Environmental Performance Report and Management Plan

DIDIPIO GOLD-COPPER PROJECT

INCREASE IN ANNUAL PLANT THROUGHPUT RATE

(3.5 Mtpa to 4.3 Mtpa)

OCEANAGOLD (PHILIPPINES), INC. (OGPI)

February 2019 – For 2nd Review

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ES.1.1 SUMMARY OF PROJECT DESCRIPTION

Project Name:	**Didipio Gold-Copper Project** **Increase in Annual Plant Throughput Rate (3.5 Mtpa to 4.3 Mtpa)**	
ECC Ref. No.	ECC-CO-1112-0022	
Project Type:	Mining Project	
Project Location:	Didipio Valley, Barangay Didipio, Municipality of Kasibu, Nueva Vizcaya	
Total Project Area:	975 hectares Partial Declaration of Mining Project Feasibility (DMPF) area within its Financial and Technical Assistance Agreement (FTAA) 001	
PROPOSED MODIFICATION	**ECC Coverage**	**Proposed Modification**
Plant throughput rate:	3.5 Million tonnes per annum (Mtpa)	**4.3 Million tonnes per annum**

ES.1.2 PROFILE OF THE PROPONENT

Name of Proponent:	**OceanaGold (Philippines), Inc. (OGPI)**
Office Address:	2nd Floor, Carlos J. Valdes Bldg., 108 Aguirre St. Legaspi Village, 1229 Makati City
Authorized Representative:	Jose P. Leviste, Jr. Chairman, OGPI Mr. David Way General Manager
Tel. No./Fax No.:	T (02) 779 6600; F (02) 892 8399

ES.1.3 PROFILE OF THE PREPARER

EIA Preparer:	**RHR Consult Services, Inc.**
Office Address:	9999-A Mt. Pulog St., Umali Subd., Los Banos, Laguna
Contact Persons:	Ryan Filiberto P. Botengan Managing Director Jess M. Addawe Project Manager Henry James P. Botengan Co-Project Manager
Tel. No.:	T (02) 411 5763

ES.1.4 Current Status of Project Implementation (Key Project Components listed in the ECC)

Project Component / Aspect	Current Status
Total Project Footprint	391 hectares Within the approved 975-hectare project area (Partial DMPF area) as of 2nd quarter of 2018
Open Pit	Approximately 53.14 hectares Length: 850 m NS Width: 800 m EW Final Pit Floor: 460 masl (RL 2460)
Underground Mine	Under development (started 1st quarter of 2015). Development as of January 2019 is for panel 2 (2250RL and Below), whilst production stoping is being conducted for Panel 1 (2280RL and above). Stope design: Long Hole Open Stope (LHOS)
Processing Plant	Operational Plant throughput: 3.5 Mtpa (proposed to be increased to 4.3 Mtpa) Area: 11.61 ha (approximate)
Paste Plant	For commissioning and operation Rated capacity: 150 m3/hr Area: 2 ha (approximate)
Tailings Storage Facility	Operational and ongoing development Capacity: 50.74 Mt Maximum embankment height: 100 m (RL 2820) Area: 65 ha (approximate)
Waste Rock Dump	Operational and ongoing development 33 million tonnes remaining capacity (based on WRD concept) The WRD design to natural ground is 89.5 meters in height at 800 meter base. Area: 70 ha (approximate)
Activated Sludge Sewage Treatment Plant	Operational Capacity: capacity to treat domestic sewage water equal to 2,000 person wastes generation. **Didipio Water Recycling and Purification Plant (DWRAPP) still in commissioning stage – treatment of sewage to potable water via hyperoxidation method by ozonation, light polarization and Ultraviolet light disinfection*
Administration and Housing Areas	Operational Operation/Accommodation Village Administration Buildings: - Administration 1 building - Light Vehicle Workshop & Mobile Services Office and Site Services Maintenance and Office Area - Core Shed and Exploration Office Area
Powerhouse (on-site power supply)	Operational Type: Diesel Generator Capacity: 16 MW
Road Networks (All-weather access road)	Operational with ongoing maintenance Length: 30 km

ES.2 Process Documentation

ES.2.1 EIA Team

The Environmental Impact Assessment (EIA) Team is composed of the following specialists:

EIA Team Member	Module / Field of Expertise	IPCO No.
Mr. Jess M. Addawe	Environmental Impact Assessment (EIA), Geographic Information System (GIS)	056
Engr. Catherine L. Addawe	Land Use (LU), Hydrology (H), Water Quality (WQ), EPRMP Integrator (EI)	055
Engr. Gilbert B. Belason	Mining (MN)	--
Mr. Henry James P. Botengan	Social Impact Assessment (S)	063
For. Armando V. Gillado, Jr.	Terrestrial Ecology (TE), Freshwater Ecology (FE)	312
Mr. Arnel M. Mendoza	Geology (G)	--
Engr. Louie June D. Sioson	Air Quality (AQ), Environmental Risk Assessment (ERA)	095

ES.2.2 EIA Study Schedule and Area

The EIA study for the proposed increase in annual plant throughput rate from 3.5 Mtpa to 4.3 Mtpa for the Didipio Copper-Gold Project focused on the potential impacts of the proposed modification and on the environmental performance of the Project's current operation. The proposed increase in annual throughput rate is a result of OGPI's plan to optimize existing operations due to the combined effects of the following:

- (1) the commencement of the underground mining operations to produce a higher-average grade ore to be blended with the surface stockpile ore for a higher mine throughput, and
- (2) the increased capability of the current process plant to handle increased mine production capacity resulting from the series of de-bottlenecking activities conducted by OGPI.

The increase in annual plant throughput will neither involve any area expansion nor changes in process technology. Thus, this EIA study covered the previously identified direct and indirect impact areas of the project which is regularly being monitored by OGPI. The assessment of project performance was based on OGPI's 5-year monitoring activities (since 2013) within the identified direct and indirect impact areas.

The project's direct impact area is confined within the 391-hectare project footprint (as of 2nd quarter of 2018) which is within the 975-hectare total project area (Partial DMPF area). Included in the direct impact area, aside from the project footprint (land use, geology, terrestrial ecology), are the sections of surface water bodies directly draining the project footprint area (hydrology, water quality, freshwater ecology), the communities surrounding the project boundaries (impact on noise and air quality), and the jurisdiction of Barangay Didipio (socio-economic impact). Indirect impact areas include those undisturbed areas within the Partial DMPF area and FTAA area (terrestrial ecology), downstream portions of streams draining the project (water quality), and the jurisdiction of the Municipality of Kasibu (socio-economic).

The schedule of the EIA activities conducted for this EPRMP is summarized below:

Date	EIA Activity
June 4-6, 2016	Initial site reconnaissance; Coordination with OGPI
June 21, 2016	1st Public Scoping
February 19, 2018	Submission of request for scoping requirements to EMB
April 6, 2018	2nd Public Scoping (conforming to the new DENR Administrative Order 2017-15)
May 5, 2018	Submission of Request for Technical Scoping Requirements (with endorsed Public Scoping Report)
May 15, 2018	Technical Scoping
June 4-8, 2018	2nd site visit Conduct of perception survey, Focus Group Discussions (FGD), Key Informant Interviews (KII)

ES.2.3 Key EIA Methodologies

The EIA conducted for this EPRMP made use of the secondary data from previous EIA reports, special studies conducted for the project, OGPI monitoring reports submitted to various regulatory agencies including DENR EMB and MGB, existing environmental management plans implemented by OGPI, and from reports from various government agencies with pertinent information relating to the project. Primary data gathering, through consultations, surveys and interviews, was also conducted for the assessment of project's social impacts.

Summarized below are the key methodologies used in this EIA study.

Module	EIA Methodology
LAND	
Land Use and Classification	- Review of secondary data and actual site visit - Updating of project area land use - Assessment of compatibility with ECA classification using DENR maps - Updating of maps using ArcMap 10.1, NAMRIA topographic maps and DENR base maps
Geology/Geomorphology	- Review of previous EIA reports for the Project - Updating of information on local geology based on OGPI's recent technical reports on Geology
Terrestrial Ecology	- Desktop review of publicly available documents - Review and processing of previous monitoring data and studies conducted by OGPI on flora and fauna - Updating of flora and fauna sampling maps integrating the previous and existing monitoring stations
WATER	
Hydrology/Hydrogeology	- Site visit, reconnaisance - Watershed approach – delineation of watershed boundaries using ArcMap 10.1 and NAMRIA topographic map - Review of OGPI's documents regarding water resource and management - Review of previous EIA and baseline studies
Water Quality	- Site visit, reconnaisance - Review and processing of OGPI's 5-year water quality monitoring data since 2013 and other documents relating to water management and water quality - Generate water quality monitoring graphs using a spreadsheet for trend analysis
Freshwater Ecology	- Review and processing of information from OGPI's previous EIA studies, special studies and monitoring reports
AIR	
Meteorology/Climatology	- Secondary data gathering and interpretation of data and maps from PAGASA - Interpretation of rainfall data from Didipio Weather Station
Air Quality and Noise	- Review and processing of OGPI's air quality and noise monitoring data and other documents relating to air quality - Generate air quality monitoring graphs using a spreadsheet for trend analysis
PEOPLE	
Demography Socio-economic Profile Culture/Lifestyle (Indigenous People) Public Perception	- Use of secondary data from municipal and barangay profiles - Site visit, reconnaissance - Public Scoping - Perception Survey - Key informant interview - Focus group discussion

ES.3 EIA SUMMARY

ES.3.1 PROJECT ALTERNATIVES

ES.3.1.1 TECHNOLOGY SELECTION/OPERATION PROCESS AND DESIGN

The OGPI Didipio mining operations is a combination of open-pit and underground mining to maximize the operating life and financial performance of the project. The open pit operations ran from 2012 up to 2017 for the production of the surface stockpiled ore, which sustained the mill operations for the same period while the development of the underground operations started in 2015 and started producing ore in December 2017.

The plan on operating the mine as a combination of open pit and underground mining has been mainly due to the geometry and ground conditions of the Didipio resource. For the expanded operations, the ROM from the open pit operations will be blended with the ROM from the underground operations to produce the 4.3 Million MT/annum ore throughput for the plant. The technique to be implemented for the underground operations is the Long-Hole Open Stoping (LHOS) with paste back-filling. The LHOS mining method is a commonly employed, high-production, low-cost mining method that is suited to steeply dipping tabular-like orebodies. The method allows a high degree of mechanisation and offers good mining selectivity, good recovery and is relatively flexible to suit variable geometries and ground conditions. It is also considered to be relatively simple to implement.

With the improvements and optimization of the mine production, OGPI has undertaken a series of studies to determine the capability of the mill plant to accommodate the ROM throughput increase. These studies focused on the de-bottlenecking of key unit operations, such as improvements to the components of the Semi-Autogenous Mill, Ball Mill, Cyclone (SABC) circuit, as well as different configurations in the recovery circuits. The copper-gold processing plant has an original nameplate capacity of 2.5 Million MT/annum which was commissioned in 2012 and reached design capacity in 2013. The plant has since expanded in 2015 with the installation of the pebble crusher, which is essentially a cone crusher that is installed specifically to de-stress the circulating load of the SAG mill. This, in effect, effectively increases the throughput of the SAG mill and by extension, the plant itself to the current capacities of about 3.5 Million MT/annum.

OGPI has conducted several optimization studies on the improvements/adjustments than can be done on the existing equipment such as the primary crusher, SAG mill, ball mill, cyclone classifier cluster, flotation circuit, thickeners, and pumps, as well as the proposed installation of additional equipment at minimal capital cost, such as the additional classification units, a tertiary VertiMill grinding unit, and gravity concentration units. From these tests and simulations, OGPI found an optimized combination of configurations that would maximize the throughput of process bottlenecks, mainly on the comminution circuit, with their corresponding down-stream adjustments in the recovery and dewatering circuits that allowed the process to be ramped-up from 3.5 Million MT/annum to 4.3 Million MT/annum.

ES.3.2 SUMMARY OF IMPACT ASSESSMENT

The increase in annual mill plant throughput capacity from 3.5 million tonnes per annum (Mtpa) to 4.3 Mtpa will not cause any changes in terms of the total project area, total project footprint, process technology or any other changes in the project components such as the mine pit, tailings storage facility (TSF), etc. thus most of the impacts presented in the table below are the previously identified project impacts or the impacts of the current project operations. The mitigation measures presented are currently being implemented by OGPI or are part of OGPI's Environmental Management Plan (EMP), Environmental Protection and Enhancement Program (EPEP), Social Development and Management Plan (SDMP), Information, Education and Communication (IEC) Program and Final Mine Rehabilitation and/or Decommissioning Plan (FMRDP) duly approved by the DENR EMB and MGB.

Summary of key impacts on land, water, air and people and the corresponding proposed mitigating measures are presented in the table below.

ES.3.2.1 Environmental Performance

Detailed assessment of the Environmental Performance of the project operations are presented in Chapter 6. From the start of the commercial operation in April 2013 to date, the project has a total disturbed area of 393.52 hectares as of Q4 of 2018 within its approved PDMF area. Currently, the company has established a total of 1,285.4712 hectares reforestation/revegetation areas. 113.33 of which are within the 975.00 hectares PDMF area and 1,172.1412 hectares are planted outside the FTAA area.

The current FTAA area after relinquishment in CY 2017 is 11,488.8811 hectares or equivalent to 38% from its original FTAA area which is 30,000 hectares. The approved PDMF area is 975 hectares or 8.5% from the current FTAA area. Furthermore, the current disturbed area of 393.52 hectares is equivalent to 40.1% from the PDMF and only 3.4% from the current FTAA area of the Company.

ES.3.2.1.1 Highlights of Surface Water Quality Monitoring

Didipio Mine monitors a total of fifteen (15) surface water quality stations which are all being reported in their quarterly Self-Monitoring Report (SMR) and semi-annual Compliance Monitoring Report (CMR) submitted to the DENR from CY 2013 to 2018. To facilitate impact assessment using watershed approach, the 15 surface water quality stations were grouped into three (3) categories: stations upstream of the project site (unaffected by the project), stations at surface water bodies directly receiving the effluent/runoff from the project area, and stations downstream of the project site. Key findings are presented below.

Parameter	Key Findings
Primary Parameters	
BOD (mg/l)	- Ambient BOD levels in all surface water stations were within the guideline value for DAO 2016-08 Class D waters.
pH (Range)	- Surface water pH in all stations were within the guideline range for Class D waters. Mean pH levels per station ranged from 7.39 – 7.94.
Total Suspended Solids (mg/l)	- Exceedances in TSS guideline value for Class D waters were observed in all stations except in SWS DP-Up (along Dinauyan River) and SWS 22 (Diduyon River). Comparing the mean TSS levels per station, SWS DP-Up (16 mg/l), SWS 22 (23 mg/l), SWS 19 (48 mg/l, Alimit River) and SWS 1 (61.94 mg/l, Luminag 1 – control) exhibited mean TSS concentrations below 100 mg/l. Top three (3) stations with high TSS levels are SWS 15 (3,336 mg/l, Camgat Creek), SWS 13(2,834 mg/l, Camgat-Surong Creek), and SWS 18 (718 mg/l, Didipio downstream). Highest recorded quarterly reading was detected in SWS 15 with TSS=34,840 mg/l. - It can be inferred from the results that one of the major contributors of TSS in surface waters is the small scale mine operations located upstream of the Project site which drains into Camgat Creek (SWS 15), then to Camgat-Surong Creek (SWS 13) down to SWS 14, SWS 17 and SWS 18 along Diduyon River. These stations exhibited relatively higher TSS levels compared to the results from other SW stations. In relation to effluent discharge of OGPI's pollution control structures, TSS levels in the effluent are generally low with mean TSS levels per station ranging from 5 mg/l to 69 mg/l. Exceedances in TSS Class D effluent standard (150 mg/l) were observed STP Plant Site TSS = 208 mg/l (3Q 2015), Carwash Bay TSS = 214 mg/l (4Q 2015) and HV Wash Bay (SP09) TSS = 192 mg/l (1Q 2016).
Chloride (mg/l)	- Ambient chloride concentrations were well within guideline values for DAO 2016-08 Class D waters.
Color (TCU)	- All samples collected in all stations during quarterly monitoring were

Parameter		Key Findings
		within Class D guideline for color.
Dissolved Oxygen (mg/l) (minimum)	-	Dissolved oxygen levels in all stations were above the minimum guideline value for Class D waters.
Total Coliform (MPN/100ml)	-	There is no guideline value for Total Coliform count for Class D waters (DAO 90-34). For comparison purposes, results were compared to Class C guidelines. Almost all SW stations exhibited very high Total Coliform counts (relative to DAO 90-34 Class C guideline value = 5,000 MPN/100ml) except SWS 16 (Surong Creek, maximum recorded value =1,600 MPN/100 ml), SWS 12 (Dinauyan River, maximum recorded value =1,600 MPN/100 ml) and SWS 19 (Alimit Creek, maximum recorded value =5,400 MPN/100 ml). Maximum recorded Total Coliform count in other SW stations ranged from 7,000 to as high as 390,000 MPN/100ml.
Fecal Coliform (MPN/100ml)	- -	Exceedances in Fecal Coliform count as per DAO-2016-08 guideline value for Class D were recorded in all stations except in SWS 19, Alimit River (for its two quarterly monitoring data). Effluent monitoring from 3Q2016 - 1Q2018 revealed low Fecal Coliform counts (most samples had below MDL) for both STPs of OGPI but with one recorded exceedance in effluent standard in STP MSA for the 3Q 2016 monitoring period)1,700 MPN/100ml > 800 MPN/100ml effluent standard). Downstream of STP MSA is SWS 17.
Nitrate (mg/l)	-	Nitrate levels in all surface water samples from all SW stations were within DAO 2016-08 Class D guidelines.
Phosphate (mg/l)	-	Phosphate levels in all surface water stations were all below the 5 mg/l Class D guideline limit. Readings ranged from 0.031 mg/l to 0.310 mg/l.
Secondary Parameters - Inorganics		
Ammonia as NH_3-N (mg/l)	-	Ammonia levels in surface waters upstream, within, and downstream of the Project Site follows the Class D guidelines during the entire monitoring period except for SWS 14 during 3Q 2017 monitoring with ammonia concentration = 0.80 mg/l.
Sulfate (mg/l)	-	Relatively higher sulfate levels were observed in stations within the project site specifically those located along Dinauyan River (SWS DP-Up, SWS DP-Down and SWS 12). Only one exceedance to the DAO 2016-08 sulfate guideline value was observed particularly in SWS DP-Down with sulfate = 551.8 mg/l during 1Q 2018 SW sampling.
Secondary Parameters - Metals		
Arsenic (mg/l)	-	As values analyzed in the SW samples were all below the 0.04 DAO 2016-09 Class D guideline value. However, some of the results prior to 2016 exceeded the DAO 90-34 guideline value which is 0.01 mg/l.
Cadmium (mg/l)	-	Cadmium levels were below method detection limit (<0.01 mg/l) for all quarterly SW samples in all SW stations during the entire monitoring period (1Q 2013 – 1Q 2018).
Hexavalent Chromium (mg/l)	-	Chromium (hexavalent) levels were below method detection limit (<0.001 mg/l) for all quarterly SW samples in all SW stations during the entire monitoring period (1Q 2013 – 1Q 2018) except in SWS 13 (Camgat-Surong downstream) wherein 0.02 mg/l Cr^{6+} was detected in 2Q 2017.
Dissolved Copper (mg/l)	-	Dissolved Cu concentrations in all surface water samples comply with the Class D guidelines. Most of the samples had Cu levels below MDL.
Iron (mg/l)	-	Exceedances were recorded in samples collected from SWS 15, SWS 13, SWS 14, SWS 17 and SWS 18. These stations are all located along Camgat Creek (SWS 15) down to Didipio River downstream (SWS 18). Note that the highest concentration of Fe was detected in SWS 15 2Q 2016 (397.5 mg/l) where small scale mine operations exist.
Lead (mg/l)	-	Monitoring data for Pb revealed that all surface water samples had Pb concentrations below MDL.

Parameter	Key Findings
Mercury (mg/l)	- Highest recorded Hg concentration was from SWS 15 (downstream of small scale mine operations) with Hg = 0.0148 mg/l for the 3Q 2016. Only SWS 16 (Surong Creek) had Hg levels below MDL for the entire monitoring period. All the other SW stations had recorded traces of Hg but with at least 80% of the monitoring data below MDL.
Zinc (mg/l)	- All SW stations exhibited Zn levels below 4 mg/l compliant with the DAO 2016-08 Class D guideline.
Secondary Parameters - Organics	
Free Cyanide (mg/l)	- All stations had free cyanide concentrations that comply with Class D guideline (<0.2 mg/l).
Oil and Grease (mg/l)	- All stations exhibited oil and grease concentrations that comply with Class D guideline (<5 mg/l).
Surfactants (MBAS) (mg/l)	- Surfactants in all stations were below MDL (<0.1) except for SWS 19 during 3Q 2016 with MBAS=0.10 mg/l.

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
LAND		
LAND USE Compatibility with existing land use - Permanent facilities such as the open pit (OP), tailings storage facility (TSF) and waste rock stack (WRS) will permanently change the land use and topography of the area	Implementation of the Final Land Use Plan (revert the conditions of the land to its condition before it was mined as much as possible): WRS: - Establishing forest tree species at the WRS through progressive rehabilitation OP: - Fencing the OP and installation of a safety berm at the top of the pit - Allow the pit to become a lake as part of its final mine rehabilitation and decommissioning plan at the end of mine life which could possibly be used for domestic and irrigation water supply or for aquaculture TSF - Option 1: create dry beaches and establish a river channel along one edge of the tailings impoundment. These dry beaches will then have top soil added and be available for agriculture or be revegetated with indigenous plants. - Option 2: Utilize the inundated area as a water reservoir; maintain the wet cover of the tails, for hydropower as raised during the stakeholder consultation for the final land use	New topography and permanent change in land use.
LAND USE / GEOLOGY Compatibility with classification as an Environmentally Critical Area (ECA) - Highly susceptible to landslide and high risk to typhoons Inducement of subsidence, liquefaction, landslides, mud/debris flow, etc.	- Implementation of progressive rehabilitation which includes reconfiguring the slope into stable angle, benching, covering the slopes with topsoil, matting, planting of selected plant species and casting of seeds - Open pit design and engineering measures to ensure pit stability; continuous monitoring of slope movement - Application of seismic design criteria (for OP, TSF, WRS and general facilities) rated to ground acceleration in accordance with existing national structural codes. - Slope stabilization and engineering measures for haul roads and general facilities - Geotechnical and structural monitoring - Implementation of existing Emergency Response Plan (ERP) and Dam Safety Emergency Management Plan; installation of emergency warning systems - Prevention and control of erosion and sedimentation via progressive rehabilitation and installation of drainage networks connected to sedimentation ponds - The TSF embankment is constructed from rockfill and earthfill that is adequately grouted and lined to allow for minimal movement during seismic events. - In the unlikely potential event of TSF failure, the WRD basin downstream of the TSF would fully contain the released tailings and water. It is assumed should a TSF dam break occur and the WRD was	Possible slope failure, structural failure or overtopping due to extreme events but risk can be considered low with proper implementation of mitigation measures.

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
	at risk of failure the pit and underground would be evacuated allowing the Dinauyan River and tailings flow to be diverted into to pit via an excavated channel to fully contain the released material.	
LAND USE Impairment of visual aesthetics – WRS & TSF embankment across the Dinauyan Valley are perceived to cause impairment of visual aesthetics in the area	- The Company has been progressively rehabilitating inactive waste dumps, portions of TSF embankment and slopes to mitigate visual impacts in accordance with the closure plan for the site - Decommissioning, removed from site or transfer to the community of other mine facilities in accordance with the closure plan	Permanent changes to visual amenity i.e. formation of a lake out of the decommissioned open pit.
GEOLOGY/GEOMORPHOLOGY Change in surface landform/ geomorphology/ topography/ terrain/ slope	- Implementation of the Final Land Use Plan (revert the conditions of the land to its general condition before it was mined as much as possible) - Implementation of progressive rehabilitation which includes reconfiguring the slope into stable angle, benching, covering the slopes with topsoil, matting, planting of selected plant species and casting of seeds	Permanent changes in topography.
GEOLOGY/GEOMORPHOLOGY Change in sub-surface geology/underground conditions	- Implementation of engineering measures to prevent subsurface collapse (i.e. rock bolting, meshing, and shotcrete); Optimization of blast requirements to prevent potential subsurface collapse	Permanent changes in sub-surface geology and underground conditions.
PEDOLOGY Soil erosion/Loss of topsoil/overburden	- Revegetation - Seedling production for progressive rehabilitation activities - Installation of erosion control blankets to cover exposed areas - Hydroseeding - Gravelling or rock surfacing - Surface roughening - Rock lining of drainage systems	Minimal. Accelerated erosion may happen in case of extreme storm events.
PEDOLOGY Loss of soil quality/fertility	- Progressive rehabilitation; covering of topsoil - Use of drip pans during vehicle and equipment maintenance - Collection and proper storage of used oil and lubricants in storage tanks or bins - Collection, transport and treatment of waste oil by a DENR-accredited hauler and treater - Implementation of industry protocols for oil clean-up in case of spilled hydrocarbons - Utilization of the existing volatilization pad to cater the contaminated soils and rocks for treatment - Fuel and process reagents storage tanks/containers are bunded per industry specifications. Bunds	None.

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
	may be in the form of concrete or any non-reactive impermeable material and are sized per 110% of the volume of the largest storage tank in the circuit to ensure effective containment of spilled material in case of a breach or spill. - Posting of Material Safety Data Sheet (MSDS) of process reagents; reinforcing containers or storage tanks depending on the volume of chemicals to be stored	
TERRESTRIAL ECOLOGY Vegetation removal and loss of habitat Threat to the existence and/ or loss of important local species Threat to abundance, frequency, and distribution of important species Hindrance to wildlife access	Continuous implementation of the following: - Implementation and maintenance of reforestation programs such as the Mining forest Program - Donation of seedlings for the carbon sink and National Greening Program - Progressive rehabilitation and re-vegetation of disturbed areas such as slopes - Maintenance of the nursery for the propagation of seedling of indigenous species for reforestation efforts - Implementation of conservation programs identified in the EPEP - Regular annual monitoring of terrestrial flora and fauna in direct and indirect impact areas of the project	None.
WATER		
HYDROLOGY Change in drainage morphology (Dinauyan River and its tributaries(	- Progressive rehabilitation of the waste rock stack and of the TSF embankment to reduce surface runoff and erosion - Affected river channels were lined to prevent scouring and seepage of water into the mine pit. - Surface water management systems on site also include sediment ponds, sumps and surface water drains - An emergency spillway was constructed upstream of the waste rock stack and TSF to allow for flows greater than the normal flow particularly during flood or high rainfall events	Permanent changes in drainage morphology due to river diversion and changes in topography.
HYDROLOGY Change in stream water depth – increased river discharge due to increased surface runoff resulting to stream bed and stream bank erosion and sedimentation downstream	- Continuous implementation of progressive rehabilitation to reduce rainfall impact and increase infiltration rates - Implementation of slope control measures such the use of cocomatting or geomembranes for erosion control, implementation of engineering measures such as use of riprap, gabions, and shotcrete along valleys or slopes - Installation of silt traps and sedimentation ponds, gravelling of roads, and rock lining of drainage systems and water ways.	None.
HYDROLOGY/ HYDROGEOLOGY Depletion of water resources / water use competition	- Establishment of Didipio Water Supply System as committed by OGPI in the 2013 Memorandum of Agreement with Barangay Didipio. Project is under commissioning stage. - Water Resource Study for Barangay Didipio Domestic Water Supply (2018) was conducted by OGPI to	None.

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
- Water withdrawal for mine use Dinauyan watershed and groundwater within the mine area may lead to reduction in flow for springs and tributaries although modeling shows impact would be localized - Increase in economic development leading to rise in population growth exert pressure on water supply	confirm potential impact of underground and mine operation on nearby communities and on the project water balance. - Continuous monitoring of groundwater levels - Implementation of water conservation measures through water treatment and recycling, and use of water associated with mine dewatering. - Installation of Didipio Water Recycling and Purification Plant (DWRAPP) in the Mine Services Area Sewage Treatment Plant to further treat sewage to a potable water quality (under commissioning stage)	
WATER QUALITY Degradation of surface and groundwater quality - Possible contamination of surface and groundwater in case of leaks/breach in containment in the process circuit and TSF - Mine dewatering	- The TSF base and its embankment is lined with clay sourced from the open pit to inhibit water transmission. - Filter drains are constructed in the embankment and its toe to prevent water transmission. - TSF embankment is regularly monitored for cracks, movement, or leaks. - Piezometers were also installed at the TSF wall to monitor any seepage and water pressure. - Pit water is pumped out of the pit flowing into a series of sediment ponds. With the use of coagulating agents, sediment will precipitate faster and any hydrocarbon is skimmed off the water.	None.
WATER QUALITY Degradation of surface and groundwater quality - Erosion from stockpiles and waste dumps resulting to siltation of receiving surface water bodies - Possibly contaminated seepage from WRS	- A vegetated buffer zone, planted with locally grown trees, is also established and maintained around the TSF to contain run-off from the surrounding catchment. - Settling ponds are established and maintained to contain settled out solids - The flow through drain is constructed and stabilized per the appropriate engineering rating. It is designed such that it can allow 100% passage of the Dinauyan River to the downstream channel to prevent scouring of the WRS. - Installation of check dams to control flow velocities within unlined drains and trap small quantities of sediments - Installation of rock filter dams and sediment fences - Waste rocks are stacked per engineering guidelines for minimal water transmission. - Also, waste rocks are isolated from non-reactive rocks and soil. A detailed net acid production potential (NAPP) and acid-base account (ABA) for the waste rocks at different alteration types and depths of extraction to determine the possibility of acid generation is continuously being monitored in the water quality monitoring program.	Minimal. Siltation may occur during extreme storm events.
WATER QUALITY Degradation of surface and groundwater	- All sewage produced on site is currently treated in the activated sludge sewage treatment plant. - Sewage from isolated locations like guard posts are stored in holding tanks and transported to the	None.

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
quality due to generation of sewage and solid wastes	sewage treatment plant by tanker on an as need basis or when the sewage holding tanks reach its full capacity. - Sludge from the sewage treatment plant is hauled out and treated by a sewage sludge third party contractor.	
WATER QUALITY Acid Mine Drainage	- High Sulphur rocks coming out of the pit are being monitored. - If present, procedures in ensuring that these are blended with high neutralizing rock will be implemented (this has not occurred to date and expected not to occur as supported by the 1994 report by Mountford and Wall) - If acid mine drainage (acidic water) will be present, it will be mitigated via treatment with neutralizing reagents such as lime, diluted with alkaline water, or collected and pumped to the water treatment plant for treatment. - Continuous monitoring of water quality for potential presence of ARD	None.
FRESHWATER ECOLOGY Threat to existence and/or loss of important local species and habitat Threat to abundance, frequency and distribution (A decline in the taxa richness of aquatic fauna composition in the area from 1997 to 2012 has been observed but apparently, data from the 2012 study up to the 2016 study shows significant recovery of the aquatic communities, which is almost similar to the aquatic community prior to the project implementation.)	- Implementation and maintenance of bank stabilization and erosion control measures (e.g. siltation/sedimentation ponds) - Progressive rehabilitation and re-vegetation of disturbed areas such as slopes - Implementation of water treatment plant and proper management of wastewater - Implementation of proper solid (e.g. maintenance of sanitary landfill) and hazardous waste management - Implementation of conservation programs identified in the EPEP - Regular annual monitoring of freshwater ecology in direct and indirect impact areas of the project	None.
AIR		
AIR QUALITY Degradation of air quality - Dust from mining activities, processing area (crushers), exploration activities such as drilling and forming of access tracks	- Dusts from each of the identified sources are suppressed using water sprays. - Haul and other roads are watered with a water cart. - Water sprays are employed to suppress the dust on the crusher or conveyor. - Dust from drilling activities is controlled by using water sprays, and shielding as appropriate. - OGPI and contractor's vehicles are required to slowdown when significant dust emission is generated while travelling on the road. Speed humps are installed and maintained near residential areas to	

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
	ensure vehicles will slow down at sensitive areas. - Signages are established in Km 0 and Km 22 to remind drivers to slow down.	
AIR QUALITY Emissions from engine-driven equipment and blasting Greenhouse gas (GHG) emissions	- Emissions from the power station are controlled by the manufacturer design and regular maintenance of the generator sets. - Carbon sink tree plantation areas (National Greening Program (NGP), reforestation on site Adopt-a-Mining Forest Program and other new plantation areas) are established to offset carbon emission from the project. - A project greenhouse gas and energy management plan (GHGEMP) was developed to provide details on carbon emission reduction programs being implemented on site. - Reduction of greenhouse gas emission from reduced use of engine driven power generator sets by connecting to the power grid through the Nueva Vizcaya Electric Cooperative (NUVELCO) which was already established. - Effective maintenance of equipment to ensure efficient operation and correspondingly reduce unnecessary carbon emissions - Use of biodiesel in the project site	
AIR QUALITY Odor from the sewage treatment plant (STP)	- Minimize odor from STPs by ensuring that the plants are maintained in good working condition, and operated are by trained personnel. - Regular maintenance is conducted to ensure that diffusers and blowers remain efficient in supplying aeration to the sewage loads to hasten bacterial digestion of organics. - The plant also has chlorination process to lower down harmful bacteria in the effluent. - To mitigate odor emission, an enclosure system with carbon filter on the surge tank of the STP is installed.	
NOISE AND VIBRATION Increase in ambient noise level Impact (stress, annoyance, diminished productivity and concentration, interference with communication) to workers, passage of vehicles producing noise, blasting Impact (annoyance) of the crusher and process plant to the nearby community	- Personal Protective Equipment (PPE) (i.e. mufflers or ear plugs) are issued to workers. - Restriction of hours of activity particularly on rock breaking activities near the crusher during the night shift. Wherever possible, hauling to the ROM pad is done during daylight hours since dumping on the ROM pad has been identified as the greatest source of noise in the neighbouring community. - Equipment and vehicle maintenance - Construction of sound barriers - Generator sets are housed within clad containers and the exhausts are fitted with appropriate silencers to reduce noise. - Tree lines are also being established in applicable areas to serve as sound barriers.	
PEOPLE		
In-migration	- A “local first” hiring policy is instituted. This is assumed to lessen the likelihood of massive migration	

MAIN IMPACTS OF EXISTING PROJECT*	PREVENTION, MITIGATION OR ENHANCEMENT MEASURES	RESIDUAL EFFECTS
	to the project-affected communities, and thereby avoid the stress and competition on local resources, job opportunities, and public services because of newcomers.	
Traffic	- A local traffic management is instituted in coordination with the concerned local government unit to control the traffic flow as necessary. - OGPI vehicle operators are equipped with road and equipment safety trainings and protocols prior to deployment to the site. - The same induction training is carried out to mine staff and visitors. - Traffic signages are strategically installed on roadways.	
Physical and economic displacement	- A compensation package conforming to national laws and international protocols, e.g., Performance Standard No. 5 (Land Acquisition and Involuntary Resettlement) of the International Finance Corporation will be implemented for project-affected persons.	

* The increase in annual mill plant throughput capacity from 3.5 million tonnes per annum (Mtpa) to 4.3 Mtpa will not cause any changes in terms of the total project area, total project footprint, process technology or any other changes in the project components such as the mine pit, tailings storage facility (TSF), etc. thus most of the impacts presented are the previously-identified project impacts or the impacts of the current project operations.

1 Project Description

1.1 Project Background

1.1.1 Financial and Technical Assistance Agreement

The Didipio operation is located in the north of Luzon Island approximately 270 km NNE of Manila, in the Republic of the Philippines.

The operation is covered by the Financial or Technical Assistance Agreement ("FTAA") No. 001 entered into between the Republic of the Philippines and Climax Arimco Mining Corporation ("CAMC") on 20 June 1994. The FTAA was subsequently assigned by CAMC to Australasian Philippines Mining Inc ("APMI") (renamed OceanaGold (Philippines), Inc. ("OGPI"), now a wholly owned subsidiary of OceanaGold Corporation ("OGC"). The FTAA was granted for a term of 25 years, renewable for a further 25 years. In collaboration with the Government of the Philippines, the FTAA grants title to OGPI to undertake large-scale exploration, development and mining of gold, silver, copper and other minerals within a fixed fiscal regime. The FTAA carries a minimum expenditure commitment of US$50 million, which has been exceeded.

Although the Didipio FTAA was granted prior to the promulgation of the Philippine Mining Act of 1995 ("Mining Act"), in common with subsequent FTAAs granted under the Mining Act and its Implementing Rules and Regulations, an Environmental Compliance Certificate ("ECC") and a Declaration of Mining Feasibility are both required as a condition for the implementation of the FTAA. Both an ECC and a Partial Declaration of Mining Feasibility ("DMPF") have been obtained and remain in place for the Didipio operation.

The FTAA now covers about 11,488.88 hectares (compared with the original 37,000 hectares). Parts of the original FTAA have been relinquished under the terms of the agreement. The Partial DMPF for the Didipio operation covers 975 hectares within the FTAA.

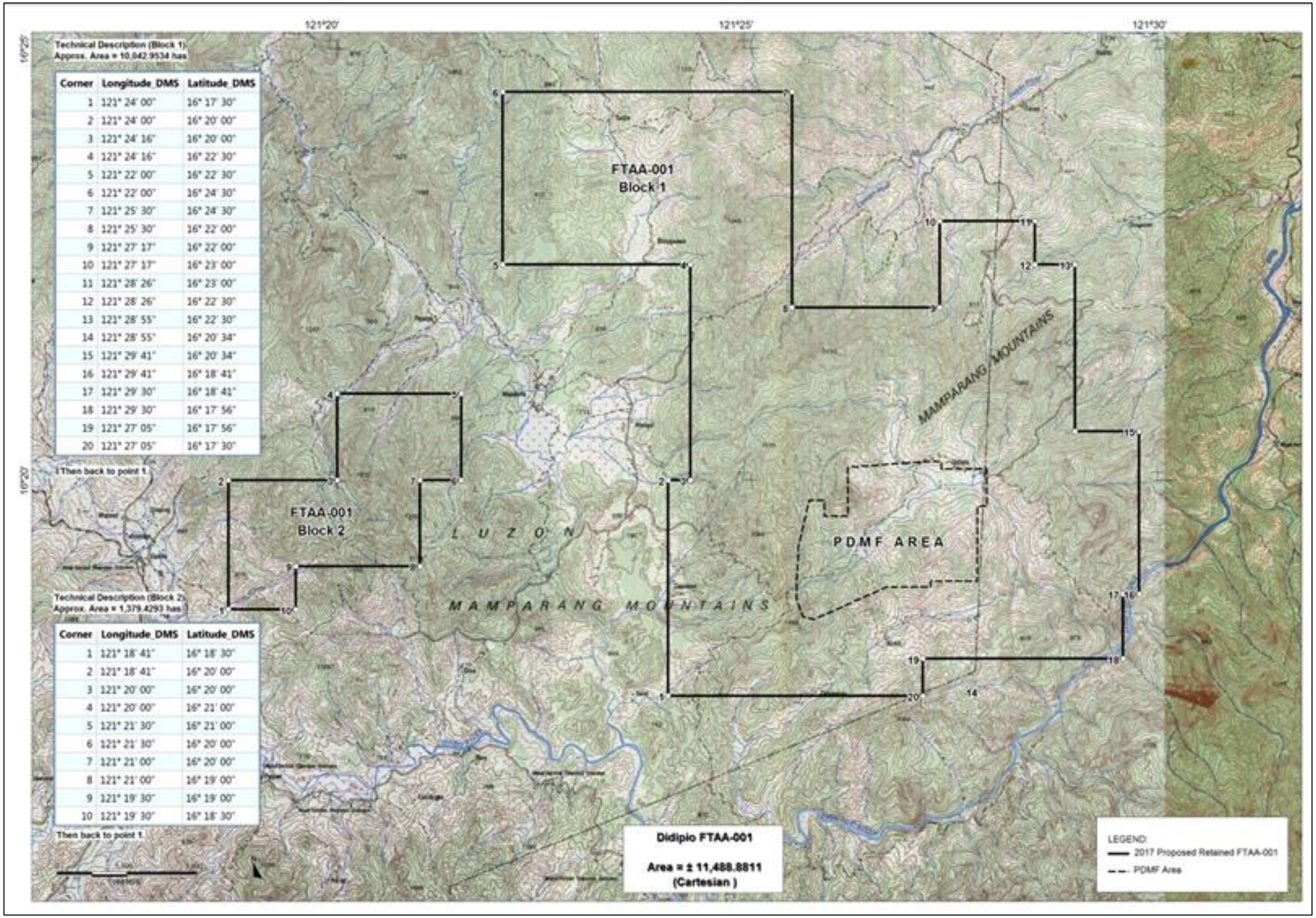
The initial term of the FTAA (established in June 1994) is 25 years and is renewable on the same terms and conditions for another 25 years as of 19 June 2019. OGPI has commenced the renewal process with the Government and is working with them to secure the renewal.

The FTAA contract area boundary is technically described in Table 1-1 and Figure 1-1.

Table 1-1: OGPI FTAA No.001 Technical Description

BLOCK 1		
Corner	Longitude	Latitude
1	121°24'00"	16°17'30"
2	121°24'00"	16°20'00"
3	121°24'16"	16°20'00"
4	121°24'16"	16°22'30"
5	121°22'00"	16°22'30"
6	121°22'00"	16°24'30"
7	121°25'30"	16°24'30"
8	121°25'30"	16°22'00"
9	121°27'17"	16°22'00"
10	121°27'17"	16°23'00"
11	121°28'26"	16°23'00"
12	121°28'26"	16°22'30"
13	121°28'55"	16°22'30"
14	121°28'55"	16°20'34"
15	121°29'41"	16°20'34"
16	121°29'41"	16°18'41"
17	121°29'30"	16°18'41"
18	121°29'30"	16°17'56"
19	121°27'05"	16°17'56"
20	121°27'05"	16°17'30"

BLOCK 2		
Corner	Longitude	Latitude
1	121°18'41"	16°18'30"
2	121°18'41"	16°19'12"
3	121°18'00"	16°19'12"
4	121°18'00"	16°20'00"
5	121°20'00"	16°20'00"
6	121°20'00"	16°21'00"
7	121°21'30"	16°21'00"
8	121°21'30"	16°20'00"
9	121°21'00"	16°20'00"
10	121°21'00"	16°19'00"
11	121°19'30"	16°19'00"
12	121°19'30"	16°18'30"



Corner	Longitude_DMS	Latitude_DMS
1	121° 24' 00"	16° 17' 30"
2	121° 24' 00"	16° 20' 00"
3	121° 24' 16"	16° 20' 00"
4	121° 24' 16"	16° 22' 30"
5	121° 22' 00"	16° 22' 30"
6	121° 22' 00"	16° 24' 30"
7	121° 25' 30"	16° 24' 30"
8	121° 25' 30"	16° 22' 00"
9	121° 27' 17"	16° 22' 00"
10	121° 27' 17"	16° 23' 00"
11	121° 28' 26"	16° 23' 00"
12	121° 28' 26"	16° 22' 30"
13	121° 28' 55"	16° 22' 30"
14	121° 28' 55"	16° 20' 34"
15	121° 29' 41"	16° 20' 34"
16	121° 29' 41"	16° 18' 41"
17	121° 29' 30"	16° 18' 41"
18	121° 29' 30"	16° 17' 56"
19	121° 27' 05"	16° 17' 56"
20	121° 27' 05"	16° 17' 30"

Corner	Longitude_DMS	Latitude_DMS
1	121° 18' 41"	16° 18' 30"
2	121° 18' 41"	16° 20' 00"
3	121° 20' 00"	16° 20' 00"
4	121° 20' 00"	16° 21' 00"
5	121° 21' 30"	16° 21' 00"
6	121° 21' 30"	16° 20' 00"
7	121° 21' 00"	16° 20' 00"
8	121° 21' 00"	16° 19' 00"
9	121° 19' 30"	16° 19' 00"
10	121° 19' 30"	16° 18' 30"

Figure 1-1: Topographic Map of Didipio FTAA-001 and Partial DMPF Area

1.1.2 Environmental Compliance Certificate (ECC)

The Environmental Compliance Certificate (ECC) for the project (ECC Ref. No. 980-100-1301) was originally granted to CAMC on 11 August 1999. Subsequent to this, some revisions and modifications to the project configuration/program were made which led to the amendment of the ECC on 12 January 2000 and 5 August 2004. In March 2005, OGPI submitted a Partial Declaration of Mining Project Feasibility (DMPF) for approval by the DENR. In conjunction with the Partial DMPF, OGPI submitted (among other things) a Definitive Feasibility Study for the project. On 11 October 2005, the Partial DMPF was approved by the DENR which provided, in effect, the permit to operate and develop the project.

As a result of the continuing exploration activities, OGPI then applied for another ECC amendment in 2011 to cover the following major changes: increase in open pit area (from 400 m x 500 m to 750 m x 850 m) and ore reserve (from 12.89 million tonnes (Mt) to 44.7 Mt), modification of underground mining method (from sub-level block caving to sub-level open stoping with paste back fill), increase in process plant throughput (from 2 million tonnes per annum (Mtpa) to 3.5 Mtpa) and increase in size and capacity of the tailings storage facility (from 24 Mt to 50 Mt). The ECC was issued on 10 December 2012 with ECC Ref. No. ECC-CO-1112-0022.

1.1.3 Brief History of Project Operations

Construction phase of the Didipio Project commenced in June 2011 and was substantially completed by December 2012. Commissioning of the mill with ore commenced in mid-December 2012 and was run through the first quarter of 2013, with official commercial production from April 2013.

Annual throughput rate has ramped up from nameplate 2.5 Mt of ore processed in 2013, to 3.5 Mtpa before 2015. Annual throughput rate is expected to reach 4.3 Mtpa over the life of mine ("LOM").

Mining will continue to be carried out by open pit methods until the end of 2017 and thereafter underground mining with mill feed is supplemented by surface stockpiles. The underground access decline commenced in the 1st quarter of 2015. Long-hole open stoping ("LHOS") with paste backfill is planned to mine underground stopes below the open pit.

1.2 Project Location and Area

1.2.1 Project Location

The Didipio project is located in the north of Luzon Island approximately 270 km NNE of Manila, in the Republic of the Philippines. The site elevation is approximately 700 m above mean sea level (AMSL) and with coordinates of longitude 121° 27' east and latitude 16° 20' north. This location is in the southern part of the Mamparang Mountain range adjacent to the border of Nueva Vizcaya and Quirino Provinces. The nearest population centers are the Nueva Vizcaya capital of Bayambong that lies approximately 35 km to the east. The nearest significant town to the Didipio project is Cabarroguis, Quirino located approximately 20 km to the north and connected by paved road to Bayombong to the west. Figure 1-2 shows the location of the Municipality of Kasibu.

There are two alternative routes connecting the Didipio site by road to the port facilities at Manila. The main route, approaching from the North via Cabarroguis, is an all-weather route suitable for heavy trucks and bulk freight. The secondary access, approaching from the south via Kasibu, is also an all-weather route and is suitable for smaller trucks and light vehicles.

The main access to the Didipio operation is via Cabarroguis. From Manila, the Maharlika Highway/Pan-Philippine Highway leads north to San Jose. From the port facility at Poro Point, La Union, the MacArthur Highway leads south and meets the Maharlika Highway at San Jose, where the routes from both ports converge. The Maharlika Highway continues north to Bayombong then Cordon and from there a concrete sealed road leads south to Debibi in Cabarroguis. From Debibi, there is a 22 km gravel all-weather road passing across a concrete bridge over the Debibi River to the mine site. From Manila, access by road via Cabarroguis generally takes approximately ten (10) hours. A secondary access connects the site by an all-weather gravel road to Kasibu, which is in turn connected by concrete road to the Pan-Philippine Highway at Bambang.

1.2.2 Direct and Indirect Impact Areas

The project's direct impact area is confined within the 391-hectare project footprint (as of 2nd quarter of 2018) which is within the 975-hectare total project area (Partial DMPF area) (Figure 1-3). Included in the direct impact area, aside from the project footprint (land use, geology, terrestrial ecology), are the sections of surface water bodies directly draining the project footprint area (hydrology, water quality, freshwater ecology), the communities surrounding the project boundaries (impact on noise and air quality), and the jurisdiction of Barangay Didipio (socio-economic impact). Indirect impact areas include those undisturbed areas within the Partial DMPF area and FTAA area (terrestrial ecology), downstream portions of streams draining the project (water quality), and the jurisdiction of the Municipality of Kasibu (socio-economic).

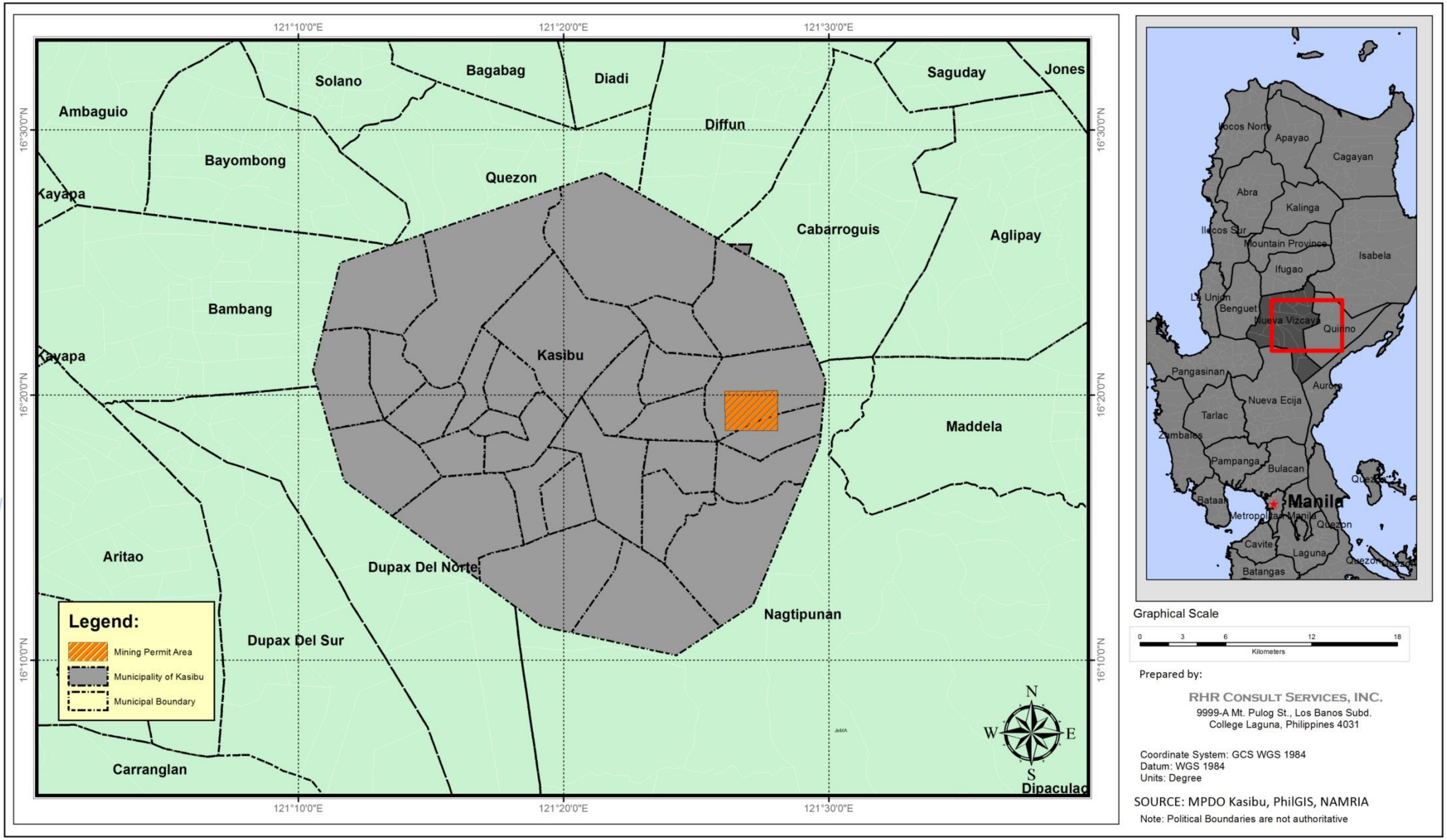


Figure 1-2: Project Location Map

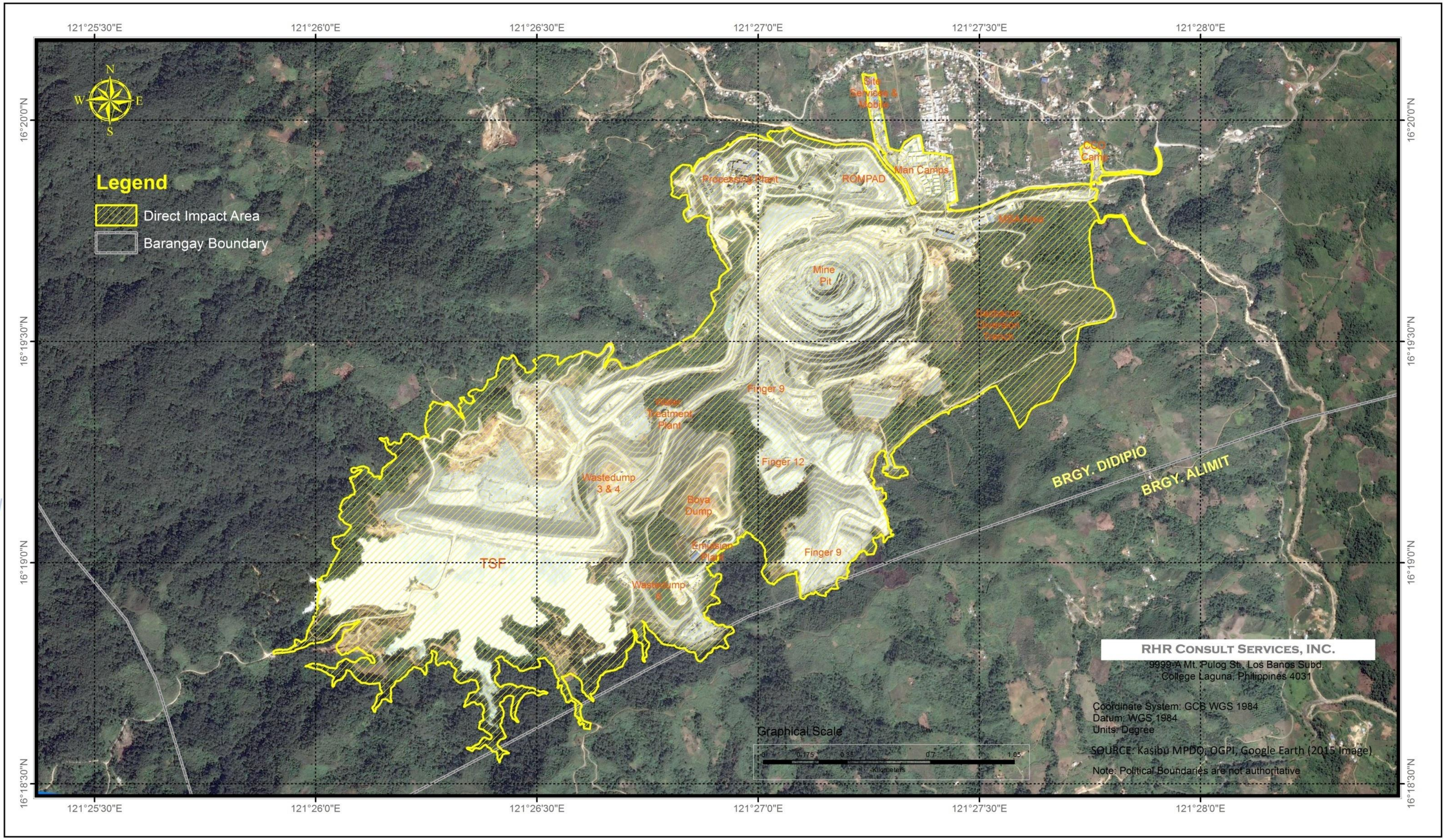


Figure 1-3: Project Direct Impact Area

1.3 Project Rationale

The Didipio ore body, bounded by the Cagayan Valley in the north and the Sierra Madre mountain range in the east, is a copper-gold porphyry-type deposit. This type of mineralization owes itself to cost-effective, well-established, and widely-used extraction technologies, such as flotation for the copper values and gravity concentration for the gold.

This Project expansion endeavors to maximize the economic utility of the mineral resources in the Didipio area, while consequently spearheading the growth of the immediate locality through the inevitable socio-economic development that is integral to any mineral development project. This includes the increased taxes and royalties levied to the government, the employment growth of the 1st degree (immediate mining-related jobs) and the supporting industries (commerce) in the area, social development, and others. This expanded operation is expected to generate additional employment in the community directly and indirectly, further promote commerce, and improve the revenue base of the local government through various taxes, permits and licenses. OGPI's environmental and social development programs are also anticipated to have positive impacts on the community.

In line with the initiative of the Philippine government of Sustainable Development in responsible mining and mineral operations, the Project expansion will continue to utilize and implement world-class technologies and practices that strike a delicate balance between efficient mining and processing recoveries, sustainable economics, and fully-controlled environment impacts.

OGPI's plan to optimize existing operations will increase the plant throughput to 4.3 Mtpa. This is the due to the combined effects of (1) the commencement of the underground mining operations to produce a higher-average grade ore to be blended with the surface stockpile ore for a higher mine throughput, and (2) the increased capability of the current process plant to handle increased mine production capacity resulting from the series of de-bottlenecking activities conducted by OGPI. This shall further strengthen financial feasibility of the operation against volatile international metal prices. Increase in Social Development and Management Program (SDMP) allocation is also foreseen with the increase in revenues arising from the expansion of operations.

1.4 Project Alternatives

To maximize the operating life and financial performance of the project, the OGPI Didipio mining operations is a combination of open-pit and underground mining. The open pit operations ran from 2012 up to 2017 for the production of the surface stockpiled ore, which sustained the mill operations for the same period while the development of the underground operations started in 2015 and started producing ore in late 2017.

The plan on operating the mine as a combination of open pit and underground mining has been mainly due to the geometry and ground conditions of the Didipio resource. However, this scheme has proven advantageous with the current situation of the management of Philippine mineral development operations, specifically on the impending decision by the Government on the disallowance of open pit mining operations. For the expanded operations, the run-of-mine (ROM) from the open pit operations will be blended with the ROM from the underground operations to produce the 4.3 Mtpa ore throughput for the plant. The technique to be implemented for the underground operations is the Long-Hole Open Stoping (LHOS) with paste back-filling. Again, the geometry and mineralization of the Didipio deposit is the basis of the selection of this underground mining method over the others, i.e. block caving, etc. The LHOS mining method is a commonly employed, high-production, low-cost mining method that is suited to steeply dipping tabular-like ore bodies. The method allows a high degree of mechanisation and offers good mining selectivity, good recovery and is relatively flexible to suit variable geometries and ground conditions. It is also considered to be relatively simple to implement.

With the improvements and optimization of the mine production, OGPI has undertaken a series of studies to determine the capability of the mill plant to accommodate the ROM throughput increase. These studies focused on the de-bottlenecking of key unit operations, such as improvements to the components of the Semi-Autogenous Mill, Ball Mill, Cyclone (SABC) circuit, as well as different configurations in the recovery circuits. The copper-gold processing plant has an original nameplate capacity of 2.5 Mtpa which was commissioned in 2012 and reached design capacity in 2013. The plant has since expanded in 2015 with the installation of the pebble crusher, which is essentially a cone crusher that is installed specifically to de-stress the circulating load of the semi-autogenous grinding (SAG) mill. This, in effect, effectively increases the throughput of the SAG mill and by extension, the plant itself to the current capacities of about 3.5 Mtpa.

OGPI has conducted several optimization studies on the improvements/adjustments than can be done on the existing equipment such as the primary crusher, SAG mill, ball mill, cyclone classifier cluster, flotation circuit, thickeners, and pumps, as well as the proposed installation of additional equipment at minimal capital cost, such as the additional classification units, a tertiary VertiMill grinding unit, and gravity concentration units. From these tests and simulations, they have found an optimized combination of configurations that would maximize the throughput of process bottlenecks, mainly on the comminution circuit, with their corresponding down-stream adjustments in the recovery and dewatering circuits that allowed the process to be ramped-up to 4.3 Mtpa. The de-bottlenecking study in the comminution stage involved investigating the nominal operating rates of the SAG mill and the ball mill as the two major processing rate-determining operations in the plant. The studies considered the shifting of load either towards the front-end (adjustments to the primary crusher) or towards the back-end (installation of a tertiary grinder), vis-à-vis their effects to the mesh-of-grind prior to the recovery. The different process configuration alternatives in consideration were rationalized based on balancing the processing efficiency indicators (i.e. metal recovery) with financial performance in terms of additional capital and operational expenses, cash flow, return of investment, and net present value, to arrive at the most optimized design being proposed to be implemented in the Project expansion, currently from 3.5 Mtpa to 4.3 Mtpa.

1.4.1 No Project Alternative

In 2017, the Didipio Mine contributed around PhP 7.32 Billion in taxes, salaries and wages, local, regional, national procurement, and community development programs. Other opportunities, without the project, are listed below:

1. Around 4000 jobs created both direct and indirect employment
2. Social development management program and other community development projects i.e. roads, electricity, and other infrastructure projects, scholarship grants, health programs, livelihood projects
3. National and local business taxes, royalties, and other government fees
4. National and local procurement of materials, supplies for the mine
5. Economic activity created by the mine i.e. businesses established, 11 Cooperatives created, flow of goods and commodities within and outside Didipio.

1.5 Project Components

Summary and brief details of project components are presented in Table 1-2 while Figure 1-4 presents the general layout of facilities of the project indicating the location, boundaries and footprint of the project facilities.

Table 1-2: Brief Details of Project Components

Project Component / Facility	Status	Details (Area, size, capacity, etc.)	Location
Open Pit	Dewatering Operation	• Approximately 53.14-hectare area (modified as per re-optimization study which resulted to a smaller pit area compared to previously reported 70 ha); • Length/ width: 850 m NS, 800 m EW; • Final Pit Floor: 460 masl (RL 2460) • Approximately 29.9 million tonnes of ore and waste have been mined in 2015 from stages 3, 4, 5, and 6 of the open pit • The ultimate pit is planned to contain 130.6 million tonnes of ore and waste	Didipio mine
Underground Mine	Under development	• Started development in Q1 2015 • 4.2 km access decline • Decline size: 5.8 m (w) x 6.2 m (h) • Stope design: LHOS • 20 m (w) x 20 m (l) x 30 m (h) stope shape • Breccia zone stope design 10 m (w) x 20 m (l) x 15 m (h) stope shape	Didipio mine
Paste Plant	For commissioning and Operation	• Rated capacity: 150 m^3/hr • Area: 2 has (approximate)	
Dewatering bores	All dewatering bores were decommissioned as of 30 July 2018	• Three (3) dewatering bores supplied make up water for process plant and camp water (already decommissioned) • Water from the underground (UG) dewatering at the pit will be the new source of raw water	Didipio mine
Processing Plant	Operational	• Area approximately 11.61 ha	Didipio mine
Waste Rock Dump	Operational and ongoing development	• 33 Mt remaining capacity (based on WRD concept) • Maximum height: (RL 2812) • Area approximately 70 ha	2 km upstream of open pit, Barangay Didipio
All-weather access road	Operational and with on-going maintenance	• 30 km	Barangay Dibibi-Tucod to Didipio site
On-site power supply (Diesel generator)	Operational	• 16 MW	Didipio mine
Accommodation Camp	Operational	• Good for 600 personnel	Didipio mine

Project Component / Facility	Status	Details (Area, size, capacity, etc.)	Location
Warehouse	Operational	• Area approximately 1.50 ha	Didipio mine
Security gatehouse and gate (APD facilities)	Operational	• Total area approximately 0.38 ha	Didipio mine
Communication Tower	Operational	• 23.3-meter high coupled with generator, guardhouse and fenced perimeter	Didipio mine
Environmental Laboratory	Operational	• Area approximately 0.1 ha	Didipio mine
Fuel Storage facility	Operational	• 1 million-litre storage capacity	Didipio mine
Light Vehicle and Heavy Vehicle Wash Bay	Operational	• Suitable for light vehicles and 100-tonne trucks	Didipio mine
Heavy Vehicle Workshop	Operational	• Suitable for four (4) heavy vehicles workshops	Didipio mine
Ore Stockpile	Operational	• Area approximately 42.59 ha	Didipio mine
ROM Pad and Mill Plant	Operational	• Area approximately 5.06 ha	Didipio mine
Construction Overflow (CCO) Camp	Operational	• Area approximately 0.62 ha	Didipio mine
Administration Buildings (Admin 1 and 2 Offices)	Operational	• Administration 1 building offices: APD Office, HV Office, CRC Office, Accounting Office, Office of the GM, Compliance Office, and Legal Team's Office • Administration 2 building offices: Mining Office, IT Office, RBO Office, Project Office, DELTA Office.	Didipio mine
Light Vehicle Workshop & Mobile Services Office and Site Services Maintenance and Office Area	Operational	• Area approximately 1.99 ha	Didipio mine
Core Shed and Exploration Office Area	Operational	• Area approximately 1.5 ha	Didipio mine
Operation/ Accommodation Village: 1. Senior Management accommodation - 2 of single bedroom bunkhouse with separate ensuites, lounge-room and kitchenette; 2. Management accommodation – 48 single bedrooms with	Operational	• Approximately with a capacity of 566 personnel	Didipio mine

Project Component / Facility	Status	Details (Area, size, capacity, etc.)	Location
separate ensuites; 3. Professionals and Superintendents – 132 bedrooms with shared ablutions between two rooms. 4. Rank and File accommodation - 48 eight bed rooms with shared ablutions block for a total of 384 bed 5. Kitchen and mess suitable for 200 persons in one sitting 6. Accommodation camp gatehouse 7. Accommodation camp laundry and linen storage 8. Recreation room 9. Camp offices 10. Tennis/basketball court 11. Shower and ablutions blocks 12. Emergency generator 13. Clinic			
Pollution Control Structures/Facilities			
Tailings Storage Facility (TSF)	Operational and ongoing development	• 50.74 Mt • Maximum embankment height: 100 m (RL 2820) • Area approximately 65 ha	2 km upstream of open pit, Dinauyan Valley, Barangay Didipio
Activated Sludge Sewage Treatment Plant (STP)	Operational	• 2,000-person cells	Didipio mine
Hyper Ozonation facility near the STP MSA	Under commissioning	• Sewage water to Potable water	Didipio mine
Water Treatment Plant	Operational	• Dimensions: 34-meter diameter clarifier • Flowrate capacity: > 2,000 m^3/hr	Didipio mine
Sanitary Landfill	Operational	• Level 2 sanitary landfill	Didipio mine

Project Component / Facility	Status	Details (Area, size, capacity, etc.)	Location
Centralized Temporary Hazardous Waste Storage Facility	Operational	• 2 units 40-footer designed to specification hazardous waste container van	Didipio mine
Forest Nursery			
OGPI Central Nursery	Operational	• Area/Size: 4.5 Hectares. • Seedlings Production Capacity: 600,000 seedlings. • Facilities: Macro-Somatic Seedlings Propagation, Nursery Office, Tools & Equipment Storage Room, Hardening Area, Germination Beds, Recovery Shed, Guard House, Piggery, Poultry House, Training Building, Organic Vegetable Propagation Nursery, Composting Area, Vermiculture Area, Organic Concoction Formulation Building, Azolla Pond, Hedge Garden, & Toolbox Meeting Area. • Nursery Manpower: Eighteen (18) Nursery Workers and Three (3) Security Guards on a rotational duty.	Barangay Tukod, Kasibu, Nueva Vizcaya (within the FTAA area of OGPI)

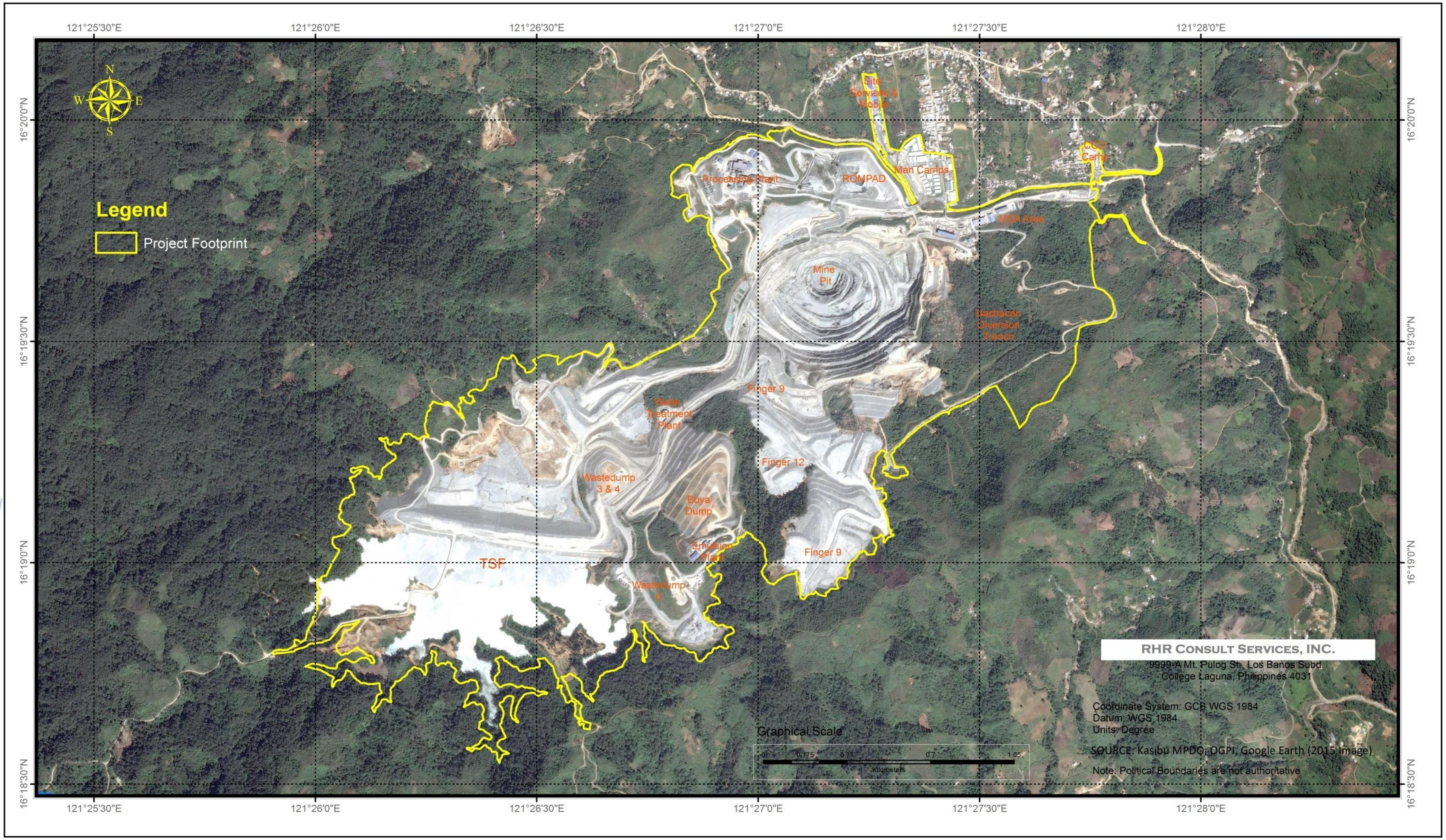


Figure 1-4: Google Earth Image (2015) of the Project with Major Components Indicated

1.5.1 Proposed Modifications

The increase in annual mill plant throughput capacity to 4.3 million tons will not cause any changes in terms of the total project area, total project footprint or any other project components such as the mine pit, TSF, etc.

PROJECT SIZE		
Project Aspect	Description / Specifications	
	Existing / Approved	Proposed Modification / Expansion
Total Project Area	The approved Partial DMPF for the Didipio operation covers 975 hectares within FTAA 001 boundaries	No changes.
Total Project Footprint	The existing total footprint area is 391 hectares (as of Q2 2018) which is within the boundaries of approved Partial DMPF area.	No changes. The proposed increase in plant throughput will not involve an increase in footprint area
Open pit	Approximately 53.14 hectares; Length/ width: 850m NS, 800m EW; Pit Floor: RL 2460m The ultimate pit is planned to contain 130.6 million tonnes of ore and waste.	No changes.
Plant Throughput Capacity (Annual)	3.5 Million tons per annum (Mtpa)	**Increase annual Plant throughput capacity to 4.3 Mtpa**

1.5.2 Power and Water Requirements

1.5.2.1 Energy

Process plant power requirements were approximately 10 MW in the first 18 months of operation since commissioning, with an increase of 1 MW occurring with the ramp-up in throughput to 4.3 Mtpa from increased ball mill charge, third stage tailings pumps, pebble crusher and an increase in overall slurry pumping volumes.

Currently, the Didipio Gold/Copper Project is already connected to the 69 kV Overhead Power Line ("OHPL") of the National Grid Corporation of the Philippines' (NGCP) transmission system at Bayombong, Nueva Vizcaya, through a Power Supply Agreement with Nueva VIzcaya Electric Cooperative (NUVELCO). Nonetheless, the 15 MW diesel generators will be maintained as a back-up power supply in case of power interruption from the grid.

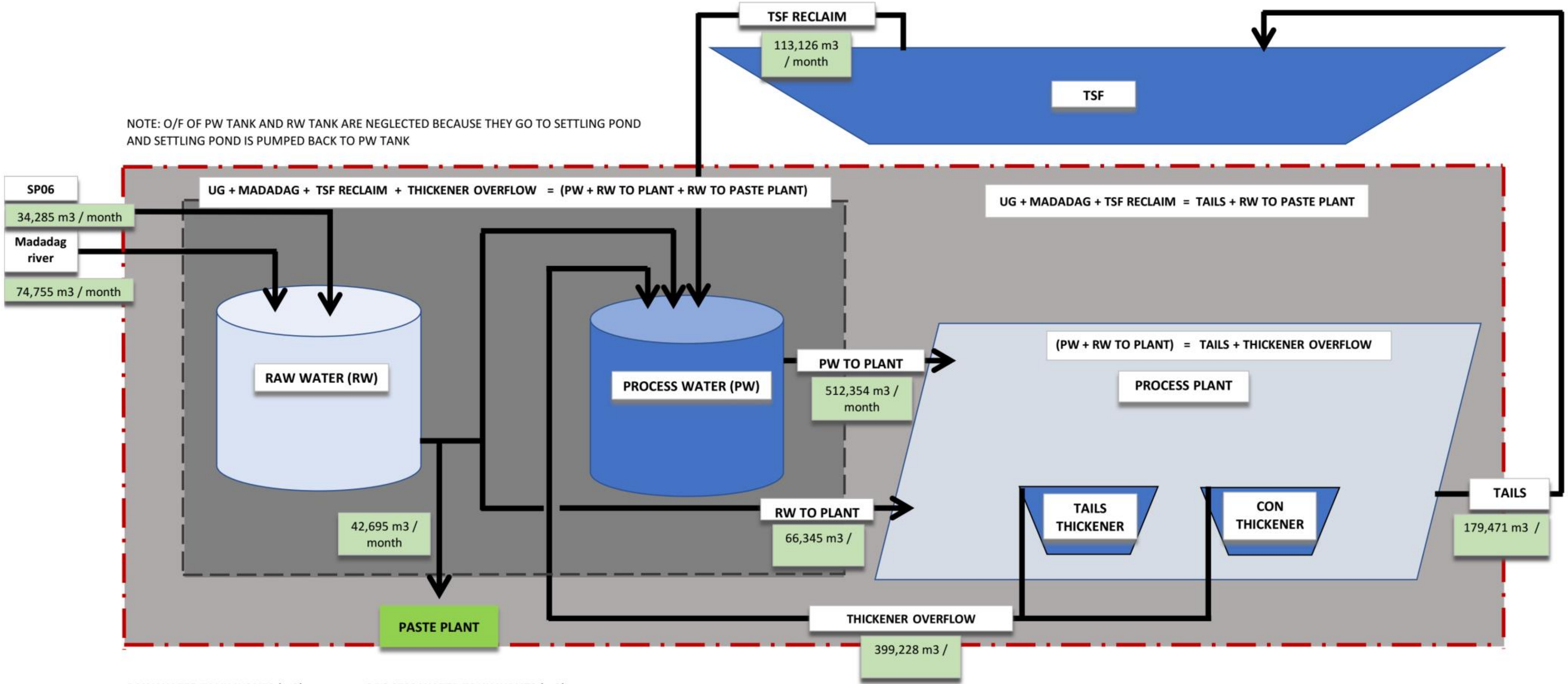
1.5.2.2 Water

The daily water demand for the Didipio operation at 3.5 Mtpa is approximately 20,000 m^3 (Figure 1-5), of which the majority is recycled water for the process plant, sourced from decant water from the thickeners and the tailings pond. Any fresh makeup water was previously sourced from two deep bores located at the perimeter of the open pit mine. These bores serve to depressurize the pit wall to improve the wall stability as well as providing a source of fresh water. As of 30 July 2018, all dewatering bores have been decommissioned. Water from the underground (UG) dewatering at the pit will be the new source of raw water to be supplied to the process plant (make up water) and camp (domestic use).

Recycle rates of process water are high, exceeding 90 % with the only raw water makeup into the system from services requiring higher quality water.

The daily water demand for the proposed expansion of 4.3 Mtpa is estimated to be 22,000 m^3 (Figure 1-6).

PROCESS PLANT WATER BALANCE



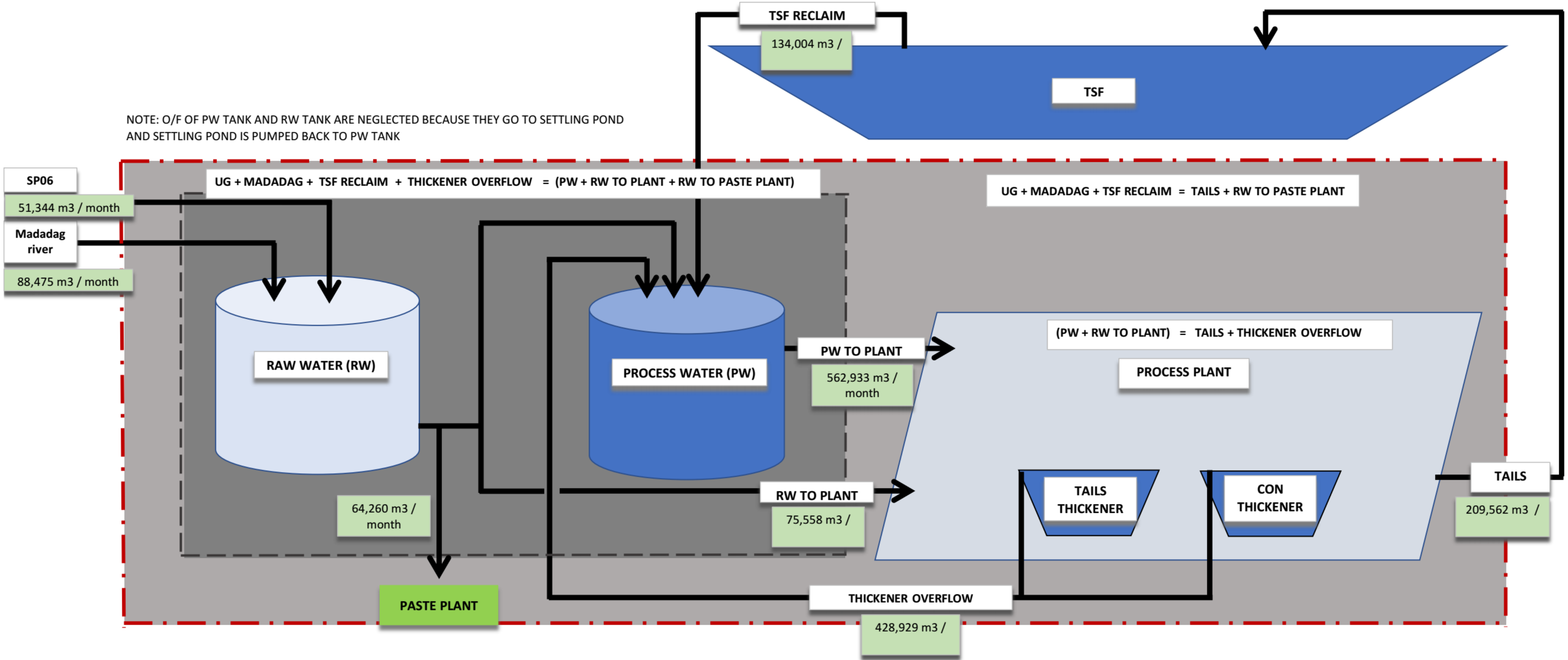
RAW WATER TANK INPUTS (m3)		PROCESS WATER TANK INPUTS (m3)	
Madadag river	74,755	TSF reclaim	113,126
Underground	34,285	Thickener overflow	399,228

RAW WATER TANK OUTPUTS (m3)		PROCESS WATER TANK OUTPUTS (m3)	
Process Plant	66,345	Process Plant	512,354
Paste plant	42,695		

RAW WATER & PROCESS WATER BLOCK % RECYCLE: 82.5 %

Figure 1-5: Water balance for 3.5 Mtpa

PROCESS PLANT WATER BALANCE



RAW WATER TANK INPUTS (m3)	
Madadag river	88,475
Underground	51,344

PROCESS WATER TANK INPUTS (m3)	
TSF reclaim	134,004
Thickener overflow	428,929

638,491
67.17853

RAW WATER TANK OUTPUTS (m3)	
Process Plant	75,558
Paste plant	64,260

PROCESS WATER TANK OUTPUTS (m3)	
Process Plant	562,933

RAW WATER & PROCESS WATER BLOCK % RECYCLE: **80.1 %**

Figure 1-6: Water Balance for 4.3 Mtpa

1.6 Process / Technology

1.6.1 Mining Methods

The Didipio deposit was being mined previously by open pit and currently by underground methods in its expected 15 years mine life (2013 start). The plan is based on a 220-meter deep open pit mined to an elevation of 2,460 mRL and underground mining by LHOS below the open pit. This is a shallower open pit and a larger underground than was previously reported.

1.6.1.1 Open Pit Mining

Open pit pre-strip operation started in January 2012 and was completed last July 2017; ore mining began in the mid-2012 and was stockpiled until the process plant started in December 2012. Materials mined during the pre-strip phase were used for the run of mine (ROM) stockpile base and used in the TSF embankment construction.

The mining method at Didipio open pit is conventional drill, blast, load and haul with standard mid-sized mining equipment comprising 90 tonne class off-road haul trucks and 200-tonne excavators. OceanaGold has had a mining contractor for open pit operations, in place since commencement of the pre-strip in January 2012. The mining fleet and ancillary fleet are owned and financed by the contractor.

Details of the mine design parameters are shown in Table 1-3.

Table 1-3: Mine Design Parameters

Parameter	Value	Parameter	Value
Pit Slopes Above base of total oxidation: • Bench height • Bench slope • Berm width • Inter-ramp slope	 20 m 45 to 37 deg 8 m 30 to 41 deg	Pit Slopes Below base of total oxidation: • Bench height • Bench slope • Berm width • Inter-ramp slope	 20 m 65 to 75 deg 8 to 10 m 46 to 50 deg
Blasting bench height	10 m	Default waste density	2.56 t/bcm
Ramp grades	10 %	Final stacked waste density	2.11 t/bcm

1.6.1.2 Underground Mining

The proposed underground mine design targets the extraction of 1.6 million tonnes per annum of ore by the LHOS mining method. This mining method is suitable for the geometry and ground conditions of the Didipio underground resource. Paste backfill with binder additive has been incorporated into the design to enable a primary-secondary extraction sequence, to maximize both resource recovery and mining productivity.

A main decline from a surface portal located in the east wall of the open pit will be used to access the mine. A fleet of 17-tonne Load Haul Dump (LHD) loaders and 60-tonne trucks will be used for material loading and transport from the underground working areas through an internal ramp system that connects all levels to the main decline. Loading will occur in close proximity to the stoping areas and ore will be hauled directly to the existing coarse ore stockpile (ROM) adjacent to the processing plant.

Key mine infrastructure includes two exhaust ventilation raises with accompanying primary fans, an intake fresh air raise, a paste backfill plant with associated infrastructure and an underground dewatering system. Excavation of underground drill platforms to facilitate infill drilling will also be a priority.

The LHOS mining method is a commonly employed, high-production, low-cost mining method that is suited to steeply dipping tabular-like ore bodies. The method allows a high degree of mechanisation and offers good mining selectivity, good recovery and is relatively flexible to suit variable geometries and ground conditions. It is also considered to be relatively simple to implement. Typical LHOS arrangement is presented in Figure 1-7.

The LHOS mining method can provide a high production rate once sufficient stopes are accessed. The method is considered low-risk because mining crews do not have to enter the stope void.

Production can commence once the top and bottom development ore drives (in ore) are established and the expansion slot raise is mined between the two levels. Drilling of the slot raise and production rings will be with a top hammer drill rig. For the study, downholes have been assumed, although it is expected that production drilling will be a combination of both upholes and downholes.

LHOS is a non-entry method, with remote mucking of blasted ore required once the stope brow is open to the extent where the operator may be exposed to uncontrolled sloughing from the stope cavity. To protect the operator from the remotely operated loader, a remote mucking stand is the minimum requirement; a remote mucking cubby excavated into the ore drive sidewall may also be used.

Once mucking of blasted ore is complete, backfilling commences with the placement of paste backfill that will be re-exposed during the extraction of the next stope in sequence. Once sufficient curing time has been allowed (scheduled at 28 days), the immediately adjacent stope can commence extraction.

The mine is designed to have 30-meter production levels which will be connected to the main decline via a series of level and footwall access. Each level is designed with provisions for ventilation, dewatering, services (electrical), material handling and other associated infrastructures. The current design parameters for development drives are summarized in Table 1-4 while Figure 1-8 shows a typical level development of the mine.

Table 1-4: Development Profiles

Lateral Development Profiles	Width (m)	Height (m)
Decline	5.8	6.2
Decline Stockpile	5.5	5.8
Level Access / Loading Bay	5.5	5.8
Sump / Paste Cuddy/Drill Drive / Dewatering Drive	5.0	5.0
Fresh Air Drive / Return Air Drive / Level Stockpile	5.0	5.0
Footwall Drive	5.0	5.0
Ore Drive	4.5	5.0
Slot Drive	5.0	5.0
Vertical Development Profiles	**Width (m)**	**Height (m)**
Ventilation Raise (Longhole Blasted)	4.0	4.0
	Diameter (m)	
Primary Vent Raises	4.0	
Escapeway Raise	1.8	
Drain Hole / Paste Backfill Hole	0.3	

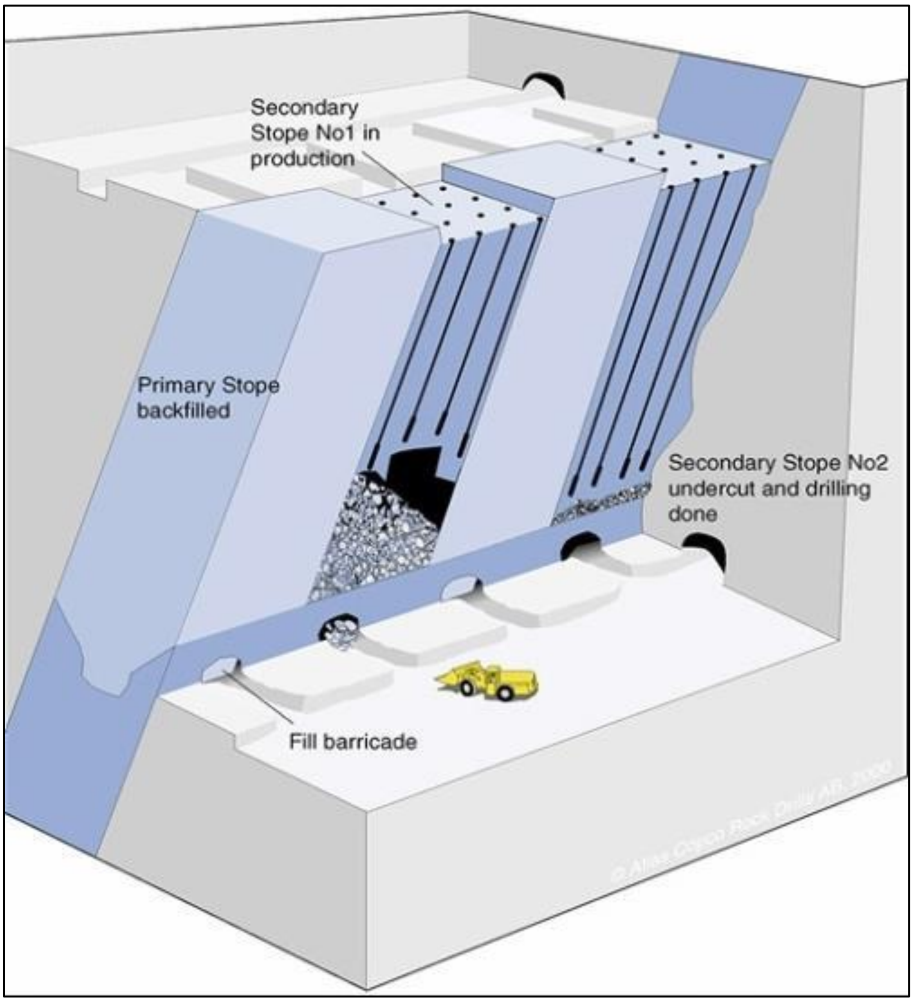


Figure 1-7: Typical long-hole open stoping (LHOS) arrangement

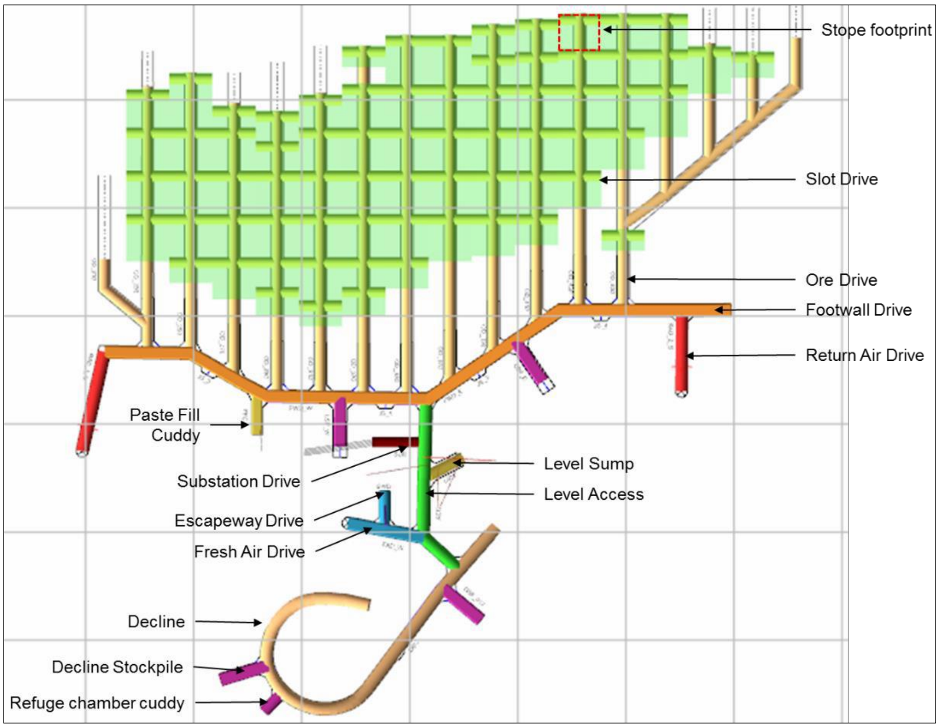


Figure 1-8: Didipio Underground Mine Design – Level Plan

The mine design includes a significant amount of raise development to establish and extend the primary air circuit. Two exhaust raises and one fresh air raise to surface will be required. As the mining levels are developed from the access decline, the primary circuit will be extended by raisebore excavations. Emergency egresses are established by developing 1.1-meter diameter raises that extend level to level and fitted with modular escape way ladders. Service holes of various sizes will be drilled to establish the network for pastefill, pumping, electricity and compressed air throughout the mine.

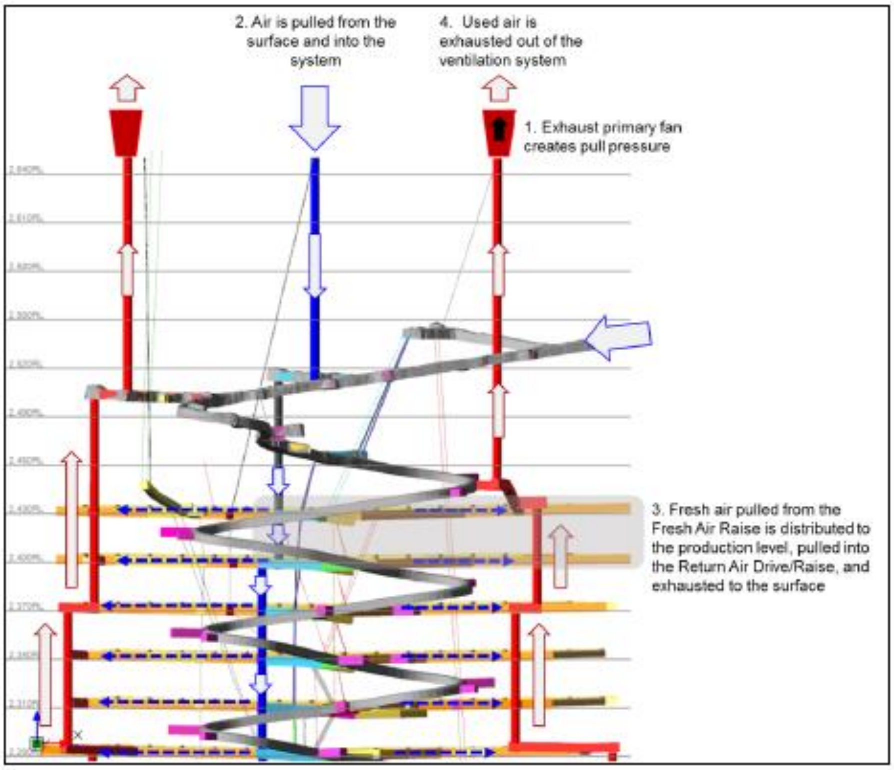
Key mine infrastructure includes two primary fans that connect to the exhaust raises, a paste backfill plant with associated infrastructure and an underground dewatering system.

Mine infrastructure will also include the following:

- Mobile refuge chambers;
- Substations installed as the decline advances;
- Dewatering stations and a suite of local settling sumps;
- Drill drives for diamond drilling infill.

Life-of-mine primary ventilation is established through a series of fresh air raises and return air raises that are constructed as the mine progresses deeper. Ventilation is designed as a “pull” or exhausting type system.

A combination of primary and series ventilation is used. More polluting activities such as production bogging, backfill placement and high-intensity development are primary ventilated to exhaust. Low-intensity development and non-diesel activities can be series ventilated upstream of other activities on the level. Level development activities prior to the establishment of primary ventilation on the levels are series ventilated off the decline. The Life-of-mine ventilation network is presented in



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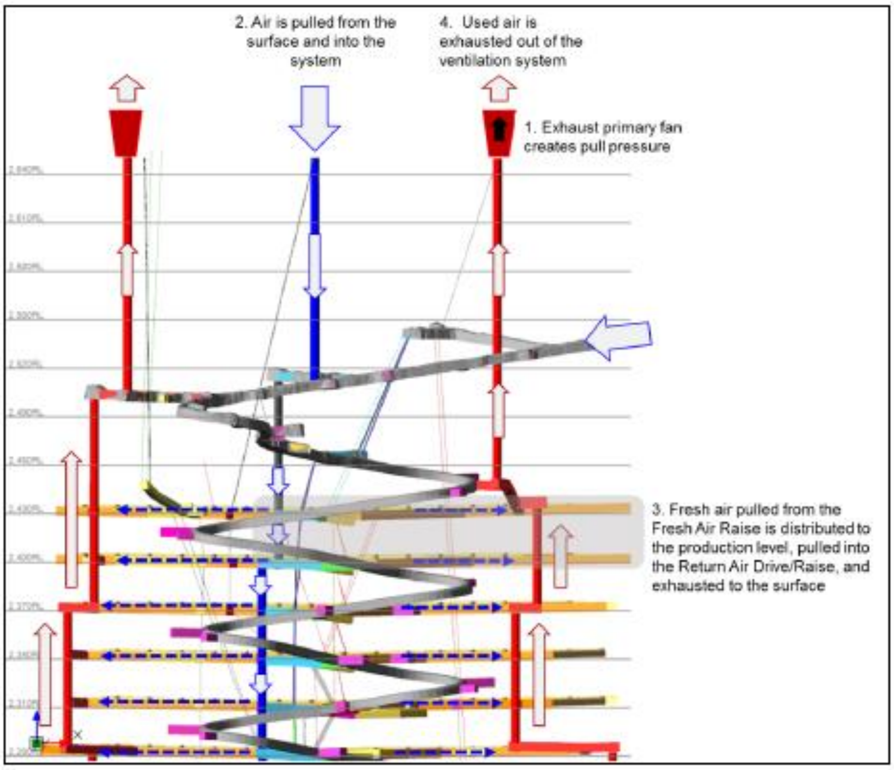


Figure 1-9: LOM Ventilation Network

The capital dewatering system for Didipio underground is designed to have three main pump stations at successively higher levels in the mine. The system is designed to pump 450 l/s maximum flow from the lowest level to the sediment ponds adjacent to the green tank at the surface. The capital pump stations and duties are summarized in Table 1-5 , and the life-of- mine dewatering schematic is provided in Figure 1-10.

Table 1-5: Pump Station Duties

Pump Station	Static head (m)	Total dynamic head (m)	Flow (l/s)
Capital Pump Station RL 2540 (Located at surface, Portal 2)	160	180	450
Capital Pump Station 2 (RL 2270)	270	322	450
Capital Pump Station 1 (RL 2010)	270	322	450

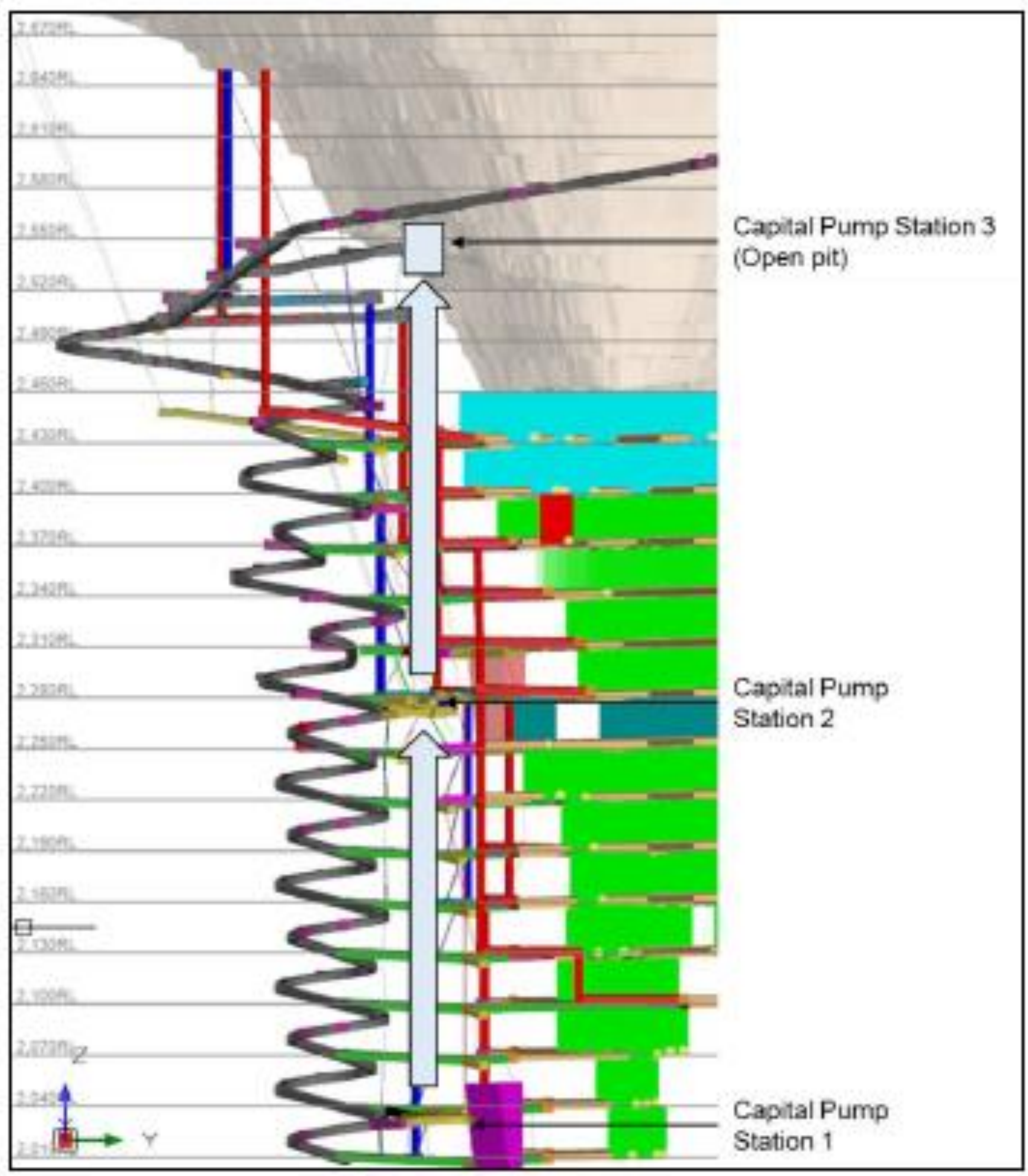


Figure 1-10: LOM Dewatering Schematic

1.6.1.3 Grade Control

Blast hole sampling was implemented in 2013, but was subsequently replaced by Reverse Circulation (RC) drilling in 2014. RC grade control drilling is oriented along a grid running parallel (azimuth 135) to the long axis of the mineralization. Drill spacing in the long axis is 10 m by 8 m across the long axis, on a staggered pattern. Inclined drilling (inclined 60 degrees to the south) was introduced in August 2014. Drilling was previously vertical, with 30 m length drilled on half patterns collared every 15 m to provide 10 m x 8 m drilling for the first 15 m and 10 m x 16 m for the next 15 m to 30-meter interval. This ensures fully drilled grade control stocks for 4 m x 3.75 m flitches, and an additional, 4 m x 3.75 m flitch drilled to half density for short term planning.

Ore block outlines are based on 5 m x 5 m ordinary kriged grade control model blocks, using gold equivalence grade. The ore block geometries are designed to allow efficient mining, whilst honoring modelled grade boundaries as much as possible.

Oxide, transitional and fresh metallurgical distinctions provide further classification, where this is based upon the extent of sulfide corrosion, rather than host rock weathering per se (almost all oxide/ transitional ore has now been mined). Where practical, rock-types are separated.

1.6.1.4 Underground Drill and Blast

Due to high levels of ground water encountered, emulsion explosive is being utilized in all the blast holes. An emulsion manufacturing plant was constructed late 2013 and commissioned in first quarter of 2014. A Mobile Mixing Unit (MMU) transports emulsion from the manufacturing plant to the designated blasting area. The emulsion plant and MMU operation is contracted to the explosives supplier, Orica.

Detonators, boosters, and packaged explosives are stored in an explosive magazine located south of the open pit.

1.6.1.5 Material Handling

All material rehandling is via the 90-tonners and 50-tonners class off-road haul trucks, with blasted rock from the pit loaded with Komatsu PC2000 and Komatsu PC1250 excavators.

High-grade ore is being hauled directly to the ROM with other medium and low grade ore hauled to long-term stockpile. Ore on the ROM is being re-handled into the crusher using front end loaders.

1.6.2 Process Plant / Mill

Recovery of copper and gold at Didipio is being achieved with froth flotation following a conventional SAG Mill-Ball Mill grinding circuit. The design criteria for the Process Plant were established from test work which has been successfully running since its commissioning.

The first ore was introduced to the plant on 14 December 2012 and the plant commenced commercial production on 1 April 2013.

Figure 1-11 shows the process flow with the corresponding material balance which utilizes a conventional process for recovery of a gold-copper concentrate and doré. The pebble crusher on the SAG mill trommel overflow was installed and was online before the end of 2014 which have ramp-up the throughput to 3.5 Mtpa.

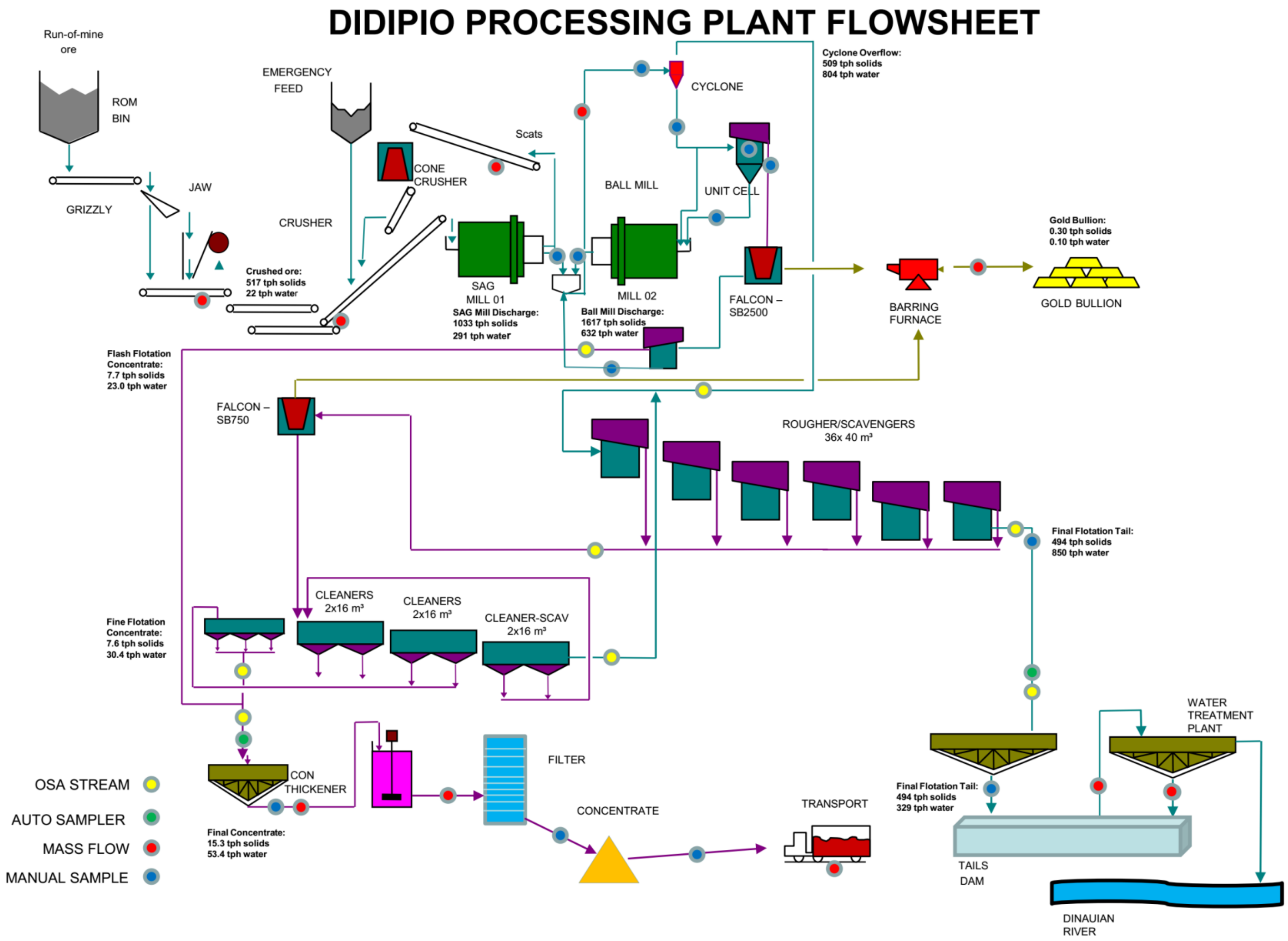


Figure 1-11: Process Plant Flowsheet with Material Balance

1.6.2.1 Process Plant Facilities Description and Design Characteristics

1.6.2.1.1 Primary Crushing

The crushing circuit is situated next to the ROM pad. Mining trucks haul ore from the open pit to the ROM pad. ROM ore is fed by a front-end loader ("FEL") through an 800 mm square aperture static grizzly into a 100-tonne live capacity ROM bin. The FEL is required to remove oversize material retained by the static grizzly.

The ROM ore is reclaimed from the ROM bin by an apron feeder and is discharged on to a static grizzly into a single toggle crusher. Fines will bypass the crusher. Static grizzly bars are set at nominally 100 mm clearance.

The single toggle crusher, selected to handle 900 mm maximum lump size, crushes the ROM ore to a typical P_{80} product size of 100 mm. An overhead travelling crane is provided for changing out crusher jaw plates and for maintenance on other adjacent equipment. Dust suppression water sprays are provided at the ROM bin and at the head of the transfer bin feed conveyor, emergency stockpile feed conveyor and SAG mill feed conveyor. The sprays will be automatically turned on/off from the plant control system.

1.6.2.1.2 Crushed Rock Handling and Storage

The ore from the crusher is transported via conveyor one (CV-001) and CV-006 to a transfer bin. The transfer bin has a live capacity of approximately 15 minutes of mill feed. An apron feeder located beneath the bin transfers the crushed ore onto the mill feed conveyor CV-003, if CV-003 (or the SAG mill) is offline a diverter gate at the top of the bin directs the ore onto CV-002 the Emergency Feed Ore ("EFO") conveyor, CV-002 discharges ore onto a 5,000-tonne emergency stockpile. Ore from this pile is rehandled to form a 12,000-tonne alternative ore supply to provide 24 hours of feed if required.

If the crusher is offline then the ore from this emergency stockpile is fed onto CV-003 via the emergency feeder which is a low profile belt feeder. The ROM FEL is utilised to feed this emergency feeder as required. This allows crusher maintenance to be done outside of mill shutdowns, to reduce overall manning levels.

1.6.2.1.3 Primary and Secondary Grinding

The 7.3 m diameter by 4.57 m effective grinding length ("EGL") grate discharge SAG mill is fitted with steel liners and pulp discharges and initially processed 2.5 Mtpa of ore. The SAG mill is equipped with a 4,300 kW wound rotor induction motor and Liquid Resistance Starter ("LRS") and has capability to provide speed variation through a Slip Energy Recovery ("SER") unit.

Media charging is from 900 kg drums of 125 mm grinding balls via a kibble to the mill feed chute. A target ball charge of 12 % is maintained with a media addition rate of 0.28 kg/tonne of feed. Mill load is determined from monitoring the hydrostatic pressure in the trunnion mill lube system and controls the mill feed rate. A microphone is used to monitor the mill for low load conditions to allow the mill speed to be reduced to minimise liner damage.

Discharge from the SAG mill flows through a rubber-lined trommel and into a common mill discharge hopper. Oversize from the trommel screen (scats) is directed first to a wash screen to remove fine particles then moves to the scats recycle conveyor. The scats recycle conveyor discharge is directed into the pebble crusher feed bin which supplies a Sandvik CH-440 pebble crusher, this reduces the scats size to < 12 mm and the crushed material then transfers back via conveyor to the mill feed conveyor. During maintenance of this pebble crushing circuit a diverter gate and second conveyor can be used allowing the crusher to be bypassed.

The 5.5-meter diameter by 8.38 m EGL rubber lined ball mill is fitted with a 4,300 kW wound rotor induction motor, LRS, trommel screen and retractable feed spout/chute. Discharge from the ball mill flows through a rubber-lined trommel into the common mill discharge hopper. The combined SAG and ball mill discharge is pumped to a nest of eight Krebs 20" hydrocyclones. The hydrocyclone underflow is split, with approximately

40 % reporting to ball mill feed. The other 60 % reports to an Outotec SK-500 Flash Flotation Rougher cell for recovery of the coarse liberated gold and copper particles. The concentrate from the Flash Flotation Rougher reports to a gravity circuit and the hydrocyclone overflow gravitates on to the flotation rougher circuit.

The Flash Flotation Rougher utilises the twin outlet design with the low density top valve tailings reporting to the common mill discharge hopper to maintain ball mill density.

1.6.2.1.4 Gravity Circuit

The purpose of the gravity circuit is to recover free gold from the Flash Flotation concentrate. The gravity circuit utilises a Falcon SB2500 concentrator batch concentrator. A bypass option allows the Flash Flotation Rougher concentrate to bypass the concentrator and report directly to the Flash Flotation Cleaner when the concentrator is in a rinse cycle or is offline. The other gravity circuit components consist of a surge bin for the concentrate, a Gemini table treating all the concentrate and a further Falcon model SB250 concentrator on the table tails, all of which is located in the secured area gold room.

The concentrate from the SB2500 concentrator unit gravitates to the gold room for further processing. The tailings from the concentrator reports to the Flash Flotation Cleaner TC-10 flotation cell where the coarse copper and gold bearing sulphide particles are recovered with the concentrate, then report to the combined final concentrate hopper with the Re-cleaner concentrate and pumped to the concentrate thickener. The tailings from the Flash Flotation Cleaner report to a hopper and are then pumped back to the combined mills discharge hopper to be pumped back to the cyclones.

1.6.2.1.5 Flotation Circuit

Cyclone overflow reports by gravity line to the first of six rougher flotation cells. Outotec TC-40 tank cells are used for the roughers with progressively increasing froth crowders installed down the train. Rougher concentrates are pumped to the cleaner cells, the rougher tailings report to the flotation tailings hopper for pumping to the tailings thickener.

Concentrate from the cleaner cells feeds the bank of re-cleaner cells. Tailings from the re-cleaner cells re-join the rougher concentrate as feed to the cleaner cells. Concentrate from the re-cleaner cells will be directed to the final concentrate pumpbox and then transferred to the concentrate thickener. The tails from the cleaner cells feed into the cleaner-scavenger cells with the tailing from these cells reporting to the cleaner-scavenger cells. The tails from the cleaner-scavenger cells reports to the flotation tails pump box.

The concentrate from the cleaner/cleaner-scavenger cleaner cells can be fed to either the feed of the re-cleaner cells or the cleaner cells dependent on concentrate grade. The concentrate from the cleaner-scavenger cells reports back to the feed of the cleaner cells.

1.6.2.1.6 Concentrate Handling

Final copper concentrate is thickened in a 12-meter diameter high rate thickener fitted with a van feedwell and deaeration tank. The underflow is pumped at about 60-70 % solids to a 400 m^3 storage tank, a second 400 m^3 tank provides extra storage if needed during filter downtime. An Outotec PF-930 horizontal plate pressure filter press produces a concentrate filter cake at about 8 % moisture, which will be suitable for transport and sea freight to smelter customers.

The filter cake discharges to a concentrate stockpile of about 15 days capacity located within the concentrate storage shed. The concentrate is loaded into rigid trucks using a FEL with a nominal payload of 20 wet tonnes per load. Composite samples are prepared from trucks as they are loaded, for moisture and metal content. A weighbridge weighs all trucks leaving site to account for movement, inventory control of material and tracking for permit requirements.

Concentrate is trucked by road to a storage shed located at Poro Point, La Union with the capacity to hold up to 15,000 t of material. Ships are loaded periodically in 5,500 or 11,000 t shipments. Turnaround time for the concentrate trucks averages 27-32 hours.

1.6.2.1.7 Tailings Handling

Combined flotation tailings will gravitate to a combined flotation tailings hopper and are pumped to a 20 m diameter high rate thickener with a vane feed well. Flocculent, Magnafloc 919, is dosed to the thickener feed box by variable speed helical rotor pumps to aid in the settling of concentrate and to provide necessary clarity in thickener overflow.

Three stage variable speed thickener underflow pumps pump thickened tails to the Tailing Storage Facility (TSF) through a 250 mm steel/HDPE line approximately 2,000 m to the dam crest. Tailings then moves through a spigot manifold along the length of the dam wall allowing formation and control of the tailings beach. Approximately 200 m^3/h of decant water (a mixture of tailings transport water and rainfall in the catchment) is pumped back to the process plant for makeup water. Excess water in the catchment is pumped to the water treatment plant for release.

1.6.2.1.8 Gravity Gold Concentrate Treatment

The concentrates from the Falcon concentrator are screened with a Kason screen and the products individually retreated using a Gemini shaking table. Fine free gold is separated from the predominantly chalcopyrite/bornite primary gravity concentrate with screening utilised to improve the processing efficiency of the table. Concentrates from the table are filtered and dried prior to smelting in a standard diesel-fired barring furnace. The tailings and middlings product from the table are retreated in a small Falcon concentrator, with the concentrates joining the table concentrates for smelting. The tailings from the secondary concentrator are returned to the final concentrate pump box to minimise any gold losses from the gravity cleaning circuit.

The dried gravity concentrates are mixed in batches with fluxes designed to allow the best separation of the gold and silver into doré. These batches are smelted and poured into moulds to produce the gold/silver doré bars, which assay 85 % gold and 15 % silver. Iron and base metal levels in the bars are typically less than 3 %.

1.6.2.1.9 SABC Circuit

SABC circuits are typically deployed when critical sized material accumulates in the SAG ore charge due to low breakage rates and is regarded as quite conventional comminution practice. Removal of pebbles via large aperture grates for cone crushing in closed circuit with the SAG mill feed results in higher milling rates by coarsening the transfer size from the SAG to ball mill. This coarsening of transfer size will result in increased SAG mill capacity, typically in the region 15 to 20 per cent depending on ore characteristics which determines pebble production rates. The economic viability of this option is subject to the sensitivity of metal recovery to a further coarsening of the grind size P_{80}. A grind size P_{80} of about 140-145 microns is anticipated at a 4.0 Mtpa milling rate with a SABC circuit.

Project execution of the SABC Circuit as Phase 2 of the 3.5 Mtpa (ramp-up) project commenced in February 2014 and was commissioned early November 2014.

1.6.2.1.10 Reagents

A number of reagents are imported to the site, generally in bulk form. Hydrated lime is imported in 1-tonne bulk bags and stored in a purpose-built reagent shed. The hydrated lime is mixed with water to a solids density of about 20 % solids and distributed to the plant using a ring main system, whereby the slurry can be fed to various distribution points as required to maintain target pH. Current operations however has discontinued the procurement and use of hydrated lime in the process due to higher metal recoveries obtained with the ore’s natural pH.

Three collectors are currently used in the process plant. CMS2500 is delivered to site in 1,000-liter IBC containers and is dosed to the flash flotation feed as a primary copper collector to minimise issues with natural hydrophobicity.

SIBX is delivered in pellet form in 850 kg bags sealed inside wooden crates and mixed on site to 5 % target strength. A header tank with a control valve and flow meter, controls dosing of SIBX to three points in the rougher circuit as a secondary copper collector.

S701 is delivered in 1,000 L IBC containers and dosed to the mills discharge hopper as a free gold specific collector via peristaltic dosing pumps.

IF6500 frother comes in 1000 L IBC containers and is distributed to the selected flotation points with peristaltic dosing pumps.

Flocculent is delivered in 25 kg bags. This powder is mixed in a Ciba Jetwet mixing unit to a 0.5 % solution strength and then stored in a storage tank. Flocculent distribution is by a variable speed pump.

1.6.2.1.11 Consumables

Key consumables (Table 1-6) in the plant are the flotation reagents and grinding media and are generally transported to site from Manila with consumption for the last 12 months of operation given below. Collector consumption rates have reduced significantly from pre-commissioning estimates with natural hydrophobicity in the orebody greatly assisting in reducing collector usage. Lime will no longer be utilized as per table below.

Table 1-6: Consumable Consumption Rates

Reagent	g/tonne
Lime	0
IF6500	32
CMS2500	4
SIBX	4
S701	1
FAZFLOC MAN 4510	25.5
FAZFLOC MNI 4520	8.5
SAG Media	280
Ball Media	480

1.6.2.1.12 Control Room and Maintenance Shop

A Yokogawa CentumVP DCS system is utilised throughout the process plant and power station for process control. A permanently manned control room monitors and controls the process from the primary crusher to the TSF return water pumps. The PI Historian from OSISoft collects process and alarm data from the DCS for reporting and analysis. A maintenance workshop facility is located adjacent to the process plant allowing for overhaul of equipment on site.

1.6.2.1.13 Metallurgical Laboratory

A metallurgical laboratory is located adjacent to the maintenance workshop and is provisioned with a laboratory rod mill, L40 Falcon Concentrator, flotation cells, pressure filters, ovens, rotary splitter and cyclosizer. The laboratory undertakes routine diagnostic testing on the process plant, processes survey samples and future ore testing programmes on drill core samples.

1.6.2.1.14 Water Treatment Plant

The level of the decant water pond in the TSF is maintained by discharging excess water to the Dinauyan River via a Water Treatment Plant (“WTP”). The WTP currently consists of a 34 meter diameter Outotec clarifier located remote from the plant capable of treating up to 2,000 m^3/h of decant water to reduce the total suspended solids to below 30 ppm prior to discharge to the river. Local coagulant and flocculent dosing systems are provided with periodic transfer of solids underflow pumped back to the main process plant tailings thickener.

The increased throughput would only produce an additional 40-50m^3/hr of water to be sent to the TSF. This is just 2-2.5% of the WTP's current capacity. We have proven that we can actually run the WTP at 2500 m^3/hr rate which is 25% above its capacity, so the additional wastewater generated from increased milling rate is insignificant.

1.7 Project Size

1.7.1 Mineral Reserves

The combined Mineral Reserves for Didipio Open Pit and Underground are summarized in Table 1-7:

Table 1-7: Combined Open Pit and Underground Mineral Reserves Estimate

Reserve Area	Reserve Class	Tonnes (Mt)	Au (g/t)	Cu (%)	Contained Au (Moz)	Contained Cu (kt)
Open Pit	Proven	6.65	1.77	0.54	0.38	35.7
	Probable	15.44	0.61	0.42	0.30	64.8
Underground	Proven	2.25	2.48	0.47	0.18	10.5
	Probable	13.67	1.76	0.43	0.77	58.1
Stockpile	Proven	10.99	0.40	0.43	0.14	47.4
	Probable	0.00	0.00	0.00	0.00	0.0
Total Proven		19.89	1.10	0.47	0.70	93.6
Total Probable		29.11	1.15	0.42	1.07	122.9
Didipio Total (September 30, 2014)		49.00	1.13	0.44	1.77	216.5

Reserves are based on the following metal price assumptions:

- Commodity selling prices of US$1,250/oz. for gold and $3.20/lb for copper.
- The cut-off grade for the open pit reserve is 0.52 g/t AuEq and for the underground is 1.3 g/t AuEq.
- The gold equivalence grade is calculated as g/t AuEq = g/t Au + 1.638 X % Cu.

1.7.1.1 Open Pit Reserves

Using a cut-off grade of 0.52 g/t AuEq, the Didipio operation's open pit Mineral Reserves are 22.10 million tonnes at a grade of 0.96 g/t Au and 0.45 % Cu.

The reserves are evaluated within an updated final stage six pit design with a basal limit of 2460 mRL.

Table 1-8: Open Pit Reserves (30 September 2014)

Reserve Area	Tonnes (Mt)	Au (g/t)	Cu (%)	Contained Au (Moz)	Contained Cu (kt)
Proven	6.65	1.77	0.54	0.380	35.7
Probable	15.44	0.61	0.42	0.301	64.8
Total Open Pit	**22.10**	**0.96**	**0.45**	**0.681**	**100.5**

The quantity of waste within the same updated stage six pit design is 52.31 million tonnes, with a strip ratio of 2.5:1 (waste:ore).

The open pit waste quantity includes approximately 4.5 million tonnes of Inferred Resource. OceanaGold is undertaking a targeted resource definition drilling programme during Q4 of 2014 with the objective of converting near term Inferred Resource tonnes to an Indicated Resource classification. This Inferred Resource material has not been included in either Mineral Reserve totals or economic evaluation, but has been included as waste.

1.7.1.2 Underground Mineral Reserves

The 2014 study supported a reduction in cut-off grade from 1.65 g/t AuEq used in the previous study undertaken in 2011, to the current value of 1.3 g/t AuEq. A revised mine design, schedule and cost model were completed and have formed the basis for the estimation of the underground Mineral Reserve as of 30 September 2014.

Using a cut-off grade of 1.3 g/t AuEq, the Didipio underground Mineral Reserves are 15.9 million tonnes at a grade of 1.86 g/t Au and 0.43 % Cu (Table 1-9).

Table 1-9: Underground Mineral Reserves, 30 September 2014

Reserve Area	Reserve Category	Tonnes (Mt)	Au (g/t)	Cu (%)	Contained Au (Moz)	Contained Cu (kt)
UNDERGROUND	Proven	2.25	2.48	0.47	0.179	10.5
	Probable	13.67	1.76	0.43	0.772	58.1
Total Underground Reserve		**15.92**	**1.86**	**0.43**	**0.952**	**68.1**

1.7.2 Planned Mine and Mill Capacity

Annual plant throughput rate is expected to reach 4.3 million tonnes per annum over the remaining life of mine. Average annual production is projected to be 120,000 ounces of gold and 14,000 tonnes of copper per annum for the remaining life of mine.

Mining will continue to be carried out by open pit methods until the end of 2017 and thereafter by underground mining where mill feed is supplemented by surface stockpiles. The underground access decline development commenced in 07 March 2015. LHOS with paste backfill is planned to mine underground stopes below the open pit. The production profile is reported in Figure 1-12.

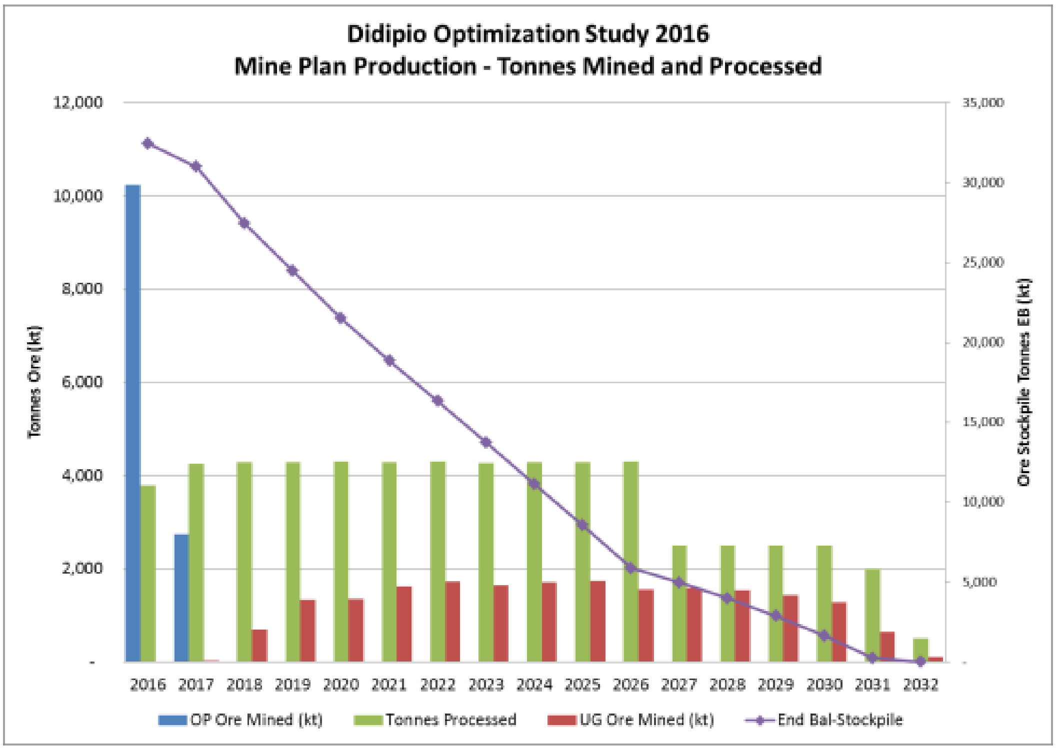


Figure 1-12: Production Summary

1.7.3 Estimated Life of Mine

The Didipio operation is an operating gold-copper mine in the northern Luzon region of the Republic of the Philippines with reserves currently estimated to be 1.77 million ounces gold and 0.21 million tonnes copper. The operating mine life remaining is 16 years or until 2032. The average ore grade is 1.13 g/t Au and 0.44 % Cu.

1.7.4 Total Project Area

The increase in annual mill plant throughput capacity to 4.3 million tons will not cause any changes in terms of the total project area, total project footprint or any other project components such as the mine pit, TSF, etc.

PROJECT SIZE		
Project Aspect	Description / Specifications	
	Existing / Approved	Proposed Modification / Expansion
Total Project Area	The approved Partial DMPF for the Didipio operation covers 975 hectares within FTAA 001 boundaries	No changes.
Total Project Footprint	The existing total footprint area is 391 hectares (as of Q2 2018) which is within the boundaries of approved Partial DMPF area.	No changes. The proposed increase in plant throughput will not involve an increase in footprint area

1.8 Development Plan, Description of Project Phases and Corresponding Timeframes

1.8.1 Open pit Development

Open pit pre-strip operations started in January 2012 and was completed last July 2017; ore mining began in the mid-2012 and was stockpiled until the process plant started in December 2012. Materials mined during the pre-strip phase were used for the run of mine (ROM) stockpile base and used in the TSF embankment construction.

1.8.2 Underground Development

As a result of the optimization study, the underground portion of the Didipio operation will be brought forward by one year with development to commence in the first quarter of 2015. Access to high grade ore will be brought forward by two years with first ore delivered for processing projected in the third quarter of 2017.

As of latest schedule, UG capital development will be completed in 2020. This includes Lateral Development and Vertical development (for ventilation). Oredrive development will continue in parallel to stoping throughout LOM. Production stoping commenced in Dec 2017 and will continue throughout LOM.

Development is currently for panel 2 (2250RL and below), whilst production stoping is being conducted for Panel 1 (2280RL and above).

1.8.2.1 Underground Pre-Production Development

Critical path pre-production activities for the underground include:

- Portal construction and development of the main decline
- Establishment of primary ventilation raises to support the advancement of the main decline
- Establishment of secondary egress
- Establishment of primary dewatering infrastructure
- Definition diamond drilling

Pre-production development will span a 36-month time frame before the first stope is mined. The ramp up to full production will require three years from the onset of stoping, with ore production commencing at the base of the upper mining block on the 2280 Level. Figure 1-13 illustrates the extent of development at the onset of stope production in Q1 Year 4.

A peak lateral development rate of 600 m per month is required, in years 3 and 4, and thereafter the maximum development rate is 550 m per month. The peak development year coincides with the availability of a large number of development headings due to the completion of the extension of the primary ventilation circuit, and with access to multiple ore headings. The majority of the headings will be of short length, and have a quick mining cycle turnaround. Additional development jumbos, loaders and trucks are scheduled for purchase in year 3 to ensure that adequate resources are available to complete the scheduled development. Approximately 60 % of the life-of-mine lateral capital development required has been completed by the end of year 3, and 25 % of the life-of-mine total lateral development.

