



Attachment 1: TERMS OF REFERENCE

Title of Assignment	Design, Supply, and Install Shade Balls Technique in the Zarqa Ma'in Dam lake.
Project Title	Job creation to prevent soil erosion and reduce evaporation in Zarqa Ma'in dam
Targeted Area to be shaded	5300 m ² of the Dam lake area
Location	Zarqa Ma'in Dam - Madaba
Duration	Two Months

1. Project Overview

About the Project

The project Job Creation to Prevent Soil Erosion and Reduce Evaporation in Zarqa Ma'in Dam project is funded by the Federal Ministry for Economic Cooperation and Development /implemented by Deutsche Gesellschaft für International Zusammenarbeit (GIZ), in partnership with (IUCN).

The project aims to improve the living condition of the Jordanian host communities and the Syrian refugees by creating job opportunities to reduce soil erosion and minimize the evaporation in the dam, in order to achieve this objective IUCN, intend to implement different types of interventions and measures such soil erosion control measures, shading techniques, afforestation, rangeland restoration, support the local community through rehabilitate the existing irrigation canal.

About Zarqa Ma'in Dam

The Zarqa Ma'in Dam is located 5 km south of Ma'in town at the top of the Ma'in Hammamet Resort, 12 km southwest of Madaba city and almost 21 km from the Jordan Valley (N 31° 38' 49.4196"; E 35° 42' 18.738"). Zarqa Ma'in Dam receives its water from the Zarqa Ma'in watershed that starts south of the village of Ma'in and it begins in Ain Al-Zarqa at an altitude of 584 m above sea level and meets with a group of springs in the area called the Ma'in Baths, its length is about 18 km.

Zarqa Ma'in dam is relatively a newly established dam, where it has begun storage in 2017. This provides a great opportunity to implement measures that can protect the dam structure from soil erosion and sediments, enhance water storage capacities, increase the life expectancy of the dam, and support beneficiaries in the long term.

In the frame of enhancing the storage capacity and reducing the evaporation from the Dam Lake, the shading technique will be applied by partially shading the dam lake using shade balls, as 11% of the average area of the dam lake, which is 5300 m².

About the shade ball

Shade balls are float thin black-skinned hollow spheres about 4 inches (10 cm) in diameter, manufactured from HDPE UV-stable and float on top of liquid surfaces to create a continuous cover layer

on the surface of liquids. Depending on the number of balls placed on a given surface, they can cover up to 91% of the surface in a regular shape, self-arranging next to each other. This cover layer separates and isolates the open surface of the liquid from its surroundings, i.e. it significantly reduces the effect of the liquid on the environment and vice versa. Several names are used for these balls, often referred to as shade ball, float ball, cover ball, armor ball, barrier ball, or bird ball.

About the tender

This tender is A design-build tender where the contractor will be responsible for both design and installation phases of this project. Accordingly, IUCN-ROWA is seeking for a qualified company to design, supply, and install shade balls and all the needed works in the Zarqa Ma'in Dam lake.

