BCLME
Benguela Current Large Marine Ecosystem Programme

INCEPTION REPORT

PROJECT BEHP/CEA/03/03:

Assessment of the Cumulative Effects of Sediment Discharges from On-shore and Near-shore Diamond Mining Activities on the BCLME.

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1. INTRODUCTION

Cumulative effects of sediment discharges are to be predicted by means of computational models set up at key sites. The models will incorporate data produced in project BEHP/CEA/03/02: *Data Gathering and Gap Analysis for Assessment of Cumulative Effects of Marine Diamond Mining Activities on the BCLME Region.* Model scenario simulations and sensitivity testing will enable an assessment of the implications of data gaps and the design of cost-effective monitoring. This information will feed back into project BEHP/CEA/03/02. Through computational modeling, tailings discharge management scenarios will also be explored. The project comprises a significant capacity building component, incorporating M.Sc studies as well as a capacity building workshop.

1.1 Terms of Reference

This study will address the following questions:

- What quantities of suspended sediment are transported into the <40m depth zone by rivers, wind and coastal currents? How does this compare with the quantity of sediment re-mobilised/discharged by land-based and near-shore mining activities and what are the relative particle size-distributions of these various sediment inputs?
- How far, and in which directions are these sediments transported and by what mechanisms. Where in the near-shore zone are they deposited?
- What is the extent and duration of the natural deposition of unconsolidated sediments on near-shore reefs and how does this compare with the potential smothering of reefs as a consequence of discharged and mobilized mining-related sediments?
- How can the tailing discharges be managed in order to minimise any effect on the rock lobster resources?

Questions formerly included in the terms of reference for project BEHP/CEA/03/03, will be addressed in project BEHP/CEA/03/04: Assessment of Cumulative Impacts of Scouring of Sub-tidal Areas and Kelp Cutting by Diamond Divers in Nearshore areas of the BCLME Region:

- How does the potential loss of kelp bed habitat (by long-term deposition of sediments) affect the abundance and distribution of rock lobsters and the recruitment success of the stocks?
- How does the periodic and/or long-term deposition of sediment on reefs affect the density and extent of kelp beds, and how does this compare with the loss of kelp bed habitat as a result of kelp cutting by shore-based divers?

2. APPROACH AND METHODOLOGY

2.1 Tasks

2.1.1 Preliminaries

Inaugural Meeting

A project inception and coordination meeting held in Windhoek on 16 and 17 August achieved the following:

- Clarification and agreement on all task requirements and finalisation of allocations and time-frames of required inputs from team members;
- Consensus on the optimal means of capacity building, with team members and capacity building participants from the three BCLME countries.

Detailed minutes and outcomes from this meeting are included in Appendix 1.

Site selection

Demonstration areas that are representative of both typical coastal regimes and regions where cumulative effects of mining are possible in the BCLME region will be selected. A preliminary list of possible areas follows:

- The region from Alexander Bay in South Africa (where significant seawall mining is underway) to some 30 km north of the sensitive Orange River mouth. This region incorporates both a rocky shore and an open sandy shore. In addition, this region will allow an assessment of potential cross-boundary effects of mine sediment discharges.
- Elizabeth Bay region, where a rocky embayment is the site of significant sediment input from a land-based operation. Vessel-based mining in the region just offshore of Elizabeth Bay is a possibility. This could contribute to cumulative effects.
- The region some 120 km north of the Orange Mouth, where shoreline mining is in progress and nearshore dredging is planned.
- The Martial Forks area, where vessel-based mining in some 30-40 m depth occurs close to nearshore reefs which serve as a habitat for rock lobster.

These sites accommodate a range of geomorphological and metocean conditions in both South Africa and Namibia. The sites represent areas of mining on a scale which could induce cumulative effects.

Computational model setup/review

Computational coastal process models (of hydrodynamics and sediment transport) will be established (or reviewed in the case of sites where models are already established) at the selected demonstration areas. Wherever possible, these models will be validated against available data to ensure their integrity.

Potential impact mechanisms

Potential impacts of sediments (and other sources) resulting from marine mining were identified in the project inception meeting. This includes a brief assessment of the mechanisms by which these impacts might affect marine ecosystems and resources.

2.1.2 Sediment dynamics and cumulative impact assessment

Employing the validated computational models, the spatial and temporal distributions of drivers of impact (as defined above, particularly sediment concentrations and deposition) will be predicted.

Natural conditions

The predictions will be conducted to assess natural conditions (particular to assess the effect of episodic major river input/floods and offshore wind-blow sediment transport) where relevant at each of the demonstration sites. This study will also rely on analysis and interpretation of data such as aerial and satellite imagery and measurements conducted after the major Orange River flood of 1988.

Effects of mine sediment discharges.