1.8.2.2 Access and Mine Infrastructure

A 4.2 km access decline driven at a -1 in 7 gradient from the surface portal will provide access for personnel and equipment. The decline has been sized at 5.8 m (w) x 6.2 m (h) to provide adequate clearance for mobile equipment operation, and to enable a low resistance intake air way.

The access decline will be excavated whilst the open pit is still operational and the design portal elevation is 2661 mRL. The position of the portal and decline relative to the final Stage 6 pit design can be seen in Figure 1-14. Later in the mine life a connection will be mined from the decline to break back into the pit, nearer the base, which will provide an alternative means of egress and fresh air supply.

After reaching the base of the final pit design, the access decline will continue as seen in Figure 1-15 connecting to each mining sub-level and associated infrastructure as the mine deepens. Scheduling priorities include the decline, the establishment of drilling platforms for diamond drilling, primary ventilation infrastructure and the primary dewatering infrastructure.

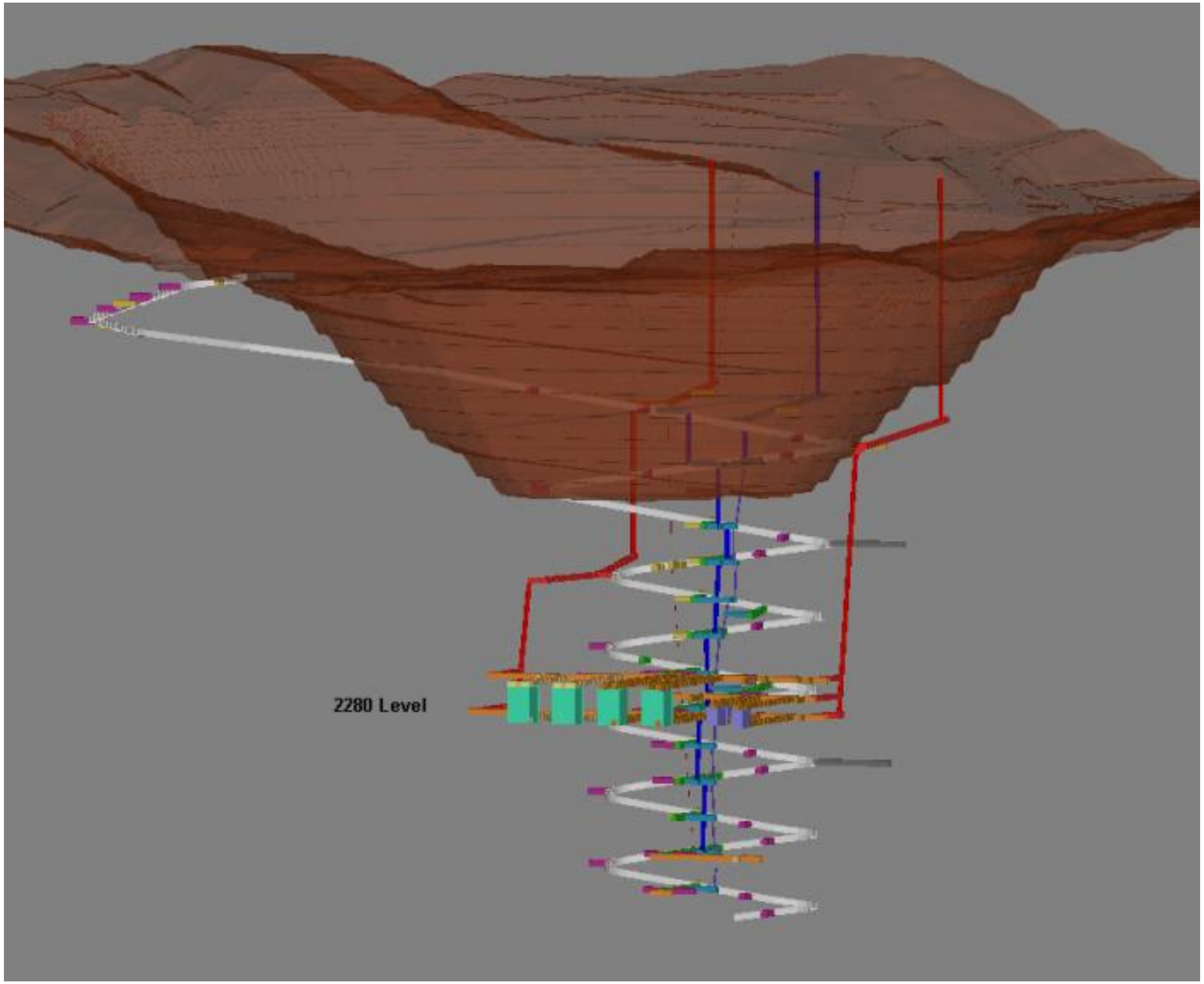


Figure 1-13: Extent of mine development at the onset of production, 2280 Level

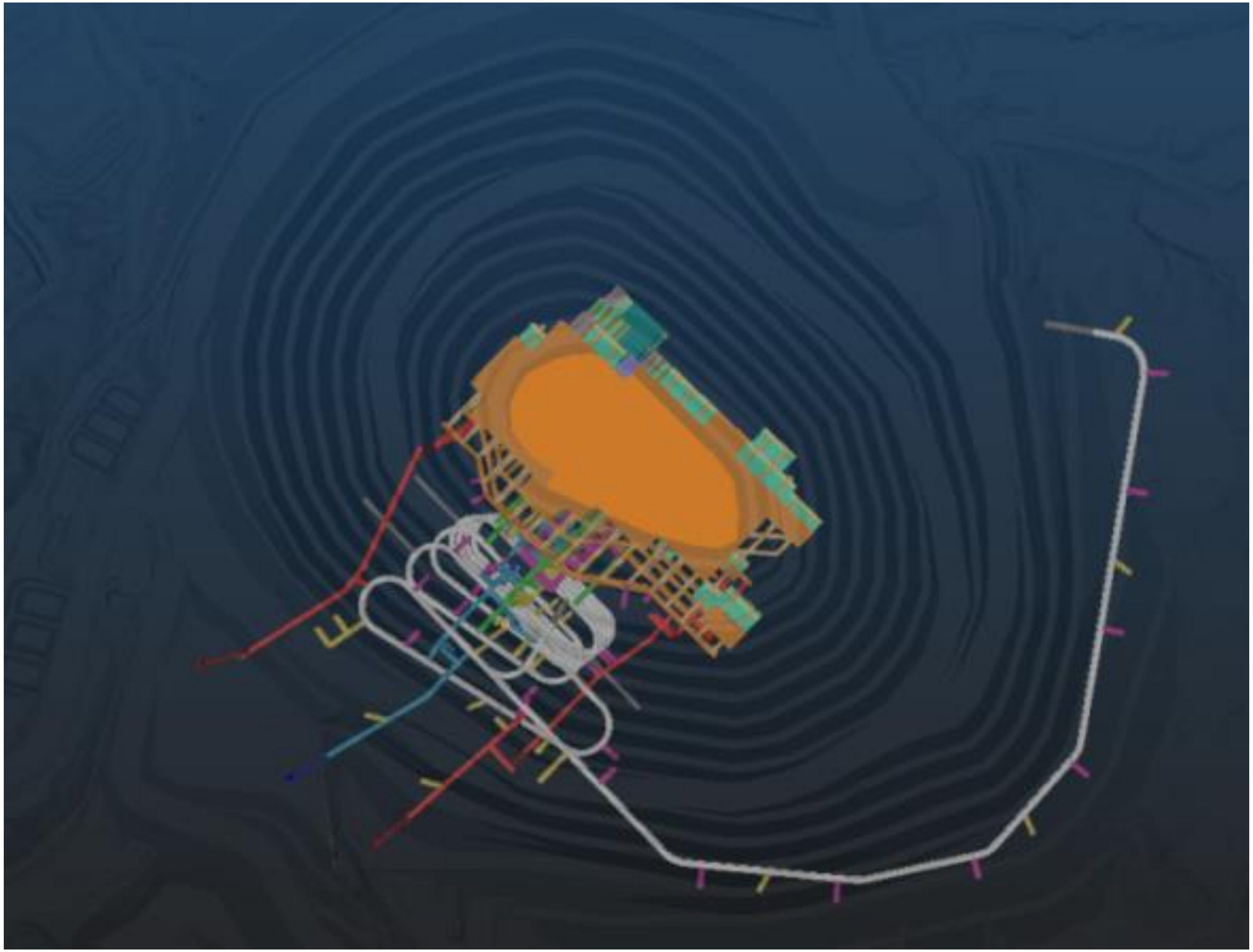


Figure 1-14: Access decline with final Stage 6 pit design - Plan View

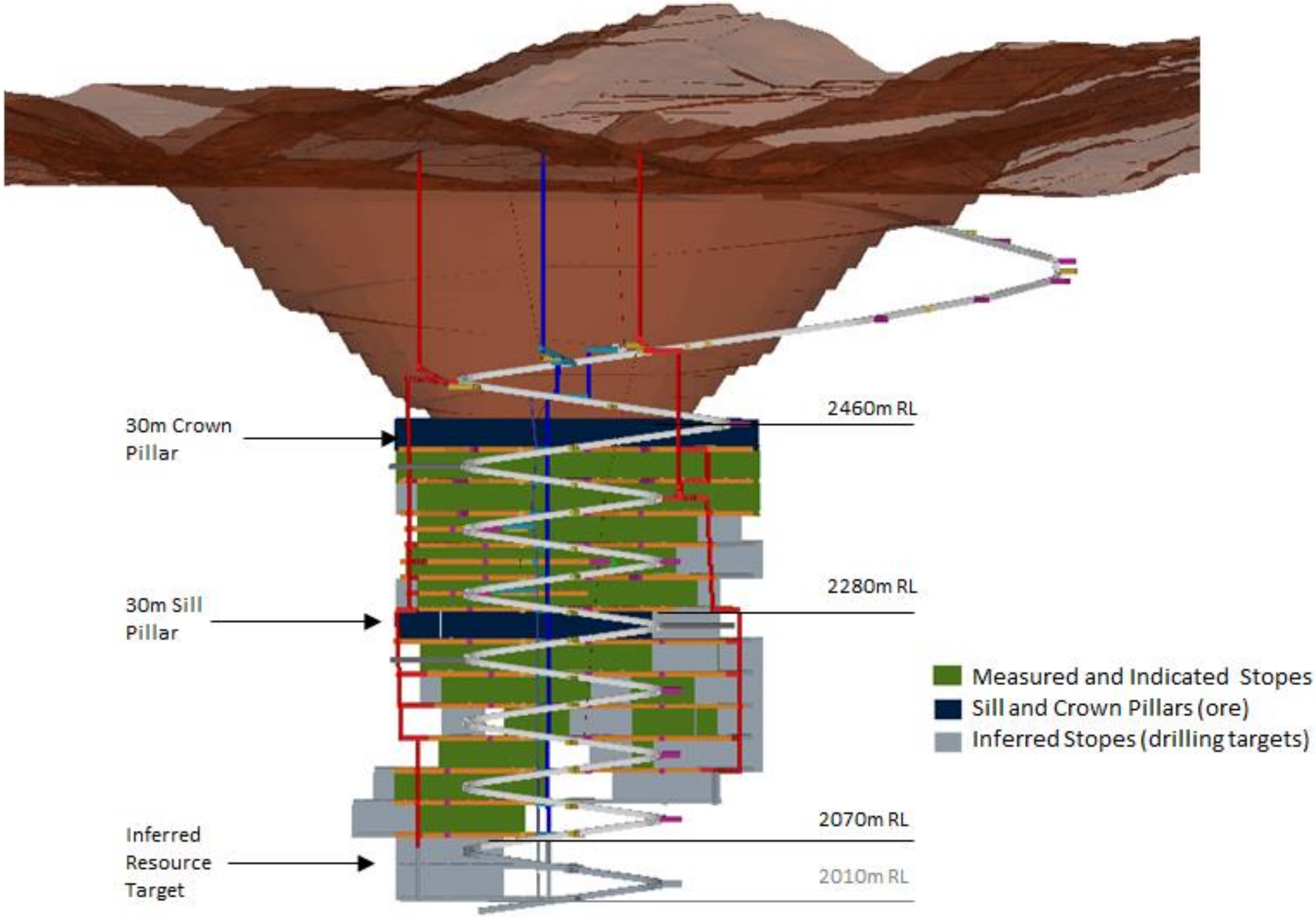


Figure 1-15: Underground mine design, long-section view looking north-east

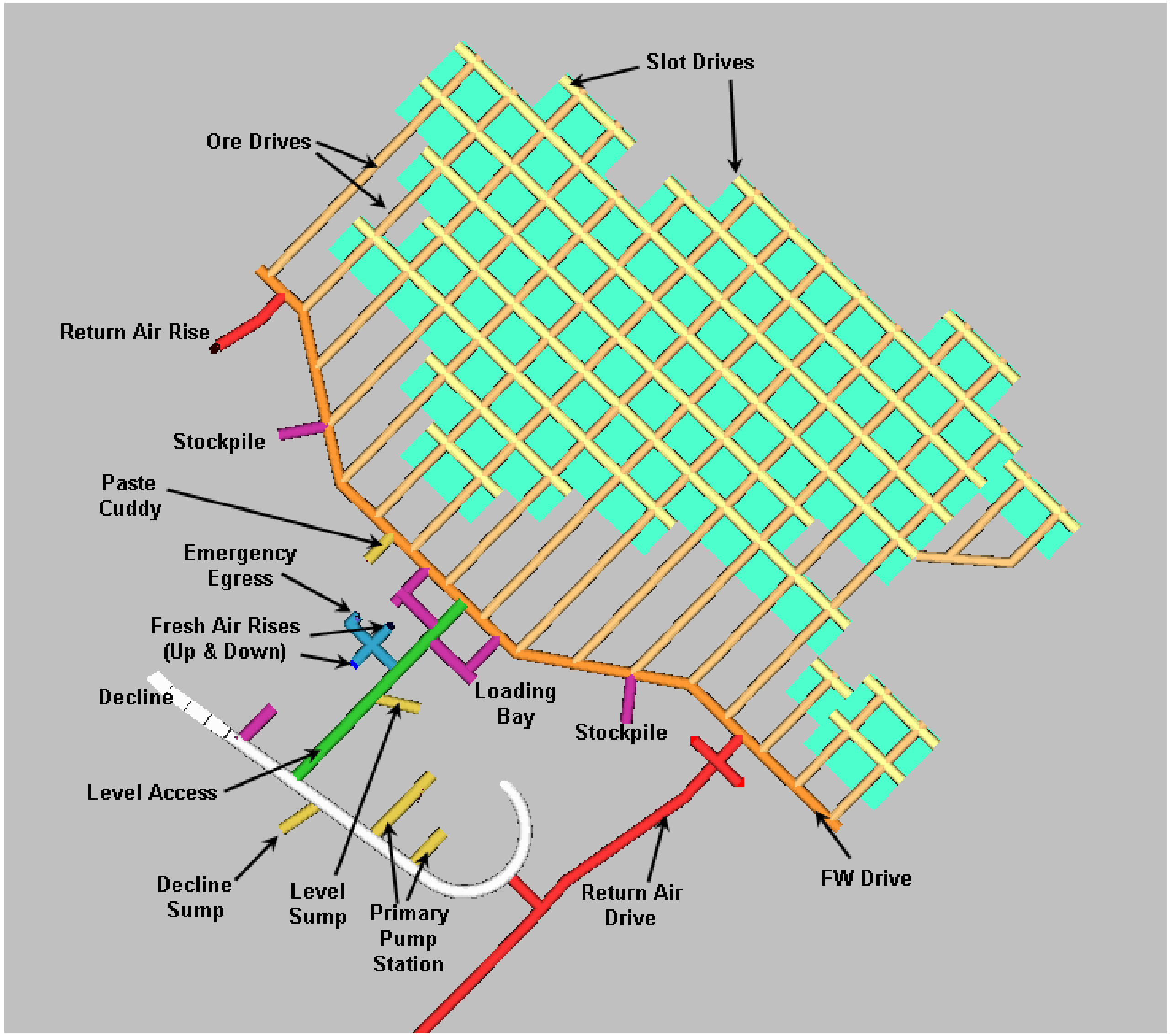


Figure 1-16: Didipio underground mine design - plan view of level layout.

The mine design includes a significant amount of raise development to establish and extend the primary air circuit. Two exhaust raises and one fresh air raise to surface will be required. As the mining levels are developed from the access decline, the primary circuit will be extended by raisebore excavations, necessary to permit the exhaust of contaminated air by advancing the primary circuit in increments. The emergency egress will be extended level to level by raiseboring 1.8 m diameter holes and installing escapeway ladders, fully caged with rest landings spaced at required intervals.

Mine infrastructure will also include:

- A workshop for the maintenance and repair of underground equipment;
- An explosives magazine and a detonator magazine;
- Permanent refuge chambers;
- An underground lunchroom;
- Substations installed as the decline advances;
- Dewatering stations and a suite of local settling sumps;
- Dedicated service holes for rising mains;
- Service holes for reticulation of paste backfill; and
- Drill drives for diamond drilling infill.

1.8.2.3 Level Development

Sublevels will be accessed from the access decline on a 30 m vertical interval that is defined by the planned stopping heights. Within the breccia zone intermediate sublevels have been included to permit the reduced stopping height of 15 m. The decline stand-off from the footwall drive has been designed to be 60 m, greater than the geotechnical recommendation to allow for capital infrastructure (fresh air raise, emergency egress, level sump, and loading bays) to be located off the level access drive between the decline and the footwall drive.

The minimum stand-off distance between the footwall drive and the orebody is 20 m. Where possible the footwall drive has been located in waste or low grade mineralization (to allow for additional footwall slopes if economics become more favorable).

Stockpiles will be used on all levels for the placement of blasted ore during the mining cycle. Trucks will be loaded in loading bays situated off the level access drives.

Ore drives outside the breccia zone are spaced at 20 m centres. Within the breccia zone ore, where the slopes have been designed to be smaller ore drives are spaced at 10 m centres. For stopping outside of the breccia zone, slot drives are developed to the width of the stope. No dedicated slot drives have been included in the breccia zone.

Development design standards considered equipment size, services, and required activity. The widest mobile equipment planned at Didipio underground, the TH663 60-tonne truck, is 3.5 m in width. Therefore, haulage-ways (designed at 5.8 m width) have ample clearance for truck and pedestrian traffic (Figure 1-17), which also shows indicative placement of flexible ventilation ducting within the haulage.

Footwall drives and ore drives were designed at 5 m high to provide adequate overhead clearance between mine equipment and services such as ventilation ducting. Ore drives were designed at 4.5 m wide to permit adequate spacing for a remote stand for remote stope mucking.

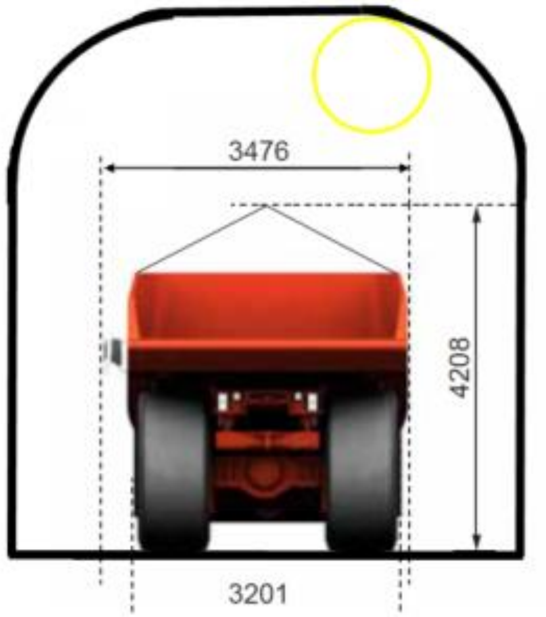


Figure 1-17: Decline profile with TH663 truck

1.8.2.4 Stope Cycle and Sequence

The mine design incorporates two major production blocks (refer to Figure 1-15). The lower horizon extends from 2070 mRL to 2280 mRL, with a 30 m high sill pillar from 2250 mRL to 2280 mRL. The upper horizon extends from 2280 mRL to 2460 mRL, with a 30 m high crown pillar from 2430 mRL to 2460 mRL, immediately below the final open pit floor. The sill pillar is to be recovered at the completion of the lower mining panel, and the crown pillar at the end of the mine life.

A transverse primary-secondary stoping sequence has been incorporated into the schedule. The overall sequence would progress bottom-up, working on top of and adjacent to previously mined stopes which have been filled with paste backfill. The mining sequence includes extraction of primary stopes followed by mining the secondary pillars. Primary stopes will be filled with cemented paste backfill to allow mining of the adjacent secondary stope. Due to the orebody geometry and the thickness of the orebody, the majority of the secondary stopes will also require a cemented backfill.

Using a primary-secondary sequence, it is possible for stoping to be undertaken concurrently in a number of working areas which allows for increased production rates compared to alternative sequence options, such as a continuous front approach.

Figure 1-18 illustrates a conceptual primary-secondary stoping sequence, in plan-view (not to scale). Primary stopes are shown in blue, with secondary stopes shown in red. Primary stopes will generally have three walls formed in rock. Overbreak from these walls is from waste country rock, or from the planned adjacent secondary stope. Secondary stopes generally have three stope walls formed in paste backfill. Dilution from paste backfill can be expected, particularly if overbreak occurred within the primary stopes, and the backfill is undercut by mining of the secondary stope.

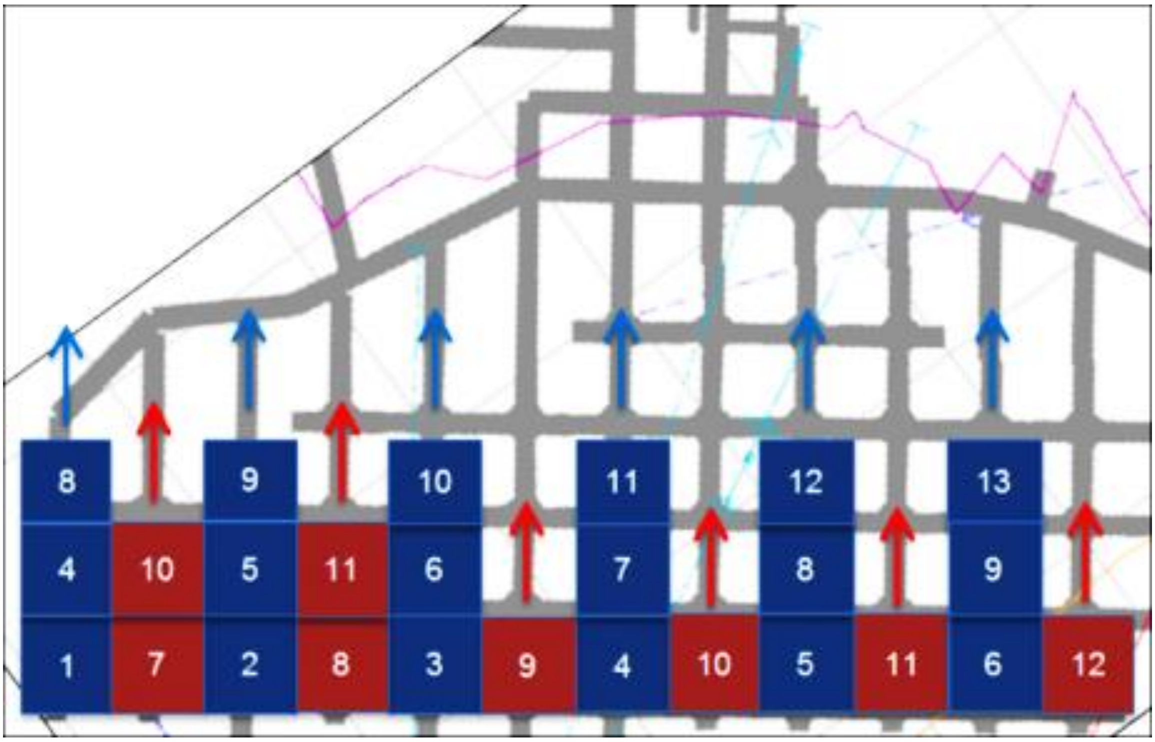


Figure 1-18: Conceptual primary-secondary stoping sequence

1.8.2.5 Stope Design

The LHOS design for Didipio consists of three stope designs:

- The standard stope design is based on a 30 m level interval, using a 20 m (w) x 20 m (l) x 30 m (h) stope shape.
- The stope design for areas mining the breccia zone are based on a 15 m level interval, using a 10 m (w) x 20 m (l) x 15 m (h) stope shape.
- The sill pillar and crown pillars are based on a 30 m level interval, using a 20 m (w) x 20 m (l) x 30 m (h) stope shape. The crown pillar is located at the base of the final pit floor (2460 mRL) whilst the sill pillar is located between 2450 mRL and 2480 mRL.
- Based on the geotechnical information available, there is potential for double lift stopes to be mined; that is 20 m (w) x 20 m (l) x 60 m (h) but the location of the more competent ground for these stopes is uncertain. Therefore no double lift stopes have been included in the mine design.

1.8.2.6 Breccia zone

Based on the geotechnical design parameters, three additional sub-levels have been included to reduce the hydraulic radius for stoping within the breccia zone. In addition, ore drive spacing for the breccia zone has been reduced from 20 m centres to 10 m centres, as shown in Figure 1-19 and Figure 1-20. Figure 1-21 shows the 2310 mRL level and the impact of the breccia zone on the design layout and the production areas, with the breccia zone 15 m (h) stopes coloured in purple and the standard 30 m (h) stopes shown in teal.

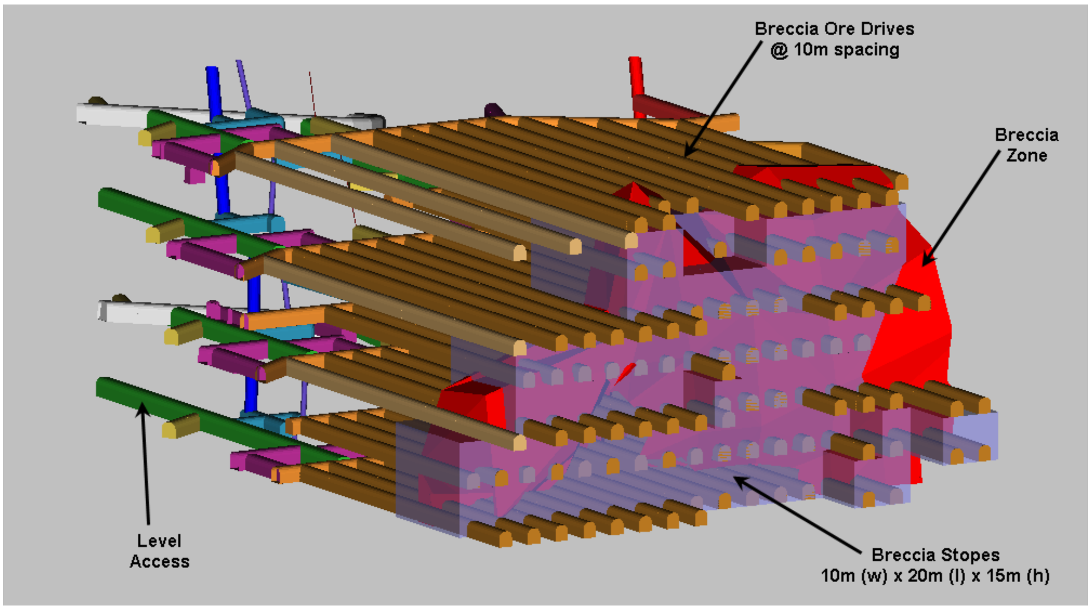


Figure 1-19: Isometric view showing breccia zone development and stopes

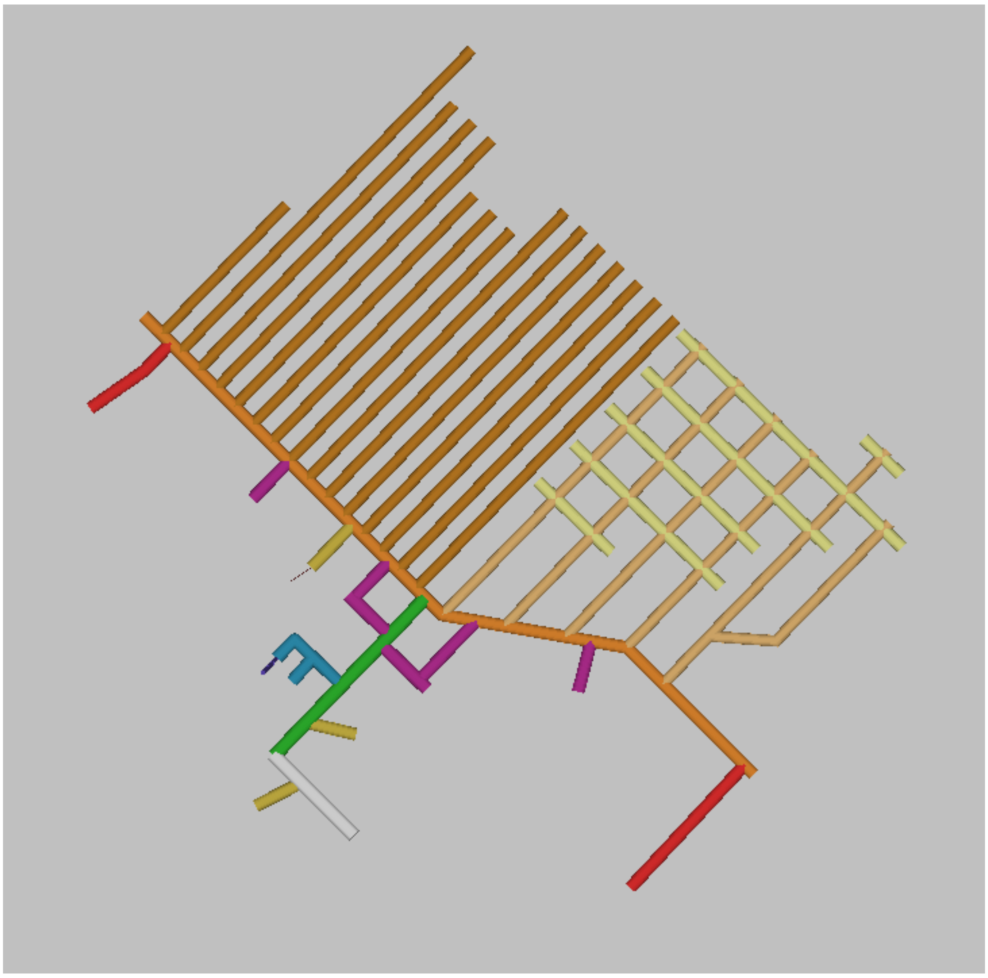


Figure 1-20: Plan view of the 2310 mRL, development only

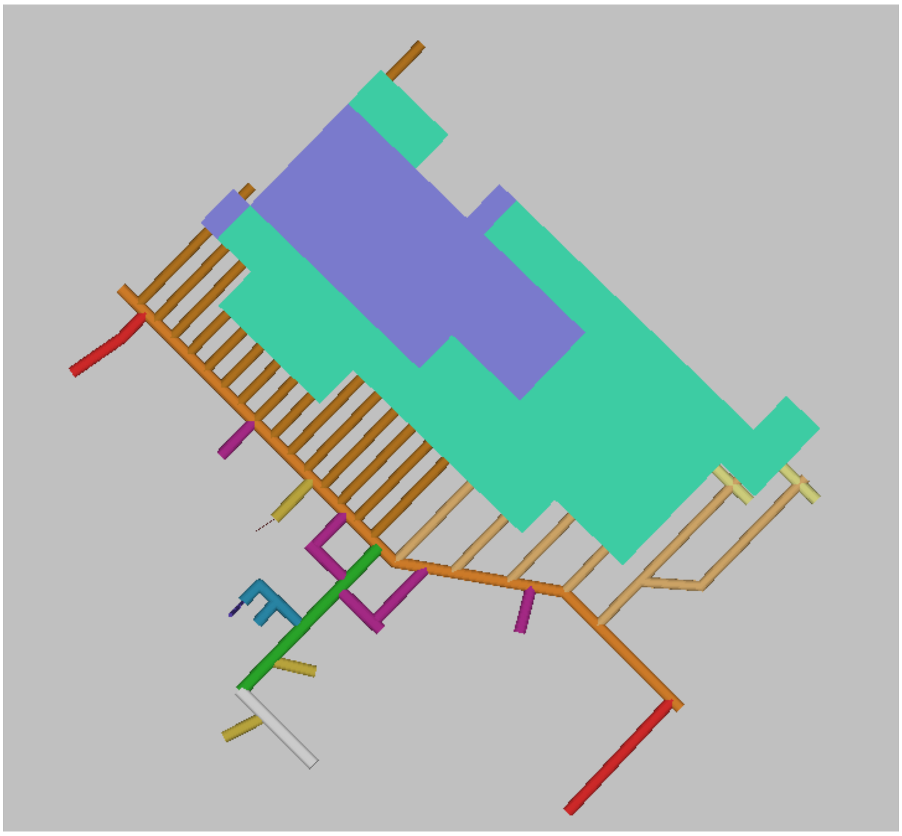


Figure 1-21: Plan view of the 2310 mRL – development and production

Production rates in the breccia zone are significantly lower due to the paste backfill curing time required between each stope in the primary-secondary stoping sequence.

Further work is required to optimise the mining method and mine design for the breccia zone. Alternative mining methods, such as cut-and-fill, may be required if the ground conditions in the breccia zone are predominantly poor and production rates are low. Conversely, the ground conditions could allow for increased stope dimension and a reduction in the designed level development.

1.8.2.7 Crown Pillar

A 30 m high initial crown pillar design had been designed below the base of the final pit, between the 2430 mRL and the 2460 mRL, and is scheduled to be extracted at the end of the mine life. The design will be further reviewed and will be subject for DENR approval.

The extraction of the crown is expected to be similar to a sub-level cave (SLC) operation, where a footwall drive will be developed as a slot drive for the entire level. A “one shot” slot raise will be fired through to surface, providing a free face for the firing of the slot drive, nominally firing 2-3 rings at a time. Once the slot drive is opened up sufficiently, the production rings associated with the ore drives can commence firing. As the firings will daylight into the pit, the number of rings fired in any one blast will be based on the planned production rate, geotechnical considerations and the remote loader capabilities.

Ground conditions for the crown-pillar stopes are expected to deteriorate once the crown stoping sequence starts. As such, the recovery of crown-pillar stopes has been reduced to 80 %. The extraction of the crown pillar should be targeted during the dry months, to minimise water inflows. Further work is required on modelling the impacts of the crown pillar extraction on overall slope stability and to determine the preferred extraction sequence for the crown pillar.

1.8.2.8 SILL PILLAR

A sill pillar has been designed between the 2250 mRL and the 2280 mRL. The extraction of the sill pillar is at the conclusion of mining the lower mining block, with an overall recovery of 80 % planned.

The extraction process for the sill pillar is expected to be similar to the crown pillar, as are ground conditions. The extraction sequence for the sill pillar assumes a continuous mining front. An allowance for paste backfilling the sill pillar post-extraction has been included in the cost estimate. Further work is required to optimise and model the preferred extraction sequence.

1.8.3 PASTE BACKFILL

An online paste backfill system continuously receives and processes tailings from the process plant. The paste plant requires an instantaneous production capacity of 120 m³ per hour at an utilisation of approximately 60 % to meet mine production requirements.

Test work has been completed which confirms that the particle size distribution of the Didipio tailings derived from the current open pit is suitable for making paste backfill. For the planned primary-secondary stoping sequence, the estimated stope fill mass design strength requirements are summarised in Table 1-10.

Table 1-10: Paste backfill mass design strength

Stope Dimension (w)(l)(h)	UCS (kPa)				Factor of Safety
	1st Exposure	2nd Exposure	3rd Exposure	4th Exposure	
20 m x 20 m x 30 m (Standard Stope)	300	350	500	550	1.5
10 m x 20 m x 15 m (Breccia Zone Stope)	200	250	300	350	1.5

The cement dosage required to meet the design strengths detailed in Table 1-10 is projected to range between 2.5 % and 4.5 %, depending on the stope dimensions and number of vertical exposures. For cost estimates all stopes excluding the sill pillar and crown pillar will be paste backfilled at a binder addition rate of 3.5 %. Sill pillar void is scheduled to be filled post-extraction, which has been included in the cost estimate at a binder addition rate of 1 %. The crown pillar is not scheduled to be filled.

Paste backfill volumes have been calculated on the in-situ stope volume and potential stope wall overbreak and over-mucking of the floor. Paste backfill delivery holes have been duplicated in the cost model to ensure continuity of operation in the event that a hole becomes blocked over time.

1.8.4 TAILINGS STORAGE FACILITY (TSF)

The tailings disposal facility was designed by the geotechnical consulting firm, GHD. The firm will continue to provide oversight and monitoring during annual construction campaigns.

1.8.4.1 DESIGN CRITERION

Design criteria for the tailings storage facility have been based on the following:

- Philippines guidelines issued by the Department of Environment and Natural Resources (DENR) Memorandum Order No. 99-32 (24 November 1999);
- Australian National Committee on Large Dams (ANCOLD) guidelines; and
- OGPI requirements.

1.8.4.1.1 Philippine Guidelines

The relevant Philippines guidelines are titled "Policy Guidelines and Standards for Mine Wastes and Mill Tailings Management" Memorandum Order No. 99-32 (24 November 1999), issued by the Department of Environment and Natural Resources (DENR). The DENR requirements are summarized as follows:

- Freeboard requirement during dam construction stage shall take into consideration the hydrology/flooding in the area. Decant, and/or water diversion or spillway systems shall be provided as necessary;
- A five (5) year flood cycle shall be considered during dam construction stage;
- Sufficient freeboard depending on the hydrological/ flooding consideration shall likewise be maintained during the operating life of the impoundment;
- A one hundred (100) year flood cycle shall be taken into account during active impoundment operation;
- Sufficient freeboard, decant, water diversion or spillway shall be provided before decommissioning to ensure that it can withstand the maximum probable storm event without serious damage to the surrounding environment or to the tailings structure;
- Seismic consideration in the design of impoundment shall not be less than 0.15 and 0.25 g under Operation Base Earthquake (OBE) and Maximum Credible Earthquake (MCE) respectively; and
- Embankments shall also be compacted to no less than ninety percent (90 %) of proctor density.

In keeping with the DENR requirements, the following general guidelines are considered in the design of the TSF:

- Diversion during construction to safely pass the 5-year Average Recurrence Interval (ARI) flood; and
- Completed TSF to include provision to contain the 100-year ARI 72-hour rain event without uncontrolled spill (the reserve storage provision) in the event that water quality temporarily fails to meet discharge parameters.

Table 1-11: Didipio Waste Management System Design Criterion

Item	Design Criterion
TSF Hazard Category (ANCOLD)	• 'High C' Hazard Category
TSF Construction	• Construction overtopping spillways to safely pass 1:5 ARI flow events
Spillways	• Construction coffer dams to store (with pumping) 1:2 ARI flow events
TSF Spillway (post construction)	• Maintain at all stages post construction an overtopping emergency spillway designed to safely store/pass a Probable Maximum Flood (PMF);
TSF Decanting System	• Utilise pumping for removal of decant water to avoid gravity pipes through embankment to minimise risk of piping on conduits (OGPI requirement); • Minimum flood storage capacity for the 100 yr ARI 72 h (1.5 Mm^3) without spilling above normal operating pond volume (the reserve storage provision) in the event that water quality temporarily fails to meet discharge parameters; • Pump capacity to pass average flow from wettest consecutive 3 months on record (823 mm/month ~ 0.8 m^3/s);
TSF/WRD Embankment Seismic Loading Operating Basis Earthquake (OBE)	• 1:475 year return period, bed-rock site PGA = 0.25 g; • Maximum Design Earthquake (MDE): 1:10,000 year return period, bed-rock site PGA = 0.50 g;

Item	Design Criterion
WRD Spillway	• Overtopping spillway to safety pass 100 yr ARI 72 h event; • Storage of PMF without overtopping following Year 5; • Flow Through Drain (FTD) to pass wettest monthly flow (2.6 m^3/s)
TSF Embankment	• Year 0 TSF commissioning tailings storage; • 1 year production (2.5 Mt); • Downstream construction methodology; • Use waste rock from mining operations where economical to do so; • Where waste rock is unsuitable, uneconomical or unavailable, maximize use of locally won materials; • Low permeability core to retain supernatant water when required and minimize seepage; • Low -permeability cut-off trench to minimize seepage; • Filter protection for clay core piping failure protection
TSF Closure	• Partial wetland/water cover, land use available for revegetation or cultivation; • Divert flow from TSF / WRD catchment (Dinauyan River) to feed the open pit lake, also used as a large sediment trap; • Retain stable (negligible erosion, settlement, blockage risk) spillway for the long term.

The overall mine waste storage concept provides an integrated solution to store waste rock materials and tailings while initially diverting and eventually throttling Dinauyan River flows, to mitigate the risk of flooding the downstream mine pit.

Based on the bathymetric survey conducted last July 2018, the quantity of tails deposited since commissioning is 13,891, cu.m. Without the proposed expansion, the TSF has a capacity of 36.43M cu.m equivalent to crest elevation of TSF at 2811RL. With the expansion, forecasted generated tailings will be 30.28M cu.m

The Expansion shall not significantly affect the quantity of tails deposited considering the life of mine. However, a change in the build schedule is determined considering maintenance of free board and allowing yearly deposition capacity for the tails.

1.8.4.2 Site Location and Concept

The mine site is located on the Dinauyan River, immediately upstream of the Surong confluence, where the combined flow becomes the Didipio River. Upstream of the mine site the Dinauyan splits with a significant tributary, the Luminag Creek taking the southern part of the catchment.

The design includes progressive diversion of the Dinauyan River, in order to excavate the planned mine pit. The initial diversion will be limited and include a series of off-stream silt traps.

As the pit develops the diversion of the Dinauyan will be required. When the pit eventually extends across the valley and into the Dinauyan River, a piped diversion will be constructed. By this time the WRD will have been developed to provide a “flow-through” underdrain and a retention pond that will allow storage of major floods and release at a manageable flow rate.

Waste rock materials from the mine pit will be placed in the upstream valley to form the TSF and WRD. As waste rock materials are excavated, they will be classified into three broad categories:

- Waste Rock Type 1 – Fresh Non-Sulphide;
- Waste Rock Type 2 – Fresh Sulphide; and

- Waste Rock Type 3 – Weathered Rock (Clay).

These pit materials will then be used for construction of the TSF and WRD, which includes the items listed below.

TSF constructed using mine waste materials including processed filters (crushed and screened Type 1 rock); and a WRD featuring a "Flow-Through" rockfill drain and flood storage capacity.

Local materials proposed to be used include:

- Extremely Weathered Diorite for use as Zone 1 Clay; and
- Alluvials (sand, gravels, cobbles and boulders with silts) stripped from the TSF foundations for use as Zone 3C and for as a source material for producing Zone 2.

If sulphide wastes rock materials (Type 2) are identified, they will be stored in designated "cells" and encapsulated with Type 3 clay to limit their acid drainage potential.

The TSF will be constructed using "downstream" construction methods using predominantly Type 1 waste rock. Type 1 rock will be classified into the various materials zone types prior to leaving the pit. The TSF will feature a low permeability clay zone, designed to allow water storage.

1.8.4.3 TSF Decant System

The TSF decant system utilizes a floating pontoon with electric pumps pumping to a small tank near the wall of the TSF and into the water treatment plant (WTP). From the small tank water is returned to the process plant by a gravity line, or when there is excess water for plant requirements discharged into the water treatment plant (WTP).

The water treatment plant constructed in 2014 is now operational and can treat TSF water at a maximum flow rate of about 2,000 m^3/h with an expected total suspended solids (TSS) level of less than 70 ppm.

The TSF has significant capacity to store inflow in excess of the above the design criterion inflows, however the intention of the TSF operation is to maintain an exposed tailings beach to both maximise tailings density and reduce geotechnical risk from prolonged periods of the TSF acting as a water storage dam with water adjacent the embankment.

A high level conservative water balance on the TSF decant pond to simulate inflows with actual rainfall data has been completed by GHD to assess the impact of the proposed pumping rate. The water balance is based on monthly site rainfall data from 1989-2005. The water balance is deemed conservative as it assumes 100 % runoff from the TSF catchment and no evaporation or seepage losses. The storage for the water balance is based on the worst case of the tailings beach at end of Year 1 with beach level of RL 2755 m and TSF crest RL 2770 m.

The water balance shows that over the 17 years rainfall data the TSF would not have spilled nor would the minimum 'reserve' storage capacity of a 1:100 year 24 h event have been exceeded. The level of storage in the TSF at which the inflows would result in the pond reaching the TSF embankment is also shown on the water balance. It can be seen that when pumping at 800 l/s this inflow would result the decant pond reaching the TSF embankment in 6 out of 17 years for an average of 1.7 months each time. A lower pumping rate of 600 l/s was checked with the decant pond reaching the TSF embankment in 10 out of 17 years for an average period of 3.2 months each time.

It was noted that although in later years the TSF has significant storage capacity, reliance on letting the TSF fill over the 'wet' season and then empty over the 'dry' season is not how the TSF should be operated. The design is for the tailings beach to be exposed most of the year to lower the geotechnical risk and maximize tailings density.

1.8.4.4 Waste Rock Dump (WRD)

Waste material is used in construction of the TSF and other infrastructure. In addition a waste rock dump has been established across the Dinauyan River Valley and will be operational throughout open pit mining. Waste generated from underground mining will be crushed and available for road maintenance, with capacity to store surplus waste from underground mining operations in the waste dump if required. No additional waste rock dumps are planned. The waste rock dump will be built in progressive lifts and as each lift is completed the faces of the lift will be rehabilitated.

A flow through drain (FTD) has been designed into the waste rock dump to allow the Dinauyan River to pass through the waste rock dump at a rate exceeding the average annual flow of the river. This flow through drain will have the effect of attenuating flood flows in the Dinauyan River during the peak of the flood and increasing the duration of slightly higher than average flows after the flood event has passed.

The WRD is constructed with a FTD which is monitored for outflows to continually assess as-constructed flow capacity in order to better understand performance and in preparation to throttle the drain at the upstream intake once the WRD has sufficient flood retention capacity.

WRD flood storage will be targeting 20 m of storage depth within the WRD, capable of storing a 1:100 yr event. The WRD downstream face shall have an overtopping spillway for overflow flood events.

The WRD design to natural ground is 89.5 meters in height at 800 meter base. The slope of the Waste Rock Dump had been designed on a 1V:3H slope. Currently the WRD is at its final height and waste is being rehandled and used for the TSF construction to form its final configuration including the spillway.

1.8.4.4.1 Overtopping Spillway

The Waste Rock dump detention basin is sized to cater for storage of a PMF event, however there is potential for the storage to be filled during a storm event, particularly during the initial development of the stack. The WRD has been designed with the inclusion of an Overtopping Rockfill Spillway designed to cater for a 1:100 year flood event.

1.8.4.5 TSF Development to 2780 mRL and Flow Through Drain with the Waste Rock Dump

To meet the tailings storage requirement at the Didipio operation in 2014, expansion of the existing 2770 mRL Tailings Storage Facility (TSF) to 2780 mRL was required. The approved 2014 development plan (by GHD) required the raising of the existing facility from 2770 mRL to 2780 mRL before the onset of the 2014 wet season (October, 2014). This commenced on 01 October 2013 and was completed on 30 September 2014. The total current storage capacity is approximately 5,000,000 m^3.

Construction of the FTD entry was undertaken in November 2013 and completed on 14 April 2014. Construction was scheduled early to protect the FTD works that would be undertaken by the operations team at Waste Dumps 3 & 4 in late 2013 to open up more dumping area for mining. The FTD intake required approximately 130,000 m^3 of rockfill to complete, and was extended 1,100 m downstream from the flow through entry location to near the open pit.

Construction of the 600 m section of the drain from the FTD entry was undertaken by the Projects team beginning in mid-April and completed in August 2014.

Accelerated development of the valley between the TSF and the mine with the construction of the FTD, raising of the TSF to 2780 mRL from 2770 mRL, Boya waste dump reaching capacity and the expansion of waste dump 3 & 4 it necessitated the relocation of the tailings pipeline corridor to a higher elevation. This will be outside of future development to limit any potential further need for relocation. Movement of the tailings pipeline included upgrading of the existing tailings pump station and the installation of a 300 mm diameter carbon steel pipe section and 450 mm HDPE tailings line to transfer tailings material from the Process Plant to the TSF.

Assessment of the location of the tailings line to the river determined the requirement to construct catchment ponds in the event of a pipeline failure, cross sectional bunding of the tailings corridor and the installation of containment measures under the pipe bridge.

To meet the needs of the required waste rock storage from the pit and the future tailings storage requirements, expansion of the TSF from 2780 mRL to 2790 mRL is required. Works commenced on this stage in April 2014 with a scheduled completion date of 30 June 2015.

1.8.4.6 TSF Design

GHD (Australia) has conducted a design and capital expenditure review of the TSF at the Didipio operation. The revised mine designs for open pit and underground have resulted in a significant reduction in mined waste volumes over the Life of Mine (LOM) and have resulted in a change to the TSF/WRD concept.

The original waste volumes enabled the TSF and WRD to merge to an integrated structure with a significant flood storage volume between the TSF and WRD crests. To enable the same flood storage capacity with the reduced waste rock volume it has been necessary for the TSF and WRD to be separated to leave a storage basin between the structures.

The impacts on the TSF / WRD due to the revised mine designs from the optimisation study are:

- Simplification of open pit cutbacks on the North wall, resulting in a single diversion of the Dinauyan River catering for the LOM, which presents savings over the originally proposed multiple cutbacks and multiple diversions;
- Cessation of open pit mining earlier than previously anticipated (meaning TSF stages need to be accelerated);
- Reduction in mine waste by approximately 60 Mt over the LOM, reducing waste available for use in the integrated TSF/WRD;
- Utilising tailings as mine backfill reduces the required tailings storage capacity by approx. 10 Mt over the LOM, resulting in a reduced ultimate TSF wall height and associated saving on tailings disposal costs; and
- Change in overall water management plan and integrated Waste Management Plan through separating the TSF and WRD facilities.

The reduction in storage requirements for mine waste (waste rock and tailings) and their impact on estimated TSF height and subsequent estimated TSF construction savings are presented in Table 1-12.

Table 1-12: Optimisation Study Impact on TSF

Description	Optimisation Study	Original Mine Plan
Forecast tailings production to end of 2014[1]	5.5 Mt	5.5 Mt
Forecast tailings production to LOM[1]	48.0 Mt	48.0 Mt
Planned underground backfill paste[1]	10.0 Mt	0 Mt
Total tailings storage required in dam[1]	43.5 Mt	53. 5 Mt

Description	Optimisation Study	Original Mine Plan
Total tailings storage required in dam (based on density of 1.3t/m^3)	33.5 Mm^3	41.2 Mm^3
PMF partly stored with safe release via spillway	3 Mm^3	3 Mm^3
Required total storage in dam	36.5 Mm^3	44.2 Mm^3
Required ultimate dam crest height	RL 2812 m	RL 2818 m
Estimated TSF embankment construction capex from (Jan 2015)[3]	15M $AUD	18M $AUD

A typical cross section through the TSF / WRD showing stages over time is presented in Figure 1-22.

1.8.4.7 Acid Rock Drainage (ARD)

Prior to project operation OceanaGold (Philippines), Inc. commissioned Environmental Geochemistry Pty. Ltd (EGi) to conduct a geochemical characterization of ore and low grade ore samples to determine its acid generation potential and acid neutralization capacity.

It was determined that based on the samples studied, the project has a high factor of safety in terms of preventing ARD formation and that the neutralizing capacity of the samples outweigh or exceed the capability to generate acid.

Acid Rock Drainage (ARD) is produced from the reaction of sulphide minerals, such as pyrite, to atmospheric water and oxygen. Generation of ARD may, in turn, facilitate leaching of metals and other elements that are typically considered toxicants to the environment. It is therefore important to assess the ARD generation capacities of the ore and its waste rock and tails early in a project to determine applicable mitigating measures to address potential ARD generation.

Previous analyses were also done by EGi during the exploration phase. The objectives of the test work were to:

- Determine the acid forming characteristics and ARD potential of the samples;
- Identify problematic material with respect to ARD generation; and,
- Determine the elemental composition and identify elements which may be of environmental concern.

A total of 33 samples from nine drill holes consisting of 17 ore and 16 low grade samples were analyzed for the following parameters and test programs:

- pH and Electrical conductivity (EC) testing;
- Total Sulphur (S) analysis;
- Acid Neutralizing Capacity (ANC) determination; and,
- Single addition Net Acid Generation (NAG) testing.

In addition, selected samples underwent further testing which included:

- Acid Buffering Characteristics Curve (ABCC);
- Sequential NAG testing; and,
- Multi-elemental scans of solid samples.

The total Sulphur tests indicate that 80% of the samples have total Sulphur content greater than 0.5%. The acid neutralizing capacities of the samples varied from 31 to 76 kg H2S04/t for the low-grade samples and from 29 to 58 kg H2S04/t for the ore samples. Approximately 64% of the samples have an acid neutralizing capacity greater than 40 kg H2S04/t.

In terms of acid-base accounting plots generated from the results of the analysis, it was determined that the samples have a high factor of safety in terms of preventing ARD formation and that the neutralizing capacity of the samples outweigh or exceed the capability to generate acid.

In summary, assuming the samples tested were representative of the ore and low-grade ore, the results of the tests show that the acid rock drainage potential of the stockpiled ore will be low. In addition, the tails that will be generated from the processing of the ore are also expected to be low.

Though most samples are significantly enriched in Ag, Cu, S and Se, the leaching capabilities of these elements will be low due to the non-acid forming characteristics of the ore.

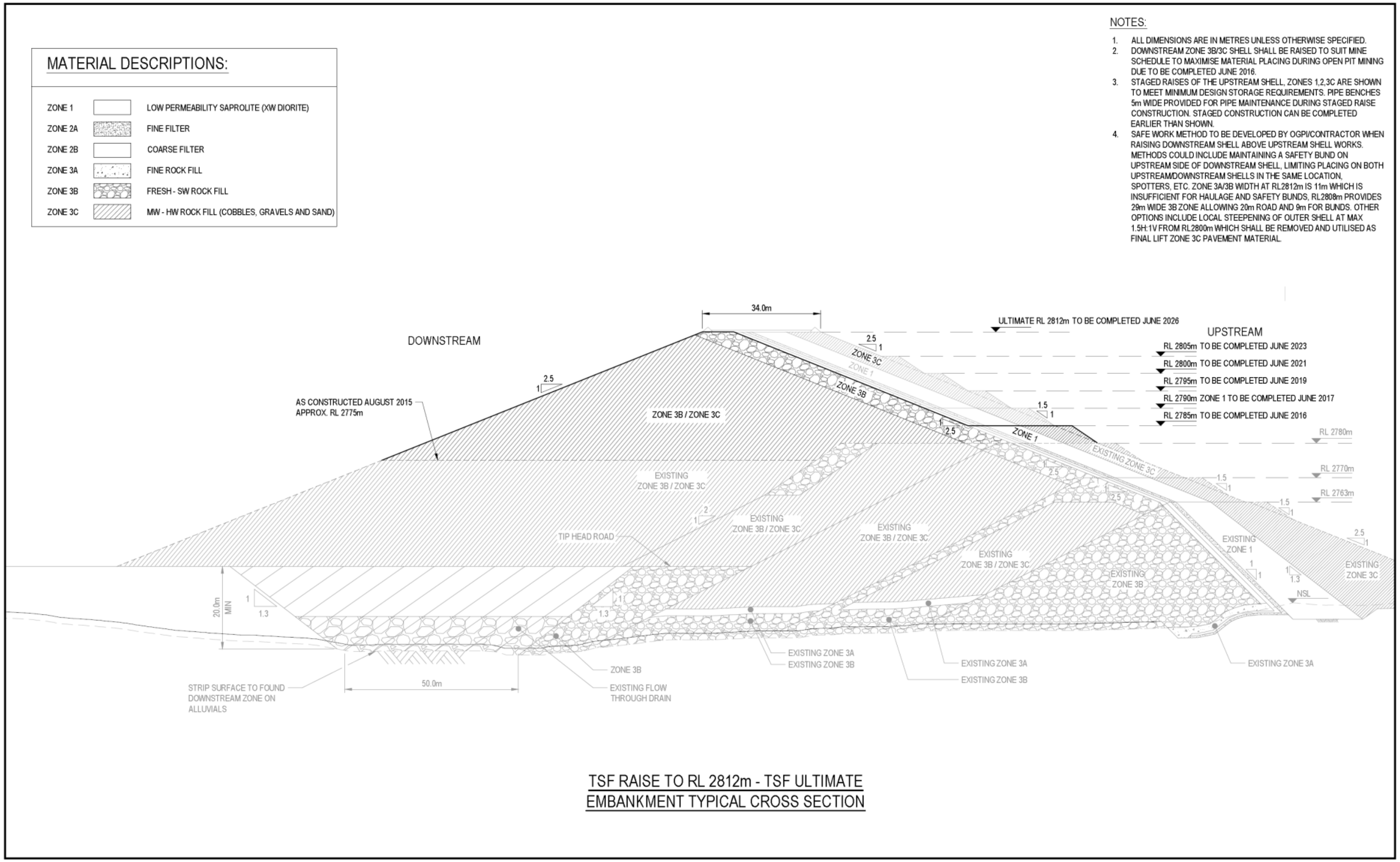


Figure 1-22: TSF Ultimate Embankment Cross-section

1.8.5 Dinauyan Diversion Channel

Part of the open pit mine plan is the diversion of the Dinauyan River diversion. The diversion channel will be a concrete lined structure to reduce the risk for ground water recharge to the pit (in accordance with the recommendation of the GHD groundwater model) and to ensure that the channel will be stable with minimal maintenance over the life of the mine.

Construction of the diversion drain will involve cutting back of the north wall which is in highly weathered material. The north wall will be an engineered slope to ensure that it meets the acceptance criteria recommended by AMC.

The diversion channel is designed without considering the water-retention benefits of the completed WRD storage and is sized to accommodate at least a 1:100-year flood event.

Figure 1-23 illustrating the current conceptual layout of the diversion channel.

The modelling undertaken has provided the following design flood flows for the Dinauyan catchment (Table 1-13) upstream of the pit to enable sizing of the future Dinauyan diversion channel for various scenarios. These scenarios cater for the impact of the WRD storage being developed and subsequent throttling of the WRD flow through underdrain back to its design flow capacity, as this is currently much higher than the design and minimal storage is currently available upstream of the WRD.

Table 1-13: Dinauyan River flood for diversion drain sizing

Average Recurrence Interval (ARI)	Dinauyan River Rood for Diversion Drain Sizing (m3/ s)	
	Without WRD / Row Through Throttling	With WRD/Row Through Throttling
1:20 year event	37.5	20.9
1:100 year event	80.2	40.7

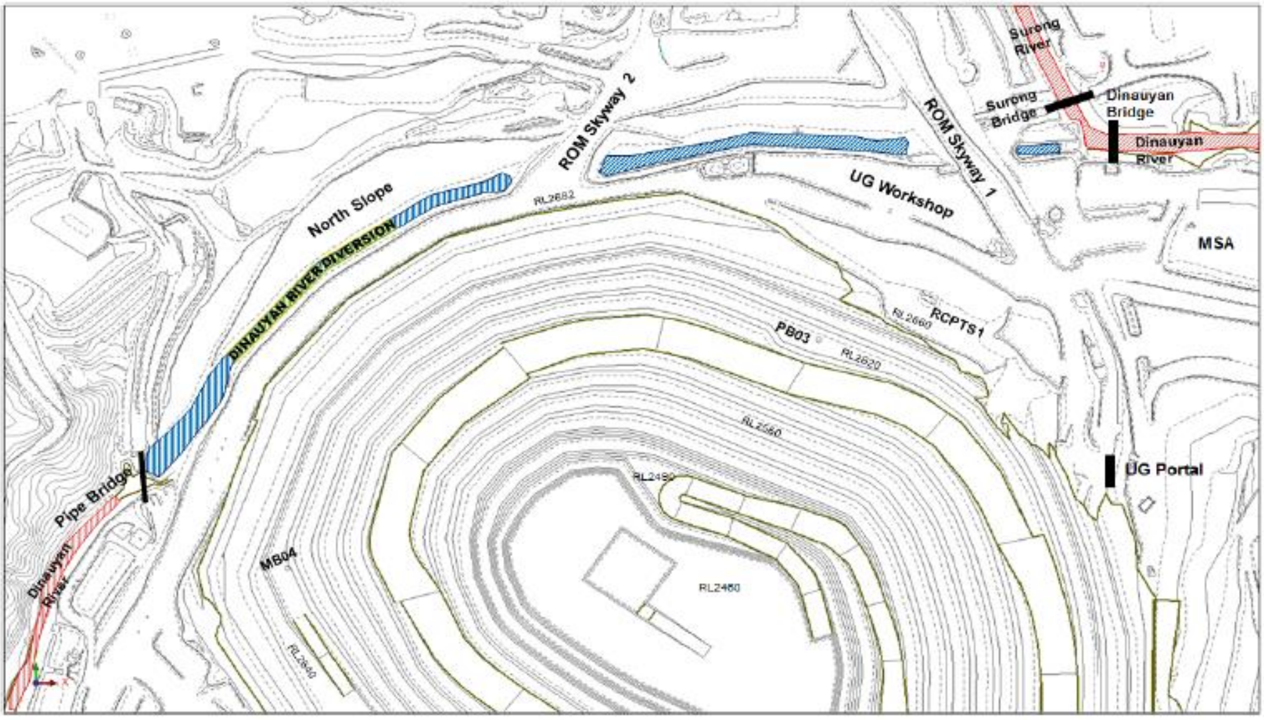


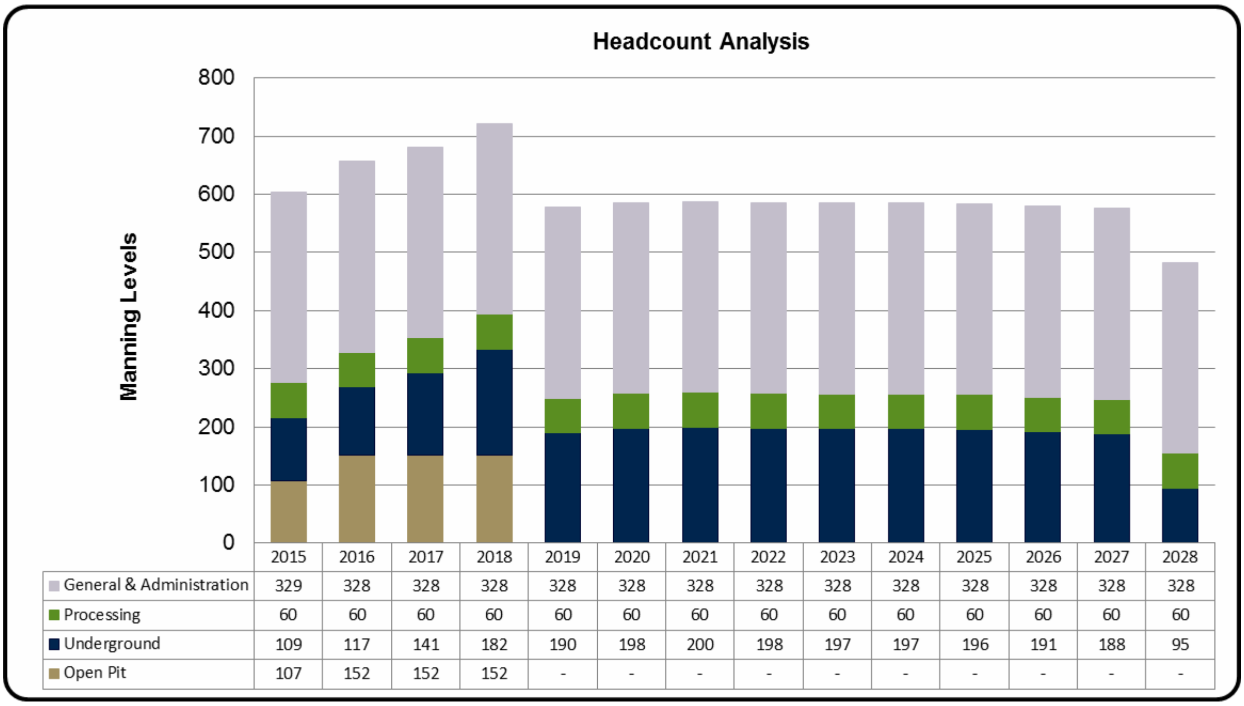
Figure 1-23: Dinauyan River Diversion relative to the final open pit design

1.9 Manpower Requirement

The Didipio Mine currently employs approximately 566 employees and 1,269 contractors (Figure 1-24). Employees generally work 12 hours per day on a 14 day on/7 day off roster. Approximately 30 % of the employees are from Didipio and over 55 % are from the provinces of Nueva Vizcaya and Quirino. A union represents rank and file employees of the collective bargaining unit. Major contractors include:

- Delta Earthmoving (TSF construction)
- Orica (explosives)
- Didipio Community Development Corporation (camp catering, concentrate hauling and road maintenance)
- SGS (assay lab)
- Saint Michael Security Service, Inc. (security staff/personnel)

The total labour force will be comprised of approximately 4 % expatriates with the remaining workforce recruited locally or nationally. With the increase in plant throughput rate, the estimated manpower requirement of the project will not be affected.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
General & Administration	329	328	328	328	328	328	328	328	328	328	328	328	328	328
Processing	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Underground	109	117	141	182	190	198	200	198	197	197	196	191	188	95
Open Pit	107	152	152	152	-	-	-	-	-	-	-	-	-	-

Figure 1-24: Estimate Headcount for the Didipio Operation

1.10 Project Cost

Open pit mining, concentrate treatment, freight, insurance and general and administrative costs have been sourced from recent corporate assumptions and approved life of mine plans. Table 1-14 reports the total life of mine operating costs, and an annual breakdown of on-site costs.

The concentrate treatment, concentrate freight and insurances cost estimate is $283 M for the life of mine.

Table 1-14: Operating Cost Summary, (excluding selling costs)

Description	Total (US$M)
Open Pit Mining	152
Stockpile Reclaim	0
Underground Mining	613
Processing	424
General and Administration	392
Total	1,581

2 Assessment of Environmental Impacts

2.1 The Land

2.1.1 Land Use and Classification

2.1.1.1 Scope

This section presents the assessment of potential impacts of the proposed project modification in relation to the existing land use and classification of the project site. The impact assessment for land use and classification focused on the following:

- Impacts in terms of compatibility with existing land use;
- Impacts on compatibility with classification as an Environmentally Critical Area (ECA);
- Impact on existing land tenure issue/s;
- Impairment of visual aesthetics; and
- Devaluation of land value as a result of improper solid waste management and other related impacts.

2.1.1.2 Methodology

The impact assessment was conducted through review of secondary data such as NAMRIA maps, land use and classification maps, ECA maps, previous Environmental Impact Assessment (EIA) Reports, and previously conducted baseline studies for the Project. The secondary data gathered were verified through actual site inspection.

2.1.1.3 Baseline Information

2.1.1.3.1 Land Use

The project operation is covered by the Financial or Technical Assistance Agreement (FTAA) No. 001 which grants title to OceanaGold (Philippines), Inc. (OGPI) to undertake large-scale exploration, development and mining of gold, silver, copper and other minerals within a fixed fiscal regime. The FTAA covers about 12,864 hectares within which is the approved 975-hectare Partial Declaration of Mining Project Feasibility (DMPF) located mainly at Barangay Didipio, Kasibu, Nueva Vizcaya, with some portions in Cabarroguis, Quirino. The existing total project footprint, covering approximately 391 hectares, is within the boundaries of the approved Partial DMPF and is located within Barangay Didipio, Kasibu, Nueva Vizcaya.

The Didipio Mine development has impacted land use by acquiring lands in the Dinauyan Valley that were previously owned by approximately 100 landowners who used the land for a combination of agriculture, logging, and small-scale mining. The alluvial gravels in the Dinauyan and its tributaries were used for small scale mining. Rice, pomelo, and vegetable crops were cultivated along the narrow river terraces. (OGPI Interim AEPEP for 2018)

In 2008, OGPI commenced the development of the Project and began clearing and leveling land near the Process Plant, ROM Pad, and Boulevard Camp. This work impacted approximately 7 hectares. In 2012, construction commenced on haul roads, waste rock stacks, tailings storage facility and other infrastructures. The area impacted by these activities including ongoing improvements and progressive rehabilitation/reforestation by the end of 2018 is summarized in Table 2-1.

Table 2-1: Project Area Land Use EOY 2018

Project Facility	Area	
	m^2	ha
CCO Camp	6,192.26	0.62
APD	3,767.96	0.38
Nursery	2,022.71	0.20
Warehouse and Assay Lab	16,021.44	1.60
Globe Tower	1,708.5	0.17
Water Tank	3,168.59	0.32
MSA and Underground area	79,353.2	7.94
Bacbacan Diversion Trench	34,165.9	3.42
Mine Pit	519,738.36	51.97
Finger 9, 12, 13 and 14	410,117.01	41.01
Raw water, sediment pond, visitor center, Northwall Dinauyan diversion	139,217.04	13.92
Rompad	77,354.23	7.74
Processing Plant	116,089.32	11.61
150 Man Camp	9,608.65	0.96
550 Man Camp	3,2591.48	3.26
Motorpool and site services	19,916.10	1.99
Waste Rock Dump, Finger 15, Boya and Emulsion Plant	705,515.6	70.55
WTP	8,195.29	0.82
Tailings Storage Facility and Flow Through Area	1,122,761.68	112.28
Road Network and Clearing Along Roads	28,977.47	2.90
TOTAL	**3,336,482.79**	**333.65**

2.1.1.3.2 LAND CLASSIFICATION

Land classification refers to the establishment of boundaries between alienable and disposable lands and forest lands. Forest lands, also known as permanent forest or forest reserves, refers to those lands of the public domain which have been the subject of the present system of classification and declared as needed for forest purposes. On the other hand, alienable and disposable lands refers to those lands which have been the subject of the present system of classification and declared as not needed for forest purposes.

The distribution of forest land and alienable and disposable land within the Partial DMPF Area is shown in Figure 2-1. Between 2005 and 2013, the Company embarked on a surface rights acquisition program whereby it acquired the surface rights and landowners were compensated for vacating their land. OGPI has acquired, leased, or occupied alienable and disposable land and forest land within the Partial DMPF area. A summary of the land acquired by the Company to date is provided in Table 2-2. (OGPI Interim AEPEP for 2018)

Table 2-2: Land Tenure Summary

Location	Area (ha)
FTAA Area	12,864.0
Partial DMPF Area	975.0
Acquired Land - Forest Land[1]	522.4
Acquired Land - Alienable and Disposable Land[1]	140.1

[1] Estimated

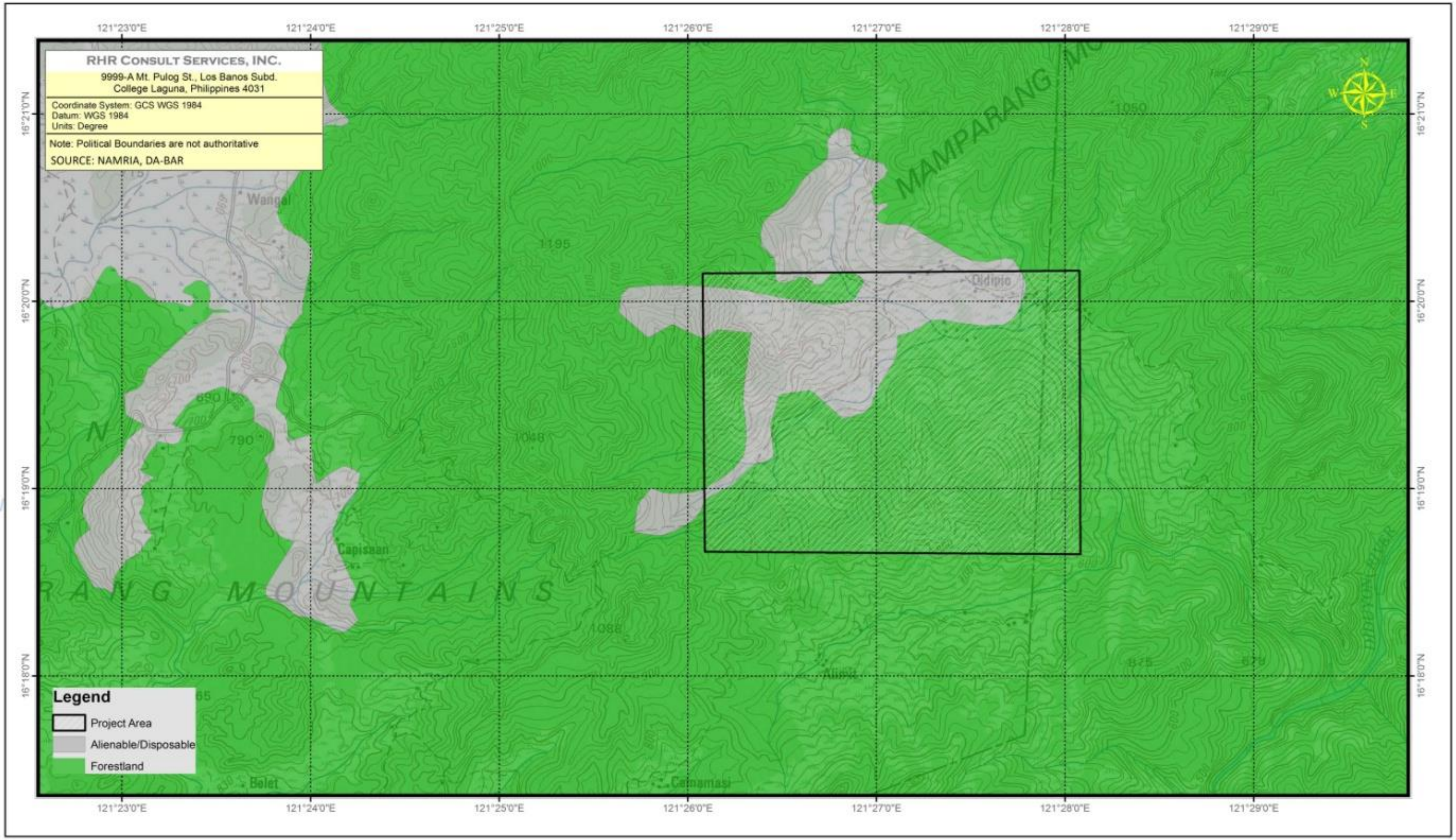


Figure 2-1: Land Classification Map showing the 975-hectare Partial DMPF Area

2.1.1.4 Impact Assessment and Mitigation Measures – Land Use and Classification

2.1.1.4.1 Compatibility with Existing Land Use

The increase in annual mill plant throughput capacity from 3.5 million tons per annum (Mtpa) to 4.3 Mtpa will not cause any changes in terms of the total project area, total project footprint or any other project components such as the mine pit, tailings storage facility (TSF), etc. thus will not affect the existing land use at the project site.

The DENR Administrative Order 1996-40, as amended, states that in the determination of a post-mining land use: *"Minesite decommissioning and rehabilitation shall aim to establish a land use capability that is functional and proximate to the land use prior to the disturbance of the mine area, unless other more beneficial land uses are predetermined and agreed in partnership with local communities and Local Government Units".*

The general intent of the Final Land Use Plan is, at a minimum, to revert the conditions of the land to its general condition before this was mined. However, it is anticipated that key mine facilities such as the Open Pit, Tailings Storage Facility and Waste Rock Stack will permanently change the land use and topography of the area. If the final land use will not be similar to or be reverted to the baseline land use, formulation of a final land use plan in consultation with the LGUs and stakeholders, allows for the determination of a more applicable and beneficial land use achievable for the project site. (OGPI FMRDP, 2015)

At this stage, the concept for waste rock stack rehabilitation is to apply soil and to establish forest species on the completed lift of the waste rock stack. The waste rock stack will be progressively rehabilitated during the life of the project. For the open pit, it will be fenced off and a safety berm will be installed at the top of the pit and will be allowed to fill with water. The pit will become a lake and may eventually be used for domestic and irrigation water supply if the water quality of the impounded water allows for it. Aquaculture can also be one of the potential future uses based on the suggestions during the consultation conducted. The foreseen closure for the TSF at this stage of the project is to create dry beaches and establish a river channel along one edge of the tailings impoundment. These dry beaches will then have top soil added and be available for agriculture or be revegetated with indigenous plants. Another option would be to utilize the inundated area as a water reservoir, maintain the wet cover of the tails, for hydropower as raised during the stakeholder consultation for the final land use. (OGPI FMRDP, 2015)

2.1.1.4.2 Compatibility with Classification as an Environmentally Critical Area

The Revised Procedural Manual for DENR Administrative Order No. 30, Series of 2003 (DAO 03-30) listed twelve (12) Environmentally Critical Areas (ECA) categories. Assessment of project's compatibility with ECA classification is presented in Table 2-3.

Table 2-3: Assessment of Presence or Absence of Environmentally Critical Areas (ECAs)

ECA Categories		Technical Description (based on Annex 2-1a of the Revised Procedural Manual of DAO 2003-30)	Present in Project Area?	Remarks
1	Areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries	The laws referred to by this provision are Presidential Decree No. 705, as amended, otherwise called as the Revised Forestry Code, Republic Act 7586 or the NIPAS Act, and other issuances including other proclamations, executive orders, local ordinances, and international commitments and declarations.	No	The project area is not located within a declared national parks, watershed reserves, wildlife preserves, or sanctuaries. Nearest to the project is the Quirino Protected Landscape (Figure 2-2).
2	Areas set aside as aesthetic potential tourist spots	Aesthetic potential tourist spots declared and reserved by the DOT or other appropriate authorities for tourism development.	No	The project site is not located within an area set aside by the DOT as aesthetic tourist spot.
3	Areas that constitute the habitat of any endangered or threatened species of Philippine wildlife (flora and fauna)	This refers to areas considered as wilderness areas and areas identified by the PAWB to be natural habitats of endangered or threatened, rare, and indeterminate species of flora and fauna, as defined by PAWB.	No	The project area is not considered as a wilderness area and is not identified by the PAWB to be natural habitats of endangered or threatened, rare, and indeterminate species of flora and fauna. However, ecology studies conducted for the project revealed presence of threatened flora and fauna species within the FTAA. There were recorded flora and fauna species to be noteworthy (endemic (Luzon), threatened species) within the Partial DMPF area and its immediate vicinities. As such, appropriate actions shall be considered prior to any activity within or adjacent the identified sites of conservation significance. Viable forest corridors remain between the forested areas within and outside the FTAA (AECOM Philippines, Inc., 2013).
4	Areas of unique historic, archaeological, or scientific interest	This refers to areas that are more than 100 years old (now superseded by new law RA10066, reduced to 50 years old) and declared by the National Historical Institute, National Museum, or National Commission for Culture and the Arts, through national or local laws or ordinances as areas of cultural, historical, and	No	There are no areas of unique historic, archaeological, or scientific interest within the project site. On November 21, 2003, the National Museum issued a Certification to the project that the Partial DMPF area was inspected for possible archaeological remains by

ECA Categories		Technical Description (based on Annex 2-1a of the Revised Procedural Manual of DAO 2003-30)	Present in Project Area?	Remarks
		scientific significance to the nation, (e.g., declared national historical landmarks, geological monuments, and paleontological and anthropological reservations).		the Archaeological, Cultural and Environmental Consultancy, Inc. The finding was that the area has no visible archaeological resources based on the over-all negative result of the archaeological assessment survey. (OGPI Interim AEPEP for 2018) OGPI was likewise mandated to report to the National Museum should archaeological materials be found in earth-moving activities. At present, no archaeological materials has been found or reported.
5	Areas that are traditionally occupied by cultural communities or tribes	This refers to all ancestral lands of the National Cultural Communities in Section 1 of Presidential Decree No. 410 and settlements designed, implemented, and maintained by the PANAMIN for national minorities (non-Muslim hill tribes referred to in Presidential Decree No. 719) as may be amended by Republic Act 8371 or the Indigenous Peoples Rights Act of 1997 and its Implementing Rules and Regulations.	N/A	N/A
6	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)	The area shall be so characterized if any of the following conditions exist: Geologic hazard areas: This refers to all areas identified by the Mines Geosciences Bureau (MGB) as geologic hazard areas. Flood-prone areas: This refers to low-lying areas usually adjacent to large active water bodies experiencing inundation of at least 2 m, twice a year for the last five years prior to the year of reckoning. For example, a determination made in 2007 will consider the weather records from 2002 to 2006. Areas frequently visited or hard-hit by typhoons: This refers to all areas where typhoon signal No. 4 was hoisted for at least twice a year during the last five years prior to the year of reckoning.	Yes	Geologic Hazard: Landslide The project site is within an area characterized by the MGB to be highly susceptible to landslide. (Figure 2-3) Areas frequently visited by typhoons The project site is located in an area characterized with high risk to typhoons since it is located in an area with high typhoon incidence. (Figure 2-4)

ECA Categories		Technical Description (based on Annex 2-1a of the Revised Procedural Manual of DAO 2003-30)	Present in Project Area?	Remarks
		Areas prone to volcanic activities/ earthquakes: This refers to all areas identified as such by the Philippine Institute of Volcanology and Seismology (PHIVOLCS) (e.g., areas within permanent exclusion zones of active volcanoes or areas within the required minimum buffer zone of fault zones as determined by PHIVOLCS).		
7	Areas with critical slopes	This refers to all lands with slopes of 50% or more classified as geohazard by MGB. Such slope conditions favor their natural susceptibility to geohazards such as landslides.	Yes	The project site is within an area characterized by the MGB to be highly susceptible to landslide. (Figure 2-3)
8	Areas classified as prime agricultural lands	Prime agricultural lands refer to lands that can be used for various or specific agricultural activities and can provide optimum sustainable yield with minimum inputs and development costs as determined by the Department of Agriculture.	No	The project is not within an area classified as prime agricultural lands.
9	Recharge areas of aquifers	Refers to sources of water replenishment where rainwater or seepage actually enters the aquifers. Areas under this classification shall be limited to all local or non-national watersheds and geothermal reservations.	No	The project is neither within a geothermal reservation nor in a locally-declared watershed or aquifer recharge area.
10	Water bodies characterized by one or any combination of the following: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities	Water bodies shall refer to waters that are tapped for domestic purposes or those which support wildlife and fishery activities within declared protected areas, including the buffer zones.	No	The project is not located within a protected area.
11	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth;	Mangrove areas shall be characterized by one or any combination of the following conditions: With primary pristine and dense young growth Adjoining mouth of major river systems;	No	Didipio River, the surface water body draining the project area, is part of the headwaters of Cagayan River. Didipio River is about 230 km (linear distance) from the mouth of Cagayan River located at Aparri,

ECA Categories		Technical Description (based on Annex 2-1a of the Revised Procedural Manual of DAO 2003-30)	Present in Project Area?	Remarks
	adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood.	Near or adjacent to traditional productive fry or fishing grounds; Areas that act as natural buffers against shore erosion, strong winds and storm floods; and Areas on which people are dependent for their livelihood, pursuant to and taking into consideration *Republic Act 7161*, which prohibits the cutting of mangrove species.		Cagayan.
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning and nursery grounds for fish; Act as natural breakwater of coastlines	Characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning nursery grounds for fish; and Act as natural breakwater of coastlines.	No	

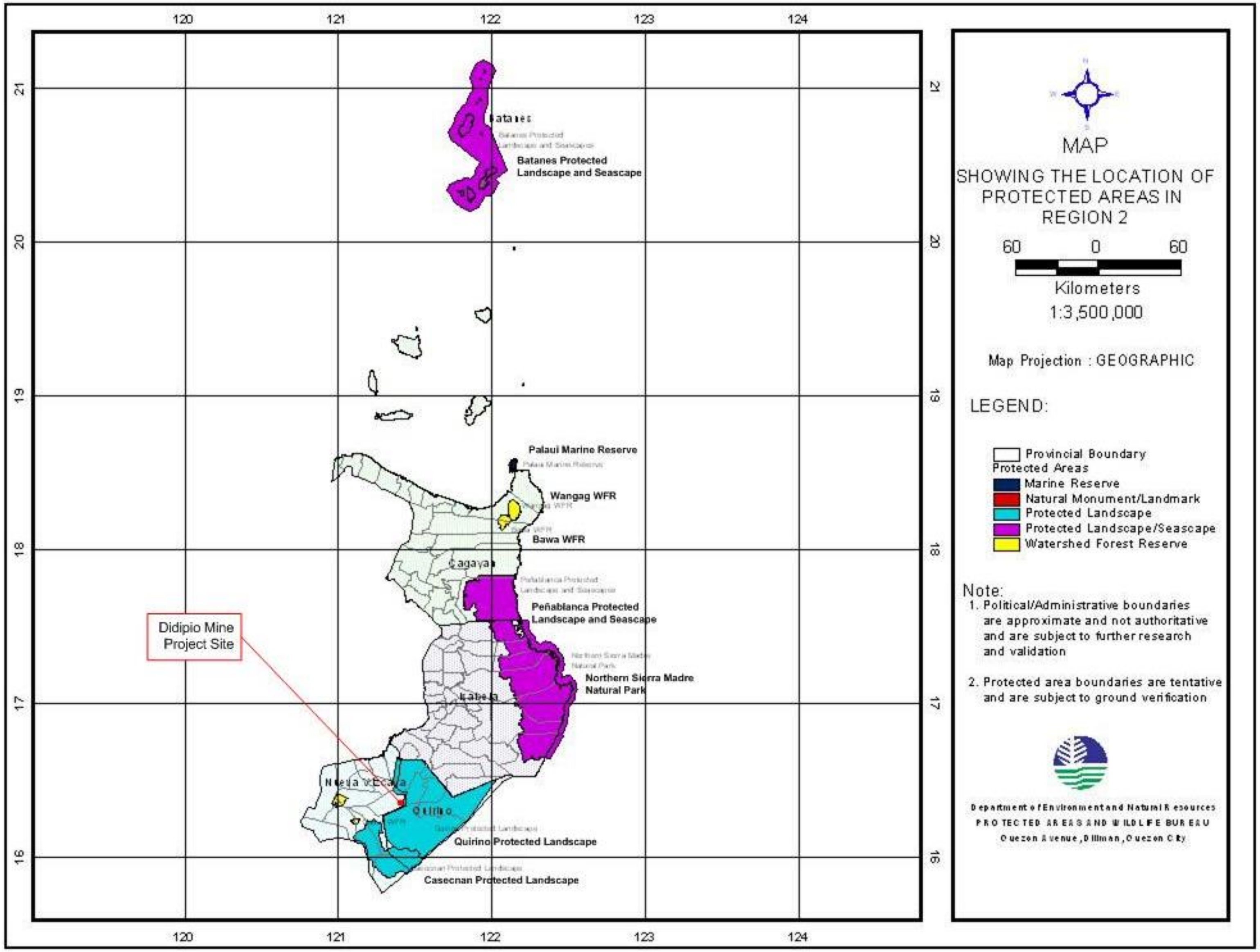


Figure 2-2: Project Location relative to the Protected Areas in Region 2

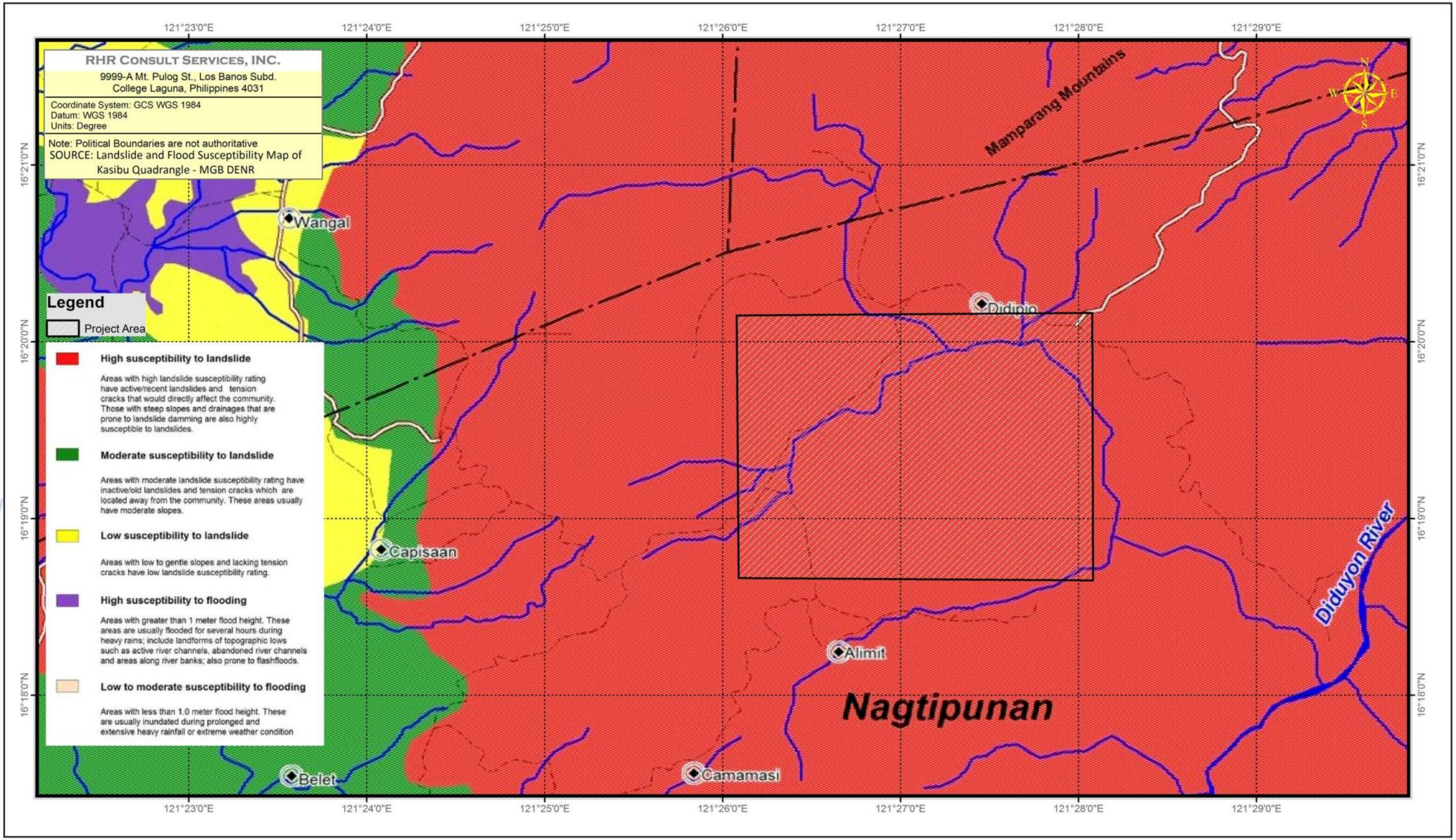


Figure 2-3: Project Overlay on MGB Landslide and Flood Susceptibility Map

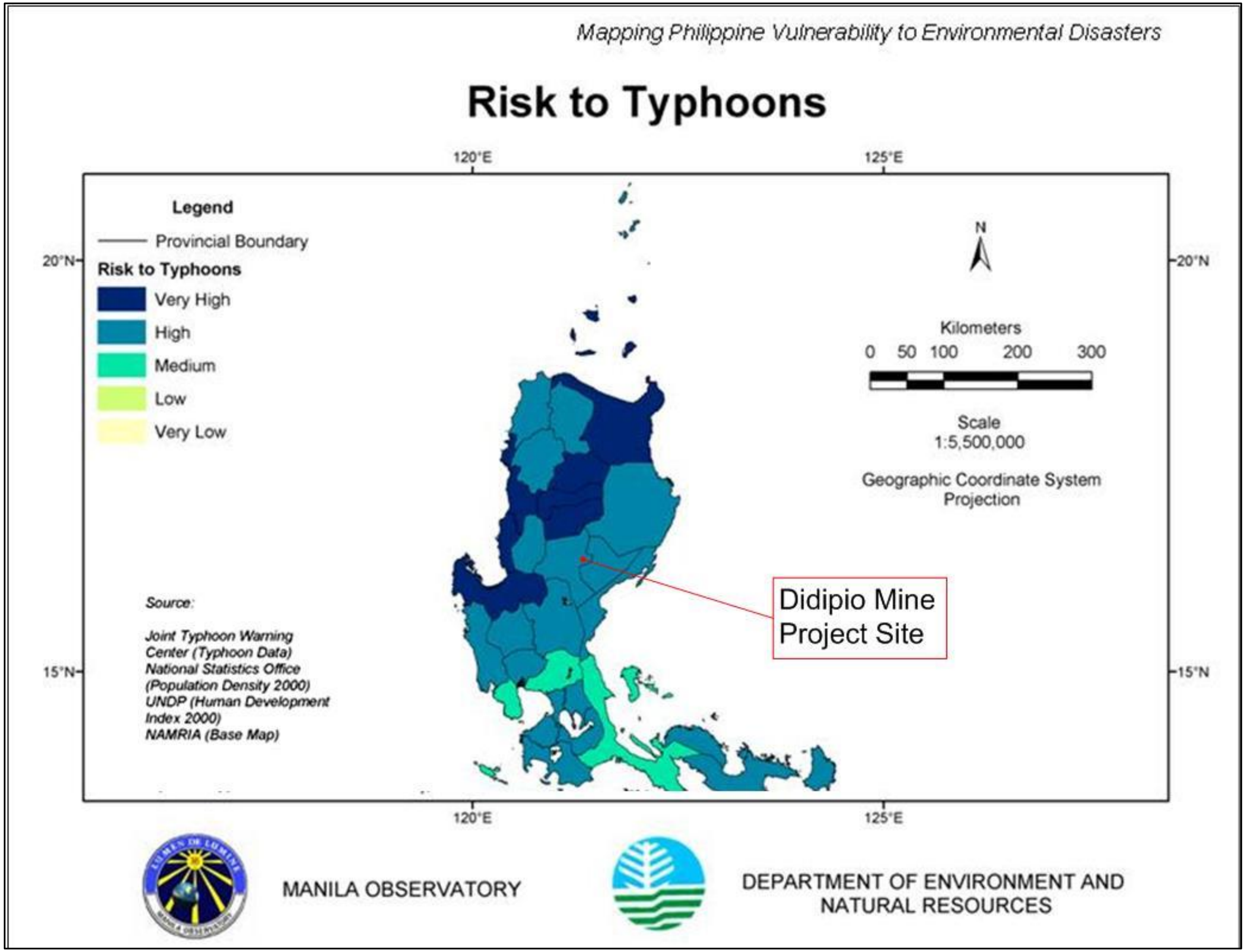


Figure 2-4: Typhoon Risk Map showing the Project Site

Source: http://vm.observatory.ph/cw_maps.html "Mapping Philippine Vulnerability to Environmental Disasters" (Center for Environmental Geomatics - Manila Observatory, 2005)

2.1.1.4.3 Land Tenure Issue/s

There are no perceived land tenure issues concerning the Project. The Company has already acquired surface rights to about 522.4 ha forest land and 140.9 ha alienable and disposable land covered by its existing mining operation in the Dinauyan Valley. These lands were previously owned by approximately 100 landowners who used the land for a combination of agriculture, logging and small-scale mining. All the landowners were compensated for vacating their land.

NCIP Ancestral Domain Claim/s

As of the time of this study, the OGPI's area of coverage is not covered by any issued CADC (Certificate of Ancestral Domain Claim), CALT (Certificate of Ancestral Land Title) and CADT (Certificate of Ancestral Domain Title) from the NCIP (National Commission on Indigenous Peoples).

The following excerpt (extracted from the discussion on the Bugkalot presented in the Section 2.4.2.2.1 of this study) shows that the Bugkalot has an additional direct CADT Application in between Quirino and Vizcaya being processed.

*Pursuant to the 1987 Constitution, Republic Act No. 8371 and its Implementing Rules and Regulations, also known as the **Indigenous Peoples Rights Act of 1997** (IPRA) empowers them* to plan for the development, management, and utilization of their resources within the coverage of their Certificate of Ancestral Domain (Titles No. RO2-NAG-O703-0012) having a total land area of 139,691.61 hectares more or less, traversing the Municipality of Nagtipunan, Quirino; Municipality of Kasibu and Dupax Del Norte, Nueva Vizcaya; and Municipality of Maria Aurora and Dipaculao. Both **CADC No. 22 & 23** have a total land area of **73,081.60** hectares more or less, traversing the Municipalities of Dupax Del Sur and Alfonso Castaneda of Nueva Vizcaya with an additional **Direct CADT Application** in between Quirino and Nueva Vizcaya currently being processed. The Bugkalot as the CADT holder/owner shall expedite its inter-generational responsibility and accountability in protecting their Ancestral Domains, institutions, customs, and cultural integrity. These are the only legacies passed on to them by their ancestors, though they were not able to enjoy its abundance*." *("them*" refers to Bugkalots)*

As the process is still ongoing, whether OGPI's area of coverage is to be included in the Recognition of the claims and awarding of the respective Certificate/s to the Bugkalots, remains under study.

2.1.1.4.4 Impairment of Visual Aesthetics

The Waste Rock Stack and the TSF embankment across the Dinauyan Valley are perceived to cause impairment of visual aesthetics in the area. The Company has been progressively rehabilitating these areas (inactive waste dumps, portions of TSF embankment and slopes – North wall and South wall) to mitigate visual impacts in accordance with the closure plan for the site.

Upon mine closure, other mine facilities will either be decommissioned and removed from site or be transferred to the community for their use in accordance with the closure plan. Recovering visual amenity is normally a key objective of rehabilitation. Visual amenity is defined by community expectations. The reclamation activities will mimic the process of forest succession whereby the structure and composition of the vegetation will change over time. Permanent changes to visual amenity have been considered. This includes a formation of a lake out of the decommissioned open pit. (OGPI FMRDP, 2015)

2.1.1.4.5 Devaluation of Land Value as a Result of Improper Solid Waste Management and Other Related Impacts

Solid waste generation is expected due to normal routine of employees, process plant and mine operations. The Company has been implementing its Integrated Waste Management Plan (IWM) to address the proper handling and disposal of wastes generated on site. The Didipio mining and processing activities will generate two major waste streams. Firstly from construction, operations and processing of the mined ore and secondly from what is called ancillary activities to the construction, operation and processing of mined ore. Both waste streams produce small amounts of hazardous wastes which will be disposed of in accordance with standards set by DENR EMB in compliance with R.A. 6969. (OGPI Integrated Waste Management Plan, 2015)

Solid wastes are collected, characterized, and segregated. Biodegradable wastes are utilized as compost material, which is as fertilizer for reforestation projects. Recyclables are kept in the Materials Recovery Facility (MRF) awaiting for disposal to scrap buyers. Residual wastes are disposed in OGPI's on-site sanitary landfill which will be rehabilitated upon mine closure in accordance to the mine closure plan.

Hazardous wastes identified from operations include waste oil, solid wastes contaminated with oil, clinic wastes, chemical contaminated containers, lead batteries, and used fluorescent bulbs. These wastes are temporarily stored in OGPI's hazardous waste storage facility and are collected and disposed of by DENR-accredited hauler and treater. All contaminated containers are decontaminated prior to disposal, while used oil materials are contained in properly labeled steel drums.

WACS or waste analysis characterization study described the determination of the quantity and composition of wastes being generated within the mine site that will provide the basis for the design and size capacity of the Sanitary Landfill (ECC-OL-R02-2016-0083). Average waste generation is 0.53 ton, SLF has an estimated lifespan of ten (10) years. Through the following policies, procedure and programs waste generation is expected to reduce and prolong SLF lifespan; OGPI-Integrated Waste Management Plan, OGPI-Waste Segregation at Source Policy, OGPI-Zero Waste Management Plan, OGPI- No to Single Use Plastic Program (Ayaw ko sa Plastic), Establishment of Material Recovery Facility-MRF, Environment Hero Program, Vermiculture/ Vermicompost, Waste to Art Program.

The generation of domestic wastes at the Didipio mine wherein recyclable wastes are being hauled by Dicorp-Didipio Community Development Corporation and sold as their additional income. Biodegradable wastes are being composted and use as a soil conditioner.

Residual wastes still to be inspected in waste sorting area to recover possible recyclable materials before final disposal to Sanitary landfill.

The table below shows various types of Residual waste produce onsite data based from one (1) week WACS

Table 2-4: Residual waste produce onsite from one (1) week WACS

Materials	Weight (kg)	Percentage
Air filter (Rubber)	142	10.2
Food Wrapper (Foil)	13	0.9
Disposable lunch box	57.5	4.1
Assorted cup noodles	9	0.6
Broken Bottles	76	5.5
Cellophane Bag	355	25.5
Paper Plate w/ film	7	0.5
Plastic spoon/fork	11	0.8
Tetra pack juice	5	0.4
Cloth (PPE)	45	3.2
Rubber Hose	8	0.6
Rubber Gloves	1	0.1
Assorted Plastics (bubble wrap, cable tie, caution tape, ragged plastics)	545	39.2
Styrofoam	26	1.9
Rope	4	0.3
Surgical gloves - used in soil and water sampling	4.5	0.3
Assorted pieces cigarettes butts, candy wrapper, bottle cap, packing tape	34	2.4
PVC pipes	5	0.4
Tarpaulin	6	0.4
Dusk Mask	0.75	0.1
Rags	4	0.3
Disposable cup	16	1.2
Hose	16	1.2
Total	**1,390.75**	**100.00**

2.1.2 GEOLOGY/GEOMORPHOLOGY

2.1.2.1 SCOPE AND METHODOLOGY

The baseline data presented in this section were lifted from the following secondary sources:

- Environmental Impact Statement for the Didipio Gold/Copper Project, Maunsell Phils., Inc. (1997)
- Environmental Impact Statement for the Didipio Gold/Copper Project, Gaia South Inc. (2004)
- Environmental Baseline Update Report for the Didipio Gold Copper Project, GHD Pty Ltd (2012)
- Technical Report for the Didipio Gold/Copper Operation, Griffiths, Simon; Holmes, Michael; Moore, Jonathan (2014)
- Didipio Mine 2018 Interim Annual Environmental Protection and Enhancement Program (AEPEP), OceanaGold (Philippines), Inc. (2017)

2.1.2.2 TOPOGRAPHY

The project area is situated within the southern part of the meridional Cagayan Valley basin in north-eastern Luzon and is bounded on the east by the Sierra Madre Range, on the west by the Luzon Central Cordillera range and to the south by the Caraballo Mountains. The project area covers the south-eastern part of Mamparang Mountains. Terrain is generally moderate to occasionally rugged with average elevation approximately 700 masl. The highest peak within the application is recorded at 1,595 masl (Figure 2-5). (OGPI Interim AEPEP for 2018)

2.1.2.3 GEOLOGIC SETTING AND MINERALIZATION

The regional geology comprises late Miocene volcanic, volcaniclastic, intrusive and sedimentary rocks overlying a basement complex of pre-Tertiary age tonalite and schist (Figure 2-6), which have been interpreted to represent an island arc depositional and tectonic setting.

The Palali Formation, Palali Batholith, Mamparang Formation and Caraballo Group underlie the project site. These formations can be further described as follows:

- Caraballo Group - The basal sequence of the Caraballo Group is of Cretaceous to Eocene age and comprises andesitic pyroclastics, andesitic lavas and basaltic tuffs with inter-layered beds of sandstone, shale and tuff. The Caraballo Group includes the Alimit Volcanics and is intruded by tonalites, diorites, quartz diorites and gabbros of the Coastal Batholith (27 to 49 mega-annum (Ma)) and the Dupax Batholith (26 to 33 Ma).
- Mamparang Formation - The Caraballo Group is unconformably overlain by the Mamparang Formation of the Oligocene age, comprising andesitic and basaltic lavas and volcaniclastic rocks ('Dark Diorite'). This was intruded by various alkalic plutonic rocks including syenite, monzonite and a variety of K-feldspar-rich igneous rocks that comprise the Palali Batholith (17 to 25 Ma). This batholith includes intrusive rocks found in the Didipio area (Didipio Igneous Complex).
- Palali Formation - Unconformably overlying the Caraballo Group and Mamparang Formation, the Palali Formation comprises basaltic and andesitic lavas, mudstones, sandstones and dacitic pyroclastics of early to middle Miocene age.

Regionally, the volcanic and sediments are folded about meridional anticlinal and synclinal axes and are cut by prominent, steeply dipping, north-west and north-trending faults sub-parallel to the major Philippine Fault zone (Figure 2-6 and Figure 2-7). A set of later, steeply north dipping, east-north-east-trending faults are associated with the batholitic intrusions.

Recent geological mapping in the Didipio region has been interpreted to indicate the Didipio Gold-Copper Deposit is hosted within the multiphase Didipio Stock, which is in turn part of a larger alkalic intrusive body, the Didipio Igneous Complex. The Didipio Igneous Complex consists of:

1. An early composite clinopyroxene-gabbro-diorite-monzodiorite pluton that comprises medium-grained, clinopyroxene-biotite rich microdiorites and monzodiorites of the dark diorite (pre-mineralisation);
2. The Surong clinopyroxene to biotite monzonite pluton. Breccia textures on the margins of the Surong pluton are interpreted to indicate that the Surong monzonite intruded into the Dark Diorite. The Didipio area lies within a circular physiographic feature, approximately six to eight kilometres in diameter. The Pimadek Porphyry (latite porphyry) occupies the topographic highs of the Didipio circular feature and is characterized by coarse K-feldspar phenocrysts (<20mm to 30mm) in a pale grey-green feldspathic groundmass. Pyroclastic deposits (ignimbrites, autobreccias) recognized in the area suggest that the Pimadek Porphyry could represent both the feeder dyke and extrusive product of an intra-caldera ignimbrite;
3. The Au-Cu mineralised Didipio Stock; and
4. Post-mineralisation andesite dykes.

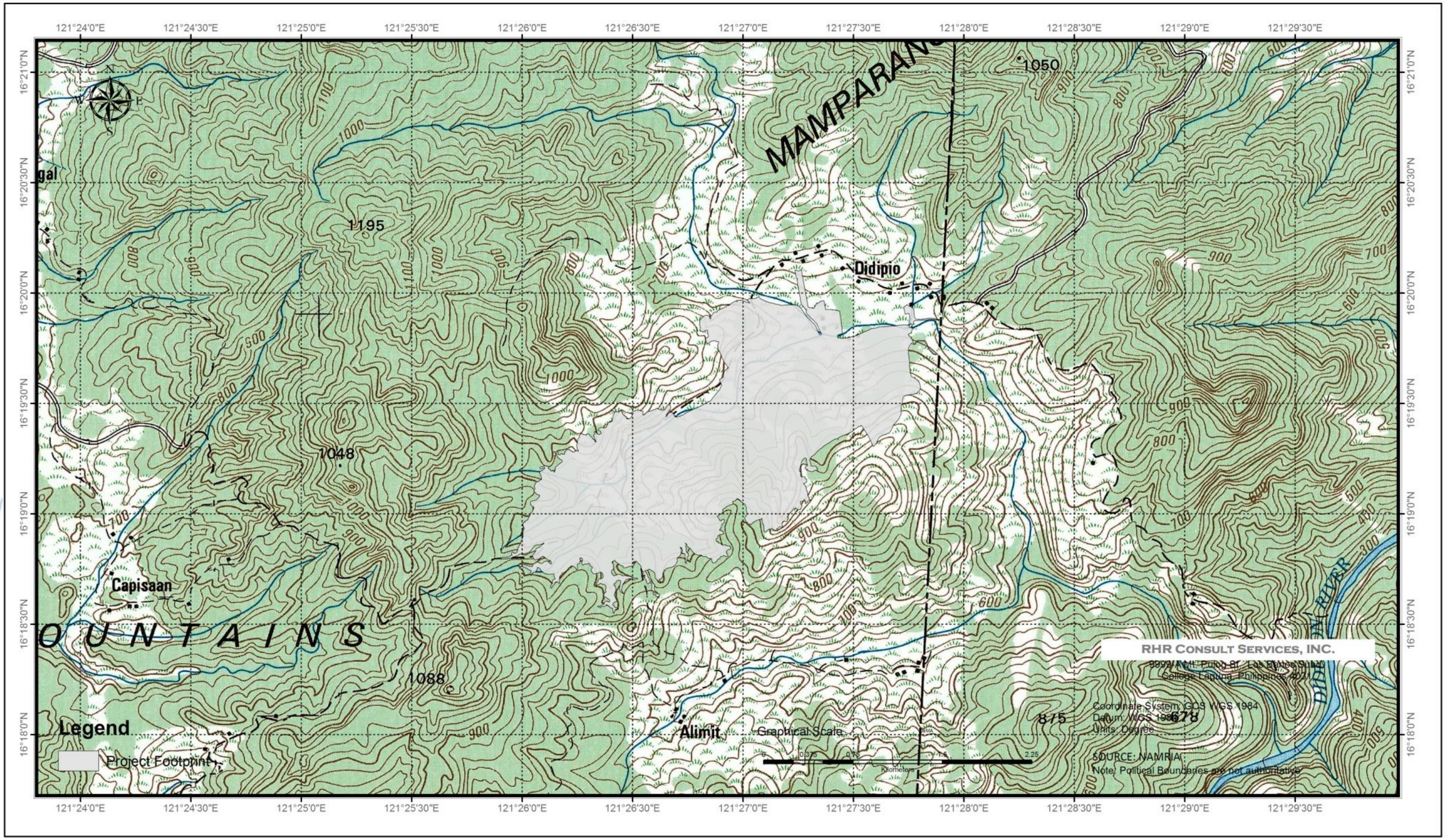


Figure 2-5: Topographic Map showing the Location of the Project

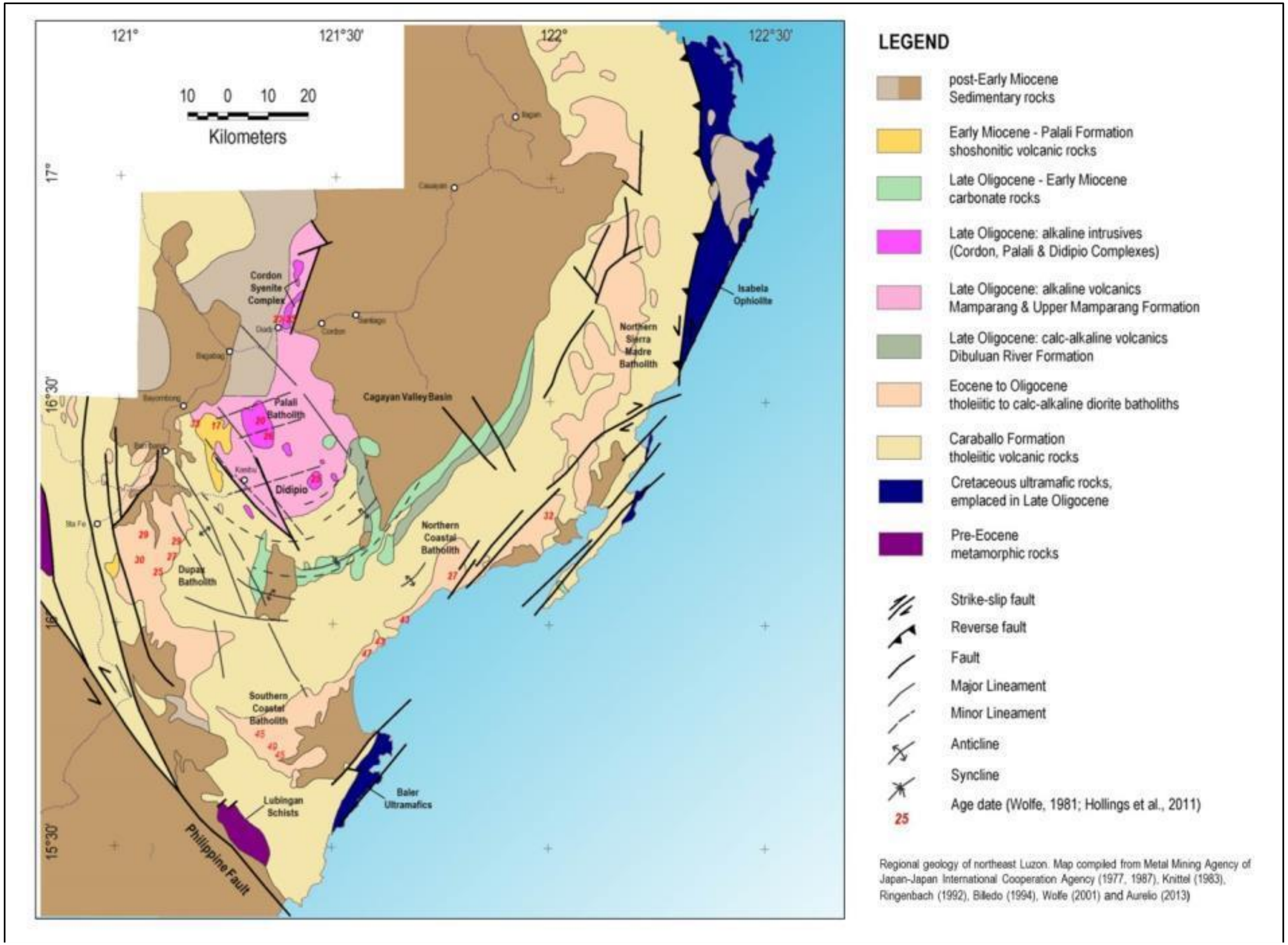


Figure 2-6: Northern Luzon – Major Geological Subdivisions and Structural Elements

Source: Technical Report for the Didipio Gold/Copper Operation (Griffiths, Holmes, & Moore, 2014)

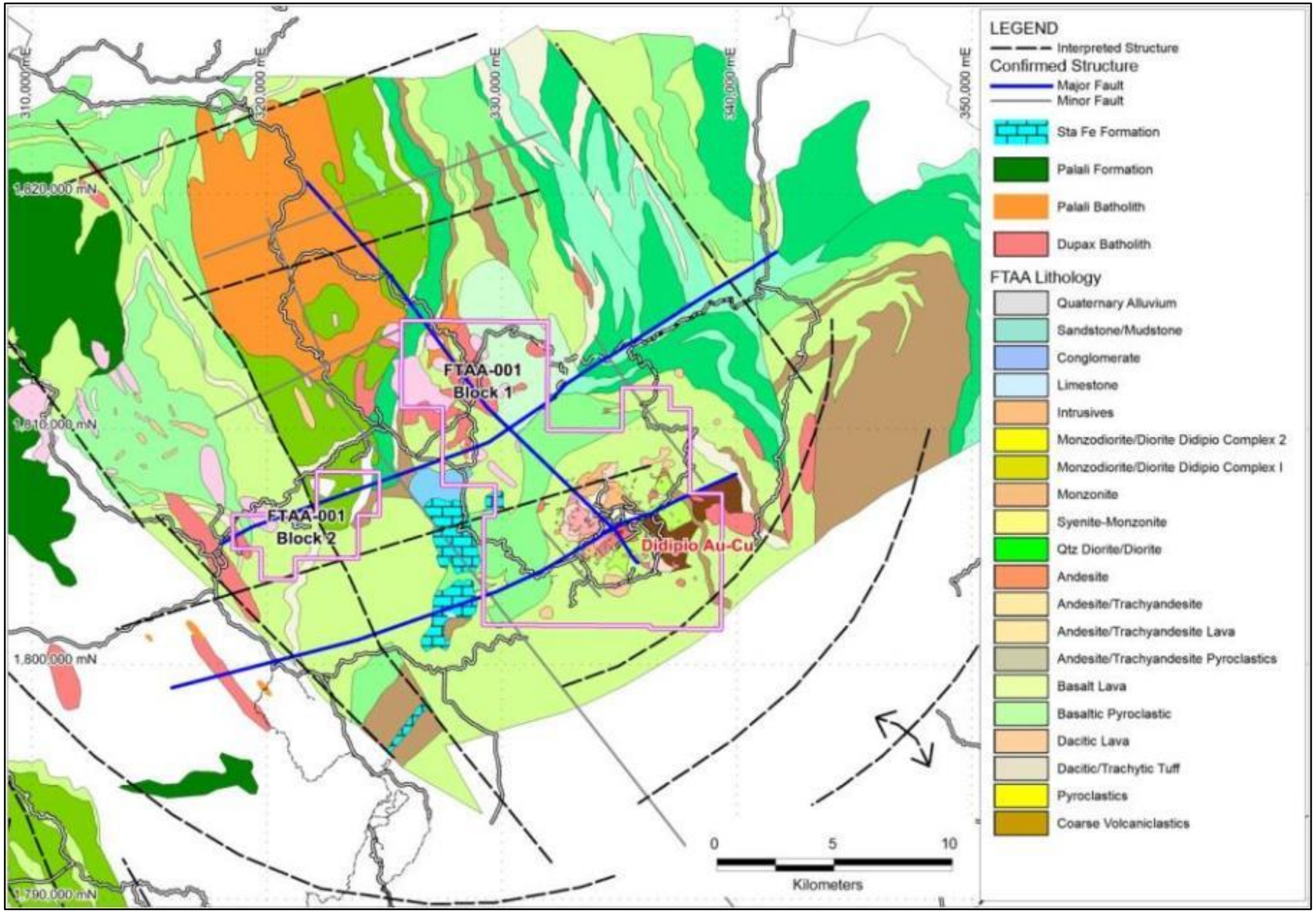


Figure 2-7: Regional Geology
Source: Technical Report for the Didipio Gold/Copper Operation (Griffiths, Holmes, & Moore, 2014)

2.1.2.3.1 DINKIDI DEPOSIT

The gold deposit in Didipio is called Dinkidi (Figure 2-8). According to the 1997 geological mapping study conducted for Didipio, Dinkidi is a gold-copper mineralized porphyry system, roughly elliptical at the surface (i.e., 450 × 150 m) and has a vertical pipe-like geometry that extends from at least 0.8 to 1 km below the surface. It consists of a NNW-trending steeply (i.e., 80°-85°) E-dipping composite microdiorite intrusive that is in contact with the Mamparang Formation.

Dinkidi intrudes the southern margin of a composite pluton and caldera complex made up of monzonitic to dioritic intrusives. About 6 to 8 km in size, the Didipio caldera is a physiographic feature that is rimmed by trachytic and andesitic porphyry that intruded the caldera ring structure. The microdiorite lies within the Didipio caldera and a circular Induced Polarization (IP) anomaly is coincident with this topographic feature. Medium-grained, clinopyroxene-biotite rich microdiorites and monzodiorites of the Dark Diorite, as well as centrally located pale grey to pink, fine-grained monzonites of the Surong Monzonite Complex comprise the pluton. Breccia textures found in the margins of the pluton suggest that the Surong Monzonite intruded the Dark Diorite.

The topographic highs of the Didipio caldera has Pimadek Porphyry that has a pale grey-green feldspathic groundmass with course K-feldspar phenocrysts (<20 mm to 30 mm). This Pimadek Porphyry may represent both the feeder dyke and extrusive product of an intracaldera ignimbrite given the pyroclastic deposits (i.e., ignimbrites, autobreccias) found in the area.

The Dinkidi deposit that consists largely of secondary silification, clay and carbonate, with copper minerals including malachite and chrysocolla, is oxidised from the surface to between 15 and 60 mbgs and averaging 30 mbgs. The oxide zone forms a blanket over the top of the deposit.

Alteration textures in igneous rocks (i.e., Bufu, Quan and Tunja Diorites), intensity, and varying mineralogy within the Dinkidi deposit indicate a continuum of intrusive and alteration events that overprinted intrusive contacts and destructively modified original rock textures. The introduction of carbonate and alteration of magnetite characterises the abrupt boundary between unaltered and altered rock in the Dinkidi deposit. Pervasive and veining alteration types comprise the eight alteration zones found in Dinkidi.

The main fault structures found within Dinkidi and surrounding areas can be grouped into three types, based on their orientation with respect to the mine grid and style (Gaia South, Inc., 2004).

These include:

- Three steeply-dipping faults and fault sets, trending NS, NW and ENE
- A shallow west-dipping fault set with an undefined strike
- Two steeply-dipping quartz-sulphide vein sets, trending NS and EW

Two major faults in the Dinkidi area consist of:

- Tatts Fault – A major grid N-S trending, steeply (i.e., 80° to 85°) E dipping fault that runs through the center of the deposit and a possible major conduit for mineralization and alteration. This fault is a major feature that controls the emplacement of the Quan Diorite and Bugoy Breccia. Although this fault is regarded as a regional lineament, movement has not been observed in this fault. In addition, it is not considered as a major plane of weakness.
- Biak Shear Zone – Mineralization is displaced at the northern end of the deposit where a major N-W trending, steeply N-E dipping fault is found. This fault contains remobilized gold copper mineralization and has a 30 to 35m-wide zone of chlorite hematite shear planes. Fault movement is dextral, with the horizontal component of movement found between 50 and 100 m north block to the east.

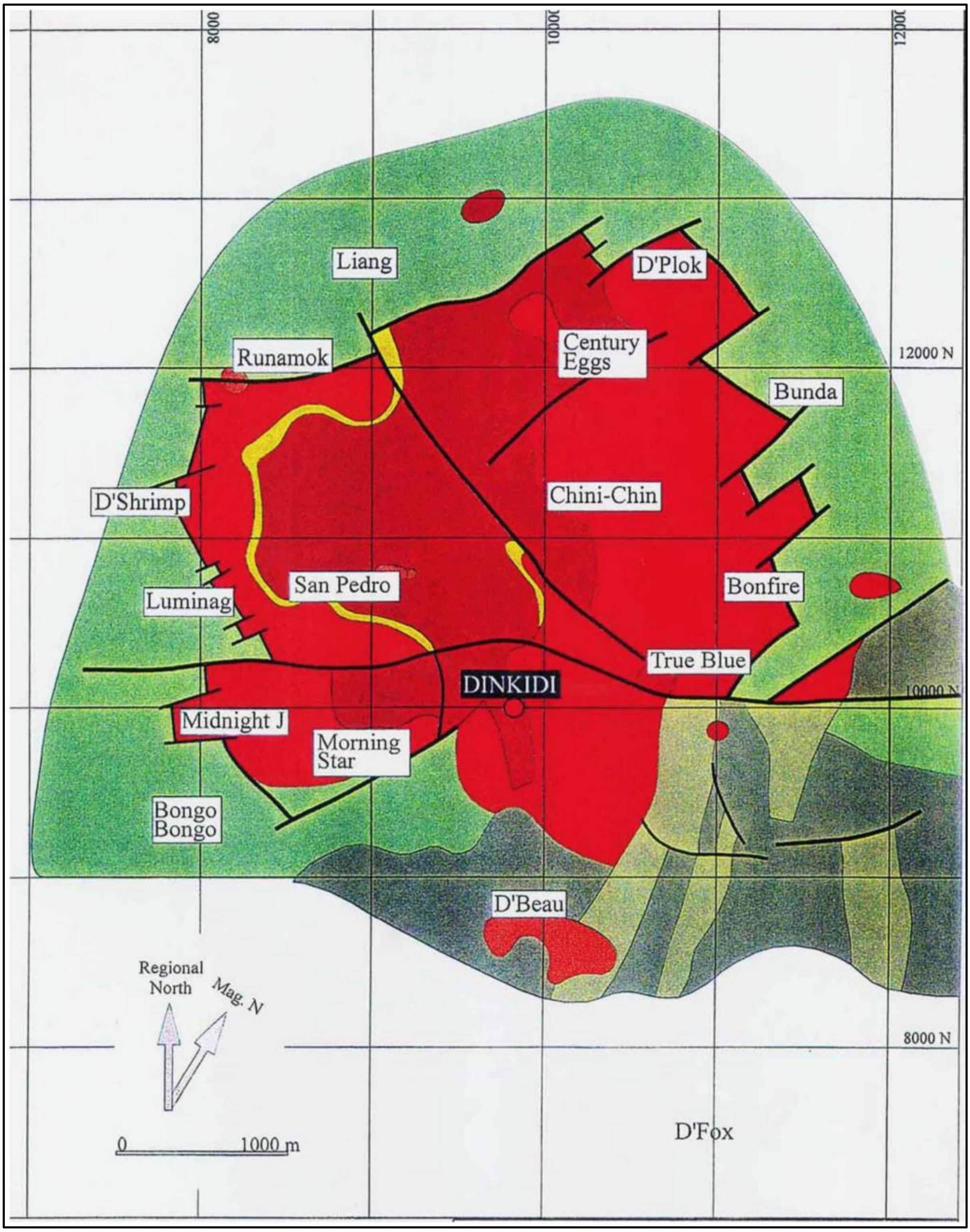


Figure 2-8: Didipio Local Geology
Source: Maunsell Phils., Inc. EIS Report 1997, GHD Environmental Baseline Update 2012

2.1.2.4 LITHOLOGY

The Didipio Gold-Copper Deposit is hosted by a series of hydrothermally altered and structurally controlled Miocene intrusives, which were emplaced along the regional Tatts Fault structure. Mineralisation is predominantly hosted by the Tunja Monzonite, which intrudes the Dark Diorite. Significant mineralisation also occurs in the surrounding Dark Diorite units immediate to the Tunja. The core of the Tunja is intruded by the Quan Monzonite porphyry, which is spatially related to the higher-grade mineralised zones (Figure 2-9 and Figure 2-10). The relationship of the Quan and a deeper intrusive, termed the Bufu, is uncertain, as Quan/Bufu contacts are both graduated and faulted in places.

The north-western end of the deposit is truncated by the Biak Shear.

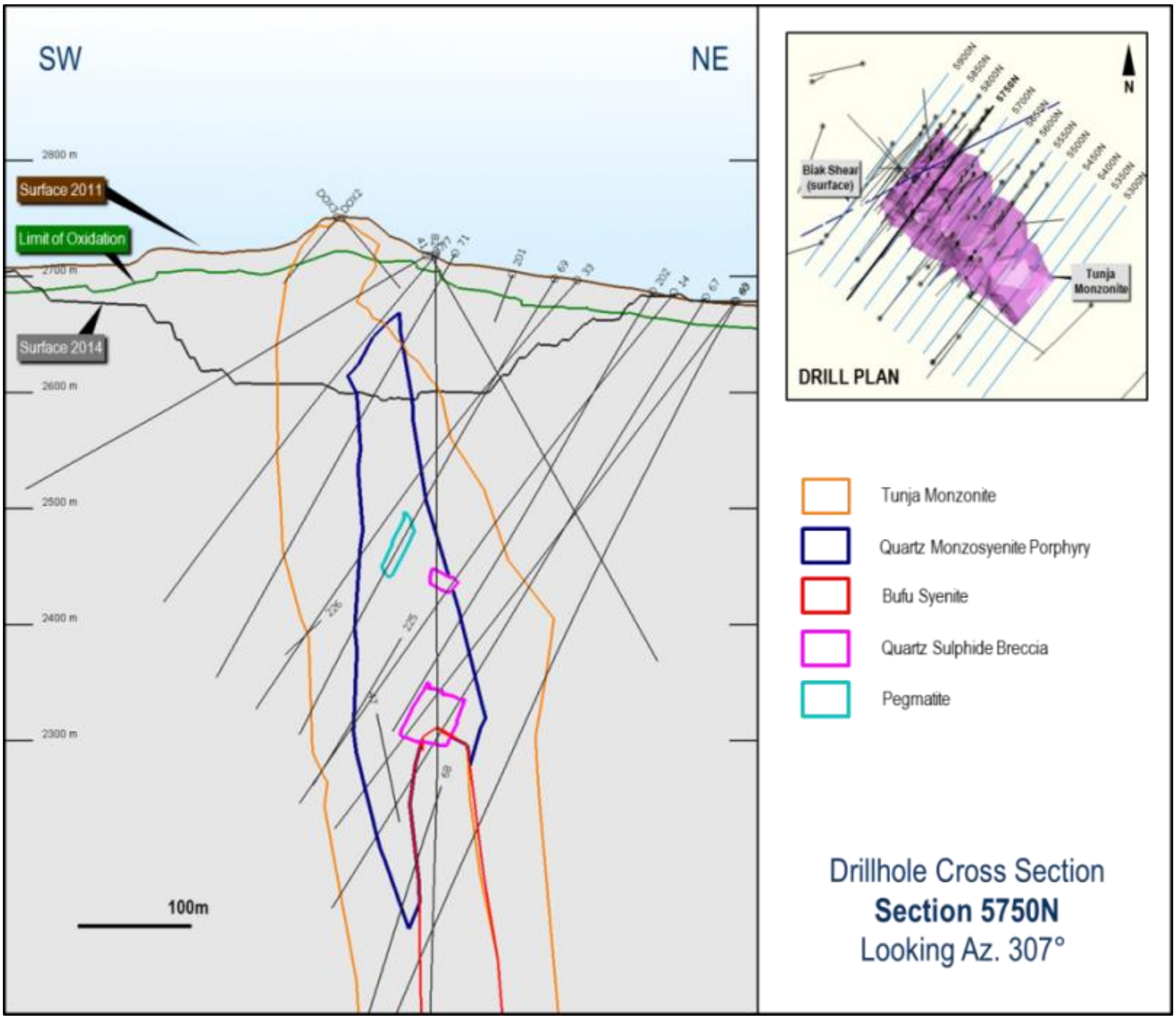


Figure 2-9: Didipio Operation Geology Section as of September 30, 2014
Source: Technical Report for the Didipio Gold/Copper Operation, Griffiths et. al., 2014

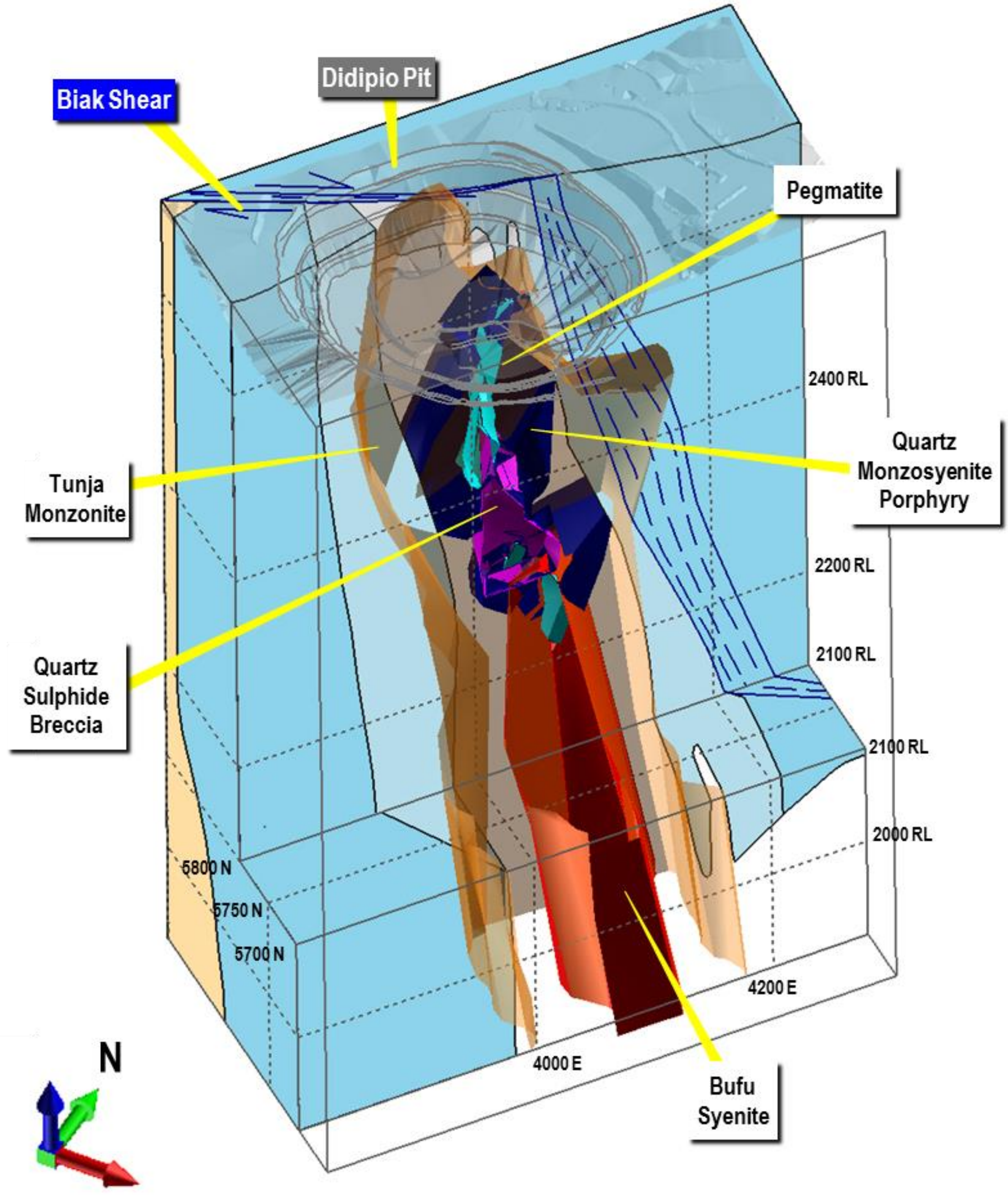


Figure 2-10: Didipio Operation Geology Cut Out as of September 30, 2014
Source: Technical Report for the Didipio Gold/Copper Operation, Griffiths et. al., 2014

2.1.2.5 Regional Tectonics and Seismicity

Southeast Asia is dominated by active plate tectonic processes that include deep oceanic trenches, island arcs and active volcanoes. Two subduction zones, namely, the Manila Trench and the Philippine Trench, are located on the western and eastern side of the Philippines (Figure 2-11). Between these two zones, a 1,200 km-long strike-slip fault runs from Luzon in the north to Mindanao in the south.

