

# WAFI-GOLPU PROJECT

## Deep Sea Tailings Placement Update

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Dr David Gwyther – WGJV DSTP and Marine Studies Advisor  
Interactive Dialogue on Deep Sea Tailings Placement – 22 November 2017

# Disclaimer

## Harmony Gold Mining Company Limited



### Forward Looking Statements

These materials contain forward-looking statements within the meaning of the safe harbor provided by Section 21E of the Securities Exchange Act of 1934, as amended, and Section 27A of the Securities Act of 1933, as amended, with respect to our financial condition, results of operations, business strategies, operating efficiencies, competitive positions, growth opportunities for existing services, plans and objectives of management, markets for stock and other matters. These include all statements other than statements of historical fact, including, without limitation, any statements preceded by, followed by, or that include the words “targets”, “believes”, “expects”, “aims”, “intends”, “will”, “may”, “anticipates”, “would”, “should”, “could”, “estimates”, “forecast”, “predict”, “continue” or similar expressions or the negative thereof.

These forward-looking statements, including, among others, those relating to our future business prospects, revenues and income, wherever they may occur in this report and the exhibits to this report, are essentially estimates reflecting the best judgment of our senior management and involve a number of risks and uncertainties that could cause actual results to differ materially from those suggested by the forward-looking statements. As a consequence, these forward-looking statements should be considered in light of various important factors, including those set forth in this report. Important factors that could cause actual results to differ materially from estimates or projections contained in the forward-looking statements include, without limitation: overall economic and business conditions in South Africa, Papua New Guinea, Australia and elsewhere, estimates of future earnings, and the sensitivity of earnings to the gold and other metals prices, estimates of future gold and other metals production and sales, estimates of future cash costs, estimates of future cash flows, and the sensitivity of cash flows to the gold and other metals prices, statements regarding future debt repayments, estimates of future capital expenditures, the success of our business strategy, development activities and other initiatives, estimates of reserves statements regarding future exploration results and the replacement of reserves, the ability to achieve anticipated efficiencies and other cost savings in connection with past and future acquisitions, fluctuations in the market price of gold, the occurrence of hazards associated with underground and surface gold mining, the occurrence of labour disruptions, power cost increases as well as power stoppages, fluctuations and usage constraints, supply chain shortages and increases in the prices of production imports, availability, terms and deployment of capital, changes in government regulation, particularly mining rights and environmental regulation, fluctuations in exchange rates, the adequacy of the Group’s insurance coverage and socio-economic or political instability in South Africa and Papua New Guinea and other countries in which we operate.

For a more detailed discussion of such risks and other factors (such as availability of credit or other sources of financing), see the Company’s latest Integrated Annual Report and Form 20-F which is on file with the Securities and Exchange Commission, as well as the Company’s other Securities and Exchange Commission filings. The Company undertakes no obligation to update publicly or release any revisions to these forward-looking statements to reflect events or circumstances after the date of this report or to reflect the occurrence of unanticipated events, except as required by law.



# Disclaimer

## Newcrest Mining Limited



### Forward Looking Statements

This document includes forward looking statements. Often, but not always, forward looking statements can generally be identified by the use of forward looking words such as “may”, “will”, “expect”, “intend”, “plan”, “estimate”, “anticipate”, “continue”, “outlook” and “guidance”, or other similar words and may include, without limitation, statements regarding plans, strategies and objectives of management, anticipated production or construction commencement dates and expected costs or production outputs. The Company continues to distinguish between outlook and guidance in forward looking statements. Guidance statements are a risk-weighted assessment constituting Newcrest’s current expectation as to the range in which, for example, its gold production (or other relevant metric), will ultimately fall in the current financial year. Outlook statements are a risk-weighted assessment constituting Newcrest’s current view regarding the possible range of, for example, gold production (or other relevant metric) in years subsequent to the current financial year.

Forward looking statements inherently involve known and unknown risks, uncertainties and other factors that may cause the company’s actual results, performance and achievements to differ materially from any future results, performance or achievements. Relevant factors may include, but are not limited to, changes in commodity prices, foreign exchange fluctuations and general economic conditions, increased costs and demand for production inputs, the speculative nature of exploration and project development, including the risks of obtaining necessary licences and permits and diminishing quantities or grades of reserves, political and social risks, changes to the regulatory framework within which the company operates or may in the future operate, environmental conditions including extreme weather conditions, recruitment and retention of personnel, industrial relations issues and litigation.