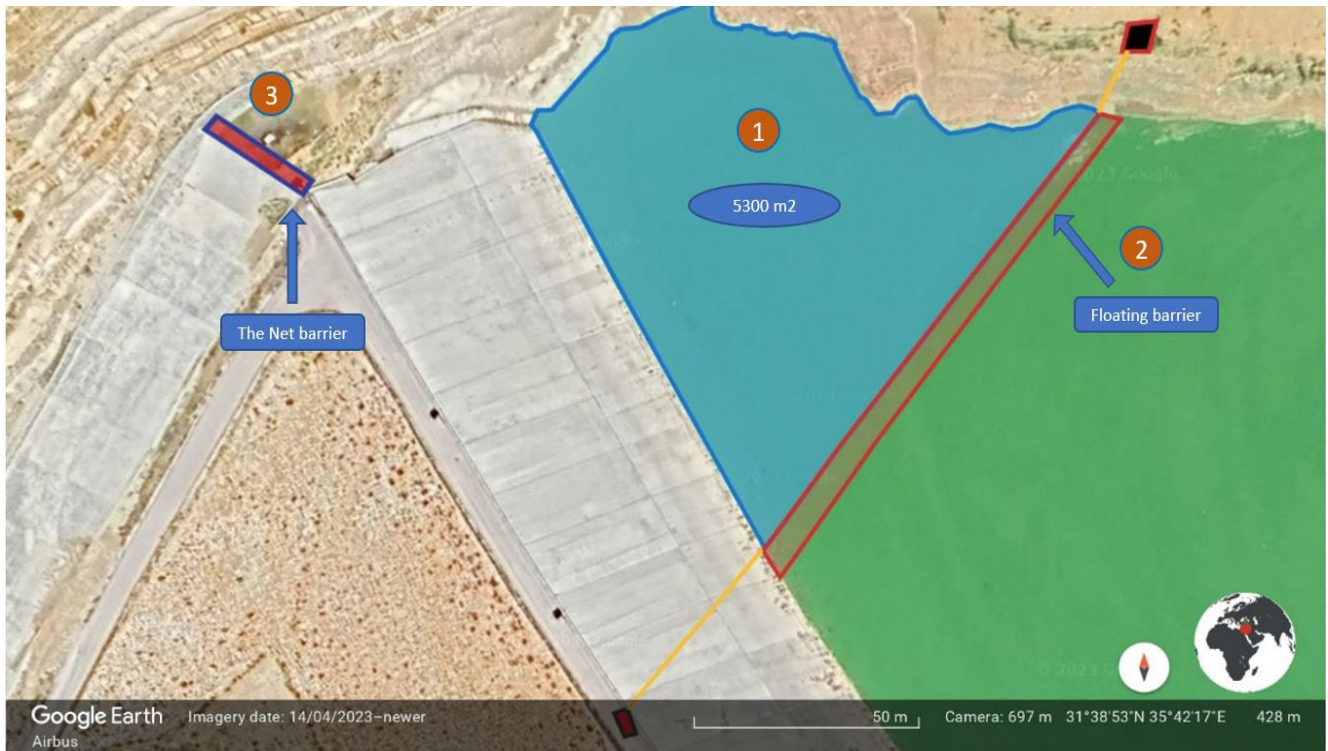
2. Scope of Work and responsibilities.

This tender aims to design, supply, and install shade ball activity components for the Zarqa Ma'in Dam lake. Under this tender, **11%** of the Dam lake area (**which is 5300 m²**) will be shaded using shade balls to reduce evaporation and enhance the storage capacity of the dam's reservoir.

The shading activity will be comprised of three main components (See Figure 1), as follows:

1. Shade 5300 m² of the dam's reservoir area by supplying and installing shade ball technology.
2. Design, supply and Install a floating barrier along the open side of the targeted area; to ensure keeping the balls close to each other in the targeted area (5300m²) to avoid spreading the balls over the entire dam lake.
3. Design, supply and Install a net barrier on the Dam's reservoir spillway; to secure the balls inside the dam's reservoir in flood cases.

Figure 1: Shading activity Components



Under this tender, the contractor is requested to design, supply, and install the components of this activity up to the highest design and installation standard under full guidance and direct supervision from the IUCN-ROWA staff and the assigned technical assistance company as a Third Party, which will be hired by the IUCN to follow up and review the design and implementation as all the submittals that will be provided by the contractor including the design, specifications, and installation methods will be subjected to be approved by this company.

3. Design and installation requirements and specification

The contractor during the design and installation of this tender must abide by all of the standards, requirements, and specifications for designing and implementing of the shade ball technique and the technical guidance by the third party, as given in the table below. Considering that the contractor will work under the full supervision and guidance of the IUCN team and the Technical Assistant company (third party), where is all the designs and submittals will be subjected to be reviewed and approved by the Technical assistant company and the IUCN.