The following events summarize seismic activity within a 400-km radius of the project, which has occurred from 1907 to present:

- The strongest recorded earthquake in the area had a magnitude of 7.7 (Richter scale) and it occurred in 1942. The epicenter of this earthquake was 316 km south of the project site and was associated with movement along the Manila Trench.
- In 1990, the strongest earthquake recorded near the site had a 6.1 magnitude and was located only 40 km west of the project site.
- The most recent earthquake occurred in 1990, which had a magnitude of greater than 3.5. Its epicenter was located 8 km southwest of the site at a depth of 33 km.
- In 16 July 1990, the North Luzon earthquake that had a magnitude of 6.4 and had a depth of 25 km, caused the site to experience the most intense aftershocks. This earthquake was associated with movement of the Philippine Fault.

Seismic data reveal that most of the larger earthquakes that occur in the Philippine Fault are relatively shallow events and are associated with the strike-slip fault, instead of the Manila Trench. Major earthquakes east of the mine site are generally associated with the East Luzon Trench and focal depths for seismic events tend to increase towards west of the surface expression of the trough. In areas further west, earthquake depths tend to be greater, which indicates an association with the Manila trench. Clusters of seismic activity appear to occur along the northern and southern parts of the Manila Trench (Gaia South, Inc., 2004).

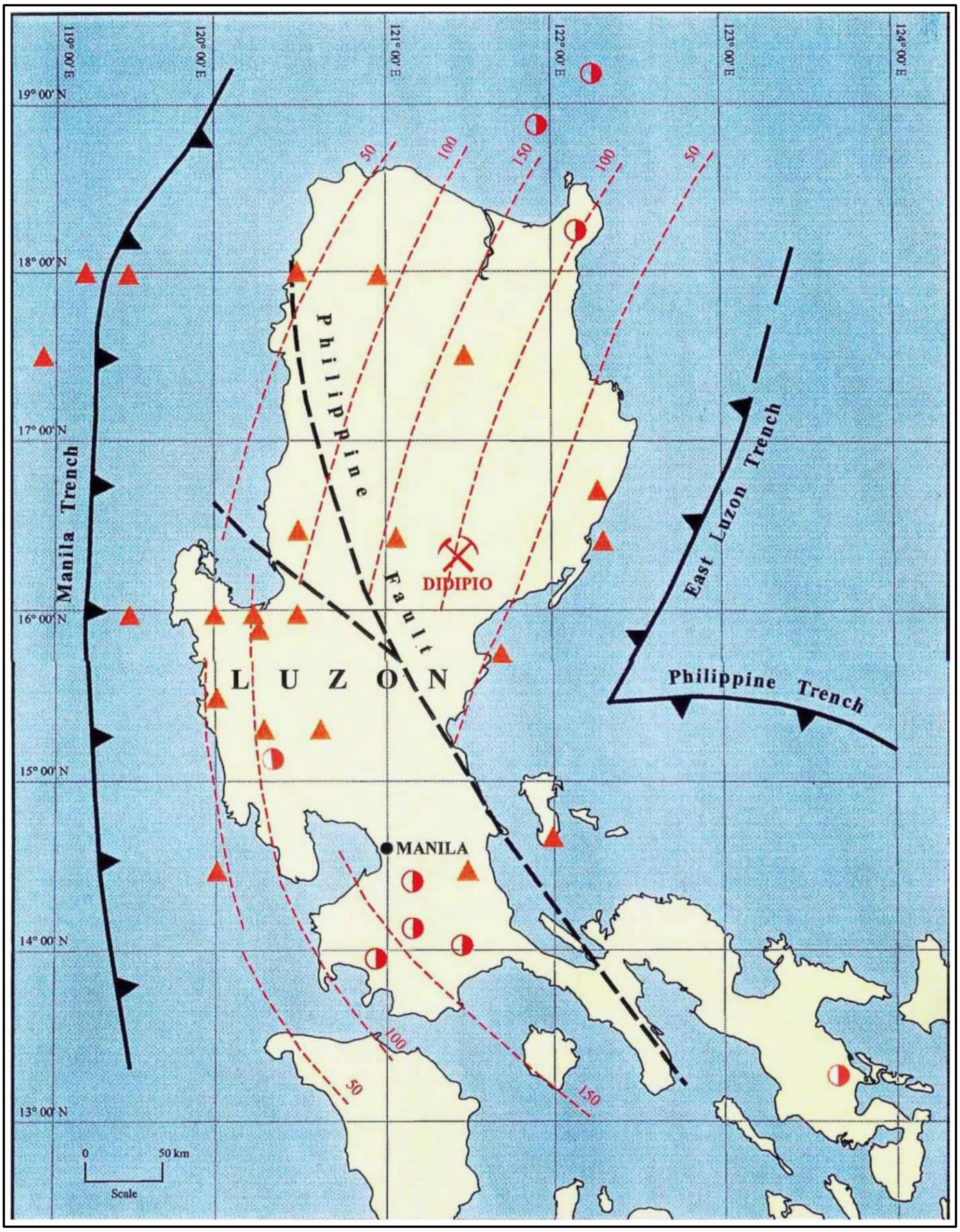


Figure 2-11: Didipio Regional Seismicity
Source: Maunsell Phils., Inc. EIS Report 1997, GHD Environmental Baseline Update 2012

2.1.2.6 Geomorphology

The area can generally be subdivided into six geomorphic units, namely, ridges-and-spurs, escarpment zones, hills-and-slopes, valley-and-gully sides, infilled valley bottom and mass movement zones (Figure 2-12).

Ridges-and-spurs occupy the highest elevations in the project site, with peaks not exceeding 1300 masl and encircling the project area between 600 to 1200 masl. Rugged terrain, steep slopes (>30%) and rapid denudational processes (e.g., landslides and rock falls) characterize ridges-and-spurs surfaces. Within this unit, soils are dominantly colluvial, poorly developed and fresh bedrock exposure is common. Good second-growth forests mark spring zones in this area. (Maunsell Philippines, Inc. 1997 cited in GHD Pty Ltd 2012)

Escarpment zones with slopes varying between 60° and 80°, represent the steepest features in the vicinity of the project site. These escarpment zones are prominent in the central section of the project area where major faults crisscross. Bedrock exposures are evident, which are associated with faultline scarps and landslides. Soil cover is uncommon, but good drainage, prevalence of springs and tributary heads and shrub patches are found onsite. (Maunsell Philippines, Inc. 1997 cited in GHD Pty Ltd 2012)

Hills-and-slopes are prominent between 600 to 800 masl elevations and are a mixture of regolithic and saprolitic surficial debris. With slopes varying between 10° to 30°, associated morphology that is geologically sensitive to mining development include concavo-convex break of slopes, mass movement scars and base-slope bulges. Morphographic positions of hills and slopes are characterized by deep weathering, good soil and well-drained conditions. Bulges that are indicative of active soil creeping are widespread in these areas. A high concentration of percolation/infiltration gullies in the area is indicative of abundant surface water and active groundwater seepage. Active gullies where springs are common are usually sources of water for perennial creeks. (Maunsell Philippines, Inc. 1997 cited in GHD Pty Ltd 2012)

Valley-and-gully sides represent the outer margins of perennial stream tributaries and gully zones in the vicinity of the project area. This unit has slopes between 30° to 40°, crosses 600 to 1000 masl elevations and is veneered by mixtures of slope debris, regolith and saprolite in and around the Didipio River Valley. Springs and groundwater seepage is evident, as well as the concentration of soil erosion and overland flow. Nonetheless, most portions of the valley-and gully sides were observed to have good soil and well-drained conditions that contribute to dense growth of shrubs, bushes and small trees. (Maunsell Philippines, Inc. 1997 cited in GHD Pty Ltd 2012)

Narrow strips of low and flat-lying areas characterize infilled valley bottoms that occupy the main Didipio Valley. Floodplain and terraces along the Didipio River are morphologically associated to these features. It is characterized by ponded alluvium, the abundance of valley fill materials, and sharp slope changes towards the boundaries and other margins. The presence of an infilled valley bottom is indicated by a few areas downstream of the Didipio River with bedrock truncation and dominant boulder fields. Infilled valley bottoms in the project area have a linear constriction associated with movement zones and the crossing of a major fault. It also narrows towards the mid-reach of the Didipio River. (Maunsell Philippines, Inc. 1997 cited in GHD Pty Ltd 2012)

Widespread presence of inactive cresecentric/arcuate surfaces indicates the present of mass movement zones around the project area. These mass movement zones coexist with the crown of landslide scars that are shallow with active scarps not exceeding a height of 1.5 m. Affected areas appear to be dormant due to vegetation protection. The occurrence of mass movement zones is evident along the borders of Alimit River and Dinauyan River catchments where there are prominent fault crossings. These are also apparent within the Didipio River headwaters where the Mamparang Formation and Caraballo Group is highly fractured and altered by the intrusion of andesite and dacite. (Maunsell Philippines, Inc. 1997 cited in GHD Pty Ltd 2012)

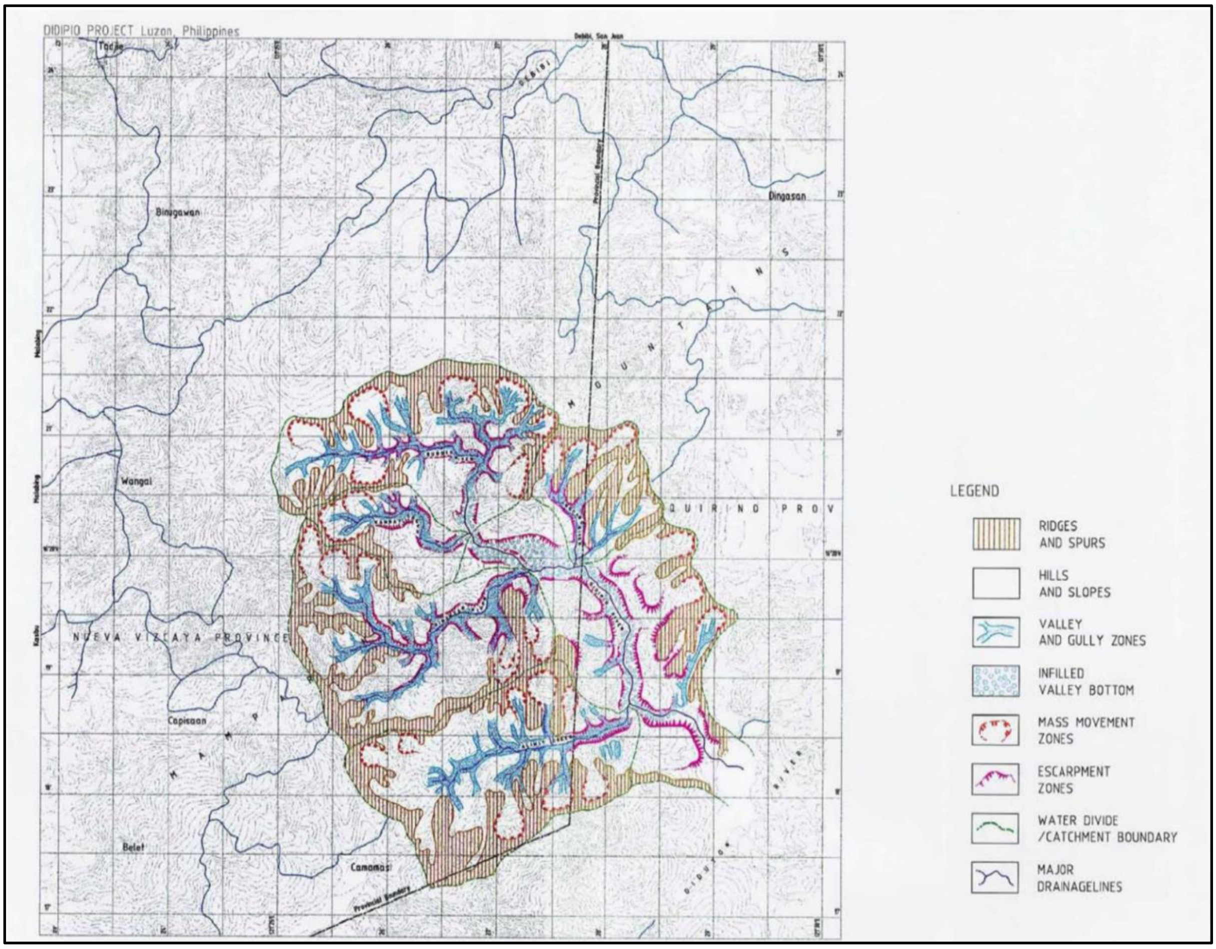


Figure 2-12: Didipio Morphological Map

Source: Maunsell Phils., Inc. EIS Report 1997 cited in GHD Environmental Baseline Update 2012

2.1.2.7 Impact Assessment – Geology/Geomorphology

2.1.2.7.1 Change in Surface Landform/ Geomorphology/ Topography/ Terrain/ Slope

The proposed increase in plant throughput to 4.3 Mtpa will not involve activities that will cause changes in surface landforms/ geomorphology/ topography/ terrain/ slope as there will be no additional surface areas to be opened.

The current mine operations, however, will inevitably alter the topography in within the project area primarily due to the development of the open pit, TSF, and waste rock dumps which involves earthmoving activities by excavating soil and rock in some areas and placing waste rock at other sites.

Prior to mining, the landscape in the area of the Dinkidi prospect ranges from 690 – 820 masl elevation. The Didipio Valley is located within a natural landscape of 600 – 1,000 masl elevation (Maunsell Phils., Inc., 1997). Currently, the open pit covers an area of approximately 51.3 ha (850 m NS, 800 m EW) with the final pit floor at 460 masl.

The construction of the TSF permanently altered the topography of the Dinauyan River valley since it is situated in one of the tributaries of Dinauyan River, Luminag Creek. Similarly, the waste rock stack across the Dinauyan River valley abutting the TSF has changes the original morphology of the Dinauyan River.

2.1.2.7.2 Change in Sub-surface Geology/ Underground Conditions

Significant excavation activities will also occur within the underground workings. Although these activities do not result in visual changes to the landscape, they do affect the geologic resources of the area. Development of the stopes and blasting may result to potential collapse of the underground workings. Underground workings (removal of rock and mineral resources) may also create a subsidence zone encompassing the open pit.

2.1.2.7.3 Inducement of Subsidence, Liquefaction, Landslides, Mud/Debris Flow, Etc.

The Didipio Valley is centrally located within known earthquake generators. The frequency of earthquakes in the area, with magnitude greater than 7 (which is potentially destructive to infrastructure) as recorded by PHILVOCS since 1990, can be as short as two years. This means than an earthquake of such intensity could occur within the life of the mine operation. (Maunsell Phils., Inc., 1997)

Pit walls and benches may potentially collapse due to pit development in critical slopes. Failure may be induced by a high seismic event, frequent and intense rainfall events, unfavorable geologic structures such as, fractures, joints, or faults, or ingress of groundwater during pit development or from the Biak Shear Zone which is adjacent to the pit’s northern wall.

The TSF embankment may be breached or fail during its development and operations. Breach or failure may be induced by seismicity and weather extremes, or inherent physical weaknesses on the embankment such as fractures. The waste rock dump or stockpile may fail due to seismic activity or high rainfall, structural weaknesses such as fractures and slip surfaces.

Overburden spoil piles/ topsoil stockpiles, if not stockpiled properly, may be eroded and consequently result to sedimentation downslope or downstream of the stockpile areas.

2.1.2.8 Mitigation Measures – Geology/Geomorphology

Mitigation control strategies for impacts to the terrain, soils and geology will consist of best engineering design practices, incorporation of best management practices and implementation of a comprehensive rehabilitation program.

2.1.2.8.1 Progressive Rehabilitation

OGPI has been implementing progressive rehabilitation across the mine site even during the onset of construction or as soon as areas become available for rehabilitation. The rehabilitation concept involves application of topsoil on battered slope and planting of native species including those that are abundant locally to reforest these areas. (OGPI AEPEP for 2018)

In the first few years there are limited areas at the site that were available for rehabilitation however there were opportunities for rehabilitation virtually from the start of construction and during operation. This early rehabilitation involves the establishing of a suitable seed bed and planting indigenous species or other species. The recovery of the fertile topsoil as well as proper conservation practices is based on the Top Soil Management Plan which is being implemented to maintain viability of topsoil for use in current and future rehabilitation activities. (OGPI AEPEP for 2018)

Progressive rehabilitation involves reconfiguring the slope into stable angle, benching, covering the slopes with top soil, matting of planting of selected plant species and casting of seeds. Rehabilitated area is being matted with coconet to hold the top soil and minimize erosion. (OGPI AEPEP for 2018)

2.1.2.8.2 Open Pit Design and Engineering Measures

Pit wall stability was reviewed and flatter slope configuration in the earlier studies was adjusted. Within the pit, each bench will be approximately 15 meters high and will have a maximum of 20-meter-high and will have bench slopes of 55 or 75 degrees. The 55-degree slopes will be in the oxide zone and the 75 degree slopes will be below the oxide zone. Each bench will have a berm that is approximately 8-10 meters wide. Design criteria based on geotechnical studies puts the maximum pit wall angles to be at 55 to 75 degrees. This design standard is implemented throughout the development and operations of the pit. Slope failure is mitigated following the approved design mention above, used gabion baskets and rock bolting in applicable areas, berm clean up and continuously monitoring slope movement via IBIS radar, inclinometer, and prisms. (OGPI AEPEP for 2018)

2.1.2.8.3 Seismic Design Criteria for Open Pit, TSF, WRS and General Facilities

The design criteria for all project works are currently rated to ground acceleration in accordance with existing national structural codes (OGPI AEPEP for 2018).

2.1.2.8.4 Slope Stabilization and Engineering Measures for Haul Roads and General Facilities

Preventative slope stabilization techniques are applied in slopes that are highly fractured or weathered, with critical angles of repose, or have the potential to topple. Preventative slope stabilization measures include cutting along slip surfaces, joints, or fractures, and regarding of the slopes to the most stable configuration. Preventative slope measures are particularly important in areas underlain by fractured diorite or highly indurated rocks and slopes along the general access roads, accommodation camp, the TSF, WRS, haul roads and other associated facilities. (OGPI AEPEP for 2018)

The working gradients of 50 to 60 degrees are adopted on slopes whenever appropriate (i.e. diorite and other rocks with high induration). If needed, additional slope control measures will be applied. Slope control measures may include the use of cocomatting or geomembranes for erosion reduction or prevention, use of riprap, gabions, and shotcrete along valleys or slopes that are along more permanent facilities such as the general access roads, and installation of weep holes or horizontal drains for to relieve high pore pressure and aid water drainage in waterlogged areas or fractured slopes. (OGPI AEPEP for 2018)

2.1.2.8.5 Geotechnical and Structural Monitoring

Piezometers are installed near the toe and of the TSF embankment and WRS to monitor movement or slippage during its operation. The use of extensometers is also advised. Physical monitoring such as observation for cracks or fracturing along the embankment, seepages other evidences of erosion or scouring are regularly conducted. If features of erosion, scouring, or potential breach are noted, these will be immediately mitigated and addressed to prevent failure. (OGPI AEPEP for 2018)

2.1.2.8.6 Emergency Response Plan

An Emergency Response Plan (ERP) and SOP for the Dam Safety Emergency Management Plan was formulated to address and manage emergencies that may result from earthquakes during the project life, chemical or contact water spills, and breach or failure of the key mine facilities such as the open pit and its underground workings, the TSF, and WRD. The ERP also include the installed of warning systems to address potential emergencies such as breach or structural failure or potential overtopping events due to extraordinary flood or rainfall. (OGPI AEPEP for 2018)

2.1.2.8.7 Prevention and Control of Erosion and Sedimentation

Progressive rehabilitation is being conducted to reduce the extent of the disturbed area at any one time and minimize or control erosion and sedimentation. In addition to the rehabilitation activities erosion and sedimentation control in the form of silt traps and sedimentation or stilling ponds will be installed near work and cleared areas to prevent sediments from moving downslope or downstream.

A surface drainage network is also installed on development areas and near the open pit, TSF, and WRD. Drainage networks proximal to the waste storage facilities will prevent generation of additional contact water particularly in the TSF and WRD. Drainage networks will also control surface run-off and prevent these from being transmitted into the mine areas and key facilities to reduce erosion and sedimentation. (OGPI AEPEP for 2018)

2.1.2.8.8 Geomorphologic Change

Identified mitigation for the geomorphologic change includes Implementation of progressive rehabilitation on disturbed areas and implementation of Final Mine rehabilitation and Decommissioning Plan (FMRDP) after LOM. (OGPI AEPEP for 2018)

2.1.2.8.9 Engineering Measures to Prevent Subsurface Collapse

For the development of the underground this year lay-out is planned accounting for a minimum amount of ground support which may include rock bolting, meshing, and shotcrete whenever required. Consideration of the hallowed ground support is also based on industry standards, the rock condition (i.e. fracturing, induration, and weathering), and the blast parameters. The vibration producing activities in the underground workings such as the blasts can be modified to optimal blast requirements while not compromising the integrity of the host rock. This can be achieved through the optimization of the ratio and volume of secondary explosive to ratios just enough to produce muck as dictated by production schedule to prevent destabilization of supporting walls. (OGPI AEPEP for 2018)

Additionally, geotechnical monitoring is being conducted regularly in the underground construction to observe for any manifestations of rockwall weakness such as fractures, cracks, or ingress of water. These observations are vital to immediately address potential problems affecting the integrity of the rockwall and which may signal potential subsurface collapse. (OGPI AEPEP for 2018)

2.1.2.8.10 Breach of Tailings Storage Facility

The TSF has been designed to the highest engineering and construction standards. Regular monitoring is conducted to identify potential signs of failure. In the very unlikely potential event of a failure of the TSF that may cause the release of tailings into the Dinauyan, a plan will be implemented to divert the tailings into the open pit through a short diversion from the Dinauyan River. The open pit can store all the tailings contained in the TSF.

2.1.3 Pedology

2.1.3.1 Impact Assessment - Pedology

2.1.3.1.1 Soil Erosion /Loss of Topsoil/Overburden

Topsoil loss due to ground preparation, and vegetation clearing may occur because of ground preparation and vegetation clearing prior to construction, earthworks during construction, and mine area development during construction and operations (OGPI AEPEP for 2018).

Vegetation clearing and ground preparation during construction of infrastructures and support facilities may result to increased erosion and consequent sedimentation downslope or downstream of the mine development areas. Likewise, development of cemented areas or hard grounds such as parking lots increases the likelihood of occurrence of surface runoff and sheet flow particularly in high rainfall events consequently increasing the occurrence of erosion and sedimentation. (OGPI AEPEP for 2018)

2.1.3.1.2 Change in Soil Quality/Fertility

Hydrocarbons from leaks from vehicles and equipment going to and from the mine areas and access roads may potentially result to soil contamination. Breach of the containers for fuel storage or leaks and accidental spills may also result to soil contamination in the fuel storage areas. Similarly, accidental spills or leaks from the containment of reagents used in the process plant may also lead to soil contamination. Transport of these reagents to the mine site may also contribute to soil contamination particularly during occurrences of accidental spills or leaks. Failure or breach in the pipes within the process plant and to the tailings storage facility may also lead to the accidental leaks or spills of contaminated water, process water, tails, and reagents that may in turn, lead to soil contamination. (OGPI AEPEP for 2018)

2.1.3.2 Mitigation Measures - Pedology

2.1.3.2.1 Erosion Control

Soil erosion is the process through which the effects of wind, water, or physical action displace soil particles, causing them to be transported. The main factors affecting surface erosion are rainfall erosivity, soil erodibility, slope length, slope steepness, soil cover, and the surface flow condition (i.e. flow type, velocity, duration, and frequency). (OGPI AEPEP for 2018)

Controlling the initial erosion of soil is often the only feasible strategy for minimizing environmental impacts resulting from disturbances of soils with a high clay or silt content. Erosion control measures concentrate on preventing, or at least minimizing, soil erosion, especially erosion resulting from raindrop impact. (OGPI AEPEP for 2018)

2.1.3.2.1.1 Revegetation

This refers to the establishment of temporary or permanent vegetation over exposed soil surfaces. Grasses and vines will be planted to control erosion on disturbed areas that will be inactive for at least six (6) months through seeding or direct planting. Unstable slopes that are highly prone to erosion are to be covered with biodegradable mat or coconet to keep the soil intact and minimize erosion. (OGPI AEPEP for 2018)

2.1.3.2.1.2 Seedling Production

- Mini Nursery at the Mine Site - The mini nursery of OGPI in Didipio serve as the temporary staging area of seedlings used in various revegetation projects at mine site. Collected seeds and wildlings of different endemic plants from the natural forest are propagated and raised in this nursery. Some ornamental plants needed for landscape greening and campsite beautification are also propagated on site.

- Main Nursery in Tucod - Bulk of the seedling requirement of OGPI for mine rehabilitation, tree plantation establishment and seedling donation to various stakeholders come from this nursery.

2.1.3.2.1.3 Erosion Control Blankets

Erosion control blankets are temporary erosion controls that provide cover over exposed soils. It reduces raindrop impacts by providing cover. These controls are commonly used on earth embankments and slopes before and during revegetation phase. Currently, Didipio mine has used and will continue to use cocomats in combination with various revegetation techniques. (OGPI AEPEP for 2018)

2.1.3.2.1.4 Hydroseeding

Hydroseeding was adopted by OGPI to address the problem of soil erosion control and progressive rehabilitation especially for those areas with insufficient soil and rock phases area. (OGPI AEPEP for 2018)

2.1.3.2.1.5 Gravelling or Rock Surfacing

Gravelling is primarily used to control raindrop impact and mud generation, and control of dust on trafficable areas. This method will be used as short-term control and will be maintained regularly (OGPI AEPEP for 2018) .

2.1.3.2.1.6 Surface Roughening

Surface roughening is an erosion control technique of which the benefits can vary significantly from site to site and shall be used on case to case basis (OGPI AEPEP for 2018).

2.1.3.2.1.7 Rock Lining

Similar with erosion control blankets rock lining provides surface cover but primarily used in drainage systems and water ways. The rocks provide a surface that covers and prevents the erodible surface from being washed away. (OGPI AEPEP for 2018)

2.1.3.2.2 Soil Pollution Control

Soil contamination with hydrocarbons, leaks and accidental spills can all be prevented with the use of pollution control measures. During vehicle and equipment maintenance, drip pans are being used. Drip pans are placed underneath equipment and vehicles to catch dripping oil from maintenance works. Collected hydrocarbons such as used oil and lubricants are being placed on storage tanks or bins for waste oil. A DENR-accredited hauler and treater will collect the waste oil. (OGPI AEPEP for 2018)

Spilled hydrocarbons are being collected using industry protocols for oil clean-up. Spilled hydrocarbons are being cleaned using non-toxic dispersants and collected into storage tanks or bins for waste oil. A third-party collector collects the waste oil. In the event of a hydrocarbon spill environmental site assessment is conducted to determine the extent of pollution and appropriate remediation measures are applied. (OGPI AEPEP for 2018)

The volatilization pad is continuously being utilized to cater the contaminated soils and rocks for treatment. Enzymes are used to disintegrate the hydrocarbons in the soils/rocks. Afterwards, the treated soil/rocks will be later introduced to the environment. (OGPI AEPEP for 2018)

Fuel storage tanks are bunded per industry specifications. Bunds may be in the form of concrete or any non-reactive impermeable material. The bunds are sized per 110% of the volume of the largest storage tank in the circuit to ensure effective containment of spilled material in case of a breach or spill. The spilled material is transferred into a waste bin or storage tank for oils. (OGPI AEPEP for 2018)

For process reagents, the Material Safety Data Sheet (MSDS) of the reagents are posted in the work areas to inform employees of the reagents' key properties particularly for corrosion, combustion, or flammability. Storage tanks for the reagents or process chemicals are designed and rated based on their properties which are also discussed in their respective MSDS. These containers or storage tanks are reinforced depending on the volume of the chemicals that will be stored. The storage tanks or containment units are also bunded per industry specifications. The bunds are in the form of concrete with lining or any non-reactive impermeable material suited to the reagents' properties. The bunds also be sized per 110% of the volume of the largest storage tank or containment unit in the circuit to ensure full containment in case of a spill. In the event of a spill in the process plant, the spilled reagents are reticulated back into the process circuit or pumped to the TSF via a two-stage pump. (OGPI AEPEP for 2018)

A quick response team is formed to address potential chemical leaks or spills outside the process plant or during transit. This team is responsible for the rapid clean-up of chemicals in the event of a spill. An environmental site assessment is conducted after clean-up to determine the extent of pollution in the event of a spill and appropriate site remediation measures that can be applied. (OGPI AEPEP for 2018)

2.1.3.2.3 Soil and Sediment Quality Monitoring

Soil and sediment quality within the vicinity of the key mine facilities such as the process plant, fuel storage, TSF, and WRS are conducted regularly to determine and monitor potential leaks or contamination due to possible breach in containment of transmission of seepage water as for the case of the TSF and WRS. The standards that are being used as references for the soil and sediment quality monitoring will be based on results of the most recent baseline surveys or applicable local and international sediment quality guidelines (SQGs). (OGPI AEPEP for 2018)

2.1.4 Terrestrial Ecology

The terrestrial flora and fauna assessment report of the Didipio Gold-Copper Project (the Project) is based on the signed and approved technical scoping checklist dated 15 May 2018 for the Environmental Performance Report and Management Plan of the project.

2.1.4.1 Terrestrial Flora

2.1.4.1.1 Key Findings

- OGPI is compliant with ECC conditions (Conditions 1,4&5) related to impact mitigations to terrestrial flora
- OGPI has planted 332,969 seedlings in various locations with 91.56 percent survival and donated 122,850 seedlings in different stakeholders in 2015
- Kaingin practices and logging activities that caused vegetation disturbance in the project area has already been recorded prior to project operation
- Permanent sampling stations with nine stations with two quadrats each station has been established in 2014 in compliance to ECC conditions
- Increase in tree species in in the project area indicates effective mitigation activities of OGPI with regards to floral vegetation
- Dipterocarp species under genus Shorea has been consistently recorded across the survey period indicating the patches of dipterocarp forest in the secondary growth is still within FTAA and that the mitigating measures being implemented are effective.
- The project modification involves an increase in annual plant throughput capacity from 3.5 Million tons per annum (Mtpa) to 4.3 Mtpa without involving any increase in the mine footprint area, thus, 1.) Vegetation removal and loss of habitat, 2.) The threat to the existence and/ or loss of important local species, and 3.) The threat to abundance, frequency and distribution of important species are unlikely.
- It is recommended to OGPI to continue the implementation and maintenance of mitigation measure and monitoring activities.

2.1.4.1.2 Methodology

A desktop review of publicly available documents was employed to assess the vegetation status and determine the possible impacts of the project and recommend applicable mitigations activities. Reviewed documents include studies conducted by OGPI and its third-party consultants, reports validated by MMT and DENR, and technical reports submitted and evaluated by MGB. Below is the list of documents that were used in writing this section.

- Environmental Impact Statement Didipio Gold/Copper Project- December 1997
- Amendment Environmental Impact Statement Didipio Gold/Copper Project-April 2004
- EPRMP for the Proposed Modifications to the Didipio Project October 21, 2011
- Environmental Compliance Certificate (Reference number ECC-CO-112-0022)
- Environmental Baseline Update Report Didipio Gold Copper Project- August 2012
- 2012 Quarterly Environmental Protection and Enhancement Program
- 2013 Quarterly Environmental Protection and Enhancement Program
- 2013 Ecological Assessment Report Didipio Gold Copper Project- January 2014
- 2013 1st Quarter Compliance Monitoring and Validation Report
- 2013 4th Quarter Compliance Monitoring and Validation Report
- 2013 1st Semester Compliance Monitoring Report
- 2013 2nd Semester Compliance Monitoring Report
- Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold Copper Project Progress Report - December 2014
- 2013 Environmental Compliance Audit Report

- 2014 1st Semester Compliance Monitoring Report
- 2014 2nd Semester Compliance Monitoring Report
- 2014 Quarterly Environmental Protection and Enhancement Program
- 2014 Annual Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold Copper Project Report - March 2015
- 2014 4th Quarter Compliance Monitoring and Validation Report
- Didipio Mine Environmental Protection and Enhancement (EPEP) Program-February 2015
- 2015 1st Semester Compliance Monitoring Report
- 2015 2nd Semester Compliance Monitoring Report
- 2015 4th Quarter Compliance Monitoring and Validation Report
- 2015 Quarterly Environmental Protection and Enhancement Program 2015 Environmental Compliance Audit Report
- Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold Copper Project Progress Report (Phase 2 October 2015 - January 2016)
- Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold Copper Project Progress Report (Phase 3 May 2016 - January 2017)

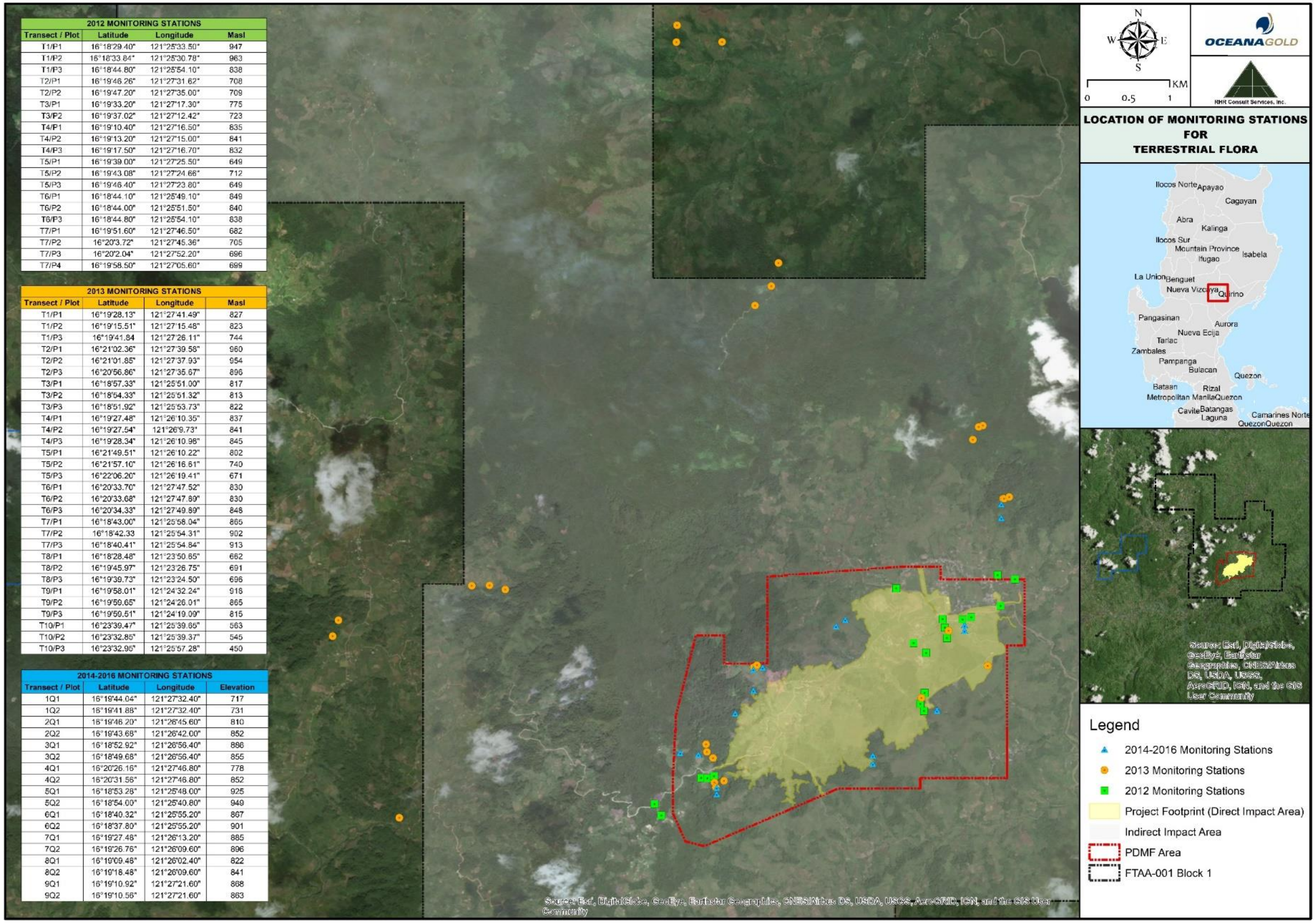
2.1.4.1.3 Sampling Site Description

Figure 2-13 presents the vegetation sampling site that was surveyed from 2012 to 2016. The 2012 vegetation survey was the updating of baseline studies while the 2013 survey activities were the first ecological monitoring activities in compliance with ECC with reference number ECC-CO-112-0022. In 2014, permanent sampling stations were established representing the present ecotypes adjacent to the project. These permanent monitoring stations have been monitored up to the present. Plate 2-1 shows monitoring activities in one of the permanent flora sampling stations.

Though the location of the sampling site has been changed from 2012 to 2014, the sampling method has been similar throughout from the updating baseline study to monitoring of permanent sampling stations. Quadrat sampling has been utilized consistently for terrestrial flora survey.

Similar computation of ecological indices across the monitoring periods has also been used for the baseline and monitoring period. Diversity indices (Shannon (H') and Evenness (e') index) for each sampling quadrats were computed during the baseline and monitoring activities.

Photo 2-1: 2015 Monitoring activities at Gmelina plantation at site 2 (photo grabbed from 2015 Ecological Assessment and Monitoring of Terrestrial and Aquatic Ecosystems in DGCP final report)



2012 MONITORING STATIONS			
Transect / Plot	Latitude	Longitude	Masl
T1/P1	16°18'29.40"	121°25'33.50"	947
T1/P2	16°18'33.84"	121°25'30.78"	963
T1/P3	16°18'44.80"	121°25'54.10"	838
T2/P1	16°19'46.26"	121°27'31.62"	708
T2/P2	16°19'47.20"	121°27'35.00"	709
T3/P1	16°19'33.20"	121°27'17.30"	775
T3/P2	16°19'37.02"	121°27'12.42"	723
T4/P1	16°19'10.40"	121°27'16.50"	835
T4/P2	16°19'13.20"	121°27'15.00"	841
T4/P3	16°19'17.50"	121°27'16.70"	832
T5/P1	16°19'39.00"	121°27'25.50"	649
T5/P2	16°19'43.08"	121°27'24.66"	712
T5/P3	16°19'46.40"	121°27'23.80"	649
T6/P1	16°18'44.10"	121°25'49.10"	849
T6/P2	16°18'44.00"	121°25'51.50"	840
T6/P3	16°18'44.80"	121°25'54.10"	838
T7/P1	16°19'51.60"	121°27'46.50"	682
T7/P2	16°20'3.72"	121°27'45.36"	705
T7/P3	16°20'2.04"	121°27'52.20"	696
T7/P4	16°19'58.50"	121°27'05.60"	699

2013 MONITORING STATIONS			
Transect / Plot	Latitude	Longitude	Masl
T1/P1	16°19'28.13"	121°27'41.49"	827
T1/P2	16°19'15.51"	121°27'15.48"	823
T1/P3	16°19'41.84	121°27'26.11"	744
T2/P1	16°21'02.36"	121°27'39.58"	960
T2/P2	16°21'01.85"	121°27'37.93"	954
T2/P3	16°20'56.86"	121°27'35.67"	896
T3/P1	16°18'57.33"	121°25'51.00"	817
T3/P2	16°18'54.33"	121°25'51.32"	813
T3/P3	16°18'51.92"	121°25'53.73"	822
T4/P1	16°19'27.48"	121°26'10.35"	837
T4/P2	16°19'27.54"	121°26'9.73"	841
T4/P3	16°19'28.34"	121°26'10.98"	845
T5/P1	16°21'49.51"	121°26'10.22"	802
T5/P2	16°21'57.10"	121°26'16.61"	740
T5/P3	16°22'06.20"	121°26'19.41"	671
T6/P1	16°20'33.70"	121°27'47.52"	830
T6/P2	16°20'33.68"	121°27'47.89"	830
T6/P3	16°20'34.33"	121°27'49.89"	848
T7/P1	16°18'43.00"	121°25'58.04"	865
T7/P2	16°18'42.33	121°25'54.31"	902
T7/P3	16°18'40.41"	121°25'54.84"	913
T8/P1	16°18'28.48"	121°23'50.65"	662
T8/P2	16°19'45.97"	121°23'26.75"	691
T8/P3	16°19'39.73"	121°23'24.50"	696
T9/P1	16°19'58.01"	121°24'32.24"	918
T9/P2	16°19'59.65"	121°24'26.01"	865
T9/P3	16°19'59.51"	121°24'19.09"	815
T10/P1	16°23'39.47"	121°25'39.65"	563
T10/P2	16°23'32.85"	121°25'39.37"	545
T10/P3	16°23'32.95"	121°25'57.28"	450

2014-2016 MONITORING STATIONS			
Transect / Plot	Latitude	Longitude	Elevation
1Q1	16°19'44.04"	121°27'32.40"	717
1Q2	16°19'41.88"	121°27'32.40"	731
2Q1	16°19'46.20"	121°26'45.60"	810
2Q2	16°19'43.68"	121°26'42.00"	852
3Q1	16°18'52.92"	121°26'56.40"	886
3Q2	16°18'49.68"	121°26'56.40"	855
4Q1	16°20'26.16"	121°27'46.80"	778
4Q2	16°20'31.56"	121°27'46.80"	852
5Q1	16°18'53.28"	121°25'48.00"	925
5Q2	16°18'54.00"	121°25'40.80"	949
6Q1	16°18'40.32"	121°25'55.20"	867
6Q2	16°18'37.80"	121°25'55.20"	901
7Q1	16°19'27.48"	121°26'13.20"	885
7Q2	16°19'26.76"	121°26'09.60"	896
8Q1	16°19'09.48"	121°26'02.40"	822
8Q2	16°19'18.48"	121°26'09.60"	841
9Q1	16°19'10.92"	121°27'21.60"	868
9Q2	16°19'10.56"	121°27'21.60"	863

Figure 2-13: Location of Vegetation Sampling Stations from 2012 to 2016

2.1.4.1.4 Results / Baseline

2.1.4.1.4.1 Land Cover and Vegetation Types

The project area is within the Greater Luzon Biogeographic unit, one of sixteen terrestrial biogeographic regions identified in the Philippines. It is strategically located in the southern portion of the lower edge of two major, almost interconnected mountain ranges, the Sierra Madre Mountain Range in the east and the Cordillera Mountain Range in the West. The two major mountain ranges comprise an interconnected complex with the Caraballo mountains and facilitate the movement of flora and fauna and ensure the survival and protection of a range of species unique to the region.

The 1997 EIS of the project recorded logging and kaingin practices in the area prior to the project that caused vegetation disturbance in the area. The present location open pit area was a grass land area. Dominant species were tambo grass (*Arundo donax*), cogon (*Imperata cylindrica*) and patches of carabao grass *(Paspalidium* sp.). The mine safety sectors were also grass land with agroforestry species. *Kaingin* activities were observed in these areas.

Based on the 2010 land cover map, the FTAA-0001 block 1 and 2 were composed of Closed Forest, Annual crop, Built up, Grass land, Inland water, Open Forest, Perennial Crop, Shrub, and wood landgrass land (Figure 2-14). The Partial DMPF area, on the other hand, is dominated by shrub (40.76%) and open forest (21.68%). The list of land cover of the Partial DMPF area is presented in Table 2-5.

Table 2-5: Land cover of Partial DMPF Area

Land cover	Area (has)	Percent
Open Forest	562.34	21.68
Shrubs	1057.53	40.76
Wooded Grassland	119.52	4.61
Grassland	476.16	18.35
Annual Crop	110.64	4.26
Annual Crop	263.72	10.17
Inland Water	4.33	0.17

The 2012 updated baseline report recorded the general landscape of the project area as a valley with a variety of ecosystems but has been logged over (i.e., a second growth forest). Majority of the area is a second-generation climax tropical rain forest at the upstream/higher elevation and agricultural/backyard gardens, agroforestry area, tree plantations, riparian and grassland ecosystems towards the foot of the valley.

In 2013 ecological monitoring, seven (7) vegetation communities based on floristic composition and structure has been identified within the OGPI FTAA namely the following:

1. Tropical Lowland Evergreen Rainforest (TLER)- these are the residual forest in Upper Tucod at 529 meters above sea level
2. Tropical Lower Montane Rainforest- characteristic of forests falling somewhere in between 700-1,300 masl depending on the size of the mountain
3. Forest Over Limestone- found in Capisaan harbor vegetation which is well adapted to soils derived from limestone substrate
4. Grassland and Fern Thickets- areas where the forests had been totally cleared and where seasonal summer fires had been more prevalent, grasslands become the major vegetation type. The most dominant grass observed was *Miscanthus floridulus* locally known as Runo in elevations 700 masl and above.
5. Cultivated and *Kaingin* Areas- areas in Capisan planted with suha (*Citrus grandis*) is planted into orchards as a cash crop. Bananas (*Musa* sp.) are also cultivated as a source of supplementary income and home consumption

6. Brushland and Scrubland- areas that have been previously cleared and left to regenerate. Some species recorded in brushlands were hauili (*Ficus septica*), binunga (*Macaranga tanarius*), *Phyllanthus* sp., *Melastoma* sp., *Dillenia* sp., and a number of grasses common in grassland community around the study area.
7. Tree Plantations and Reforestation Sites- these are the reforestation established by OGPPI within the FTAA

From 2014 to 2017 ecological monitoring report the general vegetation and ecotypes were unchanged as grasslands, logged-over forests, residual forests and reforested areas.

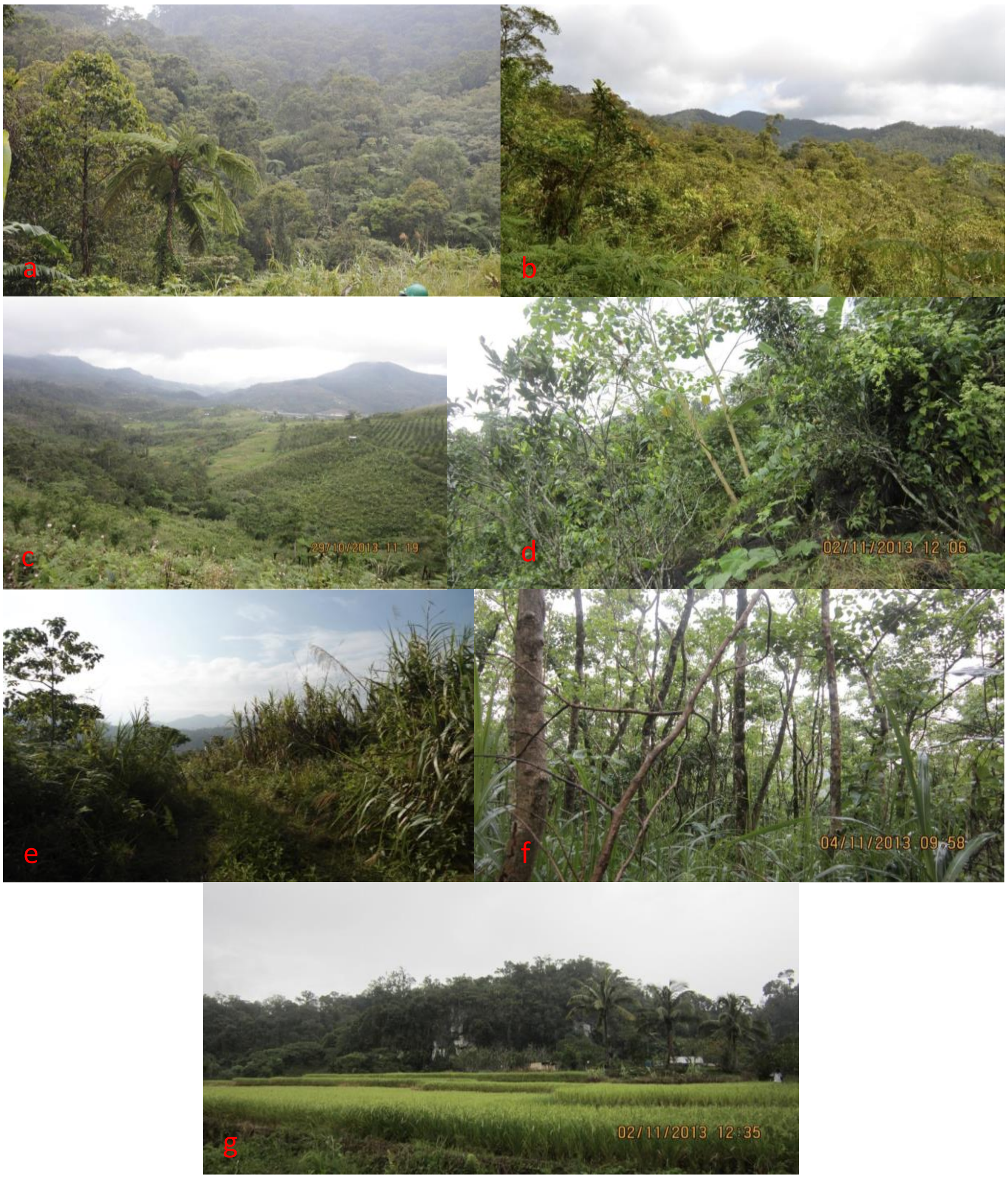
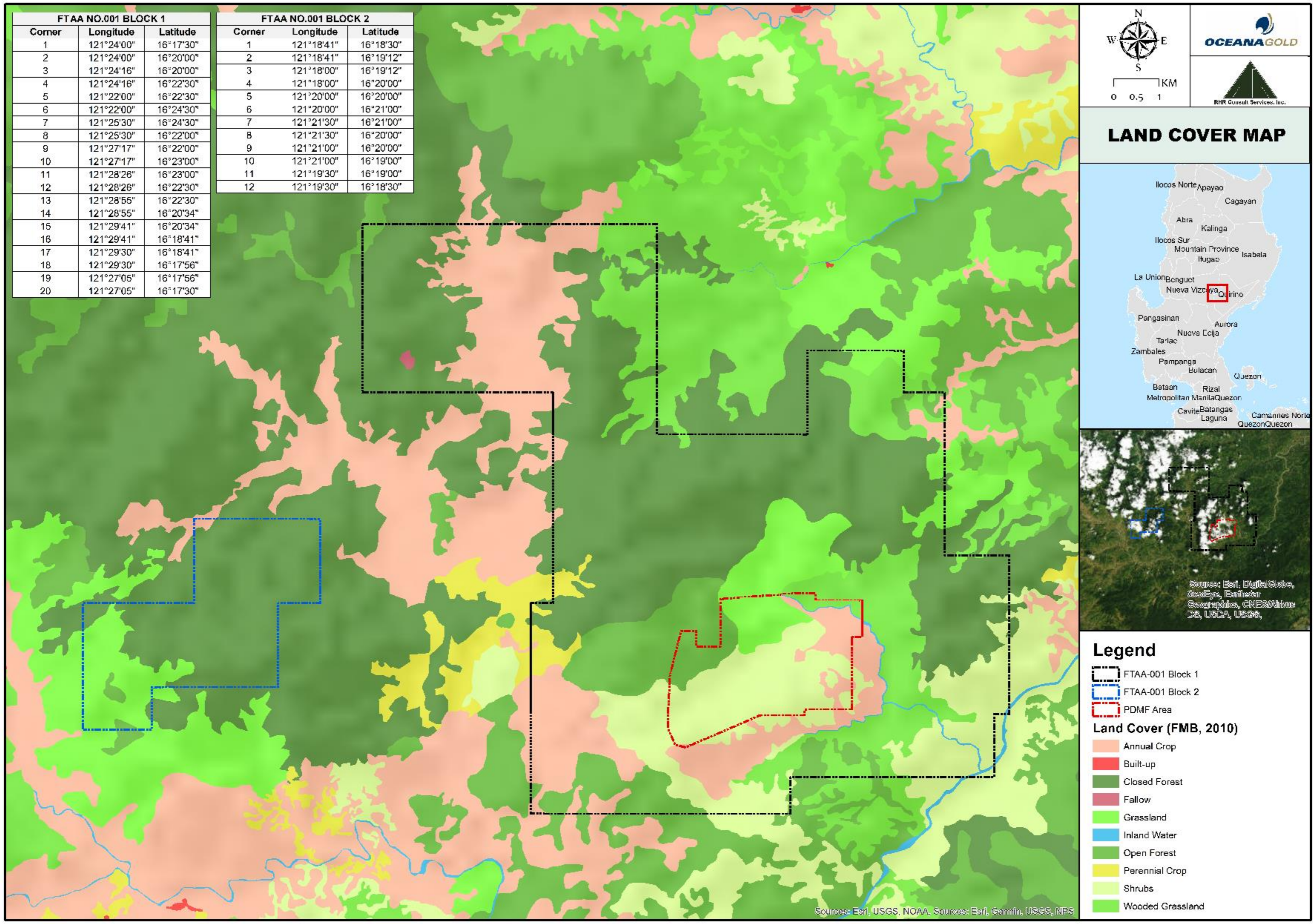


Photo 2-2:Ecological monitoring of OGPI 2013 (a) emergent dipterocaps, (b) tropical lowland evergreen rainforest, (c) patches of fruit plantation, (d) brushland, (e) grassland, (f) gmelina plantation, (g) forest over limestone2015



FTAA NO.001 BLOCK 1		
Corner	Longitude	Latitude
1	121°24'00"	16°17'30"
2	121°24'00"	16°20'00"
3	121°24'16"	16°20'00"
4	121°24'16"	16°22'30"
5	121°22'00"	16°22'30"
6	121°22'00"	16°24'30"
7	121°25'30"	16°24'30"
8	121°25'30"	16°22'00"
9	121°27'17"	16°22'00"
10	121°27'17"	16°23'00"
11	121°28'26"	16°23'00"
12	121°28'26"	16°22'30"
13	121°28'55"	16°22'30"
14	121°28'55"	16°20'34"
15	121°29'41"	16°20'34"
16	121°29'41"	16°18'41"
17	121°29'30"	16°18'41"
18	121°29'30"	16°17'56"
19	121°27'05"	16°17'56"
20	121°27'05"	16°17'30"

FTAA NO.001 BLOCK 2		
Corner	Longitude	Latitude
1	121°18'41"	16°18'30"
2	121°18'41"	16°19'12"
3	121°18'00"	16°19'12"
4	121°18'00"	16°20'00"
5	121°20'00"	16°20'00"
6	121°20'00"	16°21'00"
7	121°21'30"	16°21'00"
8	121°21'30"	16°20'00"
9	121°21'00"	16°20'00"
10	121°21'00"	16°19'00"
11	121°19'30"	16°19'00"
12	121°19'30"	16°18'30"

Figure 2-14: Land cover map of FTAA-0001 block 1 and 2 and PDMF (Partial DMPF)

2.1.4.1.4.2 Ecological Indices

2.1.4.1.4.2.1 Diversity Indices

Using Fernando's et.al (1998) diversity classification scheme, the project location has very low to moderate diversity (H'1.83 to 2.97) during the 1997 baseline gathering. Among the areas that were surveyed during the 1997 EIS were mine safety south sector with H' =1.83, mine safety east sector with H' =2.09, Dagupan Riparian Zone with H' =2.24, mine safety west sector with H' =2.6, mine safety north sector with H' =2.76, and Pimadek forest with H' = 2.97. The very low to moderate diversity values of the project area in 1997 indicates that area has already been disturbed prior to project operation. In 2012, updating of baseline studies conducted by GHD, diversity indices of the project area ranged from low to very low at canopy layer, high to very low at intermediate and moderate to very low at understory layer. In 2013 monitoring activity, the diversity indices across the intermediate and canopy layer were recorded as very low. It should be noted that the sampling locations of 1997, 2012 and 2013 vary with each other, hence, cannot be compared with each other. However, in 2014, permanent sampling/monitoring stations with nine (9) stations with two (2) quadrats in each station were established. These permanent monitoring stations are now being surveyed annually. Figure 2-15 presents the diversity indices of permanent monitoring plots from 2014 to 2016. It can be observed that the station 8 quadrat 1 (S8Q1) has the highest diversity indices with consistent moderate diversity from 2014 to 2016. This result is expected as the vegetation in this station is a natural growth forest and riparian ecosystem and also classified by UPLBFI as moderate impact area or with minimal disturbance from project because of its location.

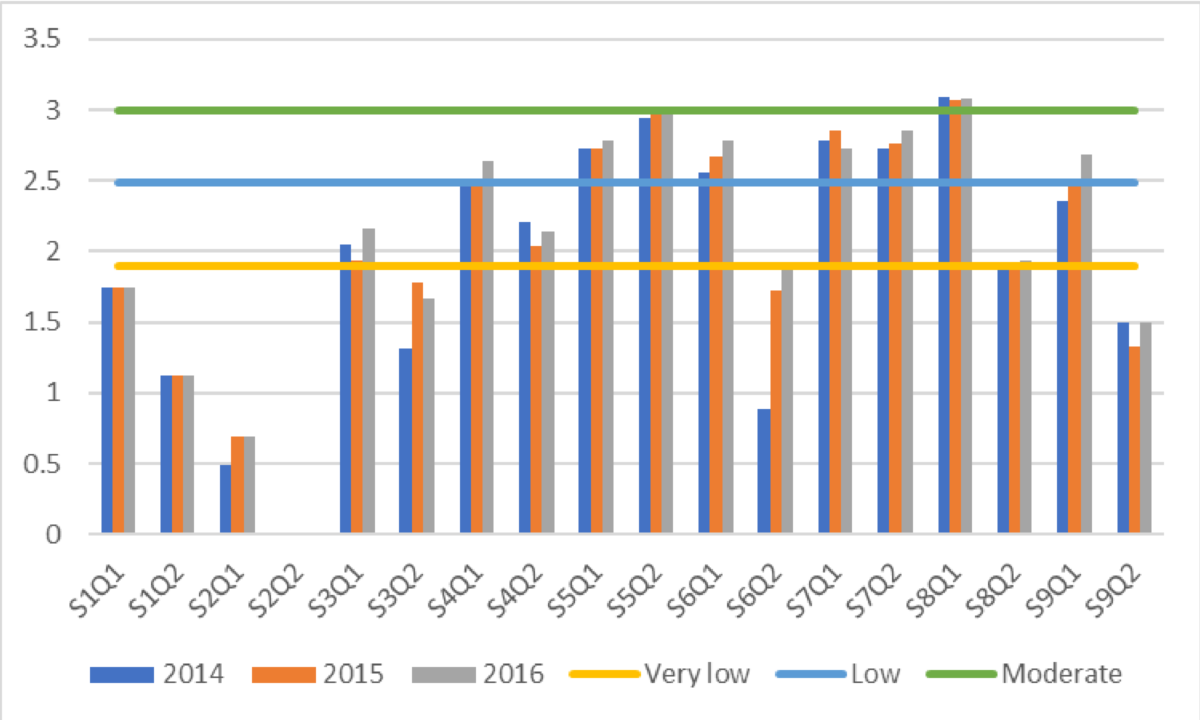


Figure 2-15: Diversity Indices of Permanent Sampling Stations

2.1.4.1.4.2.2 Importance Value (IV)

Based on computed IV of species during the 1997 baseline studies, the undergrowth vegetation of the project area was dominated grass species and agricultural crops. This includes tambo grass, cogon, carabao grass, coffee and rice. Canopy layer, on the other hand, was dominated by a *Ficus* species and three Dipterocarp species- white lauan, mayapis and tanguile. These dipterocarp species were still recorded as dominant species or has the highest IV during the 2013 to 2016 ecological monitoring activities. There is no significant change in the importance value of each species during this monitoring period. The same threatened Dipterocarps; mayapis, tanguile and white lauan were still the most dominant (Table 2-6). Dominance of these dipterocarps is expected because majority of the quadrats surveyed are either tropical lowland evergreen rainforest (Dipterocarp forest) or tropical lower montane rainforest (Tanguile-oak forest).

Table 2-6: List of species with highest importance values.

1997	2013	2014	2015	2016
Dinkidi north sector (Canopy layer)	**Canopy layer**	Mayapis (*Shorea palosapis*) = 46.67	Mayapis (*Shorea palosapis*) = 46.48	Mayapis (*Shorea palosapis*) = 45.60
Ficus sp.= 77	Tanguile (*Shorea polysperma) =* 42.51	Tanguile (*Shorea polysperma*) = 40.93	Tanguile (*Shorea polysperma*) = 39.52	White lauan (*Shorea contorta*)= 38.62
White lauan (*Shorea contorta*)= 61.63	White lauan (*Shorea contorta*)= 32.04	White lauan (*Shorea contorta*)= 38.07	White lauan (*Shorea contorta*)= 37.27	Tanguile (*Shorea polysperma*) = 36.10
	Mayapis (*Shorea palosapis*) = 18.74	Hamindang (*Macaranga bicolor*) = 13.52	Yemane (*Gmelina arborea*) =11.30	Hamindang (*Macaranga bicolor*) = 14.34
Forest Patch (intermediate layer)	*Lithocarpus* sp. = 14.39	Yemane (*Gmelina arborea*) =10.83	Hamindang (*Macaranga bicolor*) = 7.29	Yemane (*Gmelina arborea*) =12.33
Tambo *Arundo donax*)= 111.3	Balete (*Ficus benjamina*)= 12.55	*Syzygium* sp. 5.42	*Eurya japonica* ssp. *Nitida*= 4.73	*Eurya japonica* ssp. *nitida* (Korth.) T.Yamazaki =4.68
Cogon (*Imperata cylindrica*)=70.48	Yemane (*Gmelina arborea*) =11.27	Katong matsing (*Chisocheton pentandrus* subsp. *pentandrus*) = 4.53	*Syzygium* sp. = 4.56	Mapipi (*Litsea anomala* Merr.) = 4.41
	Malabignai (*Aporusa symplocifolia*) = 8.97	Palonapoi (*Lithocarpus castellarnauianus*)= 4.33	*Lithocarpus* sp. 4.54	Kamahiuan (*Ficus fistulosa* Reinw. ex Blume) = 4.20
Dinkidi Hill	*Chisocheton* sp.= 8.55	*Eurya japonica* ssp. *nitida* 4.27	Katong matsing (*Chisocheton pentandrus* subsp. *pentandrus*) = 4.30	Palonapoi (*Lithocarpus castellarnauianus*)= 3.67
Ferns= 103	*Syzygium* sp. 7.58	*Lithocarpus* sp. 4.13	Palonapoi (*Lithocarpus castellarnauianus*)= 4.16	Ambalag (*Mischocarpus pentapetalus* (Roxb.) Radlk.) = 3.61
coffee (*Coffea* sp.) = 92	*Artocarpus* sp. 6.76			
Pilmadek forest	**Understory**			
Carabao grass (*Paspaldium* sp.) = 29.77	*Sellaginella* sp. = 81.99			
Tanguile (*Shorea polysperma*) = 28.69	Uoko (*Mikania cordata*) = 60.87			
Mayapis (*Shorea palosapis*) = 23.34	*Adelmeria* sp. = 57.90			
	Scleria scrobiculata =			

	55.66			
Upper surong Valley	coffee (*Coffea* sp.) = 39.12			
Carabao grass (*Paspalidium* sp.) = 63.13	*Oplismenus compositus* = 23.8.1			
Tambo (*Arundo donax* .)= 50.53	*Elastoma* sp.= 37.89			
	Alpinia sp. = 15.32			
Dinauyan Valley	Kilob (*Gleichenia linearis* = 37.37			
rice (*Oryza sativa*) = 48.38				
Tambo grass (*Arundo donax*)= 20.63				

2.1.4.1.4.2.3 Floral Taxonomy

The floral taxonomy among the established sampling stations has been recorded from 1997 baseline studies to 2016 monitoring activities. It should be noted that the data from 1997 to 2013 (Table 2-7) were obtained from different sampling stations, hence, cannot be compared with each other. On the other hand, data from 2014 to 2016 (Table 2-8) were obtained from the established permanent sampling stations, thus, comparative with each monitoring activities. Increase in number of species identified from 2014 to 2016 indicates an effective mitigation activity of OGPI on floral vegetation. Complete list of recorded flora species during the sampling activities from 1997 to 2016 is presented in Appendix A.

Table 2-7: Floral Taxonomy of Terrestrial Vegetation of the Project from Various Survey Activities at Different Sampling Stations

Floral Taxonomy	1997	2004	2012*			2013
Morpho-species	83	28	OS	IM	US	278
Genera	74	22				203
Families	46	17	12	16	25	92

*OS=Overstory layer, IM=intermediate layer, US=Understory layer

Table 2-8: Floral Taxonomy of Terrestrial Vegetation of the Project from Permanent Sampling Stations

Floral Taxonomy	2014	2015	2016
Morpho-species	436	443	484
Genera	299	303	287
Families	105	106	111

2.1.4.1.4.2.4 Habit

Plant forms or habit of recorded species during different terrestrial flora survey were also recorded. There are at least 12 habits that were recorded from 2012 to 2016 (Table 2-9). Among these habits, trees and herbs comprised the majority of life forms. OGPPI plantations/ reforestations activities can be attributed to the continued increase in number of trees recorded from 2014 to 2016.

Table 2-9: Habit of Recorded Terrestrial Vegetation Species found within the FTAA from 2012 to 2016

Habit	2012*		2013	2014	2015	2016
	IM	US				
Ferns and allies	2	4	26	36	36	37
Grasses	0	6	11	11	11	11
Herbs	1	10	20	56	59	96
Palms	1	0	3	9	9	9
Sedges			3	3	3	3
Shrubs	11	5	28	45	25	38
Trees	31	8	146	224	228	238
Vines	1	3	12	52	52	2
Epiphytes/orchids			12			
Aroid			11			
Rattan			4			
Pandan			2			

*IM=intermediate layer, US=Understory layer

2.1.4.1.4.3 Floral Conservation Status and Endemicity

Conservation status of recorded species was assessed using DAO 2017-11 and latest available IUCN. Threatened species is a general term to denote species or subspecies considered as critically endangered, endangered, vulnerable or other accepted categories of wildlife whose population is at risk of extinction.

Endemic plant species or those that can only be found in certain geographic location were also recorded from 1997 baseline studies to 2016 monitoring activities.

The number of threatened and endemic species is presented in Table 2-10 while complete list of recorded threatened and endemic species are presented in Appendix B and C, respectively. It should be noted that the data from 1997 to 2013 were obtained from different sampling stations, hence, cannot be compared with each other. On the other hand, data from 2014 to 2016) were obtained from the established permanent sampling stations, thus, comparative with each monitoring activities. Dipterocarp species under genus Shorea has been consistently recorded across the survey period indicating the patches of dipterocarp forest in the secondary growth is still within FTAA and that the mitigating measures being implemented are effective. Photo 2-3 presents one of the threatened *Shorea* species that is being monitored in the project area. It has the largest dbh during the 2015 ecological assessment and monitoring of terrestrial and aquatic ecosystems.

Photo 2-3: The largest tree (115 cm) from Pimadek, Mayapis (*Shorea palosapis*)

Table 2-10: Floral Conservation Status and Endemicity of Recorded Plant Species from 1997 Baseline Studies to 2016 Monitoring Activities

Category	1997	2012	2013	2014	2015	2016
Threatened	ND	9	10	20	20	21
Endemic	43*	ND	27	79	79	94

*listed endemic species in 1997 EIS without scientific name is not included

2.1.4.1.5 Impact Assessment

The project modification involves an increase in annual plant throughput capacity from 3.5 Million tons per annum (Mtpa) to 4.3 Mtpa without involving any increase in the mine footprint area, thus, 1.) Vegetation removal and loss of habitat, 2.) The threat to the existence and/ or loss of important local species, and 3.) The threat to abundance, frequency, and distribution of important species are unlikely.

However, OGPI is expected continue the mitigation activities that are being implemented in compliance with conditions of various environmental related permits they acquired (e.g. ECC and Tree cutting permits). Submission of SMR and CMR to DENR and validation of MMT should also be conducted to monitor floral vegetation of the project. To mitigate and further enhance the floral diversity in the area, OGPI is recommended to continue the implementation and maintenance of mitigation measure and monitoring activities. This includes the following:

- Implementation and maintenance of reforestation programs such as the Mining forest Program
- Donation of seedlings for the carbon sink and National Greening Program
- Progressive rehabilitation and re-vegetation of disturbed areas such as slopes
- Maintenance of the nursery for the propagation of seedling of indigenous species for reforestation efforts
- Implementation of conservation programs identified in the EPEP
- Regular annual monitoring of terrestrial flora and fauna in direct and indirect impact areas of the project

2.1.4.2 Terrestrial Fauna

2.1.4.2.1 Key Findings

- High species richness of 224 terrestrial vertebrate species that was recorded from the baseline and monitoring studies conducted within the project and adjacent areas from 1997 to 2016 indicate a rich faunal and habitat diversity
- Terrestrial vertebrate fauna is composed of 164 bird species, 23 mammal species and 37 amphibian and reptiles
- Of the 224 terrestrial vertebrate fauna recorded, 95 species were endemic followed by 94 native or resident species, 19 migrant species, nine introduced species and three migrant with resident population species.
- The high endemicity of the project site and its surrounding areas reflect the diverse habitats and complex terrestrial ecosystem present in the area.
- The rich composition of foliage dwelling, soil inhabiting and nocturnal arthropods was also recorded within and adjacent the project area
- The proposed increase in the throughput rate of the project which will utilize all existing facilities will likely cause very minimal to insignificant impact to terrestrial fauna assemblage on site. Fauna assemblage in the area likely has already adapted to the project area and activities since 2012.
- A continuous record of endemic and threatened species across all studies conducted from 1997 to 2016 indicate that the mitigating measures being implemented are effective.
- It is highly recommended for OGPI to continue implementation of existing mitigation measures in accordance to the IMP, EMP, EPEP and other biodiversity conservation efforts.

2.1.4.2.2 Methodology

This terrestrial fauna assessment made use of all available and relevant secondary information from OceanaGold (Philippines), Inc. This includes the following:

- 1997 Environmental Impact Statement
- 2004 Amendment Environmental Impact Statement
- 2012 Baseline Environmental Update Report
- 2013 Ecological Assessment for Didipio Gold-Copper Project
- 2014 Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold-Copper Project, Nueva Vizcaya, Philippines
- 2015 Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold-Copper Project, Nueva Vizcaya, Philippines
- 2016 Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold-Copper Project, Nueva Vizcaya, Philippines

2.1.4.2.3 Sampling Site Description

The project area is within the Greater Luzon Biogeographic unit. It is strategically located in the southern portion of the lower edges of the Sierra Madre Mountain Range in the east and the Cordillera Mountain Range in the West. The two major mountain ranges are interconnected through the Caraballo mountains, which facilitate the movement of flora and fauna between the two major mountain ranges.

In the 1997 EIS, the project site was described as disturbed by logging and kaingin practices prior to the project implementation. The open pit area was previously a grassland area dominated by tambo grass (*Arundo donax*), cogon (*Imperata cylindrica*) and patches of carabao grass *(Paspalidium* sp.). The mine safety sectors were also grass land with agroforestry species. Kangin activities were observed in these areas.

In 2012, a biodiversity study was conducted to update the baseline conditions of the project area. The baseline report characterized the general landscape of the project area as a valley with a variety of ecosystems. Majority of the area is a second-generation climax tropical rain forest at the upstream/higher elevation and agricultural/backyard gardens, agroforestry area, tree plantations, riparian and grassland ecosystems towards the foot of the valley.

In 2013, an extensive study which covered the whole OGPI FTAA has characterized the area into seven (7) vegetation communities based on floristic composition and structure. These are Tropical Lowland Evergreen Rainforest, Tropical Lower Montane Rainforest, Forest Over Limestone, Grassland and Fern Thickets, Cultivated and Kaingin Areas, Brushland and Scrubland, Tree Plantations and Reforestation Sites.

From 2014 to 2017 ecological monitoring report the general vegetation and ecotypes were unchanged as grasslands, logged-over forests, residual forests and reforested areas.

2.1.4.2.4 Sampling Sites and Methods used during the 1997 to 2016 Studies

Table 2-11 shows the sampling stations and methods used for each of the fauna studies conducted from 1997 to 2016. It can be observed that there is variability on the location and number of sampling stations surveyed and methods used. For the 1997 and 2004 EIS amendment studies, coordinates were not available in the EIS reports but for the succeeding studies, coordinates were available. Figure 2-16 presents the fauna sampling locations from 2012 to 2016.

Table 2-11: Fauna sampling stations and methods used in the studies conducted from 1997 to 2016

Station	Transects		Elevation	Method
	Start point	End point		
1997 EIS				
Dinkidi Hill	Not available	Not available		Line transect survey King's census Bio-acoustics method Interviews
Upper Surong	Not available	Not available		
Lower Surong	Not available	Not available		
Lower Dinauyan	Not available	Not available		
Upper Dinauyan	Not available	Not available		
Dagupan	Not available	Not available		
Pimadek forest	Not available	Not available		
2004 EIS amendment				
Camgat-Surong 1	Not available	Not available		Ocular inspection using binoculars Bio-acoustics-method Ethnobiological interviews
Camgat Suring 2	Not available	Not available		
Pimadek 1	Not available	Not available		
Pimadek 2	Not available	Not available		
Pimadek 3	Not available	Not available		
WRD-diversion channel	Not available	Not available		
Dinkidi Hill	Not available	Not available		
Dinauyan-Bacbacan 1	Not available	Not available		
DinauyanBacbacan 2	Not available	Not available		
Alimit-Verona	Not available	Not available		
2012 Baseline update				
Transect 1 (Besang to Sey-ang)	N 16°18.496' E 121°25.599'	N 16°18'47.1" E 121°25'53.7"	843 m to 952 m	Line transect survey, Cage trapping Mist netting Frogging/herps survey
Transect 2 (Magazine area to Madadag)	N 16°18'13.3" E 121°27'16.8"	N 16°19'09.5" E 121°27'12.9"	792 m to 844 m	

Station	Transects		Elevation	Method
	Start point	End point		
Transect 3 (Magazine area to Accommodation Gate)	N 16°19'13.3" E 121°27'16.8"	N 16°19'37.7" E 121°27'39.1"	764 m to 844 m	Net sweeping Soil litter sampling Light trapping
Transect 4 (Accommodation Gate to Nursery)	N 16°19'37.7" E 121°27'39.1"	N 16°19'45.3" E 121°27'31.0"	690 m to 764 m	
Transect 5 (Nursery to Camp Site)	N 16°19'45.3" E 121°27'31.0"	N 16°19'40.5" E 121°27'14.3"	690 m to 711 m	
Transect 6 (Camp Site to Old Reforestation)	N 16°19'40.5" E 121°27'14.3"	N 16°19'19.7" E 121°27'06.2"	711 m to 747 m	
Transect 7 (Old Reforestation Natural Forest (Anzibe) to Dinauyan River	N 16°19'19.7" E 121°27'06.2"	N 16°19'34.2" E 121°26'55.9"	701 m to 747	
Transect 8 (TSF)	N 16°18'47.3" E 121°25'53.7"	--	838 m	
2013 Ecological Assessment				
Transect 1 (Lower Tucod)	N 16°21'56" E 121°29'10"	N 16°21'56" E 121°28'11"		Strip transect sampling Opportunistic observation Line transect survey Ethnobiological interviews
Transect 2 (Didipio Mine Site)	N 16°19'42" E 121°26'55"	N 16°19'24" E 121°26'31"		
Transect 3 (Didipio to Capisaan)	N 16°18'47" E 121°25'53"	N 16°18'38" E 121°24'59"		
Transect 4 (Capisaan)	N 16°20'20" E 121°24'40"	N 16°19'59" E 121°24'04"		
Transect 5 (Upper Tucod)	N 16°21'24" E 121°25'56"	N 16°22'17" E 121°26'24"		
Transect 6 (Alimit)	N 16°19'24" E 121°28'21"	N 16°19'24" E 121°28'07"		
2014 Ecological Assessment				

Station	Transects		Elevation	Method
	Start point	End point		
Station 1 (MSA)	N 16°19'45" E 121°27'31"	N 16°19'27" E 121°27'32"	717 m to 730 m	Transect walk method Point-area sampling method Frogging Cage trapping Net sweeping Soil litter sampling Mist netting
Station 7 (Napagayan)	N 16°19'19" E 121°26'18"	N 16°19'28" E 121°26'01"	896 m	
Station 8 (Luminag Area)	N 16°19'08" E 121°26'08"	N 16°19'09" E 121°26'03"	822 m	
Station 9 (Near Magazine Area)	N 16°19'14" E 121°27'17"	N 16°19'03" E 121°27'25"	868 m	
2015 Ecological Assessment				
Station 1 (MSA)	N 16°19'45" E 121°27'31"	N 16°19'27" E 121°27'32"	717 m to 730 m	Transect walk method Point-area sampling method Frogging Cage trapping Mist netting Net sweeping
Station 2 (Near Process Plant)	N 16°19'46" E 121°26'50"	N 16°19'38" E 121°26'46"	810 m to 851 m	
Station 3 (Crusher Area)	N 16°18'52" E 121°26'54"	N 16°18'47" E 121°27'02"	886 m	
Station 4 (Pimadek forest)	N 16°22'18" E 121°27'36"	N 16°20'28" E 121°27'50"	852 m	
Station 5 (Upper Bisang, Sey-Ang)	N 16°18'48" E 121°25'51"	N 16°18'54" E 121°25'41"	924 m to 949 m	
Station 6 (Lower Bisang, Sey-Ang)	N 16°18'44" E 121°25'52"	N 16°18'34" E 121°25'59"	867 m	
Station 7 (Napagayan)	N 16°19'19" E 121°26'18"	N 16°19'28" E 121°26'01"	896 m	
Station 8 (Luminag Area)	N 16°19'08" E 121°26'08"	N 16°19'09" E 121°26'03"	822 m	
Station 9 (Near Magazine Area)	N 16°19'14" E 121°27'17"	N 16°19'03" E 121°27'25"	868 m	

Station	Transects		Elevation	Method
	Start point	End point		
2016 Ecological Assessment				
Station 1 (MSA)	N 16°19'45" E 121°27'31"	N 16°19'27" E 121°27'32"	717 m to 730 m	Transect walk method
Station 2 (Near Process Plant)	N 16°19'46" E 121°26'50"	N 16°19'38" E 121°26'46"	810 m to 851 m	Point-area Sampling Method
Station 3 (Crusher Area)	N 16°18'52" E 121°26'54"	N 16°18'47" E 121°27'02"	886 m	Frogging
Station 4 (Pimadek forest)	N 16°22'18" E 121°27'36"	N 16°20'28" E 121°27'50"	852 m	Cage trapping
Station 5 (Upper Bisang, Sey-Ang)	N 16°18'48" E 121°25'51"	N 16°18'54" E 121°25'41"	924 m to 949 m	Mist netting
Station 6 (Lower Bisang, Sey-Ang)	N 16°18'44" E 121°25'52"	N 16°18'34" E 121°25'59"	867 m	Net sweeping
Station 7 (Napagayan)	N 16°19'19" E 121°26'18"	N 16°19'28" E 121°26'01"	896 m	
Station 8 (Luminag Area)	N 16°19'08" E 121°26'08"	N 16°19'09" E 121°26'03"	822 m	
Station 9 (Near Magazine Area)	N 16°19'14" E 121°27'17"	N 16°19'03" E 121°27'25"	868 m	

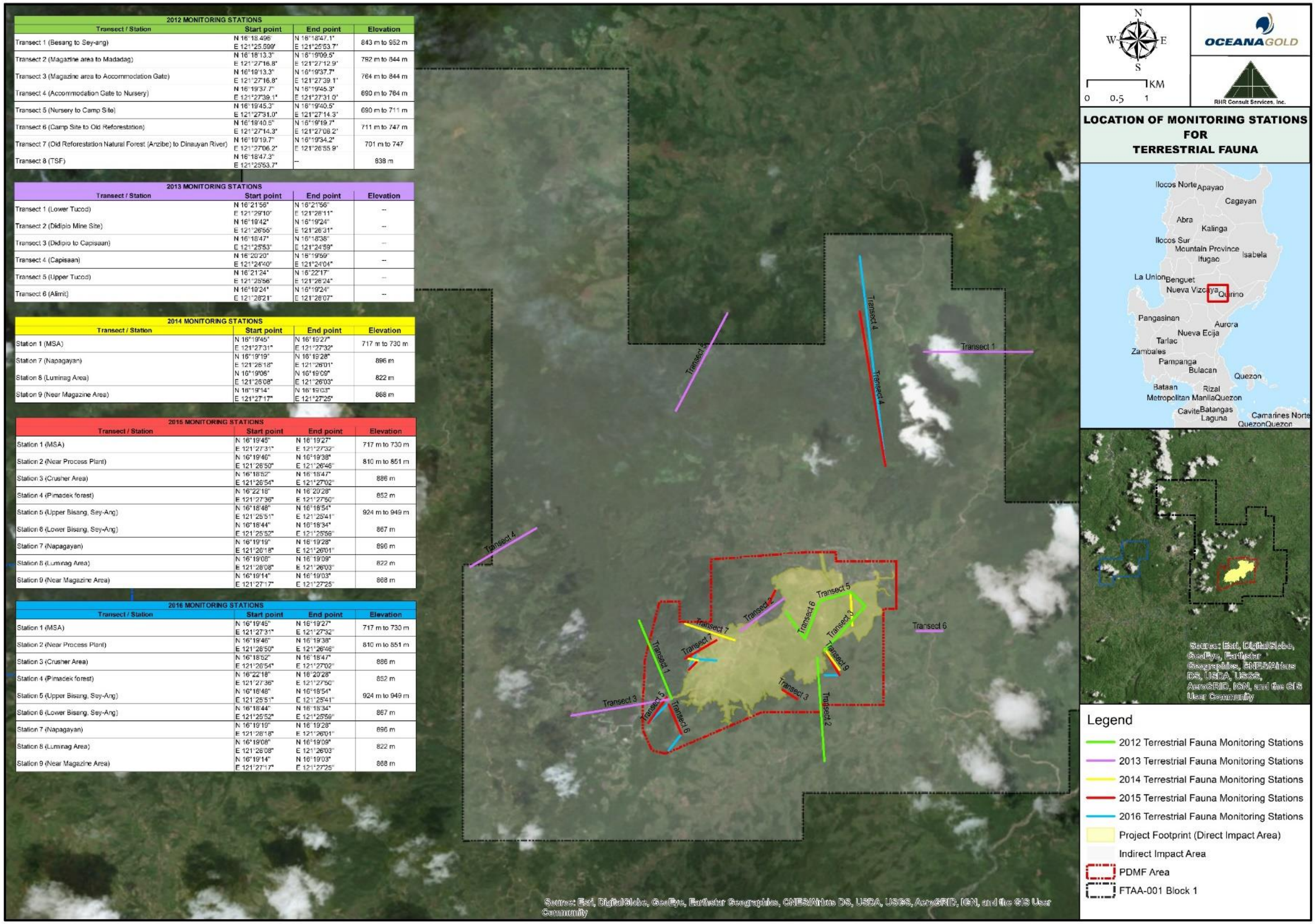


Figure 2-16: Location of fauna sampling stations from 2012 to 2016

2.1.4.2.5 RESULTS / BASELINE

A total of 224 terrestrial vertebrate species was recorded from the baseline and monitoring studies conducted within the project and adjacent areas. It is composed of 164 bird species, 23 mammal species and 37 amphibian and reptiles. This species richness recorded within the project site and adjacent areas indicate a rich faunal and habitat diversity. Most of the species recorded are endemic species or species that can only be found in the Philippines (95 species) followed by native or resident species (94 species), migrant species (19 species), introduced species (9 species), and the least by migrant with resident population species (3 species), see Figure 2-17. The high endemicity of the project site and its surrounding areas reflect the diverse habitats and complex terrestrial ecosystem present in the area. In addition, there are four species recorded that were not identified to species level, hence their residency cannot be determined.

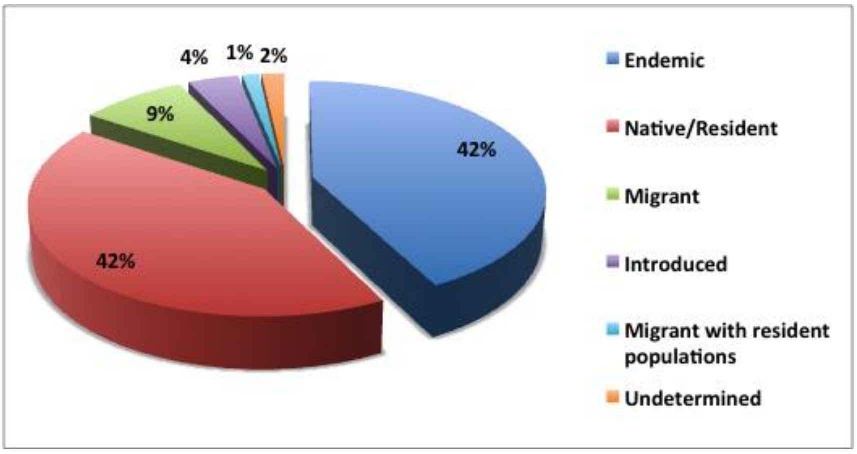


Figure 2-17: Residency of Fauna Species Recorded within and adjacent the Project Site based on Studies Conducted from 1997-2016

2.1.4.2.5.1 BIRDS

There were 164 bird species recorded within the project site and surrounding areas based on the studies and monitoring activities from 1997 to 2016. Of the 164 birds recorded, the majority is native or resident with 71 species followed by endemic with 70 species, migrant with 19 species, migrant with resident population with 3 species and introduced with one species (Figure 2-18). Endemicity was relatively high indicating the availability of various habitats that are essential for the survival of these species in the area. The presence of raptors such as the eagles, hawks, osprey, honey buzzards indicates the diverse ecosystem present in the area and its capacity to support top predators in the food chain

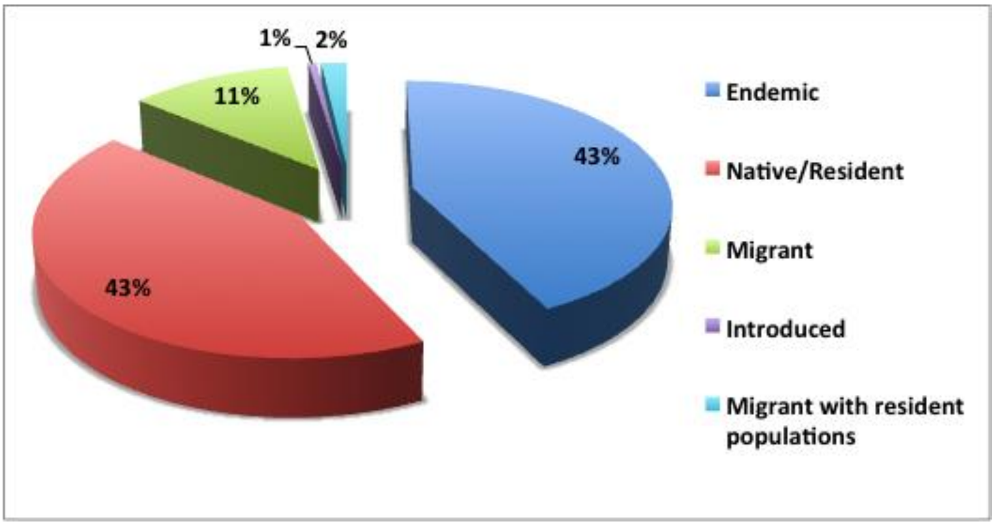


Figure 2-18: Residency of Birds Recorded within and adjacent the Project Site based on Studies Conducted from 1997 to 2016

Species richness of birds recorded in the studies conducted from 1997 to 2016 (Figure 2-19) showed varied values, which ranges from 22 species to 146 species. The variability of the species richness recorded in each of the studies is very likely the result of differences in methodology used, duration of sampling, location and number of sampling stations, and minimally on observer bias. It can be observed that the 2014 ecological assessment had the lowest species richness since there only four sampling stations surveyed for the study. All the other studies had more than five sampling stations. Noteworthy is the high species richness recorded in the 2013 ecological assessment. This study was the most extensive in terms of the area surveyed since it considered the whole FTAA. At the same time intensive of the methodology and level of effort used. Of the 146 species birds recorded in the 2013 ecological study, only 114 of these were confirmed through observation to occur on site and the remaining 32 species were recorded from accounts of locals knowledgeable of the area during the interviews conducted. Other studies conducted just focused on the direct impact areas and nearby areas with lesser study area and shorter duration of sampling.

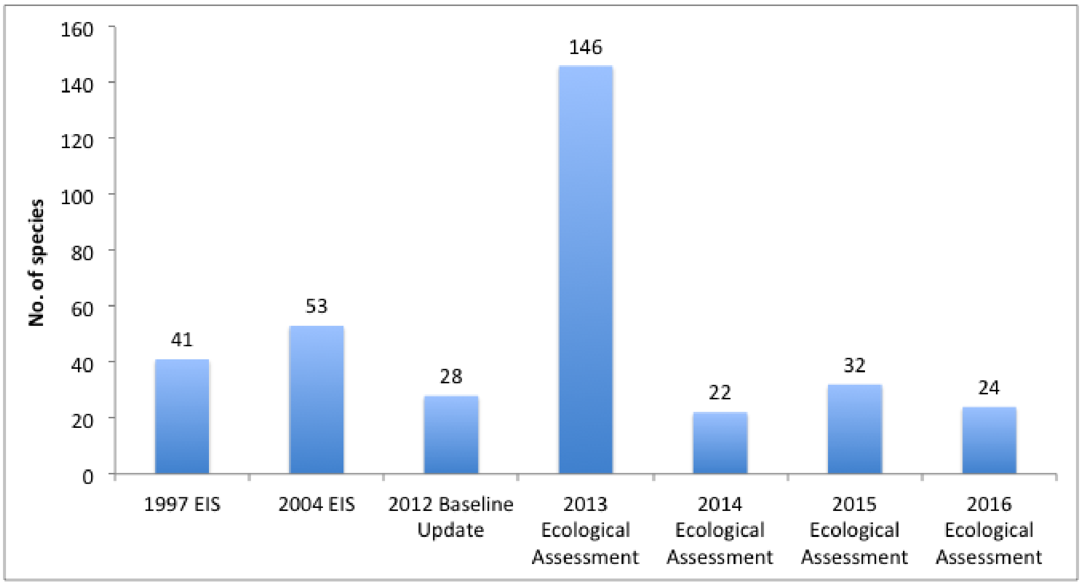


Figure 2-19: Species Richness of Birds Recorded on the Studies conducted from 1997-2016

Based on the cumulative species curve shown in Figure 2-20, the number of additional species recorded from the 1997 EIS continued to increase until the 2013 ecological assessment. After the 2013 ecological assessment, there has been no additional species recorded until the 2016 ecological assessment wherein two species were added in the overall list of birds recorded within and adjacent the project site. The plateau phase in cumulative species curve starting from the 2013 ecological assessment up to the 2016 ecological assessment could indicate that the number of bird species that can be recorded to occur on site is almost exhausted. In addition, the bird species recorded in the 1997 EIS were still recorded in the succeeding studies from 2004 to 2016 indicating that these species continue to thrive in the area even with the operation of the project. The continued existence of these species can be attributed to the existing rich ecosystem surrounding the project that serves as habitat of these species.

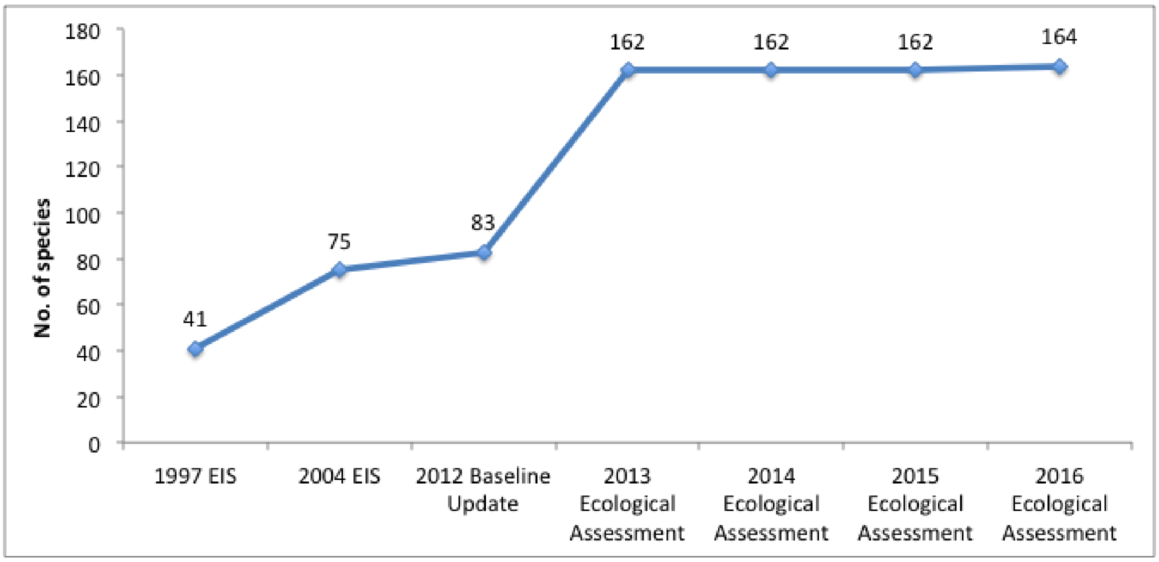


Figure 2-20: Cumulative Species Curve of Birds Recorded based on Studies conducted from 1997 to 2016

In terms of diversity, the diversity index values recorded from studies conducted from 1997 to 2016 ranged from 2.66 to 2.93 wherein this is categorized as moderate diversity in the biodiversity scale developed by Fernando (1998). Observed fluctuations in the diversity index values recorded from 1997 to 2016 can be attributed to seasonal change (on and off migration), methods used, the location of sampling stations and duration of sampling in each of the study conducted. Nevertheless, data shows that there has not been any major change in the level of diversity in the area since 1997. Figure 2-21 shows the diversity indices of birds recorded in studies conducted from 1997 to 2016.

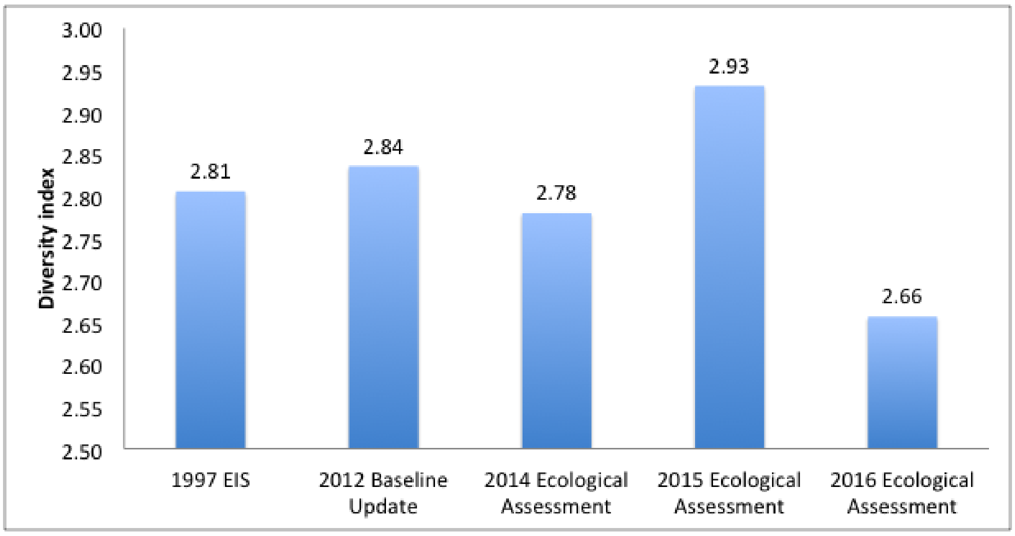


Figure 2-21: Diversity Index of Birds based on Studies Conducted from 1997 to 2016

In terms of evenness, the evenness indices ranged from 0.75 to 0.90, which is categorized as very high based on the biodiversity scale developed by Fernando (1998). High evenness is consistent across studies conducted from 1997 to 2016 (Figure 2-22). Similarly, dominance indices of birds recorded across studies conducted from 1997 to 2016 are consistently very low, ranging from 0.07 to 0.10. Very high evenness and very low dominance only indicate the absence of dominating bird species in the area. Majority of the birds recorded have even distribution in terms of their abundance in the area.

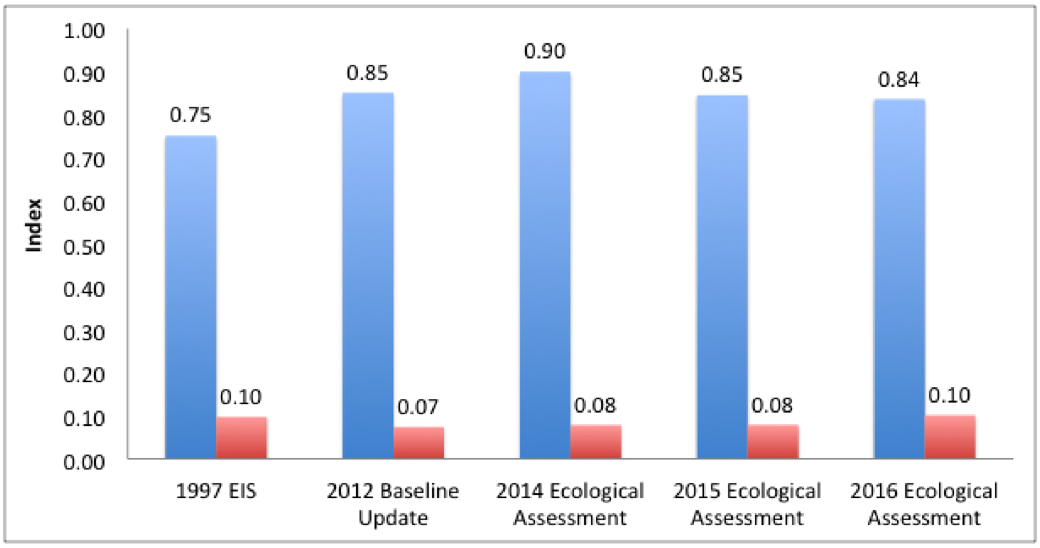


Figure 2-22: Evenness and Dominance Index of Birds based on Studies conducted from 1997 to 2016

2.1.4.2.5.2 Mammals

A total of 23 mammal species was recorded from studies conducted with the project site and adjacent areas from 1997 to 2016. Majority of which are endemic with 11 species followed by native with eight species and the least by introduced with four species (Figure 2-23). The high endemicity of mammal species can be attributed to the availability of suitable habitats particularly the forest types surrounding the project site. It should be noted that most of the studies from 1997 to 2016 primarily involved the conduct of interviews with the locals knowledgeable of the area (e.g. hunters, *kaingin* farmers, elders). This limits the assessment to species of importance to locals, which are usually medium to large mammals. Hence out of the 23 mammals recoded, only 11 species were directly observed to occur in the area. The conduct of a robust study could further record a higher mammalian species richness in the area.

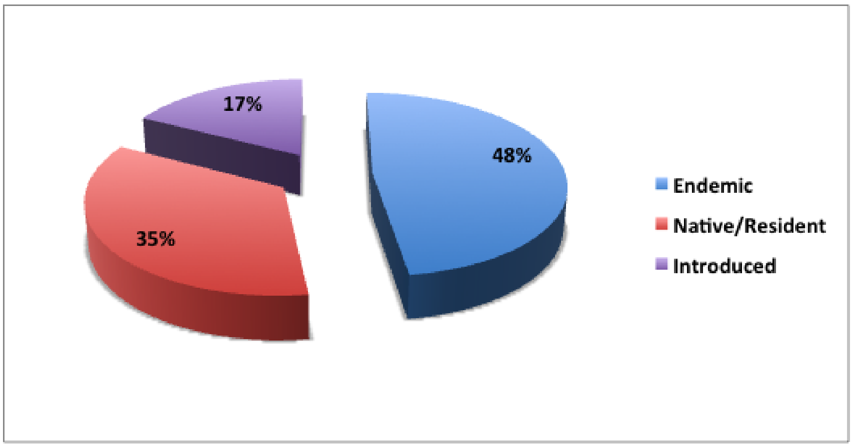


Figure 2-23: Residency of Mammals Recorded within and adjacent the Project Site based on Studies conducted from 1997 to 2017

2.1.4.2.5.3 Amphibians and Reptiles

Thirty-seven species of amphibians and reptiles were recorded from the studies conducted within the project site and its surrounding areas from 1997 to 2016. This recorded species richness of amphibians and reptiles can be considered high but more species could be recorded from detailed studies of the project area especially in forested and stream habitats. It should be noted that our of the 37 species recorded, only 19 species were directly observed to occur on site while the rest were recorded from the accounts of locals (e.g. hunters, *kaingin* farmers, elders) knowledgeable of the area.

The abundance of amphibian and reptile species also reflects the availability of aquatic and terrestrial habitats in the area. Of the 37 species recorded, there were 15 native and 14 native species recorded followed by four introduced and four unidentified species wherein three is under genus *Platymantis* and the other one is of genus *Rana* (Figure 2-24). Some of the species recorded are snakes, which further reflect the diverse ecosystem in the area that is capable of supporting top food chain predators.

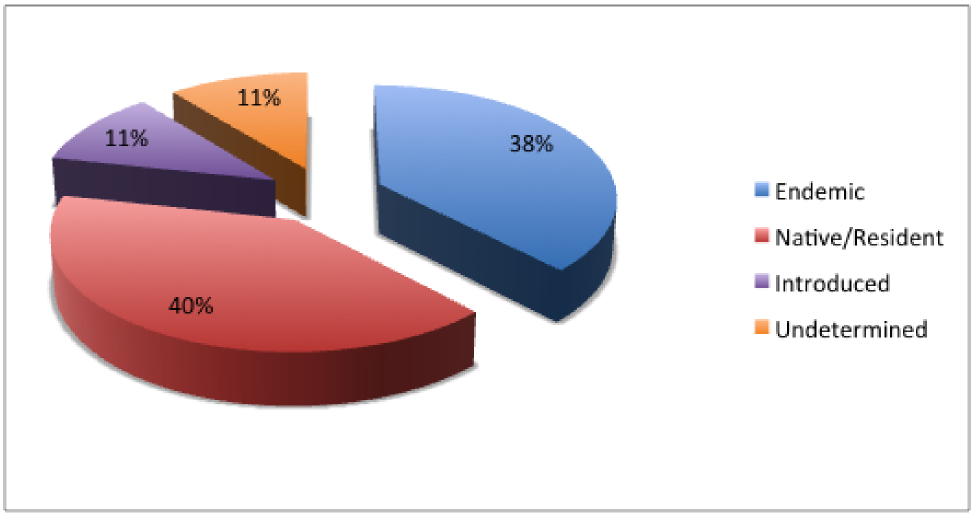


Figure 2-24: Residency of Amphibians and Reptiles Recorded within and adjacent the Project Site based on Studies conducted from 1997 to 2017

2.1.4.2.5.4 Arthropods

Foliage dwelling arthropods were surveyed in the 2012 baseline update and 2015 and 2016 ecological assessments. Of the three studies conducted, there was an increasing trend for the number of order, families, and species recorded (Figure 2-25). Although it should be noted that there were only four stations surveyed in the 2012 baseline update while the same stations were surveyed for the 2015 and 2016 ecological assessments conducted. The observed increase in foliage-dwelling arthropods in terms of the order, family and species richness particularly from 2015 to 2016 may indicate the existing good conditions of habitats particularly the diverse floral composition in the area. The diversity of foliage-dwelling arthropods rely on the diversity of floral composition in an area wherein a diverse vegetation could provide a diverse niche in which a wide array of these arthropod species can thrive. The increasing trend may also indicate the effectiveness of the re-vegetation and rehabilitation of mine-disturbed areas (e.g. slopes and bare areas) within the project area. True bugs of Order Hemiptera, beetles of Order Coleoptera and ants/bees/wasps of Order Hymenoptera were the most represented groups of foliage-dwelling arthropods.

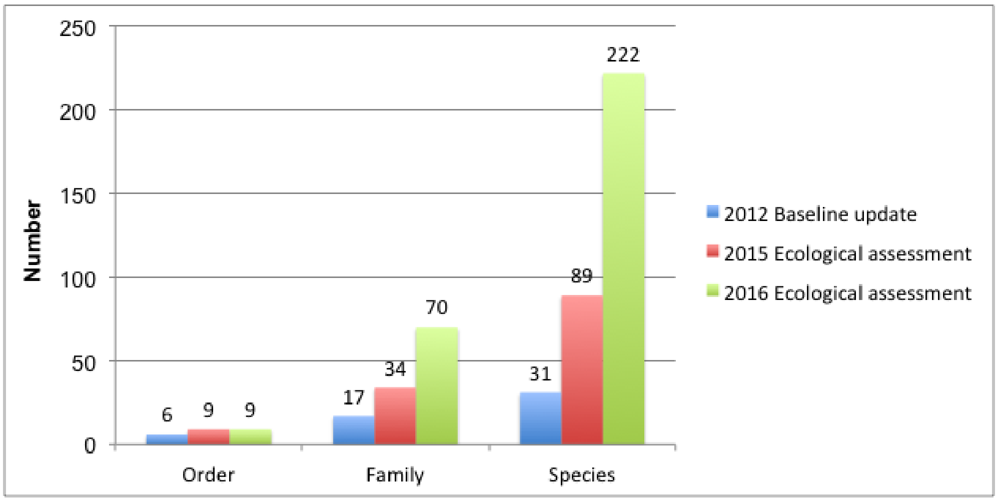


Figure 2-25: Order, Family and Species Richness of Foliage-Dwelling Arthropods Recorded in the Studies conducted from 2012 to 2016

In addition, soil inhabiting and nocturnal arthropods were also surveyed in the 2012 baseline update. Five orders, 14 families, and 57 individuals represented soil-inhabiting arthropods. Most of the soil-inhabiting arthropods were beetles (Order Coleoptera) and ants (Order Hymenoptera). For the nocturnal arthropods, a total of 15 orders, 72 families and 11750 individuals. It is the most represented group of arthropods during the 2012 baseline update, which is expected from the light trapping method used. Majority of the nocturnal arthropods recorded were ants (Order Hymenoptera, Family Formicidae) and rove beetles (Order Hymenoptera, Family Staphylinidae). The study suggested a diverse soil inhabiting and nocturnal arthropods composition within and adjacent the project area.

2.1.4.2.5.5 Noteworthy Species of Conservation Importance

Species of conservation importance are endemic and threatened species that were recorded within the project site and the adjacent areas. Based on the studies conducted from 1997 to 2016, there is a total of 110 endemic and/or threatened species recorded to occur within the project site and surrounding areas within the FTAA. These are enumerated in Appendix D.

2.1.4.2.6 Impact Assessment

OGPI proposes to increase their existing throughput rate of 3.5 million tons per annum (MTPA) to 4.3 MTPA. Based on this proposed increase in throughput rate, no additional facilities are expected to be developed except for the underground mine. They will utilize all existing project components or facilities which includes the open pit, process plant, waste rock dump, tailings storage facility, access roads, sewage and water treatment plants, accommodation camp, administrative office and other existing ancillary facilities. Consequently, no areas will be cleared and habitats that will be disturbed or lost.

OGPI has been in operation since 2012 and it is likely that fauna species occurring in the area has already adapted to the project activities and have sought refuge to suitable surrounding habitats to limit their exposure to potential project-related risks. By this time, threats to existence, abundance, frequency, distribution, and access of species particularly on endemic and threatened species should have been reduced to the very minimum by implementing mitigation measures. Further, the continuous record of the presence of endemic and threatened species across all studies conducted within and adjacent the project site from 1997 to 2016 only indicates that mitigation measures being implemented are effective. Hence with almost no net change in the project impact areas and activities, it is likely that there will be insignificant to very minimal impact of the proposed project change to the fauna communities.

To mitigate and further enhance the faunal diversity in the area, OGPI is recommended to continue the implementation and maintenance of mitigation measure and monitoring activities. This includes the following:

- Implementation and maintenance of reforestation programs such as the Mining forest Program
- Donation of seedlings for the carbon sink and National Greening Program
- Progressive rehabilitation and re-vegetation of disturbed areas such as slopes
- Maintenance of the nursery for the propagation of seedling of indigenous species for reforestation efforts
- Implementation of conservation programs identified in the EPEP
- Regular annual monitoring of terrestrial flora and fauna in direct and indirect impact areas of the project

2.2 THE WATER

2.2.1 HYDROLOGY/HYDROGEOLOGY

The proposed project modification to increase throughput from 3.5 Mtpa to 4.3 Mtpa will not involve any area expansion that may affect the existing drainage morphology within the project area. The rates of mine dewatering and extraction of water from deep wells are also not expected to be affected by the proposed modification. Although with the ongoing development, which is already covered by the existing ECC, the current pumping rates from the UG which is approximately 350 l/s is expected to increase to 450-550 l/s (OGPI Water Management Plan, 2018). There are also new pending petitions to the National Water Resources Board (NWRB) in December 2017 to increase allowable maximum intake for Water Permits 023153 and 023154.

To assess the impacts of the existing Project to drainage morphology, watershed and subwatersheds impacted by the Project were delineated using NAMRIA topographic maps and a licensed ArcMap version 10.1.

Listed in Table 2-12 are the water permits issued to OGPI by the NWRB.

Table 2-12: List of OGPI Water Permits from NWRB

Deep well/ Surface Water	Permit No.	Summary/Description
Deep well #5	023153	To utilize water from Deep well #5 by diverting water by means of pump not exceeding 17 l/s
Deep well #6	023154	To utilize water from Deep well #6 by diverting water by means of pump not exceeding 5.5 l/s
Didipio River WU#11	022924	To utilize water from Deepwell #6 by diverting water by means of intake structure not exceeding 8 l/s
Didipio River WU#10	022925	To use water from Deepwell #6 by diverting water by means of intake structure not exceeding 22.39 l/s
Didipio River WU#14	023594	To use water from Didipio River WU#14 by diverting water by means of intake structure not exceeding 5.08 l/s
Didipio River WU#15	023593	To use water from Didipio River WU#15 by diverting water by means of intake structure not exceeding 4.66 l/s

2.2.1.1 WATERSHED DELINEATION

The project area is drained mainly by Didipio River and its tributaries. From the project site, Didipio River generally flows southeastwards to join Diduyon River. The Diduyon River has a drainage area of approximately 41.29 km^2 (4,129 ha) (Figure 2-26) and is part of the headwaters of the Cagayan River Basin, the largest river basin in the country with a total drainage area of 27,732 km^2 (RBCO DENR).

Eleven (11) subwatersheds of Didipio River were delineated for this study. Delineation of the subwatersheds was based on the locations of the current surface water quality monitoring stations of OGPI. The locations of the surface water stations (SWS) were used as reference point in delineating the areas of each subwatershed identified. Results of watershed delineation are summarized in Table 2-13 while Figure 2-27 presents a simplified river flow diagram of Didipio River.

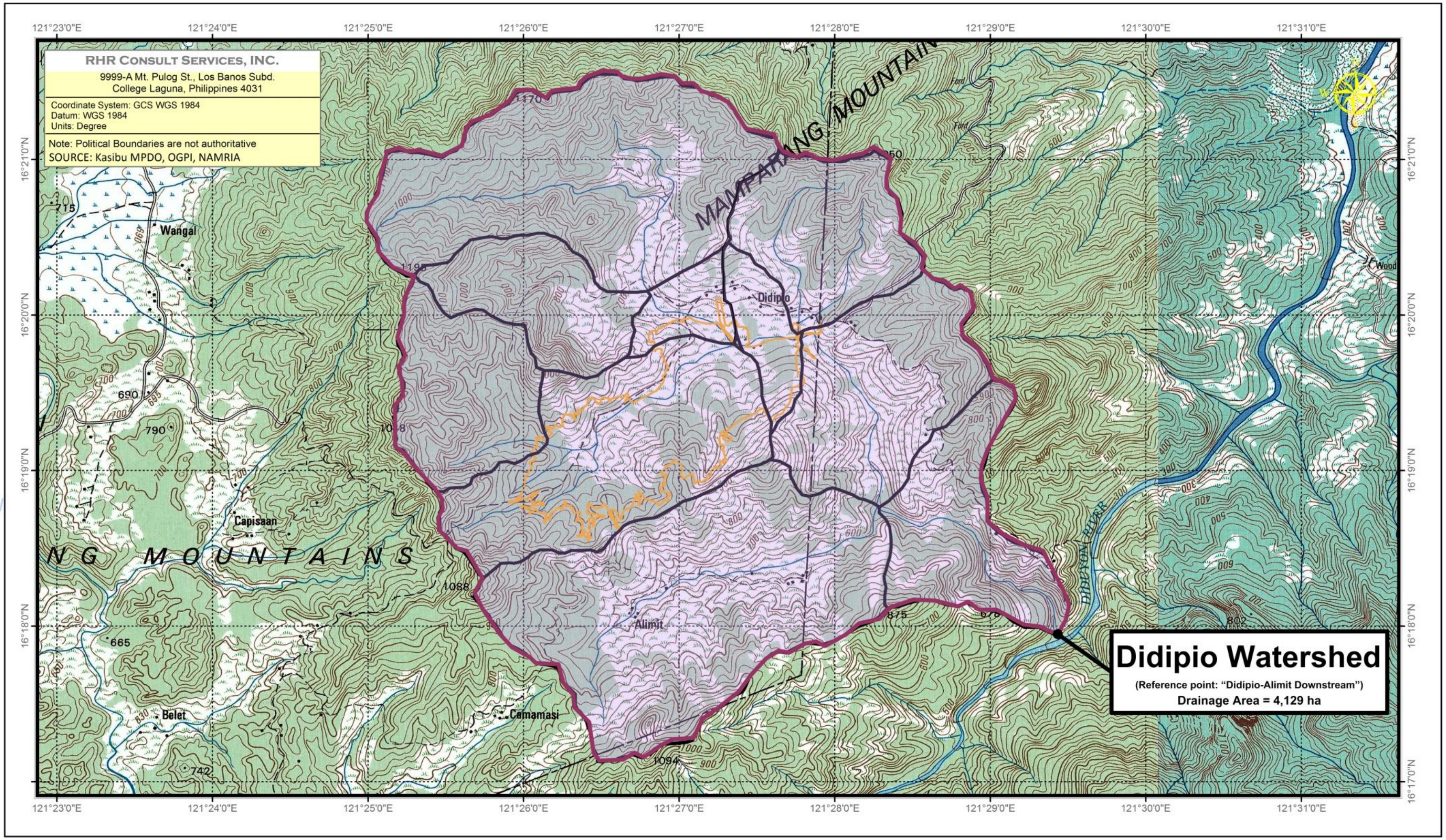


Figure 2-26: Didipio Watershed

Table 2-13: Drainage Areas of Didipio River and its Tributaries

Watershed / Subwatershed	Drainage Area (ha)	Reference Point	1997 EIS Description	Current Status
Surong Creek Figure 2-28	772	16.336579N/ 121.445719E (SWS 16)	▫ Occupies a large portion of the Didipio River headwaters ▫ Settlements and agriculture co-exist within this valley ▫ Characterized by the prominence of ridge-and-spurs, gully-and-valley sides and mass movement zones in the headwater region ▫ Terrain is undulating with gentle to moderate slopes ▫ Hills-and-slopes are dominant at the downstream portion	Not affected by the project, located upstream of the project footprint area
Camgat Creek Figure 2-28	251	16.335089N/ 121.445852E (SWS 15)	▫ Forms part of the Didipio headwater region ▫ The valley is underlain by andesitic lava belonging to the Caraballo Group ▫ Terrain is generally rolling with steep to moderately steep slopes ▫ There is a concentration of steep gullies in the headwater area ▫ Soil erosion due to upland agricultural activities appears severe	Presence of small scale mining operations within its drainage area Not affected by the project since it is located upstream of the project site
Camgat-Surong Creek Figure 2-28	1,111	16.330318N/ 121.455811E (SWS 13)	▫ Not included in the assessment	Located downstream of Camgat and Surong Creek confluence along Didipio River before Dinauyan River outlet Located within its catchment is the Carwash Bay (Mobile) of OGPI
Luminag Creek Figure 2-28	306	16.319135N/ 121.435646E (SWS 1)	▫ Not included in the assessment	One of the tributaries of Dinauyan River Upstream portion Is undisturbed (control) while its downstream portion traverses the TSF through an underground pipe connecting to

Watershed / Subwatershed	Drainage Area (ha)	Reference Point	1997 EIS Description	Current Status
				Dinauyan River
Dinauyan River Figure 2-28	909	16.329775N/ 121.455778E (SWS 12)	▫ Luminag, Madadag and Bacbacan creeks are tributaries to this catchment ▫ Lithology within the central portion of the catchment is dominantly andesitic lava belonging to the Caraballo Group ▫ Outcrops of intrusive and tracky andesitic lava occupy the headwater and higher elevations ▫ Slopes are steep, concave and highly irregular in form ▫ Vegetation cover is good with patches of upland rainfed agricultural activities	Drainage morphology has significantly changed due to the development of the TSF, Waste Rock Stacks, Mine Pit within its drainage area Dinauyan River has been diverted due to the development of the mine pit
Didipio (upstream) Figure 2-29	2,019	16.329868N/ 121.456095E (SWS 14)	▫ Not included in the assessment	Within its drainage area are Dinauyan and Camgat-Surong subwatersheds
Angcabo Creek Figure 2-28	316	16.331483N/ 121.463889E	▫ Underlain predominantly by andesitic lava belonging to the Caraballo Group ▫ Outcrops of quartz diorite exist in the headwaters where synclinal structure occurs ▫ This area shows many mass movement scarps ▫ Terrain is rolling and hilly with many ridges and spurs ▫ Surface runoff is rapid as evidenced by widespread scree fans and sheet fans ▫ Soil erosion is also severe, principally due to agricultural activities	Settlements and agricultural activities coexist within this catchment Not affected by the project
Didipio-Dupit Figure 2-29	2,443	16.331085N/ 121.464331E (SWS 17)	▫ Not included in the assessment	Within its drainage area are Dinauyan, Camgat-Surong and Angcobo subwatersheds

Watershed / Subwatershed	Drainage Area (ha)	Reference Point	1997 EIS Description	Current Status
Didipio Downstream Figure 2-29	2,870	16.311973N/ 121.470816E (SWS 18)	▫ Not included in the assessment	Drainage area was delineated from a point along Didipio River right upstream of the Alimit Creek outlet
Alimit Creek Figure 2-28	938	16.311366N/ 121.470615E (SWS 19)	▫ Principally underlain by andesitic and dacitic intrusive which are mineral-rich, highly altered and fractured ▫ Ridges and spurs dominate the headwater region while the remainder of the catchment is characterized by hills and slopes	Not affected by the project
Didipio-Alimit Figure 2-29	3,807	16.311445N/ 121.471512E (SWS20)	▫ Not included in the assessment	Combination of Alimit subwatershed and Didipio downstream watershed
Didipio River (Didipio-Alimit Downstream) Figure 2-29	4,129	16.298239N/ 121.490040E (SWS 21)	▫ Covers the entire alluvial floor and floodplain of the Didipio River ▫ Settlements and agricultural activities coexist within this catchment	Delineated from a point along Didipio River before its confluence with Diduyon River

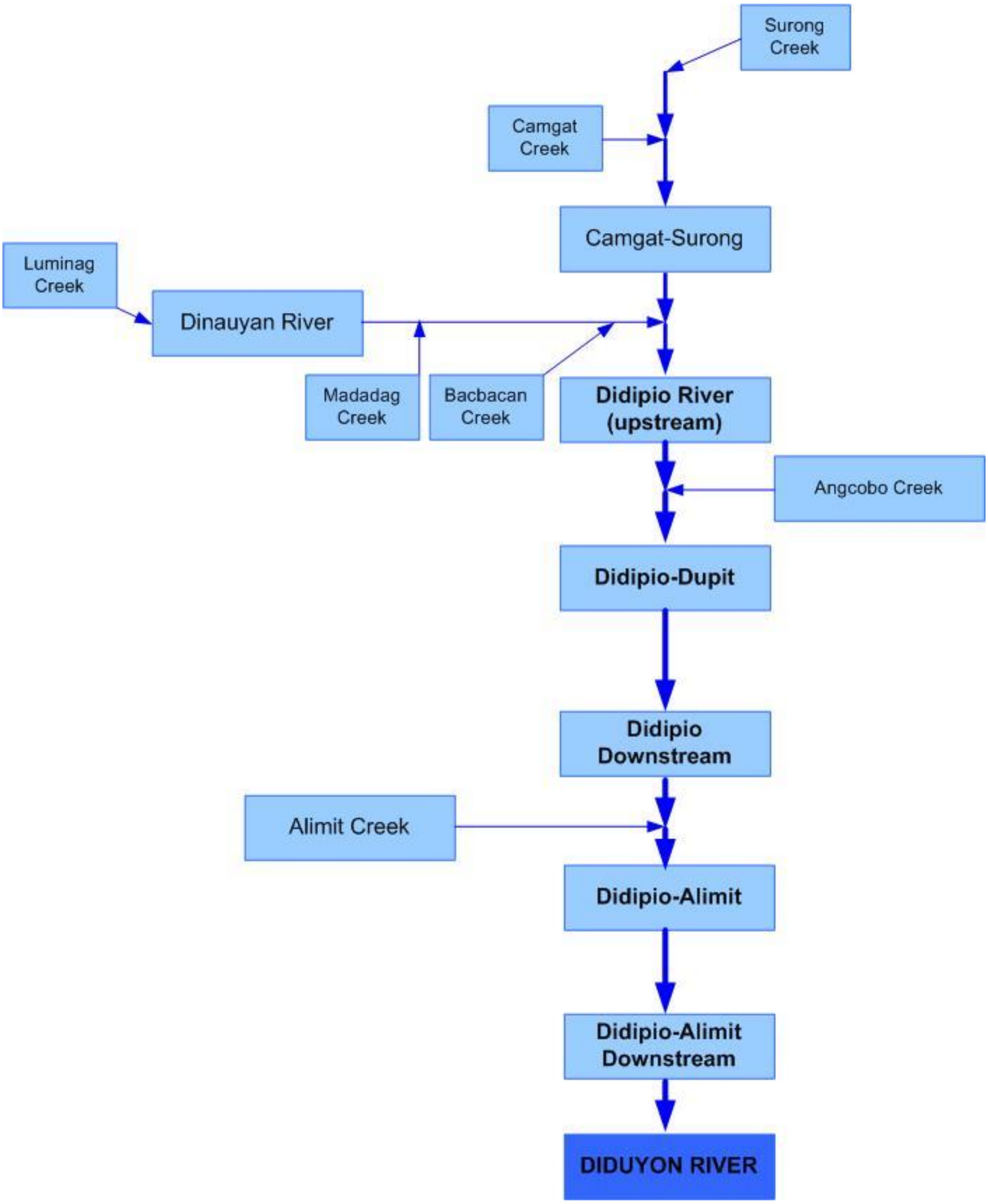


Figure 2-27: Flow diagram of rivers draining the project area

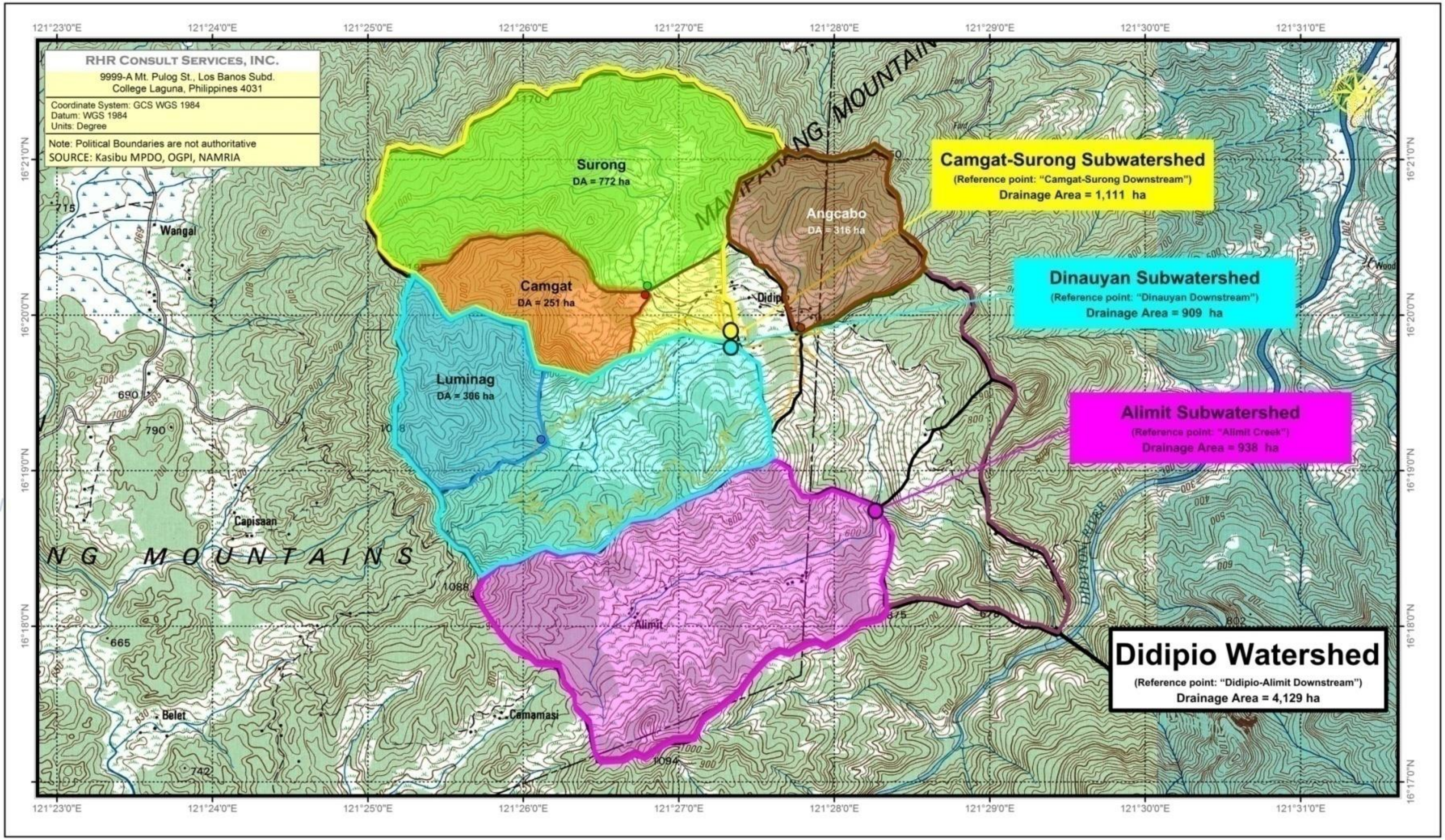


Figure 2-28: Subwatersheds of Didipio River

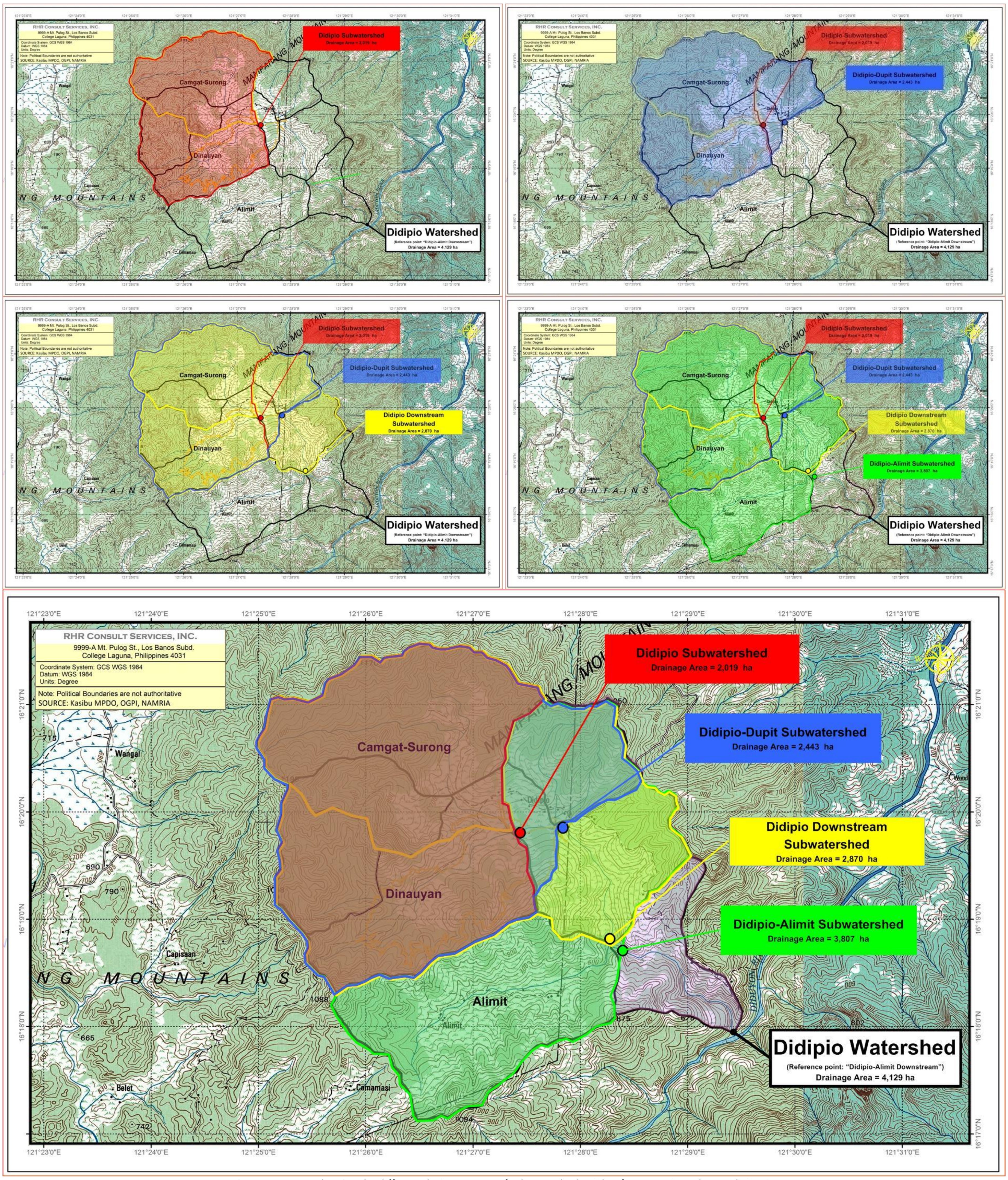


Figure 2-29: Map showing the different drainage areas of subwatersheds with reference points along Didipio River

2.2.1.2 HYDROGEOLOGY

The Water Management Plan for Didipio Operations (2018) describes the Project site as an area characterized by high rainfall with an average rainfall of 3.5 m per annum based on historical data. High groundwater inflows are also experienced from the OP (150 l/s) and UG (350 l/s). The site operating in a net positive of water due to the groundwater inflows and high rainfall experienced in the area. (OGPI Water Management Plan, 2018)

Presented in this below are the results of the Water Resource Study for Barangay Didipio Domestic Water Supply (2018). The study made use of the previous hydrological studies conducted for the Project. Findings are summarized below:

- Resistivity data at the site indicates a significant fault and/or shear zones structures which trends from the confluence of the Surong and Lower Dinauyan Rivers towards the pit. The bores located within the assumed multiple shear zone between the two NE trending faults give average transmissivity values of around 100m^2/day in the north-eastern segment signifying reasonably good permeability characteristics for the fractured rock. In addition, the quick water level response to pumping in the observation holes, even at low pumping rates indicates that the fractures and faults in the hard rock system are hydraulically connected. The presence of recharge boundaries is confirmed in most observation holes where the likely sources of the additional water could either be the overlying or nearby alluvial sequence which should be in direct hydraulic connection to the Lower Dinauyan River and the highly fractured bedrock in hydraulic connection to a watercourse. (Coffey Partners International Pty. Ltd. (CPI) 1993 cited in Soriano et. al. 2018)
- The inclined drill holes indicate that the fractured hard rocks in the NE pit segment act as an areally extensive aquifer, with the NE part of the mine having a generally high permeability. Further, the study shows that the hardrock fractures are hydrologically interconnected and are readily recharged by an external nearby source, presumably by the alluvial sequence and/or the fractured rock with the Lower Dinauyan River. (CPI 1993 cited in Soriano et. al. 2018)

Below is a more detailed information regarding the aquifer complex at Didipio (CPI 1998 cited in Soriano et. al 2018):

- **Biak Shear** – regionally continuous, 20 m wide, steeply dipping, anisotropic, heterogeneous, confined, fractured rock aquifer.
    - Airlift yields in small diameter test holes range from 3.1 lps to 7.1 lps
    - Transmissivity values around the mine site range from 24 m^2/day to 166 m^2/day, with a conservative value being 150 m^2/day, confirming its aquifer status
    - The lack of hydraulic barrier boundary indicates a regionally extensive aquifer system rather than a restricted fault line of limited areal extent
    - Water infiltration from overlying, unconfined aquifers or nearby watercourses is indicated from aquifer test data
    - There is a distinct difference in hydraulic head of 0.5m to 4m between the shallow alluvium and deep Biak Shear aquifer, the latter being under higher hydrostatic pressure
    - Groundwater issuing from the Biak Shear system would maintain baseflow in the alluvial aquifer and associated watercourses
- **Tatts Fault** – less permeable fracture system within the zone of mineralization, hydrologically connected to Biak Shear
    - Airlift groundwater yields range from 0.1 lps to 0.7 lps, indicating low permeability characteristics
    - High water inflows have been intersected in mineral exploration holes drilled into Dinkidi Orebody, in some cases well below the Biak Shear
    - In topographic lows, such as near the Dinauyan River, these holes are artesian

  - There is an overall trend for delayed aquifer recharge response to intense and prolonged rainfall events
- **Dark Diorite Country Rock** – regionally extensive, anisotropic, heterogenous, confined fractured rock aquifer, hydraulically connected to the Biak Shear.
  - High airlift yields 6.1 lps to 6.5 lps, indicating that locally the rock is quite transmissive
- **Alluvium** - shallow, unconsolidated, heterogenous, unconfined aquifer system of moderate permeability.
  - Leakage to the underlying hard rock aquifer appears to occur during pump-out tests
  - The water table corresponds with the Dinauyan River level

Below are the main findings from the CPI 1998 study:

- The Biak Shear is the major structural geological feature near the mine site. To a vertical depth of at least 600m (and probably 1000m), the Biak Shear consists of highly sheared, crushed and moderate vuggy sections, indicating highly incompetent rock mass. Its width is less than 10m near the surface increasing to around 20 m at depth. The hanging wall is highly fractured with open vugs (partially infilled with quartz and/or calcite crystals) and with a myriad of carbonate veinlets. The width of the adjacent, highly fractured crushed section of the hanging wall between 75m to 100m. The footwall of the Biak Shear appears to consist of fairly competent rock with less fracturing at depth.
- Airlift and pump-out groundwater tests re-confirm high transmissivity values for this major, heterogeneous, anisotropic, confined fractured rock aquifer system. Overall higher airlift groundwater yields are recorded close to the mine site but decreases on a regional basis, the latter inferring a reduction in permeability from the proposed mine site. Water levels monitored during pumping indicate an ellipsoidal shape of drawdown and oriented in a preferred east-west flow path direction. The Biak Shear aquifer is thus structurally controlled. The crushed shear and adjacent, highly fractured hanging wall are in direct hydraulic interconnection, and act as one aquifer system. Aquifer recharge occurs from the overlying clayey gravel alluvium and from the vertical infiltration and rainfall. The appearance of one hydraulic barrier boundary during aquifer testing indicates that the aquifer is of limited areal width in at least one direction. However, drilling and hydraulic testing did not identify the lower boundary of the Biak Shear, which is assumed to be around 800m to 1000m beneath the surface.
- The Dark Diorite country rock south of the Biak Shear appears to be of limited fracturing and water storage but it is in hydraulic connection with the Biak Shear. Horizontal drainage into the Biak Shear should be anticipated until groundwater storage in the regional fracture system becomes exhausted.