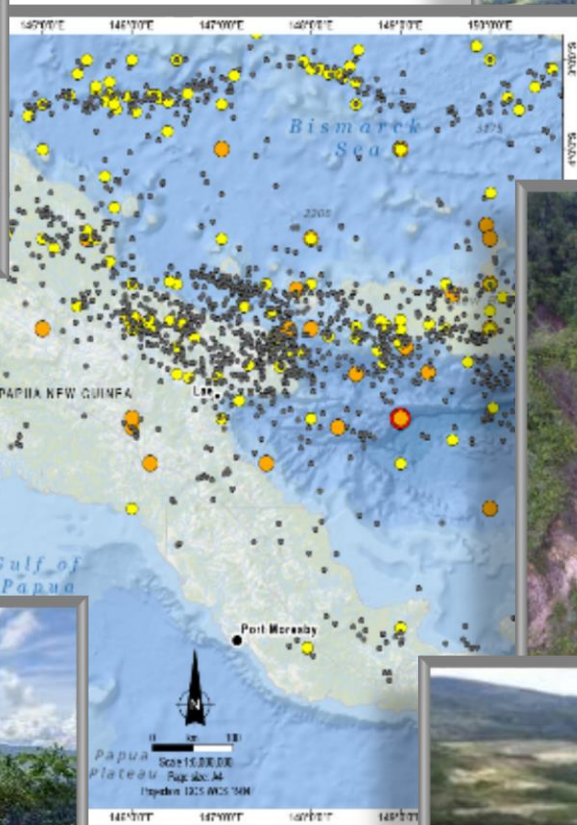
Forward looking statements are based on the Company and its management’s good faith assumptions relating to the financial, market, regulatory and other relevant environments that will exist and affect the Company’s business and operations in the future. The Company does not give any assurance that the assumptions on which forward looking statements are based will prove to be correct, or that the Company’s business or operations will not be affected in any material manner by these or other factors not foreseen or foreseeable by the company or management or beyond the company’s control. Although the company attempts and has attempted to identify factors that would cause actual actions, events or results to differ materially from those disclosed in forward looking statements, there may be other factors that could cause actual results, performance, achievements or events not to be as anticipated, estimated or intended, and many events are beyond the reasonable control of the Company. Accordingly, readers are cautioned not to place undue reliance on forward looking statements. Forward looking statements in this document speak only at the date of issue. Subject to any continuing obligations under applicable law or any relevant stock exchange listing rules, in providing this information the Company does not undertake any obligation to publicly update or revise any of the forward looking statements or to advise of any change in events, conditions or circumstances on which any such statement is based.

# Tailings - A Brief Introduction

- Once mineralised rock has been excavated from the mine, it is crushed up into a fine sand
- Valuable minerals will be separated from the fine sand mixture using a **PHYSICAL** separation process called Flotation
- The separated valuable minerals are shipped as a “**Concentrate**” to refineries around the world to recover the copper and other valuable metals
- The left over fine sand, or waste, from the separation process is termed “**Tailings**”
- Large volumes of tailings can be produced by mines and environmental and social impacts need to be safely managed
- Tailings management options typically entail the storage of tailings on-land in permanent impoundments (dams) or in underwater deposits (e.g. deep sea tailings placement).



