Notes for reader

Please note that since the completion of the EIS in 2013 there have been some modifications and overall improvements to the project. In general, the underlying studies and baseline data sets used to complete the environmental and social impact assessment remain valid, and the nature and severity of the impacts identified, and mitigation actions developed have not changed.

There are however a number of specific changes which required further work and which have now been addressed in an addendum to the EIS, including:

- A change in the location of the process plant;
- An increase in the DSTP annual discharge rate from 1.8 Mtpa to 2.4 Mtpa;
- Location and geometry of waste dumps in an effort to reduce impacts to natural surface water drainage and to minimise haul distances;
- Minor changes to pit dimensions;
- Realignment of the wharf road;
- Realignment of the DSTP pipeline required as a result of the change in location of the process plant;
- A change in location of the mine camp to provide improved access without the need to pass through the mine lease;
- Improvements to the overall water management strategy with a view to reducing impacts to the natural surface water system and to provide a more dynamic sediment control methodology.

These project modifications are addressed in the EIS addendum document with updated impact assessment where necessary.

Woodlark Mining Limited (WML)

Woodlark Island Gold Project

ENVIRONMENTAL IMPACT STATEMENT

Woodlark Mining Limited

Volume A:

Executive Summary

Prepared by:

coffey environments

SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

ENVIRONMENTAL IMPACT STATEMENT

Woodlark Island Gold Project

Volume A: Executive Summary

January 2013

CR 1412_15_v4

coffey environments
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EXECUTIVE SUMMARY

1. Introduction

1.1 Context

Woodlark Mining Limited (WML) is proposing to develop the Woodlark Island Gold Project, which is located on the remote Woodlark Island (Figure 1), situated approximately 600 km east of Port Moresby and 300 km northeast of Alotau in Milne Bay Province, Papua New Guinea (PNG). Compared to other gold deposits in PNG, the defined deposits of the Woodlark Island Gold Project (hereafter termed 'the project') are modest and will support a relatively small mine, similar to the scale of the Simberi Gold Mine located in the northeast of New Ireland Province, PNG.

Woodlark Island has a rich history of gold mining dating back to the late 19th century. Alluvial gold was first discovered on Woodlark Island in 1895 and mining started in that year. The initial alluvial mining shifted to underground mining of lode deposits in 1899 and continued to 1918 and then recommenced in 1930 before closing in 1939. Between these two main periods and from after World War Two until 1963, mining and tailing retreatment operations were intermittent. Since 1988, a succession of companies have undertaken gold exploration on the island. WML has undertaken exploration on Woodlark Island since 2005.

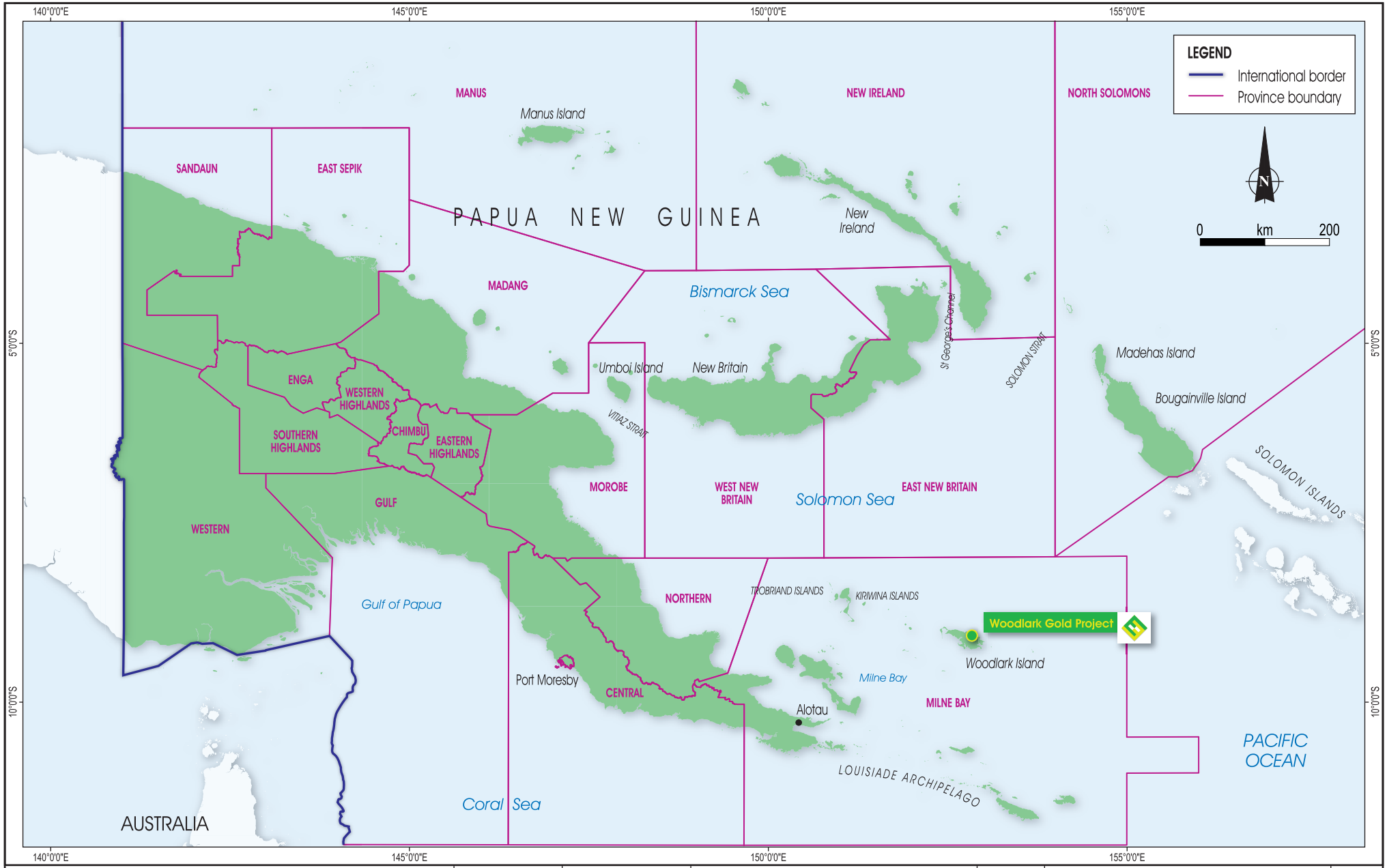
Proponents of new mineral development projects in PNG are required to meet applicable PNG laws and regulations. In November 2000, the PNG Government approved the *Environment Act 2000*, which was implemented with its associated regulations in January 2004. The Project is a Level 3 activity under the Environment (Prescribed Activities) Regulation 2002, for which an environmental impact statement (EIS) is required to be submitted to the Department of Environment and Conservation (DEC).

This Executive Summary presents the key aspects of the Project's EIS (which is the culmination of the environmental and social impact assessment, or ESIA, process), and has been prepared by Coffey Environments in accordance with s. 53 of the *Environment Act 2000*. The EIS process is described in Section 2.

1.2 Proponent Details

Woodlark Mining Limited (WML) is the proponent for the Woodlark Island Gold Project. WML is a wholly-owned subsidiary of Kula Gold Ltd, which is a publicly-listed company on the Australian Securities Exchange (ASX: KGD). Kula Gold Ltd acquired the project when it purchased WML from BDI Mining Limited in 2007. WML holds over 450 km^2 of exploration tenements on Woodlark Island, and since 2007 WML has undertaken an extensive exploration-drilling program culminating in the discovery and delineation of a JORC-compliant resource of 2.1 Moz of gold in January 2012.

Kula Gold Ltd has its headquarters in Sydney, Australia. Further information can be obtained from the company's annual reports available on the Kula Gold website.



	coffey environments	Date: 05.11.2012	Woodlark Mining Limited		Figure No: 1
		File Name: 1412_15_ES_F001_HB	Woodlark Island Gold Project	Project location	

Currently, the project is the sole focus of WML and Kula Gold Ltd. Since acquisition of the project in 2007, WML has conducted its exploration and project development activities in close collaboration with Woodlark Islanders, and enjoys an excellent working relationship with the local community.

1.3 Project Rationale

PNG promotes the development of its mineral resources through various policies to encourage investment, and it is a priority of the government that the people of PNG benefit from the development of their resources. The Constitution of PNG includes national goals and directives that outline the aspirations and principles for the development of the nation, and the fourth of these states that:

> We declare our Fourth Goal to be for Papua New Guinea's natural resources and environment to be conserved and used for the collective benefit of us all, and be replenished for the benefit of future generations.

The project involves mining gold, employing methods that are environmentally responsible, technologically feasible and economically viable. As such, project development is consistent with the above goal, as it is with PNG's strategic plans for future development, i.e., 'Vision 2050', the 'Papua New Guinea Development Strategic Plan 2010 to 2030' and the 'Medium Term Development Plan 2010 to 2015'.

While the process of mining will deplete a non-renewable resource, benefits in the form of taxes, royalties and profits derived from the project will contribute to improvements in the nation's balance of trade, direct and indirect employment and training opportunities and the potential for new industrial development. In this respect, the wealth generated by the project remains a durable economic asset for future generations, even after the original source of the wealth becomes depleted.

Moreover, the project represents continuity within PNG's mining sector and, with it, the maintenance of expertise, on which PNG's future mining industry depends. This is especially critical given that a number of the existing mines will have closed (or will be nearing closure) within the next 5 to 10 years (e.g., Porgera and Ok Tedi). From a broader perspective, the project also represents ongoing generation of human (as well as financial) capital, which will underpin further economic and social development in PNG.

From WML's perspective, the commercial objective is the profitable operation of the project that is consistent with:

- Good industry practice for health, safety and environmental management.
- Conditions and standards prescribed by the PNG Government.
- WML's principles and objectives for sustainable development.

1.4 Description of Proposed Development

Mineral Resource

Exploration and drilling programs at the Busai, Kulumadau and Woodlark King deposits have been undertaken by WML since it acquired the project in 2007 and have allowed the deposit to be classified as shown in Table 1, prepared in accordance with the Joint Ore Reserves Committee code (2004) guidelines (JORC, 2004). Ore tonnages to be mined for the project and other key project characteristics are outlined in Table 2.

Table 1 Consolidated mining reserve

Pit	Proved			Probable			Total		
	Tonnes (Mt)	Grade (g/t)	Ounces	Tonnes (Mt)	Grade (g/t)	Ounces	Tonnes (Mt)	Grade (g/t)	Ounces
Busai	3.283	2.2	233,000	2.811	1.9	175,000	6.094	2.1	408,000
Kulumadau	3.144	2.2	223,000	0.751	2.4	59,000	3.895	2.3	282,000
Kulumadau East				0.330	3.7	37,000	0.330	3.7	37,000
Woodlark King				0.704	1.7	39,000	0.704	1.7	39,000
Total	**6.427**	**2.2**	**456,000**	**4.596**	**2.1**	**310,000**	**10.991**	**2.2**	**766,000**

Consolidated mining reserve at September 2012.
Source: Woodlark Island Gold Project Feasibility Study, November 2012.

Table 2 Key characteristics of the project

Item	Description
Project location	Woodlark Island, Milne Bay Province, PNG.
Project footprint	With DSTP: approximately 847 ha. With TSF approximately 936 ha.
Mining method	Conventional open pit.
Mining reserves	10.99 Mt (proved and probable) at 2.2 g/t Au.
Open pit dimensions (final pit shell)	Busai – 967 m long x 853 m wide x 145 m deep. Kulumadau – 802 m long x 577 m wide x 250 m deep. Kulumadau East – 377 m long x 311 m wide x 100 m deep. Woodlark King – 675 m long x 266 m x 80 m deep.
Mine life	Approximately 9 years (plus 1.5-year construction period), comprising 8 years mining, with the final year processing low grade stockpiles.
Mining rate	1.8 Mt/a of ore and 12.5 Mt/a of waste (average, with a maximum rate of 20.1 Mt/a ore and waste combined).
Processing method	Conventional crushing, grinding and carbon in leach gold circuit (Figure 2).
Mill throughput	1.8 Mt/a of ore.
Gold production	Up to 120,000 oz/year.
Operating hours	Continuous operation, 24 hours per day, 7 days per week.
Tailing management	Two options considered: • On-land management in TSF north of the processing plant. • Deep sea tailing placement (DSTP) in Wamumon Bay (proposed).

