

Tasi Mane Project - Suai Supply Base Environmental Impact Assessment

Final Report

May 2012

Volume 2 - Main Report Part B





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The Tasi Mane Project – Suai Supply Base Environmental Impact Assessment Final Report is made up of separate three volumes.

- VOLUME 1 of 3: Suai Supply Base Environmental Impact Assessment Main Report Part A (Chapters 1 to 14)**
- VOLUME 2 of 3: Suai Supply Base Environmental Impact Assessment Main Report Part B (Chapters 15 to 20)**
- VOLUME 3 of 3: Suai Supply Base Environmental Impact Assessment Attachments:**

- Flora and Fauna Final Technical Report**
- Marine Ecology and Fisheries Final Technical Report**
- Tasi Mane Project Strategic Environmental Management Plan**



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ENVIRONMENTAL IMPACT STATEMENT

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CHAPTER 15 SOCIAL AND ECONOMIC VALUES



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15 SOCIAL AND ECONOMIC VALUES

15.1 Socio-economic Objectives

The objective of the socio-economic component of the project EIA is *'to identify social and economic impacts that are likely to result from the proposed project'*. This component of the EIA will:

- Population distribution
 - Present a demographic profile according to size, age, sex and ethnic group encountered in the baseline investigation;
- Socio-Economic
 - Present a description of the socio-economic profile of the local people;
 - Present general views and opinions of local people on the implementation of the project;
 - Solicit the degree of acceptance and opposition, as well as the condition set by the public on the proposed project;
 - Identify and describe anticipated negative and/or positive socio-economic impacts at the local, regional and national level; and
 - Provide recommendations for the development of potential mitigation and management measures to mitigate potential negative impacts and enhance positive impacts.

15.2 Study Method

15.2.1 Baseline Data Collection

Both desktop investigations (secondary research) and participatory techniques (primary research) were used to gather the most relevant up-to-date social and economic data.

Secondary Research

Secondary research (desktop studies) included a review of previous studies to identify information gaps and areas that require further investigation. Secondary research was predominantly used to inform the national context, except for the government census data that informed the demographic profile at a local level and spatial design planning reports that provided information on current land use within the study area. GIS analysis of aerial photography was also used to orient landmarks in potentially affected areas.

The National SPD (2011-2030) was the key document used to provide an overview of the project context nationally. The SPD outlines the government's vision for Timor-Leste and provides recent (2010) socio-economic baseline information that highlights strengths and weaknesses of Timor-Leste



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with respect to development. This document provided critical input in developing appropriate recommendations for socio-economic mitigation and management measures.

Primary Research

Primary research activities (fieldwork) focussed on the villages located closest to the project development sites that are expected to be the most directly affected (i.e., Supply Base area, industrial estates, Nova Suai, Suai Airport upgrade and the crocodile reserves). These include Matai, Labarai, Suai Loro, Belecasac and Camanasa. The Suai social study area is shown in Figure 15-1.

During this EIA, baseline information was gathered during a site visit using interviews, focus group meetings and cultural mapping. The approach for each primary research activity can be summarised as follows.

Interviews

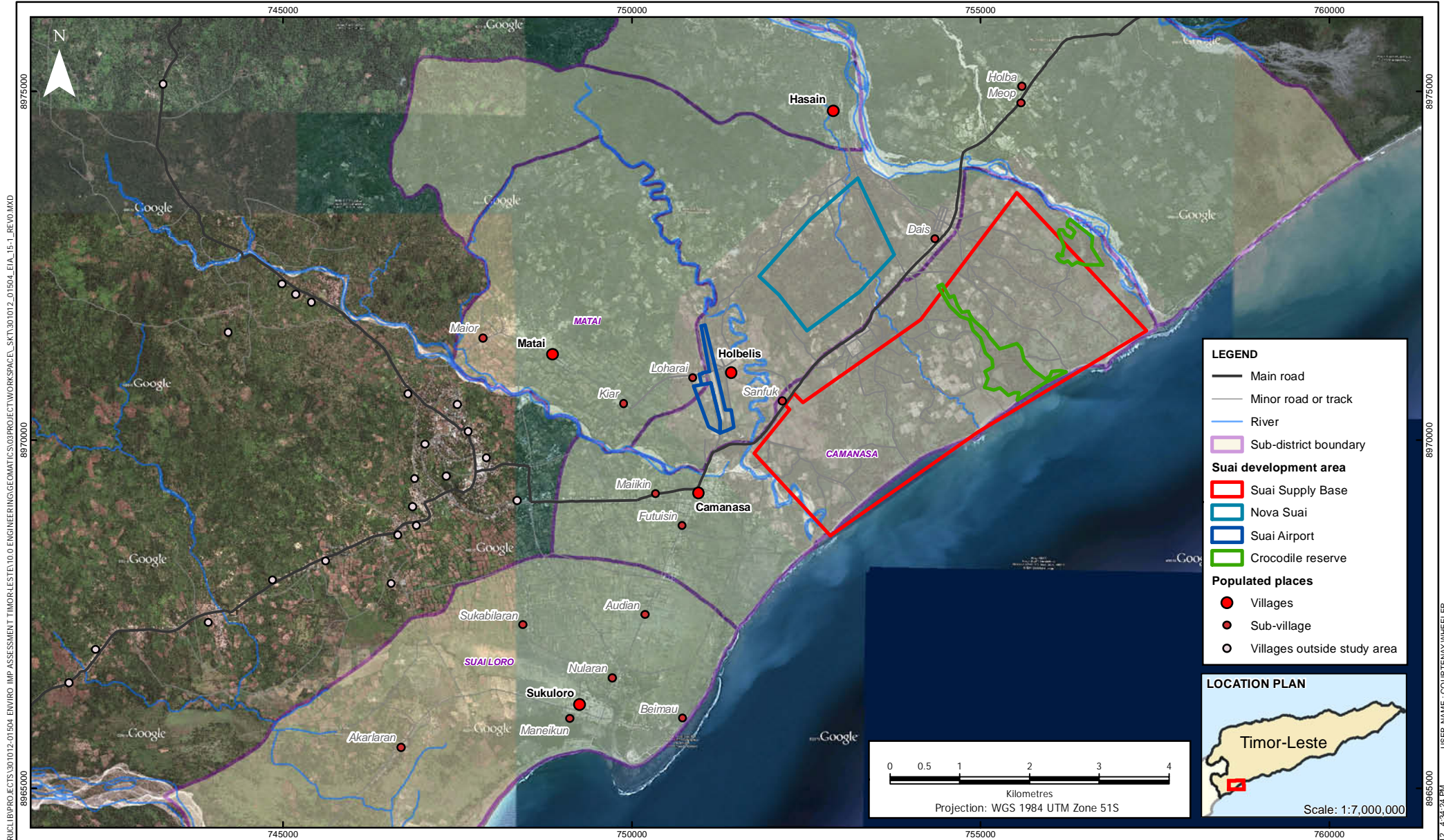
- Interviews were held with the chiefs and the traditional village council to discuss the fieldwork objectives and to notify them about the forthcoming focus group. This was done using a semi-structured questionnaire specifically designed for these interviews (refer to Appendix F);
- During these interviews, baseline information about the social organisation in the respective villages was gathered as well as perceptions about the project; and
- A telephone interview was undertaken with La'o Hamutuk, a non-government organisation.

Focus Group Meetings

- Baseline information about a wide range of socio-economic aspects in the Suai study area was gathered as well as perceptions about the project. This was done using a more detailed, semi-structured questionnaire. This questionnaire included the same questions asked in the key-informant interviews as well as additional questions about socio-economic aspects in the village that could best be answered by the respective focus group attendees (refer to Appendix G); and
- Chiefs were requested to invite individuals who fulfil specific roles within the village to ensure questions that were posed could be answered by the most suitable and knowledgeable individuals, e.g., village elders were in the best position to answer questions about sacred sites, and teachers to answer questions about the education conditions in the village.

Cultural mapping

- Following the semi-structured interviewing, the focus group attendees were requested to participate in the cultural mapping exercise;
- Large maps of the applicable site were printed out, with key landmarks indicated to orientate the participants; and
- Villagers were then asked to indicate sites of cultural value on these maps. These sites included sacred sites, water points, agricultural fields and dwellings.



NOTES:
 This map contains:
 1. Imagery: DigitalGlobe (2008-2011)
 2. Imagery: Google Earth (2010)
 3. Rivers: Geographic Information Group TimorLeste (2010)
 4. Roads: DivaGIS (2010)
 5. Villages: Geographic Information Group TimorLeste (2010)
 6. District boundaries: Geographic Information Group TimorLeste (2010)

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TASI MANE PROJECT - SUAI SUPPLY BASE
 ENVIRONMENTAL IMPACT ASSESSMENT

Figure 15-1
 Villages within the Suai social study area

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A social consultant accompanied by a Timorese interpreter and a SERN representative undertook interviews on 10 December 2011 with the five village chiefs within the Suai study area.

Focus group meetings and cultural mapping were undertaken on 10 and 11 December 2011 with the directly affected villages at the respective sites. Two focus group meetings were held with representatives from the villages within the Suai study area.

Key information interview details and focus group meeting details can be found at Table 15-1 and Table 15-2 and respectively.

Table 15-1 Key informant interview details

Meeting date	Location	Interviewee*
10 December 2011	Suai Loro	Chief Martino Mendoza
10 December 2011	Labarai	Chief Agapito Moniz
10 December 2011	Belecasac	Chief Augustino Gusmao
10 December 2011	Matai	Chief Vicente Safera
10 December 2011	Camanasa	Chief Octario do Roario

* The key informants/interviewees during these meetings were village chiefs; however, during meetings several bystanders participated spontaneously.

Table 15-2 Key informant interview details

Meeting date	Location	Number of Villagers Attending
10 December 2011	Suai Loro	Suai Loro (5 representatives) Labarai (12 representatives) Belecasac (18 representatives) Matai (15 representatives)
11 December 2011	Camanasa	Two representatives

15.2.2 Impact Assessment

Using the baseline information gathered, findings of the stakeholder engagement process, as well as an analysis of the project plan and GIS data, potential impacts on the socio-economic environment were identified for both the construction and operational phases of the project. This assessment includes positive, negative, direct, indirect, residual and cumulative impacts, taking into account concerns identified through the stakeholder consultation (Chapter 5).

As part of the assessment of socio-economic significance, consideration is given to the ability of the affected parties to adapt to changes and thus maintain livelihoods over the long term. Cumulative socio-economic impacts of the project are also analysed as part of the impact assessment.

15.2.3 Data Assumptions and Limitations

During the fieldwork with villages in the study areas, it appeared that many respondents had a limited understanding of certain aspects of the project. For example: limited understanding is focussed



ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

around the location of accommodation facilities for the construction workforce, project HR policy in terms of prioritising local employment, project details about Nova Suai, impacts on farming and fishing activities, and compensation procedures for assets and fields. As a result, these villages have not yet developed informed perceptions about the project.

This sentiment was further supported by the interview with La'o Hamutuk who reported that they were unaware if project information had been widely disclosed at a district or national level to all stakeholders (e.g. Lobby Groups and NGOs). The EIA stakeholder consultation did not disclose detailed project information to the villages. However, SERN has subsequently advised that project information has been disclosed to the community through a one week socialisation process coordinated with the Ministry of Agriculture and Fisheries (MAF), Secretary of State for Environment, Ministry of Justice, Ministry of Public Administration, and the National Police of Timor-Leste (PNTL).

Assumptions and limitations associated with the socio-economic component of the EIA include:

- Census 2010 statistics are predominantly presented in diagrams and figures and in some cases do not show exact percentages. Furthermore, the statistics are not accompanied by detailed descriptions or analysis, e.g., indicating how 'employed' (formal employment or also informal trading) or 'economic inactive' (only people between 16 and 65 or also people with disabilities) are defined. In other cases, census findings contradict some responses received during field interviews. This lack of interpretation and discrepancy between census findings and interviews necessitated a number of assumptions to be made. These assumptions have been highlighted in the baseline section where applicable;
- Uncertainty regarding projected construction expenditure, number and type of jobs associated with the project (in particular Nova Suai), and royalties and tax payment details made it difficult to accurately assess economic impacts. As a result, the impact section provides a high-level description of economic impacts that are likely to occur based on project information available and based on actual impacts of similar projects in South East Asia and other developing countries. Once project information becomes available, it is suggested that a detailed economic impact assessment with associated management plans be completed;
- Project information relating to construction expenditure and workforce numbers was obtained from a social study undertaken by EastLog Holding Pte Ltd (2011b) as part of the Supply Base Feasibility Study FEED. These figures have been used at face value; hence, the assessment of associated impacts is based on the assumption that these figures and estimates are accurate and achievable. Furthermore, the EastLog report only provides employment estimates for the first phase of construction (approximately 18 months) and not phase 2 (to be completed by 2016) or phase 3 (from 2024 to 2030);
- The socio-economic assessment did not include a social impact assessment (SIA) impact rating system due to the absence of detailed project information required to make such an impact rating system feasible;
- Rather than providing detailed management / action plans, the report provides recommendations to consider in subsequent phases of project planning due to the preliminary nature of the assessment;



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- Other information gaps which have limited the findings include:
 - Meeting details and issues and concerns raised during previous stakeholder engagement by SERN have not been provided (A number of other stakeholder engagement limitations are discussed separately in Chapter 5)
 - Details of the resettlement approach being adopted by SERN
 - Specific project plans for water, electricity, roads to be upgraded and marine areas that may have restricted access in the future;
- Due to the lack of updated aerial imagery or asset and field surveys being undertaken, the full extent of physical and economic displacement could not be accurately assessed. Therefore, land use within the footprint areas has been estimated using aerial imagery from 2003;
- The impacts associated with the construction of other government infrastructure projects, including the highway between Suai and Beaco (~170 km), and the National Electricity Grid project, including the construction of the power plant at Betano, are excluded. They are; however, considered from a perspective of cumulative impacts; and
- Stakeholder consultation for the purposes of the socio-economic chapter of this EIA (Chapter 5) indicates that the nature and timing of the disclosure of project information has resulted in an incomplete understanding of the nature of the project itself. The perceptions recorded in the EIA therefore reflect the varying levels of stakeholder and community understanding of the project.

15.3 Existing Social Environment

15.3.1 District Overview

Cova Lima is located in the western part of Timor-Leste and borders Indonesia to the west. It has a population of 59,455 inhabitants (Census 2010) and an area of 1,226 km². The capital of Cova Lima is Suai, which lies approximately 135 km south-west of Dili. Cova Lima district comprises the sub-districts of Fatululik, Fatumean, Fohorem, Zumulai, Maucatar, Suai and Tilomar.

The GoTL envisions that public investment in the Suai area will facilitate development that will create jobs and increase economic activity on the south coast. The government's plan for Cova Lima district includes a new road to connect Suai, Betano, Viqueque and Beaco to be built in the next 10 years and an upgrade of the Suai Airport. The government also plans to build health clinics in each village to provide health services for 1,000 to 5,000 people (Census, 2010).

15.3.2 Location of Villages

Figure 15-1 shows the location of villages in the Suai study area in relation to the Suai development areas. Camanasa is the closest village to the development areas and consequently, is likely to be the most directly affected by the project. Belecasac, Matai and Labarai are located within 500 m of the Suai development sites and, therefore, may be substantially affected by secondary project impacts



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such as noise or change in the social structure. Based on initial project planning, Suai Loro was going to be affected by establishment of the crocodile reserve; however, the location of the reserve changed, and this village will no longer be directly affected by the project. Nonetheless, its proximity to the development sites (500 m to 1 km) warrants its inclusion in the study area.

15.3.3 Population, Demographics Profile

According to the 2010 Census, the total population of the five villages visited is 13,737 with a relatively even gender distribution (51% male, 49% female). The total number of households across all villages is 2,515 with an average household size of 5.5 people. The most populated of the five villages is Suai Loro with a population of 3,730. The least populated village is Belecasac with 855 people. Table 15-3 shows the population numbers, total households and gender distribution for the five villages in Cova Lima District.

Table 15-3 Population in five villages in Cova Lima District

Village Name	Males	Females	Total Population	Total Households
Suai Loro	1,892	1,846	3,738	730
Labarai	1,503	1,408	2,911	523
Belecasac	418	437	855	155
Matai	1,386	1,354	2,740	495
Camanasa	1,770	1,723	3,493	612
Total	6,969	6,768	13,737	2,515

Source: Timor-Leste Census 2010

According to interview respondents, there is a natural population growth in the villages (i.e., slightly higher birth rate than mortality rate). Anecdotal evidence suggests that the mortality rate has decreased in recent years; however, no specific reason for this decrease was provided. Some people are reported to have moved into the villages in the study area. Conversely, many young people go to Dili in search of employment and, once employed, send some of their earnings home to their family. Whether a person moves to Dili usually depends on the level of assistance that their family can offer to help with the move. Some Philippine and Chinese business owners have moved to the area and reside in Suai town rather than the villages.

The age distribution across the five villages is generally young and consistent across both genders. This high proportion of children in the 0 to 14 age group shows the significant demands on schooling in the study area. It further shows the villages' vulnerability to change in that there is a large number of children whose food security would be at risk if the adult population is no longer be able to farm due to the loss of farm land or diversion to full-time employment. Table 15-4 shows the age distribution across the five villages (Census, 2010).

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****Table 15-4 Age distribution in five villages in Cova Lima District**

Village Name	Age 0 – 14 (%)	Age 15-59 (%)	Age 60+ (%)
Suai Loro	34	54	12
Labarai	42	49	9
Belecasac	45	43	12
Matai	40	50	10
Camanasa	41	45	12

Source: Timor-Leste Census 2010

According to the 2010 Census, there are two main languages spoken in the five villages, namely Tetun Terik and Bunak. As can be seen in Table 15-5, Tetun Terik is the mother tongue for the vast majority of people in Suai Loro and Camanasa villages while Bunak was dominant in Labarai and Belecasac villages. Interestingly, in Matai village the distribution of mother tongue language is almost equal. Across the five villages, only a small minority (2%) consider the national language, Tetun Prasa, to be their mother tongue.

Table 15-5 Mother tongue for the five villages in Cova Lima District

Village Name	Tetun Terik (%)	Tetun Prasa (%)	Bunak (%)
Suai Loro	94	2	4
Labarai	6	2	92
Belecasac	1	2	97
Matai	50	2	48
Camanasa	94	2	4

Source: Timor-Leste Census 2010

Legally, all land is owned by government; however, respondents explained that land ‘ownership’ (customary control over the land) is based around family groups. If someone requires land, all the family members with customary control over that piece of land are involved in negotiations. Interviewees explained that the families are customary landholders and do not have certificates or deeds of ownership.

15.3.4 Village Organisation and Vulnerable Groups

There are a number of community-based organisations (CBOs) operating in the Suai district. CBOs are formalised in the following manner according to interview respondents. Firstly, the villagers who seek to form a CBO will have an informal meeting to discuss the objectives of the committee. Thereafter they will develop a CBO structure, and request funds from the government to perform their activity via a proposal and businesses plan. If the government accepts the proposal, assistance (usually in the form of equipment; or sometimes money) is provided and distributed evenly to group members. Verification of the implementation of the business plan is carried out by a coordinator appointed by the village who works alongside a government representative and checks on the CBO status. CBOs generally meet once a fortnight.

A number of non-governmental organisations (NGOs) were reported by interview participants as being active in the Suai study area, most of whom are focused on crop production, livestock



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production, weaving, singing, martial arts, youth and women. These included the following NGOs: Child Fund, Malnutrition Care, Triangle (water and sanitation), GTZ, Tuba Rai Metin (microfinance), Grace, Oxfam Australia, Fitun Naroman and Kadalak Sulimutuk Institute (KSI).

Each village reported that there are many vulnerable people in the villages. Interview participants ascribed the vulnerability to illness (e.g., tuberculosis, blindness or leprosy), physical disability, elderly people living on their own, or due to the household being headed by a child or female.

15.3.5 Communication and Travel

Mobile phones are in use in all five villages when a when signal is available although, the high cost of using a mobile phone was reported to be a problem. Telephone landlines are not present in the area. Public meetings were also mentioned as a means of communication and occasionally, village announcements are made by use of megaphones. Reception for radio is adequate; however, not everyone has access to a radio or electricity to power a radio (WorleyParsons fieldwork, 2011).

Interview participants reported that their main means of transport were walking, horses and hired motorbikes. A bus service currently operates between Suai and Dili, while there is no bus service between the villages along the coast. Car ownership is very low. For example, in the village of Canemaca, there are less than 20 cars present, most are owned by businessmen. Car owners sometimes provide transport to locals free of charge.

15.3.6 Economic Activities

Fieldwork participants mentioned that there are four main types of livelihood in the five villages. These were listed in the same priority order for each village, namely:

- Farming;
- Livestock and fishing;
- Government jobs (e.g., teachers, nurses, police, military); and
- Small businesses.

No large-scale manufacturing or retail companies employ people in the area and the main sources of cash income are vegetables, livestock and maize production. Small businesses e.g., trade stores, also generate income.

Table 15-6 shows that in each of the five villages, the majority of the population is economically 'inactive', i.e., younger than 15 and older than 59. Across the five villages, between 31% (Camanasa) and 40% (Suai Loro) of the population are employed. Between 2% (Matai) and 6% (Camanasa) of the population were listed as unemployed in the 2010 Census. The 2010 census reports did not specify how 'employed' or economically 'inactive' were defined; however, based on interview responses, it is reasonable to assume that informal trading (e.g., selling of crops and livestock) were included as a form of employment.

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****Table 15-6 Employment profile for the five villages in Cova Lima District**

Village	Employed (%)	Unemployed (%)	Inactive (%)
Suai Loro	40	5	55
Labarai	37	4	59
Belecasac	39	5	56
Matai	34	3	63
Camanasa	31	7	62

Source: Timor-Leste Census 2010

15.3.7 Amenities

The 2010 Census data shows that of the seven household amenities listed in Table 15-7, mobile telephones are the most common, with up to two-thirds of households in Matai village owning a mobile phone. Belecasac is the exception in this regard, where only one in five households own a mobile phone.

All other amenities listed are owned by a minority of households. It is possible; however, that individuals may have access to amenities owned by other households. Radios are owned by around one-third of households. The rate of television ownership varies greatly between the five villages, with ownership rates between 1% (Belecasac) and 34% (Camanasa) recorded in the 2010 Census.

In terms of modes of transport, bicycles and motorcycles are owned by an average of 20% of households, while an average of only 3% of households in the five villages own a car or van. Belecasac and Matai have lower levels of vehicle ownership, while Suai Loro and Camanasa have relatively high levels of ownership.

Table 15-7 Percentage of households owning amenities in the five villages

Village	Car/Van (%)	Motorcycle (%)	Bicycle (%)	Freezer (%)	Mobile Telephone (%)	Television (%)	Radio (%)
Suai Loro	3	21	36	10	59	24	35
Labarai	2	22	19	2	39	7	26
Belecasac	2	13	9	3	18	1	32
Matai	2	18	14	4	66	20	29
Camanasa	7	27	28	10	59	34	33

Source: Timor-Leste Census 2010

15.3.8 Agricultural Activities

Farming is a very important livelihood in these communities. It was said that all families in the area farm (even if they have another job) and it is the main source of food for the population. The farming plots are located both near the settlement and also further away. If the fields are some distance from the village, farmers tend to have a small dwelling close to the plot. Livestock are typically taken to the

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grazing area by the owner where they are then allowed to graze and returned to the village in the evening.

The large majority of households in each of the five villages raise animals. As was recorded in the 2010 Census (and shown in Table 15-8) chickens, pigs and cattle are the most common livestock.

Table 15-8 Number of animals raised by households in the five villages in Cova Lima District

	Suai Loro	Labarai	Belecasac	Matai	Camanasa
Chickens	4,774	2,258	900	3,656	2,836
Pigs	3,155	2,099	689	1,344	1,882
Sheep	22	4	0	4	201
Goat	377	232	99	340	76
Horse	26	17	61	41	20
Cattle/cow	1,372	1,444	651	1,042	1,249
Buffalo	46	104	60	2	66
%Households	93%	93%	94%	91%	80%

Source: Timor-Leste Census 2010

Table 15-9 shows that the number of households that carry out cropping varies greatly across the five villages. According to the 2010 Census, the vast majority of households in Suai Loro and Matai villages produce crops (85% each) while a minority of households produce crops in Labarai (18%) and Belecasac (25%). Exactly half (50%) of all households produce crops in Camanasa village. During the survey period respondents from Labarai and Belecasac reported that most people produce crops, even if they have another occupation. The reason for the discrepancy between the fieldwork response and the 2010 Census data for crop production in Labarai and Belecasac is an area for further investigation.

Table 15-9 shows that each farming household produces a number of different crops. Coconut, fruit, vegetables, cassava and maize are most commonly produced by households, while coffee and rice are the least common.

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****Table 15-9 Percentage of households growing different types of crops in the five villages in Cova Lima District**

	Suai Loro (%)	Labarai (%)	Belecasac (%)	Matai (%)	Camnasa (%)
Coconut	64	12	20	80	44
Coffee	17	3	18	7	6
Fruit (permanent)	62	10	10	82	42
Fruit (temporary)	64	10	9	83	42
Vegetables	68	16	20	76	45
Cassava	69	16	21	83	47
Maize	68	16	21	83	46
Rice	65	2	2	2	18
Other permanent crops	60	8	13	84	43
Other temporary crops	60	6	13	83	44
%Households involved in crop production	85	18	25	85	50

Source: Timor-Leste Census 2010

15.3.9 Natural Resources

Sources of water differed across the five villages. According to interview participants, wells are common, particularly in areas where the water table is shallow. Other common sources of water for the population include spring water (often piped to the local village), hand pumps (from groundwater), the local river and, in one case, a borehole provided by an NGO. Only one participant reported falling ill as a result of drinking local water, which in this case was from a river.

The 2010 Census recorded the percentage of houses in each village with access to an 'improved source of drinking water'. Improved sources of drinking water includes water piped or pumped indoors or outdoors, public piped tap, tubed well or borehole, protected well or protected spring, rainwater collection or bottle water. In Suai Loro and Labarai, 40% to 60% of the population have access to an improved source, while 60% to 80% have access to an improved source in Camnasa and 80% to 100% have access to an improved source of drinking water in Belecasac and Matai.

Wood is the most commonly used energy source for cooking with an average of 96% of households using wood across the five villages. Electricity and kerosene are only used by a small minority of households. Table 15-10 shows the energy sources used for cooking across the five villages (Census, 2010).

According to respondents, kerosene is typically used for lighting with candles used occasionally, though these are seen as a more expensive option. Some villages are connected to the electricity network; however, the supply was reported to be unreliable (WorleyParsons fieldwork, 2011).



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Table 15-10 Energy sources used for cooking for the five villages in Cova Lima District (by household)

	Suai Loro (%)	Labarai (%)	Belecasac (%)	Matai (%)	Camnasa (%)
Electricity	2	2	0	1	5
Cooking gas	1	0	0	1	0
Bio gas	0	0	0	0	0
Kerosene	2	2	1	1	2
Wood	96	95	99	97	92
Other	0	0	0	0	0

Source: Timor-Leste Census 2010

Natural resources are also used for preparing traditional medicines. According to interview participants, traditional medicine is more common than western medicine in the area and medicinal plants are readily available. Some medicinal plants are cultivated while others grow naturally and are collected when necessary. Knowledge of medicinal plants is limited to certain individuals.

When participants were asked about the availability of natural resources, the amount of arable land for grazing and farming was reported to be adequate. Rice fields are abundant in some areas. In general, natural building materials are abundant; however, the supply of palm leaves (for thatching) is limited in some areas.

Honey is an important source of food and was also said to be readily available.

Fishing is an important food source and also an important source of cash income. Fishing takes place all along the coast, although no specific fishing areas were mentioned by interviews. Villagers tend to favour fishing in the ocean rather than rivers due to the prevalence of crocodiles in the rivers (WorleyParsons fieldwork, 2011).

15.3.10 Services and Infrastructure

Village infrastructure has been summarised in Table 15-11.

Interviewees reported that the nearest secondary school, hospital and police station is located in Suai Town. Designated communal waste dumps were reportedly not in use in the villages. Waste is disposed in the bush whenever necessary or through burning. On Saturdays, many local people travel to Suai Town to purchase and sell local produce.

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****Table 15-11 Facilities available in the five villages in Cova Lima District**

	Suai Loro	Labarai	Belecasac	Matai	Camanasa
Kindergarten	3	-	1	1	1**
Secondary schools	-	-	-	-	-
Primary schools	3	2	4	2	4
Hospital	-	-	-	-	-
Clinic	-	1	1	-	-
Police station	-	-	-	-	-
Churches	3	1	4	-	4
Shops (approx.)	20	5	5	10	5
Recreation	6	2	1	2	
Market	-	-	-	-	1**
Waste dump	-	-	-	-	-
Vocational training	1	-	-	-	-
Junior high school	-	-	1	-	1

Source: WorleyParsons Fieldwork, 2011

** Under construction

Housing largely consists of traditional structures built by the locals and a smaller number of modern housing structures in the Indonesian style. Modern housing is built by specialists available in the village (WorleyParsons fieldwork, 2011). The 2010 Census found that the condition of external walls for all five villages was poor (falling in the lowest category of 0 to 19.9%). Roof conditions for Suai Loro was in the 20 to 39.9% category (second lowest) and for Camanasa, Matai and Labarai 40 to 59.9% (in between the highest and the lowest). For Belecasac, roof conditions was in the range of 60 to 79.9% (second highest). The floor condition for Suai Loro, Camanasa and Labarai was in the range of 40 to 59.9% (in between the highest and the lowest category), while Matai and Belecasac was in the range of 20 to 39.9% (second lowest category).

Sanitation systems are very basic with no flush toilets and some pit latrines. People typically used vegetated areas as a latrine. Piggeries are also used for the disposal of human waste. The 2010 Census found that some villages have better access to sanitation facilities than others, with Camanasa (60 to 80%) and Suai Loro and Matai (40 to 60%) having the best access to improved sanitation facilities and Labarai (20 to 40%) and Belecasac (0 to 20%) the poorest access. Improved sanitation facilities are defined as a household using a pit latrine with slab, ventilated improved pit latrine or, pour or flush septic tank or pit.

As far as government services are concerned, local people are responsible for maintaining roads in the area while Government funding is available for water canals. In general, households do not pay for government services.

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****15.3.11 Education**

According to interview participants, most people attend primary school and complete high school while very few people complete tertiary education. Many working age people have completed high school and then try to find employment.

The key challenges for education services include a lack of teachers and inadequate infrastructure, including equipment and laboratories. Students generally have to travel a long way to attend the local primary school (WorleyParsons fieldwork, 2011).

As shown in Table 15-12, the majority of people aged 15 to 24 were literate in each of the five villages. There was little difference in the levels of literacy between men and women in this age group. Matai had the highest literacy rate of 89%.

Table 15-12 Literacy rate for people aged 15 to 24 in the five villages

	Suai Loro (%)	Labarai (%)	Belecasac (%)	Matai (%)	Camanasa (%)
Total	78	80	85	89	81
Men	78	78	84	87	77
Women	78	82	86	92	84

Source: Timor-Leste Census 2010

Table 15-13 shows the percentage of people in the five villages who are at school, have left school, or have never attended school at the time of the 2010 Census. An average of 37% of people across the five villages was attending school and an average of 29% had left school. An average of 31% across the five villages had never attended school (Census, 2010).

Table 15-13 School attendance in the five villages in Cova Lima District

	Suai Loro (%)	Labarai (%)	Belecasac (%)	Matai (%)	Camanasa (%)
At school	31	38	40	40	38
Left school	33	30	30	26	27
Never attended school	34	30	29	32	32
Not stated	2	2	1	2	3

Source: Timor-Leste Census 2010

As shown in Table 15-14, the majority of people aged five and over in the five villages had some level of education. An average of one-third of people in each village held a primary school education. An average of 15% attained pre-secondary education, while 12% had a secondary education. A very small minority had a tertiary education and an average of one-third of people in each village had no formal education.

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****Table 15-14 Level of educational achievement for the five villages in Cova Lima District**

	Suai Loro (%)	Labarai (%)	Belecasac (%)	Matai (%)	Camanasa (%)
Pre-primary	3	3	3	2	1
Primary	28	37	43	31	31
Pre-secondary	13	15	15	15	15
Secondary	17	8	7	16	13
Polytechnic or diploma	< 1	< 1	< 1	< 1	1
University	1	1	< 1	1	2
Non-formal education	< 1	< 1	< 1	< 1	< 1
No education	34	32	30	32	35

Source: Timor-Leste Census 2010

15.3.12 Health

According to fieldwork participants, the most common diseases in the villages are malaria and tuberculosis. Tuberculosis is a particular health problem for older people and access to hospitals was seen as the key challenge in terms of health services. Two hospitals are available in Suai Town including one private hospital which is under-utilised due to the cost, and one public hospital which is free to the public; however, respondents felt that it will need to expand to meet future demand.

In order to bring services and health promotion information to people who otherwise have little contact with the formal health system, the Timor-Leste Ministry of Health has prioritised a new program called Servisu Integrado Saude Communitaire (SISCa), which means 'Integrated Health Services at the Community Level' in the Tetum language. The SISCa program is an effort to provide government-funded health care to rural communities, and to give communities responsibility for assuring that care is available and accessible. A monthly SISCa service is available to people in the study area.

According to the 2010 Census, only half of all births were being assisted by a skilled health provider. Between 2005 and 2010 the percentages of births assisted by a skilled health provider was 31% for Suai Loro, 32% for Labarai, 43% for Belecasac and Matai respectively, and 51% for Camanasa. In 2009, the infant mortality rate for Timor-Leste was 44 per 1,000 live births. Data from the 2010 Census for infant mortality rates was not yet available at the time of writing.

15.3.13 Cultural Heritage, Burial Practices and Sites

Sacred sites are commonplace in Suai. They may be a stream, rock, tree, house or bush. Some of the sites are outside villages. Churches are also present in the area. Interview participants indicated that there are four sacred sites within the project area; a sacred forest, a large tree and two water streams inside a forest.

In recent times, people are buried in cemeteries; however, in the past, burials were located at the family home. SERN has recorded a cemetery within the project area. Based on project information received to date, it is uncertain whether this cemetery will have to be relocated or if it can be



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preserved. An archaeological and grave survey is an area for potential further work as there may be a number of unidentified scattered ancestral graves within the Suai development areas.

Sacred houses are of particular importance to the people of Timor-Leste. Uma-Lulik (the sacred house) is a 'tall, thatched, conical shaped building' and every family in Timor-Leste has a sacred house. Sacred houses are associated with spirituality, tradition, ancestors, self-assurance, strength and honour for the local people. They are the home of animist culture in Timor-Leste.

Certain rules and traditions apply when inside a sacred house and respect for the elders is essential. They are communal spaces and the construction of a sacred house by a village involves many meetings and ceremonies and takes approximately one year to complete (Suai Youth workshop, 2008).

The number of sacred houses per village is as follows:

- Suai Loro – 150;
- Labarai – 29;
- Matai – 82;
- Belecasac – 46; and
- Camanasa – 33.

None of these sacred houses are located within the Suai development areas.

Impacts on sacred sites and graves are discussed in more detail in the impacts and mitigation sections.

15.3.14 Social Problems and Crime

The main form of crime in the area is theft, mainly livestock and sometimes crops or household belongings. When this occurs, the police or government resolves the issue. No violence was reported by interviewees. During cultural festivities large amounts of alcohol are consumed; however, this is generally not perceived as a social problem (WorleyParsons fieldwork, 2011).

In all of the key informant and focus group interviews, the majority of responses indicated that social problems and crime are not major issues in the study area. It should be noted; however, that due to the sensitive nature of some crime-related issues (e.g., prostitution, domestic violence) questions in this regards were restricted to general statements. Further, there was no opportunity to interview women or other minority groups in isolation.

15.3.15 Key Perceptions about the Project

The following is a summary of the perceptions about the project that were noted during the key informant interviews and focus group meetings.

These perceptions were raised by all five villages in the Suai study area:



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- Development is good for Timor-Leste and the project will have a positive impact on the community;
- It is recognised that outsiders will have to be employed to fill some of the skilled positions. However, local people need to receive priority during the recruitment process over people from other districts and foreigners, especially for positions where skills are available locally;
- ‘Outside’ employees can be housed in, or adjacent to, the villages as long as their numbers remain low. However, if there will be a large number of outside employees, they should be housed at a separate location;
- It was hoped that the project will provide a brighter future through job creation, in particular for the youth;
- The project will have a positive impact in terms of infrastructure development of the area; and
- There is concern about physical and economic displacement. Compensation to be provided needs to be fair, properly negotiated with affected individuals, and payments made over a long period of time (monthly) to avoid ‘splurging’.

Village-specific perceptions include:

- Suai Loro:
 - There will be no development at this village site due to the large number of people to be relocated.
 - Embrace the idea of development in the district;
- Labarai:
 - Development will bring jobs, a new highway from Suai to Beaco, and electricity to villages
 - Concerns regarding proper compensation for losing dwellings and fields;
 - Overall the development will improve people’s lives;
- Belecasac:
 - Concern about ‘outsiders’ getting employment and not locals;
 - Concern about the loss of fields; however, the compensation that will be paid will benefit affected people;
 - Overall the development will improve people’s lives;
- Matai:
 - The project will bring local jobs and offer opportunities e.g., selling produce to the project;
 - No sacred sites will be affected by the project;
- Camanasa:



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- The project will require most of the village's customary land. Compensation needs to be fair otherwise the village will be left in a highly vulnerable position;
- Nova Suai falls on land falling under the customary rule of Belecasac and Labarai. It would be better if those being resettled from Camanasa can move closer to Camanasa village to be close to their families and friends;
- 'Outsiders' will find employment and not locals. To avoid this from happening, the project should build a training facility to build local skill levels; and
- Would like to discuss with government contracting opportunities surrounding catering services.

WorleyParsons also interviewed La'o Hamutuk, a local non-government organisation (NGO) to identify if it had any issues or concerns about the project. The following is a summary of the key perceived impacts and general concerns raised during this meeting:

- Resettlement (dwellings and fields):
 - The compensation procedure currently implemented by government is unclear and not well communicated to the affected villagers and La'o Hamutuk is not sure if the compensation procedure is in line with legal requirements
 - Arable land is scarce in Timor-Leste, thus the land being taken by the project is a very sensitive issue and will be a significant impact. The other land issue relates to the disputes around land ownership
 - There are many 'layers' of land ownership due to people being internally displaced during the Indonesian occupation. As an example, the landowner may not be the owner of the trees on that land
 - It is important to also bear in mind people's spiritual ties to the land for those being resettled and not just their physical assets
 - La'o Hamutuk questioned what will be done for people who will no longer be able to farm or fish; and
- Other impacts:
 - The project may exacerbate women/gender issues
 - Construction workers tend to be insensitive to other cultures and also tend to misbehave
 - Unrelated to the current EIA, there is a residual concern in the community regarding the amount of land that will be lost due to the construction of the highway and also the impact on people's movement patterns is a big concern
- Stakeholder engagement and accuracy of project information disclosed:
 - Generally feeling is that the government is 'overselling' the project. Promising many jobs; however, La'o Hamutuk doubts if these jobs will be available to the local population



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- Generally feel the information presented to the communities is biased. Also feel that SERN is only emphasising the positive impacts and not the negative impacts
- Asked if project affected villages have been consulted and if there are any records of these meetings
- Additional concerns:
 - Concerned that SERN is the proponent and the regulator will also be a government department. The division of roles becomes unclear and opportunities arise for political games to be played, especially considering the upcoming elections
 - Doubtful about the feasibility of the project as they have not seen any definite plans for the private sector to become involved
 - Timor-Leste needs to diversify its economy and should spend more money on other sectors such as agriculture.

15.4 Workforce

The project information presented here has been extracted from the EastLog Holding Pte Ltd (2011b) report titled 'Part IV: Social Impact Study' (EastLog, 2011). It is presented here for the purposes of setting the infrastructure development and economic contexts as they relate to social impacts.

15.4.1 Economics

Construction Workforce

During construction (over a period of 12 to 15 months), estimated employment will be:

- 30 persons at each hard rock quarry site for various functions (security, drillers, rock movers, blasters, drivers and assistants for 15 dump trucks, etc.);
- 20 persons at the river bed quarry sites (security, rock movers, drivers and assistants for dump trucks, etc.);
- 200 persons at the Suai Supply Base site for general construction activities; and
- 50 persons at the Suai Supply Base site for local administration and security.

It should be noted that the EastLog report only provides employment estimates for the first phase of construction (approximately 18 months) and not Phase 2 (to be completed by 2016) and Phase 3 (from 2024 to 2030). SERN has advised that the workforce profiles for Phases 2 and 3 are expected to be of a similar level, or perhaps higher, than that of Phase 1.

Operations Workforce

During the operations of the Supply Base, estimated employment will be:

- 200 to 250 locals working at the Suai Supply base. This will be staff of all levels; and



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- 18 to 30 locals working at each Mini Shore Base leased by production-sharing contractors (PSCs).

During the operations of the Supply Base, it is expected that 200 to 250 Timor-Leste nationals will be employed in the long term (~50 years). These jobs will cover the full spectrum of a logistics Supply Base operation, from security, logistics, port management and maintenance through to finance, administration and human resources. Moreover, each PSC in residence will employ an additional 18 warehouse and port crew and 4 to 12 administrative staff. There will be a long period of time (Phases 2 and 3) where construction and operations employment opportunities will overlap.

The human resource structure provides for six grades for full time employees:

- Grade 3 – Manager. Responsible for a department and/or team. Graduate with some experience or a non-graduate with significant experience;
- Grade 4 – Assistant manager / executive. Graduate with some experience of non-graduate with significant experience;
- Grade 5 – Supervisor / officer / coordinator. 1) Responsible for a section / crew or 2) Professional with technical skills or 3) Highly specific or niche skillset. Graduate or diploma holder with relevant skills for the appointment;
- Grade 6 – Assistant supervisor / administrator / specialist. 1) Crew member with leadership potential to cover in the absence of the Supervisor, 2) Administrative personnel, 3) Position with specific vocational skills required. Diploma holder, high school or vocational training;
- Grade 7 – General worker, high school or lower; and
- Grade 8 – General worker, junior high school or lower.

The table below shows a breakdown by department and grade level for the staff at the base.

Table 15-15 Breakdown of Suai Supply Base employees by department and grade level

Department	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	TOTAL
Management	2			1			3
Operations	2	3	13	30	30		78
Maintenance	1		9		18		28
Quality, Health, Safety and Environment	1	4	2				7
Security	1		3		45		49
Business Support Services	1		3	4	10	13	31
Finance	1		1	4			6
Human Resources	1			2			3
Sales	1		4				5
						TOTAL	210



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It is estimated that the largest job creator associated with the development of the Supply Base will be the attractiveness of the new port to other industries along the south coast. It is envisioned that the industrial estate to be built next to the Supply Base will create the largest number of employment opportunities, (EastLog, 2011).

15.4.2 Local Investment

As mentioned in Section 4.3 above, SERN has advised that the capital cost during the construction phase is expected to be in the order of US\$350 million, depending on local market conditions at the time of procurement. The final cost will be subject to normal commercial negotiations and potentially, a local content purchasing policy.

According to the Suai Social Impact Assessment (SIA) prepared by EastLog Holding Pte Ltd (EastLog, 2011):

- The Supply Base project will spend an estimated US\$4.5 million annually as operational expenditure;
- An estimated 40% of the engineering, procurement and construction contracts will be awarded to local contractors for works and services to be performed in the construction of the breakwater and Supply Base facilities as well as for purchase of local supplies and materials;
- Over the 18 to 24 month skills development program, it is expected that the project will spend US\$2.2 million in wages to hire and train the necessary employees to staff the Suai Supply Base;
- This annual operations expenditure includes wages and purchase of local supplies and services. This is only the direct impact of the Suai Supply Base and does not include indirect expenditure from expatriate employees and PSCs. Assuming an average national savings rate of 10%, the economic multiplier effect on the economy could be as much as 10 times this value; and
- Each PSC in residence at the Suai Supply Base could spend in excess of US\$1 million per month in the local community on supplies and services to support their production platform.

15.4.3 Infrastructure

The Supply Base will be a crucial investment in the development of a domestic petroleum sector and its related industries and services. It will provide an entry point for the materials and equipment needed to service the offshore exploration and production of petroleum. As a result of the Supply Base construction, social infrastructure in the local area will be upgraded. The following infrastructure associated with the Supply Base will have a direct or indirect impact on the villages in the study area.

Road infrastructure

To connect the three project sites and support growth of the petroleum industry, a highway will be built from Suai to Beaco. This highway will be built in stages. Each stage will be developed according



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to economic need and the growth of the industry. The highway project will commence by 2015 and be completed by at least 2020 (RDTL, Undated).

Over and above the highway construction, several existing roads will be upgraded and new roads will be constructed to connect project infrastructure sites. This is discussed further in Chapter 16 (Land Transport).

Fuel Storage Tank Farm

The construction activities require a large quantity of diesel and the construction contractor will have to import and store this fuel, initially in a barge and in permanent tanks once they are available (within 12 months of construction start). Bringing in large volumes of fuel by barge will reduce the fuel cost of the construction of the Supply Base.

Energy Infrastructure

With regards to energy infrastructure, it is assumed that the Supply Base will rely on electricity to be provided from the National Electricity Projects currently under construction.

Upgrade of Suai Airport

The existing airport at Suai (Figure 4-5) will be upgraded to a fully operational district airport. Improved civil aviation facilities at Suai also form part of the sustainable growth strategy set out in the (RDTL, 2002) and the (RDTL, Undated).

Multi-purpose Sea Port at Camenasa

As indicated earlier, the national port in Dili is the only international sea port in Timor-Leste and, as such, the nation is heavily dependent on it. The port infrastructure and facilities will be available for use by other businesses in the southern region (liquid fuel storage, commercial cargo, roll-on / roll-off landing craft tank (LCT) ramp, etc.).

Monthly Landing Craft Tank Liner Service to Lamongan

During construction, there will be a regular LCT and barge service between Lamongan shore base (a regency of East Java, Indonesia) and the Suai Supply Base construction site. The construction contractor will be required to release some space on each voyage to allow commercial cargo for local Suai enterprises creating new business opportunities (EastLog, 2011).

Nova Suai Infrastructure

It is estimated that around 6,000 residents will be accommodated in Nova Suai, with approximately 50% being family members of employees. The plan is to build modern facilities e.g., hotels, schools and shopping centres to cater for the needs of the residents. A new road to access Nova Suai will be built from the existing Suai to Same Road as the main entry for residents and visitors. The main entry will have a prominent gateway and security gate with access cards (RDTL, 2011a).



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Community Centre

As part of the Supply Base development a community centre is proposed to be constructed. The following facilities and services will be provided at the centre:

- Soccer field;
- Multi-purpose hall;
- Badminton / basketball court;
- Internet room; and
- Training and conference facilities (EastLog, 2011).

15.5 Socio-economic Impacts

This section of the report considers the potential socio-economic impacts associated with the Supply Base. Impacts were identified via the engagement that took place during the fieldwork period, from the documentation available, as well as analysis of the project plan and GIS data.

15.5.1 Impact 1: Employment Creation

This impact relates to the creation of both direct and indirect employment opportunities that will be created by the construction and operation of the Supply Base. For this study direct employment refers to those jobs engaged directly by the port or the industrial estate. Indirect jobs are those created in third-party organisations as a result of new opportunities in the Supply Base e.g., an existing bus company employs extra drivers to take port employees to work.

The issue that many people raised during interviews was whether the project would create jobs for people living in the local area. Villagers are keen to find a job with the project, particularly for their youth. The baseline investigation has shown that villagers within the study area have a high level of literacy; however, skills relate predominantly to subsistence farming.

Individuals trained in the various construction vocations (masonry, electrician, carpentry, etc. will have job opportunities during the construction period. Once the construction of the Suai Supply Base is completed, a large part of these positions will disappear and the individuals will then need to seek continued employment elsewhere. While construction job opportunities are temporary, the construction program spans a period of 20 years.

