Proposal for Coral Reef Restoration at .8 Acre Ship grounding site in Nassau

For

BREEF & Bahamas Government

March 4, 2006

By The

With Contributions From Reef Innovations, Inc. An Authorized Reef Ball Contractor.

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Background

On or about February 1st, 2006 a boat ran aground at the entrance to Lyford Cay Harbour. In the immediate grounded area, the coral reef is totally lost according to local monitoring and rehabilitation efforts. Secondary damage as the bow section broke off and gouged a channel approximately 400 feet long left many rescue able corals.

Satellite View of Lyford Cay

The Reef Ball Foundation was asked for advise on restoring the Reef and also for a quote on an initial survey, preservation of the site coral genetics, and stabilization of the salvageable adult coral heads and for a 2nd Phase of Coral Reef Restoration.

Project Summary

1) Preserve Genetics of Dying Corals. Establish 3 protected coral nurseries with fragments from each salvageable adult colony that was damaged to preserve the coral genetics that are at risk or already lost for future restoration efforts. Photo document the nursery and site so that lost adult colonies can be cross-referenced with the nursery fragments.

Resources: 3 Coral Team Experts for 5 days (6 nights) or 4 Coral Team Experts for 4 working days (5 nights)

2) **Stabilize High Value Salvageable Adult Colonies**. Our methods vary according to species. Hydrostatic cement is often the most useful method for this stage, but it is labor intensive. The Reef Ball Foundation's Coral Team is efficient at focusing only on the corals with a high probability of survival and species that are difficult to propagation (massive brain corals, etc.) This allows more resources to be used in restoration of the original genetics.

Resources: 8 Coral Team Transplant Experts 5 days (6 nights)

3) **Monitoring.** We need to document which adult corals survived transplanting and the grounding and which ones died and be able to cross reference that to the coral nursery @ 90 days post stabilization. This is the basis for deciding which fragments in the nurseries to select for propagation and planting.

Resources: Two Coral Team Monitoring Experts for 2 days (3 nights)

4) **Reef Base Substrate Restoration.** The lost volume (and complexity) of the reef needs to be reconstructed. The Reef Ball Foundation efficiently accomplishes this with the construction and deployment of Reef Balls. These Reef Balls will be pre-cast with our coral adapter plug system that allows for efficient and secure attachment of the rescued coral fragments to the Reef Balls. The Reef Balls can be supplied quickly from emergency stockpiles in Florida or they can be built on site in the Bahamas. Until we do a site assessment, it is difficult to estimate the number and size(s) of Reef Balls required but for an average ship grounding of this size we believe the number is probably between 40-200 Reef Balls, the Pallet Ball sized Reef Balls are the most likely size candidates from our experience in monitoring near Lyford Cay in the past. Likely, special Reef Ball styles (like the layer cake styles) will be needed to replace the complexity of the reef.

Resources: Reef Innovations, Inc is an authorized Reef Ball contractor in Florida that would either supply the Reef Balls or supervise them being built on site to coral restoration standards. Reef Innovations would also be able to deploy and anchor the units.

5) **Coral Fragment Planting**. Once the base of the reef is restored, it is a simple matter of planting the coral fragments from the original rescue to finish the restoration. The Coral Team is highly trained and efficient at this often planting over 500 corals a day once the site is set up for operations.

Resources: as needed to plant number of corals determined to be needed. I will guess about 500-1500 corals so probably 4 people for 5 days (6 nights). (2 day set up time + 500 corals a day weather dependant).

Costs & Timeframe

There are 3 levels of Reef Ball Coral Team Operations. "A-Team" projects which are typical for mitigation projects that use only our top experts to perform the work. Billing rates for A-Team members are $700/day plus expenses.

The second level, providing reliable but sometimes less efficient project outcomes is using A-Team expert leaders with Reef Ball Coral Team certified members (people that have worked with us on at least one prior project and performed satisfactorily). Coral Team Member billing rates are $375 per day (but note that each team must be lead by one A-Team member getting $700/day).

The third level, usually not used in mitigation projects but often used by non-profit organizations on tight budgets or private entities such as hotels creating snorkeling reefs for guest involves using a mixture of A-Team, Coral Team and new volunteers. These volunteers are given a chance to join the Coral Team for future projects and generally pay their own way. Although this can be significantly cheaper, the drawback is that volunteer resources are often slow to mobilize, results can be mixed and airfare and housing costs are often higher because of using less efficient labor pools.

