



Kuwait Reef Ball

Mr. Waleed Al Fadel
Kuwait Dive Team
Kuwait
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Proposal for Reef Ball Breakwater –Shoreline Stabilization of Qaro Island

Dear Mr. Waleed Al-Fadel

As requested when discussing the receding shoreline of Qaro Island, I would like to thank you for the opportunity to quote for the above mentioned project. Prior to identifying the requirements some details are required as below:

Reef Balls have very unique properties when used as a submerged breakwater. Most breakwater technologies are designed around the fact that the more "perfect" of a wave break one gets, the less energy makes it to the beach. What's really happening is when a wave break is converted from waveform into fluid flows (current); a good break sends the current in all directions rather than just toward the beach (where sand can be eroded by currents as on Qaro).

In order for Reef Balls to make a good wave break they must be close to the surface, in rows parallel to the expected waves and wide enough to break the expected wave size. So, just by good design, you can get a great wave breaking submerged breakwater **and** all the biological benefits of a Reef Ball. Reef Balls also work in other ways which do not occur with other breakwaters. The vortex holes in the Reef Balls cause whirlpools which create drag on the current flows created when a wave converts from waveform to current flows (breaking) – in other words, Reef Balls attenuate current flows as well as act as a traditional submerged breakwater. Reef Balls have also been scientifically observed changing wave types – as waves pass over the Reef Ball, the specific type of wave changes to other forms.

Design of a Reef Ball breakwater requires specialist expertise that must be used in all our projects to ensure correct application. All projects start with an on-site assessment which can take from one to a few days on site depending on the complexity of your project. In this case it may be possible for you and the KDT to gather the required initial Stage 1. data for a desk analysis by our Reef Ball expert Dr. Lee Harris. Three stages are required – 1. Data Gathering / 2. Feasibility Analysis / 3. Breakwater reef building and engineering

STAGE 1. Data Gathering and bathometric information requirements -

- ?? Nautical chart of project and surrounding area
- ?? Recent and historical photos (especially aerial shots)
- ?? Beach Profile line surveys (from landward of the beach to an offshore depth of 2-3m) including comparative historical profiles
- ?? Bottom type / and depth to rock if any, for the proposed breakwater installation area (1.5m – 2.5m depths)
- ?? Tide Range
- ?? Wave/climate data
- ?? Other Site specific factors or concerns

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If you can gather the above data I can arrange for Dr. Harris to formulate a preliminary assessment of project feasibility

STAGE 2. Data Analysis and breakwater formulation -

- ?? Feasibility
- ?? Size
- ?? Layout
- ?? Orientation
- ?? Stability
- ?? Wave attenuation
- ?? Proposal development

STAGE 3. Breakwater reef building and engineering

- ?? Reef Ball purchase
- ?? Module deployment and placement
- ?? Reef engineering

Ensure your project is a success - Our expert global reef consultants have over ten years and 3000 projects worth of experience so can review, refine and prioritise the biological and other goals of your project.

Kuwait Reef Ball Company can:

- ?? Review stakeholder views and goals including local fishing interests, governmental interests, scientific and other interests to determine potential sites for underwater survey work to determine if the potential sites are suitable for artificial reef development
- ?? Review relevant inputs including bathometric, tidal, wave climate and water quality parameters and other available scientific data
- ?? Produce final analysis and recommendations

We will ensure that all elements required for a successful designed reef are met; specific elements could include a large range of biological (such as hole sizes, surface texturing, mixture of sizes, clustering requirements, other layout features, concrete mixture changes etc) or physical elements (anchoring systems, subsidence avoidance features, stability analysis/minimum weight recommendations, etc).

Cost:

Stage 1. Until the feasibility analysis is complete we cannot assess the size and number of modules required. If you can provide the data to us for desk analysis by Dr. Harris, the professional fees will be KD500/- .



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Stage 2. Costs are dependant firstly on whether the first stage confirms that Reef balls will work in the local tolerances or not due to tide range or steep sloping beach.

Stage 3. There are a number of variables to consider in the deployment stage taking account of module costs and Reef Ball expert consultancy on-site requirements.

I recommend that you proceed with Stage 1. and in the interim we can review and scope the possible costs for stage two and three, taking account of your own expertise and resources.

With our new equipment arriving soon and then a visit from the RBDG by Mr Todd Barber we should have a good opportunity to do this project both economically and efficiently.

Regards

Mike Symns
General Manager
Kuwait Reef Ball