The jobs associated with the operation of the Supply Base can be grouped into skilled, medium skilled, low skilled and unskilled, as shown in Table 15-16.



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Table 15-16 Job categories

Skilled	Medium Skilled	Low Skilled	Unskilled
Engineers	Technical specialists	Drivers	Security
Economists	Supervisors		Cleaners
Accountants			

An exact breakdown of the percentage of skilled, medium skilled, low skilled and unskilled jobs is not currently known; however, based on experience elsewhere, it is estimated that construction phase jobs will have higher percentages of unskilled and low-skilled positions. It is expected that skilled and medium-skilled jobs (grades 3, 4, 5 and 6) will comprise of both Timor-Leste nationals and expatriates, whereas low-skilled and unskilled labour (grade s7 and 8) will be filled by the local population.

Baseline findings have revealed there are few local businesses. Nonetheless around 1,000 indirect or support job opportunities could be created during the construction phase (EastLog, 2011). These indirect job opportunities could be sub-contracted to local suppliers if they are available. This refers to accommodation, cleaning contracts, security services, canteen catering services, maintenance of equipment, recreation, transportation and other services to support the migrant workers to the Suai region.

Another challenge facing the project will be to decide on a fair mechanism for allocating jobs to local people in order to reduce the potential for conflict over employment. Currently, defining who is 'local' is relatively simple due to the limited influx of people experienced in the Suai study area to date. However, as soon as more project information and timeframes are communicated to the public, substantial numbers of people can be expected to migrate into the area.

Impact Statement

The construction and operation of the Suai Supply Base will increase job opportunities at a local level as well as district and national levels in the long term (~50 years). It is expected that skilled and medium-skilled jobs will comprise both nationals and expatriates, especially during the short- and medium-term, whereas low-skilled and unskilled labour will be filled from the local population.

15.5.2 Impact 2: Skills Development

The local population who receive training and employment will be acquiring new experience and skills that will improve their capacity to secure similar roles elsewhere in the future.

In the three to six months prior to commissioning of the Suai Supply Base, a training centre will be constructed at Suai (EastLog, 2011). The centre will focus on validating the vocational skills of Suai employees and providing oil and gas standard supplementary training for several trades such as crane and forklift operators, truck drivers, mechanics, maintenance personnel, riggers, security staff, etc. (EastLog, 2011).



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Government (through SEFOPE) in cooperation with the ADB are planning to commence medium-level skills training in 2012. The medium-level skills training will be provided in the areas of mechanics, masonry, plumbing, carpentry, electrical, among others and trainees will receive certification. The plan is to have four training centres in Tibar, Becora (Senai), Dom Bosco and Fatumaka. Based on the information available, the training will take two to four years to produce skilled individuals in line with international standards.

Impact Statement

Assuming the mitigation measures for employment are implemented, the creation of new jobs in the Suai region for the oil and gas industry is expected to upgrade the skills of the local villagers, increase the purchasing power of the Timorese nationals and boost the local economy. This skilled workforce could then become available to other industries or petroleum companies currently experiencing a shortage of skilled labour in these areas.

15.5.3 Impact 3: Creation of Economic Opportunities

This impact relates to economic opportunities from capital expenditure, indirect business opportunities and, payment of royalties and taxes.

The local procurement benefit of the Supply Base in Timor-Leste is considered to be marginal, if left unmitigated. This is as a result of a high leakage of service and material cost to other parts of Timor-Leste and internationally and the limited time available before construction of the first stage of the Supply Base commences to allow implementation of mitigation measures such as enterprise development.

There will be opportunities for local businesses and traders to become suppliers of material for projects in Nova Suai; however, new residents of Nova Suai will have higher disposable incomes and will require support services, many of which could be supplied by local businesses with relative ease e.g. provision of raw materials, transport, catering and cleaning (RDTL, 2011a).

The Suai SIA (EastLog, 2011).states there will be regular LCT and barge sailing between Lamongan Shorebase (Indonesia) and the Supply Base construction site during construction. With the assistance of the GoTL and the Province of East Java, the Suai Supply Base could act as a catalyst for the creation of greater Timor-Leste – East Java trade links.

From a cumulative impact perspective, it should be noted that business training and skills development is being done by government and other stakeholders, in addition to the Tasi Mane Project-specific plans. As indicated in the SDP, business development centres have been established in Baucau, Dili, Maliana, Maubisse, Suai, Lospalos and Oe-Cusse Ambeno by the Instituto de Apoio ao Desenvolvimento Empresarial (IADE). These centres provide training on how to identify and start a business, improve a business and expand a business. The project will liaise with these business development centres, not only in Suai, and link training modules to project specific business opportunities.



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Details regarding tax and royalty payments associated with the Supply Base are not currently available; however, it is reasonable to assume that taxes paid during construction and operation will increase revenue to the Timor-Leste government.

Impact Statement

The revenue generated from royalties and taxes, if managed transparently, will flow to the district levels and promote socio-economic growth and infrastructure development in these areas. The Supply Base will increase the opportunities for national businesses during construction and operational phase, however local businesses will require assistance to make use of these opportunities and there is limited time available to provide assistance before the construction phase is scheduled to commence. Some local procurement opportunities will be initiated for local businesses and may result in entrepreneurs and other small businesses to develop.

15.5.4 Impact 4: Physical Displacement

This impact involves the loss of scattered dwelling structures in the Supply Base footprint areas.

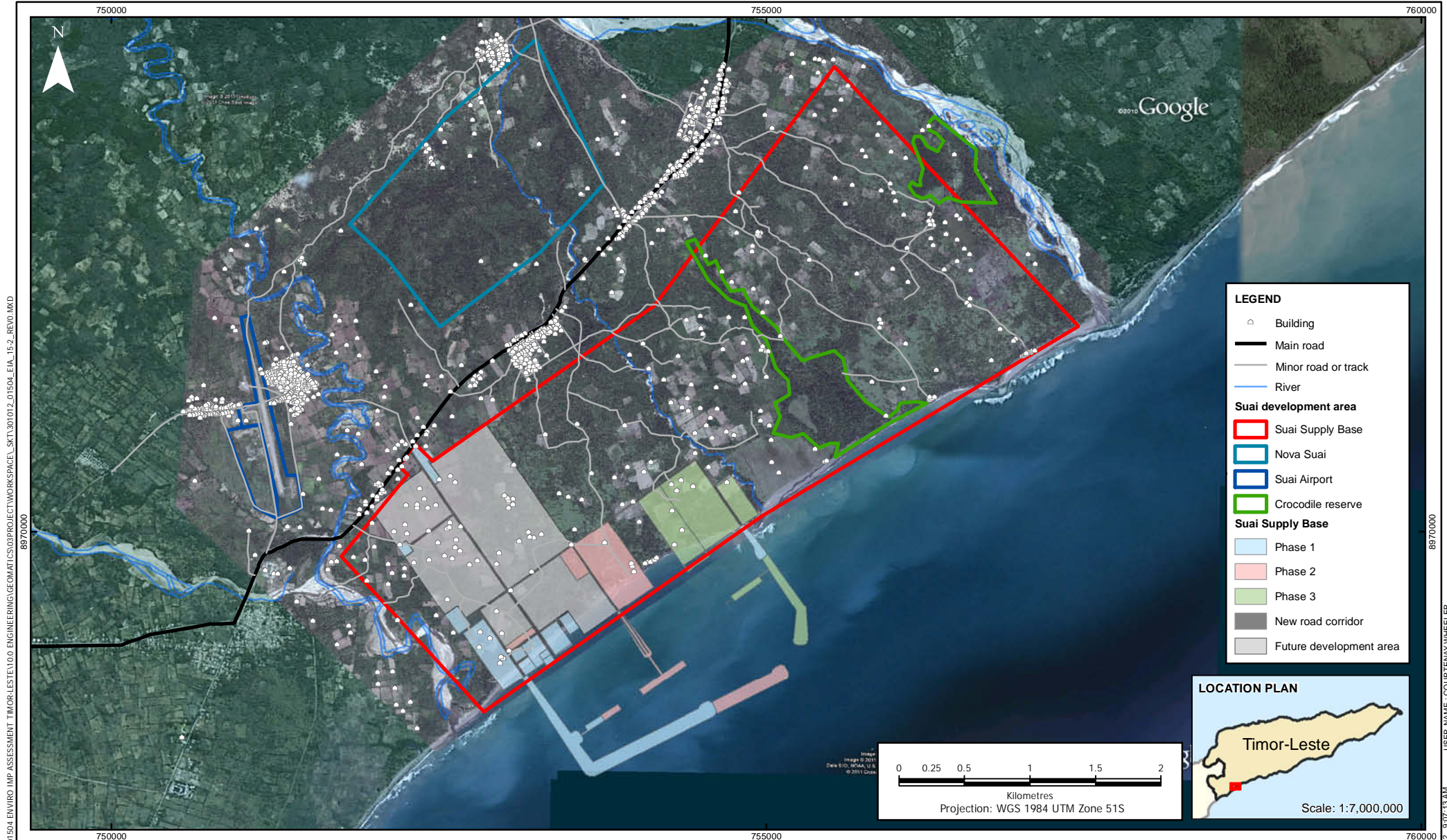
Based on an analysis of aerial imagery, approximately 62 structures would be affected within the Supply Base development areas (refer to Figure 15-2). Surveys undertaken by SERN indicate that these structures are temporary farm dwellings related to the establishment of rice and corn crops i.e. they are used for a few months then abandoned. These dwellings do not have official village status; however, fall under the administration of the villages in the Suai study area. These households stand to lose their physical, social and / or economic assets as a result of the Supply Base construction.

Table 15-17 shows the current land use in the respective footprint areas for the Suai Supply Base, however the analysis is based on aerial imagery (2010) and should therefore be verified by undertaking detailed asset and field surveys (refer to mitigation measures).

Table 15-17 Current land use in Suai footprint areas

Infrastructure	Current Land Use*
Supply base area (including industrial estate)	The area proposed for offices and logistics – many fields and few scattered dwelling structures Platform building site – mostly natural vegetation and some fields
Nova Suai	Combination of natural vegetation and some fields
Suai Airport	Possible physical relocation of some households and few fields around existing airstrip
Crocodile reserves	Mostly natural vegetation with small patch of land being cleared

* Analysis for land use is based on 2010 Google imagery and the land capability in terms of agriculture is from Cova Lima District and Suai Town Spatial Design Planning (República Democrática de Timor-Leste Ministry of Finance, 2011a).



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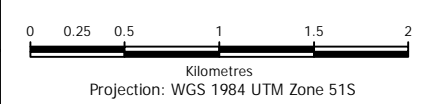
- Building
- Main road
- Minor road or track
- River

Suai development area

- ▭ Suai Supply Base
- ▭ Nova Suai
- ▭ Suai Airport
- ▭ Crocodile reserve

Suai Supply Base

- ▭ Phase 1
- ▭ Phase 2
- ▭ Phase 3
- ▭ New road corridor
- ▭ Future development area



NOTES:
 This map contains:
 1. Imagery: DigitalGlobe (2008-2011)
 2. Imagery: Google Earth (2010)
 3. Rivers: Geographic Information Group Timor-Leste (2010)
 4. Roads: DivaGIS (2010)
 5. Buildings: WorleyParsons (2012)

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resources & energy		TIMOR GAS & PETROLEO		REPUBLICA DEMOCRATICA DE TIMOR-LESTE SECRETARIA DE ESTADO DOS RECURSOS NATURAIS				Copyright © WorleyParsons Services Pty Ltd		

TASI MANE PROJECT - SUAI SUPPLY BASE ENVIRONMENTAL IMPACT ASSESSMENT

Figure 15-2
 Buildings, roads and tracks within the Suai development area

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Impact Statement

Only a few scattered dwellings are located within the areas to be disturbed by Supply Base infrastructure. Impacts associated with economic displacement (impacts 5 and 6) will have higher significance for the Supply Base than physical displacement. Nonetheless, the relocation of dwellings within the Supply Base area will be an involuntary resettlement process and, as such, needs to be treated carefully and openly to reduce the risk of conflict. If not properly managed it has the potential to result in economically disadvantaged individuals and families, and heighten the risk of civil unrest. Furthermore, awareness and understanding of one's legal rights in terms of land tenure and compensation requirements is a critical issue in resettlement. The households that require resettlement need to understand their legal rights prior to any resettlement. Although the structures identified may be abandoned within a few months, all houses are recorded by SERN and the owners compensated if they are affected by project-related works.

15.5.5 Impact 5: Loss of Land, Crops and Natural Resources Including Fishing and Potable Water

This impact relates to a loss of land affecting customary landowners, and resources such as crops and natural resources (including fishing and potable water) on the land. The latter affects land users, who may or may not be the same persons as the customary landowners.

The area occupied by the Suai project is approximately 650 ha. Officially, all land belongs to the government although there are reports of disputes relating to such issues. At a local level, land is controlled by families in the villages in the study area. In other countries, the desire to participate in compensation related to the development of a large project can result in a build-up of tension between individuals or villages where there is unclear land ownership boundaries either between or within villages. However, since landownership is not always documented or registered, it is difficult to determine the rightful landowners. In March 2010, the Council of Ministers approved three laws about land: the Land Law, the Real Estate Financing Fund and the Expropriation Law. These draft laws are currently before Parliament, awaiting discussion. However in November 2011, the process of measuring land under the Ita Nia Rai Project (INR - 'Our Land') had already measured 50,584 parcels and declared 54,509 in towns in all 13 districts. Of these 50,584 parcels, 10.3% were disputed and 89.7% had no dispute (Hamutuk, 2012a).

It was reported during the fieldwork that there is no proper land registry, no recording or verification of land transactions and no framework to determine competing claims to land. Thorough checks made during the planning stage to ensure that potential claims are settled amicably will be an important aspect of future work. Landownership is also a complex issue in Timor-Leste due to internal displacement during the Indonesian occupation which resulted in many layers of landownership e.g. the landowner is not necessarily the same person as the land user (Hamutuk 2011). Thus, identifying the rightful person eligible for compensation will have to be carefully investigated to avoid any conflicts or tensions arising. The village mostly affected in this regard is Camanasa.



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As far as land use is concerned, the land is currently utilised primarily for agricultural activities (fields and grazing) and natural resources, as shown in Table 15-17 (under impact 4). Figure 15-3 shows that approximately 315 ha of land within the Suai development areas is either cultivated land or plantation. As a consequence, there will be a loss of resources for those communities currently residing on the land and/or making use of the resources found on it.

The loss of this area of land (and the resources on it) will place greater demand and pressure on other agricultural land and natural resources. Some interviewees reported that there is an abundance of vacant agricultural land and natural resources available in the broader project area with the exception of palm leaves for thatching. Respondents from Camanasa; however, expressed their concern that most of their rice paddies are located within the proposed Supply Base area as well as most of the natural resources they need.

Table 15-18 shows the land capability within the Supply Base footprint areas. It shows that the areas to be used for the Supply Base area and Suai Airport infrastructure have relatively high agricultural potential, whereas Nova Suai is less suitable for agriculture. Overall, construction of the Supply Base will impact on land with high pastoral and industrial capability.

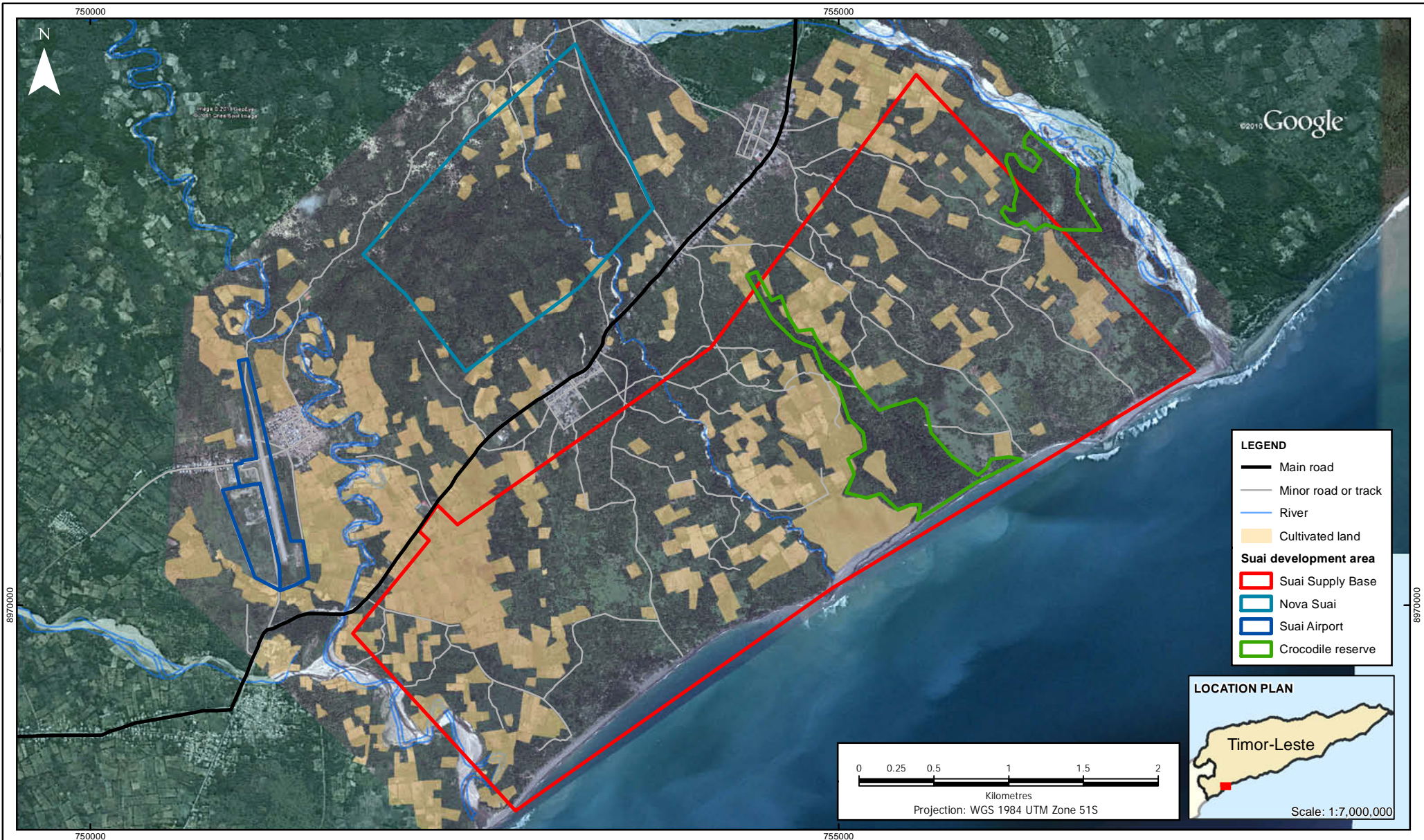
Table 15-18 Land capability within the footprint areas

Infrastructure	Land capability
Supply base area (including industrial estate)	Rice – 37% moderately suitable, 53% marginally suitable and 10% unsuitable. Horticulture - 64% moderately suitable, 11% marginally suitable and 25% unsuitable. Pasture - 74% suitable and 26% unsuitable Industrial – 74% suitable and 26% unsuitable
Nova Suai	Rice – 11% moderately suitable and 89% unsuitable. Horticulture - 29% moderately suitable, 71% marginally suitable. Pasture - 100% suitable Industrial – 100% suitable
Suai Airport	Rice – 100% marginally suitable Horticulture - 100% marginally suitable Pasture – 100% suitable Industrial – 100% suitable

Source: Cova Lima District and Suai Town Spatial Design Planning (RD TL, 2011a).

Farmers’ vulnerability to loss of arable land should also be understood in terms of the existing challenges they face. These include inadequate irrigation systems, climate change, rodent infestation, inadequate selling prices, a lack of machinery or technical knowledge, and the slow response by government to the priorities farmers have identified (Hamutuk 2011).

With respect to fishing, the construction of the Supply Base (phases 1 to 3) will result in approximately 2.4 km coastline becoming inaccessible to the villagers. This will affect onshore fishermen (fishing from the shore) and offshore fishermen (using boats); however, the impact on offshore fishermen will depend on many factors including:



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NOTES:

This map contains:

1. Imagery: DigitalGlobe (2008-2011)
2. Imagery: Google Earth (2010)
3. Rivers: Geographic Information Group TimorLeste (2010)
4. Roads: DivaGIS (2010)
5. Cultivated land: WorleyParsons (2010)

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REV	DATE	REVISION DESCRIPTION	DRN	CHK	DES	ENG	APPD	CUST	PROJECT No: 301012-001504	

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Figure 15-3
Cultivated land within the Suai development area

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ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

- The area to be dredged;
- The area required for the dredge spoil dump;
- The existing value of the marine resources in the areas affected;
- The exclusion zone associated with the new shipping traffic; and
- The target species for local fisherman.

At the time of writing, these details were not known and the full extent of the impact could not be determined.

A RO plant is proposed to provide the necessary process and potable water. The water will be sourced from the sea or from a deep well (EastLog, 2011), and will therefore not directly impact on village water sources in the study area. The fact that there will be additional water users (outside employees and jobseekers) in the area will increase water demands in the Suai study area; however, interviewees reported there is an abundance of water sources within the Suai study area due to the shallowness of the water table making it relatively easy to dig wells. Thus, it is safe to assume with the information available that the overall impact on village water sources will not be very high.

Discharge from the RO plant will increase in salinity in water which may have adverse impacts on fish stocks by affecting biological processes such as breeding and growth (This is discussed in more detail in the marine assessment). On the other hand, Phase 3 of the project will include a new eastern breakwater and the development of a terminal to serve the fishing industry, including a container terminal, container yard, passenger jetty, and associated land-based facilities. These fishing facilities will support development of the fishing industry in Timor-Leste; however, careful planning and consultation with local fishermen can help to avoid adverse impacts on existing local fishing activities.

Impact Statement

Landownership is a very sensitive issue in Timor-Leste and the Suai study area and could easily result in conflict if not dealt with sensitively. Local villages in and around the Suai Supply Base are reliant on arable land and natural resources (wood for fuel, building materials, medicinal plants, food, fishing, water, etc.). The loss of land to the Supply Base will result in the loss of agricultural land and natural resources found in and on the land. If not properly managed (refer to mitigation measures), the loss of arable land will place farmers in a highly vulnerable position bearing in mind the strong reliance on subsistence farming for food security and the various other challenges faced by farmers.

15.5.6 Impact 6: Loss of Commercial Trees

The exact number of trees within the Supply Base footprint areas was not yet recorded at the time of writing. However, based on an analysis of aerial imagery, the number of trees in the footprint areas is expected to be substantial, most important being tic and coconut trees (refer to Figure 15-3). Identifying who the rightful owners of trees are will have to be done carefully due to the various layers of ownership, as explained under impact 5.



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Impact Statement

The loss of trees is a very severe impact due to the difficulty of mitigating this impact. That is, it is not possible to provide mature replacement trees and replacement seedlings / saplings will take some years to reach maturity. The impact of the resultant loss of a food source and income stream will vary from family to family, and will need to be adequately addressed through compensation or some other offset.

15.5.7 Impact 7: Disturbance and / or Loss of Access to Sacred Sites and Scattered Graves

According to interviewees, cemeteries are located in the villages and will not be affected by the Supply Base construction. There is; however, one cemetery that was recorded within the development area although whether this cemetery will have to be relocated has not yet been determined. There may also be some scattered graves located within the Supply Base footprint areas. Only scattered graves located in the areas to be disturbed due to construction activities will be relocated. The relocation of the affected graves will require the exhumation of the human remains and reintering them elsewhere.

Interviewees indicated that there are four sacred sites within the Supply Base area, namely a sacred forest, a large tree and two streams inside a forest. The sacred forest is very close to the Supply Base and has been surveyed by SERN who told the community they intend to fence the sacred forest to avoid any disturbance (refer to mitigation measures). Despite interviewees reporting that some of the sacred sites could be 'relocated' if the appropriate rituals are performed, the impact remains very sensitive. For example, should the villagers experience any misfortune in future such as floods or droughts, they may very well ascribe the misfortune to the project causing harm to the sacred sites.

Furthermore, it should be noted that Suai Loro and Camanasa have very important cultural and historic significance, not only for the Tetum Terik speaking people but the whole country. The most significant 'sacred houses' (refer to baseline description) are found in Suai Loro. However, since these two villages will not have to be resettled, no sacred houses are likely to be directly affected by the Supply Base development.

Impact Statement

Due to the nature of the impact and the potential sensitivity related to the disturbance of culturally significant sites such as sacred sites and isolated graves, it is expected that the potential impacts are high need to be managed carefully to avoid community unrest.

15.5.8 Impact 8: Reduced Mobility due to Loss of Road Network Inter-linking Grazing Areas, Water Sources

For safety and security reasons, certain infrastructure areas within the Supply Base will be fenced off. Fencing of these areas has the potential to disturb people's normal travel habits, bearing in mind the size of the development areas (refer to Figure 15-2). The fencing of the infrastructure areas may



ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

result in villagers having to travel longer distances to reach their fields, water sources or business centres in the area. At the time of writing, the areas to be fenced off, the number of people that traverse the area or the changes arising from relocations were not known, thus the full extent of this impact could not be accurately assessed.

Impact Statement

Bearing in mind the size of the development areas and the fact that most people rely on walking as a means of transport, this could be a severe long-term impact which is also difficult to mitigate.

15.5.9 Impact 9: Population Influx

As with many large developments in developing countries it can be expected that there will be an influx of people into the area seeking employment or taking advantage of the economic growth during construction and operations. Currently, people living in the Supply Base study area live in close-knit homogenous villages belonging to the same cultural group.

During the construction phase, the number of people living in and around the Supply Base area might increase and due to the lack of cross-cultural interaction experienced by the villages, they will be vulnerable to some of the changes / impacts. These might include:

- Conflicts over jobs;
- Conflicts over access to resources – social infrastructure, housing, etc;
- Increased pressure on housing and social facilities;
- Overcrowding and associated health impacts (see health impact);
- Increased prices for goods and services;
- Increase in community health risks;
- Increase in social pathologies such as crime, prostitution, drugs abuse and alcoholism due to increased amounts of cash circulating in the study area;
- A sense of loss due to the changes taking place; and
- Increased business opportunities.

From a positive perspective, Suai will become known as a hub of activity and economic opportunity. This may inject a new level of energy into local communities who may be inspired to find ways to adapt to, and benefit from, the host of activities and opportunities associated with the Supply Base. Already, the baseline study identified the desire amongst many respondents, in particular the youth, to move away from current subsistence and rural lifestyles to a more economically engaged and active lifestyle. For these individuals, the change in the sense of place and identity will be welcomed.



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Impact Statement

The project will result in an influx of people into the Suai study area. Unless addressed, this will put a strain on socio-economic infrastructure and may erode some community values, amongst other things. The community may be vulnerable to this impact bearing in mind the currently homogenous nature of the village population. On the other hand, the influx of people will also bring positive changes such as business development opportunities, a retention of youth due to increased employment opportunities, increased skills through training and improved services.

15.5.10 Impact 10: Increased Pressure on Government to Deliver on Infrastructure, Service and Administrative Demands set by the Project

The Timor-Leste Government is in the process of implementing the National SDP (RDTL, Undated). The SDP highlights several challenges faced by government in terms of social capital and infrastructure development. EastLog Holding Pte Ltd (2011) also acknowledges that employment levels in Cova Lima district are low and that infrastructure is weak coupled with difficulties in transport and communications between Dili and Suai. A project of the magnitude of the Supply Base requires a lot of infrastructure to support it e.g. roads, electricity, and health and education facilities to accommodate newcomers. The provision of this infrastructure will be required in the short / medium term for the Supply Base and will therefore, place a lot of pressure on government, especially given the current state or absence of this type of infrastructure.

The National Spatial Plan states that Nova Suai will be a separate entity to the existing Suai town. The new town will be managed by the Timor-Leste government and will be linked with the existing regulations and institutions at the national level. However, Nova Suai is likely to have unique management issues, particularly for the maintenance and management of the public infrastructure and facilities. Any special arrangements within Nova Suai may result in duplicated bureaucracy that could hamper the unity of the country. The National Spatial Plan therefore suggests that, while the dedicated structure for the management is proposed to be under SERN, it also has to be further analysed and adjusted with the Decree Law 1/2011 on Ministry of Infrastructure (RDTL, 2011c).

Currently there is little government administrative capacity at district level. The challenge is going to be for the local administration to manage the project impacts and additional demand on services and facilities such as health, education, sanitation, roads, housing, etc. due to general population growth in the villages and not Nova Suai *per se*. With little administrative capacity in place, the tendency for similar projects in developing countries elsewhere is for the proponent to take over the responsibility of the local authority, resulting in the development of infrastructure focused primarily on the needs of the project. Depending on the timing of the project and the implementation of the SDP, there could be substantial pressure placed on the national and district administration without adequate capacity to manage the expectations. This impact will be substantially higher for the Supply Base compared to the Beaco and Betano developments due to the limited time that is available before the first stage of construction.



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Impact Statement

The number of infrastructure projects proposed to be undertaken by government prior to construction of the Supply Base will be a challenge given the current timeframes without further investment. As a result of limited government resources and the construction schedule, this will place significant pressure on the current national and district administration in the short to medium term.

15.5.11 Impact 11: Community Health and Safety

With a project of this magnitude it is recommended to involve health assessment experts to assess the need for a full Health Impact Assessment. The following list shows the potential adverse health impacts that – without management or mitigation measures – could arise due to the Supply Base development:

- Increase in the level of respiratory ailments such as tuberculosis as a result of influx of people into the area, overcrowding in settlements and poorly ventilated houses;
- Increase in the level of respiratory ailments due to increased dust caused by construction activities and to a lesser extent operation phase activities (refer to the air quality assessment for more detail);
- Increase in vector-related ailments such as malaria due to increase in population density;
- Increase in sexually transmitted infections such as the human immunodeficiency virus due to population influx;
- Increase in lifestyle risk such as alcoholism, drugs, gender and domestic violence due to increased disposable incomes;
- Increase in communicable disease such as cholera due to the rapid change in the social and physical environment; and
- Increased pressure on health services infrastructure.

As far as safety is concerned, during the construction of the Supply Base, there will be increased traffic (mostly trucks and four-wheel drives) on access roads, on many occasions 24 hours a day. The local community is not used to such heavy traffic. Vehicular traffic will also increase on the main access roads during operation. As many of these are in proximity to local villages, this will increase the risk of accidents. As traffic at the major crossroads increases, there will be a need for more sophisticated traffic management measures (i.e., traffic lights, pedestrian crossings and roundabouts on approaches to villages/towns). On many of the roads in the Supply Base area, night time travel is not safe. Also, increased night traffic will bring noise pollution in the vicinity of major transport routes. The increase in traffic will be determined by the extent and rate of development of the general industry around Suai. This is discussed in more detail in Chapter 16 (Land Transport).

There are a number of scattered dwellings in close proximity to the airstrip. It is currently not known whether these dwellings will be resettled. However, should these households remain in the same area; they may be exposed to high noise levels and vibration damages (e.g., cracks in brick or



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concrete structures) for short durations of time. The noise assessment in Chapter 10 provides more detail in this regard.

Impact Statement

Unless specifically addressed, it is likely that the construction and operation of the Supply Base may affect the health and safety of the villages in the Supply Base study area. Health-related issues like pollution (water and air), vector-related diseases and sexually transmitted infections and safety-related issues (due to increased traffic) are expected to rise among the villages in and around the Supply Base and along transport routes.

15.5.12 Impact 12: Improvement of Basic Services and Infrastructure

As explained in Section 15.1 extensive public sector investment will establish a logistics base for the petroleum sector in Suai. As a result of the construction of the project facilities, social infrastructure in the local area will also be upgraded. The following impacts are associated with infrastructure associated with the Supply Base:

Road infrastructure: The highway construction will affect the communities in the area. It should be noted; however, that a separate EIA was undertaken for this road and the highway-specific impacts (such as physical and economic displacement, improved accessibility of the area, employment opportunities during construction phase, etc.) should be viewed from a cumulative impact perspective. For the purpose of this EIA it should be noted that accessibility to the project area will be improved as a result of that initiative and not the Tasi Mane Project alone.

Over and above the highway construction, several existing roads will be upgraded and new roads will connect project infrastructure sites and improve overall accessibility to the study area.

Fuel Storage Tank Farm: Bringing in large volumes of fuel by barge will reduce the fuel cost of the construction of the Supply Base. This may also benefit the local community and local consumers by means of lower fuel prices.

Energy Infrastructure: The impacts associated with the National Electricity Project, e.g. physical and economic displacement, employment creation etc. do not fall within this EIA's scope. It is expected that the villages in the project area will have improved access to electricity; however, it is not expected to be directly associated with the Tasi Mane Project *per se* (cumulative impact).

Rehabilitation of Suai Airport: Even though the rehabilitation of the airport will not directly affect most of the local population, it will make the area more accessible to outside investment and tourism which may provide economic opportunities to local villagers.

Multi-purpose Sea Port at Camenasa: The port infrastructure and facilities will reportedly be available for use by other businesses in the southern region (fuel storage, commercial cargo, Ro-Ro LCT ramp, etc.) and this could potentially act as a catalyst for general economic activity in the Suai study area and the southern coast of Timor-Leste as a whole.



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Nova Suai Infrastructure: The construction of Nova Suai will include the development of various facilities and services, as explained in Chapter 1. The extent to which local villagers will be allowed to make use of the new facilities and services in Nova Suai is not currently known; however, with the information available it appears as if it will primarily (or exclusively) be for use by the project employees and contractors.

Community Centre: As part of the Supply Base development a community centre will be constructed. The following facilities and services will be provided at the centre (EastLog, 2011b):

- Soccer field
- Multi-purpose hall
- Badminton / basketball Court
- Internet room
- Training and conference facilities.

Other community infrastructure developments could be part of community investment programs implemented during the operation phase such as the improvement or provision of new health centres, education facilities, waste management infrastructure, sports facilities and roads.

Impact Statement

The project could have a long-term beneficial impact on the communities around the Supply Base in terms of social infrastructure development. Infrastructures such as roads, seaport, water and electricity are expected to enhance socio-economic development in the area, through job creation and increase in commercial activities. Training and conference facilities will enhance education and training opportunities in the study area.

15.5.13 Impact 13: The Construction and Operation of the Supply Base Triggering Conflict

Timor-Leste has faced many conflicts in the past, from the Portuguese colonial period to the more recent decades-long independence struggle against Indonesia. Despite the local environment being free of armed conflicts over the past few years it is reasonable to suggest that it could re-emerge if a sufficiently strong sequence of events occurred.

One potential cause of conflict may be jealousy due to inequitable compensation payments or the disparity in living conditions between existing residents and newcomers. Nova Suai is intended to house people employed in the development of the Supply Base. Most of these people will be expatriates due to the current lack of suitable skills in the area. The estimated 6,000 residents in Nova Suai will be housed in much better conditions than the villagers in the study area, have access to modern facilities (as discussed under impact 12) and they will receive higher incomes.

Additional trigger points for conflicts around the project site include the following:



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- Loss of land and livelihood resources;
- Resettlement and compensation;
- Removal of graves;
- Access to jobs and other economic opportunities;
- Weak government and inability of local authorities to maintain control;
- Lack of royalty flows to the local administration;
- Inflation and food security;
- Influx of people;
- Lack of community development;
- Safety and health hazard; and
- Poor treatment of community by security personnel.

Impact statement

The construction and operation of the Supply Base could trigger community resentment and conflict in a fragile environment such as Timor-Leste. These conflicts may arise due to a variety of reasons e.g. jealousy, inequitable compensation, unrealistic expectations, tribal and ethnic tensions, etc.

15.5.14 Impact 14: The Supply Base Development Exacerbating Gender Equality Issues in the Study Area

The Constitution of Timor-Leste supports freedom from sex-based discrimination. Timor-Leste has been a signatory to the Committee on the Elimination of Discrimination against Women (CEDAW) since 2003 and while the 2009 CEDAW report demonstrated progress, there remain significant issues that require government intervention to ameliorate discrimination against women. The 2009 NGO Report to CEDAW (titled Alternative Working Group) states that while the constitution guarantees women's rights and equality, there are nine crucial areas requiring government action in terms of legislation, practices and service delivery if discrimination is to be eliminated.

Although Timor-Leste has made significant progress in relation to women's rights since independence (2002), a United States Agency for International Development (USAID) study indicates that several factors are negatively affecting further advances – including a conservative backlash that seeks to return women to their former domestic roles. The gender division of labour at the community level is relatively rigid, and women's low level of literacy and education are often cited as reasons for excluding them from community processes (Social Institutions and Gender Index, 2011). Timor-Leste has no legal restrictions on women's rights; it is rather traditions and customary laws that constrain the ability of women to attain social equality. 2010 Census has revealed that there is no significant difference in literacy levels for girls and boys which may reflect a change in attitude in recent times.



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Government regulation (gender quotas) will require a minimum of 30% female employment at the project and at managerial level, the requirement may even be higher. This requirement can result in tension at both a workforce level and at a community/village level. At a workforce level, local men may find it difficult to work alongside female employees or to receive instructions from a female supervisor / manager due to the traditional and customary background. At a village level, men may resent women who find employment with the project, in particular if the head of household is unemployed or performs tasks of lower status than female members of the family such as subsistent farming.

Impact statement

Economic opportunities brought about by the Suai development may exacerbate gender equity issues. These issues may be experienced within the workforce and at a community / village level.

15.6 Avoidance, Management and Mitigation Measures

A key objective of an EIA (and more specifically the socio-economic component of the EIA) is to identify means of avoiding adverse impacts to the socio-economic environment by protecting humans and the things they value.

In the first instance, adverse impacts are avoided based on the technical and economic feasibility of changes to the design of the project. Where avoidance is not feasible, minimisation of impacts is achieved through mitigation measures. Mitigation measures aim to remedy or compensate for the negative impacts and to create or enhance socio-economic benefits.

15.6.1 Mitigation 1: Employment

The following mitigation measures are designed to optimise the positive impact of the Suai Supply Base with regards to job creation at a local level during the construction and operational phases of the project. The starting point of this process is a determination of the skills available in the local community matched against the needs of the project.

This will require the project to develop a workforce profile and undertake a skills audit to identify local capacity against the workforce profile. This will lead to the identification of the relevant training programs to optimise local employment. The following training suggestion were provided in the report by EastLog Holding Pte Ltd (2011).

- For the build-up to operation phase:
 - 30 (3 for each managerial position) management trainees (18 – 24 months prior to operations)
 - 120 – 150 vocational trainees (3 – 6 months vocational and supply base specific training);
- Based on the training programs identified via the skills audit, implement a Skills Development Plan for Suai Supply Base and ensure the training centre at Suai is constructed in a timeframe which delivers substantial numbers of relevantly trained people;



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- Provide guidelines for contractors that enhance local jobs;
- Design an appropriate recruitment strategy that focuses on local villages whilst avoiding any patronage with selected groups that could result in conflict;
- Implement a social investment initiative that provides technical bursaries for local children and education programs for school children developing an awareness of the local employment opportunities at the Supply Base and enhances future potential for local employment through appropriate skills development;
- Integrate the demobilization of construction personnel with the mobilisation of the operations team to minimize impact on ancillary services provided by the local community (e.g. accommodation, supplies, etc.); and
- Implement the measures outlined in the SDP, which include improving access to education, ensure sufficient number of classrooms in project areas, refurbishing existing schools and implement quality teacher training programs. The implementation of these measures will not have an immediate effect on local employment; however, considering the timeframes for the Tasi Mane project (estimated at 50+ years), implementing these measures now would result in a brighter future for the youth.

Mitigation Measures for Conflict Over Jobs

Measures designed to reduce the potential for conflict over accessibility of jobs at the local level will include:

- Develop a localisation policy which will ensure local residents are prioritised with regards to employment opportunities;
- Develop training mechanisms that will focus on increasing and improving local capacity;
- Develop systems to ensure that local residents are able to access certain categories of jobs;
- Establish a system for local procurement that has a suitable definition of 'local' that all stakeholders agree to. The system must be transparent and not open to abuse. The manner in which people are selected must be fair and trusted;
- Develop a dispute resolution mechanism that caters for dispute of employment (see grievance mechanism);
- Develop a mechanism that aligns human resource policies to community development needs;
- Ensure that recruitment prevents, rather than promotes an influx of job seekers by having clear policies, guidelines and communication strategies which prevent confusion and reduces expectations. It should be noted that this type of mitigation may be difficult to achieve given Timor-Leste's current unemployment levels;
- Recognise and understand how political dynamics might create conflict over a scarce resource such as skilled labour;
- Avoid creating long-term patronage with one group at the expense of other groups; and



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- Training of local people to be able to secure a job at the Supply Base.

15.6.2 Mitigation 2: Skills Development

Mitigation measures to further enhance this positive impact will include:

- Prioritise the development and implementation of a skills development plan;
- Use a rigorous selection process for trainee candidates to ensure the right individuals are identified, with high levels of work ethics and commitment;
- Properly communicate to the candidates the selection process and make provision for candidates who struggle during the training to downgrade and still find a suitable position at a lower level; and
- Local vocational institutes will need to develop additional curriculum (or work with an external party to do so) to train students in the areas required at the Supply Base (e.g., riggers, welders, heavy equipment operators, mechanics, etc.).

15.6.3 Mitigation 3: Economic Opportunities

Mitigation measures designed to enhance the opportunities for development as a result of the royalties and taxes paid to the Timorese government include:

- Capacity building of the district authority to utilise the royalties efficiently; and
- Promote transparency of the taxes paid to the GoTL and how these are distributed to the various district governments.

Mitigation measures designed to enhance opportunities for local businesses include:

- Develop systems to enhance the potential of Timorese businesses to supply quality goods and services to the Supply Base, in so doing improve the positive impacts of the Supply Base development. This could be done through the identification of potential local contracting enterprise opportunities and to communicate these opportunities to existing local businesses. Also to identify where existing businesses have the required capacity and where existing businesses require further assistance; and
- Establish business linkage and programs that can strengthen networks and relationships between the private sectors, government, education institutions and firms of suppliers (as noted in the SDP and the SEFOPE and ADB partnership).

15.6.4 Mitigation 4: Involuntary Resettlement

To mitigate the impact of resettlement, the project should ensure proper systems for replacement and compensation for land are put in place. Mitigation measures will include:

- A Resettlement Action Plan (RAP) should be developed to address the involuntary relocation of all affected households and associated assets (impacts 4, 5, 6 and 7). Due to limited time available before the first stage of the Supply Base construction commences, it is unlikely that



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there will be enough time for the development and implementation of a full RAP. Furthermore, it is difficult to provide recommendations without more clarity on government's existing processes to deal with this impact. It is therefore suggested that government undertake a gap analysis of their current processes against these mitigation measures and take corrective actions if and where necessary. This RAP should outline the principles governing how the project will compensate households that require relocation through the project's resettlement and compensation process. The RAP should include the following components:

- Identification of project impacts and affected population (includes mapping, census, inventory of affected assets including dwellings, fields and trees, graves, sacred sites), consultation with affected people concerning assistance benefits and development opportunities.
- Develop a legal framework in accordance with Timor-Leste law.
- Develop a compensation and entitlement framework (including compensation packages, eligibility for assistance, responsibilities and schedule for compensation payments), which also reflects legal requirements.
- Resettlement assistance and livelihood restoration (influx management, relocation schedule and assistance, replacement of services and enterprises, livelihood restoration, treatment of cultural property, special assistance to vulnerable groups as identified in the baseline section).
- A selection process and preparation of the resettlement host site. Identify the most appropriate host site in consultation with the community and bear the following aspects in mind:
 - Proximity to existing residence.
 - Access to natural resources.
 - Maintaining village organisation and cohesion e.g. it might be better to relocate scattered dwellings within Supply Base footprint areas to Camenasa rather than Nova Suai.
 - Maintain access to existing economic activities or proximity to replacement agricultural land, and land ownership and tenure rights.
- Budget and implementation schedule.
- Organisational responsibilities.
- Consultation and participation throughout the resettlement process to ensure all directly affected parties clearly understand the compensation procedure to be followed.
- Grievance redress.
- Monitoring and evaluation; and



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- Attempt to reduce physical and economic displacement associated with Nova Suai through careful town planning. Based on current planning, government should be able to achieve this as the plan is to have a series of open spaces within Nova Suai residential area.

15.6.5 Mitigation 5: Loss of Land, Crops and Natural Resources Including Fishing and Potable Water

To mitigate these impacts, actions will include:

- Undertake thorough checks during the planning stage to ensure that potential land claims are settled amicably through the use of social surveys with affected landowners and liaison with government officials;
- Develop a RAP to address the loss of crops and natural resources for all affected households (refer to mitigation for impact 4);
- The project will be required to replace or compensate affected households for the loss of natural resources in line with the outcomes of a RAP;
- For the loss of agricultural fields, provide land-based compensation, i.e., replacement fields where possible and undertake soil, water and agricultural investigations and intervene via agricultural extension programs where necessary to ensure good agricultural yields similar to or better than before the resettlement;
- Implement the SDP strategy of offering subsidies, training and expert advice to farmers, and encouraging them to use appropriate fertilisers, high yielding varieties and pesticides to ensure that the expansion of the cash crops sector over the next 20 years contributes to Timor-Leste's goal of food security and creates jobs in rural areas. This strategy should target the farmers whose fields will be affected by the Supply Base construction as this will assist them in restoring their livelihoods at replacement fields. However, this initiative should also be targeted at all farmers in the Supply Base study area, as this will increase indirect economic opportunities by selling crops to newcomers;
- Ensure the replacement of fields is done in a timely manner, to ensure affected people have a prepared field available to replace the one affected by project-related activities;
- Once detailed design has confirmed the areas that will be dredged and no longer accessible to fishermen, identify ways to reduce impacts on fishing e.g., by providing controlled access to certain fishing sites (if feasible); and
- Consult with local fishermen in the planning of the fishery terminal to minimise impacts on their existing fishing activities and to optimise local opportunities generated by these facilities.

No mitigation measures are required for impact on community water resources.

15.6.6 Mitigation 6: Loss of Commercial Trees

Compensation for the loss of commercial trees should be both financial (such as cash or in-kind based on market value) and in-kind (the provision of saplings). The calculation of the replacement



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value for fruit or nut-bearing and tic trees could be based on formulae such as the following for productivity:

- Compensation = (V x D) + CP
- Where:
 - V: Average market value of the produce of one tree for one year.
 - D: Average period of time required to re-establish the tree to an adult production level in years.
 - CP: Cost of planting (soil preparation, initial fertilisation).

For replacement saplings:

- Saplings of the same species as the trees that will be lost where possible. Whether these saplings will be planted at a location of the owner's choice or whether a nursery will be developed needs to be discussed with tree owners;
- Transport for the saplings to the respective village; and
- An additional 20% of saplings to compensate for trees that may not reach maturity.

Other methods of compensation could also be viable.

15.6.7 Mitigation 7: Disturbance or Loss of Access to Sacred Sites or Graves

Mitigation measures designed to manage the impact on sacred sites and graves are:

- Disturbance to sacred sites will be avoided where possible and enclosed or fenced off and controlled access allowed. If disturbance to sacred sites is unavoidable, the project will consult with the affected parties to find culturally appropriate solutions e.g. compensation for village elders to perform the required traditional ceremonies for site 'relocation';
- Attempt to reduce impacts on sacred sites and graves through careful project planning. For example, the area in the middle of the Suai Supply Base has a spiritual significance to the local population. The establishment of the crocodile reserve at this location may result in the preservation of this site; and
- Graves located inside the Supply Base boundary and not in areas to be disturbed by surface infrastructure placement, will be enclosed or fenced off and controlled access will be allowed.

In order to manage this delicate process, a grave relocation procedure should be developed in close consultation with relevant stakeholders. This should include the following aspects:

- Registering of all affected individual graves;
- Making use of culturally significant and appropriate methods of exhumation and reintering of remains;



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- Provision of resources to assist people in the relocation process (such as a hearse); and
- Conduct the entire process in accordance with accepted local traditions and practices.