Table 2 Key characteristics of the project (cont'd)

Item	Description
PAF waste rock storage	On-land deposition in waste rock dumps adjacent to open pits.
Power supply	Stand-alone heavy fuel oil-fired power station; separate diesel generators at the wharf and airstrip.
Power requirement	10.9 MW (average operational load) and 13.6 MW (peak load).
Raw water supply	Surface water from rainfall and pit dewatering, supplemented by groundwater abstraction.
Raw water requirement	4,448 ML/year.
Accommodation	Construction: • 200 people. Operations: • 200 people.
Employees	Construction: • Peak of approximately 300 people during 18-month construction phase. Operations: • Approximately 500 people at commencement (WML and contractors). Fly-in, fly-out (FIFO) rosters: • 16 days on, 12 days off.
Main airport	Installation of Customs, passenger and ablution facilities at existing airstrip at Guasopa.
Capital expenditure	Initial Capital: US$196 million, including mining fleet (PGK 402 million). Total life of mine: US$212 million (PGK 435 million). (calculated at US$ 1:PNGK 2.05)

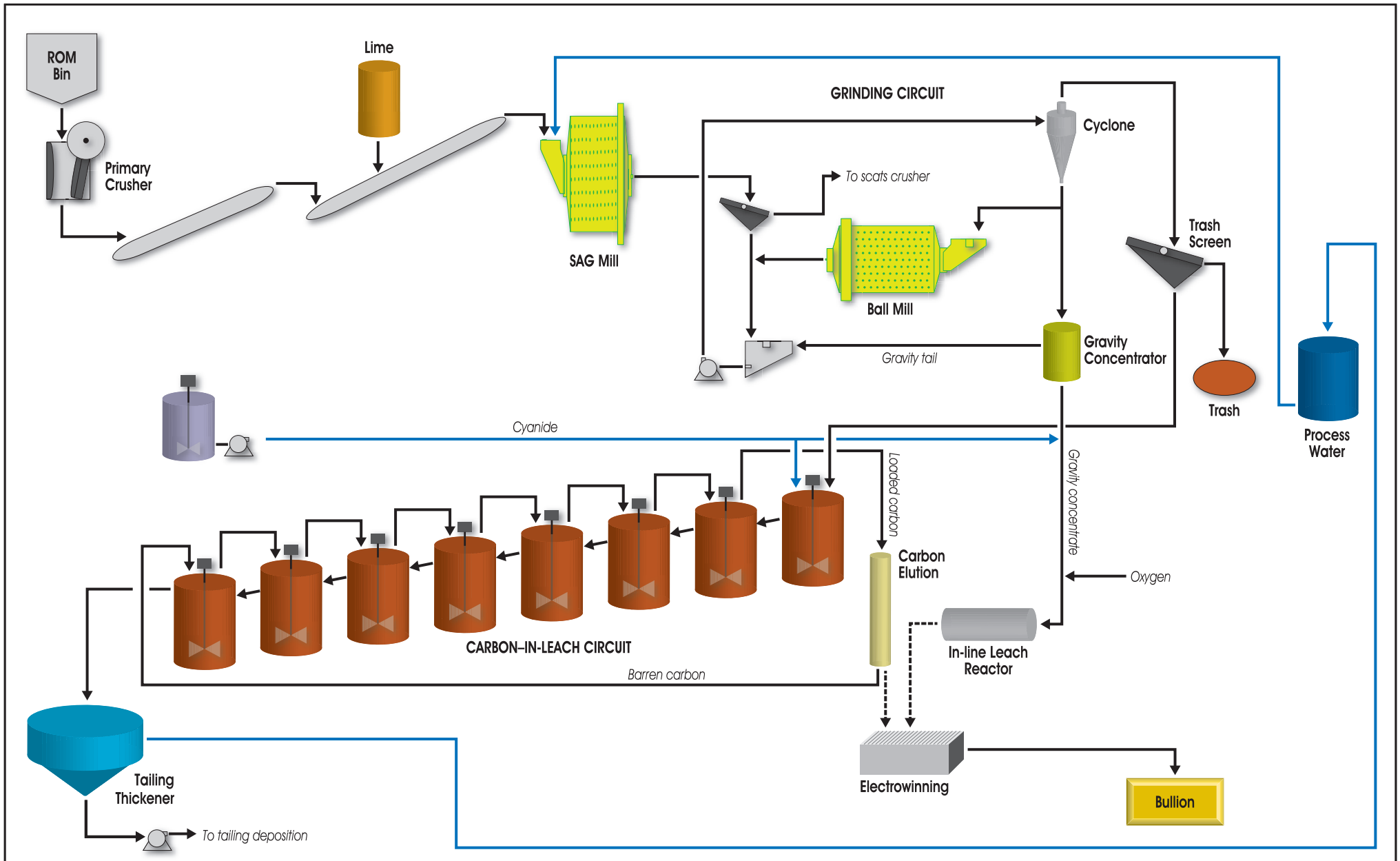
Project Area

The EIS discusses the potential impacts associated with the project in a range of spatial contexts:

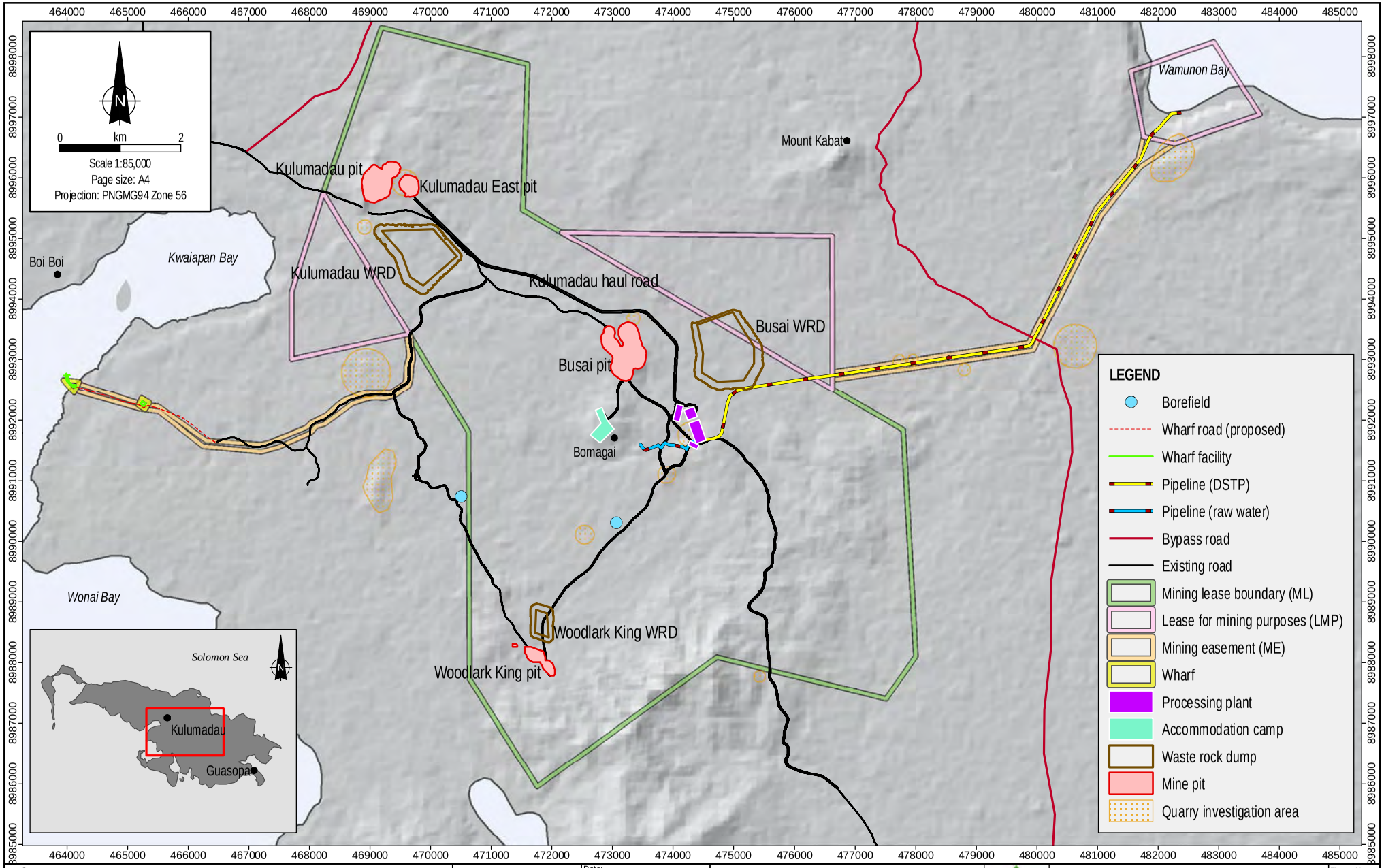
- Mining area and immediate surrounds – includes the Busai, Kulumadau and Woodlark King mining areas and waste rock dumps, processing plant and power station, wharf, option for on-land tailing storage facility (not proposed to be constructed), access roads and other ancillary infrastructure (Figure 3).
- DSTP system – overland tailing pipeline route, and mix/deaeration tank and subsea outfall pipeline located at Wamunon Bay.
- Airstrip – located at Guasopa at the site of the historical World War Two airstrip and the current location of air transport services to Woodlark Island.

Project Schedule

The overall EIS, major government approvals and development schedule for the project up to the first gold pour are shown in Figure 4. For the purposes of the EIS, and as shown in Figure 4, open pit mining is scheduled for completion at the end of 2023, marking the end of the project's nominal 9-year mine life.



	coffey environments	Date: 04.12.2012	Woodlark Mining Limited		Simplified process flow sheet	Figure No: 2
		File Name: 1412_15_ES_F002_HB	Woodlark Island Gold Project			



Source:
Infrastructure data and lease boundaries from Woodlark Mining Limited and Kula Gold, 2012.
Bore locations (production bores) from DFS Hydrogeology report by Klohn Crippen Berger, 2012 (indicative only).
DEM derived by Coffey Environments using SRTM 90m point data.
Coastline from Kula Gold, 2012 (indicative only).

