

First Addendum

ENVIRONMENTAL IMPACT ASSESSMENT

For the Proposed Reclamation of Runway Extension

Gan International Airport

Addu City, Maldives

Proponent: Addu International Airport Pvt. Ltd.



June 2013

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Consultants Declaration

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

Ahmed Zahid (EIA 08/07)

05 June 2013

Proponent's Declaration

As the proponent of the proposed development I guarantee that I have read the First Addendum to the EIA for the Proposed Reclamation of Runway Extension at Gan International Airport thoroughly and that to the best of my knowledge all information provided here is accurate and complete.

Name:

05 June 2013

Commitment letter

LETTERHEAD

Mr. Ibrahim Naeem

Director General

Environmental Protection Agency

Ameenee Magu

Malé

Date

Dear Sir,

This is in reference to the First Addendum to the Environmental Impact Assessment (EIA) for the proposed Reclamation of Runway Extension at Gan International Airport, Gan, Addu City.

As the Proponent of the project, we assure you our commitment to undertake any proposed mitigation measures and monitoring programme given in the EIA Addendum Report.

Sincerely,

Document Receipt by City/Atoll Council

To: Secretariat of Addu City Council,
Hithadhoo,
Addu City

Kindly confirm the receipt of the following document(s):

- Final draft of the First Addendum to the EIA for Proposed Reclamation of Runway Extension at Gan International Airport, Addu City.

Signature:

Name:

Designation:

Date:

Executive Summary

This report addresses the environmental concerns of the proposed dredging of access channel for the purpose of land reclamation to extend the existing runway on Gan, Addu City. This report shall be read in conjunction with the EIA report for the Proposed Reclamation of Runway Extension at Gan International Airport. This report examines expected environmental and social impacts of the newly proposed method for an access channel and potential mitigation measures.

The existing airport in Gan was recently open for international flights and needed to increase length of the runway to accommodate potential larger flights was imminent. Hence, reclamation of necessary land using a cutter-suction dredger was proposed. However, due to the existing reef and shallow lagoon, an access channel for the dredger needs to be made. The initial proposal to make the access channel on the southern side of the island was not possible due to hard substrate and strong waves. An alternative access channel from north-east side of the island through the lagoon on southern side of the island was proposed by the contractor. It shall be noted that the shorter access channel from the western rim reef that was proposed in the EIA report was proposed based on the recommendations of the Contractor(s) and with the assumption that the works would be started as planned during the calm days in Feb 2013.

The proposed access channel dredging is not envisaged to have major significant negative constructional impacts; however, there will be minor to moderate potential environmental impacts from the operations including loss of marine biota, habited and harm to coral from sedimentation. A number of mitigation measures such as use of sedimentation screens, relocation of larger colonies of live corals were identified by the consultants.

Monitoring program outlined in the EIA report was found to be sufficient and additional environmental monitoring was not found to be necessary except for water quality at the proposed dredge and fill areas.

Given that the project does not have major negative environmental impacts and is unavoidable to start construction of the project, it is recommended to allow the project to proceed as proposed.

1 Introduction

1.1 Introduction

This EIA report has been prepared in order to establish further impacts that may be associated with the proposed reclamation of runway extension at Addu International Airport, particularly the dredging component of the project. As described in the EIA report, an access channel needs to be cut through the reef to provide access for the dredger. At the time of report compilation, some of the potential Contractors have proposed excavators to be used to make a channel of 100m long and 25m wide with a basin of 40m x 40m. However, after the commencement of the construction, the Contractor had reported that the substrata were harder than anticipated; hence an alternative access option was considered including the option of micro-blasting using explosives. This addendum was compiled to discuss impacts and potential mitigation measures for them.

The findings of this report are based on the EIA report for the proposed reclamation of runway extension at Addu International Airport and similar published reports. This report has been prepared in accordance with the EIA Regulations 2012.

The methods used to identify, predict and assess impacts are based on matrices that have been established by the Consultants over a long period. In the matrix, the consultants assign a likert-scale number to represent the magnitude, significance, duration and spatial extent of the potential impact for each project activity against the key environmental and socio-economic components that the specific project activity may have an impact on. The product of the magnitude, significance, duration and spatial extent for each activity and component is summed up to measure the exact nature of the impacts by each activity and the overall impact of the proposed project is the sum of all activities.