An archaeological (including grave) and heritage survey and impact assessment will also be considered if the extent of potential adverse impacts merits it.

15.6.8 Mitigation 8: Reduced Mobility due to Loss of Road Network Inter-linking Grazing Areas and Water Sources

Mitigation measures will include:

- Through consultation with the community, allow access points to reduce impacts caused by fencing of footprint areas; and
- Before the entire project footprint area is fenced off, alternate roads and paths will be established in consultation with the affected people to minimise the distance people need to travel around the fenced-off areas.

15.6.9 Mitigation 9: Population Influx

Mitigation measures designed to reduce the number of people into the area and the impact of population influx will include:

- Undertake a social mapping program at the earliest opportunity;
- Develop a local procurement program which gives priority to local residents;
- Development of an influx management plan together with relevant authorities and traditional authorities. This could include the following:
 - A recruitment strategy that favours local residents.
 - A settlement management plan for existing housing and market place.
 - Sponsor community crime prevention programs.
 - A health management plan.
 - A grievance mechanism for people who might have complaints about not having access to jobs and other economic benefits.
 - An audit of available social infrastructure and to assess the need to increase capacity to cater for any expected influx.

15.6.10 Mitigation 10: Increased Pressure on Government to Deliver on Infrastructure, Service and Administrative Demands Set by the Project

Mitigation measures designed to increase the capacity of the national and local administration include:



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- Assess opportunities for building capacity of the district administration;
- Develop training programs which are aimed at reducing the knowledge gaps in district administration; and
- Implementation of measures outlined in the SDP and prioritising the respective study areas, which include among others:
 - From 2011 to 2015 undertake an intensive road rehabilitation program.
 - Implement bridge construction program.
 - Scoping sewerage solutions as part of the district centres' master plan, e.g. increasing the number of houses with proper toilet facilities and building community managed toilet facilities for groups of households.
 - Timely completion of the National Electricity Grid currently under construction.
 - Align the 'Millennium Development Goals Village Program' with the predicted demands from the project.

15.6.11 Mitigation 11: Community Health and Safety

Mitigation measures are designed to reduce the impact on community health and safety, and potentially improve the health standard of the communities. These measures include:

- Development of an influx management plan (as discussed under mitigation 9);
- Implement the measures outlined in the SDP, which include among others, building health clinics, hospital upgrades and expansion, expanded and improved training capacity, improved health communications and improved ambulance / transport in the health sector;
- Facilitate education and awareness programs throughout the lifespan of the Supply Base;
- Design roads and implement driver training to improve traffic safety. More specifically, the main trunk roads between Dili and Suai, around the Suai region and along the Suai-Betano-Beaco corridor should be upgraded and provided with all-weather, 24 hr capability. The construction of the highway between Suai and Beaco will partially serve as mitigation for this impact in terms of road improvement however; the highway will also result in increased safety risk. The highway construction does not form part of this EIA scope. Wherever possible, main trunk roads where volumes of traffic are expected to grow, should bypass urban centres and be controlled by appropriate signage and traffic control structures such as traffic lights or roundabouts. Alternatively, any habitation should be setback from the road and adequate traffic management measures put in place; and
- Establish a secure buffer zone from activities posing safety risks to villages or scattered dwellings.



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15.6.12 Mitigation 12: Basic Services and Infrastructure

Enhancement of this positive impact can be achieved by maximising the employment opportunities derived from the infrastructure development. This will require a concerted effort to encourage local contracting and embed supporting procurement practices as well as the mitigation measures listed for Impact 10.

The development of a multi-stakeholder model for strategic planning and management of project-related infrastructure requirements will further enhance the infrastructure development benefits. This is particularly relevant for Nova Suai where significant new infrastructure is required. Adopting a multi-stakeholder model where Government and other suitable partners deliver and maintain new infrastructure to enable government to fulfil its obligations with respect to provision of municipal services in a timely manner.

15.6.13 Mitigation 13: The construction and operation of the Supply Base triggering localised conflict

To reduce the overall risks associated with this impact, government will review and implement, where feasible, six steps that have been developed by the Boston Consulting Group (2012) to help developing countries avoid the 'resource curse'. The six steps can be summarised as follows:

1. Progressive capacity building and knowledge sharing among all stakeholders
2. A shared understanding of the benefits, costs, risks, and responsibilities related to development
3. Collaborative processes for stakeholder engagement throughout the life cycle of the project. This includes implementing the stakeholder consultation recommendations outlined in Chapter 5 to ensure full and on-going disclosure of project information, to manage community expectations about the project and to enable stakeholders to voice their concerns
4. Transparent processes and arrangements, especially with respect to compensation measures for any physical and economic displacement
5. Commonly agreed upon compliance, monitoring, and enforcement of commitments
6. Effective dispute-resolution mechanisms (BCGR, 2012).

In addition to these six steps, government should ensure the focus for infrastructure development is not restricted only to Nova Suai. That is, ensuring that basic infrastructure for the broader Suai region is developed in order to improve quality of life of local people living in the area around the proposed Nova Suai.

15.6.14 Mitigation 14: The Supply Base Development Exacerbating Gender Equality Issues in the Study Area

The following mitigation measures apply:



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- Identify gender issues among the local population by facilitating discussions with men and women separately to ensure participants feel free to voice their opinions and concerns;
- Provide resources for gender sensitisation training for government staff, contractors and communities to gain support and acceptance of inclusion of women in all aspects of the Tasi Mane Project. There are existing training modules available as well as local NGOs (Rede Feto, Fokupers) with the capacity to deliver such training. Emphasis in the training should be on the benefits to be gained from inclusiveness; and
- Put in place enabling laws, such as anti-discrimination and domestic violence legislation, in order to consolidate and strengthen the gains made in the area of governance. (E.g., gender equality is guaranteed under the constitution and the Timor-Leste government is a signatory to the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and has adopted the Millennium Development Goals targets and indicators in national planning (PRD, 2005).

15.7 Residual Impacts

Given that complete mitigation of an impact cannot always be achieved, a residual impact of some form is the impact that is predicted to remain once mitigation measures have been implemented.

The specific residual impacts that will require on-going management attention are outlined in this section.

15.7.1 Residual Impact 1: Job Creation

The implementation of mitigation measures for job creation will only marginally change the impact rating significance during the first stage of the construction phase of the Supply Base. This is based on the limited time available for the local community and economy to adapt to the change and therefore take advantage of the available opportunities.

It is expected that the percentage of local employment will gradually increase during the latter construction phases (phases 2 and 3) as more time would have been available for local people to undergo training.

Initially, local employment during operation phase will be limited by the existing technical knowledge of the local workforce; however, the number of local employees will gradually increase if intensive training programs are successfully implemented.

15.7.2 Residual Impact 2: Skills Development

On-going implementation of the mitigation measures for skills development will further enhance local capacity and in turn, lift the overall capability of Timor-Leste as a nation.



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15.7.3 Residual Impact 3: Economic Opportunities

The mitigation measures for economic opportunities will result in more effective and sustainable expenditure of tax payments. It will further increase business opportunities at a local level. However, similar to job creation, limited time will be available before construction activities are scheduled to commence, thus the consequence of implementing mitigation measures such as enterprise development initiatives will only be felt towards the latter phases of construction and operation.

15.7.4 Residual Impact 4: Involuntary Resettlement

The successful implementation of the mitigation measures for involuntary resettlement may result in the households being affected by physical displacement to be the same or better off after the resettlement e.g., improved housing conditions and better access to services and facilities. The ability to achieve this will be dependent on the time and resources applied to address the issue. Therefore, a sustained effort in this area will be required in order to ensure fair and equitable outcomes.

15.7.5 Residual Impact 5: Loss of Land, Crops and Natural Resources Including Fishing and Potable Water

The effective implementation of the proposed mitigation measures will reduce the impact of the loss of crops and natural resources for those who secure continued access to these resources.

15.7.6 Residual Impact 6: Loss of Commercial Trees

The principle mitigation measures for the loss of commercial trees can only replace immediate incomes and it is recognised that the replacement of commercial trees by new plantations at a new location represents an opportunity cost and will take several decades (or more) to replace. As a result, compensation will be of a sufficient magnitude to allow commercial purchase of replacement foods or forestry produce.

15.7.7 Residual Impact 7: Disturbance or Loss of Access to Sacred Sites and Scattered Graves

Graves and sacred sites that do not have to be relocated can be mitigated by being fenced-off and allowing controlled access to these sites. However, due to the sensitivity associated with relocating sacred sites and graves, the impact may be very high for any graves or sacred sites that are disturbed.

15.7.8 Residual Impact 8: Reduced Mobility due to Loss of Road Network Connecting Grazing Areas and Water Sources

The implementation of the mitigation measures will reduce the severity of this impact. However, it is not possible to mitigate in full as some farmers or villagers will end up having to travel longer distances to reach their fields, grazing areas or water sources despite mitigation measures being implemented.

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15.7.9 Residual Impact 9: Population Influx

Social problems often accompany a massive influx of people and rapid urbanisation. Responses to this change can vary dramatically from person to person and can change over time, as someone either adapts, or does not, to this change. Controlling the behaviour of jobseekers moving into the area can also be challenging. However, with the implementation of the mitigation measures, combined with people's tendency to adapt and accommodate change, the impacts of this change can be reduced.

15.7.10 Residual Impact 10: Increased Pressure on Government to Deliver on Infrastructure, Service and Administrative Demands from the Project

If government is able to partner effectively with the district and local government and other stakeholders in implementing mitigation measures, the significance of the impact will be modest. However, in terms of the difficulties inherent in managing the impact on local services and infrastructure, this impact may remain one of major to moderate negative significance, particularly if the developments at Betano and Beaco are delayed or are not commercially viable.

15.7.11 Residual Impact 11: Community Health and Safety

The capacity of government to respond to the new demands arising from the development of the project ultimately rely on the commercial success of the Suai Supply Base and, more specifically, the petroleum refinery at Betano and LNG Plant at Beaco. The significance of these petroleum developments in relation to the nation's future is recognised in the SDP.

Whilst the implementation of the mitigation measures will reduce the severity of this impact, this impact cannot be mitigated entirely. The influx of people will result in an increase in social problems affecting the health of the community. The type of behaviour that leads to these risks such as excessive drinking or prostitution is difficult to fully control (see Impact 8). Similarly, the increase in traffic will bring with it a number of key risks to the local community which can be mitigated though not completely avoided.

15.7.12 Residual Impact 12: Improvement of Basic Services and Infrastructure

The mitigation measures provided will increase the longevity of this positive impact by ensuring government can independently govern Nova Suai and any other new infrastructure to be developed.

15.7.13 Residual Impact 13: Conflict Affecting Construction and Operation of the Supply Base

The successful mitigation of these risks will substantially reduce the impact of any conflict. However, the limited time available before construction activities are scheduled to commence for the Supply Base pose serious risks to the project as there may not be adequate time to implement some mitigation measures in full.



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15.7.14 Residual impact 14: The Supply Base Development Exacerbating Gender Equality Issues

This impact will be difficult to mitigate and will require a long-term implementation strategy, especially to change attitudes and views among the adult population that have been formed over many years.

15.8 Monitoring and Reporting

Monitoring is usually an internal and on-going management responsibility. It is carried out to scrutinize progress that has been made in the implementation of proposed mitigation measures, to take remedial action and to review and update plans where necessary. It also highlights key successes and failures that need to be addressed.

In order to assess whether the mitigation measures are effective in managing the socio-economic impacts associated with the Supply Base, a monitoring plan will be required. Such a plan would include performance criteria, milestones and the resources needed to carry out the monitoring. The effective implementation of this monitoring and review process is further outlined in Chapter 18 Environmental Management Framework and the appended EMP. Such a program is crucial to identify and respond to social issues as they arise. It is intended to do this from the community office in Suai.

The project will therefore provide for the following:

- Review existing social monitoring policies/program (if applicable) to include the monitoring of mitigation / management measures as proposed in the EIA.
- Undertake internal and external monitoring of the social management plans at a frequency determined by operations management.
- Progress reports (quarterly or bi-annual) should be written by the internal and external evaluators to monitor progress made toward mitigating adverse social impacts.
- Evaluators to monitor progress made toward mitigation adverse social impacts.
- Funds for external monitoring should be provided under the project's budget and should be factored in from the onset of the project.

15.9 Further Work

Due to the brevity of the study period and the lack of some types of information, the full extent of certain impacts could not be determined. Table 15-19 outlines the impacts and associated mitigation measures that require further work and the information required to complete the assessment. The primary motivation for this work is that it provides the means of identifying concerns within the community at an early stage and allows resolution in the most timely and cost-efficient manner.



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Table 15-19 Impacts and mitigation measures requiring further work (Part 1)

Impact	Outstanding Information	Task
Impact 1: Employment. Impact 2: Skills development.	<ul style="list-style-type: none"> Accurate estimates for Supply Base workforce (especially industrial estate). 	Verify and potentially reassess impacts of direct employment on the local population. Develop workforce skills database and workforce skills development strategy.
Impact 3: Economic opportunities.	<ul style="list-style-type: none"> Royalties and tax payments associated with the Supply Base. Breakdown of contracting opportunities and establish minimum requirements for local contractors to successfully bid for contracts. 	Reassess economic impacts associated with Supply Base.
Impact 4: Involuntary resettlement. Impact 5: Loss of land, crops natural resources (including fishing and potable water). Impact 6: Loss of commercial trees.	<ul style="list-style-type: none"> Current resettlement approach followed by government to compensate for physical and economic displacement in the footprint areas of the project. Detailed baseline data as to the number of households in scattered dwellings, fields and trees in the project footprint area, linked to owners' details and the socio-economic dynamics of these households. Roads that will be constructed or upgraded. Areas that will be dredged and off-limits to fishermen. 	Perform gap analysis of existing resettlement process against mitigation measures outlined in this EIA. Reassess impacts associated with physical and economic displacement.
Impact 7: Disturbance and / or loss of access to sacred sites and graves.	<ul style="list-style-type: none"> Exact location of scattered graves and sacred sites within footprint areas. 	Reassess impact if and when recommended heritage and archaeology surveys have been undertaken Develop grave relocation protocols with local villages. Incorporate locations into construction EMP.



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Table 15-19 Impacts and mitigation measures requiring further work (Part 2)

Impact	Outstanding Information	Task
Impact 8: Reduced mobility due to loss of road network inter-linking grazing areas, water points	<ul style="list-style-type: none"> • Areas to be fenced off and approach to be adopted by government e.g., will alternative access routes be developed before fencing commence. 	Develop alternate roads and pathways in consultation with local residents.
Impact 9: Population influx.	<ul style="list-style-type: none"> • Type and location of construction workforce accommodation. 	Reassess impact once more project information has been obtained.
Impact 10: Increased pressure on government to deliver on infrastructure, service and administrative demands set by the project.	<ul style="list-style-type: none"> • Detailed infrastructure construction schedule to determine whether proposed timeframes are realistic. 	Reassess impact once more project information has been obtained and keep communities informed.
Impact 11: Community health and safety.	<ul style="list-style-type: none"> • Seek health specialist advice whether a health impact assessment is required. 	Reassess health impacts based on specialist report (if necessary).
Impact 12: Improvement of basic services and infrastructure.	<ul style="list-style-type: none"> • Roads that will be upgraded or constructed. • Energy supply for Supply Base construction and operation. • Confirmation about accessibility of Nova Suai to local villagers. 	Verify and potentially reassess impact once more project information has been obtained.
Impact 13: Construction and operation of the Supply Base triggering resentment (and potentially conflict).	<ul style="list-style-type: none"> • Updated project information for the project related sites. • Obtain details of previous consultation undertaken by SERN. 	Review any change in community perceptions about the project and formulate appropriate responses as required to accurately assess how views and concerns about the project may inform this impact, among other impacts.



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15.10 Future Consultation

As outlined in Chapter 5 ongoing consultation with identified stakeholders will continue following the submission of the EIA. Communication and grievance mechanisms are further discussed in Section 6.11 to ensure stakeholders are well informed.

15.10.1 Disclosure of Additional Project Information and EIA Findings

To ensure proper disclosure of project information, public meetings will be held at Dili and Suai. Project information to be presented at these meetings may include a basic project description, descriptions of the infrastructure to be built, project plans for water, electricity, roads, labour and skills requirements, and business opportunities. Importantly, for Suai in particular, information needs to be presented in a way that is easily understood by the local population due to the low literacy rates in many villages.

To provide feedback of the key EIA findings, a draft EIA report should be presented to stakeholders at a national, district and local level as well as other stakeholders such as NGOs and lobby groups. These EIA feedback meetings should be held at Dili and Suai respectively and could be combined with the project information disclosure meetings.

To ensure the findings of the EIA report are clearly understood, a non-technical summary of the findings of the EIA should be developed for distribution to stakeholders and the general public. The minutes from the EIA feedback meetings to be held in 2012 should be distributed to ensure that an accurate account of the meetings is kept and to allow IAPs the opportunity to ratify the minutes from each meeting. All concerns, issues and suggestions raised should be documented in the minutes. Copies of the minutes should be made available at Dili and relevant village halls within the Suai study area.

Undertaking these meetings will enable the IAPs to identify additional potential issues and perceived impacts. Their responses and proposed measures to address these issues will be integrated in the final EIA.

15.10.2 Communication Mechanisms

There are a number of culturally appropriate communication mechanisms which will be considered to support the disclosure of additional project information and EIA findings:

Background Information Documents: Detailed project information will inform stakeholders about the proposed project, the area involved, additional project activities, the timeline for the proposed project, initial issues (both positive and negative) identified by the project team and the further consultations. These should be distributed in Portuguese and Tetum Teric. Background information documents should be targeted at stakeholders with a higher level of education and technical understanding of petroleum developments.



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Educational posters: These should be distributed in Portuguese and Tetum Teric to assist people who have little or no knowledge about the petroleum industry to allow a basic understanding of the activities of the proposed project. These posters should be placed at the directly affected villages to convey information by means of illustrations to cater for illiterate people in the villages.

Letters of Invitation: Letters detailing dates, times and venues inviting relevant authorities and interested and affected parties to meetings should be distributed.

Notification posters: These should be distributed in Portuguese and Tetum Teric to advise the general public and specific villages about the proposed project and about public and community meetings. These notices should be placed at the respective villages at each site.

Radio announcements should be prepared in Tetum Teric and broadcast via radio to remind the general public and communities about the public village meetings taking place in their areas. These announcements should be broadcast on a regular basis commencing two weeks before meetings are to occur.

Megaphones (loud hailers) should also be used on the day of meetings to remind villagers who do not have radios of the meeting.

Response sheets: These sheets mainly target IAPs at a national and district level and not so much directly affected villagers. The sheets should be sent to authorities, interested parties and the general public in Portuguese and Tetum Teric to give IAPs an opportunity to register for the project and raise their concerns, issues or suggestions. Response sheets should also be the method by which IAPs who are unable to attend meetings can become a part of the stakeholder consultation process.

15.10.3 Grievance Mechanism

A grievance procedure should be developed to ensure that concerns and potential conflicts arising during the continuing project feasibility and development stages can be satisfactorily addressed. A grievance mechanism framework has been developed to guide initial discussion with stakeholders (including government) and allow further refinement to meet stakeholder needs through consultation.

Once defined, project staff (comprising a representative who will receive grievances at a nominated location office, and a Dili office representative) should be provided with training. These staff will accept and log incoming grievances and, if the grievance is directly related to the project's actions, follow a prioritisation process to identify the required remedial action.

Figure 15-4 illustrates a suggested procedure for managing and resolving complaints during the feasibility stage. The procedure is equally relevant during the development stage of the project with responsibility for resolution shared between the project proponent and the construction contractor. It is important to ensure the following values are upheld throughout the grievance process:

- Awareness.
- Accessibility.
- Transparency.
- Expediency.



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Stakeholder awareness of the existence of the mechanism will mean that when an issue arises, community members will know where to go to address and resolve the issue. This will encourage the issue to be dealt with through the appropriate mechanism and will improve expediency of resolution and good will with the community. Therefore, when engaging with the villages and other stakeholders they should be made aware of the grievance mechanism and where or whom they should contact to access the mechanism.

Accessibility to the grievance mechanism will also enable stakeholders to air their complaints directly thereby avoiding other forums such as the media. Typically, the earlier the proponent becomes aware of potential issues, the more efficiently these can be mitigated and contained. Furthermore, early detection of potential issues can prevent problems arising later in the project lifecycle. It will be essential to break down barriers to accessibility which, based on baseline investigations, include, geographic location, literacy levels, language and cultural appropriateness, and distrust in government or corporate structures. Recommended strategies to overcome these barriers include:

- Nominating an officer located in Dili and at the Suai study area to respond to grievances.
 - According to the *Suai Supply Base Feasibility Study and FEED – Part IV: Social Impact Assessment* (EastLog, 2011 5.3.2), EastLog has committed to create a community office in Suai to serve as a single point of contact with the community during the construction phase. Should the establishment of the EastLog's community office at Suai only commence at a much later stage, government may be required to establish an interim community information office for the Suai development.
- Upon request, remote locations and vulnerable individuals (e.g., elderly and disabled) should be visited by a representative of the project who will disseminate information regarding the project and receive complaints from stakeholders at their village or residence. This will promote accessibility of the grievance procedure and help build a relationship with communities and encourage dialogue.
- Complaints should be able to be registered via a toll-free telephone line to allow direct access to each individual to the grievance mechanism. Another option is to provide a pre-paid mobile phone to each village chief to be exclusively used for lodging grievances. The mobile phone would allow the chief to send a message to the nearest grievance officer requesting them to visit the village and record the grievance. The pre-paid mobile option needs to be further investigated in consultation with village chiefs.
- Representatives should be instructed to note down complaints where the individual is unable or unwilling to write the complaint themselves.
- Local people fluent in the relevant languages should be engaged as representatives.
- Locals should be consulted regarding the cultural appropriateness of the complaints process.
- Complainants should be given the option of maintaining anonymity throughout the complaints process.



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Transparency of process cultivates trust and ensures expectations among the stakeholders are set at an appropriate level. Elements of the grievance procedure which will encourage transparency include explaining the process and timescales associated with processing a complaint, providing the complainant with a copy of the complaint when it has been submitted and ensuring the complainant is kept informed of developments in processing their complaint. Written complaints should be held at the respective grievance offices where the complainant (or a designated advocate) should be allowed access.

Expediency will enable efficient processing of complaints. In order to encourage expediency the project should set deadlines for processing complaints and a case management approach should be established among the relevant staff, with oversight from a senior individual who should be assigned responsibility for management of the grievance mechanism.

As well as committing to the values mentioned here, it is suggested for the project to work to International Finance Corporation (IFC) guidelines (IFC, 2011) regarding grievance mechanisms.



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Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

CHAPTER 16 LAND TRANSPORT



ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

16 LAND TRANSPORT

Development of the Suai Supply Base is predicted to result in the increased use of land transport links, between the Suai development area, the proposed development sites at Betano (Petrochemical Refinery) and Beaco (LNG Plant), as well as other locations in Timor-Leste.

The purpose of this section is to:

- Describe the methods used to assess the potential land transport-related impacts of the Suai Supply Base.
- Report the results of the impact assessment.
- Outline measures for mitigating and monitoring predicted impacts.

It should be noted that the proposed highway from Suai to Viqueque has not been included in this scope of work.

16.1 Study Method

There is currently no established guidance or methods for undertaking traffic and transport impact assessments within Timor-Leste.

The methods used to assess potential land transport impacts associated with the project are based on the UK Institute of Highway Engineers (IHT) *Guidelines for Traffic Impact Assessment* (1994). Use of the standard assessment method set out in these guidelines conforms to international practice as requirements for assessing impacts in the UK are subject to highly stringent European and UK legislation.

In addition to the use of these guidelines, three other guidelines were reviewed and used where appropriate. They are:

- *Guidelines for Preparation of Traffic Impact Assessment Reports Revision* (2011) Land Transport Authority (LTA), Singapore;
- *Guide to Traffic Generating Developments Version 2.2* October 2002 Road and Traffic Authority, New South Wales, Australia; and
- *Transport Assessment Guidelines for Developments Version for Trial and Evaluation*, August 2006, Department of Planning and Infrastructure, Western Australia, Australia.

It should be noted that these guidelines, and many of the methods set out within them, are based on more defined, dense urban locations where significant baseline monitoring data is available. Not all of the formulae or impact measurements set out in these guidelines have been applied to the project given the nature of the existing land transport network and the limited availability of baseline data.



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16.1.1 Study Area

The study area comprises existing and proposed land transport infrastructure associated with the Suai Supply Base as defined in Section 1.2.

The study area is shown in Figure 16-1 with the primary road network highlighted.

16.1.2 Scope of the Study

This traffic impact assessment is predominantly a desktop assessment of the existing road network and the land transport infrastructure proposed as part of the Suai Supply Base development. This traffic impact assessment excludes impacts associated with aviation, the upgrade of Suai Airport and maritime transport as it relates to the Suai port development (i.e., increased vessel calls).

The desktop assessment has been supplemented by onsite observations from the study area. The impacts of the proposed development have taken into account these baseline conditions although, it is recognised that these observations only represent a 'snapshot' of existing traffic patterns and longer-term study may yield different conclusions.

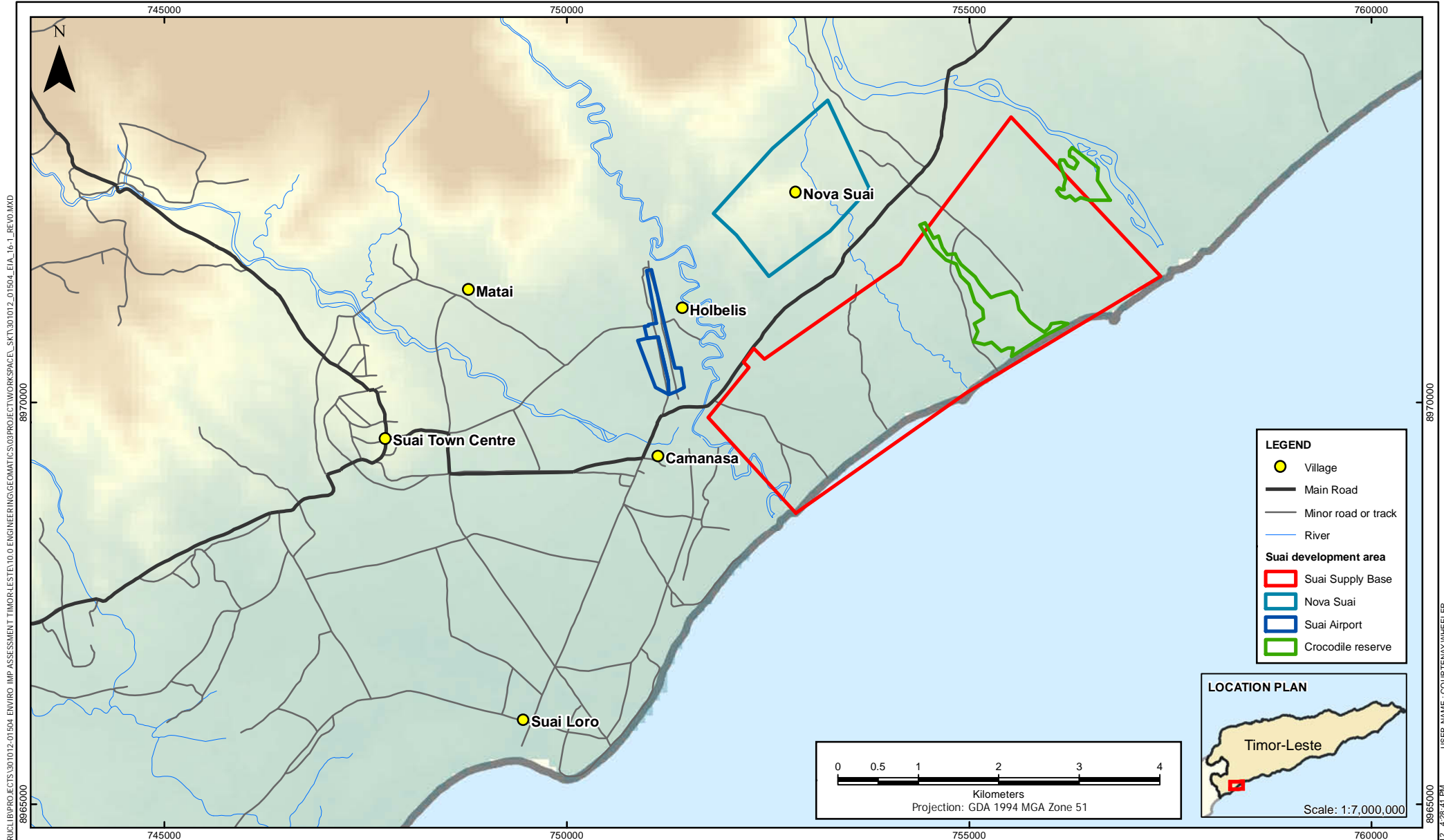
As with projects of this scale and nature, the project will be subject to more detailed planning and development which could alter the baseline assumptions and assessment outcomes. The lack of baseline data and information regarding the proposed works, limits the application of the findings of this traffic and transport assessment.

16.1.3 Method

As set out in Section 16.1, the study method used to assess traffic impacts is based on the UK IHT *Guidelines for Traffic Impact Assessment* (1994) and three other internationally-recognised traffic impact assessment guidelines.

The purpose of an impact assessment is to establish the difference between baseline conditions (as the land transport network currently exists in both infrastructure and patterns of use) and those during the construction and operational stages of the project. It is also important to understand the manner in which anticipated traffic from the project will be distributed and affect on the study area.

From this assessment, potential mitigation measures can be predicted and assessed which will help to reduce impacts on the existing network and sensitive receptors in the study area, such as residences, community facilities and commercial districts.



NOTES:
 This map consists of:
 1. DEM: SRTM (2011)
 2. Rivers: Geographic Information Group Timor-Leste (2010)
 3. Roads: DivaGIS (2010)

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TASI MANE PROJECT - SUAI SUPPLY BASE
 ENVIRONMENTAL IMPACT ASSESSMENT

Figure 16-1
 Suai study area and existing road network

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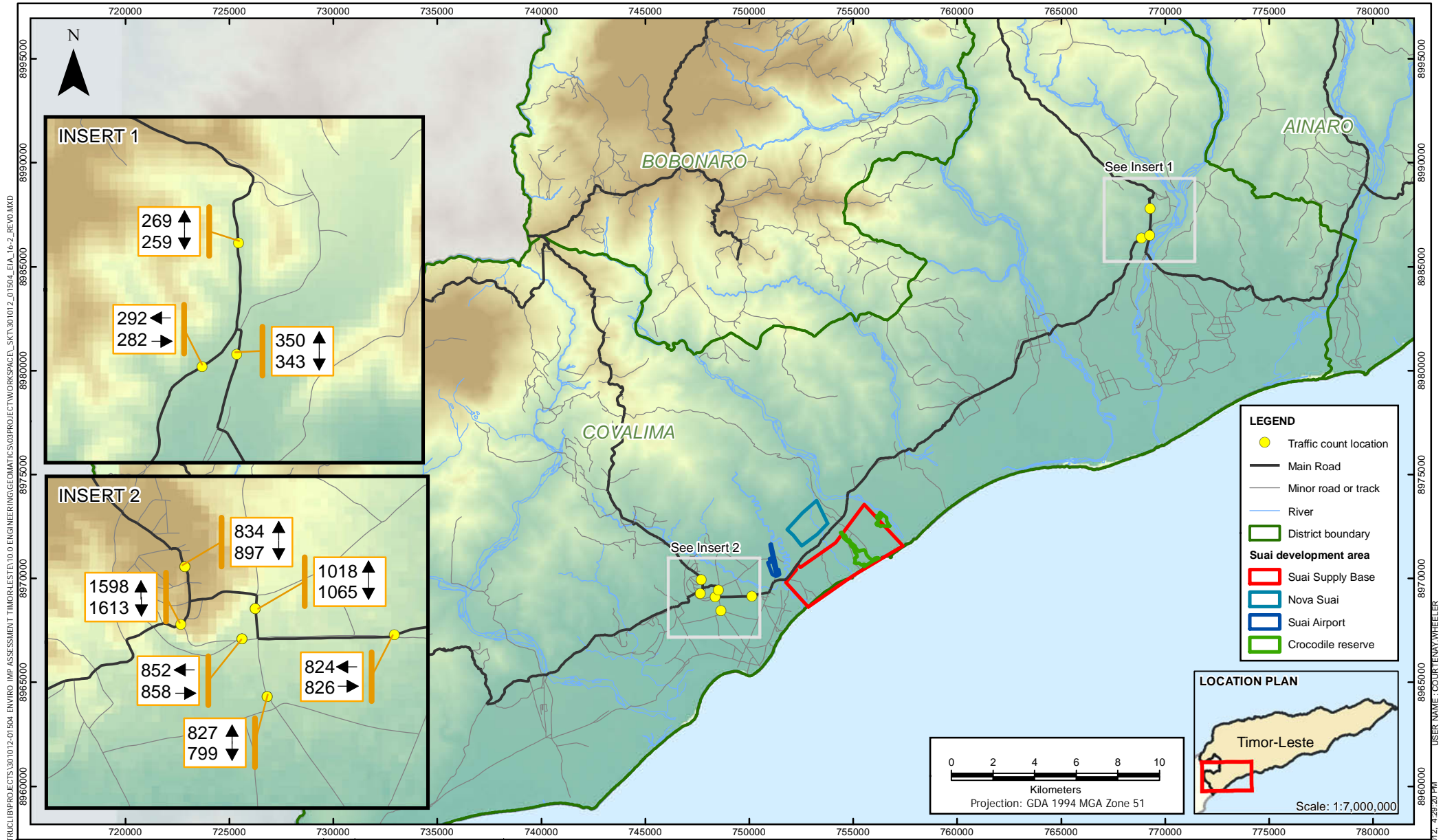
ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

Broadly, there were seven key stages in the assessment of the land transport impacts of the project. These were:

- Desktop material review;
- Onsite observations and assessment of existing conditions through development of a spreadsheet model.
 - Traffic observations were carried out on site at both major turning locations and at link locations (Figure 16-2). The chosen sites were monitored and movements recorded.
 - The methods applied to the traffic counts was taken from previous studies undertaken in both the UK and Australia using methods set out within guidelines referred to in Section 16.1.
 - The duration for link count observations at each site was 12 hours for two consecutive days. Turning movement observations were conducted during the morning and evening peak hours.
 - All the data collected from the site observations has been used to develop an overview spreadsheet model of the local land transport network. This model has assisted the identification of both existing trip generators and existing trip distribution.

The spreadsheet model was created to display the collected traffic count data and establish the volumes on transport links throughout the study area. With the base year conditions identified, the traffic volumes associated with the project are able to be assigned to specific transport links;

- Review of proposed development trip generation;
- Assessment of traffic distribution in the study area by reviewing the existing traffic volumes and possible travel routes through the study area network. Impact on land transport network;
- Although specific waterway crossings were not assessed as part of this project, it is envisaged that any crossing along a primary route between Suai, Betano and Beaco will need to accommodate a greater number of vehicle movements and also provide a reliable, permanent crossing; and
- Mitigation, monitoring and future work required.



NOTES:
 This map consists of:
 1. DEM: SRTM (2011)
 2. Rivers: Geographic Information Group TimorLeste (2010)
 3. Roads: DivaGIS (2010)
 4. District boundaries: Geographic Information Group TimorLeste (2010)
 5. Traffic counts: WorleyParsons (2012)

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REV	DATE	REVISION DESCRIPTION	DRN	CHK	DES	ENG	APPD	CUST	PROJECT No: 301012-001504	
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Figure 16-2
 Suai average daily traffic observations

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ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

16.1.4 Impact Assessment

Impacts on the land transport network arising from development of the project can be measured in both qualitative and quantitative means. This includes the following:

- Changes in volumes of vehicles;
- Changes in vehicle types using land transport links;
- Fluctuations in number of people accessing the study area;
- Increase or decrease in the length of the road network;
- Increase or decrease in the number of intersections;
- Changes in the number of pedestrian or cycle movements; and
- Change in distance that vehicles travel.

The measurement of impacts is set out in Section 16.2.

Both the construction and operational phases of the project have been tested as separate traffic scenarios. It is understood that the construction stage of the project is likely to span a 20 year period, and that this will result in some overlap with the operational phase. To accurately model and assess this staged impact we would recommend a detailed traffic model is built.

For desktop assessment purposes, it has been assumed that the construction traffic detailed in the Eastlog report as well as Quarry related trips occur at the same time. To reflect that there will be some level of operation during the construction phase, a nominal amount of daily light and heavy vehicles have been assigned between Suai, Betano and Beaco. Through the spreadsheet modelling process it is not accurate to suggest a growth rate attributed to the construction traffic, rather, the per cent change in volume on individual links is presented. An average growth across all links through the Suai study area details an increase of approximately 11% over the current volumes.

The operational scenario tested assumes 6,500 people resident at Novo Suai and to account for the ongoing construction phases of Betano and Beaco, daily light and heavy vehicle trips have been assigned between Suai and the other development areas. The average growth across all links through the Suai study area details an increase of approximately 17% over the current volumes.

16.1.5 Data Assumptions and Limitations

Limited data availability has increased the reliance on a series of 'high-level' assumptions relating to both current and future use, and condition of the road network. Specific limitations and assumptions are described below and are discussed in relation to the assessment in Section 16.3.

There is limited availability of traffic count information in Timor-Leste. Historical data is set out within two separate reports which provide limited information on traffic counts around the study area. These two reports are:



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- *Road Sector Investment Planning in Timor-Leste*, The Louis Berger Group, Inc. Technical Working Paper October 2006 (LBG, 2006); and
- *Road Sector Investment Planning in the Pacific*. An Example of Good Practice, Timor-Leste, Asian Development Bank, July 2007 (ADB, 2007).

Historical traffic count data and trends in land transport modes are important in establishing patterns in traffic use on specific roads over time. These trends provide an indication of the level of underlying growth in traffic that isn't attributed to the project's construction and operational phases.

16.2 Existing Environment

The existing land transport network in the study area is small by comparison to other nations in the region. As set out in ADB (2007), the core road network of Timor-Leste in 2007 comprised 1,400 km of national roads and 800 km of district roads. Since 2007, there has been little expansion in the core network, which comprises of the following (road designation number is in brackets):

- National road between Suai and Uemassa heading west from the study area (A15);
- National road between Suai and Zumalai heading east from the study area (A02);
- National road between the Suai to Uemassa road heading north to Fatululik (A15 and A16);
- District road between Suai and Fatululik heading north from the study area (C21); and
- District road between Lolotoe and Beaco (C32).

Other roads in the study area are primarily urban roads within townships and rural roads leading from either urban roads or the core network to individual properties or locations. There are no known cycle paths and limited pedestrian pathways. The majority of roads in the area are not surfaced, in poor condition and frequently affected by seasonal rainfall.

16.2.1 Desktop Assessment

There is limited existing information available on the land transport network in the study area, for example, there are no strategic or statutory land transport plans for Timor-Leste in existence. The primary source of information for the land transport network is ADB (2007). This report sets out information and data on the existing land transport network in Timor-Leste as well as recommendations for forward planning and strategic development of the road network.

The status of recommendations from this report is unknown; however, the plans presented in ADB (2007) for improving land transport links, did not include a significant funding allocation for core network roads within the study area.

Some traffic observations and network condition reporting are recorded in LBG's Road Sector Investment Planning report (2006). Available data for roads within the study area, which informed the recommendations in ADB (2007) are set out in Table 16-1.

**ENVIRONMENTAL IMPACT ASSESSMENT
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From	To	Surface	Length	Width	Last surfaced	Quality	Annual Average Daily Traffic (AADT) (year data recorded)
Zumalai	Suai	Paved	29.8 km	4.3 m	1996	Poor	275(2005)
Suai	Tilomar	Paved	12.2 km	4.3 m	1995	Poor	130 (2005)
Fatululik	Tilomar	Earth	48.0 km	3.2 m	1994	Very Poor	50 (2005)
Suai	Fatululik Junction (A16)	Paved	26.1 km	3.5 m	1995	Very Poor	44 (2005)
Lolotoe	Beaco	Paved	22.8 km	3.5 m	2003	Good	142 (2007)

16.2.2 Existing Conditions – Land Transport Network

Onsite road conditions in the study area were assessed during site observations completed 2011.

It is apparent that no noticeable investment or significant improvement in road conditions for the core road network has occurred since the completion of the assessment by the ADB between 2005 and 2007. Core roads linking villages and towns within the study area are in poor condition with the urban and rural roads in poor condition and subject to significant impacts from high rainfall events.

Two examples of existing road surface conditions are shown in Plate 16-1 and Plate 16-2.

Traffic management throughout the land transport network is limited. There are no controls at intersections with the exception of roundabouts installed at some intersections in urban areas. Pedestrian pathways are minimal in towns and villages and are generally restricted to untreated and informal paths which have formed over years of use.

16.2.3 Onsite Observations

Traffic observations were undertaken in the study area in late 2011 at two main locations:

- Suai Market intersection with link counts for roads to Maukatar, Tabaco and Salele; and
- Suai Tugu roundabout with link counts to Tabaco, Camanasa, Asumetan and Suai Loro. Turning movement counts at the roundabout were also completed to inform trip distribution patterns.

The locations of the traffic count observations through the Suai area are shown in Figure 16-2 and actual site photographs are set out in Plate 16-3 and Plate 16-4.

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Observations were taken in Suai to understand the movements around the urbanised area within the study area. It should be noted that the data was collected in late 2011 during the start of the wet season. Travel behaviour often changes during seasons and, as such, there is significant uncertainty associated with the data collected. The level of activity around the observation sites and movement of people to key locations such as the market place does not reflect the much lower traffic counts between urban areas as shown in Table 16-2. The counts provided in Table 16-2 reflect average daily link volumes at the locations shown in Figure 16-2.

Table 16-2 Study area traffic observations 2011

Link Name	Between		Road Number	Direction 1	Direction 2	Direction 1 and 2 Combined
Beaco	Suai	Approach to A12-3	A02-7	292	282	573
Kasa	Kasa	Junction A12-3	A02-6	343	350	693
Lepo	Kasa	Oeleu Louba	A12-3	269	259	528
Suai Loro	Asumaten	Suai Loro	Local	799	827	1626
Tabaco	Asumaten	Suai Tugu roundabout	A02-7	1065	1018	2083
Camanasa	Suai Tugu roundabout	Camanasa	A02-7	824	826	1649
Asumetan	Suai Tugu roundabout	Debos	Local	858	852	1709
Salele	Salele	Suai Market	A15-1	1613	1598	3210
Maukatan	Suai Market	Fatalulik	C21	897	834	1731

The volume of vehicles observed at each location was consistent across the two recording days. The two locations with the highest recorded daily counts, Tabaco and Salele, reflect the activity around the Suai urban area and market place.

Traffic observations were restricted to vehicle counts; however, on-site observations suggest there is a significant volume of pedestrian movements around key locations such as the Suai Market intersection. Movement of pedestrians at other link count locations appeared to be localised.

16.2.4 Existing Trip Generation

In general, the differences in observations between the details provided in LBG (2006) and the 2011 observations set out in Table 16-2 reflect that a large number of vehicle movements are localised and would take place between residential properties and local areas of activity such as the market, schools and other community facilities.



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These locations produce the greatest amount of trip generation as they are the key meeting places and focus of commerce in the study area. No other known or observed single land use or facility produced significant trip generation on the local road network.

16.2.5 Existing Trip Distribution

The distribution of trips through the Suai local road network appears relatively consistent throughout the day, with a lack of a specific tidal movement from one area to another at a certain time of day. The 2011 surveys suggest a strong local movement through the immediate town network of short distance trips. Slightly longer distance trips were also recorded between local town centres (counts on the A02-7 between Suai and Beaco) although, these traffic movements are not as frequent as local trips.

16.3 Environmental Impacts

This section describes the impacts of the project on the land transport network in the study area for both construction and operational phases. Where possible, reference is made to existing conditions described in Section 16.2 to provide a clear separation between the impact of movement arising from the project, and the existing and expected impacts without the project.

For the purposes of trip generation within the study area, it has been assumed the only growth in the local traffic levels is that associated with both the construction and operational stages of the project as described earlier in Section 16.1.4. . This is due to a number of reasons, namely:

- The lack of historic traffic count information makes any direct comparison between previous years and 2011 difficult. The exact location of observation points may be varied, the time of the year is a key factor for both weather and seasonal movement of rural produce and accuracy of counts may not be as dependable as more developed countries. As a result, it is difficult and impractical to try and establish a growth factor in traffic to apply to either the construction or operational period;
- Outside of the influence of the project, there are very few other land uses which would generate traffic levels that could impact on the land transport network. No other significant developments are known for the study area;
- Travel patterns of the local population are unlikely to be altered as the majority of trips made on the land transport network are localised and relate to key daily activities, commerce, school trips, work trips and movement between villages and key urban areas;
- There are no significant influences of inter-regional trips along the core road network. There are no significant trip generators or new links known of outside the study area which could heavily influence traffic patterns on the local transport network; and
- There are no known government strategies or plans in place to change investment levels in the road network or make improvements to the land transport network conditions outside of those that may be required for the project. Transport network proposals set out in ADB (2007) do not appear to have progressed within the project area and represent very little investment



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in improving existing roads. Without road improvements, it is a reasonable assumption that there would be limited, if any growth in background traffic outside the volume recorded in 2011.

16.3.1 Construction Impacts

Trip Generation

Trip generation for the construction stage is taken from the Eastlog report and is based on the maximum anticipated daily movement associated with the project. The assumptions made for trip generation for the study area over a 12 hour period are as follows.

- Movements in the study area are primarily heavier vehicles associated with the construction of the project. 200 staff are located at the Supply Base and are not considered as any light vehicle trips on the surrounding network would be minimal;
- Movement of 30 staff to each quarry site within the project area from Suai by bus.
- Movement of 20 staff to the riverbed from Suai by bus;
- Movement of 50 staff to the Supply Base from Suai including security and administration staff;
- 40 truck trips to and from each quarry site around the study area;
- 40 light vehicle trips between the Supply Base construction site and other locations for the project; and
- 40 heavy vehicle trips between the Supply Base construction site and other locations for the project.

Trip Distribution

Anticipated trip distribution for the construction stage of the project is set out in Table 16-3. These volumes are based on the project as described in Chapter 4 and the trip generation set out in the previous section. The distribution pattern information includes the following.

- Location of the link. Not all links will have impacts during the construction stage as there will be no significant known generation of traffic along those links. Where there is no impact, no information is provided in Table 16-3;
- 2011 AADT count information taken from Table 16-2;
- Anticipated heavy vehicle trip generation of buses and trucks;
- Anticipated trip generation of light vehicles; and
- Difference in the 2011 AADT count and the additional traffic generated by the project.