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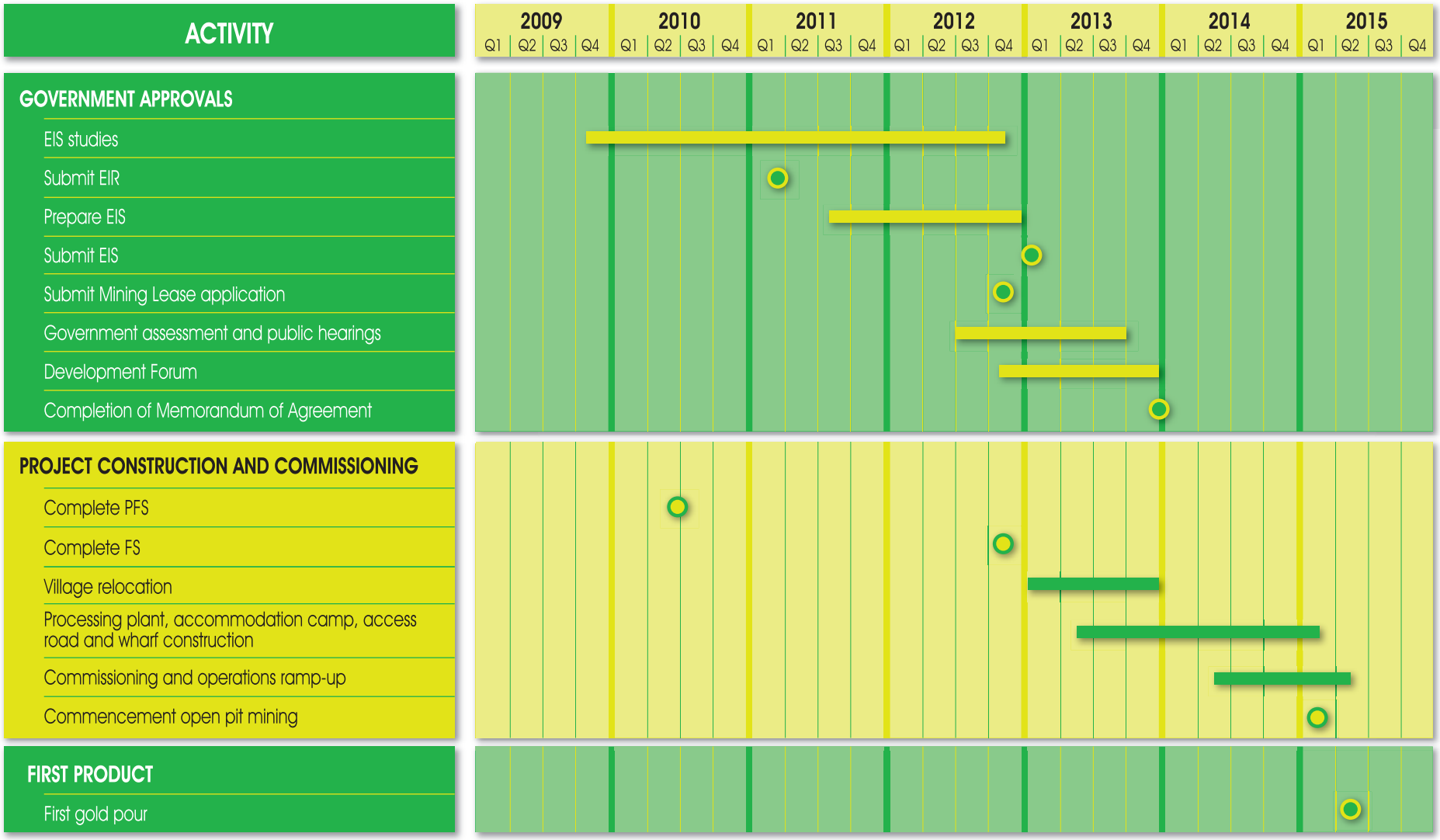
Date: 10.01.2013
MXD: 1412_15_GIS018_v0_8
File Name: 1412_15_F003_GIS

Woodlark Mining Limited

Woodlark Island Gold Project

Project overview

Figure No: **3**



Task Milestone

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Date: 09.11.2012

File Name: 1412_15_ES_F004_HB

Woodlark Mining Limited

Woodlark Island Gold Project

Project development schedule

Figure No: 4

Project Alternatives

Resource development projects are restricted in the manner of their development by physical, environmental, social and economic constraints. In particular, a fundamental constraint of all mineral resource developments is that they can only occur where a commercial deposit is found. Notwithstanding such constraints, a number of alternatives for the location and design of the project were considered during project development, before settling on the general arrangement and design (as shown in Figure 3). The project development concept contained in the EIS represents the current optimisation of engineering, economic, environmental and social considerations. Consistent with development proposals of this nature, further optimisation will occur during detailed design.

2. EIS Process

2.1 Regulatory Process

In PNG, an EIS is prepared under the *Environment Act 2000*, which is administered by DEC. As required by s. 51 of the Environment Act 2000, the environment impact assessment is a three-step process involving:

- Registration of intention to undertake preparatory work on Level 2 and Level 3 activities.
- Submission of an environmental inception report (EIR).
- Submission of an environmental impact statement (EIS).

The EIS addresses the issues described in the EIR, which was submitted on 30 March 2011. WML did not receive feedback on the EIR from DEC until 17 October 2011, approximately three months after expiry of the statutory assessment period. As a consequence, this EIS has been prepared in accordance with the scope of investigations outlined in the EIR, while also taking into account the DEC feedback on the EIR where possible.

The EIS is consistent with the relevant DEC guideline, which requires the EIS to assess potential environmental and social impacts of the project and to describe how the proponent intends to avoid, manage or mitigate these impacts.

An EIS must accompany an environment permit application for a Level 3 activity. The environment permit will contain conditions that address a number of aspects of the project, including waste discharges and the use of water resources.

2.2 Stakeholder Engagement

PNG legislation, international standards and WML policies outline the requirements for stakeholder engagement during the environmental approvals process. Throughout all phases of project development, WML will develop and implement engagement activities to address these requirements.

The WML Community Affairs team and Coffey Environments have conducted targeted stakeholder engagement activities to support the EIS. The stakeholder engagement process required the following steps:

- The identification of stakeholders and community members.
- The provision of information to the stakeholders.
- Engagement with stakeholders and the collation of information provided.
- Integration of the information gathered into design of the project, where appropriate.

Stakeholder engagement activities for the project has/will incorporate:

- Project briefings.
- Public hearings.
- Site tours.
- Surveys and awareness-raising sessions.
- Community meetings and informal discussions.
- Distribution of project fact sheets and information.
- An EIR roadshow, also incorporating a tailing management roadshow.
- An ESIA roadshow.
- The EIS roadshow.

The main issues identified by the general public during stakeholder engagement undertaken to date includes:

- Waste management – with emphasis on waste rock, tailing and the potential impacts of DSTP.
- Relocation of communities directly impacted by mine activities.
- Maximising the equitable spread of benefits in the form of employment, local business, royalties and compensation.
- Maximising local employment.
- Security concerns, land ownership issues and compensation.
- Project timetable, status and length of exploration activities.
- Environmental management, protection and conservation, and impacts to fishing.
- Post closure environmental management and rehabilitation.

2.3 EIS Structure

The EIS is presented in three volumes, i.e., Volume A – Executive Summary, Volume B – Main Report, and Volume C – Appendices. The format of the main report is:

- Chapter 1 – Introduction.
- Chapter 2 – Viability and Purpose of the Development.
- Chapter 3 – Policy, Legal and Administrative Framework.
- Chapter 4 – Stakeholder Engagement.
- Chapter 5 – Project Description.
- Chapter 6 – Assessment of Alternatives.
- Chapter 7 – Description of the Existing Environment.
- Chapter 8 – Biophysical Impact Assessment.
- Chapter 9 – Socio-economic Impact Assessment.
- Chapter 10 – Natural Hazards and Accidental Events.
- Chapter 11 – Environmental Management, Monitoring and Reporting.
- Chapter 12 – Conclusion.
- Chapter 13 – Study Team.
- Chapter 14 – Glossary.
- Chapter 15 – References.

3. Project Setting

3.1 Biophysical Setting

The project components are spread across Woodlark Island, with the project area and main focus of activity located in the central part of the island, the DSTP overland pipeline travelling from the project area to the outfall on the north coast at Wamunon Bay, and the airstrip at Guasopa in the southeast of the island.

Climate

Climatically, the island is dominated by the northwest monsoon (wet) season between November and April, and the southeast monsoon (dry) season between May and October. Average annual maximum temperatures are around 33°C on the island, with annual average minimum temperature around 21°C. Average annual rainfall on the island is around 4,000 mm, with little seasonal variation. Rainfall greatly exceeds evaporation.

Geomorphology and Seismicity

Most of Woodlark Island is composed of flat-lying limestone plains, with a central spine of andesitic and basaltic volcanics dividing its eastern and western halves. The central part of Woodlark Island rises to 325 m above sea level. Woodlark Island is much less seismically active than areas to the north, however intra-slab earthquakes below Woodlark Island have been recorded.

Terrestrial Ecology

While there has been historical disturbance on Woodlark Island through mining and logging operations, vegetation is largely intact (including through regeneration following disturbance). The project is predominantly located within lowland rainforest, which is the most widespread vegetation type on the island. Due to the previous extensive logging on the island, there are many weed species already present.

The terrestrial ecology on Woodlark Island exhibits varying levels of endemism, reflecting its isolation from other islands and from mainland PNG. A total of 10 flora species, 7 mammal species, 10 bird species, 8 frog species, 5 reptile species and 44 invertebrate species have been identified as endemic species. The island also has several species that may not have been previously described, which may also be endemic species. The distribution of these species across Woodlark Island has been influenced by the previous anthropogenic disturbance, however most habitat types occur across the island, and few species occupy restricted ecological niches.

Aquatic Ecology

Water quality on Woodlark Island is generally good with few identified contaminants of concern. Turbidity and total suspended sediment were highly variable and slightly elevated compared to pristine tropical streams. There are three main types of freshwater habitats on Woodlark Island: rainforest streams, rivers and small landlocked lakes. Aquatic macrophytes are absent from rainforest streams and upper brackish/estuarine sections of rivers exception for seagrasses present at the river mouths. The main freshwater fauna of Woodlark Island include aquatic insects, crustaceans, molluscs and fishes. Crocodiles are also present, particularly around the area of Lake Lelua and mangroves.

Nearshore Marine

The northern coastline of Woodlark Island is largely exposed, with no rivers discharging to it; the northern shelf is extremely narrow before dropping off to very deep water of the Solomon Sea

(Figure 5). Conversely, the southern coastline of Woodlark Island has many rivers and streams discharging to it, with extensive mangrove communities and a wide and shallow southern shelf featuring many exposed and immersed reefs, as well as small scattered islands surrounded by a mainly sandy seafloor. Seagrass dominates the sublittoral zone along southern Woodlark Island, playing important functions as habitat, shelter and food source for a diverse marine fauna including mobile and sessile invertebrates, herbivorous fishes, turtles and dugong.

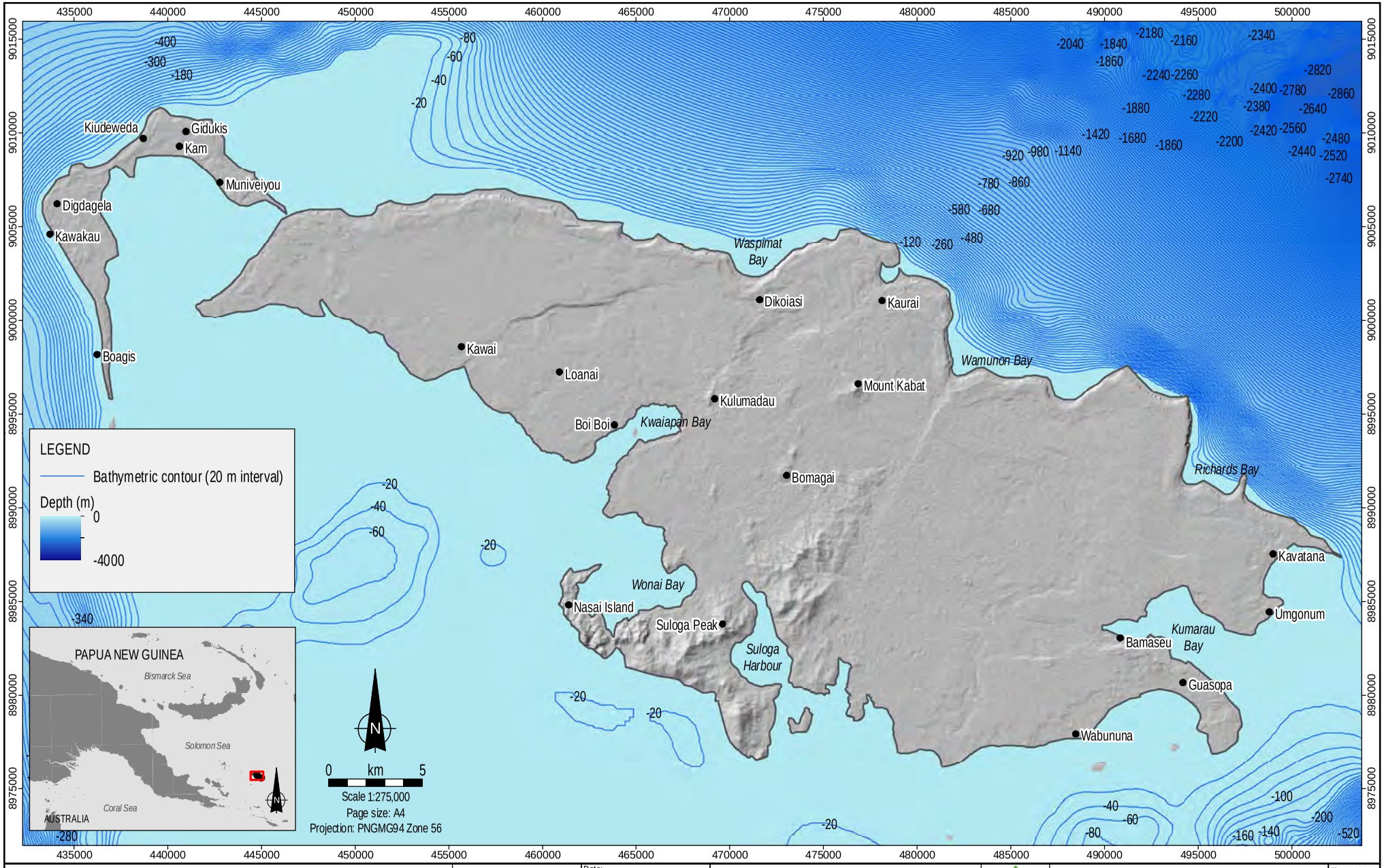
Deep-ocean

Off the north coast of Woodlark Island, water depth generally increases rapidly and to great depths, reaching over 3.500 m about 40 km north/northeast of the island (Figure 6).