The effect of sediment inputs resulting from diamond mining (both recent and in the future) will be predicted and assessed from available measurements. The results of modelling will be agglomerated employing GIS to provide a synthesis of the cumulative sediment deposition and suspended concentrations across the nearshore diamond mining region of the BCLME. Incorporating available information on reefs and lobster habitat areas, impact thresholds and rates of recovery of biota will facilitate an assessment of cumulative impacts across the entire nearshore region of the BCLME. Key to this assessment will be comparison to the natural context as established above.

2.1.3 Sensitivity testing and monitoring programme design

The sensitivity of predicted impact mechanisms (and corresponding conclusions regarding sediment impacts) to sediment inputs (present and future) and to other data input will be tested in the computational models. This process will facilitate an assessment of the severity of data limitations (in both validation data and sediment input data) and therefore will define what data is important to acquire by means of monitoring. This modelling will also provide insights on the optimum location and times of monitoring, thus ensuring design of an economical and successful monitoring programme.

2.1.4 Tailings discharge management plan.

Through model scenario testing, the management of tailings discharge strategies (testing variable discharge locations, rates and compositions) to mitigate impacts on rock lobster resources will be explored. Some such tests have been conducted on the Oranjemund and Elizabeth Bay shorelines to date, and it has been shown that alteration of discharge strategy can indeed mitigate the extent of sediment deposition in sensitive areas (e.g. reefs, river mouths).

2.1.5 Capacity building workshop

A workshop will be held in Windhoek, with the following objectives:

- To provide feedback on the results of the study;
- To explore how to transfer technology for assessment and prediction of nearshore coastal processes, with a view to assessing impact of these processes on biota (and particularly lobster);
- If appropriate, to conduct initial technology transfer (via a training workshop) on nearshore physical processes;
- To explore future roles of the Natural Resources Programme of Research (University of Namibia) and other organisations in the context of required future monitoring for BCLME.

Representatives of marine diamond mining companies will be invited to attend and participate in this workshop (particularly the feedback on study results) at their own expense.

The Natural Resources programme at University of Namibia is intended to be the beneficiary of the capacity building initiatives of this workshop.

2.1.6 Output results

This phase will deliver the outputs of the project:

- A comprehensive, descriptive report will describe all of the above tasks, results and findings and recommendations;
- Draft publications submitted to international peer reviewed journals. At least one publication is planned.
- A set of validated computational models, which can be employed to investigate the cumulative effect of future sediment discharges, explore mitigation actions, and refine monitoring programmes,

The final draft report will be reviewed (by a well-qualified reviewer with a good

knowledge of the region).

2.2 Methodology

The methodology of the study is based on:

1) A wealth of past and present monitoring data collected by the project team under existing projects conducted for mining companies.

2) The application of computational models representing coastal processes.

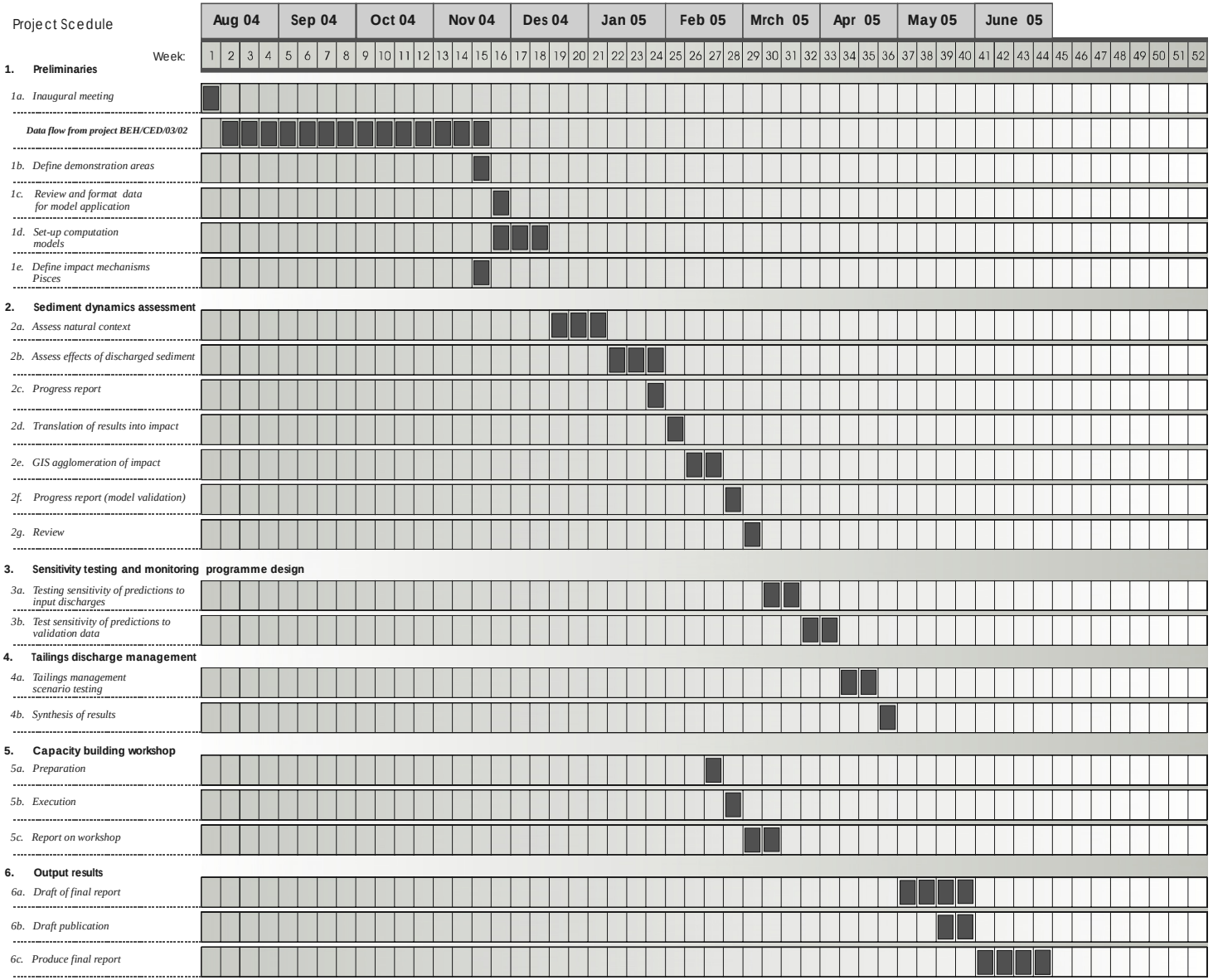
The study will employ the coupled Delft3D models, a suite of well established and internationally recognized hydrodynamic (incorporating the effects of waves, tides and currents) and sediment transport modelling platforms. This modelling suite will be employed primarily to predict behaviour of the primary mechanisms of impact to marine biota, i.e. the increase in fine suspended sediment concentrations, as well as the deposition of fine sediment.