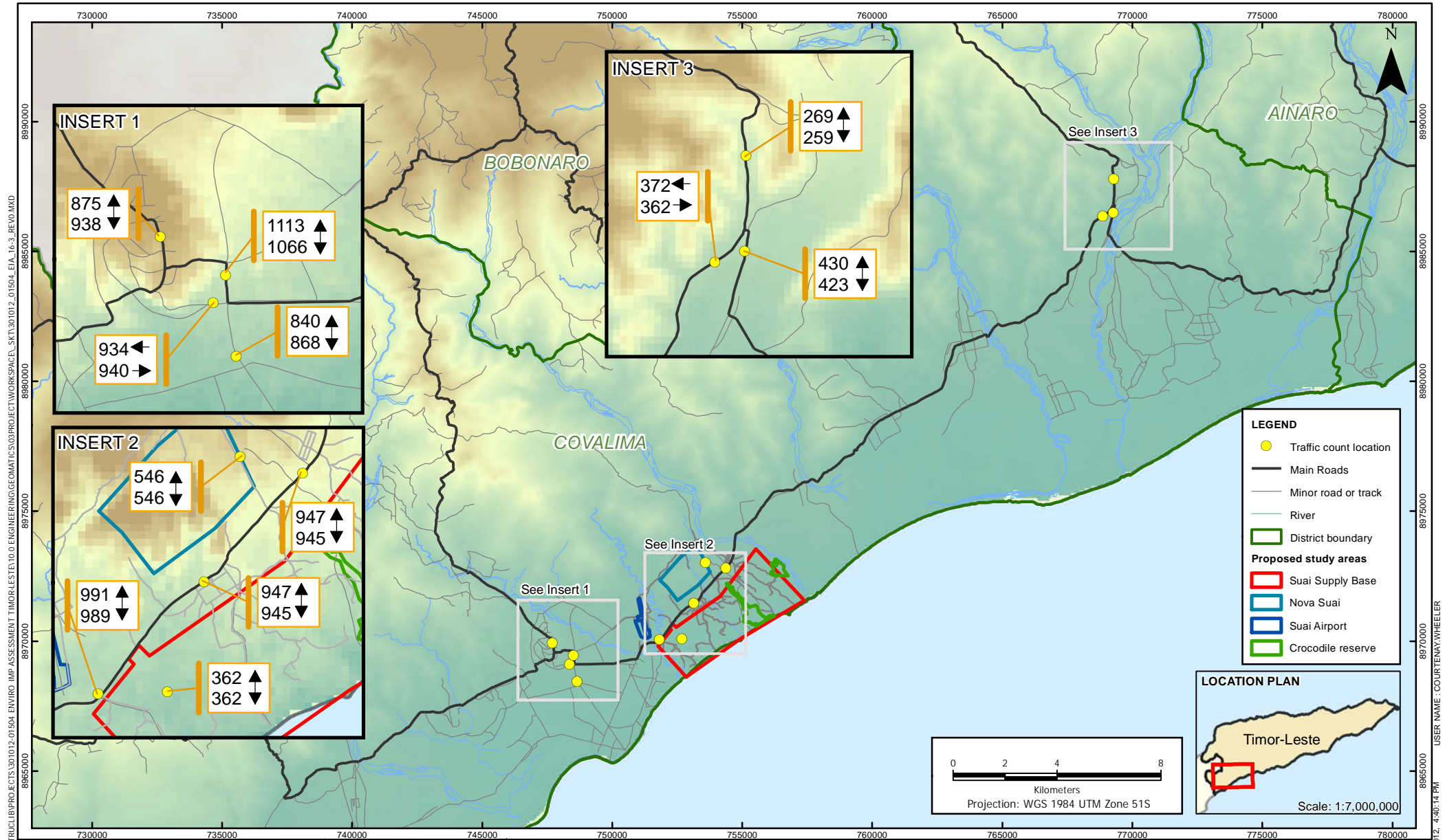
**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE**

Table 16-3 Construction trip generation

Link Name	From	To	Combined AADT (2011)	Trip Generation (Heavy)	Trip Generation (Light)	% Difference from 2011 (Total)
Beaco	Suai	Approach to A12-3 (A02-7)	573	80	80	27.4% (west) 28.4% (east)
Kasa	Kasa	Junction A12-3 (A02-6)	693	80	80	23.4% (south) 22.9% (north)
Lepo	Kasa	Oeleu Louba (A12-3)	528	-	-	-
Suai Loro	Asumaten	Suai Loro (Local)	1626	82	0	5.0% (south) 5.0% (north)
Tabaco	Asumaten	Suai Tugu roundabout (A02-7)	2083	96	0	4.5% (south) 4.7% (north)
Camanasa (west of Supply Base)	Suai Tugu roundabout	Supply depot entrance (A02-7)	1649	331	0	20.0% (west) 20.0% (east)
Camanasa (east of Supply Base)	Supply depot entrance	Camanasa (A02-7)	1649	162	80	14.7% (west) 14.7% (east)
Supply base road	Supply depot entrance	Junction A02-7	-	644	80	-
Asumetan	Suai Tugu roundabout	Debos (Local)	1709	164	0	3.6% (west) 3.6% (east)
Salele	Salele	Suai Market (A15-1)	3210	-	-	-
Maukatar	Suai Market	Fatalulik (C21)	1731	82	0	4.6% (south) 4.9% (north)

Land Transport Network

The Base 2011 traffic volumes and construction traffic volumes are shown in Figure 16-3. All of the links with additional traffic resulting from the project will see an increase in the volume of heavy vehicles. Although the 2011 count information did not record the proportion of heavy vehicles on the road network, anecdotal information, knowledge of the road network conditions and details provided in LBG (2006) indicate that there is currently very little movement of heavy vehicles in the study area.



NOTES:
 This map contains:
 1. DEM: SRTM (2011)
 2. Rivers: Geographic Information Group TimorLeste (2010)
 3. Roads: DivaGIS (2010)
 4. District boundaries: GIGTimorLeste (2010)
 5. Traffic counts: WorleyParsons (2012)

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resources & energy		TIMOR GAS & PETROLEO		REPUBLICA DEMOCRATICA DE TIMOR-LESTE SECRETARIA DE ESTADO DOS RECURSOS NATURAIS				Copyright © WorleyParsons Services Pty Ltd		

TASI MANE PROJECT - SUAI SUPPLY BASE ENVIRONMENTAL IMPACT ASSESSMENT

Figure 16-3
 Predicted total Suai traffic volumes during construction

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 USER NAME : COURTNEY.WHEELER



ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

Given the low existing traffic volumes and the deteriorated road surfaces, the impacts on other users, adjoining land uses and on the core road network conditions will be far more noticeable. These impacts are set out below:

- Increase in the volume of traffic along roads in the study area, primarily heavy vehicles, may affect air and noise quality along key links at Camanasa and Asumentan;
- The nature of existing road network conditions will also likely require slow speeds and constant deceleration and acceleration of trucks and buses increasing impacts on local air and noise conditions;
- The ability of many roads to handle a significant increase in daily movements of heavy vehicles is questionable given the very poor pavement conditions;
- Use of heavy vehicles on the core road network will result in a further deterioration of road conditions as described in Section 16.2. Impacts will be pronounced during the wet season where sideways movement of trucks and buses along roads in poor condition will exacerbate the existing poor condition of the majority of roads;
- Increase in the volume of traffic passing through Suai in particular will reduce the level of safety for other road users around the Suai Market. At present, the majority of vehicle movements at this location are motorcycles or small vehicles. Increasing heavy vehicles in this location will place at risk the more vulnerable road users such as pedestrians and cyclists;
- Movement of heavy vehicles along all core roads in the area during heavy rainfall events or at dusk will result in reduced safety for other road users;
- Increase in the number of light vehicles between the Supply Base and other project locations along the Camanasa link is likely to have an impact on road safety and road conditions as the increase in overall volume, 14.7% in each direction, is significant; and
- The impacts on the Asumetan and Suai Loro links are likely to be most pronounced as they are local road links. Introduction of more daily heavy vehicle movements on local roads is likely to have a greater impact on local air quality, noise and safety than on core network roads.

16.3.2 Operational Impacts

Trip Generation

Trip generation for the operational stages is based on the project described in Chapter 4. The assumptions made for trip generation for the study area over a 12 hour period are as follows. The trip generation is based on the maximum anticipated daily movement during the operational stages. To reflect the ongoing construction phase, some additional daily light and heavy vehicle trips have been assigned between Suai, Betano and Beaco.



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- Of the approximate 6,500 residents located at Nova Suai, approximately 3,250, or 50%, will be workers;
- Movement of workers from Nova Suai to the Supply Base by private vehicle will total 163 which represents 5% of total private vehicle trips from Nova Suai;
- Of the 3,250 non-workers located at Nova Suai, a total of 5% undertake trips outside of the site by light vehicles daily. These trips are evenly split between Suai and in an easterly direction along the A02-7, towards Camanasa;
- Movement of workers from Nova Suai to the other operational locations of the project at Betano and Viqueque by private vehicle will total 163 which represents 5% of total trips from Nova Suai;
- 90% of workers from Nova Suai to the Supply Base will travel by bus. A total of 59 bus trips would be completed;
- The 250 local staff required for the Supply Base are split between 50% being located on site, and therefore having no impact on the road network, and 50% being located in Suai. Staff located in Suai would travel to the site by bus. A total of four bus trips have been included;
- Movement of light vehicles to Betano and Viqueque from the Suai Supply Base is estimated at a total of 40 in each direction on a daily basis; and
- Movement of heavy supply and construction material vehicles to Betano and Viqueque from the Suai Supply Base is estimated at a total of 40 in each direction on a daily basis.

Trip Distribution

Anticipated trip distribution for the operational stages of the project is set out in Table 16-3. These volumes are based on the project described in Chapter 4 and the trip generation set out in the previous section. The distribution pattern information within Table 16-4 includes the same details as provided in Table 16-3.

Land Transport Network

The Base 2011 traffic volumes and operation traffic volumes are shown in Figure 16-4. Vehicle movements on the road network in the study area for the operational stage will see a greater number of light vehicle trips than heavy vehicle trips. This is particularly true of the Beaco link where only a small number of vehicles were surveyed to use this link in 2011.

Heavy haulage and construction vehicles would be shipped to Betano and Viqueque from the Suai Supply Base by road; however, the majority of the heavy vehicle trips associated with the construction phase from surrounding quarry sites would no longer impact on the network. This will result in a reduction or removal of many vehicle trips, and associated impacts, from a number of roads.



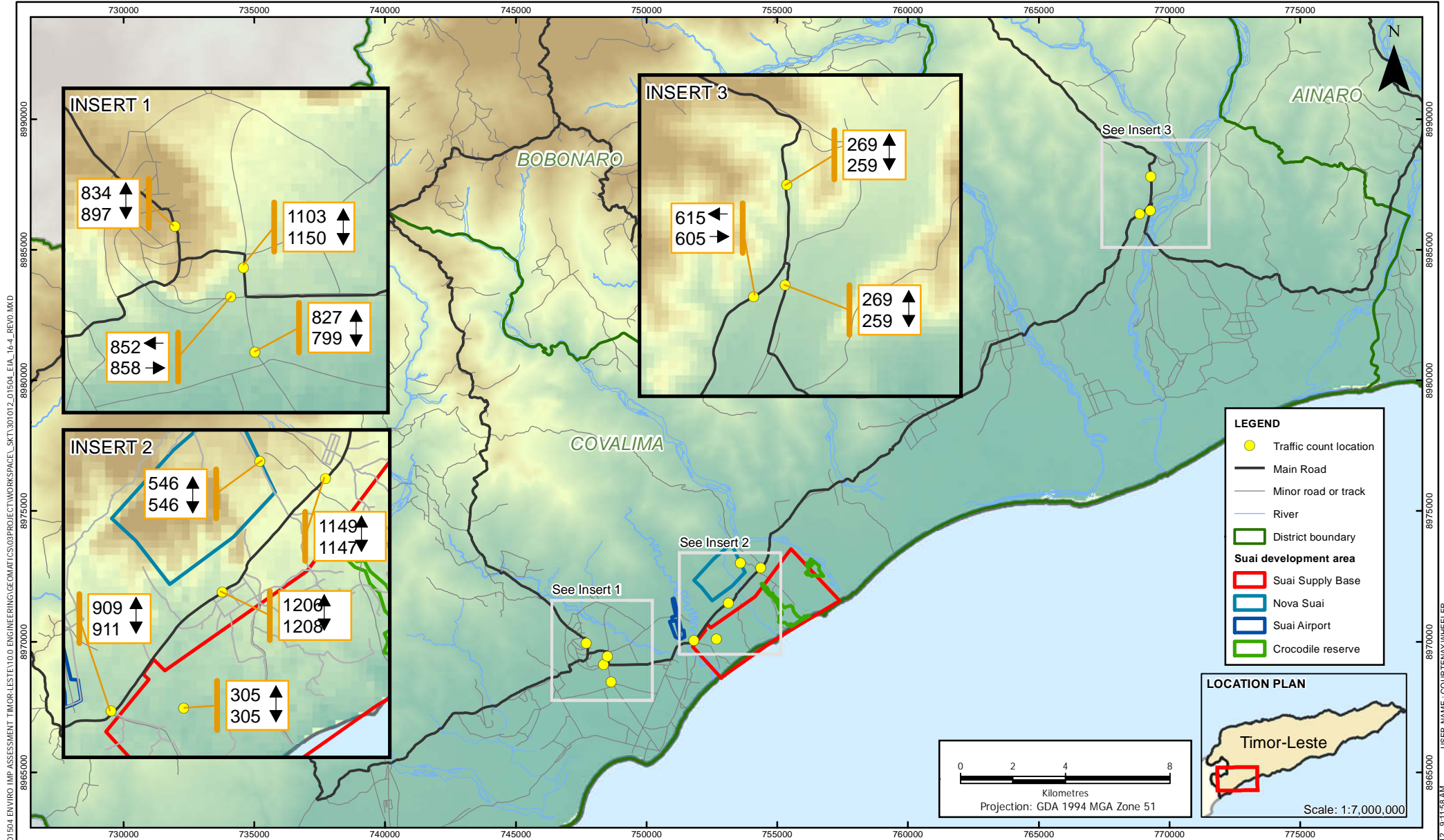
**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE**

Table 16-4 Operation trip generation

Link Name	From	To	Average AADT (2011)	Trip Generation (Heavy)	Trip Generation (Light)	% Difference from 2011 (Total)
Beaco	Suai	Approach to A12-3 (A02-7)	573	80	568	111% (west) 115% (east)
Kasa	Kasa	Junction A12-3 (A02-6)	693	80	568	94% (south) 92% (north)
Lepo	Kasa	Oeleu Louba (A12-3)	528	-	-	-
Suai Loro	Asumaten	Suai Loro (Local)	1626	-	-	-
Tabaco	Asumaten	Suai Tugu roundabout (A02-7)	2083	8	162	8.0% (south) 8.4% (north)
Camanasa (west of Supply Base)	Suai Tugu roundabout	Supply depot entrance (A02-7)	1649	8	162	10.4% (west) 10.3% (east)
Camanasa (east of Supply Base)	Supply depot entrance	Camanasa (A02-7)	1649	118	646	46.4% (west) 46.3% (east)
Nova Suai	Nova Suai	Junction A02-7	-	118	976	-
Asumetan	Suai Tugu roundabout	Debos (Local)	1709	-	-	-
Salele	Salele	Suai Market (A15-1)	3210	-	-	-
Maukatar	Suai Market	Fatalulik (C21)	1731	-	-	-

The majority of vehicle trips associated with the operational stage of the project would be from Nova Suai to the Supply Base, and from Nova Suai to Betano and Viqueque. This will result in a forecast volume of nearly 2450 vehicles along a key section of the A02-7 between Nova Suai and the Supply Base entrance.

Heavy vehicle impacts would be removed from the town centre as no trucks bringing material from quarries would be diverted around the town. The only heavy vehicles to operate from the Supply Base to the Suai town centre would be buses provided for the workforce at the Supply Base.



NOTES:
 This map contains:
 1. DEM: SRTM (2011)
 2. Rivers: Geographic Information Group TimorLeste (2010)
 3. Roads: DivaGIS (2010)
 4. District boundaries: GIGTimorLeste (2010)
 5. Traffic counts: WorleyParsons (2012)

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REV	DATE	REVISION DESCRIPTION	DRN	CHK	DES	ENG	APPD	CUST	PROJECT No: 301012-001504	
									Copyright © WorleyParsons Services Pty Ltd	

TASI MANE PROJECT - SUAI SUPPLY BASE ENVIRONMENTAL IMPACT ASSESSMENT

Figure 16-4
 Predicted total Suai traffic volumes during operation

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**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE**

Impacts Summary

Impacts on the land transport network associated with the project have been measured through qualitative criteria set out within the UK IHT *Guidelines for Traffic Impact Assessment (1994)* and the supporting *Guidelines for the Environmental Assessment of Road Traffic* (Institute of Environmental Assessment, 1991). The criteria attributed to impacts are set out in Table 16-5.

Table 16-5 Significance criteria

Significance	Criteria
Major	These effects are likely to be important considerations at a regional or district scale but, if adverse, are potential concerns to the project, depending on the relative importance attached to the issue during the decision making process. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.
Moderate	These effects, if adverse, while important at the local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource. They represent issues where effects will be experienced but, mitigation measures and detailed design work may ameliorate/enhance some of the consequences upon affected communities or interests. Some residual effects will still arise.
Minor	These effects may be raised as local issues but, are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the project and consideration of mitigation or compensation measures.
Negligible	No effects or those which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

A summary of the impact categories and the predicted level of impact on the land transport network are set out in Table 16-6.

**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE****Table 16-6 Impacts summary - land transport network**

Impact	Stage	Criteria Measurement
Air and noise quality impacts.	Construction	Moderate
Deterioration of road condition due to significant increase in daily movements of heavy vehicles.	Construction	Moderate
Deterioration of roads from significant increase in daily movements of light vehicles.	Construction	Moderate
Reduction in safety for other road users around the Suai Market location.	Construction	Moderate
Change in road safety for pedestrians in the study area.	Construction	Moderate
Impact on existing intersections.	Construction	Moderate
Air and noise quality impacts.	Operation	Moderate
Deterioration of roads from significant increase in daily movements of light vehicles.	Operation	Moderate
Change in road safety for pedestrians in the study area.	Operation	Moderate
Introduction of new intersections.	Operation	Minor
Impact on existing intersections.	Operation	Minor
Local road network management in Nova Suai.	Operation	Negligible

16.4 Avoidance, Management and Mitigation Measures

The impacts of the construction and operational phases of the project set out within Table 16-6 are subject to detailed engineering design and preparation of a traffic management plan, including further development of mitigation measures such as the diversion of heavy vehicle traffic around key population centres. These measures would be designed to reduce the environmental impacts on the local transport network. Each of the impacts set out in Table 16-6 have been addressed individually in the following sections.

16.4.1 Construction***Air and Noise Quality Impacts***

Detailed assessment of air quality issues, impacts and mitigation measures are set out in Section 16.5.

Detailed assessment of noise issues, impacts and mitigation measures are set out in Section 16.6

Road Condition

- The existing core road network that could be used by project related vehicles (both light and heavy) in the study area is in poor condition. The impact of additional heavy vehicle use, in particular during and after rainfall, will cause further deterioration of national and district roads;



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- Roads used to service future quarry sites should be upgraded in accordance with accepted design standards to handle both the anticipated volumes and nature of the various heavy vehicles employed on the project. The road surfaces should be designed to withstand the multiple construction phases and reflect accepted design standards;
- Alternative route(s) to and from quarry sites around Suai Market, away from existing dense residential areas or key community facilities, should be reviewed to determine if heavy vehicle traffic can avoid the location;
- Where appropriate, pedestrian crossing points should be included, in particular through the Suai Market area which will see some of the largest increases in heavy vehicle volumes. Pedestrian crossing points and controls should be provided for the most visible and obvious pedestrian routes within the market area;
- Drainage is a key issue for the maintenance of pavement conditions during the construction stage and beyond. Roads should be designed with the requisite drainage to avoid negative impacts on existing drainage features or properties;
- Clear, bilingual signage should be provided along the quarry routes noting the presence of heavy vehicles;
- Heavy vehicles moving to, and from, the Supply Base to the quarry sites should be restricted to key routes only and should not travel on local roads, except to access the quarries. Where local roads are used, they should be upgraded or constructed to accepted design standards;
- Traffic management controls should be upgraded to provide priority for through movements which will reduce deceleration and acceleration of heavy vehicles where appropriate. Each intersection along the key routes from the Supply Base to the quarries and to the east of the study area should be examined for improvements in traffic management; and
- Regular maintenance and review of pavement and drainage features should be undertaken during the construction period and repaired as required.

Decreased Level of Safety for Road Users around Suai Market

Road network improvements proposed to cater for construction vehicles will provide some mitigation for the potential impacts around Suai Market.

Strict speed limits should be introduced for construction vehicles passing through the market.

Dedicated areas for motorcycle parking should be provided away from the proposed heavy vehicle routes through Suai Market.

A road safety audit should be completed of the design of the road network improvements through the Suai Market location to highlight whether or not improvements could be provided.

Change in Road Safety for Pedestrians

Increase in heavy traffic volumes and the proposed improvements to the road network will result in a changed environment for pedestrians.



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Temporary manned and controlled pedestrian crossing points should be provided at key locations where there is significant heavy vehicle traffic. These locations include in front of schools, commercial locations and community facilities.

A Traffic Management Plan should be developed for each construction stage of the Suai Supply Base Development which clearly sets out which routes vehicles can use, when these routes will be used, the volume of vehicles anticipated and any special road or traffic conditions that exist.

Impact on Existing Intersections

The road improvements proposed as part of the project will affect the management of existing intersections.

A detailed review of the existing road network function and impacts at intersections should be undertaken as part of the design process.

16.4.2 Operation

Air and Noise Quality Impacts

Detailed assessment of air quality issues, impacts and mitigation measures are set out in Section 16.5

Detailed assessment of noise issues, impacts and mitigation measures are set out in Section 16.6

Road Condition

Key roads used for access to the project should be upgraded using accepted design standards to be able to accommodate the anticipated level of traffic and provide all year round access.

Drainage is a key issue for the maintenance of pavement conditions during the operational phase. Roads should be designed to include the requisite level of drainage that does not otherwise impact negatively on existing drainage features or properties.

Appropriate lighting should be provided on key links where there is likely to be significant traffic flow at night.

Change in Road Safety for Pedestrians

An assessment of the existing pedestrian routes along the A02-7 should be undertaken to understand the impacts of the new road access into the Supply Base and how people will access the area.

Formalised pedestrian crossings should be provided along the A02-7 where there is anticipated to be movement of pedestrians across the section of road anticipated to be more heavily trafficked.

Introduction of New Intersections

Clear signage and lighting should be provided within the design of new intersections for the project along the A02-7.

Traffic management controls should be provided at new intersections providing priority along the A02-7.



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Pedestrian crossing points should be incorporated into intersection design.

Impact on Existing Intersections

A detailed review of the existing road network function and impacts at intersections should be undertaken as part of the design process of the road network and intersection improvements proposed for the operation stage.

Local Road Network Management in Nova Suai

The road network design for Nova Suai should be completed to a high standard and include pedestrian facilities where possible.

16.5 Residual Impacts

Mitigation and management measures set out in Section 16.4 have been designed to address the key impacts on the land transport network. Not all impacts can be mitigated entirely, as the introduction of additional traffic on the road network in the study area will result in ongoing impacts and issues related to road safety and interaction of pedestrians, cyclists and motorcyclists with heavier vehicles associated with the project.

The most critical mitigation measure will be the improvement in the condition of the existing road network which is, currently, poor to very poor. This; however, is likely to result in more informal use of the road by pedestrians and motorcyclists due to the better road conditions compared to others in the area. This, in turn, will highlight the importance of road safety issues and management of the road network to reduce potential road trauma. These issues can be assessed and managed at a local level.

The residual criteria measurement for each impact after introduction of mitigation measures is set out in Table 16-7.



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Table 16-7 Residual impacts summary land transport network

Impact	Stage	Criteria Measurement
Air and noise quality impacts.	Construction	Minor
Wear and tear on roads from significant increase in daily movements of heavy vehicles.	Construction	Minor
Wear and tear on roads from significant increase in daily movements of light vehicles.	Construction	Minor
Decreased level of safety for other road users around the Suai Market location.	Construction	Minor
Change in road safety for pedestrians in the study area.	Construction	Minor
Impact on existing intersections.	Construction	Minor
Air and noise quality impacts.	Operation	Minor
Wear and tear on roads from significant increase in daily movements of light vehicles.	Operation	Minor
Change in road safety for pedestrians in the study area.	Operation	Minor
Introduction of new intersections.	Operation	Negligible
Impact on existing intersections.	Operation	Negligible
Local road network management in Nova Suai.	Operation	Negligible

16.6 Monitoring and Reporting

The monitoring and reporting measures for the land transport network during the construction and operational phases are set out below.

- Annual pavement condition reports should be undertaken for all key links in the core road network to allow for programming of maintenance. These condition reports may be used to prioritise upgrades required for the project;
- Annual review of all traffic management measures, including signage and lighting, should be undertaken to maintain all traffic management controls in place. Ongoing maintenance of traffic management measures should be undertaken on an as-needed basis e.g., replacement of signage, remarking lines and markers and replacement of road safety items such as ‘cats eyes’ (raised pavement markers); and
- All incidents or near miss vehicle incidents for all traffic generated by the project should be recorded, including traffic moving to, and from, the Supply Base to quarries and other sites during construction and all vehicles moving to, and from, Nova Suai to the Supply Base and other sites during the operational stage. A management plan for dealing with the health and safety implications for all vehicle incidents and recommending improvements should be developed and updated annually.



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16.7 Further Work

It is recommended that a full Transport Impact Assessment be undertaken for the Suai Supply Base. To enable this assessment to be prepared, it is important to gain a full and robust understanding of the current local conditions for the local area. This baseline data collection program should include:

- It was noted in Section 16.1 that there is a lack of historical traffic data for the study area and this has resulted in there being limited understanding of traffic growth or distribution patterns. In order to understand the impact of both construction and operation traffic on the land transport network, annual traffic observations should be undertaken on key links included within Table 16-2. These observations should be recorded and made available to the GoTL along with 2011 baseline information included in this EIA to track the traffic volumes in the study area;
- Current traffic movements through all useable roads in the local area. This data should be gathered at various times during the year as a representative baseline of traffic count data;
- Accurate population, employment and travel to work data should be gathered for the Suai area which will inform the distribution and assignment of traffic through the road network;
- Accurate vehicle fleet composition to enable the capacity on existing infrastructure to be calculated;
- All development proposals (land and road network) in the area that will impact on the community's movements and travel behaviours;
- Full detailed proposals for the operational phase of the Supply Base, Betano Petroleum and Beaco associated Refinery and LNG plant should be compiled for testing. These details should include the proposed number of trips between all sites and the proposals for routes and delivery of materials and products from each location. This will enable the impact for the wider area along the south coast to be assessed as well as the Suai area itself;
- Staged development of the transport network, including costings, should be updated to reflect revised plans for land uses along the south coast of Timor-Leste; and
- Development of a Traffic Management Plan to enable the safe planning and design of the road network through both the construction and operational phases of the project.

It is also recommended that the GoTL develop a transport master plan, complete with local infrastructure plans, strategies and policies to address potential growth in the area as a result of infrastructure and industrial improvements.



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Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

CHAPTER 17 WASTE MANAGEMENT



ENVIRONMENTAL IMPACT ASSESSMENT TASI MANE PROJECT – SUAI SUPPLY BASE

17 WASTE MANAGEMENT

The focus of this chapter is to describe typical waste management strategies that could be employed at Suai. Waste management at the Suai development area will rely on the development of new facilities and waste management areas as in general, there are no suitable industrial-scale waste management facilities available there currently.

This chapter does not address the potential impacts of waste on air, land, water, biodiversity, land use and visual amenity, as these impacts have been described in earlier chapters.

Section 17.1 details the existing waste environment in the Suai development area and surrounds.

Section 17.2 details the waste types that will typically be generated during construction and operations and Section 17.3 provides estimates of likely waste quantities.

Sections 17.4 and 17.5 describe typical waste management strategies and processes that could be employed, including reduction, reuse and recycle, treatment and disposal, storage and transportation and monitoring.

Section 17.6 details the waste management facilities required at the Suai development area to deal with the wastes described and estimated in Sections 17.2 and 17.3.

17.1 Existing Waste Environment

Minimal solid and liquid waste management facilities currently exist in Timor-Leste. As a result, waste is often left untreated resulting in contamination of land and waterways. This is particularly prevalent in highly populated towns and coastal villages.

Solid Waste

Solid waste in Timor-Leste's capital, Dili, is collected by commercial operators and transported to the Tibar landfill for disposal. The Tibar landfill, approximately 80 km north north-east of Nova Suai, 70 km north north-west of Nova Betano and 110 km north west of Nova Beaco, is the only landfill site available to dispose of solid waste from Dili. The landfill accepts medical (hospital) waste, including non-hazardous and hazardous waste (Carlos Lopes Ximenes, 2011).

Despite solid waste being collected in Dili, there is not complete coverage, therefore a lot of waste is left lying on streets and eventually enters streams then the sea (GoTL (2008b) in World Bank, 2009). Occasionally the piles of garbage are burned (Sandlund *et al*, 2001).

Illegal dumping of waste is also common. Large piles of waste are dumped on the side of streets and at abandoned lots without treatment or compaction. Mangroves are also used as dumping grounds for solid waste, particularly in areas adjacent to the coastal highways (Stockwell (2002) in World Bank, 2009).

There is another landfill near Baucau, approximately 150 km north-east of Nova Suai, 110 km north-east of Nova Betano and 50 km north of Nova Beaco; however, like the Tibar landfill near Dili, is too



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far away from the development areas to be considered as a viable alternative to deal with the wastes produced (Sandlund *et al*, 2001).

Litter is a substantial problem in Timor-Leste, particularly in urban areas. During heavy rainfall, plastic and other materials are washed into the ocean from rivers and open drains (IMF, 2005). Drainage channels are also becoming blocked with solid waste, kangkung and sediment, resulting in flooding and dangerous levels of pollution (RDTL, Undated).

The GoTL does not have a formal system for the collection, transportation and disposal of solid waste outside of Dili (GoTL (2008b) in World Bank, 2009) and existing systems for solid waste disposal are described as inadequate (IMF, 2005). In the Covalima, Manufahi and Viqueque districts, a single individual produces between 1 and 3 litres of waste per day (RDTL, 2011a). As the population of these districts continue to grow, it is imperative that effective solid waste management systems are implemented.

Liquid Waste

Liquid waste is a major issue in Timor-Leste as it can cause soil and water contamination, as well as impact the health of terrestrial and aquatic species (Carlos Lopes Ximenes, 2011). Existing systems for liquid waste disposal are currently inadequate (IMF, 2005).

Waste Oils

Hundreds of small workshops produce waste oil which often leaks into the city drainage and has been known to contaminate the soil (Plate 17-1) (World Bank, 2009). The Secretary of State of Environment has constructed a facility to store used oil at the Tibar landfill. The facility contains seven tanks, each with a capacity of 120,000 litres (Plate 17-2). Two collection trucks have also been made available to transport the waste oil to the facility.

Waste oils and other dangerous wastes are also dumped at the Tibar landfill near Dili, where children are allowed to play and adults are allowed to sift through the garbage (Sandlund *et al*, 2001).

Sewerage System

No sewerage system currently exists in Timor-Leste. Despite 36 per cent of the population having access to toilet facilities and sanitation, the waste is generally left untreated to flow into open drains and out to the beaches (GoTL (2008b) in World Bank, 2009). Those households without proper sewage facilities use drains, rivers, fields or gardens for disposal. This results in the contamination of waterways, groundwater and shallow wells, which is particularly important in population centres such as Dili, that rely on the shallow wells for their water supply (World Bank, 2009). Contact with the contaminated water by kangkung farmers, children playing in the drainage channels and the general community also poses a serious health risk (RDTL, Undated).

Septic tanks are currently used in some homes in Nova Suai, Betano and Beaco. The septic tanks are rectangular in shape, with 1 meter length, 1 meter width and 1.5 meters depth, or round shape with a diameter of 0.8 meter and 1 meter depth (RDTL, 2011a).

Source: Carlos Lopes Ximenes, 2011



Plate 17-1 Typical leaking oil drum

Source: Carlos Lopes Ximenes, 2011



Plate 17-2 Oil storage tanks at Tibar



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17.2 Waste Types

17.2.1 Construction

The waste types that will typically be generated at the Suai development area during construction will largely comprise of general (domestic) and industrial waste. These wastes are listed below.

- Greenwaste, timber, topsoil and ASS from early works to prepare the site;
- Construction debris (i.e., wood, scrap metal, glass, insulation and plastic) and general industrial waste (i.e., concrete, steel, metal);
- General (domestic) waste, paper and cardboard;
- Waste clothes and fabric;
- Domestic sewage and greywater;
- Tyres;
- Redundant electrical goods;
- Empty drums and containers;
- Batteries;
- Waste oils, grease and fuels;
- Oily rags and filters;
- Waste chemicals, paints, adhesives and solvents;
- Medical and first-aid station waste;
- Stormwater run-off;
- Dredging material (i.e., spoil from the shipping channels and establishment of the docks);
- Waste rock and soils;
- Ash from any incinerators; and
- Gaseous and particulate emissions from earthworks and vehicle movements.

17.2.2 Operation

The waste types that will typically be generated at the Suai development area during operations will comprise waste from maintaining the Supply Base, industrial estate, Nova Suai and Suai Airport (Table 17-1). The crocodile reserves may generate small amounts of sewage from tourist traffic; however, this will be treated onsite and otherwise not considered further in this report.



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Table 17-1 Waste types generated during operations

Waste Type	Source Location			
	Suai Supply Base	Industrial Estate	Nova Suai	Suai Airport (upgrade)
General (domestic) waste	√	√	√√	√
Domestic sewage and greywater	√	√	√√√	√
Batteries	√√√	√√	√	√
Waste oils, grease and fuels	√√√	√√√	√	√
Oily rags and filters	√√√	√√√	√	√
Stormwater run-off	√	√	√	√
Ash from high-temperature incinerator ¹	-	-	-	-
Contaminated soil from accidental spillages	√√	√√	√	√
Contaminated groundwater from process water release	√	√	-	-
Saline plume from the RO plant	-	-	-	-
Gaseous and particulate emissions from vehicle movements	√	√	√	√

¹ Ash from a high-temperature incinerator that would potentially be generated at the Waste Management Area (see Section 17.6).

√ Refers to the likelihood and relative volume of the waste type being generated at the source location.

17.3 Waste Quantities

An estimate of the typical waste quantities that will be generated at the Suai development area during construction and operations is not known at this stage and will be determined during the detailed design stage. Management strategies and disposal methods are discussed in more detail in Section 17.5 and are summarised in Table 17-2.

17.4 Waste Management Hierarchy

Waste management for the Suai development area will comply with relevant and applicable parts of the RDTL Government Decree Law 5/2011 on environmental licensing.

Where possible, the reuse, reduce and recycle hierarchy (RDTL, 2011a) will be adopted for the management of waste materials generated during construction, operations and maintenance activities at the Suai development area. This hierarchy includes the following:

- **Reduce.** Avoid, eliminate or reduce practices that result in waste generation;
- **Reuse.** Reuse waste materials where practicable; and
- **Recycle.** Convert waste into other useable materials.



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17.4.1 Reduce

Processes will be designed and implemented, as part of the project's EMP, to avoid, eliminate and reduce the generation of waste. This will include:

- Considering alternative products, i.e., substituting raw materials with less hazardous or toxic materials, and substituting materials for more environmentally friendly options;
- Using good housekeeping and operating practices, including inventory control;
- Using strict segregation processes to prevent the co-mingling of water and waste streams;
- Using low-sulfur diesel-powered equipment, where practicable;
- Ensuring equipment is maintained in accordance with manufacturer's specifications; and
- Clearing the smallest construction footprint possible, therefore reducing the generation of greenwaste, topsoil, spoil, overburden, ASS and greenhouse gases.

17.4.2 Reuse and Recycle

The total amount of waste will be reduced through the implementation of recycling and reuse strategies. These strategies will include:

- Identifying reuse opportunities and assessing which materials could potentially be recycled;
- Identifying market demands for waste streams in the vicinity of Suai (i.e., reuse of concrete to build roads);
- Installing dedicated skip bins for designated wastes around the construction site; and
- Establishing a waste management area where waste can be sorted.

Potential recycling or reuse of wastes, as given in Table 17-2 may include scrap metal, glass, some industrial waste (i.e., concrete), some general (domestic) waste, drums, containers and some waste oils.

17.5 Waste Management Strategies

Additional waste management strategies will be adopted following implementation of the waste management hierarchy (see Section 17.4), and will include:

- **Treatment and disposal.** Use treatment methods to render wastes safe and dispose of products that can no longer be reused or recycled to an appropriate location;
- **Storage and transportation.** Appropriately store and transport wastes to minimise accidental releases to air, soil or water resources; and
- **Monitoring.** Regularly monitor activities to ensure waste management strategies are effective.



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Waste management strategies have been provided below and are presented in Table 17-2. The proposed treatment and disposal methods will be further developed as part of the project’s EMP.

17.5.1 Treatment and disposal

Waste materials generated after implementing reduce, reuse and recycling measures will be treated before disposal.

Sewage, greywater and stormwater will be the only wastes treated. They will all be treated by the wastewater treatment plant, before being irrigated to land and reused onsite. Treated water that is not irrigated will be discharged to the sea.

Waste disposal will be in accordance with the methods given in Table 17-2 and in a manner that, as far as practicable, avoids potential impacts to human health and the environment. Waste disposal will only occur at permitted facilities within the waste management area.

Due to the limited number of waste management facilities in Timor-Leste, incineration is likely to be a viable option to reduce disposal volumes. Ash from any incinerated waste would need to be disposed of at a landfill. The use of a high-temperature incinerator is outlined further in Section 17.6.3.

Table 17-2 Generated waste types, and management and disposal methods (Part 1)

Waste type	Management Strategies/Treatment	Disposal Methods
Greenwaste	Stored in a bin before being incinerated or disposed of in a landfill.	Incinerator ash to landfill, if incineration is used.
Construction debris – wood material	Stored in a skip before being reused and/or incinerated.	Incinerator ash to landfill, if incineration is used.
Construction debris – scrap metal	Sorted, segregated and stored in a skip before being reused and/or transported to landfill.	Recycled or landfill.
Construction debris – glass	Sorted, segregated and stored in a skip.	Recycled or landfill.
Construction debris – insulation	Stored in a skip before being incinerated transported to landfill.	Incinerator ash to landfill.
Construction debris – plastic	Stored in a skip before being incinerated transported to landfill.	Incinerator ash to landfill, if incineration is used.
Industrial waste (i.e., concrete, steel, metal)	Sorted, segregated and stored in a skip or a designated area.	Recycled or landfill.
General (domestic) waste, paper and cardboard	Sorted, segregated and stored in a bin prior to transport to landfill..	Recycled or landfill.
Waste clothes and fabric	Stored in a bin before being removed.	Landfill.



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Table 17-2 Generated waste types, and management and disposal methods (Part 2)

Waste type	Management Strategies/Treatment	Disposal Methods
Domestic sewage and greywater	Collected and pumped to the wastewater treatment plant. Note: The option of dewatering the sewage and incinerating the sewage sludge may be considered in the future, depending on quantities to be generated.	Wastewater treatment plant. Following treatment it will be reused onsite or discharged to sea.
Tyres	Stored in a skip or a designated area. Shredding and debanding by an industrial shredder.	Landfill.
Redundant electrical goods	Stripped of restricted materials then stored in a skip.	Landfill.
Drums and containers	Sorted, segregated and stored in a skip. Cleaned and crushed (using the industrial shredder).	Recycled or landfill.
Batteries	Sorted, segregated and stored in a skip.	Recycled or returned to the manufacturer.
Waste oils, grease and fuel	Sorted, segregated and stored in individual drums and tanks, before being collected by a licenced operator for off-site disposal.	Recycled, or removed from site for licenced disposal.
Oily rags and filters	Sorted, segregated and stored in a skip before being incinerated or transported to landfill.	Incinerator ash to landfill, if incineration is used.
Waste chemicals, paints and adhesives	Sorted, segregated and stored in individual drums and skips prior to being collected by a licenced operator for off-site disposal.	Incinerator ash to landfill, if incineration is used.
Medical waste	Incinerated and/or collected by a licenced operator for off-site disposal.	Incinerator ash to landfill, if incineration is used.
Stormwater run-off	Collected (using a drainage and sump system) then pumped to the wastewater treatment plant.	Wastewater treatment plant. Following treatment it will be reused onsite or discharged to sea.
Topsoil	Stockpiled and managed for reuse during rehabilitation.	Reuse onsite.
Overburden and waste rock	Stockpiled and managed for reuse onsite.	Reuse onsite.
Process water	Collected (using a drainage and sump system) then pumped to the wastewater treatment plant.	Wastewater treatment plant. Following treatment it will be reused onsite or discharged to sea.
Saline plume from the RO plant	Discharged to the marine environment.	Pipeline discharge to sea.



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17.5.2 Storage

Wastes will be stored appropriately to minimise the risk of accidental releases to air, soil or water resources. The following measures will be implemented:

- Storage of wastes in a manner that prevents co-mingling or contact between incompatible wastes (e.g., acids and alkalis);
- Storage of wastes that allows for the inspection of containers, i.e., to monitor any potential leaks or spills;
- Storage of chemicals, fuel, paint and adhesives in appropriately sized drums and on hard standing surfaces;
- Conducting periodic inspections of waste storage areas to ensure compliance with safety standards;
- Locating spill kits near liquid waste storage areas;
- Training all employees in spill response;
- Covering domestic waste storage bins; and
- Stockpiling excess topsoil for reuse onsite. Stockpiles will be managed to ensure run-off is controlled and erosion is minimised.

17.5.3 Transportation

Onsite and offsite waste transportation will be undertaken in a manner that minimises the possibility of spills and potential impacts to human health and the environment. An EMP will be prepared to document the procedures that apply to all aspects of waste management, including transportation.

17.5.4 Monitoring

Monitoring activities will include the following:

- Recording and reporting the wastes generated by the project;
- Assessing the actual quantities and types of wastes compared to the predicted estimates. Following this, recommending and implementing improvements to waste management practices;
- Auditing the transportation and disposal of waste; and
- Regular visual inspections of the waste management area.

These waste monitoring procedures will be further developed as part of the project's EMP.



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17.6 Waste Management Area

A designated waste management area will need to be established in close proximity to the Suai development area. The designated waste management area is required for the following management, treatment and disposal techniques (as given in Table 17-2):

- Sorting and segregating wastes;
- High-temperature incineration (if required – refer to Section 17.6.3);
- Engineered landfill;
- Wastewater treatment;
- Tyre shredding (prior to disposal at a landfill); and
- Drum cleaning and crushing before disposal at a landfill.

The location of the waste management area will be selected based on the following regional criteria (RDTL, 2011a):

- Free of geotechnical risks (fault area, landslide prone area or earthquake prone area);
- Reduced hydrogeological risk, which is an area with less than 3 metres groundwater depth, water absorbance soil, closes proximity with water source. If these terms are not fulfilled a technical consultation is required;
- Reduced topographical risk (more than 20% land slope);
- Not within close proximity of the airport (minimum distance is 1.5 to 3 km away); and
- Not a conservation area.

Construction contractors and waste management companies will be responsible for the proper transport and handling of all the waste they produce. This will be detailed in the project's EMP.

17.6.1 Sorting and Segregating Wastes

The waste management area will include a designated area for sorting and segregating wastes.

Sorting and segregation of wastes will not always be undertaken in the waste management area as, in some instances, it may be easier to sort and segregate the wastes at the work site.

17.6.2 Engineered Landfill

A local engineered landfill will be required to receive all non-hazardous waste materials generated at the Suai development area during construction and operation. The capacity of existing landfills, and design of a new local landfill has not yet been determined by SERN, and it is understood this work will be commissioned during the detailed design stage.



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17.6.3 Incineration

A high-temperature incinerator will be installed in the waste management area, should the quantity and type of waste material generated be significant. At this stage, a design study for the potential incinerator has not commenced.

17.6.4 Wastewater Treatment Plant

A wastewater treatment plant will be required to treat the sewage, greywater and stormwater generated at the Suai development area. More detailed consideration of a wastewater plant will be undertaken at a later stage once estimates of wastewater production, prior to and during the construction stage, are known. A wastewater treatment plant would need to be built as part of the early works stage of the development.

17.6.5 Tyre Shredding

The waste management area will include an industrial shredder to shred and debead tyres before they are sent to the landfill for disposal. This will ensure there is available landfill capacity during construction and operations.

The industrial shredder can also be used to shred other waste such as drums. Tyres and drums can be stockpiled initially until a shredder is installed later in the project development schedule.

17.6.6 Drum Disposal

Drums will be cleaned and crushed (by the industrial shredder) before they are sent to the landfill for disposal. As above, this will ensure there is available landfill capacity during construction and operations.

17.7 Further Work

A detailed assessment of the volumes and types of wastes generated will need to be undertaken in order to appropriately size the required waste management facilities for the project.



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CHAPTER 18 ENVIRONMENTAL MANAGEMENT FRAMEWORK

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**ENVIRONMENTAL IMPACT ASSESSMENT
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18 ENVIRONMENTAL MANAGEMENT FRAMEWORK

The GoTL is committed to conducting activities for the project in an environmentally and socially responsible manner and intends to implement environmental and social management practices systematically. The ultimate purpose of an environmental management system is to ensure the environmental and social impacts arising from the development of the project remain within acceptable boundaries defined by the GoTL, based on the EIS.

This chapter outlines the environmental and social management framework for the project that will be applied throughout construction, commissioning and operation.

18.1 Commitment to Environmental Management

Environmental management is only as effective as the people that drive it. Leadership, commitment and accountability are important factors in achieving project success and excellence. Leaders should establish the vision and set achievable objectives and all employees at all levels, including contractors, should be held accountable for environmental performance. To meet high standards of performance, adequate resources should be assigned and employees should be well trained.

The GoTL will ensure the roles and responsibilities for environmental and social management will be clearly defined and all employees and contractors will be carefully selected, inducted and trained to ensure they are competent to perform the environmental and social duties relevant to their position. Comprehensive training and induction programs will be developed and implemented prior to commencement of construction and operation.

18.2 Environmental and Social Impact Assessment

Integral to any EIA, is the need to identify the points of interaction of the project, either negatively or positively, with the existing environment. The identification of environmental and social aspects, their impacts and associated avoidance, management and mitigation measures form the basis of how a project will be managed to reduce potentially adverse impacts. For this project, the environmental and social impacts and associated management measures are outlined in chapters 6 to 17 and are summarised in Table 18-1.

As planning and design for the project proceeds, these management measures will be refined and supplemented with greater detail and technical input. Similarly, an environmental and social policy statement that embodies the general philosophy of the GoTL towards these issues should be developed to guide development of the rest of the management framework.

To ensure all appropriate management measures are consistent with the commitments in this EIA, and are captured and implemented, a well-documented and robust management system is required. These environmental and social commitments will be a repository to capture and update all avoidance, management and mitigation measures throughout the life of the project, as a result of, for example, contractors input or implementation of monitoring programs.

**ENVIRONMENTAL IMPACT ASSESSMENT
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Reference	Commitment
<i>Topography, Geology and Soils</i>	
Chapter 7	1. Spills register. 2. Material safety data sheets. 3. Dangerous goods list.
<i>Land Use and Visual Amenity</i>	
Chapter 8	4. Re-vegetation strategy. 5. Lighting strategy.
<i>Hydrogeology</i>	
Chapter 12	6. Groundwater monitoring plans. 7. Spill response plan. 8. Environmental monitoring plan for surface and subsurface petroleum storage and distribution facilities. 9. Sanitation system and waste disposal plan.
<i>Marine Biodiversity</i>	
Chapter 14	10. Protocols for the management of antifouling. 11. Protocols for dredging operations and dredged material disposal.
<i>Social and Economic Values</i>	
Chapter 15	12. Resettlement Action Plan. 13. Local procurement program. 14. Dispute resolution mechanism that caters for dispute of employment.
<i>Waste Management</i>	
Chapter 17	15. Waste management strategies.

18.3 Environmental Management Plans

EMPs are essentially action plans and are typically an intermediate step between the general requirements and commitments defined in the SIA and EIA and the specific tasks to be implemented by project staff and contractors as defined in individual work instructions. The scope of an EMP can vary but, for this project, a strategic EMP has been developed and a range of specific activity EMPs will need to be developed. The strategic EMP is a separate and supporting document to this EIA and has been developed in accordance with the requirements of the Decree Law 5/2011 on environmental licensing and in recognition of the amount of information available at the time of preparing the EIA. The strategic EMP will capture the commitments outlined in the EIA.

The detailed EMPs will be prepared in a consistent style and format. The detailed EMPs will be consistent with the strategic EMP and will capture any conditions of approval stipulated by the Direcção Nacional dos Serviços do Meio Ambiente (DNSMA). The typical structure of the detailed EMPs is provided in Table 18-2.