2 Project Description

2.1 Project Proponent

The Proponent is the same as that given in the EIA report, i.e. Addu International Airport Pvt. Ltd.

2.2 Project Location

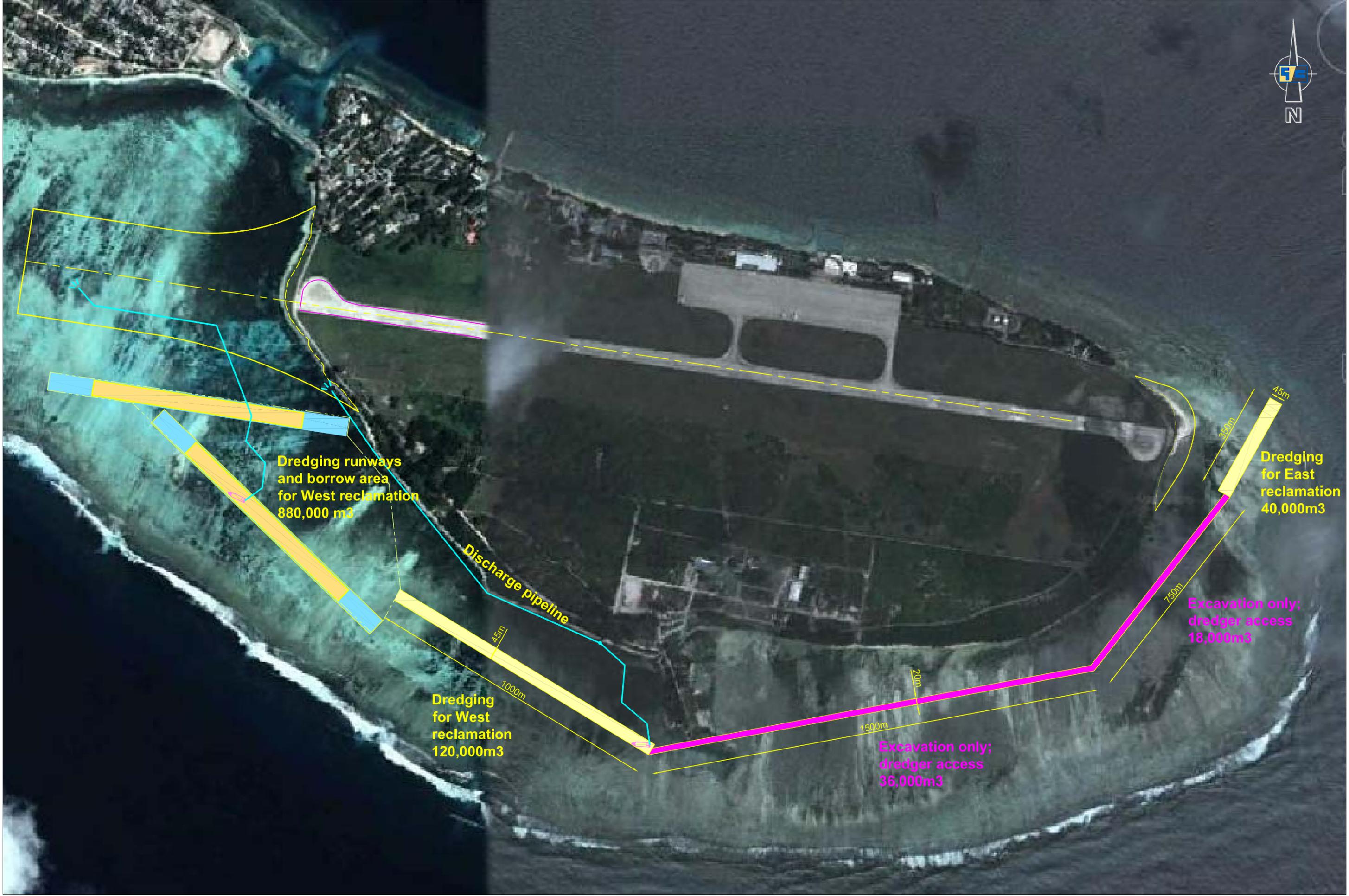
The proposed access channel is on the southeast side of the island. Figure 2-1 shows the proposed new access channel.