Recorded ocean currents off Wamunon Bay on the north coast were strongest at the mid-depth site (depth of 1,500 m), with an average of 7.48 cm/s, more than twice that of the currents at the deepest site (depth of 3,500 m), whose average horizontal current speed was 3.26 cm/s. Currents at the shallowest site (depth of 200 m) had an average of 4.16 cm/s. There was no evidence of upwelling in either upper ocean profiling data collected during the 23-month sampling period or in available satellite images of sea surface temperatures from a selected period following a possible period when upwelling may have occurred in 1997.

The measured rate of natural sedimentation in the deep ocean north of Woodlark is very low and one millimetre of sea floor sediment takes approximately 20 years to accumulate. Background levels of sediment-borne copper, mercury and nickel are naturally elevated. The sediment on the seabed of the deep-ocean is typically fine sand and clay, with little organic content. Nematodes were the most dominant meiofauna and macrofauna species found at all sites.

WML completed a deep-slope fishing survey to characterise the deep-slope fishing resource of Wamunon Bay, the potential for local villagers to exploit it, and the baseline levels of metal concentrations in fishes. A total of 28 species were caught in waters from 50 to 300 m deep, with snapper the most common species caught. The survey found that few, if any, villagers catch deep-slope fish on the north coast of Woodlark Island, and in Kaurai they do not have the equipment required to do so. Background metal concentrations in fish tissue and liver were elevated in some species.



Source:
Bathymetric contours (50m) derived from SRTM data.
10m DEM from Coffey Environments.
Coastline from Kula Gold, 2012 (indicative only).

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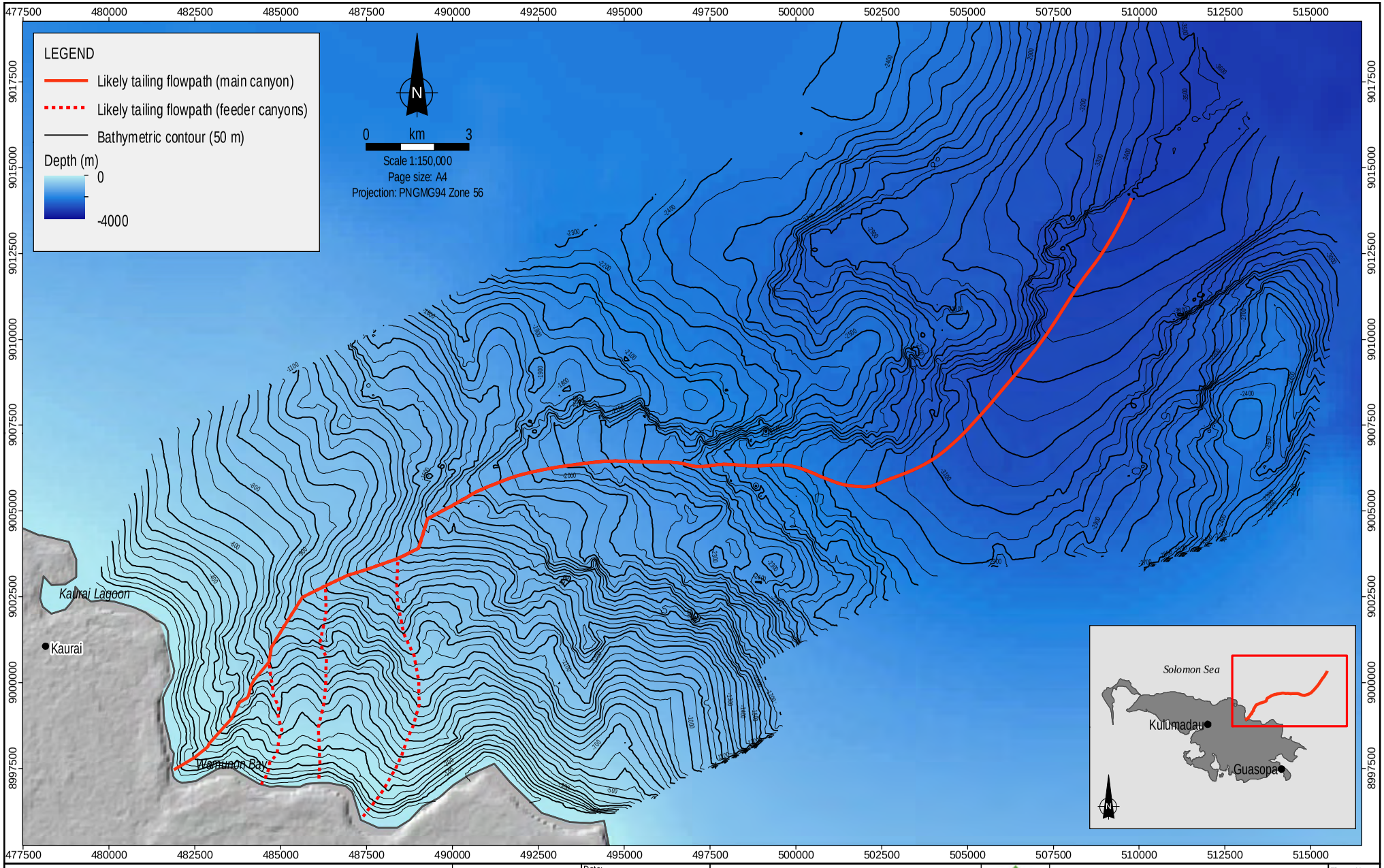
File Name: 1412_15_F005_GIS

Woodlark Mining Limited

Woodlark Island Gold Project

Regional bathymetry

Figure No: **5**



Source:
Bathymetric contours, likely tailings flowpath and
DEM surface (10m pixel) derived from SRTM data by Coffey Environments.
Coastline from Kula Gold, 2012 (indicative only).

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Date: 10.01.2013
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File Name: 1412_15_F006_GIS

Woodlark Mining Limited

Woodlark Island Gold Project

Wamunon Bay and submarine canyon bathymetry

Figure No: **6**

3.2 Socio-economic Setting

Woodlark is culturally and linguistically distinct from mainland PNG. Woodlark Islanders are descended from Austronesian people, and speak 'Muyuw', an Austronesian language, and most also speak English; Tok Pisin is rarely spoken.

Economy

The cash economy on Woodlark Island is still of secondary importance to subsistence activities. Due the remoteness of Woodlark Island and the lack of infrastructure and employment opportunities, the overwhelming majority of people are subsistence cultivators and fishermen. As a result, incomes vary greatly from village to village, and household to household, with many families having virtually no income. The presence of WML has already been significant in determining the income of residents. Expenditure is constrained by the absence of consumable goods and mains electricity on Woodlark Island.

Residents of Woodlark Island have traditionally participated in the ceremonial 'kula' exchange network – a ceremonial network extending across the islands of the Massim archipelago. Participation in the kula exchange network remains strong, however its persistence is not without challenges.

Health

Access to health facilities and treatment on Woodlark Island varies widely between the surveyed communities. The nearest hospital is at Alotau, the capital of Milne Bay Province and located on the mainland approximately 300 km to the southwest of Woodlark Island (in other words, approximately three days distance by motorised dinghy). There are operational aid posts at Kulumadau, Madau Island and Kaurai and a health centre at Guasopa, which are also difficult to reach. With a reasonable proportion of families having employment with WML, most health access is through the WML clinic nurse and health extension officer.

Environmental and lifestyle factors affecting the health status of Woodlark Islanders includes isolation/access to healthcare facilities, smoking, alcohol consumption, unprotected drinking water supplies, overcrowding, lack of awareness, and/or lack of availability of contraceptives. There was a low prevalence of asthma, chronic bronchitis and arthritis on the island, and families have sufficient food to eat with an above-average nutritional profile.

Education

The formal educational qualifications of adults on Woodlark Island are low. Of particular significance in explaining the low levels of high school education is the fact that there is no high school on Woodlark Island; children proceeding to secondary education must leave the island and travel to the mainland or Fergusson Island. Frequently, those who are successful at high school will never return to live permanently on the island.

Law and Order

No formal law and order capability exists on Woodlark Island and there is no official police presence. Major crimes, however, appear to be rare; the last known murder was at Guasopa in 2010. WML is in discussion with local authorities regarding the establishment of a permanent police presence on the island.

Cultural Heritage

Pottery is the main cultural signature of the region, and formed a regular item of trade. Other distinctive cultural features of the region include stone monuments and potted burials. Large megalith monuments are found throughout the region, including on Woodlark Island. Prior to

European contact, potted burials were a common occurrence throughout the region. On Woodlark Island, bones of deceased relatives were collected and placed in clay pots, and the pots were placed in caves, limestone niches and rock shelters. There are also relics from historic mining activity on the island.

4. Potential Issues

4.1 Biophysical

The environmental inception report (EIR) identified the following major biophysical environment issues for the project:

- Effects of the project on land, water and marine resources used by local people.
- Effects of the project on terrestrial biodiversity.
- Effects of increased sediment loading on the downstream drainage and nearshore waters.
- Water quality effects of runoff and/or leachate from the processing plant site and waste rock dumps and discharge of mine water from the open pits.
- The behaviour and fate of tailing after discharge from a DSTP outfall or after storage on land, and the biophysical impacts of this.
- Rehabilitation and closure planning.

The specialist studies for the EIS were scoped to address these major issues, and the discussion of the predicted biophysical impacts of the project presented in the EIS focuses on them.

4.2 Socio-economic

The environmental inception report (EIR) identified the following major, direct socio-economic issues for the project:

- Alienation of land from customary use due to the exclusive need of land for mining, ore processing and project infrastructure, and the socio-economic impacts of this.
- Landowner issues:
  - Workforce employment and training policies.
  - Local business development.
- Increased direct employment opportunities and increased family cash incomes, and other benefit streams to local populations such as royalties and community development programs.
- In-migration and associated impacts (e.g., law and order, communicable disease, social tension).
- Household relocation.
- Amenity impacts (air quality, noise and visual).
- Effects on the general quality of life of local villagers in the project area, with particular focus on their livelihoods, subsistence resource use, and local culture and customs.
- Disturbance or destruction of archaeological and/or cultural heritage sites.

Associated with these potential issues are the substantial benefits, both social and economic, that will be generated by the project. The focus of WML's socio-economic planning and management

aspects of the project has therefore been on maximising the benefits while minimising the adverse impacts associated with project development.

