FIRST ADDENDUM

to the

EIA for the Integrated Water Resource Management Project

AA. Ukulhas, Maldives

MODIFICATION TO PROPOSED FEEDWATER INTAKE

Proponent: Ministry of Environment and Energy

Sandcays

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Consultants Declaration

This EIA has been prepared according to the EIA Regulations 2012. I certify that the statements in this Addendum to the Environmental Impact Assessment report are true, complete and correct to the best of my knowledge and abilities.

Ahmed Zahid

Consultant Registration No. EIA 08/07

Proponent's Declaration

On behalf of the proponent of the proposed development I guarantee that I have read the report thoroughly and that to the best of my knowledge all information provided here is accurate and complete.

1 Introduction

This is the first addendum to the Environmental Impact Assessment report prepared for the Integrated Water Resource Management Project, AA. Ukulhas, Maldives. This report is based on the scope identified by the EPA on 11 June 2014. The report covers the request to change the feed water intake from the lagoon to extracting water by boreholes there are disadvantages in taking water from the lagoon which is proposed in the EIA report. The location of the borehole is given in Figure 1.

2 Proposed Modifications

The report covers the request to change the feed water intake from the lagoon to drawing water from one or more boreholes. There are disadvantages in taking water from the lagoon which is proposed in the EIA report. These two methods have been discussed below for their environmental, social and economic implications in order to understand the reasons for the proposed modification to the feedwater intake method.

1.1 Lagoon Intake

Although the lagoon intake is the proposed method for the feed water intake of the proposed system in AA. Ukulhas, it could pose several problems. Firstly, during lagoon intake, sediments from the marine environment may be drawn into the pipe which cause blockages and decrease membrane life. Furthermore, due to the increased tendency of blockages, the maintenance cost of this method of feed water intake would be higher. Moreover, relating to how the project is based on, the RO plants are most depended in the dry seasons of the year, when the water is scarce. Therefore if the pipes are getting blocked, that would mean that the service might be halted from time to time. This would result in social unrest and health issues, especially at an age where climate change is happening at an increased rate and the climate predictions are inaccurate, it would be impossible for the locals to prepare for what might happen as the dry period may last much more than expected. If the RO plants fail, they have to turn to more expensive sources of water such as bottled water. This would be another burden for them in a time of distress.

Furthermore the trapping of marine organisms against the intake screens by the velocity and force of water flowing to it (impingement) and smaller marine organisms passing through the

intake screens and getting into process equipment (entrainment) are two further impacts of sea intakes or reef intakes. If the equipment is damaged by entrainment, it would decrease the life span of the system and might require changes to the components of the RO plant. Finally lagoon intake can pose aesthetic concerns, therefore this method is not recommended.

2.1 Boreholes

In the Maldives, the Borehole Guidelines indicates that the borehole should be 30m below the ground and that the feed water shall have an electrical conductivity not less than 50,000uS/cm. Therefore, the proposed method is to draw water from a 30m-deep borehole.

However, since this is a Guideline, alternatives may be adopted in consultation with the Environmental Protection Agency. There are two alternative options: groundwater direct from the water lens and brackish water using a borehole drawing water from below the water lens at about 10m below the water table. While these options are believed to have minor impact on the overall groundwater lens since the boreholes are usually in the periphery of the island, these options need to be studied further. Of these, the option of drawing direct from the water lens would reduce costs dramatically, however, may not be allowed as it could have a negative impact on groundwater aquifer or neighbouring household wells. However, if the borehole is on the periphery of the island as shown in figure 1, brackish water below the freshwater lens could be obtained as shallow as 10m from the surface. This is not expected to have an impact on the groundwater aquifer during operational phase for small water works.

The deep borehole option may be expected to be cheaper than the seawater intake option in that the draw water would be generally free of sediments thereby increasing membrane life. However, most existing systems in Maldives use the seawater intake possibly due to ease of installation and for some potential for anoxious conditions resulting in ammoniacal or hydrogen sulphide smell in the product water if groundwater were used.

3 Regulatory requirements

These have been discussed in the original EIA report in detail including the borehole guidelines, which are discussed below.

3.1.1 The Borehole Guidelines

Borehole Drilling Technical Specifications and Guidelines were issued by EPA dated 25 September 2011. The Guidelines covers drilling of boreholes and installation of electric pumps for source water extraction for various water supply development projects. The Guidelines state that boreholes shall be drilled at the location(s) designated by the client in consultation with Environmental Consultant and Environmental Protection Agency (EPA). It is also stated that care must be taken in handling and storage of all drilling fluids, oils, greases and fuel on site, to avoid any environmental pollution, damage and degradation. Any toxic materials, drilling fluids and other additives, cuttings and discharged water shall be disposed in a manner that do not cause damage to the environment, public and private property.

According to the Guidelines, the in-land borehole depth shall be more than 30m even if the electrical conductivity of discharge water has reached 50-60mS/cm before reaching 30m depth. If electrical conductivity of discharge water at 30m depth is measured less than 50-60mS/cm, drilling shall continue until electrical conductivity reaches to 50-60mS/cm. This aspect of the Guidelines has raised concerns especially with reference to boreholes at the periphery of the island where, according to renowned hydro-geologists, the freshwater lens may not exist and therefore shallower depths may be considered. Further studies are proposed under the scope of the proposed project in order to determine the exact nature of this.

