGION ROHINGYA RESPONSE**

**Beneficiaries**

The master plan has taken into account the population growth (natural growth population rate = 2.59%) and the minimum standard for population density provided by UNHCR in this camp (20 m2/person).

The complete network of water distribution systems has been designed for **881,951 people** in 26 camps so far.

**Standards**

|  |  |  |
| --- | --- | --- |
| **TOPIC** | **UNITS** | **VALUE** |
| Minimum Taps per water point | Taps | **4** |
| People per tap | People | **100** |
| Maximum distance from HH to the tap | Meters | **100** |
| Minimum Number of tap stands | Tap stand | **1 per MAHJI BLOCK** |
| Daily water demand for population | Litres/person\*day | **20** |
| Daily water demand in schools | Litres/day\*pupil | **3** |
| Daily water demand in health centre per inpatient/bed | Litres/day | **50** |
| Daily water demand in health centre per outpatient | Litres/day | **10** |
| Design life (\*) | Years | **20** |
| Factor of wastage and leaking | % | **20** |
| Design flow per tap | Litres/sec | **0.175** |
| Pressure limits (taps closed) | Bar | **0.3 - 5** |
| Minimum pressure within the tap open | Bar | **0.3** |
| Pipe flow velocity limits | Meters/sec | **0.3 – 2.0** |
| Minimum pipe PN | Bar | **6** |
| Minimum pipe fittings PN | Bar | **10** |
| Minimum trench depth | mm | **1000** |
| Minimum burial depth under road surface (\*\*) | mm | **1000** |
| Water storage for fire risk per water storage location | % | **10** |
| Daily water per mosque | Litres/day | **500** |

(\*) Population growth will be forecast for 20 years. However, it is recognised that there is likely to be a maximum possible density of people.

(\*\*) Pipes buried under roads will be protected for a GI pipe.

**WATER SOURCE**

Tipam Sandstone aquifer: The extents of the aquifer underlying the mega camp are currently unknown. So far it is understood that the aquifer is at least 400 meters deep (based on a borehole drilled by JICA/IOM that is understood did not reach the Bokabil Shales which constitute the base of the aquifer).

A groundwater model needs to be developed to help determine and predict impacts. The model needs to be developed using reliable, good quality data from the entire aquifer extents both within and outside of the camp

**GENERAL CONCEPT OF SAFE water DISTRIBUTION NETWORK**

After analysing different options for a sustainable water distribution system in the Rohingya refugee camps, taking into account topography, population figures and density, humanitarian partners work on-going, CapEx and OpEx expected, flooding areas, etc., in June 2018 was decided among a group of experts from IOM, UHNCR, UNICEF, DPHE and Oxfam that the water network will consist in a number of individual systems non-connected between them. Each of this system will supply water to a different amount of population, from around 2,000 until a maximum of 30,000, although most of them will cover a population in a range between 2,500 and 7,500 people.

To avoid gaps and overlapping, the water distribution systems implementation will be organized by areas or zones “Water Distribution Zone” (WDZ). The complete area covered by the 26 camps included in this Master Plan have been divided in 138 WDZ’s.

Through the drilling of good quality production boreholes (minimum of 6” casing for installation of submersible pump and 700 feet deep) and using **only solar power** (not hybrid system although the IP can decide to have any back-up system), the underground water will be pumped to a water storage and distribution tank. In the pumping line will be connected a variable rate dosing pump for chlorination in-line before the tank. The water storage tank will have capacity to collect and supply all the water pumped with solar power during all the solar hours. At the same time, the tank will have a storage capacity for at least 15 litres per person per day.

From the water storage tank (situated in the highest point of the area to be supplied), a pipeline system (using PE pipes) distribute the chlorinated water by gravity to the tap stands. There must be at least one tap stand per Mahji block, and the location and design of the tap stand will be selected by the community supplied. The pipelines will avoid crossing flooding areas.

The implementing agencies, following up designs, standards and technical specifications provided by the master plan and/or technically reviewed by the WASH sector, will ensure the chlorinated water supplied to the community during the 24 hours of the day in a minimum quantity of 20 litres per person per day during the worst month of solar energy in the area (July).

The layouts have been designed to have certain flexibility for the final implementation as the changes in the settlement during the design of the master plan, the yield of the different production boreholes, and the capacity of the different IP’s.

**Quality (parts of the network and CE)**

* COMMUNITY ENGAGEMENT

During design and implementation of any water distribution system, the Community Engagement (CE) approach will be used. This is a participatory consultative process that works with diverse sections of the community to make collective decisions. It is planned to align with timeframes within engineering workplans. The CE process is flexible dependent on the capacity of the organisation and must be iterative (repeated visits, particularly if construction is slower than planned).

Bringing a focus on community engagement and collective decision making to the network mapping and construction work, the water distribution facilities are better managed and more sustainable as beneficiaries are decision makers for the design and building activities.

Community Engagement at the initial stage can also contribute to better sustainability in the longer term. Moreover, it can contribute to minimising tensions, safety concerns, protection issues and increase access for marginalised groups.