The socio-economic specialist studies for the EIS focussed on these major, direct socio-economic issues, and the discussion of the predicted socio-economic impacts of the project presented in the EIS focuses on them, where they have not already been addressed in the biophysical impact assessment (e.g., air and noise, impacts to freshwater and marine resource use).

5. Main Findings

5.1 Summary

The following discussion focuses on the predicted positive impacts, and the major negative impacts, associated with the project. Predicted lesser impacts are discussed where particularly relevant or likely to be of interest to stakeholders.

5.2 Benefits

In October 2012, the capital cost estimate for the project was approximately US$196 million (PGK401.8 million) including the capital cost for the mining fleet, with a total life of mine capital cost estimated at US$212 million (PGK435 million), calculated at US$1:PGK2.05. This estimate is based on the feasibility study and subsequent studies and includes direct infrastructure costs and indirect costs such as management, overheads, freight, duty and taxes.

A number of direct benefit streams will be generated by the project that will result in increased provincial wealth (e.g., from royalties, spin-offs and wages) and national wealth (e.g., from royalties and taxes). These royalties, taxes and levies will be subject to the prevailing gold prices.

Substantial economic multipliers for Milne Bay Province are likely to be associated with the project, as will economic linkages within PNG's economic sectors that drive local, provincial and national economic growth.

The project is expected to have mainly positive impacts for Woodlark Islanders, given its relatively small scale and commitment to employing local staff. The project will provide training and skills, contribute wages, provide improved health services, local business development assistance (for businesses that serve the mine), and other community investment made in consultation with the local people. The average annual income streams accruing on Woodlark Island during operations will total approximately US$7.5 million (PGK15.4 million), which will be a combination of:

- Wages and contracts US$4 to 5 million (PGK8.2 – 10.25 million).
- Royalties US$1.8 million (PGK3.7 million).
- Compensation of US$0.31 million (PGK0.64 million).
- Other of US$0.4 million (PGK0.82 million).

WML will encourage Woodlark Islanders to invest some of the benefits they receive into business opportunities off Woodlark Island so that these businesses can continue to provide benefits after the project has closed.

5.3 Landform, Soils and Land Resource Use

Project infrastructure such as waste rock dumps will result in a change to the pre-mining landform by providing localised topographic highs in otherwise gentle relief areas. This changed landform will result in a change to the visual landscape of the project area.

The primary potential impact on soils is erosion of natural soils. The constructed mine waste landforms may be subject to erosion due to the high level of rainfall received on Woodlark Island, which will result in a loss of topsoil and quality soils to the downstream environment. This may impede progressive and final rehabilitation of areas of land disturbed by the project.

Geochemical characterisation of waste rock was undertaken to determine the acid forming characteristics of a representative cross section of waste rock lithologies expected to be encountered during mining the Busai, Kulumadau and Woodlark King deposits. Classification of the acid-forming potential of the samples as non–acid-forming (NAF) or potentially acid-forming (PAF) determined that: 95% of samples from Busai were NAF; 70% of samples from Kulumadau were NAF and 93% of samples from Woodlark King were NAF. Therefore, waste rock from Kulumadau has the greatest acid-generating potential.

The Kiriwina limestone widespread across the project area has significant buffering capacity. Analysis of selected samples show that runoff from freshly mined rock will be circum-neutral or slightly alkaline and have relatively low concentrations of soluble salts and metals. Runoff from sulfidic NAF rock will result in the minimal release of environmentally important metals. Runoff from PAF rock, however, will result in AMD with high concentrations of sulfate, iron and aluminium, as well as elevated levels of other metals. WML will undertake continuous in-pit identification of PAF material so that it can be appropriately handled, and has designed the waste rock dumps so that NAF waste rock will be encapsulated within NAF material to minimise the potential for AMD.

The main impact of the project to land resource use will be the reduction in general bushland available in central Woodlark Island for hunting, accessing flora and fauna to provide food and medicine, and collecting building materials. The amount of bushland cleared will be small in the context of the total area of bushland on Woodlark Island, and the majority of areas will be rehabilitated so the impact will only be for the life of the mine (with the exceptions of the open pits, which will remain as pit lakes). Existing gardening land around Kulumadau will be cleared for the Kulumadau and Kulumadau East pits. However, the Kulumadau households will be relocated to an agreed place and will have access to new gardening land, and transitional arrangements will be put in place to provide food and water until their new gardens are established. Therefore, a reduction in gardening land for these villagers is unlikely and the gardening land for other villages should not be affected by the project.

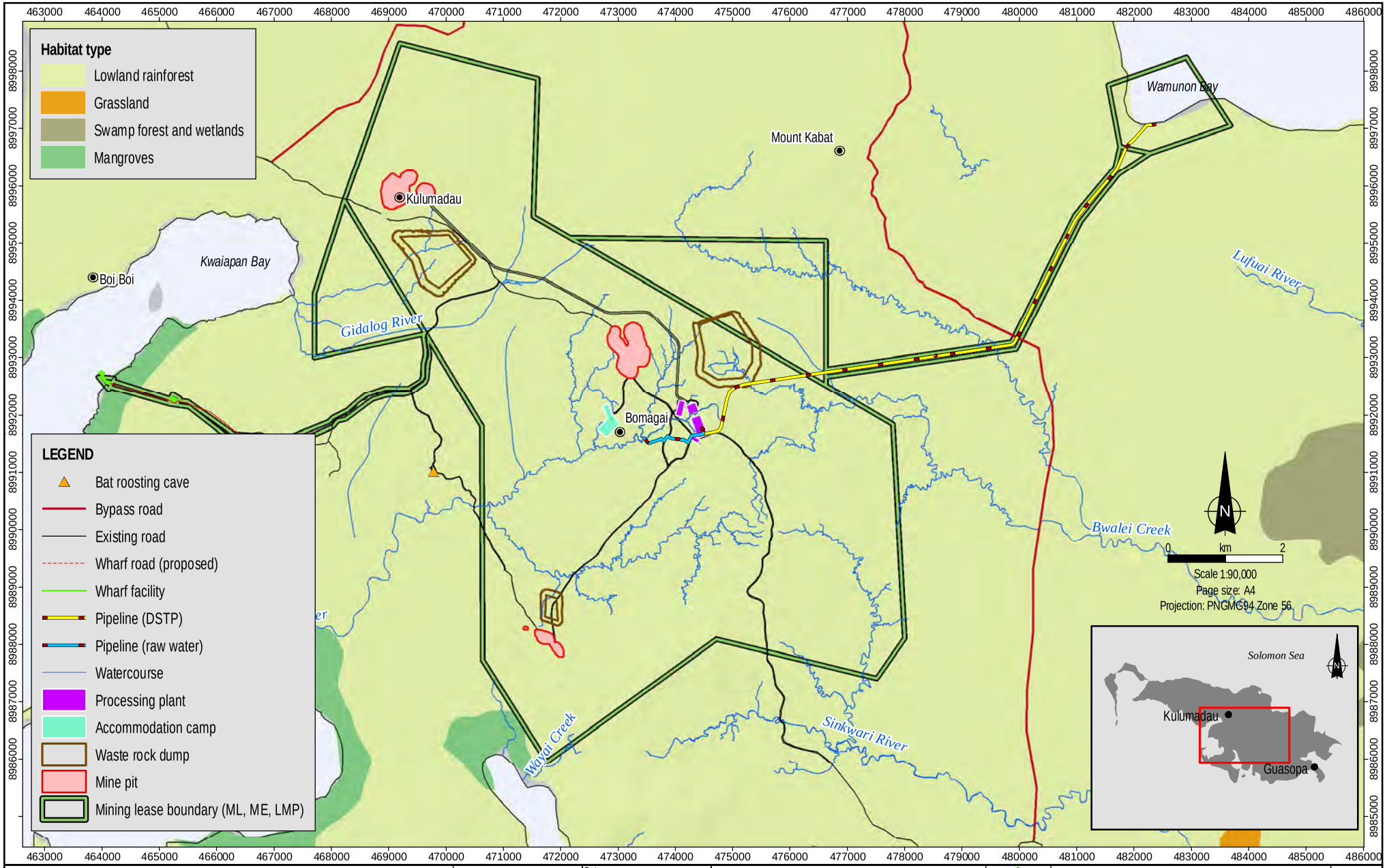
Impact Summary

The residual impacts to landform and soils are predicted to be localised, short-term to prolonged and low to moderate severity. Residual impacts to bushland and gardening resources will be localised, short to prolonged duration and low severity.

5.4 Terrestrial Ecology

The introduction of invasive fauna species as a result of the project is predicted to be the biggest threat to terrestrial ecology on the island, as it may lead to a loss or significant decline in the population of endemic species, as has occurred on other islands in the Pacific. WML will develop and implement a project-wide quarantine management plan to minimise the potential introduction of invasive fauna species, and response measures should invasive fauna be found as a result of the project.

The most likely impact upon terrestrial ecology will be as a result of vegetation clearing for project infrastructure (Figure 7), and edge effects associated with this. A total of approximately 759 ha of



Source:
Infrastructure data and lease boundaries from Woodlark Mining and Kula Gold, 2012.
Watercourses from Knight Piesold and Coffey Environments, 2012.
Habitat type from Forest Inventory Mapping System (FIMS), 1975-96 by CSIRO and PNG NFS. Optimum scale 1:100:000.
Coastline from Kula Gold, 2012 (indicative only).

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File Name: 1412_15_F007_GIS

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Woodlark Island Gold Project

Project layout and terrestrial ecology habitat types

Figure No: **7**

land will be cleared for the project. Most habitat types to be cleared occur across the island, and few species occupy restricted ecological niches. Given this, local populations in the project area will be impacted but these impacts are not predicted to extend to populations of species nor across Woodlark Island. After mining, successful rehabilitation will restore habitat for terrestrial species in most areas except the pit voids, which will remain as pit lakes.

The vegetation clearance for the project may cause edge effects to develop along the boundaries of the forest adjacent to the cleared areas, however this will be very localised.

The release of sediment into watercourses, particularly during construction, will also reduce the quality of habitat for species used to living in and near clear streams, such as frogs and dragonflies. WML will progressively construct sedimentation dams as the project proceeds to minimise the impact to watercourses downstream of the project area; further detail about this is provided in Section ES5.6. Effects are likely to be localised, as only streams draining disturbed parts of the project area will be affected and the impact may be prolonged.

Fauna may also be disturbed by light, noise and vibration, or killed by vehicle strikes, during the project. Management measures will be used to minimise the likelihood of this. These impacts are likely to be restricted to the project area and will cease once the project stops. Any disturbance to fauna from this is expected to be localised, short duration and low severity.

Other impacts, such as the creation of barriers to fauna movement, contamination from general waste, process waste or tailing, and the introduction of new weed species could all have impacts to fauna, however WML will develop and implement targeted management and mitigation measures to minimise the potential for this. Linear infrastructure will be rehabilitated during closure and rehabilitation. Therefore, barrier effects will be localised, short duration and low severity.

Impact Summary

The residual impacts to terrestrial ecology will vary widely, depending on the nature of the impact; they are expected to range from localised to potentially island-wide (should introduced fauna such as crazy ants or fire ants become established), be of short to prolonged duration and of negligible to high severity.

5.5 Hydrogeology

The main concerns in relation to groundwater are impacts on groundwater quantity and quality. Groundwater will be intercepted by the four pits within the project area to varying extents, with groundwater inflows to the pits expected to occur. The use of multiple in-pit dewatering bores and pit-periphery bores will aim to drawdown the water table to enable mining. Subsequent drawdown of the surrounding water table will result from pit dewatering activities. Once mining stops, groundwater levels are predicted to return to near pre-mining levels within about one year.

While the project will create a reduction in groundwater flow and availability on a localised scale, the severity of the impact of this will be moderate and they are not expected to last beyond one year from the completion of the project.