2.3 The Project

The component of the project within the scope of this addendum involves making a long access channel from the eastern end of Gan to the proposed borrow area. The depth of the channel will be maintained at 1.3m depth. The first 350m will be 45m wide and the material from this area would be used for filling at the eastern end. This will be approximately 40,000m³ of sand. The next 2250m will be about 20m wide and the material will be pulled through the channel towards the borrow area. A further 1000m by 45m wide channel will be dredged from the middle of Gan towards the main borrow area proposed in the EIA report. This will be approximately 120,000m³. The remaining material will be dredged from the proposed main borrow area.

The main equipment used for this operation would be;

- Medium-sized cutter suction dredger (about 400m³/hour)
- Self-propelled work boat (500HP)



Dredging runways
and borrow area
for West reclamation
880,000 m³

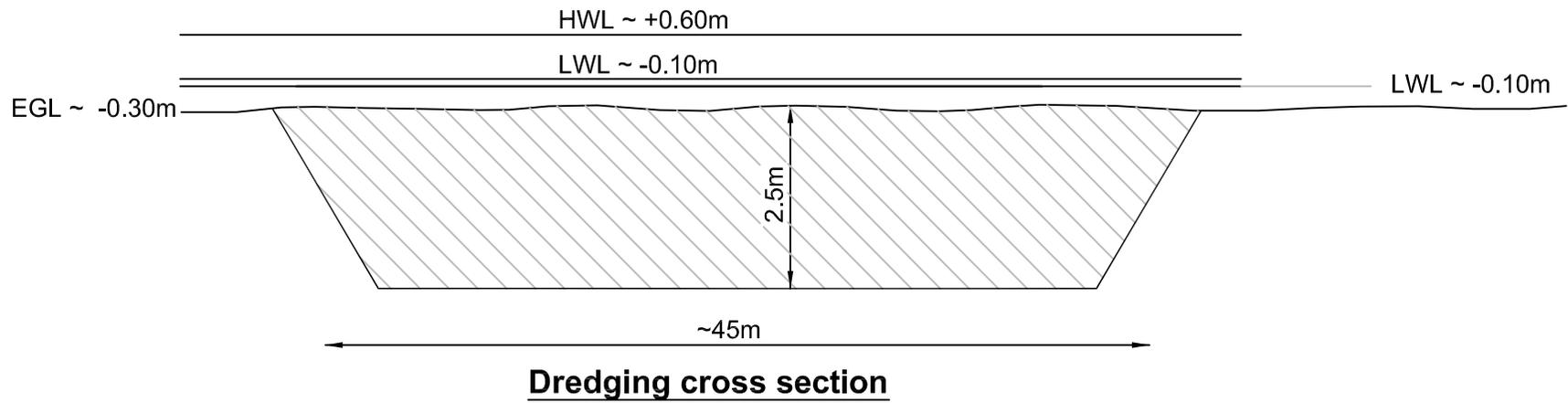
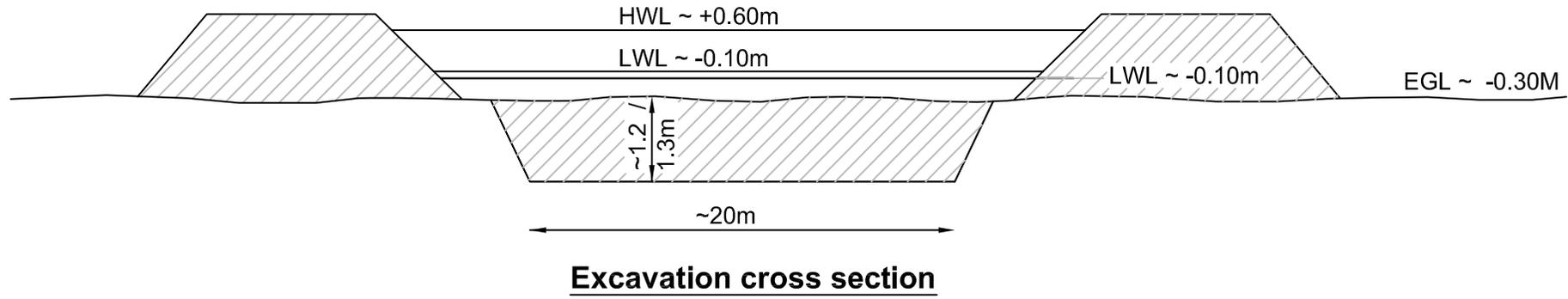
Discharge pipeline