For purposes of this proposal, only the top to alternatives will be proposed.

COST ESTIMATES USING CORAL EXPERTS ONLY (CORAL TEAM A-MEMBERS)

1) Preserve Genetics of Dying Corals.
Resources: 4 Coral Team Experts for 4 working days (5 nights)

$11,200 Fees
$8,000 Estimated Expenses ($4,000 Airfare, $4,000 Room & Board)
$1,000 Estimated Material/Diving Costs
Total $20,200

2) **Stabilize High Value Salvageable Adult Colonies**.
Resources: 8 Coral Team Transplant Experts 5 days (6 nights)

$28,000 Fees
$17,600 Estimated Expenses ($8,000 Airfare, $9,600 Room & Board)
$5,000 Estimated Material /Diving Costs
Total $50,600

3) **Monitoring.**
Resources: Two Coral Team Monitoring Experts for 2 days (3 nights)

$2,800 Fees
$4000 Estimated Expenses ($2,000 Airfare, $2,000 Room & Board)
$200 Estimated Material Costs
Total $7,000

4) **Reef Base Substrate Restoration.**
Resources: Reef Innovations, Inc is an authorized Reef Ball contractor in Florida that would either supply the Reef Balls or supervise them being built on site to coral restoration standards. Reef Innovations would also be able to deploy and anchor the units.

$30,000-$115,000 (Average 50,000)

5) **Coral Fragment Planting**.

4 people for 5 days (6 nights). (2 day set up time + 500 corals a day weather dependant).

$14,000 Fees
$8800 Estimated Expenses ($4,000 Airfare, $4,800 Room & Board)
$5000 Estimated Material Costs (Coral Table, transplant epoxy, diving, etc).
Total $27,800

EXPERT ONLY COST SUMMARY
$70,800 Phase I (Assessment, Nursery & Stabilization)
$84,800 (+65,000 or –20,000) Phase II (Monitoring, Base Reef & Coral Restoration)

Total US$ 155,600 (+65,000 or –20,000)

Note: Traditional Coral Restoration (not being proactive and waiting until the financial matters are settled in court and all the corals have died) typically averages $484 / square meter or $1,560,000 for a .8 acre restoration. Therefore, the insurance company can save about 1.4 million dollars through an immediate settlement.

Note, these are estimated fees and expenses based on similar Caribbean projects. These can very plus or minus 15%. These costs do not reflect possible weather delays. Our teams will generally not bill on days when we cannot work, but expenses are still incurred. For “Rapid Activation” projects (projects where our planning horizon is less than 4 months). We require an advanced retainer fee of 100% for each project phase. At the end of each phase excess payments will be applied to the next phase or refunded if it is the final phase. If payments are not sufficient to cover a phase, you will be billed fees and expenses exceed the retainer. Bills must be paid within 10 days of receipt by electronic wire transfer into our accounts.

FEE SAVINGS FOR USING THE CORAL TEAM WITH EXPERT LEADERS INSTEAD OF ALL EXPERTS.

1) Preserve Genetics of Dying Corals.
3 Coral Team 1 Expert for 4 working days (5 nights)

Fee Savings: $4,875

2) **Stabilize High Value Salvageable Adult Colonies**.
Resources: 6 Coral Team 2 Experts 5 days (6 nights)

Fee Savings $9750 Fees

3) **Monitoring.**
Resources: 1 Coral Team 1 Monitoring Experts for 2 days (3 nights)

Fee Savings $650 Fees

4) **Reef Base Substrate Restoration.**
Resources: Reef Innovations, Inc is an authorized Reef Ball contractor in Florida that would either supply the Reef Balls or supervise them being built on site to coral restoration standards. Reef Innovations would also be able to deploy and anchor the units.

No savings for this phase

5) **Coral Fragment Planting**.