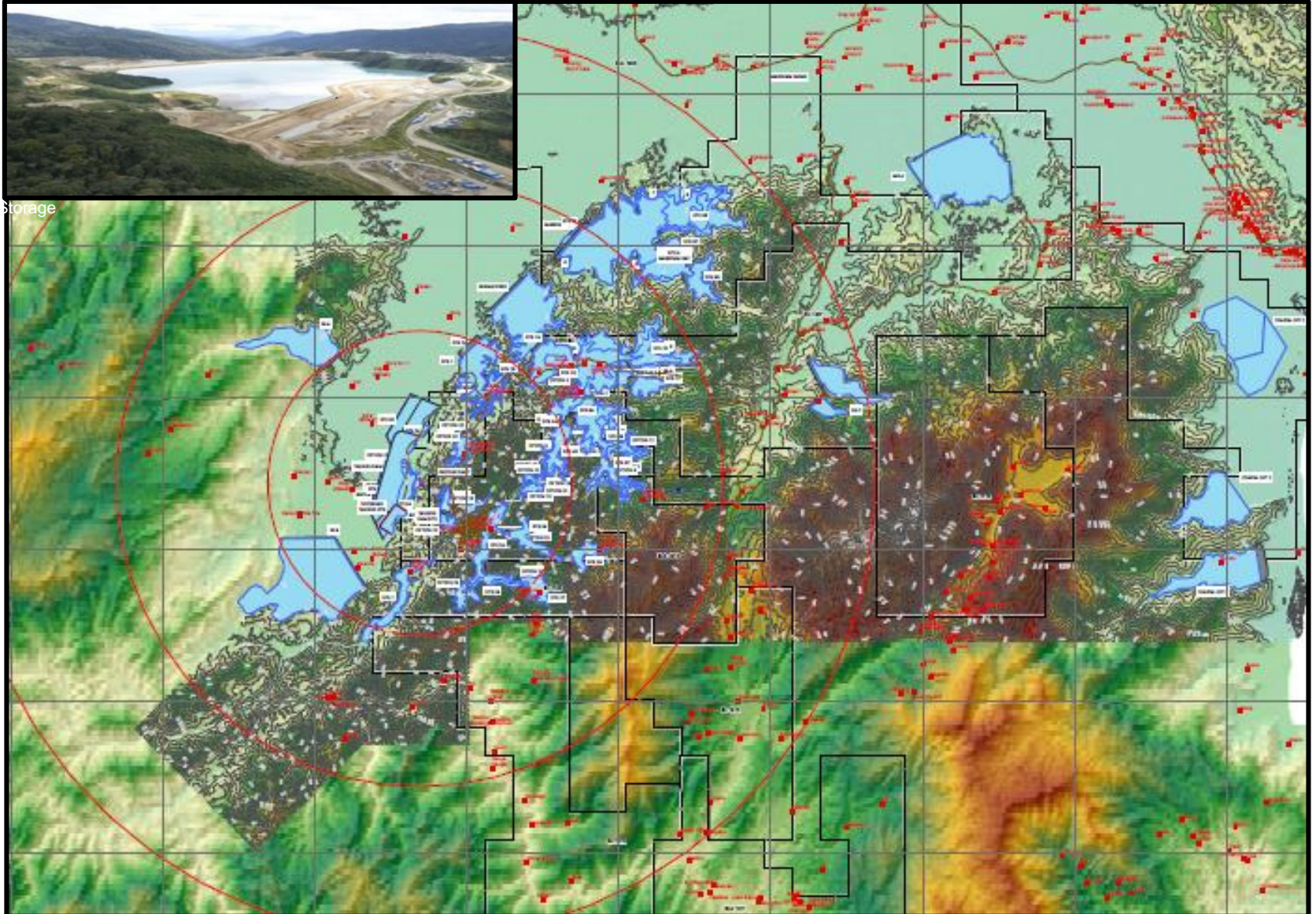
# Land-based Tailings Storage





# Investigation of Terrestrial Storage Facilities

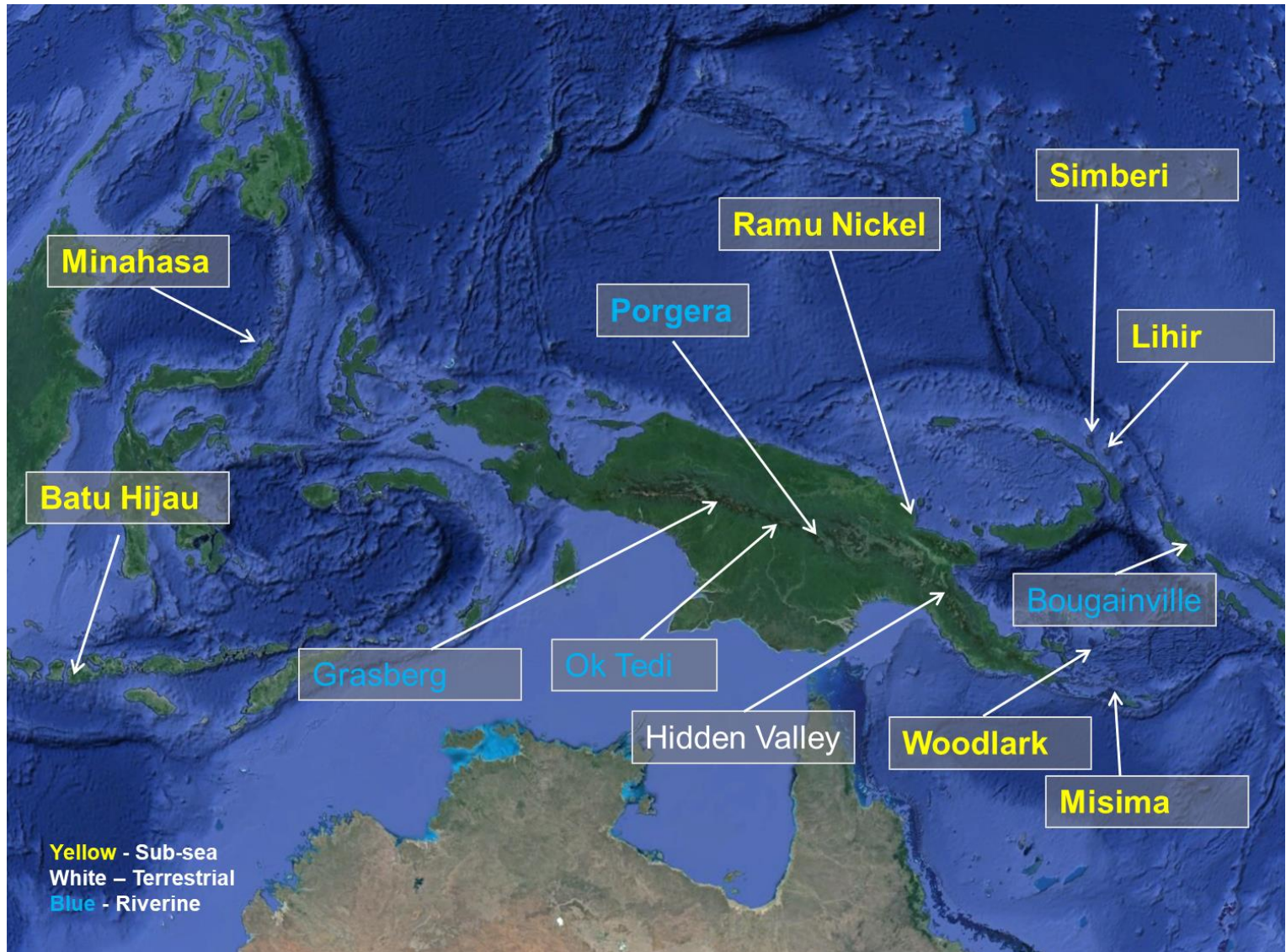
Many options have been considered





# Regional Tailings Management Options

Terrestrial , riverine and sub-sea



# Deep Sea Tailings Placement Option

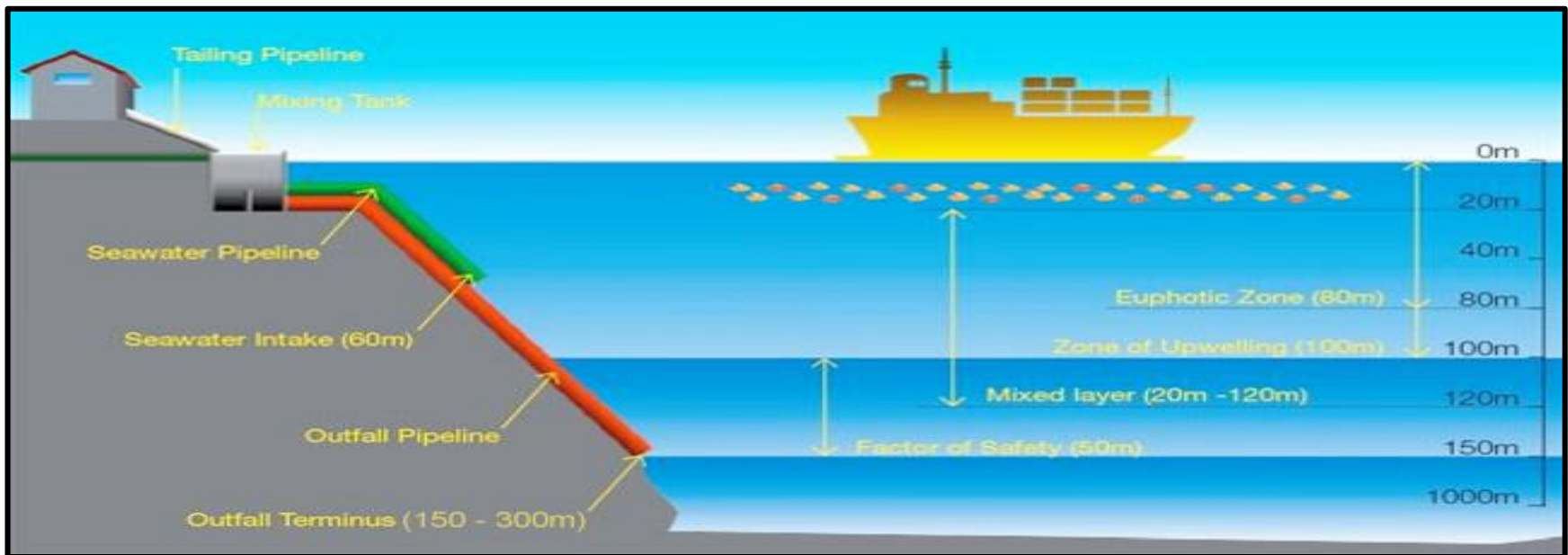
## Why consider DSTP?

### What is DSTP

- Discharge of a dense tailings slurry from a pipeline with an outfall terminus located deep below the ocean surface
- Tailings gravity flow along the seafloor as a bottom-attached density current to deposit in the deep ocean (typically at depths >1000m)

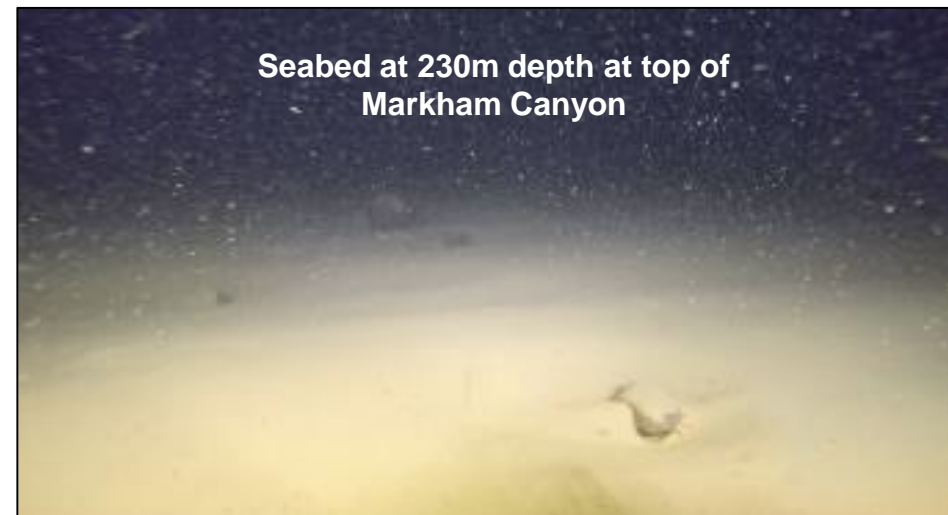
### Aims of DSTP

- To protect marine ecosystems and fisheries within the productive nearshore coastal environment, and the people that use these
- To achieve the tailings management option with least social and environmental risk and impact.





- No exposure to coastal ecosystems
- Deposition well below risks to human “food chain”
- Impacts confined to deep seabed
- Return of natural sedimentation and burial after closure
- Tailings solids do not oxidise, no Acid Rock Drainage
- Easier to accommodate future mine expansion and closure



# DSTP Environmental Evaluation

Informed by SAMS Draft DSTP Guidelines (PNG)



## Key considerations include:

### 1. Receiving environment studies:

- Upwelling and mixing zones
- Currents
- Plankton migration
- Geochemistry
- Tailings deposition / model
- Benthic community

### 2. Avoid impacts of environmental, social or economic significance

4. Sufficient water depth and slope for coherent tailings flow
5. No potential adverse affect on bioresources (fisheries)
6. Significance and reversibility of potential impacts on benthos understood / tailings leaching
7. Tailings deposition capacity