Slandered, Requirements, and Specifications for the designing and implementing of the shading ball components
<p>1. Shade Balls: The contractor should supply and install the shade ball according to the required specification as well as should provide all the documentation, third-party testing, and certification for the below prescribed specifications:</p> <p><u>Dimensions and Materials specifications:</u></p> <ul style="list-style-type: none"> • Shade balls should be float-thin black-skinned hollow spheres. • The ball should be 4 inches (10 cm) in diameter and 40 g in weight. • Manufactured out of virgin HDPE UV- additive materials, Carbon Black Additive. • Fully Recyclable. • Shall not release any toxic gases, vapours and unpleasant odours, as defined in the latest EPA List of Hazardous Air Pollutants, and in accordance with the Ministry of Environment recommendations. <p><u>Applications:</u></p> <ul style="list-style-type: none"> • Suitable to use in the dam’s reservoirs (open surface water). • Suitable for all water quality (drinking, domestic, agricultural). <p><u>Efficiency and warranty:</u></p> <ul style="list-style-type: none"> • Cover efficiency should be not less than 90% of the water surface. • Wind resistance should be not less than wind speed of 80 km/h measured 1 meter above the water surface. • Requires no maintenance. • 10-year manufacturing and installation warranty. • The efficiency in reducing evaporation should be not less than 85%. <p><u>Quantity:</u></p> <ul style="list-style-type: none"> • The balls quantity should be not less than 116 balls/m²; or to achieve Shading percentage not less than 90% <p><u>Other:</u></p> <ul style="list-style-type: none"> • Should be able adaptable to water level variation. • Installation method- dumping. • Packaging: bag, cardboard, or in bulk.

2. Floating barrier: The contractor should design, supply and install a floating barrier according to below design and installation requirements.

Purpose and dimensions of floating barrier:

The barrier should be designed and installed along the open side of the targeted area (shaded area), see figure 1.

The barrier should be designed to secure and keep the shade balls in the targeted area and avoid spreading them over the entire dam's lake.

Based on the initial assessment, the length of the barrier will be from 100 - 120 m. (it's indicative quantity, should be validated and measured in the design stage)

Hydrodynamic Forces:

The design should consider the potential impact of water flow, currents, and waves generated by the dam's operations.

Reservoir Level Fluctuations:

Dam Lake always has water level fluctuations. So, the barrier should be designed with enough flexibility to accommodate these changes while maintaining its effectiveness. Considering the operation and maintenance aspects.

Balls Containment and Management:

The floating barrier should be designed to contain and secure shade balls and ensure the barrier's design prevents balls from bypassing it to keep the balls in the targeted area.

Safety Considerations:

Prioritize safety by designing barriers that do not pose risks to people, or wildlife. Ensure that the barrier is visible, and properly marked, and should be designed to prevent entanglement.

Durability and Corrosion Resistance:

The barrier materials should be selected to withstand the water's chemical composition and potential corrosion due to long-term exposure to dam lake conditions. All fixtures, connections, accessories shall be made of suitable approved anticorrosive material in compliance with relevant ASTM standards.

Anchoring and Mooring:

The design should develop a robust anchoring system that can securely hold the barrier in place, considering avoiding fixing it on the dam's infrastructure as well as considering the potential need for adjustments based on water level changes which could lead to widening and narrowing of the shaded area.

The contractor shall submit a full set of structural design calculations for the anchor system. The barrier and the anchor systems shall be designed for Flood Load, as per ASCE-7-16, for approved "Design Flood" flow. The Contractor is responsible to obtain all relevant data from the Ministry of Water and Irrigation and the JVA, to design the system for 100-year flood intensity.

Water Quality Impact:

The design should consider the potential impact of the barrier on water quality. as the barrier materials should be non-toxic and do not adversely affect the lake's ecosystem.