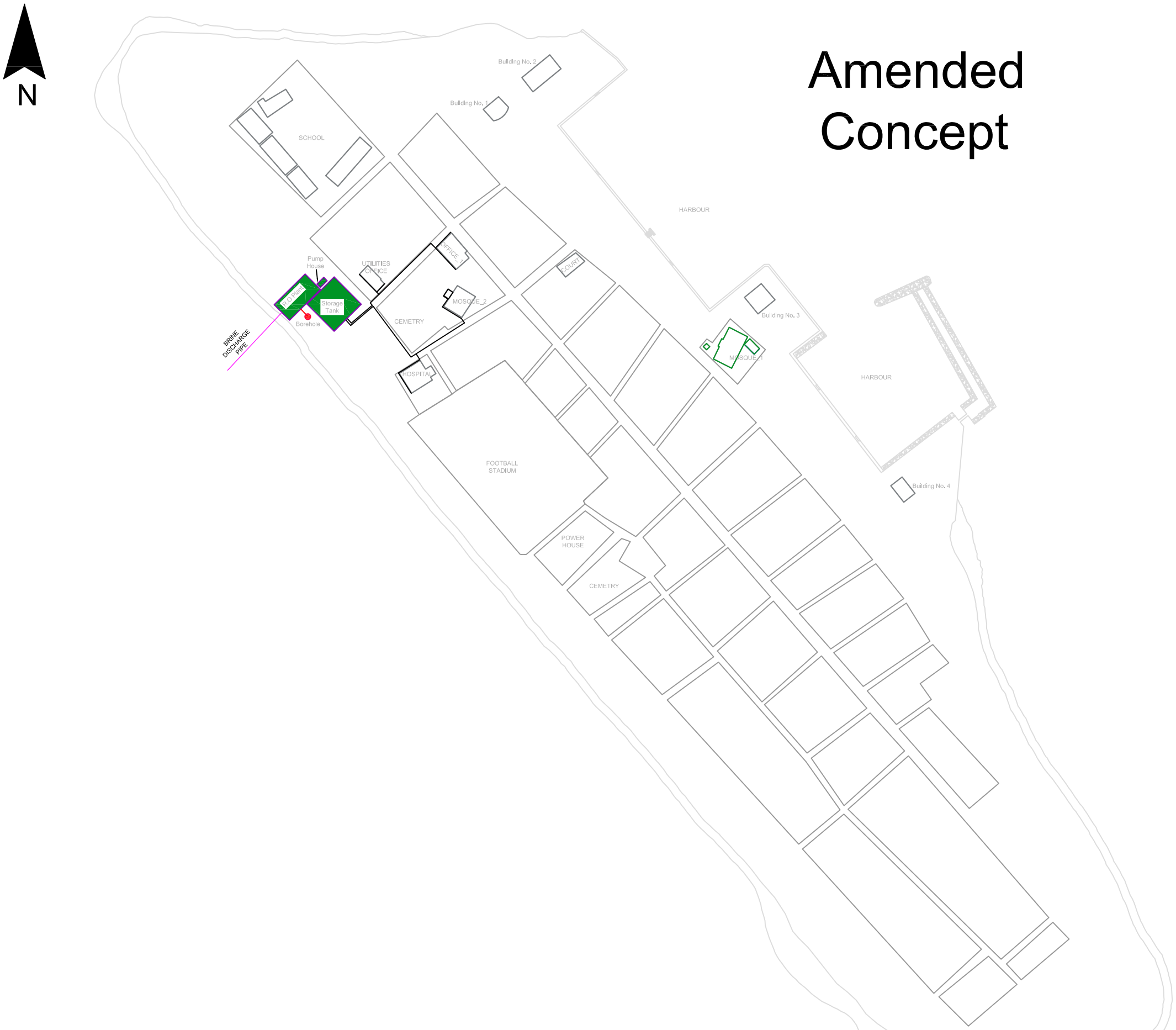
The Guidelines also provide guidelines for the different records that ought to be made during the drilling process. For monitoring purpose, boreholes drilled shall provide water sampling tubes at the interval of 5m from top to bottom. Water quality testing that may be necessary to be performed upon completion of the borehole has also been indicated in the Guidelines.

This guideline would be respected in case desalination is considered for the project and a borehole is the preferred option for feedwater.

4 Conclusions

Given assessment of the two options, the option of extracting water through bore holes is preferred over the lagoon intake due to decreased environmental impacts, more reliability to the operation of the RO plant, which is a major point as the service provided would be depended upon by the community of Ukulhas, and the sustainability of the project, where the use of boreholes are expected to increase the life span of the project.

Amended Concept



	WAPCOS Plot No 76C Institutional Area Sector 18 Gurgaon, Haryana, India	Client Ministry of Environment and Energy Government of The Republic of Maldives	Project Title	**Feasibility Report, Detailed Scheme Report, Bidding Documents and supervision of construction for a Roof Water Harvesting based Water Supply Scheme in AA.Ukulhas**
			Drawing Title	Intake and Brine Disposal Locations
			Status	Drawing No. / Rev.
				Scale: Nts / 0

Appendix: Terms of Reference