Groundwater contamination may occur. There are numerous pathways for project-related activities to contaminate groundwater, such as acidic seepage from pits or WRDs, and these may not always be contained. Pit water has the potential to contaminate groundwater where aquifers are intercepted and seepage occurs. Due to the complex nature of the hydrogeology of the project area, and in particular the influence of fractures and faults on groundwater movement, it is not possible to accurately predict the fate of contaminated groundwater in the project area, should

it occur. However, there will be no villages in the immediate vicinity of the pits and no critical groundwater resources for local villagers have been identified within the ML (and the water resources used by the Kulumadau village will be replaced with alternative sources at the major relocated village site).

WML will implement management and mitigation measures to minimise the potential for contamination of groundwater by the project. The impact of reduced groundwater quality will be localised, short-term to prolonged and moderate severity.

Impact Summary

The residual impacts to hydrogeology are expected to be localised, short-term to prolonged and of moderate severity.

5.6 Freshwater Environment and Resource Use

The main issue affecting the freshwater environment will be the mobilisation of sediment from disturbed areas around the mine site. Sediment delivery will be the highest in early construction phases of the project and will decrease as WML constructs sedimentation dams and progressively rehabilitates disturbed areas. The sedimentation dams will reduce sediment loads reaching downstream of the project area, however sedimentation may still:

- Increase total suspended solids in watercourses downstream of disturbed areas.
- Cause bank over-topping and increase flood risk.
- Transport high concentrations of metals.
- Reduce freshwater ecology health.
- Cause the loss and/or reduction of fauna sensitive to increased channel turbidity, such as clear stream-dwelling dragonflies, and filter- and collector-feeding organisms.
- Cause the loss of and/or reduction in fauna and edible water plants due to smothering.

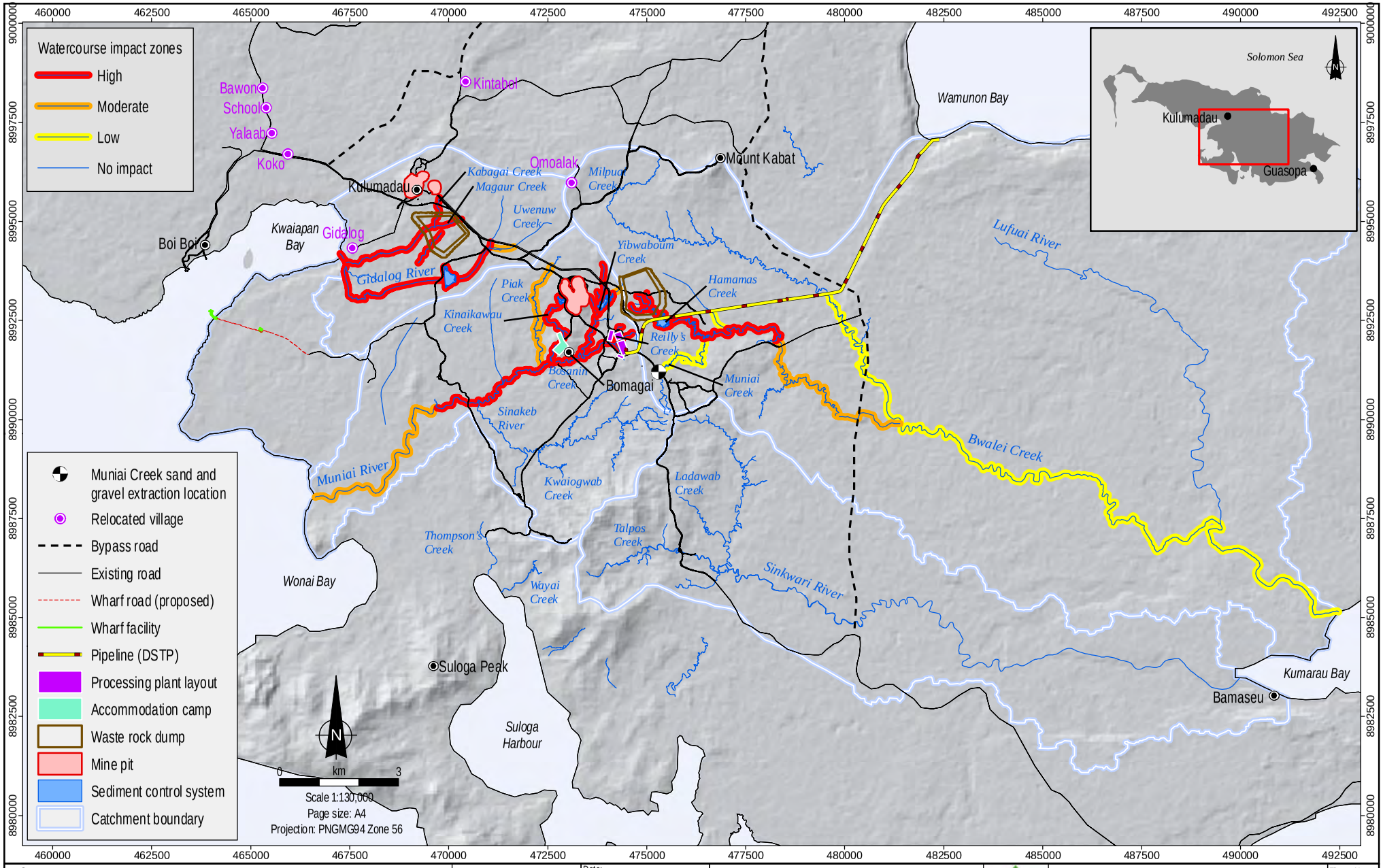
The residual impacts of increased sediment loads will be localised, short to prolonged duration and moderate to high severity.

The impacts to the freshwater environment will be greatest in the Guidalog, Muniai and Sinakeb rivers that drain southwest to Kwaiapan and Wonai bays, as the catchments of these watercourses will be most disturbed by the construction and operation of the project. Figure 8 shows the predicted zones of impact for the freshwater environment during construction of the project. Lake Lelua will not be impacted by the project.

Due to the presence of PAF material in the pit walls, there is the potential for acidic pit water during and after mining. The Kiriwina limestone in the pit walls will buffer most of this. During in-pit dewatering, WML will capture this water and, if it is not of sufficient quality for direct release to the environment, return it to the processing plant for use there.

Although WML will actively manage the potential for AMD through the identification and appropriate handling of PAF waste rock, should AMD occur then it will be captured in seepage drains at the toes of the waste rock dumps and returned to the processing plant for use there. The closure of the waste rock dumps will be designed to minimise the potential for ongoing AMD.

Residual impacts to water quality from other contaminants will be localised, prolonged and moderate severity. However, monitoring will be required to confirm this prediction.



Source:
Watercourses from Knight Piesold, Arccon and Coffey, 2012.
Relocated village locations from Kula Gold, 2012.
Infrastructure data from Woodlark Mining, 2012.
Sediment control structures and coastline data from Kula Gold, 2012.

Catchment boundaries from Knight Piesold and Coffey Environments are indicative only.
DEM surface (10m pixel) derived from SRTM data by Coffey Environments.

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File Name: 1412_15_F008_GIS

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Woodlark Island Gold Project

Predicted impacts to watercourses as a result of the project during construction

Figure No: **8**

With the exception of the Kulumadau village, the project area does not contain watercourses of critical resource use importance to the main villages on Woodlark Island. The small creeks (Kabagi and Magaur creeks) that currently provide secondary water sources for Kulumadau will be negatively affected by the construction of the Kulumadau pit; these effects will be localised, prolonged and high severity but the relocation of Kulumadau village to an area with alternative freshwater supplies will mitigate this. There will be no impact to the spring-fed primary water sources of Kaurai and Dikoiasi, as there is no surface water connection with watercourses draining the project area and the reduction in groundwater flow and availability due to pit dewatering will be on a localised scale. Other villages on Woodlark Island will be able to continue using their usual springs, rivers/streams, wells and rainwater tanks to provide water for domestic use. However, the use of the main Gidalog, Muniai and Sinakeb river systems downstream of the project area for a range of domestic purposes by Woodlark Islanders will be disturbed during the life of the project. This will restrict the use of these rivers for recreation and gathering food.

Impact Summary

The residual impacts to the freshwater environment as a result of the project are expected to be localised, prolonged and of moderate to high severity.

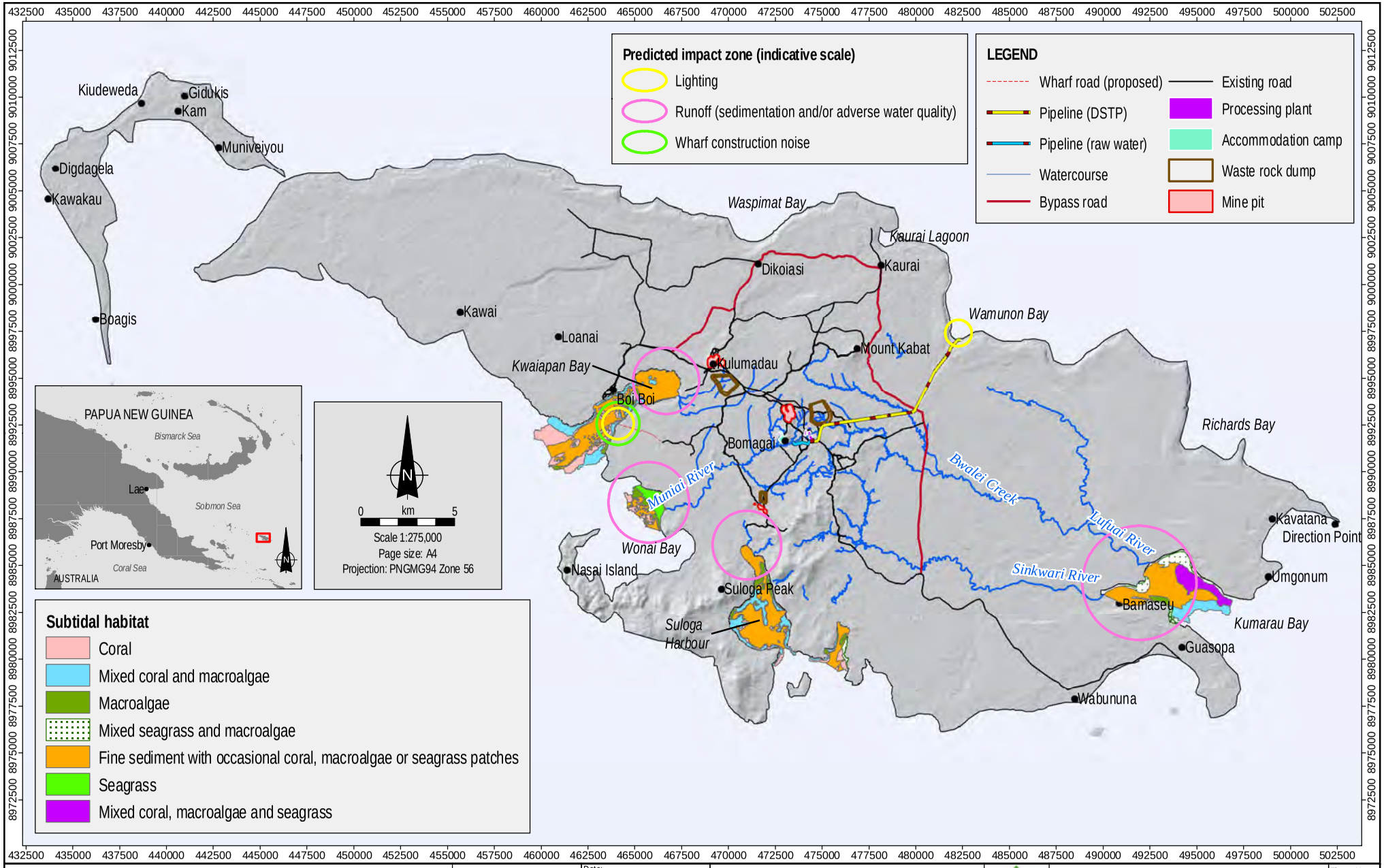
5.7 Nearshore Marine Environment and Resource Use

Sediment mobilised in the freshwater rivers and streams has the potential to enter the nearshore marine environment. The main areas at risk of sedimentation are the seagrass beds, corals and macroalgal beds, which may be impacted by smothering or by reduced availability of light. The filter-feeding mechanisms of organisms such as mussels, oysters and clams are also at risk of clogging by excess sedimentation. The main period of risk of sedimentation to the nearshore marine environment is during construction, when areas or erodible soils are cleared and exposed to erosion by rainfall. This will be greatest in areas downstream of the project area. The zones of likely impact within the nearshore marine environment are shown in Figure 9.