The HDPE material shall meet the ANSI/NSF requirements for potable hot water pipes.

Aeration system shall be designed, supplied and installed, if needed to maintain the percentage of dissolved oxygen in the lake and maintain the water quality. The Contractor shall conduct a Water Quality Environmental Impact Assessment to evaluate the effect of covering the water surface on the lake's water quality.

Emergency Preparedness:

The design of the barrier should consider emergency situations in which the system can be removed, adjusted, or stabilized in acceptable timely manner, especially in case of emergency water discharge.

Weather and Climate Considerations:

The design should consider weather conditions and temperature variations in the design. The barrier should be able to withstand extreme weather events such as storms, high winds (90 km/hr. at 1-meter elevation above water surface level), and variations in temperatures.

Maintenance and Accessibility:

The design of the barrier to be easily maintained and accessed for inspections, repairs, and adjustments. This is crucial for ensuring the barrier's ongoing effectiveness.

Collaboration with Experts:

Collaborate with engineers, environmental experts, and relevant stakeholders to ensure a well-informed and effective barrier design that addresses all aspects of the dam lake environment.

IUCN assigned Technical Assistance (third party, as it will be named formally by email after tender awarding) to review all the design packages and method statements for the floating barrier.

Submittal:

The contractor is requested to develop a full package design for the barrier including calculation (design report), drawings and specifications as well as method statement for installation, these documents should be submitted to the IUCN and the TA firm for reviewing and approval before starting installation.

3. Net Barrier: The contractor should design, supply and install a net barrier according to the below design and installation requirements.

Purpose of the net barrier:

The barrier should be designed and installed along the entrance of the spillway from the dam lakeside.

The barrier should be designed to secure and avoid getting out the balls from the dam lake in case of a flood.

Based on the initial assessment, the length of the barrier will be from 20 - 25 m in length and 3 meter in height. (it's indicative quantity, should be validated and measured in the design stage)

Flood Forces:

The design should consider the potential impact of water flood, and the water level that could be reached during flood, as described above.

Balls secure and Management:

The net barrier should be designed to secure shade balls and prevent balls from bypassing them to keep the balls inside the dam lake. (The opens of the net should be less than 10 cm)

Safety Considerations:

Prioritize safety by designing barriers that do not pose risks to people, or wildlife. Ensure that the barrier is visible, and properly marked, and should be designed to prevent entanglement.

Durability and Corrosion Resistance:

The barrier materials should be selected to withstand the water's chemical composition and potential corrosion due to long-term exposure to weather conditions. All fixtures, connections, accessories shall be made of suitable approved anticorrosive material in compliance with relevant ASTM standards.

Anchoring and Mooring:

The design should develop a robust anchoring system that can securely hold the barrier in place, considering avoiding fixing it on the spillway infrastructure.

The contractor shall submit a full set of structural design calculations for the anchor system. The barrier and the anchor systems shall be designed for Flood Load, as per ASCE-7-16, for approved "Design Flood" flow. The Contractor is responsible to obtain all relevant data from the Ministry of Water and Irrigation and the JVA, to design the system for 100-year flood intensity.

Emergency Preparedness:

The design of the barrier should consider emergency situations in which the system can be removed, adjusted, or stabilized in acceptable timely manner, especially in case of emergency water discharge.

Weather and Climate Considerations:

The design should consider weather conditions and temperature variations in the design. The barrier should be able to withstand extreme weather events such as storms, high winds (90 km/hr. at 1-meter elevation above water surface level), and variations in temperatures.

Maintenance and Accessibility:

The design of the barrier is to be easily maintained and accessed for inspections, repairs, and adjustments. This is crucial for ensuring the barrier's ongoing effectiveness.

Collaboration with TA:

IUCN will assign Technical Assistance (a consultant firm, third party, as it will be named formally by email after tender awarding) to review all the design packages and method statements for the net barrier.