2.2.1.2.1 WELL INVENTORY

Based on the site's geomorphology prior to project development, there is a high concentration of percolation/infiltration gullies in the hills and slopes area prominent between 600 to 800 masl elevations showing indications of abundant surface water and active groundwater seepage. Active gullies where springs are common are usually sources of water for perennial creeks. Valley-and-gully sides representing the outer margins of perennial stream tributaries and gully zones show evident springs and groundwater seepage. (Maunsell Phils., Inc. 1997 cited in GHG Pty Ltd 2012)

In August 2011, GHD conducted surface and groundwater quality monitoring within and around the vicinity of the project site. Five (5) groundwater stations were visited for the said sampling activity (Table 2-14 and Figure 2-30). It was noted during the 2011 sampling activity that groundwater flowed continuously from artesian wells. Also, it was noted that ideally, groundwater originating from shallow aquifers is sampled to monitor environmental impacts of activities conducted at the ground surface. Groundwater borehole logs however, indicate that groundwater wells are deep, *i.e.*, bore depths >800 m, and implies that groundwater quality may not be representative of impacts of activities at the surface. Previous groundwater modeling study conducted in 2006 also indicates that the Biak Shear is the main aquifer source in the area and extends to about 1000 m.

Nonetheless, because these groundwater wells were previously sampled and are used for domestic purposes (except for drinking), the baseline update study was conducted. (GHD Pty Ltd, 2012)

OGPI currently monitors water quality in three (3) monitoring bores at the site namely DWB01, DWB02 and DWB03 (new station). Other monitoring stations previously monitored by OGPI are TDDH111 (same as GHD monitoring station), CWS and RSCPT01 (decommissioned since September 2017). Description and locations of these stations are presented in Figure 2-31.

Table 2-14: Geographic Coordinates and Description of GHD Groundwater Quality Sampling Stations (2011 Well Inventory)

Station	Location/Description	Photo
DDDH26	N: 16° 19' 43.8" E: 121° 27'11.6" A monitoring well located at the western portion of the site. During the time of sampling, it was dry.	
DDDH54	N: 16° 19' 45.9" E: 121° 27'15.4" Located at the western portion of the site and east of monitoring well DDDH26. It is an enclosed artesian well used by employees onsite for bathing and washing clothes.	

Station	Location/Description	Photo
DDDH51	N: 16° 19’ 46.9” E: 121° 27’20.7” Located at the western portion of the site. This well is not enclosed and has a rubber boot attached to the pipe from which water flows out of.	
RCPT14	N: 16° 19’ 46.5” E: 121° 27’24.6” Located at the central portion of the site. This well is not enclosed and water flows out of a pipe.	
TDDH111	N: 16° 19’ 50.9” E: 121° 27’34” Located in the eastern portion of the site. Water from this well surrounded by residential houses, is used for domestic purposes.	

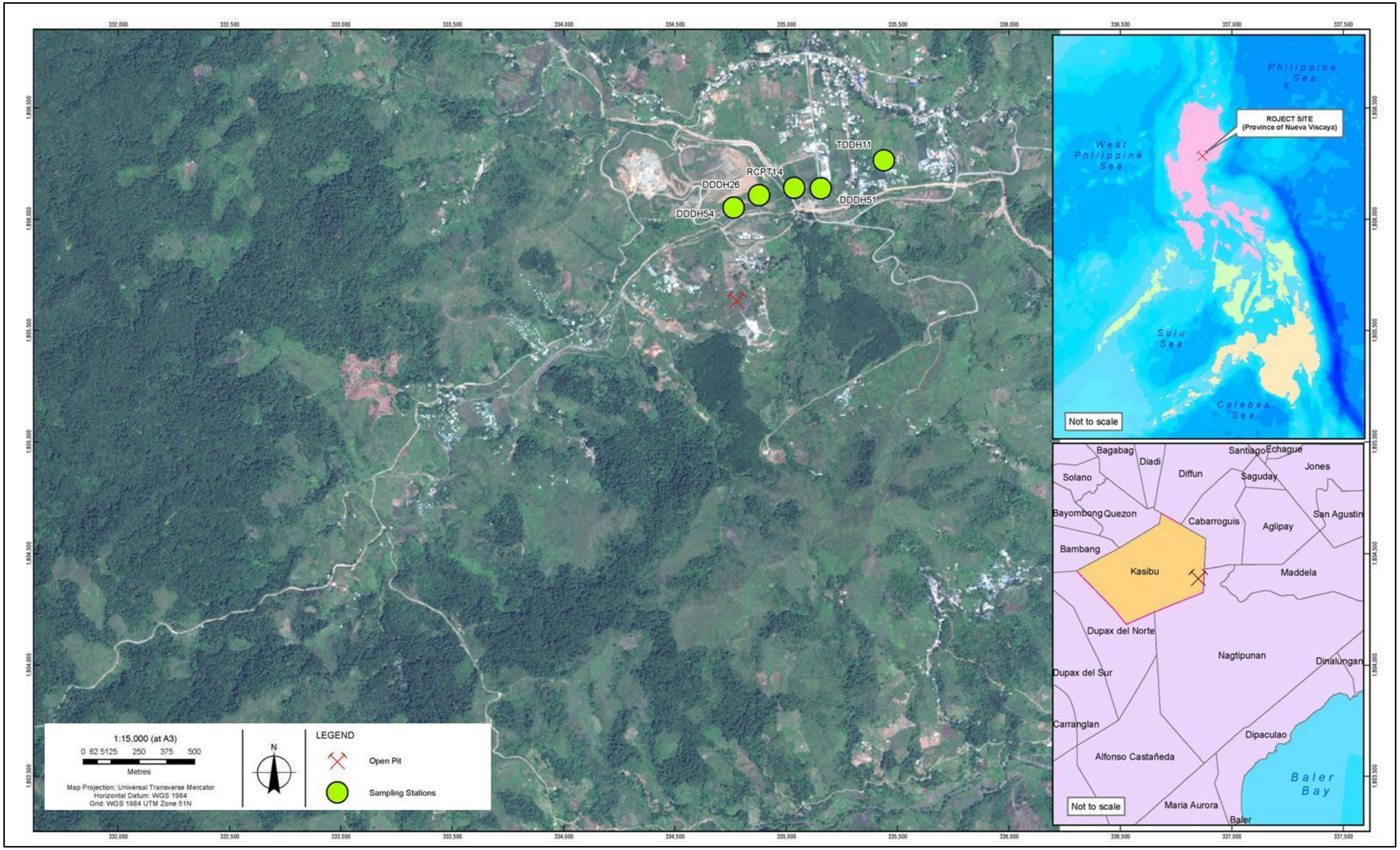
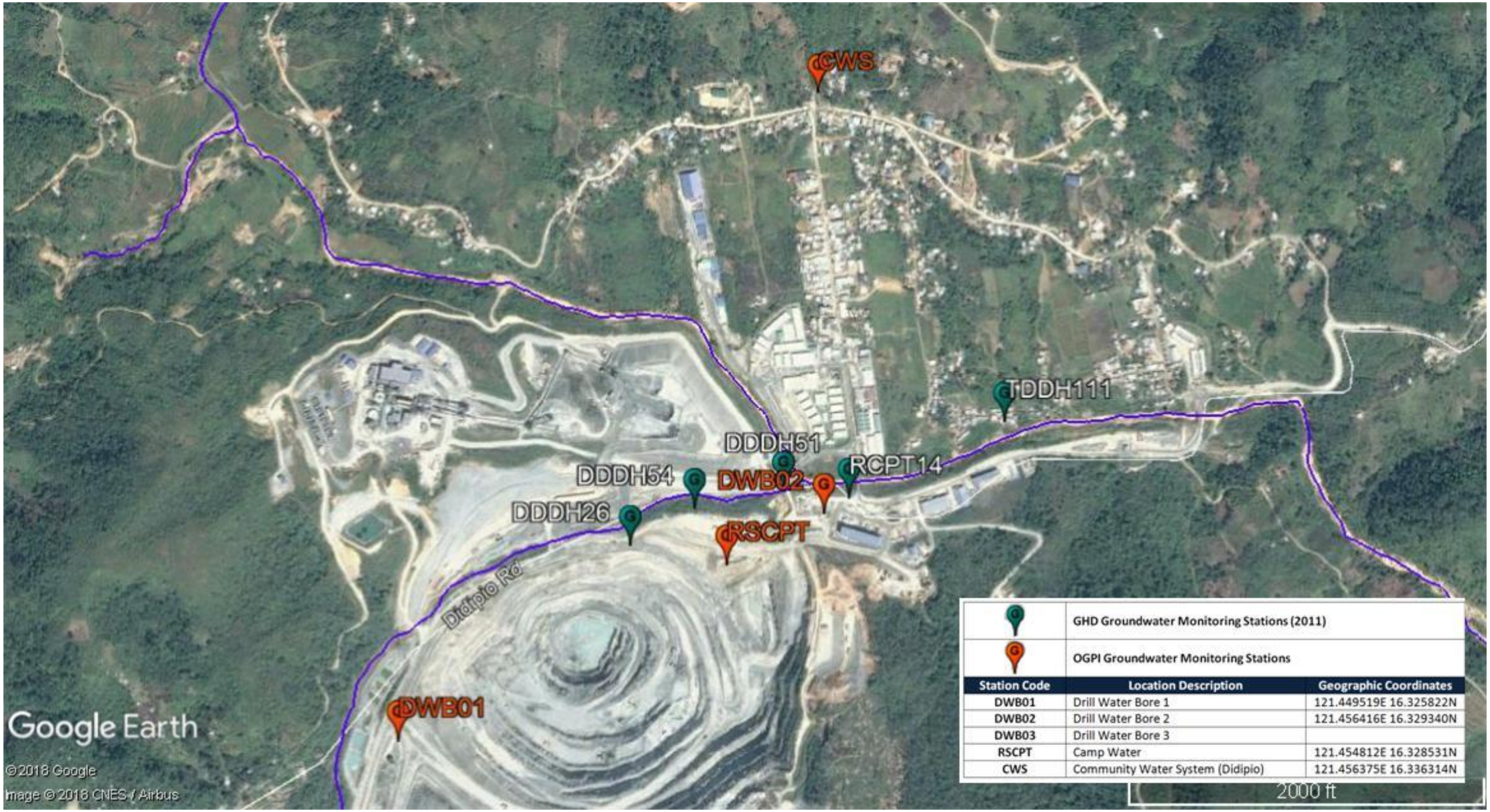


Figure 2-30: Groundwater sampling map/well inventory map of GHD in 2011 water sampling activity

Source: Environmental Baseline Update Report for the Didipio Gold Copper Project (GHD Pty Ltd, 2012)



Station Code	Location Description	Geographic Coordinates
DWB01	Drill Water Bore 1	121.449519E 16.325822N
DWB02	Drill Water Bore 2	121.456416E 16.329340N
DWB03	Drill Water Bore 3	
RSCPT	Camp Water	121.454812E 16.328531N
CWS	Community Water System (Didipio)	121.456375E 16.336314N

Figure 2-31: OGPI Groundwater Monitoring Map (Also shown in the map are the locations of previous groundwater monitoring stations of GHD in the 2011 baseline study)

2.2.1.2.2 MINE DEWATERING

Mine water is defined as the combined groundwater and surface water that reports to the OP and the UG development. It includes the groundwater inflows, pit wall rainfall runoff, UG water directed to the OP and service water used within the underground. (OGPI Water Management Plan, 2018)

All mine water is to run through a series of desilting processes before being discharged into the river system. In the OP this comprises of water reporting to the OP sump which includes flow through filters (gabions). The UG water initially reports to level sumps, where after it is either pumped to interim pumping system which includes filter screens or water is drained to a storage stope and subsequently flows to the vertical dam, which includes screen before pumped to surface. The storage stope is a large sediment control stope designed to specifically capture silt from the UG workings. All mine dewatering water reports to the Green Tank ponds (SP12), for further treatment (physical and chemical) prior to discharge. (OGPI Water Management Plan, 2018)

OP dewatering system is designed to pump 300 l/s during the wet season with contingency of adding another 150 l/s using diesel pumps. In the dry season the OP dewatering requirement is in the range of 100-150 l/s, with water maintained at 2458-2460 mRL. Current pumping rates from the underground is approximately 350 l/s, which is expected to increase to 450-550 l/s with ongoing development.

Monitoring of flow rates and water volume abstracted for all pump stations is completed daily and reported to the NWRB monthly as per the dewatering license requirement (023594). Dewatering volumes from capital pump stations are monitored and recorded in the OptiMine system managed by the UG Fixed Plant Maintenance. The electric pontoon pump station flow meters will also be connected to OptiMine once fibre optic cables are installed.

Water pumped from production bore MB02/PB02 is utilized for Process Plant and BFPP, while PB03 is being utilized for the camp water supply, kitchen and laundry area, safety showers and eyewash around site, and fire hydrant. Water coming from the bores is non-potable and only used as domestic water only. The company also supplies water to the community at Sitio Dagupan and Sitio Boulevard in Barangay Didipio (conditions of NWRB Water Permits 023153 and 023154).

The water permits from National Water Resources Board (NWRB) have no expiration. However, there are new pending petitions to increase the allowable maximum intake volume for water permit 023153 and 023154 submitted to NWRB last December 2017.

2.2.1.3 IMPACT ASSESSMENT AND MITIGATION MEASURES– HYDROLOGY/HYDROGEOLOGY

2.2.1.3.1 CHANGE IN DRAINAGE MORPHOLOGY

The proposed project modification will not entail any area expansion and will not involve earthworks that would change the existing drainage system at the project site. Discussed below are the impacts of the current operations and the mitigation measures that are being implemented on site.

One of the major changes in drainage morphology was the diversion of Dinauyan River. Dinauyan River Diversion (Photo 2-4 and Figure 2-32) was constructed in accordance to the OGPI Mining optimization study which incorporate the Stage 4 and 5/6 final pit shells. The 705 m long, 2 m deep by 8 m deep wide engineered concrete channel was designed by GHD to withstand flooding in events up to a 1:100-year flood. A tributary of Dinauyan River particularly Luminag Creek was also diverted to allow the development of the TSF. The downstream portion of the Luminag Creek flows through an underground pipe traversing the northern portion of the TSF. It then joins the Dinauyan River downstream of the TSF. The clay-lined and rock-armored Madadag Levee was constructed to divert clean water around the Didipio mine area directly into the river system.

Photo 2-4: Dinauyan River Diversion
Source: Water Management Plan – Didipio Operations, 2018

The construction of the TSF, mine pit and waste rock stack within the Dinauyan watershed has also significantly changed the original morphology of the Dinauyan River valley. Increased surface runoff due to vegetation clearing to allow the construction of the existing TSF, waste rock stack, mine pit, process plant etc. is also one of the impacts of the current operations.

The Didipio mine area is characterized by high rainfall with an average rainfall of 3.5 m per annum based on historical data. In addition, high groundwater inflows are experienced from the open pit (OP) (150 l/s) and underground (UG) (350 l/s) (OGPI Water Management Plan, 2018). The groundwater inflows and high rainfall result in the site operating in net positive water. OGPI implements its Water Management Plan to ensure compliance with discharge permit conditions (rate of discharge, water quality) with the following key elements:

- Clean water characterized by natural seeps, creeks or water course within the mine footprint are diverted directly into the major rivers.
- All water from areas disturbed by mining activities (haul roads, stockpiles/waste rock dumps, borrow pits, OP and UG) are directed towards sedimentation ponds before being discharged offsite.
- All tailing produced through mineral processing is piped to the TSF, water from the TSF is recycled within the Process Plant and excess water is treated at the Water Treatment Plant (WTP), thereafter discharged into the environment.
- Ongoing rehabilitation of disturbed areas to minimize erosion, sediment loads and improve runoff water quality reporting to sediment ponds.

Additional mitigation measures that are being implemented on site include progressive rehabilitation of the waste rock stack and of the TSF embankment to reduce surface runoff and erosion. Affected river channels were also lined to prevent scouring and seepage of water into the mine pit. Surface water management systems on site also include sediment ponds, sumps and surface water drains.

TSF is rated and designed per a flood event with ARI of 1:100 or the maximum flood event which will be rated from historical flood and rainfall events. Gauges are installed at the TSF to monitor water levels particularly in periods of prolonged rainfall. An emergency spillway was constructed upstream of the waste rock stack and TSF to allow for flows greater than the normal flow particularly during flood or high rainfall events. The spillway will be sized to account for the Probable Maximum Flood (PMF) with a 15-m base and 2H:1V batter slopes and 1.6 m water depth with freeboard (OGPI Interim AEPEP for 2018). A detention basin between the TSF and WRD is provided with storage capacity approaching the PMF event which allows controlled manner of release through the WRD spillway which is constructed of coarse rock and capable of passing the 1 in 100 AEP-72-hour flood event.

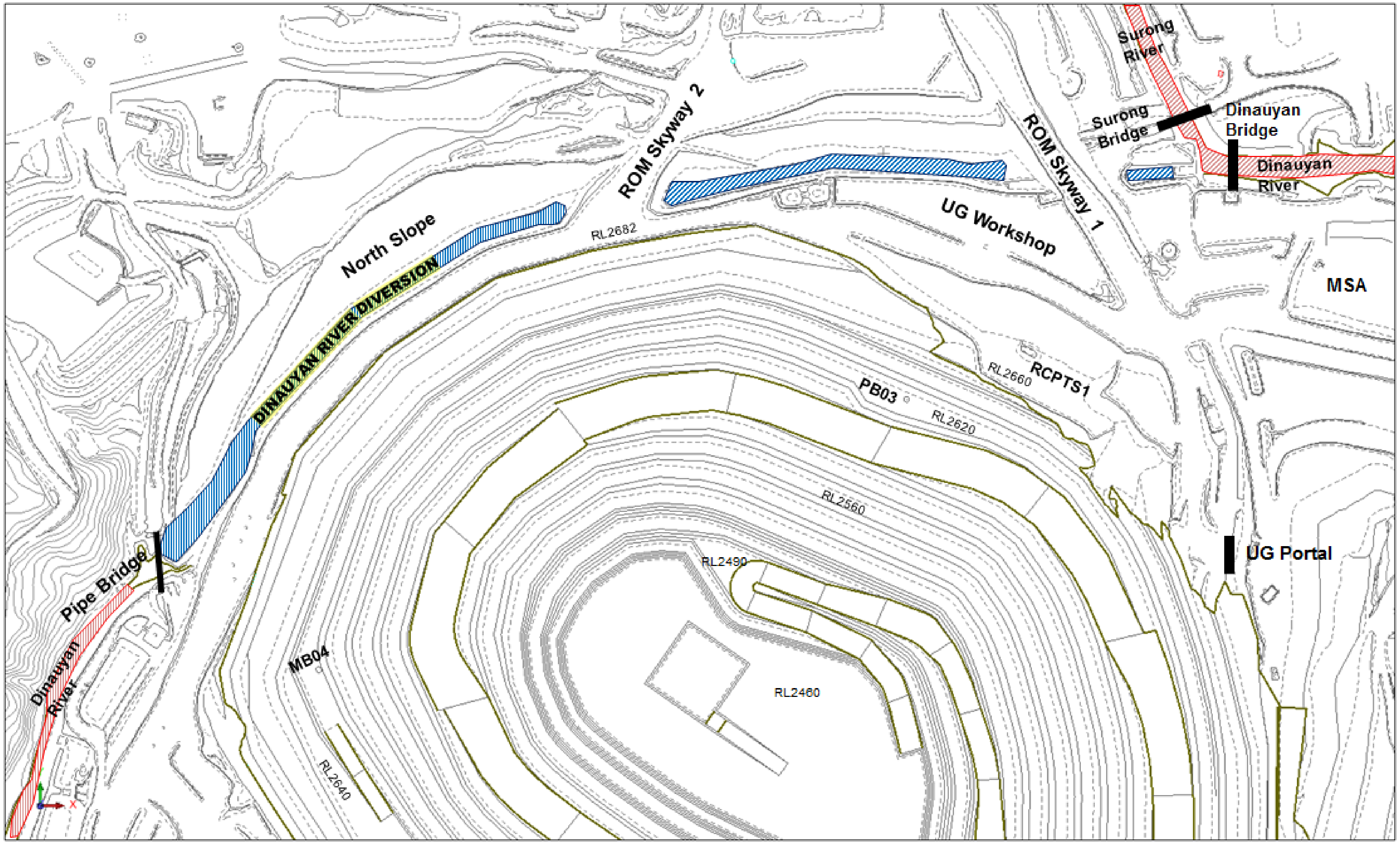


Figure 2-32: Dinauyan River Diversion relative to the final open pit design

2.2.1.3.2 CHANGE IN STREAM WATER DEPTH

The proposed project modification is not expected to significantly affect the water depths of streams draining the project area. However, activities of the current operations may cause changes in stream water depth through increased river discharges due to increased surface runoff thereby causing stream bed and stream bank erosion which may eventually result to increased stream depths in some areas while decreased stream water depth due to sedimentation of the downstream portions of the affected rivers. These impacts are currently being mitigated through progressive rehabilitation, implementation of slope control measures such the use of cocomatting or geomembranes for erosion control, implementation of engineering measures such as use of riprap, gabions, and shotcrete along valleys or slopes, installation of silt traps and sedimentation ponds, gravelling of roads, and rock lining of drainage systems and water ways.

2.2.1.3.3 DEPLETION OF WATER RESOURCES / COMPETITION IN WATER USE

The daily water demand for the Didipio operation at 3.5 Mtpa is approximately 20,000 m^3, of which the majority is recycled water for the process plant, sourced from decant water from the thickeners and the tailings pond. Any fresh makeup water is sourced from two deep bores located at the perimeter of the open pit mine. These bores serve to depressurize the pit wall to improve the wall stability as well as providing a source of fresh water. (OGPI Interim AEPEP for 2018)

A schematic diagram of OGPI Site Water Distribution is presented in Figure 2-33.

Discussed in the following sections are the identified impacts of the current project operation on the quantity of water resource.

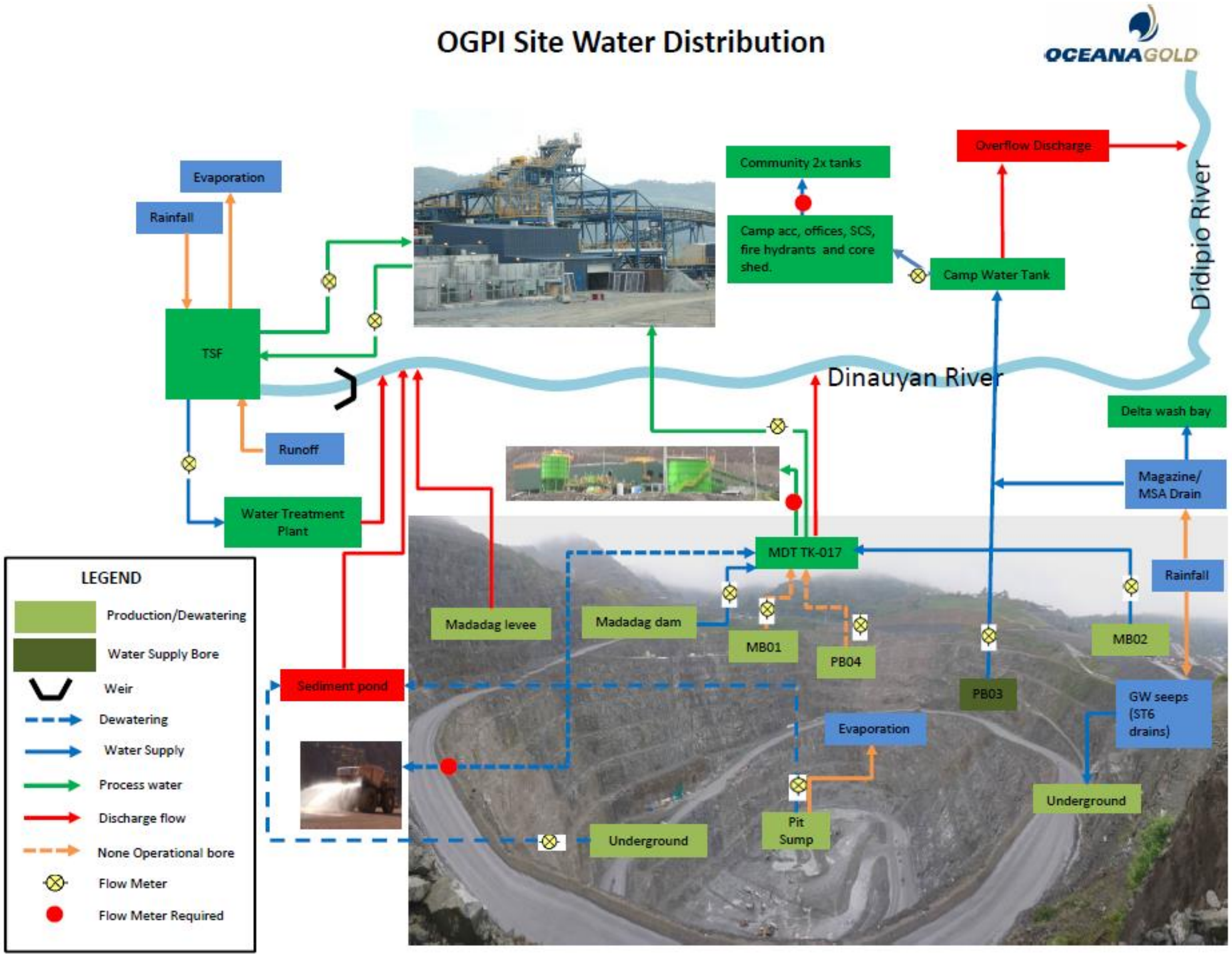


Figure 2-33: Schematic Diagram of Site Water Management
Source: Water Management Plan for Didipio Operations, 2018

2.2.1.3.3.1 Increase in Population and Water Competition

Drawing water for mine use from the watershed of the Dinauyan River and groundwater within the mine area may lead to reduction in flow for springs and tributaries in the secondary impact areas and bring about water competition with other users such as irrigators and communities in the secondary impact areas. Modeling of the impact indicates that the impact will be localized, however it is possible also that several springs and wells near the dewater operations will either reduce in flow or dry up (OGPI Interim AEPEP for 2018).

In addition, the population of Barangay Didipio has been closely linked to the mining operations of OGPI. While the mining activity brings about changes in the physical landscape and the surface and groundwater movement, the resulting economic development also drives local population growth that could exert pressure on the water supply requirements for the community. (Soriano et. al., 2018)

One of the activities conducted for the *Water Resource Study for Barangay Didipio Domestic Water Supply* (2018) was a Focus Group Discussion (FGD) with participants coming from the different sitios of Barangay Didipio. The FGD was conducted to determine the state of water supply in their respective sitios, with respect to quantity and quality. The following were noted from the participants regarding their water supply during the FGD:

- Presence of Foreign Bodies (e.g. dirt, mud) which appear mostly during the rainy days
- Some households have own filters to address foreign bodies but others simply ignore them and drink the water (which could be unsafe)
- Cost of water depends on the source of water [i.e. those with direct connections to springs are not paying, those without opt to buy water from refilling stations (at P25 per 16 liters) or connect to households with direct connection for a fee]
- Supply of water in some sitios are currently low and springs as sources of water are perceived to be not sufficient, more so during the summer periods
- Current distribution of water supply in Didipio is not managed (i.e. those near sources have abundant supply while those far from sources receive minimal supply, only those with finances can afford to have own direct connection to sources
- Lack of sufficient water is blamed on the following: rapid increase of population, intensified ‘kaingin’ activities in the area and perceived loss of water due to mine operation

Also noted during the FGD are the sources of water in Barangay Didipio summarized in Table 2-15.

Table 2-15: Sources of water in Barangay Didipio

Sitio	Drinking				Other Domestic Use		
	Refilling Station	Spring	Underground	Tunneled	Spring	Underground	Tunneled
1. Bacbacan	✓	✓			✓		
2. Boulevard	✓				✓		
3. Camgat		✓			✓		
4. Centro 1		✓			✓		
5. Centro 2		✓			✓		
6. Dagupan	✓		✓	✓		✓	✓
7. Dinauyan		✓			✓		
8. Dupit	✓	✓			✓		
9. Pimmadek		✓			✓		
10. Surong		✓			✓		
11. Waterfalls		✓			✓		
12. Verona	✓	✓			✓		

Source: Water Resource Study for Barangay Didipio Domestic Water Supply. Soriano et. al. 2018

OGPI is currently implementing mitigation measures to address project impacts in terms of water supply from surface and groundwater sources in Barangay Didipio. OGPI has a groundwater monitoring program that regularly assesses the depth of the groundwater onsite and installed groundwater monitoring bore near the community to greatly assess if really, the mining activity is affecting the source of community water. Moreover, the company has provided alternative sources of non-potable water from the bores for the community as per the condition in the ECC, particularly in Sitio Dagupan and Sitio Boulevard in Barangay Didipio. Monitoring of flow rates and water volume abstracted for all pump stations is also being conducted on a daily basis and reported to the NWRB monthly as per the dewatering license requirement.

One of the commitments of the Company is the establishment of Didipio Water Supply System as stipulated in the 2013 Memorandum of Agreement with Barangay Didipio. The provision of alternative water supply to the community is also one of the requirements of the Environmental Compliance Certificate (ECC) as stipulated in the condition no. 6 in which "the proponent shall immediately provide alternative source of potable water to the affective community" in an event that the development/operation activities affects the existing water sources. According to Soriano et. al. (2018), there is currently an existing perception and persisting alleged water losses issues from the community which is claimed to be due to project development and operation. The proposed Water Supply and Distribution System in Barangay Didipio intends to satisfy the MOA and ECC commitments and mitigate existing alleged water loss issues. The water supply project will include the design, permitting, construction, and commissioning of level 3 potable water supply system project for Barangay Didipio, Kasibu, Nueva Viscaya and is designed to supply water to about 816 households.

As of December 2018, the establishment of Didipio Water Supply System is 30% complete. The source was identified by the Didipio Barangay Local Government Unit which is upstream of the Barangay at Sitio Napagayan.

A detailed water drawdown impact study is being conducted to confirm potential impact of underground and mine operation on nearby communities and on the project water balance. Initial studies suggest that the mining activity is unlikely to affect community water supply. This study will determine of the mining activity is indeed affecting the community water supply (as alleged) or provide information to anticipate potential impact on ground water supply. A water balance study will proceed after this study. (OGPI Interim AEPEP for 2018)

Monitoring of groundwater levels are also done using installed of piezometers at boreholes (installed in 2014) strategically located within the project area. An online PI System was set-up and is currently being used to capture all the data generated from the flow meter devices, this is an upgrade to the conventional manual recording to ensure all records are centralized and logged accurately to the system. (OGPI Interim AEPEP for 2018)

2.2.1.3.3.2 Water Conservation Measures

Aside from OGPI's commitment to establish a water supply system to the impact barangay, OGPI also implements water conservation measures through water treatment and recycling, and use of water associated with mine dewatering. One of the objectives of OGPI's Water Management Plan is to reuse and recycle as much water as possible on site. Ground water dewatering bores is expected to be suitable quality for discharge without treatment, and is the main source of water for process makeup, site fire water storage tank, and dust suppression (OGPI Interim AEPEP for 2018). On the other hand, pit dewater, associated with pit wall seepage and rainfall into the pit, is pumped out of the pit into a series of sediment ponds to be used first as make up water for the process plant. Upon meeting the process plant make up water requirement, excess pit dewater is used for dust suppression during dry periods. Excess water is then analyzed to determine suitability for discharge to the Dinauyan River via a series of sediment ponds. (OGPI Interim AEPEP for 2018)

OGPI also installed a facility called Didipio Water Recycling and Purification Plant (DWRAPP) in its sewage treatment plants at the Mine Services Area (STP MSA) to provide further treatment of STP MSA's effluent to a potable water quality via hyperoxidation method by ozonation, light polarization and further water disinfection using Ultraviolet light. At present, the facility is not operating due to some improvements being made to enhance the system. (OGPI Water Management Plan, 2018)

OGPI also utilizes water from the Tailings Storage Facility (TSF) to supply around 79% of the Process Plant's water requirement. In 2017, of the total 6.7 million m^3 of water pumped out of the TSF, 71% was treated in the Water Treatment Plant (WTP), 28% was discharged directly to river and 1% is recycled to the process plant. (OGPI Water Management Plan, 2018)

The Company has committed to improving water recycling to lower the consumption from natural water sources such as the Madadag creek and groundwater production bores. Post commissioning, raw water from natural sources was used to make-up the balance of the plant Process water requirements (Figure 2-34). In order to reduce requirement on clean water sources for raw water make-up, a second return water line from the TSF to the Process Water Tank (PWT) was installed, this approximately doubled the flow available from the TSF and increased the recycling of Process/Raw water block to 90% (internal plant recycling via the thickeners) and overall recycling effort to 79% (excludes thickener recovery so is a measure of recycling effort external to the plant). A further change was made in 2017 to lower natural water source consumption by piping a portion of the WTP overflow (water normally destined for discharge to the Dinauyan River) to the Mine Dewatering Tank (MDT TK-017) to provide alternative source of water supply in the event of extremely low raw water supply. Production bore MB02 (PB02) also supplies the MDT on a continuous basis. (OGPI Water Management Plan, 2018)

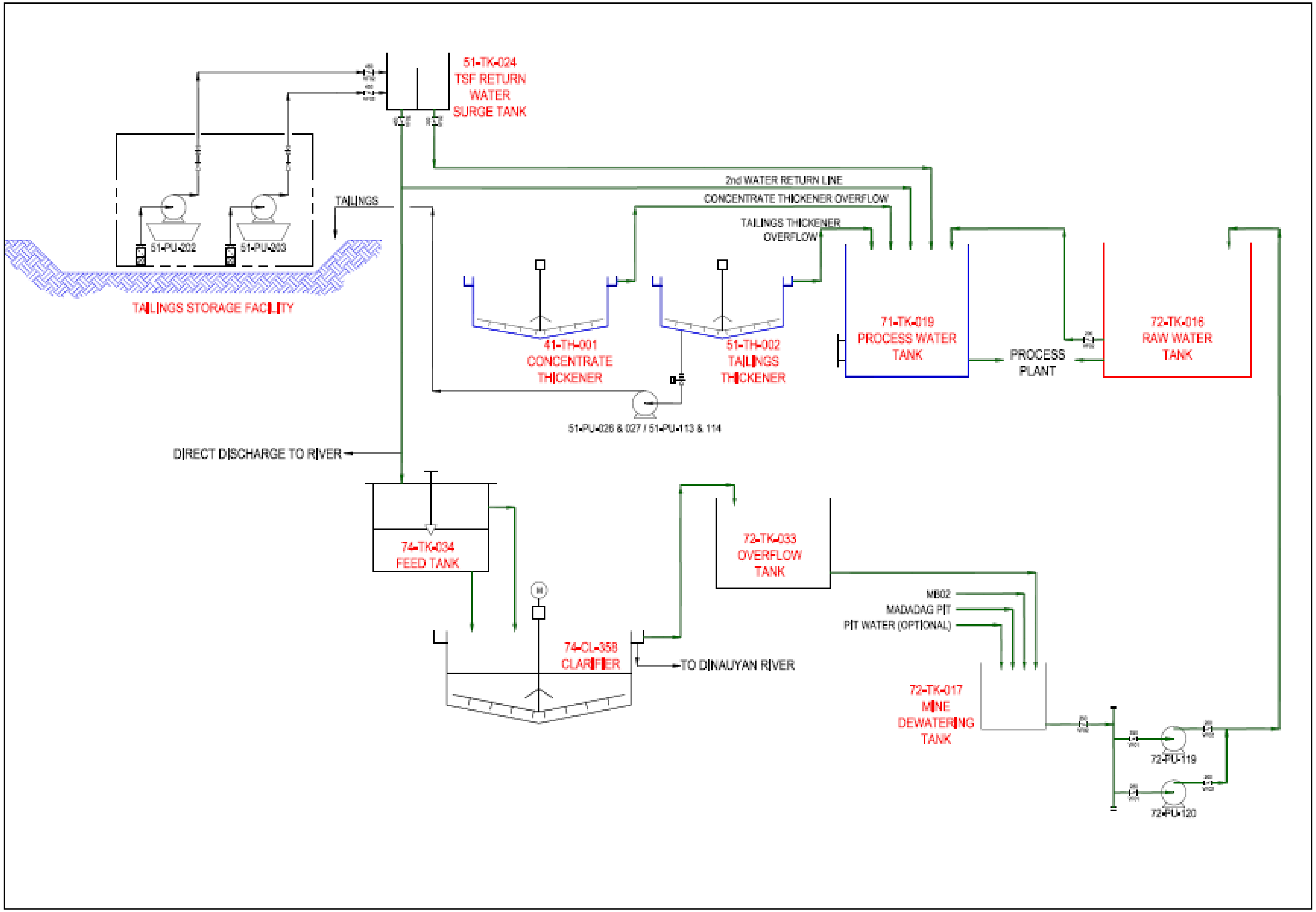


Figure 2-34: Process Plant Water Balance

Source: Water Management Plan for Didipio Operations, 2018

2.2.2 Water Quality Monitoring

Water quality monitoring of OGPI consists of sampling and testing the water quality within the natural streams and watercourses as well as the various mining operation components. Water quality monitoring stations were established along the rivers and creeks upstream, within and downstream of the project area. It is worth noting that some of the water bodies were identified to be heavily impacted by ongoing rampant and unregulated small-scale mining activities which are adjacent to Didipio Mine's operations and such activities resulted to increase siltation of rivers/creeks particularly during heavy rainfall. This is being constantly monitored, documented, and reported by OGPI to regulatory bodies. (OGPI Interim AEPEP for 2018)

2.2.2.1 Effluent Monitoring

2.2.2.1.1 Wastewater Management

The key elements of the Project's Water Management System are as follows:

- Clean water from natural seeps, creeks or water course within the mine footprint is diverted directly into the major rivers.
- All water from areas disturbed by mining activities (haul roads, stockpiles/waste rock dumps, borrow pits, open pit (OP) and underground (UG) are directed towards sedimentation ponds before discharge offsite.
- All tailings produced through mineral processing is piped to the Tailings Storage Facility (TSF), water from the TSF is recycled within the Process Plant and excess water is treated at the Water Treatment Plant (WTP), thereafter discharged into the receiving water bodies.
- Ongoing rehabilitation of disturbed areas to minimize erosion and sediment loads and improve runoff water quality through sediment ponds.

Didipio mine discharges clean water (diverted from peripheral seeps and creeks) and treated water from the Water Treatment Plant (WTP), Sewage Treatment Plant (STP) and treated mine runoff and dewatering water. Water generated on site that requires management primarily comes from mine dewatering, surface runoff from disturbed areas of the site, and surplus process water derived from tailings (OGPI Water Management Plan, 2018). Sewage generated from the Plant Site and at the Mine Services Area (MSA) is also being treated in two (2) separate units of Sewage Treatment Plants (STP) at OGPI. Other water treatment facilities discharging effluent include Wash Bays, Fuel Farm Oil and Water Separator and Volatilization Pad.

The overall approach to water management at the Didipio mine operation is to minimize discharge from the operating site and direct all polluted surface water flows including any waste rock seepage to a series of sediment ponds to remove TSS before discharge. Water is monitored prior to release to ensure compliance with DENR's effluent standards for Class D waterways (OGPI Interim AEPEP for 2018).

The Tailings Storage Facility (TSF) is the repository of Process Plant slurry (solids and water) tailings throughout the life of the mine. TSF water is either recycled back to the Process Plant[1] or pumped to the Water Treatment Plant (WTP). The Water Treatment Plant (WTP) is an integral part of the water management system. During the wet season, large volume of surface water runoff goes into the TSF. To maintain the 5-meter freeboard at the TSF, TSF water is pumped to the WTP for treatment prior to discharge to Dinauyan River[2]. In select cases when water quality conditions are met at the TSF, water is directly discharged from TSF through the TSF Direct Discharge point. (OGPI Water Management Plan, 2018)

[1] About 79% of the water requirement of the Processing Plant is provided by the TSF recycled water.

[2] In 2017, of the total 6.7 million cubic meters of water pumped out from the TSF, 71% was treated in the WTP, 28% was discharged directly to the river and 1% recycled to the Process Plant.

There are two (2) units of STPs at OGPI; one is located at the Mine Services Area (MSA) and another one unit at the Plant Site area. The STPs at the MSA (4 modules) cater for the waste coming from three (3) accommodation camp offices at MSA and kitchens while the STP Plant site (single module) caters the domestic wastewater from the Plant site. The STP MSA is equipped with a facility called Didipio Water Recycling and Purification Plant (DWRAPP) which main purpose is to provide further treatment of STP MSA's effluent to a potable water quality via hyperoxidation method by ozonation, light polarization and further water disinfection using Ultraviolet light although the facility is not operating to date due to some improvement being done to enhance the system. (OGPI Water Management Plan, 2018)

Other water treatment facilities in OGPI include three (3) wash bays, the Carwash Bay located at mobile maintenance area for light vehicles (LV) washing, the heavy vehicle (HV) and LV wash bay at MSA and underground (UG) wash bay at UG workshop area. All wash bays are equipped with oil and water separator chambers to prevent oil from being discharged to the receiving water bodies. OGPI also monitors effluent coming from the Fuel Farm oil and water separator (OWS) and from the Volatilization Pad. The Fuel Farm OWS is designed to ensure that the wastewater coming from the fuel farm is within the standard limit while the Volatilization Pad facility is used for treating soil that are contaminated with hydrocarbons through volatilization and biodegradation with subsequent OWS to treat remnant oil (OGPI Water Management Plan, 2018) .

2.2.2.1.2 Pollution Control Facilities and Effluent Quality Monitoring

Listed in Table 2-16 are the effluent monitoring stations of OGPI. Initially, only one (1) the Carwash Bay Area (Mobile) was monitored (3rd - 4th quarter of 2012) since the other water pollution control facilities were still in the commissioning stage due to modifications and improvements being done during that time. Parameters monitored for the Carwash Bay Area were 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS) and oil and grease (O&G). Results were compared to Class D standards of the DENR Administrative Order 35 of 1990 (DAO 90-35). The Class D classification was according to the Fresh Surface Water Classification of DENR Administrative Order 34 of 1990 (DAO 90-34) which was based on the current beneficial use (i.e. agriculture, irrigation, livestock watering, industrial water supply Class II) of the receiving water bodies (rivers and creeks) impacted by the Project. Results during the initial monitoring activity for the Carwash Bay Area were all within DAO 35 standards (<1 to 1 mg/l for BOD); <2.5 mg/l for TSS; 0.40-0.52 mg/l for O&G).

In 2013, all the pollution control facilities of OGPI were being modified and improved thus were still in commissioning stage. Effluent monitoring resumed again in the second quarter of 2014 (2Q 2014) wherein five (5) discharge outlets were monitored: Sewage Treatment Plant (STP) at the Plant Site, STP at the Mine Services Area (MSA), Carwash Bay Area (Mobile), Oil Lube Shed and the Tailings Storage Facility (TSF). Five (5) additional water pollution control structures were commissioned and monitored as the project continues to operate, these are: Heavy Vehicles (HV) Wash Bay (Silt Pond 09 (SP09)) in 2015 and Volatilization Pad, Fuel Farm Oil and Water Separator (OWS), Underground (UG) Wash Bay, and Silt Pond 06 in 2016. On the other hand, monitoring of the Oil Lube Shed was discontinued in the 4th quarter of 2016 due to no discharge since its commissioning (applied for non-renewal of discharge permit). At present, OGPI monitors a total of nine (9) discharge outlets for effluent quality. Results are being reported in the quarterly Self-Monitoring Report submitted to DENR EMB.

It should be noted that prior to the new *Water Quality Guidelines and General Effluent Standards of 2016* (DENR Administrative Order 08 of 2016 (DAO 2016-08), results of effluent quality monitoring were compared to Class D standards of DAO 90-35 based on the DENR EMB Regional Office 02 classification of the Didipio River[3]. This was consistent with the intended beneficial use of the receiving water bodies in the area (i.e.

[3] Discharge Permit issued on December 28, 2015 for the Carwash Bay (DP No. 2015-DP-J-0250-011) stated that the effluent's quality standard limits shall follow Class D for Didipio River. There was no reclassification of Didipio River to date by the DENR EMB R.O. 02 in their latest issuances of discharge permits for the Project.

agriculture, irrigation, livestock watering, industrial water supply Class II). However, with the new DAO 2016-08, the current beneficial use of the receiving water bodies (rivers and creeks) of the Project falls under Class C water body classification. At present, Class D standards for different parameters monitored are still being used as basis for evaluating effluent quality and compliance to standards as also reported in the Self-Monitoring Reports (SMRs) since there was no reclassification of Didipio River to date by the DENR EMB R.O. 02 in their latest issuances of discharge permits for the Project.

After ratification of the current river reclassification of Didipio River by DENR-EMB as mandated under DAO 2016-08, the Company will fully align its compliance to the standard limits of the new classification. For the meantime, pending its approval, the company will still abide by the current official classification of Didipio River under Class D norms.

Details of the effluent monitoring stations of OGPI are presented in Table 2-16.

Table 2-16: Effluent Monitoring Stations of OGPI

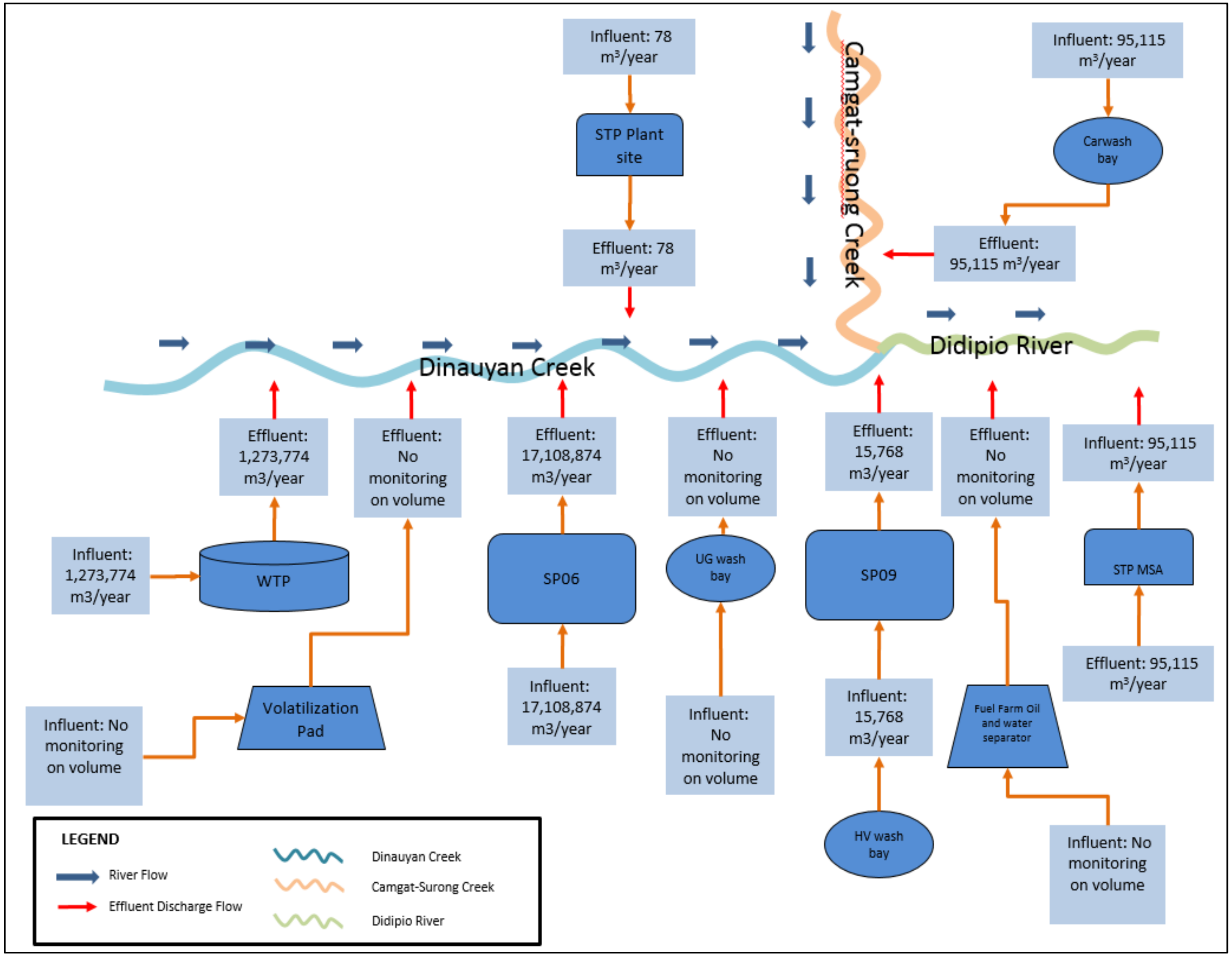
Station ID	Geographic Coordinates / Location	Discharge Permit No.	Discharge Permit Details	Expiry Date	Parameters required to be monitored in the discharge permit	Significant Effluent Quality Parameters (DENR A.O. 2016-08)	Parameters analyzed by OGPI based on their 2018 Water Management Plan	Parameters reported in the SMR
WTP/TSF Discharge Commissioned 4Q 2014 but started effluent sampling in 2Q 2014	16.325961N/ 121.448409E Water Treatment Plant (WTP) for the decant water coming from the Tailings Storage Facility (TSF)	2017-DP-D-0250-010	Discharge its effluent from Tailings Storage Facility – Water Treatment Facility and the final discharge off to Dinauyan River	08-Apr-2018 **submitted renewal application 02 April 2018 as of January 2019 still awaiting advice from EMB R2*	BOD Fecal Coliform Ammonia Nitrate Oil and Grease Surfactants	Gold Ore Mining Copper Ore Mining pH Total Suspended Solids Nitrate Cyanide Copper Zinc Arsenic Mercury Lead Cadmium Iron Sulfate	BOD Fecal Coliform Ammonia Nitrate Oil and Grease Surfactants Total Suspended Solids pH Temperature Dissolved Copper Total Arsenic Total Boron Total Cadmium Chloride Hexavalent Chromium COD Free Cyanide Total Iron Total Lead Total Mercury Phenol and Phenolic Substances Sulfate Total Zinc Phosphate	Nitrate Oil and Grease Total Suspended Solids Zinc Arsenic Cadmium Free Cyanide Iron Lead Mercury Sulfate
STP Plant Site Commissioned 2Q 2014	16.330300N/ 121.449360E Sewage Treatment	2018-DP-A-0250-009	Discharge its effluent from Plant Site's one (1) unit Sewage Treatment	28-Jan-2019 **submitted renewal application 21*	BOD Fecal Coliform Ammonia Nitrate	Sewerage BOD Fecal Coliform	BOD Fecal Coliform Ammonia Nitrate	BOD Fecal Coliform Ammonia Nitrate

Station ID	Geographic Coordinates / Location	Discharge Permit No.	Discharge Permit Details	Expiry Date	Parameters required to be monitored in the discharge permit	Significant Effluent Quality Parameters (DENR A.O. 2016-08)	Parameters analyzed by OGPI based on their 2018 Water Management Plan	Parameters reported in the SMR
	Plant (STP) at Mine Site		Plant to Dinauyan River	*December 2018; on-process status*	Phosphate Surfactants (MBAS) Oil and Grease	Ammonia Nitrate Phosphate Surfactants (MBAS) Oil and Grease	Phosphate Surfactants Oil and Grease Total Suspended Solids	Oil and Grease Total Suspended Solids
STP Camp Site/MSA Commissioned 3Q 2014	16.330120N/ 121.459790E Sewage Treatment Plant (STP) at Mine Services Area (MSA)	2017-DP-L-0250-007	Discharges its effluent from the MSA/Campsite final discharge point that passes through the four (4) units STP to Didipio River	7-Dec-2018 **submitted renewal application 16 November 2018; on-process status*	BOD Fecal Coliform Ammonia Nitrate Phosphate Surfactants (MBAS) Oil and Grease	Sewerage BOD Fecal Coliform Ammonia Nitrate Phosphate Surfactants (MBAS) Oil and Grease	BOD Fecal Coliform Ammonia Nitrate Phosphate Surfactants Oil and Grease Total Suspended Solids	BOD Fecal Coliform Ammonia Nitrate Oil and Grease Total Suspended Solids
Carwash Bay Area Commissioned 2Q 2014	16.332944N/ 121.45445E Carwash Bay Area (mobile) – Camgat-Surong Creek	2017-DP-J-0250-011	Discharge its effluent from Carwash Bay's two (2) units three (3) chambered oil and water separator and one (1) unit sedimentation pit to Didipio River (Camgat-Surong Creek)	25-Oct-2018 **submitted renewal application 17 October 2018; on-process status*	BOD Total Suspended Solids Oil and Grease Surfactants (MBAS)	Oil Water Separators + Maintenance & repair of vehicles pH Total Suspended Solids Oil and Grease Color Ammonia Nitrate Nickel Cadmium Mercury Lead	BOD Total Suspended Solids Oil and Grease Surfactants (MBAS) pH Ammonia Benzo(a)pyrene Total Cadmium Color Total Lead Total Mercury Total Nickel Nitrate	BOD Total Suspended Solids Oil and Grease Surfactants (MBAS) pH Ammonia Benzo(a)pyrene Cadmium Color Lead Mercury Nickel Nitrate

Station ID	Geographic Coordinates / Location	Discharge Permit No.	Discharge Permit Details	Expiry Date	Parameters required to be monitored in the discharge permit	Significant Effluent Quality Parameters (DENR A.O. 2016-08)	Parameters analyzed by OGPI based on their 2018 Water Management Plan	Parameters reported in the SMR
						Benzo(a)pyrene Surfactants		
HV and LV Wash Bay (SP09) Commissioned 4Q 2014	16.329720N/ 121.45611E Heavy and Light Vehicle Wash Bay Area (MSA) (SP09)	2017-DP-J-0250-013	Discharge its effluent from Heavy Vehicle wash bay's two (2) units three (3) chambered oil and water separator and one (1) unit sedimentation pit to Didipio River	07-Oct-2018 **submitted renewal application 02 October 2018; on-process status*	pH Total Suspended Solids Oil and Grease Lead Mercury Surfactants	Oil Water Separators + Maintenance & repair of vehicles pH Total Suspended Solids Oil and Grease Color Ammonia Nitrate Nickel Cadmium Mercury Lead Benzo(a)pyrene Surfactants	pH Total Suspended Solids Oil and Grease Total Lead Total Mercury Surfactants (MBAS) BOD Ammonia Benzo(a)pyrene Total Cadmium Color Total Nickel Nitrate	pH Total Suspended Solids Oil and Grease Lead Mercury Surfactants (MBAS) BOD Ammonia Benzo(a)pyrene Cadmium Color Total Nickel Nitrate
		2017-DP-I-0250-018	Discharge its effluent from Silt Pond 09 to Dinauyan River	13-Sep-2018 **submitted renewal application 12 September 2018; on-process status*	pH Total Suspended Solids Oil and Grease		BOD Ammonia Benzo(a)pyrene Total Cadmium Color Total Lead Total Mercury Total Nickel Nitrate Surfactants (MBAS) Fecal Coliform	

Station ID	Geographic Coordinates / Location	Discharge Permit No.	Discharge Permit Details	Expiry Date	Parameters required to be monitored in the discharge permit	Significant Effluent Quality Parameters (DENR A.O. 2016-08)	Parameters analyzed by OGPI based on their 2018 Water Management Plan	Parameters reported in the SMR
UG Wash Bay	16.32977N / 121.45472E Underground Wash Bay	2018-DP-D-0250-017	Discharges effluent from wash bay's oil and water separator to Dinauyan River	17-Apr-2019	pH, Ammonia, Nitrate, Nickel, Cadmium, Mercury, Lead, TSS, Oil and Grease, Surfactants	Oil Water Separators + Maintenance & repair of vehicles pH Total Suspended Solids Oil and Grease Color Ammonia Nitrate Nickel Cadmium Mercury Lead Benzo(a)pyrene Surfactants	pH Total Suspended Solids Oil and Grease Total Lead Total Mercury Surfactants (MBAS) BOD Ammonia Benzo(a)pyrene Total Cadmium Color Total Nickel Nitrate Fecal Coliform	Total Suspended Solids Oil and Grease Lead Mercury Surfactants BOD Ammonia Benzo(a)pyrene Cadmium Color Total Nickel Nitrate Phosphate Fecal Coliform
Fuel Farm OWS	16.32986N / 121.45888E Fuel Farm Oil Water Separator (OWS)	2017-DP-I-0250-015	Discharge its effluent from Fuel Farm's oil and water separator facility to Didipio River	08-Sep-2018 **submitted renewal application 03 September 2018; on-process status*	pH Total Suspended Solids Oil and Grease	Oil Water Separators pH Total Suspended Solids Oil and Grease	Total Suspended Solids Oil and Grease BOD	Total Suspended Solids Oil and Grease BOD
Volatilization Pad OWS	16.31805N / 121.44805E Volatilization Pad Oil Water Separator	2018-DP-H-0250-014	Discharge its effluent from Volatilization Pad's three-chambered Oil and Water Separator to	08-Aug-2019	pH Total Suspended Solids Oil and Grease Lead Surfactants	Oil Water Separators pH Total Suspended Solids	Total Suspended Solids Oil and Grease BOD	Total Suspended Solids Oil and Grease BOD

Station ID	Geographic Coordinates / Location	Discharge Permit No.	Discharge Permit Details	Expiry Date	Parameters required to be monitored in the discharge permit	Significant Effluent Quality Parameters (DENR A.O. 2016-08)	Parameters analyzed by OGPI based on their 2018 Water Management Plan	Parameters reported in the SMR
			Dinauyan River			Oil and Grease		
SP06 Discharge	16.326660N/ 121.44916E Silt Pond 06 near Dinauyan River	2017-DP-I-0250-019	Discharge its effluent from Silt Pond 06 to Dinauyan River	18-Sep-2018 **submitted renewal application 05 September 2018; on-process status*	pH Total Suspended Solids Oil and Grease		pH Total Suspended Solids Oil and Grease BOD Ammonia Benzo(a)pyrene Total Cadmium Color Total Lead Total Mercury Total Nickel Nitrate Surfactants (MBAS) Fecal Coliform	Total Suspended Solids Cadmium Lead Mercury Nitrate Zinc Iron Arsenic Free Cyanide Sulfate



***Water Treatment Plant (WTP)** – All standards were satisfied*

***STP MSA** - Most standards were satisfied except for some instances were Ammonia and Fecal coliforms exceeded the standard limit.*

***STP Plant site** - Most standards were satisfied except for some instances were Ammonia, Nitrate, Phosphate and TSS exceeded the standard limit.*

***Car wash bay** - Most standards were satisfied except for an instance were BOD, TSS and Oil and Grease exceeded the standard limit.*

***HV wash bay** - Most standards were satisfied except for an instance were TSS exceeded the standard limit.*

***UG wash bay** – All standards were satisfied*

***Fuel Far oil and water separator** – All standards were satisfied*

***Volatilization Pad** - All standards were satisfied*

Figure 2-35: Effluent Discharge Block Diagram

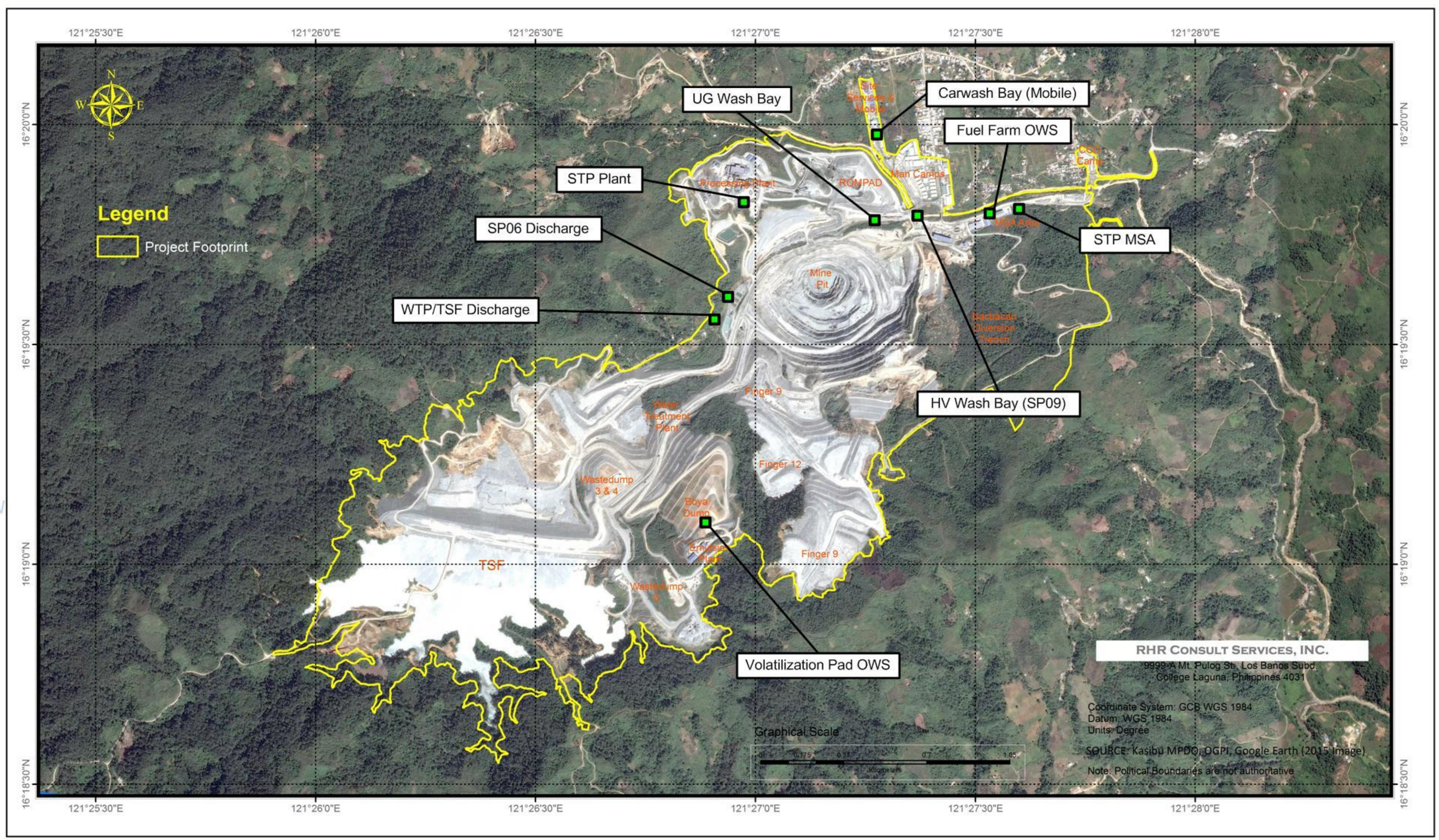


Figure 2-36: OGPI Effluent Discharge Map

2.2.2.1.2.1 Water Treatment Plant and Tailings Storage Facility

The Water Treatment Plant (WTP) has been designed to treat Tailings Storage Facility (TSF) decant water prior to discharge to river by reducing the suspended solids to allowable limit or lower. WTP feed source comes from the TSF header tank and is gravity fed to the WTP feed tank and then into the feed well of 34-m diameter WTP Clarifier. To reduce the incoming feed TSS concentration, coagulant is dosed into the TSF decant water before going into the feed tank to neutralize the strong surface charge of colloidal particles which leads to the particles remaining in suspension. Flocculant reagent is then added prior to the Clarifier feed well together with the underflow solids recycle to bind and settle the solids impurities. (OGPI Water Management Plan, 2018)

The flocculated slurry settles to form a bed surface with a well-defined interface with clarified liquid above it. The thickened slurry from the Clarifier underflow that are recycled back to the feed tank increase and maintain the required feed density and enhance the contact between the polymeric flocculants and the fine suspended solids in the feed stream. To reduce the bed of solids down to the lower limit as indicated by the bed pressure transducer, the thickened slurry is discharged to the TSF. (OGPI Water Management Plan, 2018)

The treated water containing the permissible TSS level flows to a peripheral collection launder at the top of the clarifier and is then discharged into the Dinauyan River. This water is also collected in the overflow tank and is utilized for pump gland seal, flocculant mixing, flocculant dilution and as flushing water in the WTP. (OGPI Water Management Plan, 2018)

A line from the overflow tank is also laid out to TK-017, the Mine Dewatering Tank, as a contingency in the event of shortage of raw water for Process Plant and BFPP operation (OGPI Water Management Plan, 2018).

The Tailings Storage Facility (TSF) (Photo 2-5), on the other hand, is the repository of process plant slurry (solids and water) tailings throughout the life of the mine. About 79% of the water requirement of the Processing Plant is provided by the TSF recycled water. During the wet season, large volume of surface water runoff reports to the TSF. To maintain the level at TSF of 5 m freeboard, TSF water is pumped to WTP for treatment prior to discharge to Dinauyan River. Of the total 6.7 Mm^3 of TSF water pumped out in 2017, 71% was treated in the WTP, 28% was discharged directly to river and 1% recycled to the process plant. (OGPI Water Management Plan, 2018)

Photo 2-5: Tailings Storage Facility

2.2.2.1.2.2 Sewage Treatment Plant

There are two sewage treatment plants in the mine site:

- Plant STP (Single module), which treats waste water and sewage from Process Plant ablution blocks.
- STP MSA (4 modules), which treats waste water and sewage from the 550 man-camp, the 150 man-camp, CCO, as well as all the buildings along the MSA.

All waste generated from the toilets, showers, kitchens, and laundries are directed to the STP. Wastewater from the main facilities such as the operations village and the process plant are likewise piped to the STP. Wastewater from isolated site locations such as guard houses may be collected and transported to the sewage treatment plant by trucking. Waste sludge from the STP is being hauled off site for treatment via DENR-accredited hauler and treater. (OGPI Interim AEPEP for 2018)

The flow coming from the sewerage tank is discharged into pre-aeration tank and divided into four streams. Each module has its own transfer pump in the pre-aeration tank, plus one spare pump, which can be utilized for any of the modules by valve settings. The extended aeration process makes use of biological processes to remove organic matter from sewage, thereby purifying it before it is returned to the river system. The STP MSA is equipped with a facility called Didipio Water Recycling and Purification Plant (DWRAPP) which main purpose is to provide further treatment of STP MSA's effluent to a potable water quality via hyperoxidation method by ozonation, light polarization and further water disinfection using Ultraviolet light although the facility is not operating to date due to some improvement being done to enhance the system. (OGPI Water Management Plan, 2018)

One of the conditions in the discharge permits issued for the sewage treatment plants of OGPI is the monitoring of the following effluent parameters: BOD, Fecal Coliform, ammonia, nitrate, phosphate, surfactants and oil and grease. In addition to these parameters, OGPI also analyzes other effluent quality parameters significant to gold and copper ore mining projects for self-monitoring purposes. These significant parameters include TSS, arsenic, lead, cadmium, mercury, pH, zinc, free cyanide, sulfate, iron, and dissolved copper. Other parameters monitored by OGPI for the WTP/TSF discharge include COD, hexavalent chromium, boron, chloride, phenol and phenolic substances, and phosphate.

Photo 2-6: STP Plant Site Discharge

Photo 2-7: STP MSA Sampling Station

2.2.2.1.2.3 Wash Bay Facilities

Light Vehicle Carwash Bay facility, near the Site Services work area, was constructed to cater all light vehicles being used in the mine. The facility is equipped with silt trap and oil and water separator to trap oil particles from the wastewater. The wastewater from the wash bay flows through a two-chambered silt pan or sediment chambers and three chambers of oil and water separator and is discharged to the nearby gully before joining the Camgat-Surong Creek. (OGPI Water Management Plan, 2018)

Heavy Vehicle and Light Vehicle Wash Bay was constructed to cater both heavy and light vehicles of the mine site and is located near the MSA workshop. This wash bay is equipped with a silt trap chamber and three oil and water separator chambers that trap silt and oil from the wastewater of the wash bay. The water from the oil and water separator is being pumped to Silt Pond 09 (SP09) for further desilting treatment. SP09 sediment ponds were initially constructed to manage water from UG, LV/HV wash bay and surface runoff from Skyway 1. However, on December 2016 UG water discharge was diverted and only water from the LV/HV wash bay and surface runoff is now directed to these ponds. The water goes through a series of over topping walls and is treated with Magnasol, before release into the Dinauyan River. (OGPI Water Management Plan, 2018)

The underground (UG) wash bay facility was constructed to cater both heavy (UG) and light vehicles of the mine site and is located near the UG workshop. This wash bay is equipped with a silt trap chamber and three oil and water separator chambers that trap silt and oil from the wastewater of the wash bay. The water from the oil and water separator is being discharged into the Dinauyan River. (OGPI Water Management Plan, 2018)

Parameters required to be monitored as specified in one of the conditions of the discharge permits for the Wash Bay facilities are BOD, TSS, oil and grease, and surfactants. In addition to these parameters, OGPI also monitors pH, cadmium, lead, mercury, ammonia, benzo(a)pyrene, color, nickel, and nitrate in the discharge of its three wash bay facilities. The selection of these parameters were based on the DAO 2016-08 list of significant effluent quality parameters for oil and water separators and maintenance and repair of vehicles facilities.

2.2.2.1.2.4 Fuel Farm Oil and Water Separator and Volatilization Pad Oil and Water Separator

OGPI Didipio Mine, depends heavily on the use of diesel fuel to run its mobile equipment, vehicles and generators around the mine site. The Fuel Farm was constructed to store hydrocarbons and has a storage capacity of 1,224,000 L of diesel. The facility is equipped with an oil and water separator with a capacity of 3 m^3 to prevent hydrocarbons from discharging to the river. (OGPI Water Management Plan, 2018)

Wastewater being generated at the oil and water separator at the fuel farm comes from the housekeeping being conducted daily (wash downs). Spent diesel spill coming from refueling is flushed straight onto the gutter wherein the gutter leads to the oil and water separator and the overflow is directed to the nearby gully leading to the Didipio River. (OGPI Water Management Plan, 2018)

OGPI Didipio Mine, constructed a Volatilization pad which caters for hydrocarbon soil contaminated materials generated on site. This facility uses volatilization and biodegradation by bacterial action and a subsequent oil and water separation unit for further remediation of remnant oil. The facility is located at Boya dump area inside the mine premises. This oil and water separator has 3 chambers with a total capacity of 13 m^3.

Parameters required to be monitored as per discharge permit for the Fuel Farm OWS are pH, TSS and oil and grease which are also the significant effluent quality parameters for oil and water separators based on DAO 2016-08. In OGPI's Water Management Plan, parameters being analyzed for the Fuel Farm OWS are TSS, BOD and oil and grease. As for the Volatilization Pad, the parameters required to be monitored are pH, TSS, oil and grease, lead and surfactants. Similar to Fuel Farm OWS, the parameters analyzed by OGPI are TSS, oil and grease and BOD.

2.2.2.1.2.5 Sediment Ponds

Didipio mine has implemented wide variety of sediment ponds to treat surface run-off from haul roads and slopes. Surface water drains along roads are designed to intercept water and direct towards the nearest sediment ponds before discharge into the environment. Several sediment ponds serve as both runoff and mine dewatering discharge points. OGPI has two (2) discharge locations for treated mine water, namely Silt Pond 06 (SP06) (Photo 2-8) and Silt Pond 09 (SP09) (Photo 2-9). It should be noted that SP09 also receives water from the oil and water separator coming from the HV/LV Wash Bay for further desilting treatment. All clean water seeps around Didipio mine area have been diverted directly into the river system. (OGPI Water Management Plan, 2018)

A total of thirteen (13) sediment ponds were commissioned in Didipio mine (Figure 2-37). These sediment ponds are not only used to desilt mine water but also to accommodate surface run-off from the active work areas. Majority of these sediment ponds are sealed using a combination of clay/geofabric and rock armored using locally sourced material. During the wet season, ongoing maintenance of sediment ponds is required due to large volume of sediment rich water passing through the ponds. The maintenance frequency during the dry season is reduced. (OGPI Water Management Plan, 2018)

One of the conditions in the discharge permit for Silt Pond 06 (SP06) is the quarterly monitoring of effluent parameters pH, TSS and oil and grease. Parameters monitored and reported by OGPI in their SMR are TSS, BOD, cadmium, arsenic, lead, mercury, iron, zinc, dissolved copper, nitrate, sulfate and free cyanide.

Photo 2-8: SP 06

Photo 2-9: UG Sediment Pond (SP09)

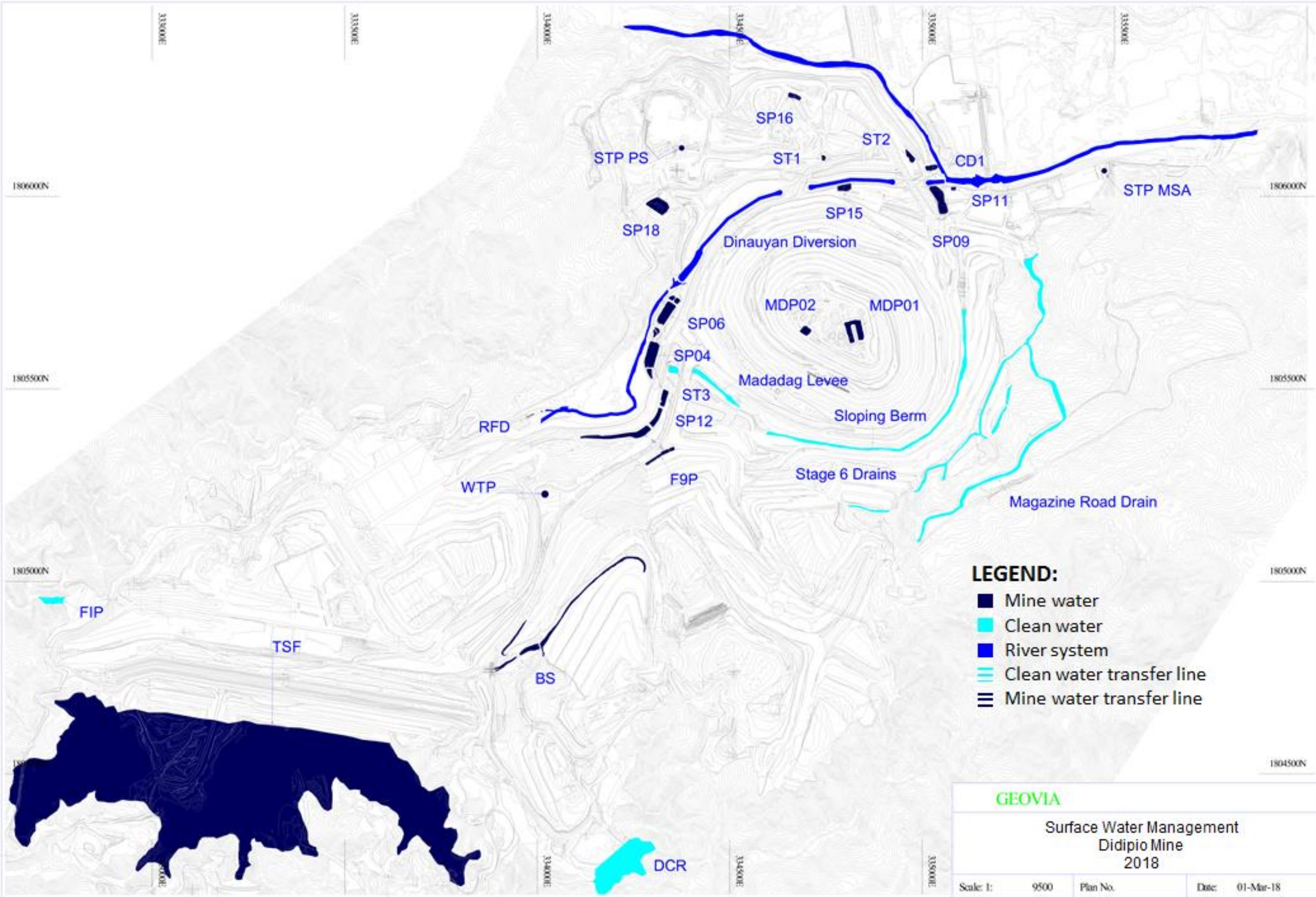


Figure 2-37: Collection and Sediment Ponds at the Site
Source: Water Management Plan for Didipio Operations, 2018

2.2.2.2 Surface Water Quality Monitoring

Surface water quality monitoring stations established by OGPI are summarized in Table 2-17 while Table 2-18 presents the water quality monitoring parameters and schedule for surface water. Locations of surface water quality monitoring stations are shown in Figure 2-38 while Figure 2-39 presents the locations of pollution point sources relative to the surface water stations.

Didipio Mine monitors a total of fifteen (15) surface water quality stations which are all being reported in their quarterly Self-Monitoring Report (SMR) and semi-annual Compliance Monitoring Report (CMR) submitted to the DENR. Station SWS 01 located at Luminag Creek serves as a reference site or control station as it is located upstream of the mine operations, specifically the Tailings Storage Facility (TSF), and is not impacted by any small-scale mining activities observed to be rampant in the surrounding areas of the Didipio Mine. From Luminag Creek, water passes within the project area through a pipe and reappears downstream of the TSF along Dinauyan River. Two stations were established along Dinauyan River where a small-scale mine operation labeled as “Dumulag Property” is located. The stations SWS DP-Up and SWS DP-Down were established upstream and downstream of the said small scale mining operations to monitor its potential impacts on water quality. From station SWS DP-Down, Dinauyan River traverses the northern border of the mine pit before connecting to the Didipio River. Station SWS 12 was established downstream of the Dinauyan River before it joins the Didipio River. Station SWS 12 represents water coming from Dinauyan River combined with two smaller creeks, Madadag and Bacbacan Creeks. Several sediment control structures are in place near Dinauyan River namely RFD, SP04, SP05, SP06, SP07, SP10 and SP12.

OGPI also monitors two creeks located at the northwestern side of the project area. These are SWS 15 along Camgat Creek and SWS 16 along Surong Creek. Both Creeks are upstream of the project area and are part of Didipio River headwaters. The creeks were observed to be impacted by small-scale mining operations outside the project area. Downstream of the confluence of Camgat and Surong Creeks is Station SWS 13. Camgat-Surong Creek and Dinauyan River meets downstream of SWS 12 and SWS 13 to form the Didipio River where station SWS 14 was established. Three silt ponds are placed surrounding the Didipio River mixing zone namely CD1, SP11 and SP09. Farther downstream of Didipio River is station SWS 17 located at Purok Dupit near OGPI main gate. The station was established as part of monitoring on downstream communities.

The abovementioned surface water quality monitoring stations (nine (9) stations) are being monitored daily, every other day, weekly or quarterly depending on the water quality parameters and their location (see Table 2-18). Results of water quality monitoring from these stations represent the direct impact of the project on surface water as well as the combined impact of the small-scale mining operations surrounding the Didipio Mine.

The remaining six (6) surface water quality monitoring stations, located farther downstream of the project area, are being monitored on a quarterly basis. Stations SWS 18, SWS 19 and SWS 20, representing Didipio River downstream, Alimit Creek and Didipio-Alimit confluence, respectively, are situated about 2.4 km downstream of the project site. Stations SWS 21 (Didipio-Alimit downstream), SWS 22 (Diduyon River) and SWS 23 (Alimit-Diduyon Confluence) are about 4.6 km downstream of Didipio Mine.

Table 2-17: Surface Water Quality Monitoring Stations of OGPI

Station ID	Geographic Coordinates	Elevation (m)	Location	Purpose	Point Source/s (OGPI Effluent discharge received by the water body)
Stations upstream of the Project Site					
SWS 1	16.319135N/ 121.435646E	774	Luminag 1 (Control Point)	Luminag Creek, reference site and tributary of Dinauyan River which is upstream of TSF	None
SWS 15	16.335089N/ 121.445852E	753	Camgat Creek	Drains to the northwest section of the project and part of Didipio River headwaters. Also impacted by small-scale mining operation	None *(Impacted by small-scale mining operation)*
SWS 16	16.336579N/ 121.445719E	752	Surong Creek	Drains to the northwest section of the project and part of Didipio River headwaters. Also impacted by SSM Operation	None *(Impacted by small-scale mining operation)*
Stations within the Project Site					
SWS 12	16.329775N/ 121.455778E	686	Dinauyan River Downstream	Combined with Madadag and Bacbacan creeks	SP06 Discharge WTP/TSF Discharge STP Plant Volatilization Pad UG Wash Bay HV Wash Bay (SP09) Stations upstream: SWS1, DP-Up, DP-Down *(Also impacted by small-scale mining operation – Dumulag Property)*
SWS 13	16.330318N/ 121.455811E	683	Camgat-Surong Downstream	Downstream of Camgat-Surong confluence	Carwash Bay (Mobile) Stations upstream: SWS 15, SWS 16
SWS 14	16.329868N/ 121.456095E	701	Didipio River	Didipio River mixing zone	Mixing zone/confluence of Camgat-Surong Creek and Dinauyan River Stations upstream:

Station ID	Geographic Coordinates	Elevation (m)	Location	Purpose	Point Source/s (OGPI Effluent discharge received by the water body)
					SWS 01, DP-Up, DP-Down, SWS 12 SWS 15, SWS 16, SWS 13
SWS DP-Up	16.323997N/ 121.445481E	732	Dumulag Property Upstream	Upstream of small scale mining operations	None
SWS DP-Down	16.325819N/ 121.448612E	698	Dumulag Property Downstream	Downstream of small scale mining operations	None *(Impacted by small-scale mining operation – Dumulag Property)*
SWS 17	16.331085N/ 121.464331E	700	Didipio River - Dupit	Didipio River at Purok Dupit and part of monitoring on downstream communities	Fuel Farm OWS STP MSA Downstream of SWS 14 and a creek coming from the settlement area (community)
Stations downstream of the Project Site					
SWS 18	16.311973N/ 121.470816E	679	Didipio River Downstream	Further downstream of Didipio river and is part of monitoring on downstream communities	Downstream of SWS 17
SWS 19	16.311366N/ 121.470615E	679	Alimit Creek	Represents the northeast portion of the Didipio river and is drained by Alimit Creek	None
SWS 20	16.311445N/ 121.471512E	679	Didipio - Alimit Confluence	Confluence of Didipio River and Alimit Creek	Stations upstream: SWS 18, SWS 19
SWS 21	16.298239N/ 121.490040E	381	Didipio - Alimit Downstream	Monitoring of combined Alimit Creek and Didipio River	Downstream of SWS 20
SWS 22	16.297896N/ 121.490090E	359	Diduyon River	Monitoring of Diduyon River before joining Alimit Creek	None
SWS 23	16.298735N/ 121.491253E	357	Alimit - Diduyon Confluence	Downstream of Alimit-Diduyon confluence. This station represents Diduyon River with combined flows from six catchments of Dinauyan, Didipio, Camgat, Surong, Alimit, and Angcabo. Observation and monitoring of this river presents an opportunity to evaluate the overall watershed condition of the combined watersheds of the Project area.	Stations upstream: SWS 21, SWS 22

Photo 2-10: SWS 1 - Luminag Creek

Photo 2-11: SWS DP-Up

Photo 2-12: SWS DP-Down

Photo 2-13: SWS 12 - Dinauyan Downstream

Photo 2-14: Camgat-Surong Creek (Midstream)

Photo 2-15: SWS 13 - Camgat-Surong Downstream

Photo 2-16: SWS 17 - Didipio-Dupit

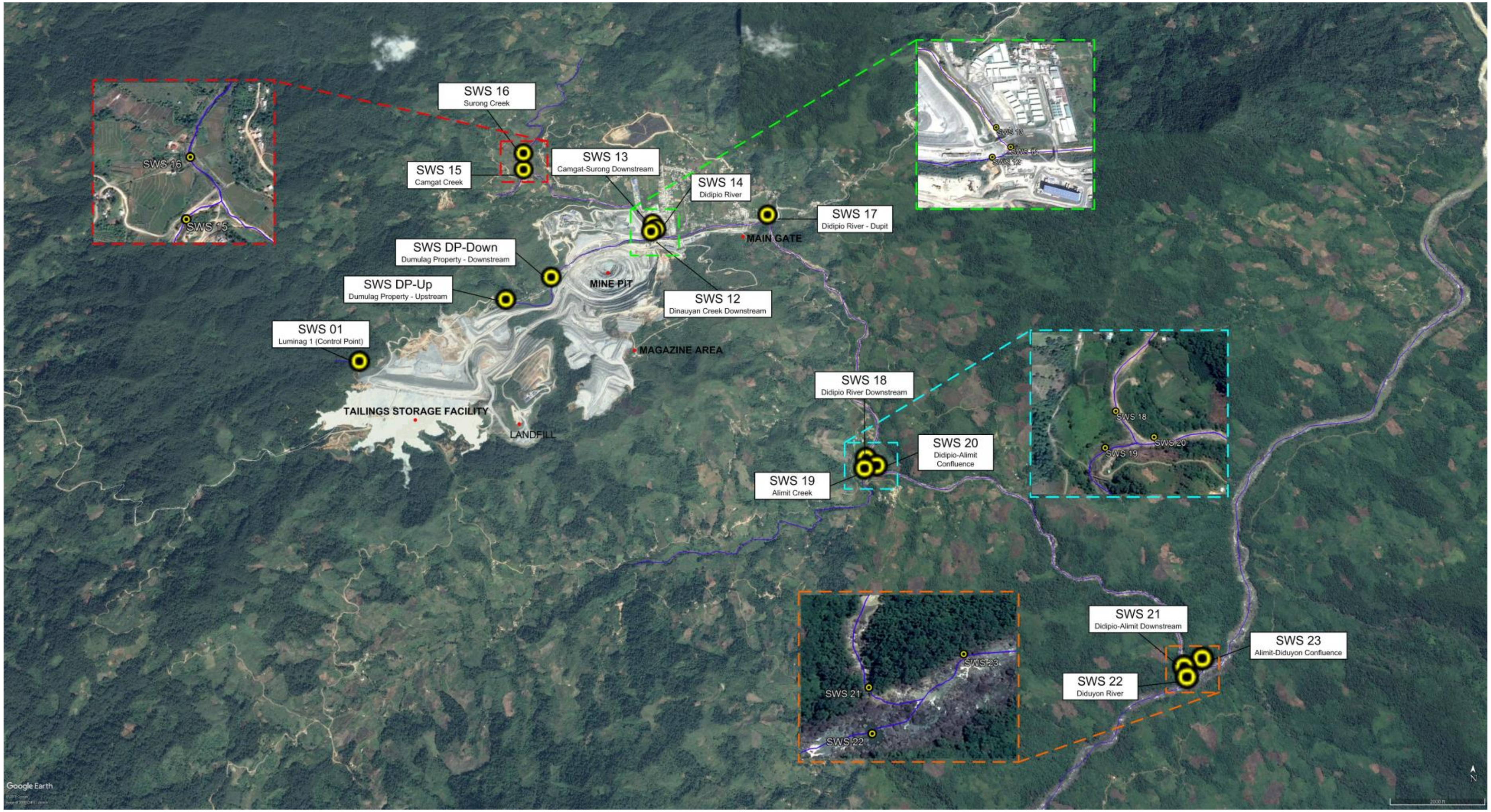


Figure 2-38: Surface Water Stations (SWS) Map of OGPI

Figure 2-39: Map showing the locations of OGPI point sources relative to the surface water stations

Table 2-18: Summary of Water Quality Monitoring Schedule

<table>
<tr><th rowspan="2">Station ID</th><th rowspan="2">Location</th><th colspan="5">Parameters / Monitoring Frequency</th></tr>
<tr><th>Daily</th><th>Every other day</th><th>Weekly</th><th>Monthly</th><th>Quarterly</th></tr>
<tr><td>SWS 1</td><td>Luminag 1 (Control Point)</td><td rowspan="7">pH, TSS, EC, DO, Turbidity</td><td rowspan="7">Dissolved Cu</td><td rowspan="7">O&G</td><td rowspan="9">Zn, As, Fe, Hg, Cr^{+6}, Pb, Cd, NO_3, NH_3, TOC</td><td rowspan="9">Free CN, Total Kjeldahl Nitrogen

Sediments: Cu, Zn, As, Fe, Hg, Cr^{+6}, Pb, Cd</td></tr>
<tr><td>SWS 12</td><td>Dinauyan River Downstream</td></tr>
<tr><td>SWS 13</td><td>Camgat-Surong Downstream</td></tr>
<tr><td>SWS 14</td><td>Didipio River</td></tr>
<tr><td>SWS DP-Up</td><td>Dumulag Property Upstream</td></tr>
<tr><td>SWS DP-Down</td><td>Dumulag Property Downstream</td></tr>
<tr><td>SWS 17</td><td>Didipio River - Dupit</td></tr>
<tr><td>SWS 15</td><td>Camgat Creek</td><td rowspan="2" colspan="2"></td><td rowspan="2">pH, TSS, EC, DO, Turbidity, Dissolved Cu and O&G</td></tr>
<tr><td>SWS 16</td><td>Surong Creek</td></tr>
<tr><td>SWS 18</td><td>Didipio River Downstream</td><td rowspan="6" colspan="4"></td><td rowspan="6">pH, TSS, EC, DO, Turbidity, Zn, As, Fe, Hg, Cr^{+6}, Pb, Cd, Free CN, Total Kjeldahl Nitrogen
NO_3, NH_3, TOC

Sediments: Cu, Zn, As, Fe, Hg, Cr^{+6}, Pb, Cd</td></tr>
<tr><td>SWS 19</td><td>Alimit Creek</td></tr>
<tr><td>SWS 20</td><td>Didipio - Alimit Confluence</td></tr>
<tr><td>SWS 21</td><td>Didipio - Alimit Downstream</td></tr>
<tr><td>SWS 22</td><td>Diduyon River</td></tr>
<tr><td>SWS 23</td><td>Alimit - Diduyon Confluence</td></tr>
</table>

2.2.2.3 GROUNDWATER QUALITY MONITORING

OGPI monitors groundwater quality for mine site use. Ideally, groundwater originating from shallow aquifers is sampled to monitor environmental impacts of activities conducted at the ground surface. Groundwater borehole logs however, indicate that groundwater wells are deep, *i.e.*, bore depths >800 m, and implies that groundwater quality may not be representative of impacts of activities at the surface. Nonetheless, because these groundwater wells are used for industrial and domestic purposes (except for drinking), water from drill water bores are being monitored by OGPI (Table 2-19). Locations of groundwater monitoring stations are shown in Figure 2-40.

Table 2-19: Groundwater Quality Monitoring Stations of OGPI

Station ID	Geographic Coordinates	Location/Description	Monitoring Period
DWB01	121.449519E, 16.325822N	Drill Water Bore 1	1Q2013 – 3Q2016
DWB02	121.456416E, 16.329340N	Drill Water Bore 2	1Q2013 – 1Q2018
DWB03	121.454165E, 16.328384N	Drill Water Bore 3	1Q2018
RSCPT	121.454812E, 16.328531N	Camp Water	2Q2013 – 3Q2017 *(Decommissioned last Sept. 2017)*
CWS	121.456375E, 16.336314N	Community Water System (Didipio)	

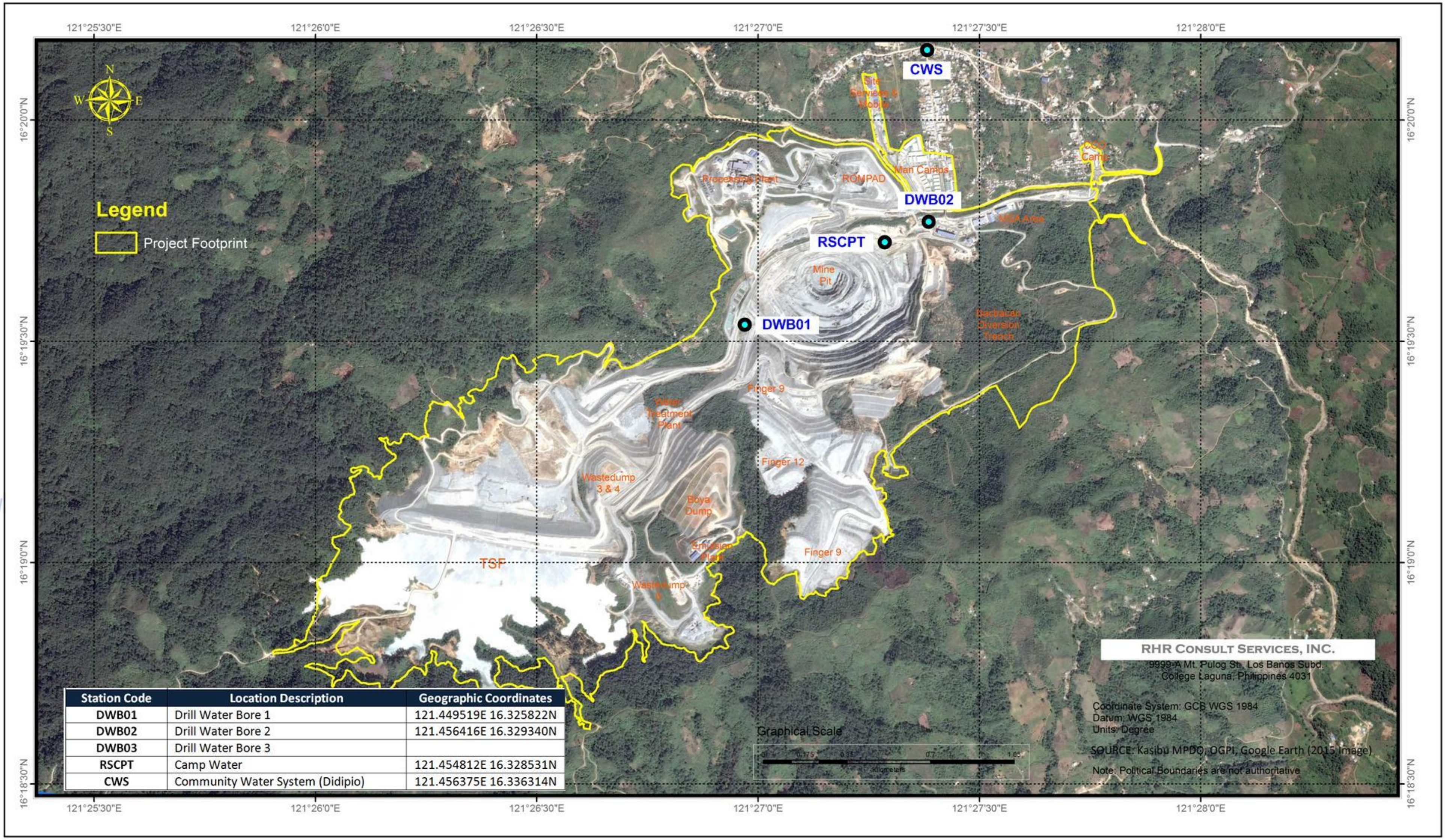
Photo 2-17: DWB01

Photo 2-18: DWB02

Photo 2-19: DWB03

Photo 2-20: RSCPT

Photo 2-21: CWS



Station Code	Location Description	Geographic Coordinates
DWB01	Drill Water Bore 1	121.449519E 16.325822N
DWB02	Drill Water Bore 2	121.456416E 16.329340N
DWB03	Drill Water Bore 3	
RSCPT	Camp Water	121.454812E 16.328531N
CWS	Community Water System (Didipio)	121.456375E 16.336314N

Figure 2-40: Groundwater Quality Monitoring Map

2.2.2.4 Acid Rock Drainage

Acid Rock Drainage (ARD) is produced from the reaction of sulphide minerals, such as pyrite, to atmospheric water and oxygen. Generation of ARD may, in turn, facilitate leaching of metals and other elements that are typically considered toxicants to the environment. It is therefore important to assess the ARD generation capacities of the ore and its waste rock and tails early in a project to determine applicable mitigating measures to address potential ARD generation. (OGPI Interim AEPEP for 2018)

Prior to project operation OceanaGold (Philippines), Inc. commissioned Environmental Geochemistry Pty. Ltd (EGi) to conduct a geochemical characterization of ore and low grade ore samples to determine its acid generation potential and acid neutralization capacity. (OGPI Interim AEPEP for 2018)

It was determined that based on the samples studied, the project has a high factor of safety in terms of preventing Acid Rock Drainage (ARD) formation and that the neutralizing capacity of the samples outweigh or exceed the capability to generate acid. (OGPI Interim AEPEP for 2018)

In summary, assuming the samples tested were representative of the ore and low-grade ore, the results of the tests show that the acid rock drainage potential of the stockpiled ore will be low. In addition, the tails that will be generated from the processing of the ore are also expected to be low. Though most samples are significantly enriched in Ag, Cu, S and Se, the leaching capabilities of these elements will be low due to the non-acid forming characteristics of the ore. (OGPI Interim AEPEP for 2018)

2.2.2.5 Impact Assessment and Mitigation Measures – Water Quality

The impact assessment and mitigation measures by OGPI consistent with their 2018 Interim Annual EPEP submitted to MGB DENR. The mitigation measures presented are currently being implemented by the Company.

2.2.2.5.1 Impacts: Degradation of Surface and Groundwater Quality

2.2.2.5.1.1 Ore Stockpiles and Waste Rock Stacks

Due to erosion of stockpiles, sediments may be transmitted downslope and downstream increasing the turbidity, total suspended solids, and heavy metal concentrations of streams proximal to the stockpile or waste dump areas.

2.2.2.5.1.2 Process Water

Accidental spills, breach in containment or leaks in the process circuit of the process plant may cause potential contamination of surface water with process chemicals or mine contact/ process water. Spilled materials may find its way to groundwater through soil infiltration if not quickly cleaned-up or contained.

2.2.2.5.1.3 Tailings Pond

Contamination with tails of proximal streams and tributaries may result because of tailings pump failure, breach of the tails pipeline, failure of the TSF decant system, or failure of the decant water. Failure from this scenario may also mean failure to meet DAO 2016-08 Class D standards for the Dinauyan River.

2.2.2.5.1.4 Waste Rock Dump

Proximal surface and ground water sources to the WRD may potentially be contaminated with heavy metals from sulphides bearing rocks stored at the WRD if seepage water from the WRD is not properly contained or isolated. Likewise, if the waste rocks are not properly encapsulated with inert materials, surface run-off from the WRD may result to surface water contamination as well as ground water contamination if contact water infiltrates the soil.

2.2.2.5.1.5 Infrastructure and other Support Facilities

Clearing of vegetation and soil stripping during ground preparation and construction as well as the development of hard ground and cemented areas may lead to increased run-off and consequently increased erosion. These, in turn, may lead to increased sedimentation and turbidity of adjacent surface water bodies to the developed areas.

2.2.2.5.1.6 Sewerage

Improper disposal of sewage may lead to surface and groundwater contamination.

2.2.2.5.1.7 Solid Waste Disposal

Improper disposal of solid wastes may lead to surface water contamination.

2.2.2.5.2 Water Impact Control Strategies

The overall approach to water management at the Didipio operation is to minimise discharge from the operating site and direct all dirty surface water flows including any waste rock seepage to a series of settlement ponds to remove TSS before discharge to the Dinauyan River. Water is monitored prior to release to ensure compliance with the DENR's water standards for Class D waterways.

2.2.2.5.2.1 Acid Mine Drainage

High Sulphur rocks coming out of the pit are being monitored. Procedure in ensuring that these are blended with high neutralizing rock if present. To date, this has not occurred and expected not to occur as supported by the 1994 report by Mountford and Wall. If acid mine drainage (acidic water) will be present, it will be mitigated via treatment with neutralizing reagents such as lime, diluted with alkaline water, or collected and pumped to the water treatment plant for treatment. Water quality monitoring are also conducted to monitor potential presence of ARD.

2.2.2.5.2.2 Mine Dewatering

There are three main sources of water associated with mine dewatering these are:

- Ground water dewatering bores;
- Pit dewater associated with pit wall seepage and rainfall into the pit; and
- Dewatering the underground mine seepage.

Each of these sources will have different environmental impacts and therefore different controls.

Ground water dewatering bores is expected to be suitable quality for discharge without treatment, and is the main source of water for process makeup, site fire water storage tank, and dust suppression.

Pit water, on the other hand, is expected to contain sediment, possibly hydrocarbons and soluble copper and potential conceivably acid from sulfide rock. Pit water are pumped out of the pit flowing into a series of sediment ponds. With the use of coagulating agents, sediment will precipitate faster and any hydrocarbon is skimmed off the water. The water from the pit is used first as make up water for the process plant, water more than this requirement is used for dust suppression during dry periods, other excess water is analyzed for pH, total suspended solids (TSS) and dissolved copper content to determine suitability for discharge. If the water is suitable for discharge the water is discharged to the Dinauyan River via series of sediment ponds.

Dewatering the underground mine seepage is being conducted as the development progresses.

2.2.2.5.2.3 Tailings Impoundment

Current chemical analyses of the tailings indicate that there are very low concentrations of soluble metals in the tails. The water discharged to the TSF will have an elevated pH. It is necessary to discharge water from the TSF, primarily due to inflows associated with rainfall within the catchment of the TSF. This water is discharged to the Dinauyan River through a decant pumping system and water treatment plant (WTP).

Most the water used on site is recycled from the TSF via floating pontoon mounted pumps to the plant for reuse in the process cycle. A project design water balance was completed in the development stage by Knight Piésold and this was updated by MWES Consulting, covering the range of possible rainfall events. This determined that a net discharge would be necessary in most years and this is managed via the decant system discharging to the processing plant and the water treatment plant.

A water discharge permit is currently held to allow the release of up to 67,462.8 m_3 per day of clean water from the decant pond on the surface of the TSF. A water treatment plant with capacity to process > 2,000 m^3 per hour ensures OGPI meets the required discharge standards for the TSF.

In the event of a storm more than the combined capacity of the decant system, the water treatment plant and available storage capacity in the TSF, clean decant water from the TSF can be discharged via a spillway to the Dinauyan River. Permit would cover any such discharge. In practice, OGPI maintains a 5-m freeboard at all times.

The TSF embankment is constructed from rockfill and earthfill that is adequately grouted and lined to allow for minimal movement during seismic events. The TSF base and its embankment is lined with clay sourced from the open pit to inhibit water transmission.

Filter drains are constructed in the embankment and its toe to prevent water transmission. Materials to be used for this are geo-membranes and graded rock to allow minimal water seepage and protection against erosion or scouring. Waste rocks are deposited abutting against the toe of the TSF embankment to strengthen and support it. The TSF embankment is regularly monitored for cracks, movement, or leaks. Problems observed in integrity will be quickly resolved by a delegated geotechnical or engineering group.

A vegetated buffer zone is also established or maintained around the TSF to contain run-off from the surrounding catchment. The buffer zone is planted with locally grown trees and serves as a component of the progressive rehabilitation program. Vegetated buffers are areas of natural or established vegetation maintained to protect the water quality of neighboring areas. Buffer zones slow storm water runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment. Slowing runoff also helps to prevent soil erosion and streambank collapse.

2.2.2.5.2.4 Tailings Dam Seepage Collectors and Polishing Pond

The TSF development is built as per approved design, were clay and rock fill are used preventing any seepage and water pressure from the TSF. Piezometers were also installed at the TSF wall to monitor any seepage and water pressure.

2.2.2.5.2.5 Sediment controls

The following are some of the sediment control techniques being implemented on site to control sediments.

2.2.2.5.2.5.1 Sediment ponds and seepage Collection Dams

Settling ponds are established and maintained to contain settled out solids before the confluence with the Surong River. The discharge criteria must meet the DENR Class D standards. Runoff drainage are also established in appropriate areas.

The flow through drain is constructed and stabilized per the appropriate engineering rating. It is designed such that it can allow 100% passage of the Dinauyan River to the downstream channel to prevent scouring of the WRS. The flow through drain is constructed to encourage the segregation of the waste rock so the large boulders fall first to the base of the drain forming a thick permeable zone for flow to pass through before the general waste rock is stacked above the drain.

2.2.2.5.2.5.2 Rock check dams

Primary function of check dams is to control flow velocities within unlined drains. Check dams also trap small quantities of sediment, thus allowing these structures to as both as drainage and sediment control devices.

2.2.2.5.2.5.3 Rock filter dam

This control is primarily used within constructed drainage channels. The dam provides both filtration and velocity reduction.

2.2.2.5.2.5.4 Sediment fence

Sediment fence are primarily used to collect coarse sediment. Treatment is primarily achieved through gravity-induced settlement resulting from the temporarily ponding of sediment-laden water up-slope of the fence. Filtration is only a secondary function of the fence.

2.2.2.5.2.6 Sewage Treatment

All sewage produced on site is currently treated in the activated sludge sewage treatment plant. This plant is a modular design with four separate modules each capable of treating the waste from camp accommodation. Sewage is generally piped to the sewage treatment plant. Sewage from isolated locations like guard posts are stored in holding tanks and transported to the sewage treatment plant by tanker on a regular basis. All sewage generated on the mine site is treated in the sewage treatment plant. Sewage from isolated holding tanks are transported to the Sewage Treatment Plant on an as need basis or when the sewage holding tanks reach its full capacity. Existing septic tanks will be either be decommissioned or used as pump out storage tanks when at isolated locations.

Sludge from the sewage treatment plant is hauled out and treated by a sewage sludge third party contractor. Sludge is disposed in a sludge treatment facility in Sual, Pangasinan where sludge are treated by anaerobic fermentation.

Potential other means for sludge management will be either via landfilling or dewatered sludge use as a soil conditioner. A lime may need to be added if the sludge is to be used as a soil conditioner to suppress odor and biological activity. Management of sewage sludge will be strictly in accordance with RA 9275 Philippine Clean Water Act of 2004 IRR DENR No. 2005-10 Sec.3 Rule 3 item 3.1.

Screenings from the sewage treatment plant are unsuitable for any use and disposed of to an on-site landfill.

For 2017, it is planned to tap the STP water and soon the WTP water to be a domestic water source inside the camp. Another treatment line is installed at the STP as a pilot study facility to further treat its effluents.

2.2.2.5.2.7 Waste Rock Storage Management

Waste rocks are stacked per engineering guidelines for minimal water transmission. Also, waste rocks are isolated from non-reactive rocks and soil. A detailed net acid production potential (NAPP) and acid-base account (ABA) for the waste rocks at different alteration types and depths of extraction to determine the possibility of acid generation is continuously being monitored in the water quality monitoring program.

2.2.3 Freshwater Ecology

2.2.3.1 Methodology

This freshwater ecology assessment made use of all available and relevant secondary information from OceanaGold (Philippines), Inc. listed below:

- 1997 Environmental Impact Statement
- 2004 Amendment Environmental Impact Statement
- 2012 Baseline Environmental Update Report
- 2013 Ecological Assessment for Didipio Gold-Copper Project
- 2014 Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold-Copper Project, Nueva Vizcaya, Philippines
- 2015 Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold-Copper Project, Nueva Vizcaya, Philippines
- 2016 Ecological Assessment and Monitoring of Biodiversity in Terrestrial and Aquatic Ecosystems in Didipio Gold-Copper Project, Nueva Vizcaya, Philippines

2.2.3.2 Results

2.2.3.2.1 Benthic and Planktonic Algae, and Bryophytes

Based on the studies conducted from 1997 to 2015, a total of 38 algae and bryophyte taxa has already been recorded along the rivers and creeks within and surrounding the mine site. Recorded taxa richness from 1997 to 2015 ranged from 10 to 17 with the least taxa recorded in 2013 and 2014 and highest during the 1997 study (Figure 2-41). The decline from 1997 EIS to 2013 and 2014 ecological assessments could be contributed to the construction activities, which could have heavily affected the bodies of water particularly in Dinauyan River. These activities included diversion of the Dinayuan River, construction of upstream facilities such as the TSF, waste rock dump, access/diversion roads and surface runoff from bare areas especially during high rainfall events. On the other hand, an increase in taxa richness was recorded in 2015, which may somehow indicate minimized impacts upon completion of construction phase and effectiveness of mitigation measures in place such as slope protection, erosion control measures (e.g. re-vegetation of slopes, open and bare areas, flow through design of the waste rock dump), and proper waste management (e.g. implementation of a water treatment plant and sanitary landfill)

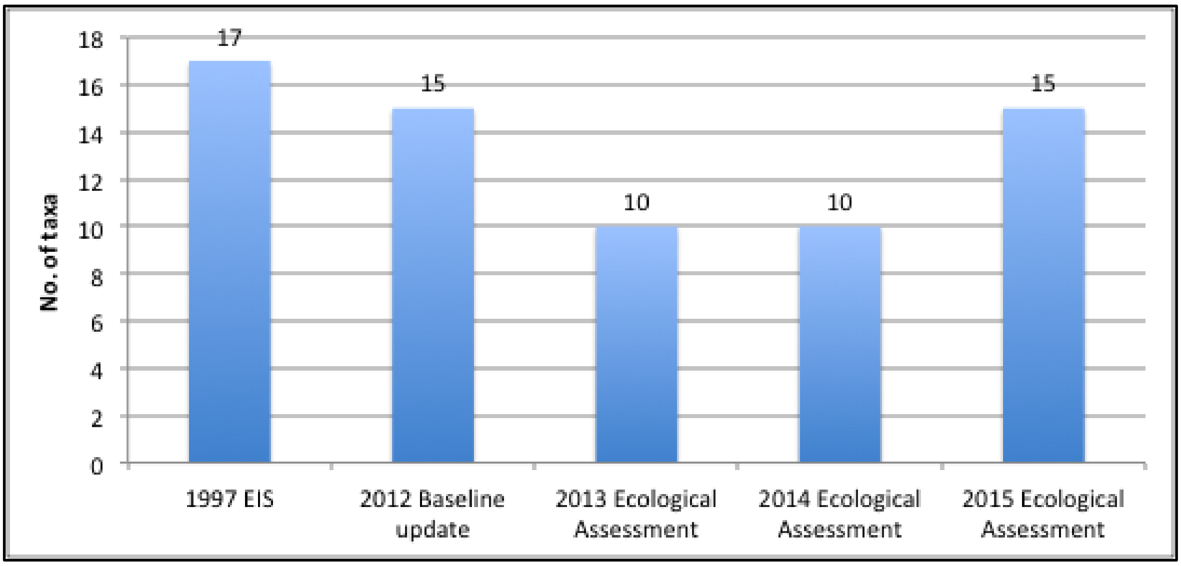


Figure 2-41: Taxa richness of periphyton recorded in the studies conducted from 1997 to 2015

In terms of relative mean density, there were five major groups of benthic (periphyton) and planktonic algae and bryophytes (moss) recorded in the studies conducted from 1997 to 2015. These are the Bacillariophyta (diatoms), Chlorophyta (green algae), Cyanophyta (blue green algae), Rhodophyta (red algae) and Bryophyta (moss). Bacillariophyta, Chlorophyta and Cyanophyta were the groups that were recorded across all the studies conducted from 1997 to 2015. Rhodophyta and Bryophyta were only recorded in 2012 and 2014, respectively. A decline in relative mean densities of Bacillariophyta and Cyanophyta recorded from the 1997 study to the 2012 study was recorded which could be attributed to mine construction activities from 1997 to 2012. Nevertheless, an increasing trend in the relative mean densities of Bacillariophyta and Cyanophyta was recorded from 2012 to the 2015 studies indicating recovery of this group from the impacts of the project. On the other hand, the relative mean density of Chlorophyta increased from 5% in the 1997 study to 79% in the 2012 study while a decreasing trend in relative mean density was recorded from the 2012 study to the 2015 study. Comparison of the 2015 study to the 1997 study shows almost similar algal composition prior to the project implementation. This indicates the possibility of the algal communities to be restored to their composition and structure prior to the project. Further, this could only indicate effective mitigation measures being implemented by OGPI.

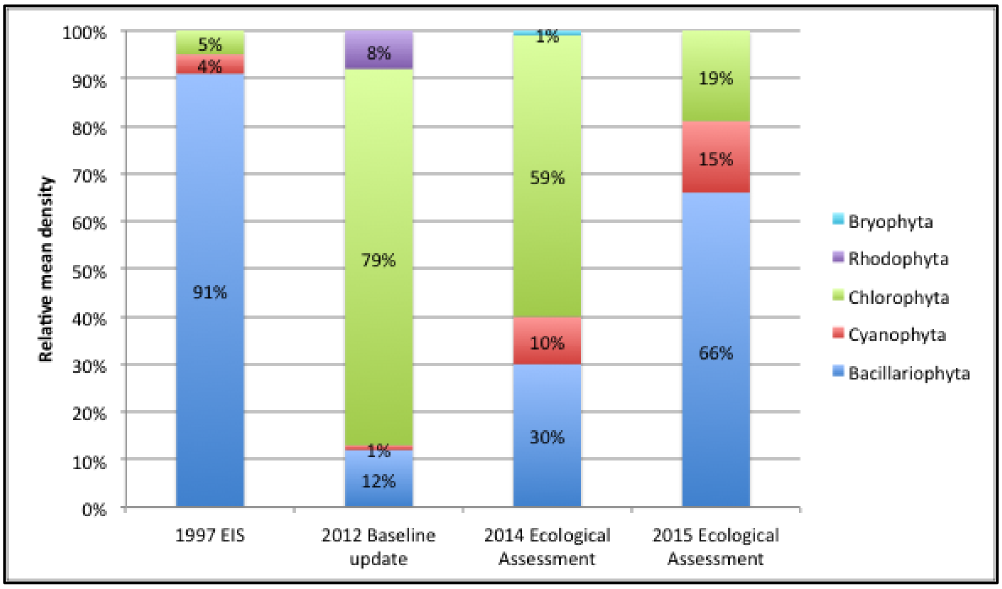


Figure 2-42: Relative mean density of benthic and planktonic algae and bryophyta recorded in the studies conducted from 1997 to 2015

2.2.3.2.2 Zooplankton

Assessment of zooplankters was only conducted in the 2012 study by GHD. Based on the results of the study, there were only three groups represented by eight taxa, which composed the zooplankton community along the bodies of water present within and adjacent the mine site. Majority of the zooplankton community is composed of Rotifera (wheel animals) with 65% relative mean abundance followed by Protozoa (single-celled eukaryotes) with 20% relative mean abundance and the least is Arthropoda (invertebrates with jointed appendages) with 15% relative mean abundance. Recorded abundance of each of the groups in each station sampled ranged from 1 to 4 individuals/L indicating low abundance of zooplankters in the area, which is expected due to the fast water flow in the rivers and creeks sampled. Zooplankters are best suited in freshwater ecosystems with low to no flow conditions.

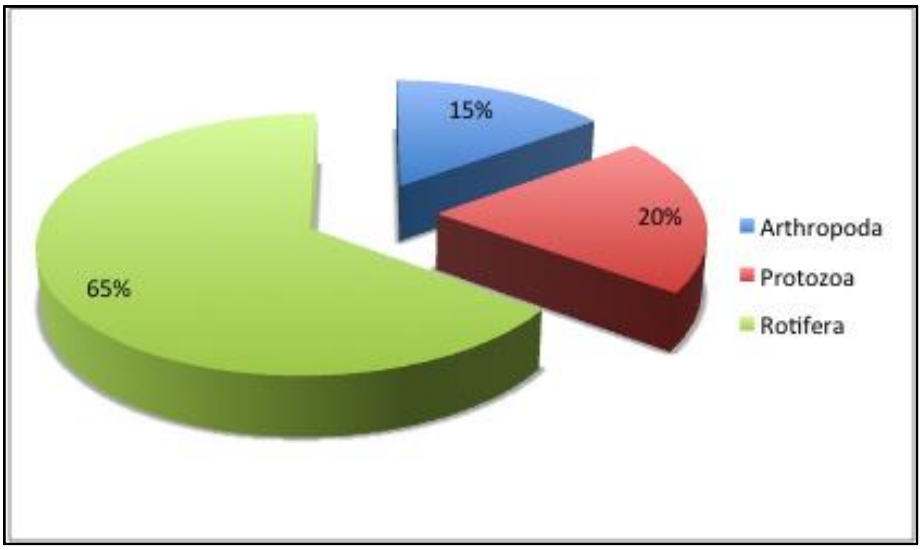


Figure 2-43: Relative mean abundance of zooplankton groups recorded in the 2012 study conducted by GHD

2.2.3.2.3 MACROBENTHOS

A total of 96 macrobenthos taxa was recorded in the studies conducted from 1997 to 2015. This represented five major groups namely Arthropoda (insects and arachnids), Mollusca (clams and snails), Annelida (worms), Chordata (fish), and Cnidaria (hydra). Based on the previous studies conducted, taxa richness declined from the 28 taxa recorded in the 1997 study to 17 taxa in the 2012 study which could be attributed to the construction activities such as clearing and earthworks within the mine to give way for the major facilities such as the TSF, WRD, process plant, accommodation and other ancillary facilities. Impact on macrobenthos could have been further aggravated by high rainfall events in the area. Declines were also observed outside the mine which could be due to activities and inputs from small scale mining along the rivers and creeks during the period from 1997 to 2012. Nevertheless, an increasing trend from the 2012 study to the 2015 study was observed (Figure 2-44). From 17 taxa recorded in the 2012 study, there was an increase to 40 taxa in the 2015 study. This strongly indicates survival of these taxa in the area, minimized impact of the project since construction phase is already completed and effective mitigation measures being implemented by OGPI particularly on the slope protection and erosion control measures (e.g. re-vegetation of open and sloping areas, and bank stabilization), operation of a sanitary landfill, water treatment plant, flow through design of the WRD and an effective waste management put in place.

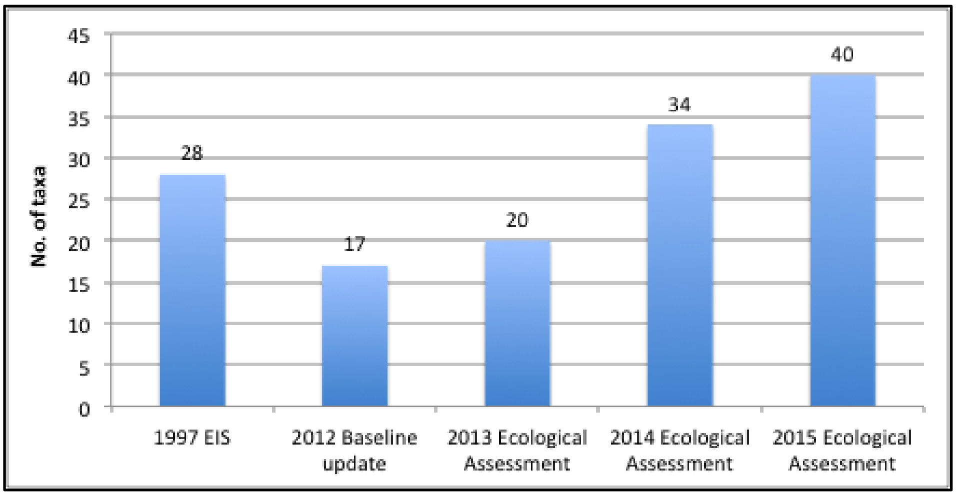


Figure 2-44: Taxa richness of macrobenthos recorded in the studies conducted from 1997 to 2015

In terms of the relative abundance of macrobenthos, there was no significant change in the composition of macrobenthos within the rivers and creeks sampled. Arthropoda consistently dominated the macrobenthos composition from the 1997 study up to the 2015 study with high relative abundances ranging from 83% to 100% (Figure 2-45). Relative abundance of other groups of macrobenthos recorded ranged from 0.15 to 10% and was observed to fluctuate across the studies conducted from 1997 to 2015, which could be attributed to conditions (e.g. high surface runoff, substrate) during and at the time of sampling. Recorded relative abundances only indicate minimal impact of the project on these types of communities.

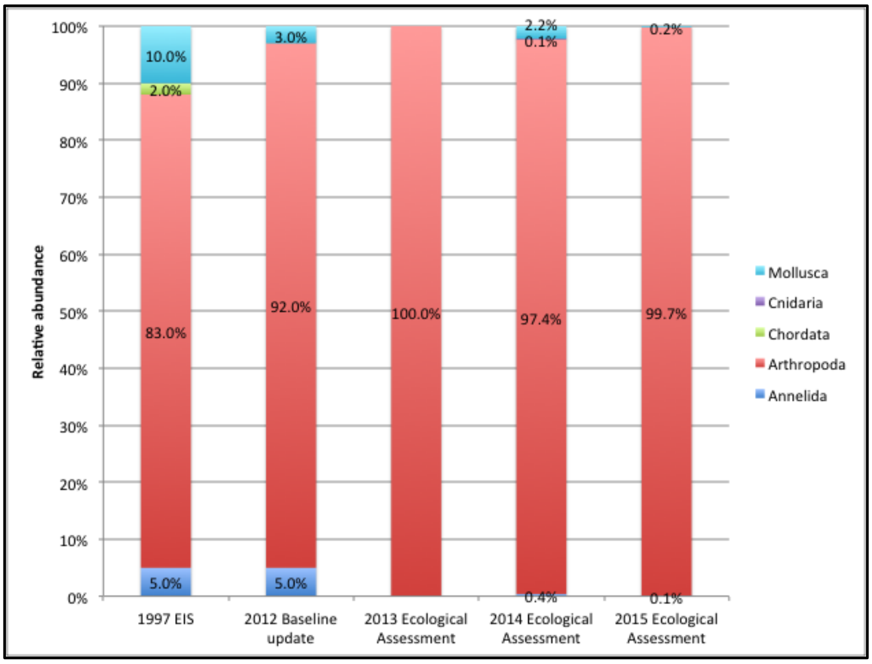


Figure 2-45: Relative abundances of macrobenthos recorded in the studies conducted from 1997 to 2015

2.2.3.2.4 FISH

There were 10 fish species recorded in the studies conducted from 1997 to 2015. Of the 10 species recorded, only six of these were confirmed present on site while the remaining four species were reported but not confirmed to occur on site. Based on the studies conducted, there is very low richness of fish in the area (Figure 2-46). Species recorded to be present in the area include the common carp (*Cyprinus carpio*), Nile tilapia (*Oreochromis niloticus*), guppy (*Poecilia reticulata*), African catfish (*Clarias gariepinus*), rock goby (*Rhinogobius bucculentus*), and the Asian swamp eel (*Monopterus albus*). All of these species are introduced except for the rock goby (*Rhinogobius bucculentus*) which is endemic to the Philippines. Based on interviews with locals during the 2012 monitoring conducted by AECOM, fishing activity is rare, often for recreational purposes only.

Fishes also provide ecological services that are critical in the freshwater ecosystem dynamics. Grazers or herbivore types such as the Nile tilapia feed on plankton, filamentous algae and macrophytes which control algal blooms and proliferation of aquatic plants. Predator fishes such as the common carp, Asian swamp eel, and guppy consume zooplankton/larvae (i.e. mosquito), benthic organisms, shrimps and other fish which are indicative of a dynamic food chain. Fishes also play an important role in nutrient cycling such as the African catfish that can feed on living and dead animal matter.

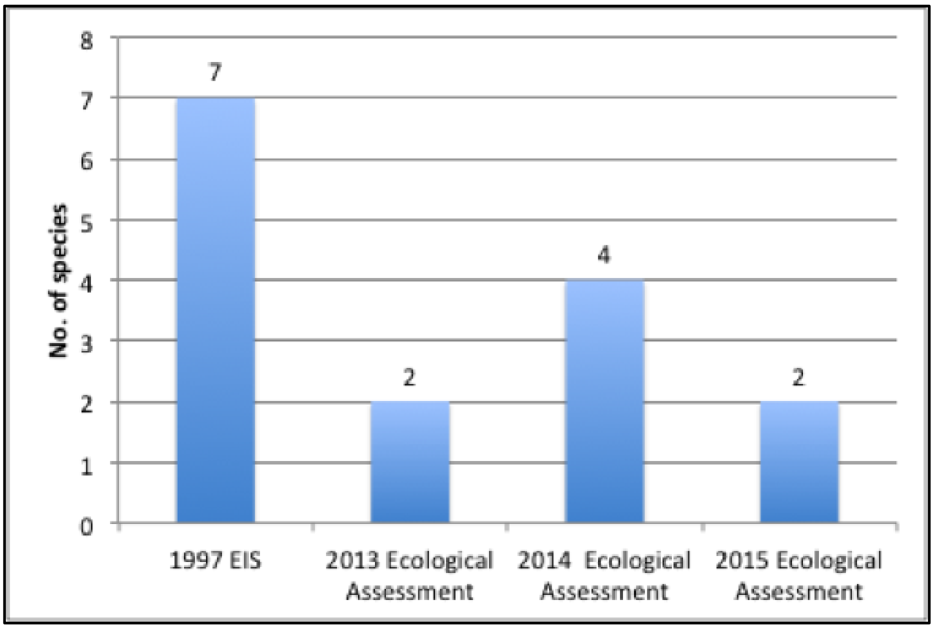


Figure 2-46: Taxa richness of fish recorded in the studies conducted from 1997 to 2015

2.2.3.2.5 Trace Metal Analysis

2.2.3.2.5.1 Arsenic

Arsenic levels in the tissues analyzed on the previous studies from 1997 to 2016 were either undetected or low. Nevertheless, all concentrations recorded are within the permissible concentrations set by Australia New Zealand Food Authority (ANZFA) (Figure 2-47).