If sedimentation of nearshore marine areas occurs, it will be of moderate severity, and may cause short-term and prolonged changes to the nearshore marine environment.

Invasive marine species may be introduced by ships travelling to the wharf facilities in Kwaiapan Bay and these could spread around Woodlark Island and compete with native species. The international cargo vessel bringing equipment into the country is proposed to go through customs and quarantine inspection either in Lae, Alotau or at Woodlark Island. On-shipment from other areas in PNG to site will be via transfer to local LCT cargo vessels, typical of those that operate between PNG ports. The risks to Woodlark Island are therefore indirect and no different from other areas of PNG. WML will develop management and mitigation measures as part of its quarantine management plan to minimise the likelihood of the introduction of invasive marine species.

If invasive marine species are introduced to the nearshore marine environment and become established, this could lead to high severity, prolonged changes to the ecology of the nearshore environment of Woodlark Island.



Source:
Subtidal habitats from Hydrobiology, 2011.
Infrastructure data from Woodlark Mining, 2012.
Impact zones from Coffey Environments, 2012.
Watercourses from Knight Piesold, 2012.
Coastline from Kula Gold, 2012 (indicative only).
DEM surface (10m pixel) derived from SRTM data by Coffey Environments.

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File Name: 1412_15_F009_GIS

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Woodlark Island Gold Project

Zones of likely impact to the nearshore marine environment

Figure No: 9

Within Kwaiapan Bay, marine fauna may be negatively affected by noise from construction of the wharf facilities. The environment within Kwaiapan Bay may also be affected by contamination from spillages at the wharf facility during its operation. Noise from the construction of the wharf facilities in Kwaiapan Bay that disturbs and/or alienates fauna species that are accessed for resource use will cause some concern to local villagers but impacts will only be localised, short duration and of moderate severity. If spills of leaks from vessels or the wharf area occur, they will most likely be localised and short-term in nature and of low severity.

The construction of the DSTP system in Wamunon Bay will have very localised impacts to the nearshore marine environment during trenching and laying of the seawater intake and outfall pipelines. No other impacts to the nearshore marine environment from DSTP are predicted. Impacts will be localised in extent, of short duration and low severity.

Impact Summary

With the exception of the possible introduction of invasive marine species, residual impacts on the nearshore marine environment are expected to be localised, of short term to prolonged duration and low to moderate severity.

5.8 Deep Ocean Environment

The proposed DSTP system has been designed to meet best practice for DSTP and the outfall has been sited on a slope steep enough to prevent tailing solids deposition immediately below the DSTP outfall and avoid the risk of plugging of the pipe.

Oceanographic investigations over a period of almost three years found no evidence of nearshore upwelling and this has been corroborated by an independent assessment. However, it is not possible to say that upwelling does not occur off the north coast of Woodlark Island and this possibility will be proactively managed by WML at times when upwelling may possibly occur.

The proposed DSTP system will require the laying to two pipelines on the seafloor with trenching and riprap protection. Construction effects on the nearshore and deepwater seafloors are expected to be short term and of high severity but extremely localised.

The proposed DSTP system incorporates pre-discharge dilution in a shoreline mix/deaeration tank to attenuate potential contaminants prior to discharge from the outfall at 200 m depth. On exiting the outfall pipe, the tailing slurry will be transformed into a density current that will flow by gravity down the steep submarine slope and into deep water. Within the density current, elevated suspended sediment concentrations are expected to occur throughout the operating life of the DSTP system and tailing solids deposition is similarly expected beneath and along the margins of the density current.

Subsurface tailing plumes are expected to shear off the descending density current, at various depths but will remain trapped at depth by the ocean water column's natural stratification. Experience at other DSTP mines shows that these subsurface tailing plumes are very dilute and will be transported laterally by ocean currents while gradually dispersing and becoming progressively more and more dilute before the solids eventually settle on the deep ocean floor remote from the outfall.

Ultimately, the tailing solids in the density current will settle out and form tailing deposits on the ocean floor. A main zone of tailing solids deposition is predicted to occur along the density current pathway between of 0.1 and 1.9 m in thickness and cover an area of 61 km^2. Deposition is expected to be patchy with the thickest and most extensive deposition below 3,400 m water depth. Tailing solids deposition, up to 0.1 m in thickness, will also occur outside the main zone of

tailing solids deposition but cannot be predicted with certainty. Tailing deposition will be on a regional scale and prolonged but will be of low severity.

Measured in-situ current speeds are too weak to resuspend the deposited tailing and there is no potential for deposited tailing to be reworked and dispersed.

PNG water quality criteria is expected to be met within 1,000 m of the outfall and this distance has been suggested as a suitable boundary for a mixing zone to be included in the project's future environment permit i.e., a circle with a radius of 1,000 m.

On average, some 95% of species inhabiting the ocean water column below 200 m are expected to be protected (with 50% confidence) within a horizontal distance of 1,205 m from the proposed DSTP outfall. This distance will extend to a maximum of 4,327 m for some of the time. This finding is relevant to the species that inhabit the ocean water column below the proposed outfall depth of 200 m, whereas species in the biologically more productive near-surface waters (such as within the euphotic zone) will be unaffected.

Water quality impacts will persist for the duration of the DSTP discharge and will cease shortly after closure.

Sediment quality on the deep ocean floor below 200 m depth will be affected, particularly within the main zone of tailing solids deposition, but this will extend beyond to where suspended sediment from the subsurface tailing plumes eventually settle on the ocean floor. Impacts will therefore be regional in scale and the sediment quality effects will be long-term and persist long after closure until the tailing deposits are buried by natural sedimentation.

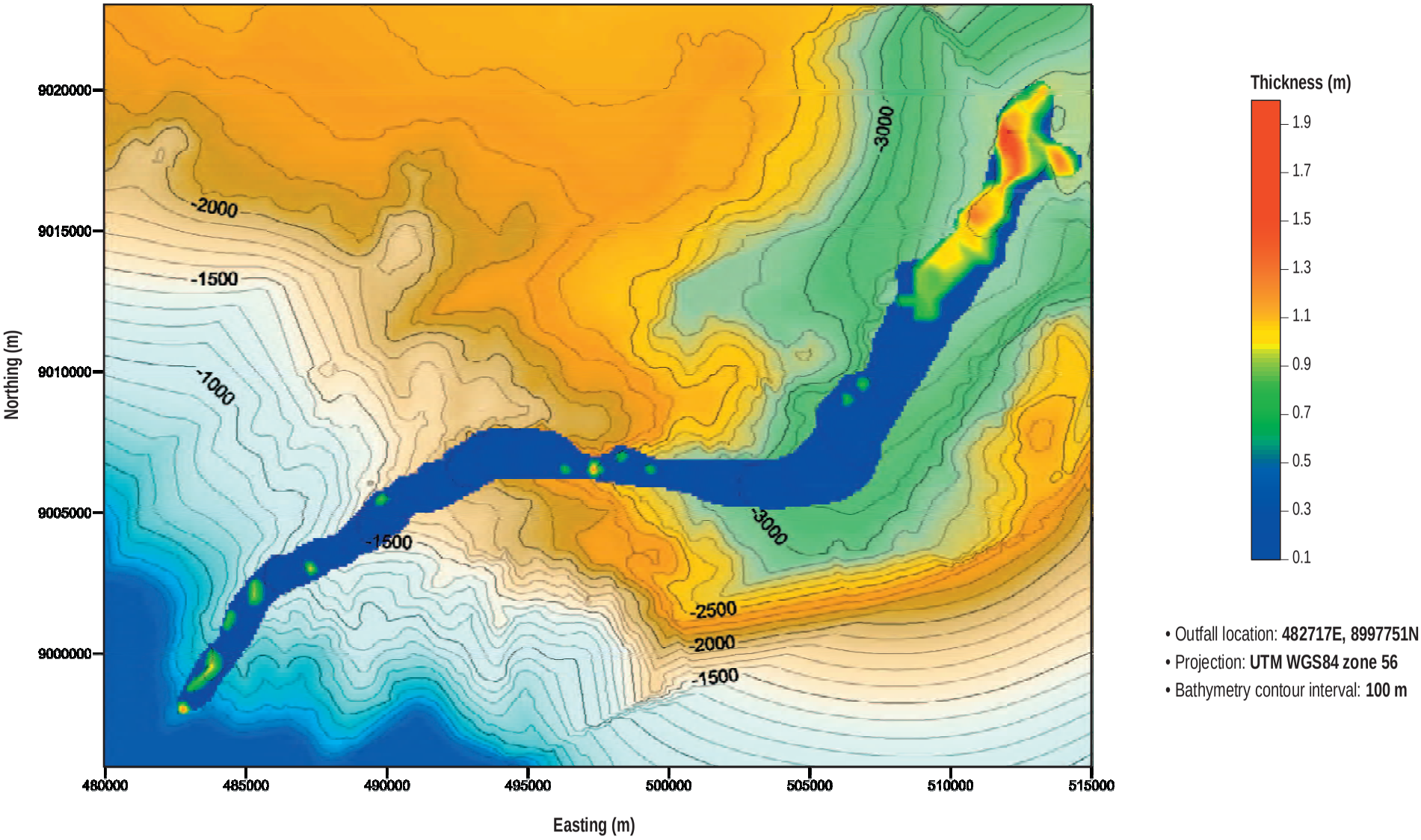
Testwork showed that the tailing solids were not toxic to survival or reproductive output of either species used in the whole sediment bioassay tests. In addition, metal concentrations that were elevated in the tissue of another species used in the bioaccumulation bioassay test had not caused detrimental effects on its survival after 30 days of testing. These testwork findings are encouraging for the eventual recolonisation of tailing deposits on the deep ocean floor.

The main biological impacts will be physical (smothering and burial) effects, displacement effects and chemical (bioaccumulation) effects on the benthic and pelagic communities. Overall, the impacts to benthic fauna will be of regional scale and high severity during the life of the project, but will gradually reduce with time as the tailing deposits are recolonised.

Adverse impacts to the existing midwater plankton and pelagic communities of moderate severity are expected to occur in the immediate vicinity of the formation of the subsurface tailing plumes but such impacts are expected to rapidly diminish with distance, and will stop after tailing discharge ceases.

Bioaccumulation of metals into the food chain can occur from processes of bentho-pelagic coupling, or direct uptake by benthic or planktonic organisms. Direct uptake by benthic or planktonic organisms and transfer to higher trophic levels in the food chain remains theoretically possible but is without empirical evidence in any of the analogous sites described in the main report.

The predicted main zone of tailing solids deposition is shown in Figure 10.



- Outfall location: **482717E, 8997751N**
- Projection: **UTM WGS84 zone 56**
- Bathymetry contour interval: **100 m**

coffey environments	Date: 10.01.2013	Woodlark Mining Limited		Predicted main zone of tailing solids deposition	Figure No: 10
	File Name: 1412_15_ES_F010_HB	Woodlark Island Gold Project			

There are no beneficial uses of the seafloor along either the density current pathway below 200 m water depth or the main zone of tailing solids deposition by the people of Woodlark Island. While deep-slope fish are expected move away from the density current, these fish are not currently caught by Woodlark Islanders and evidence from other past and present mines in PNG using DSTP shows that there has been no significant increase in metal concentrations in fish tissue at these sites compared to baseline levels.

Impact Summary

The residual impacts to the deep ocean from DSTP are predicted to vary widely; from localised to regional in scale, short-term to prolonged in duration and negligible to high severity.