Dredging
for West
reclamation
120,000m³

Excavation only;
dredger access
36,000m³

Excavation only;
dredger access
18,000m³

Dredging
for East
reclamation
40,000m³



3 Existing Environment

The existing environment of the island has been discussed in detail in the EIA report. This report has been compiled based on the baseline data from the EIA report hence, no additional details will be covered in this report.

The access channel passes through reef on the eastern side of the island which has been assessed for ecological and physical parameters in the baseline study. This area was under Site 03, Section 5.8.3.4 (Existing Environment: Ecology- Marine Ecological Survey Results) of the original report. This area of reef will face the greatest impact from the proposed component and does have a fair amount of marine biota. The reef was dominated by dead coral (up to 50% of the substrata) and colonies of *Goniastra sp.*, *Porites sp.*, *Platygyra sp.* The fish community was not particularly rich in terms of biodiversity and species richness, though different types of surgeonfish, Humbug Dascyllus, sweetlips and parrotfish were seen on the site.

As for the lagoon on south-east side of the island, no live colonies of coral were seen within the proposed channel area though large fields of sea grass covered the sea bed. Additionally, large chunks of what seem to be parts of old vehicles and a lot of glass bottles were seen on the lagoon during low tide. This could prove to be a nuisance during construction of the access channel and may even harm the equipment if not careful.



Figure 3-1: Photos of the project area

4 Project Alternatives

There are a few alternatives to the proposed components of dredger access and use/disposal of fill material. These are discussed in the subsections below.

4.1 Options for Dredger Access

For the dredger access component, these include adopting the option proposed in the EIA report of a channel on the western rim reef by adopting any or more of the following options.

1. Drop hammer to break the hard substrata
2. Micro-blasting to blast away the hard substrata of the channel
3. Cut through the causeway between Feydhoo and Gan
4. Postpone the dredging to around February 2014 when the weather may be expected to foster conditions suitable for dredge/excavate in the area

However, it must be noted that none of these options are feasible at this stage of the project given that by time the dredger has been moved to site to start dredging it is the southwest monsoon rendering it impossible to work on the reef flat on the rim reef here. On this southwest and western side of the island, extremely large waves (over 4m of peak-peak amplitude) were observed on the reef crest. Operating machinery in this environment would be extremely risky and even impossible depending on the weather condition. Hence this alternative is not recommended although there will be some advantages in terms of cost in comparison to the proposed as the length of access channel is much shorter as well as the lesser degree of negative environmental impact. In fact, the option of access channel on the rim reef was investigated with the initial plan that the works can be started during February 2012, however, the project was delayed due to delays in EIA approval as a result of which the project was started at the onset of the southwest monsoon when the climatic conditions do not allow for such works in the area. Since the contract was already negotiated and the dredger has been moved to site an option proposed in this report was considered to be the most economically feasible option. In spite of that, the Proponent/the Contractor did try to implement the initial plan to make an access channel on the western rim reef, closer to the

dredging area using excavators. However, due to strong waves and because the substratum was too hard for the excavators to handle, an alternative had to be considered.

4.1.1 Drop Hammer Alternative

Using a drop hammer to break the hard sections was one of the options suggested by EPA during the discussions to find an alternative for the proposed channel dredging. However, as has been noted earlier, the climatic conditions at the time of project implementation are not expected to foster such trials. If it can be implemented, this option would have much lesser direct impact on the marine environment than the use of explosives proposed as the alternative option.