3 Coral Team, 1 Expert for 5 days (6 nights). (2 day set up time + 500 corals a day weather dependant).

Fee Savings $4875

CORAL TEAM WITH EXPERT LEADERS ONLY COST SUMMARY
$14,625 Fee Savings for Phase I (Assessment, Nursery & Stabilization)
$5,525 Fee Savings for Phase II (Base Reef & Coral Restoration)

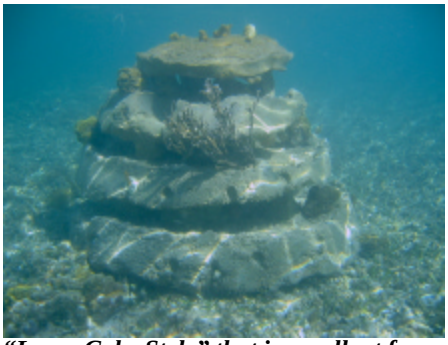
Total Fee Savings $20,150

Appendix A: Aids for understanding project methods

It is presumed that you already understand our methods from our prior work wit h Breef, however, here are a few photos and descriptions from other proposals that might help us in discussing the project.

Various Styles of Reef Balls

"Standard Style (planted)" the void or hole in the center is ideal for fish.



"Layer Cake Style" that is excellent for small fish and lobsters.

"Thicket Style" that mimics branching or pillar corals.

Steps for Coral Propagation and Transplanting

The Reef Ball Foundation has a separate division called our Coral Team Division. The Coral Team specializes in assisting clients in propagating and transplanting both hard and soft corals onto Reef Balls. They also assist clients in aquascaping their Reef Balls to make attractive snorkeling and diving sites from a human visual perspective.

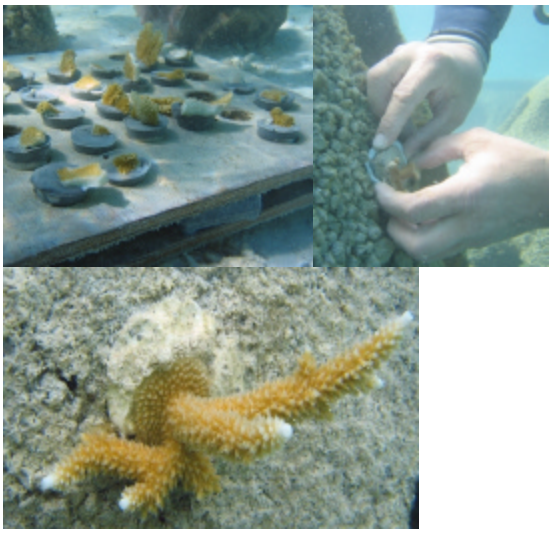
Working with coral scientists and propagation experts, the Reef Ball Foundation Coral Team has developed specialized methods for asexually reproducing both hard and soft corals and planting them onto Reef Balls. The team often allows the use volunteers and local people to increase project sizes or reduce costs. Previous projects show a remarkably high survival rate of the p lanted corals, 90-100% depending upon species types.

Corals can be asexually reproduced for a variety of project goals including; preservation of genetics, increasing the number of colonies, selecting specific genetic traits, re -growing a coral reef faster than with sexual reproduction, aquaculture, education, or ecotourism purposes. Goals should be defined specifically before working with coral propagation technologies, as propagation of corals should not be undertaken lightly and without strict supervis ion of trained Reef Ball Foundation Coral Team Leaders.

In addition to coral damaged in the grounding, . Other damaged marine life such as live rocks, anemones etc. will also be stabilized to Reef Balls to further enhance the restoration.

These pictures show coral “plugs” being made:

The coral base for restoration uses specially designed Reef Balls that are prefabricated concrete modules that are designed to mimic natural reefs. These modules are constructed with built-in adapters for planting live corals. The pictures below show the coral plugs and the planting of the plugs onto the Reef Balls:



Planted corals growing on Reef Balls are shown in the underwater photograph below:

Further information:

www.reefball.org, home page of the Reef Ball Foundation

www.reefball.com/map/antiguascience/antiguapressrelease.htm, recent project

www.artificialreefs.org/Photogallery/gallery.htm, photos.

www.reefball.com/reefballcoalition/index.html, Coral Team Division

Expected growth rates for fast growing Acropora often used in restoration projects to speed in rapid recover of the lost assets

Comparison at planting, 3 months and 6 months
(Top Elkhorn, Bottom Staghorn).

Below: Reef Ball Restoration of a dynamite blast scar in Indonesia after 5 years.