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Table 18-2 Typical EMP Structure and Content

EMP Component	Content
Impact	Potential or actual adverse environmental impacts resulting from the activity (e.g., soil contamination, soil erosion, land instability, disturbance to ASS).
Objective(s)	The environmental or social management objectives(s) that relates to the environmental or social issue affected by the activity.
Avoidance, management and mitigation measures	Strategies to avoid, manage or mitigate impacts of tasks or actions.
Monitoring	Monitoring requirements to measure performance (e.g., auditing and inspection requirements).
Responsibilities	Specifies the title of the person responsible for the plan.
Reporting	Type and timing of reporting requirements.

Contractors working on the project will be obliged to comply with the environmental requirements, specifications and procedures set out in the EMPs, as applicable to their specific scope of works.

EMPs will be developed for both the construction and operation phases of the project. For construction, the following EMPs are envisaged:

- ASS management plan, in the event of either actual or potential ASS is present in areas where excavation or dewatering cannot be avoided;
- Biodiversity management plan. This plan may include sub-plans specific to significant species, habitats or ecological values;
- Chemical management plan;
- Compensation plan;
- Cultural heritage management plan;
- Dust management plan;
- Marine pest management plan;
- Noise management plan;
- Pest and disease management plan;
- Quarantine management plan;
- Rehabilitation plan;
- Resettlement action plan;
- Skills development plan;
- Soil contamination management plan;
- Soil and erosion management plan;



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- Spill response plan;
- Stakeholder engagement plan;
- Traffic management plan;
- Vegetation management plan;
- Waste management plan; and
- Water management plan. This plan is likely to have sub-plans on:
 - Acid sulfate soils
 - Erosion and sediment control
 - Surface water and stormwater
 - Wastewater
 - Watercourse crossing.

Management plans for the operations stage of the project are likely to include:

- Air quality management plan;
- Biodiversity management plan. This plan may include sub-plans specific to significant species, habitats or ecological values;
- Chemical management plan;
- Cyclone management plan;
- Noise management plan;
- Pest and disease management plan;
- Quarantine management plan;
- Skills development plan;
- Soil contamination management plan;
- Spill response plan;
- Stakeholder engagement plan;
- Traffic management plan;
- Waste management plan;
- Water management plan. This plan is likely to have sub-plans on:
 - Surface water and stormwater.
 - Wastewater; and
- Weed management plan.



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A decommissioning plan will also be developed. However, it is expected that this will be submitted to the regulator closer to the end of the project life.

18.4 Work Instructions

Environmental work instructions will need to be developed for the project. They are an implementation tool containing practical procedures for use by the workforce. They are concise and typically detail the purpose and scope of the work instruction, relevant definitions, various tasks and accountability of the responsible worker.

Examples of relevant work instructions include:

- Construction of bunds;
- Storage, segregation and disposal of waste streams;
- Refueling procedure; and
- Complaints procedure.

18.5 Environmental Monitoring Programs

The GoTL will need to develop environmental monitoring programs to monitor the performance of its activities, measure the effectiveness of management practices and to ensure compliance with its legal obligations. The programs will be developed in consultation with the relevant government agencies and incorporate any conditions of approval of the project. Typical monitoring programs that may be relevant to the project are outlined below.

18.5.1 Dust Monitoring

Dust monitoring is undertaken to assess compliance with the specified performance criteria in order to meet the objective of minimising dust emissions at sensitive receptors i.e., permanent residences. Dust gauges will be placed at appropriate locations, typically upwind and downwind of nearby sensitive receptors. Real-time monitors are installed to detect fine particulate matter (PM₁₀ and PM_{2.5}) to assess public health and total suspended particulates to assess public amenity, on a continuous basis during construction periods. Dust sampling is supported by daily monitoring of wind speed and direction.

18.5.2 Air Quality Monitoring

Air quality monitoring typically involves assessing the volume and composition of emissions to the atmosphere to protect air quality at sensitive receptors. In addition to dust, monitoring will be implemented to assess particular site-specific hazards. For the Suai Supply Base, few other air emissions are likely to threaten air quality apart from dust, whereas at the Betano Refinery and Petrochemical Complex and Beaco LNG Plant, gaseous emissions such as benzene, toluene, ethylbenzene, and xylenes, and oxides of sulfur, nitrogen and carbon will be monitored.



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18.5.3 Noise Monitoring

Noise gauges are placed at appropriate locations in the vicinity of the sensitive receptors during construction and ongoing operations to quantify the emissions detected during the day, evening and night time periods and assess compliance with the relevant noise criteria. Noise monitoring will assist in understanding the levels at which public amenity, recorded as complaints, are affected. Noise monitoring is supplemented by daily monitoring of wind speed and direction.

18.5.4 Water Quality Monitoring

The goals of an ambient water quality monitoring program are to determine the status of the aquatic ecosystem that potentially can be affected by the project and to detect any changes that may occur over time. This is achieved by conducting monitoring programs both upstream and downstream of the project activity, to assess and ensure existing water quality values and beneficial uses of the water resources are maintained throughout construction and operation of the project.

Both physio-chemical and biological indicators are typically included. Metals, nutrients and total suspended solids in the receiving waters are physio-chemical indicators that may be assessed. Sampling may include both routine, time-based sampling and event sampling, such as following a significant rainfall event.

Monitoring of biological indicators can be difficult due to the dynamic and variable nature of ecosystems. Macroinvertebrates and fish sampling (abundance, distribution and diversity) can be undertaken to provide ambient monitoring of freshwater systems.

18.5.5 Biodiversity Monitoring

The presence and abundance of endangered biodiversity species may be monitored as well as the control of potentially introduced animals, plants and diseases. A key element of biodiversity monitoring is the use of control plots and reference areas to ensure that impacts that may arise unrelated to the project development can be identified and compared against those within the project area.

18.5.6 Soil Monitoring

The presence of contamination in the vicinity of the oil bores near the Suai Loro area prompts the need for ongoing monitoring of the nature and extent of contaminated soils and potentially groundwater, to identify the recommended method for remediating potential environmental and/or human health impacts from the leaking oil.

18.5.7 Mangrove Health Monitoring

A mangrove health monitoring program for the remnant mangrove communities will be required to document the health of mangrove species during the construction and operation phase of the project.



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18.5.8 Crocodile Monitoring

A monitoring program for the proposed crocodile reserves may need to be designed and implemented at the completion of a baseline assessment.

18.6 Review and Reporting

All components of the environmental management framework will be documented and subject to review and modification by means of auditing, routine monitoring, incident or complaint investigations, legislative amendments and refinement of project development.

An environmental audit program will need to be developed, including definition of the scope and timing of audits. Audits will be conducted to assess performance in relation to:

- Compliance with established standards;
- 'Trigger levels' that indicate continued compliance is at risk;
- Identification and assessment of environmental and social risk; and
- Environmental management (i.e., EMPs, work instructions and monitoring programs).

Where audits, monitoring or investigations indicate that performance does not conform to environmental management requirements, corrective action will be required. Corrective action procedures will need to be established to:

- Determine the cause of non-conformance;
- Identify and implement corrective action;
- Initiate preventative actions;
- Apply controls to ensure that preventative actions are effective; and
- Record any changes in written procedure resulting from the corrective action.

Corrective actions will need to include management responsibilities for addressing, tracking and close-out of audits, monitoring programs and investigations.

Reporting of the environmental performance will be undertaken on a routine basis to inform affected communities of the status and progress of the project and regulators to assess compliance with licence and approval requirements.



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CHAPTER 19 CONCLUSIONS AND RECOMMENDATIONS



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19 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Timor-Leste is one of the world's newest and least economically-developed democracies. It has established a bold vision for its future that is currently, heavily reliant on the proposed exploitation of known oil and gas reserves in the Timor Sea.

Development of the Suai Supply Base and its related infrastructure is an important step in the overall development of Timor-Leste's offshore oil and gas industry and leading from that, the social and economic development of the country as a whole. This first step will take place within a new administrative and regulatory framework that has not been previously applied to a project of this scale. Similarly, this EIA is the first to occur under Environmental Decree Law No.5/2011.

The specialist studies that informed this study took place within a narrow timeframe, in many instances without the benefit of the historical information or baseline information necessary to place into context the observations made during the fieldwork and in desktop studies. In addition, the level of engineering design detail available can best be described as preliminary in nature. Considered collectively, the conclusions that can be drawn in this report should be regarded with some caution as there is little doubt that, with the benefit of additional engineering design information and scientific data, the information presented and recommendations contained in this report will almost certainly change.

The economic benefit to Timor-Leste and the urgency surrounding this project are unquestionable. Nevertheless, it has to be acknowledged that approval of the Suai Supply Base and any development based on the current state of knowledge (engineering, environmental, cultural, economic and social) does carry with it a heightened level of risk. That said, given the nature of the proposed works, the principal impacts to the natural environment associated during construction and operation of the project will be:

Construction:

- Short-term (i.e., 1 to 2 years at time in three phases) and localised emissions of noise and dust.
- Re-suspended sediment in the area affected by dredging and construction of the breakwater.
- The forced relocation of approximately 60 residences and the families living in them.
- Clearance of native vegetation that may be important to the Critically Endangered yellow-crested cockatoo.
- Loss of farmland.
- Coastal landscape changes and interruption of sediment transport (i.e., coastal erosion).



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Operations:

- Disposal of treated sewage.
- Storage of hazardous materials such as heavy fuel oil and diesel.
- An offshore plume of saline wastewater from the reverse osmosis plant.
- Domestic and light-industrial refuse disposed to landfill.
- Particulate, gas and noise emissions to air from fixed and mobile, plant and machinery.

With appropriate care, the potential loss of habitat used by the Critically Endangered yellow-crested cockatoo (*Cacatua sulphurea*) and the culturally significant estuarine crocodile (*Crocodylus porosus*) can be largely avoided.

The existing community that live and farm in and around Suai will experience changes to the local social and natural environment unprecedented in the area. Approximately 60 structures will need to be relocated to make way for the new facilities and reestablished elsewhere. However, as previously outlined (Chapter 15), these structures are believed to be temporary farm dwellings related to the establishment of rice and corn crops. Although the structures identified may be abandoned within a few months, all houses are recorded by SERN and the owners compensated if they are affected by project-related works.

In addition, there will be an influx of as many as 6,500 new residents in the new town of Nova Suai. This new group of people and the injection of both the initial capital expenditure and ongoing operating expenditure will bring about changes- both positive and negative- to the existing communities. These changes represent challenges that are not unique to Suai or Timor-Leste and there are many models in South East Asia and elsewhere that provide useful models to manage this change successfully. This will require close management by the GoTL.

Recommendations

If the Government of Timor-Leste wishes to reduce the current level of risk associated with the amount and scope of information to inform its decision on whether the project should proceed, an extensive array of further work is recommended. This is discussed in detail at the end of each chapter. The most important of these recommendations are summarised in Chapter 18, Environmental Management Framework.



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**ENVIRONMENTAL IMPACT ASSESSMENT
TASI MANE PROJECT – SUAI SUPPLY BASE**

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WorleyParsons

resources & energy

TIMOR GAP, E.P.
TIMOR GÁS & PETRÓLEO



REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE
SECRETARIA DE ESTADO DOS RECURSOS NATURAIS

Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX A



GOVERNO
República Democrática de Timor-Leste
Secretaria de Estado dos Recursos Naturais
GABINETE DO SECRETÁRIO DE ESTADO

TERMS OF REFERENCE (TOR)

**Environmental Impact Assessment/Study of Proposed
Development Area
In
Southern Coast of Timor Leste**

1. Background Information

1.1 Introduction

The exploration and production of petroleum resources from the Timor Sea has contributed a significant income to the Government of Timor-Leste (GTL) of which if strategically managed, it will bring long term revenue and opportunities to its people. Therefore, it is anticipated that the petroleum sector, including oil and gas production and downstream industries, will provide a significant industrial base to the economy. This strategic vision of GTL will drive new economic activities that can facilitate long term and sustainable social and economic growth to the country.

In this regard, the GTL has committed to build a full modern infrastructures and facilities at the south of the country to support the growing activities of the petroleum sector. The proposed development will be undertaken with great attention and protection of the natural environment, so that the development does not compromise the natural beauty or the ecosystem functions of the country.

1.2 Implementation Arrangement

The Government of Timor Leste (GTL), through the Secretary of State for Natural Resource, hereinafter referred to as the "Employer" has made available funds in order to finance the EIA Study for South Cost of Timor Leste.

The EIA study shall be conducted based on the GTL Decree Law no.5/2011 on 'Environmental Licensing'.

2. The Objectives

The EIA study and consultancy works for the Proposed Development of Suai Supply Base, Betano Refinery and Petrochemical Industries and Beaco LNG Plant to be undertaken by Consultant, aims to achieve the following global objectives:

- To determine the baseline conditions of the physical, biological and human environment around the vicinity of the site of the proposed project
- To identify the nature and extent of major environmental impacts that is likely to result from the proposed project
- To assess significant environmental impacts resulting from construction, installation and operation of the project based on predictions using appropriate modeling work
- To identify social and economic impacts that is likely to result from the proposed project
- To assess the environmental significance of potential residual impacts due to the installation of the proposed project
- To identify the qualitative environmental costs and benefits of the proposed project to the affected communities, and
- To recommend mitigating and ameliorating measures that will eliminate or minimize deleterious impacts of the proposed project as well as to propose plans for surveillance and monitoring of environmental effects.
- To train local staff related to experience, skill and knowledge transference.

3. Area of Study

The Area of EIA study works will encompass, but not limited to, the following:

- Suai:
 - Supply base area
 - Industrial estates
 - Nova Suai
 - Suai Airport
 - Crocodile farm
- Betano:
 - Refinery and Petrochemical complex
 - Petroleum city (Nova Betano)
- Beaco:
 - LNG Plant complex (up to 20 Million Tons per Annum / MTPA)
 - Nova Beaco
 - Nova Viqueque
 - Viqueque airport



Figure 1 – Proposed three centers for the Southern Coast Development

The above study is pertinent to ensure that the proposed development protects and preserves as much as possible the natural environment, maintain the functionality of the eco-system and embrace the concept of sustainable development.

4. Scope of Study

The Consultant is expected to undertake the scope of the EIA study for each of the three (3) sites. We anticipated that each site will need to be assessed separately, as they are distinct from each other and being separated by a distance of 50 to 90km.

4.5 Mitigation and Control Measures

To propose mitigating measures so as to minimize the negative impacts to the environment. Recommendations for environmental pollution control and management of environmental impacts will be made based on professional judgment of known applications of technology for the control of pollutants into the environment. Environmental pollution control technologies that are proposed will be reviewed for their performance and track record of use in similar operations to the extent possible, based on information that is supplied by the technology supplier and/or secondary information about such technologies.

4.6 Environmental Management Planning

Development of an outline Environmental Management Plan (EMP) for the project will be made with emphasis on the following:

- Environmental audit and monitoring requirements that would help enhance the development of the project and minimize environmental impacts
- Administrative arrangements for environmental management of the project
- Safety and emergency response procedures to avoid and respond to accidents and emergency situations

The findings of the EIA study will lead to the conclusion as to acceptability of the environmental impacts and the measures that can be taken to minimize effects on the environment. The need and benefits of the project should outweigh the adverse impacts, where the plant is deemed to have incorporated all relevant considerations in terms of the plant design, control systems and mitigation measures.

5. Environmental Baseline

The existing environment characteristics of areas within the Proposed Project site and the surrounding vicinity shall be described based on primary data and reviews of available published information or on data sourced from public and private organizations. The EIA Consultant shall carry out appropriate reconnaissance surveys during the tenure of the EIA study to supplement and/or update available information.

6. Prediction and Assessment of Environmental Impacts

The EIA Consultant shall predict the potential impacts to the environment based on results of existing environment studies and the effects that the project will impose to the environment.

7. Minimum Staff Numbers and Qualification Requirement

The following Table considers minimal qualification for staff/personnel to undertake this project. Staff with less than the minimum qualifications will score zero under the staff assessments in technical evaluation.

The number of experience years required in the table below shall reflect the experiences directly and/or closely related to EIA projects.

Minimum Qualification

International Experts requirement			
No.	International Experts	Qualifications	Experience (years)
1	Project Manager/Team Leader	Master of Chemical Engineering	15
2	Hydrologist	Master of Hydrology	10
3	Geotechnical Engineer	B.Sc. for Geoscience	10
4	Ecologist/Zoologist	B.Sc. of Ecology	10
5	Environmentalist	Master of Environment	10
6	Socio Economy	B.Sc. of Environment	10
7	Mineralogists	B.Sc. for Mineralogy	10
8	Health Environmentalist	B.Sc. for Environment	10
9	Mechanical Engineer	B. Engineering	5
Domestic Staffs requirement			
No.	National Experts	Qualifications	Experience (years)
	Environmentalist	Environmental graduated	2
	Geoscientist	B.Sc for Geoscience	2

Important Note:

The Consultant must submit its proposal on the basis of the above staff requirements and the estimated man-months as specified in Article 8 below. If the Consultant deems it appropriate, proposed changes must be specified in RFP Section 3 – Form TECH 3 and this will be discussed during the contract negotiations.

8. Person Months Requirement

It is estimated that **36 man-months** of Staff services are required for the EIA study.

9. Work Program

The required services for the EIA study shall be completed in **four (4) months**.

10. Reports

The Consultant shall submit the following reports all in English:

- (i) Draft report
- (ii) Finalization of the Completion Report, two (2) weeks after receiving comments from Employer.
- (iii) Any other reports needed/requested from time-to-time by Employer.

11. Facilities to be provided by the Consultant

The Consultant will make his own arrangements for the following facilities and include the cost in his financial proposal

- i) Transportation — transportation of equipment and personnel
- ii) Testing Services.

12. Facilities to be provided by the Employer

The Employer will make available copies of all relevant reports, maps and other relevant reference material and will provide liaison with other government agencies, as required to carry out the consulting assignment. The Employer will also allow the Consultant any reasonable use of equipment apparatus/facilities required to execute the investigations for which provision is not already made under the contract. Employer will facilitate the issue of visas, work permits and other documents required for carrying out the assignments under contract as appropriate.

13. Payment Milestone

No.	Milestone	Payment
1	Upon Contract Award	20%
2	Upon submission of draft report to SERN	50 %
3	Upon acceptance of final report	30 %
	Total	100%

14. Expected Output

The deliverables of this project shall include, but not limited to, the following:

No.	Component study	Expected Output
01	Topography and land use	Land use compatibility assessment
02	Geology	1.Characteristic of study area 2.Geotechnical assessment for the surface condition 3.Assessment of soil erosion
03	Climate and meteorology	1.Seasonal and annual wind speeds and directions in the form of wind rose 2. Climate parameters 3. Rainfall patterns
04	Air Quality	Air quality of study area
05	Noise	Noise quality levels in comparison with the limits as per WHO environmental guidelines
06	Hydrology and Drainage	Rainfall – runoff relationship Estimation of Q (m ³ /s) during dry and wet season Flooding scenario
07	Marine and River water quality	Existing water quality data for freshwater and marine water at the selected sampling stations will be established
08	Land Transport	Future traffic condition from or to the project area
09	Terrestrial flora and fauna	Description of species found within and outside the proposed project area whose habitats will be affected by the development A list of fauna species found within and outside the proposed project area.

No.	Component study	Expected Output
10	Marine ecology and Fisheries	<p>Checklist and diversity of marine communities around the proposed project site</p> <p>The existing freshwater ecosystem quality estimation using diversity indices</p>
11	Population distribution	<p>Present a description demographic profile of the local population according to size, age, sex, and ethnic group encountered during the survey.</p>
12	Socio - Economic	<p>To present a description of socio-economic profile of the local people</p> <p>To present general view and opinions of local people on the implementation of the project</p> <p>To solicit the degree of acceptance and opposition, as well as the condition set by the public on the proposed project</p>



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Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX B



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: February 2008

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10	20.90	25.20	23.40	72.00	93.00	81.00	75.60	6.81	10.50	3.21
11	22.70	26.70	24.20	70.00	87.00	79.50	38.40	5.13	18.29	4.40
12	22.40	26.30	23.90	72.00	87.00	80.00	39.60	5.15	13.42	3.71
13	22.20	26.00	24.00	71.50	86.00	80.00	37.20	4.40	11.33	3.39
14	22.40	26.20	24.00	70.00	88.50	78.50	10.80	4.44	11.98	3.47
15	21.80	27.50	24.20	62.50	86.00	74.00	21.00	5.54	23.00	5.42
16	21.00	27.70	24.00	61.50	87.50	76.00	3.00	5.01	13.30	4.27
17	22.30	30.30	24.70	61.00	94.50	79.50	22.80	1.64	14.94	3.66
18	20.50	28.90	24.20	62.00	94.00	75.50	100.80	2.55	13.95	3.65
19	21.70	27.50	24.90	65.00	77.50	72.00	0.00	3.39	11.46	3.76
20	21.80	28.10	23.80	60.50	119.50	78.50	25.20	4.51	17.28	3.69
21	21.40	26.40	23.10	68.50	90.50	81.50	106.80	5.03	11.90	3.55
22	21.20	25.30	23.20	69.50	87.50	79.00	80.40	4.36	12.29	3.44
23	23.00	29.40	25.30	56.00	93.50	73.50	0.00	2.41	21.16	4.86
24	22.00	28.80	24.60	62.50	90.00	74.50	0.00	3.21	16.25	4.21
25	23.30	28.30	24.90	61.00	85.50	71.50	9.60	3.40	22.36	5.19
26	22.00	30.90	25.30	52.00	89.50	71.50	0.00	2.07	21.73	5.10
27	22.40	30.20	25.00	52.50	92.50	73.00	0.00	1.70	17.30	4.21
28	21.80	31.00	25.10	58.00	92.50	77.00	0.00	1.41	16.65	3.93
29	21.80	31.50	25.50	38.00	94.00	73.00	0.00	1.63	23.56	5.41
30										
31										
Decade 1	20.90	25.20	23.40	72.00	93.00	81.00	75.60	6.81	10.50	3.21
Decade 2	21.88	27.52	24.19	65.60	90.75	77.35	298.80	4.18	14.90	3.94
Decade 3	22.10	29.09	24.67	57.56	90.61	74.94	196.80	2.80	18.13	4.44
MONTH	21.93	28.11	24.37	62.30	90.80	76.45	571.20	3.69	16.13	3.86

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: March 2008
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	21.40	30.90	25.30	51.00	94.00	75.50	0.00	1.50	19.54	4.49
2	21.80	29.30	23.40	66.00	96.00	87.50	27.60	1.08	9.67	2.48
3	21.20	29.00	24.30	62.50	93.50	80.00	0.00	1.10	16.28	3.55
4	20.70	30.50	24.20	62.00	94.50	82.00	0.00	1.38	20.09	4.26
5	21.10	29.80	24.00	62.50	93.50	83.00	38.40	1.15	15.62	3.49
6	20.60	31.70	23.70	59.00	96.00	82.50	270.00	1.13	15.04	3.52
7	20.60	30.60	24.30	56.50	96.00	82.00	291.60	1.39	15.67	3.71
8	20.10	30.60	23.80	62.00	96.00	85.00	0.00	1.31	17.08	3.77
9	21.20	27.60	22.80	68.00	94.00	85.50	211.20	1.02	6.87	1.97
10	21.10	30.70	24.80	53.00	89.00	75.00	2.40	0.93	20.08	4.25
11	21.50	30.30	23.60	66.50	96.50	87.50	146.40	0.93	10.19	2.52
12	20.90	29.00	23.30	66.50	95.50	83.00	116.40	1.19	10.39	2.60
13	20.60	29.90	23.90	60.50	89.50	79.00	0.00	1.34	17.71	3.92
14	21.50	31.00	24.50	61.00	92.50	78.50	0.00	1.24	20.26	4.31
15	21.30	31.00	23.70	61.50	95.50	88.50	72.00	0.95	12.97	3.05
16	20.90	28.70	23.60	73.00	96.50	87.50	1.20	1.11	10.18	2.42
17	20.30	30.50	22.80	63.00	97.50	87.00	385.20	1.15	10.68	2.72
18	20.90	29.50	24.50	64.00	94.50	82.00	0.00	1.32	20.53	4.21
19	21.00	30.90	24.40	63.00	93.50	83.50	28.80	1.24	20.43	4.27
20	20.80	26.00	23.20	77.50	95.50	90.00	2.40	0.83	7.86	1.89
21	20.70	29.90	23.80	67.00	95.50	86.50	25.20	1.08	12.82	2.94
22	21.10	30.30	23.40	62.50	95.50	88.00	127.20	0.95	10.99	2.70
23	20.70	29.00	23.20	65.50	95.50	88.00	63.60	1.16	11.64	2.77
24	20.20	29.90	24.10	62.00	95.50	83.00	12.00	1.55	22.97	4.61
25	21.20	29.40	23.10	66.00	95.50	88.50	55.20	1.24	12.39	2.91
26	20.70	30.30	24.10	57.50	94.50	83.00	28.80	1.15	19.74	4.13
27	20.90	29.50	24.10	67.50	92.50	83.00	0.00	1.24	15.04	3.32
28	21.40	29.30	24.00	64.00	94.50	84.00	2.40	1.23	11.59	2.84
29	20.80	29.10	23.90	70.00	96.00	87.00	6.00	1.31	15.97	3.37
30	21.40	28.90	24.10	69.00	93.50	85.00	4.80	1.23	17.04	3.55
31	21.00	29.70	23.60	68.00	96.00	88.50	34.80	1.02	14.42	3.11
Decade 1	20.98	30.07	24.06	60.25	94.25	81.80	841.20	1.20	15.59	3.55
Decade 2	20.97	29.68	23.75	65.65	94.70	84.65	752.40	1.13	14.12	3.19
Decade 3	20.92	29.57	23.76	65.36	94.95	85.86	360.00	1.19	14.96	3.29
MONTH	20.95	29.77	23.85	63.81	94.65	84.16	1953.60	1.17	14.90	3.35

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION



MONTHLY METEOROLOGICAL BULLETIN: April 2008
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004

Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	21.00	28.60	23.10	69.00	96.50	89.00	158.40	1.27	12.23	2.79
2	20.60	28.70	23.70	68.50	94.50	83.00	0.00	1.19	11.89	2.75
3	20.90	29.10	23.60	62.00	95.50	84.50	0.00	1.15	17.04	3.58
4	21.30	27.30	23.50	74.00	93.00	85.50	0.00	1.31	10.33	2.44
5	20.90	27.80	22.40	76.00	97.50	90.50	100.80	1.18	7.88	1.97
6	19.40	27.60	23.40	62.00	96.50	80.00	0.00	2.30	17.55	3.81
7	20.30	29.00	23.20	56.00	95.50	81.50	7.20	2.12	16.75	3.95
8	20.70	25.50	22.40	80.00	96.00	90.50	36.00	2.28	9.16	2.16
9	20.90	28.80	23.70	53.50	90.50	78.50	0.00	2.34	22.21	4.83
10	20.60	27.60	23.30	60.50	93.50	79.00	0.00	2.36	20.17	4.24
11	20.90	28.30	23.60	54.00	92.50	80.50	0.00	2.38	20.18	4.50
12	20.80	27.50	26.00	62.00	86.00	83.50	1.20	0.97	5.21	1.84
13	22.20	29.80	29.30	66.00	95.50	66.50	2.40	0.23	1.19	0.80
14										
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17										
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28										
29										
30										
31										
Decade 1	20.66	28.00	23.23	66.15	94.90	84.20	302.40	1.75	14.52	3.25
Decade 2	21.30	28.53	26.30	60.67	91.33	76.83	3.60	1.20	8.86	2.38
Decade 3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
MONTH	20.81	28.12	23.94	64.88	94.08	82.50	306.00	1.62	13.21	#DIV/0!

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: June 2008
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1										
2										
3										
4										
5										
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13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23	21.30	27.20	23.40	69.00	99.50	88.50	25.20	0.61	4.72	1.36
24	22.20	29.00	24.00	58.00	96.50	84.00	1.20	0.97	8.20	2.18
25	19.90	28.60	24.10	57.00	97.50	81.00	0.00	1.15	17.99	3.45
26	20.00	28.80	23.60	57.00	98.00	81.50	0.00	1.09	15.59	3.13
27	19.10	28.90	23.50	58.50	97.50	82.50	1.20	0.93	15.61	3.05
28	19.80	30.30	24.50	52.00	98.50	81.50	24.00	1.08	16.42	3.38
29	22.40	29.50	25.10	63.00	97.00	85.00	78.00	0.95	17.16	3.36
30	21.30	29.90	25.10	65.00	98.00	85.50	50.40	1.05	17.01	3.34
31										
Decade 1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
Decade 2	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
Decade 3	20.75	29.03	24.16	59.94	97.81	83.69	180.00	0.98	14.09	2.91
MONTH	20.75	29.03	24.16	59.94	97.81	83.69	180.00	0.98	14.09	#DIV/0!

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: July 2008
AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	20.60	30.60	24.70	52.00	97.50	83.50	1.20	1.02	18.14	3.62
2	20.10	29.40	24.70	62.00	99.00	84.00	0.00	1.28	17.33	3.42
3	19.20	29.00	24.70	58.50	97.50	79.00	0.00	1.13	18.16	3.49
4	21.20	28.70	24.20	60.50	95.50	81.00	2.40	0.90	14.86	2.99
5	18.30	28.60	23.10	53.00	99.00	79.50	1.20	1.13	17.52	3.39
6	18.90	28.80	23.80	50.50	97.50	78.50	0.00	0.93	15.15	3.07
7	19.80	28.50	24.00	58.00	96.50	79.50	0.00	0.98	13.81	2.87
8	18.80	29.80	24.20	49.00	92.50	71.00	1.20	1.49	18.01	3.82
9	18.30	29.20	23.30	50.00	91.50	71.50	0.00	1.15	10.21	2.67
10	18.90	26.00	22.00	68.50	95.50	88.50	21.60	0.57	4.32	1.31
11	19.70	28.40	23.50	59.50	98.00	82.00	0.00	0.82	13.02	2.68
12	18.90	28.80	23.80	62.00	97.50	82.50	8.40	0.96	15.97	3.10
13	20.60	29.40	24.50	57.00	98.00	83.50	0.00	0.93	17.27	3.38
14	18.90	30.90	23.80	39.00	99.00	78.50	2.40	0.98	19.40	3.85
15	17.40	29.20	23.50	57.00	98.00	81.50	0.00	0.90	19.17	3.52
16	19.30	29.60	23.80	58.50	99.00	83.50	1.20	1.09	19.38	3.67
17	17.30	29.30	23.30	53.00	99.50	81.00	2.40	0.98	19.51	3.63
18	16.70	29.40	23.30	51.00	100.50	80.00	0.00	0.79	17.67	3.32
19	20.30	29.70	25.10	59.50	96.50	80.50	4.80	0.78	17.58	3.39
20	23.30	27.00	23.60	76.50	96.50	90.00	22.80	0.46	3.37	1.09
21	18.70	30.00	24.10	49.00	99.50	82.00	3.60	0.57	17.31	3.25
22	22.50	29.50	24.60	52.50	96.50	82.50	0.00	0.54	12.45	2.64
23	20.80	29.50	24.30	59.50	96.00	81.50	9.60	0.98	12.20	2.74
24	19.30	26.50	22.50	63.00	98.00	84.00	3.60	0.50	5.76	1.52
25	18.00	28.40	23.10	55.50	98.50	78.00	0.00	0.81	13.63	2.79
26	19.30	28.10	23.50	49.50	92.50	72.00	0.00	0.73	13.73	2.84
27	18.40	28.50	23.20	52.00	94.50	75.50	0.00	0.91	19.28	3.61
28	19.70	28.80	23.90	50.00	92.50	72.00	1.20	1.02	20.39	3.88
29	16.30	28.60	22.40	56.00	98.50	81.00	1.20	1.06	19.46	3.60
30	16.40	28.90	22.70	50.00	99.00	79.00	1.20	1.02	19.29	3.65
31	18.00	28.90	22.60	48.00	97.50	78.00	1.20	1.09	18.86	3.68
Decade 1	19.41	28.86	23.87	56.20	96.20	79.60	27.60	1.06	14.75	3.06
Decade 2	19.24	29.17	23.82	57.30	98.25	82.30	42.00	0.87	16.23	3.16
Decade 3	18.85	28.70	23.35	53.18	96.64	78.68	21.60	0.84	15.67	3.11
MONTH	19.16	28.90	23.67	55.48	97.02	80.15	91.20	0.92	15.56	3.11

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: August 2008
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	17.60	28.80	23.00	49.00	94.50	76.00	0.00	1.02	18.44	3.60
2	18.60	29.30	23.50	58.00	98.00	78.50	1.20	1.39	20.71	3.98
3	16.80	29.10	23.00	53.50	94.50	76.50	0.00	1.39	20.05	3.93
4	18.70	29.20	23.70	54.50	96.50	79.00	1.20	1.15	20.19	3.89
5	18.20	29.70	23.50	53.50	99.00	81.00	1.20	1.31	20.98	4.08
6	17.30	29.90	23.70	53.00	98.00	78.00	1.20	1.62	20.98	4.22
7	19.40	29.50	24.40	58.00	93.00	73.50	0.00	1.79	18.81	4.00
8	18.00	29.20	23.70	56.50	92.50	72.50	0.00	1.76	18.33	3.90
9	17.10	28.90	23.30	53.00	93.50	74.50	1.20	1.06	16.04	3.33
10	20.60	29.30	24.60	54.50	90.50	76.50	0.00	1.01	16.49	3.47
11	18.20	29.10	24.50	55.50	98.50	76.00	0.00	1.28	20.15	3.96
12	22.10	29.90	24.80	51.50	91.50	75.00	0.00	1.08	15.82	3.51
13	19.10	29.60	24.00	54.00	97.50	78.00	1.20	1.12	20.00	3.94
14	18.60	29.80	23.70	55.50	99.50	78.50	0.00	0.91	14.43	3.09
15	18.10	29.90	24.10	48.00	96.00	75.50	0.00	1.05	19.63	3.94
16	19.70	29.60	24.40	48.50	94.00	76.00	0.00	0.96	17.75	3.67
17	20.20	29.50	24.30	52.50	96.00	74.50	1.20	1.22	15.15	3.41
18	20.60	29.30	24.50	47.00	86.50	67.00	0.00	1.47	18.31	4.10
19	18.70	28.60	23.60	53.00	88.00	71.00	0.00	1.06	17.58	3.62
20	19.60	29.40	24.90	56.50	91.50	75.50	25.20	1.22	16.51	3.57
21	22.40	29.10	24.50	67.50	96.50	86.50	96.00	1.19	13.46	2.97
22	19.60	29.40	24.20	60.00	98.50	83.50	1.20	1.41	20.82	4.12
23	21.50	29.90	25.50	58.50	96.00	76.50	0.00	1.57	17.13	3.81
24	22.00	29.00	24.50	63.50	93.00	76.00	0.00	1.31	9.38	1.25
25	19.80	29.80	24.90	61.50	96.00	81.50	8.40	1.23	19.19	3.90
26	22.10	30.70	25.60	62.00	97.50	84.00	0.00	1.26	18.52	3.92
27	21.70	30.40	25.90	63.50	98.00	82.50	1.20	1.52	22.36	4.50
28	21.90	31.00	26.00	60.50	96.50	81.00	0.00	1.61	20.91	4.43
29	22.80	30.80	26.00	62.50	96.00	81.50	0.00	1.41	22.10	4.54
30	22.00	30.10	26.00	62.00	95.50	81.00	1.20	1.06	21.05	4.24
31	20.90	30.60	25.60	63.00	98.50	83.00	0.00	1.19	20.97	4.23
Decade 1	18.23	29.29	23.64	54.35	95.00	76.60	6.00	1.35	19.10	3.84
Decade 2	19.49	29.47	24.28	52.20	93.90	74.70	27.60	1.14	17.53	3.68
Decade 3	21.52	30.07	25.34	62.23	96.55	81.55	108.00	1.34	18.72	3.81
MONTH	19.80	29.63	24.45	56.45	95.19	77.74	141.60	1.28	18.46	3.78

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: September 2008

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	19.80	30.50	25.50	64.00	99.00	83.00	0.00	1.03	17.90	3.70
2	21.70	30.10	25.00	68.00	98.00	87.00	13.20	1.11	13.47	3.01
3	20.60	30.30	25.40	57.50	99.00	82.00	1.20	1.61	22.86	4.66
4	19.40	30.60	25.10	57.00	98.50	80.00	0.00	1.45	22.87	4.62
5	19.10	30.90	25.10	53.50	96.00	77.50	0.00	1.35	22.62	4.64
6	19.70	30.90	25.40	50.50	94.50	77.00	1.20	1.22	21.73	4.52
7	20.00	30.50	25.60	56.50	97.50	78.00	0.00	1.06	22.66	4.52
8	22.30	31.30	26.10	56.00	94.00	79.00	0.00	1.09	20.34	4.32
9	21.50	31.20	26.60	57.50	96.50	77.50	0.00	1.46	20.95	4.51
10	20.50	31.30	25.80	42.00	96.00	73.50	0.00	1.54	21.25	4.80
11	19.20	30.90	25.00	61.50	95.50	78.50	1.20	1.20	21.48	4.35
12	18.80	30.40	24.60	57.50	98.50	80.00	0.00	1.08	22.24	4.40
13	18.80	32.50	25.20	47.50	96.50	74.50	1.20	1.02	23.26	4.78
14	17.10	31.00	24.50	48.50	89.00	71.00	0.00	1.05	23.19	4.65
15	22.50	31.00	26.00	60.50	90.50	77.00	0.00	1.02	16.31	3.67
16	21.90	31.90	26.60	51.00	93.50	75.50	0.00	1.15	23.01	4.87
17	18.40	31.20	25.50	54.00	94.50	75.50	0.00	1.13	22.38	4.59
18	20.80	33.10	26.80	46.50	93.50	73.50	0.00	1.10	22.36	4.86
19	21.30	33.60	26.90	40.50	94.50	72.00	0.00	1.02	23.04	5.01
20	19.20	32.20	26.00	45.00	89.50	71.00	0.00	1.02	23.29	4.86
21	18.50	32.30	25.70	46.50	90.50	71.00	1.20	1.08	23.51	4.90
22	20.20	31.50	25.90	45.00	93.00	74.00	0.00	1.19	23.76	4.99
23	19.70	31.80	26.00	51.50	94.50	75.50	0.00	1.01	23.43	4.81
24	21.10	32.80	26.60	50.00	93.00	76.00	1.20	1.55	22.82	5.13
25	20.70	32.20	26.40	55.00	92.50	75.00	0.00	1.48	22.56	4.93
26	21.60	32.40	26.50	38.00	86.50	70.00	0.00	1.31	19.08	4.66
27	20.60	32.10	26.30	45.00	93.50	73.50	9.60	1.37	21.73	4.88
28	21.00	31.70	26.20	50.00	98.00	77.00	1.20	1.17	24.00	5.01
29	19.30	31.60	25.70	51.00	96.00	75.00	0.00	1.24	22.40	4.75
30	21.00	31.50	26.50	54.50	95.50	74.00	0.00	1.24	22.51	4.78
31										
Decade 1	20.46	30.76	25.56	56.25	96.90	79.45	15.60	1.29	20.67	4.33
Decade 2	19.80	31.78	25.71	51.25	93.55	74.85	2.40	1.08	22.06	4.60
Decade 3	20.37	31.99	26.18	48.65	93.30	74.10	13.20	1.26	22.58	4.88
MONTH	20.21	31.51	25.82	52.05	94.58	76.13	31.20	1.21	21.77	4.61

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: October 2008

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	21.70	31.60	26.40	52.50	91.50	74.50	0.00	1.16	19.08	4.30
2	21.00	32.20	26.70	53.00	94.00	75.00	0.00	1.20	23.02	4.93
3	22.60	32.10	27.20	57.50	94.50	76.50	0.00	1.09	21.49	4.64
4	22.30	33.40	27.70	48.00	93.50	72.00	0.00	1.12	23.87	5.22
5	21.90	32.30	27.40	53.00	92.50	75.00	0.00	1.20	22.94	4.98
6	22.10	33.40	27.90	45.50	93.00	72.00	0.00	1.02	24.02	5.21
7	23.80	33.30	28.20	52.50	94.50	75.50	122.40	1.25	21.46	4.90
8	23.40	32.30	27.50	65.50	98.00	83.00	0.00	1.23	23.18	4.91
9	23.20	32.60	27.70	53.50	96.00	78.50	3.60	1.06	22.88	4.96
10	22.60	32.40	27.60	56.00	97.00	77.00	0.00	1.52	24.46	5.31
11	22.30	33.40	27.70	53.00	90.50	75.00	0.00	1.55	24.15	5.45
12	22.60	32.80	27.70	58.00	94.00	78.00	0.00	1.32	24.01	5.20
13	22.60	32.80	27.80	56.00	96.00	77.00	0.00	1.31	24.00	5.21
14	22.10	32.90	27.80	54.50	95.50	75.50	0.00	1.25	24.36	5.26
15	22.70	33.10	28.20	55.00	93.00	75.50	0.00	1.27	24.50	5.35
16	23.90	32.80	28.30	56.50	93.50	77.50	1.20	1.13	22.91	5.04
17	23.80	33.40	28.30	52.50	91.50	74.50	0.00	1.31	24.56	5.47
18	22.80	33.00	31.80	53.50	90.50	55.50	0.00	0.31	5.24	1.68
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Decade 1	22.46	32.56	27.43	53.70	94.45	75.90	126.00	1.19	22.64	4.93
Decade 2	22.85	33.03	28.45	54.88	93.06	73.56	1.20	1.18	21.72	4.83
Decade 3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
MONTH	22.63	32.77	27.88	54.22	93.83	74.86	127.20	1.18	22.23	#DIV/0!

