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KZ:dmc

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John Goulee
Project Manager
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Dear John

MARINE INVESTIGATIONS BINNINGUP - ADDITIONAL SCOPE OF WORKS

In response to the Water Corporation's request to provide additional scope of works relating to Marine Investigations at Binningup, Kellogg Brown and Root Pty Ltd (KBR) is pleased to submit our proposal below.

INTRODUCTION

The total scope of works to be provided by KBR is as follows:

- Oceanographic Survey and Coastal Processes
- Bathymetric, Geotechnical and Benthic Habitat Survey
- Water Quality Monitoring.
- Sediment and Bio-monitoring
- Outfall Diffuser Design
- Hydrodynamic Modelling of Desalination Brine
- Dye Dispersion Study
- Seaglider Monitoring, Analysis and Reporting
- Miscellaneous Services

KBR has aligned Water Corporation's environmental scoping summary (Appendix A) with KBR's summary of proposed works (Appendix B). The proposed schedule for this work is presented in Appendix C. More detailed information relating to each component listed above is provided below.

Note that this proposal is valid until 31 August 2007.

SCOPE OF WORK

Oceanographic Conditions & Coastal Processes

Additional intensive field survey - spring 2007

- Purpose: To gather knowledge of oceanographic conditions in the spring season corresponding with KBR's water quality field monitoring
- Methodology: Undertake an additional 3-day CTD, drifter and turbulence measurements field survey
- Frequency: 1 survey in spring 2007
- Deliverables: Short summary report
- Cost: Refer Table 1

Monthly downloading of ADCP inclusive of monthly reporting

- Purpose: To ensure that oceanographic data is collected on a monthly basis and therefore reduce the impact of possible malfunction of instruments and loss of data.
- Methodology: Monthly download of ADCP, CTD-DO and thermistors
- Frequency: 4 Visits - July, August, October & November 2007
- Deliverables: Short monthly summary report
- Cost: Refer Table 1

Detailed coastal processes

- Purpose: To establish coastal processes data required for the inlet and outlet engineering design.
- Methodology: Includes assessment of the:
- wave climate,
 - cross shore sediment transport,
 - beach stability,
 - longshore sediment transport,
 - rates of sediment accumulation,
 - wave modelling with SWAN model, and
 - review of relevant data sets from nearby locations.
- Deliverables: Single report
- Cost: Refer Table 1

Baseline beach profiling

- Purpose: Provide baseline data on beach morphological changes over time.
- Methodology: Set up 7 beach profile monitoring lines, establish bench marks, relate to survey markers. The 7 lines would include one at the proposed pipeline location; 3 sites to the north (200m, 500m 1000m) and 3 sites to the south (200m, 500m, 1000m).
- Frequency: Monitoring at bi-monthly intervals - July, September, November, January
- Deliverables: Single report
- Cost: Refer Table 1

Current/long-shore drift adjacent to shoreline

- Purpose: To provide information to be used for pipeline design and it's assessment of longshore sediment transport.
- Methodology: Deploy Nortek Aquadopp ADCP and Nortek ADV current meters in the surf zone at the proposed pipeline location to measure the longshore current during a sea breeze cycle. It is recommended that the instruments be deployed for a period of 3 days over two separate periods to cover a range of sea breeze conditions to obtain the maximum currents. The ADCP will be located just outside the surf-zone and will record the vertical current profile at 1Hz with 0.20m bins. The Nortek ADV current meter will record the 3-dimensional currents at a single location continuously at 2Hz. Both instruments will record the wave conditions through a pressure sensor and the acoustic backscatter.
- Frequency: 2 surveys in summer season, each consisting of 3-day surf zone measurements
- Deliverables: Single report
- Cost: Refer Table 1

Wave data records tied into a longer source

- Purpose: To predict extreme wave conditions at the outfall location
- Methodology: At present the ADCP is set to record significant wave height, period and direction every 4 hours for a 12 month period. Data from a deep water station, maintained by the DPI off Cape Naturalist is available for an extended period (>5 years). Through direct correlation of the offshore and nearshore data as well as using the SWAN wave propagation model, extreme wave conditions expected at the outfall location will be predicted.
- Deliverables: Single report
- Cost: Refer Table 1.

Storm erosion analysis

Purpose: Predict maximum coastal erosion under the action of storms. This will be important for locating the desalination plant infrastructure.

Methodology: Maximum storm erosion will be predicted using the SBEACH model. Model requires a time series of wave height, period, water level and an initial cross-shore profile. Usually a storm lasting 3-4 days is simulated. The model outputs the evolution of the beach profile with time. Through the analysis of longer term wave data (through comparison between the inshore and offshore data), several extreme storms will be selected for input to the model to obtain the maximum erosion under the action of storms.

Deliverables: Single report

Cost: Refer Table 1

Bathymetric Survey, Habitat Mapping and Geotechnical Survey

Bathymetry Survey

Purpose: To determine accurate bathymetry and seabed surface features of the surveyed area to assist in accurate modelling of brine dispersion and pipeline construction.

Methodology: The survey would be carried out in a single phase with the bathymetric data being obtained at the same time as the sub bottom information.

A Multi-beam Echo Sounder will provide bathymetry data as well as backscatter information which is used to chart seabed surface features. Sub bottom profiling will be acquired using a Boomer Sub Bottom Profiler system. Seabed samples will be obtained using a bucket grab sampler.

Frequency: Once - July 2007

Deliverables: *Reporting:*

- Full description of survey operations complete with supporting documentation
- Full description and analysis of survey data complete with survey conclusions and recommendations

Charts:

- Bathymetry chart(s)
- Isopach chart(s)
- Backscatter charting of the seabed

Electronic Deliverables:

- Adobe .pdf copy of report and charts on CD
- Charts in .dgn format
- Processed bathymetry data in an ASCII file

Cost: Refer Table 1

Note: Fugro Survey standby day rates may apply in the event of poor weather.

Habitat Mapping

Purpose: To provide a detailed habitat map of the seabed to provide knowledge of existing marine benthic primary producers and their existing habitats and to ultimately avoid/minimise any potential damage caused by pipeline construction

Methodology: Habitat mapping field operations would be carried out straight after the bathymetry data has been gathered and field processed. A towed sled complete with high definition video camera will be towed behind the vessel along pre-determined transects. At locations of particular interest, a high resolution still camera will be introduced to capture bottom conditions. The video survey would investigate, and confirm the interpretation of the bathymetric survey, from which a habitat classification scheme for the survey area can be generated.

Frequency: Once - July 2007

Deliverables: *Reporting:*

- Full description of survey operations complete with supporting documentation
- Full description and analysis of survey data complete with survey conclusions and recommendations

Charts:

- Habitat Classification Map

Electronic Deliverables:

- Adobe .pdf copy of report and charts on CD
- Data layers in ESRI ArcView shapefile format, with metadata

Cost: Refer Table 1.

Note: Fugro Survey standby day rates may apply in the event of poor weather.