## Appendix 10

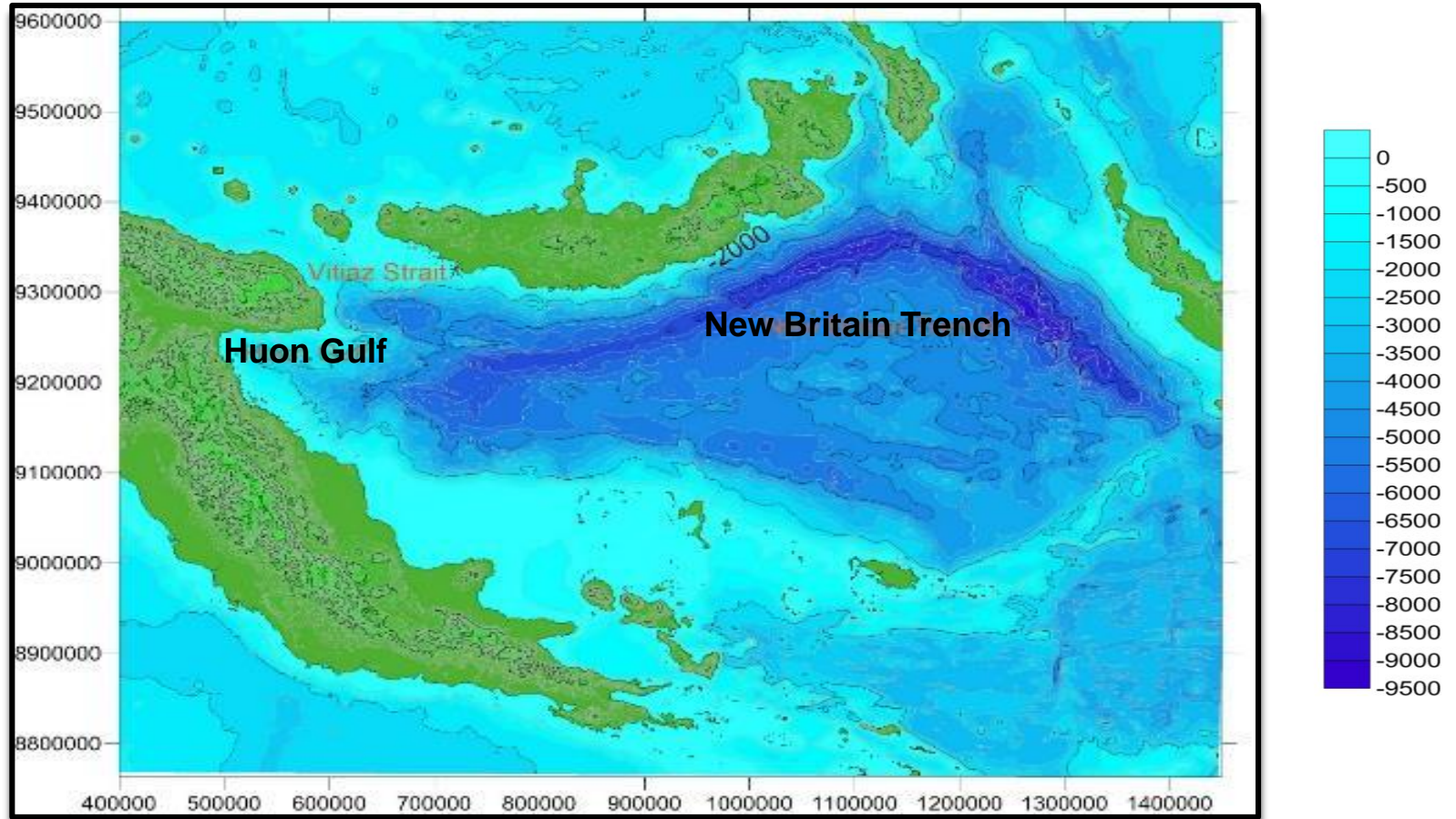
Draft Guidelines for Deep-Sea Tailings Placement

Project Number: 8.ACP.PNG.18-B/15



# Deep Water Conditions Highly Suitable for DSTP

Very deep near-shore environment



- Very deep water lies close to the Morobe coast as the Huon Gulf forms the western slope of the mega New Britain Trench, with max. depths exceeding 9,000m

# Near-shore Markham Canyon

Natural conduit for riverine sediments



- Bathymetric studies reveal the near-shore steeply incised Markham Canyon that conveys riverine sediments to depths of over 3000m