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: November 2008

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	23.50	31.50	26.00	61.00	96.00	85.00	0.00	1.56	22.55	4.88
2	23.80	34.40	28.60	39.50	94.00	71.50	0.00	1.55	22.65	5.57
3	21.60	33.10	27.80	50.00	92.50	73.00	78.00	1.44	21.86	5.05
4	24.00	32.90	28.00	57.00	98.00	79.50	0.00	1.06	23.76	5.14
5	22.10	33.70	28.10	46.00	95.50	71.50	0.00	1.02	23.02	5.10
6	23.30	32.90	28.40	53.50	90.50	72.00	0.00	1.25	21.60	4.93
7	24.10	33.90	28.80	53.00	90.00	73.00	0.00	1.18	20.87	4.89
8	24.60	35.10	29.20	47.50	90.00	71.00	0.00	1.04	19.11	4.67
9	24.70	34.20	29.20	52.50	90.00	73.00	0.00	1.19	21.65	5.07
10	23.30	34.40	29.20	51.00	93.50	71.00	1.20	1.30	22.59	5.25
11	24.10	33.50	28.80	56.00	88.50	73.00	0.00	1.23	18.59	4.48
12	23.80	33.60	29.10	52.50	88.00	72.00	28.80	1.23	20.61	4.86
13	24.60	33.90	29.00	53.00	97.00	78.00	0.00	1.05	21.27	4.87
14	23.80	34.10	29.00	50.00	92.50	72.50	0.00	1.23	22.80	5.26
15	24.20	33.70	29.10	55.50	89.00	71.50	0.00	1.33	22.03	5.12
16	25.30	33.80	28.30	56.00	94.50	78.50	19.20	1.27	18.79	4.53
17	24.50	33.40	27.90	58.50	96.00	83.00	61.20	1.00	14.66	3.62
18	24.20	33.90	28.30	57.00	98.00	81.00	2.40	0.93	20.49	4.61
19	23.60	34.20	28.90	54.00	96.50	76.50	26.40	1.22	25.08	5.56
20	23.90	33.60	28.80	50.00	98.00	76.50	0.00	1.06	25.29	5.52
21	23.90	35.00	29.40	39.00	94.00	71.00	0.00	1.08	24.27	5.57
22	24.50	35.40	29.50	48.50	86.00	70.00	0.00	1.27	23.38	5.57
23	24.80	35.00	29.20	47.00	90.00	73.00	1.20	1.31	20.38	5.06
24	24.60	35.20	29.60	51.00	91.50	73.50	58.80	1.18	20.80	5.01
25	25.00	34.70	29.20	54.50	95.00	76.50	2.40	1.26	23.21	5.36
26	25.10	34.30	27.80	55.50	94.50	83.00	25.20	0.87	15.28	3.76
27	24.20	34.60	27.60	53.50	96.00	84.00	51.60	0.94	17.06	4.11
28	24.40	32.50	26.50	62.50	98.00	90.00	40.80	0.66	12.14	2.92
29	23.40	34.00	28.10	58.50	98.50	81.00	6.00	0.82	19.98	4.45
30	24.30	33.00	26.90	61.50	96.50	86.50	172.80	0.95	13.74	3.36
31										
Decade 1	23.50	33.61	28.33	51.10	93.00	74.05	79.20	1.26	21.97	5.02
Decade 2	24.20	33.77	28.72	54.25	93.80	76.25	138.00	1.15	20.96	4.95
Decade 3	24.42	34.37	28.38	53.15	94.00	78.85	358.80	1.03	19.02	4.40
MONTH	24.04	33.92	28.48	52.83	93.60	76.38	576.00	1.15	20.65	4.79

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: December 2008

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	23.90	33.20	27.90	60.50	96.50	81.50	48.00	1.31	22.63	5.02
2	24.10	34.20	27.40	53.00	94.50	82.00	4.80	0.98	19.02	4.45
3	24.10	32.70	27.30	62.00	96.00	84.50	24.00	0.96	16.07	3.75
4	24.00	32.70	27.50	59.00	97.00	84.50	48.00	0.88	21.76	4.70
5	24.40	33.40	28.50	63.00	98.50	82.50	1.20	0.95	24.44	5.24
6	24.60	33.80	29.00	57.50	95.00	76.50	1.20	1.13	26.06	5.68
7	24.00	33.90	27.90	54.50	95.00	81.50	75.60	1.08	20.90	4.77
8	24.00	33.20	27.60	58.00	96.50	82.00	0.00	0.83	18.44	4.16
9	23.60	33.20	27.60	62.00	97.00	85.00	8.40	0.75	16.53	3.76
10	24.80	32.80	28.50	62.00	97.00	83.00	1.20	0.93	18.60	4.21
11	24.50	33.70	28.00	55.50	96.50	82.00	93.60	0.97	21.22	4.76
12	24.40	34.20	28.40	53.50	98.00	81.00	30.00	0.91	20.00	4.58
13	23.30	32.30	26.80	64.50	100.00	87.00	10.80	1.11	17.30	3.90
14	24.10	33.70	27.40	56.50	94.50	82.00	2.40	1.12	17.03	4.12
15	24.30	32.60	27.60	58.50	96.00	82.00	0.00	0.82	15.25	3.60
16	24.40	32.20	26.40	59.00	97.50	87.50	0.00	0.57	9.35	2.42
17	24.00	32.90	27.20	60.00	98.50	87.50	0.00	0.60	16.80	3.74
18	24.40	35.00	28.30	55.50	94.50	80.50	0.00	0.41	14.67	3.40
19	24.80	34.70	28.10	54.50	97.50	80.00	0.00	0.78	19.33	4.42
20	22.70	34.00	27.90	57.00	99.00	84.00	0.00	0.38	18.75	4.03
21	23.40	34.60	28.50	52.50	96.50	78.00	0.00	0.71	23.64	5.11
22	23.90	33.20	27.40	59.00	96.50	82.50	4.80	1.04	18.64	4.27
23	23.30	32.50	26.30	59.00	98.50	88.50	15.60	0.66	15.76	3.55
24	23.40	32.40	27.00	57.50	98.50	85.50	1.20	0.78	16.93	3.82
25	24.30	32.00	26.70	66.50	98.00	88.00	0.00	0.94	15.93	3.61
26	24.30	32.20	26.50	63.00	97.00	90.00	0.00	0.66	15.80	3.54
27	23.50	31.40	26.20	69.50	98.00	89.00	1.20	0.51	13.61	3.03
28	24.00	32.70	27.90	53.50	96.50	81.00	10.80	0.75	17.06	3.91
29	24.20	32.80	27.30	58.00	96.50	84.00	18.00	1.10	21.06	4.69
30	23.00	33.20	26.70	56.00	98.00	84.50	4.80	0.84	16.93	3.89
31	23.70	32.80	26.00	61.50	97.50	90.50	1.20	0.46	9.67	2.41
Decade 1	24.15	33.31	27.92	59.15	96.30	82.30	212.40	0.98	20.45	4.58
Decade 2	24.09	33.53	27.61	57.45	97.20	83.35	136.80	0.77	16.97	3.90
Decade 3	23.73	32.71	26.95	59.64	97.41	85.59	57.60	0.77	16.82	3.80
MONTH	23.98	33.17	27.48	58.77	96.98	83.81	406.80	0.84	18.04	4.09

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: January 2009

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	23.60	34.30	28.10	52.00	98.50	80.00	1.20	1.01	21.53	4.88
2	23.40	32.30	26.60	59.00	95.00	87.00	2.40	0.78	9.78	2.63
3	23.70	33.10	27.40	55.50	97.00	82.00	43.20	0.95	20.12	1.86
4	24.10	33.50	26.60	56.50	98.50	88.00	30.00	0.83	16.85	3.89
5	23.30	33.80	26.70	55.50	98.00	86.50	178.80	0.76	16.11	3.75
6	23.00	34.40	27.70	58.50	99.00	83.50	0.00	0.87	21.30	4.70
7	24.90	33.80	27.80	58.00	96.00	84.50	6.00	0.88	18.83	4.31
8	23.50	34.40	28.40	54.50	98.50	79.00	0.00	1.13	24.54	5.43
9	23.60	35.20	28.60	53.00	96.00	77.50	0.00	0.91	22.30	5.03
10	24.20	35.00	28.30	47.50	95.00	80.00	90.40	0.90	20.19	4.71
11	24.10	33.90	27.70	54.00	98.00	82.50	6.80	0.88	17.56	4.11
12	22.70	33.40	27.90	52.00	96.50	78.50	0.00	0.75	22.47	4.84
13	24.20	33.00	28.00	58.50	96.50	83.00	3.60	0.75	16.34	3.78
14	24.30	34.20	28.50	53.50	95.00	77.50	0.00	0.84	19.13	4.41
15	23.60	35.30	28.90	49.00	93.50	74.00	0.00	0.88	22.50	5.10
16	24.00	34.00	27.50	54.00	93.50	80.50	209.80	0.84	16.84	3.99
17	23.70	32.70	26.90	58.00	98.50	85.00	29.00	0.84	18.30	4.09
18	23.30	34.60	28.80	49.50	97.00	72.00	0.00	1.10	22.90	5.21
19	24.70	34.90	29.20	50.00	94.00	73.00	0.00	1.17	20.27	4.89
20	23.40	33.10	27.00	57.50	97.50	86.00	277.20	0.86	17.42	3.98
21	22.50	33.00	27.80	57.00	99.50	82.50	7.20	1.02	23.92	5.12
22	24.30	31.80	26.90	64.00	98.00	87.00	12.00	0.74	10.94	2.72
23	23.40	32.00	27.30	62.00	99.50	85.00	3.60	0.69	15.87	3.57
24	24.30	32.90	27.00	60.00	97.00	86.00	4.80	0.75	16.58	3.78
25	23.20	33.30	26.70	58.50	99.00	87.50	157.20	0.78	19.23	4.23
26	22.90	33.40	27.40	61.00	99.00	84.50	0.00	0.67	17.55	3.91
27	23.30	33.60	27.40	56.00	98.00	83.00	289.20	0.89	21.31	4.69
28	23.30	32.90	27.40	62.00	99.50	87.00	6.00	0.66	15.43	3.51
29	24.20	31.60	26.90	70.00	98.50	89.00	56.40	0.57	9.49	2.35
30	24.40	33.50	28.00	58.50	97.00	81.50	0.00	0.84	12.16	3.12
31	23.40	34.10	27.90	47.50	97.50	79.00	0.00	0.81	17.53	4.13
Decade 1	23.73	33.98	27.62	55.00	97.15	82.80	352.00	0.90	19.16	4.12
Decade 2	23.80	33.91	28.04	53.60	96.00	79.20	526.40	0.89	19.37	4.44
Decade 3	23.56	32.92	27.34	59.68	98.41	84.73	536.40	0.77	16.36	3.74
MONTH	23.69	33.58	27.65	56.21	97.23	82.32	1414.80	0.85	18.24	4.10

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: February 2009

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	22.90	33.70	27.50	54.00	99.00	81.00	2.40	0.80	17.78	4.07
2	23.20	34.20	27.40	51.50	96.00	80.50	19.20	1.23	20.82	4.87
3	23.20	34.20	28.20	51.50	98.00	76.00	0.00	1.25	21.02	4.91
4	24.50	33.70	28.20	45.50	92.00	71.50	0.00	1.22	17.25	4.40
5	23.80	33.10	27.00	58.50	94.50	82.00	33.60	0.78	11.75	3.00
6	24.30	34.50	28.00	48.50	96.00	78.00	15.60	0.91	17.34	4.20
7	24.50	33.90	28.20	50.50	94.00	76.00	4.80	0.94	15.51	3.87
8	24.10	34.10	27.40	53.00	95.00	83.00	10.80	0.72	13.42	3.35
9	24.00	33.60	26.70	55.50	97.00	85.50	9.60	0.89	14.38	3.54
10	23.40	33.70	26.60	54.50	97.50	87.00	60.00	1.10	14.51	3.68
11	24.40	33.50	27.50	55.50	98.00	84.00	4.80	0.82	14.62	3.55
12	24.20	33.90	29.00	54.00	94.50	71.50	0.00	1.23	18.52	4.49
13	24.80	34.50	27.90	52.50	96.50	78.00	19.20	1.01	14.77	3.78
14	23.00	32.90	27.40	56.00	99.00	83.50	0.00	1.11	19.85	4.48
15	24.10	32.20	27.50	63.00	96.00	81.50	0.00	0.90	19.60	4.30
16	23.70	33.40	27.20	55.00	94.50	81.00	0.00	0.60	12.27	3.03
17	23.80	33.10	26.30	61.50	96.50	86.50	7.20	0.60	11.93	2.89
18	23.70	33.30	26.60	54.00	97.50	83.50	0.00	0.75	11.60	2.99
19	22.30	33.20	26.10	51.00	96.50	85.00	64.80	0.69	13.12	3.22
20	22.60	32.40	26.80	56.50	99.00	83.00	139.20	1.12	23.57	5.02
21	23.80	31.80	27.40	63.00	96.00	83.00	7.20	1.32	22.11	4.80
22	23.70	32.20	27.50	60.00	98.50	84.00	0.00	0.93	23.79	5.01
23	23.90	33.10	28.10	53.50	94.50	79.00	24.00	1.06	20.83	4.72
24	23.60	33.20	27.90	58.00	98.00	83.50	0.00	0.87	20.53	4.52
25	23.20	34.80	27.10	48.50	97.00	82.00	1.20	0.96	16.99	4.15
26	23.00	34.20	27.70	54.50	97.00	79.50	0.00	0.87	19.22	4.37
27	23.70	32.60	27.20	62.00	96.50	84.50	8.40	0.88	16.19	3.72
28	23.60	32.30	31.50	66.50	98.50	67.00	0.00	0.19	3.06	3.32
29										
30										
31										
Decade 1	23.79	33.87	27.52	52.30	95.90	80.05	156.00	0.98	16.38	3.99
Decade 2	23.66	33.24	27.23	55.90	96.80	81.75	235.20	0.88	15.99	3.77
Decade 3	23.56	33.03	28.05	58.25	97.00	80.31	40.80	0.88	17.84	4.32
MONTH	23.68	33.40	27.57	55.29	96.54	80.73	432.00	0.92	16.66	4.03

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: March 2009

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	23.50	32.40	26.20	65.50	99.00	90.50	66.00	0.59	13.82	3.13
2	23.30	32.20	26.90	60.50	99.50	86.50	247.20	0.93	20.93	4.48
3	23.30	32.00	26.70	66.50	99.00	89.00	2.40	0.58	15.04	3.33
4	23.80	32.70	27.30	62.50	98.50	85.50	1.20	0.69	19.59	4.22
5	23.70	33.50	26.50	58.50	97.50	89.00	104.40	0.67	15.53	3.56
6	23.80	33.40	27.20	63.00	99.50	88.00	0.00	0.58	16.05	3.58
7	23.60	32.50	27.60	63.00	97.00	83.00	4.80	0.98	20.22	4.41
8	23.30	32.90	27.60	58.50	96.50	81.50	0.00	0.90	20.10	4.42
9	23.00	32.80	27.60	58.00	95.50	80.50	0.00	0.93	23.31	4.95
10	23.30	32.90	27.70	54.00	96.00	78.50	7.20	1.00	22.59	4.90
11	23.40	32.60	27.70	58.00	96.50	81.00	0.00	0.98	23.86	5.05
12	23.20	32.50	27.80	59.00	93.50	78.00	0.00	1.00	25.04	5.24
13	22.50	32.40	27.60	50.50	94.50	77.00	0.00	1.09	24.00	5.13
14	23.30	32.90	27.70	52.50	93.50	77.50	0.00	0.98	20.72	4.60
15	23.80	30.40	25.30	70.00	97.50	89.00	243.60	0.66	5.48	1.64
16	22.10	30.90	26.50	66.50	99.50	87.00	3.60	0.69	18.73	3.89
17	23.30	32.90	26.80	59.00	99.00	85.50	0.00	0.74	18.97	4.11
18	23.80	32.90	28.20	57.00	94.50	80.00	0.00	0.84	22.70	4.85
19	23.30	32.40	27.70	61.00	98.00	81.00	0.00	1.03	24.77	5.15
20	21.00	33.10	27.30	44.50	95.50	74.50	1.20	1.06	25.38	5.35
21	22.50	32.30	26.80	50.50	93.50	77.50	26.40	1.00	15.07	3.66
22	21.80	32.60	27.10	47.50	98.00	77.50	0.00	0.78	22.96	4.77
23	22.50	33.20	27.60	49.50	94.50	76.00	0.00	1.00	23.67	5.06
24	23.00	32.60	27.70	56.50	94.50	77.50	0.00	1.12	24.42	5.16
25	21.50	33.70	27.60	49.50	93.00	75.50	37.20	1.02	23.48	5.05
26	22.10	32.40	26.60	50.00	99.00	81.50	6.00	0.84	18.77	4.11
27	22.80	33.10	27.00	56.00	98.50	82.50	0.00	0.80	16.42	3.72
28	21.60	33.10	26.00	48.50	97.50	82.50	148.80	1.05	14.79	3.66
29	21.80	32.70	26.00	57.50	98.50	84.00	1.20	1.01	18.80	4.11
30	21.10	32.70	26.00	55.50	99.50	85.00	68.40	0.93	22.66	4.67
31	22.80	31.80	26.50	62.00	99.50	87.00	39.60	0.83	18.35	3.91
Decade 1	23.46	32.73	27.13	61.00	97.80	85.20	433.20	0.78	18.72	4.10
Decade 2	22.97	32.30	27.26	57.80	96.20	81.05	248.40	0.91	20.97	4.50
Decade 3	22.14	32.75	26.81	53.00	96.91	80.59	327.60	0.94	19.94	4.35
MONTH	22.83	32.60	27.06	57.13	96.97	82.23	1009.20	0.88	19.88	4.32

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: April 2009
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	23.80	31.40	26.90	64.50	99.50	86.50	6.00	0.88	21.65	4.46
2	23.10	32.10	27.30	64.50	99.50	84.50	1.20	0.96	24.03	4.90
3	21.70	31.70	26.50	62.00	100.00	84.00	1.20	1.19	24.03	4.86
4	21.10	31.70	26.50	57.00	100.00	81.50	1.20	1.28	23.71	4.87
5	21.70	33.00	26.90	48.50	100.00	78.00	1.20	1.08	23.97	5.02
6	21.00	32.20	26.80	53.00	99.00	79.00	1.20	0.86	23.64	4.77
7	22.40	32.50	27.00	49.50	99.00	78.00	0.00	0.83	21.46	4.50
8	23.30	32.60	27.70	54.00	96.50	78.00	1.20	1.02	22.94	4.84
9	22.10	32.80	27.50	53.00	97.50	78.50	0.00	0.82	23.04	4.74
10	23.60	32.70	27.90	56.00	97.00	81.00	0.00	0.84	22.78	4.74
11	24.00	32.70	28.10	61.00	98.00	82.00	105.60	0.94	20.63	4.41
12	24.40	32.80	28.10	62.00	99.50	85.00	0.00	0.98	22.85	4.79
13	23.60	33.10	28.00	58.00	99.50	83.00	1.20	0.86	22.40	4.69
14	24.30	32.90	28.40	60.00	99.50	83.00	3.60	0.86	21.40	4.53
15	24.20	33.70	28.50	54.50	98.00	81.50	0.00	0.79	20.46	4.42
16	24.40	33.20	28.50	55.50	96.00	80.50	7.20	0.75	17.19	3.84
17	25.20	33.90	28.70	55.50	99.00	82.00	3.60	0.81	20.76	4.50
18	25.00	33.40	28.60	58.00	96.00	82.00	195.60	1.06	17.07	3.96
19	24.00	30.90	26.40	68.50	98.00	87.50	2.40	0.67	8.17	2.08
20	22.90	32.20	26.90	61.50	99.50	85.50	0.00	0.61	18.40	3.81
21	22.60	32.10	27.30	59.00	99.50	83.00	1.20	0.78	20.06	4.14
22	21.10	32.50	26.50	54.50	99.50	81.00	1.20	0.73	21.49	4.31
23	22.50	32.50	27.30	56.00	95.50	79.00	0.00	1.05	20.67	4.38
24	21.80	33.00	27.30	50.00	94.00	75.00	0.00	1.01	21.25	4.51
25	22.60	32.10	27.40	60.00	93.50	79.00	0.00	1.01	20.95	4.35
26	21.90	31.60	31.50	61.50	94.50	64.00	1.20	0.19	2.28	4.20
27	22.40	32.40	27.10	54.50	98.50	79.00	1.20	1.10	21.35	4.47
28	20.90	32.10	27.00	54.00	99.00	79.00	0.00	0.93	21.31	4.33
29	22.40	32.10	26.70	55.50	98.00	78.50	1.20	0.91	20.96	4.29
30	21.50	32.00	26.40	55.50	95.50	77.00	0.00	0.94	19.17	4.00
31										
Decade 1	22.38	32.27	27.10	56.20	98.80	80.90	13.20	0.98	23.13	4.77
Decade 2	24.20	32.88	28.02	59.45	98.30	83.20	319.20	0.83	18.93	4.10
Decade 3	21.97	32.24	27.45	56.05	96.75	77.45	6.00	0.86	18.95	4.30
MONTH	22.85	32.46	27.52	57.23	97.95	80.52	338.40	0.89	20.34	4.39

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: May 2009
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	21.80	31.90	26.90	53.50	95.50	77.50	1.20	0.95	19.92	4.14
2	23.40	33.00	27.60	51.50	94.50	78.00	10.80	0.86	17.63	3.87
3	22.90	28.40	25.70	74.00	98.50	89.50	15.60	0.80	9.69	2.20
4	24.00	28.30	24.80	77.50	98.50	95.00	159.40	0.68	6.56	1.65
5	23.30	29.70	25.30	76.00	99.50	93.50	283.40	0.64	7.50	1.82
6	23.40	30.20	24.80	75.00	99.50	93.50	40.80	1.00	8.20	2.02
7	22.80	27.00	24.00	86.00	98.50	96.00	404.40	1.01	7.80	1.74
8	21.60	30.20	25.20	67.00	100.00	88.50	0.00	0.91	16.76	3.37
9	21.80	31.60	25.30	63.50	99.50	89.00	2.40	0.90	14.04	3.06
10	21.70	31.00	26.00	63.50	99.50	85.00	0.00	0.81	18.64	3.70
11	22.60	30.70	25.60	62.50	96.50	86.50	26.40	0.73	14.21	3.02
12	22.60	31.10	26.00	61.00	96.50	83.00	289.20	0.90	13.35	3.00
13	22.90	30.40	25.60	66.50	100.00	86.00	0.00	0.56	10.54	2.35
14	23.40	29.70	25.30	63.50	98.00	85.00	1.20	0.65	8.89	2.14
15	21.40	31.10	25.90	56.00	99.00	84.00	17.40	0.86	19.02	3.79
16	23.80	31.80	27.00	67.50	99.00	87.00	22.20	0.96	18.68	3.82
17	22.90	31.20	26.60	64.00	99.50	87.00	0.00	0.81	19.15	3.81
18	22.70	31.60	26.50	68.00	100.00	87.50	1.20	0.71	18.59	3.68
19	22.50	32.00	26.60	62.00	100.00	86.50	1.20	0.63	18.54	3.68
20	22.90	31.40	26.80	62.50	99.50	85.50	1.20	0.73	18.56	3.70
21	22.80	31.60	26.40	56.50	99.50	85.00	0.00	0.87	15.87	3.38
22	22.10	31.20	26.00	65.50	99.50	84.00	0.00	1.05	14.47	3.11
23	23.50	31.70	26.40	58.00	94.50	81.00	0.00	0.76	13.64	3.02
24	22.40	31.00	26.30	62.00	99.00	84.00	1.20	0.88	16.28	3.36
25	23.70	30.70	26.20	66.00	94.00	82.00	0.00	1.06	18.66	3.77
26	20.60	30.60	25.00	58.50	99.00	81.50	1.20	1.06	18.01	3.60
27	20.50	30.70	25.00	57.00	99.00	82.00	1.20	1.01	19.37	3.78
28	18.50	30.60	24.50	63.00	99.50	84.00	0.00	0.86	16.44	3.22
29	20.50	31.70	25.80	56.50	99.00	82.00	1.20	0.89	18.86	3.74
30	21.00	31.50	26.00	61.00	98.00	82.50	19.20	0.82	19.03	3.71
31	22.90	31.20	26.30	61.50	99.50	85.00	1.20	1.12	19.17	3.86
Decade 1	22.67	30.13	25.56	68.75	98.35	88.55	918.00	0.86	12.67	2.76
Decade 2	22.77	31.10	26.19	63.35	98.80	85.80	360.00	0.75	15.95	3.30
Decade 3	21.68	31.14	25.81	60.50	98.23	83.00	25.20	0.94	17.25	3.50
MONTH	22.35	30.80	25.85	64.08	98.45	85.69	1303.20	0.85	15.36	3.19

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)

Agro-Meteorological section contact: Raimundo Mau (raibatumanu@yahoo.com)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: June 2009
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	21.60	31.60	25.90	56.00	99.50	82.00	1.20	1.16	19.36	3.93
2	21.60	31.80	25.80	50.50	99.00	82.00	0.00	1.08	18.60	3.85
3	22.00	31.40	25.60	58.50	98.00	84.00	1.20	1.09	15.43	3.33
4	20.20	31.30	25.50	55.00	99.00	81.00	1.20	0.93	18.85	3.70
5	20.60	31.00	25.20	53.50	99.50	81.50	1.20	0.82	18.40	3.58
6	19.80	30.30	24.80	57.50	98.50	81.50	1.20	0.88	18.84	3.58
7	20.20	30.90	24.90	53.50	99.00	80.00	1.20	0.87	18.85	3.64
8	19.40	30.80	24.90	54.50	99.50	81.50	0.00	0.80	18.17	3.49
9	20.50	30.00	29.90	61.00	98.00	62.50	1.20	0.24	3.72	1.21
10										
11										
12										
13										
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Decade 1	20.66	31.01	25.83	55.56	98.89	79.56	8.40	0.87	16.69	3.37
Decade 2	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
Decade 3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
MONTH	20.66	31.01	25.83	55.56	98.89	79.56	8.40	0.87	16.69	#DIV/0!

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: July 2009
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	19.50	30.20	24.70	52.00	97.50	83.50	1.20	1.02	18.14	3.57
2	20.10	29.40	24.70	62.00	99.00	84.00	0.00	1.28	17.33	3.42
3	19.20	29.00	24.70	58.50	97.50	79.00	0.00	1.13	18.16	3.49
4	21.20	28.70	24.20	60.50	95.50	81.00	2.40	0.90	14.86	2.98
5	18.30	28.60	23.10	53.00	99.00	79.50	1.20	1.13	17.52	3.39
6	18.90	28.80	23.80	50.50	97.50	78.50	0.00	0.93	15.15	3.07
7	19.80	28.50	24.00	58.00	96.50	79.50	0.00	0.98	13.81	2.87
8	18.80	29.80	24.20	49.00	92.50	71.00	1.20	1.49	18.01	3.82
9	18.30	29.20	23.30	50.00	91.50	71.50	0.00	1.15	10.21	2.66
10	19.30	29.40	24.20	51.00	92.50	73.50	0.00	0.54	10.26	2.30
11	18.80	29.90	24.50	48.00	94.50	71.00	0.00	0.94	17.34	3.45
12	21.30	28.50	24.50	61.50	90.50	77.00	0.00	0.36	5.15	1.45
13	20.50	30.30	24.90	60.50	94.00	79.50	0.00	0.75	14.40	2.95
14	20.40	31.10	24.50	39.00	98.50	72.50	0.00	0.89	19.58	3.86
15	18.20	30.70	24.00	50.50	90.50	74.00	0.00	0.86	18.07	3.53
16	19.60	30.60	24.90	56.00	94.50	76.50	72.00	1.20	16.70	3.51
17	22.10	28.00	23.60	65.50	97.50	88.00	26.40	0.57	4.32	1.36
18	19.30	28.40	22.80	66.50	98.00	89.00	115.20	0.90	7.62	1.93
19	21.70	30.60	24.80	49.50	99.50	83.50	0.00	0.60	7.68	2.05
20	22.30	29.80	25.00	68.50	96.50	88.50	13.20	0.44	9.53	2.10
21	22.20	31.00	25.60	60.00	98.00	84.50	0.00	0.75	17.17	3.43
22	19.90	30.60	25.10	63.50	100.00	85.50	14.40	0.90	14.80	3.05
23	21.00	30.00	25.00	56.50	100.50	84.00	1.20	1.05	19.83	3.84
24	18.80	30.20	24.30	58.00	100.50	82.00	1.20	0.97	20.00	3.78
25	18.70	30.30	24.20	56.50	100.50	82.50	0.00	0.93	19.83	3.75
26	20.00	30.90	24.70	53.00	100.00	82.00	1.20	0.90	19.67	3.82
27	19.40	29.70	24.20	63.00	100.50	85.00	1.20	0.79	18.57	3.49
28	17.70	30.90	24.20	42.50	100.50	77.00	0.00	1.27	19.48	4.05
29	17.40	30.60	24.00	39.00	94.50	74.00	62.40	1.25	16.67	3.75
30	19.60	29.50	24.30	52.00	99.00	78.00	1.20	0.78	14.28	2.98
31	20.20	29.70	25.00	49.50	90.50	70.50	0.00	1.10	16.23	3.51
Decade 1	19.34	29.16	24.09	54.45	95.90	78.10	6.00	1.06	15.35	3.16
Decade 2	20.42	29.79	24.35	56.55	95.40	79.95	226.80	0.75	12.04	2.62
Decade 3	19.54	30.31	24.60	53.95	98.59	80.45	82.80	0.97	17.87	3.59
MONTH	19.76	29.77	24.35	54.95	96.69	79.53	315.60	0.93	15.17	3.12

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: August 2009
AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	22.00	29.30	24.80	59.50	92.50	76.50	6.00	1.02	11.42	2.71
2	21.30	29.70	24.40	58.00	96.00	82.00	55.20	1.09	13.31	3.00
3	22.10	27.60	23.70	70.50	99.00	90.50	14.40	0.49	5.37	1.44
4	19.40	29.60	24.60	56.50	99.50	81.50	0.00	0.71	19.61	3.68
5	21.20	30.50	25.40	60.50	98.50	80.50	0.00	0.83	19.73	3.84
6	19.80	29.90	24.70	54.00	99.00	79.00	0.00	0.91	19.85	3.84
7	19.50	30.70	24.80	39.00	94.50	70.50	1.20	1.03	20.91	4.21
8	18.70	29.50	24.30	51.50	93.00	75.50	0.00	1.19	19.07	3.87
9	18.80	31.00	24.90	39.00	96.50	74.00	1.20	0.96	20.57	4.13
10	18.70	30.00	24.80	56.50	99.00	77.50	0.00	1.18	18.48	3.75
11	17.00	29.30	24.30	55.00	96.50	78.00	1.20	1.03	18.72	3.67
12	18.10	31.40	24.50	41.00	99.50	75.00	1.20	1.01	21.24	4.25
13	18.70	30.50	24.50	42.50	98.50	74.50	0.00	1.08	21.30	4.25
14	20.20	30.70	25.60	49.50	99.00	79.00	2.40	1.04	19.30	3.97
15	20.60	30.70	25.90	60.00	99.00	81.50	6.00	0.86	15.19	3.24
16	22.70	31.10	25.70	53.50	99.00	81.50	1.20	1.19	21.26	4.37
17	18.20	30.20	24.00	52.50	99.50	78.00	1.20	1.46	21.57	4.33
18	17.60	30.80	25.00	55.50	99.50	74.50	0.00	1.70	21.36	4.41
19	16.90	30.90	24.20	50.50	91.50	74.00	0.00	1.38	21.43	4.40
20	19.80	30.00	24.90	49.50	92.50	75.00	0.00	1.15	19.92	4.10
21	18.80	30.60	24.60	48.50	99.00	76.50	0.00	0.96	21.69	4.25
22	17.90	30.90	24.10	50.00	99.50	76.50	0.00	1.09	21.28	4.23
23	16.70	30.40	23.50	53.00	98.00	76.50	0.00	1.08	21.16	4.13
24	18.80	30.80	24.70	46.50	96.00	72.50	0.00	0.98	21.08	4.23
25	19.20	30.00	24.70	49.00	99.50	74.00	0.00	1.01	21.96	4.30
26	19.60	30.90	25.70	48.00	96.00	74.00	0.00	1.06	21.51	4.38
27	20.60	31.40	25.70	53.00	94.00	77.00	0.00	1.20	20.85	4.38
28	19.80	31.40	25.80	54.00	96.00	77.50	37.20	1.12	21.73	4.44
29	22.00	30.70	26.10	62.00	99.00	83.00	7.20	0.84	21.78	4.31
30	20.80	30.70	25.70	61.50	99.00	83.00	0.00	0.84	20.75	4.11
31	21.90	31.30	26.20	62.00	98.00	82.50	1.20	0.90	17.25	3.67
Decade 1	20.15	29.78	24.64	54.50	96.75	78.75	78.00	0.94	16.83	3.45
Decade 2	18.98	30.56	24.86	50.95	97.45	77.10	13.20	1.19	20.13	4.10
Decade 3	19.65	30.83	25.16	53.41	97.64	77.55	45.60	1.01	21.00	4.22
MONTH	19.59	30.40	24.90	52.97	97.29	77.79	136.80	1.05	19.38	3.92

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: September 2009

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	22.10	31.60	26.40	55.50	97.50	79.50	0.00	0.96	19.65	4.14
2	20.10	31.60	25.60	48.00	99.00	75.50	0.00	1.31	23.02	4.79
3	18.40	31.80	24.90	45.00	98.00	74.00	0.00	1.28	22.88	4.77
4	19.20	31.50	25.30	50.50	94.50	73.50	0.00	1.38	22.99	4.79
5	18.80	30.90	25.40	55.00	96.50	76.50	0.00	0.93	18.92	3.92
6	20.80	31.90	26.80	54.00	97.50	75.50	0.00	1.28	20.90	4.50
7	21.80	31.90	27.00	53.50	98.00	76.00	0.00	0.95	19.73	4.21
8	20.50	31.90	26.70	53.50	97.50	77.50	0.00	1.02	20.86	4.38
9	21.00	34.70	27.20	45.00	95.50	75.50	1.20	0.97	20.62	4.61
10	20.10	31.80	26.30	54.00	96.50	78.00	0.00	1.05	22.48	4.62
11	20.10	32.80	26.40	45.00	99.00	77.50	0.00	1.03	21.92	4.67
12	20.90	32.00	26.60	51.50	94.00	75.50	1.20	1.20	21.68	4.65
13	19.90	31.60	26.30	59.00	94.50	76.50	0.00	1.23	19.89	4.26
14	20.90	32.10	26.70	54.50	95.50	75.50	0.00	1.13	22.34	4.70
15	22.00	32.90	27.10	49.00	95.50	73.50	1.20	1.06	22.38	4.82
16	20.70	32.40	26.60	51.00	96.50	75.50	0.00	1.02	22.66	4.74
17	19.90	32.60	26.50	48.50	94.50	73.00	0.00	1.20	22.35	4.82
18	20.20	32.50	26.30	50.00	92.50	73.00	0.00	0.98	22.19	4.67
19	19.30	32.70	26.40	41.00	89.50	67.50	0.00	1.11	23.24	4.98
20	22.60	32.00	27.40	53.50	85.00	70.00	0.00	1.23	19.95	4.53
21	22.30	31.90	27.20	57.00	91.50	75.00	0.00	0.94	20.07	4.33
22	23.80	32.10	27.60	55.50	86.00	74.00	0.00	1.38	21.16	4.80
23	21.90	32.70	27.50	52.00	91.50	75.00	0.00	1.28	21.53	4.81
24	22.00	33.00	27.80	54.50	90.50	76.00	0.00	1.32	20.08	4.62
25	23.90	32.80	27.80	58.00	92.00	77.00	0.00	1.00	20.03	4.45
26	22.20	32.20	27.10	54.00	92.50	74.50	0.00	0.98	19.64	4.33
27	22.30	32.90	27.50	53.00	93.50	76.00	0.00	1.02	20.10	4.47
28	21.30	32.80	27.10	46.50	87.00	70.50	0.00	1.16	21.71	4.86
29	21.10	32.30	27.10	49.00	89.50	71.50	0.00	1.11	22.09	4.81
30	22.20	33.00	27.90	50.50	89.50	71.50	0.00	1.11	21.29	4.77
31										
Decade 1	20.28	31.96	26.16	51.40	97.05	76.15	1.20	1.11	21.21	4.47
Decade 2	20.65	32.36	26.63	50.30	93.65	73.75	2.40	1.12	21.86	4.69
Decade 3	22.30	32.57	27.46	53.00	90.35	74.10	0.00	1.13	20.77	4.62
MONTH	21.08	32.30	26.75	51.57	93.68	74.67	3.60	1.12	21.28	4.59

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: October 2009
AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	24.90	32.70	28.30	61.00	89.00	74.50	43.20	1.13	18.30	4.25
2	24.60	32.40	28.10	56.50	96.50	77.00	0.00	1.02	23.11	4.97
3	24.50	32.40	28.10	59.00	89.00	75.50	0.00	1.26	23.39	5.13
4	22.80	33.80	28.60	41.00	87.00	69.00	0.00	1.10	22.67	5.16
5	23.60	33.50	28.50	54.50	92.50	76.00	0.00	1.13	22.37	5.00
6	23.80	33.10	28.10	53.00	95.00	76.00	0.00	1.35	21.61	4.94
7	22.10	33.60	27.80	48.50	90.50	73.50	0.00	1.00	22.69	4.99
8	22.20	33.50	27.70	45.50	94.00	71.50	0.00	1.06	21.76	4.89
9	21.80	32.50	27.50	52.00	91.50	72.00	0.00	1.35	21.76	4.90
10	19.70	31.20	31.00	55.00	93.00	60.00	0.00	0.20	5.39	1.61
11	22.50	35.00	25.00	52.00	92.00	74.00	0.00	1.25	20.30	4.80
12	20.50	33.50	27.50	60.50	75.50	74.50	0.00	1.50	22.50	5.12
13	22.30	32.20	26.50	45.00	91.00	65.00	0.00	1.75	22.30	5.29
14	23.50	33.50	27.10	50.00	92.00	75.00	0.00	1.50	23.41	5.38
15	22.10	32.60	28.10	39.00	85.00	70.50	0.00	1.15	21.35	4.94
16	20.50	33.00	27.50	58.00	91.50	68.00	0.00	1.75	23.41	5.24
17	22.00	32.20	26.00	45.30	87.00	72.50	0.00	1.35	22.50	5.11
18	22.00	32.70	27.50	53.50	87.50	71.00	0.00	1.45	22.39	5.09
19	20.20	33.90	27.20	43.00	84.00	67.50	0.00	1.16	22.41	5.11
20	20.50	33.10	27.40	42.50	92.50	71.00	0.00	1.15	21.38	4.87
21	23.10	33.70	27.90	58.50	91.50	75.50	14.40	1.75	21.75	5.12
22	23.80	32.80	28.00	61.50	98.00	78.50	0.00	1.55	23.77	5.21
23	21.70	32.90	27.80	46.50	91.00	70.50	0.00	1.44	23.88	5.40
24	22.10	33.20	27.50	47.00	91.00	70.00	0.00	1.32	23.49	5.30
25	21.00	33.00	27.10	45.50	90.00	68.50	0.00	1.16	22.95	5.10
26	20.10	33.70	27.40	39.00	87.50	65.00	0.00	1.15	23.41	5.27
27	20.80	33.40	27.60	50.50	87.00	69.00	0.00	1.17	22.90	5.10
28	21.20	35.90	28.10	33.50	89.50	62.50	0.00	0.98	22.80	5.29
29	20.70	34.00	27.70	42.50	83.00	66.00	0.00	1.09	22.37	5.10
30	22.40	33.20	28.00	55.50	88.50	73.50	0.00	1.11	21.28	4.79
31	22.00	33.20	27.70	51.50	85.50	71.00	0.00	1.45	21.87	5.11
Decade 1	23.00	32.87	28.37	52.60	91.80	72.50	43.20	1.06	20.31	4.58
Decade 2	21.61	33.17	26.98	48.88	87.80	70.90	0.00	1.40	22.20	5.09
Decade 3	21.72	33.55	27.71	48.32	89.32	70.00	14.40	1.29	22.77	5.16
MONTH	22.10	33.21	27.69	49.88	89.63	71.10	57.60	1.25	21.79	4.95

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: November 2009

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	22.20	33.50	28.10	47.50	92.00	70.00	26.40	1.44	22.55	5.25
2	22.70	32.90	27.80	61.00	98.00	77.50	0.00	1.37	21.76	4.82
3	22.00	33.30	28.00	48.00	96.00	74.50	0.00	1.28	21.21	4.91
4	22.20	33.00	27.90	51.50	91.50	73.00	0.00	1.34	21.24	4.91
5	21.60	33.10	27.80	52.50	90.50	72.50	0.00	1.31	21.17	4.87
6	21.70	33.80	28.10	39.00	92.50	69.50	0.00	1.23	22.25	5.19
7	23.10	33.00	28.50	55.50	85.50	70.00	0.00	1.50	21.96	5.12
8	22.40	33.50	28.30	53.50	88.50	72.00	0.00	1.37	22.21	5.12
9	22.90	33.80	28.70	55.50	90.50	73.00	0.00	1.52	23.11	5.33
10	23.40	33.10	28.80	56.50	87.00	73.50	0.00	1.34	21.27	4.93
11	23.50	33.50	29.00	56.00	89.50	74.00	0.00	1.72	23.25	5.44
12	25.70	33.70	29.50	55.50	87.50	74.00	0.00	1.81	23.53	5.64
13	23.20	33.90	28.80	52.00	89.50	71.50	0.00	1.18	24.21	5.42
14	23.20	33.90	28.90	47.50	83.00	67.50	0.00	1.09	22.18	5.11
15	23.10	33.70	28.80	50.50	85.50	69.00	0.00	1.03	24.48	5.40
16	22.40	36.80	28.60	44.00	86.50	69.00	0.00	1.11	24.83	5.77
17	22.80	36.00	29.90	30.50	83.50	59.00	0.00	1.13	24.70	5.83
18	24.20	35.20	29.70	46.50	78.50	67.00	0.00	1.33	22.59	5.52
19	24.90	34.70	29.70	50.00	93.00	69.50	32.40	1.45	20.76	5.12
20	24.70	32.20	27.60	50.00	94.00	75.50	0.00	1.44	9.41	3.10
21	24.40	34.00	28.80	53.00	90.50	72.50	0.00	1.26	19.81	4.77
22	25.10	33.90	29.30	51.50	90.50	71.50	0.00	1.37	24.44	5.62
23	24.80	33.70	29.50	52.50	85.00	70.00	0.00	1.33	23.51	5.45
24	25.10	34.10	29.40	53.50	81.50	71.00	0.00	1.46	20.90	5.15
25	24.90	33.30	28.60	58.50	92.00	75.50	6.00	1.22	20.21	4.69
26	25.10	34.60	28.60	50.00	93.50	74.00	0.00	0.96	15.49	3.94
27	24.20	34.30	29.00	54.00	85.50	72.00	0.00	1.11	20.36	4.82
28	24.40	35.10	29.80	50.00	86.00	69.00	0.00	1.31	24.77	5.77
29	25.50	34.40	30.30	52.00	86.00	69.50	0.00	1.31	25.09	5.80
30	24.80	34.30	30.10	53.50	83.00	68.50	0.00	1.24	25.34	5.77
31										
Decade 1	22.42	33.30	28.20	52.05	91.20	72.55	26.40	1.37	21.87	5.04
Decade 2	23.77	34.36	29.05	48.25	87.05	69.60	32.40	1.33	21.99	5.24
Decade 3	24.83	34.17	29.34	52.85	87.35	71.35	6.00	1.26	21.99	5.18
MONTH	23.67	33.94	28.86	51.05	88.53	71.17	64.80	1.32	21.95	5.15

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: December 2009

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	26.00	34.20	30.20	56.50	93.00	72.00	26.40	1.31	21.05	5.01
2	24.40	34.60	28.50	50.50	95.00	79.50	75.60	1.17	24.01	5.45
3	24.40	34.30	29.20	52.00	96.00	76.50	0.00	1.10	24.51	5.48
4	25.30	34.00	28.60	53.50	94.50	75.00	138.00	1.63	24.56	5.70
5	23.40	34.60	28.90	48.50	99.00	76.00	0.00	0.90	24.17	5.32
6	24.80	33.60	29.80	51.50	92.00	72.00	0.00	1.15	22.53	5.17
7	26.30	35.20	30.40	52.50	86.50	70.00	0.00	1.12	23.90	5.58
8	24.30	35.50	30.10	48.50	87.50	69.50	0.00	1.06	22.61	5.31
9	25.10	35.70	30.20	47.50	89.00	70.50	1.20	1.33	23.20	5.62
10	24.80	35.40	30.20	46.00	91.00	68.00	0.00	1.41	23.66	5.71
11	26.00	35.40	29.10	50.00	93.50	72.00	9.60	1.49	20.87	5.25
12	24.60	35.30	29.60	47.50	93.00	71.00	0.00	1.31	22.42	5.39
13	26.00	32.00	27.50	53.50	93.50	78.50	8.40	0.83	3.54	1.70
14	24.30	32.40	27.60	56.00	90.00	76.50	3.60	1.04	8.99	2.74
15	23.50	34.70	27.30	51.50	98.50	82.50	320.40	0.89	14.59	3.67
16	24.30	34.20	28.80	53.00	98.50	79.00	4.80	0.89	16.61	4.00
17	25.30	33.40	29.20	57.00	91.00	76.50	0.00	1.28	15.65	4.01
18	25.80	34.70	28.50	51.50	91.50	80.50	104.40	0.91	17.31	4.24
19	25.00	31.40	31.40	68.00	94.00	68.00	0.00	0.06	2.86	4.44
20	23.20	33.70	27.70	57.00	95.00	82.00	190.80	0.90	16.55	3.91
21	24.10	33.50	27.40	60.50	98.00	84.00	96.00	1.01	20.57	4.58
22	23.60	33.20	27.00	58.50	99.50	86.50	68.40	0.87	19.41	4.30
23	24.30	33.20	28.10	58.50	96.50	82.00	6.00	0.79	16.22	3.78
24	25.60	32.20	28.20	66.00	96.50	83.50	1.20	1.03	14.92	3.55
25	25.30	33.20	29.40	47.00	90.50	70.50	0.00	1.52	26.08	5.96
26	24.60	33.60	28.80	54.50	94.50	77.50	43.20	1.31	20.11	4.77
27	25.40	32.80	28.00	67.00	97.00	84.50	28.80	1.03	17.15	3.94
28	23.90	33.50	27.50	60.50	98.50	83.50	62.40	1.25	23.69	5.17
29	22.70	32.80	28.40	58.50	97.00	80.00	1.20	0.86	23.39	4.98
30	25.60	33.40	29.20	64.00	95.00	80.00	0.00	1.10	19.26	4.44
31	25.00	33.90	29.70	55.50	96.50	76.50	0.00	0.90	21.66	4.89
Decade 1	24.88	34.71	29.61	50.70	92.35	72.90	241.20	1.22	23.42	5.43
Decade 2	24.80	33.72	28.67	54.50	93.85	76.65	642.00	0.96	13.94	3.93
Decade 3	24.55	33.21	28.34	59.14	96.32	80.77	307.20	1.06	20.22	4.58
MONTH	24.74	33.86	28.85	54.92	94.24	76.90	1190.40	1.08	19.23	4.65

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: January 2010
AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	24.30	34.00	29.10	57.00	94.00	77.50	0.00	0.88	22.29	4.95
2	24.20	34.60	29.00	54.00	95.00	78.00	19.20	0.96	21.10	4.84
3	24.40	35.70	29.00	41.00	96.50	73.50	0.00	1.17	16.32	4.39
4	22.40	33.20	27.60	52.00	96.00	80.00	117.60	0.82	13.92	3.44
5	24.70	35.70	29.20	49.00	95.00	73.50	0.00	0.88	20.92	4.88
6	24.60	35.90	29.20	42.50	91.50	72.50	0.00	0.94	18.77	4.64
7	24.50	35.70	28.50	42.00	94.50	77.00	13.20	1.10	20.42	5.01
8	24.60	34.30	29.20	49.50	96.00	74.50	0.00	0.82	15.85	3.89
9	24.20	35.30	28.50	50.00	94.00	76.00	3.60	0.98	23.02	5.24
10	23.30	33.50	27.10	56.00	96.50	84.00	177.60	0.98	18.17	4.20
11	23.50	35.70	27.40	42.00	98.50	82.00	20.40	0.83	21.03	4.84
12	22.60	35.20	28.10	41.50	98.00	75.00	2.40	0.96	23.55	5.31
13	23.50	35.40	29.00	41.50	94.50	69.50	2.40	1.13	20.95	5.08
14	24.80	34.20	28.20	54.50	93.50	78.00	4.80	1.03	18.62	4.43
15	24.50	35.20	27.90	46.00	96.50	81.50	2.40	0.95	17.87	4.38
16	24.80	32.90	28.10	60.00	97.00	80.00	9.60	0.81	15.18	3.59
17	24.40	34.40	28.80	47.50	96.50	71.00	13.20	0.93	15.46	3.91
18	23.20	32.10	27.50	53.00	93.50	74.00	9.60	1.08	12.92	3.39
19	23.90	34.10	27.90	51.00	94.00	76.50	49.20	1.09	18.73	4.49
20	24.00	32.60	27.80	57.00	94.50	74.00	1.20	1.49	11.53	3.33
21	23.70	35.20	29.50	44.50	93.50	66.00	0.00	1.34	19.74	4.99
22	24.60	35.60	29.50	43.50	92.00	71.00	0.00	1.05	21.24	5.11
23	24.00	34.00	27.80	53.50	94.00	80.00	0.00	0.93	18.08	4.26
24	23.60	32.90	26.80	59.00	96.50	86.50	61.20	0.67	11.85	2.93
25	22.80	34.80	28.40	53.00	99.50	79.50	0.00	1.12	23.30	5.24
26	21.80	34.00	28.00	41.00	96.50	76.00	0.00	1.27	24.97	5.63
27	23.20	33.40	28.00	52.50	96.50	78.00	0.00	1.16	22.95	5.12
28	22.50	37.20	28.80	31.00	94.00	72.50	0.00	1.12	21.93	5.47
29	23.30	37.60	29.20	39.50	92.50	71.00	0.00	1.10	20.35	5.17
30	23.90	34.80	27.60	51.50	98.00	82.00	50.40	0.93	14.88	3.76
31	24.30	34.60	28.20	55.00	99.00	84.00	24.00	0.95	20.90	4.75
Decade 1	24.12	34.79	28.64	49.30	94.90	76.65	331.20	0.95	19.08	4.55
Decade 2	23.92	34.18	28.07	49.40	95.65	76.15	115.20	1.03	17.58	4.27
Decade 3	23.43	34.92	28.35	47.64	95.64	76.95	135.60	1.06	20.02	4.77
MONTH	23.81	34.64	28.35	48.74	95.40	76.60	582.00	1.02	18.93	4.53

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: February 2010

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	24.50	35.20	28.90	48.50	99.00	78.00	0.00	0.68	15.53	3.78
2	23.90	35.30	28.60	53.50	95.50	78.00	1.20	0.86	17.39	4.18
3	23.70	33.60	27.60	57.50	96.50	82.50	150.00	0.81	16.73	3.89
4	23.40	32.60	26.70	67.50	99.00	90.00	180.00	0.83	13.25	3.12
5	22.90	32.70	27.60	62.50	101.50	84.50	40.80	0.82	22.41	4.75
6	23.70	32.90	28.20	62.50	100.00	83.50	0.00	0.88	22.15	4.77
7	23.60	29.70	29.60	73.00	99.00	73.50	90.00	0.10	0.90	20.69
8	23.50	28.50	29.00	72.50	85.00	74.50	16.00	0.85	23.00	4.74
9	23.70	36.00	29.00	46.50	95.50	85.00	2.00	0.80	16.50	4.09
10	23.40	35.00	28.00	56.00	98.00	77.00	0.00	1.05	16.50	4.05
11	24.50	34.50	29.50	57.50	95.50	76.50	1.50	0.88	15.50	3.80
12	24.30	34.00	27.00	62.00	102.00	88.00	100.00	0.90	15.20	3.60
13	24.00	33.00	28.00	60.00	100.00	85.50	0.00	0.80	19.00	4.22
14	24.20	34.60	28.40	58.00	99.00	82.00	260.40	0.98	23.50	5.19
15	24.00	33.50	28.20	60.00	101.00	85.00	0.00	0.72	19.28	4.27
16	24.30	33.90	28.00	62.50	98.50	84.50	3.60	0.83	17.15	3.94
17	24.90	33.10	28.60	62.50	98.00	81.50	0.00	0.86	21.05	4.63
18	24.30	33.50	28.70	56.50	96.50	80.50	4.80	0.89	19.61	4.45
19	24.90	33.60	29.20	55.50	93.50	78.00	0.00	1.13	20.98	4.84
20	24.00	34.00	29.40	57.50	94.00	75.50	0.00	1.32	25.18	5.61
21	25.20	34.50	28.90	56.00	94.00	77.50	0.00	1.01	20.87	4.82
22	24.40	34.20	27.80	59.00	96.50	83.50	18.00	0.84	16.27	3.85
23	24.30	34.20	27.40	58.00	98.00	85.50	163.20	0.86	13.76	3.42
24	23.70	33.80	27.40	61.50	100.00	88.00	212.40	0.91	21.28	4.65
25	23.70	36.70	29.10	46.00	101.00	78.00	0.00	0.78	21.89	5.01
26	25.20	35.20	28.90	52.50	94.00	75.50	0.00	1.01	15.71	4.01
27	24.70	35.50	29.10	46.50	95.00	74.00	0.00	1.01	16.96	4.30
28	25.00	36.60	29.70	45.50	94.00	73.00	0.00	0.78	19.24	4.61
29										
30										
31										
Decade 1	23.85	33.44	28.27	60.00	97.81	81.75	845.50	0.80	17.12	5.81
Decade 2	24.46	34.28	28.54	56.50	96.55	80.35	398.40	0.96	19.66	4.46
Decade 3	24.85	36.05	29.40	46.00	94.50	73.50	0.00	0.89	18.10	4.33
MONTH	24.14	33.93	28.45	57.75	97.13	80.66	1243.90	0.86	18.10	4.86

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: March 2010
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	25.30	36.60	29.20	46.50	93.00	76.00	2.40	0.83	18.48	4.52
2	24.20	34.00	27.30	56.50	98.00	85.00	7.20	0.87	14.06	3.47
3	23.90	32.60	26.20	63.50	100.00	91.00	85.20	0.68	9.96	2.52
4	24.20	33.20	26.80	62.00	99.00	86.50	21.60	0.54	11.61	2.79
5	23.40	33.40	27.30	58.00	100.00	85.00	8.40	0.65	17.05	3.81
6	24.10	32.90	27.50	66.00	99.50	85.50	1.20	0.61	12.74	2.99
7	23.80	33.80	28.40	55.00	98.00	80.50	0.00	0.94	24.36	5.25
8	21.70	33.40	28.10	52.50	94.50	75.50	0.00	0.94	25.31	5.33
9	23.30	32.90	28.40	55.50	98.00	77.50	0.00	0.97	25.39	5.36
10	24.00	33.40	28.50	58.50	98.00	79.00	0.00	0.91	24.72	5.27
11	23.60	33.20	28.30	52.50	100.00	79.00	31.20	1.06	24.81	5.33
12	22.60	32.90	27.80	57.50	98.50	78.50	0.00	1.00	23.37	4.97
13	23.10	32.90	28.10	53.50	95.50	74.50	0.00	0.89	25.10	5.27
14	22.80	35.00	28.50	46.00	94.50	73.00	13.20	1.02	23.03	5.19
15	24.40	33.90	28.60	51.00	96.50	75.00	0.00	1.04	21.50	4.87
16	24.10	33.40	28.80	55.00	92.50	76.50	0.00	0.98	25.11	5.39
17	23.50	33.70	28.40	54.00	96.00	78.00	27.60	0.87	21.46	4.71
18	24.50	33.30	28.40	55.50	98.50	82.00	6.00	0.86	22.43	4.85
19	23.50	33.60	28.90	53.50	100.00	76.00	0.00	0.80	24.09	5.12
20	25.70	33.50	29.00	53.50	90.00	74.50	0.00	1.06	22.62	5.08
21	23.70	33.60	28.60	54.50	94.50	75.50	0.00	0.93	24.98	5.32
22	24.10	33.50	28.80	55.00	94.00	75.50	0.00	0.97	24.90	5.33
23	24.10	34.10	29.20	50.00	99.50	73.00	0.00	0.98	24.51	5.33
24	24.60	33.60	29.30	53.50	94.50	74.00	10.80	1.10	24.15	5.30
25	24.00	33.80	29.00	55.50	99.00	78.50	1.20	0.91	23.81	5.12
26	24.50	33.60	29.00	55.50	92.00	76.50	0.00	1.15	19.98	4.61
27	24.50	34.50	29.40	52.50	96.00	76.50	0.00	1.05	23.74	5.26
28	25.60	34.30	29.40	53.00	91.50	75.00	2.40	1.13	19.52	4.63
29	24.40	34.20	29.60	55.00	92.50	74.50	0.00	1.12	21.83	4.95
30	24.00	34.20	28.90	53.50	94.50	73.50	120.00	1.05	19.86	4.56
31	23.40	34.80	28.60	49.00	98.00	79.50	3.60	1.00	21.12	4.78
Decade 1	23.79	33.62	27.77	57.40	97.80	82.15	126.00	0.80	18.37	4.13
Decade 2	23.78	33.54	28.48	53.20	96.20	76.70	78.00	0.96	23.35	5.08
Decade 3	24.26	34.02	29.07	53.36	95.09	75.64	138.00	1.04	22.58	5.02
MONTH	23.95	33.74	28.46	54.61	96.32	78.08	342.00	0.93	21.47	4.74

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PESCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: April 2010
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	24.10	34.20	27.40	52.00	99.50	85.00	607.20	0.88	17.46	4.03
2	22.30	33.40	27.70	58.50	102.00	83.00	98.40	0.79	20.19	4.31
3	23.90	33.20	28.30	60.00	100.00	81.50	0.00	0.84	20.91	4.49
4	24.70	33.60	28.90	57.00	95.00	77.00	0.00	1.01	22.80	4.96
5	24.50	33.60	28.70	53.50	93.00	77.00	0.00	1.12	23.82	5.19
6	22.50	33.50	28.60	51.00	96.00	76.50	0.00	1.00	23.39	4.99
7	23.30	33.40	28.60	52.00	96.00	77.00	1.20	0.98	22.84	4.91
8	22.20	34.00	28.60	46.50	90.50	73.00	0.00	1.00	20.73	4.64
9	25.30	33.70	28.10	55.00	98.50	81.50	210.00	0.73	13.75	3.30
10	23.70	33.60	27.40	60.50	101.00	87.00	9.60	0.61	17.41	3.77
11	24.00	32.80	27.30	67.00	100.00	89.50	94.80	0.68	15.57	3.42
12	24.00	33.00	27.70	67.00	100.00	86.50	0.00	0.66	16.29	3.55
13	24.10	33.00	27.90	62.50	97.00	84.50	0.00	0.53	18.59	3.93
14	24.10	33.50	28.00	58.50	100.00	84.50	31.20	0.67	19.45	4.15
15	25.20	33.30	28.40	60.00	99.50	85.50	11.00	0.61	18.99	4.08
16	24.70	33.00	27.80	63.00	99.00	85.50	299.80	0.94	17.01	3.80
17	24.10	----	24.80	99.00	100.00	100.00	----	0.06	0.00	-
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Decade 1	23.65	33.62	28.23	54.60	97.15	79.85	926.40	0.90	20.33	4.46
Decade 2	24.31	33.10	27.41	68.14	99.36	88.00	436.80	0.59	15.13	3.82
Decade 3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
MONTH	23.92	33.43	27.89	60.18	98.06	83.21	1363.20	0.77	18.19	#DIV/0!