The prediction of coarse sediment transport and deposition will be predicted employing a combination of longshore transport modelling, cross-shore transport modelling (focussing on storm events) and assorted established coastal engineering analysis methods. Longshore transport (and corresponding shoreline evolution) modelling will be achieved employing the UNIBEST CL+ model that is well-validated for the region. Prediction of storm-driven cross-shore sediment transport and the resulting sea-bed changes will be predicted by means of the SBEACH model which has been validated against storm erosion data in the region.

As mentioned, the study will draw on data and information accessed and collated in project BEHP/CEA/03/02 for model validation and other analyses.

2.3 Project timetable

This project commenced with the first task in the form of the inaugural meeting, held in Windhoek on 16-17 August 2004. The updated project schedule is as follows:


Project Scedule
Aug 04
Sep 04
Oct 04
Nov 04
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Jan 05
Feb 05
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Apr 05
May 05
June 05
Week:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
1. Preliminaries
1a. Inaugural meeting
Data flow from project BEH/CED/03/02
1b. Define demonstration areas
1c. Review and format data for model application
1d. Set-up computation models
1e. Define impact mechanisms Pisces
2. Sediment dynamics assessment
2a. Assess natural context
2b. Assess effects of discharged sediment
2c. Progress report
2d. Translation of results into impact
2e. GIS agglomeration of impact
2f. Progress report (model validation)
2g. Review
3. Sensitivity testing and monitoring programme design
3a. Testing sensitivity of predictions to input discharges
3b. Test sensitivity of predictions to validation data
4. Tailings discharge management
4a. Tailings management scenario testing
4b. Synthesis of results
5. Capacity building workshop
5a. Preparation
5b. Execution
5c. Report on workshop
6. Output results
6a. Draft of final report
6b. Draft publication
6c. Produce final report

3. CAPACITY BUILDING AND TRAINING

It is understood that capacity building and training are a high priority in the BCLME Programme. This project will facilitate an MSc Degree with a candidate from the Department of Geophysics, Universidade Agostinho Neto, as has been agreed with the Department co-ordinator, Joaquim Boavida. This university department has expressed its support and enthusiasm for this form of capacity building and cooperation, and the approach to be adopted in this in this study is closely aligned to the department's own concepts of capacity building.

In accordance with the department's ideals, the student will receive formal graduate training at the University of Stellenbosch, and training on computational models of coastal processes within the project. A focus on sediment transport and beach and nearshore morphology will help to equip the student with the necessary tools to address problems such as those associated with the morphology of large sand spits (restingas) in Angola. Understanding and maintenance of these sedimentary features are essential to protect some important harbours in Angola. After the project, the student will return to share and develop this capacity at UAN. As stated in the project proposal, the project includes a scholarship for the first year of MSc study, with the following year/s to be funded from other sources.

APPENDIX 1: INCEPTION WORKSHOP REPORT