# Significant Riverine Sediment Discharges

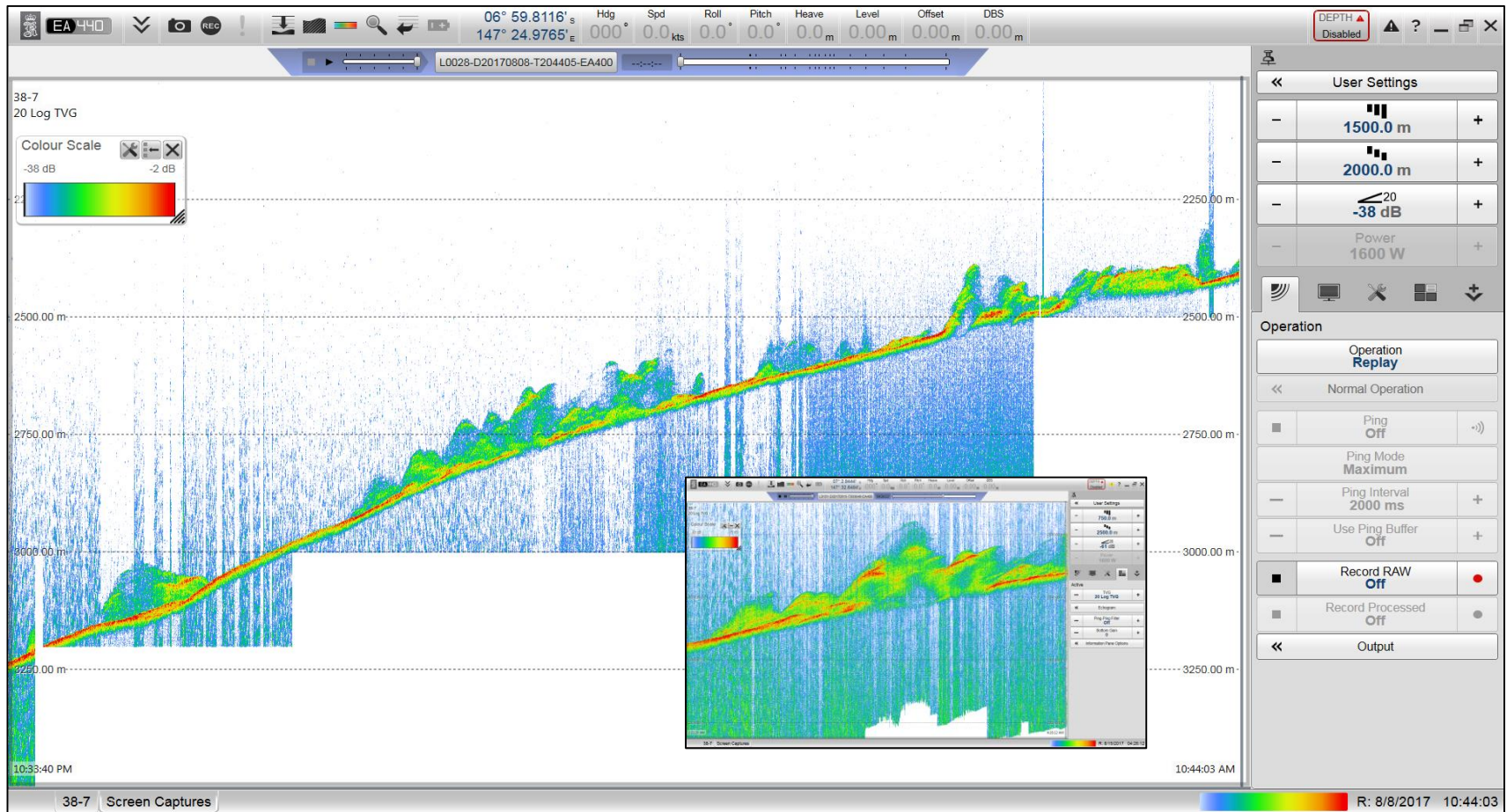
Dominate the Huon Gulf receiving environment



- Local rivers are estimated to discharge approximately 60 million tons of sediment annually into the Huon Gulf. This is some 4 times the quantity of proposed tailings discharge annually

# Echo Sounding in the Markham Canyon

## Detects natural sediment bed-transport and plumes



- Sediment plumes of up to 150m high and mass movement events have been detected traveling down the axis of the Markham Canyon

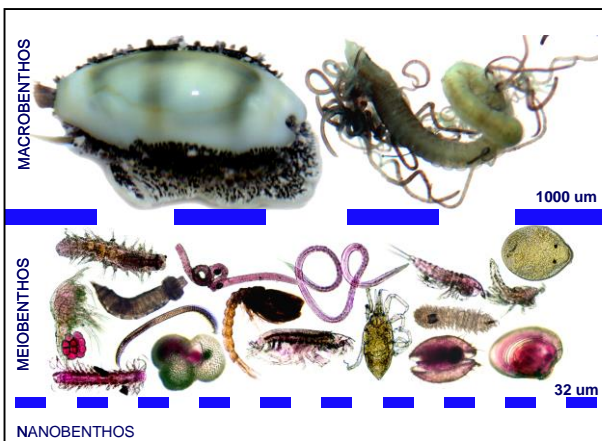
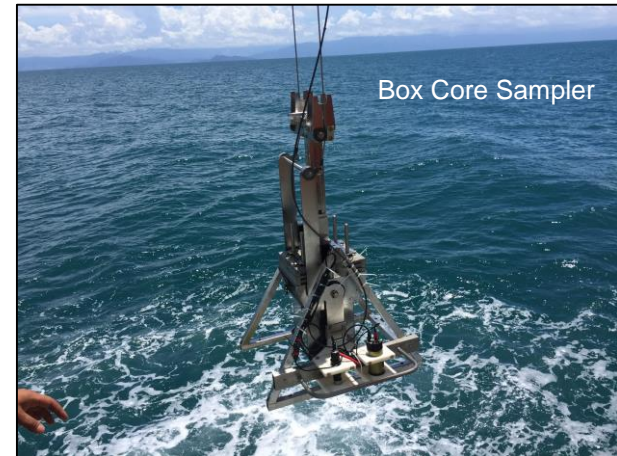


# Riverine discharges affect marine life

Turbidity and dynamic sediment flows directly impact benthos

## Deep ocean floor studies (benthic)

- Macrobenthos (>5mm) - generally very low abundance and diversity in the Markham Canyon
- Microbenthos (<5mm) – highly variable with lower abundance generally inside the Markham Canyon