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: Agust 2011
AUTOMATIC WEATHER STATION (Enerco 420): Suai
Altitude: 22 Latitude: -9.31873 Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24	----	----	<<<<	----	----	<<<<	0	0	0	>>>>
25	25.30	28.80	<<<<	49.00	93.50	<<<<	3.60	0.12	20.17	>>>>
26	18.90	29.40	23.70	45.50	100.00	81.50	1.20	0.10	15.55	3.35
27	19.50	31.00	24.50	44.00	105.50	79.50	0.00	0.11	21.13	4.27
28	18.40	30.10	24.40	56.00	106.50	83.00	1.20	0.08	20.81	3.97
29	20.70	29.90	25.10	65.00	106.00	87.00	0.00	0.09	18.63	3.67
30	20.30	30.70	25.20	57.00	106.00	84.00	1.20	0.09	20.38	4.03
31	19.40	30.80	24.50	60.00	106.50	85.50	1.20	0.12	21.30	4.20
Decade 1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
Decade 2	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!
Decade 3	20.36	30.10	24.57	53.79	103.43	83.42	8.40	0.09	17.25	3.91
MONTH	20.36	30.10	24.57	53.79	103.43	83.42	8.40	0.09	17.25	3.91

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value
RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value
WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: September 2011

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	17.70	30.70	24.30	44.50	106.50	80.50	0.00	0.08	20.88	4.09
2	19.10	30.60	24.90	55.00	106.50	83.00	1.20	0.09	21.81	4.23
3	20.60	30.70	25.20	64.00	106.00	86.00	1.20	0.11	20.00	3.99
4	20.40	30.40	25.20	63.50	106.50	86.00	0.00	0.11	22.05	4.28
5	19.20	31.00	24.90	54.50	106.50	82.00	1.20	0.12	22.27	4.43
6	19.20	30.60	24.90	54.50	106.50	82.00	1.20	0.12	22.01	4.37
7	21.70	30.40	25.90	65.00	106.00	84.50	0.00	0.12	20.93	4.18
8	21.50	30.20	25.80	56.50	105.50	84.00	0.00	0.10	20.92	4.21
9	19.20	31.90	25.30	39.00	106.00	78.50	1.20	0.14	21.13	4.64
10	18.50	31.20	25.20	57.50	104.50	82.00	1.20	0.13	21.57	4.36
11	23.10	29.90	26.00	54.50	97.50	75.50	3.60	0.18	19.15	4.29
12	21.30	29.30	25.00	53.00	99.00	75.00	0.00	0.16	18.67	4.07
13	19.00	29.60	24.60	51.50	93.50	73.50	0.00	0.15	19.62	4.22
14	19.30	30.00	24.60	60.00	97.50	76.50	0.00	0.15	19.25	4.05
15	19.00	30.20	24.60	53.00	99.50	80.00	1.20	0.13	20.92	4.29
16	18.70	30.10	24.60	60.50	106.00	84.50	0.00	0.12	22.30	4.34
17	19.00	30.50	25.00	62.00	106.50	85.00	1.20	0.13	21.47	4.27
18	19.20	30.80	25.70	62.50	106.50	83.50	0.00	0.11	23.36	4.58
19	21.60	31.00	26.30	62.00	105.50	83.00	0.00	0.11	21.93	4.44
20	23.90	32.60	27.50	48.50	98.50	78.00	0.00	0.10	21.02	4.60
21	20.40	31.40	26.30	56.50	101.00	82.50	0.00	0.09	21.26	4.36
22	20.60	31.10	26.20	52.00	106.00	81.50	0.00	0.12	20.92	4.40
23	20.60	30.70	25.70	60.00	105.50	84.50	1.20	0.10	21.25	4.29
24	20.30	31.40	25.80	58.50	103.00	83.50	1.20	0.11	21.31	4.38
25	19.90	30.50	25.50	60.00	106.00	82.00	0.00	0.11	21.82	4.38
26	20.90	31.10	25.60	57.50	104.00	80.00	0.00	0.11	21.39	4.38
27	18.00	31.50	25.60	51.50	103.00	76.50	1.20	0.10	22.61	4.58
28	19.80	31.60	25.70	46.00	104.50	77.50	0.00	0.10	22.85	4.70
29	19.30	31.30	25.60	50.00	103.00	75.50	0.00	0.11	23.05	4.69
30	21.00	31.50	26.90	57.00	99.00	75.50	0.00	0.11	23.32	4.80
31										
Decade 1	19.71	30.77	25.16	55.40	106.05	82.85	7.20	0.11	21.36	4.28
Decade 2	20.41	30.40	25.39	56.75	101.00	79.45	6.00	0.13	20.77	4.31
Decade 3	20.08	31.21	25.89	54.90	103.50	79.90	3.60	0.11	21.98	4.50
MONTH	20.07	30.79	25.48	55.68	103.52	80.73	16.80	0.12	21.37	4.36

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: October 2011

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	20.70	30.70	26.40	61.50	101.00	79.50	0.00	0.11	22.13	4.50
2	22.50	30.80	27.20	63.00	98.50	81.00	3.60	0.15	17.91	3.98
3	24.90	29.40	26.20	74.00	104.00	90.50	287.60	0.11	6.35	1.76
4	22.80	27.80	24.50	78.00	105.50	94.00	34.00	0.10	9.88	2.20
5	23.40	30.30	25.80	66.00	105.50	90.50	9.60	0.11	14.69	3.24
6	22.20	30.70	26.40	68.00	106.50	88.00	6.00	0.09	18.40	3.82
7	22.50	29.60	26.30	74.00	106.00	91.50	7.20	0.11	16.75	3.48
8	23.70	30.40	26.90	72.50	104.50	88.00	4.80	0.10	18.03	3.78
9	23.00	30.70	27.00	69.50	105.50	88.00	75.60	0.13	19.20	4.03
10	22.90	31.00	27.00	59.00	104.50	85.50	0.00	0.13	22.66	4.74
11	23.20	31.10	27.10	61.50	101.50	84.00	0.00	0.15	22.66	4.79
12	21.90	31.80	27.00	63.50	105.50	85.00	1.20	0.11	22.91	4.72
13	22.70	32.30	27.00	66.00	106.50	87.50	0.00	0.10	22.78	4.70
14	20.80	31.10	26.80	63.00	103.50	81.50	0.00	0.11	24.44	4.91
15	25.40	31.20	28.00	69.00	99.50	83.00	0.00	0.11	21.05	4.48
16	23.10	32.20	28.00	65.50	105.50	83.50	0.00	0.11	23.45	4.90
17	23.00	31.80	27.50	67.00	105.50	85.50	0.00	0.14	20.93	4.44
18	22.40	32.10	27.60	61.50	106.00	83.50	0.00	0.11	22.51	4.73
19	23.10	31.80	27.70	64.50	106.00	84.00	0.00	0.15	22.86	4.82
20	23.30	32.10	27.80	66.50	106.00	84.00	0.00	0.15	23.79	4.98
21	22.60	32.00	27.40	66.00	106.00	85.00	0.00	0.14	23.06	4.81
22	22.70	32.30	27.40	65.50	106.50	86.00	0.00	0.11	23.05	4.80
23	23.20	32.00	27.20	67.00	106.00	86.00	0.00	0.13	22.56	4.71
24	21.90	32.30	27.40	64.50	106.00	84.00	0.00	0.12	23.04	4.81
25	21.90	32.40	27.70	62.50	106.00	84.50	0.00	0.13	22.88	4.83
26	22.80	31.90	27.40	62.50	106.50	85.50	0.00	0.12	23.30	4.87
27	22.50	32.30	27.40	57.00	106.50	82.50	0.00	0.11	21.28	4.57
28	23.20	31.90	27.70	64.00	104.50	83.00	3.60	0.10	20.54	4.38
29	23.40	33.90	28.20	53.00	102.00	79.50	0.00	0.10	22.99	5.03
30	23.20	32.80	28.00	56.00	102.50	80.50	0.00	0.12	21.44	4.73
31	23.00	32.70	27.60	58.50	100.50	83.50	0.00	0.11	20.45	4.50
Decade 1	22.86	30.14	26.37	68.55	104.15	87.65	428.40	0.11	16.60	3.55
Decade 2	22.89	31.75	27.45	64.80	104.55	84.15	1.20	0.12	22.74	4.75
Decade 3	22.76	32.41	27.58	61.50	104.82	83.64	3.60	0.12	22.24	4.73
MONTH	22.84	31.46	27.15	64.84	104.52	85.10	433.20	0.12	20.58	4.34

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PISCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: November 2011

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	22.80	31.40	26.80	67.50	104.50	88.00	0.00	0.82	19.90	4.17
2	23.20	33.20	27.80	56.00	101.00	80.00	0.00	1.09	22.38	4.90
3	21.40	33.20	27.40	52.50	101.00	78.00	0.00	1.09	21.86	4.80
4	22.10	31.90	27.50	53.50	101.50	79.50	2.40	1.25	21.72	4.76
5	22.20	32.60	27.50	56.00	101.50	80.50	0.00	1.03	21.78	4.72
6	22.70	32.60	27.80	63.50	102.50	81.50	0.00	1.04	21.51	4.62
7	22.70	33.00	28.40	54.00	103.00	80.50	0.00	1.04	22.09	4.84
8	24.10	33.20	28.70	55.00	96.50	77.50	0.00	1.20	21.45	4.88
9	24.30	33.60	28.70	60.00	104.00	82.00	147.60	1.16	22.45	4.96
10	24.30	33.10	28.20	64.50	106.50	87.00	42.00	0.97	23.55	5.01
11	23.90	33.20	28.40	63.00	106.50	85.00	1.20	0.90	23.08	4.94
12	23.50	33.20	28.40	56.50	106.00	83.00	0.00	0.98	23.56	5.07
13	22.20	32.70	27.80	50.50	105.50	79.50	1.20	1.04	25.40	5.35
14	22.00	33.00	28.10	51.00	103.50	79.00	0.00	1.11	25.78	5.47
15	22.80	33.20	28.40	56.50	103.50	80.50	37.20	1.09	24.37	5.23
16	23.20	32.50	27.70	57.50	106.50	83.50	30.00	1.24	23.66	5.07
17	23.30	33.30	28.30	59.00	106.00	83.00	44.40	1.05	24.86	5.29
18	23.60	33.60	28.40	58.50	106.00	85.00	117.60	1.01	24.65	5.28
19	24.20	33.20	28.50	62.50	106.50	85.00	60.00	1.00	24.94	5.29
20	24.20	34.20	28.70	55.50	106.00	83.50	0.00	0.98	24.26	5.29
21	23.60	33.20	27.10	58.50	104.50	88.00	20.40	1.10	17.19	3.99
22	24.20	33.70	28.80	51.00	103.00	79.50	0.00	1.31	24.81	5.52
23	24.50	33.40	28.80	50.50	96.00	76.50	0.00	1.35	25.56	5.70
24	24.10	33.30	28.80	53.50	94.00	77.00	34.80	1.25	25.54	5.61
25	24.60	32.90	27.70	64.00	106.00	89.50	24.00	0.83	17.94	3.98
26	25.40	32.90	27.80	68.50	106.50	90.00	8.40	0.93	20.84	4.49
27	24.00	32.90	27.90	58.50	106.00	87.50	0.00	0.83	13.50	3.26
28	23.30	34.00	29.00	59.00	106.50	83.50	1.20	1.12	24.20	5.27
29	25.10	33.60	29.40	62.50	106.00	85.00	0.00	0.94	23.17	5.06
30	25.10	34.30	29.40	62.50	104.00	83.50	1.20	1.04	22.77	5.06
31										
Decade 1	22.98	32.78	27.88	58.25	102.20	81.45	192.00	1.07	21.87	4.77
Decade 2	23.29	33.21	28.27	57.05	105.60	82.70	291.60	1.04	24.46	5.23
Decade 3	24.39	33.42	28.47	58.85	103.25	84.00	90.00	1.07	21.55	4.79
MONTH	23.55	33.14	28.21	58.05	103.68	82.72	573.60	1.06	22.63	4.93

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



MINISTERIO DE AGRICULTURA, FLORESTA E PASCAS
AGRO-METEOROLOGY SECTION

MONTHLY METEOROLOGICAL BULLETIN: December 2011

AUTOMATIC WEATHER STATION (Enerco 420): Suai

Altitude: 22

Latitude: -9.31873

Longitude: 125.26004



Day	T min (°C)	T max (°C)	T mean (°C)	RH min (%)	RH max (%)	RH mean (%)	RR (mm)	WS mean (m/s)	RGm (MJ/m ²)	Eto (mm)
1	24.90	34.30	29.70	56.00	104.00	80.50	0.00	1.04	24.89	5.49
2	23.40	34.70	29.10	50.50	102.50	80.50	0.00	0.91	25.41	5.53
3	23.60	34.80	28.70	54.00	103.50	82.50	96.00	1.01	23.31	5.18
4	25.00	34.80	29.50	55.50	105.00	81.50	1.20	1.02	24.38	5.42
5	24.90	34.50	29.00	55.50	104.50	81.00	6.00	0.95	17.66	4.18
6	24.60	34.20	28.70	54.00	104.50	80.00	0.00	0.83	16.79	3.96
7	25.30	34.00	29.10	50.50	98.50	77.50	13.20	1.34	21.30	5.05
8	24.90	33.40	27.70	57.00	106.00	88.50	75.60	1.25	19.11	4.41
9	24.30	32.90	27.60	57.50	103.00	86.00	6.00	0.91	13.34	3.29
10	24.20	33.40	28.00	61.00	120.00	85.50	190.80	0.98	23.96	5.06
11	23.40	32.90	28.00	61.50	106.50	85.00	0.00	0.66	21.47	4.57
12	24.50	33.80	28.90	56.00	105.00	81.50	82.80	0.98	23.87	5.22
13	24.50	33.90	27.80	63.00	106.50	90.00	288.00	0.94	19.34	4.31
14	23.60	33.70	26.70	55.50	106.50	90.00	42.00	0.50	12.50	2.96
15	23.70	35.00	27.20	58.00	106.00	89.50	37.20	0.58	18.09	4.03
16	23.70	32.60	26.80	68.50	106.00	91.50	66.00	0.78	17.16	3.74
17	23.90	32.50	26.80	66.50	107.00	92.50	32.40	0.52	14.14	3.16
18	23.90	33.40	27.30	64.00	107.00	90.00	45.60	0.63	19.68	4.23
19	23.70	32.70	27.00	68.50	107.00	93.00	302.40	0.69	17.59	3.81
20	23.80	34.40	28.70	66.50	108.00	87.00	7.20	0.84	22.58	4.89
21	24.80	28.00	25.70	91.50	106.00	99.50	46.80	0.53	2.61	0.83
22	23.90	31.40	27.50	71.00	107.00	91.50	0.00	0.68	9.55	2.33
23	25.20	33.20	28.30	66.00	106.00	88.50	0.00	0.78	16.91	3.81
24	24.20	34.30	28.50	56.00	106.00	85.50	0.00	0.89	17.21	4.03
25	23.40	34.60	28.90	54.50	104.00	82.50	0.00	0.88	20.92	4.71
26	23.80	36.00	28.70	51.50	106.50	86.50	24.00	0.75	20.13	4.60
27	23.30	35.20	29.40	54.00	107.50	84.50	0.00	0.84	23.50	5.19
28	24.90	34.90	28.80	60.50	106.50	85.50	0.00	1.02	21.32	4.81
29	23.80	34.40	27.70	54.00	106.00	87.00	9.60	0.80	18.58	4.22
30	23.90	34.80	28.40	54.50	107.00	86.00	199.20	0.69	19.25	4.33
31	24.10	33.20	26.40	67.00	107.00	94.00	159.60	0.50	11.53	2.69
Decade 1	24.51	34.10	28.71	55.15	105.15	82.35	388.80	1.03	21.02	4.76
Decade 2	23.87	33.49	27.52	62.80	106.55	89.00	903.60	0.71	18.64	4.09
Decade 3	24.12	33.64	28.03	61.86	106.32	88.27	439.20	0.76	16.50	3.78
MONTH	24.16	33.74	28.08	60.00	106.02	86.60	1731.60	0.83	18.65	4.21

RR: rainfall T min: Air temperature minima value T max: Air temperature maxima value T mean: Air temperature average value

RH min: Air relative humidity minima value RH max: Air relative humidity maxima value RH mean: Air relative humidity average value

WS mean: Wind speed average value RG: Solar radiation value ETo: Reference Evapotranspiration (FAO, 1998)



WorleyParsons

resources & energy

TIMOR GAP, E.P.
TIMOR GÁS & PETRÓLEO



REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE
SECRETARIA DE ESTADO DOS RECURSOS NATURAIS

Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX C

QUALITY CONTROL REPORT

Work Order	: EB1202480	Page	: 1 of 10
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Brisbane
Contact	: GRANT HICKSON	Contact	: Customer Services
Address	: LEVEL 3/600 MURRAY STREET WEST PERTH WA, AUSTRALIA 6005	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: grant.hickson@worleyparsons.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 08 9278 8111	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: 301012-01504-Timor Leste-Environmental Impact Assessment	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: Timor Leste-Environmental Impa	Date Samples Received	: 27-JAN-2012
C-O-C number	: Teimor Leste EIA	Issue Date	: 09-FEB-2012
Sampler	: Joana Fernandes	No. of samples received	: 78
Order number	: ----	No. of samples analysed	: 77
Quote number	: EN/034/11		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002 : pH (Soils) (QC Lot: 2147987)									
EB1202480-004	TPSS II-0.39m	EA002: pH Value	----	0.1	pH Unit	8.4	8.4	0.0	0% - 20%
EB1202480-011	TPAirport Suai V-1m1m	EA002: pH Value	----	0.1	pH Unit	8.6	8.6	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 2147995)									
EB1202480-021	TPNB East IV-0.5m	EA002: pH Value	----	0.1	pH Unit	8.3	8.3	0.0	0% - 20%
EB1202480-031	TPLNG III-0.5m	EA002: pH Value	----	0.1	pH Unit	8.3	8.3	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 2148008)									
EB1202480-041	TPNC I-1.5m	EA002: pH Value	----	0.1	pH Unit	8.8	8.8	0.0	0% - 20%
EB1202480-051	TPNV I-0.5m	EA002: pH Value	----	0.1	pH Unit	9.2	9.2	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 2148014)									
EB1202480-061	TPNV V-1m	EA002: pH Value	----	0.1	pH Unit	8.4	8.4	0.0	0% - 20%
EB1202480-071	TPLNG II-Topsoil	EA002: pH Value	----	0.1	pH Unit	8.2	8.1	0.0	0% - 20%
EA010: Conductivity (QC Lot: 2147988)									
EB1202480-004	TPSS II-0.39m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	278	280	0.7	0% - 20%
EB1202480-011	TPAirport Suai V-1m1m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	241	242	0.4	0% - 20%
EA010: Conductivity (QC Lot: 2147996)									
EB1202480-021	TPNB East IV-0.5m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	117	113	3.5	0% - 20%
EB1202480-031	TPLNG III-0.5m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	87	88	1.1	0% - 20%
EA010: Conductivity (QC Lot: 2148010)									
EB1202480-041	TPNC I-1.5m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	378	384	1.6	0% - 20%
EB1202480-051	TPNV I-0.5m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	258	263	1.9	0% - 20%
EA010: Conductivity (QC Lot: 2148015)									
EB1202480-061	TPNV V-1m	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	141	139	1.4	0% - 20%
EB1202480-071	TPLNG II-Topsoil	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	82	85	3.6	0% - 20%
EA055: Moisture Content (QC Lot: 2149129)									
EB1202480-004	TPSS II-0.39m	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	23.4	24.1	3.1	0% - 20%
EB1202480-011	TPAirport Suai V-1m1m	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	24.4	25.1	2.6	0% - 20%
EA055: Moisture Content (QC Lot: 2149130)									
EB1202480-024	TPNB East V-1m	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	25.7	26.1	1.5	0% - 20%
EB1202480-031	TPLNG III-0.5m	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	2.2	1.9	15.4	No Limit
EA055: Moisture Content (QC Lot: 2149131)									
EB1202480-044	TPNC III-0.5m	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	8.0	8.1	1.3	No Limit
EB1202480-051	TPNV I-0.5m	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	16.5	16.6	0.6	0% - 50%
EA055: Moisture Content (QC Lot: 2149132)									
EB1202480-064	TPSS III-Topsoil	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	31.6	31.4	0.6	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 2149132) - continued									
EB1202480-071	TPLNG II-Topsoil	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	<1.0	<1.0	0.0	No Limit
ED021: Bicarbonate Extractable Potassium (Colwell) (QC Lot: 2149208)									
EB1202480-001	TPSS I-0.5m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	250	680	91.4	0% - 20%
EB1202480-009	TPSS IV-1.5m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	<200	0.0	No Limit
ED021: Bicarbonate Extractable Potassium (Colwell) (QC Lot: 2149209)									
EB1202480-021	TPNB East IV-0.5m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	550	820	38.9	0% - 20%
EB1202480-029	TPLNG II-1m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	<200	0.0	No Limit
ED021: Bicarbonate Extractable Potassium (Colwell) (QC Lot: 2149210)									
EB1202480-041	TPNC I-1.5m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	230	270	17.6	0% - 20%
EB1202480-049	TPNC V-1m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	<200	0.0	No Limit
ED021: Bicarbonate Extractable Potassium (Colwell) (QC Lot: 2149212)									
EB1202480-061	TPNV V-1m	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	310	44.2	0% - 20%
EB1202480-069	TPNB East IV-Topsoil	ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	810	830	1.6	0% - 20%
ED042T: Total Sulfur by LECO (QC Lot: 2151794)									
EB1202480-001	TPSS I-0.5m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.0	No Limit
EB1202480-010	TPAirport Suai V-0.5m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 2151796)									
EB1202480-021	TPNB East IV-0.5m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.0	No Limit
EB1202480-030	TPLNG II-1.5m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 2151798)									
EB1202480-041	TPNC I-1.5m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.0	No Limit
EB1202480-050	TPNC V-1.5m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 2151800)									
EB1202480-061	TPNV V-1m	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.0	No Limit
EB1202480-070	TPNB West V-Topsoil	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.01	0.01	0.0	No Limit
EK055: Ammonia as N (QC Lot: 2147775)									
EB1202480-002	TPSS I-1m	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EB1202480-010	TPAirport Suai V-0.5m	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EK055: Ammonia as N (QC Lot: 2147777)									
EB1202480-022	TPNB East IV-1m	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EB1202480-030	TPLNG II-1.5m	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EK055: Ammonia as N (QC Lot: 2147778)									
EB1202480-042	TPNC II-0.5m	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EB1202480-050	TPNC V-1.5m	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EK055: Ammonia as N (QC Lot: 2147787)									
EB1202480-062	TPSS I-Topsoil	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EB1202480-070	TPNB West V-Topsoil	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2147989)									



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2147989) - continued									
EB1202480-004	TPSS II-0.39m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1202480-011	TPAirport Suai V-1m1m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2147998)									
EB1202480-021	TPNB East IV-0.5m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1202480-031	TPLNG III-0.5m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2148012)									
EB1202480-041	TPNC I-1.5m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1202480-051	TPNV I-0.5m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2148016)									
EB1202480-061	TPNV V-1m	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1202480-071	TPLNG II-Topsoil	EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	0.4	0.4	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2147990)									
EB1202480-004	TPSS II-0.39m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.2	0.0	No Limit
EB1202480-011	TPAirport Suai V-1m1m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.2	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2147999)									
EB1202480-021	TPNB East IV-0.5m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.4	0.4	0.0	No Limit
EB1202480-031	TPLNG III-0.5m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	2.1	2.4	9.8	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2148013)									
EB1202480-041	TPNC I-1.5m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.2	0.0	No Limit
EB1202480-051	TPNV I-0.5m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2148017)									
EB1202480-061	TPNV V-1m	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1202480-071	TPLNG II-Topsoil	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	8.7	9.0	3.3	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2147950)									
EB1202480-001	TPSS I-0.5m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	100	140	27.5	No Limit
EB1202480-011	TPAirport Suai V-1m1m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	460	460	0.0	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2147951)									
EB1202480-021	TPNB East IV-0.5m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	920	990	7.0	0% - 20%
EB1202480-031	TPLNG III-0.5m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	420	430	0.0	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2147960)									
EB1202480-041	TPNC I-1.5m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	450	460	0.0	0% - 20%
EB1202480-051	TPNV I-0.5m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	460	420	8.6	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2147961)									
EB1202480-061	TPNV V-1m	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	510	460	10.5	0% - 20%
EB1202480-071	TPLNG II-Topsoil	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	740	740	0.0	0% - 20%
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 2147788)									
EB1202480-001	TPSS I-0.5m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	22	15	37.8	No Limit
EB1202480-010	TPAirport Suai V-0.5m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	6	6	0.0	No Limit



Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 2147789)									
EB1202480-018	TPRB III-0.5m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	<2	<2	0.0	No Limit
EB1202480-027	TPLNG I-1.5m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	2	<2	0.0	No Limit
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 2147790)									
EB1202480-035	TPLNG IV-1m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	28	23	19.6	0% - 50%
EB1202480-044	TPNC III-0.5m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	15	13	14.3	No Limit
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 2147791)									
EB1202480-052	TPNV I-1m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	5	<2	85.7	No Limit
EB1202480-061	TPNV V-1m	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	<2	<2	0.0	No Limit
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QC Lot: 2147792)									
EB1202480-069	TPNB East IV-Topsoil	EK080: Bicarbonate Ext. P (Colwell)	----	2	mg/kg	54	61	12.2	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2151795)									
EB1202480-001	TPSS I-0.5m	EP003: Total Organic Carbon	----	0.02	%	0.08	0.08	0.0	No Limit
EB1202480-011	TPAirport Suai V-1m1m	EP003: Total Organic Carbon	----	0.02	%	0.38	0.37	0.0	0% - 50%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2151797)									
EB1202480-021	TPNB East IV-0.5m	EP003: Total Organic Carbon	----	0.02	%	0.87	0.89	2.4	0% - 20%
EB1202480-031	TPLNG III-0.5m	EP003: Total Organic Carbon	----	0.02	%	0.31	0.30	0.0	0% - 50%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2151799)									
EB1202480-041	TPNC I-1.5m	EP003: Total Organic Carbon	----	0.02	%	0.56	0.56	0.0	0% - 20%
EB1202480-051	TPNV I-0.5m	EP003: Total Organic Carbon	----	0.02	%	0.47	0.45	4.3	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2151801)									
EB1202480-061	TPNV V-1m	EP003: Total Organic Carbon	----	0.02	%	0.28	0.28	0.0	0% - 50%
EB1202480-071	TPLNG II-Topsoil	EP003: Total Organic Carbon	----	0.02	%	0.77	0.74	3.6	0% - 20%



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)
Method: Compound	CAS Number	LOR	Unit				LCS	Low
EA002 : pH (Soils) (QCLot: 2147987)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	94	103
EA002 : pH (Soils) (QCLot: 2147995)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	94	103
EA002 : pH (Soils) (QCLot: 2148008)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	94	103
EA002 : pH (Soils) (QCLot: 2148014)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	99.6	94	103
EA010: Conductivity (QCLot: 2147988)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	92.8	83	110
EA010: Conductivity (QCLot: 2147996)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	95.4	83	110
EA010: Conductivity (QCLot: 2148010)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	92.8	83	110
EA010: Conductivity (QCLot: 2148015)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.3	83	110
ED021: Bicarbonate Extractable Potassium (Colwell) (QCLot: 2149208)								
ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	----	----	----	----
ED021: Bicarbonate Extractable Potassium (Colwell) (QCLot: 2149209)								
ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	----	----	----	----
ED021: Bicarbonate Extractable Potassium (Colwell) (QCLot: 2149210)								
ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	----	----	----	----
ED021: Bicarbonate Extractable Potassium (Colwell) (QCLot: 2149212)								
ED021: Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	----	----	----	----
ED042T: Total Sulfur by LECO (QCLot: 2151794)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	104	70	130
ED042T: Total Sulfur by LECO (QCLot: 2151796)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	97.3	70	130
ED042T: Total Sulfur by LECO (QCLot: 2151798)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	98.4	70	130
ED042T: Total Sulfur by LECO (QCLot: 2151800)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	103	70	130
EK055: Ammonia as N (QCLot: 2147775)								



Sub-Matrix: SOIL

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EK055: Ammonia as N (QCLot: 2147775) - continued									
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	500 mg/kg	102	90	110	
EK055: Ammonia as N (QCLot: 2147777)									
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	500 mg/kg	105	90	110	
EK055: Ammonia as N (QCLot: 2147778)									
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	500 mg/kg	102	90	110	
EK055: Ammonia as N (QCLot: 2147787)									
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	500 mg/kg	102	90	110	
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2147989)									
EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	88.6	81	127	
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2147998)									
EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	99.4	81	127	
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2148012)									
EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	96.0	81	127	
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2148016)									
EK057G: Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	96.0	81	127	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2147990)									
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	100	72	124	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2147999)									
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	90.0	72	124	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2148013)									
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	92.3	72	124	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2148017)									
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	108	72	124	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147950)									
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	534 mg/kg	80.5	70	118	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147951)									
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	534 mg/kg	81.3	70	118	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147960)									
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	534 mg/kg	78.6	70	118	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147961)									
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	534 mg/kg	78.8	70	118	
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 2147788)									
EK080: Bicarbonate Ext. P (Colwell)	----	100	mg/kg	<100	----	----	----	----	
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 2147789)									
EK080: Bicarbonate Ext. P (Colwell)	----	100	mg/kg	<100	----	----	----	----	
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 2147790)									



Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 2147790) - continued									
EK080: Bicarbonate Ext. P (Colwell)	----	100	mg/kg	<100	----	----	----	----	
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 2147791)									
EK080: Bicarbonate Ext. P (Colwell)	----	100	mg/kg	<100	----	----	----	----	
EK080: Bicarbonate Extractable Phosphorus (Colwell) (QCLot: 2147792)									
EK080: Bicarbonate Ext. P (Colwell)	----	100	mg/kg	<100	----	----	----	----	
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2151795)									
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	98.6	70	130	
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2151797)									
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	101	70	130	
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2151799)									
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	103	70	130	
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2151801)									
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	99.1	70	130	



Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					MS	Low	High
EK055: Ammonia as N (QCLot: 2147775)							
EB1202480-001	TPSS I-0.5m	EK055: Ammonia as N	7664-41-7	100 mg/kg	101	70	130
EK055: Ammonia as N (QCLot: 2147777)							
EB1202480-021	TPNB East IV-0.5m	EK055: Ammonia as N	7664-41-7	100 mg/kg	108	70	130
EK055: Ammonia as N (QCLot: 2147778)							
EB1202480-041	TPNC I-1.5m	EK055: Ammonia as N	7664-41-7	100 mg/kg	101	70	130
EK055: Ammonia as N (QCLot: 2147787)							
EB1202480-061	TPNV V-1m	EK055: Ammonia as N	7664-41-7	100 mg/kg	101	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2147989)							
EB1202480-005	TPSS III-0.5m	EK057G: Nitrite as N (Sol.)	----	2.0 mg/kg	103	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2147998)							
EB1202480-022	TPNB East IV-1m	EK057G: Nitrite as N (Sol.)	----	2.0 mg/kg	98.0	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2148012)							
EB1202480-042	TPNC II-0.5m	EK057G: Nitrite as N (Sol.)	----	2.0 mg/kg	100	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2148016)							
EB1202480-062	TPSS I-Topsoil	EK057G: Nitrite as N (Sol.)	----	2.0 mg/kg	103	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2147990)							
EB1202480-005	TPSS III-0.5m	EK059G: Nitrite + Nitrate as N (Sol.)	----	2.0 mg/kg	122	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2147999)							
EB1202480-022	TPNB East IV-1m	EK059G: Nitrite + Nitrate as N (Sol.)	----	2.0 mg/kg	89.0	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2148013)							
EB1202480-042	TPNC II-0.5m	EK059G: Nitrite + Nitrate as N (Sol.)	----	2.0 mg/kg	94.1	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2148017)							
EB1202480-062	TPSS I-Topsoil	EK059G: Nitrite + Nitrate as N (Sol.)	----	2.0 mg/kg	# Not Determined	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147950)							
EB1202480-002	TPSS I-1m	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	103	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147951)							
EB1202480-022	TPNB East IV-1m	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	104	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147960)							
EB1202480-042	TPNC II-0.5m	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	81.7	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2147961)							
EB1202480-062	TPSS I-Topsoil	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	102	70	130

CERTIFICATE OF ANALYSIS

<p>Work Order : EB1202480</p> <p>Client : WORLEY PARSONS - INFRASTRUCTURE MWE</p> <p>Contact : GRANT HICKSON</p> <p>Address : LEVEL 3/600 MURRAY STREET WEST PERTH WA, AUSTRALIA 6005</p> <p>E-mail : grant.hickson@worleyparsons.com</p> <p>Telephone : +61 08 9278 8111</p> <p>Facsimile : ----</p> <p>Project : 301012-01504-Timor Leste-Environmental Impact Assessment</p> <p>Order number : ----</p> <p>C-O-C number : Teimor Leste EIA</p> <p>Sampler : Joana Fernandes</p> <p>Site : Timor Leste-Environmental Impa</p> <p>Quote number : EN/034/11</p>	<p>Page : 1 of 18</p> <p>Laboratory : Environmental Division Brisbane</p> <p>Contact : Customer Services</p> <p>Address : 32 Shand Street Stafford QLD Australia 4053</p> <p>E-mail : Brisbane.Enviro.Services@alsglobal.com</p> <p>Telephone : +61 7 3243 7222</p> <p>Facsimile : +61 7 3243 7218</p> <p>QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement</p> <p>Date Samples Received : 27-JAN-2012</p> <p>Issue Date : 09-FEB-2012</p> <p>No. of samples received : 78</p> <p>No. of samples analysed : 77</p>
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPSS I-0.5m	TPSS I-1m	TPSS I-1.5m	TPSS II-0.39m	TPSS III-0.5m
				19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00
				EB1202480-001	EB1202480-002	EB1202480-003	EB1202480-004	EB1202480-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.0	8.5	8.6	8.4	8.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	64	88	81	278	1320
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	4.2	15.9	10.1	23.4	26.2
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	250	230	210	340	230
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	<0.01	0.02	0.02	0.18
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.8	0.8	0.8	0.2	0.3
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.8	0.8	0.8	0.2	0.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	100	260	200	760	580
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	100	260	200	760	580
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	22	22	11	123	30
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.08	0.16	0.10	0.61	0.32



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPSS III-1m	TPSS IV-0.5m	TPSS IV-1m	TPSS IV-1.5m	TPAirport Suai V-0.5m
				19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00	20-DEC-2011 15:00
				EB1202480-006	EB1202480-007	EB1202480-008	EB1202480-009	EB1202480-010
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.9	8.4	8.4	8.5	9.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	2400	104	109	89	426
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	27.5	19.0	8.4	6.0	25.6
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	230	230	250	<200	250
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.16	0.01	0.02	0.01	0.02
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.1	0.2	0.1	0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.4	2.0	1.0	0.5	0.4
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.5	2.2	1.1	0.6	0.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	580	460	570	280	580
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	580	460	570	280	580
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	4	23	20	34	6
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.32	0.40	0.54	0.24	0.66



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				TPAirport Suai V-1m1m	TPRB I-0.5m	TPRB I-1m	TPRB I-1.5m	TPRB II-0.5m
				20-DEC-2011 15:00	21-DEC-2011 15:00	21-DEC-2011 15:00	21-DEC-2011 15:00	20-DEC-2011 15:00
Compound	CAS Number	LOR	Unit	EB1202480-011	EB1202480-012	EB1202480-013	EB1202480-014	EB1202480-015
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.6	7.7	8.5	8.9	8.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	241	16	121	64	89
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	24.4	9.0	22.5	4.2	16.9
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	260	250	820	<200	590
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.01	<0.01	0.01	<0.01	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.3	<0.1	0.2
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.9	0.9	0.2	0.6
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.9	1.2	0.2	0.8
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	460	320	450	110	240
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	460	320	450	110	240
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	27	36	16	17	<2
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.38	0.24	0.31	0.09	0.20



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPRB II-1m	TPRB II-1.5m	TPRB III-0.5m	TPRB III-1m	TPRB III-1.5m
				20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00
				EB1202480-016	EB1202480-017	EB1202480-018	EB1202480-019	EB1202480-020
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.4	8.6	8.7	7.9	8.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	165	123	83	19	110
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	18.8	20.0	17.8	10.2	24.7
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	310	230	920	790	670
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.1	0.2	0.2	<0.1	0.2
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.4	0.3	0.7	1.1	0.3
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.5	0.5	0.9	1.1	0.5
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	560	430	320	380	560
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	560	430	320	380	560
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	37	34	<2	9	10
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.45	0.26	0.17	0.40	0.46



Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	TPNB East IV-0.5m	TPNB East IV-1m	TPNB East V-0.5m	TPNB East V-1m	TPLNG I-0.5m
				20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00	10-DEC-2011 15:00
				EB1202480-021	EB1202480-022	EB1202480-023	EB1202480-024	EB1202480-025
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.3	8.3	8.3	8.3	8.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	117	115	118	128	66
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	16.7	20.2	24.4	25.7	2.0
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	550	770	<200	<200	<200
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	0.03	0.02
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.4	0.5	0.2	0.1	2.4
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.4	0.6	0.2	0.1	2.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	920	1020	700	520	170
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	920	1020	700	520	170
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	6	9	14	16	23
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.87	1.18	0.45	0.38	0.13



Analytical Results

Sub-Matrix: SOIL

Compound	CAS Number	LOR	Unit	Client sample ID	TPLNG I-1m	TPLNG I-1.5m	TPLNG II-0.5m	TPLNG II-1m	TPLNG II-1.5m
				Client sampling date / time	10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00
					EB1202480-026	EB1202480-027	EB1202480-028	EB1202480-029	EB1202480-030
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		8.8	9.0	8.6	9.0	9.0
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		57	57	72	54	54
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		2.0	3.0	3.5	1.3	<1.0
ED021: Bicarbonate Extractable Potassium (Colwell)									
Bicarbonate Extractable K (Colwell)	----	10	mg/kg		<200	<200	<200	<200	<200
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		0.02	0.02	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	----	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	----	0.1	mg/kg		0.3	<0.1	1.3	0.1	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.3	<0.1	1.3	0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		60	60	220	50	40
EK062: Total Nitrogen as N (TKN + NOx)									
Total Nitrogen as N	----	20	mg/kg		60	60	220	50	40
EK080: Bicarbonate Extractable Phosphorus (Colwell)									
Bicarbonate Ext. P (Colwell)	----	2	mg/kg		10	2	10	4	4
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.05	0.04	0.12	<0.02	<0.02



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPLNG III-0.5m	TPLNG III-1m	TPLNG III-1.5m	TPLNG IV-0.5m	TPLNG IV-1m
				10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00
				EB1202480-031	EB1202480-032	EB1202480-033	EB1202480-034	EB1202480-035
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.3	8.9	9.0	7.4	7.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	87	54	53	13	12
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	2.2	1.4	3.1	5.5	3.1
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	<200	<200	250	<200
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	2.1	<0.1	<0.1	0.3	0.3
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	2.1	<0.1	<0.1	0.3	0.3
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	420	60	40	550	220
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	420	60	40	550	220
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	4	<2	<2	<2	28
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.31	0.02	<0.02	0.57	0.17



Analytical Results

Sub-Matrix: SOIL

				Client sample ID	TPLNG IV-1.5m	TPLNG V-0.5m	TPLNG V-1m	TPNC I-0.5m	TPNC I-1m
				Client sampling date / time	10-DEC-2011 15:00	10-DEC-2011 15:00	10-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00
Compound	CAS Number	LOR	Unit		EB1202480-036	EB1202480-037	EB1202480-038	EB1202480-039	EB1202480-040
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		8.7	8.2	8.4	9.1	8.7
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		64	117	139	455	217
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		3.2	13.0	13.8	22.7	16.8
ED021: Bicarbonate Extractable Potassium (Colwell)									
Bicarbonate Extractable K (Colwell)	----	10	mg/kg		<200	380	250	210	240
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		<0.01	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	----	0.1	mg/kg		<0.1	<0.1	<0.1	0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	----	0.1	mg/kg		0.1	0.5	0.2	1.1	1.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		0.1	0.5	0.2	1.2	1.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		120	1330	540	460	630
EK062: Total Nitrogen as N (TKN + NOx)									
Total Nitrogen as N	----	20	mg/kg		120	1330	540	460	630
EK080: Bicarbonate Extractable Phosphorus (Colwell)									
Bicarbonate Ext. P (Colwell)	----	2	mg/kg		<2	<2	27	<2	5
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.08	1.56	0.53	0.52	0.72



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPNC I-1.5m	TPNC II-0.5m	TPNC II-1m	TPNC III-0.5m	TPNC III-1m
				12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00
				EB1202480-041	EB1202480-042	EB1202480-043	EB1202480-044	EB1202480-045
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.8	8.8	8.7	8.6	9.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	378	354	874	104	102
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	20.9	17.2	17.4	8.0	8.4
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	230	<200	270	<200	<200
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	<0.01	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.3	0.2	0.4	0.2
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.3	0.2	0.4	0.2
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	450	490	330	450	220
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	450	490	330	450	220
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	<2	<2	36	15	<2
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.56	0.73	0.25	0.42	0.21



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPNC IV-0.5m	TPNC IV-1m	TPNC V-0.5m	TPNC V-1m	TPNC V-1.5m
				12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00
				EB1202480-046	EB1202480-047	EB1202480-048	EB1202480-049	EB1202480-050
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.0	8.8	9.0	8.9	9.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	273	1230	233	1050	1040
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	15.0	19.2	15.6	16.6	22.5
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	270	410	<200	<200	220
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.02	<0.01	0.02	0.02
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	0.1	0.1	0.8	0.6
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	0.1	0.1	0.8	0.6
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	460	270	600	330	260
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	460	270	600	330	260
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	5	<2	12	<2	<2
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.32	0.18	0.48	0.18	0.15