5.9 Air Quality and Greenhouse Gas Emissions

Modelling has shown that the project will generally comply with relevant Australian guidelines (as there are no PNG guidelines) for air quality. There may be occasional exceedances due to dust emissions, particularly during operation of the mine. The high rainfall on Woodlark Island will suppress dust, with WML to use dust suppression measures during extended dry periods.

Ground-level concentrations of NO_2, SO_2 and particulates emitted by the power plant are predicted to be well below Australian air quality standards at sensitive receptors.

The project will contribute less than 1.8% of the total emissions from PNG.

Impact Summary

Residual impacts to air quality and greenhouse gas emissions will be localised to regional in extent, short duration and negligible to moderate severity.

5.10 Noise and Vibration

Some villages will be disturbed by noise from the project at night. The affected villages will be Boi Boi, Gidalog, Koko, Telepon 3 and Omoalak. A significant bat roosting cave may also be affected by noise and vibration from the project. Noise levels will be within Australian guidelines (as there are no PNG guidelines) during the day. Vibration levels will be within Australian guidelines (as there are no PNG guidelines) at all times.

Impact Summary

Localised increased noise levels will be of short duration (i.e., they will be restricted to the life of the project) and will be of low to moderate severity.

5.11 Socio-economic

Potential Positive Impacts

The project will have a direct impact on employment and training in the study area through the creation of employment opportunities and the stimulation of training and skills development, which do not currently exist on Woodlark Island. The positive employment and training impacts are likely to result from the anticipated nine-year mine life.

About 300 people will be employed during construction and employment will peak at approximately 500 people at the commencement of operations. WML will preferentially employ Woodlark Islanders for all positions, depending on the ability of a potential recruit to meet the requirements of that position.

Average annual income streams accruing on Woodlark Island during operations will total approximately US$7.5 million (PKG15.4 million). These will not occur without the project. The equality of the income distribution will dictate how positive the impacts are for the community.

The project will lead to the development of local businesses to support the operations of the mine, which will allow income to flow into the Woodlark Island economy. While these businesses are unlikely to continue following mine closure, positive benefits will still be obtained during the mine life. WML will encourage Woodlark Islanders to invest some of the benefits they receive into longer-term business opportunities off Woodlark Island counter this.

WML has already provided substantial health treatment to Woodlark Islanders through the WML clinic nurse and health extension officer. The project has the potential to continue to directly improve the health of these people due to improved access to reliable health care on Woodlark Island. Other potential positive impacts of the project to health include:

- Additional revenue, through royalties, to government for the development of health facilities on Woodlark Island and the funding of staff, medical equipment and medical supplies.
- General improvement in personal and family health due to improved housing, sanitation and access to medial treatment as a result of increased cash incomes from project-related employment.

The project will have positive impacts associated with transport, specifically the provision of improved infrastructure and the transport of goods and services to Woodlark Island. While some existing infrastructure (specifically the section of the Guasopa–Lake Lelua Road that traverses the project area) will be lost, WML will construct an alternative bypass road to ensure travel across the island can continue. Other items of infrastructure will be constructed or upgraded as part of the project.

Impact Summary

The residual positive effects on socio-economic aspects such as employment, skills levels, income, business development and health are expected to be island-wide in scale, prolonged and have a high positive impact.

Potential Negative Impacts

In-migration

One of the main potential socio-economic impacts associated with the project will be unsolicited in-migration to Woodlark Island. This will have flow-on consequences for law and order, social cohesion, women, health and the environment. WML will seek to deter unsolicited in-migration to the island by only hiring non-Woodlark Island residents at offices in Alotau (for other residents of Milne Bay Province) and Port Moresby (for other residents of PNG). Non-Woodlark Islanders will not be able to gain employment by travelling to Woodlark Island and applying for work at the mine site.

However, villagers from other areas of the Murua Regional Local Level Government area will travel to Woodlark Island to seek employment, and people may also travel from other parts of Milne Bay Province and other parts of PNG for the same purpose. The difficulty in travelling to the island and the processing of work applications by WML being done solely in Alotau and Port Moresby will deter this somewhat.

WML will work with the Murua Regional Local Level Government to manage in-migration.

Should outsiders migrate to Woodlark Island the impacts will be prolonged if migrants remain after mine closure and will be of high severity, as outsiders often do not understand local cultural protocols and Muyuw people are strongly opposed to large numbers of outsiders moving to the island and the social tension this will cause.

Migration onto the Mining Lease

Households at Kulumadau within the Mining Lease will be relocated to outside of this lease prior to the commencement of construction. Relocation and Compensation Agreements have been signed with the affected parties and lodged with the Mineral Resources Authority. There will be major safety issues if locals on Woodlark Island try to move onto the mining lease during mine operations, to try and seek compensation, or for workers to try and locate themselves as close as possible to their workplace. WML will make it clear that no further compensation will be granted for people settling onto areas within the Mining Lease. WML will also provide transport to the mine site each day for workers from villagers outside the Mining Lease.

Disputes over land ownership associated with accessing the financial benefits of the mine may occur as a result of the project, which could lead to a breakdown of the clan and sub-clan system on Woodlark Island.

Impacts will be localised, but they may be prolonged if Muyuw people migrate onto or near the ML and decide to stay there after the completion of the project.

Women

It is anticipated that the mine operations will employ up to 300 local residents. This may limit labour available for traditional subsistence farming, meaning more gardening work would fall on other members of the family, most likely to be female. However, there will still be a proportion of the local population not directly employed by WML who will continue to be able to provide labour for subsistence agriculture. The project may also result in more domestic work falling on women, women being excluded from cash benefits, women and children being subject to increased violence, and women losing access to shared decision-making.

WML's proposed management and mitigation measures will minimise the severity of impacts to women. The extent of these impacts will be Woodlark Island-wide and may be prolonged if the project experiences significant in-migration and increased social tension that does not dissipate once the project is completed.

Impact on Kula Exchange

It is possible that the project will impact upon the existing kula exchange network, as the emergence of the cash economy as a result of the mine may erode the important role of the kula exchange system in traditional society, or lead to a concentration of kula on the island.

The impacts will be at least short-term in duration, as they will generally be restricted to the duration of the project (when the accumulation of cash will be greatest); how prolonged the impacts are will depend on how quickly the kula exchange network is re-established after completion of the project.

Health

The project may indirectly affect the health of people living on Woodlark Island. The principal pathways through which this could occur is:

- Changes in diet leading to increased obesity and heart disease.
- Increased exposure to STDs (including HIV/AIDS).

- Increased exposure to other communicable diseases leading to acute and/or chronic reduced health, particularly in the young and the elderly.
- Health problems from the potential consequences of in-migration, including increased alcohol consumption, promiscuity, law-and-order issues (i.e., violence).

WML will continue to support initiatives on Woodlark Island to improve the health of the community.

The potential negative health impacts that may be indirectly caused by the project may be of moderate to high severity should serious health issues such as an increased risk of HIV/AIDS, heart disease, other chronic diseases result.

Archaeology and Cultural Heritage

There are nine archaeological or cultural heritage sites identified by specialists as requiring further study that are either partially or wholly within the project footprint. The project will disturb most of these sites; however, WML will develop and implement a cultural heritage management plan to minimise the impact to them and to map, salvage and relocate important sites where necessary. Pre-construction surveys will be undertaken to identify as-yet undiscovered sites prior to disturbance, and WML will salvage and relocate them prior to disturbance if they are assessed to be of high or very high significance.

The residual impacts to archaeology and cultural heritage will be localised, short duration and of low severity.

Impact Summary

The residual negative impacts to the socio-economic environment are predicted to be island-wide in scale, short-term to prolonged and low to high severity, depending on the aspect.

5.12 Closure

A conceptual mine closure and rehabilitation plan has been prepared for the project that describes decommissioning and rehabilitation concepts commensurate with the level of detail available for this phase of the project.

WML's goal for closure of the project is to rehabilitate disturbed areas in such a manner that they will be able to support self-sustaining vegetation that is consistent with that of surrounding natural areas, where possible, and to leave a lasting legacy for impacted communities in the form of transferred skills and self-sustaining community development programs.

Areas of disturbance which are no longer required for operations will be rehabilitated progressively, but most will only become available for rehabilitation at the end of the project life.

6. Management and Monitoring

6.1 Management

The ESIA process, as reflected in the EIS, has identified a number of potential biophysical and socio-economic impacts. A range of management measures have been proposed to address these potential impacts, with a focus on minimising the potentially negative impacts of the project and enhancing the potential benefits where possible.

The management measures described in the EIS reflect an 'in principle' approach to addressing potential impacts. Preparation of an environmental management plan (EMP) is expected to be a condition of the project's environment permit. The EMP for the project will outline onsite

implementation of the environmental management, monitoring and reporting processes required to achieve the objectives of the EMS outlined above. The aims of the EMP will be to:

- Document the more general aspects of WML's approach to environmental management, such as the schedule for environmental management and organisational structure and responsibilities.
- Describe how the project's environmental and social issues will be addressed. WML's management measures will be based on a hierarchical approach determined by technical feasibility, cost and benefit, and involving firstly, avoidance and secondly, mitigation or containment of the impact.
- Detail an integrated program to monitor, manage and report on the project's impacts and its compliance with regulatory permits and licences. In particular, this program will:
  - Validate and monitor impact predictions.
  - Identify unforeseen effects and the need for additional management, mitigation or remedial measures.
- Document auditable commitments made by WML for reference in future internal and external audits.

The EMP will describe the following components:

- Identified issues and impacts.
- Performance targets.
- Mitigation and management measures.
- Monitoring requirements and activities.
- Implementation schedules.
- Responsibilities and lines of communication.

In addition, a social management plan will be developed and implemented. The social management plan will address behavioural protocols for mine workers when/if interacting with the local community, and the inclusion of female participation in the project to enhance female representation. It will also detail compensation payments, relocation arrangements and a community investment strategy.

6.2 Monitoring

Environmental monitoring will facilitate accurate impact measurement, assessment of the effectiveness of management measures, provision of meaningful reports to stakeholders, and demonstration of regulatory compliance.

WML will take corrective action should monitoring indicate that management measures are not effective.

Inherent in the project's EMP will be a conventional three-phase monitoring system (operational, sentinel and ambient monitoring) that will be adopted for the project. An overview of this is as follows:

- *Operational Monitoring.* This is general monitoring of the operation that will take place on a routine, day-to-day basis. The aim will be to enable operators at this initial level of surveillance to identify environmentally-significant incidents. Operational monitoring will include:

  - Ore and mine waste production.
  - Diesel and other consumables usage rates.
  - Potable water quality consumption.
  - Waste production and recycling rates.
  - Tailing chemistry.
  - Pit water quality.

- *Sentinel Monitoring.* Sentinel monitoring will record the passage of environmental contaminants or nuisance at points outside the perimeter of the main project activities. This component of the monitoring system will generally aim to record significant unforeseen impacts from discharges of contaminants from the project. Examples of items for sentinel monitoring include:

  - Treated mine water.
  - Compliance monitoring at the end of any mixing zones.
  - DSTP discharge.

- *Ambient Monitoring.* While operational and sentinel monitoring will determine if environmentally significant releases have occurred, effects on the receptors within the receiving environment will be determined through the ambient monitoring program, including air quality, noise and local community aspects (e.g., community health, sustainable commercial ventures and use/availability of local bush resources).

Monitoring programs will be developed as the project proceeds into detailed design to take into consideration the requirements of the PNG Government, as well as conditions of the environment permit(s). The monitoring programs will typically include the environmental aspects relevant to each project-related activity, descriptions of the components to be monitored, and frequency of monitoring and purpose, where the latter will address both routine ongoing monitoring and intensive ‘validation’ surveys aimed at validating the impact predictions contained herein, with monitoring frequency then being reduced.

The types of parameters to be measured and potential measurement methods will address topics such as water quality, air quality, noise emissions and vibration. These parameters will be revisited and expanded with specific key performance indicators, monitoring locations and frequencies in subsequent iterations of the EMP.

Particular attention will be given to monitoring of the marine environment to confirm that performance of the DSTP system is operating as designed and predicted.