# Riverine discharges affects broader ecology

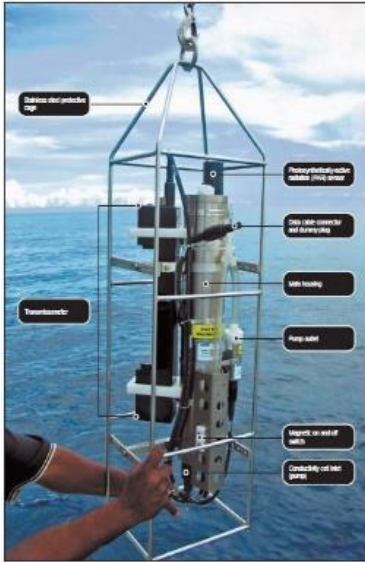
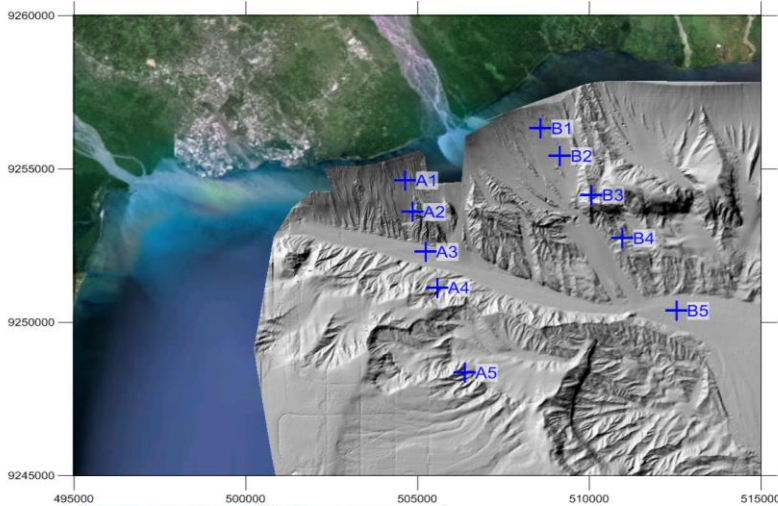
- The turbid riverine discharge is reflected by no coral reefs in areas around the Markham River, Lae, Wagang and Busu
- There is also limited community fishing and no commercial or deep sea fishing in the area
- Deep sea (100-500m depth) and pelagic fish studies found:
  - Much lower diversity of species and catch rate compared to other DSTP baseline studies in PNG
  - Deep water species dominated by sharks (93%) with no catches of deep slope snappers typical of other DSTP sites
  - No pelagic fish captured in trolling (16.5 hours)
- **The Western Huon Gulf generally has low relative biological productivity due to the high riverine sediment discharges**



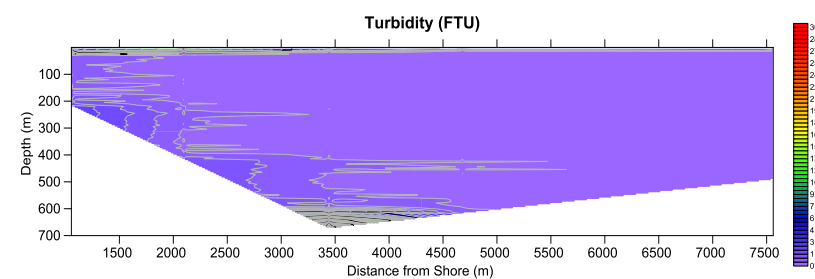
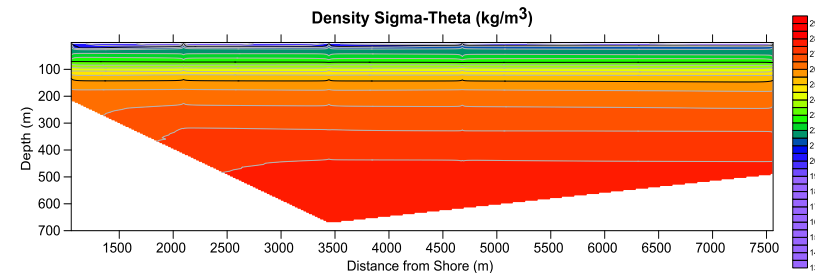
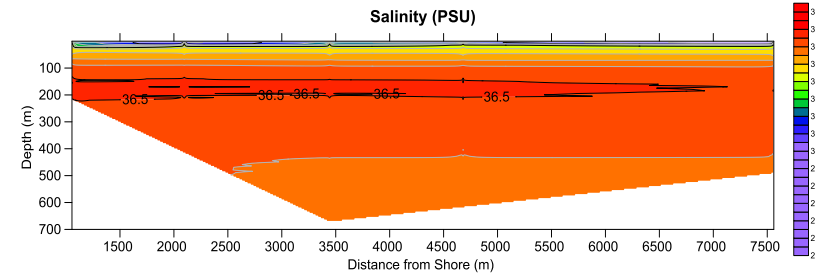
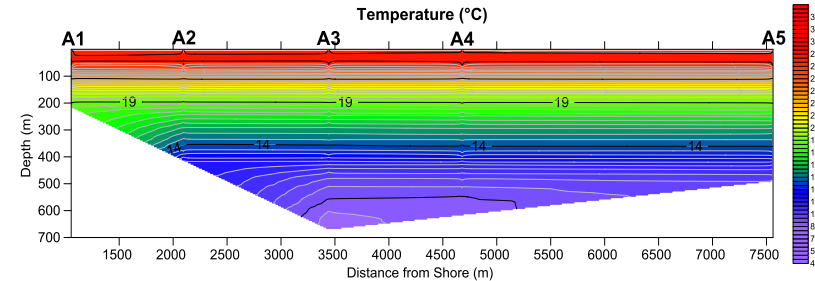