Submittal:

The contractor is requested to develop a full package design for the barrier including calculation (design report), drawings and specifications as well as a method statement for installation, these documents should be submitted to the IUCN and the TA firm for reviewing and approval before starting installation.

3. Time Frame

The contractor should provide a detailed work plan to design, supply and install the shading balls technique according to the tender documents and the approved design, assuring implementation of this tender within not more than two months of signing the agreement.

4. Deliverables and Reporting

Under this tender, the contractor must deliver and submit the followings:

1. The contractor should provide a full design package for the floating and net barriers as well as a compliance sheet for the shade ball according to the required specification (section 3), as must be approved by the IUCN & the Technical Assistant (Consultant Firm; third party) before starting installation.
2. The contractor should supply, install, commission, and hand over 5300 m² shaded with shade balls, floating barrier, and net barrier in accordance with the tender documents, drawing, specs, and method statement, as it should be approved by the IUCN-ROWA and the TA.
3. The contractor should develop and submit a final report including; as-built drawings for the installed balls, barriers, and other parts, maintenance guideline and best practice, catalogues & warranty (if

any), data sheet, spare parts, and any further documents or parts could be requested by the IUCN-ROWA. (final report structure should be approved by IUCN-ROWA in prior).

5. Required key staff

The contractor should provide a qualified design and installation team (key team) which should include at least comprise of a civil engineer, and a mechanical engineer, the table below illustrates the minimum requirement of the contractor team:

Key staff	Min. Qualifications
Civil Engineer (Construction)	<ul style="list-style-type: none"> • University degree in civil, environmental, or relevant field (master\PhD degree is an advantage). • A minimum of 8 years of experience in the area of construction. • Experience in the field of water projects. • Experience in the construction and designing of water infrastructure projects (particularly Dams) • Advanced knowledge of English and Arabic languages. • Strong interpersonal skills and the ability to communicate with various stakeholders in politically sensitive situations with diplomacy and tact.
Mechanical Engineer	<ul style="list-style-type: none"> • University degree in mechanical or relevant field, master\PhD degree is an advantage. • A minimum of 8 years of experience in the area of water infrastructure. • Experience in the field of water projects. • Experience in the construction and designing of water infrastructure projects (particularly Dams) • Advanced knowledge of English and Arabic languages. • Strong interpersonal skills and the ability to communicate with various stakeholders in politically sensitive situations with diplomacy and tact

6. Remunerations (payments)

The payments will be made to the contractor in accordance to the below table:

No.	Payments	Amount	Payment's Requirement
1	The First Instalment	Corresponding to 50% of the total contract amount	Upon sign the agreement.
2	The Final Instalment	Corresponding to 50% of the total contract amount	This payment is subject to release upon satisfactory tender completion, commissioning, and handing over to the IUCN. As well as submitting all the deliverables and reports stated in section 4.

7. Risks and limitations

As a part of ensuring the implementation of the tender up to high standards of performance and safety, the contractor should consider and address properly the following risks in the technical proposal:

- Considering and addressing that the activity will be implemented in Dam which owned and operated by the JVA.
- Accessibility to the site locations.
- Far/distance from the settlements.
- No public transportation.
- Different sources of hazards may happen in the workplace such as falling, slipping, snake bites, and random accidents. For controlling such risks, the contractor should apply restricted safety procedures and measures.
- Extreme weather conditions and floods: Extreme hot and cold temperatures and High-intensity rainfall events can affect contractor progress in terms of productivity and safety; thus, the contractor should monitor weather forecasts daily.
- Large vehicles and construction machines might not be able to easily access most of the Wadi area. Besides, the topography of the Wadi area is steep and has limited and narrow unpaved roads.
- Most of the Wadi areas are private ownership. Some of the Wadi mainstream areas might be owned by the government.
- The security of the contractor's machinery and equipment is the contractor's responsibility, and we recommend assigning a guard from the contractor's side and at his own expense.