* PRODUCTION BOREHOLES

The Master Plan includes bill of Quantity and technical specifications for a 6” casing borehole that provide a flow of around 20 m3/h. Inside of this type of borehole it would be possible to install submersible pumps that could supply water to a population of maximum 6,700 people in the worst month of solar radiation during a complete the year. However, the design of the production borehole is not closed to this design as in the region and among the drilling companies in the area are different capacities and drilling rigs.

The use of centralizers to ensure quality of the production boreholes is recommended. Moreover, in view of the poor quality of the lithological log based on samples collected during drilling, it is strongly advised to run geophysical logs (resistivity, SP and gamma) upon completion of drilling, before the casing is installed.

* SOLAR PUMPING SYSTEM

To simplify the operation and maintenance of the water distribution system and for the sustainability of the system, it has been decided the installation of pumping solar systems that could provide without any support the minimum quantity of water to the population in the worst month of the year (solar radiation available).

In this master plan, it is suggested 6 schemes for solar pumping system based in the study done with the software Compass (from Lorentz solar pumping) that can be found in the Annexe 4. It is not necessary to use this specific brand for implementation; however it is included some technical specifications that must be followed by implementing partners to ensure the quality of the solar pumping system in case of the IP use for implementation other solar pumping company.

Moreover, in the Annexe 4 are three types of design for the mounts use for the installation of the PV panels as the availability of space is one of the main challenges for the implementation of these systems.

* CHLORINATION SYSTEM

All the water supplied to the beneficiaries must be chlorinated. The chlorination will be done in-line throughout the installation of a chemical dosing pump with variable rate connected to the pumping pipeline before the entrance of the water into the tank. This dosing pump will be connected electrically to a water meter and will receive the power from the solar system used for the submersible water pump.

The characteristics of the dosing pump and an installation manual can be found in the Annexe 5.

* Water Distribution/storage tank

There must be a unique location for the storage/water distribution tank volume required. This will reduce the operation and maintenance process in daily bases. It must be placed in the highest point of the water distribution zone (if possible). This area must be assessed to ensure the stabilization of the ground when the tanks will be full of water (extra weight) and with the heavy rains flowing (drainage and soil stabilization works must be done if required).

The volume required has been studied taking into account the volume of pumping during the hours and the consumption estimated during the day among the beneficiaries, with two picks of consumption (at the beginning of the morning and in late afternoon). Moreover, the complete volume of the tank must cover the water needs for emergency (15 litres/person/day) of the population supplied for one complete day.

Due to the existing risk of fire in the camps, it is required also a minimum of 10% extra capacity for firefighting. This volume should be self-contained for exclusive use in case of emergency. It could be use a different storage or a system of valves at different heights in the same water tank used for distribution.

* pipelines

It will be used PE pipes for distribution purposes and it is suggested the use of butt fusion technology for a reliable, robust and durable jointing of pipes.

The pies must be completely protected by sieved material (layers of 10 cm below and above the pipe).

Every branch of the system will have a control valve (inside of a manhole/valve box) for easier maintenance and control of the system.

In case of a pipeline is passing through a high point where there has not been installed a tap stand, it is essential the installation of an air release valve.

**Guidance for coordinate the implementing partners**

**ANNEX 1: CODING SYSTEM**

**ANNEX 2: COMMUNITY ENGAGEMENT PROCESS**

**ANNEX 3: PRODUCTION BOREHOLES**

* **Bill of Quantity (6” casing)**
* **Technical specifications**
* **Bore log template**
* **Pumping test guide**

**ANNEX 4: SOLAR PUMPING SYSTEM PROPOSED AND TECHNICAL SPECIFICATIONS**

* **Technical specifications minimum requirements**
* **Sample for Water Solar Pumping System Tender**
* **Solar systems proposed and technical specifications x 6 times including:**
	+ **Irradiation and output expected**
	+ **System characteristics**
	+ **Wiring diagram**
	+ **Solar system layout**
	+ **Pump technical data**
	+ **Accessories technical data**
* **Resume of solar systems proposed**
* **Structure for PV modules design x 3 times**

**ANNEX 5: DOSING PUMP VARIABLE RATE SPECIFICATIONS AND INSTALLATION PROCEDURE**

* **Variable rate dosing pump 12 V technical specifications**
* **Installation manual**

**ANNEX 6: WATER TANKS AND SOIL STABILIZATION**

* **Guide Installation for Oxfam Tank**
* **BoQ, design and construction methodology for ferro-cement tank**
* **Comparative table for tanks installation**
* **Design and BoQ for concrete platform to elevate Oxfam tank.**
* **Soil stabilization and drainage**

**ANNEX 7: LAYOUTS**

* **Layouts of water system per WDZ**
* **Layouts of water distribution per camps**

**ANNEX 8: OPERATION AND MAINTENANCE PLAN**

* **O&M plan**
* **O&M cost expected**

**ANNEX 9: WATER QUALITY**

* **Parameter of water quality**
* **Water quality surveillance protocol**

**ANNEX 10: PICTURES OF THE WATER NETWORK COMPONENTS**

**ANNEX 11: DRAWINGS OF OTHER ELEMENTS FOR THE WATER NETWORK**

* **Pipe Trench**
* **Valve Box**
* **Pump House**

**ANNEX 12: INFORMATION MANAGEMENT**

**ANNEX 13: CONSTRUCTION SPECIFICATIONS (VEI/DSS?)**