# Upwelling & Oceanography Studies

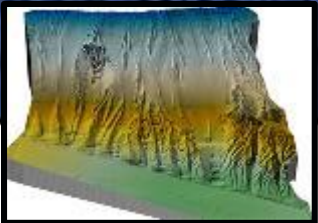
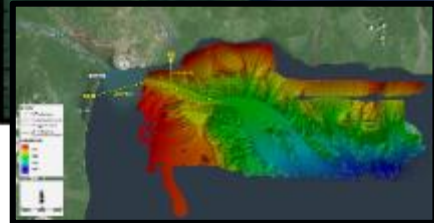
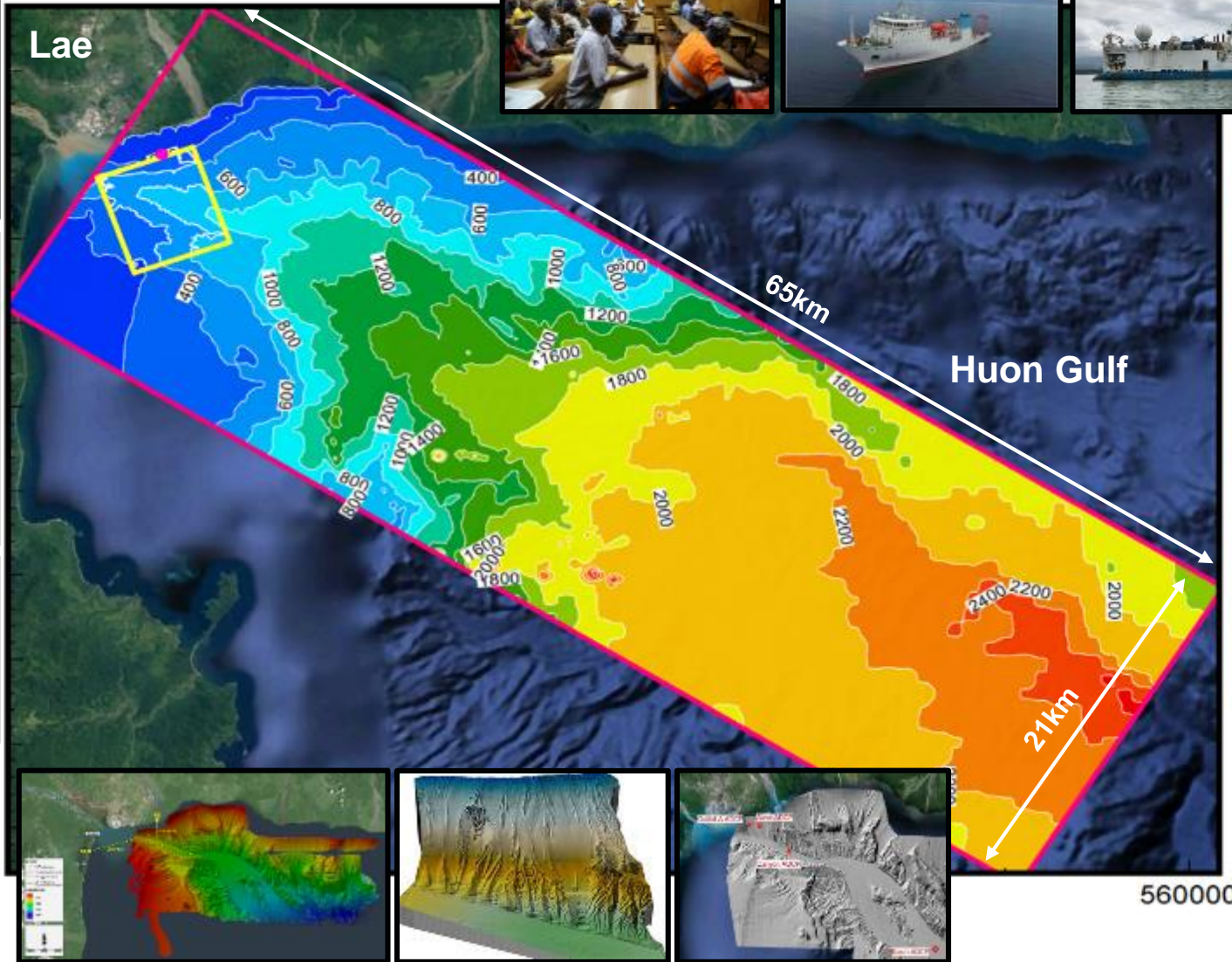
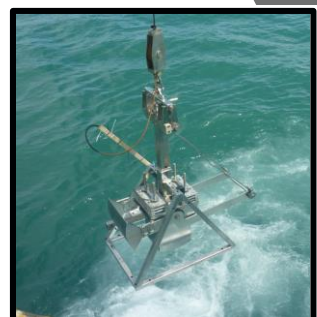
No evidence of upwelling or extended surface layer mixing



To measure surface mixed layer and detect any upwelling



# Huon Gulf is a highly suitable location for DSTP





# Engagement with Our Stakeholders

- Since July 2016, seventeen DSTP-specific meetings have been held with communities and local/provincial government, totaling 1,276 participants
- Community feedback incorporated into Project design
- Shared information placed on Wafi-Golpu website [www.wafigolpujv.com](http://www.wafigolpujv.com)





# QUESTIONS?



# EM TASOL – DANGE NGAYAM

Any questions?

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