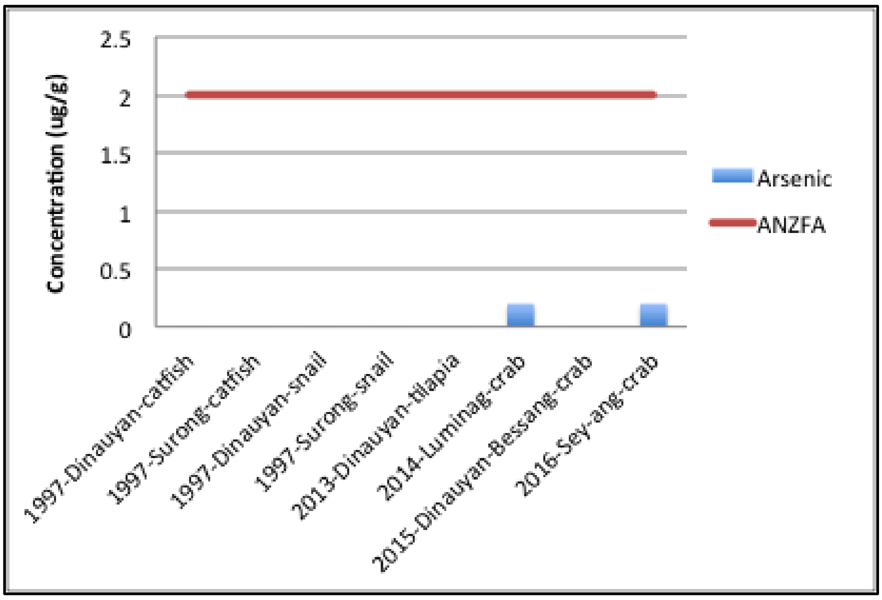


Figure 2-47: Concentration of arsenic in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.2 Cadmium

Concentrations of cadmium were within the permissible levels set by ANZFA and the European Commission (EC) except in the tissues of snail analyzed on the 1997 study wherein the project was not yet implemented

(Figure 2-48). High concentration in the snails could be due to their slow mobility resulting to prolonged exposure in areas with high concentrations of cadmium.

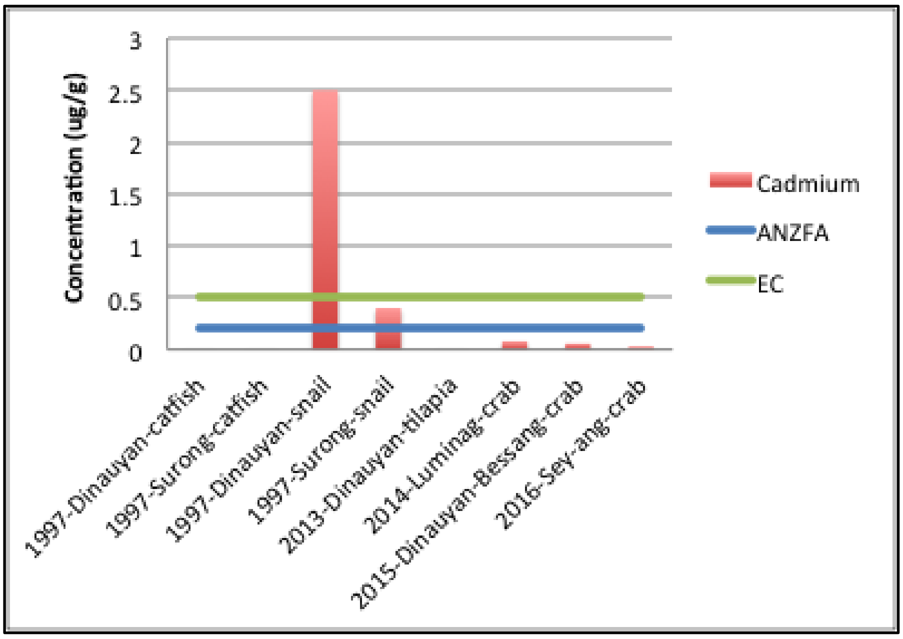


Figure 2-48: Concentration of cadmium in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.3 Chromium

Chromium levels in fish and snail tissues analyzed during the 1997 study were below detection limits. On the other hand, chromium levels were detected in the tissues analyzed from the 2013 to 2016 can be considered low (Figure 2-49). It should be noted that the tissue samples exhibiting levels of chromium were collected mostly in control stations not affected by the project operation except for the station in the 2013 study. Hence, this could only indicate that chromium is naturally available and bio-accumulated by aquatic fauna species in these areas.

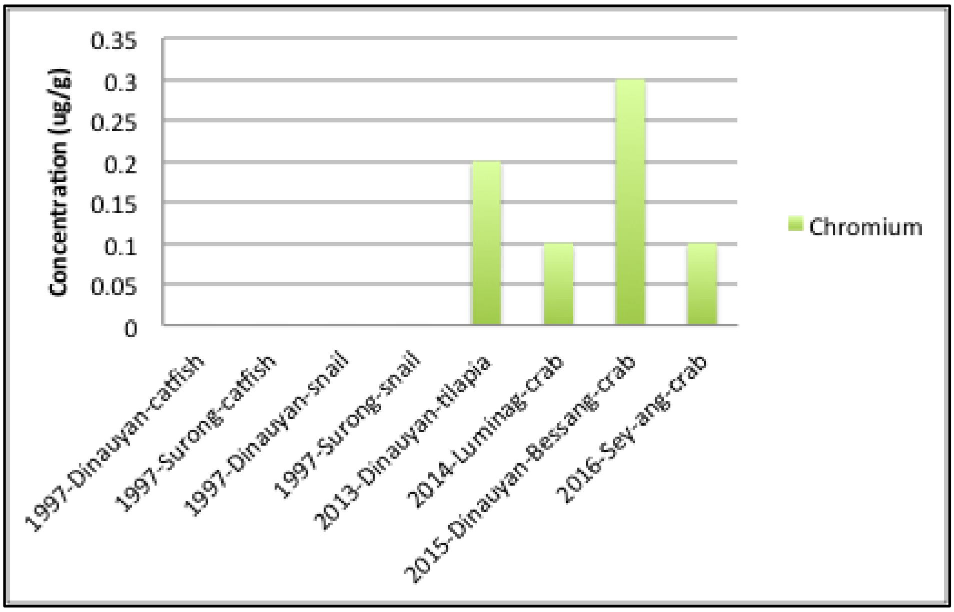


Figure 2-49: Concentration of chromium in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.4 COPPER

Copper levels in tissues analyzed on the studies conducted from 1997 to 2016 ranged from 0.5 ug/g to 44 ug/g (Figure 2-50). Relatively high concentrations were recorded in the tissue samples in the 1997, 2015 and 2016 studies. High copper levels in snails could be attributed to their slow mobility, which prolongs their exposure in copper-rich substrates such as sediments. On the other hand, relatively high copper concentrations in tissue samples collected from control stations during the 2015 and 2016 studies indicate that the area is naturally rich with copper.

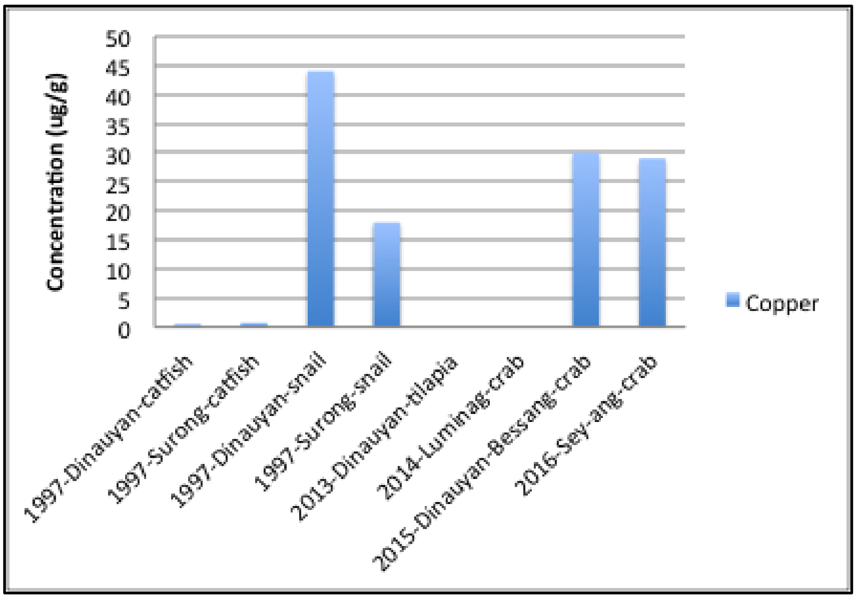


Figure 2-50: Concentration of copper in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.5 IRON

There is no standard for iron in tissues. Iron levels in tissue samples were relatively low except for the snail tissues analyzed in the 1997 study (Figure 2-51). Similar to previous metals, the exceptionally high level of iron in snail tissue samples could be attributed to their slow mobility, which prolongs their exposure to metals in substrates such as sediments.

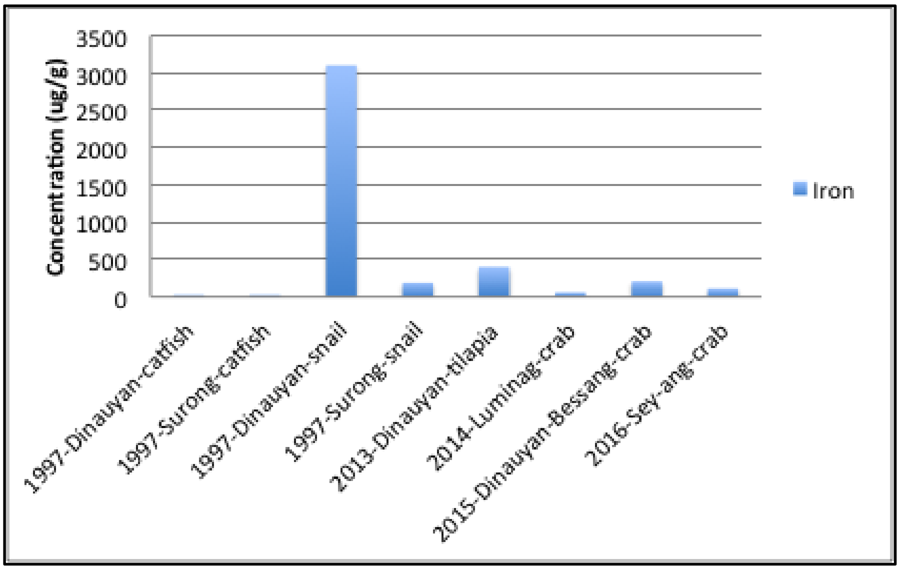


Figure 2-51: Concentration of iron in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.6 LEAD

Based on the results of tissue analysis conducted, all lead concentrations were below the prescribed limits set by ANZFA, EC, codex Alimentarius and the UNFAO except for the snail tissues analyzed in the 1997 study (Figure 2-52). High concentration of lead in snail tissue could be attributed to its long exposure to contaminated water or sediments due to its slow mobility.

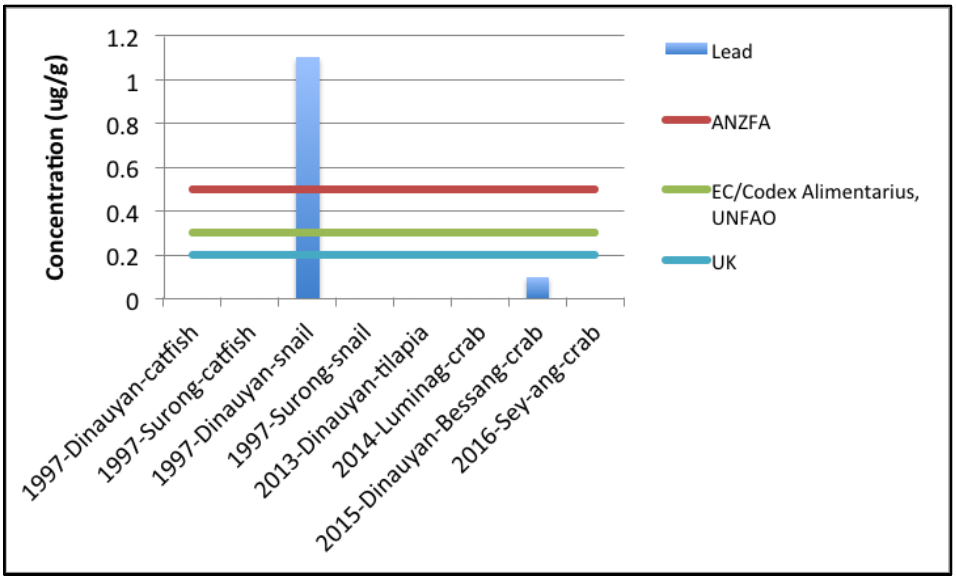


Figure 2-52: Concentration of lead in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.7 MANGANESE

Manganese was not analyzed in the 1997 study but concentrations of this metal in the succeeding studies from 2013 to 2016 indicate its presence in the tissue samples analyzed. Relatively high concentrations were recorded especially in the 2015 and 2016 studies (Figure 2-53). However, it should be noted that tissue samples from these two studies were collected in control stations not affected by the project operations. This only indicates that manganese is naturally present and readily available for bioaccumulation of aquatic fauna.

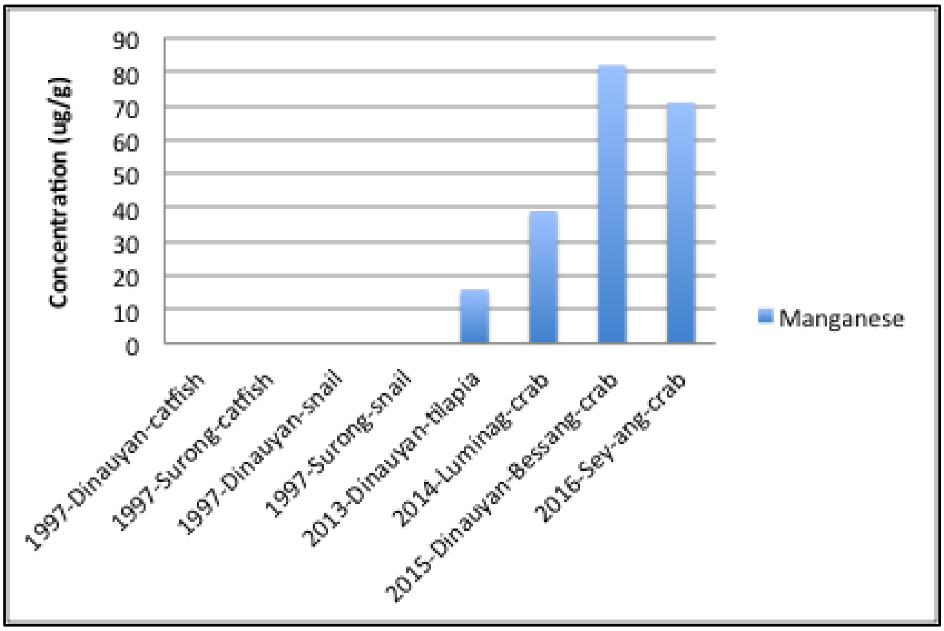


Figure 2-53: Concentration of manganese in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.8 MERCURY

Concentration of mercury in tissue samples was already recorded in the 1997 study prior to the project implementation, which could be attributed to small-scale mining activities in the area at that time. Based on the study conducted in 2013, mercury was still recorded in the tilapia collected from Dinauyan River but was below the prescribed limits by ANZFA, EC, USFDA, Codex Alimentarius and UNFAO (Figure 2-54). Later studies conducted in 2014 to 2016 showed undetectable presence of mercury in the tissues since these were collected in control stations. Amount of samples collected from impact rivers/creeks during the 2014 to 2016 studies were inadequate for tissue analysis.

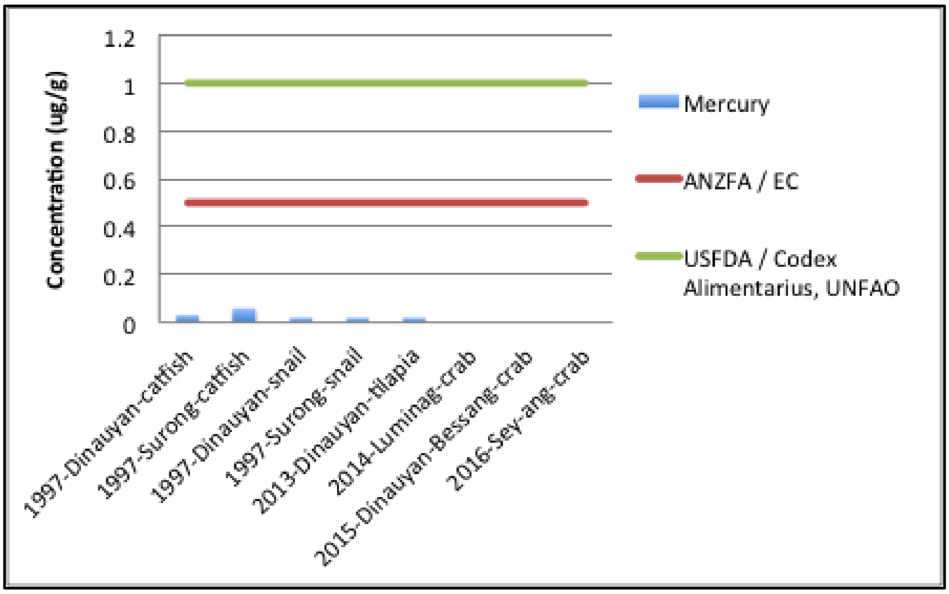


Figure 2-54: Concentration of mercury in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.2.5.9 ZINC

Zinc was detected in tissues analyzed in the studies conducted from 1997 to 2016. Nevertheless, all recorded concentrations were below the prescribed limits set by ANZFA and UK except for the zinc concentration in the snail tissue analyzed in the 1997 study (Figure 2-55). High concentration of zinc recorded in the snail tissue could be attributed to its slow mobility, which prolongs exposure of the animal to zinc-rich water, sediments and food.

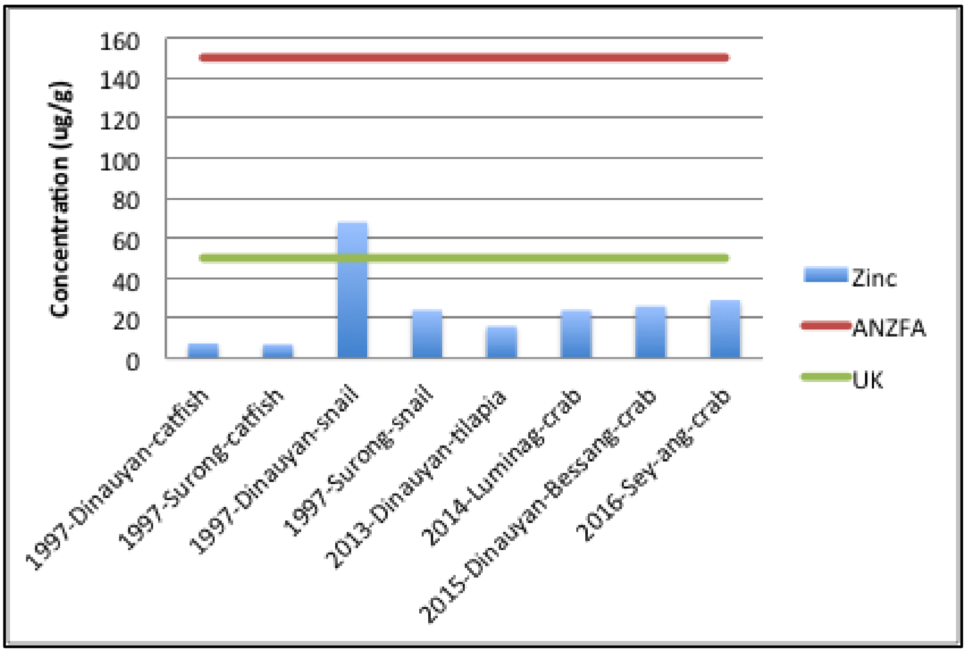


Figure 2-55: Concentration of zinc in aquatic fauna tissues analyzed in the studies conducted from 1997 to 2015

2.2.3.3 Impact Assessment and Mitigation Measures– Freshwater Ecology

Based on the proposed development, OGPI is proposing to increase its throughput rate from 3.5 million tons per annum (MTPA) to 4.3 MTPA. There will be nil to minimal changes in the existing facilities as these will still be utilized and operation will just include the underground mine development. In general, the proposed change is likely to cause insignificant to minimal impacts to freshwater ecosystems in the area.

In addition, OGPI has been in operation since 2012 and a decline in the taxa richness of aquatic fauna composition in the area from 1997 to 2012 has been observed due to the construction activities and from the anthropogenic disturbances especially from small-scale mining activities nearby the mine site. But apparently, data from the 2012 study up to the 2016 study shows significant recovery of the aquatic communities, which is almost similar to the aquatic community prior to the project implementation. This could be attributed to the completion of the construction phase of the project and that the impacts identified in the previous studies, which are primarily concerned on erosion, siltation/sedimentation and pollution of freshwater ecosystems are being effectively mitigated by OGPI.

Hence with almost no net change in the project impact areas and activities based on the proposed development, it is likely that there will be insignificant to minimal impact to the aquatic ecosystems in the area as long as OGPI continues to implement and maintain mitigation measures put in place.

To mitigate and further support the aquatic communities in the area, OGPI is recommended to continue the implementation and maintenance of mitigation measure and monitoring activities, which include but not limited to the following:

- Implementation and maintenance of bank stabilization and erosion control measures (e.g. siltation/sedimentation ponds)
- Progressive rehabilitation and re-vegetation of disturbed areas such as slopes
- Implementation of water treatment plant and proper management of wastewater
- Implementation of proper solid (e.g. maintenance of sanitary landfill) and hazardous waste management
- Implementation of conservation programs identified in the EPEP
- Regular annual monitoring of freshwater ecology in direct and indirect impact areas of the project

2.3 AIR

2.3.1.1 METEOROLOGY/CLIMATOLOGY

The meteorology at the project site provides information on general climate in the area, including temperature, rainfall, relative humidity, evapotranspiration, wind speed and direction and tropical cyclones.

Meteorological data were gathered from the Didipio Weather Station, as well as the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) synoptic station in Casiguran, Quezon, which is located 70.57 km away from the project site.

Based on the Modified Coronas System of Climate Classification (Figure 2-56), the proposed project site falls under the category of Type IV climate. This type of climate is characterized by a more or less evenly distributed rainfall. Areas that have a Type IV climate experience a similar climate to those in Type II areas found in the eastern coast of the Philippines, which is open to the northeastern monsoon and where maximum rainfall is experienced between December and January. Type IV climate however, has a dry season, unlike Type II. The tropical cyclone map (Figure 2-57) indicates that the vicinity of the project site may experience two tropical cyclones throughout the year.

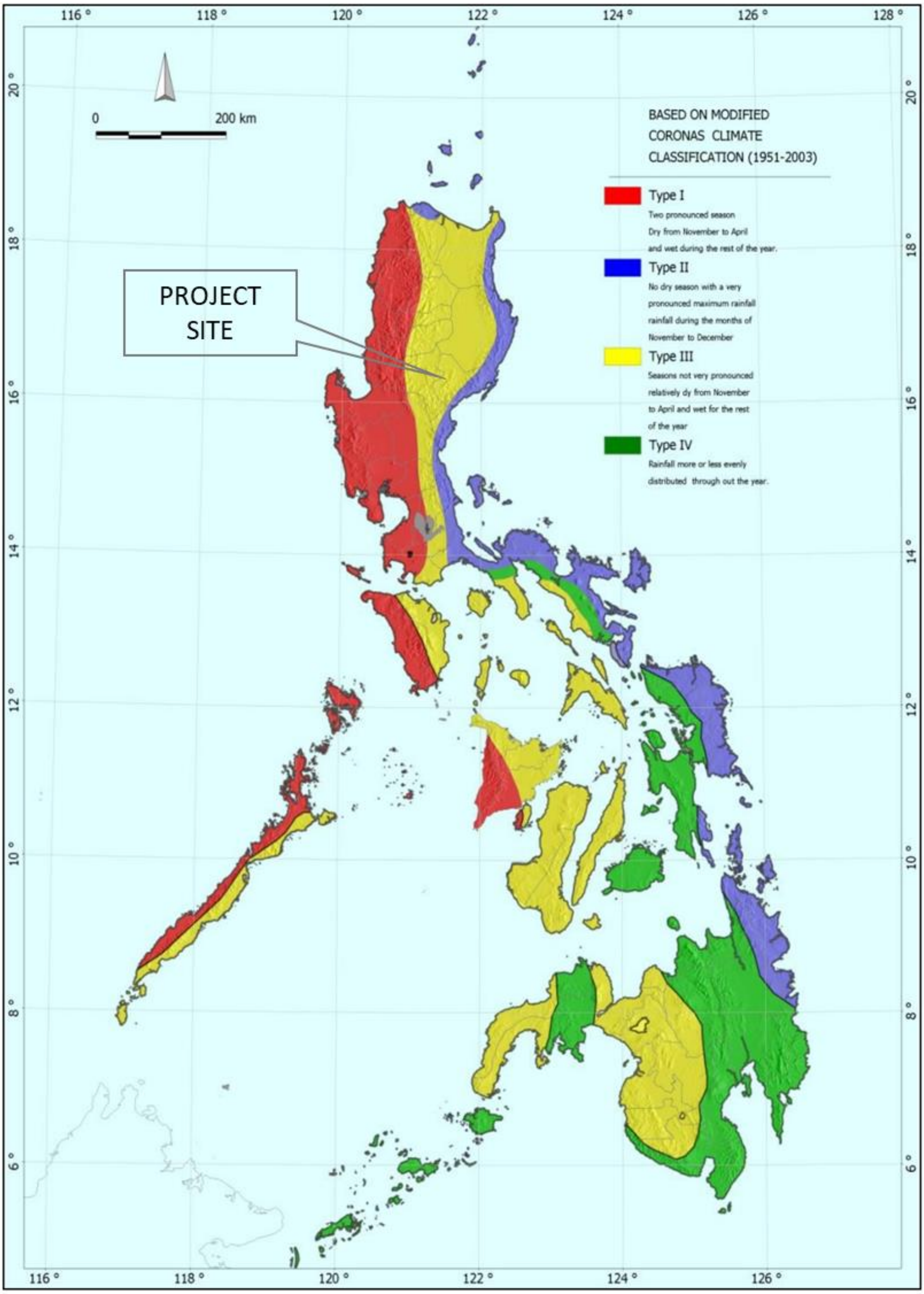


Figure 2-56: Climate Map of the Philippines

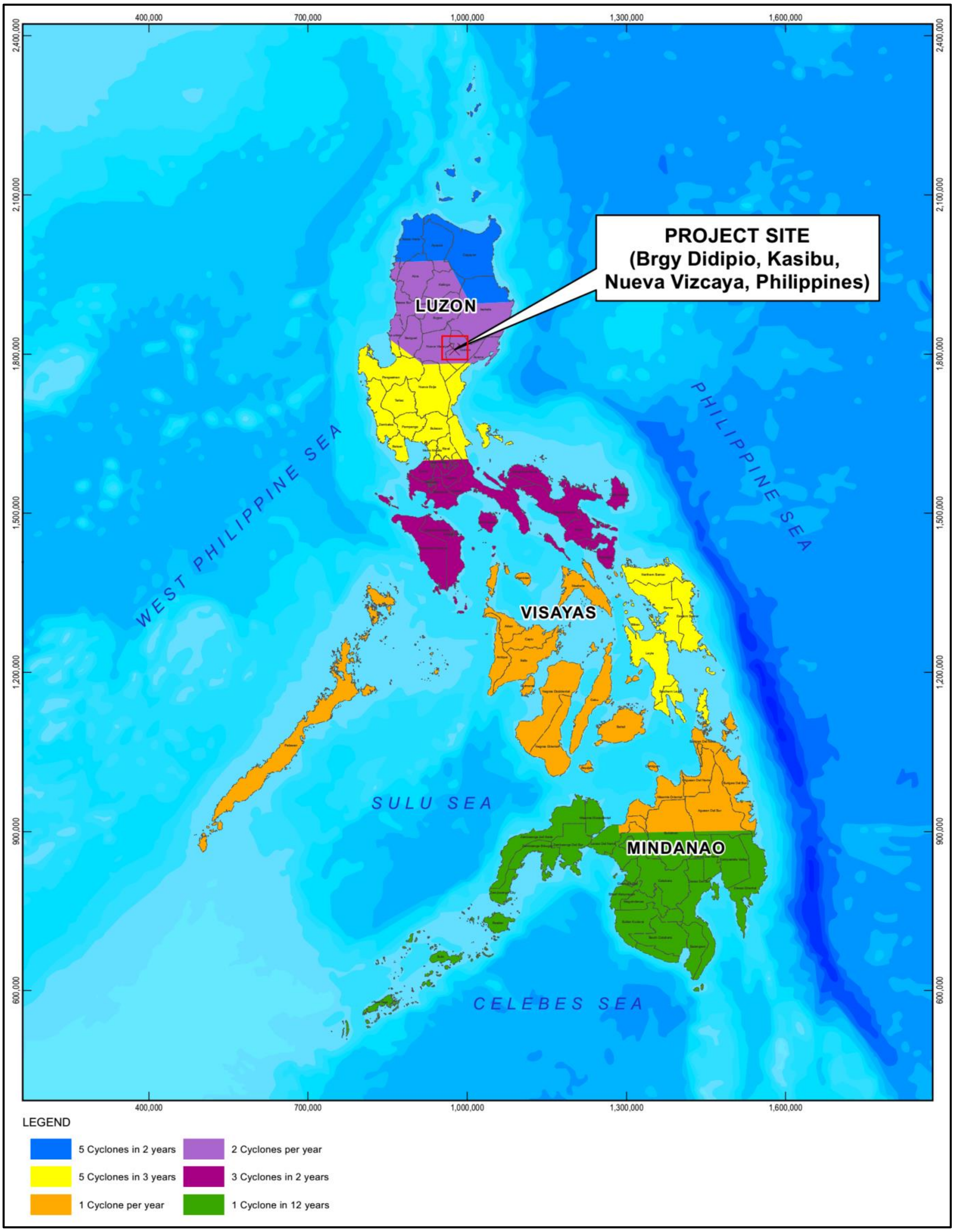


Figure 2-57: Tropical Cyclone Map
Source: GHD Baseline Report (2012)

Annual rainfall data from Didipio Weather Station from 1989 to 2010 is in Table 2-20. Normal values for rainfall, temperature, vapour pressure, relative humidity and wind, which were computed from data collected at the Casiguran, Quezon station from 1981 to 2010 are shown in Table 2-21. The average annual rainfall at the site is 3,162.7 mm (Table 2-20). Although rainfall is experienced throughout the year, higher precipitation usually occurs during the months of October to December, where average monthly rainfall is around 426 to 506 mm. Months February to April appear to be relatively drier than other months. Based on the Casiguran, Quezon data, rainy days range between 12 and 19 throughout the year, with November having the most rainy days and April having the least number of rainy days.

Prevailing wind over the project area is towards the northeast (Figure 2-58), with speed of around 1 to 2 m/s. Normal monthly maximum temperature ranges from 27.6 to 33.3 °C. Monthly mean minimum temperature ranges from 19.8 to 23.7 °C with annual mean of 22.1 °C. Based on the data from the Casiguran, Quezon synoptic station, lowest monthly minimum temperature was recorded at 19.8 °C in January, whilst highest monthly minimum temperature was recorded in June at 23.7 °C.

Table 2-20: Annual Rainfall Data from Didipio Weather Station (1989-2010)

YEAR	RAINFALL TOTAL / MONTH (mm)												ANNUAL TOTAL RAINFALL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1989	ND	ND	ND	ND	369.3	175.6	361.9	113.4	430.6	459.6	578.7	76.1	2565.2
1990	72.0	70.0	40.0	43.3	201.5	259.0	404.0	231.8	321.0	475.0	486.0	313.8	2917.4
1991	86.5	182.4	10.0	185.0	145.3	39.8	237.1	290.5	339.5	63.8	296.8	194.9	2071.6
1992	140.0	28.9	39.0	71.7	205.4	105.8	418.2	197.5	305.9	623.5	528.7	374.2	3038.8
1993	141.4	71.0	65.0	91.5	2.5	187.4	120.0	275.0	251.2	699.0	644.5	1110.3	3658.8
1994	356.3	167.5	309.0	24.0	206.6	172.9	348.5	327.9	247.3	462.0	169.5	203.5	2995.0
1995	165.0	190.5	19.5	0.0	252.2	106.4	243.5	300.6	217.9	528.0	832.5	1114.1	3970.2
1996	225.5	232.0	141.5	289.6	214.5	85.0	371.5	122.5	354.0	221.0	586.0	306.5	3149.6
1997	124.0	212.2	122.5	221.3	195.5	251.5	491.0	161.0	354.5	170.4	225.1	134.1	2663.1
1998	85.3	14.7	75.5	145.5	139.0	99.3	182.7	309.2	233.0	813.0	366.5	1223.3	3687.0
1999	262.4	86.5	153.1	286.5	246.0	155.8	197.7	176.2	359.9	406.6	457.9	977.0	3765.6
2000	380.0	278.5	198.0	177.0	223.9	156.4	299.8	228.9	275.1	604.7	426.2	672.2	3920.6
2001	472.0	297.8	175.0	0.0	39.8	125.0	469.9	478.8	220.7	258.8	418.3	472.0	3428.0
2002	131.2	110.8	28.3	25.0	137.0	16.0	ND	ND	ND	ND	ND	ND	448.3
2003	ND	ND	ND	ND	84.0	75.8	355.8	447.2	479.3	120.3	423.8	386.7	2372.9
2004	122.0	229.6	95.5	213.5	100.5	164.5	400.7	315.3	116.7	184.5	1077.0	526.0	3545.7
2005	153.0	49.0	241.0	85.0	260.1	278.5	102.3	239.7	638.5	594.5	488.5	1035.5	4165.6
2006	552.0	214.5	326.0	12.0	22.3	61.0	353.7	331.3	482.5	810.7	287.4	511.6	3965.0
2007	217.3	54.1	96.0	115.6	322.7	148.3	104.8	440.0	428.9	524.4	834.1	482.4	3768.6
2008	509.7	323.8	113.7	111.8	609.8	243.8	170.5	306.0	186.6	254.0	510.7	319.5	3659.9
2009	354.6	209.0	157.2	422.6	352.6	144.2	297.8	189.2	515.8	386.0	200.2	29.0	3258.2
2010	87.4	5.4	68.2	36.2	81.6	1061	328.6	108	49.1	286.6	303.6	149.7	2565.4
Average	**231.9**	**151.4**	**123.7**	**127.9**	**200.6**	**187.0**	**298.1**	**266.2**	**324.2**	**426.0**	**482.9**	**505.4**	**3162.7**

Table 2-21: Normal Values for Rainfall, Temperature and Wind at Casiguran, Quezon from 1981-2010

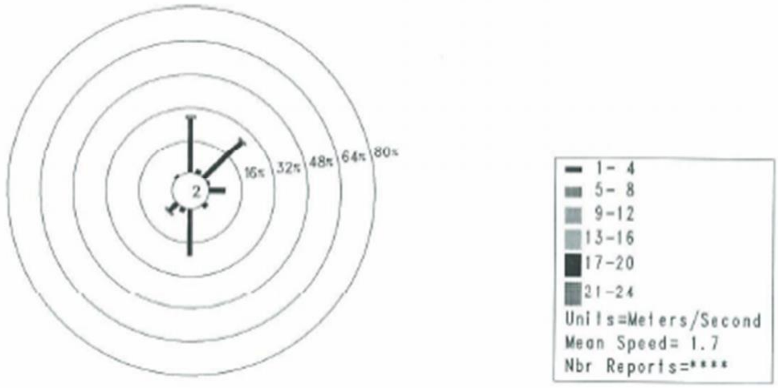
Month	Rainfall		Temperature									Wind			No; Days w/	
	Amount (mm)	No. of RD	Max CO	Min (°C)	Mean CO	Dry Bulb CO	Wet Bnlb CO	Dew Pt CO	Vapor Pressure (mbs)	ReL Hum. %	MSLP (MBS)	Dm (16 Pt)	SPD (mps)	Cloud Amount (okta)	TSTM	LTNG
JAN	272.5	17	27.6	19.8	23.7	23.6	22.3	21.7	26.0	89	1014.2	NE	2	6	0	0
FEB	226.6	14	28.4	20.1	24.2	24.0	22.7	22.2	26.7	89	1014.0	NE	2	5	0	0
MAR	203.0	14	30.0	20.9	25.4	25.3	23.8	23.2	28.4	88	1013.0	NE	2	5	0	0
APR	183.0	12	31.9	22.2	27.0	26.9	25.2	24.6	30.9	87	1011.3	NE	2	4	2	3
MAY	238.5	15	33.0	23.2	28.1	28.0	26.3	25.7	33.0	87	1008.9	S	1	5	7	10
JUN	225.2	14	33.3	23.7	28.5	28.4	26.7	26.1	33.8	88	1007.6	S	1	5	5	11
JUL	282.8	15	32.6	23.5	28.1	27.9	26.3	25.8	33.1	88	1006.9	S	2	5	5	8
AUG	208.8	14	32.8	23.5	28.1	27.9	26.2	25.6	32.8	87	1006.0	S	2	6	5	8
SEP	280.9	16	32.2	23.0	27.6	27.4	25.8	25.2	32.1	88	1007.5	NE	1	6	6	9
OCT	537.4	17	31.0	22.5	26.8	26.5	25.1	24.6	30.9	89	1009.3	NE	2	5	4	4
NOV	591.3	19	29.6	21.9	25.8	25.6	24.2	23.7	29.2	89	1011.3	NE	2	6	1	1
DEC	495.6	17	28.0	20.6	24.3	24.2	22.9	22.4	27.0	90	1013.5	N	2	6	0	0
ANNUAL	**3745.6**	**184**	**30.9**	**22.1**	**26.5**	**26.3**	**24.8**	**24.2**	**30.3**	**88**	**1010.3**	**NE**	**2**	**5**	**35**	**54**

Source: PAGASA, January 2011

WIND ROSE DIAGRAM, 1971-2000

CASIGURAN, QUEZON

Annual



FREQUENCY TABLE

Casiguran, Aurora

Wind Speed and Direction

Annual (1971-2000)

Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1-4	26.8	2.1	25.7	1.0	8.0	0.2	2.0	0.2
5-8	0.6	0.1	0.6	0.1	0.0	0.0	0.0	0.0
8-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	27.4	2.2	26.3	1.1	8.0	0.2	2.0	0.2

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									1.7
1-4	21.7	1.9	4.7	0.1	0.3	0.0	0.7	0.1	95.5
5-8	0.4	0.2	0.6	0.0	0.0	0.0	0.1	0.0	2.7
8-12	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
13-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	22.2	2.1	5.3	0.1	0.3	0.0	0.8	0.1	100.0

Figure 2-58: Annual Wind Rose Diagram of Casiguran, Quezon

2.3.1.2 Air Quality and Noise – Impact Assessment

Presented in this section are the identified project impacts in terms of air quality and noise and the corresponding mitigation measures being implemented by OGPI consistent with the Company's Interim Annual EPEP for 2018 which was duly submitted to MGB DENR.

2.3.1.2.1 Potential Air Impacts

2.3.1.2.1.1 Dust from Mining Activities

Dust is generated from the open pit during periods of dry weather. The identified sources of dust are: drilling and blasting, loading of haul trucks and vehicles entering or leaving the pit.

On the other hand, dust is not expected to be an issue from the underground as continual seepage into the underground mine will minimize the possibility of dust generation.

2.3.1.2.1.2 Dust from Processing Area (crushers)

The main potential sources of dust from the processing area are: stacking of ore, loading the crusher, crushing and conveying ore to the process plant. Once delivered to the process plant dust will not be generated as the process involves a wet circuit. The concentrate has a moisture content of 8-10% and stored in a storage shed which prevents dust from being generated.

2.3.1.2.1.3 Fumes from the Processing Plant

Xanthates including sodium isobutyl xanthate hydrolyze in water and liberate CS_2 which is an odorous toxic gas. The reaction is controlled by maintaining an elevated pH in the solution. There are strict occupational health and safety exposure limits at the plant that when complied with, will eliminate the possibility of adverse impact on the community.

2.3.1.2.1.4 Dust from Vehicle Movement

Vehicle movements are the most likely source of dust from the mine site. Roads specifically haul roads have the potential to become very dusty in dry weather.

2.3.1.2.1.5 Dust from Exploration Activities such as Drilling and the Forming of Access Tracks

Dust produced during near site exploration activities is limited due to the limited nature of this program. Dust is minimized using water sprays, shielding of drill rig and usage of additives for borehole lubrication. Additives like CR650 and AMC Aus-Gel are being used as borehole lubricants for exploration activities.

2.3.1.2.1.6 Other Sources

The other air quality impact sources identified are the smoke emission from the power station, foul odour at the sewage treatment plant, and dust generation for blasting activities.

2.3.1.2.1.7 Emissions from Engine-driven Equipment

The power station produces fine particles, oxides of nitrogen, oxides of sulfur, carbon monoxide, water vapor and carbon dioxide. The power station meets Philippines requirements for stack emissions and meets ground level concentration at the most impacted point.

Emission from mobile equipment and other engine driven equipment from use of fuel are considered to be significant sources of greenhouse gas emissions such as Carbons.

2.3.1.2.1.8 Odor from the Sewage Treatment Plant

If not properly managed the sewage treatment plant may produce offensive odor that may impact the community. The sewage treatment plants are maintained by trained sewage treatment plant operators, and therefore odor is not expected to be an issue in the long run.

2.3.1.2.1.9 Emissions from Blasting

Blasting activities, primarily during the open pit excavation, produce gases like carbon dioxide (CO_2), carbon monoxide (CO), nitrous oxides (NO_x), sulfur oxides (SO_x) and ammonia (NH_3). These emissions are short and sudden and are only momentarily concentrated around the blast site. These gases are usually easily dissipated in the atmosphere.

2.3.1.2.2 Air Impact Control Strategies

2.3.1.2.2.1 Dust Suppression

Dusts from each of the identified sources are suppressed using water sprays. Haul and other roads are watered with a water cart. Water sprays are employed to suppress the dust on the crusher or conveyor. Dust from drilling activities is controlled by using water sprays and shielding as appropriate.

2.3.1.2.2.2 Maintenance and Emission Monitoring for the Generator Sets (Power Station)

Emissions from the power station are controlled by the manufacturer design and regular maintenance of the generator sets. The sets are low emission by design and the fuel is Philippines Standard Diesel which will further reduce particulate and sulfur dioxide emissions.

This year OGPI will continue the Annual Air Stack Ambient Monitoring from its power sources. A local laboratory will be hired to do the task. This activity will be monitored by the EMB-Region 2 personnel.

2.3.1.2.2.3 Maintenance and Emission Monitoring for the Sewage Treatment Plant

Odor from the sewage treatment plants (STPs) are minimized by ensuring that the plants are maintained in good working condition and operated are by trained personnel. Regular maintenance is conducted to ensure that diffusers and blowers remain efficient in supplying aeration to the sewage loads to hasten bacterial digestion of organics. The plant also has chlorination process to lower down harmful bacteria in the effluent.

To mitigate odor emission, an enclosure system with carbon filter on the surge tank of the STP is installed.

Another treatment line was installed to tap the sewage treatment plant as a source of potable water.

2.3.1.2.2.4 Control of Dust from Vehicle Movement

OGPI and contractor's vehicles are required to slowdown when significant dust emission is generated while travelling on the road. Speed humps are installed and maintained near residential areas to ensure vehicles will slow down at sensitive areas. Water carts are used to sprinkle water to reduce dust dispersion.

Signage are established in Km 0 and Km 22 to remind drivers to slow down. Likewise, tarpaulin is set up at Total Cabarroguis to serve as an IEC material.

2.3.1.2.2.5 Establish Carbon Sink Plantation Areas

Carbon sink tree plantation areas are established to offset carbon emission from the project. These areas include those under the National Greening Program (NGP), reforestation on site Adopt-a-Mining Forest Program and other new plantation areas. The Mining Forest Program of the company was officially started on CY 1997 which is part of the exploration phase of the project. It was first implemented by Climax Arimco Mining Corporation (CAMC) and was assigned to Australasian Philippines Mining Inc. (APMI) who later changed its name to OceanaGold Philippines, Inc. (OGPI) following the merger between OceanaGold and Climax in 2006.

As of December 2018, the Company has already established a total of 1,285.4712 Hectares including OGPI's National Greening Program (NGP) accomplishments, replacement planting projects as part of the compliance of the company to the previously issued Tree Cutting Permits by the DENR. Based on the validated report of MFP-NEC, the company has currently planted a total of 1,351,921 seedlings of various forestry and agroforestry species.

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A summary of the estimated annual fuel consumption and carbon emission, for 2018 are presented in Table 2-22.

Table 2-22: Estimated Carbon Emission

Year	Fuel Consumption (liters)	Carbon Emission (T)
2017	14,384,332	10,014.18
2018	8,831,592	4,756.06

The above computation was based on EMB and USEPA online references and may be subject to change after review by concerned agencies. Any updates or changes will be reflected or adjusted in the annual EPEP.

Reference of the emission computations are as follows:

- Tracking greenhouse gases: An inventory manual (Including Module 1 worksheet 1-1s1-3)
- USEPA Emission data calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results

The equivalent number of trees was based on prevailing conversion of 500 trees per hectare. Compliance to the previous TCP requiring an area of 123 ha to be planted, as of October 2017, is around 75 ha.

2.3.1.2.2.6 Greenhouse Management Plan

A project greenhouse gas and energy management plan (GHGEMP) was developed to provide details on carbon emission reduction programs being implemented on site. Part of the program is the reduction of greenhouse gas emission from reduced use of engine driven power generator sets by connecting to the power grid through the Nueva Vizcaya Electric Cooperative (NUVELCO) which was already established. The site also maintains effective maintenance of equipment to ensure efficient operation and correspondingly reduce unnecessary carbon emissions from inefficient running of equipment.

2.3.1.2.2.7 Use of Biodiesel

The diesel fuel use in the project site is 2% Coco Methyl Ester (CME) which is classified as bio fuel (Biodiesel). Studies revealed that utilization of biodiesel or biodiesel blends can reduce carbon emissions approximately equivalent to the percentage of biodiesel in the blend.

2.3.1.2.3 Potential Noise and Vibration Impacts

2.3.1.2.3.1 Impact to Workers in Open Pit, Process Plant, ROM Pad, Haul Roads and other Work Areas

Noise from the operations will disturb the natural background noise levels. Changes in the usual condition may cause non-auditory effects to workers which include stress, annoyance, diminished productivity and concentration, and interference with communication.

2.3.1.2.3.2 On- and Off-Road Vehicles

Regular passage of large vehicles along the general access road and haul roads will generate noise particularly during the construction and operations phase.

2.3.1.2.3.3 Explosives

Explosives are used in both the open pit and underground construction. OGPI implements one blast per day at a fixed time in both the open pit and underground. Sequenced blasts are used to break rock and minimize the maximum noise and vibration produced. As the open pit was already concluded blasting only occurs at the underground development.

2.3.1.2.3.4 Crusher and Process Plant

The crusher is in the ROM pad approximately 400 m from the nearest community residence. The major noise sources at the process plant are the mills, pumps and blowers used to process the ore. The process plant is located approximately 500 m from the nearest community member.

2.3.1.2.3.5 Power Station

Electricity of the mine site is generally tapped within the national grid thus minimizing the utilization of the diesel-powered generator sets thereby lessening the noise in the process plant operation. The generator sets are utilized for emergency purposes only.

2.3.1.2.3.6 Others

Project related vehicles using the main access have the potential to impact on the noise environment of the community along the access road.

2.3.1.2.4 Noise Control Strategies

2.3.1.2.4.1 Ambient Noise and Occupational Safety and Health Standards

OGPI follows the Philippine Ambient Noise Standard established by the Department of Environment and Natural Resources DENR). The acceptable average noise levels are based on the land use classification of the area and dependent on the period of the day.

The workers are covered by the Occupational Health and Safety Standard (OSHS) where permissible levels of noise exposure are specified. To minimize the noise impacts on workers, Personal Protective Equipment (PPE) are issued to workers. PPEs include ear mufflers or ear plugs to minimize the noise heard by workers particularly for employees who work with heavy machinery, large vehicles, and blasting. The use of PPEs is strictly implemented.

2.3.1.2.4.2 Restriction of Hours of Activity

The mine operates on a 7-day per week, 24-hour per day basis. Restriction has been placed on rock breaking activities near the crusher during the night shift. Wherever possible, hauling to the ROM pad is done during daylight hours since dumping on the ROM pad has been identified as the greatest source of noise in the neighbouring community.

2.3.1.2.4.3 Equipment and Vehicle Maintenance

All equipment and vehicles used on site are required to be fitted with manufacture approved exhaust systems and the exhaust systems are being maintained in good condition.

2.3.1.2.4.4 Construction of Sound Barriers

Should noise from the process plant adversely impact on the community, noise barriers are erected close to the main noise source or the affected community to minimize the impact to the community.

The crusher is mainly buried in the ROM pad and therefore the community is shielded from crusher noise by the ROM pad and stockpile. Still, there will be scheduled improvements in shielding noise in this area by further increasing the height of surrounding buffers/bund walls. This will be made possible through elevating the road surrounding the crusher eventually encapsulating the equipment within a cove and burying it deep in the landscape. To further lower the noise impact, the ROM pad road going to the Process Plant was elevated to also serve as noise barrier. Additional bio-solutions are established tree lines along the periphery of the landscape enhance noise abatement.

The 14 units 1.3MW generators at the power station are housed within clad containers and the exhausts are fitted with appropriate silencers to reduce noise. Exhaust noise is not expected to have a significant impact on the community. Should mechanical noise from the generator sets cause excessive noise in the community, additional cladding will be added to the containers to reduce the noise. Tree lines are also being established in applicable areas to serve as sound barriers.

2.3.1.2.4.5 OTHERS

2.3.1.2.4.5.1 POWER STATION

Noise from the power station is controlled using manufacturer specified exhaust systems and the power station building is clad. If noise from the power station is adversely impacting the community, further cladding will be added to the building.

2.3.1.2.4.5.2 VEHICLES

All vehicles used on site comply with manufacturers standards for noise control to minimize the noise impact associated with their use. All vehicles directly associated with site which use the access road are required to be maintained in good working order. Vehicle speed restrictions are applicable to all vehicles on site. This control minimizes the noise impacts on the community. Where practical, vehicles access to site will be restricted during work hours of the day up to early evening so as not to disturb the communities along the general access road.

2.3.1.2.4.5.3 NOISE MONITORING

Noise monitoring is conducted regularly on strategic areas such as near communities to determine if the prescribed noise levels in the Philippine Ambient Noise Standards or the OSHS noise levels are exceeded by project operation.

2.4 PEOPLE

The study focuses on the impact areas of the existing project and proposed modification, particularly Barangay Didipio, in the Municipality of Kasibu, Province of Nueva Vizcaya. This is deemed as the direct impact area where the project components are located. The municipality of Cabarogguis is considered as the secondary impact area, so a presentation of its demographic profile is included as well. The following sections present the demographic and socio-economic profile of the impact areas as well as the issues/concerns/possible impacts regarding the project and corresponding proposed mitigation/enhancement measures.

2.4.1 METHODOLOGY

Various methods were employed in gathering information on the socio-economic conditions of the impact area as discussed in the following sections.

2.4.1.1 SITE VISIT/RECONNAISSANCE

During the reconnaissance survey, the general condition of the impact areas and communities were observed and noted. In this method, one can generalize the socio-economic and demographic conditions of the covered areas and communities. Brief random interviews of the residents within the area were also conducted to research on the general situation of the area and the communities and help determine the perception of the respondents towards the project.

Site visits/ ocular inspections/ area reconnaissance/ preliminary surveys were regularly conducted starting from mid-2016, towards 2017, and onto 2018, with the final visit on June 5-7, 2018.

2.4.1.2 PUBLIC SCOPING

The Public Scoping for Barangay Didipio, Kasibu was conducted on June 21, 2016 with details shown in Table 2-23.

Table 2-23: Date and venue of Public Scoping

Municipality	Venue	Date	Attendees
Municipality of Kasibu, Nueva Vizcaya	Didipio Barangay Hall, Barangay Didipio, Kasibu, Nueva Vizcaya	April 6, 2018	46

2.4.1.3 REVIEW OF SECONDARY DATA

Socio-demographic and economic data were obtained from pertinent documents from respective government institutions such as City and Provincial LGUs, as well as online sources for background information. All sources were exhausted in the study. These sources include:

- Comprehensive Land Use Plan of Cabarroguis, Quirino (CY 2013-2023)
- Quirino Provincial Development and Physical Framework Plan, 2011-2040
- Provincial Development and Physical Framework Plan 2014-2019 (Province of Nueva Vizcaya)

Table 2-24: Checklist of available data sources/references from Government Agencies

Document	Province		City	
	Quirino	Nueva Vizcaya	Cabarroguis	Kasibu
CLUP Cabarroguis Quirino	✓		✓	
Quirino Provincial Development and Physical Framework Plan, 2011-2040	✓			
Provincial Development and Physical Framework Plan 2014-2019		✓		

Table 2-25: Checklist of available data sources/references from OGPI and contractors

Document Source	Items/Category/Subject	
	Manpower	Health and Safety
OGPI	✓	
DELTA	✓	
DiCorp	✓	

Figure 2-59: Sample document covers obtained from LGUs

2.4.1.4 PERCEPTION SURVEY

A Perception Survey was conducted in the Direct Impact Barangay of Didipio. This was conducted from June 5-7, 2018. Table 2-26 presents the summary of Perception Survey conducted for the proposed project. Further details and photo documentation are shown in the succeeding sections.

The methodology used for the perception survey conducted was purposive sampling. The respondents were selected based on the criteria of their present residency's, property's, lifestyle/cultural activities' and livelihood's distance and accessibility-in-relation to the project site. Also considered are factors such as those that may be most affected by the project's impacts, upon the Ocular Inspection/Site Visit/Area Reconnaissance of the Study Team and Specialists, thru their consultations, and in coordination with Key Agency/Office Authorities and Community Leaders, IP Elders and Stakeholder Representatives.

The number of respondents was pegged at 100, this was to double the previous number of respondents from the perception survey conducted during the EIS stage of the project, so as to have a broader but proportionate sample. The distribution per sitio and purok was also readjusted, as there have been changes already and movement of people into, out of and within the different areas of the barangay.

The survey was divided into six major components, namely (1) Socio-Demographic Profile of respondents (2) Health Concerns (3) Community Concerns (IV) Environmental Concerns (V) Project concerns (VI) DRR-CCA Concerns.

Table 2-26: Methods used for Perception Survey

Method	Date of Survey	Location	No. of Respondents
Purposive Sampling	June 5-7, 2018	Brgy Didipio	100

2.4.1.5 Key Informant Interview (KII)

Key Informant Interview (KII) was also used primarily to provide an in-depth discussion on the condition of the community and to determine the perceptions and interests of several groups in the host barangays. This was administered to the knowledgeable and influential people in the locale. Among those interviewed were members of Union and DiCorp in the Direct Impact Barangays. A questionnaire consisting of both closed and open-ended questions was prepared for the purpose.

Photo 2-22: Union and DiCorp members during the key informant interview

2.4.1.6 Focus Group Discussion

A Focus Group Discussion (FGD) was held with the leaders and members of UNION and Didipio Community Development Corporation (DiCorp) and the Barangay Officials of Barangay Didipio in the Project Area. This was on June 6, 2018 in Barangay Didipio Kasibu, Nueva Vizcaya.

Table 2-27: FGDs Conducted

SECTOR	DATES
Union	June 6, 2018
DiCorp	June 6, 2018
Barangay LGU	June 7, 2018

Photo 2-23: Barangay Officials of Didipio and DiCorp members during the Focus Group Discussion

2.4.2 Baseline Socio-economic Conditions

2.4.2.1 Demographic Profile

2.4.2.1.1 Land Area and Classification

Municipality of Kasibu, Nueva Vizcaya

The Municipality of Kasibu is a 3rd class municipality in the Nueva Vizcaya province. The early inhabitants of Kasibu are traced to the Bugklots or Ilongots, a nomadic tribe occupying the areas of Payupay, Gumiad, Tuguep, Oyao and Manggod, which areas are now under the territorial jurisdiction of the municipality of Dupax del Norte. It was during these years that the term "Kasibu" from the Ilongot dialect denotes a venue where people settle their differences. It was that time, when the Ilongot clans were at war with each other, that persisted for several years until finally the elders of clans, decided to hold a beyao, another Ilongot term (Pronounced buh'zaw), which means a peaceful settlement. They decided to set a permanent meeting place and they called it Kasibu which was situated along the Tubo River, located at the heart of the municipality. This eventually became the name of the town when it separated from Bambang in 1956 to become an independent municipality.

The early 19th century saw the Ilocano tribes settling at the more fertile valleys of Kongkong, Cordon and Macalong. Other minority tribes specifically the Ifugaos, Ibaloi, Kalanguya and other tribes from the Mountain Province followed in the early 50's through a government resettlement program. This wave of settlers occupied the areas of Malabing Valley, Kasibu proper, Alloy and later spreading out to the southern and western barangays of Muta and Kongkong Valleys.

The Commission on National Integration (now National Commission on Indigenous Peoples), a government agency instituted to help alleviate and resettle poor minority tribes to Kasibu. The resettlement program attracted more minority people who after finding gold along the rivers of Kasibu spread the words to their fellowmen. There followed an onrush of migration for gold panning from Ifugao and other provinces flocked to Kasibu up to the 70's and eventually settling in the area. Today, several cultural groups including Ilocanos populated Kasibu.

By virtue of Executive Order No. 59 signed on 01 January 1926 by Governor General Leonard Wood, Kasibu was established as part of the municipal district of Bambang. However, by virtue of a Proclamation issued by Governor Leon Cabarroguis in 1933 the Municipal District of Kasibu was reorganized as a municipal district with Paulino Alhambra as the first elected Municipal District President from 1933 to 1950.

In November 9, 1950, Executive Order 368 signed by President Elpidio Quirino, abolished the municipal district structure in government and reattached Kasibu to Bambang. The very low population caused the abolition as residents started to evacuate and abandon Kasibu due to the presence of dissidents from 1950 to 1955.

In January 9, 1956, when peace and order was restored, President Ramon Magsaysay issued Executive Order No. 160 creating Kasibu as a separate municipality but losing Teguep, Manacgoc, Paangancan and Munguia, all on the eastern side in favor of Dupax del Norte.

Since its creation as a municipal district of Bambang, and or as a municipality up to the 1960's, Kasibu remained a wilderness so to speak. It remained isolated from adjacent municipalities due to the absence of access roads and means of communication. The municipality of Bambang serves as its North entry point and is considered its nearest adjacent municipality. The only means of access between and among its barangays were limited to foot trails and carabao trails, and the means of transporting goods from one place to the other, is by use of "patuki" (a carabao-drawn carriage) or simply hiking.

Note: No other updated data. No updated CLUP and CBMS as of July 2018, existing CLUP is circa 2000. Please refer to perception survey results for sample demographic data of the impact Barangay in Kasibu.

Municipality of Cabarroguis

Cabarroguis is approximately located on the northwestern part of the province of Quirino. It lies on a meridians of approximately 121 degrees 31 minute latitude and 16 degree 25 minutes latitude. It is bounded on the north, northwest and northeast by the municipality of DIffun and Saguday respectively, on the east and southeast by the municipality of Aglipay, on the south by the municipalities of Maddela and Nagtipunan and on the west by the province of Nueva Vizcaya. It is about 12 kilometers from the provincial boundary between Quirino and Isabela at barangays San Antonio, Diffun, Quirino.

The municipality occupied a total land area of 26,902 hectares which is approximately 8.8 percent of the provincial land area. It ranks Fourth of the largest municipality in the province. The area is further distributed into the seventeen (17) barangays comprising the municipality including barangay Didipio which remains to be in the municipality and the province of Nueva Vizcaya and Quirino.

Table 2-28: Names of barangays with the corresponding land areas

Barangays	Land Area (has.)
Urban:	
1. Gundaway	629.6612
2. Zamora	427.1250
3. Mangandingay	500.7266
4. San Marcos	667.7311
Sub-total	2,255.2439
Rural:	
1. Villarose	843.1654
2. Banuar	546.6502
3. Villamor	865.3353
4. Del Pilar	550.1530
5. Villapena	642.1622
6. Burgos	1,288.4090
7. Eden	1,001.8760
8. Gomez	491.8008
9. Dingasan	3,108.0650
10. Calaocan	677.9979
11. Dibibi	3,491.2367
12. Sto. Domingo	299.6062
13. Tucod (including Didipio)	10,869.8230
Sub-total	24,646.7561
Total	**26,902**

2.4.2.1.2 Population and Household Profile

Cabarroguis

Census year 2010 shows that the total population of the Municipality of Cabarroguis is registered at 29,395 which is distributed to the 17 Barangays with Barangay Gundaway as the most populated barangay with a population of 3,884. It was followed by barangay Burgos with a recorded population of 3,583; barangay Mangandingay with 3,404 population; barangay Zamora with 3,082 population: Barangay Dibibi with 2,560 population; barangay San Marcos with 2,276:barangay Villamor with 2,272; Tucod with 1,586 population; barangay Dingasan with 1,189 population; barangay Eden with 1,162 registered population; barangay Calaocan with 740 population: barangay Villarose with 723 population; barangay Villapeňa with 671 population; barangay Sto Domingo with 642 population; barangay Del Pilar with 555 population; barangay Gomez with 538 population and barangay Banuar which registered the least population of 528.

Latest census 2010 as per record displays a household of 6,912 in the municipality, Barangay Gundaway has the biggest number of household of 1,065. With an average family nucleas of the municipality of 4.25 which relays an average head count per family of four and above.

Table 2-29 presents the total population and number of households per municipality and impact barangays.

Table 2-29: Total Population and Household Population by Barangay CY 2010

Barangay	Total Population	Household Population
Urban:		
Gundaway	3,995	1,065
Zamora	3,200	744
Mangandingay	3,606	749
San Marcos	2,394	502
Sub-total	**13,155**	**3,060**
Rural:		
Villarose	706	155
Banuar	558	138
Villamor	2,403	537
Del Pilar	541	139
Villapeña	698	166
Burgos	3,525	842
Eden	1,154	307
Gomez	1,235	227
Dingasan	549	139
Calaocan	837	144
Dibibi	3,028	638
Sto. Domingo	708	163
Tucod (including Didipio)	1,466	257
Sub-total	**17,408**	**3,852**
Total	**30,563**	**6,912**

2.4.2.1.3 Population density

Cabarroguis

Based on NSO records of census year 2000, the overall population density of the municipality was 0.96 persons per hectare; census year 2001 with a municipal population density of 0.98 person per hectare; census year 2002 with a municipal population density of 0.99 persons per hectare census year 2003 with a municipal population density of 1.01 person per hectare and the last years census year 2004 it reveals that the municipal population density of the municipality is 1.03 persons person per hectare. Census 2007 with a municipal population density of 1.04 and census 2010 with a 29,395 population and a population density of 1.092has/head of Records from census year 2000 up to 2010 manifested the continuing increase of density of person within the municipality. The density also shows that the municipality is not thickly populated instead it is predominantly rural in setting. For the population density by Barangay, refer to Table 2-30.

Table 2-30: Population Density

BARANGAY	Area in has.	Population Density/has													
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Urban															
GUNDAWAY	630	6.17	6.27	6.37	6.47	6.57	6.68	6.78	6.89	7.00	7.11	7.23	7.35	7.46	7.58
ZAMORA	427	7.22	7.33	7.45	7.57	7.69	7.81	7.93	8.06	8.19	8.32	8.46	8.59	8.73	8.87
MANGANDINGAY	501	6.80	6.91	7.02	7.13	7.24	7.36	7.48	7.60	7.72	7.84	7.97	8.09	8.22	8.36
SAN MARCOS	668	3.41	3.46	3.52	3.57	3.63	3.69	3.75	3.81	3.87	3.93	4.00	4.06	4.12	4.19
Sub-Total	2,225	5.68	5.77	5.87	5.96	6.06	6.15	6.25	6.35	6.45	6.56	6.66	6.77	6.88	6.99
Rural															
VILLAROSE	843	0.86	0.87	0.88	0.90	0.91	0.93	0.94	0.96	0.97	0.99	1.00	1.02	1.04	1.05
BANUAR	547	0.97	0.98	1.00	1.01	1.03	1.05	1.06	1.08	1.10	1.11	1.13	1.15	1.17	1.19
VILLAMOR	865	2.63	2.67	2.71	2.75	2.80	2.84	2.89	2.93	2.98	3.03	3.08	3.13	3.18	3.23
DEL PILAR	550	1.01	1.03	1.04	1.06	1.07	1.09	1.11	1.13	1.15	1.16	1.18	1.20	1.22	1.24
VILLA PEÑA	642	1.04	1.06	1.08	1.10	1.11	1.13	1.15	1.17	1.19	1.21	1.22	1.24	1.26	1.28
BURGOS	1,288	2.78	2.83	2.87	2.92	2.96	3.01	3.06	3.11	3.16	3.21	3.26	3.31	3.36	3.42
EDEN	1,002	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.43
GOMEZ	492	1.09	1.11	1.13	1.15	1.17	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34
DINGASAN	3,108	0.38	0.39	0.39	0.40	0.41	0.41	0.42	0.43	0.43	0.44	0.45	0.46	0.46	0.47
CALAOCAN	678	1.09	1.11	1.13	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34
DIBIBI	3,492	0.73	0.74	0.76	0.77	0.78	0.79	0.81	0.82	0.83	0.85	0.86	0.87	0.89	0.90
STO DOMINGO	300	2.14	2.18	2.21	2.25	2.28	2.32	2.36	2.39	2.43	2.47	2.51	2.55	2.59	2.63
TUCOD	10,870	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.18	0.18
Sub-Total	24,677	0.68	0.69	0.70	0.71	0.72	0.73	0.75	0.76	0.77	0.78	0.80	0.81	0.82	0.83
Total	**26,902**	**1.09**	**1.11**	**1.13**	**1.15**	**1.16**	**1.18**	**1.20**	**1.22**	**1.24**	**1.26**	**1.28**	**1.30**	**1.32**	**1.34**

Source: National Statistics Office Latest Census data

Annual municipal growth rate: 1.60

2.4.2.1.4 POPULATION GROWTH

Cabarroguis

The trend of population growth in the municipality is evidently increasing. Initially, year 1970 recorded a population of 7,835 person followed by census year 1975 which registered a total population of 12,226 that manifested a growth rate of 9.29%. Another increase of population was observed during census year 1980 which recorded 17,450 displaying a growth rate of 2.2% and for census year 1995, it manifested a 22,812 person displaying a growth rate of 2.25%. Base year of 2000 recorded a total population of 25,832 which manifested a growth rate of 2.25%. As of census year 2007, the population increased to 28,024 which manifested a growth rate of 1.21%.

2.4.2.1.5 GENDER AND AGE PROFILE

Cabarroguis

National Statistics Office census of Population and Housing Census year of 2000 also reveals a total municipal population of 25,832, it was also group into age brackets but not classified like the given records from the Office of the Municipal Agriculturist. Also age-group bracket is from below 1 year old, 1-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and so forth up to 85 years and over. Based on the above age-grouping, also age-group dominates the number of populace of 1,661 population. It is followed by age-group 10-14 with 1,527 population; age-group 15-19 with 1,411 population; age-group 14 with 1,216 population; age-group 20-24 with 1,239; age-group 25-29 with 998 population and so forth following the ascending order of age group from 85 years and over. It further reveals that of the 25,832 of 2000 municipal population male sex dominates with a number of 13,235 while female sex with a number of 12,597. The record also shows a sex ratio of 105 male:100 females.

Census of Population and Housing Census year of 2007 also reveals a total municipal population of 27,901, it was also grouped into age brackets but not classified like the given records from the Office of the Municipal Agriculturist. Based on the above age-grouping, also age-group 10-14 dominates the number of populace of 3,386 population. It further reveals that of the 27,901 of 2007 municipal population male sex dominates with a number of 14,340 while female sex with a number of 13,561. The record also shows a sex ratio of 106 male:100 females.

Table 2-31: Population Distribution by Age and Sex

Ages	Both Sexes	Male	Female	Percent
A. CHILD AND YOUTH				
Under 1	633	312	321	2.27
1-4	2,524	1,326	1,198	9.05
5-9	3,139	1,633	1,506	11.25
10-14	3,386	1,699	1,687	12.14
SubTotal	9,682	4,970	4,712	34.70
B. PRODUCTIVE				
15-19	2,943	1,531	1,412	10.55
20-24	2,450	1,308	1,142	8.78
25-29	2,394	1,531	1,412	8.58
30-34	1,951	1,025	926	6.99
35-39	1,850	962	888	6.63
40-44	1,596	830	766	5.72
45-49	1,426	729	697	5.11
50-54	1,190	590	600	4.27
55-59	824	427	397	2.95
60-64	519	265	254	1.86

Ages	Both Sexes	Male	Female	Percent
Sub Total	17,143	9,198	8,494	61.44
C. DEPENDENT				
65-69	418	196	222	1.50
70-74	291	120	171	1.04
75-79	188	85	103	0.67
80 and over	179	69	110	0.64
Sub Total	1,076	470	606	3.86
Total	**27,901**	**14,638**	**13,812**	**100%**

Source: CLUP-Cabarroguis thru National Statistic Office (NSO) 2007 census

2.4.2.1.6 LITERACY RATE

Cabarroguis

The municipal literacy rate last census year 2000 shows that out of 19,353 population six (6) years old and over, 17,911 are literate while 1,442 are illiterate which reveals that the literacy rate of the municipal populace was 93%. This high literacy rate is most likely the effect of free secondary education program and effective curriculum program as well as computer education to every education level in both urban and rural areas. Also 2007 census reveal 93% are literacy rate, latest Census 2010, 92% are literacy rate.

Table 2-32: Literacy Rate of Municipality of Cabarroguis

AGE GROUP	2000	2007	2010
Population 5 year old & over	19, 353	24, 867	26, 084
Literate	17, 911	23, 014	24,140
Illiterate	1,442	1,853	1,943
Literacy	**93%**	**93%**	**92%**

Source: National Statistics Office (Census on Population and Housing 2010

2.4.2.1.7 IN-MIGRATION

Didipio, Kasibu

Please refer to Perception Survey Results Section, particularly regarding Birth place, and Years of Residency (following section).

2.4.2.1.8 HOUSING OWNERSHIP PROFILE

Cabarroguis

The tabulated tenure status of the housing units shows that there were 5,336 household in occupied housing unit, 4,879 are owned/being amortized, 99 are rented, 243 are being occupied for free with consent of owner and, 9 are being occupied for free without consent of owner and 106 units are not reported as per NSO 2000 data.

Data from NSO 2000 shows that for Cabarroguis of the total number of occupied housing units which is 5,237 units, 5,144 units are of the single type, 46 units are of duplex type and 8 units are multi-unit residential building as stated on Table 2-33.

Data further reveals that of the 5,142 occupied housing unit one household are living in each unit while a units there are two households living in each unit while 4 units, here are 3 household staying in each unit. For an average number of 1:01 units per household. Furthermore, the 5,052 units for the single type of building one household are living in each unit .89 units are occupied by two household and 3 units. There are three household in the single type of building per households of the 46 units in a duplex type of building a total of one household occupy each unit and two units are occupied by two household per unit of one average of 1:04

unit per household while for the multi-unit residential building of the 8 units a total of one household occupy each unit or an average of 1.0 unit per household.

Table 2-33: Occupied housing Units, Households and household Population by Type of Building

Type of Building	Occupied Housing Units	Households	Household Population	Ratio	
				Household to Occupied Housing Units	Household Population to Occupied Housing Units
Single	5,114	5,239	25,318	1.02	4.92
Duplex	48	50	220	1.04	4.58
Multi-Unit Residential	8	8	42	1	5.25
Commercial/ Industrial/	8	10	36	1	4.5
Agricultural					
Institutional Living Quarters	1	1	6	1	6
Other Housing Unit	2	2	5	1	2.5
Not Reported	26	26	187	1	7.19
Total	**5,237**	**5,336**	**25,814**	**1.02**	**4.93**

Source: National Statistics Office (Census on Population and Housing 2007)

NSO data reveals that of the 5,237 occupied housing units 4,118 are made of galvanized iron/aluminum materials, while 17 are made of tile/concrete/clay tile type material while 37 housing unit have need half galvanized iron and half concrete as presented in Table 2-34.

In addition, a total of 39 housing unit are using wood as their construction material, 991 are made of cogon /nipa/ anahaw, while 7 units are using makeshift/salvaged/improvised materials 1 unit using asbestos material and with 21 not reported as shown on Table 2-34.

Table 2-34: Occupied Housing Units by Construction Materials of the Outer Walls and Roof. Municipality of Cabarroguis: 2007

Construction Materials of the Outer Walls and City/Municipality	CONSTRUCTION MATERIALS OF THE ROOF								
	Total Occupied Housing Units	Galvanized Iron/Aluminum	Tile Concrete Clay Tile	Half Galvanized Iron and Half Concrete	Wood	Cogon, Nipa, Anahaw	Make shift, Salvaged Improvised	Asbestos/ Others	Not Reported
Concrete/ Brick/ Stone	1350	1325	9	3	2	11	-	-	-
Wood	2199	1643	3	14	26	511	1	1	-
Half Concrete/ Brick/Stone & Half Wood	750	727	-	12	1	10	-	-	-
Galvanized Iron / Aluminum	49	44	-	2	1	2	-	-	-
Bamboo, Sawali, Cogon, Nipa	774	332	-	6	6	427	3	-	-
Makeshift/ Salvaged/ Improvised Materials	49	18	-	-	2	26	3	-	-
Asbestos/ Glass	1	1	-	-	-	-	-	-	-
Others/ Not Reported	63	27	5	-	1	3	-	-	27
No Walls	2	1	-	-	-	1	-	-	-
Total	**5237**	**4118**	**17**	**37**	**39**	**991**	**7**	**1**	**27**

2.4.2.2 CULTURAL/LIFESTYLE CHANGE

2.4.2.2.1 EXISTING CULTURE AND LIFESTYLE

Didipio, Kasibu

The culture and lifestyle of the community is that of a rural highland farming community, with the residents mostly with Indigenous People roots and background from the Indigenous People in the Cordillera region, particularly the Ifugaos. Thus culture and lifestyle practices adhere mainly to their Indigenous People Background. But with the influx of migrants due to the construction and operation of the OGPI mine, there has been subtle changes, one of which is the use of the Filipino language, which is becoming more used compared to before, wherein the mostly it has been Ilocano, the vernacular language of the region.

Another noticeable change is the increase of number of students going to the tertiary level or higher level of education beyond the secondary due to the improved access brought about by the development of the road system since the existence of the OGPI.

With the increase in income, employment and livelihood of members of the community, there has also been improvement in housing and other household infrastructures, providing a better sense of housing security.

Mobility within and outside of the community, as well as access to communication facilities has also improved and increased, increasing the capacity and potential of interaction of the residents' with those outside of their community and present environment.

As most of the migrants are all employees of the OGPI, they are mostly quartered within the OGPI compound which provides housing and food and other services within their compound for their employees. Thus their proliferation in the community has not been as widespread compared to other formerly relatively remote communities that encounter in-migration and influx of outsiders that mainly dwells and lives in the community and vicinity outside of their work hours.

2.4.2.2.2 DEMOGRAPHIC DATA OF INDIGENOUS PEOPLES

With regards to the specific Data on the Indigenous People present in the Area, there are No Data Available. Please refer to the Perception Survey Results section, particularly in the Ethnic Background item. Though since the majority of the community residents are of Indigenous People Ethnic Background, the other demographic data based on the perception survey may be used as reference. Also refer to section 2.4.2.2.1 Existing Culture and Lifestyle, which presents further discussion also on the Impact of the OGPI on the Indigenous People or particularly Ifugao based culture and lifestyle.

Through primary and secondary data gathering used in this study, albeit there has been no recorded presence of settlement or frequent presence for livelihood, trade, cultural purposes of the Bugkalot in the project area, nevertheless, the relatively vast general area of the location of the OGPI, namely the provinces of Nueva Vizcaya and Quirino and extending to vast portions of Isabela, Aurora, and Nueva Vizcaya has been historically the habitation of the Bugkalot. For this reason, we shall be presenting a discussion on the Bugkalot, as well as their claims to the resources and stewardship of the territories covering the OGPI operations and area coverage.

The "**Bugkalot**" like any other people have an innate pride in their unique culture. Outsiders and lowlanders often wonder why they unashamedly refer to themselves as such. They call their tribe and language "*Bugkalot*" from the root word "Ka-lot" – meaning "interweave" or "interwoven". Their lifestyle is generally interwoven as can be seen in the way they build their houses which must be interwoven with rattan. Their costumes and native attire must also be interwoven with many colorful decorations. Their artifacts too, are traditionally interwoven with rattan or bamboo and other endemic natural materials like feathers, animal fur, etc. The Bugkalot Tribe, more commonly known to lowlanders as "Ilongots", are located in the Northern part of the island of Luzon in the Philippines, primarily in the provinces of Aurora, Nueva Ecija, Nueva Vizcaya, and Quirino. As of this year 2016, it has a population of more or less 15,000.

The original and true tribal name "BUGKALOT" was declared as their official name, when the over-all organization of the Bugkalot clans, '*Bugkalot Confederation*' was organized in 1967. Headed by their former Chieftain Molina Salvador, their elders agreed to use a name that comes from them, instead of '**Ilongot**' which is not from them. Chieftain Molina said, "*Ma Bugkalot siyay ma binangonan si*" – meaning "Bugkalot is a name from us and to which we have awakened". The term '**Ilongot**' came around in the first half of the eighteenth century and is still being used up to this time. Due to the appropriateness of its meaning, it is still being used to call them as it is already recorded in many documents, internet and even in their Certificate of Ancestral Domain Title where they are defined as "Bugkalot/Ilongot", for legal purposes.

The BUGKALOT are traditionally an animistic people with different names for their gods: in the field he is called "***ioma***" (god in the field/farm), in the water "***pi-ngit***", on the ground "***idegin***", in the forest "***igongot***" and others. But notably there is a higher being that they respect the most, they call him "***BINANGONAN***" – existent before they came into being, He is the ONE that has no beginning – the God whom they believe is their Creator. (source: http://bugkalot-tribe.com/about-us/background-beginnings/)

2.4.2.3 Physical Cultural Resources

On November 21, 2003, the National Museum issued a Certification to the project that the Partial DMPF area was inspected for possible archaeological remains by the Archaeological, Cultural and Environmental Consultancy, Inc. The finding was that the area has no visible archaeological resources based on the over-all negative result of the archaeological assessment survey. (OGPI Interim AEPEP for 2018)

Based on the area visit and interviews held in the Community, there has been no declared Physical Cultural resource or Heritage site by prevalent or historical practice. Nevertheless the community, particularly the elders, value the surrounding natural environment with sanctity and reverence, as it is a prevalent and historical value of Indigenous People.

2.4.2.4 Public/Social Services

The list of establishments in Barangay Didipio are:

- Sari-sari stores
- Churches
- Talyer/Repair Shop
- Multi-purpose/Barangay Hall
- Elementary School
- Restaurant/Carinderia

Public / Social services available in direct impact areas are presented in Section 2.4.3 while the following sections discuss the services in indirect impact areas:

2.4.2.4.1 Water supply

Cabarroguis

Of the total households of 5,336, 814 households own, use faucet, community type of water system, while shared faucet community water system totals of 874 household. Those owning, use tubed/piped deep well, a total of 976 households are users, while shared totals to 812 households are users, while shared totals to 783 households for tubed/piped shallow well users, 153 household uses. This is their main source of drinking and cooking while dug well users totals to 659 households a total of 265 use spring latus, rain, river or creeks, peddlers and others.

Table 2-35: Number of Occupied Housing Units by Main Source of Drinking Water. Municipality of Cabarroguis: 2010

Main Source of Drinking Water	Number of Households
Own Use, Faucet, Community Water System	814
Shared Faucet, Community Water System	874
Own Use, Tubed/Piped Deep Well	976
Shared, Tubed/piped Deep Well	812
Tubed/Piped Shallow Well	783
Dug Well	153
Spring, Lake, River, Rain, etc.	659
Peddler	-
Bottled Water	-
Others	265
Total	**5,336**

Source: National Statistics Office (Census on Population and Housing 2010)

Table 2-36: Source of Water Supply. Municipality of Cabarroguis: 2010

Barangay	SOURCE OF WATER SUPPLY		
	Creek or Spring	Individual Water Pumps	Communal Water System
URBAN:			
Gundaway	1	374	LUWA
Zamora	-	624	LUWA
Mangandingay	2	60	BAWASA
Sub-total	3	1,058	3
RURAL:			
San Marcos	1	38	BAWASA
Villarose	4	14	-
Banuar	1	1	-
Villamor	3	10	BAWASA
Del Pilar	2	55	3
Villapena	5	5	2
Burgos	12	71	BAWASA
Eden	7	17	-
Dingasan	34	-	-
Gomez	9	-	-
Calaocan	5	-	-
Dibibi	10	-	BAWASA
Sto. Domingo	1	7	BAWASA
Tucod	6	-	-
Sub-total	100	218	7
Total	**103**	**1,276**	**10**

Source: Primary Survey/LUWA

Table 2-37: Level I System. Municipality of Cabarroguis: 2010

Barangay	Number	Total Number of Household	Household Population Served	
			No.	%
URBAN:				
Gundaway	57	711	119	
Zamora	90	612	154	
Mangandingay	46	637	62	

Barangay	Number	Total Number of Household	Household Population Served	
			No.	%
San Marcos	51	499	86	
Sub-total	244	2459	421	
RURAL:				
Villarose		110	5	
Banuar		99	5	
Villamor	73	455	129	
Del Pilar	1	104	11	
Villapena	1	132	86	
Burgos	66	682	95	
Eden		223		
Dingasan		179		
Gomez		114		
Calaocan		125		
Dibibi	24	577	26	
Sto. Domingo	1	107	13	
Tucod		219	2	
Sub-total	166	3126	372	0
Total	**410**	**5585**	**793**	**0**

Table 2-38: Level II System. Municipality of Cabarroguis: 2010

Location of Water Sources	Location and Number of Pumps	Capacity (liters/ second)	Number of Communal Faucets	Barangay Served	Household Population Served		Household Population Served	
					No	%	No	%
Local Water Utilities Association	Sto. Domingo I	2	42	Gundaway	81	11.39	630	88.61
	Sto. Domingo I	2	85	Zamora	70	11.44	542	88.56
	Sto. Domingo I	2	--	Sto. Domingo	43	40.19	64	59.81
	Capillangan	2	--	--	--	--	--	--
Barangay NAWASA	Mangandingay	2	40	Mangandingay	298	46.78	339	53.22
	San Marcos	2	28	San Marcos	30	6.00	469	94.00
	Villamor	2	51	Villamor	91	20.00	364	80.00
	Burgos	2	38	Burgos	266	39.00	416	61.00
	Dibibi	2	26	Dibibi	22	3.81	555	96.19

Source: LUWA, Cabarroguis, Quirino

Table 2-39: Level III System. Municipality of Cabarroguis: 2010

Barangays	Number	Household Population	Household Population Served	
			Number	%
URBAN:				
Gundaway		711	15	2.11
Zamora		612	14	2.29
Mangandingay		637	24	3.78
San Marcos		499	1	0.20
Sub-total		1,960	53	8.18
RURAL:				
Villarose		110	80	77.73
Banuar		99	-	-
Villamor		455	-	-

Barangays	Number	Household Population	Household Population Served	
			Number	%
Del Pilar		104	2	1.92
Villapena		132	-	-
Burgos		682	399	58.50
Eden		223	71	31.84
Dingasan		179	21	11.74
Gomez		114	114	100.00
Calaocan		125	128	
Dibibi		577	1	0.17
Sto. Domingo		107	-	-
Tucod		219	49	22.37
Sub-total		3,625	919	23.91
Total		**5,582**	**919**	

Source: Primary Survey

2.4.2.4.2 Power Supply

Cabarroguis

The power needs of the municipality is provided by Quirino Electric Cooperative Incorporated (QUIRELCO) with office located at Diffun, Quirino which purchases wholesale power supply from the National Power Corporation (TRANSCO & GENCO).

To date all of the seventeen (17) barangays of which, 4,727 households were energized as of December 31, 2004. Data also reveals that of the 6506 potential households connections 4,727 were connected with electricity on 71% households potentials households to be energized on representing about 29% of the potential households to be served. QUIRELCO has total members of 4,228 households on 64% of the total potential household's connections.

The municipality's first barangays to be energized are barangays Gundaway and San Marcos which were energized on July 15, 1980 and the latest to be energized is barangay Dingasan which was supplied with electricity last December 15, 2004 as presented on Table 2-40.

The table also shows the different municipalities of the Province of Quirino which were energized by QUIRELCO and data reveals that out of the 139 potential barangays, 125 were energized on 83% of the 139 barangays were supplied with electricity.

In addition, data further reveals that Urban households connections served totals to 2177 households and 43 households unserved on a total of 97.3% households served with electricity.

While rural households served totals to 2550 households with 1736 households unserved on 50% of the whole households were energized.

Table 2-40: Number and Types of Consumers Served by Electricity. Municipality of Cabarroguis: 2004

Barangay	Date	Household Connection				
		Potential	Actual	Percent	Member	Percent
Urban:						
1. Gundaway	July 15, 1980	800	795	97.00%	728	90.00%
2. Zamora	October 30, 1980	720	710	97.00%	704	97.00%
3. Mangandingay	July 20, 1980	700	672	100.00%	611	92.00%
Sub-total		2,220	2,177	98.00%	2,043	93.00%
Rural:						

Barangay	Date	Household Connection				
		Potential	Actual	Percent	Member	Percent
1. San Marcos	July 15, 1980	550	546	97%	446	79.00%
2. Villarose	November 15, 1982	116	64	48%	59	43.00%
3. Banuar	October 25, 1984	736	142	19%	122	16.00%
4. Villamor	June 21, 1982	470	464	96%	399	83.00%
5. Del Pilar	October 4, 1984	92	72	74%	67	68.00%
6. Villapena	October 25, 1984	138	57	44%	54	35.00%
7. Burgos	September 29, 1982	711	581	80%	500	68.00%
8. Eden	June 30, 1991	200	106	48%	102	46.00%
9. Dingasan	December 15, 2003	183	19	8%	18	9.00%
10. Gomez	June 3, 1996	103	41	38%	39	36.00%
11. Calaocan	May 5, 1998	113	43	32%	41	30.00%
12. Dibibi	August 23, 1983	455	284	62%	226	49.00%
13. Sto. Domingo	October 25, 1984	151	81	38%	66	35.00%
14. Tucod	December 23, 1991	268	46	18%	46	16.00%
Sub-Total		4,286	2,546	50%	2,185	43.79%
Grand Total		**6,506**	**4,723**	**72%**	**4,228**	**65.00%**

Source: Quirino Electric Cooperative, Inc.

Table 2-41: Electrification Status per Municipality. Municipality of Cabarroguis: 2004

District	Municipality	Number of Barangays			House Connections			Un-energized
		Potential	Actual	%	Potential	Actual	%	Barangays
I	Diffun	33	31	94	9,258	6,656	71	2
II	Cabarroguis	17	17	100	6,506	4,727	72	0
III	Saguday	9	9	100	2,637	2,124	80	0
IV	Aglipay	25	22	88	4,575	3,139	68	3
V	Maddela	32	29	91	7,356	5,512	74	3
VI	Nagtipunan	16	10	63	3,434	1,522	44	6
TOTAL		**132**	**118**	**89**	**33,766**	**23,680**	**70**	**16**

Source: Quirino Electric Cooperative (QUIRELCO)

Table 2-42: Number and Types of Consumers Served by Electricity. Municipality of Cabarroguis: 2004

Barangay	Type of Consumers						
	Residential	Commercial		Public Building	Street Lights	Industrial	Total
		Small	Big				
Urban:							
1. Gundaway	493	86	16	28			623
2. Zamora	326	62	13	10	1		412
3. Mangandingay	506	35	10	12			563
Sub-total	1,325	183	39	50	1	-	1,598
Rural:							
1. San Marcos	229	20	5	21	1	2	278
2. Villarose	59			3			62
3. Banuar	163	12	2	7			184
4. Villamor	256	30	4	6			296
5. Del Pilar	57	4		3			64
6. Villapena	48	3		2			53
7. Burgos	391	34	6	9			440
8. Eden	101	4		3			108
9. Dingasan	27			3			30

Barangay	Type of Consumers						
	Residential	Commercial		Public Building	Street Lights	Industrial	Total
		Small	Big				
10. Gomez	36			1			37
11. Calaocan	44	1	8				53
12. Dibibi	126	27		10			163
13. Sto. Domingo	62	7		3			72
14. Tucod	30	1		3			34
Sub-Total	1,629	143	25	74	1	2	1,874
Grand Total	**2,954**	**326**	**64**	**124**	**2**	**2**	**3,472**

Source: Quirino Electric Cooperative (QUIRELCO)

2.4.2.4.3 Communication

Cabarroguis

The postal needs of the municipality are provided by the Philippine Postal Corporation (PHILPOST) with office located within the municipal compound at Barangay Zamora (Poblacion. It is manned by three (3) postal personnel, headed by the Postmaster and assisted by two (2) postmen. The postal office is equipped with a metered machine, weighing scales, typewriter, mail cabinets, tables and chairs, a vault and mail bags. PHILPOST base at the municipality renders the following services such as delivery of mails and packages/parcels, postal stamps, money order and other postal and other related services.

Data provided by the Postal Office for Calendar Year 2004 as shows on Table 2-43 that a total of 67,275 mails were received and were delivered well and 17 packages were received and delivered for the year. Compared to CY 2003, a total of 61,946 mails were received and delivered while 28 packages are received and also delivered. CY 2002 recorded a total of 65,506 mails or letters that are received and likewise delivered wherein there were 46 packages received and delivered. The highest number or volumes of mails received delivered usually falls on the months of November because of the advent of Christmas season where families with relatives and friends abroad and outside the municipality usually received mails or parcels. For the last three (3) years, the highest volume of mails or letters posted and delivered was recorded within CY 2004 with a total of 67,275 and was followed by CY 2002 with a volume of 65,506 mails and CY 2003 with the least volume of mails or letters compared to the other years. In terms of the number of packages that was been received and delivered for the last three years, Cy 2002 registered 46 packages which recorded the highest volume of transaction within the span of three (3).

Volume of incoming and outgoing mails within the span of three years (2002-2004) shows a fluctuating trend as it revealed a negative annual growth rate of two (2) % from 2002-2003 and a six (6) % positive annual growth rate from 2003-2004.

Table 2-43: Postal Service Facilities. Municipality of Cabarroguis: 2000-2004

Postal Facility		Number				
		2000	2000	2001	2003	2004
1	Post Office	1	1	1	1	1
2	Mail Distribution Center	-	-	-		
3	Mail Boxes	-	-	-		
4	Money Order Machine Issued	180,855.26	171,551.68	182,889.45	173,273.95	175,044.00
5	Stamping Machine 9-meter)	167,921	138,529	108,893	95,174	131,533
6	Postal Stations / Circuits	-				
7	Mail Transport Vehicle (e.g. motorcycle, bicycle, vans, etc.)	1 van	1	1	1	1

Source: Cabarroguis Post Office

Table 2-44: Volume of Transaction for the Last Three Years. Municipality of Cabarroguis

	Types of Services	2002	2003	2004
a	Telegram / telegraph	-	-	-
b	Telex	-	-	-
c	Telegraphic Transfer	-	-	-
d	Letter (Received Posted / Delivered)	65,506	61,546	67,275
e	Packages	46	28	17

Source: Cabarroguis Postal Office

Data from the Office of the Municipal Agriculturist located at Barangay Zamora further revealed that of the seventeen (17) barangays of the municipality, only three (3) barangays are with available source of telephone or landline of which two (2) are found in the urban area which includes barangay Gundaway and Zamora and one (1) is at barangay San Marcos which is a part of the rural area. The availability of mobile phones nowadays as a source of communication of the populace serves most of the barangays wherein four (4) barangays are not with enough and sufficient coverage on any type of communication facility. The said barangays are commonly found in the rural upland areas namely barangay Villarose, Dingasan, Calaocan and Tucod. Data further revealed that of the 26,966 municipal population for year 2004, 22,213 of the populace or an average of 82.13 % are covered and served by mobile cellphones and telephones or landlines of which 8,810 are from the urban barangays 13,403 in the rural barangays while 3,601 or 13. 35 % are with no coverage of any type of communication facility as it was shown on Table 2-45.

Table 2-45: Barangays Covered and Non-covered with Telephone. Municipality of Cabarroguis: 2004

BARANGAYS	With Telephones		With-out Telephones		Remarks
	Number	Population	Number	Population	
URBAN:					
Gundaway	1	3,401	-		Landline/Cellphone
Zamora	1	2,391	-		Landline/Cellphone
Mangandingay	1	3,081	-		Mobile Cellphones
Sub-total	3	8,810	0		
RURAL:					
San Marcos	1	1,922	-		Landline/Cellphone
Villarose	-		1	507	No Cellsite Coverage
Banuar	-	372	-		Mobile Cellphones
Villamor	1	2,173	-		Mobile Cellphones
Del Pilar	1	417	-		Mobile Cellphones
Villapena	1	634	-		Mobile Cellphones
Burgos	1	3,367	-		Mobile Cellphones
Eden	1	946	-		Mobile Cellphones
Dingasan	-		1	1,036	No Cellsite Coverage
Gomez	1	467	-		Mobile Cellphones
Calaocan	-		1	600	No Cellsite Coverage
Dibibi	1	2,434	-		Mobile Cellphones
Sto. Domingo	1	671	-		Mobile Cellphones
Tucod	-		1	1,458	No Cellsite Coverage
Sub-total	10	13,403	4	3,601	Landline/Cellphone
Total	**13**	**22,213**	**4**	**3,601**	**Landline/Cellphone**

Source: Municipal Agriculture Office

Table 2-46: Type of Broadcast Media Available. Municipality of Cabarroguis: 2000

Facilities	Location	Area occupied of the facility	Area Coverage
A. Print Media			
1. Television			
a. GMA Network	San Marcos	1,000 sq.m.	Province-wide

Facilities	Location	Area occupied of the facility	Area Coverage
2.1 Cable TV			
a. Quirino Cable	Zamora	1,000 sq. m.	San Marcos, Zamora, Mangandingay, Balagbag of Diffun, Quirino and selected Barangay of Saguday.

Source: Primary Survey

2.4.2.4.4 Peace and Order

Cabarroguis

Protective Services

Data supported by the Philippines National Police of Cabarroguis shows that its police force is 20 personnel and the PNP is serving a population on 25,832 based on the 2000 NSO data. The Philippine National Police of Cabarroguis is headed by a Police Chief Inspector who is the Chief of Police (COP) and ably assisted by 5 Senior Police Officer IV (SPOIV), 1 Senior Police Office III (SPOIII),2 Senior Police Officer II (SPOII), 4 Senior Police Office I (SPO1), 3 Police Officer III (POIII), 4 Police Officer II (POII). The PNP force is complemented with 132 Barangay Tanod assigned and posted in the various barangays of the municipality. The Philippine National Police of Cabarroguis is located at Barangay Zamora, a part of Poblacion and is situated in one of the municipal compounds occupying a lot area of 1,960 square meters with a building having a floor area of 63 square meters. The 20 Police Force serves a population of 25,832 on a force-population ration of 1: 1,348. In Addition of its headquarters at Barangay Zamora, the PNP Police Force has 1 detachment stations, 1 Police Outpost, 2 Patrol vehicles, various short and long firearms, 1Prison Cell, 3 Communication Facilities, tables, chairs and cabinets.

Servicing the fire protection needs of the municipality is 11 man Bureau of Fire Protection Unit. The Bureau of Fire Protection Unit of Cabarroguis is headed by a Municipal Fire Marshall and assisted by 10 Fire Officers. The Bureau of Fire Protection Unit (BFPU) is located at Barrage Zamora occupying an aggregate land area of 500 square meters with a building having a floor area of 132 square meters. The Bureau of Fire Protection Unit serves a population of 25,832 (NSO, 2000 data) or a force-population ratio of 1:2541. The Fire Protection Unit aside from its building is equipped with one (1) fire truck(s), fire fighting equipments, base radio, tables, chairs, cabinets. Data supplied from the files of the BFPU shows that from CY 2000-2004, a total of 18 fire incidence were reported of which CY 2004 has the largest recorded fire incidence while CY 2002 recorded the lowest and cause of fire were due to the following incidence; two (2) residential and three (3) grassfire incidents.

The Bureau of Jail Management and Penology (BJMP) Unit of Cabarroguis consist of seventeen (17) personnel. The BJMP Unit of the Municipality is headed by a District Jail Warden and assisted by 16 Jail Officers consisting of the Following, one (1) Inspector who act as the District Jail Warden, one (1) Senior Jail Officer IV, three (3)Senior Jail Officer III, two(2) Senior Jail Officer II, one (1) Senior Jail Officer I and one(1) Jail Officer III, three (3) Jail Officer II, five (5) Jail Officer I.The Jail Protection Unit of Cabarroguis is located within the compound of the local Government Unit at Barangay Zamora occupying a lot area of 3,000 square meters with a building and prison cell floor area of 416 square meters. The Force size unit of Caters to a population of 25,832 (NSO data) of a force to population ratio of 1: 1,586.Aside from its Headquarters Building and Prison Cell, the Unit is equipped with 14 short arm and 4 long firearms, 1 vehicle, radio transmitters, tables, chairs and cabinets and other accessories which the BJMP unit is utilizing. Data from the BJMP units shows that a total of 360 criminal offenses were committed within five(5) year period from CY 2000-2004. The total number of prisoners to date CY 2004 is 72 of which crimes committed of offenses are murder, arson, PD 705, rape, homicide, RA 9615, theft, robbery, RA 6425, Acts of Lasciviousness and Illegal Possession of Firearms to name a few.

Table 2-47: Location, Area, Size of Force, Force-Population Ratio Facilities and Equipment. Cabarroguis, Quirino: 2012

Protective Services	Location	Area (sq.m.)
Police Force Headquarters	Zamora	1,960 sqm.
Sub-Stations/	-	-
Stations	-	-
Outpost/s	-	
Traffic Outpost/s	-	-
Fire Protection Headquarters	Zamora	500 sq.m.
Sub-station/	-	-
Stations	-	-
Private Security Agencies &	-	-
Detective services	-	-
Civilian	-	-
Volunteers	-	-
Tanod	All barangays	
Traffic	-	-
Auxillary	-	-
Lupong Pagapamayapa	All barangays	
Military Camps	-	
Outpost in the Municipality & Immediate Vicinity	Gund, Mang, Burgos & Dibibi	
Bureau of Jail Management and Penology	Zamora	416 sq.m.

Crime Incidence

Data taken from the files of PNP-Cabarroguis from CY 2000-2005 reveals that a total of 15 crimes were committed in the municipality and Calendar Year 2000 shows the highest recorded crime incidence rate of 29 percent while the lowest was recorded in CY 2001 with 11 crime reported. In terms of offenses or crimes committed that murder ranks number one (1), while the lowest is rape with 2 recorded.

Table 2-48: Crime Incidence. Municipality of Cabarroguis: 2012

Types of Offenses		Frequency of Occurrence							
		2000	2001	2002	2003	2004	2010	2011	2012
1	Rape	3	-	-	-	2			
2	Murder	11	3	6	4	5			
3	Robbery	7	2	8	4	2			
4	Theft	-	1	-	-	1			
5	Homicide (T.R.)	-	1	4	3	4			
6	Homicide (T.R.)	7	3	3	1	4			
7	Physical Injury	1	1	1	1	-			
8	P.D. 1602	-	-	-	-	4			
9	P.D. 1866	-	-	-	-	-			
10	P.D. 705	-	-	-	-	-			
Total		**29**	**11**	**22**	**13**	**22**			

Source: PNP/LGU

2.4.2.4.5 Education Facilities

Cabarroguis

The municipality of Cabarroguis has a complete educational level wherein there are 4 Private Primary Schools and 23 Public Elementary Schools; 10 Secondary Schools of which 2 are Private School. There are also 2 Tertiary Schools in the municipality, a public and a private school. Majority of the schools are located at urban areas and mostly are government owned. Out of the existing schools within the municipality, there is only one (1) private school for both Primary and Elementary while there is also a private tertiary school for both Secondary and Tertiary Level.

The 27 Elementary Schools occupies a total aggregate area of 58,837.8 hectares. Among those Elementary Schools, only six (6) possess complete school facilities such as shops, library, computer rooms, administration office, comfort room and playgrounds. Others have facilities but limited to shop, comfort room and playground. Textbooks and references are limited to pupils in each school.

There are 140 existing Elementary School buildings within the municipality of which 117 are permanent, 21 semi-permanent and 2 temporary. Out of the total number of school buildings, 120 are found in good condition, 12 are dilapidated and 8 are deteriorating.

Table 2-49: Elementary Enrollments for the Last Two School Years

SCHOOL	SY 2008-2009	SY 2009-2010
1. Ambuklao Elementary School	38	57
2. Banuar Elementary School	62	57
3. Burgos Elementary School	394	397
4. Cabarroguis Central School	689	708
5. Cabarroguis Christian School	88	99
6. Calaocan Integrated School	127	112
7. Dibibi Integrated School	160	160
8. Dingasan Integrated School	117	103
9. Eden Elementary School	164	177
10. Eternal Life Christian Academy	37	39
11. General Luna Elementary School	151	154
12. Gomez Elementary School	90	78
13. Loacan Elementary School	135	123
14. Mangandingay Elementary School	414	409
15. Potia Elementary School	140	117
16. Renaissance Christian School	63	107
17. Saint Mark School	124	115
18. San Marcos Elementary School	361	346
19. Sto. Domingo Elementary School	154	157
20. Tucod Elementary School	164	181
21. Upper Dibibi Elementary School	59	52
22. Upper Dingasan Elementary School	102	79
23. Villamor Elementary School	320	308
24. Villarose Integrated School	120	107
25. Villapena Elementary School	107	105
26. Waterfalls Elementary School	64	60
27. Zamora Elementary School	127	113
TOTAL	**4,290**	**4,200**
Increase/Decrease		*(decrease) 90*

Table 2-50: Secondary Enrollments for the Last Two School Years

SCHOOL	SY 2008-2009	SY 2009-2010
1. Burgos National High School	258	269
2. CNSAT	577	566
3. Calaocan Integrated School	112	105
4. Cagayan Valley Colleges	119	100
5. Dingasan Integrated School	179	152

6. Dibibi Integrated School	235	237
7. Quirino General High School	1,173	1,166
8. Saint Mark School	214	200
9. Tucod National High School	146	138
10. Villarose Integrated School	71	78
TOTAL	**2,751**	**2,711**
Increase/Decrease		*(decrease) 27*

Table 2-51: Tertiary Enrollments for the Last Two School Years

SCHOOL	SY 2008-2009	SY 2009-2010
Quirino Polytechnic College	1,235	1,394
Cagayan Valley College of Quirino		

Table 2-52: Types of Construction and Existing Condition of Building

Type Of Construction Materials	CONDITION							
	GOOD		DILAPIDATED		COMMENDABLE		TOTAL	
	Building	Classroom	Building	Classroom	Building	Classroom	Building	Classroom
Permanent	108	168	6	14	3	5	117	187
Semi-permanent	11	14	6	10	4	7	21	31
Temporary	1	1	0	0	1	1	2	3

2.4.2.4.6 Fire Protection

Cabarroguis

Servicing the fire protection needs of the municipality is a 11-man Bureau of Fire Protection Unit. The Fire Protection shall be responsible for prevention and suppression of all destructive fires on buildings, houses and other structures, forest, land transportation vehicles and equipment, ships or vessels, docked at Piers or Wharves or other similar incidents as well as the enforcement of the Fire Code and other related laws. The Bureau of Fire Protection Unit of Cabarroguis is headed by a Municipal Fire Marshall and assisted by 10 Fire Officers. The Bureau of Fire Protection Unit (BFPU) is located at Barrage Zamora occupying an aggregate land area of 500 square meters with a building having a floor area of 132 square meters. The Bureau of Fire Protection Unit serves a population of 25,832 (NSO, 2000 data) or a force-population ratio of 1:2541. The Fire Protection Unit aside from its building is equipped with one (1) fire truck(s), firefighting equipment, base radio, tables, chairs, cabinets.

2.4.2.4.7 Recreation Facilities

Cabarroguis

Being the seat of the provincial government, Cabarroguis serves as the center of sports activities and cultural presentations during provincial meets, Quirino day even regional meets (CAVRAA) or collegiate sports activities. During those mentioned athletic meets, major sports events are being held in the area such as outdoor ball games, like basketball, softball, baseball, track and field and other related events, Most of the sports events are held at the QUIRINO SPORTS COMPLEX while other events are done in selected schools with adequate space and facilities.

At present, the municipality of Cabarroguis is equipped with sports facilities like gymnasium, athletic field, basketball and volleyball courts.

As of primary survey conducted by the office of the Municipal Development Coordinator, six (6) gymnasium are evident in the municipality which are useful for programs and sports activities, 3 of which are situated among the urban Barangay and 3 are within the rural areas of San Marcos, Burgos and Villamor.

Most of the existing gymnasiums are converted into basketball and volleyball courts of which in the urban areas, the 6 gymnasiums are converted. Into 10 basketball courts, 2 at Barangay Gundaway, 4 at Zamora, and 4 also at Mangandingay.In the rural areas of the municipality, there are 38 basketball courts. With all this data, it just proved the fact that basketball is now considered as one of the major sports facilities aside from the other sports due to the fact that it caught the interest of the populace and most of the schools in the municipality train students to this kind of events in order to avoid them it engage to any kind of criminality so the local government is pursuing and implementing its sports program every year

Volleyball courts are also evident within wherein there are 91 of which 10 are situated in the rural Barangay and 81 are at the rural Barangay for a total of 91 volleyball courts. This proves that there are more volleyball courts than basketball courts for the reason that women are already given the opportunity to engage in sports

There are also 40 existing playground for sports purposes such as athletic and other related sports events. There are 9 evident athletic fields in the areas considering the Quirino Sports Complex and 31 are located in the rural barangays. Almost of the said athletics fields or playground are situated among the schools at the municipality wherein most sports events during sports activities are being held.

At present, the only movie house at the province was no longer in operation for almost more than 10 years. The only park in the municipality is no longer operational due to lack of improvement and fund for its continuing development. Cockpits are no longer advisable in the municipality due to the insistent resistance of the local government in relation to its anti- gambling programs and its efforts against illegal gambling actions.

All billiard halls is also evident but not regular in operation and leisure to male populace specially the youth and young adults to maintain and improved their shooting stamina. This billiard hall is evident in the urban core.

Of the gathered data, a total of 185 major sports and recreational facilities evident in the municipality that caters athletic and cultural activities of the populace and the province as whole of the 185 facilities, 32 are located in urban Barangay and 153 are in the rural Barangay.

Table 2-53: Existing Sports & Recreational facilities. Municipality of Cabarroguis: 2012

BARANGAY	FACILITY			
	Gymnasium	Playground	Basketball Court	Volleyball Court
URBAN:				
Gundaway	1	2	2	2
Zamora	3	5	3	3
Mangandingay	1	2	1	4
San Marcos	3	2	4	4
Sub-total	8	11	10	13
RURAL:				
Villarose	1	1	1	2
Banuar	1	1	1	2
Villamor	1	1	1	2
Del Pilar	1	1	1	2
Villapena	1	2	1	2

BARANGAY	FACILITY			
	Gymnasium	Playground	Basketball Court	Volleyball Court
Burgos	1	2	1	4
Eden	1	1	1	2
Dingasan	1	2	3	3
Gomez	1	1	1	2
Calaocan	1	1	1	2
Dibibi	1	8	1	8
Sto. Domingo	1	1	2	2
Tucod (Didipio)	1	2	3	4
Sub-total	13	24	18	37
Total	**6**	**40**	**48**	**91**

2.4.2.5 PUBLIC HEALTH AND SAFETY

2.4.2.5.1 HEALTH RESOURCES

Cabarroguis

The Rural Health Unit of Cabarroguis is situated at the Municipal Hall Compound, Zamora, Cabarroguis, Quirino. The facility is composed of the following health personnel: One (1) Municipal Health Officer, one (1) Public Health Nurse, one (1) Medical Technologist, one (1) Nutritionist, one (1) Population Officer, seven (7) Regular Midwives, 104 BHW's and 27 BNS which are all trained.

The municipality has seven (7) Barangay Health Station, one Main Health Center located at Barangay Zamora and one (1) Provincial Hospital located at Barangay San Marcos, Cabarroguis, Quirino.

The Rural Health Unit of Cabarroguis rendered services as follows; consultation, maternal health care especially for pregnant women, post partum mothers and lactating mothers, child care given to infants and children given HEPA B vaccine, breastfed infants, children with diarrheal cases, children cases given Vitamin A supplements, Family Planning services, disease control, Sanitation Code, referrals, immunization and medical distribution.

The municipality has registered 449 births for 2010 giving a Crude Birth Rate (CBR) of 14.69%. This shows a decrease from 2009 Crude Birth Rate of 19.22%. In the same year, 10 infants death were registered equivalent to an infant mortality rate of 22.27% out of the recorded 449 live births.

The Crude Death Rate of 2010 is at 4.28% of the 131 recorded death of all causes which manifested an increase of 0.12% from the CDR of 4.16% in 2009 excluding the death from the other municipalities.

Leading Causes of Morbidity and Mortality

The ten (10) leading causes of morbidity for 2010 are upper respiratory tract infection/acute respiratory infection, hypertension, urinary tract infection, skin diseases, iron deficiency syndrome, injury/wound, muscuskeletal problem, diarrhea, asthma and flu.

In 2010 the ten (10) leading causes of mortality were Cardio-vascular Disease, malnutrition, status asthmaticus, diabetes milletus, cancer, myocardial infarction, peptic ulcer, cardio respiratory arrest, blood dyscresia and chronic obstructive pulmonary disease.

Table 2-54: Lists of Health Programs

TYPE OF SERVICES	Number of Person Served	Rate (%)
1.Maternal & Child Health Program		
2.TT2 Immunization (Pregnant Women)	684	64%
3.Post Partum Visit	665	72%
4.Family Planning Program		
a.)New Acceptor	114	9%
b.)Continuing Users	2,367	62%
5.Maternal Tuberculosis Program		
a.)FIC	716	86%
b.)Infants given Hepa B vaccine	641	77%
c.)Infants with diarrhea cases	114	100% actual
6.Disease Control NTP		
a.)Symptomatic & Sputum Exam.	410	100% actual
b.)Treated	34	85%
c.)Retreated	-	
7.Malaria Diseases		
a.)Case Finding	1,119	100% actual
b.)Clinically Diagnosed	0	
c.)Given Treatment	*0*	
8.Anti-Rabies		
a.)Animal Bite Cases Seen	15	100% actual
b.)Given Immunization	0	

2.4.2.5.2 MALNOURISHED CHILDREN

Cabarroguis

Despite of the program/ projects initiated addressed against the nutrition among children populace, data for the past five years of 2000 to 2004 as stated on the table below reveals the presence of malnourished children within the municipality but of minor quantity. Records of year 2000 further reveals that, out of 1,622 children actually weight, 1,352 found to be normal, there are 17 moderately underweight, 205 found to be mildly underweight, 3 are found severely underweight and 45 were found overweight.

For year 2001, there are 2,032 children actually weight and found that there are 1,739 normal children, 5 moderately underweight, 250 mildly underweight, 9 severely underweight and 29 overweight.

Record from the personnel's of the municipal nutrition Committee, as of year 2002, also show that there are 293 actual weight children within the municipality wherein 2,283 were found normal, 34 were moderately underweight, 471 were mildly underweight, 5 were found severely underweight and 120 were overweight.

Year 2003 record reveals that the numbers of children which are actually weighted by the Barangay Nutrition Council in the municipality were 1,500 wherein 1,438 were found to be normal, there was incomplete data on moderately and are mildly underweight children while there was only 1 recorded severely underweight and 61 were found to be overweight.

Base on records as of year 2004 there were 3,555 children populace within the municipality were actually weighted by the BNS and BHW during the Operation Tim bang (OPT). There were found 2,978 normal children, 237 were found to be moderately underweight, children which are found severely underweight, and 44 were recorded to be overweight

Table 2-55: Malnourished Children for the Last Three Years. Cabarroguis, Quirino

DEGREE OF	2010	2011	2012

MALNUTRITION	NO.	NO.	INCREASE/ DECREASE	NO.	INCREASE/ DECREASE
Underweight	169	95		93	
Severely Underweight	15	19		18	
Overweight	25	25		20	
Total					

2.4.2.6 ENVIRONMENTAL HEALTH AND SANITATION

Cabarroguis

Households of the municipality of Cabarroguis is practicing different manners in disposing garbage whether disposable of not, of the 5,336 total households, 3,595 are burning their garbage, 1583 are disposing their garbage in an individual pit, 114 households disposable garbage are being picked-up by garbage truck, 66 buried their garbage, 47 are practicing composting garbage used as fertilizer later, 21 households feed their garbage to animals and 11 households disposed their garbage in such other manners not mentioned.

Households of the municipality as of CY 2004 relate that the populace are using water sealed toilet and open pit. Majority of the populace are using water sealed both owned and shared. Open pit are mostly used by households living in the rural areas.

As to Primary survey conducted by the MPDC office through the Municipal Nutrition Council. Data further stated that out of 5,535 total households for the year, there are 3,695 households using water sealed toilet owned and shared. Wherein 1,710 are in the urban area and 1,985 are in the urban barangays. Non-users of any toilet facility are mostly located in the rural barangays having 111 households.

2.4.2.7 SOCIO-ECONOMIC PROFILE

2.4.2.7.1 MAIN SOURCES OF INCOME

Cabarroguis

Based on Land Use Survey, result shows that the existing agricultural land of Cabarroguis is approximately 5,255.59 hectares of which greater area were devoted to the production of rice. The municipality also produces other crops such as corn, peanuts, fruits and vegetables. However, land areas and number of producers were not determined.

The production yield per hectare was determined by type of crops. Average yield of rice per hectare range from 15,435 MT for irrigated and 691.6 MT for rainfed; Corn yields from 25 MT for white corn and 7,009.2 MT for yellow corn and for different type of fruits 18,300 MT for banana, 252 MT for mango and 64 MT for citrus.

Livestock production existing in the municipality was dominated by Swine with a total production of 3,477 heads which provides the greatest kilograms of meat produced. However, dogs are also catered too but meat production was not encouraged in the municipality.

The municipality has a minimal number of backyard poultry productions. Chicken is commonly the main source of poultry meat in the municipality with a total number of 27,400 heads.

Table 2-56: Backyard Poultry by Barangay

Barangay	Chicken	Duck	Turkey	Geese
Urban:				
Gundaway	1,225	560	27	22
Zamora	1,130	380	12	11
Mangandingay	1,879	1,036	10	12

Barangay	Chicken	Duck	Turkey	Geese
San Marcos	3,501	970	20	0
Sub-total	7,735	2,946	69	45
Rural:				
Villarose	1485	230	0	15
Banuar	449	75	0	1
Villamor	1,050	538	02	9
Del Pilar	137	13	0	0
Villapeña	1,025	232	0	3
Burgos	3,724	958	30	30
Eden	2,032	63	0	0
Gomez	1,843	287	1	9
Dingasan	502	17	2	2
Calaocan	3,840	37	0	0
Dibibi	2,610	104	1	0
Sto. Domingo	729	209	2	10
Tucod (including Didipio)	239	49	1	1
Sub-total	19,665	2,812	39	80
Total	**27,400**	**5,758**	**108**	**125**

Table 2-57: Backyard Livestock by Barangay

Barangay	Carabao	Cattle	Goat	Swine	Sheep
Urban:					
Gundaway	68	32	52	321	0
Zamora	72	45	34	232	0
Mangandingay	71	58	67	243	5
San Marcos	44	35	143	136	4
Sub-total	255	170	296	932	9
Rural:					
Villarose	78	85	102	258	0
Banuar	24	21	42	47	3
Villamor	107	50	130	110	12
Del Pilar	17	8	7	13	0
Villapeña	79	5	70	78	0
Burgos	221	57	184	611	0
Eden	200	0	18	222	0
Gomez	66	1	35	123	0
Dingasan	119	5	43	286	0
Calaocan	99	24	44	140	0
Dibibi	144	23	28	424	0
Sto. Domingo	29	22	16	117	0
Tucod (including Didipio)	100	0	2	116	0
Sub-total	1,283	301	721	116	15
Total	**1,538**	**471**	**1,017**	**3,477**	**24**

Table 2-58: List of Existing Facilities

Facilities	Number
1.Multi-Purpose Pavement (MPDP)	62
2.Mechanical Dryer	1
3. Wheel Tractor	1
4. Hand Tractor	136
5.Rice-Corn Thresher/Sheller	80
6. Baby Cono/Kiskisan	9

Facilities	Number
7. Warehouse	12
Total	**303**

Table 2-59: Agricultural Input Facilities

Facilities	Number	Location	Type/Agency
1.Credit Facilities			
a. Land Bank	1	San Marcos	Government
b. Mallig Plains	1	Gundaway	Private
c. Producers Bank	1	Gundaway	Private
d. Lagawe MPDC	1	Gundaway	Private
e. Kiangan MPDC	1	Gundaway	Private
f. CARD Inc.	1	Gundaway	Private
g. ADVANCE Finance	1	San Marcos	Private
h. Cooperatives	17	All barangays	NGO's
2.Agricultural Input Dealers			
a. Fertilizer Dealers	3	Gundaway	Private
	1	Zamora	Private
b. Farm Tool Dealers	4	Gundaway, Zamora	Private
3.Commercial Establishments			
a. Market Building	1	Gundaway	Public/Gov't.
b. Slaughter House	1	Sto. Domingo	Public/Gov't.
c. Department Store	2	Gundaway	Private
		San Marcos	Government

Table 2-60: Agricultural Land Area and Number of Farmers

Crops	Area (hectares)	Number of Farmers
1.Palay		
Irrigated	1,715	1,600
Rainfed	91	78
2.Corn		
White	10	15
Yellow	2,124	2,029
3.Vegetable		
Squash	20	
Ginger	5	10
Ampalaya	20	50
4.Rootcrops		
Gabi	10	20
Cassava	15	15
5.Fruits		
Banana	1,525	500
Citrus	64	25
Mango	63	37
Papaya	1	1
8.Fishery		
Fishpond	11	210

Table 2-61: Area, Yield and Value of Production of Major Crops

Crops	Area	Cropping Intensity	Average Yield Per Hectare	Total Yield
Rice:				

Crops	Area	Cropping Intensity	Average Yield Per Hectare	Total Yield
Irrigated	1,715.0 has.	2 croppings	4.5 MT	15,435 MT
Rainfed	91.0 has.	2 croppings	3.8 MT	691.6 MT
Corn:				
White	10.0 has.	2 croppings	2.5 MT	25 MT
Yellow	2,124.0 has.	2 croppings	3.3 MT	7,009.2MT
Vegetables:				
Leafy	1.0	once	2.0 MT	2 MT
Ampalaya	20.0	once	10.0 MT	200 MT
Squash	20.0	Once	20.0 MT	400 MT
Root crop:				
Gabi	10.0	Once	5,000.0	20
Ginger	5.0	once	2.0 MT	10
Cassava	15.0	once	20 MT	300
Fruits:				
Mango	63.0	Once	4.0 MT	252 MT
Citrus	64.0	Once	1.0 MT	64 MT
Banana	1,525.0	2 croppings	6.0 MT	18,300 MT
Papaya	1.0	2 croppings	6.00 MT	120.0 MT
Fishery:				
Fishpond	11.0	2 croppings	4.6 MT	96.25

Table 2-62: Number of Agriculture Personnel

Position	Number	Services
Municipal Agricultural Officer	1	Supervisory
Agricultural Technologist	8	Extension
Data Entry Machine Operator	1	Extension

2.4.2.7.2 Social Welfare

Cabarroguis

There are four (4) Social Welfare Staff devolved to the municipality. The Office is composed of a Municipal Social Welfare and Development Officer, Development Officer Aide, and two (2) Social Workers and Permanent Day Care Workers.

The services catered by this agency in support to the needs of the populace in every barangay are: Parent Effectiveness Services, Marriage Counseling, Emergency Relief Assistance, Practical Skills Development, Peer Group Services, Referrals, Education/Youth Assistance, Day Care Services, Self-Employment Assistance, Disabled Person Welfare Program, Women Welfare Program, Children Welfare Program, Elderly Welfare Program and Aid to Individuals in Crisis Situations. These social welfare services are catered to target clientele that are socially, physically, spiritually and economically depressed. Number of clientele however, varied yearly due to variables occurrence of needy populace in the whole municipality.

Aside from social welfare at the urban core and its facilities, there are 22 day care centers and one women center. These day care centers are not evenly distributed to the 17 barangays of the municipality.

Table 2-63: Social Programs

TYPE OF PROGRAM	NUMBER OF CLIENTELE		
	2008	2009	2010
1.Aid to Individual Crisis	342	311	323
2.Referrals	89	639	389

TYPE OF PROGRAM	NUMBER OF CLIENTELE		
	2008	2009	2010
3.Pre-marriage Counseling	97 couples	72 couples	79 couples
4.Emergency Relief	113 families	205 families	2,025 families
5.Day Care Centers	505 preschoolers	485 preschoolers	500 preschoolers
6.Education Assistance	209 students	304 students	210 students
7.Disabled Elderly Person Welfare	1,666	1,016	1,000
8.Self Employment	5		
9.Children In conflict with the Law(CICL)	9	6	8
10.Violence Against Women Cases	24	15	47
11.Womens Welfare	252	250	241
12.Skills Training	60 women		
13.Suplemental Feeding	79	106	85
14.Tindahan Natin Project	19		
15.Youth Forum		1,000 pupils/students	1,000 pupils/students

2.4.2.7.3 Employment rate/profile

No Secondary Data Available. Please refer to Perception Survey Results Section, particularly the item on livelihood, as well as the Section on the Manpower of the OGPI, as well as that of its Contractors DELTA and DiCorp (whose Manpower Data also includes those not directly servicing OGPI).

2.4.2.7.4 Poverty Incidence

No Secondary Data Available. Please refer to the Perception Survey Results, particularly to the item on household income, livelihood, bread winners and land ownership for reference.

2.4.2.7.5 Commercial establishments and activities

Cabarroguis

Commercial activity within the municipality is commonly on retailing, wholesaling and service- oriented. Retail trade dominates the activity with a total of 503 recorded establishments of which 400 are mostly sari-sari stores, 4 gasoline station, 11 drugstores. Majority of the retailers are commonly located in the urban centers.

Table 2-64: Number of Retailers

Location	Sari-sari Store	General Merchandize	Gasoline Station	Drug Store
Urban:				
Gundaway	55	31	3	2
Zamora	41	1	0	1
Mangandingay	57	0	1	1
San Marcos	38	0	0	6
Rural:				
Villarose	13	0	0	0
Banuar	12	0	0	0
Villamor	25	1	0	0
Del Pilar	14	0	0	0
Villapeña	10	0	0	0
Burgos	50	1	0	0
Eden	14	0	0	0
Gomez	5	0	0	0
Dingasan	8	0	0	0
Calaocan	6	0	0	0

Location	Sari-sari Store	General Merchandize	Gasoline Station	Drug Store
Dibibi	33	0	0	0
Sto. Domingo	9	0	0	0
Tucod (including Didipio)	10	0	0	0

Table 2-65: Number of Wholesalers

Location	Warehouse	General Merchandize
Gundaway	3	8
Zamora	1	4
Burgos	2	2
Dibibi	0	0
Mangandingay	2	2
San Marcos	2	6
Villamor	2	2

Table 2-66: Number of Service-Oriented Establishments

Location	Beauty Shops	Restaurant/ Carinderia	Photo Shops	Funeral Parlor
Gundaway	4	10	4	1
Zamora	6	10	2	0
Burgos	1	3	0	0
Dibibi	0	5	0	0
Mangandingay	1	7	1	0
San Marcos	1	8	4	0
Villamor	0	0	0	0

2.4.2.8 TRAFFIC

Cabarroguis

Records on file from the office of the Municipal Planning and Development show that there are 196.70 kilometers of roads traversing the whole municipality with 5 kilometers classified as National Road of which is 100% concrete road surface and has been overlay by asphalt . Provincial roads totals to 26.8 kilometers with 9.8 kilometer concrete, 2km asphalt and 15 kilometers graveled the municipal roads traversing the poblacion totals to 37.99 kilometers of which 4.96 kilometers are concrete, 16.12 kilometers are unpaved or gravel surface, Barangay roads has a total road length of 137.82 kilometers of which 2.19 kilometers are concrete and 64.87 kilometers are gravel surfaced.

Out of the 196.70 kilometers road length recorded, 20.49 kilometers is found concrete, 105.99 kilometers are gravellede and 70.66 are earthfilled.

In addition to the roads, there are bridges interlinking with other Barangay and the urban core and four (4) are RCDG type of bridge two (2) overflow bridge, two bailey bridges, three (3) box culverts and three (3) hanging bridges. These are found in the different Barangay of Cabarroguis.

Land Transportation vehicle traversing in the province particularly in the municipality of Cabarroguis compared to previous years, manifested an increase among the different types of vehicles either for public utility, government or private utility due to the existing conditions of roads which are now improved and made accessible to all types of vehicles. As of CY 2004, there are 5,614 land transport vehicles rendering its services to the province and to the municipality. Out of the 5,614 vehicles, 3,265 of it are privately owned by individuals while 2,200 are public owned and 149 are government use.

Table 2-67: Inventory of Roads, Cabarroguis, Quirino: 2004

Road Name and Administrative Classification	Length (Km.)	ROAD SURFACE							
		Paved				Unpaved			
		Concrete		Asphalt		Gravel		Earthfill	
		Length km	%	Length km	%	Length	%	Length	%
A. National	5	5	100%						
B. Provincial	32.8	7.8	23.78%			25.0	76.22%		
C. City/ Municipality	21.08	4.96	23.53%			16.12	76.47%		
D. Barangay	137.82	2.19	1.59%			64.87	47.07%	70.76	51.34%
Total	196.70	20.49	10.14%			105.99	53.88%	70.76	35.97%

2.4.3 Perception Survey Results

The Perception Survey was conducted in the Barangay Didipio of the proposed project. Number of respondents per sitio/purok is presented in Table 2-68.

Table 2-68: Number of respondents of Perception Survey per sitio/purok in Barangay Didipio

Purok/Sitio	Respondents (n=100)
Centro1	9
Centro2	12
Boulevard	13
Surong	10
Camgat	5
Dinaoyan	1
Dagupan	17
VeronaAnkabo	9
Waterfalls	3
Bacbacan	1
Dupit	10
Trublue	3
Pimadek	7
Total	**100**

2.4.3.1 Demographic Profile of Respondents

2.4.3.1.1 Gender

The respondents were composed of 37% male and 63% female.

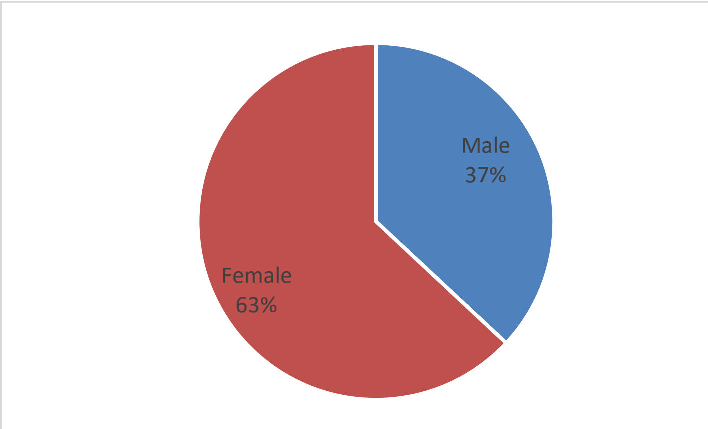

Figure 2-60: Gender of respondents

2.4.3.1.2 Age

Most of the respondents interviewed were in the 20-40 age group (69%); followed by the 41-60 age group (26%); with only 5% belonging to age group of 61-70.

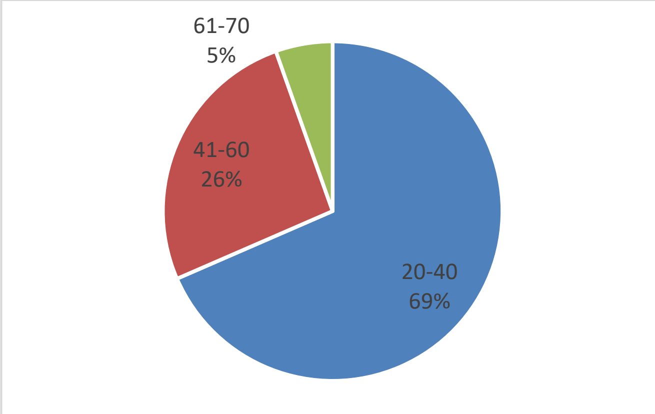

Figure 2-61: Age of the Respondents

2.4.3.1.3 Birth Place

As observed in Figure 2-62, 38% of the people interviewed were born in the barangay they lived in today while 62% are migrants from Luzon.