Analytical Results

Sub-Matrix: SOIL

Compound	CAS Number	LOR	Unit	Client sample ID	TPNV I-0.5m	TPNV I-1m	TPNV I-1.5m	TPNV II-0.5m	TPNV II-1m
				Client sampling date / time	11-DEC-2011 15:00	11-DEC-2011 15:00	11-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00
				EB1202480-051	EB1202480-052	EB1202480-053	EB1202480-054	EB1202480-055	
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit	9.2	8.6	9.0	9.0	8.9	
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm	258	1840	1220	222	3140	
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%	16.5	25.1	24.2	13.4	12.8	
ED021: Bicarbonate Extractable Potassium (Colwell)									
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	300	250	250	<200	
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.16	0.03	<0.01	0.56	
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	1.2	0.8	0.4	0.2	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	1.2	0.8	0.4	0.2	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg	460	340	420	550	190	
EK062: Total Nitrogen as N (TKN + NOx)									
Total Nitrogen as N	----	20	mg/kg	460	340	420	550	190	
EK080: Bicarbonate Extractable Phosphorus (Colwell)									
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	34	5	9	17	<2	
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%	0.47	0.22	0.20	0.38	0.19	



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPNV III-0.5m	TPNV III-1m	TPNV IV-0.5m	TPNV IV-1m	TPNV V-0.5m
				12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00
				EB1202480-056	EB1202480-057	EB1202480-058	EB1202480-059	EB1202480-060
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.8	9.3	8.5	9.0	8.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	803	996	456	865	130
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	15.8	17.5	14.5	17.8	11.3
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	360	490	240	280	<200
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.02	0.02	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	0.1	0.2	0.2	<0.1	0.2
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.1	0.2	0.2	<0.1	0.2
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	340	210	1040	380	460
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	340	210	1040	380	460
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	<2	46	<2	19	<2
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.14	0.10	0.89	0.24	0.28



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPNV V-1m	TPSS I-Topsoil	TPSS II-Topsoil	TPSS III-Topsoil	TPNS IV-Topsoil
				12-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00	19-DEC-2011 15:00
				EB1202480-061	EB1202480-062	EB1202480-063	EB1202480-064	EB1202480-065
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.4	8.4	8.5	8.2	8.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	141	81	500	603	222
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	13.1	10.0	30.5	31.6	20.1
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	230	340	1020	1100
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.01	0.05	0.08	0.03
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	30	60	40
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	3.2	15.7
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	14.9	<0.1	17.3	16.5
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	14.9	<0.1	20.5	32.2
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	510	680	3320	4520	2590
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	510	690	3320	4540	2620
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	<2	6	23	22	85
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.28	0.62	3.61	4.91	3.09



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPRB I-Topsoil	TPRB II-Topsoil	TPRB III-Topsoil	TPNB East IV-Topsoil	TPNB West V-Topsoil
				20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00	20-DEC-2011 15:00
				EB1202480-066	EB1202480-067	EB1202480-068	EB1202480-069	EB1202480-070
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.7	8.2	8.0	8.3	8.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	133	150	185	142	117
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	20.0	23.1	28.8	28.8	24.7
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	710	770	980	810	550
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.01	0.02	0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.7	<0.1	1.4	0.7	0.2
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	38.5	20.2	33.7	14.9	15.6
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	39.2	20.2	35.1	15.6	15.8
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	1910	1840	2120	2380	1640
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	1950	1860	2160	2400	1660
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	97	22	15	54	15
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	2.18	2.01	2.14	3.17	1.85



Analytical Results

Sub-Matrix: SOIL

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	TPLNG II-Topsoil	TPLNG V-Topsoil	TPNC I-Topsoil	TPNC II-Topsoil	TPNC III- Topsoil
				10-DEC-2011 15:00	10-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00	12-DEC-2011 15:00
				EB1202480-071	EB1202480-072	EB1202480-073	EB1202480-074	EB1202480-075
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.2	7.7	8.3	8.2	8.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	82	360	168	234	169
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	<1.0	4.7	19.8	15.2	21.3
ED021: Bicarbonate Extractable Potassium (Colwell)								
Bicarbonate Extractable K (Colwell)	----	10	mg/kg	<200	640	890	380	460
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.02	<0.01	0.01	0.02
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	80	<20	40
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	----	0.1	mg/kg	0.4	4.9	0.3	1.1	0.3
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	----	0.1	mg/kg	8.3	43.4	10.6	26.3	25.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	8.7	48.3	10.9	27.4	25.4
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	740	3660	1750	2800	2370
EK062: Total Nitrogen as N (TKN + NOx)								
Total Nitrogen as N	----	20	mg/kg	750	3710	1760	2830	2400
EK080: Bicarbonate Extractable Phosphorus (Colwell)								
Bicarbonate Ext. P (Colwell)	----	2	mg/kg	60	32	16	11	19
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.77	3.11	1.93	3.10	2.41



Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	TPNC IV-Topsoil	TPNC V-Topsoil			
				Client sampling date / time	12-DEC-2011 15:00	12-DEC-2011 15:00	----	----	----
				EB1202480-076	EB1202480-077				
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		7.9	8.3	----	----	----
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		111	128	----	----	----
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		28.0	16.8	----	----	----
ED021: Bicarbonate Extractable Potassium (Colwell)									
Bicarbonate Extractable K (Colwell)	----	10	mg/kg		570	310	----	----	----
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		<0.01	<0.01	----	----	----
EK055: Ammonia as N									
Ammonia as N	7664-41-7	20	mg/kg		<20	<20	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N (Sol.)	----	0.1	mg/kg		0.2	<0.1	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N (Sol.)	----	0.1	mg/kg		34.5	4.2	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg		34.7	4.2	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	20	mg/kg		1710	1280	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)									
Total Nitrogen as N	----	20	mg/kg		1740	1280	----	----	----
EK080: Bicarbonate Extractable Phosphorus (Colwell)									
Bicarbonate Ext. P (Colwell)	----	2	mg/kg		11	17	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		1.71	1.38	----	----	----



WorleyParsons

resources & energy

TIMOR GAP, E.P.
TIMOR GÁS & PETRÓLEO



REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE
SECRETARIA DE ESTADO DOS RECURSOS NATURAIS

Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX D

AIR CANISTER CHAIN OF CUSTODY

Source: From ALS Laboratory, please tick →



CLIENT: *WorleyParsons*
OFFICE: *London*
PROJECT: *WorleyParsons*
CANISTER REQUEST NO.: *1509100*
PROJECT MANAGER: *John*
SAMPLER: *WorleyParsons*
COC Emitted to ALS? (YES / NO): *NO*
Serials Reports to (with default to PM if no other addresses are listed): *WorleyParsons*
Email Invoice to (with default to PM if no other addresses are listed): *WorleyParsons*

TURNAROUND REQUIREMENTS:
 Standard TAT (List due date): *18/1/2012*
 Non-Standard or urgent TAT (List due date):
LABORATORY USE ONLY (COCs):
 Suspect Soil Inert? NE Y/N
 Value based on Receipt? NE Y/N
 Contaminated - Damaged and Not Damaged? NE Y/N
 Other comment:

COCS: 1 2 3 4 5 6 7
 RELINQUISHED BY: *[Signature]*
 RECEIVED BY: *[Signature]*
 DATE: *18/1/12*

LAB ID	GAS SAMPLE CONTAINER INFORMATION				CANISTER / SAMPLE DETAILS				CANISTER Gauge Pressures (PSI)				ANALYSIS REQUIRED				Additional Information
	SERIAL NO.	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX (eg Air)	Dispatch	Post Sampling	Receipt	Analysis	Disturb (Calc)	TO-14	TO-15	TO-15X	NOx	Comments on COCs required, particularly relevant to contamination levels or substances requiring particular attention due to service user's specific use.			
			5/1/2012 11:00am	Air -30	-30	0	0			X			X	Comments on COCs required, particularly relevant to contamination levels or substances requiring particular attention due to service user's specific use. X All canisters were inflated over a 20min period.			
			5/1/2012 09:40am	Air -30	-30	0	0			X			X				
			4/1/2012 10:27am	Air -30	-30	0	0			X			X				
			20/1/2012 5:30pm	Air -30	-30	0	0			X			X				

COCS: 1 2 3 4 5 6 7
 RELINQUISHED BY: *[Signature]*
 RECEIVED BY: *[Signature]*
 DATE: *18/1/12*

Environmental Division
Newcastle
Work Order
EN1200380

Job Sample Instructions:
 Telephone : + 61-2-4968 9483

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: EN1200380		
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Newcastle
Contact	: GRANT HICKSON	Contact	: Carsten Emrich
Address	: LEVEL 3/600 MURRAY STREET WEST PERTH WA, AUSTRALIA 6005	Address	: 5 Rosegum Road Warabrook NSW Australia 2304
E-mail	: grant.hickson@worleyparsons.com	E-mail	: carsten.emrich@alsenviro.com
Telephone	: +61 08 9278 8111	Telephone	: +61 7 3243 7123
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: 301012-01504TIMOR LESTE EIA	Page	: 1 of 2
Order number	: 301012-01504-CNT-051211A-MW	Quote number	: EB2012WORPAR0273 (BN/734/11)
C-O-C number	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	: GD/GH		

Dates

Date Samples Received	: 31-JAN-2012	Issue Date	: 31-JAN-2012 16:33
Client Requested Due Date	: 14-FEB-2012	Scheduled Reporting Date	: 09-FEB-2012

Delivery Details

Mode of Delivery	: Carrier	Temperature	: ----
No. of coolers/boxes	: ----	No. of samples received	: 4
Security Seal	: N/A	No. of samples analysed	: 4

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exist.

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EN1200380-002 : 06-JAN-2012 09:49 : 4995 - VIQUEQUE SQUARE

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: AIR

Laboratory sample ID	Client sampling date / time	Client sample ID	AIR - EP101-14 VOCs in Air by USEPA TO14ar	AIR - EP101-14-MV VOCs in Air by USEPA TO14ar (µg/m³)	AIR - GAS-AIR (Subcontracted) Permanent Gases and Hydrocarbons in Air	AIR - MISC-AIR (Subcontracted) Miscellaneous Subcontracting
EN1200380-001	05-JAN-2012 11:59	4994 BETANO CSO	✓	✓	✓	✓
EN1200380-002	06-JAN-2012 09:49	4995 VIQUEQUE SQUARE	✓	✓	✓	✓
EN1200380-003	04-JAN-2012 10:23	4984 SUAI MARKET	✓	✓	✓	✓
EN1200380-004	20-DEC-2011 17:33	4993 BEACO CSH	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: AIR

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method		Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)	Container			Date	Evaluation	Date	Evaluation
EP101-14: Volatile Organic Compounds in Air by USEPA TO14							
4993	Summa Canister	----	19-JAN-2012	31-JAN-2012	✗	----	----
GAS-AIR: Fixed Gases and Hydrocarbons in Air							
4984	Tedlar bag	----	11-JAN-2012	31-JAN-2012	✗	----	----
4993	Tedlar bag	----	27-DEC-2011	31-JAN-2012	✗	----	----
4994	Tedlar bag	----	12-JAN-2012	31-JAN-2012	✗	----	----
4995	Tedlar bag	----	13-JAN-2012	31-JAN-2012	✗	----	----

Requested Deliverables

GRANT HICKSON

- *AU Certificate of Analysis - NATA (COA) Email grant.hickson@worleyparsons.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) Email grant.hickson@worleyparsons.com
- *AU QC Report - DEFAULT (Anon QC Rep) - USEPA (QC-USEPA) Email grant.hickson@worleyparsons.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN) Email grant.hickson@worleyparsons.com
- Attachment - Report (SUBCO) Email grant.hickson@worleyparsons.com
- Chain of Custody (CoC) (COC) Email grant.hickson@worleyparsons.com
- EDI Format - ENMRG (ENMRG) Email grant.hickson@worleyparsons.com
- EDI Format - XTab (XTab) Email grant.hickson@worleyparsons.com

MR ANTHONY FAULKNER

- A4 - AU Tax Invoice (INV) Email anthony.faulkner@worleyparsons.com

CERTIFICATE OF ANALYSIS

Work Order	: EN1200380	Page	: 1 of 6
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Newcastle
Contact	: GRANT HICKSON	Contact	: Carsten Emrich
Address	: LEVEL 3/600 MURRAY STREET WEST PERTH WA, AUSTRALIA 6005	Address	: 5 Rosegum Road Warabrook NSW Australia 2304
E-mail	: grant.hickson@worleyparsons.com	E-mail	: carsten.emrich@alsenviro.com
Telephone	: +61 08 9278 8111	Telephone	: +61 7 3243 7123
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: 301012-01504TIMOR LESTE EIA	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 301012-01504-CNT-051211A-MW	Date Samples Received	: 31-JAN-2012
C-O-C number	: ----	Issue Date	: 06-FEB-2012
Sampler	: GD/GH	No. of samples received	: 4
Site	: ----	No. of samples analysed	: 4
Quote number	: BN/734/11		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Peter Keyte	Newcastle Manager	Newcastle



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **Analysis of Nitrogen Oxides was conducted by DTI Thornton, NATA Accreditation No.2325, Report No T12-00059/0001-0004 dated 03-Feb-2012.**
- **EP101: Results reported in $\mu\text{g}/\text{m}^3$ are calculated from PPBV results based on a temperature of 25°C and atmospheric pressure of 101.3 kPa. $\mu\text{g}/\text{m}^3$ results should be corrected to account for actual conditions during sampling.**
- **EP101: Sample canisters were received at sub-ambient pressures and may have required dilution in the laboratory prior to analysis. Where applicable, LOR values have been adjusted accordingly.**
- **Samples were received outside of recommended ALS holding times for TO14 and gas analysis. Results should be scrutinised accordingly.**
- **Sulfur Dioxide analysis will be reported separately.**



Analytical Results

Sub-Matrix: AIR				Client sample ID				
				4994	4995	4984	4993	----
				BETANO CSO	VIQUEQUE SQUARE	SUAI MARKET	BEACO CSH	----
Client sampling date / time				05-JAN-2012 11:59	06-JAN-2012 09:49	04-JAN-2012 10:23	20-DEC-2011 17:33	----
Compound	CAS Number	LOR	Unit	EN1200380-001	EN1200380-002	EN1200380-003	EN1200380-004	----
EP101: VOCs by USEPA Method TO14 (Calculated Concentration)								
^ Freon 12	75-71-8	2	µg/m³	4	4	4	4	----
^ Freon 114	76-14-2	4	µg/m³	<4	<4	<4	<4	----
^ Vinyl chloride	75-01-4	1	µg/m³	<1	<1	<1	<1	----
^ Bromomethane	74-83-9	2	µg/m³	<2	<2	<2	<2	----
^ Chloroethane	75-00-3	1	µg/m³	<1	<1	<1	<1	----
^ Freon 11	75-69-4	3	µg/m³	<3	<3	<3	<3	----
^ 1.1-Dichloroethene	75-35-4	2	µg/m³	<2	<2	<2	<2	----
^ Dichloromethane	75-09-2	2	µg/m³	<2	<2	<2	<2	----
^ Freon 113	76-13-1	4	µg/m³	<4	<4	<4	<4	----
^ 1.1-Dichloroethane	75-34-3	2	µg/m³	<2	<2	<2	<2	----
^ cis-1.2-Dichloroethene	156-59-2	2	µg/m³	<2	<2	<2	<2	----
^ Chloroform	67-66-3	2	µg/m³	<2	<2	<2	<2	----
^ 1.2-Dichloroethane	107-06-2	2	µg/m³	<2	<2	<2	<2	----
^ 1.1.1-Trichloroethane	71-55-6	3	µg/m³	<3	<3	<3	<3	----
^ Benzene	71-43-2	2	µg/m³	<2	5	3	<2	----
^ Carbon Tetrachloride	56-23-5	3	µg/m³	<3	<3	<3	<3	----
^ 1.2-Dichloropropane	78-87-5	2	µg/m³	<2	<2	<2	<2	----
^ Trichloroethene	79-01-6	3	µg/m³	<3	<3	<3	<3	----
^ cis-1.3-Dichloropropylene	10061-01-5	2	µg/m³	<2	<2	<2	<2	----
^ trans-1.3-Dichloropropene	10061-02-6	2	µg/m³	<2	<2	<2	<2	----
^ 1.1.2-Trichloroethane	79-00-5	3	µg/m³	<3	<3	<3	<3	----
^ Toluene	108-88-3	2	µg/m³	<2	13	7	2	----
^ 1.2-Dibromoethane (EDB)	106-93-4	4	µg/m³	<4	<4	<4	<4	----
^ Tetrachloroethene	127-18-4	3	µg/m³	<3	<3	<3	<3	----
^ Chlorobenzene	108-90-7	2	µg/m³	<2	<2	<2	<2	----
^ Ethylbenzene	100-41-4	2	µg/m³	<2	<2	<2	<2	----
^ meta- & para-Xylene	108-38-3 106-42-3	4	µg/m³	<4	6	<4	<4	----
^ Styrene	100-42-5	2	µg/m³	<2	<2	<2	<2	----
^ 1.1.2.2-Tetrachloroethane	79-34-5	3	µg/m³	<3	<3	<3	<3	----
^ o-Xylene	95-47-6	2	µg/m³	<2	<2	<2	<2	----
^ Total Xylenes	1330-20-7	6	µg/m³	<6	8	<6	<6	----
^ 1.3.5-Trimethylbenzene	108-67-8	2	µg/m³	<2	<2	<2	<2	----
^ 1.2.4-Trimethylbenzene	95-63-6	2	µg/m³	<2	<2	<2	<2	----
^ 1.3-Dichlorobenzene	541-73-1	3	µg/m³	<3	<3	<3	<3	----
^ 1.4-Dichlorobenzene	106-46-7	3	µg/m³	<3	<3	<3	<3	----



Analytical Results

Sub-Matrix: AIR

Client sample ID

Client sampling date / time

				4994	4995	4984	4993	----
				BETANO CSO	VIQUEQUE SQUARE	SUAI MARKET	BEACO CSH	----
				05-JAN-2012 11:59	06-JAN-2012 09:49	04-JAN-2012 10:23	20-DEC-2011 17:33	----
Compound	CAS Number	LOR	Unit	EN1200380-001	EN1200380-002	EN1200380-003	EN1200380-004	----
EP101: VOCs by USEPA Method TO14 (Calculated Concentration) - Continued								
^ 1,2-Dichlorobenzene	95-50-1	3	µg/m³	<3	<3	<3	<3	----
^ 1,2,4-Trichlorobenzene	120-82-1	4	µg/m³	<4	<4	<4	<4	----
^ Hexachlorobutadiene	87-68-3	5	µg/m³	<5	<5	<5	8	----
Subcontracted Analysis								
Nitrogen Dioxide	10102-44-0	0.0001	%	<0.0001	<0.0001	<0.0001	<0.0001	----
Nitric Oxide	----	0.0001	%	<0.0001	<0.0001	<0.0001	<0.0001	----
USEPA Air Toxics Method TO14ar								
Freon 12	75-71-8	0.5	ppbv	0.8	0.8	0.9	0.9	----
Freon 114	76-14-2	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Vinyl chloride	75-01-4	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Bromomethane	74-83-9	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Chloroethane	75-00-3	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Freon 11	75-69-4	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1,1-Dichloroethene	75-35-4	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Dichloromethane	75-09-2	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Freon 113	76-13-1	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1,1-Dichloroethane	75-34-3	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
cis-1,2-Dichloroethene	156-59-2	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Chloroform	67-66-3	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1,2-Dichloroethane	107-06-2	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1,1,1-Trichloroethane	71-55-6	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Benzene	71-43-2	0.5	ppbv	<0.5	1.7	1.0	<0.5	----
Carbon Tetrachloride	56-23-5	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1,2-Dichloropropane	78-87-5	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Trichloroethene	79-01-6	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
cis-1,3-Dichloropropylene	10061-01-5	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
trans-1,3-Dichloropropene	10061-02-6	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1,1,2-Trichloroethane	79-00-5	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Toluene	108-88-3	0.5	ppbv	<0.5	3.4	1.8	0.6	----
1,2-Dibromoethane (EDB)	106-93-4	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Tetrachloroethene	127-18-4	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Chlorobenzene	108-90-7	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	1.0	ppbv	<1.0	1.3	<1.0	<1.0	----
Styrene	100-42-5	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----



Analytical Results

Sub-Matrix: AIR

Client sample ID

Client sampling date / time

				4994	4995	4984	4993	----
				BETANO CSO	VIQUEQUE SQUARE	SUAI MARKET	BEACO CSH	----
				05-JAN-2012 11:59	06-JAN-2012 09:49	04-JAN-2012 10:23	20-DEC-2011 17:33	----
Compound	CAS Number	LOR	Unit	EN1200380-001	EN1200380-002	EN1200380-003	EN1200380-004	----
USEPA Air Toxics Method TO14ar - Continued								
1.1.2.2-Tetrachloroethane	79-34-5	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	ppbv	<0.5	0.5	<0.5	<0.5	----
4-Ethyltoluene	----	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1.3.5-Trimethylbenzene	108-67-8	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1.2.4-Trimethylbenzene	95-63-6	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1.3-Dichlorobenzene	541-73-1	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1.4-Dichlorobenzene	106-46-7	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1.2-Dichlorobenzene	95-50-1	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
1.2.4-Trichlorobenzene	120-82-1	0.5	ppbv	<0.5	<0.5	<0.5	<0.5	----
Hexachlorobutadiene	87-68-3	0.5	ppbv	<0.5	<0.5	<0.5	0.8	----
USEPA Air Toxics Method TO14ar								
4-Bromofluorobenzene	460-00-4	0.1	%	83.7	87.8	87.0	86.1	----



Surrogate Control Limits

Sub-Matrix: AIR		Recovery Limits (%)	
Compound	CAS Number	Low	High
USEPA Air Toxics Method TO14a			
4-Bromofluorobenzene	460-00-4	60	140

QUALITY CONTROL REPORT

Work Order	: EN1200380	Page	: 1 of 7
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Newcastle
Contact	: GRANT HICKSON	Contact	: Carsten Emrich
Address	: LEVEL 3/600 MURRAY STREET WEST PERTH WA, AUSTRALIA 6005	Address	: 5 Rosegum Road Warabrook NSW Australia 2304
E-mail	: grant.hickson@worleyparsons.com	E-mail	: carsten.emrich@alsenviro.com
Telephone	: +61 08 9278 8111	Telephone	: +61 7 3243 7123
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: 301012-01504TIMOR LESTE EIA	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 31-JAN-2012
Sampler	: GD/GH	Issue Date	: 06-FEB-2012
Order number	: 301012-01504-CNT-051211A-MW		
Quote number	: BN/734/11	No. of samples received	: 4
		No. of samples analysed	: 4

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

WORLD RECOGNISED
ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Peter Keyte	Newcastle Manager	Newcastle



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: AIR

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
USEPA Air Toxics Method TO14ar (QC Lot: 2151284)									
EN1200380-001	4994 BETANO CSO	EP101-14: Freon 12	75-71-8	0.5	ppbv	0.8	0.8	0.0	No Limit
		EP101-14: Freon 114	76-14-2	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Vinyl chloride	75-01-4	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Bromomethane	74-83-9	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Chloroethane	75-00-3	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Freon 11	75-69-4	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.1-Dichloroethene	75-35-4	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Dichloromethane	75-09-2	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Freon 113	76-13-1	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.1-Dichloroethane	75-34-3	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: cis-1.2-Dichloroethene	156-59-2	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Chloroform	67-66-3	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.2-Dichloroethane	107-06-2	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.1.1-Trichloroethane	71-55-6	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Benzene	71-43-2	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Carbon Tetrachloride	56-23-5	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.2-Dichloropropane	78-87-5	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Trichloroethene	79-01-6	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: cis-1.3-Dichloropropylene	10061-01-5	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: trans-1.3-Dichloropropene	10061-02-6	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.1.2-Trichloroethane	79-00-5	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Toluene	108-88-3	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.2-Dibromoethane (EDB)	106-93-4	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Tetrachloroethene	127-18-4	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Chlorobenzene	108-90-7	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Ethylbenzene	100-41-4	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Styrene	100-42-5	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.1.2.2-Tetrachloroethane	79-34-5	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: ortho-Xylene	95-47-6	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.3.5-Trimethylbenzene	108-67-8	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.2.4-Trimethylbenzene	95-63-6	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.3-Dichlorobenzene	541-73-1	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.4-Dichlorobenzene	106-46-7	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.2-Dichlorobenzene	95-50-1	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: 1.2.4-Trichlorobenzene	120-82-1	0.5	ppbv	<0.5	<0.5	0.0	No Limit
		EP101-14: Hexachlorobutadiene	87-68-3	0.5	ppbv	<0.5	<0.5	0.0	No Limit

Page : 4 of 7
 Work Order : EN1200380
 Client : WORLEY PARSONS - INFRASTRUCTURE MWE
 Project : 301012-01504TIMOR LESTE EIA



Sub-Matrix: **AIR**

Laboratory Duplicate (DUP) Report

<i>Laboratory sample ID</i>	<i>Client sample ID</i>	<i>Method: Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<i>Original Result</i>	<i>Duplicate Result</i>	<i>RPD (%)</i>	<i>Recovery Limits (%)</i>
USEPA Air Toxics Method TO14ar (QC Lot: 2151284) - continued									
EN1200380-001	4994 BETANO CSO	EP101-14: meta- & para-Xylene	108-38-3 106-42-3	1.0	ppbv	<1.0	<1.0	0.0	No Limit



Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control terms Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (DCS) refers to certified reference materials, or known interference free matrices spiked with target analytes. The purpose of these QC parameters are to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS and DCS.

Sub-Matrix: AIR

Method: Compound	CAS Number	Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report							
		LOR	Unit	Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)		
						LCS	DCS	Low	High	Value	Control Limit	
USEPA Air Toxics Method TO14ar (QCLot: 2151284)												
EP101-14: Freon 12	75-71-8	0.5	ppbv	<0.5	10 ppbv	108	106	70	130	1.0	25	
EP101-14: Freon 114	76-14-2	0.5	ppbv	<0.5	10 ppbv	104	105	70	130	0.7	25	
EP101-14: Vinyl chloride	75-01-4	0.5	ppbv	<0.5	10 ppbv	102	104	70	130	2.2	25	
EP101-14: Bromomethane	74-83-9	0.5	ppbv	<0.5	10 ppbv	101	103	70	130	2.0	25	
EP101-14: Chloroethane	75-00-3	0.5	ppbv	<0.5	10 ppbv	100	105	70	130	4.6	25	
EP101-14: Freon 11	75-69-4	0.5	ppbv	<0.5	10 ppbv	109	106	70	130	3.1	25	
EP101-14: 1,1-Dichloroethene	75-35-4	0.5	ppbv	<0.5	10 ppbv	106	106	70	130	0.1	25	
EP101-14: Dichloromethane	75-09-2	0.5	ppbv	<0.5	10 ppbv	106	104	70	130	1.5	25	
EP101-14: Freon 113	76-13-1	0.5	ppbv	<0.5	10 ppbv	105	104	70	130	0.8	25	
EP101-14: 1,1-Dichloroethane	75-34-3	0.5	ppbv	<0.5	10 ppbv	106	108	70	130	1.9	25	
EP101-14: cis-1,2-Dichloroethene	156-59-2	0.5	ppbv	<0.5	10 ppbv	103	89.2	70	130	14.6	25	
EP101-14: Chloroform	67-66-3	0.5	ppbv	<0.5	10 ppbv	108	105	70	130	3.1	25	
EP101-14: 1,2-Dichloroethane	107-06-2	0.5	ppbv	<0.5	10 ppbv	113	107	70	130	5.0	25	
EP101-14: 1,1,1-Trichloroethane	71-55-6	0.5	ppbv	<0.5	10 ppbv	109	106	70	130	2.6	25	
EP101-14: Benzene	71-43-2	0.5	ppbv	<0.5	10 ppbv	99.5	101	70	130	1.7	25	
EP101-14: Carbon Tetrachloride	56-23-5	0.5	ppbv	<0.5	10 ppbv	110	107	70	130	3.4	25	
EP101-14: 1,2-Dichloropropane	78-87-5	0.5	ppbv	<0.5	10 ppbv	104	103	70	130	1.4	25	
EP101-14: Trichloroethene	79-01-6	0.5	ppbv	<0.5	10 ppbv	91.5	101	70	130	10.2	25	
EP101-14: cis-1,3-Dichloropropylene	10061-01-5	0.5	ppbv	<0.5	10 ppbv	106	105	70	130	1.3	25	
EP101-14: trans-1,3-Dichloropropene	10061-02-6	0.5	ppbv	<0.5	10 ppbv	88.9	87.9	70	130	1.2	25	
EP101-14: 1,1,2-Trichloroethane	79-00-5	0.5	ppbv	<0.5	10 ppbv	105	102	70	130	3.5	25	
EP101-14: Toluene	108-88-3	0.5	ppbv	<0.5	10 ppbv	94.5	105	70	130	10.8	25	
EP101-14: 1,2-Dibromoethane (EDB)	106-93-4	0.5	ppbv	<0.5	10 ppbv	109	107	70	130	2.1	25	
EP101-14: Tetrachloroethene	127-18-4	0.5	ppbv	<0.5	10 ppbv	105	103	70	130	2.4	25	
EP101-14: Chlorobenzene	108-90-7	0.5	ppbv	<0.5	10 ppbv	99.5	98.0	70	130	1.6	25	
EP101-14: Ethylbenzene	100-41-4	0.5	ppbv	<0.5	10 ppbv	101	99.1	70	130	1.7	25	
EP101-14: meta- & para-Xylene	108-38-3 106-42-3	1	ppbv	<1.0	20 ppbv	103	101	70	130	1.6	25	
EP101-14: Styrene	100-42-5	0.5	ppbv	<0.5	10 ppbv	88.2	86.8	70	130	1.6	25	
EP101-14: 1,1,2,2-Tetrachloroethane	79-34-5	0.5	ppbv	<0.5	10 ppbv	103	100	70	130	2.3	25	
EP101-14: ortho-Xylene	95-47-6	0.5	ppbv	<0.5	10 ppbv	101	99.2	70	130	1.8	25	
EP101-14: 1,3,5-Trimethylbenzene	108-67-8	0.5	ppbv	<0.5	10 ppbv	102	97.1	70	130	4.8	25	
EP101-14: 1,2,4-Trimethylbenzene	95-63-6	0.5	ppbv	<0.5	10 ppbv	101	98.6	70	130	2.3	25	
EP101-14: 1,3-Dichlorobenzene	541-73-1	0.5	ppbv	<0.5	10 ppbv	100	96.9	70	130	3.4	25	
EP101-14: 1,4-Dichlorobenzene	106-46-7	0.5	ppbv	<0.5	10 ppbv	98.4	98.7	70	130	0.4	25	



Sub-Matrix: AIR		Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report							
		LOR	Unit	Result	Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)		
Concentration	LCS				DCS	Low	High	Value	Control Limit			
<i>Method: Compound</i>	<i>CAS Number</i>											
USEPA Air Toxics Method TO14ar (QCLot: 2151284) - continued												
EP101-14: 1,2-Dichlorobenzene	95-50-1	0.5	ppbv	<0.5	10 ppbv	104	99.5	70	130	4.6	25	
EP101-14: 1,2,4-Trichlorobenzene	120-82-1	0.5	ppbv	<0.5	10 ppbv	95.1	94.6	70	130	0.6	25	
EP101-14: Hexachlorobutadiene	87-68-3	0.5	ppbv	<0.5	10 ppbv	104	96.0	70	130	8.4	25	



Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**
-

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: EN1200380	Page	: 1 of 5
Client	: WORLEY PARSONS - INFRASTRUCTURE MWE	Laboratory	: Environmental Division Newcastle
Contact	: GRANT HICKSON	Contact	: Carsten Emrich
Address	: LEVEL 3/600 MURRAY STREET WEST PERTH WA, AUSTRALIA 6005	Address	: 5 Rosegum Road Warabrook NSW Australia 2304
E-mail	: grant.hickson@worleyparsons.com	E-mail	: carsten.emrich@alsenviro.com
Telephone	: +61 08 9278 8111	Telephone	: +61 7 3243 7123
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: 301012-01504TIMOR LESTE EIA	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 31-JAN-2012
C-O-C number	: ----	Issue Date	: 06-FEB-2012
Sampler	: GD/GH	No. of samples received	: 4
Order number	: 301012-01504-CNT-051211A-MW	No. of samples analysed	: 4
Quote number	: BN/734/11		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers



Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: AIR

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
USEPA Air Toxics Method TO14ar							
Summa Canister (EP101-14) 4984 - SUAI MARKET	04-JAN-2012	----	----	----	02-FEB-2012	03-FEB-2012	✓
Summa Canister (EP101-14) 4994 - BETANO CSO	05-JAN-2012	----	----	----	02-FEB-2012	04-FEB-2012	✓
Summa Canister (EP101-14) 4995 - VIQUEQUE SQUARE	06-JAN-2012	----	----	----	02-FEB-2012	05-FEB-2012	✓
Summa Canister (EP101-14) 4993 - BEACO CSH	20-DEC-2011	----	----	----	02-FEB-2012	19-JAN-2012	*
Subcontracted Analysis							
Tedlar bag (GAS-AIR) 4984 - SUAI MARKET	04-JAN-2012	----	----	----	02-FEB-2012	11-JAN-2012	*
Tedlar bag (GAS-AIR) 4994 - BETANO CSO	05-JAN-2012	----	----	----	02-FEB-2012	12-JAN-2012	*
Tedlar bag (GAS-AIR) 4995 - VIQUEQUE SQUARE	06-JAN-2012	----	----	----	02-FEB-2012	13-JAN-2012	*
Tedlar bag (GAS-AIR) 4993 - BEACO CSH	20-DEC-2011	----	----	----	02-FEB-2012	27-DEC-2011	*



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(when) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **AIR**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type	Analytical Methods	Method	Count		Rate (%)			Quality Control Specification
			QC	Regular	Actual	Expected	Evaluation	
Duplicate Control Samples (DCS)								
Volatile Organic Compounds in Air by USEPA TO14		EP101-14	1	4	25.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Duplicates (DUP)								
Volatile Organic Compounds in Air by USEPA TO14		EP101-14	1	4	25.0	10.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)								
Volatile Organic Compounds in Air by USEPA TO14		EP101-14	1	4	25.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)								
Volatile Organic Compounds in Air by USEPA TO14		EP101-14	1	4	25.0	5.0	✔	NEPM 1999 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Canister Sampling - Field Data	CAN-001	AIR	USEPA TO14 / TO15
Volatile Organic Compounds in Air by USEPA TO14	EP101-14	AIR	USEPA TO14ar
VOCs in Air by USEPA TO14 (mass/volume)	EP101-14-MV	AIR	USEPA TO14ar Volatile Organic Compounds in Air by USEPA TO14 (Calculated Concentration)
Fixed Gases and Hydrocarbons in Air	GAS-AIR	AIR	Based on USEPA Method 3 GC-TCD CO ₂ , CH ₄ , CO by NDIR, O ₂ by paramagnetic gas analysis, H ₂ , Hydrocarbons by GC-FID Heat of Combustion by calculation
Miscellaneous subcontracting	MISC-AIR	AIR	Miscellaneous subcontracting



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.
- For all matrices, no Matrix Spike outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: AIR

Method Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
Subcontracted Analysis						
Tedlar bag 4984 - SUAI MARKET	----	----	----	02-FEB-2012	11-JAN-2012	22
Tedlar bag 4994 - BETANO CSO	----	----	----	02-FEB-2012	12-JAN-2012	21
Tedlar bag 4995 - VIQUEQUE SQUARE	----	----	----	02-FEB-2012	13-JAN-2012	20
Tedlar bag 4993 - BEACO CSH	----	----	----	02-FEB-2012	27-DEC-2011	37
USEPA Air Toxics Method TO14a						
Summa Canister 4993 - BEACO CSH	----	----	----	02-FEB-2012	19-JAN-2012	14

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- No Quality Control Sample Frequency Outliers exist.



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REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE
SECRETARIA DE ESTADO DOS RECURSOS NATURAIS

Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX E



TSI Dusttrak - Model 8520

Calibration Certificate

Report Number: DT106313

Page 1 of 2

Customer	Thermo Fisher Scientific
Address	121 Beringarra Avenue
	Malaga WA 6090
Contact	Ian Skutt
Equipment	TSI Dusttrak
Model	8520
Serial Number	85201175
Calibration Date	19/08/2011
Condition as Received	As Left

Reference Instruments


Measurement Variable	Model No.	Serial No.	Calibration Date
Photometer	8587A	71002264	24/07/2011
DC Voltage (Keithley)	2700	1260416	27/07/2011
Pressure	276140-SP	4146296	20/07/2011
Flow and Temperature	4140	41400951036	26/04/2011
Microbalance	DV215DC	1124010888	13/04/2011
1 um PSL		36795	Not Applicable
2.8 um PSL		580457	Not Applicable
10 um PSL		612530	Not Applicable

ENVIRONMENTAL CONDITIONS

Ambient Temp	21°C
Humidity	42%RH
Barometric Pressure	998hPa

Kenelec Scientific Pty Ltd Certifies That :-

All performance and acceptance tests required were successfully conducted according to required specifications. All test and calibration data supplied by Kenelec Scientific has been obtained using emery oil and has been nominally adjusted to respirable mass standard ISO 12103-1 AI Test Dust (Arizona Dust)

Procedures Followed:	LABP1
Approved Signatory:	
Date:	19-8-2011

KENELEC SCIENTIFIC PTY LTD
ABN 88 064 373 717

23 Redland Drive
Mitcham Vic 3132

T 03 9873 1022
F 03 9873 0200

info@kenelec.com.au www.kenelec.com.au

This Calibration Certificate shall not be reproduced except in full, without the written approval of Kenelec Scientific Pty Ltd





TSI Dusttrak - Model 8520 Calibration Certificate

Report Number: DT106313

CALIBRATION RESULTS			
As Found Verification Data			
Testing Number	Calibration Reference mg/m3	Instrument Output	Allowable Range +/-10%
1	0.101	0.114	0.091 0.111
2	0.690	0.860	0.621 0.759
3	4.244	5.065	3.820 4.668
4	24.885	30.047	22.397 27.374

CALIBRATION RESULTS			
Calibration Verification Data			
Testing Number	Calibration Reference mg/m3	Instrument Output	Allowable Range +/-10%
1	0.093	0.086	0.084 0.102
2	0.606	0.633	0.545 0.667
3	3.699	3.685	3.329 4.069
4	21.681	21.78	19.513 23.849



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SECRETARIA DE ESTADO DOS RECURSOS NATURAIS

Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX F



Appendix F Key Informant Questionnaire

General information

1. Date & Time
2. Location / Settlement Name
3. Name of Interviewee
4. Affiliation and Position in Community (if not Chefe de Suco)
5. Details of any bystanders during key informant interview (e.g. the settlement's 'village council' or 'elders')

Population, demographics, influx

6. Estimated number of people in this settlement?
7. Has the settlement grown in the last 2 years and last 2 months? Why? Is growth perceived a positive or negative change? Why?
8. Is there regular movement of people in and out of the area or do people live in one area for many years? If the case, why do people leave the area?
9. Approximate number of people per household/family?
10. If you have to divide the population into three categories, what percentage is children (0-15), working class (16-64), and older (65-older)? (*Rough estimation*) Compared to other villages, are this settlement noticeably different e.g. more children or old people, why?
11. Is there a noticeable difference between the number of men and women in the village? Compared to other villages, are this settlement noticeably different e.g. more women or more men, why?
12. How does landownership and tenure work in the settlement?
13. How do new-comers apply for land in the settlement?
14. Which ethnic groups are found in the settlement? (*Rough indication of dominant groups and minority groups*)
15. Which language groups are found in the settlement? (*Rough indication of mostly spoken to least spoken*)



Social organisation

16. Briefly explain the settlement structure (social organisation), i.e. the relationship between government and traditional structures, and the connection between local, regional and national level governance.
17. Are there community based organisations in the settlement e.g. women's groups, youth groups, farming committees, fishing committees, etc?
18. Are there any NGOs active in the community? Who are they and how are they involved?
19. Are there many vulnerable people in the settlement (*elderly, disabled, orphans, etc.*)?

Services and infrastructure

20. Do households have to pay for government services? (*Indicate which*)
21. Do government provide any assistance to households who cannot afford to pay for these services?
22. Are there any other services provided by government?

Education

23. What are the key challenges as far as education services are concerned?

Health

24. What are the key challenges as far as health services are concerned?

Heritage

25. Are there any important burial sites and sacred sites? (*Obtain GPS point if permitted, otherwise find out in which direction the site is located and distance from settlement*)
26. Are there places of ancestral value (*fountains, rivers, creeks, hills, stones, places of worship*)? (*Obtain GPS points*)

Social Issues and Crime

27. Is crime a problem in the area? What are the main types of crimes (*e.g. serious theft, petty theft, murder, domestic violence*)?
28. How is crime controlled / managed in the area? (*e.g. government or traditional structures*)

Perceptions about the project

Methods of engagement



29. Have you been informed and consulted about this project? By whom, how often, method of communication?
30. Have the wider community also been informed?
31. Are you pleased with the way in which project information has been shared previously?
32. If not, what would be the best way to share information about the project going forward? *(E.g. if / when other companies or organisations have interacted with your community, what are the things that you liked about their approach?)*

Awareness and perceptions about the project

33. What words or things come to mind when you think about this project?
34. Do you have any particular concerns about the project? Please explain.
35. What is your (and your settlement's) expectations from the project?
36. What do you foresee will be the positive impacts of the project? *(Can probe if no response: employment, business opportunities e.g. selling food to newcomers, improved infrastructure and accessibility, etc.)*
37. What do you foresee will be the negative impacts of the project? *(Can probe if no response: Loss of land / fields / dwelling structures, newcomers moving into the area resulting in pressure on infrastructure, change in culture, disrespect to sacred sites (e.g. harm to crocodiles), etc.)*
38. As a whole, do you think this project will make people's lives better or worse? Why do you feel that way?



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Tasi Mane Project – Suai Supply Base Environmental Impact Assessment

APPENDIX G



Appendix G Focus Group Meeting Questionnaires

(Questions in red were additional question covered during the focus group meetings)

General information

1. Date & Time
2. Location / Settlement Name
3. Name of Interviewee
4. Affiliation and Position in Community (if not Chefe de Suco)
5. Details of any bystanders during key informant interview (e.g. the settlement's 'village council' or 'elders')

Population, demographics, influx

6. Estimated number of people in this settlement?
7. Has the settlement grown in the last 2 years and last 2 months? Why? Is growth perceived a positive or negative change? Why?
8. Is there regular movement of people in and out of the area or do people live in one area for many years? If the case, why do people leave the area?
9. Approximate number of people per household/family?
10. If you have to divide the population into three categories, what percentage is children (0-15), working class (16-64), and older (65-older)? (*Rough estimation*) Compared to other villages, are this settlement noticeably different e.g. more children or old people, why?
11. Is there a noticeable difference between the number of men and women in the village? Compared to other villages, are this settlement noticeably different e.g. more women or more men, why?
12. How does landownership and tenure work in the settlement?
13. How do new-comers apply for land in the settlement?
14. Which ethnic groups are found in the settlement? (*Rough indication of dominant groups and minority groups*)
15. Which language groups are found in the settlement? (*Rough indication of mostly spoken to least spoken*)



Social organisation

16. Briefly explain the settlement structure (social organisation), i.e. the relationship between government and traditional structures, and the connection between local, regional and national level governance.
17. Are there community based organisations in the settlement e.g. women's groups, youth groups, farming committees, fishing committees, etc?
18. Are there any NGOs active in the community? Who are they and how are they involved?
19. Are there many vulnerable people in the settlement (*elderly, disabled, orphans, etc.*)?

Communication, language and travel

20. How do people communicate with one another in the area? (e.g. radio, cell phones, word of mouth)
21. How do people travel between settlements e.g. Dili and between the respective project sites?

Economic activities

22. What are the main forms of livelihood in the settlement? Farming, livestock, fishing, small businesses?
23. Are some people employed? If so, in which sectors, by which companies, and where are these employees located?
24. What are the main sources of cash income in the settlement?

Agricultural activities

25. What are the most common types of crops people farm with?
26. Is farming the main source of food?
27. Do all families farm?
28. Are fields typically located close to the settlement or scattered over a wider area? How far do people travel to reach their fields?
29. What types of livestock are generally found in the settlement?
30. Are the livestock only for subsistence purposes or sold?
31. Do they graze freely or in designated areas close to the settlement?



Natural resources

- 32. Where do people get water?
- 33. Is the water clean and safe for drinking?
- 34. Do people use natural vegetation to produce medicine?
- 35. What are the main sources of energy (wood, gas, paraffin, petrol, electricity)?
- 36. Is there an abundance of natural resources to meet the people's demand or is there a scarcity? (E.g. land with good farming potential, firewood, medicinal plants, thatching grass)
- 37. Do people fish at specific locations or at scattered fishing spots all along the coast line?

Services and infrastructure

38. What community infrastructure do you have in the settlement? E.g.

Type of infrastructure	Number of facilities in settlement	Number of facilities in other nearby locations	Name of nearest location in other nearby locations	Provided by Government, Church or NGO
Primary schools				
Secondary schools				
Hospital				
Clinic				
Police station				
Churches				
Shops				
Recreation				
Market				
Waste dump				
Other				

- 39. Is there any waste disposal system in the settlement, e.g. communal waste dumps?
- 40. What sanitation system does people use, e.g. pit latrines, flushing toilets?
- 41. Do households have to pay for government services? (*Indicate which*)
- 42. Do government provide any assistance to households who cannot afford to pay for these services?
- 43. Are there any other services provided by government?
- 44. What types of housing do people have? (*Get description of general types e.g. mud with thatch, brick with corrugated iron etc.*)



45. Who is responsible for constructing and maintaining roads?

Education

46. Do most children go to school? If no, why?

47. What is the general level of education attained (primary or secondary level)?

48. What are the key challenges as far as education services are concerned?

Health

49. What are the most common diseases in the settlement?

50. Has the levels of health increased or decreased in the last 2 years?

51. Do people consult traditional or modern medical practitioners or both?

52. What are the key challenges as far as health services are concerned?

Heritage

53. Are there any important burial sites and sacred sites? (*Obtain GPS point if permitted, otherwise find out in which direction the site is located and distance from settlement*)

54. Are people buried in the settlement or in remote areas? (*Are graves confined to cemeteries or do you find scattered grave sites?*)

55. Are there places of ancestral value (*fountains, rivers, creeks, hills, stones, places of worship*)? (*Obtain GPS points*)

Social Issues and Crime

56. Is crime a problem in the area? What are the main types of crimes (*e.g. serious theft, petty theft, murder, domestic violence*)?

57. How is crime controlled / managed in the area? (*e.g. government or traditional structures*)

58. Are there problems with drugs and alcohol abuse in the settlement?

59. Is the police / military involved in managing crime? (*Are they helpful? Do they use violence and or intimidation?*)

60. Is there prostitution in the area?



Perceptions about the project

Methods of engagement

61. Have you been informed and consulted about this project? By whom, how often, method of communication?
62. Have the wider community also been informed?
63. Are you pleased with the way in which project information has been shared previously?
64. If not, what would be the best way to share information about the project going forward? (*E.g. if / when other companies or organisations have interacted with your community, what are the things that you liked about their approach?*)

Awareness and perceptions about the project

65. What words or things come to mind when you think about this project?
66. Do you have any particular concerns about the project? Please explain.
67. What is your (and your settlement's) expectations from the project?
68. What do you foresee will be the positive impacts of the project? (*Can probe if no response: employment, business opportunities e.g. selling food to newcomers, improved infrastructure and accessibility, etc.*)
69. What do you foresee will be the negative impacts of the project? (*Can probe if no response: Loss of land / fields / dwelling structures, newcomers moving into the area resulting in pressure on infrastructure, change in culture, disrespect to sacred sites (e.g. harm to crocodiles), etc.*)
70. As a whole, do you think this project will make people's lives better or worse? Why do you feel that way?