4.1.2 Reef Blasting Alternative

Instead of using drop hammer, micro-blasting techniques could be used to blast away the sections impossible to cut through using an excavator. However, this is the least preferable option as there is not only public concern but its direct impact on the marine biota would be much greater. Though the impact radius from the blast could be as small as 500m and none of the buildings on land would be affected, the sudden blast would harm a lot of mobile fauna as they will not have time to react. This would not be the case for other options. Additionally, the risk of operating machinery in the strong wave condition still remains.

4.1.3 Cut through the Causeway

Cutting through the causeway between Feydhoo and Gan involves providing temporary sand bund diversion between Feydhoo and Gan on the western side prior to cutting through the causeway and also widening the existing channel on the eastern reef. This option is quite viable if the proposed alternative in the EIA report to reclaim the area between Feydhoo and Gan were to be considered. Otherwise, this option would involve creating the sand bund diversion road by using excavators, which would create a large volume of sediment in the dredge area unlike the use of cutter suction dredger alone. Also, cutting through the causeway would require demolition of a section of causeway. In addition, the sand bed would have to be removed later to allow flow in the channel. The total length of moving the dredger to primary dredge location and the total length of sand road and removing is similar to the total length of dredging involved in the proposed option.

Furthermore, sedimentation due to excavation as well as dredger movement and cutting a section of the causeway would allow settlement of sediments in the eastern reef on the atoll lagoonward side. In this area, according to the EIA report, several turtles and napoleon wrasse were seen unlike other areas of the reef surveyed. Their habitat would be affected due to sedimentation.

4.1.4 Postpone Project

The option to postpone project until the weather conditions become suitable for the excavation of a channel on the western rim reef, which would be early 2014 would have several socio-economic, especially economic implications since the dredger has already been moved to site and major costs have already been incurred. The net impact index of the project would be greatly positive if the project were to continue after finding a potentially feasible alternative to the project.

4.2 Options for disposal of fill material

It is proposed in this Addendum to reclaim the eastern end of Gan using material dredged from the dredger access channel. As has been identified in the EIA report, reclaiming at this end will have a greater sedimentation impact unless appropriate bunding can be provided prior to reclamation of the area. Since it is vital to get the dredger to the main borrow area, there may not be sufficient time to bund the eastern reclamation area. Therefore, it is recommended not to directly place sand in this area in order to minimize potential sedimentation on the reef. However, if bunding can be provided and measures such as silt curtains can be used to mitigate such impacts, then this component may be worth the while.

However, there are other options that may be considered and they are discussed below.

1. The Proponent may consider to place the borrow material on land at a location away from the eastern reef area for future reclamation of the eastern end. This will minimize sedimentation on the reef and provide material for future reclamation.
2. The dredged sand could be moved to the main borrow area as has been proposed for the other sections of the channel and thereby narrow the access channel in the proposed first section of the channel area as well.

These options would minimize the siltation or sedimentation on the eastern reef, which is a live reef providing protection to the island.

4.3 Recommended option

Table 4-1 gives a comparison of the different alternative options discussed above against the proposed option. Based on this brief comparison, it is recommended that the proposed option to dredge a channel from the eastern reef to the main borrow area proposed in the EIA report is the best available option at this time. It would have been ideal to have made an impact matrix for each of these options to illustrate their impact potential. However, due to time constraints imposed on the author as a result of time constraints on the project, the following comparison is considered sufficient to make an informed decision.