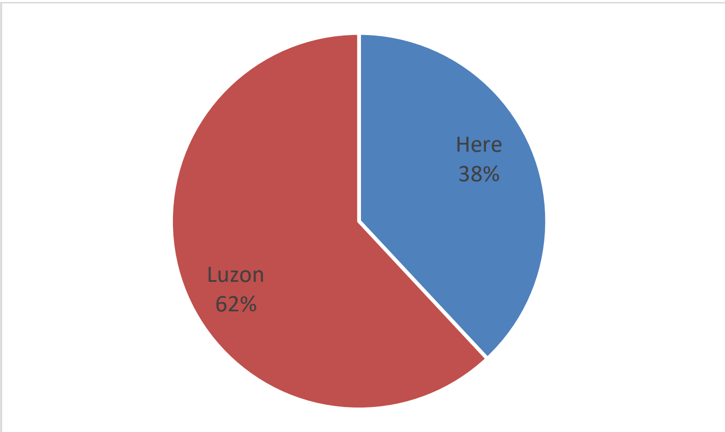

Figure 2-62: Place of Birth of Respondents

2.4.3.1.4 Civil Status

Ninety-three percent (93%) of the total respondents interviewed are married. Four percent (4%) are single and 3% are widowed.

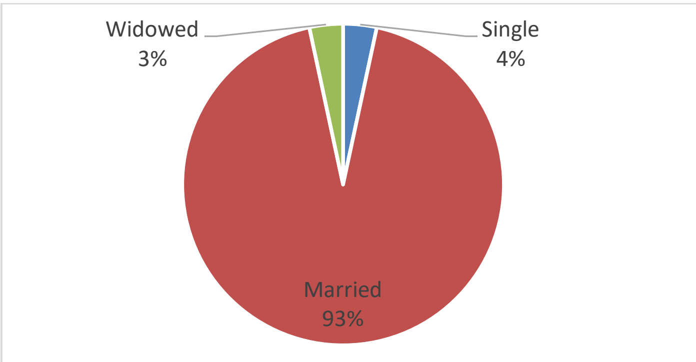

Figure 2-63: Civil Status of Respondents

2.4.3.1.5 Religion

Fifty-four percent (54%) of the total respondents interviewed are Roman Catholic practitioners.

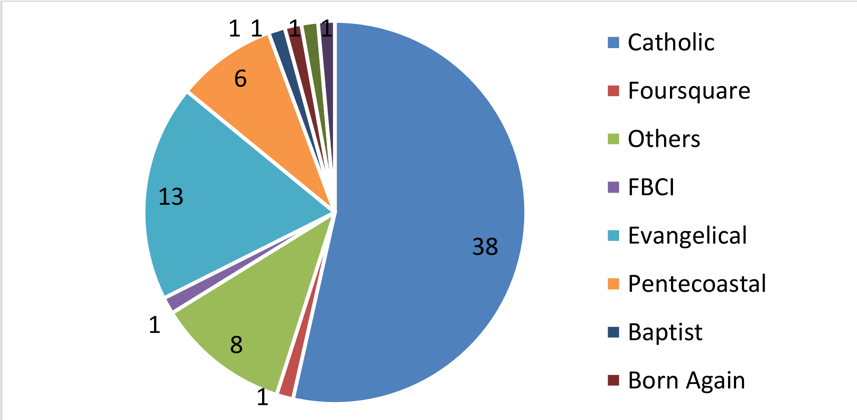

Figure 2-64: Religion of Respondents

2.4.3.1.6 Ethnicity

Ninety-four percent (94%) of the total respondents are Ifugao, 4% are Igorot, 1% are Banaw, and 1% are Kankana-oy.

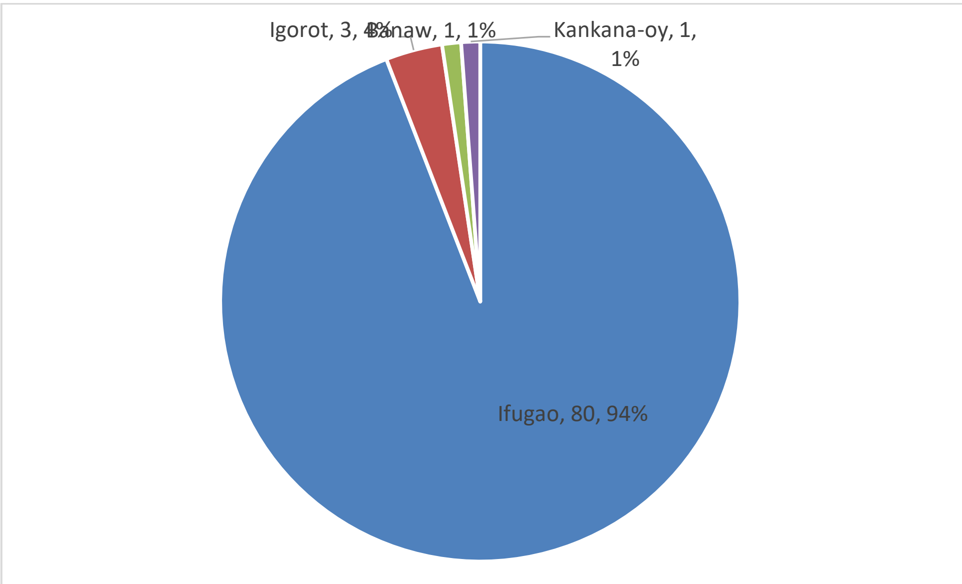

Figure 2-65: Ethnicity of Respondents

2.4.3.1.7 Settlement History

Thirty-six percent (36%) of the total respondents have resided in the Barangay for 1-10 years already. Moreover, approximately 19% of the total respondents have been living in the barangay for 21-30 years.

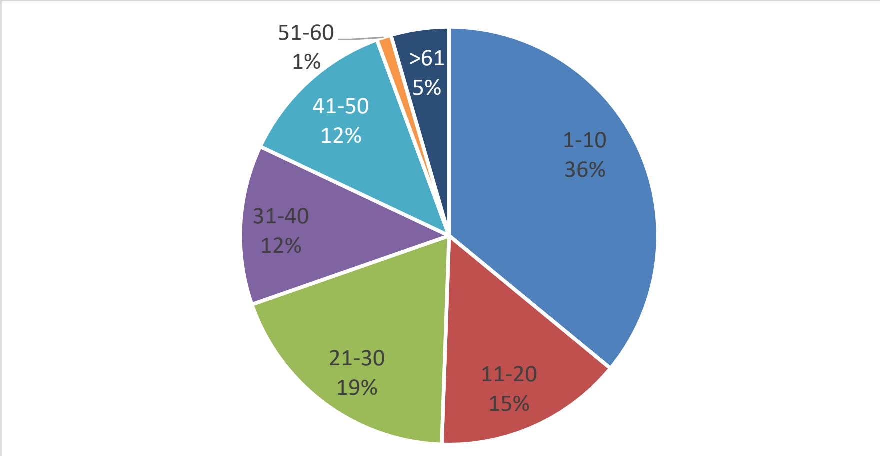

Figure 2-66: Years of Residence in the Barangay

2.4.3.2 Socio-Economic Profile of Respondents

2.4.3.2.1 Income, Livelihood and Employment

The majority primary means of living is from salary work and farming (36%), followed by selling with 12%. On the other hand, 62% of the respondents stated that the husband is the primary earner in the household while 27% has the wife as the primary earner.

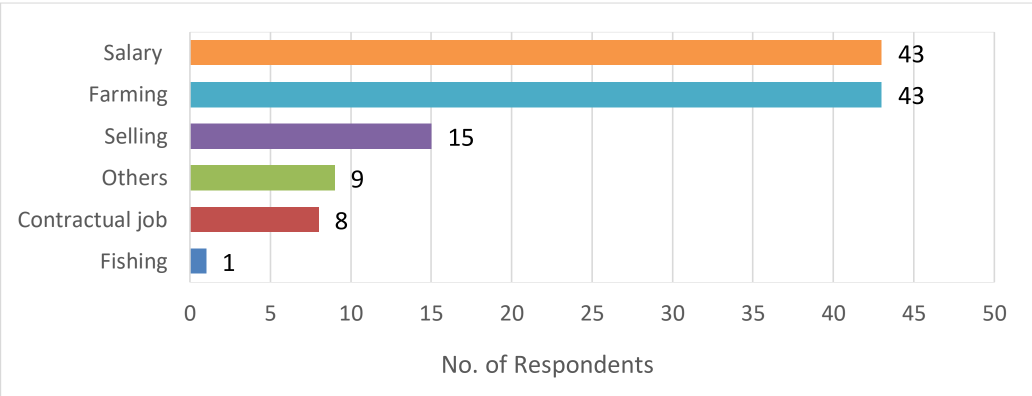

Figure 2-67: Main Source of Livelihood of Respondents (Total Number)

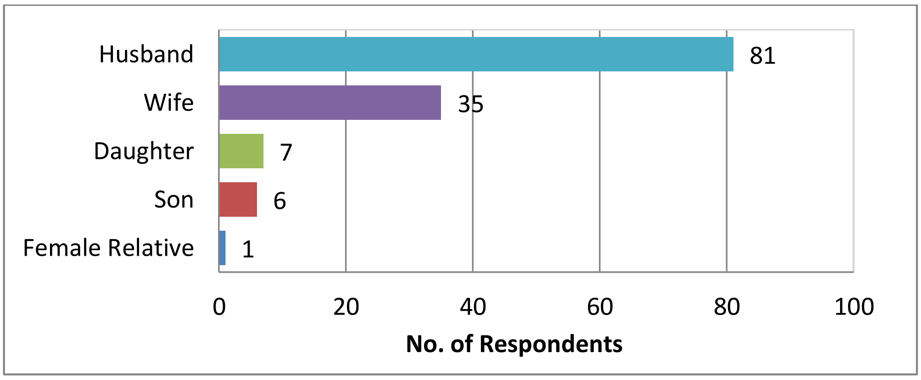

Figure 2-68: Primary earner in the household

The monthly poverty threshold for a family of five, according to NSO, is an average income of P8,022 per month. This amount is enough to cover a single family's basic food and non-food needs. Poverty threshold refers to the minimum income a family or individual must earn in order to be considered "not poor".

In Figure 2-69, it is observed that 8% of the respondents earn at least 1,000 pesos per month and 28% of the respondents earn between 1,000 and 4,999 pesos per month. Moreover, 33% indicated that their monthly income is 5,000 to 9,999 pesos while 32% of the respondents claim that they receive higher than the poverty threshold. Hence, more than 68% of the interviewed respondents are classified as "poor".

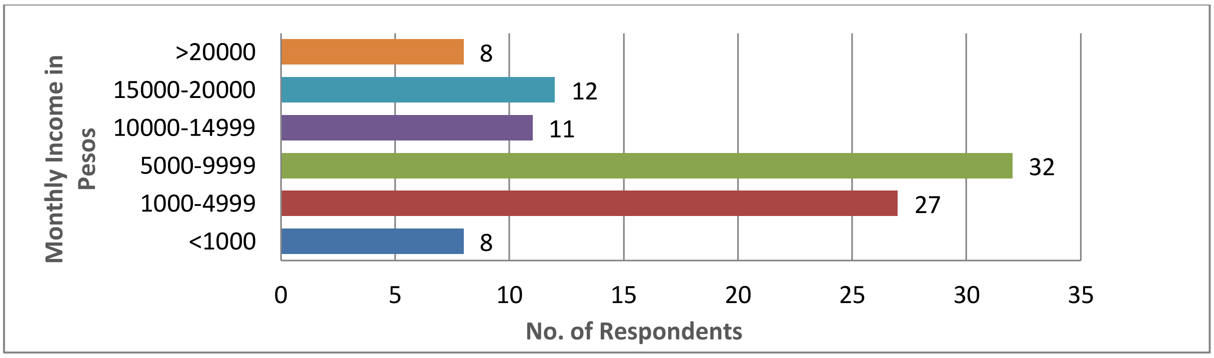

Figure 2-69: Monthly income of respondents

2.4.3.2.2 Housing Condition

Fifty-one percent (51%) own their land, 23% are tenants only, and 10% renting. Sixteen percent (16%) did not indicate their landholding status. On the other hand, 34% of respondents planted rice as well as banana (15%), and vegetables (12%), citrus (10%), root crops (9%), and corn (7%).

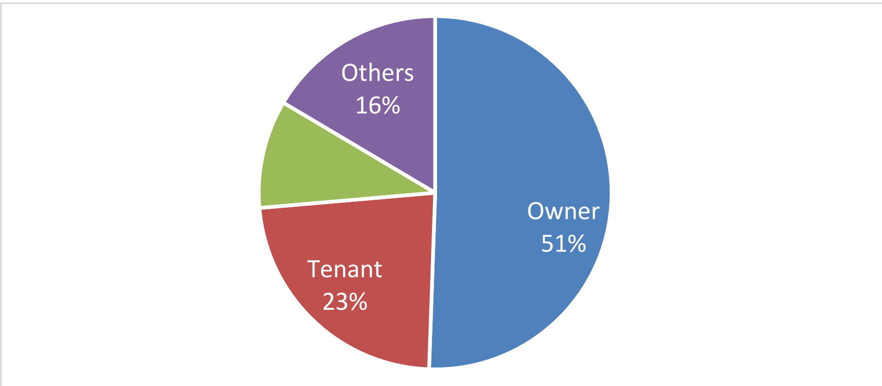

Figure 2-70: Landholding Status of Respondents

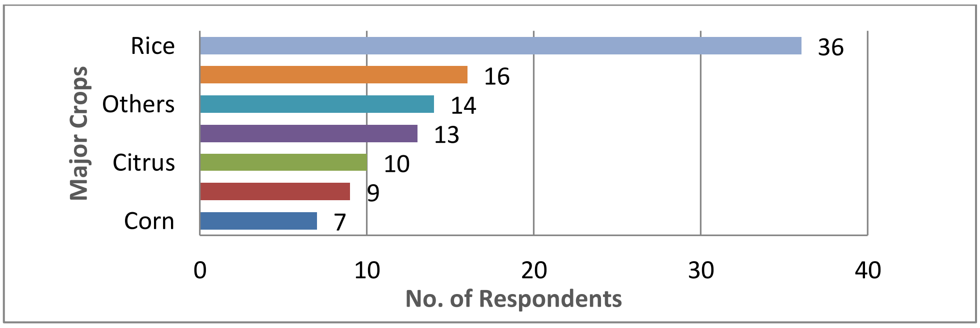

Figure 2-71: Major Crops of Respondents

2.4.3.2.3 Educational Attainment

High School graduates comprise the largest percentage (39%) of the respondents followed by College (25%) and Elementary graduates (25%).

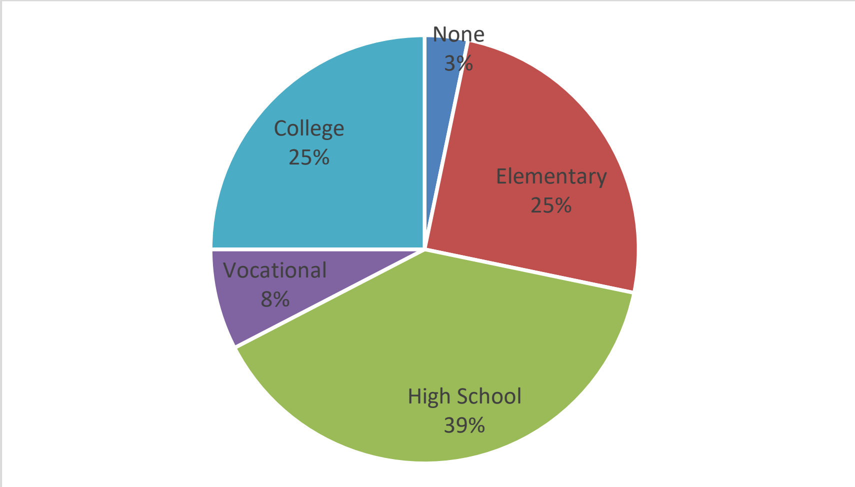

Figure 2-72: Educational attainment of respondents

2.4.3.2.4 Health Profile

For the previous year, 81% of the respondents have at least one of their household members who got ill. Fever and cough combined are the most prevalent in the area with 33% and 32%, respectively. Thirty-seven percent (37%) of the respondents stated that the primary source of treatment for such illnesses in the household was in the nearest Private Clinic and 32% in the nearest health center.

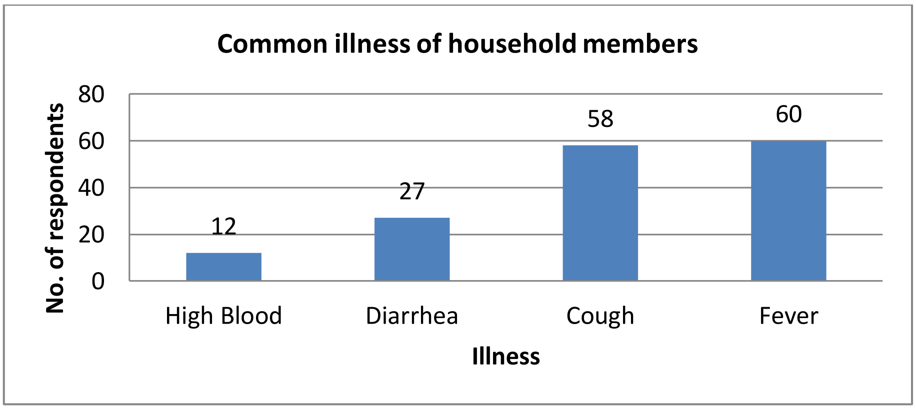

Figure 2-73: Common illness in the barangay

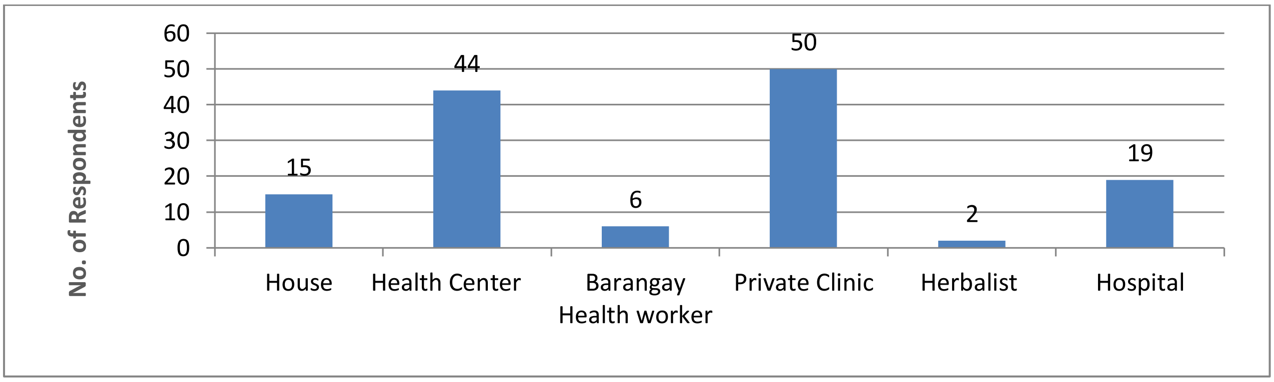

Figure 2-74: Source of treatment for illness of respondents

2.4.3.2.5 Environmental Health and Sanitation

Based on the following figures, 98% of the total number of respondents has access to improved sanitation facilities. Unsanitary practices and facilities may cause diseases and infections that are detrimental to health and might even cause death. Majority (77%) of the respondents have water-sealed toilet.

Moreover, 28% of respondents have access to water supply system while 65% get their water supply from spring.

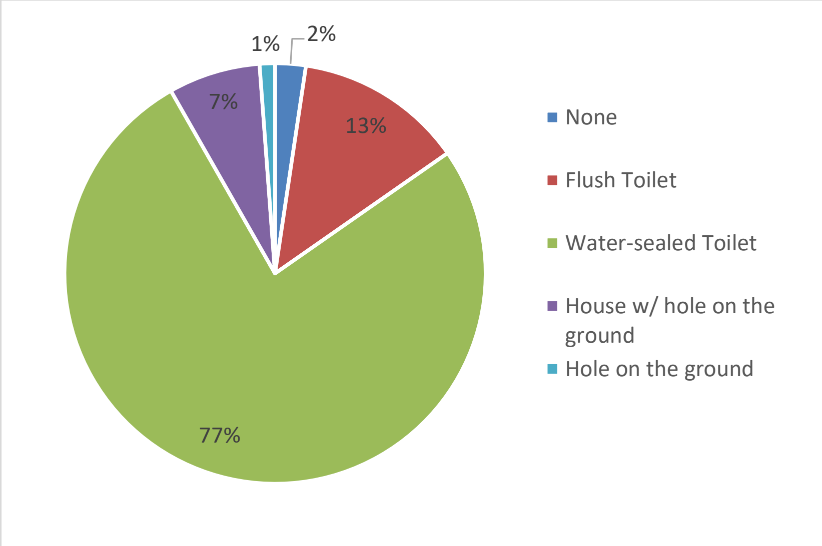

Figure 2-75. Type of toilet facility used by respondents

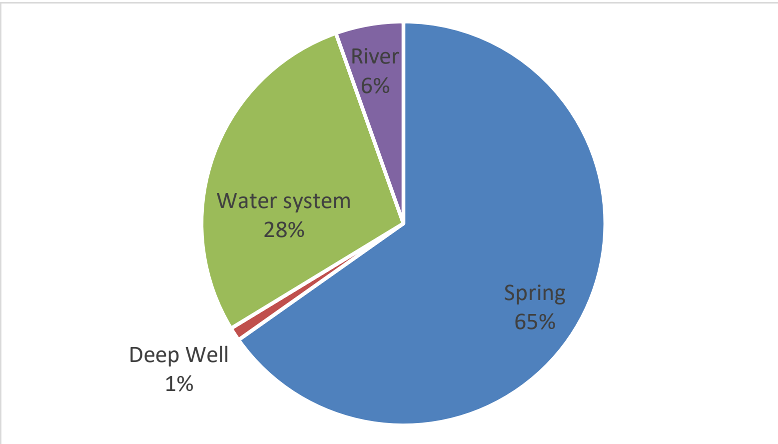

Figure 2-76: Source of water supply

2.4.3.2.6 Disaster Response

All respondents (93%) in the survey areas have experienced typhoon/storm and even earthquakes. They declared that typhoons last from 1 to 3 days. Such calamities have affected properties, environment, food supplies, water supplies and infrastructures.

Thirty-nine percent (39%) of the respondents stated that the level of capability of the community for disasters is adequate, 10% stated it is inadequate, while 51% stated they are not capable during disasters.

In terms of disaster preparation, earthquake drills were performed in schools and disaster risk preparations were conducted for barangay officials.

Lacking equipment/spaces according to the respondents includes:

- Bulldozer
- Rescue /Vehicles
- Box culverts
- Big and wide evacuation center
- Fire trucks
- No doctors
- No waste truck and dumpsite

2.4.3.2.7 Perception

2.4.3.2.7.1 Perceived Community Problems

Forty-one percent (41%) of the total number of respondents stated that cleanliness/sanitation is the biggest problem faced by their community. This is followed by livelihood (15%) in the impact areas, peace and order (14%) and health (14%).

2.4.3.2.7.2 Project Awareness and Acceptability

Seventy-one percent (71%) of the total number of respondents was aware of the proposed project. Most of them knew about the project from the barangay.

2.4.3.2.7.3 Perceived Positive and Negative Impacts of the Project

The respondents' perceive benefits from the proposed expansion project are:

1. Livelihood
2. Land Tax
3. Improvement of roads
4. Improvement of government service
5. Prevent destruction of properties/self-domain
6. SDMP Scholarship
7. Other infrastructures

On the other hand, the perceived negative effects of the project to the community are:

1. Loss of livelihood in fishing, small scale mining, and farming
2. Water loss
3. Water quality affected
4. Damage/destruction or loss of farm/agricultural lands
5. Moral damages
6. Chemicals
7. Air pollution
8. Noise

2.4.4 Results of FGD and KII

Table 2-69: Results of FGD and KII with Representatives of Employees

Issues and Concerns	Company's Response (according to GDG and KII Participants)
Impolite/disrespectful behaviour of some of the Expat Officers towards the local Rank and File.	▫ Investigation and Assessment together with the Union

<table>
<tr><th>Issues and Concerns</th><th>Company's Response (according to GDG and KII Participants)</th></tr>
<tr><td>Ex.
Cursing
Shouting</td><td rowspan="3">▫ Inter-Cultural Management Seminars
▫ Courageous Behavior Campaign
▫ wherein workers are encouraged to assert their rights,
▫ reprimand fellow OGPI personnel no matter which rank and position,
▫ and report undue behaviour to the respective OGPI offices</td></tr>
<tr><td>Occasional inconsiderate work demand
Ex.
Insisting the worker to attend to work even after the worker has been cleared or recommended by the Clinic to stop work and rest, or even after leaves that are pre-scheduled or with advanced notice are already approved</td></tr>
<tr><td>Communication Issues between locals and foreigners
- lack of proficiency of local workers to engage in conversations with the expats, leading to being passive</td></tr>
</table>

2.4.4.1 Results of FGD and KII with Representatives of DiCorp

Issues and Concerns

- Denial of Proposals for OGPI Outsourced Projects

2.4.4.2 Results of FGD and KII with Representatives of LGU

Issues and Concerns

- Threat of non-accomplishments of OGPI commitments to the Community
- Lack of a more Comprehensive discussion of OGPI Operations and the proposed project with the community
- Threat of Increase of Tailings pond Area and Volume
- Threat of Further Forest Cover Denudation due to perceived increase of tailings pond area
- Lack of access and knowledge on the Environmental Monitoring of OGPI particularly the Tailings Pond Area
- Possible contamination of downstream water bodies and system due to the Tailings pond

2.4.5 Issues and Concerns to be Addressed

1. Stakeholders' Understanding of the Project

Even though the respondents of the survey as well as participants of the FGDs and KIIs were aware of the project, they and most of the members of the community, and segments of the OGPI workforce themselves, have very limited to almost no understanding of the project. What is mostly understood by the respondents is that there may be an increase in the area of coverage of the mining operations, either horizontal or vertical, which is not the case. The term "THROUGHPUT" is not easily understood, leading to the aforementioned misunderstanding, misinterpretation and misconceptions about the "Increase in Annual Plant Throughput Rate to 4.3 MTPA" project.

2. Acceleration of decrease of operations workforce

In terms of the projected remaining overall lifespan of the mining operations (14 years or until 2032), there shall be no decrease. But since there shall be an increase in the throughput production, there will be increasing level of decrease in workload as the target input/output is being reached.

3. **Accommodation of Products and Services needed by OGPI that are available and may be provided by segments and sectors in the Community**

4. **Lack of Information of the Community and other Stakeholders with regards to Environmental Monitoring, mitigation, and enhancement reports, activities, programs and practices of OGPI.**

2.4.6 Impact Assessment and Mitigation Measures – People

The impact assessment discussed below and the corresponding mitigation measures being implemented by OGPI are consistent with the duly submitted (to MGB DENR) Interim Annual EPEP for 2018.

The proposed increase in throughput from 3.5 to 4.3 Mtpa will not affect the current status socio-economic condition of the direct and indirect impact areas of the Project. The impacts and mitigations presented below are the impacts of the existing project and it is deemed that with the project modification, the Project will have the same impacts thus the implementation of the same mitigation measures currently being implemented.

2.4.6.1 Potential Social Issues - People

2.4.6.1.1 Employment

The project provides direct and indirect employment and income to the host communities. The direct economic impact of construction to the local community will be significant and will provide employment opportunities to skilled and unskilled members of labor force. On the other hand, the impact of workers' consumer expenditures, which will be derived from their wages as employees, will generate indirect employment in other sectors of the local economy, the immediate sectors being agriculture and retail.

2.4.6.1.2 Migration

The employment opportunities of the project bring in migrants, mostly job-seekers some of whom are accompanied by their families. This employment-driven migration would displace and push aside local job-seekers and even in the short-term, burden existing public services. The anonymous characters and varied backgrounds of migrants would diminish the community cohesion and social control.

Informal settling and non-conforming land uses may be established by migrant who cannot be accommodated by OGPI and who decide to settle while waiting for chances to be employed.

2.4.6.1.3 Local Economy

2.4.6.1.3.1 Life of Mine

The local economy is also expected to expand because of the daily purchases, principally food, supplies, and services. These direct purchases will translate to an expansion of local commerce with corresponding impact on employment in these sectors.

2.4.6.1.3.2 Traffic

There will be increased vehicular traffic of various sizes that would include passenger, personal (most likely motorcycles), and hauling vehicles. There will also be movement of heavy equipment. The risks of accidents, vehicular and pedestrian, would therefore increase.

2.4.6.1.3.3 Physical and Economic Displacement

During the operational phase, there will be minimal physical and economic displacement including minimal disruption of livelihood in areas especially under the FTAA where small scale mining is actively operating.

2.4.6.1.3.4 Health and Safety

Various activities during the operational phase will generate nuisance that may expose and affect workers and even adjacent communities. Chemical exposure to aerosols produced in the operations of the processing plant such as SO_2, NOx, CO, other volatile compounds, metals, etc., may manifest as acute or chronic signs, symptoms, and illnesses. Community exposure, on the other hand, may come from hazards from various environmental pathways which reaches the vulnerable sectors of the population.

There could also be potential spread of microorganisms, infectious diseases, biologically contaminated waste materials due to indiscriminate and improper disposal of biological waste products or by-products potentially contaminated with microbes, and inadequate toilet facilities and access to safe water supply.

There will be potential ergonomic problem for workers because the operations of the mine and the processing plant involve processes that entail transport and machinery operations. Ergonomic problem may arise from poor match between people and machines and other work situations that could cause poor productivity and adverse health conditions, e.g. repetitive strain injury, low back pain.

The project could also cause indirect health impacts, which may include economic dislocation, inadequacy or disruption of social services, community disintegration because of development caused by factors that include in-migration into the community because of availability of work, increasing demand for limited community health resources and other services, increasing criminality and social problems like drugs, alcohol, gambling, and prostitution. These effects on health are indirect but pervasive since it affects all members of the community.

2.4.6.2 Control Strategies - People

2.4.6.2.1 Employment

OGPI announced a list of positions that need to be filled up at various stages of the project life and the skills needed for these positions. A scheme where the first shot at a job is offered to qualified residents of the project-affected communities; after which to other adjacent barangays and municipalities. A skills training program are undertaken to prepare residents to compete in the local job market.

2.4.6.2.2 Migration

A “local first” hiring policy is instituted. This is assumed to lessen the likelihood of massive migration to the project-affected communities, and thereby avoid the stress and competition on local resources, job opportunities, and public services because of newcomers.

2.4.6.2.3 Local Economy

Work processes that could be outsourced to local providers, e.g., local service cooperatives, are identified. Corresponding training and development of local service cooperatives are also undertaken to capacitate the locals to bid, compete, and managed outsourced job contracts / orders.

2.4.6.2.3.1 Traffic

A local traffic management is instituted in coordination with the concerned local government unit to control the traffic flow as necessary. OGPI vehicle operators are equipped with road and equipment safety trainings and protocols prior to deployment to the site. The same induction training is carried out to mine staff and visitors. Traffic signages are strategically installed on roadways.

2.4.6.2.3.2 Physical and Economic Displacement

A compensation package conforming to national laws and international protocols, e.g., Performance Standard No. 5 (Land Acquisition and Involuntary Resettlement) of the International Finance Corporation will be implemented for project-affected persons.

To ensure that the community remains sustainable the DAO 2010-13 imposes the following duties and responsibilities of the mining company on the development of the host and mining communities. These will be taken into consideration in the formulation of livelihood programs to address the economic displacement impact. Details of the program are discussed in the 5-Year Social Development Management Plan (SDMP).

- Coordinate with proper authorities in the provision and implementation of development plans for the host and neighbouring communities;
- Promote community service and volunteerism by encouraging members of the host and neighbouring communities to impart time, knowledge, skills and talents in the development and implementation of community P/P/As as a way of instilling community ownership and achieving a more cohesive and stronger community;
- Help create self-sustaining income generating activities such as, but not limited to, reforestation and production of goods and services needed by the mine and the community. Where traditional self-sustaining income generating activities are identified to be present within the host and/or neighbouring communities, the Contractor/Permit Holder/Lessee shall work with such communities towards the preservation and/or enhancement of such activities; and
- Give preference to qualified Filipino citizens in the hiring of personnel for its mining operations, the majority of which shall originate according to priority from the host and neighbouring communities, the host municipality and province where the mine is located: Provided, That the Contractor/Permit Holder/Lessee shall organize, at its own expense, skills enhancement programs in the absence of the needed skills; Provided, further, that it shall give its firm commitment to skills re-formation and entrepreneurship development for people in the mining communities as an integral part of the mine closure process.

2.4.6.2.3.3 Health and Safety

Various programs, procedures and plans are sustained and updated to address issues related to environment, health, and safety. These include but not limited to the following:

- Various Community Environment, Health and Safety and Social Programs.
- Occupational Safety and Health Program;
- Hazardous Waste Management Program;
- Emergency Response Plan;
- First Aid Training; and
- Solid Waste Management Plan.

The Environment, Safety, and Asset Protection Departments implement and monitor the compliance to such programs, procedures, and plans.

2.4.6.2.4 Information, Education and Communications (IEC) Campaign and Livelihood Seminars/Money Management

The community relations group regularly conducts IEC activities to regularly update the host community and other stakeholders on the project updates of the mine to address fears and anxieties of the stakeholders regarding the project.

To enable the stakeholders to effectively manage the economic benefits of the project and to ensure the benefits are multiplied and sustained beyond mine closure, residents are provided in the form of IECs, information on entrepreneurship, financial management, and planning. These IEC's will enable the stakeholders create opportunities for sustainable livelihood to effectively utilize the benefits of the mine.

2.4.6.2.5 SDMP Implementation

Social Development Management Plan (SDMP) is currently being implemented jointly with the community to address local needs and requirements on a sustainable basis in accordance to the approved plan.

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3 ENVIRONMENTAL MANAGEMENT PLAN

3.1 MITIGATION MEASURES IMPLEMENTED BY OGPI

This chapter presents the appropriate mitigation/management measures being implemented by OGPI for the identified key impacts discussed in Chapter 2 – Assessment of Environmental Impacts.

3.1.1 LAND

3.1.1.1 LAND USE AND CLASSIFICATION

3.1.1.1.1 FINAL LAND USE

The increase in annual mill plant throughput capacity from 3.5 million tons per annum (Mtpa) to 4.3 Mtpa will not cause any changes in terms of the total project area, total project footprint or any other project components such as the mine pit, tailings storage facility (TSF), etc. thus will not affect the existing land use at the project site.

The DENR Administrative Order 1996-40, as amended, states that in the determination of a post-mining land use: *"Minesite decommissioning and rehabilitation shall aim to establish a land use capability that is functional and proximate to the land use prior to the disturbance of the mine area, unless other more beneficial land uses are predetermined and agreed in partnership with local communities and Local Government Units".*

The general intent of the Final Land Use Plan is, at a minimum, to revert the conditions of the land to its general condition before this was mined. However, it is anticipated that key mine facilities such as the Open Pit, Tailings Storage Facility and Waste Rock Stack will permanently change the land use and topography of the area. If the final land use will not be similar to or be reverted to the baseline land use, formulation of a final land use plan in consultation with the LGUs and stakeholders, allows for the determination of a more applicable and beneficial land use achievable for the project site. (OGPI FMRDP, 2015)

At this stage, the concept for waste rock stack rehabilitation is to apply soil and to establish forest species on the completed lift of the waste rock stack. The waste rock stack will be progressively rehabilitated during the life of the project. For the open pit, it will be fenced off and a safety berm will be installed at the top of the pit and will be allowed to fill with water. The pit will become a lake and may eventually be used for domestic and irrigation water supply if the water quality of the impounded water allows for it. Aquaculture can also be one of the potential future uses based on the suggestions during the consultation conducted. The foreseen closure for the TSF at this stage of the project is to create dry beaches and establish a river channel along one edge of the tailings impoundment. These dry beaches will then have top soil added and be available for agriculture or be revegetated with indigenous plants. Another option would be to utilize the inundated area as a water reservoir, maintain the wet cover of the tails, for hydropower as raised during the stakeholder consultation for the final land use. (OGPI FMRDP, 2015)

3.1.1.1.2 VISUAL AESTHETICS

The Waste Rock Stack and the TSF embankment across the Dinauyan Valley are perceived to cause impairment of visual aesthetics in the area. The Company has been progressively rehabilitating the inactive waste dumps, portions of TSF embankment and slopes – North wall and South wall to mitigate visual impacts in accordance with the closure plan for the site.

Upon mine closure, other mine facilities will either be decommissioned and removed from site or be transferred to the community for their use in accordance with the closure plan. Recovering visual amenity is normally a key objective of rehabilitation. Visual amenity is defined by community expectations. The reclamation activities will mimic the process of forest succession whereby the structure and composition of the vegetation will change over time. Permanent changes to visual amenity have been considered. This includes a formation of a lake out of the decommissioned open pit. (OGPI FMRDP, 2015)

3.1.1.1.3 Integrated Waste Management Plan to Mitigate Devaluation of Land

The Company has been implementing its Integrated Waste Management Plan (IWM) to address the proper handling and disposal of wastes generated on site. The Didipio mining and processing activities will generate two major waste streams. Firstly from construction, operations and processing of the mined ore and secondly from what is called ancillary activities to the construction, operation and processing of mined ore. Both waste streams produce small amounts of hazardous wastes which will be disposed of in accordance with standards set by DENR EMB in compliance with R.A. 6969. (OGPI Integrated Waste Management Plan, 2015)

Solid wastes are collected, characterized, and segregated. Biodegradable wastes are utilized as compost material, which is as fertilizer for reforestation projects. Recyclables are kept in the Materials Recovery Facility (MRF) awaiting for disposal to scrap buyers. Residual wastes are disposed in OGPI's on-site sanitary landfill which will be rehabilitated upon mine closure in accordance to the mine closure plan.

Hazardous wastes identified from operations include waste oil, solid wastes contaminated with oil, clinic wastes, chemical contaminated containers, lead batteries, and used fluorescent bulbs. These wastes are temporarily stored in OGPI's hazardous waste storage facility and are collected and disposed of by DENR-accredited hauler and treater. All contaminated containers are decontaminated prior to disposal, while used oil materials are contained in properly labeled steel drums.

3.1.1.2 Geology/Geomorphology

Mitigation control strategies for impacts to the terrain, soils and geology will consist of best engineering design practices, incorporation of best management practices and implementation of a comprehensive rehabilitation program.

3.1.1.2.1 Progressive Rehabilitation

OGPI has been implementing progressive rehabilitation across the mine site even during the onset of construction or as soon as areas become available for rehabilitation. The rehabilitation concept involves application of topsoil on battered slope and planting of native species including those that are abundant locally to reforest these areas. (OGPI AEPEP for 2018)

In the first few years there are limited areas at the site that were available for rehabilitation however there were opportunities for rehabilitation virtually from the start of construction and during operation. This early rehabilitation involves the establishing of a suitable seed bed and planting indigenous species or other species. The recovery of the fertile topsoil as well as proper conservation practices is based on the Top Soil Management Plan which is being implemented to maintain viability of topsoil for use in current and future rehabilitation activities. (OGPI AEPEP for 2018)

Progressive rehabilitation involves reconfiguring the slope into stable angle, benching, covering the slopes with top soil, matting of planting of selected plant species and casting of seeds. Rehabilitated area is being matted with coconet to hold the top soil and minimize erosion. (OGPI AEPEP for 2018)

3.1.1.2.2 Open Pit Design and Engineering Measures

Pit wall stability was reviewed and flatter slope configuration in the earlier studies was adjusted. Within the pit, each bench will be approximately 15 meters high and will have a maximum of 20-meter-high and will have bench slopes of 55 or 75 degrees. The 55 degree slopes will be in the oxide zone and the 75 degree slopes will be below the oxide zone. Each bench will have a berm that is approximately 8-10 meters wide. Design criteria based on geotechnical studies puts the maximum pit wall angles to be at 55 to 75 degrees. This design standard is implemented throughout the development and operations of the pit. Slope failure is mitigated following the approved design mention above, used gabion baskets and rock bolting in applicable areas, berm clean up and continuously monitoring slope movement via IBIS radar, inclinometer, and prisms. (OGPI AEPEP for 2018)

3.1.1.2.3 Seismic Design Criteria for Open Pit, TSF, WRS and General Facilities

The design criteria for all project works are currently rated to ground acceleration in accordance with existing national structural codes (OGPI AEPEP for 2018).

3.1.1.2.4 Slope Stabilization and Engineering Measures for Haul Roads and General Facilities

Preventative slope stabilization techniques are applied in slopes that are highly fractured or weathered, with critical angles of repose, or have the potential to topple. Preventative slope stabilization measures include cutting along slip surfaces, joints, or fractures, and regarding of the slopes to the most stable configuration. Preventative slope measures are particularly important in areas underlain by fractured diorite or highly indurated rocks and slopes along the general access roads, accommodation camp, the TSF, WRS, haul roads and other associated facilities. (OGPI AEPEP for 2018)

The working gradients of 50 to 60 degrees are adopted on slopes whenever appropriate (i.e. diorite and other rocks with high induration). If needed, additional slope control measures will be applied. Slope control measures may include the use of cocomatting or geomembranes for erosion reduction or prevention, use of riprap, gabions, and shotcrete along valleys or slopes that are along more permanent facilities such as the general access roads, and installation of weep holes or horizontal drains for to relieve high pore pressure and aid water drainage in waterlogged areas or fractured slopes. (OGPI AEPEP for 2018)

3.1.1.2.5 Geotechnical and Structural Monitoring

Piezometers are installed near the toe and of the TSF embankment and WRS to monitor movement or slippage during its operation. The use of extensometers is also advised. Physical monitoring such as observation for cracks or fracturing along the embankment, seepages other evidences of erosion or scouring are regularly conducted. If features of erosion, scouring, or potential breach are noted, these will be immediately mitigated and addressed to prevent failure. (OGPI AEPEP for 2018)

3.1.1.2.6 Emergency Response Plan

An Emergency Response Plan (ERP) and SOP for the Dam Safety Emergency Management Plan was formulated to address, and manage emergencies that may result from earthquakes during the project life, chemical or contact water spills, and breach or failure of the key mine facilities such as the open pit and its underground workings, the TSF, and WRD. The ERP also include the installed of warning systems to address potential emergencies such as breach or structural failure or potential overtopping events due to extraordinary flood or rainfall. (OGPI AEPEP for 2018)

3.1.1.2.7 Prevention and Control of Erosion and Sedimentation

Progressive rehabilitation is being conducted to reduce the extent of the disturbed area at any one time and minimize or control erosion and sedimentation. In addition to the rehabilitation activities erosion and sedimentation control in the form of silt traps and sedimentation or stilling ponds will be installed near work and cleared areas to prevent sediments from moving downslope or downstream.

A surface drainage network is also installed on development areas and near the open pit, TSF, and WRD. Drainage networks proximal to the waste storage facilities will prevent generation of additional contact water particularly in the TSF and WRD. Drainage networks will also control surface run-off and prevent these from being transmitted into the mine areas and key facilities to reduce erosion and sedimentation. (OGPI AEPEP for 2018)

3.1.1.2.8 Geomorphologic Change

Identified mitigation for the geomorphologic change includes Implementation of progressive rehabilitation on disturbed areas and implementation of Final Mine rehabilitation and Decommissioning Plan (FMRDP) after LOM. (OGPI AEPEP for 2018)

3.1.1.2.9 Engineering Measures to Prevent Subsurface Collapse

For the development of the underground this year lay-out is planned accounting for a minimum amount of ground support which may include rock bolting, meshing, and shotcrete whenever required. Consideration of the hallowed ground support is also based on industry standards, the rock condition (i.e. fracturing, induration, and weathering), and the blast parameters. The vibration producing activities in the underground workings such as the blasts can be modified to optimal blast requirements while not compromising the integrity of the host rock. This can be achieved through the optimization of the ratio and volume of secondary explosive to ratios just enough to produce muck as dictated by production schedule to prevent destabilization of supporting walls. (OGPI AEPEP for 2018)

Additionally, geotechnical monitoring is being conducted regularly in the underground construction to observe for any manifestations of rockwall weakness such as fractures, cracks, or ingress of water. These observations are vital to immediately address potential problems affecting the integrity of the rockwall and which may signal potential subsurface collapse. (OGPI AEPEP for 2018)

3.1.1.2.10 Breach of Tailings Storage Facility

The TSF has been designed to the highest engineering and construction standards. Regular monitoring is conducted to identify potential signs of failure. In the very unlikely potential event of a failure of the TSF that may cause the release of tailings into the Dinauyan, a plan will be implemented to divert the tailings into the open pit through a short diversion from the Dinauyan River. The open pit can store all the tailings contained in the TSF.

3.1.1.3 Pedology

3.1.1.3.1 Erosion Control

Soil erosion is the process through which the effects of wind, water, or physical action displace soil particles, causing them to be transported. The main factors affecting surface erosion are rainfall erosivity, soil erodibility, slope length, slope steepness, soil cover, and the surface flow condition (i.e. flow type, velocity, duration, and frequency). (OGPI AEPEP for 2018)

Controlling the initial erosion of soil is often the only feasible strategy for minimizing environmental impacts resulting from disturbances of soils with a high clay or silt content. Erosion control measures concentrate on preventing, or at least minimizing, soil erosion, especially erosion resulting from raindrop impact. (OGPI AEPEP for 2018)

3.1.1.3.1.1 Revegetation

This refers to the establishment of temporary or permanent vegetation over exposed soil surfaces. Grasses and vines will be planted to control erosion on disturbed areas that will be inactive for at least six (6) months through seeding or direct planting. Unstable slopes that are highly prone to erosion are to be covered with biodegradable mat or coconet to keep the soil intact and minimize erosion. (OGPI AEPEP for 2018)

3.1.1.3.1.2 Seedling Production

- Mini Nursery at the Mine Site - The mini nursery of OGPI in Didipio serve as the temporary staging area of seedlings used in various revegetation projects at mine site. Collected seeds and wildlings of different endemic plants from the natural forest are propagated and raised in this nursery. Some ornamental plants needed for landscape greening and campsite beautification are also propagated on site.

- Main Nursery in Tucod - Bulk of the seedling requirement of OGPI for mine rehabilitation, tree plantation establishment and seedling donation to various stakeholders come from this nursery.

3.1.1.3.1.3 Erosion Control Blankets

Erosion control blankets are temporary erosion controls that provide cover over exposed soils. It reduces raindrop impacts by providing cover. These controls are commonly used on earth embankments and slopes before and during revegetation phase. Currently, Didipio mine has used and will continue to use cocomats in combination with various revegetation techniques. (OGPI AEPEP for 2018)

3.1.1.3.1.4 Hydroseeding

Hydroseeding was adopted by OGPI to address the problem of soil erosion control and progressive rehabilitation especially for those areas with insufficient soil and rock phases area. (OGPI AEPEP for 2018)

3.1.1.3.1.5 Gravelling or Rock Surfacing

Gravelling is primarily used to control raindrop impact and mud generation, and control of dust on trafficable areas. This method will be used as short-term control and will be maintained regularly (OGPI AEPEP for 2018) .

3.1.1.3.1.6 Surface Roughening

Surface roughening is an erosion control technique of which the benefits can vary significantly from site to site and shall be used on case to case basis (OGPI AEPEP for 2018).

3.1.1.3.1.7 Rock Lining

Similar with erosion control blankets rock lining provides surface cover but primarily used in drainage systems and water ways. The rocks provide a surface that covers and prevents the erodible surface from being washed away. (OGPI AEPEP for 2018)

3.1.1.3.2 Soil Pollution Control

Soil contamination with hydrocarbons, leaks and accidental spills can all be prevented with the use of pollution control measures. During vehicle and equipment maintenance, drip pans are being used. Drip pans are placed underneath equipment and vehicles to catch dripping oil from maintenance works. Collected hydrocarbons such as used oil and lubricants are being placed on storage tanks or bins for waste oil. A DENR-accredited hauler and treater will collect the waste oil. (OGPI AEPEP for 2018)

Spilled hydrocarbons are being collected using industry protocols for oil clean-up. Spilled hydrocarbons are being cleaned using non-toxic dispersants and collected into storage tanks or bins for waste oil. A third-party collector collects the waste oil. In the event of a hydrocarbon spill environmental site assessment is conducted to determine the extent of pollution and appropriate remediation measures are applied. (OGPI AEPEP for 2018)

The volatilization pad is continuously being utilized to cater the contaminated soils and rocks for treatment. Enzymes are used to disintegrate the hydrocarbons in the soils/rocks. Afterwards, the treated soil/rocks will be later introduced to the environment. (OGPI AEPEP for 2018)

Fuel storage tanks are bunded per industry specifications. Bunds may be in the form of concrete or any non-reactive impermeable material. The bunds are sized per 110% of the volume of the largest storage tank in the circuit to ensure effective containment of spilled material in case of a breach or spill. The spilled material is transferred into a waste bin or storage tank for oils. (OGPI AEPEP for 2018)

For process reagents, the Material Safety Data Sheet (MSDS) of the reagents are posted in the work areas to inform employees of the reagents' key properties particularly for corrosion, combustion, or flammability.

Storage tanks for the reagents or process chemicals are designed and rated based on their properties which are also discussed in their respective MSDS. These containers or storage tanks are reinforced depending on the volume of the chemicals that will be stored. The storage tanks or containment units are also bunded per industry specifications. The bunds are in the form of concrete with lining or any non-reactive impermeable material suited to the reagents' properties. The bunds also be sized per 110% of the volume of the largest storage tank or containment unit in the circuit to ensure full containment in case of a spill. In the event of a spill in the process plant, the spilled reagents are reticulated back into the process circuit or pumped to the TSF via a two-stage pump. (OGPI AEPEP for 2018)

A quick response team is formed to address potential chemical leaks or spills outside the process plant or during transit. This team is responsible for the rapid clean-up of chemicals in the event of a spill. An environmental site assessment is conducted after clean-up to determine the extent of pollution in the event of a spill and appropriate site remediation measures that can be applied. (OGPI AEPEP for 2018)

3.1.1.3.3 Soil and Sediment Quality Monitoring

Soil and sediment quality within the vicinity of the key mine facilities such as the process plant, fuel storage, TSF, and WRS are conducted regularly to determine and monitor potential leaks or contamination due to possible breach in containment of transmission of seepage water as for the case of the TSF and WRS. The standards that are being used as references for the soil and sediment quality monitoring will be based on results of the most recent baseline surveys or applicable local and international sediment quality guidelines (SQGs). (OGPI AEPEP for 2018)

3.1.1.4 Terrestrial Flora

OGPI is expected continue the mitigation activities that are being implemented in compliance with conditions of various environmental related permits they acquired (e.g. ECC and Tree cutting permits). Submission of SMR and CMR to DENR and validation of MMT should also be conducted to monitor floral vegetation of the project. To mitigate and further enhance the floral diversity in the area, OGPI is recommended to continue the implementation and maintenance of mitigation measure and monitoring activities. This includes the following:

- Implementation and maintenance of reforestation programs such as the Mining forest Program
- Donation of seedlings for the carbon sink and National Greening Program
- Progressive rehabilitation and re-vegetation of disturbed areas such as slopes
- Maintenance of the nursery for the propagation of seedling of indigenous species for reforestation efforts
- Implementation of conservation programs identified in the EPEP
- Regular annual monitoring of terrestrial flora and fauna in direct and indirect impact areas of the project

3.1.1.5 Terrestrial Fauna

OGPI has been in operation since 2012 and it is likely that fauna species occurring in the area has already adapted to the project activities and have sought refuge to suitable surrounding habitats to limit their exposure to potential project-related risks. By this time, threats to existence, abundance, frequency, distribution, and access of species particularly on endemic and threatened species should have been reduced to the very minimum by implementing mitigation measures. Further, the continuous record of the presence of endemic and threatened species across all studies conducted within and adjacent the project site from 1997 to 2016 only indicates that mitigation measures being implemented are effective. Hence with almost no net change in the project impact areas and activities, it is likely that there will be insignificant to very minimal impact of the proposed project change to the fauna communities.

To mitigate and further enhance the faunal diversity in the area, OGPI is recommended to continue the implementation and maintenance of mitigation measure and monitoring activities. This includes the following:

- Implementation and maintenance of reforestation programs such as the Mining forest Program

- Donation of seedlings for the carbon sink and National Greening Program
- Progressive rehabilitation and re-vegetation of disturbed areas such as slopes
- Maintenance of the nursery for the propagation of seedling of indigenous species for reforestation efforts
- Implementation of conservation programs identified in the EPEP
- Regular annual monitoring of terrestrial flora and fauna in direct and indirect impact areas of the project

3.1.2 WATER

3.1.2.1 HYDROLOGY/ HYDROGEOLOGY

3.1.2.1.1 CHANGE IN DRAINAGE MORPHOLOGY

The proposed project modification will not entail any area expansion and will not involve earthworks that would change the existing drainage system at the project site. Discussed below are the impacts of the current operations and the mitigation measures that are being implemented on site.

- Clean water characterized by natural seeps, creeks or water course within the mine footprint are diverted directly into the major rivers.
- All water from areas disturbed by mining activities (haul roads, stockpiles/waste rock dumps, borrow pits, OP and UG) are directed towards sedimentation ponds before being discharged offsite.
- Ongoing rehabilitation of disturbed areas to minimize erosion, sediment loads and improve runoff water quality reporting to sediment ponds.

Additional mitigation measures that are being implemented on site include progressive rehabilitation of the waste rock stack and of the TSF embankment to reduce surface runoff and erosion. Affected river channels were also lined to prevent scouring and seepage of water into the mine pit. Surface water management systems on site also include sediment ponds, sumps and surface water drains.

TSF is rated and designed per a flood event with ARI of 1:100 or the maximum flood event which will be rated from historical flood and rainfall events. Gauges are installed at the TSF to monitor water levels particularly in periods of prolonged rainfall. An emergency spillway was constructed upstream of the waste rock stack and TSF to allow for flows greater than the normal flow particularly during flood or high rainfall events. The spillway will be sized to account for the Probable Maximum Flood (PMF) with a 15-m base and 2H:1V batter slopes and 1.6 m water depth with freeboard. (OGPI Interim AEPEP for 2018)

3.1.2.1.2 CHANGE IN STREAM WATER DEPTH

Potential changes in stream water depth are currently being mitigated through progressive rehabilitation, implementation of slope control measures such the use of cocomatting or geomembranes for erosion control, implementation of engineering measures such as use of riprap, gabions, and shotcrete along valleys or slopes, installation of silt traps and sedimentation ponds, gravelling of roads, and rock lining of drainage systems and water ways.

3.1.2.1.3 DEPLETION OF WATER RESOURCES / COMPETITION IN WATER USE

OGPI is currently implementing mitigation measures to address project impacts in terms of water supply from surface and groundwater sources in Barangay Didipio. OGPI has a groundwater monitoring program that regularly assesses the depth of the groundwater onsite and installed groundwater monitoring bore near the community to greatly assess if really, the mining activity is affecting the source of community water. Moreover, the company has provided alternative sources of non-potable water from the bores for the community as per the condition in the ECC, particularly in Sitio Dagupan and Sitio Boulevard in Barangay

Didipio. Monitoring of flow rates and water volume abstracted for all pump stations is also being conducted on a daily basis and reported to the NWRB monthly as per the dewatering license requirement.

One of the commitments of the Company is the establishment of Didipio Water Supply System as stipulated in the 2013 Memorandum of Agreement with Barangay Didipio. The provision of alternative water supply to the community is also one of the requirements of the Environmental Compliance Certificate (ECC) as stipulated in the condition no. 6 in which "the proponent shall immediately provide alternative source of potable water to the affective community" in an event that the development/operation activities affects the existing water sources. According to Soriano et. al. (2018), there is currently an existing perception and persisting alleged water losses issues from the community which is claimed to be due to project development and operation. The proposed Water Supply and Distribution System in Barangay Didipio intends to satisfy the MOA and ECC commitments and mitigate existing alleged water loss issues. The water supply project will include the design, permitting, construction, and commissioning of level 3 potable water supply system project for Barangay Didipio, Kasibu, Nueva Viscaya and is designed to supply water to about 816 households.

A detailed water drawdown impact study is being conducted to confirm potential impact of underground and mine operation on nearby communities and on the project water balance. Initial studies suggest that the mining activity is unlikely to affect community water supply. This study will determine of the mining activity is indeed affecting the community water supply (as alleged) or provide information to anticipate potential impact on ground water supply. A water balance study will proceed after this study. (OGPI Interim AEPEP for 2018)

Monitoring of groundwater levels are also done using installed of piezometers at boreholes (installed in 2014) strategically located within the project area. An online PI System was set-up and is currently being used to capture all the data generated from the flow meter devices, this is an upgrade to the conventional manual recording to ensure all records are centralized and logged accurately to the system. (OGPI Interim AEPEP for 2018)

Aside from OGPI's commitment to establish a water supply system to the impact barangay, OGPI also implements water conservation measures through water treatment and recycling, and use of water associated with mine dewatering. One of the objectives of OGPI's Water Management Plan is to reuse and recycle as much water as possible on site. Ground water dewatering bores is expected to be suitable quality for discharge without treatment, and is the main source of water for process makeup, site fire water storage tank, and dust suppression (OGPI Interim AEPEP for 2018). On the other hand, pit dewater, associated with pit wall seepage and rainfall into the pit, is pumped out of the pit into a series of sediment ponds to be used first as make up water for the process plant. Upon meeting the process plant make up water requirement, excess pit dewater is used for dust suppression during dry periods. Excess water is then analyzed to determine suitability for discharge to the Dinauyan River via a series of sediment ponds. (OGPI Interim AEPEP for 2018)

OGPI also installed a facility called Didipio Water Recycling and Purification Plant (DWRAPP) in its sewage treatment plants at the Mine Services Area (STP MSA) to provide further treatment of STP MSA's effluent to a potable water quality via hyperoxidation method by ozonation, light polarization and further water disinfection using Ultraviolet light. At present, the facility is not operating due to some improvements being made to enhance the system. (OGPI Water Management Plan, 2018)

OGPI also utilizes water from the Tailings Storage Facility (TSF) to supply around 79% of the Process Plant's water requirement. In 2017, of the total 6.7 million m^3 of water pumped out of the TSF, 71% was treated in the Water Treatment Plant (WTP), 28% was discharged directly to river and 1% is recycled to the process plant. (OGPI Water Management Plan, 2018)

The Company has committed to improving water recycling to lower the consumption from natural water sources such as the Madadag creek and groundwater production bores. Post commissioning, raw water from natural sources was used to make-up the balance of the plant Process water requirements. In order to reduce requirement on clean water sources for raw water make-up, a second return water line from the TSF to the Process Water Tank (PWT) was installed, this approximately doubled the flow available from the TSF and increased the recycling of Process/Raw water block to 90% (internal plant recycling via the thickeners) and overall recycling effort to 79% (excludes thickener recovery so is a measure of recycling effort external to the plant). A further change was made in 2017 to lower natural water source consumption by piping a portion of the WTP overflow (water normally destined for discharge to the Dinauyan River) to the Mine Dewatering Tank (MDT TK-017) to provide alternative source of water supply in the event of extremely low raw water supply. Production bore MB02 (PB02) also supplies the MDT on a continuous basis. (OGPI Water Management Plan, 2018)

3.1.2.2 Water Quality

The overall approach to water management at the Didipio operation is to minimise discharge from the operating site and direct all dirty surface water flows including any waste rock seepage to a series of settlement ponds to remove TSS before discharge to the Dinauyan River. Water is monitored prior to release to ensure compliance with the DENR's water standards for Class D waterways.

3.1.2.2.1 Acid Mine Drainage Monitoring

High Sulphur rocks coming out of the pit are being monitored. Procedure in ensuring that these are blended with high neutralizing rock if present. To date, this has not occurred and expected not to occur as supported by the 1994 report by Mountford and Wall. If acid mine drainage (acidic water) will be present, it will be mitigated via treatment with neutralizing reagents such as lime, diluted with alkaline water, or collected and pumped to the water treatment plant for treatment. Water quality monitoring are also conducted to monitor potential presence of ARD.

3.1.2.2.2 Mine Dewatering

There are three main sources of water associated with mine dewatering these are:

- Ground water dewatering bores;
- Pit dewater associated with pit wall seepage and rainfall into the pit; and
- Dewatering the underground mine seepage.

Each of these sources will have different environmental impacts and therefore different controls.

Ground water dewatering bores is expected to be suitable quality for discharge without treatment, and is the main source of water for process makeup, site fire water storage tank, and dust suppression.

Pit water, on the other hand, is expected to contain sediment, possibly hydrocarbons and soluble copper and potential conceivably acid from sulfide rock. Pit water are pumped out of the pit flowing into a series of sediment ponds. With the use of coagulating agents, sediment will precipitate faster and any hydrocarbon is skimmed off the water. The water from the pit is used first as make up water for the process plant, water more than this requirement is used for dust suppression during dry periods, other excess water is analyzed for pH, total suspended solids (TSS) and dissolved copper content to determine suitability for discharge. If the water is suitable for discharge the water is discharged to the Dinauyan River via series of sediment ponds.

Dewatering the underground mine seepage is being conducted as the development progresses.

3.1.2.2.3 Tailings Impoundment

Current chemical analyses of the tailings indicate that there are very low concentrations of soluble metals in the tails. The water discharged to the TSF will have an elevated pH. It is necessary to discharge water from the TSF, primarily due to inflows associated with rainfall within the catchment of the TSF. This water is discharged to the Dinauyan River through a decant pumping system and water treatment plant (WTP).

Most the water used on site is recycled from the TSF via floating pontoon mounted pumps to the plant for reuse in the process cycle. A project design water balance was completed in the development stage by Knight Piésold and this was updated by MWES Consulting, covering the range of possible rainfall events. This determined that a net discharge would be necessary in most years and this is managed via the decant system discharging to the processing plant and the water treatment plant.

A water discharge permit is currently held to allow the release of up to 67,462.8 m3 per day of clean water from the decant pond on the surface of the TSF. A water treatment plant with capacity to process > 2,000 m^3 per hour ensures OGPI meets the required discharge standards for the TSF.

In the event of a storm more than the combined capacity of the decant system, the water treatment plant and available storage capacity in the TSF, clean decant water from the TSF can be discharged via a spillway to the Dinauyan River. Permit would cover any such discharge. In practice, OGPI maintains a 5-m freeboard at all times.

The TSF embankment is constructed from rockfill and earthfill that is adequately grouted and lined to allow for minimal movement during seismic events. The TSF base and its embankment is lined with clay sourced from the open pit to inhibit water transmission.

Filter drains are constructed in the embankment and its toe to prevent water transmission. Materials to be used for this are geo-membranes and graded rock to allow minimal water seepage and protection against erosion or scouring. Waste rocks are deposited abutting against the toe of the TSF embankment to strengthen and support it. The TSF embankment is regularly monitored for cracks, movement, or leaks. Problems observed in integrity will be quickly resolved by a delegated geotechnical or engineering group.

A vegetated buffer zone is also established or maintained around the TSF to contain run-off from the surrounding catchment. The buffer zone is planted with locally grown trees and serves as a component of the progressive rehabilitation program. Vegetated buffers are areas of natural or established vegetation maintained to protect the water quality of neighboring areas. Buffer zones slow storm water runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment. Slowing runoff also helps to prevent soil erosion and streambank collapse.

3.1.2.2.4 Tailings Dam Seepage Collectors and Polishing Pond

The TSF development is built as per approved design, were clay and rock fill are used preventing any seepage and water pressure from the TSF. Piezometers were also installed at the TSF wall to monitor any seepage and water pressure.

3.1.2.2.5 Sediment ponds and seepage Collection Dams

Settling ponds are established and maintained to contain settled out solids before the confluence with the Surong River. The discharge criteria must meet the DENR Class D standards. Runoff drainage are also established in appropriate areas.

The flow through drain is constructed and stabilized per the appropriate engineering rating. It is designed such that it can allow 100% passage of the Dinauyan River to the downstream channel to prevent scouring of the WRS. The flow through drain is constructed to encourage the segregation of the waste rock so the large boulders fall first to the base of the drain forming a thick permeable zone for flow to pass through before the general waste rock is stacked above the drain.

3.1.2.2.6 Rock check dams

Primary function of check dams is to control flow velocities within unlined drains. Check dams also trap small quantities of sediment, thus allowing these structures to as both as drainage and sediment control devices.

3.1.2.2.7 Rock filter dam

This control is primarily used within constructed drainage channels. The dam provides both filtration and velocity reduction.

3.1.2.2.8 Sediment fence

Sediment fence are primarily used to collect coarse sediment. Treatment is primarily achieved through gravity-induced settlement resulting from the temporarily ponding of sediment-laden water up-slope of the fence. Filtration is only a secondary function of the fence.

3.1.2.2.9 Sewage Treatment

All sewage produced on site is currently treated in the activated sludge sewage treatment plant. This plant is a modular design with four separate modules each capable of treating the waste from camp accommodation. Sewage is generally piped to the sewage treatment plant. Sewage from isolated locations like guard posts are stored in holding tanks and transported to the sewage treatment plant by tanker on a regular basis. All sewage generated on the mine site is treated in the sewage treatment plant. Existing septic tanks will be either be decommissioned or used as pump out storage tanks when at isolated locations.

Sludge from the sewage treatment plant is hauled out and treated by a sewage sludge third party contractor.

Potential other means for sludge management will be either via landfilling or dewatered sludge use as a soil conditioner. A lime may need to be added if the sludge is to be used as a soil conditioner to suppress odor and biological activity. Management of sewage sludge will be strictly in accordance with RA 9275 Philippine Clean Water Act of 2004 IRR DENR No. 2005-10 Sec.3 Rule 3 item 3.1.

Screenings from the sewage treatment plant are unsuitable for any use and disposed of to an on-site landfill.

For 2017, it is planned to tap the STP water and soon the WTP water to be a domestic water source inside the camp. Another treatment line is installed at the STP as a pilot study facility to further treat its effluents.

3.1.2.2.10 Waste Rock Storage Management

Waste rocks are stacked per engineering guidelines for minimal water transmission. Also, waste rocks are isolated from non-reactive rocks and soil. A detailed net acid production potential (NAPP) and acid-base account (ABA) for the waste rocks at different alteration types and depths of extraction to determine the possibility of acid generation is continuously being monitored in the water quality monitoring program.

3.1.2.3 Freshwater Ecology

To mitigate and further support the aquatic communities in the area, OGPI is recommended to continue the implementation and maintenance of mitigation measure and monitoring activities, which include but not limited to the following:

- Implementation and maintenance of bank stabilization and erosion control measures (e.g. siltation/sedimentation ponds)
- Progressive rehabilitation and re-vegetation of disturbed areas such as slopes
- Implementation of water treatment plant and proper management of wastewater
- Implementation of proper solid (e.g. maintenance of sanitary landfill) and hazardous waste management
- Implementation of conservation programs identified in the EPEP
- Regular annual monitoring of freshwater ecology in direct and indirect impact areas of the project

3.1.3 Air

3.1.3.1 Air Quality

3.1.3.1.1 Dust Suppression

Dusts from each of the identified sources are suppressed using water sprays. Haul and other roads are watered with a water cart. Water sprays are employed to suppress the dust on the crusher or conveyor. Dust from drilling activities is controlled by using water sprays, and shielding as appropriate.

3.1.3.1.2 Maintenance and Emission Monitoring for the Generator Sets (Power Station)

Emissions from the power station are controlled by the manufacturer design and regular maintenance of the generator sets. The sets are low emission by design and the fuel is Philippines Standard Diesel which will further reduce particulate and sulfur dioxide emissions.

This year OGPI will continue the Annual Air Stack Ambient Monitoring from its power sources. A local laboratory will be hired to do the task. This activity will be monitored by the EMB-Region 2 personnel.

3.1.3.1.3 Maintenance and Emission Monitoring for the Sewage Treatment Plant

Odor from the sewage treatment plants (STPs) are minimized by ensuring that the plants are maintained in good working condition, and operated are by trained personnel. Regular maintenance is conducted to ensure that diffusers and blowers remain efficient in supplying aeration to the sewage loads to hasten bacterial digestion of organics. The plant also has chlorination process to lower down harmful bacteria in the effluent.

To mitigate odor emission, an enclosure system with carbon filter on the surge tank of the STP is installed.

Another treatment line was installed to tap the sewage treatment plant as a source of potable water.

3.1.3.1.4 Control of Dust from Vehicle Movement

OGPI and contractor’s vehicles are required to slowdown when significant dust emission is generated while travelling on the road. Speed humps are installed and maintained near residential areas to ensure vehicles will slow down at sensitive areas. Water carts are used to sprinkle water to reduce dust dispersion.

Signages are established in Km 0 and Km 22 to remind drivers to slow down. Likewise, tarpaulin is set up at Total Cabarroguis to serve as an IEC material.

3.1.3.1.5 Establish Carbon Sink Plantation Areas

Carbon sink tree plantation areas are established to offset carbon emission from the project. These areas include those under the National Greening Program (NGP), reforestation on site Adopt-a-Mining Forest Program and other new plantation areas.

3.1.3.1.6 Greenhouse Management Plan

A project greenhouse gas and energy management plan (GHGEMP) was developed to provide details on carbon emission reduction programs being implemented on site. Part of the program is the reduction of greenhouse gas emission from reduced use of engine driven power generator sets by connecting to the power grid through the Nueva Vizcaya Electric Cooperative (NUVELCO) which was already established. The site also maintains effective maintenance of equipment to ensure efficient operation and correspondingly reduce unnecessary carbon emissions from inefficient running of equipment.

3.1.3.1.7 Use of Biodiesel

The diesel fuel use in the project site is 2% Coco Methyl Ester (CME) which is classified as bio fuel (Biodiesel). Studies revealed that utilization of biodiesel or biodiesel blends can reduce carbon emissions approximately equivalent to the percentage of biodiesel in the blend.

3.1.3.2 Noise Control Strategies

3.1.3.2.1 Restriction of Hours of Activity

The mine operates on a 7-day per week, 24-hour per day basis. Restriction has been placed on rock breaking activities near the crusher during the night shift. Wherever possible, hauling to the ROM pad is done during daylight hours since dumping on the ROM pad has been identified as the greatest source of noise in the neighbouring community.

3.1.3.2.2 Equipment and Vehicle Maintenance

All equipment and vehicles used on site are required to be fitted with manufacture approved exhaust systems and the exhaust systems are being maintained in good condition.

3.1.3.2.3 Construction of Sound Barriers

Should noise from the process plant adversely impact on the community, noise barriers are erected close to the main noise source or the affected community to minimise the impact to the community.

The crusher is mainly buried in the ROM pad and therefore the community is shielded from crusher noise by the ROM pad and stockpile. Still, there will be scheduled improvements in shielding noise in this area by further increasing the height of surrounding buffers/bund walls. This will be made possible through elevating the road surrounding the crusher eventually encapsulating the equipment within a cove and burying it deep in the landscape. Additional bio-solutions are established tree lines along the periphery of the landscape enhance noise abatement.

The generator sets are housed within clad containers and the exhausts are fitted with appropriate silencers to reduce noise. Exhaust noise is not expected to have a significant impact on the community. Should mechanical noise from the generator sets cause excessive noise in the community, additional cladding will be added to the containers to reduce the noise. Tree lines are also being established in applicable areas to serve as sound barriers.

3.1.3.2.4 Others

Noise from the power station is controlled using manufacturer specified exhaust systems and the power station building is clad. If noise from the power station is adversely impacting the community, further cladding will be added to the building.

All vehicles used on site comply with manufacturers standards for noise control to minimize the noise impact associated with their use. All vehicles directly associated with site which use the access road are required to be maintained in good working order. Vehicle speed restrictions are applicable to all vehicles on site. This control minimizes the noise impacts on the community. Where practical, vehicles access to site will be restricted during work hours of the day up to early evening so as not to disturb the communities along the general access road.

3.1.4 People

3.1.4.1 Control Strategies - People

3.1.4.1.1 Employment

OGPI announced a list of positions that need to be filled up at various stages of the project life and the skills needed for these positions. A scheme where the first shot at a job is offered to qualified residents of the project-affected communities; after which to other adjacent barangays and municipalities. A skills training program are undertaken to prepare residents to compete in the local job market.

3.1.4.1.2 Migration

A “local first” hiring policy is instituted. This is assumed to lessen the likelihood of massive migration to the project-affected communities, and thereby avoid the stress and competition on local resources, job opportunities, and public services because of newcomers.

3.1.4.1.3 Local Economy

Work processes that could be outsourced to local providers, e.g., local service cooperatives, are identified. Corresponding training and development of local service cooperatives are also undertaken to capacitate the locals to bid, compete, and managed outsourced job contracts / orders.

3.1.4.1.3.1 Traffic

A local traffic management is instituted in coordination with the concerned local government unit to control the traffic flow as necessary. OGPI vehicle operators are equipped with road and equipment safety trainings and protocols prior to deployment to the site. The same induction training is carried out to mine staff and visitors. Traffic signages are strategically installed on roadways.

3.1.4.1.3.2 Physical and Economic Displacement

A compensation package conforming to national laws and international protocols, e.g., Performance Standard No. 5 (Land Acquisition and Involuntary Resettlement) of the International Finance Corporation will be implemented for project-affected persons.

To ensure that the community remains sustainable the DAO 2010-13 imposes the following duties and responsibilities of the mining company on the development of the host and mining communities**.** These will be taken into consideration in the formulation of livelihood programs to address the economic displacement impact. Details of the program are discussed in the 5-Year Social Development Management Plan (SDMP).

- Coordinate with proper authorities in the provision and implementation of development plans for the host and neighbouring communities;
- Promote community service and volunteerism by encouraging members of the host and neighbouring communities to impart time, knowledge, skills and talents in the development and implementation of community P/P/As as a way of instilling community ownership and achieving a more cohesive and stronger community;
- Help create self-sustaining income generating activities such as, but not limited to, reforestation and production of goods and services needed by the mine and the community. Where traditional self-sustaining income generating activities are identified to be present within the host and/or neighbouring communities, the Contractor/Permit Holder/Lessee shall work with such communities towards the preservation and/or enhancement of such activities; and

- Give preference to qualified Filipino citizens in the hiring of personnel for its mining operations, the majority of which shall originate according to priority from the host and neighbouring communities, the host municipality and province where the mine is located: Provided, That the Contractor/Permit Holder/Lessee shall organize, at its own expense, skills enhancement programs in the absence of the needed skills; Provided, further, that it shall give its firm commitment to skills re-formation and entrepreneurship development for people in the mining communities as an integral part of the mine closure process.

3.1.4.1.3.3 Health and Safety

Various programs, procedures and plans are sustained and updated to address issues related to environment, health, and safety. These include but not limited to the following:

- Various Community Environment, Health and Safety and Social Programs.
- Occupational Safety and Health Program;
- Hazardous Waste Management Program;
- Emergency Response Plan;
- First Aid Training; and
- Solid Waste Management Plan.

The Environment, Safety, and Asset Protection Departments implement and monitor the compliance to such programs, procedures, and plans.

3.1.4.1.4 Information, Education and Communications (IEC) Campaign and Livelihood Seminars/Money Management

The community relations group regularly conducts IEC activities to regularly update the host community and other stakeholders on the project updates of the mine to address fears and anxieties of the stakeholders regarding the project.

To enable the stakeholders to effectively manage the economic benefits of the project and to ensure the benefits are multiplied and sustained beyond mine closure, residents are provided in the form of IECs, information on entrepreneurship, financial management, and planning. These IEC's will enable the stakeholders create opportunities for sustainable livelihood to effectively utilize the benefits of the mine.

3.1.4.1.5 SDMP Implementation

Social Development Management Plan (SDMP) is currently being implemented jointly with the community to address local needs and requirements on a sustainable basis in accordance to the approved plan.

3.2 IMPACT MANAGEMENT PLAN

Table 3-1 Impact Management Plan

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
OPERATION PHASE				
Earth works at TSF, Mine pit, Waste rock dump, and roadways	The land	(-) Loss of vegetation and wildlife	• Secure tree cutting permits to limit cutting of trees • Limit clearing activities • Replace affected trees per regulatory requirement • Establish offset plantation areas of 2 hectares per 1 hectare disturbed • Recover wildlings prior to clearing • Conduct immediate revegetation such as grassing	Mining and Environment
		(-) Poor aesthetics	• Progressive rehabilitation • Immediate re-vegetation of disturbed and open areas with grasses. Use of centrocema, cocomats and vetiver • Planting of ornamental plants • Establish natural barriers such as tree line	Mining and Environment
		(-) Change in land use	• Progressive rehabilitation	Mining and Environment
		(-) Top soil lost	• Progressive rehabilitation • Provision of top soil stockpile area	Mining and Environment
	The water	(-) changes to local watershed drainage patterns (-) changes in surface runoff volume (-) operation of a division system (-) changes in surface water runoff and spring water yield (-) sedimentation of rivers and water ways	• Control flows by storage and diversion from tailings dam impoundment • Design water control facilities for normal daily flows and storm events • Geotechnical monitoring of dam and waste rock dumps • Best management practices for erosion control	Mining

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
		(-) potential metals discharge	• Protection of remnant forests along crests and ridges • Flow through waste rock dump	
	The air	(-) Dust emission	• Use of water trucks for water sprinkling • Wetting of materials. Water sprayer for crusher • Controlled blasting. Ensure proper loading of explosive. • Vehicle to slow down during dusty condition at populated areas • Provision of load cover on concentrate trucks during transport	Mining
	The flora and fauna	(-) Habitat disturbance (-) Loss of flora and fauna	• Limit or minimize clearing activities • Replace affected trees per regulatory requirement • Relocate endangered affected habitats if any • Maintain reforestation areas •	Mining and Environment
Vehicle and equipment movements	The air	(-) Dust emission	• Use of water trucks for water sprinkling • Wetting of materials. Water sprayer for crusher • Controlled blasting. Ensure proper loading of explosive. • Vehicle to slow down during dusty condition at populated areas • Provision of load cover on concentrate trucks during transport	All
	The people	(-) Noise generation	• Limit noisy activities during day time • Use of properly maintained equipment • Use of mufflers in noisy equipment • Establish long term noise barriers such as tree line or containment walls • Controlled blasting. Ensure proper loading of explosive during blasting	All

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
			• Enclosure of crusher with ore materials to serve as noise barriers • Noise level monitoring	
Use of fuel at power plant, vehicles, mining equipment, and other engine driven equipment	The air	(-) Exhaust/carbon emissions	• Conduct regular maintenance of equipment to ensure efficient operation • Use of biodiesel fuel • Establish and maintain carbon sink plantations • Reduce the use of engine driven equipment • Connect equipment in power line • Prefer the use of NUVELCO for power supply as applicable • Proper operation of equipment • Implement greenhouse gas management plan	All
General mining and milling, and support operation	The land and water	(-) Solid waste generation	• Provide adequate waste bins • Segregate waste at source • Daily collection and disposal of waste • Establish on-site waste disposal facility • Implement solid waste management programs	Mining and Processing
	The people	(-) Noise generation	• Limit noisy activities during day time • Use of properly maintained equipment • Use of mufflers in noisy equipment • Establish long term noise barriers such as tree line or containment walls • Controlled blasting. Ensure proper loading of explosive during blasting • Enclosure of crusher with ore materials to serve as noise barriers • Noise level monitoring	Mining and Processing
Vibration and noise during blasting at mine pit and Underground	The people	(-) Excessive vibration and noise	• Controlled blasting technique. Ensure proper loading of explosive during blasting. • Reduce explosive load if vibration is excessive	Mining

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
Operation of Laboratory, Kitchen, Site services, and Equipment maintenance workshop	The land and water	(-) Hazardous waste generation (-) Potential for land and water contamination	• Proper collection and storage • Use of non-hazardous materials as applicable • Dispose hazardous waste using accredited treaters and transporter	Environment, Processing, Processing, and Site and Community Services
Runoff from Plant Site, Fuel bays, Reagent storage, emulsion plant, Underground	The water	(-) Contaminated water from surface runoff (-) potential metals discharge	• Proper storage of chemicals • Direct process plant runoff to collection pond and pump to TSF • Establish oil and water separator at maintenance areas • Provide adequate rain protection of materials • Provide proper drainage • Direct drainages to containment sumps and treatment facilities • Use of designated washbay areas for vehicles	Mining and Processing
Wastewater discharge from TSF, Mine pit, Underground, and process plant	The water	(-) sedimentation of rivers and water ways (-) metals discharge	• Use of water treatment plant prior to discharge • Use of cleaner technology for processing of ore (e.g. no use of cyanide or mercury) • Return pipeline to process plant to minimize discharge • Tailings contain very low concentrations of soluble metal • Discharge controlled to ensure that discharge quality limits met • Discharge thickening at plant • TSF decant can be shut-off	Mining and Processing
Breakdown of sewage treatment plant and water treatment facility	The water	(-) sedimentation of rivers and water ways (-) potential metals discharge (-) biological and nutrient load increase (-) foul odor emission	• Regular maintenance and efficient operation of water treatment facilities	Processing
Operation of Sewage treatment	The air	(-) foul odor emission	• Regular maintenance and efficient operation of	Processing

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
plant		(-) biological and nutrient load increase	water treatment facilities • Use of carbon filters at STP surge tank • Segregation of biodegradable from residual waste at sanitary landfill • Regular covering of waste at sanitary landfill	
Sewage waste generation	The water	(-) water pollution (-) biological and nutrient load increase (-) foul odor emission	• Collection and treatment at sewage treatment plant • Conduct regular effluent monitoring	Site and Community Services
Operation of Sanitary landfill	The land	(-) decrease in volume of solid waste, brought for disposal	• segregation of waste • collection of biodegradable wastes	Environment
		(-) poor aesthetic appearance	• provide green buffers around the perimeter of the facility • establish vegetation within the facility	Environment
	The water	(-) leachate contamination of surface and groundwater resources	• provide impermeable material underneath/liners • provide proper drainage system (b) • installation of leachate collection system	Environment
	The air	(-) foul odor emission	• implement "first in, first out" policy • adequate compaction of the earth/inert cover • provide vegetation buffer/s	Environment
	The people	(-) sickness of workers	• provide workers with Personal Protective Equipment (PPE), i.e., gloves, rubber boots, nose mask • designate separate areas for dressing, washing, eating, etc	Environment
		(+) generation of permanent employment	• prioritize hiring of local workers	Human Values
	The fauna	(-) proliferation of flies, rodents and other disease-carrying vectors	• adequate daily/intermediate soil/inert covering and compaction • provide fencing material • implement good housekeeping rules and	Environment

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
			regulations	
Operation of equipment Washbays	The water	(-) Non-compliant water discharge/water pollution	• Provision of oil and water separators • Regular maintenance and efficient operation of facilities	Mining, Processing and Site and Community Services
Hydrocarbon spills	The water	(-) Water pollution (-) Increase in oil and grease level at water bodies	• Storage areas will be bunded and shall be able to contain at least 110% of the biggest container • Use of drip trays and floor liners during maintenance works • Ensure availability of spill response materials for immediate response • Immediate clean-up of spills • Proper training of personnel on the safe handling and use procedures • Conduct preventive maintenance of equipment	All
Exposed road access, Open areas, Steep slopes , and stockpiles	The land and water	(-) Erosion and sedimentation of waterbodies	• Immediate re-vegetation of inactive disturbed and open areas with grasses. Use of centrocema, cocomats and vetiver. • Establish and maintain sedimentation ponds along drainages • Direct runoff to sedimentation ponds • Proper benching of slopes • Provide rock sheet on roadways • Use sediment fence at the toe of earth stockpiles • Progressive rehabilitation	Mining and Environment
Use of water	The water	(-) Loss of natural water source for the community	• Provision of alternative water supply to affected residents	All
		(-) Generation of wastewater	• Treatment at sewage treatment plant	All
Use of local roads	The people	(-) Traffic	• Give way to local residents • Provide traffic aides at road working areas.	All

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
Slope failures at open pit, WRD, ROM Pad, and Stock piles	The land and water	(-) Sedimentation (-) Poor aesthetics (-) Water pollution	• Progressive rehabilitation • Proper engineering design such as proper bench height, slope angle and seismic design • Geotechnical and structural monitoring • Pit dewatering	Mining
Underground development	The land	(-) Subsidence and collapse from underground workings	• Proper engineering design • Geotechnical and structural monitoring • Use of paste backfill to fill-up stope voids • Bottom to top underground mining approach	Mining Underground
		(-) Flooding	• Pit dewatering • Provision of Crown and Sill Pillars at underground mine • Paste backfilling of underground stopes to reduce water infiltration • Diversion of Dinauyan River	Mining and Mining Underground
Water at open pit	The land	(-) Liquefaction	• Progressive rehabilitation • Proper engineering design • Geotechnical and structural monitoring • Emergency response plan and installation of monitoring systems • Pit dewatering	Mining and Environment
	The land	(-) Flooding	• Pit dewatering • Diversion of Dinauyan River • Designed for maximum flood event of ARI 1:100	Mining
TSF breach	The water	(-) release of tailings (-) sedimentation and erosion	• Proper engineering design such as proper bench height, slope angle and seismic design • Geotechnical and structural monitoring • Maintain exposure of tailings above water • Risk assessment and emergency warning system • Emergency response plan and installation of	Mining and Processing

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
			monitoring systems • Provision of spillway • Maintain freeboard of more than 5 meters at all times • Diversion of TSF tailings to open pit in an event of failure	
		(-) TSF overtopping	• TSF decant system (regular dewatering) • Provision of spillway	Mining
Ground water supply	The water	(-) ground water contamination	• Ground water quality monitoring program • Provision of alternative water supply to affected residents	Environment, and Community Relations and Communications
Dinauyan River diversion	The water	(-) reduction in peak flow of Dinauyan River	• Built as per design and specifications • Water flow monitoring	Mining
Concentrate spills during hauling	The air	(-) dust emission (-) land contamination	• Provision of load cover • Implementation of spill response procedures • Strictly follow travel plan	Commercial
Acid mine drainage	The water and land	(-) release of acid mine drainage (-) movement of dissolved heavy metals *Note: Low potential for AMD generation as per study.*	• Water quality monitoring • Materials monitoring for potential high sulphur rocks • Blending of materials with high alkaline rocks if found • Treatment of ARD water in water treatment plant • Provision of collection ponds • Use of neutralizing reagents such as lime • Dilution with alkaline water.	Mining and Environment
Socio economic aspects	The people	(+) Employment (+) Improvement of local skills through trainings (-) Contractualization of employment opportunities	• Social development and management programs • Priority hiring of local residents • Posting of job vacancies • Provision of skills training program	Human values, and Community Relations and Communications
		(+) Improved local, provincial and	• Social development and management programs	Community Relations

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
		national economy		and Communications
		(-) Increase in immigration (-) Reduced available local resources and diminishing community cohesion social control due to migrations	• Local first hiring policy • Operation of community relations office	Human values, and Community Relations and Communications
		(+/-) Changes in the community life of Didipio (+) Employment of local and regional residents (+) Improved infrastructure and transportation systems (+) Increased local and regional tax income	• Implementation of Community and Business Development Program • Preferential hiring of local residents	Human values, and Community Relations and Communications
		(-) Physical and economic displacement	• Provision of compensation package as necessary	Human values, and Community Relations and Communications
		(-) Health and safety exposures	• Implementation of OSH program and environmental management plans • Information, Education and Communications (IEC) Campaigns	Safety, and Community Relations and Communications
ABANDONMENT PHASE				
Water Quality	The water	(-) Chemical releases to the environment	• Chemicals to be removed and / or neutralized • Any potentially acid generating materials and tailings to be capped and revegetated • Tailings storage facility will be contoured to control drainage and a river channel established to direct flow into Dinauyan River • Continued water quality monitoring • Possible contaminants to be taken off-site	All
Hydrology and water resources	The water	(-) Changes in watershed patterns (-) Changes in flow volume	• Diversion structures to be removed • Tailings storage facility will be contoured to control drainage and a river channel established	Mining

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity/Department
			to direct flow into Dinauyan River • The peak flows from the Dinuyan will be forever effected/reduced	
Physical stability of Dinauyan River	The water	(-) Erosion and sedimentation (-) Altered flows	• Flow through Rock Stack attenuates high flow events	Mining
Terrain and landscape	The land	(-) Presence of open pit, waste rock dumps and tailings dam and impoundment	• Areas to be regraded and revegetated with indigenous plants and vegetation • Tailings Storage Facility may be used for agriculture or revegetated with indigenous plants • Open pit surrounds contoured and lake established	Mining and Environment
Wildlife	The flora and fauna	(-) removal of wildlife habitat	• Maintenance of a revegetation program to final closure that will use indigenous plants and will replicate the existing diversity	Mining and Environment
Aquatic Habitat	The fauna and water	(-) Changes to the project area's rivers and creeks	• Vegetated buffers established along Dinauyan and Didipio Rivers	Mining and Environment

4 Environmental Risk Assessment (ERA) & Emergency Response Policy and Guidelines

4.1 Background

The Environmental Risk Assessment (ERA) for the Didipio Gold-Copper Project was undertaken consistent with the framework set forth in the Philippines EIS System (PEISS) as detailed in the Revised Procedural Manual (RPM) of DENR Administrative Order (DAO) 2003-30. In the context of PEISS, the ERA is concerned with human safety where risks are characterized by probabilities, consequences, accidental nature, and acute effects. The DAO further defines ERA as a process of analyzing and describing the risks associated with a project or activity to ecosystems, human health and welfare.

The scope of this ERA for the Didipio Gold-Copper Project is consistent with the requirements of the DAO and with the approved Technical Scoping Checklist (TSC) for the project's EPRMP, which include the following:

- Description of conditions, events and circumstances which could be significant in bringing about identified safety and physical risk;
- Description & assessment of the possible accident scenarios posing risk to the environment;
- Description of the hazards, both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the release of toxic substances, as applicable;
- The safety policy and guidelines shall be consistent with the Mines and Geosciences Bureau requirements. Emergency preparedness should also consider natural hazards to the infrastructure and facilities;
- Present actual Emergency Response Policy, record of drills and recorded events;
- Description of conditions, events and "trigger" which could be significant in bringing about identified physical risk;
- Description and assessment of the possible accident scenarios posing risk to the environment; and
- Description of the hazards both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the failure of structure, as applicable.

On the other hand, this ERA does not cover geological risks and health risks characterized by exposures and chronic human health effects, since these types of risks are assessed and covered by the Engineering Geological and Geohazard Report (EGGAR) requirement of the Mines and Geosciences Bureau (MGB) and he Environmental Health Impact Assessment (EHIA) under the DOH mandate, respectively. The EGGAR and EHIA have their own procedural processes that are not covered by the EIA System and not required by the ECC application.

4.1.1 Levels of Coverage and Requirements of ERA

Annex 2-7e of the RPM of the DAO 2003-30 defines how the ERA is done at the EIA stage. Using the guidelines set forth in the said DAO, the project will be evaluated using Figure 4-1 to determine under which category the project falls and the corresponding report that will be prepared.

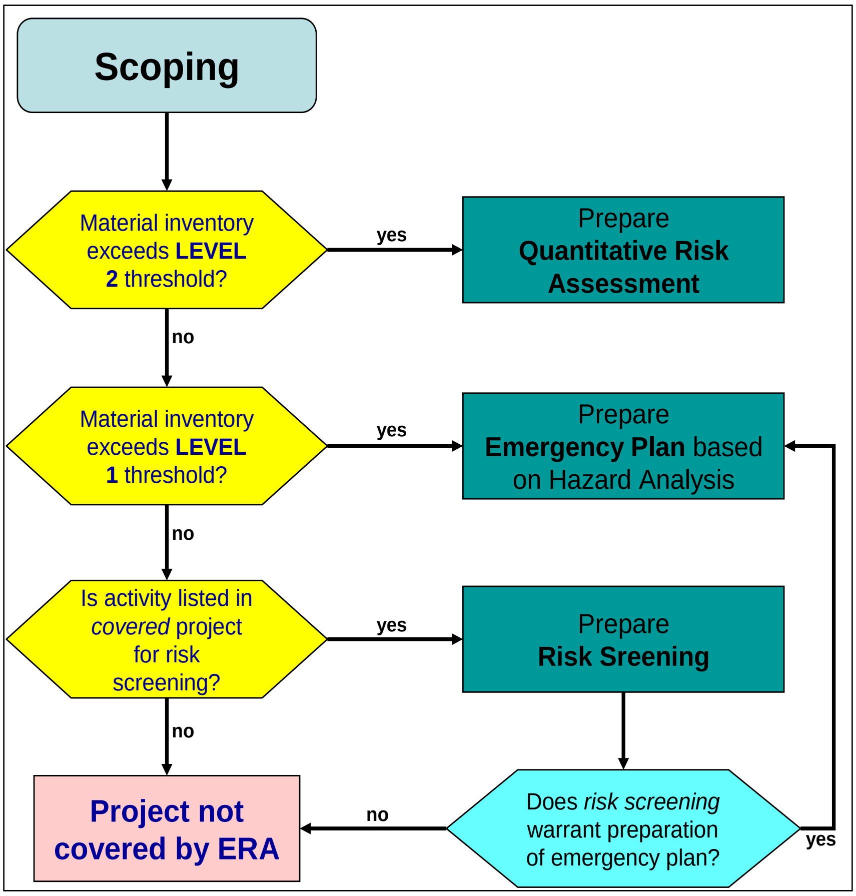


Figure 4-1: Guidelines of the Environmental Risk Screening

Further, the same DAO requires that an ERA is required if a proposed project will use, handle, transport, store substances that are classified as explosive, flammable, oxidizing, or toxic. The RPM of the DAO provides the following categories to determine whether or not an ERA is required:

1) Facilities for the production or processing of organic or inorganic chemicals using:
   a. alkylation
   b. amination by ammonolysis
   c. carbonylation
   d. condensation
   e. dehydrogenation
   f. esterification
   g. halogenation and manufacture of halogens
   h. hydrogenation
   i. hydrolysis
   j. oxidation
   k. polymerization
   l. sulphonation
   m. desulphurization, manufacture and transformation of sulphur-containing compounds
   n. nitration and manufacture of nitrogen-containing compounds
   o. manufacture of phosphorus-containing compounds
   p. formulation of pesticides and of pharmaceutical products.
   q. distillation
   r. extraction
   s. solvation

2) Installations for distillation, refining or other processing of petroleum products.
3) Installations for the total or partial disposal of solid or liquid substances by incineration or chemical decomposition.
4) Installations for the production or processing of energy gases, for example, LPG, LNG, SNG.
5) Installations for the dry distillation of coal or lignite.
6) Installations for the production of metals or non-metals by a wet process or by means of electrical energy.
7) Installations for the loading/unloading of hazardous materials as defined by RA 6969 (or DAO 29).

Under this category, an ERA report is required for the Didipio Gold-Copper Project as part of its EPRMP given that the project operates a processing plant for the production of metals using a wet process and that the project operation includes handling, transporting, and usage of hazardous substances defined under Republic Act No. 6969 "*An Act to Control Toxic Substances and hazardous and Nuclear Wastes*".

A Risk Screening (RS) is done for the proposed project as a component of the EPRMP. The RS provides an initial assessment of hazard consequences in hazardous materials handling and storage based on available information, as well as an assessment of physical risks throughout the project phases. The RS Report follows the prescribed format in Annex 2-7e of the RPM of DAO 2003-30.

4.1.2 Levels 1 and Level 2 Threshold Inventory

Table 4-1 presents the threshold levels were used to determine the type of ERA Report [e.g. RS, Hazard Analysis, and Quantitative Risk Assessment (QRA)] that shall be required for the proposed project.

Table 4-1: Threshold Levels

Category	Level 1 (tons)	Level 2 (tons)
Explosives	10	50
Flammable substances	5,000	50,000
Highly flammable substances	50	200
Extremely flammable substances	10	50
Oxidizing substances	50	200
Toxic substances (low)	50	200
Toxic substances (medium)	10	50
Toxic substances (high)	5	20
Toxic substances (very high)	0.2	1
Toxic substances (extreme)	0.001	0.1
Unclassified (Type A)	100	500
Unclassified (Type B)	50	200

Definitions of different categories of hazardous materials / substances, presented in Table 4-1, are discussed in Table 4-2.

Table 4-2: Definition of Different Categories of Hazardous Materials

Category	Definition
A. Explosives (Reactivity)	1. A substance or preparation which creates the risk of an explosion by shock, friction, fire, or other sources of ignition.
	2. A pyrotechnic substance (or mixture of substances) designed to produce heat, light, sound, gas, or smoke or a combination of such effects through non-detonating self-sustained exothermic chemical reactions.
B. Flammable Substances	1. Flammable substances are substances and preparations having a flash point

Category	Definition
	equal to or greater than 21°C and less than or equal to 55°C, capable of supporting combustion.
(Highly flammable and extremely flammable substances)	2. Highly flammable substances are substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy, or substances which have a flash point lower than 55°C and which remain liquid under pressure, where particular processing conditions, such as high pressure or high temperature, may create major-accident hazards.
	3. Extremely flammable substances are liquid substances and preparations which have a flash point lower than 0°C and the boiling point (or, in the case of a boiling range, the initial boiling point) of which at normal pressure is less than or equal to 35°C; gaseous substances and preparations which are flammable when in contact with air at ambient temperature and pressure, whether or not kept in the gaseous or liquid state under pressure; or, liquid substances or preparations maintained at a temperature above their boiling point.
C. Oxidizing substances	Substances which give rise to highly exothermic reaction when in contact with other substances, particularly flammable substances.
D. Toxic Substances	Low, medium, high, very high and extreme toxicity of substances or preparation are classified as follows:
	1. A substance shall be considered as a liquid if vapor pressure is less than 1 bar at 20°C.
	2. A substance shall be considered as a gas if vapor pressure is greater than 1 bar at 20°C.
	3. The sum of (a) and (b) as provided in Table 2 and Table 3 shall determine the toxicity class as contained in Table 1.
E. Unclassified Substances	Substances or preparations that react violently with water (Type A), and substances or preparations which release or liberate toxic gas in contact with water (Type B).

4.2 Conceptual Framework, Approach and Methodology

4.2.1 Conceptual Framework

Risk assessment is the scientific determination of the levels of risk related to situations and recognized threats inherent to a project, with the ultimate objective of proposing management solutions to bring risk exposure to an acceptable and manageable level. It involves the following basic steps:

- Identification of hazards such as aspects, substances, activities, processes and natural phenomena that may cause harm or deterioration of safety;
- Evaluation of the magnitude and frequency occurrence of hazards, and its possible consequences to the environment and to the human welfare and safety; and
- Determination of appropriate measures to eliminate or control the hazards.

A conceptual flow diagram for ERA is shown in Figure 4-2.

Figure 4-2: Conceptual flow diagram for Qualitative Risk Assessment

Based on the threshold levels of existing hazardous materials (e.g. explosives, diesel flammable, and chemicals) present at the project site, it only warrants the preparation of a Risk Screening study. Risk assessment used to this ERA report utilizes approaches and methods of Quantitative and Qualitative Risk Assessment, particularly using the Risk Assessment Matrix (RAM) tool developed and applicable to the project. Risks are tabulated in a matrix along with the potential causes and consequences of such risk. The likelihood and the risk level of such consequences and causes are rated based on three (3) scenarios:

1. No mitigating measures;
2. Incorporating Current Critical Controls; and
3. Incorporating additional risk treatment action.

The definitions of each steps for a qualitative risk assessment is discussed briefly in the succeeding sections.

4.2.1.1 Hazard Identification

Hazard identification involves the identification of all possible aspects, events or processes that could lead to disastrous or fatal incidents. It also entails defining the inherent and potential hazards of the substances or materials used, as well as process hazards with potential to adversely affect project personnel, the public, and the environment.

4.2.1.2 Risk Assessment

Consequence analysis is the second step, involving the estimation and/or assessment of the effects or results of an incident. It uses models beginning with release rates calculations, dispersion and physical effects.

Frequency analysis is the third step and may be defined as the estimation of the likelihood of occurrence of the identified hazard. Risk is the product function of the frequency and consequence analyses.

Risk assessment is defined as the examination, analysis, evaluation, and estimation of an adverse or undesirable event occurring in a given project area which could cause unacceptable impacts or results, expressed as fatalities per million per year.

4.2.1.3 Risk Management

Risk management encompasses the risk assessment process. It is the term applied to a logical and systematic method of identifying, analyzing, assessing, treating, monitoring and communicating risks associated with any activity, function or process in a manner that would enable one to minimize losses and maximize opportunities.

Risk is defined as a measure of potential human injury/ death, economic loss, or environmental damage in terms of the probability of the loss, injury/ death or damage occurring and the magnitude of the loss, injury/death or damage if it occurs. It is the product of the calculated consequence of a postulated accident scenario and the probability or frequency of occurrence of such event.

4.2.1.4 Risk Communication

Risk communication is the process of informing all employees and stakeholders about potential hazards of each undertaking, aspect, or activity of the project. Risk communication is a science-based approach for communicating effectively in situations of high stress, high concern or controversy.

From the company's perspective, the purpose of risk communication is to educate all company employees to understand the processes of risk assessment and management, to form scientifically valid perceptions of the likely hazards, and to participate in making decisions about how risk should be managed. The company implements its risk communication using the tools such as written, verbal, and visual statements containing information about risk.

4.2.2 Approach and Methodology

This risk assessment screening method was based on the ERA procedural guidelines prescribed in Annex 2-7e of the Revised Procedural Manual of Administrative Order 30 series of 2003 (DAO 2003-30). Under the DAO, projects are categorized based on the hazardous substance inventory that is being used, handled, and stored for the project's operations and related activities. There are three threshold levels of coverage and scoping requirements detailed in the Procedural Guidelines for Scoping of ERA.

- Level 2 – Requires to prepare a Quantitative Risk Assessment (QRA) and an Emergency/Contingency Plan;
- Level 1 – Requires to prepare an Emergency/Contingency Plan only; and
- Risk Screening Level – Requires conducting a risk screening study.

Table 4-3 lists the hazardous substances expected to be used and/or produced by the Project. None of the chemicals or substances used, handled, and stored by this Project exceeded the thresholds set in Annex 2-7e of DAO 2003-30 and thus a risk screening is only warranted for this assessment.

4.3 Details of the Project's Hazardous Materials

The Project will utilized various chemical substances for the gold and copper processing, explosives for the underground mining operation, and flammable substances such as diesel fuel to provide electricity requirement and fuel for diesel-powered equipment and machineries.

Table 4-3 and Table 4-4 show the details of chemicals, explosives, and diesel fuel handled, used, and stored in the project.

Table 4-3: Details of the Project's Reagents and Diesel Fuel

Chemical	Category	Unit Rate	Yearly Consumption (MT/Annum)	Use
Reagents / Chemicals				
Hydrated Lime	Non-Toxic, Non-Corrosive	173 g/t	467.273 MT	To adjust the pH of the pulp for collection
Nascol S701 (collector or equivalent)	Non-Toxic, Non-Corrosive	1 g/t	2.701 MT	Primary collector for the gold particles in the pulp
Sodium Isobutyl Xanthate (SIBX)	Non-Toxic, Non-Corrosive	75 g/t	202.575 MT	Secondary collector for the copper and gold with associated sulfides
IF-56, or equivalent (frother)	Non-Toxic, Non-Corrosive	30 g/t	81.03 MT	Organic surfactant for bubble stabilization in flotation
Magnafloc919 Flocculant (thickening)	Non-Toxic, Non-Corrosive	30 g/t	81.03 MT	Reagent for agglomeration of suspended solids for faster settling rate and dewatering
Fuel				
Diesel	Flammable		1.6 million Liters	Use as fuel for various diesel-powered equipment and machineries.

Table 4-4: Details of the explosive materials

Explosives	Unit	Volume (in MT)
Emulsion	1,950	MT
Electronic Blasting Cap (EBC)	13,500	Pieces
Non-Electronic Blasting Cap (Nonel)	13,400	Pieces

4.3.1 Determining the Category of the Project

Using the guidelines set forth in Annex 2-7e of DAO 2003-30 and based on the information presented in the previous item, below lists the hazardous substances expected to be used and/or produced by the Project vis-à-vis the threshold limits set forth in the said DAO.

Category	Definition	Evaluation	Criteria Met?
Explosives (e.g. ANFO, Bulk Emulsion – Fortis Advantage, Packaged Explosives – Senatel, and boosters – Pentex)			
A. Explosives (Reactivity)	Risk of an explosion by shock, friction, fire, or other sources of ignition.	Explosive materials including the detonator and primer are considered highly explosive.	YES
B. Flammable Substances	Flash point range is 21°C to 55°C and capable of supporting combustion.		NO
(Highly flammable and extremely flammable substances)	Substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy, or substances which have a flash point lower than 55°C and which remain liquid under pressure, where particular processing conditions, such as high pressure or high temperature, may create major accident hazards.		NO
Extremely flammable substances	Liquid substances and preparations with a flash point <0°C and the boiling point (or, in the case of a boiling range, the initial boiling point) of which at normal pressure is <= 35°C; gaseous substances and preparations which are flammable when in contact with air at ambient temperature and pressure, whether or not kept in the gaseous or liquid state under pressure; or, liquid substances or preparations maintained at a temperature above their boiling point.		NO
C. Oxidizing substances	Results in highly exothermic reaction when in contact with other substances, particularly flammable substances.		NO
D. Toxic Substances	Low, medium, high, very high and extreme toxicity of substances or preparation.		NO
E. Unclassified	Substances or preparations that react		NO

Category	Definition	Evaluation	Criteria Met?
Substances	violently with water (Type A), and substances or preparations which release or liberate toxic gas in contact with water (Type B).		
Diesel Fuel Oil			
A. Explosives (Reactivity)	Risk of an explosion by shock, friction, fire, or other sources of ignition.	Not explosive in normal form (liquid)	NO
B. Flammable Substances	Flash point range is 21°C to 55°C and capable of supporting combustion.	Flash point = 52°C (NIOSH International Chemical Safety Cards)	YES
(Highly flammable and extremely flammable substances)	Substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy, or substances which have a flash point lower than 55°C and which remain liquid under pressure, where particular processing conditions, such as high pressure or high temperature, may create major accident hazards.		NO
Extremely flammable substances	Liquid substances and preparations with a flash point <0°C and the boiling point (or, in the case of a boiling range, the initial boiling point) of which at normal pressure is <= 35°C; gaseous substances and preparations which are flammable when in contact with air at ambient temperature and pressure, whether or not kept in the gaseous or liquid state under pressure; or, liquid substances or preparations maintained at a temperature above their boiling point.		NO
C. Oxidizing substances	Results in highly exothermic reaction when in contact with other substances, particularly flammable substances.	Stable	NO
D. Toxic Substances	Low, medium, high, very high and extreme toxicity of substances or preparation.	Vapor pressure at 20°C = 2.17 mm Hg and rat LC50 4hr = 5.3 ppm1. Tables 2 & 3 in Annex 2- 7e RPM showed a value of 7 (medium toxicity).	YES
E. Unclassified Substances	Substances or preparations that react violently with water (Type A), and substances or preparations which release or liberate toxic gas in contact with water (Type B).	Immiscible with water. Do not react violently with water.	NO

Category	Definition	Evaluation	Criteria Met?
Reagents (e.g. Cyanide, Lime, Nascol S701, SIBX, Frother, Flocculant)			
A. Explosives (Reactivity)	Risk of an explosion by shock, friction, fire, or other sources of ignition.		NO
B. Flammable Substances	Flash point range is 21°C to 55°C and capable of supporting combustion.		NO
(Highly flammable and extremely flammable substances)	Substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any input of energy, or substances which have a flash point lower than 55°C and which remain liquid under pressure, where particular processing conditions, such as high pressure or high temperature, may create major accident hazards.		NO
	Liquid substances and preparations with a flash point <0°C and the boiling point (or, in the case of a boiling range, the initial boiling point) of which at normal pressure is <= 35°C; gaseous substances and preparations which are flammable when in contact with air at ambient temperature and pressure, whether or not kept in the gaseous or liquid state under pressure; or, liquid substances or preparations maintained at a temperature above their boiling point.		NO
C. Oxidizing substances	Results in highly exothermic reaction when in contact with other substances, particularly flammable substances.		NO
D. Toxic Substances	Low, medium, high, very high and extreme toxicity of substances or preparation.		NO
E. Unclassified Substances	Substances or preparations that react violently with water (Type A), and substances or preparations which release or liberate toxic gas in contact with water (Type B).		NO

Table 4-5: Threshold Levels of Hazardous Substances for the Didipio Gold-Copper Project.

Category	Level 1 (tons)	Level 2 (tons)	Storage Inventory (MT)	Coverage
Explosives	10	50	>2	Below the threshold
Flammable substances	5,000	50,000	1,416	Below the threshold
Highly flammable substances	50	200	None	n/a
Extremely flammable substances	10	50	None	n/a
Oxidizing substances	50	200	None	n/a
Toxic substances (low)	50	200	>50	Below the threshold
Toxic substances (medium)	10	50	None	n/a

Category	Level 1 (tons)	Level 2 (tons)	Storage Inventory (MT)	Coverage
Toxic substances (high)	5	20	None	n/a
Toxic substances (very high)	0.2	1	None	n/a
Toxic substances (extreme)	0.001	0.1	None	n/a
Unclassified (Type A)	100	500	None	n/a
Unclassified (Type B)	50	200	None	n/a

Table 4-5 shows that the project's identified hazardous materials are all below the threshold levels set by Annex 2-7E of the RPM. With this, a Risk Screening (RS) Report will be prepared that will follow the prescribed format in Annex 2-7e of the RPM of DAO 2003-30 and will contain the following:

a. Identification of the hazardous substance that will be used by the proposed project;
b. Presentation of the physical and chemical properties of the hazardous substance;
c. Discussion of the hazards associated with the used and storage of these substance(s);
d. Conduct consequence analysis for the worse-case scenario; and
e. Recommend emergency response measures.

The RS will provide an initial assessment of hazard consequences of the project's identified hazardous substances based on available information. The RS will focus on consequence assessment using worst-case accident scenarios.

However, as required in the agreed Technical Scoping Checklist of the Project, a Quantitative Risk Assessment (QRA) on dam failure is required as part of the EPRMP.

4.4 Hazard Identification

Hazard is defined as a physical situation with a potential for human injury, damage to the environment, damage to property, or a combination of these. The hazards identified in the Project are categorized under physical, chemical and occupational hazards:

- Physical hazards include naturally occurring phenomena or events that are triggered by natural physical conditions that pose as threats people and the environment;
- Chemical and process hazards involve materials that can induce hazardous chemical processes that threat the physical safety of people and the environment; and
- Occupational hazards are objects, events or conditions that may cause physical, emotional, and mental harm to personnel.

Hazards associated with the project can be grouped into the following categories:

- Flammable Substances and Explosives Materials;
- Hazardous Substances;
- Structural Failure; and
- Occupational Hazards
    - Mechanical Equipment Failure
    - Electrical Hazard
    - Temperature Hazards
    - Noise Hazards

4.4.1 Explosives (PD N0. 1866) Hazards

An explosive is defined as a substance or preparation which creates the risk of expansion by shock, friction, fire or other sources of ignition (DAO 2003-30). Explosives such as 2, 4, 6-trinitrotoluene or TNT have been used in the past for military, industrial, mining and quarrying purposes, among others.

Development of the open pit and the underground workings require explosives as part of the drilling and blasting program. Explosives used onsite include ammonium nitrate - fuel oil (ANFO), bulk emulsion (Fortis Advantage), packaged explosives (Senatel) and boosters (Pentex). These belong to a subclass of high explosives, called blasting agents. They are materials or mixtures that consist of a fuel and an oxidizer. Despite this, none of the individual ingredients are classified as an explosive. Blasting agents have to be initiated by a primer. During mining operations, dry blast holes will be charged with ANFO and the primer. Wet holes will be charged with bulk emulsion and the primer.

The hazards associated with explosive materials are the same as those for explosion of the fuel source.

Explosives are used throughout the open pit and underground environments at Didipio operations on a daily basis. Table 4-6 provides the summary of practices carried out involving explosives at Didipio operations.

Table 4-6: Explosives Interaction throughout Didipio Operations

Orica Philippine Incorporated-OPI (Explosives Contractor)	Descriptor
Explosives and accessories transported to site	Explosives and explosive accessories are transported to site under the control of Orica Philippines Incorporated. All explosives and explosives accessories are delivered to the OGPI explosives Magazine located on Didipio Site.
Manufacturing of explosives	The mixing of explosives raw materials including fuel oils and ammonium nitrate prills to produce ANFO and emulsion products is carried out on site by Orica Philippines Incorporated (OPI).
Transport into open pit areas	Bulk explosives are transported to the drill holes in explosives trucks MMU (Mobile Manufacturing Units), and pumped down the drill holes.
Drill patterns	ANFO Emulsion product store in the MMU vehicle is pumped into holes throughout the designated drill and blast pattern as designed. The patterns are under the control of the OPI shotfirer and blast crew.
Underground	Descriptor
Transport OGPI surface magazine to headings	Designated explosives vehicle transports explosives from surface explosives magazine into the various underground mine headings.
Headings charged and fired	The underground has designated explosives vehicles to transport and load pre drilled holes as per design. The headings are primed and charge with explosives and then at the end of the shift are tied into a central firing line. Once the tag board is cleared and the designated charge up operator has confirmed this, he asks for approval from the shift supervisor and once granted the headings are fired from a safe location underground.
Explosives ute park up area	Designated area on the surface for explosives vehicle to park
Misfires in faces or stopes	Misfires do occur and once they have been identified they are reported to the shift supervisor and entered into the misfire log.

4.4.2 Flammable or Explosive Materials Hazards

Diesel fuel will be used to fuel the mine vehicles and the electric power generators. Storage will be in above ground storage tanks located near the generators and the mill/processing area. It is considered hazardous materials and can be considered an environmental risk. Approximately 1.6 million liters of diesel fuel will be stored on site. The facility will meet the applicable Philippine regulations for storage of flammable liquid, as stipulated in RA 9540 (Fire Code of the Philippines) Section 10.3.4.2 and will include secondary containment structures to contain spills.

Diesel Oil No. 2 is a heavy residual oil, composed primarily of unbranched paraffins. The specific gravity is 0.872. The flash point is between 100 to 199 °F (38 to 98°C) and is insoluble in water. Diesel used within the Philippines contains some impurities, notably sulphur. The material is combustible and is considered a fire hazard. The material is flammable and could result in an explosion. Thermal radiation and over pressure impacts are associated with this occurrence.

The specification of the diesel fuel used for the project is presented in Table 4-7.

Table 4-7: Specification of the Diesel Fuel for the Project

Parameter	Specifications
Specific Gravity @ 60°C	0.82 min 0.86 max
Sulfur % wt. Mercaptan sulfur, ppm	0.30 max -
Viscosity cSt @ 40°C Pour Point °C	1.5 min 5.6 max 10.0 max
Flash Point °C	60.0 min
Hydrogen % wt.	16.5 max
Distillation 90% Pt, °C	370.0 max
Cetane Index	40.0 min
Carbon residue wt % whole	0.1 max
Carbon residue wt % 10% bottoms	1.0 max
Ash ppm	50.0 max

Risks associated with diesel materials include fire and explosion of the fuel and the fuel oil storage and explosion damage from the mine blasting program or explosives storage area.

4.4.3 Chemical and Hazardous Substances Hazards

The identification of chemical hazards associated with the Project was based on the -chemical properties of the chemicals and substances that are used, stored, handled, consumed and produced during the operation of the project.

In relation to chemicals, a hazard is a set of inherent properties of substance, mixture, article or process that may cause adverse effects to organisms or the environment. There are two broad types of hazards associated with hazardous chemicals which may present an immediate or long term injury or illness to people. These are:

- Health hazards – these are properties of a chemical that have the potential to cause adverse health effects. Exposure usually occurs through inhalation, skin contact or ingestion. Adverse health effects can be acute (short term) or chronic (long term). Typical acute health effects include headaches, nausea or vomiting and skin corrosion, while chronic health effects include asthma, dermatitis, nerve damage or cancer.
- Physico-chemical hazards – These are physical or chemical properties of the substance, mixture or article that pose risks to workers other than health risks, as they do not occur as a consequence of the biological interaction of the chemical with people. They arise through inappropriate handling or use

and can often result in injury to people and/or damage to property as a result of the intrinsic physical hazard. Examples of physico-chemical hazards include flammable, corrosive, explosive, chemically reactive and oxidizing chemicals.

The company's primary duty is to ensure, so far as is reasonably practicable, that the health and safety of workers and other persons are not put at risk from work carried out as part of the conduct of the business. This includes ensuring the safe use, handling and storage of hazardous materials and chemical substances.

4.4.3.1 PROCESSING PLANT

All the reagents are in compliance with RA 6969 as stated in their accompanying Safety Data Sheet (SDS). However, release of minor quantities of reagents to the environment may result in short term impacts to the ecological system within the Project Area. This includes Sodium Iso-Butyl Xanthate (SIBX), CMS2500 & S701 sulphide mineral collectors (Isopropyl ethyl thionocarbamate), IF6500 Frothing agent (Alkyl Aryl Ester), flocculants (polyacrylamide, anionic), ore concentrates, and process waters and tailings slurry.

In the previous project operation, the chemical used for the treatment process was sodium ethyl xanthate, which was found to be toxic to fish. This chemical has now been changed to sodium isobutyl xanthate. While the risk of impact on fish onsite was low, a decision was made to change chemicals.

Sodium Isobutyl xanthate is 1/1000th the toxicity of sodium ethyl xanthate. The chemical SIBX is registered for use in the Philippines (Reg. no. 25306-75-6). The chemicals/consumables will be stored in a reagent storage area at the Process Plant. Both SIBX and lime will be delivered and stored in either 1000 L intermediate bulk container (IBC) bins or 205 L (44 gal) drums. The storage areas for liquid chemicals will include secondary containment to prevent accidental spillage escaping into the surrounding environment. Control measures will be implemented to eliminate or control this hazard within the operation and also upon decommissioning.

Release of diesel and fuel oils to the environment may result in an impact to the flora and fauna of the Project Area. The most susceptible will be the aquatic environment. Control measures will be implemented to eliminate or control this hazard up to the decommissioning stage. These will be addressed by proper bunded storage of used fuel and handling and disposal off-site of used fuel by an accredited third party hauler during the decommissioning stage.

4.4.4 STRUCTURAL FAILURE

Structural failure as a hazard is related primarily to the Tailings Dam, Open Pit, water diversion and collection system, sediment control dams, and waste rock dumps. Failure of any of these facilities may release tailings and waste rock to the local streams. A breach of the dams may also result in release of water and flooding within the Dinauyan River, Didipio River and vicinities. Adequate planning and effective decommissioning and rehabilitation will be implemented to assure the minimization of risks these structures pose to the environment.

4.4.4.1 TAILINGS DAM

Tailings will be disposed of within a single impoundment located on the Dinauyan River. A zoned earth fill dam will contain the tailings and surface water runoff within the tributary watershed. Upon completion of the project, approximately 50,000,000 tonnes of tailings will be stored within the impoundment.

The dam itself will be constructed as a zoned earthfill structure with a maximum height of approximately 100m. A reclaim barge and pumping system will return water from the impoundment to the mill and processing facilities for reuse. The volume of water stored within the impoundment will vary as the tailings deposition and dam construction progresses.

Throughout the operations, a minimum available storage volume will be maintained to contain a 100-year, 24-hour storm event.

Failure of the tailings dam will result in the release of tailings, waste rock and water to the Dinauyan River. During mining operations, this would likely impact the open pit and underground workings and possibly result in flooding within the Dinauyan River and Didipio River downstream of the open pit. Similarly a dam failure after closure and reclamation of the facilities could also result in flooding downstream of the two rivers.

Potential impacts associated with a tailings dam failure include loss of life, property damage or loss, water quality degradation, and aquatic habitat degradation. Best quality engineering standards will be maximized to ensure that failure of this facility will be prevented; this includes the building of a large rock abutment directly next to the TSF, which has already commenced.

4.4.4.2 Failure of Appurtenant Tailings Dam Structures

Failure during operations of the appurtenant structures associated with the tailings dam, such as the spillway may result in the overtopping of the tailings dam and/or flooding downstream of the dam. This will affect the downstream mine workings and the downstream reaches of the Dinauyan River.

During closure and post-closure activities, a failure of the spillway may also result in flood impacts within the downstream reaches of the Dinauyan River.

Potential impacts are similar to those of the Tailings Dam. As such, it will be stressed that best quality engineering standards for these structures are to be implemented.

4.4.4.3 Sediment Dams

A series of sediment control dams have been constructed in the mine operations and TSF areas as part of the surface water diversion and collection system. Their purpose is to collect sediment from surface water runoff from disturbed areas before the water is discharged to the Dinauyan River and the Didipio River. These structures are in a state of constant upgrade as site surface contours vary due to ongoing earthworks. Hazards associated with a structural failure consist of a release of sediments and limited downstream flooding. This impact will be significantly less than a failure of the Tailings Dam.

4.4.5 Mechanical Equipment Failure

Mechanical hazards are hazards encountered during the operation of an apparatus or tool of a mechanical nature. A multitude of hazardous mechanical hazards may be present during the Project especially in the labor intensive mining and processing operations. These hazards vary from movement of rotating arms and members, moving belts, meshing gears, cutting teeth, shearing parts and any parts may cause mechanical injury.

Failure of mechanical equipment, which may also pose a hazard to human health and safety, is a potential source of environment impact. Failure of equipment may result in release of chemicals, fuel oil, or tailings to the environment during operations. Mechanical failure safeguards would consist of facilities such as fire control and suppression, primary and secondary spill containment, and pumping and conveyance systems. Contaminations, if there would be any, will be the main concern during post-mining stages. It will be assured that the area will be free from contamination before abandonment, and that this equipment will be decommissioned properly. This mechanical equipment is planned to be sold after mining operations.

4.4.5.1 Electrical Hazards

Electrical hazards are hazards caused by electricity. Electrical hazards present in the Project include power lines, generators, energized equipment, wiring and batteries. The severity of electrical injury ranges from just a faint shock to severe burns or even cardiac arrest and possibly even death. The most common electricity related injuries are burns suffered in electrical accidents which may be classified into three types: electrical burns, arc burns, and thermal contact burns. All three types of burns could possibly occur simultaneously.

In electrical burns, tissue damage is caused by the heat generated by the current flow through the body. Arc or flash burns, on the other hand, are the result of high temperatures occurring near exposed tissues and are produced by an electric arc or explosion. Finally, thermal contact burns (related to temperature hazards) are those normally experienced when the skin comes in contact with hot surfaces of overheated electric conductors, conduits, or other energized equipment (OSHA 2008). There is a multitude of method for protecting people from the hazards brought about by electricity. These include insulation, guarding, grounding, wearing electrical protective equipment and safe work practices.

4.4.5.2 Temperature Hazards

Working outside in the heat especially during the dry season can bring about hazards related to temperature. Personnel working in enclosed spaces with running machinery may also be vulnerable to temperature related hazards. The four environmental factors which determine heat stress are temperature, humidity, ventilation and radiant heat. In many operations, combinations of these factors may result in serious heat stress to the workers, who may be performing heavy work, and producing large amounts of body heat, thus also exacerbating the heat stress problem.

The most common types of heat disorders are heat stroke, cramps, dehydration and heat exhaustion. This hazard may be minimized by regular crew rotation, provision appropriate ventilation / air conditioning if possible and having access to drinking water.

4.4.5.3 Noise Hazards

Hazards brought about by noise or sound includes equipment noise, impact noise, vibration, high-pressure release, etc. Continuous exposure to intense noise may cause hearing loss, whether temporary or irreversible. Ear protection, such as ear plugs, should be provided to all employees who work in any situation where high noise levels may be encountered.

Vibration hazards may be encountered in blasting or excavation operations during the use of hand pneumatic tools. Localized vibrations may lead to neurovascular alterations in the hands, bone alterations, including formation of cysts on some of the bones of the hand, weakness and atrophy, etc.

Vibration hazards may be minimized by regular breaks and shift change.

4.4.6 Environmental Pathways

Prior to characterizing the risks associated with each identified hazard and the management opportunities available for those risks, an evaluation of the environmental pathways is needed. The primary pathways are air or wind action, surface water runoff, groundwater transport and soil infiltration.

4.4.6.1 Air and Wind

Air and wind action provide a primary pathway and a means of dispersion of potential pollutants and contaminants that may impact both the environmental ecosystem as well as human health. The release of material into the atmosphere starts a complex situation where atmospheric gases and aerosols are driven by forces with different origins, magnitudes and directions.

The identified hazards that would be transported through the air pathway include:

- Combustion gases and particulates from power supply generators;
- Fumes produced by chemical mixing and use in the Process Plant and exhaust from equipment;
- Fumes from flammable and explosive material during use and storage; and

- Shock waves and thermal radiation impacts resulting from fire and explosions.

These will be mitigated, as measures for proper storage will be used, and appropriate handling and decommissioning will be done during the post-mining activities.

4.4.6.2 Groundwater

Groundwater generally provides a longer-term impact scenario compared to the other pathways. Physical and chemical factors influence the substance migration of contaminants, as well as the timing and degree of impact. The physical processes that control distribution of pollutants in groundwater are advection, dispersion and diffusion. There are numerous chemical and biochemical reactions that can alter contaminant concentrations in groundwater flow systems, thereby complicating the pathway mechanism. These can be grouped into: adsorption-desorption reactions, acid-base reactions, solution-precipitation reactions, oxidation-reduction reactions, ion pairing and complexing, and microbial cell synthesis.

Pollution can be the result of either point or non-point sources. Within the Project area the potential sources of groundwater pollution will generally be point sources. The identified hazards that would be transported by the groundwater pathway include:

- Leakage and release of chemicals, reagents and flammable substances from the processing facilities, fuel storage and chemical storage areas;
- Seepage from the Tailings Dam that may contain elevated concentrations of metals; and
- Seepage from the Open Pit and Underground Workings that may contain elevated concentrations of metals.

Contaminations to the groundwater will be prevented by using adequate containment facilities, best quality standards for engineering structures, and proper handling of chemicals throughout the operations and closure stage.

4.4.6.3 Surface Water

Surface water runoff is generally the fastest and most short-term pathway for potential pollutant impact. In many cases, this pathway is also a combination of surface water runoff and groundwater. Rain that falls at rates less than the soil infiltration rates enters the soil and become part of the groundwater pathway. Rainfall that exceeds the capacity of the soil to absorb water flows overland to local streams and rivers. During storms, most of the water in surface watercourses is derived from that portion of rain that fails to infiltrate the soil. When stream flows are low, the bulk of the water in the streams and rivers is the contribution of groundwater derived from rain that infiltrated during storms. The physical and chemical processes that affect migration of contaminants within the surface water pathway are the same as those that affect the groundwater pathway. Additionally, topographic and geomorphologic conditions influence this pathway.

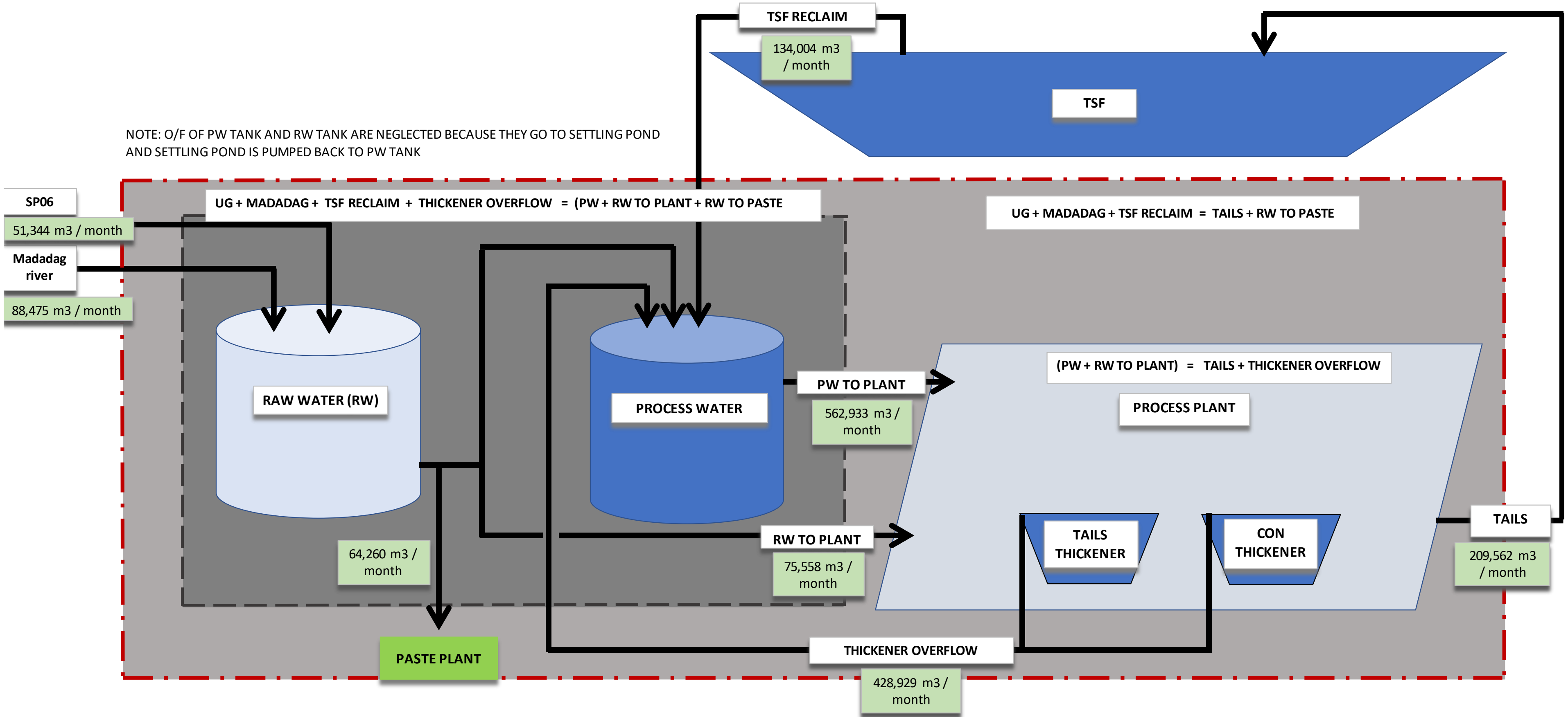
The project’s process plant water requirement is estimated to be 638,541 cubic meters per month, as illustrated in the project’s water balance diagram presented in Figure 4-3. The total water requirement of the process plant is supplied by a combination of raw water and process water. Only a total of 139, 819 cubic meters per month of raw water or roughly 22% of the total process plant water requirement is sourced from Madadag River and underground source. An estimate of about 78% of the water consumption is recycled for the process plant operation.

Potential pollution can be the result of point or non-point sources. Within the Project area, the potential sources of surface water pollution are primarily point sources. The identified hazards that could be transported by surface water pathways include:

- Leakage and release of chemicals, reagents and flammable substances from the processing facilities, fuel storage and chemical storage areas;
- Release of tailings and water from the Tailings Dam that may have elevated metal concentrations;
- Release of water from the Open Pit and Underground Workings that may have elevated metal concentrations;
- Discharge of contaminated groundwater; and
- Sediment transported from exposed areas to local streams and rivers.

Mitigations to prevent contamination to surface waters are similar with that for the groundwater.

PROCESS PLANT WATER BALANCE



RAW WATER TANK INPUTS (m3)		PROCESS WATER TANK INPUTS (m3)	
Madadag river	88,475	TSF reclaim	134,004
Underground	51,344	Thickener overflow	428,929

638,491
67.17853

RAW WATER TANK OUTPUTS (m3)		PROCESS WATER TANK OUTPUTS (m3)	
Process Plant	75,558	Process Plant	562,933
Paste plant	64,260		

RAW WATER & PROCESS WATER BLOCK % RECYCLE: 80.1 %

Figure 4-3. Process Plant Water Balance

4.4.6.4 Soil Infiltration

The same physical and chemical processes that influence contaminant migration in groundwater systems also influence infiltration and movement of contaminants through soil and other geologic material. Sources of pollution can be the result of point or non-point sources. Within the Project area, the potential sources of soil contamination are generally point sources. The identified hazards that would be distributed via soil pathways include:

- Leakage and release of chemicals, reagents and flammable substances from the processing facilities, fuel storage and chemical storage areas.
- Proper bunding and containment facilities will be used for chemicals and fuel oils to minimize the risk of soil contamination up to the decommissioning stage.

4.5 Risk Characterization

Risk characterization can incorporate a number of both quantitative and qualitative factors associated with the identified hazard. The primary objective of each characterization process is to answer three questions:

- What can go wrong?
- What is the range of severity of the adverse consequences?
- How likely are these adverse consequences to occur?

To answer these questions and thereby address the risks associated with the projects operation, activities, and undertakings, each of the associated hazards were evaluated individually. This was done by constructing accident event scenarios. For each scenario, the consequences and the likelihood of occurrence were determined.

4.5.1 Accident Scenarios

A “what-if” type of procedure was used to construct the different accident scenarios following an Event Tree. This approach begins with selection of a component failure, followed by a “forward” analysis to identify how these failures can lead to major accidents. Variations in these scenarios can result in a large number of accident scenarios and risk characterization analyses. These accidents can rank from minor to quite severe. Some have a much higher probability of occurrence while others are significantly less probable. This study focuses on the most probable worst case scenarios with the potential to adversely affect the environment and human health.

The major accident scenarios considered are as follows:

- Release of chemicals from the mill and processing areas to the environment;
- Fuel oil tank fire and possible tank explosions; and
- Ignition of materials at the explosives storage facility.

4.6 Risk Assessment

Risk assessment involves three different analyses: consequence analysis, frequency analysis and risk estimation. Consequence analysis involves the estimation and/or assessment of the effects of a hazard to people, assets and the environment. It uses various models beginning with release rates calculation to dispersion modelling. Frequency analysis is defined as the estimation of the likelihood of occurrence of the identified hazards. Risk estimation determines the outcome of an activity taking it account the probability of occurrence where risk is the product of impact and probability.

For physical and occupational hazards a Qualitative Risk Assessment was conducted utilizing the risk matrix found in the risk levels were estimated and presented in Table 4-8. The risk levels are based on qualitative only and were not lifted from existing standards that require quantitative assessment.

4.6.1 Quantitative Risk Assessment on Dam Failure

The quantitative risk assessment is consists of a probabilistic risk methodology. In particular to the Project's major infrastructure such as the tailings dam, fault tree or event tree methods are used to characterize the risks and probabilities of occurrence. In general, this involves a four step process and consists of the following:

- Risk identification to recognize and list various factors which could contribute to a failure event;
- Risk estimation such that probabilities are assigned to failure events;
- Risk acceptance evaluation, which focuses on identifying the degree of safety or residual risk that is acceptable; and
- Risk aversion formulation to identify and evaluate actions or measures which may be taken to reduce or lower the identified risks.

A summary of the QRA approach and method of analysis is presented in Figure 4-4.

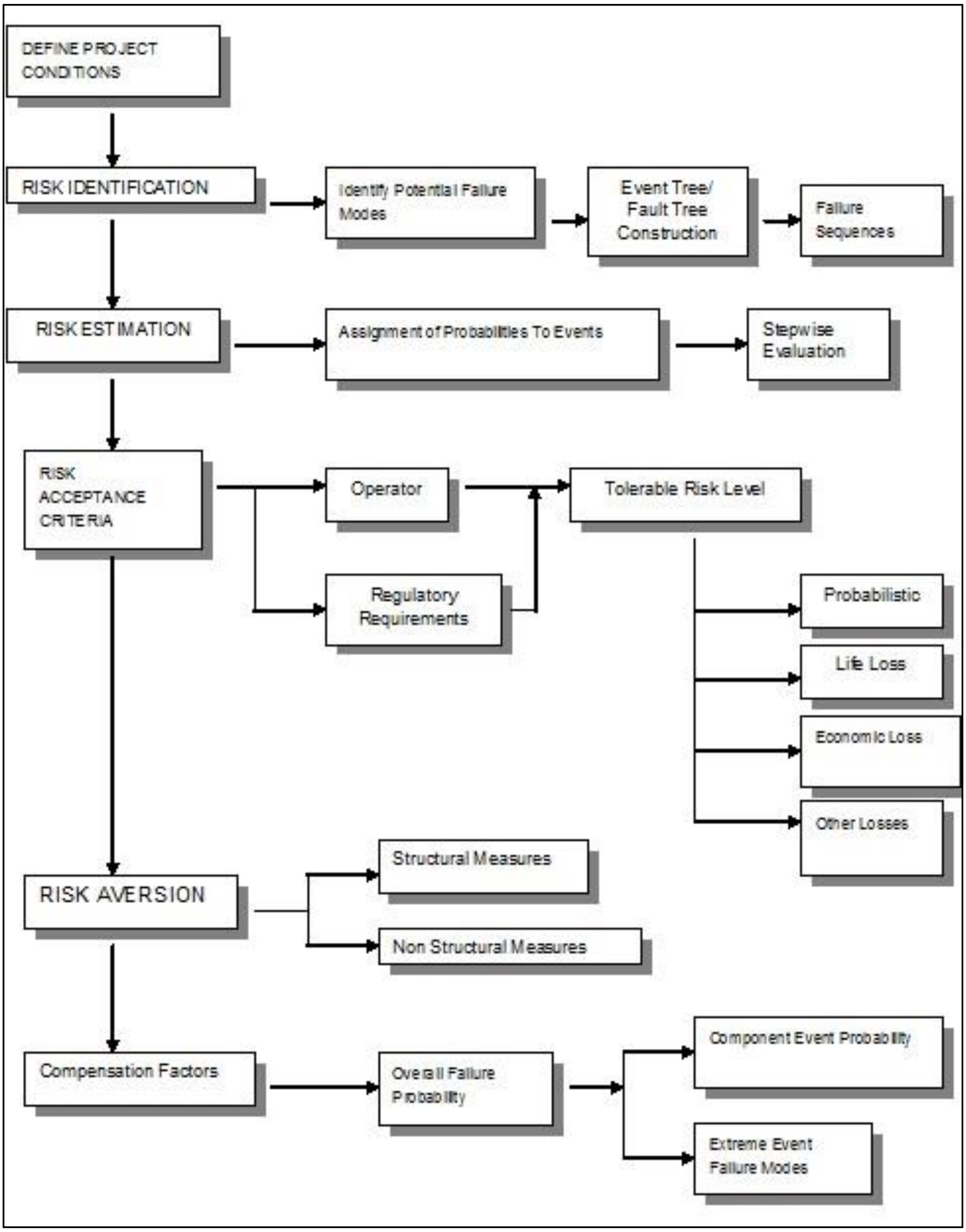


Figure 4-4: Quantitative Assessment Process

4.6.1.1 TAILINGS STORAGE FACILITY (TSF) DAM STRUCTURAL FAILURE

The TSF is a reservoir that store mine tailings which is waste material discharged from an ore processing plant. The TSF includes pits, dams, ponds, integrated pipelines, erosion protection bunds, levee banks, diversion channels, spillways and seepage collection trenches associated with the storage of tailings.

The primary function of the TSF is the safe and economical storage of tailings in an erosion-resistant, non-polluting structure that minimizes environmental impacts.

Failure of the Tailings Dam can occur as a sudden activity resulting from a dam breach or a facility failure (spillway, decant structure or a long term failure resulting from seepage release). The consequence of a dam breach will be the discharge of tailings and water into the Dinauyan River. This will be contained somewhat by the presence of the Open Pit; however, the storage within the pit is limited and overflow into the Dinauyan River will likely occur. The maximum estimated volume of the open pit is approximately 3.65 million m^3.

For purposes of consequence analyses, it was assumed a dam breach would occur if the inflow design flood was exceeded or the design earthquake was exceeded. Other causes of failure not associated with floods or earthquakes also exist. These are related to piping, seepage, foundation failure and other geotechnical considerations. These types of failure can be eliminated through appropriate engineering design and construction practices. Assigning a probability of failure resulting from these factors is difficult; however, the consequences would be similar. As such, only the inflow design flood and earthquake conditions were evaluated.

At the present time, there are no fully accepted analytical techniques to simulate the mechanics of a breach opening. Given the limited data availability, simpler techniques were used and combined with worse case assumptions.

Evaluating the consequences of a dam breach requires routing of the dam break flood hydrograph downstream. This can be done using a variety of techniques once the breach size and release characteristics are known. For this particular case however, downstream routing is quite complex due to hydraulic controls provided by the change of flow through drain and the release of tailings rather than only water. The transport mechanics and hydraulic characteristics of tailings flow are quite different that those of water. However, some basic assumptions were made that are representative of a worst-case scenario. These are discussed below and are applicable with the said scenario.

- All of the free water stored within the Tailings Dam above the tailings surface is released prior to release of the tailings;
- All the tailings are released from the impoundment following release of the free water;

The breach and dam failure is caused by overtopping of the embankment or sudden slope failure due to a seismic event or piping;

- There are no residents or structures located along the Dinauyan River between the Tailings Dam and the confluence with the Didipio River; and
- A bund is constructed around the Open Pit and diverts all the tailings and water around the Open Pit.

The peak water discharge would be in the range 200 to 240 m^3/s. The peak flow would be reduced by the time it reached the Didipio River due to attenuation and energy losses.

Since tailings and waste rock are different in their mechanical properties from water, uniform deposition within the Dinauyan River valley will not likely occur. The local valley topography and friction along the valley floor and sides will control the flow. The discharge wave will eventually slow down and stop because of a loss of energy. The distance traveled is difficult to estimate without numerical modelling. It can be assumed the depth of deposition within the upstream portion of the valley will be greater than the downstream portion.

4.6.1.2 Release of Reagents from Mill and Process Facilities

This accident scenario focuses primarily on the release of chemicals and reagents used within the mill and processing facilities, and release of fuels from the storage tank facilities. Both groundwater and surface water pathways will be the method of transport and will be subject to immediate impacts.

For the mill and processing plant, none of the reagents or chemicals proposed is listed as toxic or hazardous. All facilities will be protected by primary and secondary containment structures and emergency spill procedures are in place for each chemical should a spill occur.

In the event all control measures fail, any release of chemicals or reagents will be to the Dinauyan River downstream of the Tailings Dam. Since the flow within this reach of the river will be controlled by releases from the Tailings Dam, this will provide an additional means of control and treatment. Fuel spills will also be directed to the Dinauyan River downstream of the Tailings Dam. Secondary River containment structures and emergency spill response plans will be part of the risk control and management.

Consequences related to either spill condition are limited to water quality degradation and aquatic habitat impact within a controlled reach of the Dinauyan River. Water within this reach of the river will not be used for potable or agricultural uses. Construction of the Open Pit and diversion bunds will alter the aquatic habitat conditions during operations. As such, any spills will not have a significant impact.

4.6.2 Qualitative Risk Assessment

OGPI maintains an Environmental Aspects and Impacts Identification, Risk Assessment and Determination of Controls document, which is a live document that allows identification of EHS hazards and impacts, and evaluation of significant risk rating of regular, new, and long-term activities, products and processes. OGPI's standard system procedure on Environmental Aspects and Impacts/Hazard Identification, Risk Assessment and Determination of Controls is provided in Annex I.

All identified and determined risks to cause impact on the environment, safety and health as a result of the project activities, aspects, undertakings were subjected to a risk screening or a qualitative risk assessment. Using the Risk Assessment Matrix, the risk levels were estimated and presented. The risk levels are based on qualitative assessment only and were not lifted from existing standards that require quantitative assessment.

A five-level qualitative description of the likelihood and consequences for each risk was used to provide a semi-quantitative method showing the interaction of consequence and likelihood as a final rating for each identified risk, as shown in Table 4-8**.**

The identified risks have been initially assessed in terms of its likelihood and consequence level without incorporating any mitigating controls. Mitigation measures to address the specific risk events were then identified, and the risks were again assessed in consideration of the mitigating measures employed / in-place. The Residual Risk, or the remaining level of risk following the development and implementation of the mitigating measures is reassessed and mitigated to an acceptable level. The residual risk provides guidance for the identified risk level as the project goes forward, and allows OGPI the opportunity to reduce this further, consistent with their risk management policies.

Table 4-8: OGPI's Risk Assessment Matrix

			1	2	3	4	5
Consequences	**People**		Minor injuries (first aid or report only injuries/illness)	Medical treated injury	Lost time or restricted work injury/illness (<2weeks)	Serious lost time injury/illness (>2weeks) or permanent disabling injury	Single or multiple fatalities
	Equipment Damage or Process Loss		<\$1,000 Low financial loss	<\$1,000 - \$5,000 Low financial loss	\$5,000 - \$50,000 Medium financial loss	\$50,000 - \$500,000 High financial loss	>\$500,000 Extreme financial loss
	Environmental Impact		No measurable environmental impact, contained within site boundaries, minimal clean-up required. Uncontrolled discharge <40L	Low environmental impact over a small area, contained within site boundaries. Minor clean-up of the impacted area which can be completed within 24hours. Technical and administrative non-compliance to regulatory requirements and isolated non-compliance events that have no potential for environmental harm or prosecution.	Measurable environmental impact contained on site or low environmental impact off site requiring clean up to 7days. Any breach of regulatory requirement that has potential to cause environmental harm or prosecution, including repeated no-impact, non-compliances.	Measurable environmental impact onsite and off-site with significant clean up and rehabilitation efforts up to 30days. Non-compliance event that is likely to generate investigation by a regulator including repeated no-impact non-compliances. Likely potential for prosecution.	Measurable long term environmental impacts on-site or off-site outside of approved environmental impacts. Extensive clean up and rehabilitation in excess of 30 days required. Non-compliance events resulting in almost certain prosecution and regulator intervention.
Likelihood	A Common	Happens often, is likely to happen again, has a high frequency of occurrence	**11**	**16**	**20**	**23**	**25**
	B Likely	Is a likely occurrence more than once per year	**7**	**12**	**17**	**21**	**24**
	C Possible	It could occur at least once every 1 to 5 years	**4**	**8**	**13**	**18**	**22**
	D Unlikely	Not expected to occur but could occur once within a 5 to 10 year timeframe	**2**	**5**	**9**	**14**	**19**
	E Rare	Has rarely occurred in the industry and/or is not expected to ever occur again	**1**	**3**	**6**	**10**	**15**

Legend	Action Required	Approval	Incident Notifications
Low (1 - 5)	Accept risk and manage by routine procedures	Supervisor	Supervisor notifies Foreman/ Superintendent
Moderate (6 - 12)	Develop a corrective and preventive action plan and document in JSA or SOP	Supervisor/ Foreman	Foreman/ Superintendent notifies Manager
High (13 - 20)	Complete a Risk Assessment and immediately implement the corrective and preventive actions	Superintendent/ Manager	Manager notifies General Manager
Extreme (21 – 25)	Complete a formalized Risk Assessment which is reviewed by a subject matter expert	General Manager	General Manager notifies COO

4.6.2.1 PROJECT'S EXISTING RISK

The details of the existing risks identified as a result of the project's activity, processes and undertakings are presented in Annex J which provides the details of the inherent and residual risks of the project.

OGPI's updated risk registry reveals that, there are a total of 74 inherent risks classified as "Extreme risk" and 275 classified as "High risk", which are mostly associated with the surface mining and mineral processing operations. These risks were identified as consequences of the different types of hazards that are inherent to the project, which may potentially affect health and safety of the workers, the environment, or threats that may result to financial loss, or possible regulatory or legal disputes that can affect the company and the project.

After applying critical control measures and company's standard procedures, previously rated as "extreme" and "high" risk levels (worst-case scenarios) were reduced to acceptable and manageable levels that are within the standard of OGPI.

4.6.2.2 PROJECT'S NEW RISK

The expansion of the project's annual production capacity from 3.5MTPY to 4.2MTPY will only involve maximizing the existing equipment, machinery, and designed capabilities of the processing plant. No additional operation or undertaking will be introduced as a result of the increase in production.

4.7 RISK MANAGEMENT

Procedures and task based work instructions have been developed to provide guidance for the safe, effective, and efficient method for work. Where there is no procedure in place, a risk assessment is required (Stop and Think, Job Hazard Analysis) to be undertaken to identify hazards and control methods for managing the risks of work.

The previous analyses have shown the level of residual risk, after incorporating critical mitigating measures, may be considered manageable with further measures to be implemented by the company.

It should be stressed that the estimated risk levels assume worst-case accident scenarios with no risk management. This however is not the case. Hazard Management is being implemented throughout the mine, mill and processing areas. Continuous assessment of more specific design information is done to improve risk management.

OGPI ensures that health, safety and environmental risks are assessed, understood and controlled to reduce operational risks and exposures in every phase of its operation. Aligned to the principle of OGPI's mother company, Oceanagold Corporation, the company implements and adopts extensive sets of standards on health, safety and environment compliances.

Where risk assessments indicate the need for controls, the standard hierarchy of controls are adopted, as demonstrated in Figure 4-5.

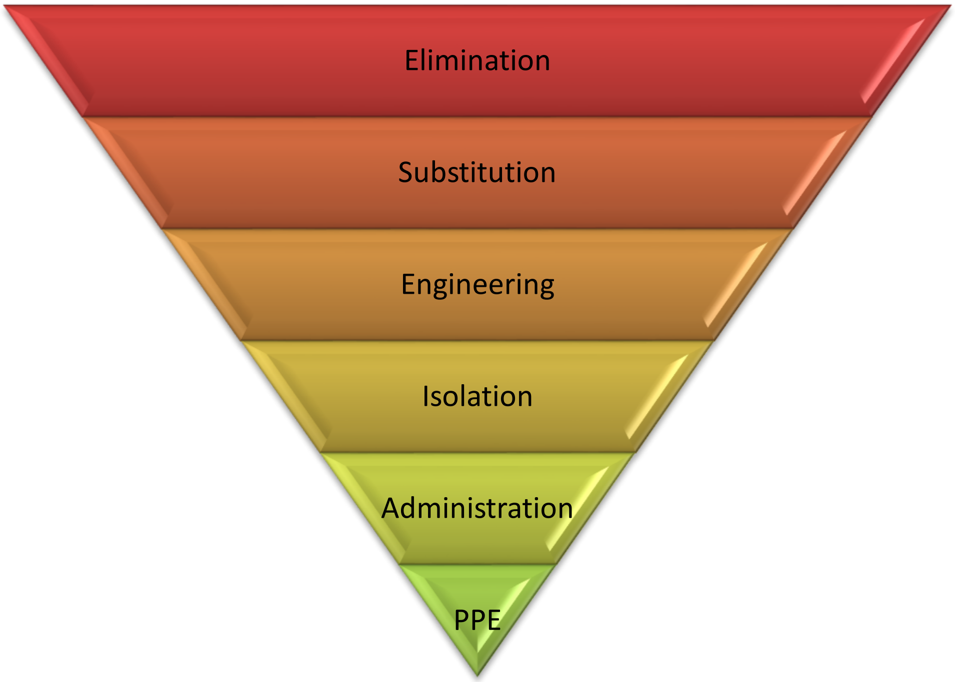


Figure 4-5: OGPI Hierarchy of controls

Elimination	Removal of the hazard from the process
Substitution	Use of safer process, equipment or material
Engineering	Installation of physical barriers or innovations reduce risk of exposure
Isolation	Separation of hazard from the worker
Administration	Instruction and training to increase employee awareness
Personal Protective Equipment (PPE)	Hard hat, glasses, gloves – last line of defense control

4.7.1 CHEMICAL HAZARDS

All hazardous substances to be used by the company will be stored, and handled in compliance with all applicable Philippine and international regulations. OGPI is committed to preventing, to the greatest extent possible, both inadvertent release of these hazardous substances to the environment and accidents resulting from mishandling or mishap.

In order to insure that hazards or risks that may be posed by the project are further minimized, OGPI has established and implements and operational Standard Procedures covering the proper and safe handling, usage, storage, and disposal of chemical materials and chemical wastes generated by the project. In general, the standard management plan for hazardous materials and chemical substances includes procedures on:

- Supply and Logistics
    - Process for a new or change of hazard material and chemical substances
    - Labelling of hazard materials and chemical substances
    - Safety Data Sheets
    - Transportation of hazard materials and chemical substances
    - Transportation of dangerous goods by a logistic provider
    - Contract management for hazardous materials and chemical substance

- Onsite Storage and Handling
  - Hazard materials and chemical substance register – chem alert
  - Storing hazard materials and chemical substances
  - Signage
  - Storage tanks and piping
  - Mixing and distribution systems of hazard materials and chemical substances
  - Using hazard materials and chemical substances
  - PPE and emergency showers/eye wash stations
  - New installations
  - Change of volume or type of chemicals stored
- Waste Management
  - Empty containers
  - Spill response
  - Disposing of hazard materials and chemical substances

Particularly, OGPI's RFI-R-OG-000012 – Management Plan for Hazardous Materials and Chemical Substance details the step by step procedure on handling, storage, usage, and disposal of the hazardous materials. The standard procedures and management plans of OGPI applies to all requirements, activities and persons in any capacity accessing or within the Didipio Project associated with hazardous material and chemical substances.

4.7.2 Explosives Hazards

Principal Hazard Management Plan – Explosives (PHMP-EX) describes how Didipio Project of OGPI manages risks associated with handling, transport and use of explosives which may result in serious accident or business interruption. The PHMP, specifically, describes how the project's operation manages risks associated with the hazard of:

- Transporting, handling and storage of explosives and explosives accessories
- Manufacture of explosives
- Charging, firing of explosives, and
- Recovery, refiring or disposal of misfire explosives.

The PHMP-EX is a document authorized by OGPI and applies to all workers at the project's operation and forms part of the long list of company's standard procedures. OGPI's principal hazard management plan, as provided in the company's standard operating procedure for explosives (RFI-R-OG-000012-Explosives Management Plan) must, at the minimum, address the following matters:

a. Transportation of explosives at the mining operation
b. Explosive accessories
c. Inspection of and reporting on the safety of equipment used at the mining operation for manufacturing, storing, transporting and delivering explosives
d. The appropriate action to be taken to make safe of utilized equipment
e. How explosives brought into the mining operation and used at the mining operation will be accounted for
f. How explosives will be checked for any deterioration in the explosives and isolated if they have deteriorated
g. The establishment of secure storage for explosives at the mining operation, including a system for signing explosives in and out of storage
h. In the case of underground mining operations and tunneling operations, a process to remove explosives from underground at the operation unless there is an approved facility to store the explosives underground.

i. The establishment of declared danger zones that no person may enter while blasting operations are taking place
j. The procedure to find, recover, and detonate misfired explosives
k. A record to be kept of misfired explosives
l. A register of people at or providing a service to the mining operation who are approved handlers under the DAO No. 2000-98 Mine Safety and Health Standards the Philippine Explosive Law to handle explosives
m. The co-operation required between the mining operation and any person authorized under the DAO No. 2000-98 Mine Safety and Health Standards the Philippine Explosive Law regarding the safety of the storage, handling, transportation and use of explosives at the mining operation, including compliance with any conditions attached to the authorization under the DAO and the Philippine Explosive Law of the person handling the explosive.

4.7.2.1 CONTROL PROCEDURE

All controls for the principal hazard explosives have been identified and area listed in PHMP-EX. The controls are broken up into three categories such as (1) specific site controls, (2) generic controls and critical controls.

Specific site controls are controls at department level that have been implemented to reduce the risk of the principal hazard. These include inductions, training, SOP's, procedures, management plans, inspection, etc.

Critical control is a control that will have the greatest impact on preventing the risks relating to the principal hazard from occurring, or if the risk was to occur the critical control would provide the greatest mitigation of the potential consequences.

Critical controls have been identified through the risk review and analysis process. The Critical Controls are identified in the Principal Hazard Management Plan of OGPI and identify the delegated responsible person, a description of the control and any treatment plans that have been identified to improve the performance and reliability of the critical controls in managing the principal hazard.

This approach was taken by OGPI to maintain focus on the high level controls that, if removed, would lead to the top event. Therefore there is a conscious exclusion of the low level generic type controls as these would be identified and form part of the procedural documentation that also form part of the PHMP-EX.

OGPI's explosive third-party contractor is required to comply, at the minimum, with the standard operating procedures of the company, especially on explosives. Consistent to this, OGPIs current contractor, Orica Philippines, implements its own standard operating procedure for guidance and implementation of its personnel in-charge for the project.

Orica owns licenses and maintains the Magazines. Orica manages them in accordance with the Contract as Supplier of Explosives. Separate magazines that meet the requirements and regulations of the Mines & Geosciences Bureau, Mine Health and Safety Standard and the Headquarters of Philippine National Police, Firearms and Explosive Division. The Philippine National Police under the Explosives Implementing Rules and Regulation (IRR), regulates and controls purchase, transport, storage and use of explosives.

The compatibility group, which describes the type of explosives, is denoted by the letter which follows the division number. Explosives bearing the same letter are deemed to be compatible unless otherwise specified. Example, SENATEL POWERFRAG and ANZOMEX primers are both classed 1.1D – therefore both these products can be stored in the same magazine. Exel detonators are classified as 1.1B and thus must be stored separately SENATEL POWERFRAG.

As a general rule, different compatibility groups cannot be stored together.

4.7.3 TSF Dam Failure Hazards

The most effective risk management for TSF dam failure hazards is the carrying out of appropriate engineering design and subsequently the best engineering practices during construction phase. Consistent with the principles of best engineering practices, OGPI's tailings disposal facility was designed by a globally known and reputable geotechnical consulting firm, GHD, that up to this phase of the project continues to provide oversight and monitoring during annual construction campaigns. To ensure the integrity of the TSF, design criteria for the tailings storage facility have been based on the following:

- Philippines guidelines issued by the Department of Environment and Natural Resources (DENR) Memorandum Order No. 99-32 (24th November 1999);
- Australian National Committee on Large Dams (ANCOLD) guidelines; and
- OGPI requirements.

The relevant Philippines guidelines are titled "Policy Guidelines and Standards for Mine Wastes and Mill Tailings Management" Memorandum Order No. 99-32 (24th November 1999), issued by the Department of Environment and Natural Resources (DENR). The DENR requirements are summarized as follows:

- Freeboard requirement during dam construction stage shall take into consideration the hydrology/flooding in the area. Decant, and/or water diversion or spillway systems shall be provided as necessary;
- A five (5) year flood cycle shall be considered during dam construction stage;
- Sufficient freeboard depending on the hydrological/ flooding consideration shall likewise be maintained during the operating life of the impoundment; A one hundred (100) year flood cycle shall be taken into account during active impoundment operation;
- Sufficient freeboard, decant, water diversion or spillway shall be provided before decommissioning to ensure that it can withstand the maximum probable storm event without serious damage to the surrounding environment or to the tailings structure;
- Seismic consideration in the design of impoundment shall not be less than 0.15 and 0.25 g under Operation Base Earthquake (OBE) and Maximum Credible Earthquake (MCE) respectively; and.
- Embankments shall also be compacted to no less than ninety percent (90%) of proctor density.

In keeping with the DENR requirements, the following general guidelines guide the design of the TSF:

- Diversion during construction to safely pass the 5 year Average Recurrence Interval (ARI) flood; and
- Completed TSF to include provision to contain the 100 yr ARI 72 hr rain event without uncontrolled spill (the reserve storage provision) in the event that water quality temporarily fails to meet discharge parameters.

Table 4-9: Didipio Waste Management System Design Criterion

Item	Design Criterion
TSF Hazard Category (ANCOLD)	'High C' Hazard Category
TSF Construction	Construction overtopping spillways to safely pass 1:5 ARI flow events
Spillways	Construction coffer dams to store (with pumping) 1:2 ARI flow events
TSF Spillway (post construction)	Maintain at all stages post construction an overtopping emergency spillway designed to safely store/pass a Probable Maximum Flood (PMF);
TSF Decanting System	Utilize pumping for removal of decant water to avoid gravity pipes through embankment to minimize risk of piping on conduits (OGPI requirement) Minimum flood storage capacity for the 100 yr ARI 72 hr (1.5Mm3) without spilling above normal operating pond volume (the reserve storage provision) in the event that water quality temporarily fails to meet

Item	Design Criterion
	discharge parameters Pump capacity to pass average flow from wettest consecutive 3 months on record (823mm/month ~ 0.8m3/s);
TSF/WRD Embankment Seismic Loading Operating Basis Earthquake (OBE)	• 1:475 year return period, bed-rock site PGA = 0.25g • Maximum Design Earthquake (MDE): • 1:10,000 year return period, bed-rock site PGA = 0.50g;
WRD Spillway	• Overtopping spillway to safety pass 100 yr ARI 72 hr event • Storage of PMF without overtopping following Year 5 • Flow Through Drain to pass wettest monthly flow (2.6m3/s)
TSF Embankment	• Year 0 TSF commissioning tailings storage; 1 year production (2.5 Mt); • Downstream construction methodology; • Use waste rock from mining operations where economical to do so • Where waste rock is unsuitable, uneconomical or unavailable, maximize use of locally won materials • Low permeability core to retain supernatant water when required and minimize seepage. • Low -permeability cut-off trench to minimize seepage • Filter protection for clay core piping failure protection
TSF Closure	• Partial wetland/water cover, land use available for revegetation or cultivation; • Divert flow from TSF / WRD catchment (Dinauyan River) to feed the open pit lake, also used as a large sediment trap; • Retain stable (negligible erosion, settlement, blockage risk) spillway for the long term.

The overall mine waste storage concept provides an integrated solution to store waste rock materials and tailings while initially diverting and eventually throttling Dinauyan River flows, to mitigate the risk of flooding the downstream mine pit.

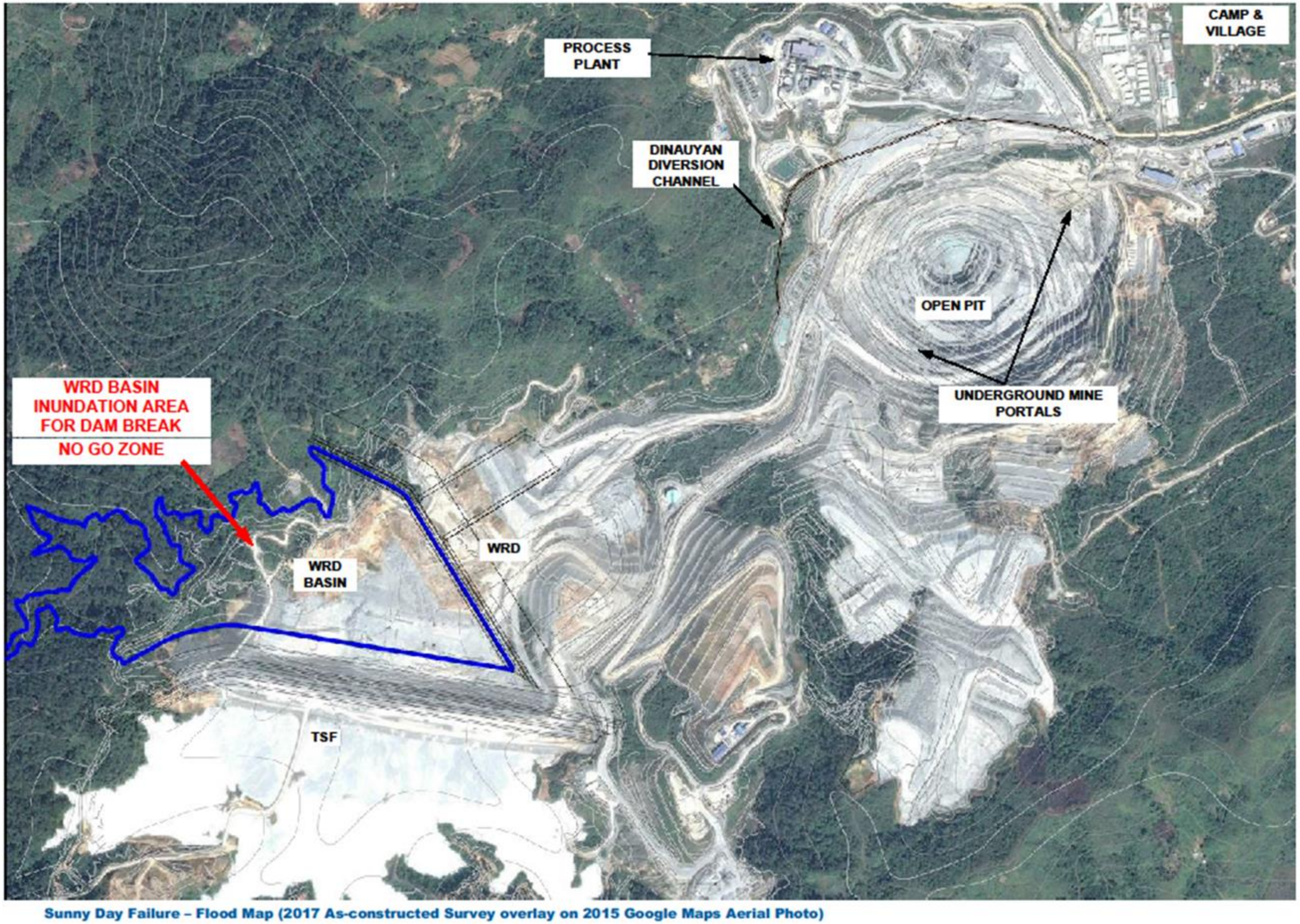


Figure 4-6: Sunny Day Failure – Flood Map

4.8 Health and Safety Reports

OGPI records and reports incidences, accidents, morbidity data, breaches in Safety and Health policies and other health and safety data on a monthly basis to the Mines and Geosciences Bureau, through the submissions of Monthly General Accident Report, Monthly Employer's Report of Accident or Illness, among other safety reports.

From Year 2015 to the 1st Quarter of 2018, a total of 1,735,790 combined manhours worked by OGPI and its contractors. During this period, only a total of 20 accidents was recorded where 19 are Non-Lost Time Accident (NLTA) and only 1 Lost Time Accident (LTA). This number of accidents resulted to a total of 384 days lost (about 9,216 manhours) that is less than 1% of the total manhours combined during the same period.

Figure 4-7 shows the accident statistics from 2015-2018.

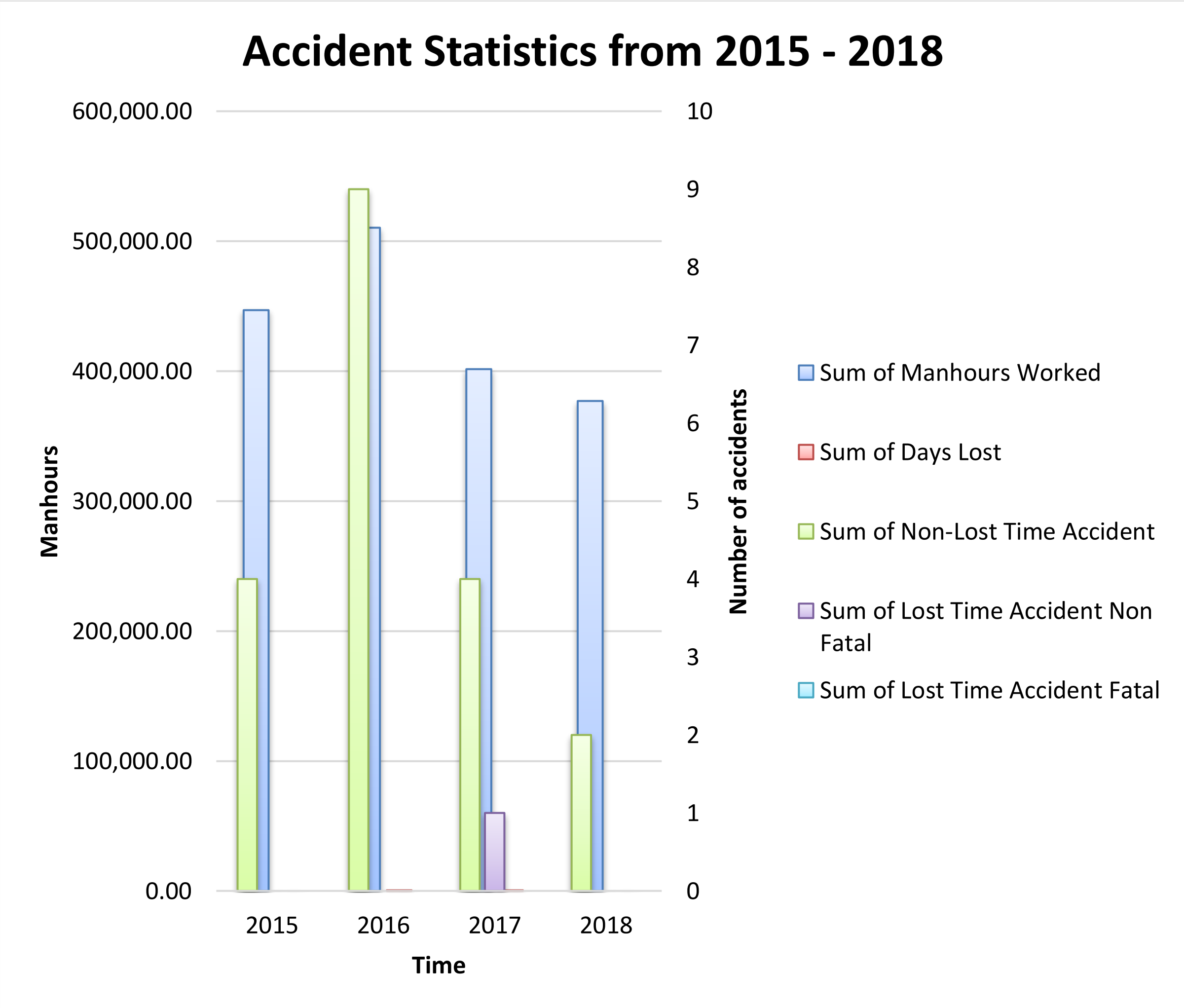


Figure 4-7: Accident Statistics from 2015-2018

The 2015-2018 accident distribution shows that out of the total of 20 recorded incidents, 9 are associated to OGPI and 11 (including the 1 LTA) are from its Contractor.

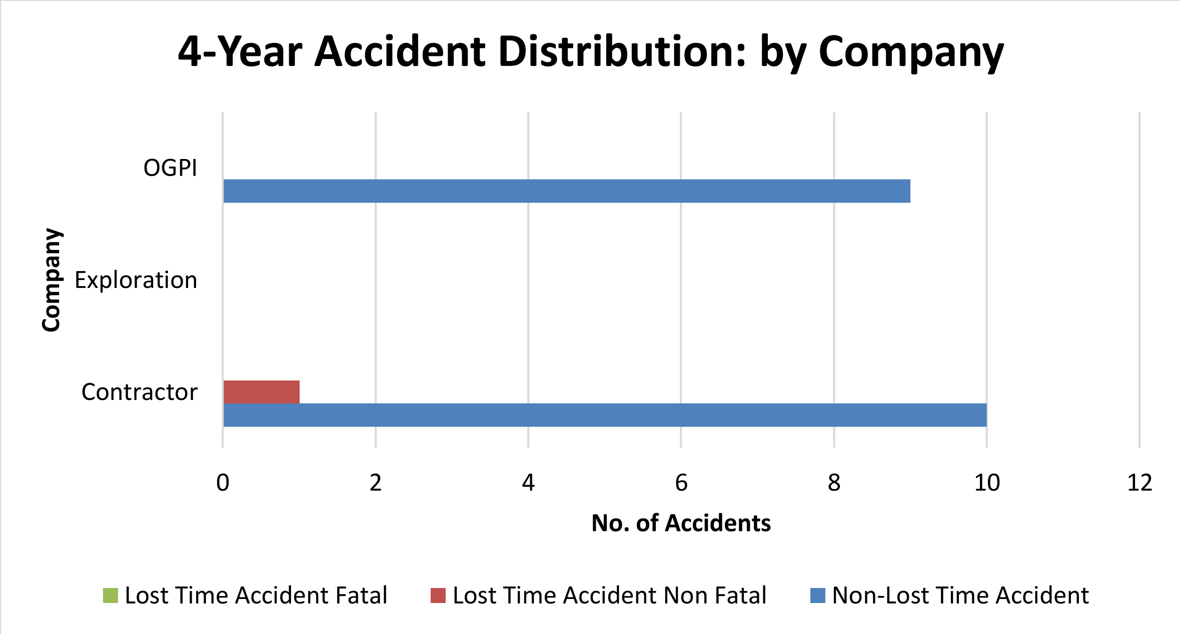


Figure 4-8: 2015-2018 Accident Distribution by Company

The submitted safety and health reports further show that of the 20 recorded accidents 18 are due to unsafe practices and only 2 are due to unsafe condition, as shown in Figure 4-9. The accidents are caused mainly of the Labor workforce accounting to 17 accidents and 1 accident each caused by the Mechanic, Manager, and Supervisor levels, as shown in Figure 4-10.

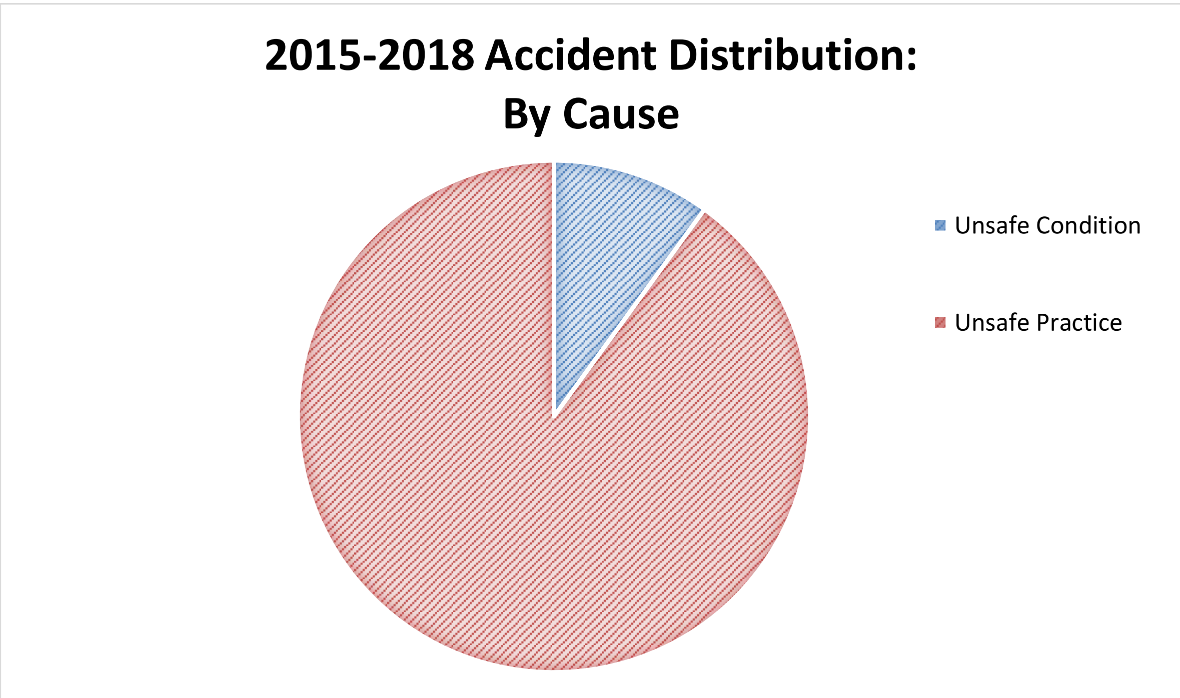


Figure 4-9: 2015-2018 Accident Distribution by Cause

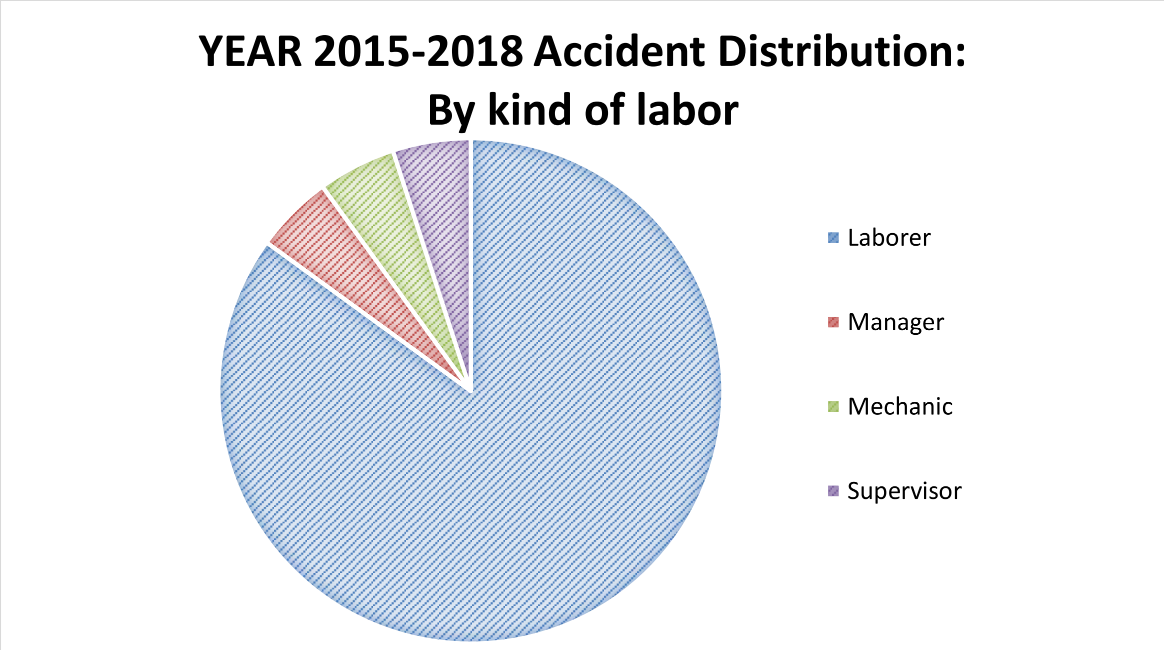


Figure 4-10: 2015-2018 Accident Distribution by Workforce

Most of the recorded accidents resulted to eye or forehead minor injuries. Figure 4-11 illustrates the distribution of accident by body part.

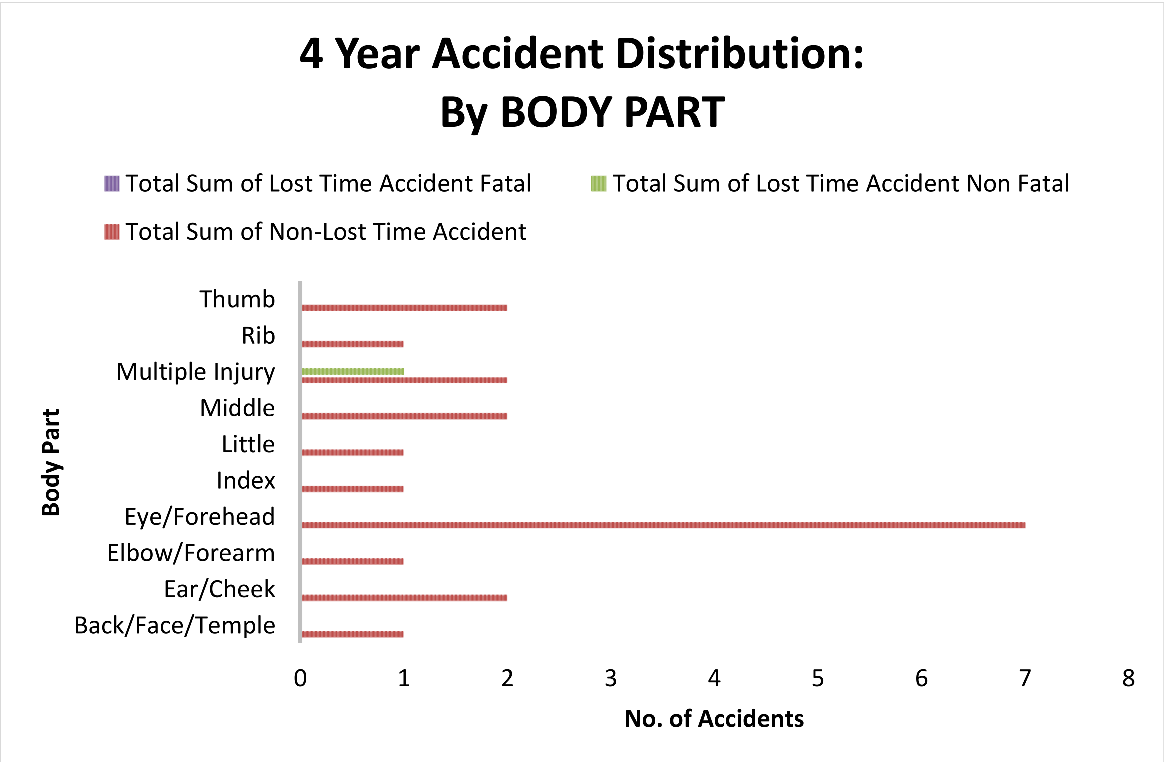


Figure 4-11: 2015-2018 Accident Distribution by Body Part

4.9 Emergency Response Plan

OGPI currently maintains an operationalized and institutionalized Crisis and Emergency Management (CEM) Plan designed to assist in protecting the company from the corporate consequences of a crisis event, whether sudden(emergency) or escalating in nature, by ensuring prompt and effective handling of strategic, contractual and public image aspects arising. The CEM is provided in Annex K.

OGPI is committed to zero harm in its workplaces and continuously take every reasonable precaution to avoid incidents by operating in a safe and responsible manner. The Company's CEM procedures, undertakes to establish and maintain appropriate emergency and crisis event preparedness for all its operation, business unit operations and corporate activities.

OGPI's CEM Plan covers all activities, and/or business unit locations and associated operations. Activities of primary contractors, subcontractors and suppliers are also covered under our CEM Plan and are designed to be activated in the event of an crisis event, primarily to support:

- A serious corporate//business unit specific Level 3 – crisis event that requires ongoing corporate or business continuity management and related involvement; or
- An non-emergency related Level 5 crisis event that has the potential to significantly impact or destabilize the entire organization - i.e. major financial loss; rally; etc.

4.9.1 Definition of Terms

Emergency	An emergency is an unexpected event that poses a threat to life, property or the environment and requires immediate action to prevent or limit the effect such a threat. This Emergency Response Plan sets out the minimum procedures that should be undertaken by personnel acting on behalf of OGPI and its contractors. For the purposes of our OGC Emergency Management Planning, Emergency includes: • A sudden, unexpected, abnormal or dangerous "incident"; • Requiring precise and immediate action; • To control, correct and return to a safe condition.
Crisis	In the event that the emergency escalated and cannot be contained by the site Emergency Response Team (ERT) and Emergency Management Team (EMT), the OGPI Crisis & Emergency Plan (CEP) should be used. It is designed to minimise the impact of the incident or event on the OGPI enterprise. The goal of the Crisis & Emergency Plan is to support this CEP, by providing a consistent communication framework that supports the operational response to a crisis and will enable OGPI to provide timely, accurate information to all our stakeholders. • A major business interruption event; • Has the potential to significantly impact or destabilize part of, or the entire OGPI organization; • Could significantly affect the company's personnel, operations, business continuity; Attract intense scrutiny from regulators and/or media jeopardize its positive public or shareholder image; or a combination of the above.
CEP	Crisis & Emergency Plan: A plan developed to allow the CM to implement the appropriate controls necessary to address emergency situations
CMT	Crisis Management Team: A group of personnel designated to convene and function when any emergency reaches crisis level, and might normally operate in Makati Office in accordance with the Crisis & Emergency Plan
EM	Emergency Manager: The OGPI General Manager or project site Construction Manager or a senior manager available on site at the time of the emergency
CM	Command Centre: A room generally remote from location of emergency incident, which is

	equipped with the necessary communication equipment and other facilities deemed to be necessary for the management of an emergency
EMT	Emergency Management Team: The identified team responsible for the support activities in relation to an emergency incident
EO / RBO	Emergency Operator: The person who would normally receive emergency calls on a dedicated phone or base radio
IC	Incident Control
ERT	Emergency Response Team - group of on-site personnel who provide a tactical response to an emergency eve
ERTC	Emergency Response Team Coordinator: The fulltime OGPI emergency coordinator on site
GM	General Manager
OGPI	OceanaGold Philippines Incorporated: The company's registered name

The existing Emergency Management Plan of OGPI is capable to address and manage the old and new risks associated to the project's operation. The plan covers all OGPI staff, employees, contractors, sub-contractors, and others On-Site are obliged to comply with the provisions of the plan. OGPI's Emergency Management Plan is attached as Annex L.

4.9.2 Emergency Priorities

At OGPI's Didipio Project, in the event of an emergency situation the order of priority for management is always:

- Management of people
- Management of the environment
- Management of equipment, materials and production

4.9.3 Foreseeable Emergencies

Risk assessments conducted have identified the following foreseeable emergencies which are grouped under each of the principal hazards

Principal hazards are those that could create a risk of multiple casualties and/or fatalities in a single accident or a series of recurring accidents. A Principal Hazard Management Plan (PHMP), Principal Control Plan, Management Plan or Standard Operating Procedure (SOP) is required for each of the following and outlines how OGPI effectively manage each hazard.

On site responses will include activation of Emergency Response Team (ERT), medical response (Site doctor and nurses), utilization of any available mining equipment and plant to manage the emergency and activation of the Emergency Management Team (EMT) as required.

Table 4-10: Some of the Foreseeable Emergencies

	Potential Incident / Accident	Potential Location	Internal response required	Casualty management outcome
1	Fire and explosion • Surface – structural, wild fire • Underground • Tyre and rim failure • Machinery failure	All areas	APD, ERT, Medical Water carts, dozers	Burns, smoke inhalation, fractures Multi-casualty

	Potential Incident / Accident	Potential Location	Internal response required	Casualty management outcome
	• Electrical failure • Chemical • Pressure vessels • Explosions			
2	Ground and/or Strata Failure • Pit wall failure • TSF • Landslide • Entrapment	Mining areas, TSF, earthworks	APD, ERT, Medical, Engineers, Geologists, Surveyors	Asphyxiation, respiratory distress, fractures, multiple injuries
3	Tips, ponds, voids • Slumping or collapse of WRS • Equipment falling over tip head • Falling materials from tip head • Water saturation and drainage of stockpiles/dumps	TSF Silt ponds Water storage dams Waste rock stacks – fingers and tip heads	APD, ERT, Medical, Engineers, Geologists, Surveyors	Entrapment, multiple injuries
4	Explosion • Unplanned detonation • Misfire		APD, ERT, Medical, explosive personnel	Multiple injuries
5	Hazardous materials / chemicals • Release • Spill • Exposure	Process Plant, Chemical Storage Areas SGS Laboratory	APD, ERT, Medical	Respiratory distress, burns, asphyxiation
6	Extreme weather events • Flooding • Typhoon • Earthquake	All areas	APD, ERT, Medical	Multiple injuries
7	Roads and vehicles • Vehicle / vehicle interaction • Vehicle / worker interaction • Off-site vehicle / pedestrian / motor vehicle / animal interaction	All areas	APD, ERT, Medical	Head injuries, fractures, lacerations, crush injuries

4.9.4 Emergency Management Plan

OGPI's Emergency Management Plan is based on the recommended structure by the Philippine National Disaster Risk Reduction Management (NDRRMC) and Office of Civil Defense (OCD) and ICS515:ICS Active Defense and Incident Response and OGCHSE Compliance Standards. The management of emergencies can be outlined into four elements – Prevention, Preparedness, Response, Recovery. Figure 4-11 illustrates the four elements.

Figure 4-12: Elements of Emergency Management

4.9.5 Procedures

4.9.5.1 Emergency Procedure

In the event of an emergency, the OGPI General Manager and or Construction Manager (or most senior person available) shall implement the CEP. He will assume the role of EM. In conducting the response the EM shall operate under the guidance of the CMT (if activated) and information provided from the scene of the incident by the ERTC.

The ERTC will consult with EM as to the emergency level ("ie"1, 2, or 3), the scale of the potential of the incident and whether the CMT needs to be activated in Manila office. Activation of the CMT will be in accordance with the CEP.

4.9.5.2 Crisis Management Procedure

Effective crisis response during a major disruption is critical to achieving successful outcomes. Trying to work it out' after an incident has occurred is dangerous and typically results in greater damage to the organization. Instead, there needs to be a well-planned, coordinated and tested crisis response capability in place including, detailed planning, strong leadership, excellent teamwork and regular communication. The initiation of these parameters will limit potential reputational damage, financial cost and legal liability.

Figure 4-13 demonstrates the flow of OGPI's emergency and/or crisis management plan.

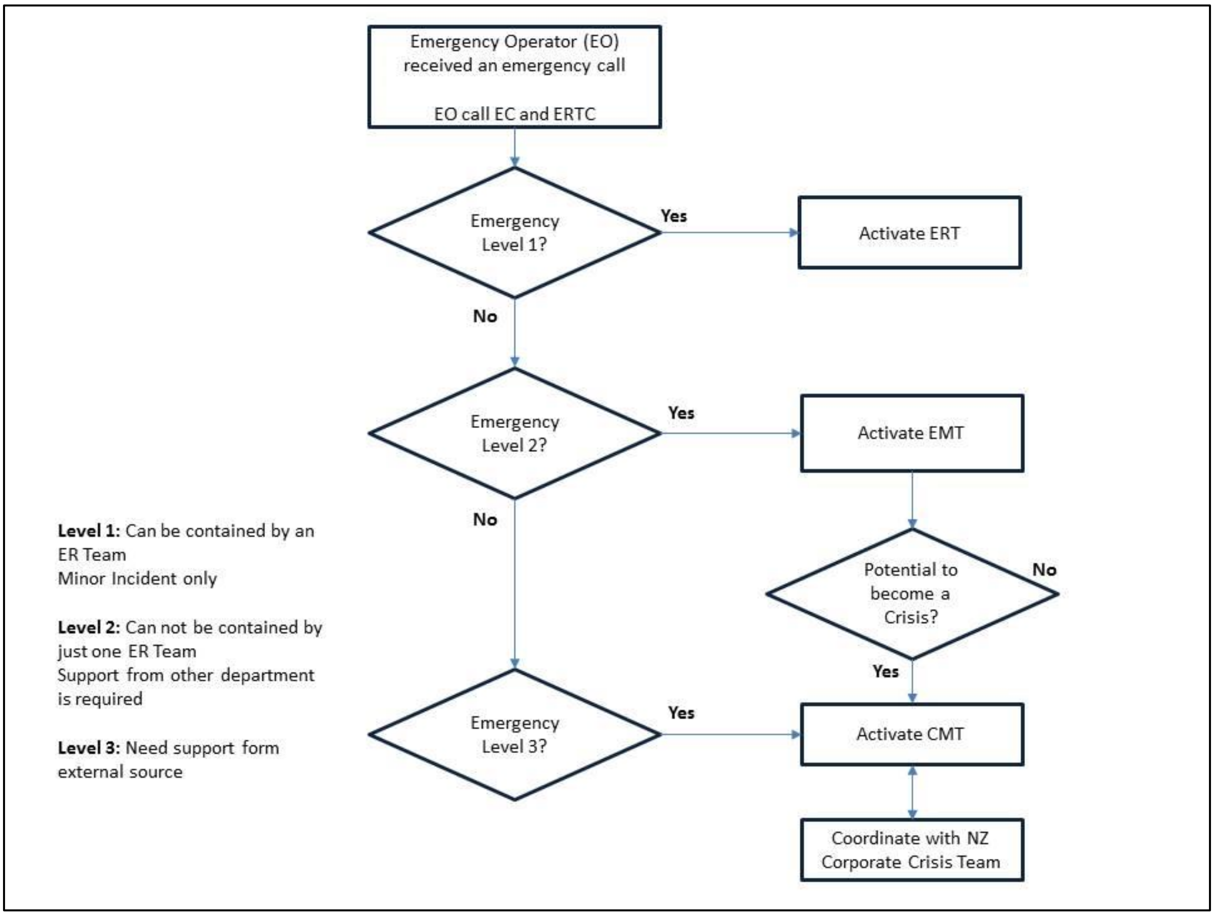


Figure 4-13: Emergency and Crisis Management Response Flow

4.9.6 Specific Emergency Responses

Following is a series of Field Incident Guides (FIG) that will assist individuals and first responders discovering or arriving at an emergency and course of action that might be taken in order to ensure the incident is addressed by suitably qualified personnel in a timely fashion.

4.9.6.1 Chemical Spills/ Leak / Gas Release

This section applies to all chemical spills including but not limited to sediment, oil/diesel spills. The cause of the spill could include pipeline/tank failure, vehicle accident, dam/bund overtopping, and other failure of containment systems.

When a spill, or uncontrolled release of a hazardous substance occur never attempt to clean up the spill unless the hazardous properties of the substance are known and it is safe to do so.

All chemical spills will be cleaned up by trained competent persons using site SOP's for the chemical in question and contained and disposed of as per site environmental safety procedures.

In any chemical emergency the workers should evacuate the area where the toxic chemical spill has occurred and remain uphill and upwind of the incident site.

If personal contact with the chemical:

- Wash eyes with water for at least fifteen (15) minutes, seek medical assistance
- Remove contaminated clothing and wash skin with water for fifteen (15) minutes.
- Make yourself safe

- Check that the area is safe; if necessary follow the procedure for a chemical spill/leak
- Contact first aider/ERT team for assistance
- Obtain a copy of the relevant SDS for the chemical concerned

Job Title	Duties
Any person discovering the emergency	Contact the EO/RBO by phoning +63917-857-1111 or Local 911 or radio channel one • provide your name, location and nature of the incident including, wind direction, any injuries and nature of injuries • Follow any instruction given by the EO/RBO
EO / RBO	EO/RBO shall Inform the ERTC of the situation
ERTC	ERTC shall: • Inform the GM & POSH (depending on level of emergency) • Respond the ERT to the incident • Advise GM at conclusion of emergency • Provide point of communication from IC
Person in charge of incident area (Employee / contractor)	Person in charge of incident (Employee/contractor) shall, if not putting self or others in danger, • Determine the type of chemical spilt if safe to do so • Evacuate the area, dependant on the nature and size of the spill • Post a sentry outside the area to ensure people keep clear • Contact your supervisors & advise of situation • Tape the area off with danger/hazard tape at least ten (10) metres away from the spillage (further depending on the nature and size of the spill). • If a strong wind is blowing, secure the area downwind to prevent personnel coming in contact with windblown chemicals. • Source the appropriate SDS (Safety Data Sheet) available in the plant control room or wherever the chemical is stored or mixed/used. • For chemical spills in the Process Plant area obtain a copy of the relevant SOP for the spilt chemical and type of spill i.e. wet or dry • Await the arrival of the follow further instruction
IC	Take leadership role
ERT	ERT shall: • Mobilise the appropriate resources • Respond to the incident location • Approach incident from uphill/upwind • Use whatever means to identify the material involved in the spill • Obtain specialist advice from available product experts and or SDS • Establish incident control zones and clearly identify with barrier tape (other visible marker) • Gather information from distance maintaining uphill/upwind position • Do not enter smoke, gas or vapour clouds without material identification • All personnel to wear the assessed level of PPE to perform duties • Identify if any persons require rescue, determine location and rescue strategy • Rescues to be conducted only if there no risk of contamination to personnel • Rapid initial rescue attempts from uphill, upwind if person has had minimal exposure and is showing visible signs of life

Job Title	Duties
	• Identify environmental exposures and protective measures (e.g. damming drains) and have EO/RBO advise Environmental Officer of any issues • Water run-off and smoke to be monitored for community health and environmental impact • Establish a Decontamination Sector for all relevant persons, protective clothing, firefighting equipment and fire appliances/vehicles • Ensure that all relevant persons are tagged and details recorded in a Hazardous Exposure Report • Report incident under control to ERTC when applicable • Hand over incident scene to incident recovery team (under the management of the Environmental Section and OSH Manager • Conduct an incident debrief on return to base • Complete the necessary incident report for the GM and other stakeholder
Recovery Team	Recovery team shall: • Take control of the clean-up in accordance with site SOP and requirements of SDS • Dispose of the waste in accordance with OGPI Environmental Policy • Hand the area back to the responsible operator • Compile the necessary report for the interest of the GM and other stakeholders

4.9.6.2 Evacuation Procedures

A condition may arise requiring a general evacuation of all or non-essential personnel. The reasons for such an evacuation are varied but may be due to fire, explosion, bomb threat, hazardous material spill, gas escape or building/structural collapse.

Job Title	Duties
Any person discovering the emergency	• Contact the EO/RBO by phoning +63917-857-1111 or Local 911 or radio channel one • provide your name, location and nature of the incident including, wind direction, any injuries and nature of injuries • Follow any instruction given by the EO/RBO
EO / RBO	EO/RBO shall Inform the EM ERTC
EM	EM shall ensure the emergency siren is activated
ERTC	ERTC shall Place the ERT on standby at a strategically and safe location
All personnel	On activation of the evacuation siren, all non-essential personnel Shall proceed to the Evacuation Assembly Area (Muster Point).
Area or Group Wardens	Area or Group Wardens shall: • Maintain open communication with OGPI Construction Manager • Know the names of the personnel in their area or group • Know how to exit from the area and any alternatives • Carry out a quick search of the area to ensure all persons have evacuated • Remain at assembly area until all clear is given by ERT Area Manager

Job Title	Duties
Fire Wardens	Fire Wardens shall: • Ensure that evacuation starts and all persons in the emergency area have evacuated • Proceed to assembly area to confer with Area Managers/supervisors and report to EO/RBO that all persons are accounted for or persons are reported missing. • In reporting persons missing, the Warden shall inform the EO/RBO of the numbers missing and the possible location of those personnel.
EO / RBO	On receiving advice that persons are reported missing, the EO/RBO shall advise the EM and ERTC of the situation
ERTC	On receiving advice that there are persons reported missing, the ERTC shall respond the ERT (if not done sooner)
Area Managers and Supervisors	Area Managers/Supervisors shall assist all persons to evacuate to the assembly area
Department Managers and Construction area Managers	Department Managers & Construction Area Managers shall: • Ensure all persons under their responsibility evacuate to designated muster points • Ensure a roll-call is carried out at the muster point and report findings to EO/RBO for the information of the ERTC
IC	Take leadership role
ERT	ERT shall Wait for mobilization instruction from the ERTC
POSH / OSH Manager	Project Health & Safety Manager shall: • In the absence of the OGPI Site Construction Manager, stand-in in the event of an emergency involving an evacuation • Assist the OGPI Site Construction Manager in whatever capacity is required until the termination of the emergency

4.9.7 Fire and Explosion

The Person-in-Charge or Emergency Manager (EM) is to be informed immediately of any fire in or around the site. Minor fires may be dealt with by using OGPI or contractor fire-fighting equipment and a full and comprehensive report submitted to the OSH Manager within 24 hours.

The ERT has the responsibility to respond the quickest time possible to prevent unnecessary loss of lives and company properties. It is expected that the team must be ready at all time, firefighting equipment must be in all good condition and properly maintained. Firefighting team should have undergone basic firefighting training programs and joined regular firefighting exercises to ensure effectively, safety and competency in exercising this procedure.

Determine Tactical Response

Each fire involving a building presents many variables (e.g. risks, exposures, available resources). The Incident Commander on field must adapt knowledge (e.g. pre-incident planning, training, previous experiences and innovative approaches) and obtain incident information to safely resolve the situation with the most effective and efficient use of available resources.

OGPI also has a standard procedure on firefighting (*OGPI-AP-PRO-018 Fire Fighting Response Procedure).*

4.9.8 TSF Dam Failure / Breach

OGPI's standard procedure on Tailings Storage Facility (TSF) dam safety, Didipio Tailings Storage Facility Dam Safety Emergency Management Plan (DSEMP), was prepared and established as standard operating procedure in the event of TSF dam failure.

In the event of TSF spill accident requiring immediate response to mitigate the adverse effect to the environment and community, it is very crucial to inform the GM and all concerned department to activate OGPI's standard response procedure, as presented in Figure 4-14.

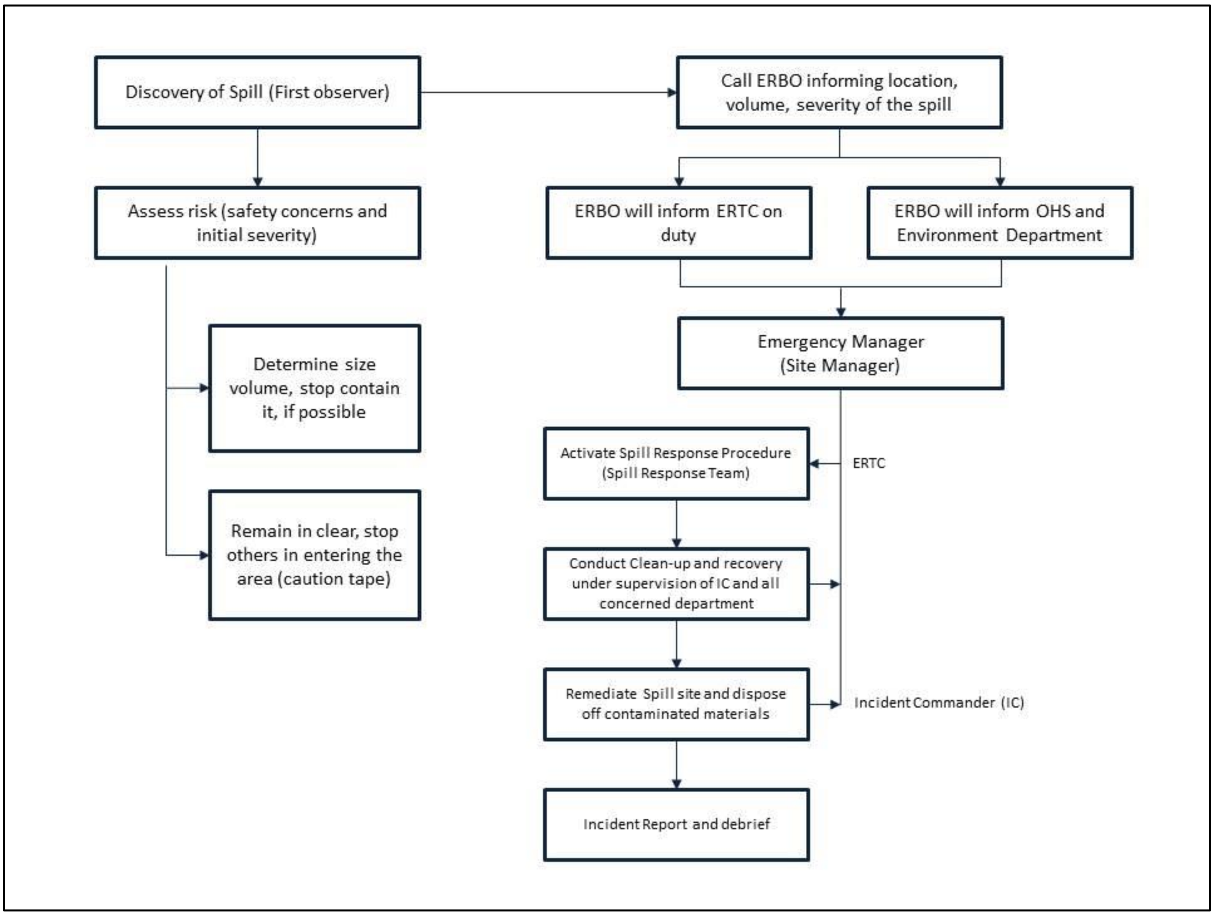


Figure 4-14: Spill reporting and response procedure

The standard operating procedure of OGPI includes step-by-step procedure on two types of spill scenarios - spill on land and spill in body of water.

4.9.8.1 Spill on Land

Spill on dry land landscape could be caused by several factors such as pipeline failure, dam breach caused by natural phenomenon or man-made accidents.

Table 4-11: Spill Emergency Response Roles and Duties

Job Title	Duties
Person or any personnel discovering incident	• Determine if safe to approach, make reasonable attempt to contain the concentrate spill • Participate in spill response as member of clean-up crew. • Contact the EO/RBO by phoning +63917-857-1111 or Local 911 or radio channel one

Job Title	Duties
	• Provide the EO/RBO with as much information as possible such as: a. Spill location b. Volume c. Terrain condition at the spill site • Follow any instruction given by the EO / BRO
EO / RBO	EO / RBO shall • Advise the ERTC of the incident • Standby for information from ERTC • Maintain periodic incident updates to the ERTC until the incident is closed • Inform concerned department on the details of the incident • Inform OHS for safety investigation • Inform duty Process supervisor and Environment Department if warranted by the situation
Process Department	• Should ascertain the cause of spill and or stop transfer flow to the affected area • Ensure safety of personnel in the area • Ensure discharge containment area is holding all spilled materials • Establish Exclusion Zone and safe work areas for the responding team • Re tighten bolts, drain the hose and renew gasket, or replace faulty hose (pipeline failure) • Do not re-start transfer operation until leakage has been stopped • Dispose collected and clean-up materials to TSF
Mining Department	• Assist in mobilizing equipment to contain and recover the spilled materials • Assist in the fortification of damage structure and environmental landscape
Environmental Department	• Conduct sampling for possible contamination on bodies of water • Monitor and evacuate affected plants and animals and provide temporary relocation area until clean-up is completed • Recommend and supervise rehabilitation of the affected areas • Coordinate with ENRO in the development of the spill response and recovery • Take photo documentation on the affected areas
Community and Relation Communication	• Inform Government offices concerned in the accident NERO, BFAR, PDRRMC, DOH etc. Didipio ERT
APD – ERT	• Activate ERT spill response procedure upon the approval of the EM • Monitor the response procedure with the IC • Assist in the containment of the spill • Pump spilled spill containers for disposal according to environmental standard • Assist in the recovery of the spill • Mobilizing vacuuming units as appropriate • Assist in soil disposal according to Environment hazardous waste disposal procedure • Render first aid for injured personnel or any person affected of the spill

Job Title	Duties
	• Organize and manage any patient evacuation that may be necessary • Collate any information that may be necessary for a future investigation

4.9.8.2 Spill in Body of Water

During the course of the mine life, it is possible that a dam breach due to natural phenomenon and manmade accident would happen and TSF would release its load towards the downstream body of water. Such a release could affect water quality and will result in flora and aquatic habitat degradation.

Assessing the feasibility of containment is critical and clean-up must be based on water body and flow rates. The emergency response approach for an in water concentrate spill are similar to those outlined for oil spills as provided in OGPI's Oil Spill Response Procedure, Emergency Response Management. The role and duties of personnel involved is the same as discussed in Table 4-11.

4.9.9 Adverse Weather and Heavy Rain Downpour

In an instant recognition of adverse weather condition (heavy rain downpour and adverse weather condition will be used interchangeably in this document) the following shall be implemented:

- The Safety Manager, Superintendents, Supervisors and Officers shall help in the assessment of the situation. Safety staff shall be mobilised in all affected areas and shall monitor the situation. This shall be done with safety in mind to as low as reasonably practicable. They shall provide additional advice to APD especially in river crossings and Mine Pits.
- The duty Incident Controller shall immediately establish radio contact with the ERTC The incident controller is the point person on site and shall direct all responses on the field. He reports only to the ERTC or Safety Manager or in his absence the Safety Supervisor and Safety Superintendent.
- ERT duty of the week members shall be on standby mode. It is the responsibility of the Asset Protection Department (APD) to secure all river crossings on the mine site during heavy rainfall events.

In an instant recognition of heavy rain downpour, the APD will activate the following procedures:

- The department will issue alert order to all stations through radio and take necessary precautions. The Typhoon Alert Procedure shall be immediately followed.
- The RBO will announce the condition of the river levels to all stations through radio.
- Designated guards will be deployed at all river crossings (Dupit, Bacbacan and DDP004 bridges) to:
- ▪ Monitor the situation, especially water levels,
- ▪ Regulate the flow of traffic (vehicles and pedestrians),
- ▪ Lower the boom gates, as necessary,
- ▪ Inform the RBO to activate the siren, if the boom gate is necessary to be lowered
- ▪ Raise the boom gates when cleared, after the Safety Department assessed the integrity of the river crossings continue monitoring the situation until ordered to return to their assigned posts.
- ▪ The RBO will activate the Siren, as necessary.

The Health and Safety Department should issue guidelines to follow when to activate the Siren. In case of injuries or accidents, the ERT will take over. Debriefing will be immediately conducted after the incident to:

- ▪ Assess/evaluate performance in dealing with the contingency,
- ▪ Make necessary changes to improve response to the contingency, if any,
- ▪ Review and submit record of the incident.

The APD must ensure that nobody is able to open the boom gates or permit people to attempt to walk across the bridge until the danger has passed. The RBO with another APD approved person shall man the station and record information in the log books. Main APD stations shall maintain an accurate record of events on the log book.

All Employees and contractors must follow instructions given by APD personnel in this regard.

All Persons Working on site;

- Stop work, seek safe shelter and get advice from area managers or supervisors.
- The person providing permission must inspect the work area prior to providing permission and can withdraw permission at any time should conditions require this;
- Persons working in the affected area are not to work alone in inclement weather.

Common Rain: General rainfall that causes slippery and muddy conditions which may require the stoppage of pit operations but doesn't cause streaming of water down ramps and walls that can cause substantial damage.

Heavy Rain: Sheeting rain that greatly impairs visibility and/or causes water to run down ramps in streams and/or makes driving on normal roads difficult or hazardous.

Refer to DID-2S0-PRO-OS9ADVERSE WEATHER PROCEDURE

4.9.10 Drill and Simulation Procedure

OGPI conducts, at the minimum, a quarterly emergency drill and simulation activity for the ultimate purpose of preparing the company's in-placed procedures, trained personnel, and availability and efficiency of resources.

To respond effectively to any type of emergency off site and on site, it is necessary to have a preparedness and response procedure to facilitate organized and coordinated actions during incidents. With this, OGPI has develop various standard procedures that must be tested frequently so that it can be continuously evaluated, adapted and updated before and after an actual incident. Emergency drills and simulation aims to:

- Evaluate the decision-making capacity of personnel responsible for emergency and disaster preparedness and response, in the context of an organization's existing emergency plans and procedures.
- Validate the emergency preparedness and response plan for a specific facility or department.
- Test the effectiveness of mechanisms meant to coordinate the response of different sectors and agencies in emergency situations.
- Prepare personnel who have decision-making authority to manage the crisis and to manage information in emergency situations.

OGPI's Standard Operating Procedure on Drill and Simulation Procedure details the guideline on conducting a emergency drill and simulation. The procedure details, among others, the specific drills and simulation procedure on:

- Injuries
- Fire fighting
- Vehicle or mobile equipment accident (entrapment)
- Chemical spills / leak/ gas release
- Bomb threats
- Typhoon evacuation
- Earthquake drill

- Snake bite incident
- Live voltage incident

4.9.10.1 Emergency Drill in the past 5years (2014-2018)

OGPI regularly conducts emergency preparedness and response related activities consistent to its standard operating procedure on Drill and Simulation Procedure. In the last five (5) years of implementation, period 2014 to 2018, OGPI's Emergency Response Reports data shows a focused on preparedness and awareness trainings, emergency simulations and exercises, routine activities, and actual emergency responses to both on-site and community medical related emergencies.

Trainings are conducted mostly on a monthly scheduled from basic to advance first aid, earthquake drills, hazmat and oil spill response, firefighting, confined space rescue, among other general and specialized trainings needed for a specific type of activity. Routine activities are conducted daily that involves monitoring, inspection and maintenance of siren test, lightning tracker monitoring, emergency vehicle, fire hoses maintenance, fire truck maintenance, pit familiarization, fire hydrant inspection, mechanical and hydraulic inspection, fire pump inspection, and ERT equipment inventory.

In 2014, the first quarter of the year marked the readiness of the team in any site emergencies particularly in fire related incident and several grass fire that were prevented and controlled. The ERT continued to upgrade their skills in Firefighting by facilitating the conduct of the Fire Brigade Training Course attended by all ERT Team and several contractors conducted by the Province's Bureau of Fire Protection. Emergency, safety and health related trainings continued throughout the 4th quarter of 2014. In the 1st Quarter. An average of 300 participants attend the different trainings conducted by OGPI.

A significant number of community medical emergencies were also assisted by the team from actual clinic assistance to emergency transfers to medical facilities. To further improve the team skills in responding medical and traumatic incidents, the Skills and Competency Evaluation in Basic Life Support with External Defibrillator were conducted by the Philippine Red Cross Nueva Vizcaya Chapter and this initiative leaves an outstanding numbers of ERT personnel and contractors who passed the said evaluation. To proactively prevent or minimize the effects of any on site or off site emergencies, several simulations were conducted such as Crisis Management, Low Voltage Incident, Hauling accident and a number of fire and trauma response exercise.

As training in Basic Life Support and Fire Extinguisher training course were continuously scheduled in all personnel, specialized skills in High Angle Rescue, Confined space, fire truck and Hydraulic operations were conducted regularly among ERT responders. Routine fire risk assessment, familiarizations such as pit and all ERT equipment were also included in weekly basis.

Several issues found from the simulations conducted were response time improvement and additional ERT equipment should be procured. Training in Water Safety and Under Ground rescue are the outstanding activities need to be scheduled as soon as possible.

In 2015 to 2018, emergency and safety and health programs and trainings continued and strengthened. Trainings were conducted in-house by OGPI ERT and external trainings conducted by local and national government agencies were regularly attended and participated. Simulations and exercises continued with the objective of generating actions for the improvement in emergency response. With this, the team conducted several simulations involving, electrical fire incidents, grass fires, earthquake, among others. These simulations identified several procedures that improved the emergency responses, equipment to be maintained and to be purchased, skills of the ERT, and the awareness of all employees.

For the period 2014-2018, only one (1) incident of oil spill was recorded and was appropriately responded and controlled by the contractor, MEPEO, and ERT. The spill was recorded on December 22, 2017 after the diesel oil spilled from the fuel truck due to ruptured hydraulic hose. This single oil spill incident in the past five (5) years can be considered minimal as compared to the scale of the project's operation. Also, it further shows that this single incident can be attributed to the effective implementation of in-place procedures and management system.

5 Social Development and Management Plan (SDMP) and IEC Plan/Framework

5.1 Social Development and Management Program

Social Development and Management Programs (SDMP) aims to prevent/mitigate and enhance a project's adverse and positive impacts, respectively, on people's livelihood, health and environment. The SDP that is consistent to Annex 2-18 of the Revised Procedural Manual (RPM) for DAO 2003-30 is formulated in every proposed projects focusing on addressing the social issues and concerns raised by the projects' stakeholders during consultations, discussion and other social engagement activities.

The issues raised during the public scoping were considered and addressed in the formulation of the SDP. Moreover, issues of the communities obtained from the focus group discussions, key informant interviews, and perception survey were also included. These are the following:

1. Stakeholders' Understanding of the Project
   Even though the respondents of the survey, as well as participants of the FGDs and KIIs were aware of the project, they and most of the members of the community, and segments of the OceanaGold (Philippines) Inc. (OGPI) workforce themselves, have very limited to almost no understanding of the project. What is mostly understood by the respondents is that there may be an increase in the area of coverage of the mining operations, either horizontal or vertical, which is not the case. The term "THROUGHPUT" is not easily understood, leading to the aforementioned misunderstanding, misinterpretation and misconceptions about the "Increase in Annual Plant Throughput Rate to 4.3 MTPA" project.

2. Acceleration of decrease of operations workforce
   In terms of the projected remaining overall lifespan of the mining operations (14 years or until 2032), there shall be no decrease. But since there shall be an increase in the throughput production, there will be increasing level of decrease in workload as the target input/output is being reached.

3. Accommodation of Products and Services needed by OGPI that are available and may be provided by segments and sectors in the Community

4. Lack of Information of the Community and other Stakeholders with regards to Environmental Monitoring, mitigation, and enhancement reports, activities, programs and practices of OGPI.

The Social Development and Management Programs already and being implemented by OGPI are presented in **Table 5-1.**

Table 5-1: SDMP Projects/Programs Implemented By OCEANAGOLD Philippines Inc.

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
2013 Access to Education and Educational Support Programs											
2013	Assistance to Trainings of School Teachers and Students	All schools of the 10 SDMP Barangays	18 Trainings; 21 Seminars	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	24 School Teachers,165 Pupils/ Students	100%	Enhance potentials of teachers and school children	80,000.00	60,927.00	76%	Remaining balance is reprogrammed to other projects
2013	Support to Scholarship Program	Didipio, Alimit, Tukod, Capisaan, Wangal, Binogawan	40 Scholars	Payment of tuition and miscellaneous fees of qualified scholars	40 scholars	100%		200,000.00	53,445.00	27%	Remaining balance is reprogrammed to other projects
2013	Support to School Lot Titilings	Didipio Elementary School	1	litigation and lot titling	1 School lot	100%		50,000.00	49,671.17	99%	Remaining balance is reprogrammed to other projects
2013	Support to Various School Activities & Competitions	Various schools of the 10 SDMP Barangays	District & Provincial Meet, Athletics, Envi Day, ALS & OSY Activities, Graduation Day, Science fair, English Fair, immersion,	Athletic Uniforms, meals, transport, accommodation & other logistics	80 school children and 12 teachers	100%		133,000.00	235,423.83	177%	Negative balance was charged to savings from other PPA's

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
			etc.								
2013	Purchase of Various School /Office Supplies, Equipments and Facilities	Various schools of the 10 SDMP Barangays	15 Desktop computers, 3 laptop, various sports equipment, office furniture & fixtures, weighing scales, visual aids, 6 LED TV, 6 projectors, 50 chairs, manipulative toys, drum & lyre instruments, laboratory equipment, gen set	Desktop computer, laptop, outdoor facilities, office furniture & fixtures, Visual aids, reference materials, manipulative toys, chairs, drum and lyre equipment	5,000 school children and 200 teachers	100%		1,514,750.00	1,718,154.00	113%	Negative balance was charged to savings from other PPA's
2013	Subsidy of Elementary & High School Teachers, Day Care Workers, Kinder Teachers, School Clerk, School Utility/Security Guards	Various schools of the 10 SDMP Barangays	80 Elementary school teachers,60 high school teachers, on teaching staff	teachers, school clerk, security guards, day care workers	42 teachers	100%		2,046,004.00	1,848,954.71	90%	Remaining balance is reprogrammed to other projects
SUB-TOTAL								4,023,754.00	3,966,575.71	99%	
2013 Assistance to Infrastructure Development & Support Services											

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2013	Construction of Irrigation Canal System	Capisaan	30 mtrs Irrigational Canal	Irrigation Canal	15 farmers	100% Completed		100,000.00	87,020.00	87%	Reprogrammed to other projects
2013	Installation of Street Lights	Didipio, Tukod	LED Street Lights, Purchase of Electric Posts	Street Lights, LED Bulbs	60 household	100% Completed		70,000.00	70,000.00	100%	Completed
2013	Construction of Po Offices, Coop Building, BDRRMC Outpost	Tukod, Binogawan, Didipio, Dingasan, Tucod, Dibibi, Camamasi, Alimit	Construction of 2 SK Office, 1 Senior Citizen, Bldg,1 Cooperative Bldg, 7 BDRRMC Outpost, 6 Chapel	SK Office, Senior Citizen Bldg, Cooperative Bdg, BDRRMC Outpost, Chapel	10 NGO's	100% Completed		1,116,800.00	1,116,800.00	100%	Completed
2013	Construction of Concrete School Fence	Tucod National High School	35 meters concrete perimeter school fence	Concrete Perimeter Fence, Semi concrete with interlinks	1 School	100% Completed		172,000.00	211,441.50	123%	Negative balance was charged to savings from other PPA's
2013	Purchase of barangay lot	Didipio	1 parcel of lot	lot	1 barangays	100% Completed		350,000.00	320,000.00	91%	Reprogrammed to other projects
2013	Construction/Improvement of School Buildings	All Barangays	5 Day Care Center, 3Classroom,2 Comfort Rooms, , 3 Handwashing	Day Care Center, Kinder Building, Classroom Bldg., Handwashing/Lavatory	350 school children	100% Completed		2,173,661.36	2,173,661.36	100%	Completed
2013	Construction/Improvement of Multipurpose	All Barangays	2 units Barangay Hall, 3 Gymnasium,	3 Storey Barangay Hall, Bungalow Type	3000 household	100% Completed		1,421,300.00	1,421,300.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Building		stage/bleachers, evacuation center	Barangay Office, Gymnasium, Stage, Bleacher, Evacuation Center							
2013	Construction/ improvement of Barangay Health Clinic	Alimit, Binogawan, Didipio, Dibibi, Camamasi	5 Barangay Clinic, 1 Nutrition Room	Barangay Clinic, Nutrition Room	1300 household	100% Completed		926,062.50	926,062.50	100%	Completed
2013	Construction of Post-Harvest Facilities	All Barangays	3 MPDP, 5 Corn & Rice Shed	Multipurpose Drying Pavement, Corn Shed, Rice Shed	200 household	100% Completed		778,000.00	778,000.00	100%	Completed
2013	Construction/Improvement of Water System	All Barangays	Drilling, Installation of Distribution lines, Intake and Distribution tanks, Reservoir	Drilling, Distribution lines, SDR Pipes, Intake & Distribution Tanks, reservoir	4450 household	100% Completed		2,235,000.00	2,235,000.00	100%	Completed
2013	Construction of Public Comfort Room	Belet, Binogawan, Tucod, Capisaan, Cabarroguis, Dingasan, Dibibi	2 Public Comfort Room	Concrete 2 Door Comfort Room	public	100% Completed		101,563.00	101,563.00	100%	Completed
2013	Construction/Improvement of Hanging Bridge	Binogawan, Capisaan, Dibibi,Alimit ,Didipio,	3 Hanging Bridge,	Hanging Bridge	2300 household	100% Completed		50,000.00	323,850.00	648%	Negative balance was charged to savings from

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
		Dingasan, Tucod, Tukod, Camamasi									other PPA's
2013	FMR Improvement	All Barangays	Road Opening, widening, grading, gravelling (6kms), concreting (1kms),3box culvert, 5 RCPC installation,	opening, widening, gravelling, grading, concreting, installation of box culvert & RCPC	23000 household	100% Completed		9,711,136.80	9,544,187.11	98%	Reprogramme d to other projects
SUB-TOTAL								19,205,523.66	19,308,885.47	101%	
2013 Access to Health Services, Health Facilities and Health Professionals											
2013	Support to Family Planning Program	Didipio, Kasibu, Nueva Vizcaya	N/A		65 Participant s	100% Completed		62,500.00	40,102.08	64%	Reprogramme d to other projects
2013	Construction & Improvement of Barangay Health Clinic	Didipio, Binogawan, Camamasi	3Units Barangay Clinic, Improvements of 3 Barangay Clinic, Installation of water system	Construction of Barangay Clinic, Improvements(f encing, painting, rehabilitation of old structures	1446 Household	100% Completed		60,000.00	60,000.00	100%	Completed
2013	Assistance to Clean & Green Brigade Program	Didippio, Alimit, Binogawan, Tukod	various	Construction of garbage pit, purchase of seedlings, backyard	1257 Household	100% Completed		60,000.00	60,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
				gardening, establishment of nursery and MRF, distribution of water sealed bowls							
2013	Trainings & Seminars related to Health Programs	Didipio & Alimit	various	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	1071 Household	100% Completed		40,000.00	40,000.00	100%	Completed
2013	Assistance to Nutrition Program	Didipio	Feeding Program to several wasted children, provision of medicines/ vitamins	Feeding program		100% Completed		66,000.00	48,000.00	73%	Reprogramme d to other projects
2013	Conduct of Medical Mission, Purchase of Medicines & Vitamins	Capisaan	1 Medical missions, purchase of medicines	Purchase of medicines & other logistics	210 household	100%compl eted		10,000.00	19,982.90	200%	Negative balance was charged to savings from other PPA's
2013	Purchase of Health Clinic Supplies, Equipment, Furnitures & Fixtures	Didipio, Dibibi, Capisaan, Camamasi, Binogawan, Dingasan	1 delivery bed, 1 medicines cabinet, 2 tables, 3 weighing scale, 6 first aide kit	various clinic facilities & equipment	1272 household	100% Completed		209,000.00	151,421.00	72%	Reprogramme d to other projects
2013	Subsidy of	Alimit,	N/A	monthly subsidy	4460	100%		531,636.00	531,634.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Health Workers	Belet, Binogawan, Capisaan, Camamasi, Dibibi, Didipio, Dingasan,Tucod, Tukod, Wangal,		of Barangay Health Workers, Barangay Nutrition Scholars, Midwife, Community Health team and Nurse	Household	Completed					
SUB-TOTAL								1,039,136.00	951,139.98	92%	
2013 Enterprise Development and Networking											
2013	Support to Agriculture	Didipio, Binogawan	insecticides, seedlings,and other tools use in farming	insecticides, seedlings, gardening tools	farmers organization	100%		296,764.00	398,739.50	134%	Negative balance was charged to savings from other PPA's
2013	Poultry Production	Tucod, Wangal	200 chicken laying eggs, cages	chicken laying eggs		100%		27,000.00	27,000.00	100%	Completed
2013	Dressmaking	Camamasi, Capisaan	weaving, knitting supplies	weaving, knitting supplies	women's organization	100%		50,000.00	50,000.00	100%	Completed
2013	Agricultural Tools/ Equipment/ Machineries	Camamasi, Tucod, Binogawan	5 knapsack & 18 power sprayers			100%		230,124.50	230,124.50	100%	Completed
2013	Trainings & Seminars	Capisaan	1 training for mushroom production	mushroom production	45 individuals	100%		130,000.00	130,000.00	100%	Completed
2013	Integrated Hog Production	Didipio, Binogawan	piggery & piglets	purchase of piglets & construction of pig pen	20 individuals	100%		100,000.00	100,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2013	Starting Capital	Didipio	starting capital			100%		560,000.00	560,000.00	100%	Completed
SUB-TOTAL								1,393,888.50	1,495,864.00	107%	
2013 Protection and Respect of Socio-Cultural Values											
2013	Assistance to Senior Citizens & Person's With Disability (PWD's)	All SDMP Barangays	Milk, blankets, shirts, umbrellas	various supplies & materials	3,409 senior citizens	100%		30,000.00	30,000.00	100%	Completed
2013	Support to Barangay Assembly Meetings	All SDMP Barangays	10 general assembly meetings	meals & other logistics	85,225 residents	100%		40,000.00	40,000.00	100%	Completed
2013	Assistance to Indigenous People's Organization	All SDMP Barangays	10 People's Org	supplies & materials & other logistics		220%		20,000.00	44,019.00	220%	Negative balance was charged to savings from other PPA's
2013	Assistance to Improvement, Repair & Rehabilitation Churches	All SDMP Barangays	18 churches repaired, improved	supplies & materials & other logistics	73,795 church members	100%		65,000.00	65,000.00	100%	Completed
2013	Assistance to Barangay & Municipal Fiesta, Summer & Winter League	All SDMP Barangays	16 festivals	supplies & materials & other logistics	85,225 residents	100%		982,000.00	982,000.00	100%	Completed
SUB-TOTAL								1,137,000.00	1,161,019.00	102%	
2013 Human Resource Development and Capacity Building											
2013	Engineering & Administrative Expenses	All SDMP Barangays	10 SDMP Barangays	program of Work preparation, transpo, meals & other logistics	65 staffs & engineers	100%		2,279,561.98	1,631,553.98	72%	Reprogramme d to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Trainings/Seminars/Workshops/ EC Campaign	All SDMP Barangays	90 BLGU Officials & employees	meals, transpo, registration fees, facilitators fee & other logistics	35,000 residents	100%		862,000.00	786,744.00	91%	Reprogrammed to other projects
2013	Anti-Dengue Campaign	All SDMP Barangays				100%		20,000.00	20,000.00	100%	Reprogrammed to other projects
2013	Subsidy of SDMP Staff & Barangay Employees	All SDMP Barangays	18 employees subsidized	monthly subsidy	1,355 SDMP Staffs & Barangay employees	100%		1,093,163.00	734,240.31	67%	Reprogrammed to other projects
2013	Conduct of Community Monitoring & Evaluation	All SDMP Barangays	100 M&E & SDMP Working Committee members with incentive	per diem & other logistics	495 members of Community Monitoring & Evaluation	100%		726,316.30	420,315.00	58%	Reprogrammed to other projects
SUB-TOTAL								4,981,041.28	3,592,853.29	72%	
2013	Kasibu	Various Barangays & LGU Employees		Downloaded to LGU Accounts		100%		1,486,927.50	1,304,324.90	88%	Reprogrammed to other projects
2013	Cabarroguis	Various Barangays & LGU Employees		Downloaded to LGU Accounts		100%		1,193,250.00	1,193,250.00	100%	Completed
2013	Common Fund	10 SDMP barangays		Spent to various activities common to all SDMP Barangays		100%		805,878.69	785,878.69	98%	Reprogrammed to other projects
GRAND TOTAL								35,266,399.63	33,759,791.04	96%	

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
2014 Access to Education and Educational Support Programs											
2014	Assistance to Trainings of School Teachers and Students	Didipio, Dibibi, Binogawan, Capisaan	5 Trainings;5 Seminars	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	5 School Teachers,800 Pupils/ Students	100%		250,000.00	36,588.44	15%	Reprogrammed to other projects
2014	Construction/Improvement of School Buildings & Other facilities	All schools of the 10 SDMP Barangays	Improvement of 20 Day Care Centers; 500 meters tire path, 6 swing;6 slides; Construction of 8 built in comfort room; 6 handwashing areas; 5 school shed, 1 school canteen,1 mini museum; 4school gymnasium	Day Care Center, Mini museum, school gymnasium, school building, concrete pathway, outdoor facilities, comfort rooms, handwashing areas, school shed, school canteen	10,000 school children	100%		3,113,903.83	3,186,664.32	102%	Negative balance was charged to savings from other PPA's
2014	Support to Scholarship Program	Didipio, Alimit, Tukod, Capisaan, Wangal, Binogawan	45 Scholars	Payment of tuition and miscellaneous fees of qualified scholars	45 scholars	100%		350,000.00	277,708.50	79%	Reprogrammed to other projects
2014	Support to School Lot Titilings	Didipio Elementary School	1	litigation and lot titling	1 School lot	100%		150,000.00	131,480.00	88%	Reprogrammed to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2014	Support to Various School Activities & Competitions	Various schools of the 10 SDMP Barangays	District & Provincial Meet, Athletics, Envi Day, ALS & OSY Activities, Graduation Day, Science fair, English Fair, immersion, etc	Athletic Uniforms, meals, transpo, accommodation & other logistics	600 school children and 25 teachers	100%		947,500.00	901,960.11	95%	Reprogramme d to other projects
2014	Purchase of Various School /Office Supplies, Equipment and Facilities	Various schools of the 11 SDMP Barangays	3Desktop computers, 2laptop, various sports equipment, office furniture & fixtures, weighing scales, visual aids, 2 LED TV,	Desktop computer, laptop, outdoor facilities, office furniture & fixtures, Visual aids, reference materials, chairs, drum and lyre equipment	5,000 school children and 200 teachers	100%		1,142,622.64	1,075,743.00	94%	Reprogramme d to other projects
2014	Subsidy of Elementary & High School Teachers, Day Care Workers, Kinder Teachers, School Clerk, School Utility/Security Guards	Various schools of the 10 SDMP Barangays	50 Elementary school teachers,60 high school teachers, non teaching staff	teachers, school clerk, security guards, day care workers	200	100%		2,522,676.76	2,486,434.33	99%	Reprogramme d to other projects
SUB-TOTAL								8,476,703.23	8,096,578.70	96%	

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2014 Assistance to Infrastructure Development & Support Services											
2014	Construction of Irrigation Canal System	Binogawan, Capisaan & Didipio	100 mtrs Irrigational Canal	Irrigation Canal	40 farmers	100%		300,000.00	277,173.60	92%	Reprogrammed to other projects
2014	Installation of Street Lights	Cabarroguis, Didipio, Wangal, Tukod	Installation of 7KM electric line, Installation of 6LED Street Lights, Purchase of Electric Posts	Electric Line, Street Lights, LED Bulbs, Electric Post	100 household	100%		400,000.00	382,862.20	96%	Reprogrammed to other projects
2014	Construction/Improvement of Po Offices, Coop Building, BDRRMC Outpost	Didipio, Dingasan, Tucod, Dibibi, Camamasi, Alimit	1 Senior Citizen,3 BDRRMC Outpost, 3 Chapel	SK Office, Senior Citizen Bldg, Cooperative Bdg, BDRRMC Outpost, Chapel	7 NGO's	100%		820,000.00	891,108.92	109%	Negative balance was charged to savings from other PPA's
2014	Construction/Improvement of School Buildings	Didipio, Camamasi, Tukod	2 Day Care Center, 1 Comfort Rooms,1 School Cottage,2 School Building	Day Care Center, School Cottage	150 Day Care Children	100%		3,135,641.29	3,226,610.78	103%	Negative balance was charged to savings from other PPA's
2014	Construction of Tirepath	Dibibi, Tukod, Tucod, Camamasi, Dingasan	320 meters concrete pathway	Concrete Tirepath	1600 households	100%		1,696,200.00	1,972,492.00	116%	Negative balance was charged to savings from other PPA's
2014	Construction/Improvement of	All Barangays	2 units Barangay Hall,	3 Storey Barangay Hall,	3200 household	100%		6,020,826.50	6,546,189.94	109%	Negative balance was

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Multipurpose Building		1 Gymnasium, stage/bleachers, evacuation center	Bungalow Type Barangay Office, Gymnasium, Stage, Bleacher, Evacuation Center							charged to savings from other PPA's
2014	Construction/Improvement of Barangay Health Clinic	Binogawan, Didipio, Dibibi	3 Barangay Clinic,	Barangay Clinic	1300 household	100%		1,229,062.50	2,198,079.67	179%	Negative balance was charged to savings from other PPA's
2014	Construction of Post Harvest Facilities	All Barangays	7 MPDP, 6 Corn & Rice Shed	Mulitpurpose Drying Pavement, Corn Shed, Rice Shed		100%		635,000.00	633,483.00	100%	Negative balance was charged to savings from other PPA's
2014	Construction/Improvement of Water System	All Barangays	Drilling, Installation of Distribution lines, Intake and Distribution tanks, Reservoir	Drilling, Distribution lines, SDR Pipes, Intake & Distribution Tanks, reservoir	4450 household	100%		4,799,699.50	4,930,115.39	103%	Negative balance was charged to savings from other PPA's
2014	Construction/Improvement of Hanging Bridge	Binogawan, Capisaan, Dibibi, Dingasan, Tukod	3 Hanging Bridge, 2 overflow bridge	Hanging Bridge, overflow bridge	2300 household	100%		1,883,220.63	2,010,601.98	107%	Negative balance was charged to savings from other PPA's
2014	FMR Improvement	All Barangays & 2 Municipaliti	Road Opening, widening, grading, gravelling	opening, widening, gravelling, grading,	23000 household	100%		33,618,195.12	35,431,104.04	105%	Negative balance was charged to savings from

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
		es	(8kms), concreting (3kms),4box culvert, 7 RCPC installation,	concreting, installation of box culvert & RCPC							other PPA's
SUB-TOTAL								54,537,845.54	58,499,821.52	107%	
2014 Access to Health Services, Health Facilities and Health Professionals											
2014	Construction & Improvement of Barangay Health Clinic	Didipio, Binogawan	Construction 2 Units Barangay Clinic, Improvements of 3 Barangay Clinic, Installation of water system	Construction of Barangay Clinic, Improvements(fencing, painting, rehabilitation of old structures	1446 Household	100% Completed		881,000.00	878,760.00	100%	Completed
2014	Assistance to Clean & Green Brigade Program	Didippio, Alimit, Binogawan, Tukod	various	Construction of garbage pit, purchase of seedlings, backyard gardening, establishment of nursery and MRF, distribution of water sealed bowls	257 Household	100% Completed		156,800.00	142,176.96	91%	Reprogrammed to other projects
2014	Assistance to Nutrition Program	Didipio, Binogawan, Alimit	Feeding Program to several wasted children,	Feeding program		100% Completed		112,500.00	84,861.00	75%	Reprogrammed to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
			provision of medicines/ vitamins								
2014	Conduct of Medical Mission, Purchase of Medicines & Vitamins	Didipio, Dingasan, Tucod, Wangal,	4 Medical missions, purchase of medicines	Purchase of medicines & other logistics	3,191	100% Completed		275,000.00	238,043.95	87%	Reprogrammed to other projects
2014	Purchase of Health Clinic Supplies, Equipment, Furnitures & Fixtures	Didipio, Wangal, Tukod, Tucod, Dibibi, Capisaan, Camamasi	3 delivery bed, 4medicines cabinet,5 tables, 2 fetal duppler,4 weighing scale, 1 ambu bag,1 basinet,1 autoclave,8 bp apparatus	various clinic facilities & equipment	1972 household	100% Completed		518,000.00	474,124.00	92%	Reprogrammed to other projects
2014	Subsidy of Health Workers	Alimit, Belet, Binogawan, Capisaan, Camamasi, Dibibi, Didipio, Dingasan, Tucod, Tukod, Wangal,	N/A	monthly subsidy of Barangay Health Workers, Barangay Nutrition Scholars, Midwife, Community Health team and Nurse	4460 Household	100% Completed		842,163.00	821,252.00	98%	Reprogrammed to other projects
SUB-TOTAL								2,785,463.00	2,639,217.91	95%	Reprogrammed to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2014 Enterprise Development and Networking											
2014	Support to Agriculture/ Farm Inputs	All SDMP Barangays	insecticides, seedlings, 5 knapsack sprayer, 18 power spray and other tools use in farming	insecticides, seedlings, knapsack sprayers, gardening tools	8,344 coop members	100%		2,037,500.00	2,039,930.81	100%	Completed
2014	Poultry Production	Tucod, Wangal	200 chicken laying eggs, cages	chicken laying eggs				215,000.00	215,000.00	100%	Completed
2014	Construction of Fishpond & Purchase of Fingerlings	Dingasan, Tukod	1 fish pond, 1,000 fingerlings	fishpond, fingerlings	220 coop members			5,000.00	5,000.00	100%	Completed
2014	Trainings & Seminars	All SDMP Barangays	2 Barangays conducted mushroom production & food processing training, 8,000 coop members for fundamentals, governance, policy making & management coop training	registration fee, facilitators fee, meals, transpo & other logistics	8,344 coop members	100%		30,000.00	30,000.00	100%	Completed
2014	Integrated Hog Production	Didipio, Binogawan	piggery & piglets		4,982 coop members	100%		1,055,000.00	1,055,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2014	Starting Capital	All SDMP Barangays	5M starting capital		8,344 coop members	100%		3,246,787.39	3,246,787.39	100%	Completed
2014	Starting Capital for Hardware							2,000,000.00	2,000,000.00	100%	Completed
SUB-TOTAL								8,589,287.39	8,591,718.20	100%	Completed
2014 Protection and Respect of Socio-Cultural Values											
2014	Assistance to Senior Citizens & Person's With Disability (PWD's)	All SDMP Barangays	10 Senior Citizen Organization, 10 PWD Organization	Purchase of supplies, equipment & facilities; improvement of offices	3,409 senior citizens	100%		152,000.00	151,258.00	100%	Completed
2014	Support to Barangay Assembly Meetings	All SDMP Barangays	Community	meals & other logistics during conduct of assembly meetings	85,225 residents	100%		25,000.00	50,000.00	200%	Negative balance was charged to savings from other PPA's
2014	Assistance to Indigenous People's Organization	All SDMP Barangays	IP Organizations, Community	Meals & other logistics during conduct of meetings; purchase of native attires		100%		794,006.39	707,725.00	89%	Reprogrammed to othe projects
2014	Assistance to Improvement, Repair & Rehabilitation Churches	All SDMP Barangays	Various churches	provision of church supplies & facilities; improvement of churches	73,795 church members	100%		1,304,999.99	1,326,099.39	102%	Negative balance was charged to savings from other PPA's
2014	Assistance to Barangay & Municipal Fiesta, Summer & Winter League	All SDMP Barangays	All Barangay fiesta, Municipal festival and summer &	meals, transpo, uniforms, referees fee & other logistics	85,225 residents	100%		1,593,133.34	1,568,130.50	98%	Reprogrammed to othe projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
			winter league								
SUB-TOTAL								3,869,139.72	3,803,212.89	98%	
2014 Human Resource Development and Capacity Building											
2014	Purchase of office supplies, equipments, etc.	All SDMP Barangays	purchased 2 laptops, 3 desktops, 6 office tables, 4 printers,& other office supplies	purchased laptops, desktops, office tables, swivel chairs, printers, consumable & other office supplies	Barangay employees / community	100%		391,662.93	327,545.51	84%	Reprogrammed to other projects
2014	Maintenance & Other Operating Expenses	All SDMP Barangays	Maintenance and improvement of 11 Barangay offices	Maintenance and improvement of 11 Barangay offices	Barangay employees /community	100%		1,500,000.00	1,452,365.00	97%	Reprogrammed to other projects
2014	Engineering & Administrative Expenses	All SDMP Barangays	6 Engineer & project supervisor	engineering fee	Barangay employees /community	100%		208,022.40	198,000.00	95%	Reprogrammed to other projects
2014	Trainings, Seminars, Workshop, Assessments	All SDMP Barangays	various organization, BLGU Officials & Employees	meals, transpo , registration fee, facilitators fee & other logistics	35,000 residents	100%		6,206,894.06	4,435,189.35	71%	Reprogrammed to other projects
2014	Support to SDMP Working Committee	All SDMP Barangays	100 BLGU officials	per diem during actual supervision of projects	100 BLGU Officials	100%		980,000.00	980,000.00	100%	Completed
2014	Purchase of BDRRMC Equipment/ Gadgets	All SDMP Barangays	80 pairs safety boots, 80 hard hats, 80 lamps, 80 safety uniforms	purchase of various gadgets for BDRMMC	80 safety assistants/tanods	100%		363,359.91	363,359.91	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
2014	Subsidy of SDMP Staff & Barangay Employees	All SDMP Barangays	150 employees subsidized	150 employees subsidized	150 SDMP Staffs & Barangay employees	100%		964,068.37	964,068.37	100%	Completed
2014	Conduct of Community Monitoring & Evaluation	All SDMP Barangays	30 M&E members with incentive	per diem during actual supervision of projects & meal, transpo & other logistics	30 members of Community Monitoring & Evaluation	100%		2,570,847.07	1,339,886.32	52%	Reprogrammed to other projects
SUB-TOTAL								13,184,854.74	10,060,414.46		
2014	Kasibu	Various Barangays & LGU Employees	Downloaded to LGU Accounts					4,460,153.03	4,460,153.03	100%	Completed
2014	Cabarroguis	Various Barangays & LGU Employees	Downloaded to LGU Accounts					4,124,375.53	4,124,375.53	100%	Completed
2014	Common Fund	10 SDMP barangays & 2 municipalities						1,556,807.02	1,353,381.25	87%	Ongoing implementation
2014 GRAND TOTAL								**101,584,629.20**	**101,628,873.49**	**100%**	**Completed**
2015 Access to Education and Educational Support Programs											
2015	Assistance to Trainings of School Teachers and Students	All schools of the 10 SDMP Barangays	10Trainings;20 Seminars	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	18 School Teachers,60 Pupils/Students	100%		220,000.00	220,000.00	100%	Completed
2015	Support to	6 Day Care	Yearly conduct	Purchase of	350 Day	100%		345,000.00	345,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Nutrition Program	Centers in Didipio	of feeding program to Day Care Pupils	nutritious foods and vitamins	Care Pupils						
2015	Construction/Improvement of School Buildings & Other facilities	All schools of the 10 SDMP Barangays	Improvement of 6 Day Care Centers; 30 meters tire path, 6 swing;6 slides; 3 handwashing areas; 2 school shed, 1 school canteen,1 mini museum; 1school gymnasium	Mini museum, school gymnasium, school building, concrete pathway, outdoor facilities, comfort rooms, handwashing areas, school shed, school canteen	3,000 school children	100%		800,000.00	799,953.37	100%	Completed
2015	Support to Scholarship Program	Didipio, Alimit, Tukod, Capisaan, Wangal,Binogawan	45 Scholars	Payment of tuition and miscellaneous fees of qualified scholars	45 scholars	100%		460,000.00	458,329.38	100%	Completed
2015	Support to Various School Activities & Competitions	Various schools of the 10 SDMP Barangays	District & Provincial Meet, Athletics, Envi Day, ALS & OSY Activities, Graduation Day, Science fair, English	Athletic Uniforms, meals, transpo, accommodation & other logistics	400 school children and 30 teachers	100%		777,120.00	810,781.94	104%	Negative balance was charged to savings from other PPA's

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			Fair, immersion, etc								
2015	Purchase of Various School /Office Supplies, Equipment and Facilities	Various schools of the 10 SDMP Barangays	5 Desktop computers, 3 laptop, various sports equipment, office furniture & fixtures, weighing scales, visual aids, manipulative toys, drum & lyre instruments, laboratory equipments, gen set,	Desktop computer, laptop, outdoor facilities, office furniture & fixtures, Visual aids, reference materials, manipulative toys, chairs, drum and lyre equipment	3000 school children and 20 teachers	100%		1,286,000.00	1,276,178.00	99%	Reprogrammed to other projects
2015	Subsidy of Elementary & High School Teachers, Day Care Workers, Kinder Teachers, School Clerk, School Utility/Security Guards	Various schools of the 10 SDMP Barangays	18 Elementary school teachers,3 high school teachers,non teaching staff	teachers, school clerk, security guards, day care workers	3000 school children and 18 teachers;6 non teaching	100%		3,611,376.76	3,611,796.76	100%	Completed
SUB-TOTAL								7,499,496.76	7,522,039.45	100%	
2015 Assistance to Infrastructure Development & Support Services											
2015	Installation of	Cabarroguis,	Installation of	Street Lights,	100	100%		700,000.00	700,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Street Lights	Didipio, Wangal, Tukod	10 LED Street Lights, Purchase of Electric Posts	LED Bulbs, Electric Post	household						
2015	Construction of Po Offices, Coop Building, BDRRMC Outpost	Tukod, Binogawan, Didipio, Dingasan, Tucod, Dibibi, Camamasi, Alimit	Improvement of 5 Senior Citizen Bldg, 3 Chapel	Improvement of Senior Citizen Bldg and Chapel	NGO's	100%		380,000.00	380,000.00	100%	Completed
2015	Purchase of barangay lot	Didipio, Alimit, Camamasi	3parcel of lot	lot	3 barangays	100%		680,000.00	680,000.00	100%	Completed
2015	Construction/Improvement of School Buildings	Various schools of the 10 SDMP Barangays	8 Day Care Center,2 Classroom,3 Comfort Rooms, 2 School Cottage,2 Handwashing	Improvement of 8 Day Care Center,2 Classroom,3 Comfort Rooms, 2 School Cottage, Construction of2 Handwashing Area	350 School children	100%		3,737,000.00	3,737,000.00	100%	Completed
2015	Construction of Tirepath	Dibibi, Tukod, Wangal, Tucod, Alimit, Camamasi, Dingasan	630 meters concrete pathway	Concrete Tirepath	1600 households	100%		1,118,000.00	1,118,000.00	100%	Completed
2015	Construction/Im	all	Construction	Construction of 1	3500	100%		5,324,640.00	5,061,858.75	95%	Reprogramme

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	provement of Multipurpose Building	barangays	of 1 barangay hall; improvement of 4 units Barangay Hall, construction of evacuation center, construction of gymnasium	barangay hall; improvement of 4 units Barangay Hall, construction of evacuation center, construction of gymnasium	household						d to other projects
2015	Construction/Improvement of Barangay Health Clinic	Didipio	1Barangay Clinic	Improvement of barangay clinic	800 household	100%		150,000.00	150,000.00	100%	Completed
2015	Construction of Post Harvest Facilities	all barangays	6 MPDP, 10 Corn & Rice Shed; Improvement of various post-harvest facilities	Construction of MPDP, Construction 10 Corn & Rice Shed	3500 household	100%		2,600,000.00	2,600,000.00	100%	Completed
2015	Construction/Improvement of Water System	All Barangays	Drilling, Installation of Distribution lines, Intake and Distribution tanks, Reservoir	Drilling, Distribution lines, SDR Pipes, Intake & Distribution Tanks, reservoir	3500 household	100%		3,437,697.87	3,437,690.87	100%	Completed
2015	Construction of Communal Irrigation System	Binogawan, Tucod, Capisaan, Dingasan,	180 meters irrigation canal	Construction/ Improvement of 180 meters irrigation canal	60 farmers	100%		112,120.00	112,120.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
		Wangal									
2015	Construction/Improvement of Hanging Bridge	Binogawan, Capisaan, Dibibi, Alimit, Didipio, Dingasan, Tucod, Tukod, Camamasi	Construction of 3 Hanging Bridge, Improvement of 5 Hanging Bridge' construction of 1 overflow bridge	Construction of 3 Hanging Bridge, Improvement of 5 Hanging Bridge' construction of 1 overflow bridge	2300 household	100%		1,009,028.27	1,009,028.27	100%	Completed
2015	FMR Improvement	All Barangays	Road Opening, widening, grading, gravelling (10kms), concreting (6kms),5box culvert, 9 RCPC installation,	opening, widening, gravelling, grading, concreting, installation of box culvert & RCPC	23000 household	100%		23,231,643.95	25,528,097.83	110%	Negative balance was charged to savings from other PPA's
SUB-TOTAL								42,480,130.09	44,513,795.72	105%	
2015 Access to Health Services, Health Facilities and Health Professionals											
2015	Support to Family Planning Program	Didipio, Kasibu, Nueva Vizcaya	N/A		15 Participants	100% Completed		62,500.00	62,500.00	100%	Completed
2015	Construction & Improvement of Barangay Health Clinic	Didipio, Binogawan, Camamasi	2 Units Barangay Clinic, Improvements of 5 Barangay Clinic, Installation of	Improvement of 2 Barangay Clinic, Improvements(fencing, painting, rehabilitation of old structures	1446 Household	100% Completed		339,000.00	297,000.00	88%	Reprogrammed to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			water system								
2015	Assistance to Clean & Green Brigade Program	Didippio, Binogawan	2 garbage pit construction	Construction of garbage pit and establishment of MRF, distribution of water sealed bowls	1257 Household	100% Completed		240,000.00	240,000.00	100%	Completed
2015	Trainings & Seminars related to Health Programs	Didipio, Binogawan, Tucod & Alimit	6 trainings; 4 seminars	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	8 Health Workers	100% Completed		150,000.00	126,000.00	84%	Reprogramme d to other projects
2015	Assistance to Nutrition Program	Didipio, Binogawan, Alimit	Feeding Program to several wasted children, provision of medicines/vita mins	Feeding program	60 severely wasted children	100% Completed		70,000.00	70,000.00	100%	Completed
2015	Conduct of Medical Mission, Purchase of Medicines & Vitamins	Alimit, Camamasi, Dibibi, Didipio, Dingasan, Tucod,	6 Medical missions, purchase of medicines	Purchase of medicines & other logistics	600 patients	100%compl eted		25,000.00	25,000.00	100%	Completed
2015	Purchase of Health Clinic Supplies, Equipment,Furni tures & Fixtures	Didipio, Wangal, Tukod, Tucod, Dibibi, Capisaan,	2 fetal duppler, 12 weighing scale, 1 ambu bag,1 basinet,1	various clinic facilities & equipment	2972 household	100% Completed		563,000.00	497,715.73	88%	Reprogramme d to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
		Camamasi	autoclave, 8 bp apparatus								
2015	Subsidy of Health Workers	Alimit, Belet, Binogawan, Capisaan, Camamasi, Dibibi, Didipio, Dingasan, Tucod, Tukod, Wangal,	N/A	monthly subsidy of Barangay Health Workers, Barangay Nutrition Scholars, Midwife, Community Health team and Nurse	4460 Household	100% Completed		1,125,800.00	1,125,800.00	100%	Completed
SUB-TOTAL								2,575,300.00	2,444,015.73	95%	
2015 Enterprise Development and Networking											
2015	Support to Agriculture	All SDMP Barangays	insecticides, seedlings, and other tools use in farming	insecticides, seedlings, gardening tools	8,344 coop members	100%		520,000.00	520,000.00	100%	Completed
2015	Poultry Production	Tucod, Wangal	200 chicken laying eggs, cages	chicken laying eggs	8,344 coop members	100%		145,000.00	145,000.00	100%	Completed
2015	Trainings & Seminars	All SDMP Barangays	2 Barangays conducted mushroom production & food processing training, 8,000 coop members for fundamentals, governance,	registration fee, facilitators fee, meals, transpo & other logistics	80 individuals	212%		30,000.00	30,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			policy making & management coop training								
2015	Additional Capital	All SDMP Barangays	Additional capital	Additional capital	8,344 coop members	100%		1,504,128.00	3,191,638.42	212%	Negative balance was charged to savings from other PPA's
SUB-TOTAL								2,199,128.00	3,886,638.42	177%	Negative balance was charged to savings from other PPA's
2015 Protection and Respect of Socio-Cultural Values											
2015	Assistance to Senior Citizens & Person's With Disability (PWD's)	All SDMP Barangays	3 Senior Citizen Organization, 4 PWD Organization	Purchase of supplies, equipment & facilities; improvement of offices	300 senior citizens & 28 PWD	100%		117,000.00	117,000.00	100%	Completed
2015	Support to Barangay Assembly Meetings	All SDMP Barangays	Community	meals & other logistics during conduct of assembly meetings	10000 individuals	100%		225,000.00	225,000.00	100%	Completed
2015	Assistance to Indigenous People's Organization	All SDMP Barangays	IP Organizations, Community	Meals & other logistics during conduct of meetings; purchase of native attires	10 IP Organizations	100%		182,120.00	182,070.00	100%	Completed
2015	Assistance to	All SDMP	Various	provision of	3200	100%		1,409,120.00	1,435,811.00	102%	Negative

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Improvement, Repair & Rehabilitation Churches	Barangays	churches	church supplies & facilities; improvement of churches	church members						balance was charged to savings from other PPA's
2015	Assistance to Barangay & Municipal Fiesta, Summer & Winter League	All SDMP Barangays	All Barangay fiesta, Municipal festival and summer & winter league	meals, transpo, uniforms, referees fee & other logistics	10000 individuals	100%		1,850,308.27	1,810,232.50	98%	Reprogramme d to other projects
SUB-TOTAL								3,783,548.27	3,770,113.50	100%	
2015 Human Resource Development and Capacity Building											
2015	Purchase of office supplies, equipment, etc.	All SDMP Barangays	Purchased 6 laptops, 6 desktops, 20 office tables, 10 swivel chairs, 6 printers,& other consumable office supplies	purchased laptops, desktops, office tables, swivel chairs, printers,& other consumable office supplies	BLGU Official 7 Employees /Communit y	100%		1,991,662.93	327,545.51	16%	Reprogramme d to other projects
2015	Maintenance & Other Operating Expenses	All SDMP Barangays	Maintenance and improvement of various Barangay offices;		550 Barangay employees	100%		1,320,000.00	1,248,000.00	95%	Reprogramme d to other projects
2015	Engineering & Administrative Expenses	All SDMP Barangays	3 Engineer and project supervisor	3 Engineer and project supervisor	engineers	100%		208,022.40	208,022.38	100%	Completed
2015	Trainings,	All SDMP	BLGU Official,	meals,transpo,	BLGU	100%		3,606,894.06	3,183,715.61	88%	Reprogramme

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Seminars Workshops	Barangays	Employees & Other PO's	registration fees & other logistics	Official, Employees & Other PO's						d to other projects
2015	Conduct of Mid Year & Annual SDMP Assessments	All SDMP Barangays	BLGU Official, Employees & Other PO's	meals,transpo, registration fees & other logistics	BLGU Official, Employees & Other PO's	100%		185,000.00	174,000.00	94%	Reprogramme d to other projects
2015	Support to BDRRMC	All SDMP Barangays	160 safety assistants subsized/BDRR MC	payment of monthly subsidies of safety assistants	160 safety assistants/ BDRRMC	100%		582,636.50	536,000.00	92%	Reprogramme d to other projects
2015	Support to SDMP Working Committee	All SDMP Barangays	100 BLGU Officials per diem	per diem during actual validation of PPA's & other logistics	495 officials	100%		1,650,000.00	1,325,000.00	80%	Reprogramme d to other projects
2015	Purchase of BDRRMC Equipments/Gad gets	All SDMP Barangays	various BDRRMC equipments/s upplies	purchase of various BDRRMC equipments/sup plies	160 safety assistants/ tanods	100%		630,000.00	586,000.00	93%	Reprogramme d to other projects
2015	Subsidy of SDMP Staff & Barangay Employees	All SDMP Barangays	65 BLGU Employees	Subsidy of BLGU employees	65 SDMP Staffs & Barangay employees	100%		964,068.37	657,200.37	68%	Reprogramme d to other projects
2015	Conduct of Community Monitoring & Evaluation	All SDMP Barangays	30 M&E members with incentive	payment of per diem of CMET members & other logistics during conduct of actual validation of projects	30 members of Community Monitoring & Evaluation	100%		1,870,847.07	1,848,520.00	99%	Reprogramme d to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
SUB-TOTAL								13,009,131.33	10,094,003.87	78%	
2015	Kasibu	Various Barangays & LGU Employees						3,244,750.46	2,908,972.72	90%	
2015	Cabarroguis	Various Barangays & LGU Employees						3,244,750.46	3,337,935.93	103%	
2015	Common Fund	11 SDMP barangays & 2 municipalities						3,082,515.23	1,863,531.98	60%	
2015 GRAND TOTAL								**81,118,750.60**	**80,341,047.32**	**99%**	
2016 Access to Education and Educational Support Programs											
2016	Assistance to Trainings of School Teachers and Students	All schools of the 11 SDMP Barangays	35 Trainings;40 Seminars	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	15 School Teachers,180 Pupils/Students	100%		360,000.00	244,839.80	68%	Continuing
2016	Support to Nutrition Program	6 Day Care Centers in Didipio	Yearly conduct of feeding program to Day Care Pupils	Purchase of nutritious foods and vitamins	350 Day Care Pupils	100%		365,000.00	364,650.00	100%	Completed
2016	Construction/Improvement of School Buildings & Other facilities	All schools of the 11 SDMP Barangays	Improvement of 12 Day Care Centers; 120 meters tire path, 6 swing;6 slides;	Day Care Center, Mini museum, school gymnasium, school building, concrete	3000 school children	100%		1,229,363.00	764,551.98	62%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			Construction of 4 built in comfort room; 3 handwashing areas; 2 school shed, 1 school canteen,1 mini museum;	pathway, outdoor facilities, comfort rooms, handwashing areas, school shed, school canteen							
2016	Support to Scholarship Program	Didipio, Kasibu, Cabarroguis, Belet, Alimit, Tukod, Capisaan, Wangal, Binogawan	85 Scholars	Payment of tuition and miscellaneous fees of qualified scholars	85 scholars	100%		1,163,568.37	986,049.19	85%	Continuing
2016	Support to Various School Activities & Competitions	Various schools of the 11 SDMP Barangays	District & Provincial Meet, Athletics, Envi Day, ALS & OSY Activities, Graduation Day, Science fair, English Fair, immersion, etc	Athletic Uniforms, meals, transport, accommodation & other logistics	1000 school children and 50 teachers	100%		835,000.00	872,793.69	105%	Completed
2016	Purchase of Various School /Office Supplies, Equipments and	Various schools of the 11 SDMP	5 Desktop computers,6 laptop, various sports	6 Desktop computers,6 laptop, various sports	800 school children and 30 teachers	100%		813,536.36	774,493.80	95%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Facilities	Barangays	equipments, office furnitures & fixtures, weighing scales, visual aids, 2 LED TV,2 projectors,250 plastic chairs, various manipulative toys, drum & lyre instruments, laboratory equipment, gen set,	equipment, office furniture & fixtures, weighing scales, visual aids, 2 LED TV,2 projectors,250 plastic chairs, various manipulative toys, drum & lyre instruments, laboratory equipments, gen set,							
2016	Subsidy of Elementary & High School Teachers, Day Care Workers, Kinder Teachers, School Clerk, School Utility/Security Guards	Various schools of the 11 SDMP Barangays	35 Elementary school teachers,18 high school teachers, non teaching staff	subsidy of teachers, school clerk, security guards, day care workers	35 Elementary school teachers,18 high school teachers, non teaching staff	100%		4,820,976.76	4,038,714.28	84%	Continuing
SUB-TOTAL								9,587,444.49	8,046,092.74	84%	
2016 Assistance to Infrastructure Development & Support Services											
2016	Construction of Communal Irrigation System	Wangal	180 Meters Concrete Irrigation	concreting of irrigation canal	22 Farmers	100%Completed		350,000.00	350,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			Canal								
2016	Installation of Street Lights	Tukod	Purchase of Electric Posts	Electric Post	30 household	100%Comp leted		50,890.00	50,890.00	100%	Completed
2016	Construction of Po Offices, Coop Building, BDRRMC Outpost	Tukod	1 Senior Citizen	Senior Citizen Bldg	1 NGO	100%Comp leted		50,000.00	49,310.00	99%	Completed
2016	Construction of Concrete School Fence	Tucod, Capisaan, Didipio	190 meters concrete perimeter school fence	Concrete Perimeter Fence, Semi concrete with interlinks	5 Schools	100%Comp leted		180,000.00	179,601.87	100%	Completed
2016	Purchase of barangay lot	Didipio, Alimit, Camamasi, Capisaan	11 parcel of lot	lot	4barangays	100% Completed		300,000.00	300,000.00	100%	Completed
2016	Construction/Im provement of School Buildings	All Barangays	2 Day Care Center; 1 Kinder Building; 6 Day Care Center, 6 Classroom,6 Comfort Rooms,3 School Cottage, Concrete fencing, Painting & other carpentry works	3 Day Care Center; 1 Kinder Building; 6 Day Care Center, 6 Classroom,6 Comfort Rooms,3 School Cottage, Concrete fencing, Painting & other carpentry works	5000 school children	75% Completed		8,309,319.10	7,454,985.68	90%	Continuing
2016	Construction of	Dibibi,	300 meters	Concrete	1600	98%		700,000.00	699,917.93	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Tirepath	Tukod, Wangal, Tucod, Alimit, Camamasi, Dingasan	concrete pathway	Tirepath	households	Completed					
2016	Construction/Improvement of Multipurpose Building	All Barangays	6 units Barangay Hall, 3 Gymnasium, stage/bleachers, evacuation center	3 Storey Barangay Hall, Bungalow Type Barangay Office, Gymnasium, Stage, Bleacher, Evacuation Center	3500 household	80% Completed		4,760,947.02	3,918,649.94	82%	Continuing
2016	Construction/Improvement of Barangay Health Clinic	Alimit	1 Barangay Clinic	Construction of 1 Barangay Clinic	150 household	100% Completed		250,000.00	249,273.85	100%	Completed
2016	Construction of Post Harvest Facilities	All Barangays	2 MPDP, 4 Corn & Rice Shed	Multipurpose Drying Pavement, Corn Shed, Rice Shed, Storage Bldg		96% Completed		356,612.72	325,987.86	91%	Continuing
2016	Construction/Improvement of Water System	All Barangays	Drilling, Installation of Distribution lines, Intake and Distribution tanks, Reservoir	Drilling, Distribution lines, SDR Pipes, Intake & Distribution Tanks, reservoir	4450 household	80% Completed		1,235,000.00	1,168,850.61	95%	Continuing
2016	Construction of Public Comfort	Tucod	1 Public Comfort Room	Concrete 2 Door Comfort Room	public	57% Completed		110,000.00	109,865.67	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Room										
2016	Construction/Improvement of Hanging Bridge	Binogawan, Capisaan, Dibibi, Alimit, Didipio	4Hanging Bridge,1 overflow bridge	Hanging Bridge, overflow bridge	2300 household	100% Completed		1,604,612.98	1,544,715.70	96%	Continuing
2016	FMR Improvement	All Barangays & 2 Municipalities	Road Opening, widening, grading, gravelling (22kms), concreting (5kms),5box culvert, 10 RCPC installation,	opening, widening, gravelling, grading, concreting, installation of box culvert & RCPC	23000 household	85% Completed		31,603,296.86	24,140,177.96	76%	Continuing
SUB-TOTAL								49,860,678.68	40,542,227.07	81%	
2016 Access to Health Services, Health Facilities and Health Professionals											
2016	Survey & Titling of Barangay Health Center Lot	Dingasan	1 lot	Survey and titling	1600 Residence	100% Completed		250,000.00	250,000.00	100%	Completed
2016	Purchase of Ambulance	Capisaan, Kasibu, Nueva Vizcaya	1	purchase of 1 unit ambulance	14000	100% Completed		600,000.00	600,000.00	100%	Completed
2016	Support to Family Planning Program	Didipio, Kasibu, Nueva Vizcaya	various	Conduct of trainings & seminars to mothers	65 Participants	100% Completed		125,000.00	125,000.00	100%	Completed
2016	Construction & Improvement of Barangay Health	Didipio	Improvements of 1 Barangay	Improvements Barangay Clinic	1446 Household	100% Completed		320,000.00	269,882.43	84%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Clinic		Clinic,								
2016	Assistance to Clean & Green Brigade Program	Didipio, Alimit, Binogawan, Tukod	various	Construction of garbage pit, purchase of seedlings, backyard gardening, establishment of nursery and MRF, distribution of water sealed bowls	1257 Household	100% Completed		450,000.00	400,000.00	89%	Continuing
2016	Trainings & Seminars related to Health Programs	Didipio & Alimit	various	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	1071 Household	100% Completed		30,000.00	30,000.00	100%	Completed
2016	Assistance to Nutrition Program	Didipio, Binogawan, Alimit	Feeding Program to several wasted children, provision of medicines/vitamins	Feeding program		100% Completed		133,500.00	125,490.00	94%	Continuing
2016	Conduct of Medical Mission, Purchase of Medicines & Vitamins	Alimit, Belet, Binogawan, Capisaan, Camamasi, Dibibi, Didipio,	55 Medical missions, purchase of medicines	Purchase of medicines & other logistics	10,491	100% completed		380,000.00	379,992.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
		Dingasan, Tucod, Tukod, Wangal, Municipality of Kasibu, Municipality of Cabarroguis									
2016	Purchase of Health Clinic Supplies, Equipment, Furnitures & Fixtures	Didipio, Wangal, Tukod, Tucod, Dibibi, Capisaan, Camamasi	3 delivery bed,4 medicines cabinet, 10 tables, 4 fetal duppler, 8 weighing scale, 4 ambu bag,2 basinet,1 autoclave, 6 bp apparatus	various clinic facilities & equipment	2972 household	100% Completed		467,776.00	461,416.00	99%	Completed
2016	Subsidy of Health Workers	All barangays	68 Health Workers	monthly subsidy of Barangay Health Workers, Barangay Nutrition Scholars, Midwife, Community Health team and Nurse	4460 Household	100% Completed		1,360,520.00	1,360,750.04	100%	Completed
SUB-TOTAL								4,116,796.00	4,002,530.47	97%	Completed
2016 Enterprise Development and Networking											