Table 4-1: Comparison of the different alternatives against proposed option

Option	Advantages/positive impacts	Disadvantages/negative impacts
Drop Hammer	<ul style="list-style-type: none"> • Gives fish and other mobile organisms time to react – minimal deaths compared to use of explosives • Lower sedimentation than explosives 	<ul style="list-style-type: none"> • Increases the project time frame, therefore costs incurred • Greater weather-related risks including accidents and injuries
Controlled reef blasting	<ul style="list-style-type: none"> • Speeds up the process of channel clearance/excavation • Minimizes overall project costs due to quick results 	<ul style="list-style-type: none"> • Kills fish and other mobile organisms • Increased sedimentation compared to drop hammer or excavator
Postpone project implementation to dredge channel on western rim reef using excavator and/or options above	<ul style="list-style-type: none"> • Impact on the eastern reef due to proposed option would be avoided 	<ul style="list-style-type: none"> • Very high costs • May have to use all options and end up with the last option of blasting
Not reclaim the eastern end without a proper bund	<ul style="list-style-type: none"> • Sedimentation on the eastern reef can be avoided or minimized • Borrow material can be minimized, therefore cost of project minimized. 	<ul style="list-style-type: none"> • Possible future costs of reclamation of the eastern end of Gan
Cut through the causeway	<ul style="list-style-type: none"> • Causeway may be improved 	<ul style="list-style-type: none"> • Impact on some of the protected species observed in the area • Greater economic cost than the proposed alternative option • Slower operation resulting in delays in implementing the overall project

5 Impacts and Mitigation Measures

There are essentially two main environmentally significant impacts from the proposed component of the project during the construction phase;

- Loss of biota and habitat
- Harm to reef building corals from sedimentation

The only environmentally significant impact from the proposed component during operational phase would be lack of a physical structure to dissipate wave energy on the eastern end of the island. However, it should be noted, this component of the project is essential for commencing rest of the dredging and reclamation project.

5.1 Loss of biota and habitat

5.1.1 Impact

Dredging access channel, particularly the section on the reef will cause loss of sessile fauna such as corals, clams and coralline algae. These organisms play a major role in the food web and providing safe refuge to juvenile and smaller fish and other organisms. Their loss will be detrimental to the marine community in the area. However the channel is narrow and is nearly perpendicular to the reef line, hence the quantity of corals and related structures lost will be relatively small. Mobile fauna will flee and will seek other suitable habitats. The loss of seagrass which is part of diet for herbivorous marine life forms such as green turtle is fairly insignificant. Seagrass are fast growing marine plants; loss of some quantity due to dredging will soon be recovered after the construction period. In fact, seagrass is not considered an important habitat and has aesthetic concerns. All of these impacts are considered minor to moderate in terms of severity.

5.1.2 Mitigation Measures

- Relocating large and potentially old colonies of corals to suitable locations
- Minimizing dredging on the reef to the smallest possible extent
- Starting the operation slow to give time for mobile fauna to flee
- Finishing the dredging components as soon as possible

5.2 Sedimentation

5.2.1 Impact

Part of sediment from dredging access channel as well as proposed reclamation of the eastern end will be transported eastwards and deposit on the eastern reef judging by the direction of the currents (predominant direction during both monsoons being easterly, especially during the southwest monsoon). Rest of the sediment plume will be deposited on the island beaches and some may be carried away due to resuspension. Sedimentation plumes on the reef will cause loss of light for the corals and cannot do photosynthesis. This would starve them, and if sedimentation is prolonged they will face massive fatalities. However, the effect of sedimentation on corals depends on the life forms as well. For instance, branching corals perform better against sedimentation episodes than massive corals. The ecological survey of the area showed an abundance of massive corals and lack of branching corals in the area. Consequently sedimentation from dredging access channel will have a significant impact on the corals. Nonetheless, construction access channel is not expected to last long hence the severity of this impact is also considered moderate.

5.2.2 Mitigation Measures

One of the most effective means of reducing sediment overflow into the surrounding marine environment is by using physical barriers in which sediments will be only confined to a certain location in the operation area. In this regard, the dredging area shall be bunded by an earthen berm, so that suspended sediment will be only confined to that particular area. Use of silt screens downstream of the sediment flow within the marine environment may not be practicable given the short duration and that impact areas would be small. Also, the currents will disperse and dilute sediments rapidly given that the works will be undertaken during the southwest monsoon when the easterly current is strongest dispersing the sediment plume away from the reef rapidly. Additionally, use of cutter-suction dredger in contrast to excavators will cause considerably less sedimentation.

5.3 Loss of physical barrier

Removal of part of the reef for the access channel leaves a gap in the natural barrier formed by corals on the eastern end of the island. This could lead to erosion of the beach in the long term. However, this impact shall be studied as part of the monitoring programme and if need be a breakwater or similar measure to mitigate the impact may be considered. Long term monitoring of beach dynamics is essential for this and has already been incorporated into the monitoring programme given in the EIA report.

Table 5-1: Summary of potential impacts from the proposed component

Activity	Causal Factors	Impact	Impact Significance
Dredging Access Channel	Removal and destruction of substrata	Loss of habitat and food source Loss of physical barrier from waves	Moderate
	Sedimentation	Harm and potential loss to corals on the eastern side of the island	Low to moderate impact
	Engine emissions, fuel requirement	Changes in air quality (cumulative) and increased cost	Minor negative
	Rapid implementation of the airport runway extension project	Direct and indirect economic opportunities Direct and indirect employment opportunities Increased national revenue Improved living standards	Major positive
Reclamation on the eastern end	Sedimentation	Harm and potential loss to corals on the eastern side of the island	Moderate to major negative
	Creation of land	Opportunities for improved airport services	Minor to moderate positive

5.4 Uncertainties in Impact Prediction

The level of uncertainty, in the case of the proposed access channel dredging is expected to be low due to the experience of such dredging in similar settings in the Maldives. Nevertheless, it is important to consider that there are elements that are new and that there will be uncertainties, especially in terms of impacts on the hydrodynamics and to undertake voluntary monitoring as described in the monitoring programme given in the EIA report.

6 Environmental Monitoring

The monitoring programme given in the EIA report is considered sufficient to cover the data needed to assess impacts from the proposed component as there were no additional major components to the project but rather change of location of one component. Also, the proposed monitoring programme given in the EIA report covers all important and potential impact areas for the proposed project for the reclamation for airport runway extension.

However, 5 additional locations from the proposed dredge area on the eastern end including the reef flat area is incorporated among the water quality monitoring for the fill and borrow areas. This is reflected in the revised monitoring programme given in Table 6-1.

Table 6-1: Revised annual monitoring programme

No.	Indicator/locations	Parameters to be monitored	Frequency and duration	M1	M4	M7	M10	M12	Total	Rate (USD)	Total (USD)
1	Marine water quality (borrow and fill areas)	Water quality: Turbidity, TSS	Every three months (for the first two years only)	15	15	15	15		60	15.00	900.00
2	Marine water quality (8 locations)	Water quality: temperature, pH, salinity/TDS/EC, dissolved oxygen, turbidity, TSS	Every six months	8		8			16	50.00	800.00
3	Marine life/biodiversity (4 locations)	Live coral cover and fish survey Photo quadrates/LIT and fish survey	Every six months	4		4			8	35.00	280.00
4	Shorelines - low tide, high tide and mean tide lines (Gan and Feydhoo)	DGPS tracks	Every three months	3	3	3	3		12	45.00	540.00
5	Currents/hydrodynamics (10 locations)	Drogue tracks	Every three months	10	10	10	10		40	30.00	1,200.00
6	Beach dynamics (10 locations as in EIA)	Beach profiles	Every three months	10	10	10	10		40	25.00	1,000.00
7	Beach dynamics (5 additional locations on the southwest shoreline of Feydhoo)	Beach profiles	Every three months	5	5	5	5		20	25.00	500.00
8	Summary Monitoring Report					1			1	290.00	290.00
9	Annual Monitoring Report							1	1	770.00	770.00
TOTAL				1,450.00	910.00	1,740.00	910.00	770.00			6,280.00

Note:

M indicates Month

7 Conclusions

There are no major environmentally significant impacts from the proposed project component and there are no additional costs involved due to dredging of the long access channel. However, the impacts due to reclamation of the eastern end without adequate protection such as bundwall would cause significant sedimentation on the eastern reef and shall be avoided if possible. It is recommended to stockpile the material for future reclamation after providing bunds or by carefully placing dry sand to minimize sedimentation.

Given the central nature of the component for the rest of the project, the consultants recommend to carry out the proposed component as proposed by the Proponent as the alternatives considered in this report do not have major benefits over the proposed plan.

Time constraints in which this EIA Addendum has been prepared shall be taken into consideration. Despite that, every effort has been made to consider all relevant impacts as well as possible alternatives into consideration.