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2016	Support to Agriculture	All SDMP Barangays	insecticides, seedlings, 5 knapsack sprayer, 18 power spray and other tools use in farming	insecticides, seedlings, knapsack sprayers, gardening tools	8,344 coop members	100%		34,036.36	34,037.36	100%	Completed
2016	Poultry Production	Tucod, Wangal	200 chicken laying eggs, cages	chicken laying eggs		100%		73,636.36	73,636.36	100%	Completed
2016	Establishment of Income generating Project on Tourism	Kasibu	1 constructed tourism office	Tourism office	35,000 Kasibunian s	100%		400,000.00	382,220.00	96%	Continuing
2016	Purchase of Cooperative Lot	Camamasi	3 improved coop building	Cooperative Building		100%		60,000.00	-	0%	Continuing
2016	Trainings & Seminars	Didipio, Binogawan, Belet,Dibibi	Training on livestock production; weaving; CDA Trainings	registration fee, facilitators fee, meals, transpo & other logistics	120 coop officer/me mbers	100%		90,000.00	90,000.00	100%	Completed
2016	Integrated Hog Production	Didipio, Binogawan	piggery & piglets		25 coop members	100%		50,000.00	50,000.00	100%	Completed
2016	Starting Capital	All SDMP Barangays	Additional Capital		8,344 coop members	100%		3,250,750.00	1,546,999.00	48%	Continuing
SUB-TOTAL								3,958,422.72	2,176,892.72	55%	
2016 Protection and Respect of Socio-Cultural Values											
2016	Assistance to Senior Citizens & Person's With Disability	All SDMP Barangays	6 Senior Citizen Organization, 8 PWD	Purchase of supplies, equipments & facilities;	3,409 senior citizens	98%		693,301.36	679,798.88	98%	Reprogramme d to other projects

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	(PWD's)		Organization	improvement of offices; financial assistance							
2016	Support to Barangay Assembly Meetings	All SDMP Barangays	Community	meals & other logistics during conduct of assembly meetings	5,225 residents	98%		328,690.00	322,300.00	98%	Reprogrammed to other projects
2016	Assistance to Indigenous People's Organization	All SDMP Barangays	IP Organizations, Community	Meals & other logistics during conduct of meetings; purchase of native attires; conduct of trainings on cultural preservation	Indigenous people's Organization in all SDMP barangays	100%		267,136.00	266,572.00	100%	Completed
2016	Assistance to Improvement, Repair & Rehabilitation Churches	All SDMP Barangays	Various churches	provision of church supplies & facilities; improvement of churches	3000 church members	99%		1,492,095.00	1,475,574.00	99%	Reprogrammed to other projects
2016	Assistance to Barangay & Municipal Fiesta, Summer & Winter League	All SDMP Barangays	All Barangay fiesta, Municipal festival and summer & winter league	meals, transpo, uniforms, referees fee & other logistics	35,225 residents	103%		3,410,695.21	3,497,956.12	103%	Completed
SUB-TOTAL								6,191,917.57	6,242,201.00	101%	
2016 Human Resource Development and Capacity Building											
2016	Purchase of office supplies,	All SDMP Barangays &	purchased 6 laptops, 4	purchase of various office	550 Barangay			1,365,263.94	1,107,910.37	81%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	equipment, etc.	2 LGU's	desktops, 5 office tables, LCD projectors, office refrigerators, Tax Mapping Gadgets, camera, filing cabinets & other consumable office supplies	equipment & supplies	employees						
2016	Maintenance & Other Operating Expenses	All SDMP Barangays & 2 LGU's	Maintenance and improvement of 11 Barangay offices	electric bills, meals, accommodation & other logistics	550 Barangay employees			329,600.00	329,600.00	100%	Completed
2016	Engineering & Administrative Expenses	All SDMP Barangays & 2 LGU's	BLGU Official & Employees	Administrative related expenses	135 BLGU Employees & Officials			3,049,064.34	1,636,439.56	54%	Continuing
2016	Conduct of Barangay Census	Didipio		meals, transpo & per diem of enumerators	35,225 residents			35,000.00	35,000.00	100%	Completed
2016	Support to BLUP	Didipio	BLGU Official & Employees; other Government & En Praxis	meals, transpo & other logistics	35,225 residents			250,000.00	250,000.00	100%	Completed
2016	Trainings, Seminars, Workshop	All SDMP Barangays & 2 LGU's	MLGU/BLGU Official & Employee; teachers;	registration fees, accom, meals, transpo & other logistics	180 BLGU/MLGU Officials &			2,210,000.00	2,109,163.61	95%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			NGO's		Employees; teachers NGO's						
2016	Conduct of Mid Year & Annual SDMP Assessments	All SDMP Barangays & 2 LGU's	MLGU/BLGU Official & Employee	registration fees, accom, meals, transpo & other logistics	180 BLGU/MLGU Officials & Employees; teachers NGO's			609,678.96	332,495.00	55%	Continuing
2016	Support to BDRRMC	All SDMP Barangays	150 safety assistants	subsidy of safety assistants	150 safety assistants/ BDRRMC			650,000.00	576,000.00	89%	Continuing
2016	Support to SDMP Working Committee	All SDMP Barangays	130 MLGU/BLGU Official & Employee	per diem of SDMP Working Committee during conduct of actual project monitoring & supervision	130 MLGU/BLGU Official & Employee			923,223.90	726,434.39	79%	Continuing
2016	Purchase of BDRRMC Equipments/ Gadgets	All SDMP Barangays	Various Rescue Gadgets	Purchase of various rescue equipments/ gadgets	150 safety assistants/ BDRRMC; community			730,000.00	489,630.00	67%	Continuing
2016	Subsidy of SDMP Staff & Barangay Employees	All SDMP Barangays & 2 LGU's	40 BLGU SDMP subsidized employees	monthly subsidy of BLGU/MLGU SDMP Staff	40 SDMP Staffs & Barangay employees			3,118,354.00	2,770,856.85	89%	Continuing
2016	Conduct of Community Monitoring & Evaluation	All SDMP Barangays	45 CMET members	per diem of CMET Members & other logistics	45 members of Community Monitoring			1,085,000.00	1,020,000.00	94%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
					& Evaluation						
SUB-TOTAL								14,355,185.14	11,383,529.78	79%	
2016	Common Fund	11 SDMP barangays & 2 municipalities						1,797,356.00	1,118,133.00	62%	Continuing
2016 GRAND TOTAL								**88,070,444.60**	**72,393,473.78**		
2017 Access to Education and Educational Support Programs											
2017	Assistance to Trainings of School Teachers and Students	All schools of the 11 SDMP Barangays	10 Trainings;5 Seminars	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	15 School Teachers,130Pupils/Students	73% Completed		200,000.00	163,640.00	82%	Continuing
2017	Support to Nutrition Program	6 Day Care Centers in Didipio	Yearly conduct of feeding program to Day Care Pupils	Purchase of nutritious foods and vitamins	350 Day Care Pupils	99% Completed		365,000.00	354,025.01	97%	Continuing
2017	Construction/Improvement of School Buildings & Other facilities	Didipio	Improvement of 6Day Care Centers;	Day Care Center	350 Day Care Pupils	84% Completed		1,292,490.00	688,951.19	53%	Continuing
2017	Support to Scholarship Program	Didipio, Kasibu, Cabarroguis, Belet, Alimit, Tukod, Capisaan, Wangal,	85 Scholars	Payment of tuition and miscellaneous fees of qualified scholars	85 scholars	68% Completed		954,200.00	364,425.00	38%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
		Binogawan									
2017	Support to Various School Activities & Competitions	Various schools of the 11 SDMP Barangays	District & Provincial Meet, Athletics, Envi Day, ALS & OSY Activities, Graduation Day, Science fair, English Fair, immersion, etc	Athletic Uniforms, meals, transpo, accommodation & other logistics	3000 school children and 30 teachers	86% Completed		1,393,250.00	998,032.26	72%	Continuing
2017	Purchase of Various School /Office Supplies, Equipments and Facilities	Various schools of the 11 SDMP Barangays	4Desktop computers,2laptop, various sports equipments, office furnitures & fixtures, weighing scales, visual aids, 4 LED TV,6 projectors, manipulative toys, drum & lyre instruments, laboratory equipment, gen set,	4Desktop computers,2laptop, various sports equipment, office furniture & fixtures, weighing scales, visual aids, 4 LED TV,6 projectors, manipulative toys, drum & lyre instruments, laboratory equipment, gen set,	5,000 school children and 60 teachers	90% Completed		701,245.00	492,654.00	70%	Continuing
2017	Subsidy of	Various	35 Elementary	teachers, school	35	94%		4,076,976.76	3,460,657.37	85%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Elementary & High School Teachers, Day Care Workers, Kinder Teachers, School Clerk, School Utility/Security Guards	schools of the 11 SDMP Barangays	school teachers,20 high school teachers,15 Day Care Workers, 12 kinder teacher; 8 non-teaching staff	clerk, security guards, day care workers	Elementary school teachers,20 high school teachers, 8 non teaching staff	Completed					
SUB-TOTAL								8,983,161.76	6,522,384.83	73%	
2017 Assistance to Infrastructure Development & Support Services											
2017	Installation of Street Lights	Cabarroguis	Installation of 30 units Street Lights	Street Lights	50 household	90% Competed		100,000.00	78,580.00	79%	Continuing
2017	Construction of Po Offices, Coop Building, BDRRMC Outpost	Tukod	Construction of1 Senior CitizenBldg,1 Cooperative Bldg	Construction of1 Senior CitizenBldg,1 Cooperative Bldg	2 NGO's	59% Completed		370,000.00	-	0%	Continuing
2017	Purchase of barangay lot	Didipio, Tukod	1 parcel of lot	Cooperative lot of Tukod & Terminal for Didipio	4barangays	100% Completed		1,250,000.00	1,000,000.00	80%	Continuing
2017	Construction/Improvement of School Buildings	Didipio	6 Day Care Center	Improvement of 6 Day Care Center		75% Completed		3,650,011.00	149,918.76	4%	Continuing
2017	Construction of Tirepath	Dibibi,Tukod	1200 meters concrete pathway	Concrete Tirepath	1600 households	98% Completed		2,250,000.00	2,243,832.71	100%	Reprogrammed to other projects
2017	Construction/Improvement of Multipurpose	Wangal, Capisaan, Binogawan,	1 unit Barangay Hall, 3 Gymnasium,	3 Storey Barangay Hall, Gymnasium,	3200 household	80% Completed		6,065,000.00	3,699,186.09	61%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
	Building	Tukod, Dingasan	stage/bleachers, evacuation center	Stage, Bleacher, Evacuation Center							
2017	Construction/Improvement of Barangay Health Clinic	Binogawan	1 Nutrition Room; fencing of barangay clinic	Barangay Clinic, Nutrition Room	180 household	100% Completed		289,750.00	49,965.40	17%	Continuing
2017	Construction of Post Harvest Facilities	Cabarroguis, Tucod, Camamasi	1 MPDP, 16 Multipurpose Shed	Multipurpose Drying Pavement, Corn Shed, Rice Shed	250 household	96% Completed		901,015.00	841,920.49	93%	Continuing
2017	Construction/Improvement of Water System	Belet,Tucod, Tukod, Binogawan	Drilling, Installation of Distribution lines, Intake and Distribution tanks, Reservoir	Drilling, Distribution lines, SDR Pipes, Intake & Distribution Tanks, reservoir	480 household	80% Completed		1,520,000.00	1,122,319.10	74%	Continuing
2017	Construction of Public Comfort Room	Belet, Binogawan, Tucod	3 Public Comfort Room	Construction of Comfort Room	public	57% Completed		270,000.00	69,925.70	26%	Continuing
2017	Construction/Improvement of Hanging Bridge	Dibibi, Alimit, Dingasan	4Hanging Bridge	Hanging Bridge	1200 household	100% Completed		540,050.00	300,000.00	56%	Continuing
2017	FMR Improvement	All Barangays & 2 Municipalities	Road Opening, widening, grading, gravelling (10kms), concreting (1.5kms),3 box culvert, 8	opening, widening, gravelling, grading, concreting, installation of box culvert & RCPC	3000 household	85% Completed		28,486,942.24	7,076,239.47	25%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
			RCPC installation,								
SUB-TOTAL								45,692,768.24	16,631,887.72	36%	
2017 Access to Health Services, Health Facilities and Health Professionals											
2017	Support to Family Planning Program	Didipio, Kasibu, Nueva Vizcaya	3Trainings	Conduct of trainings & seminars to mothers	45 Participants	100% Completed		100,000.00	56,669.20	57%	Continuing
2017	Construction & Improvement of Barangay Health Clinic	Cabarroguis, Tucod, Binogawan, Camamsi	1 lactation room,2 Units Birthing Clinic;1 Barangay Clinic,	Construction of 1 Lacation Room; Improvement of Birthing Clinic	1446 Household	100% Completed		425,000.00	142,916.15	34%	Continuing
2017	Assistance to Clean & Green Brigade Program	Didippio, Alimit, Binogawan, Tukod	various	Construction of garbage pit, purchase of seedlings, backyard gardening, establishment of nursery and MRF, distribution of water sealed bowls	1257 Household	100% Completed		670,000.00	575,826.80	86%	Continuing
2017	Trainings & Seminars related to Health Programs	Didipio & Alimit	various	Registration Fee. Facilitators Fee, Meals, Snacks, Transportation and Other Logistic	1071 Household	100% Completed		110,000.00	103,941.65	94%	Continuing
2017	Assistance to	Didipio,	Feeding	Feeding	60	100%		60,000.00	60,000.00	100%	Completed

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Nutrition Program	Binogawan, Alimit, Dingasan, Camamasi, Belet	Program to several wasted children, provision of medicines/vitamins	program; Prizes for Clean & Green program	Household	Completed					
2017	Conduct of Medical Mission, Purchase of Medicines & Vitamins	Alimit, Belet, Dibibi, Didipio, Dingasan, Tucod, Tukod,	4 Medical missions, purchase of medicines	Purchase of medicines & other logistics	3800 household	100%completed		549,245.00	526,649.32	96%	Continuing
2017	Purchase of Health Clinic Supplies, Equipment, Furnitures & Fixtures	Dibibi,Alimit ,Capisaan, Camamasi	1 speculum,1 delivery bed; various medicine cabinets, tables & chairs	various clinic facilities & equipments	1372 household	100% Completed		118,750.00	114,366.74	96%	Continuing
2017	Subsidy of Health Workers	All Barangays	60 health workers	monthly subsidy of Barangay Health Workers, Barangay Nutrition Scholars, Midwife, Community Health team and Nurse	3200 Household	100% Completed		1,678,920.00	1,402,928.33	84%	Continuing
SUB-TOTAL								3,711,915.00	2,983,298.19	80%	
2017 Enterprise Development and Networking											
2017	Support to Agriculture	Belet, Dibibi, Tucod, Cabarroguis	Agricultural Inputs	purchase of various farm inputs	944 coop members	92%		712,000.00	461,808.64	65%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
2017	Poultry Production	Tucod, Wangal	200 chicken laying eggs, cages	chicken laying eggs		0%		110,235.00	101,538.00	92%	Continuing
2017	Establishment of Income generating Project on Tourism	Kasibu	1 constructed tourism office	Tourism office	35,000 Kasibunian s	100%		300,000.00	-	0%	Continuing
2017	Dressmaking	Capisaan	1 Training & materials Women's Organization on dressmaking/ weaving	2 Training & materials Women's Organization on dressmaking/we aving	65 members	100%		50,000.00	50,000.00	100%	Completed
2017	Construction of Fishpond & Purchase of Fingerlings	Dingasan	4 fish pond	Construction of fishpond	220 coop members	100%		200,000.00	200,000.00	100%	Completed
2017	Support to Mushroom Production	Binogawan	1 Barangays conducted the training	registration fee, facilitators fee, meals, transpo & other logistics	30 coop members	10%		30,000.00	29,999.00	100%	Completed
2017	Starting Capital	Camamasi, Wangal, Kasibu,Alimi t,Dingasan, Didipio	Additional revolving capital	Additional fund for cooperative lending & other businesses	2,344 coop members	25%		3,230,245.00	309,240.00	10%	Continuing
SUB-TOTAL								4,632,480.00	1,152,585.64	25%	
2017 Protection and Respect of Socio-Cultural Values											
2017	Assistance to Senior Citizens & Person's With	Didipio, Tucod, Cabarroguis	Additional revolving capital, chairs,	purchase of various equipments &	420 senior citizens	86%		284,000.00	244,583.90	86%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish-ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplishment Status	Remarks
			No.	Unit	Details						
	Disability (PWD's)		musical instruments, kitchen wares	financial assistance							
2017	Support to Barangay Assembly Meetings	Camamasi, Dibibi, Dingasan, Tucod, Capisaan, Camamasi, Binogawan	twice a year conduct of general assembly meeting	meals & other logistics during assembly meetings	15,225 residents	95%		450,000.00	427,012.00	95%	Continuing
2017	Assistance to Indigenous People's Organization	Belet, Binogawan, Dibibi, Cabarroguis, Capisaan	Cultural Attires & IP Day Celebration	Purchase of Cultural Attires & logistics during IP Day Celebration	5 IP organizatio n	71%		140,000.00	100,000.00	71%	Continuing
2017	Assistance to Improvement, Repair & Rehabilitation Churches	All SDMP Barangays	various construction materials & church equipments	purchase of construction materials & church equipments	56 Churches	85%		1,635,000.00	1,387,307.00	85%	Continuing
2017	Assistance to Barangay & Municipal Fiesta, Summer & Winter League	All SDMP Barangays	All Barangay fiesta, Municipal festival and summer & winter league	uniforms, referees fee, tranpo, meals & other logistics during fiesta celebration	15,225 residents	81%		3,602,425.00	2,918,275.77	81%	Continuing
SUB-TOTAL								6,111,425.00	5,077,178.67	83%	
2017 Human Resource Development and Capacity Building											
2017	Purchase of office supplies, equipments,etc.	All SDMP Barangays & 2 LGU's	projectors, laptops, desktop, printers & consumable	projectors, laptops, desktop, printers & consumable office supplies	BLGU/ MLGU	77%		1,095,612.00	846,223.04	77%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
			office supplies								
2017	Maintenance & Other Operating Expenses	All SDMP Barangays & 2 LGU's	Maintenance and improvement of 11 Barangay offices	electric bills, meals, accommodation & other logistics	550 Barangay employees	89%		1,632,400.00	1,450,303.68	89%	Continuing
2017	Trainings, Seminars, Workshops	All SDMP Barangays & 2 LGU's	250 MLGU/BLGU Officials & Employees, NGO's	Participation/Attendance to various trainings, seminars & workshops	250 MLGU/BLGU Officials & Employees, NGO's	74%		2,147,000.00	1,590,188.87	74%	Continuing
2017	Conduct of Mid Year & Annual SDMP Assessments	All SDMP Barangays & 2 LGU's	SDMP Assessment & general Assembly Meetings	meals, accommodation & other logistics	4500 household/ BLGU & MLGU Officials	55%		560,000.00	306,172.36	55%	Continuing
2017	Purchase of BDRRMC Equipment/ Gadgets	All SDMP Barangays	Various Rescue Equipment & Supplies	purchase of various rescue gadgets/ equipment	180 safety assistants/ BDRRMC	52%		678,000.00	351,462.67	52%	Continuing
2017	Support to SDMP Working Committee	All SDMP Barangays	150 MLGU/BLGU Officials	per diem of SDMP Working Committee & Other logistics	150 MLGU/BLGU Officials	44%		692,250.00	306,889.00	44%	Continuing
2017	Subsidy of SDMP Staff & Barangay Employees	All SDMP Barangays & 2 LGU's	40 SDMP Staff & Barangay Paid Employees	monthly subsidy of SDMP Staff & employees	40 SDMP Staffs & Barangay employees	76%		3,828,304.00	2,920,569.96	76%	Continuing
2017	Conduct of Community Monitoring & Evaluation	All SDMP Barangays	35 CMET Members	495 M&E members with incentive	35 members of Community	16%		1,084,684.00	173,511.00	16%	Continuing

Year	Project/ Program/ Activity (PPA)	PHYSICAL						FINANCIAL			
		Location	Beneficiaries			Accomplish -ment Status	Remarks	Annual Allotment	Actual Expenditures	Accomplish ment Status	Remarks
			No.	Unit	Details						
					Monitoring & Evaluation						
SUB-TOTAL								11,718,250.00	7,945,320.58	68%	
2017	Common Fund	11 SDMP barangays & 2 municipalities						1,650,000.00	1,292,425.80		
2017 GRAND TOTAL								**82,500,000.00**	**41,605,081.43**	**50.4%**	**Continuing**

5.1.1 APPRENTICESHIP AND LEADERSHIP PROGRAM

Table 5-2: List of Beneficiaries

Apprenticeship Program	Beneficiary	End Date
Masonry NC II	Leonardo C. Licyayo	January 2, 2018
Plumbing NC II	Randy P. Pumihic	January 2, 2018
Refrigeration and Air-conditioning NC II	Mario M. Lammao	January 2. 2018
Automotive Serving NC II	Jun-Jun P. Donato	December 28, 2017
Automotive Electrician	Ian Chris P. Paclibare	January2, 2018
Carpentry NC II	Fernando D. Buyuccan	December 28, 2017
Scaffold ErectionNC II	Martin A. Pugong	December 28, 2017
Tire Recapper	Lucas D. Dulnuan	December 28, 2017
Learnership Program		
Construction Painting NC II	Joshua C. Calingayan	October 6, 2017
Shielded Metal Arc Welding NC II	Claro T. dulnuan	October 27, 2017
Shielded Metal Arc Welding NC II	Gemar T. Bahatan	October 27, 2017

Table 5-3: List of Offered Apprenticeship and Learnership Programs

No.	Competency	Program	Date Issued
1	Masonry NC II	Apprenticeship	March 20, 2017
2	Plumbing NC II	Apprenticeship	March 20, 2017
3	Refrigeration and Air-conditioning NC II	Apprenticeship	March 20, 2017
4	Automotive Servicing NC II	Apprenticeship	March 20, 2017
5	Automotive Electrician	Apprenticeship	March 20, 2017
6	Carpentry NC II	Apprenticeship	March 20, 2017
7	Scaffold Erection NC II	Apprenticeship	March 20, 2017
8	Tire Recapper	Apprenticeship	March 20, 2017
9	Construction Painting NC II	Learnership	March 20, 2017
10	Gas Metal Arc Welding NC II	Learnership	March 20, 2017
11	Shielded Metal Arc Welding NC II	Learnership	March 20, 2017
12	Driving NC II	Learnership	January 20, 2016
13	Driving NC III	Learnership	January 20, 2016
14	Commercial Cooking NC II	Apprenticeship	July 4, 2015
15	Housekeeping NC II	Learnership	July 4, 2015

Table 5-4: List/Table of Awards

Name of Award	Date awarded	Issuing Agency/Institution
Global Corporate Social Responsibility and Awards		
• Special Recognition Award for 5 Consecutive Years of CSR Excellence	2018	
• Gold Awardee – Best Workplace Practices	2018	
• Gold Awardee – Best Workplace Practices	2017	
• Gold Awardee – Best Workplace Practices	2016	
• Gold Awardee – Empowerment for Women	2014	
TESDA Kabalikat Award		

Name of Award	Date awarded	Issuing Agency/Institution
Regional Kabalikat Awardee – Industry Partner Category	August 31, 2016	TESDA
2016 National Kabalikat Awardee	September 22, 2016	TESDA

Table 5-5: List/Table of Certificates

Name of Certificate	Date awarded	Issuing Agency/Institution
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-001 (MASONRY NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-002 (PLUMBING NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-003 (REFRIGERATION AND AIRCONDITIONING NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-004 (AUTOMOTIVE SERVICING NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-005 (AUTOMOTIVE ELECTRICIAN)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-006 (CARPENTRY NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-006 (CARPENTRY NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-007 (SCAFFOLD ERECTION NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION AP NO. 2017-02-04-008 (TIRE RECAPPER)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION LP NO. 2017 -02-04-002 (SHIELDED METAL ARC WELDING NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION LP NO. 2017 -02-04-003 (GAS METAL ARC WELDING NC II)	March 20, 2017	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION LP NO. 16-02-04-001 (DRIVING NC II)	January 20, 2016	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION LP NO. 16-02-04-002 (DRIVING NC III)	January 20, 2016	Technical Education and Skills Development Authority (TESDA)
CERTIFICATE OF TVET PROGRAM REGISTRATION LP NO. 15-02-04-005 (COMMERCIAL COOKING NC II)	July 04, 2015	Technical Education and Skills Development Authority (TESDA)

5.2 Social Development Program for the Proposed Increase in Annual Plant Throughput Rate to 4.3 MTPA

A review of the previously presented accomplished and ongoing Social Development Programs, alongside the SDMP, shows a broad and deep comprehension in scope.

- Nevertheless, improvement should be made in the time table, time frame, duration, and precedence of the implementations.

- Furthermore, dialogues, consultations and feedback mechanisms should be more frequent, deep and broad with the community and other stakeholders in order to ascertain public participation principles, community involvement and accountability in decision making and implementation, and address grievances promote a healthy relationship, and also for a more efficient, effective and impactful programs, projects and implementations.

Programs/projects with “ongoing status” as indicated in Table 5-1 will be implemented continuously and/or along with the proposed Social Development Plan for the proposed project presented in Table 5-6.

Table 5-6: Indicative Social Development Plan/Framework for the Project

Concern	Program Actions	Lead Organization	Responsible Community Member/Beneficiary	Indicative Timeline	Source of Fund
Economic empowerment and Capability-Building	• *Agricultural based Livelihood and technology programs, projects, trainings and seminars such as, but not limited to: - vegetable gardening - fruit bearing tree farms- fruit preserves and other fruit based products - goat raising and goat meat and goat's milk and other goat products derivative - organic/free range chicken raising	OGPI, DA, TESDA, CSWD	• Barangay Committees • Communities within impact barangay • Pos and NGOs of impact barangays	Operation Abandonment	OGPI
	• OGPI Mining operations augmenting/ peripheral enterprises such as: - Public Works (Roads, culverts, etc) - Housekeeping - Food Services and Food Sourcing - Uniform making and procurement	OGPI, DTI, TESDA, CSWD	• Barangay Committees • Communities within impact barangay • Pos and NGOs of impact barangays	Operation Abandonment	OGPI
Gender Concerns	• Gender Sensitivity Training Seminars	OGPI, LGU Committees	• Barangay Committees • Communities within impact barangay • Pos and NGOs of impact barangays	Operation Abandonment	OGPI
Health	• Set-up community based health program in project affected areas; regular monitoring and consultation on medical services. • Herbal Gardening • Herbal Medicine Production (ex. Lagundi, etc), Distribution, and Stockpiling/ Storage (Household/ Community Pharmacy) • Maternal Care and Child Health Care: Prenatal, Intranatal, Postnatal, Child birth in health centers or hospitals	OGPI, DOH, DepEd, City Health Officer, Brgy Committee on Health, BHW	• Barangay Committee on Health, Barangay Health Workers • Residents affected by the project • Pos and NGOs of impact barangay • Employees of the project • Barangay Nutrition scholars and Health Workers; Women	Operation Abandonment	OGPI

Concern	Program Actions	Lead Organization	Responsible Community Member/Beneficiary	Indicative Timeline	Source of Fund
			and children of the affected barangays		
Hazards and disaster preparedness	• Disaster Risk Management Plan* • Seminars/training for communities on Disaster Risk Preparedness and Mitigation • Provision of equipment and aid in response and recovery of affected communities	OGPI in partnership with local authorities and community organizations DRRMC	• Communities of impact barangays • OGPI Employees	Operation Abandonment	
Transportation	Improvement of roads	OGPI in partnership with local authorities and community organizations	• Barangay Committees • Communities within impact barangay • Pos and NGOs of impact barangay	Operation	
Water supply	Provision for, or assistance for water supply sourcing and storage and distribution for the community	OGPI in partnership with local authorities and community organizations	• Barangay Committees • Communities within impact barangay • Pos and NGOs of impact barangay	Operation	
Peace and Order	Provision of equipment and facilities as aid in keeping order in the community	OGPI, PNP, Barangay LGU – Tanod	• Barangay Committees • Communities within impact barangay • Pos and NGOs of impact barangay	Operation	OGPI
Environment	• Reforestation • Landscape and Waterscape Rehabilitation	OGPI, DENR, LGUs	Community, General Public	Operation	OGPI
Environment Aesthetics	Landscaping and Land Use Planning	OGPI, LGU, DENR, DoT	Community, General Public	Operation Abandonment	OGPI

Concern	Program Actions	Lead Organization	Responsible Community Member/Beneficiary	Indicative Timeline	Source of Fund
Stakeholder Grievances	• Robust IEC Campaigns • Robust Community Engagement Programs and Practices • Community Involvement and Stakeholders Participatory Dialogues, Consultations, For a, and Assemblies • Frequent, in Depth and broader Community and Stakeholder Engagement	OGPI, OGPI - CRO, LGU, OGPI Partners,	• Community • Stakeholders • Aggrieved Sectors • Segments and Organizations General Public	Operation Abandonment	OGPI
Mining plant closure	• Fast track of prior and ongoing SDP and SDMP commitments and projects • Landscape and Waterscape Rehabilitation • Landscaping and Land Use Planning • Psycho-social services to Project-affected families • Re-training and enhancement of alternative livelihood programs for workers in the affected areas • Assistance for skills and livelihood training for opportunities and enterprises not dependent on OGPI's operations	• OGPIs, LGU, NGOs , POs • OGPI, DENR, LGUs, DPWH • OGPI, LGU, DENR, DoT, DPWH • OGPI, DSWD • OGPI, DTI • OGPI, DTI	• Employees of the company • OGPI Partners • Community	Abandonment	OGPI

Note: *proposed addition to the existing SDP

Programs catering to the OGPI workforce and contractors, pertaining to labor related and occupational health and safety concerns, such as those presented in the Manpower and Health and Safety Section of Chapter 2, should be continued and enhanced.

Dialogues, consultations and feedback mechanisms should be more frequent, deep and broad with the workforce and contractors in order to ascertain their participation involvement and accountability in decision making and implementation, and address grievances better and promote a healthy relationship, and also for a more efficient, effective and impactful programs, projects and implementations.

5.1 INFORMATION, EDUCATION AND COMMUNICATION (IEC)

A comprehensive and intensive Information Education and Communication (IEC) Campaign is designed for the better information and education of the communities and the general public pertaining the objectives, necessity and benefits of the project, and the processes involved with the construction and operation of the proposed project. These shall be done through the distribution and posting of written materials such as brochures, newsletters, media statements and articles, bulletins and posters, comics, and online presence. Moreover, non-written types such as symposia, conferences, workshops, community discussions and hearings, interpersonal focus discussions, house-to-house and purok-to-purok information drives, information desk/center, community seminars, mine visits audio visual presentations, radio and TV programs and/or guestings, etc., can also be used for the campaign. The IEC materials and activities will also serve as a venue for continuous dialogue, feedback and check and balance mechanism for the parties involved.

Table 5-7 summarizes the implemented IEC programs for the previous project. On the other hand, Table 5-8 presents the proposed IEC Programs for the Expansion Project.

Table 5-7: Information, Education and Communication Programs/Activities Implemented By OGPI

Project/ Program/ Activity (PPA)	Location	Beneficiaries		Status	Annual Allotment						Actual Expenditures						Remaining Balance
		Unit/ No.	Details		2013	2014	2015	2016	2017	Total	2013	2014	2015	2016	2017	Actual Expenditures	
Mine Tours/ Mobile IEC Truck	Nueva Vizcaya, Quirino, Metro Manila	Approx. 10,000	Expenditures include transportation, food, and accommodation	Ongoing	3,500,000	4,900,000	2,886,667	2,025,200	3,645,617.88	16,957,484.88	2,699,739.74	7,979,896.66	4,395,056.19	1,625,561.71	6,148,648.47	22,848,902.77	-5,891,417.89
Operation of Info & Visitor's center	n/a				963,200	1,037,462	1,388,908	2,631,800	1,500,000	7,521,370	176,933.45	377,109.75	546,818	781,357.99	814,399.70	2,696,618.89	4,824,751.11
Printing Newsletter, Bimmoble, Reports	Nueva Vizcaya, Quirino, Metro Manila	25,000	Distributed to both internal and external stakeholders	Ongoing		1,161,330	1,200,000	2,795,000	2,000,000	7,156,330	553,163.89	415,254.97	651,720	2,029,755.68	3,460,975.70	7,110,870.24	45,459.76
Media Ads/ Advertising Campaigns/AVPs	n/a				1,080,000	1,750,000	1,761,000	550,000	500,000	5,641,000		362,321.04	3,200,000	2,016,867.10	1,006,699.40	6,585,887.54	-944,887.54
Events, Sponsorships, Campaigns, Immersion	n/a				1,149,000	3,400,000	3,781,100	5,383,560	4,000,000	17,713,660	136,454.56	4,203,716.61	3,208,179	6,609,401.02	4,965,994.49	19,123,745.68	-1,410,085.68
Signage, Media Contracts, Promotional	n/a					1,000,000	2,772,076	2,350,000	2,000,000	8,122,076			3,178,093	3,928,563.05	978,238.49	8,084,894.54	37,181.46
IEC Tools, Equipment & Software	n/a				360,679.93	550,000		825,000		1,735,679.93				618,780.68	1,077,974.38	1,696,755.06	38,924.87
Collaboration Meetings/ Strategic Planning/ Mining Matters	n/a						2,434,000	230,000		2,664,000			223,365	306,924.43	1,078,502.74	1,608,792.17	1,055,207.83
Professional Services/	n/a					1,212,000		983,000	1,000,000	3,195,000				1,468,017.97	450,000.00	1,918,017.97	1,276,982.03

Project/ Program/ Activity (PPA)	Location	Beneficiaries		Status	Annual Allotment						Actual Expenditures						Remaining Balance
		Unit/ No.	Details		2013	2014	2015	2016	2017	Total	2013	2014	2015	2016	2017	Actual Expenditures	
Subscriptions/ Publications																	
Supplies and Materials	n/a							200,000		200,000	53,808.45	103,883.09	159,919	658,912.28	282,396.95	1,258,919.77	-1,058,919.77
Eco-Tourism Package	n/a								1,000,000	1,000,000					50,000.00	50,000.00	950,000.00
Social/ Digital Marketing Program	n/a								1,000,000	1,000,000					232,396.95	232,396.95	767,603.05
TOTAL					7,052,879.93	15,010,792	16,223,751	17,973,560	16,645,617.88	72,906,600.81	3,620,100.09	13,442,182.12	15,563,150.19	20,044,141.91	20,546,227.27	73,215,801.58	-309,200.77

Table 5-8: IEC Plan/Framework for the Expansion Project

Key Messages	Target Sector	Scheme/ Strategy / Methods	Information Medium	Timelines and Frequency	Responsible Party	Cost
Discussion on the Increase in Annual Throughput Rate to 4.3 MPTA • Particular clarification and explanation of what is "Throughput" • Discussion of the Impacts	All stakeholders particularly the ff: • Residents • LGUs • Workforce	• Assemblies • Dialogues • Consultations • Meetings • Informal Discussions • Publicly Accessible Feedback Mechanisms • Regular, constant and Continuous Community IEC Fieldwork	Written or Published Materials such as but not limited to: • Brochures/Flyers/Leaflets • Newsletters • Wall Bulletins/Posters • Primers Online • Website with contact mechanisms • Online Social Media Accounts Audio-Visual Presentations • Slide Presentations	During the whole Operations until the Abandonment Phase • Continuous • Repeating • Recurring	• OGPI • CRO • Envi Dept	
Environmental Impact Mitigation, enhancement, and Monitoring Activities, programs and Practices	All stakeholders particularly the ff: • Residents • LGUs • Environment Advocacy and Interest Groups • General Public				• OGPI • CRO • Envi Dept	

Key Messages	Target Sector	Scheme/ Strategy / Methods	Information Medium	Timelines and Frequency	Responsible Party	Cost
Social Development and Corporate Social Responsibility(CSR) Programs	All stakeholders particularly the ff: • Residents • LGUs • Environment Advocacy and Interest Groups • General Public		• Video Presentations On Site/On Ground IEC Personnel Presence and Presentations • Knowledgeable and Skilled IEC Personnel/s to provide presentations, discussions and solicit feedbacks • Community Based/ Area of Work coverage are the communities and other pertinent offices and agencies		• OGPI • CRO	
Grievance Concerns	All stakeholders particularly the ff: • Residents • LGUs • Environment Advocacy and Interest Groups • General Public				• OGPI • CRO	

6 ASSESSMENT OF ENVIRONMENTAL IMPACTS

6.1 ENVIRONMENTAL PERFORMANCE

The Environmental Management Plan (EMP) currently being implemented was designed to address the potential environmental impacts resulting from the Project operations. These include management of land and water resources, air quality, conservation values, heritage, cultural values and social issues.

The company's environmental management strategy is set on sustainable development principles and practices which include:

- Avoid, remedy and mitigate environmental impacts;
- Obtain and comply with resource consents;
- Institute environmental projects;
- Manage waste; and
- Carry out rehabilitation progressively.

The following subsections presents the status of implementation of the project's approved EMP and Environmental Monitoring Plan and compliance to the conditions set forth in the Environmental Compliance Certificate.

6.1.1 LAND RESOURCES

Land resource management is focused on rehabilitation of disturbed areas, waste management and reforestation activities. The approved ECC provides specific conditions aim to address or enhance potential impacts on land resources. Condition No. 1 provides that proper stockpiling and disposal of the materials generated from the project site, silt materials scooped-out from settling ponds, and other solid wastes in permanent, stabilised areas need to be observed to mitigate pollution of any water body and drainage systems, and maintaining them in safe and non-polluting conditions. The same condition further require that OGPI shall observe strict implementation of stabilisation and erosion control in all affected areas including slopes of the roads and nearby gullies, creeks and rivers with the project site, as well as those of settling ponds. Based on the 2015 Environmental Compliance Audit conducted by an independent third-party, GHD PTY LTD, OGPI has demonstrated efforts and initiative to implement the requirements of the condition. Particularly, OGPI observed proper stockpiling of ore/waste materials through strict implementation of its Top Soil Management as part of the EMP. Disturbed slopes were provided with coco-fiber matting and planted with vetiver grass. Slope rehabilitation activities within the DP site are in accordance with OGPI's Standard Operating Procedure on Slope Rehabilitation.

The sections below demonstrate some of the rehabilitation and re-vegetation efforts of OGPI in some of the project's critical areas.

6.1.1.1 GEOLOGY

Piezometers are installed near the toe and of the TSF embankment and WRS to monitor movement or slippage during its operation. The use of extensometers is also advised. Physical monitoring such as observation for cracks or fracturing along the embankment, seepages other evidences of erosion or scouring are regularly conducted. If features of erosion, scouring, or potential breach are noted, these will be immediately mitigated and addressed to prevent failure.

6.1.1.2 PEDOLOGY


Photo 6-1: Rock lining and rock surfacing

Erosion controls implemented on site are presented below.

6.1.1.2.1 Erosion Control Blankets

Erosion control blankets are temporary erosion controls that provide cover over exposed soils. It reduces raindrop impacts by providing cover. These controls are commonly use on earth embankments and slopes before and during revegetation phase. Currently, Didipio mine has used and will continue to use cocomats in combination with various revegetation techniques.

Photo 6-2: Rehab at Finger 4

Photo 6-3: Rehab at ROM Pad

Photo 6-4: Rehab at Lower Boya

Photo 6-5: Rehab at Upper Boya

Photo 6-6: Rehabilitation of ROM ringroad

Photo 6-7: Cocomatting and revegetation at ROM ringroad

Photo 6-8: Cocomatting and revegetation at ROM northwall

Photo 6-9: Cocomatting at lower Boya dump area

6.1.1.2.2 HYDROSEEDING

Hydroseeding was adopted by OGPI to address the problem of soil erosion control and progressive rehabilitation especially for those areas with insufficient soil and rock phases area.

Photo 6-10: MacFlex application on Trial Slopes

Photo 6-11: Application on the Batch Plant slopes

Photo 6-12: Result at UG MSA

6.1.1.3 FLORA AND FAUNA

The Environmental Compliance Certificate with reference number ECC-CO-112-0022 provides at least three conditions to minimize the adverse impact of the project with regard to terrestrial flora. These are Condition number 1, Condition number 4 and Condition number 5.

Condition number 1 indicates that OGPI should practice observance of good vegetative practices, proper land use, and sound soil management. According to the 2011 EPRMP of the project, under the environmental compliance monitoring section, "a buffer zone of forty (40) meter width shall be provided and maintained along the entire periphery of the project site as well as between the nearest water body and mine and mill facilities, it shall be kept with dense vegetative cover and planted with additional endemic species to enhance its conditions." The 2015 Environmental Compliance Audit (ECA) reported that a buffer zone of forty (40) meters along water bodies has been identified and based on CMR for the 2nd semester of 2015, the total rehabilitated area within the mine site is approximately 92.19 hectares.

Condition No. 4 of the ECC requires OGPI to annually monitor the terrestrial flora and fauna and aquatic ecosystems of the mining areas during the mining operations, the results and findings of which need to be integrated accordingly to the EMP. In compliance to this, OGPI has engaged the UPLB Foundation, Inc. (UPLBFI) for the ecological assessment and monitoring of terrestrial and aquatic ecosystems within the project site. In terms of terrestrial ecology, there are a few terrestrial flora that require conservation priority, while all terrestrial fauna recorded have a conservation status of Least Concern (IUCN).The monitoring activity was conducted in October to December 2014. Since then, yearly ecological assessment and monitoring of biodiversity in terrestrial and aquatic ecosystems in the project site were conducted by the UPLBFI for the study period of year 2016-

2017. The results and discussion of the study were considered in the preparation of the Annual Environmental Protection and Enhancement Plan of the Company.

Condition No. 5 requires OGPI to establish a reforestation and carbon sink program to mitigate greenhouse gas (GHG) emissions of the project in line with the DENR's thrust for GHG emission reduction programs.In compliance to this, among other programs that aim to mitigate GHG emissions, OGPI also implements a GHG and Energy Management Plan (Appendix E) to monitor, manage and reduce net GHG emissions and maximise energy use efficiency of OGPI operations.

Based accomplishment reports for the NGP and Mining Forest Program that have been submitted to the MGB there are 332,969 seedlings planted by OGPI with 91.56 percent survival. Table 6-1 presents the plantation activities of OGPI from 2012 to 2015.

Table 6-1: OGPI NGP and Mining Forest Program Report

Aspect	Date of planting activities							Total
	Jan-Dec 2012	Jan-Jun 2013	Jul-Dec 2013	Jan-Jun 2014	Jul-Dec 2014	Jan-Jun 2015	Jul-Sept 2015	
No. of seedlings planted	65,600	19,483	160,120	230	65,763	1,773	20,000	332,969
No. of seedling replanted	3,242	975	15,515	4	7,234	48	1,076	28,094
No. of surviving plants	62,358	18,508	144,605	226	58,529	1,725	18,924	304,875
Percent survival (%)	**95.06**	**95**	**90.31**	**98.26**	**89.00**	**97.29**	**94.91**	**91.56**

In addition to NGP and Mining Forest Program planted trees, OGPI has donated 122,850 seedlings of various species in 2015 to different stakeholders including adjacent barangays and Cabarroguis, DENR-CENRO Dupax del Norte, among others. The EMB Region II also received a total of 21,000 various seedling species from OGPI as part of the company's commitment. In line with this commitment at least two nurseries were established by OGPI at Tucod and Mine site to supply seedlings for the reforestation activities.

6.1.1.4 Progressive Rehabilitation

OGPI has been implementing progressive rehabilitation across the mine site even during the onset of construction or as soon as areas become available for rehabilitation. The rehabilitation concept involves application of topsoil on battered slope and planting native species including those that are abundant locally to reforest these areas. AS of the first quarter of 2018, OGPI has a total of 35.47 hectares revegated cumulative accomplishment and a total of 33,680 assorted seedlings were donated to DENR-CENRO, Malasin, DENR-CENRO, Dupax, Exploration Team, Brgy. Alimit and Brgy.Kasibu.

In the first few years there are limited areas at the site that were available for rehabilitation however there were opportunities for rehabilitation virtually from the start of construction and during operation. This early rehabilitation involves the establishing of a suitable seed bed and planting indigenous species or other species. The recovery of the fertile topsoil as well as proper conservation practices is based on the Top Soil Management Plan which is being implemented to maintain viability of topsoil for use in current and future rehabilitation activities.

Progressive rehabilitation involves reconfiguring the slope into stable angle, benching, covering the slopes with topsoil, matting of planting of selected plant species and casting of seeds. Rehabilitated area is being matted with coconet to hold the top soil and minimize erosion. Figure 6-1 presents the location maps of various rehabilitation and revegetation activities done on site.

Table 6-2: Estimated Disturbed and Remaining Area for Rehabilitation

Year	Total Disturbed Area (ha)	Rehabilitated area (ha)	Remaining Disturbed Area (ha)	Area / Location of rehabilitation
EOY[1] 2015	305.7	10.7	295	• Boya dump • North slope/ diversion channel
EOY 2016	329.45	5.4	324.05	• South Wall slope • TSF Wall (bottom 15m elevation)
EOY 2017	333.64	5.6	328.04	• TSF Wall (bottom 30m elevation)

[1]EOY – End of Year

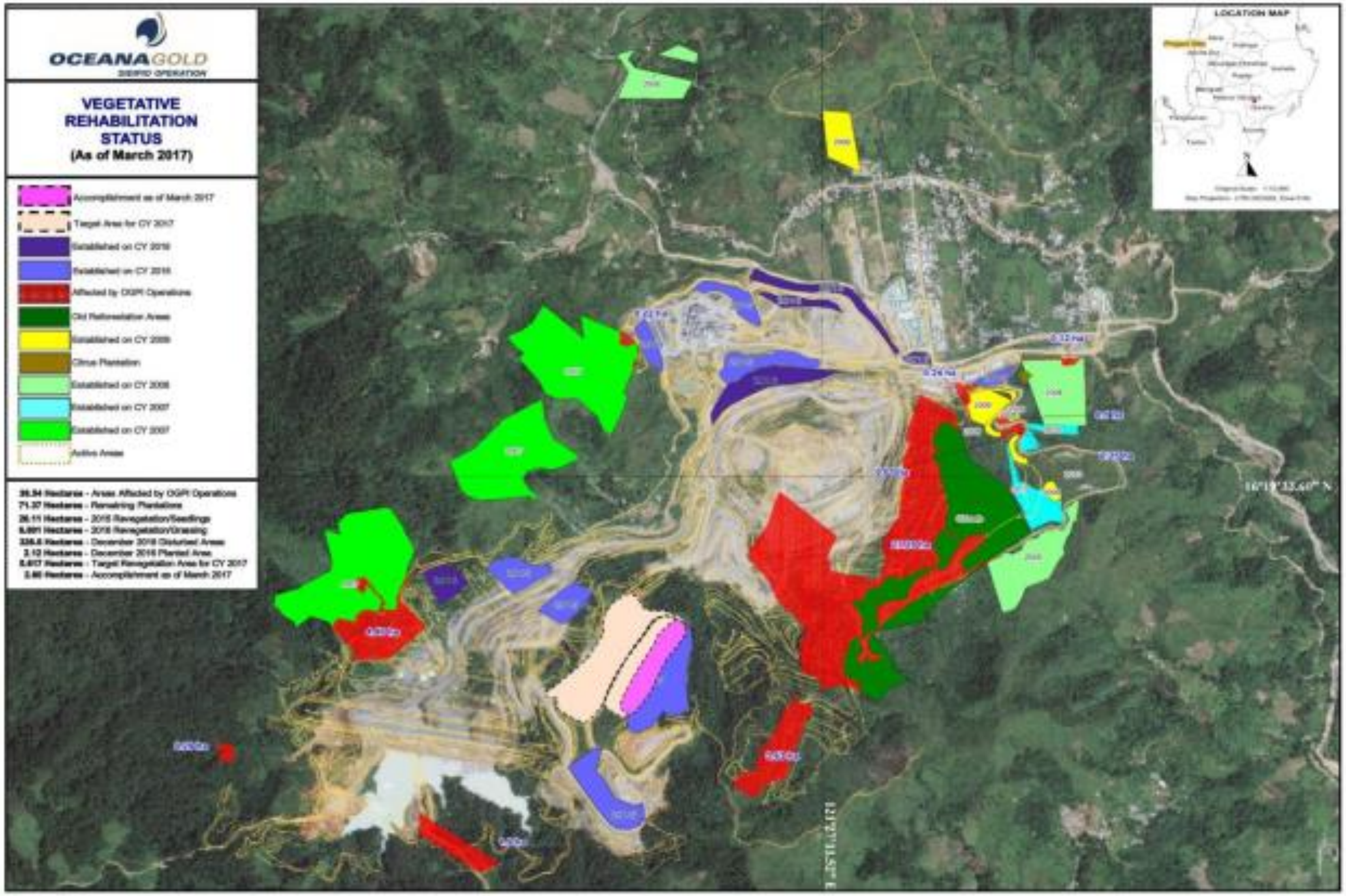


Figure 6-1: Rehabilitation Map as of Year 2017

6.1.1.4.1 Method and sequence of planting

Selected species can be planted in bare root, earth balled or in potted medium. Earth balling and bare root system of planting will be used for wildlings collected directly from the nearby forest while potted or containerized seedlings for those grown in OGPI nursery

Trial planting of additional forest trees will be conducted to study different native species with good potential in rehabilitation works. Naturally growing trees, shrubs grasses and other forms pioneer vegetation will be allowed to naturally colonize the rehabilitation sites as they are good indicators of forest regeneration.

Once the rehabilitated area is established and become stable, climax forest tree species and light sensitive plants will be reintroduced in the rehabilitation site. These includes several species of trees belonging to Dipterocarp family like mayapis, tanguili and lauan, Philippine Oak (*Lithocarpus* sp.) and other endemic species with high conservation values that are known thriving in Didipio. This rehabilitation strategy thru sequential planting aims to replicate the natural ecosystem and restore biological biodiversity.

Table 6-3: Considerations in the Progressive Rehabilitation

Item	Description
Planting materials	Use of larger planting materials whenever possible and use of bio-fertilizer with active microorganisms like mycorrhiza for faster site development
Planting design	Mixed planting of different endemic plant species instead of monoculture
Maintenance	Continuous maintenance after establishment to include fertilizer application, replacement of dead seedlings and ring weeding if needed
Species diversity	Naturally occurring vegetation whether grass, vines, herbs, and lesser known tree species shall be allowed to grow and reproduce. Any forms of naturally occurring vegetation will not be removed unless they become threat to the health and growth of the preferred plant species
Monitoring of planted seedlings	Periodic monitoring will be conducted to determine which among the species is the best suited at mine site
Planting materials	Use of larger planting materials whenever possible and use of bio-fertilizer with active microorganisms like mycorrhiza for faster site development

6.1.1.4.2 Rehabilitation Standard

Rehabilitation is carried out to meet the following minimum requirements:

- The land form and soils are stable and not subject to gross erosion; and,
- The rehabilitated area does not pose any significant risk to the environment or human health.

6.1.1.4.3 Rehabilitation methods

The methods that used for rehabilitation include:

- Where possible stripping and stockpiling of topsoil during site preparation, for reuse in rehabilitation;
- Removal of non-retained buildings and structures for sale or scrap;
- Surface preparation ripping and or contouring;
- Topsoil preparation, it is not viable to stockpile topsoil for long periods of time, it is therefore necessary to generate or regenerate topsoil. Generation involves the selection of suitable oxide material, and then blending in organic matter, usually in the form of compost or mulch, and possibly nutrients to produce a soil that has similar properties to topsoil. Regeneration involves the aeration of stockpiled material, the addition of organic matter and possibly nutrients;
- Contouring as necessary to provide for long term stable slopes and landforms;
- Planting with appropriate species to provide a land use and vegetation cover in accordance with the closure plan;

- Establishing water courses that are stable and capable of withstanding the maximum probable flood;
- In those areas designated for native planting seedling raised for seed or seedlings collected from or near the site will be used;
- In those areas where the land is prepared for agricultural production, the land will be prepared and planted with an initial crop or planted with suitable economic species; and,
- These areas planted for any purpose other than crops will be maintained and any plants that die will be replaced with the same species, until a viable self-sustaining land form is well established.

6.1.1.5 REFORESTATION

Under the progressive rehabilitation program, mined-out areas will be prepared immediately for revegetation. Land preparation which includes re-contouring will be done prior to revegetation activities. Replanting, soil amelioration, mulching, fertilizer application and watering, if necessary, will be part of the overall activity of the reforestation.

This refers to the establishment of temporary or permanent vegetation over exposed soil surfaces. Temporary seeding is a process of providing temporary grass cover during construction delays, or when final further soil disturbance is expected within a given area and short-term erosion measures are deemed necessary.

Grasses and vines are planted to control erosion on disturbed areas that will be inactive for at least six (6) months through seeding or direct planting. Vines and grasses serve as the temporary covers of exposed and unused slopes. Roots of these plants help stabilize the slopes and hold the soil intact making it less vulnerable to erosion. Thick ground covering shall serve as filter for sediments passing through the slopes. It also helps restore soil fertility by providing additional organic matter into the soil.

Unstable slopes that are highly prone to erosion are to be covered with biodegradable mat or coconet to keep the soil intact and minimize erosion. Areas that require temporary covers includes road batters, inactive borrow pits, periphery of sanitary landfill and inactive waste dump and other stockpile areas. The grasses and vines used on revegetation are presented in the photos below.

Photo 6-13: Mungbean, *Vigna radiata*

Photo 6-14: *Centrosema pubescens*

Photo 6-15: Kudzu, *Pueraria phaseoloides*

Photo 6-16: Vetiver grass, *Chrysopogon zizanioides*

6.1.1.5.1 National Greening Program

In the promotion of environmental excellence, OGPI is committed to produce 100,000 assorted seedlings in support to the National Greening Program (NGP) for CY 2017, although based on the Memorandum Order No. 2011-03 the company is only expected to revegetate 8.2 ha based on the2017 projected disturbed area of 4.1 ha or has a seedling equivalent of 4,100 to be planted. Existing reforestation projects in Kasibu, Nueva Vizcaya and commercial tree plantation in Brgy. Dibibi, Cabarroguis, Quirino are maintained thru periodic weeding and application of fertilizer until such time that sustainable growth is evident.

Since 2012 up to October 2016, the total area planted based on the National Greening Program report is around 807.1227 ha.

6.1.1.5.2 Buffer Zone

A vegetated buffer zone was established and maintained along water bodies consistent to the buffer zone distance of forty (40) meters. Most especially, critical facilities such as the Tailings Storage Facility (TSF) are the subject and priority of the buffer zone establishment. The buffer zone is planted with locally grown trees and serves as a component of the progressive rehabilitation program.

Vegetated buffers are areas of natural or established vegetation maintained to protect the water quality of neighbouring areas. Buffer zones slow storm water runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment. Slowing runoff also helps to prevent soil erosion and stream bank collapse.

6.1.1.5.3 Nursery Operations / Seedling Production

OGPI has established and continuously maintains a Plant Nursery facility that propagates various seedling species for project rehabilitation and reforestation/re-vegetation. Bulk of the seedling requirement of OGPI for mine rehabilitation, tree plantation establishment and seedling donation to various stakeholders come from its main Nursery located in Brgy. Tucod with an approximate area of 4.5 ha.

It also serves as clonal laboratory in the propagation of important endemic plants with very limited seeds or wildlings. Some of the plants that may require clonal propagation are dipterocarps due to their irregular flowering and short viability of seeds hence vegetative method of reproduction is necessary.

A portion of the nursery is allocated as demo farm planted with fruit bearing trees and agricultural crops. An established bud wood garden served as source of bud wood sticks for rubber seedling production.

Photo 6-17: OGPI's Plant Nursery

In addition to the main nursery, a mini nursery was established to serve as temporary staging area of seedlings used in various revegetation projects at mine site. Collected seeds and wildlings of different endemic plants from the natural forest are propagated and raised in this nursery. Some ornamental plants needed for landscape greening and campsite beautification are also propagated on site.

6.1.1.6 WASTE MANAGEMENT

As part of OGPI's commitment to sustainable development and in compliance with OGPI's ISO 14001:2001 certification, a Waste Management Plan is being implemented to facilitate the reduction, handling, and proper disposal of wastes. The summary of wastes generated by OGPI for the Year 2017 is provided in Table 6-4.

Solid wastes are collected, characterized, and segregated. A total of 279,608 kg of solid waste was generated for the year 2017. This comprised of recyclable (31%), biodegradable (35%), and residual (34%) wastes (Figure 6-2). Biodegradable wastes are utilized as compost material, which is as fertilizer for reforestation projects. Recyclables are kept in the Materials Recovery Facility (MRF) awaiting for disposal to scrap buyers. Residual wastes are disposed in OGPI's on-site sanitary landfill.

Hazardous wastes identified from operations include waste oil, solid wastes contaminated with oil, clinic wastes, chemical contaminated containers, lead batteries, and used fluorescent bulbs. These wastes are temporarily stored in OGPI's hazardous waste storage facility and are collected and disposed of by DENR-accredited hauler and treater. All contaminated containers are decontaminated prior to disposal, while used oil materials are contained in properly labeled steel drums.

Table 6-4: Summary of Waste Generation (2017)

Waste Type		1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solid Waste	Recyclable (kg)	7,171	7,905	8,065	6,329	9,507	5,780	8,627	5,880	7,059	8,506	5,139	8,303
	Biodegradable (kg)	8,239	8,801	10,212	10,103	8,957	7,066	7,754	8,079	3,567	8,673	7,123	8,107
	Residual (kg)	7,975	8,247	8,818	9,034	5,622	5,575	8,417	9,324	8,088	8,080	8,118	7,358
Hazardous waste	Waste Oil	13,700 L			20,790 L			1,800 L			5,000 L		
	Solid Contaminated with Oil	29,348 kg			19,240.15 kg			12,200 kg			9,858 kg		
	Pathogenic or Infectious wastes	50 kg			50 kg			50 kg			30 kg		
	Mercury and mercury compounds	861 pc			861 pc			423 pc			30 pc		
	Lead compound	-			-			-			-		
	Ink powder cartridge wastes	1,200 pc			330 pc			235 pc			15 pc		
	Contaminated containers	200 kg			732.85 kg			2,700 kg			-		
	Used oil	29,348 L			50,800 L			200 L			4,200 L		
	WEEE	52.5 kg			52.5 kg			156.5 kg			8 kg		
	Organic Waste	15,200 L			11,003 L			3,000 L			8,000 L		
	Spent Resin	-			-			12,000 kg			-		

Source: OGPI SMRs, 2017

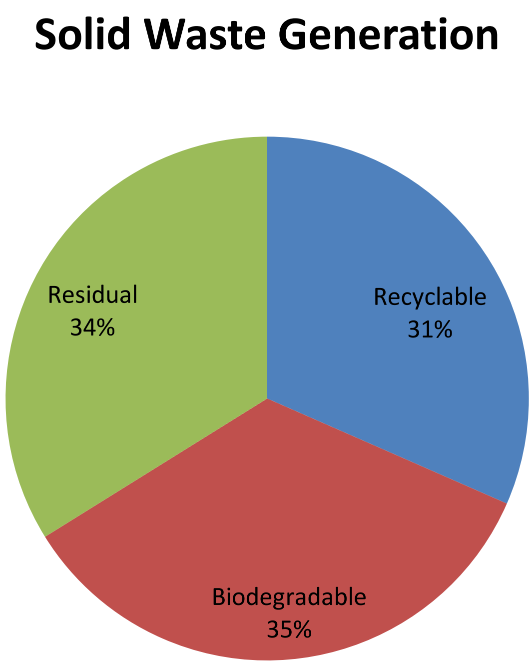


Figure 6-2: Solid Waste Generated (2017)

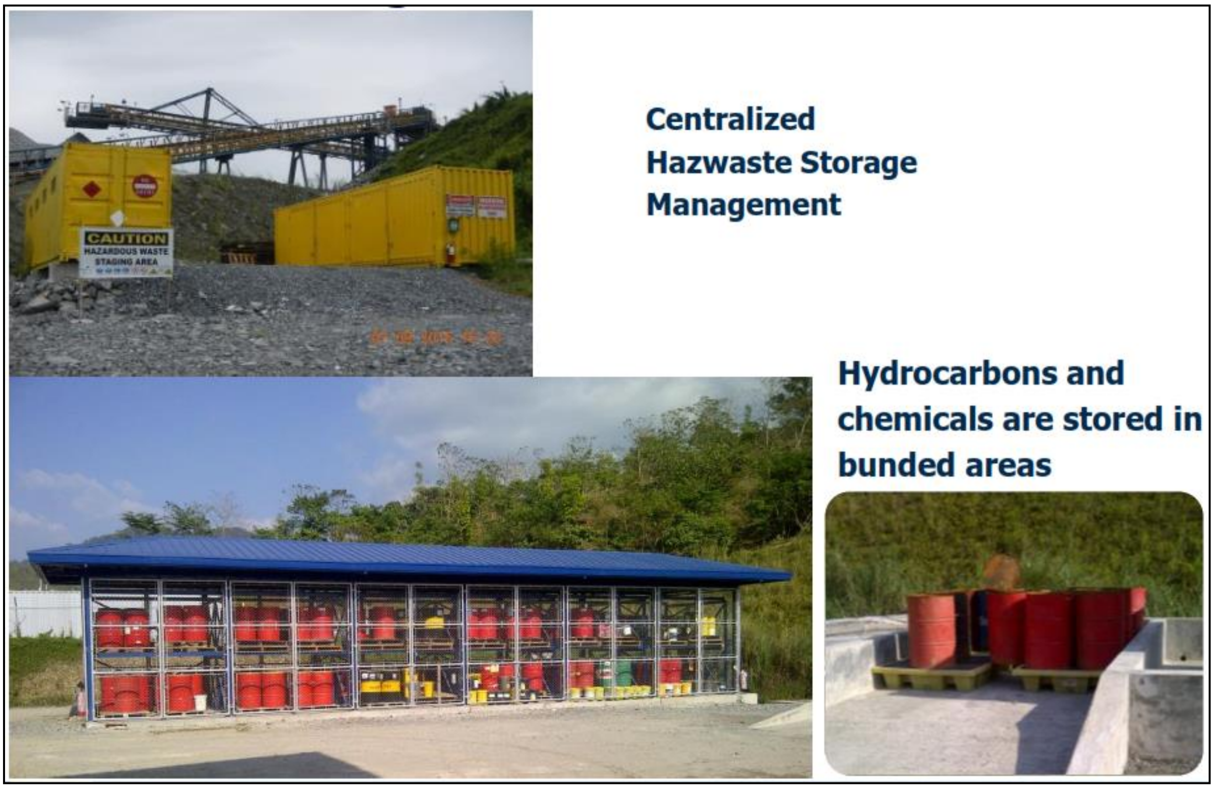


Photo 6-18: OGPI's Centralized Hazardous Storage Management

6.1.2 WATER RESOURCES

6.1.2.1 WATER USE

The daily water demand for the Didipio operation at 3.5 Mtpa is approximately 20,000 m^3, of which the majority is recycled water for the process plant, sourced from decant water from the thickeners and the tailings pond. Any fresh makeup water is sourced from two deep bores located at the perimeter of the open pit mine. These bores serve to depressurize the pit wall to improve the wall stability as well as providing a source of fresh water.

Recycle rates of process water are high, currently as of December 2017, averaging around 90 % in the RW block and 78% overall water recycling. Figure 6-3 shows a schematic diagram of the water flow around the process plant while Table 6-5 presents the actual Process Plant water use data in 2017.

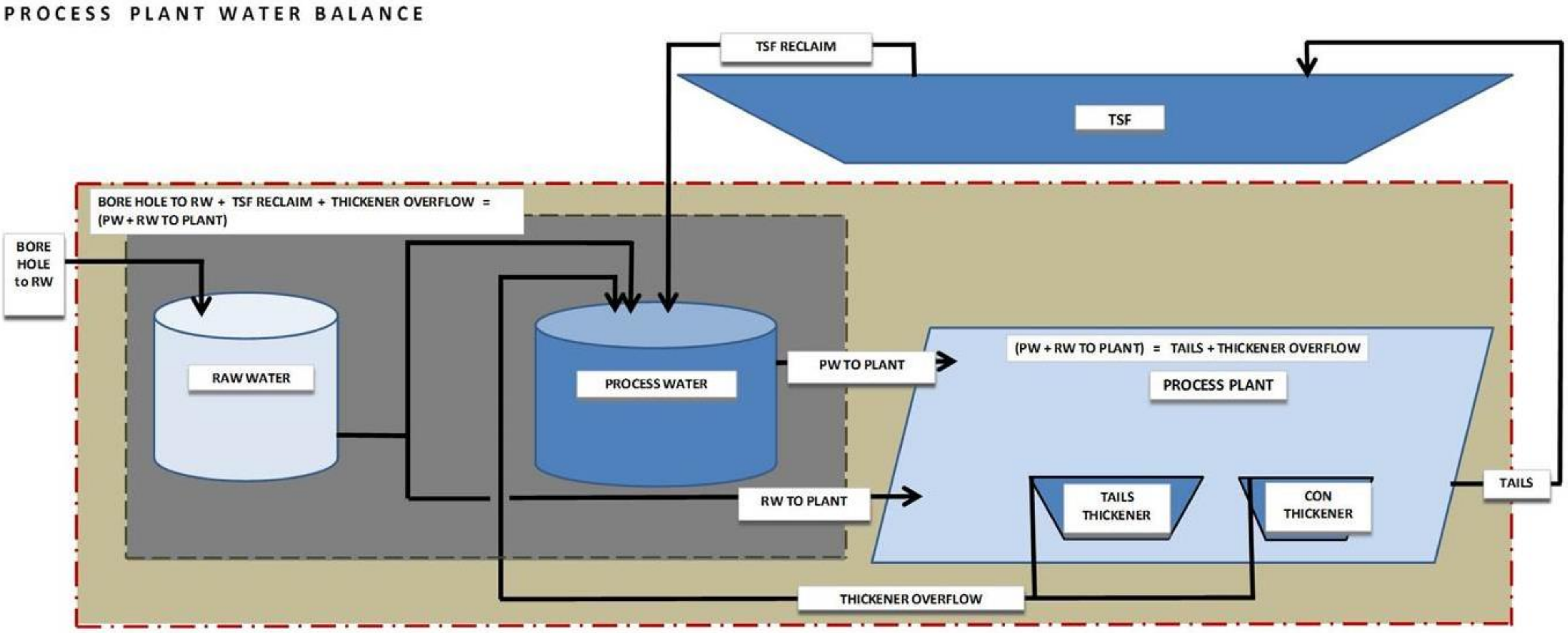


Figure 6-3: Simplified diagram of Process Plant Water Cycle
Source: OGPI

Table 6-5: Process Plant Water Balance Data, 2017

	Water Input, m³			% RECYCLE	
	Make up / Clean	Recycled		RW & PW BLOCK[2]	OVERALL[3]
	TK017[1] TO RW	TSF RECLAIM	THICKENER OVERFLOW		
JAN	92,285	217,128	312,395	85%	70%
FEB	68,481	152,636	328,825	88%	69%
MAR	77,080	311,135	411,214	90%	80%
APR	52,719	292,884	301,401	92%	85%
MAY	61,467	231,719	351,486	90%	79%
JUN	55,838	260,905	397,843	92%	82%
JUL	74,961	215,957	426,353	90%	74%
AUG	53,134	213,625	368,491	92%	80%
SEP	60,919	236,841	331,188	90%	80%
OCT	69,569	254,450	416,047	91%	79%
NOV	66,508	262,879	351,342	90%	80%
DEC	28,487	79,554	119,401	87%	74%
TOTAL	**761,448**	**2,729,713**	**4,115,986**	**90%**	**78%**
Raw Water to Plant	**761,448**				
Total Recycled Water		**6,845,699**			
Total Process Water Used	**7,607,147**				
Daily Consumption	**20,841**				

[1] TK017 – Mine Dewatering Tank

Raw Water (RW) and Process Water (PW) Tank Water Balance:
Bore Hole to RW + TSF Reclaim + Thickener Overflow = (PW + RW to Plant) = Tails – Thickener Overflow

Overall Block Water Balance:
Bore Hole to RW + TSF Reclaim = Tails

% RECYCLE = RECYCLE STREAM BACK TO INPUT / TOTAL INPUT

[2] **RW & PW Tank Block Water Balance % Recycle:**
% Recycle = (TSF Reclaim + Thickener Overflow) / (TSF Reclaim + Thickener Overflow + Bore hole to RW)

[3] **Overall Block Water Balance: Input proportion of recycle water**
% Recycle = TSF Reclaim / (TSF Reclaim + Bore hole to RW)

6.1.2.2 WATER QUALITY

The key elements of the Project's Water Management System are as follows:

- Clean water from natural seeps, creeks or water course within the mine footprint is diverted directly into the major rivers.
- All water from areas disturbed by mining activities (haul roads, stockpiles/waste rock dumps, borrow pits, open pit (OP) and underground (UG) are directed towards sedimentation ponds before discharge offsite.

- All tailings produced through mineral processing is piped to the Tailings Storage Facility (TSF), water from the TSF is recycled within the Process Plant and excess water is treated at the Water Treatment Plant (WTP), thereafter discharged into the receiving water bodies.
- Ongoing rehabilitation of disturbed areas to minimize erosion and sediment loads and improve runoff water quality through sediment ponds.

It should be noted that prior to the new *Water Quality Guidelines and General Effluent Standards of 2016* (DENR Administrative Order 08 of 2016 (DAO 2016-08), results of water quality monitoring were compared to Class D standards of DAO 90-34 (ambient) and DAO 90-35 (effluent) based on the DENR EMB Regional Office 02 classification of the Didipio River[1]. This was consistent with the intended beneficial use of the receiving water bodies in the area (i.e. agriculture, irrigation, livestock watering, industrial water supply Class II). However, with the new DAO 2016-08, the current beneficial use of the receiving water bodies (rivers and creeks) of the Project falls under Class C water body classification. At present, Class D standards for different parameters monitored are still being used as basis for evaluating ambient and effluent quality and compliance to standards as also reported in the Self Monitoring Reports (SMRs) since there was no reclassification of Didipio River to date by the DENR EMB R.O. 02 in their latest issuances of discharge permits for the Project.

6.1.2.2.1 Effluent Quality Monitoring

6.1.2.2.1.1 Water Treatment Plant/Tailings Storage Facility

Parameters required to be monitored as listed in the discharge permit for the WTP/TSF are BOD, oil and grease, surfactants, nitrate, ammonia, and Fecal Coliform. In addition to these parameters, OGPI also analyzes other effluent quality parameters significant to gold and copper ore mining projects for self-monitoring purposes. These significant parameters include TSS, arsenic, lead, cadmium, mercury, pH, zinc, free cyanide, sulfate, iron, and dissolved copper. Other parameters monitored by OGPI for the WTP/TSF discharge include COD, hexavalent chromium, boron, chloride, phenol and phenolic substances, and phosphate.

Results of WTP/TSF effluent monitoring for all parameters were compliant with the applicable DENR effluent standards (Table 6-6). Monitoring data per parameter were plotted in Figure 6-4 to Figure 6-17.

[1] Discharge Permit issued on December 28, 2015 for the Carwash Bay (DP No. 2015-DP-J-0250-011) stated that the effluent's quality standard limits shall follow Class D for Didipio River (main river draining the project area). There was no reclassification of Didipio River to date by the DENR EMB R.O. 02 in their latest issuances of discharge permits for the Project.

Table 6-6: Summary of WTP/TSF Effluent Monitoring Data

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Required in the Discharge Permit							
BOD (mg/l)	2Q 2014 – 1Q 2018	120[a,b]	10	1.0 – 5.1	2.8	0	Compliant (Figure 6-4)
Oil and Grease (mg/l)	3Q 2014 – 1Q 2018		12	< 0.50 – 1.4	0.83	0	Compliant 2 out of 12 samples had O&G concentrations below MDL. (Figure 6-5)
Surfactants (MBAS) (mg/l)	4Q 2014 – 2Q 2016	30[b]	5	<0.10 – 0.10	0.10	0	Compliant with DAO 2016-08 Class D standards; 4 out of 5 samples exhibited MBAS below MDL. Continuous (quarterly) monitoring of MBAS must be conducted in compliance with the discharge permit conditions. (Figure 6-6)
Nitrate*as NO_3-N (mg/l)	4Q 2016 – 1Q 2018	30[b]	6	< 0.2 – 1.1	0.55	0	Compliant 2 out of 6 samples had nitrate levels below MDL (Figure 6-7)
Ammonia as NH_3-N (mg/l)	1Q 2017 – 1Q 2018	7.5[b]	5	0.16 – 0.40	0.30	0	Compliant (Figure 6-8)
Fecal Coliform (MPN/100ml)	3Q 2017 – 1Q 2018	800[b]	3	53.6 – 436.0	204.9	0	Compliant Monitoring of Fecal Coliform started only in 3Q 2017. Prior to this, WTP/TSF samples were analyzed for Total Coliform. Quarterly monitoring of Total Coliform from 3Q 2014 – 1Q 2015 range from <1.8 – 13 MPN/100ml. (Figure 6-9)
Additional parameters analyzed							
COD (mg/l)	2Q 2014 – 1Q 2018	200[a,b]	11	< 5.0 – 37.0	10.6	0	Compliant 7 out of 11 samples exhibited COD values below MDL (Figure 6-10)
Total Suspended Solids* (mg/l)	2Q 2014 – 1Q 2018	150[a, b]	14	2 - 129	49.9	0	Compliant. Highest TSS value (129 mg/l) was recorded in 4Q 2015 (October). (Figure 6-11)
Arsenic* (mg/l)	2Q 2014 – 1Q 2018	0.08[b]	11	< 0.0010 – 0.0036	0.0016	0	Compliant 6 out of 11 samples had As concentrations below MDL (Figure 6-12)

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Lead* (mg/l)	2Q 2014 – 1Q 2018	0.2[b]	12	< 0.05	< 0.05	0	Compliant. All twelve (12) samples had Pb levels below method detection limit (< 0.05).
Cadmium* (mg/l)	2Q 2014 – 1Q 2018	0.02[b]	12	< 0.01	< 0.01	0	Compliant. All twelve (12) samples had Cd levels below method detection limit (< 0.01).
Hexavalent Chromium (mg/l)	2Q 2014 – 1Q 2018	0.04[b]	9	< 0.001	< 0.001	0	Compliant. Cr6+ concentrations in all 9 samples were all below MDL (< 0.001).
Mercury* (mg/l)	3Q 2014 – 1Q 2018	0.008[b]	10	< 0.0010 – 0.0014	0.0010	0	Compliant. All quarterly samples exhibited Hg concentrations below MDL except for Q1 2017 with Hg = 0.0014 mg/l but still within the effluent standard for Hg.
pH* (range)	2Q 2015 – 1Q 2018	5.5 – 9.5[b]	7	7.56 – 8.81	8.32	0	Compliant (Figure 6-13)
Zinc* (mg/l)	4Q 2016 – 1Q 2018	8[b]	6	< 0.01 – 0.02	0.012	0	Compliant. All quarterly samples exhibited Zn concentrations below MDL except for Q1 2017 with Zn = 0.02 mg/l but still within the Class D effluent standard for Zn.
Free Cyanide* (mg/l)	4Q 2016 – 1Q 2018	0.4[b]	6	<0.01	<0.01	0	Compliant. All 6 quarterly samples had concentrations below MDL.
Sulfate* (mg/l)	4Q 2016 – 1Q 2018	1000[b]	5	32.3 - 121	69.74	0	Compliant (Figure 6-14)
Iron* (mg/l)	4Q 2016 – 1Q 2018	35[b]	6	<0.05 – 0.44	0.15	0	Compliant 3 out of 6 samples had Fe concentrations below MDL (Figure 6-15)
Boron (mg/l)	1Q 2017 – 1Q 2018	12[b]	5	< 0.01 – 0.076	0.037	0	Compliant 2 out of 5 samples had B concentrations below MDL (Figure 6-16)
Chloride (mg/l)	1Q 2017 – 1Q 2018	500[b]	5	4.3 - 14	8.14	0	Compliant (Figure 6-17)
Phenol and Phenolic Substances (mg/l)	1Q 2017 – 1Q 2018	5[b]	5	< 0.001 – 0.036	0.0134	0	Compliant Phenol levels in 4 out of 5 samples were below MDL
Dissolved Copper* (mg/l)	2Q 2017 – 1Q 2018	0.08[b]	4	< 0.01	< 0.01	0	Compliant. Dissolved Cu concentrations in all samples were all below MDL (< 0.01).
Phosphate (mg/l)	1Q 2018	10[b]	1	0.01	0.01	0	Compliant

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for gold and copper ore mining as per DAO 2016-08

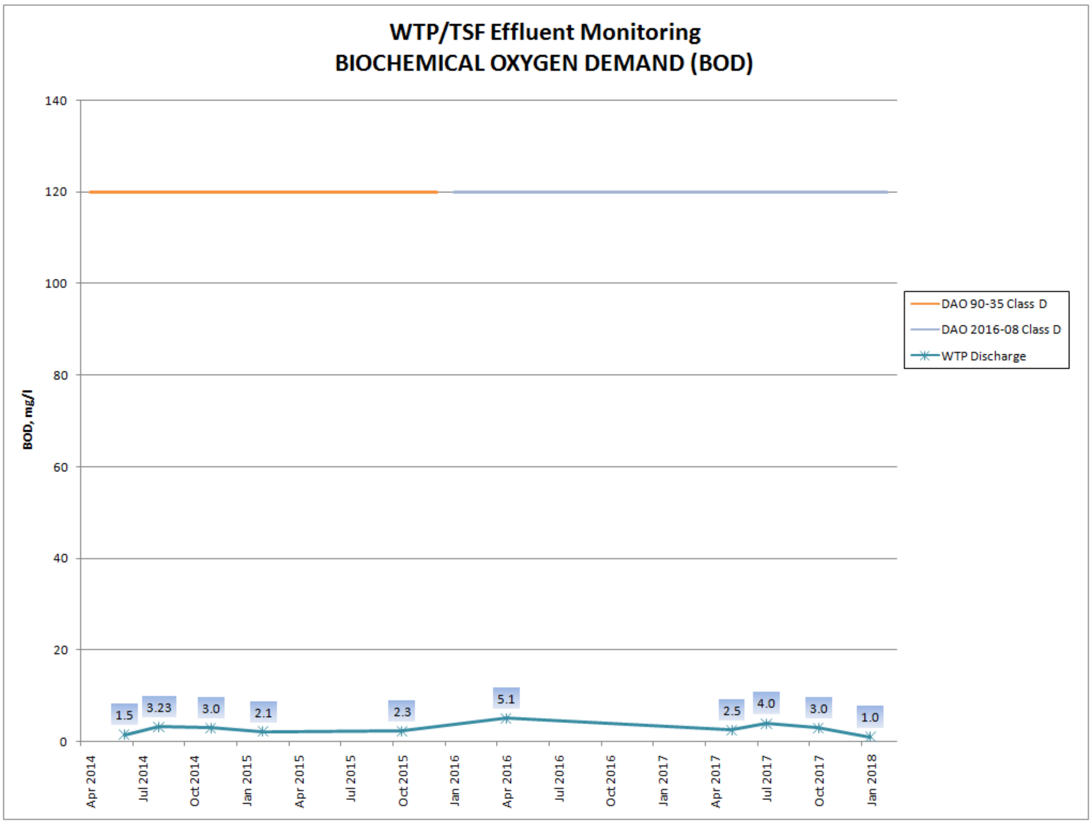


Figure 6-4: WTP/TSF Effluent Monitoring Trend for Biochemical Oxygen Demand (BOD)

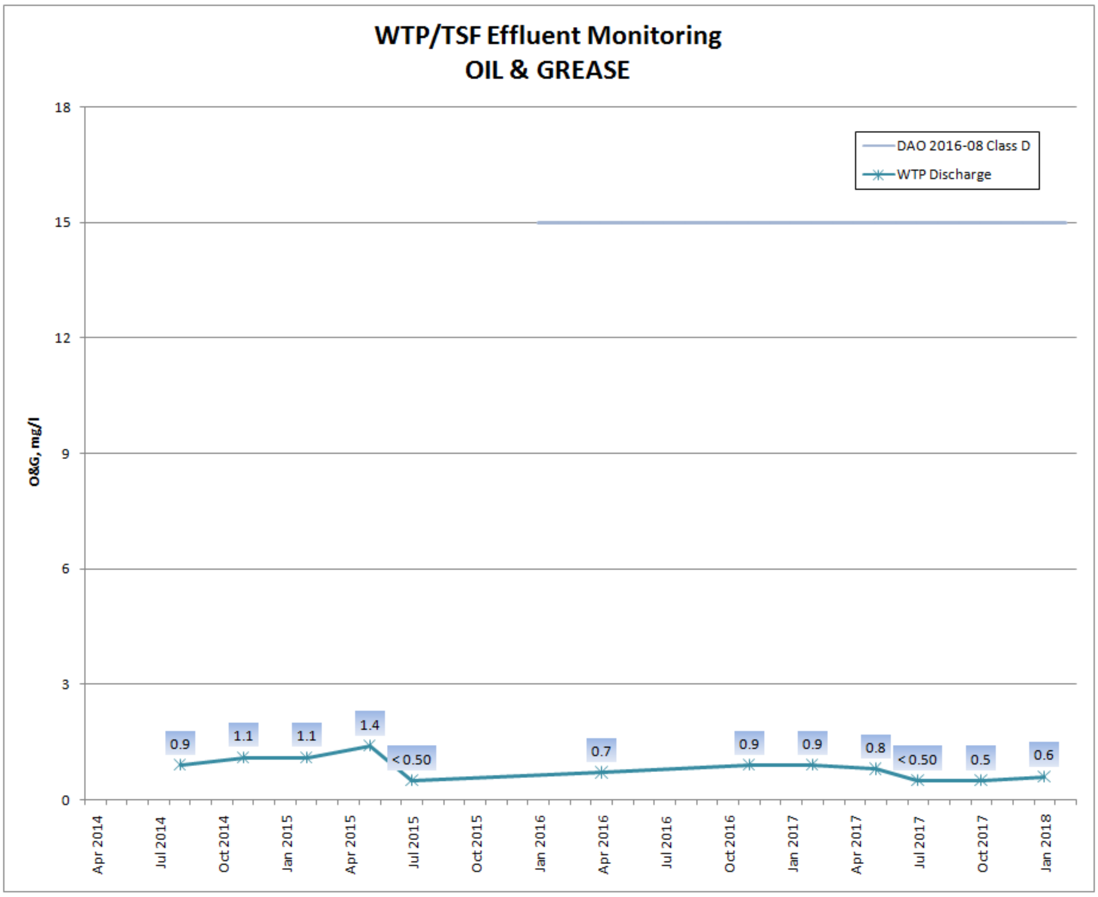


Figure 6-5: WTP/TSF Effluent Monitoring Trend for Oil and Grease (O&G)

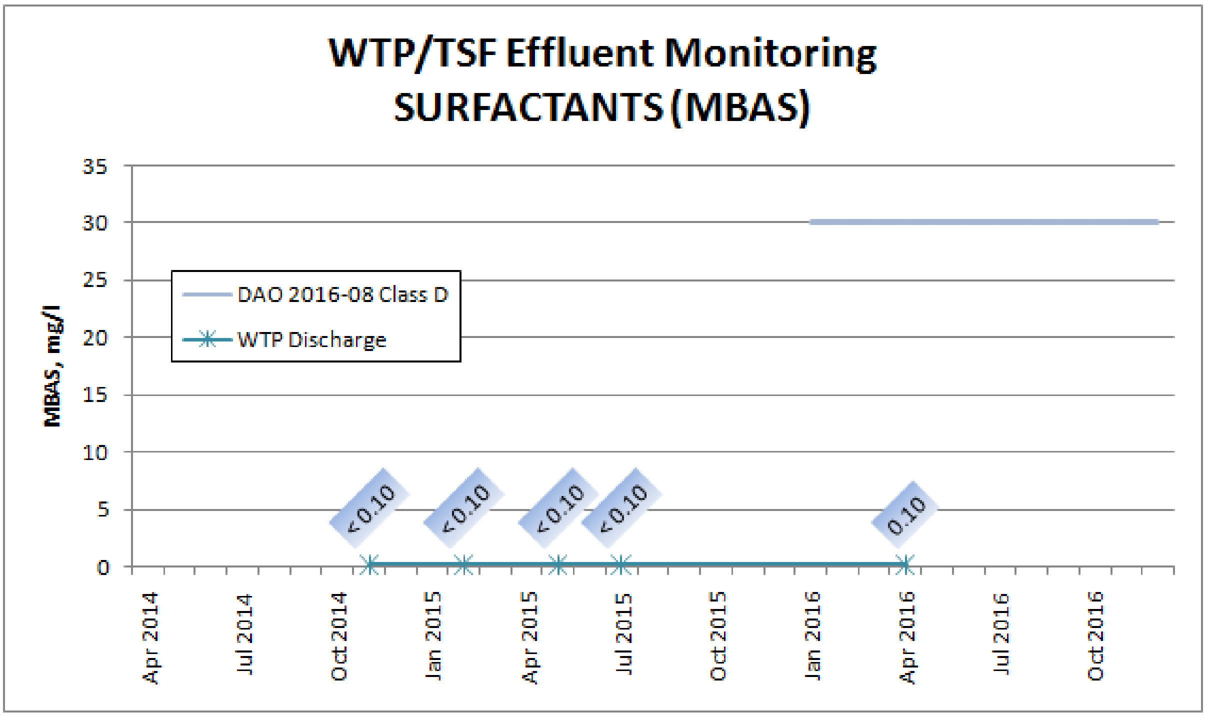


Figure 6-6: WTP/TSF Effluent Monitoring Trend for Surfactants (MBAS)

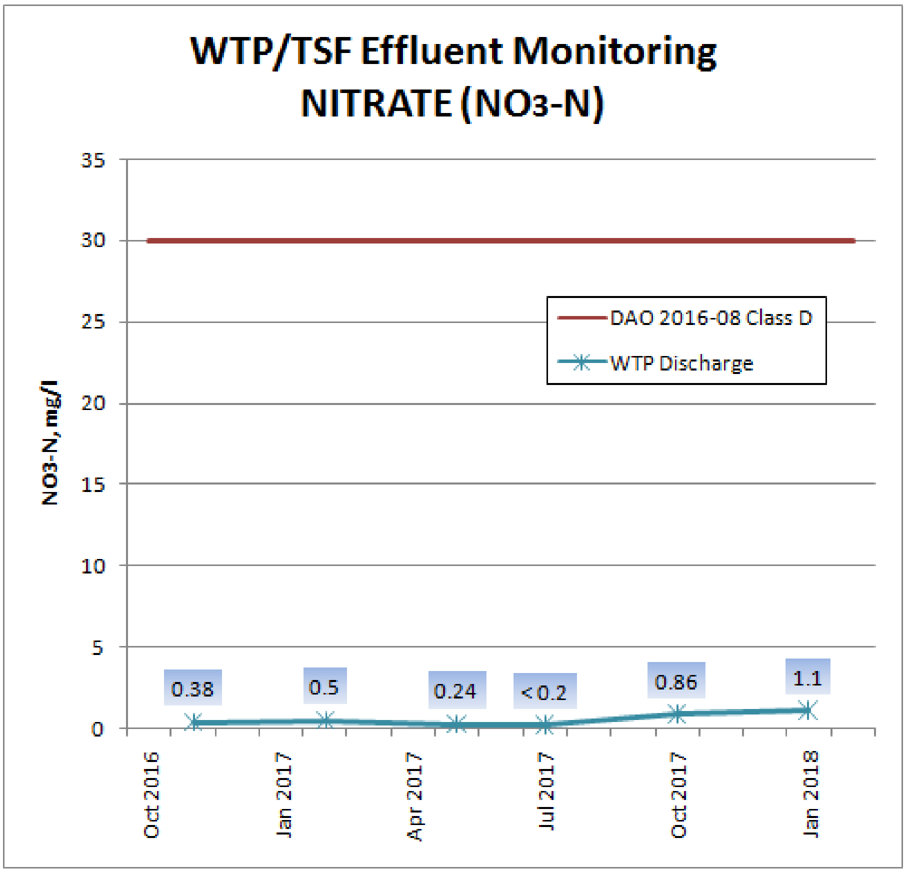


Figure 6-7: WTP/TSF Effluent Monitoring Trend for Nitrate (NO3-N)

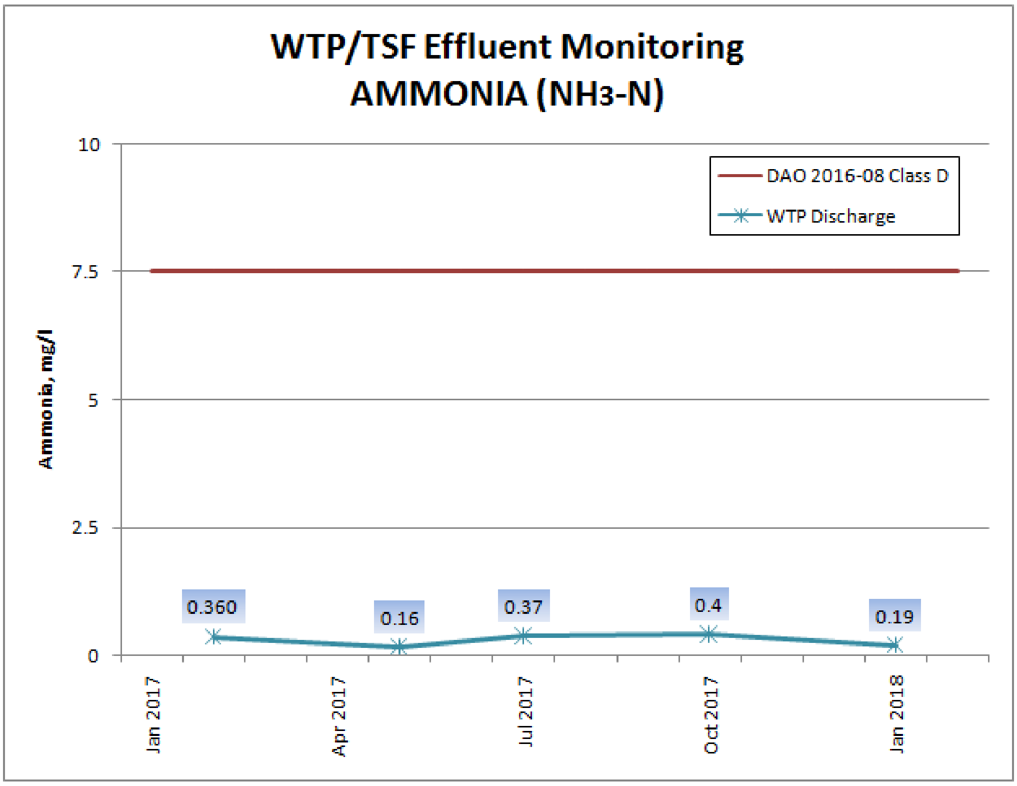


Figure 6-8: WTP/TSF Effluent Monitoring Trend for Ammonia (NH3-N)

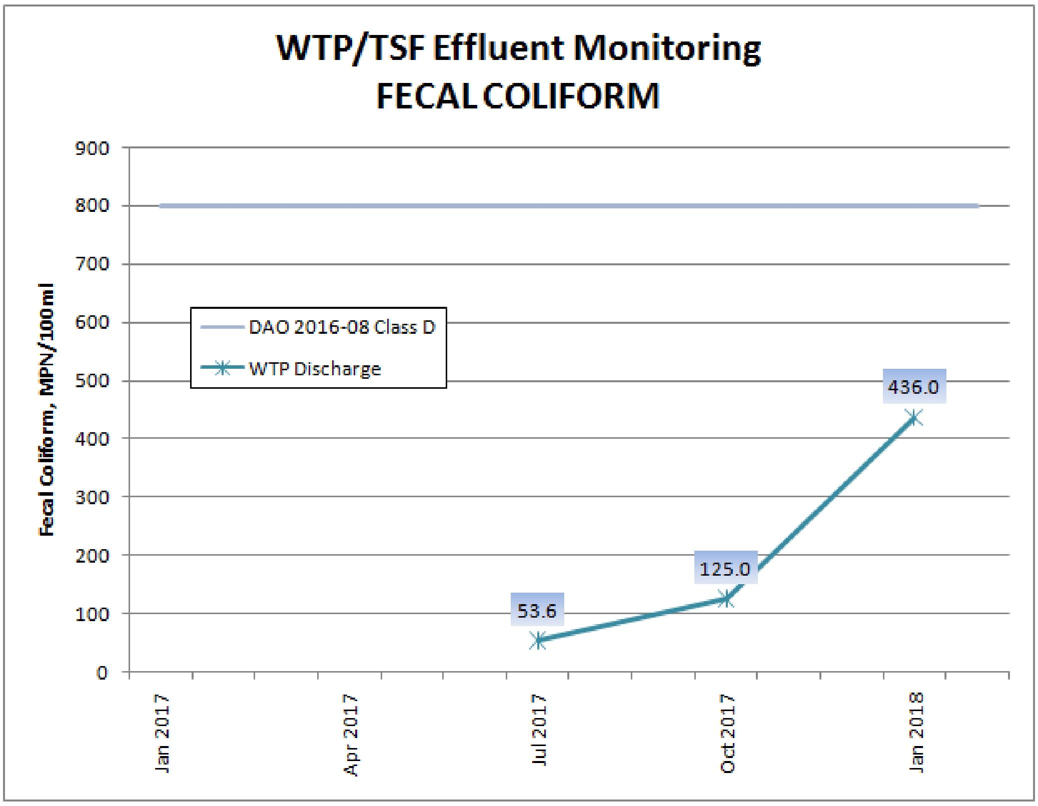


Figure 6-9: WTP/TSF Effluent Monitoring Trend for Fecal Coliform

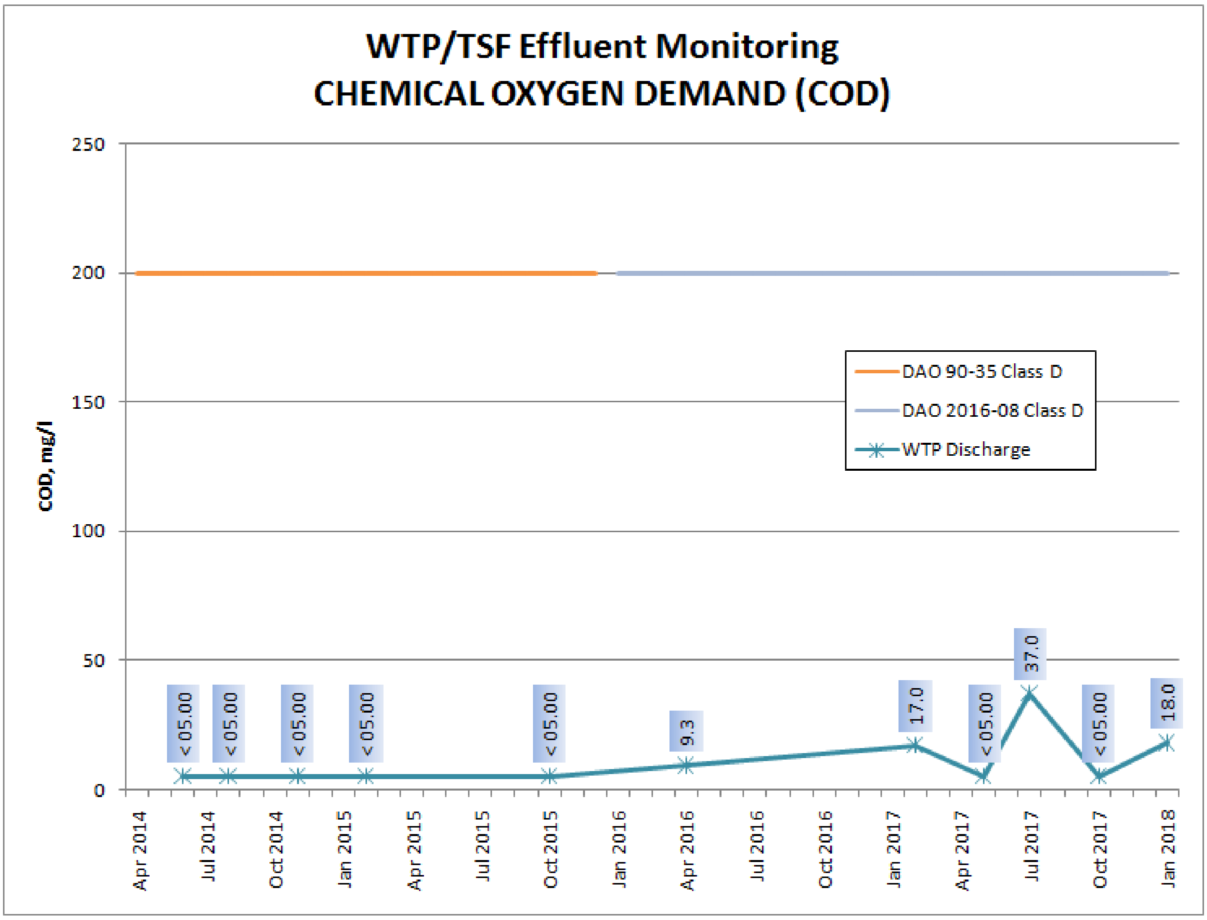


Figure 6-10: WTP/TSF Effluent Monitoring Trend for Chemical Oxygen Demand (COD)

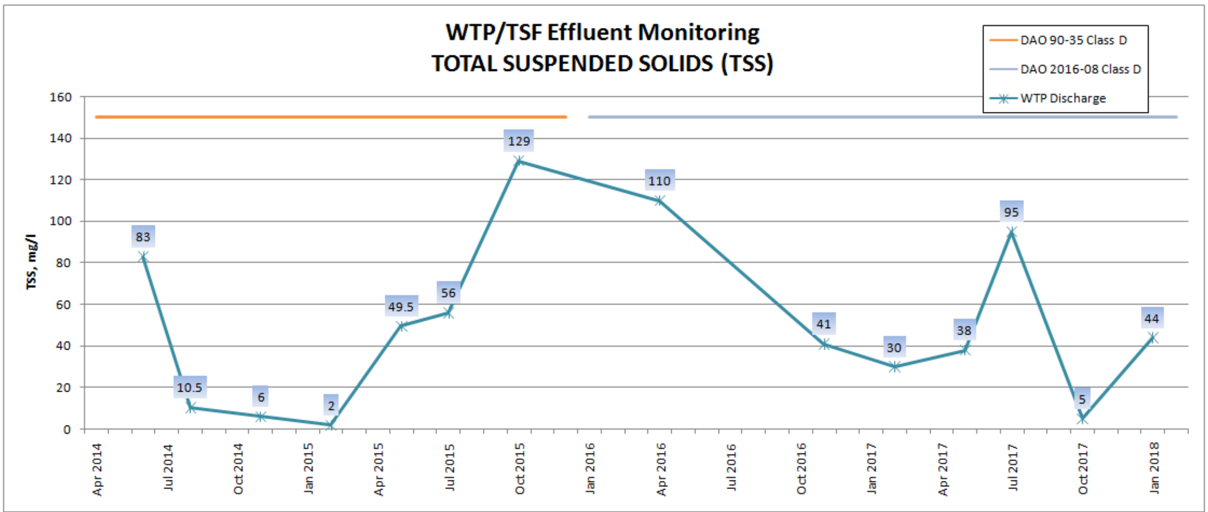


Figure 6-11: WTP/TSF Effluent Monitoring Trend for Total Suspended Solids (TSS)

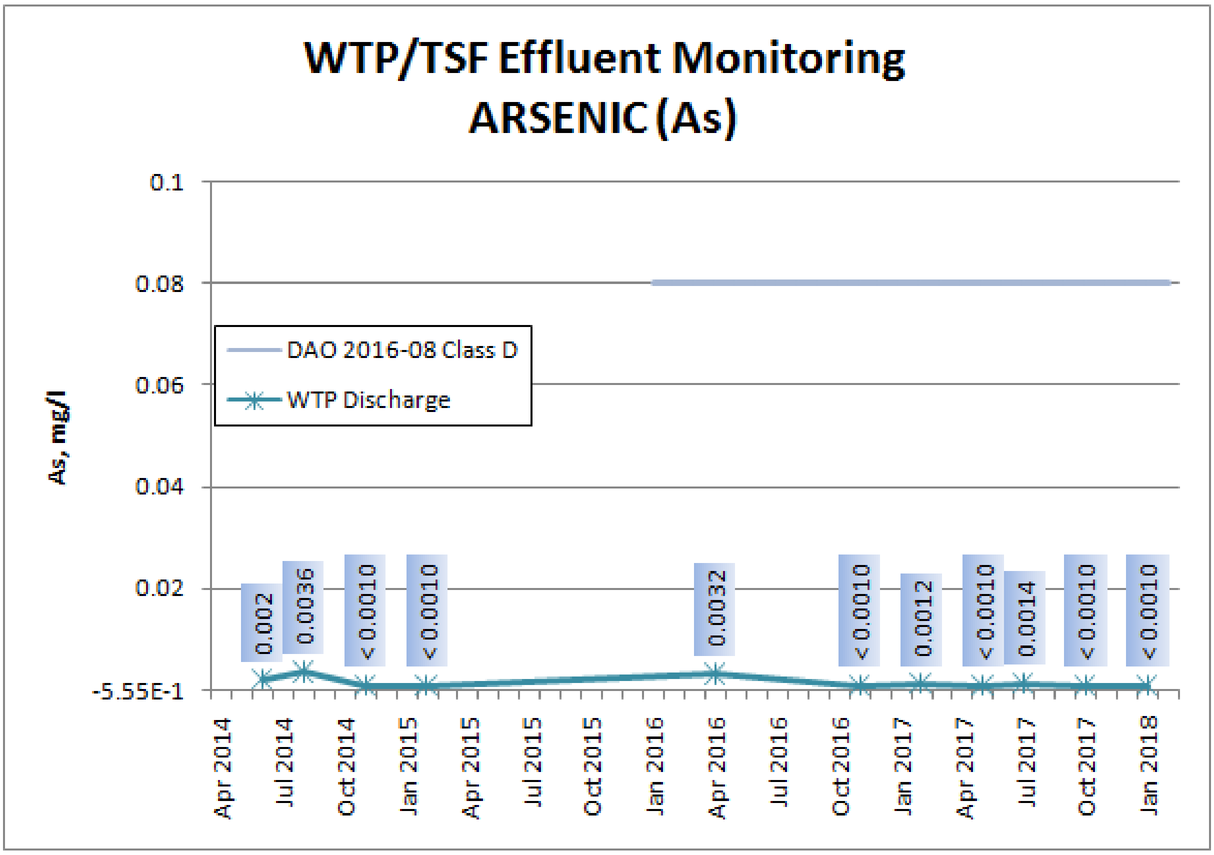


Figure 6-12: WTP/TSF Effluent Monitoring Trend for Arsenic

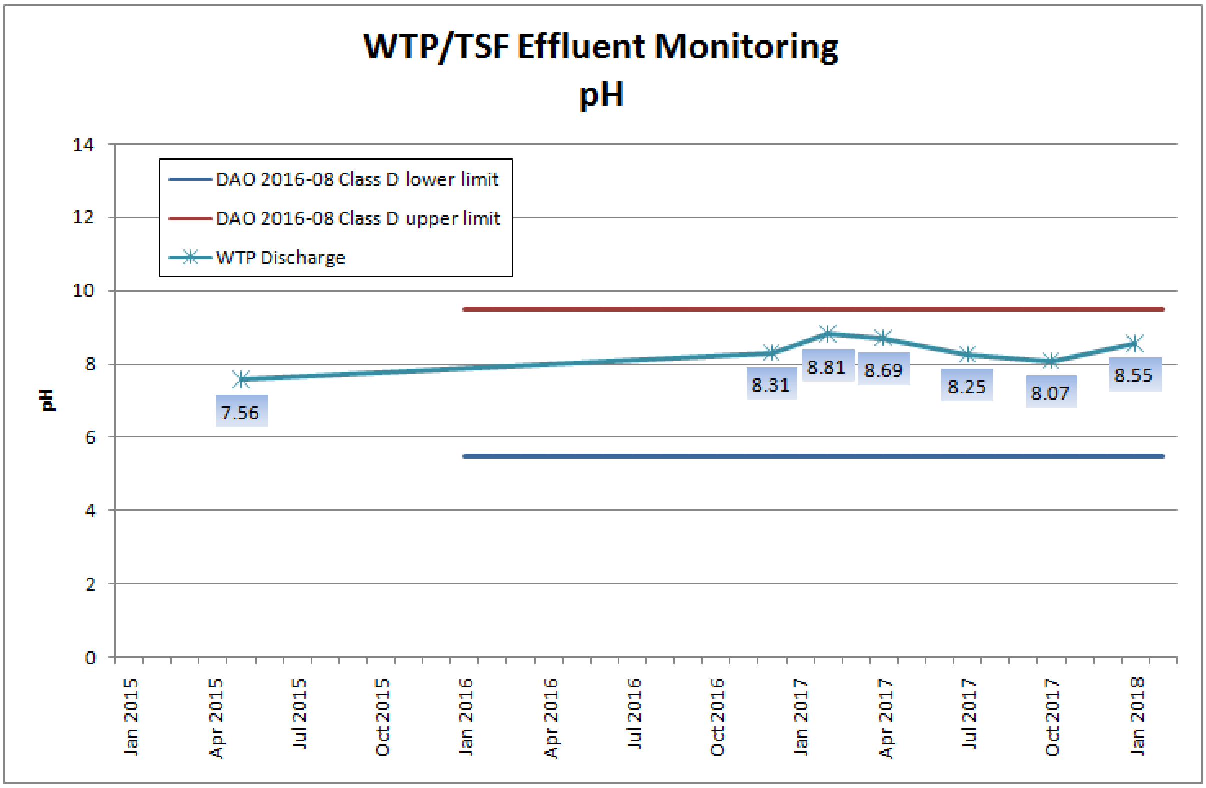


Figure 6-13: WTP/TSF Effluent Monitoring Trend for pH

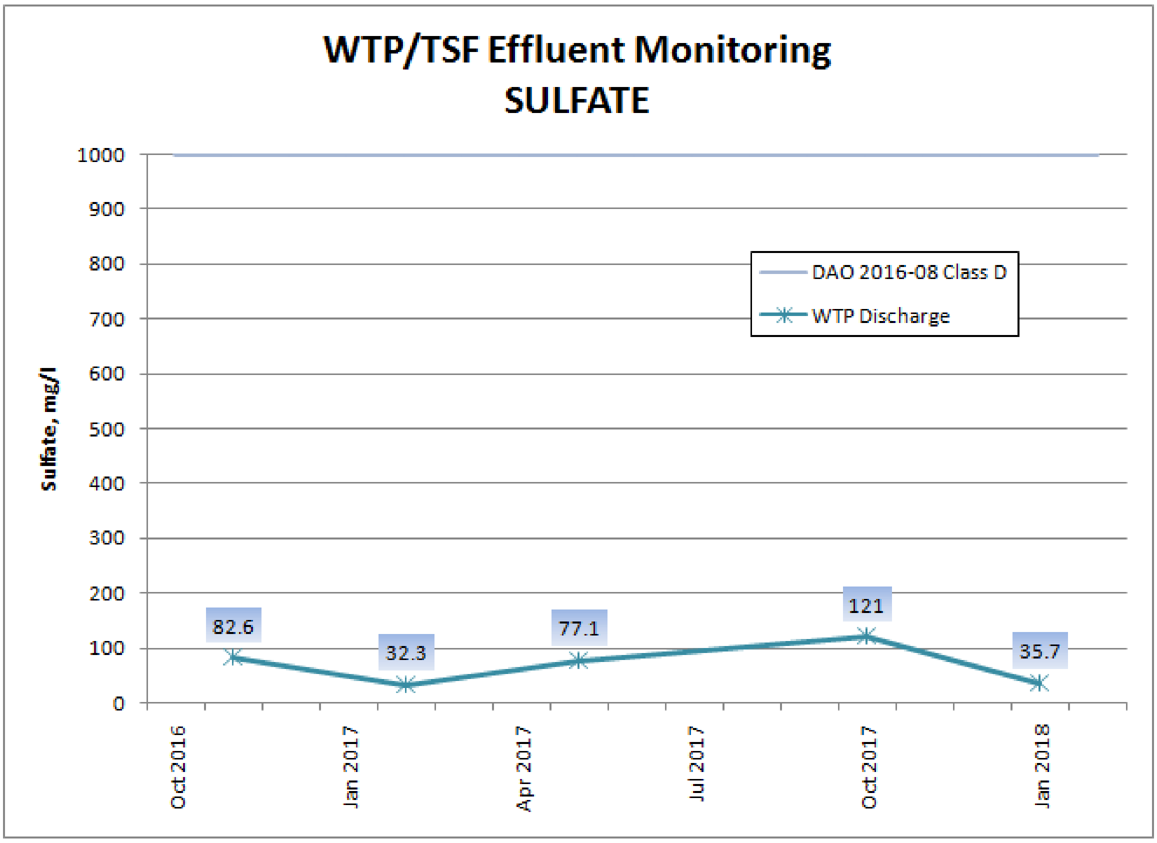


Figure 6-14: WTP/TSF Effluent Monitoring Trend for Sulfate

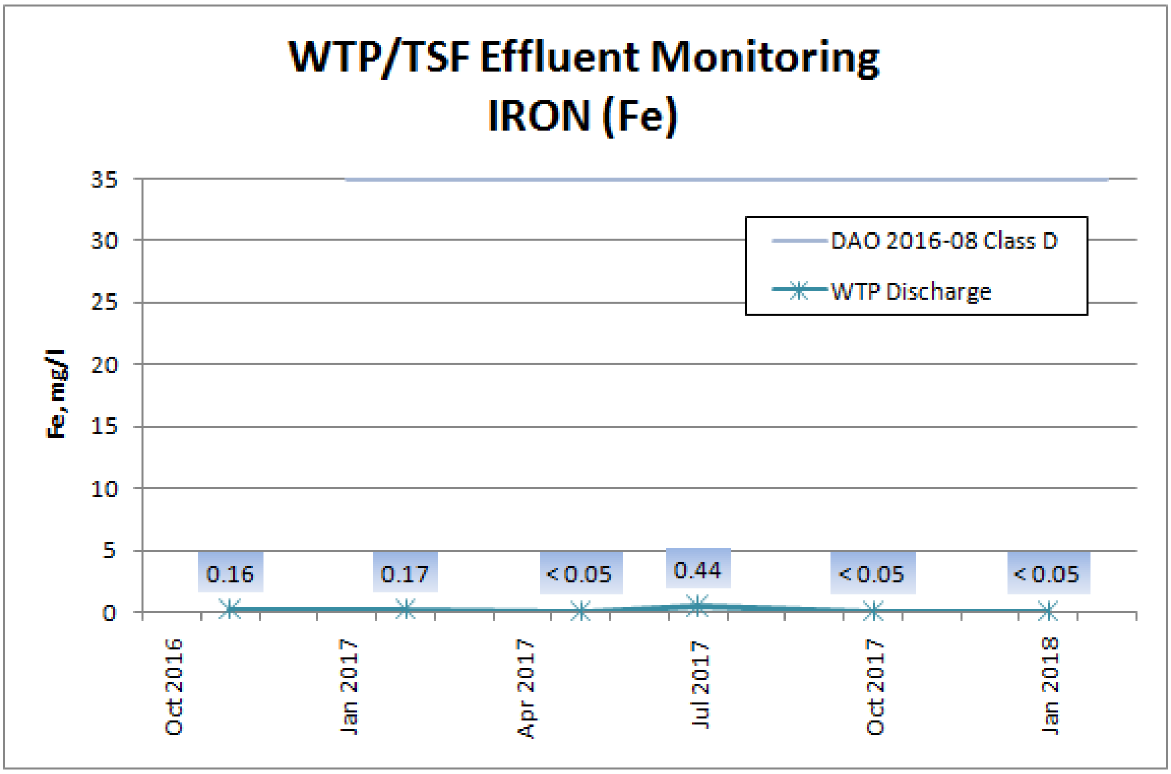


Figure 6-15: WTP/TSF Effluent Monitoring Trend for Iron

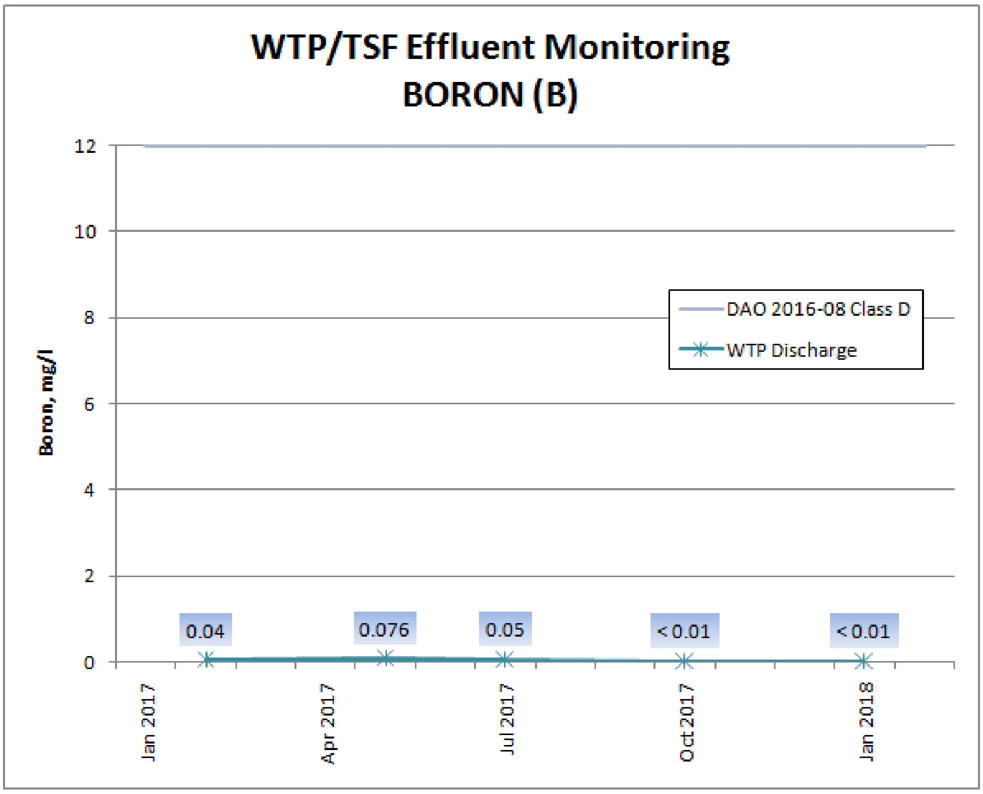


Figure 6-16: WTP/TSF Effluent Monitoring Trend for Boron

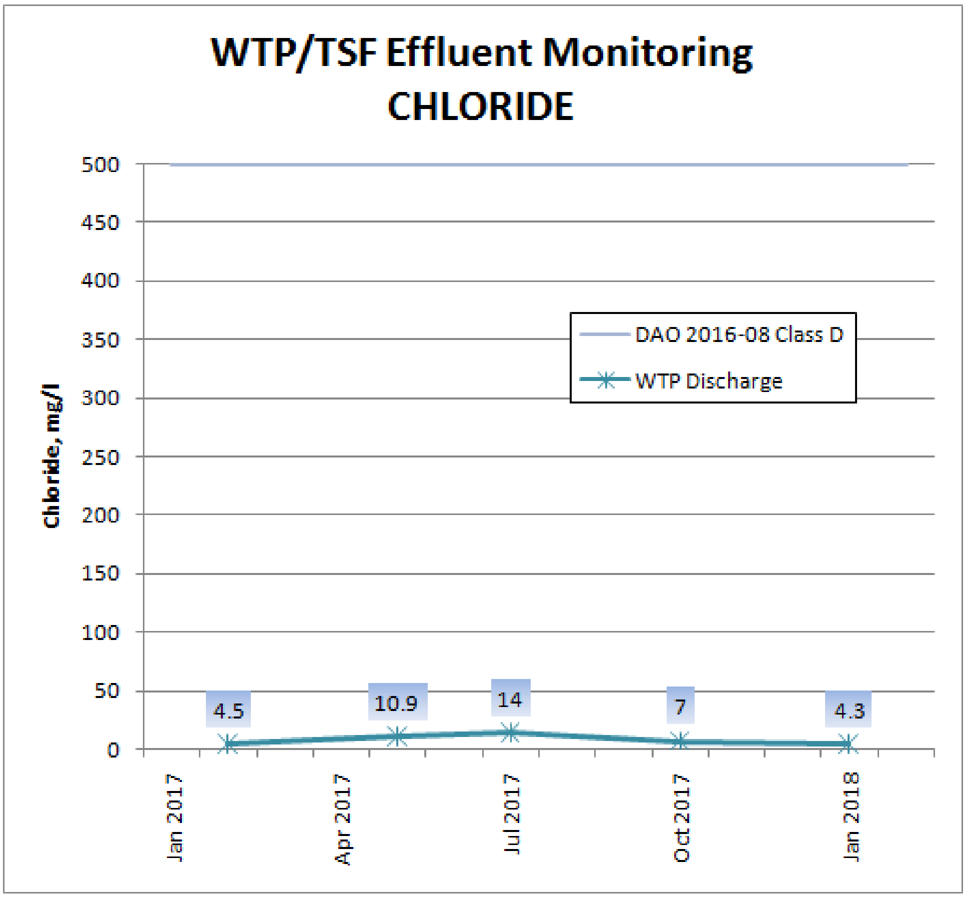


Figure 6-17: WTP/TSF Effluent Monitoring Trend for Chloride

6.1.2.2.1.2 SEWAGE TREATMENT PLANTS

Summaries of STP Plant and STP MSA effluent monitoring data for all parameters are presented Table 6-7 and Table 6-8, respectively. Monitoring data per parameter were plotted in Figure 6-18 to Figure 6-24 to illustrate possible trends in the results. Parameters of concern for the Sewage Treatment Plants include Total and Fecal Coliform count, Ammonia, Nitrates, Phospates, and TSS due to exceedances observed in some of the effluent samples taken from STP Plant Site and STP MSA discharge outlet. The exceedances were observed prior to 2017 except for ammonia in STP MSA effluent sample which was recorded in January 2018.

Table 6-7: Summary of STP Plant Site Effluent Monitoring Data

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Required in the Discharge Permit							
BOD* (mg/l)	2Q 2014 – 1Q 2018	120 [a, b]	24	1.0 – 36.8	12.0	0	Compliant (Figure 6-18)
Fecal Coliform* (MPN/100ml)	3Q 2016 – 1Q 2018	800[b]	7	< 1 – 7.5	2	0	Fecal Coliform count of 5 out of 7 samples were below MDL. (Figure 6-19). Monitoring of Fecal Coliform in STPs started only in 3Q 2016. Prior to this, effluent samples were sent to the laboratory of SGS Philippines, Inc. to be analyzed for Total Coliform. Quarterly monitoring of Total Coliform from 3Q 2014 – 2Q 2016 for STP Plant ranged from <1.8 – 5,400,000.0 MPN/100ml (9 samples). Extremely high Total Coliform counts were recorded in three of eight effluent samples collected during said period: Q4 2014 (5,400,000.0 MPN/100ml), Q1 2015 (1,100,000.0), Q2 2015 (24,000 MPN/100ml) and Q3 2015 (5,400,000.0 MPN/100ml). According to OGPI, possible causes of high Total Coliform Count are: • In 2014, OGPI is still in transition of using chlorine tablet in the chlorination chamber to liquid chlorine; • In 2015, cause of exceedances could be the chlorine dosing pump malfunction; • Sample holding time is also considered as one of the factors since prior to 2017, samples for Total/Fecal Coliform analysis were sent to SGS Philippines, Inc. laboratory in Makati from site. Considering the effect of holding time in the results, analysis of Fecal Coliform is currently being done in the Environment Laboratory of

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
							OGPI to meet the holding time requirement for Coliform tests.
Ammonia* as NH_3-N (mg/l)	3Q 2016 – 1Q 2018	7.5[b]	7	0.039 – 78.9	13.7	1	Exceedance recorded in 4Q 2016 with ammonia concentration at 78.9 mg/l (Figure 6-20). According to OGPI, exceedance observed is possibly due to incomplete digestion due to high influx of influent. OGPI is continuously monitoring all of its pollution control facilities for evaluation and further improvement.
Nitrate* as NO_3-N (mg/l)	3Q 2016 – 1Q 2018	30[b]	7	2.1 – 103.1	31.5	2	Exceedances were observed in effluent samples collected during 3Q and 4Q of 2016 with Nitrate levels 31.0 mg/l and 103.1 mg/l, respectively (Figure 6-21). According to OGPI, exceedances observed are possibly due to incomplete digestion due to high influx of influent. OGPI is continuously monitoring all of its pollution control facilities for evaluation and further improvement.
Phosphate* (mg/l)	4Q 2016 – 1Q 2018	10[b]	6	1.3 – 32.9	7.5	1	Exceedance observed in 4Q 2016 with phosphate level reaching 32.9 mg/l (Figure 6-22). According to OGPI, exceedance observed is possibly due to incomplete digestion due to high influx of influent. OGPI is continuously monitoring all of its pollution control facilities for evaluation and further improvement and is committed to take the necessary actions and adjustments to ensure compliance with the DENR effluent standards.
Surfactants* (MBAS) (mg/l)	4Q 2014 – 2Q 2016	30[b]	15	< 0.10 – 0.23	0.12	0	Compliant 10 out of 15 samples had concentrations below MDL
Oil and Grease* (mg/l)	3Q 2015 – 1Q 2018	15[b]	12	0.7 – 6.8	2.7	0	Compliant (Figure 6-23)
Additional parameters analyzed							
Total Suspended Solids (mg/l)	2Q 2014 – 1Q 2018	150[a, b]	24	2.5 – 208	46.5	1	Exceedance observed in 3Q 2015 (September) effluent sample with TSS concentration = 208 mg/l (Figure 6-24).

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for sewerage (sewage treatment facilities) as per DAO 2016-08

Table 6-8: Summary of STP MSA Effluent Monitoring Data

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Required in the Discharge Permit							
BOD* (mg/l)	2Q 2014 – 1Q 2018	120 [a, b]	24	2.1 – 97.8	24.9	0	Compliant (Figure 6-18).
Fecal Coliform* (MPN/100ml)	3Q 2016 – 1Q 2018	800[b]	6	< 1 – 1,700	299	1	Exceedance recorded in 3Q 2016 (1,700 MPN/100ml) 2 out of 6 samples had Fecal Coliform count below MDL Monitoring of Fecal Coliform in STPs started only in 3Q 2016. Prior to this, effluent samples were sent to the laboratory of SGS Philippines, Inc. to be analyzed for Total Coliform. Quarterly monitoring of Total Coliform from 3Q 2014 – 2Q 2016 for STP MSA ranged from 4.5 – 16,000,000.0 MPN/100ml (10 samples with mean value = 4,676,600 MPN/100ml). Total Coliform counts > 15,000 MPN/100ml were recorded in 9 out of 10 effluent samples collected during said period. Sample holding time is considered as one of the major factors resulting to high Coliform count recorded in the samples. Prior to 2017, samples for Total/Fecal Coliform analysis were sent to SGS Philippines, Inc. laboratory in Makati from site. Considering the effect of holding time in the results, analysis of Fecal Coliform is currently being done in the Environment Laboratory of OGPI to meet the holding time requirement for Coliform tests (Figure 6-19).
Ammonia* as NH_3-N (mg/l)	3Q 2016 – 1Q 2018	7.5[b]	7	2.135 – 19.8	7.7	2	Exceedance observed in 3Q 2016 and 1Q 2018 with ammonia levels at 14.9 mg/l and 19.8, respectively. (Figure 6-20)
Nitrate* as NO_3-N (mg/l)	3Q 2016 – 1Q 2018	30[b]	7	3.0 – 15.8	8.9	0	Compliant (Figure 6-21)

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Phosphate* (mg/l)	4Q 2016 – 1Q 2018	10[b]	6	1.0 – 8.9	4.9	0	Compliant (Figure 6-22)
Surfactants* (MBAS) (mg/l)	4Q 2014 – 2Q 2016	30[b]	16	<0.10 – 2.20	0.27	0	Compliant 10 out of 16 samples had concentrations below MDL
Oil and Grease* (mg/l)	3Q 2015 – 1Q 2018	15[b]	14	0.9 – 9.7	3.2	0	Compliant (Figure 6-23)
Additional parameters analyzed							
Total Suspended Solids (mg/l)	2Q 2014 – 1Q 2018	150[a, b]	24	9 – 105	37.3	0	Compliant (Figure 6-24)

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for sewerage (sewage treatment facilities) as per DAO 2016-08

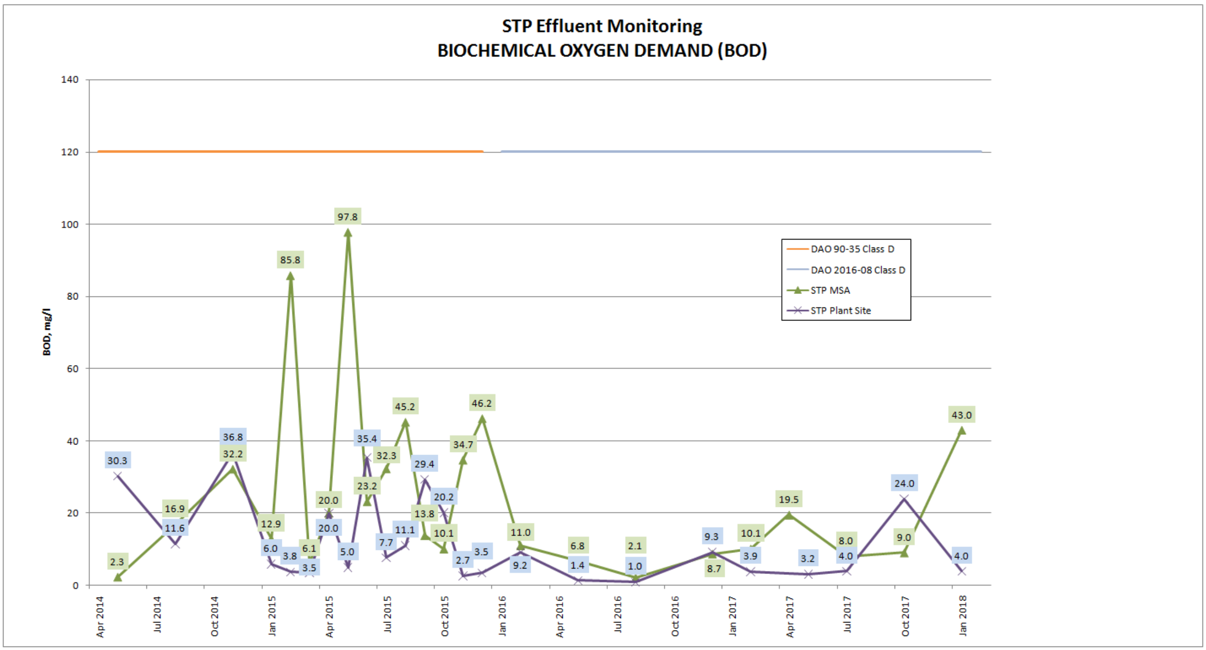


Figure 6-18: STP Plant Site and STP MSA Effluent Monitoring Trend for BOD

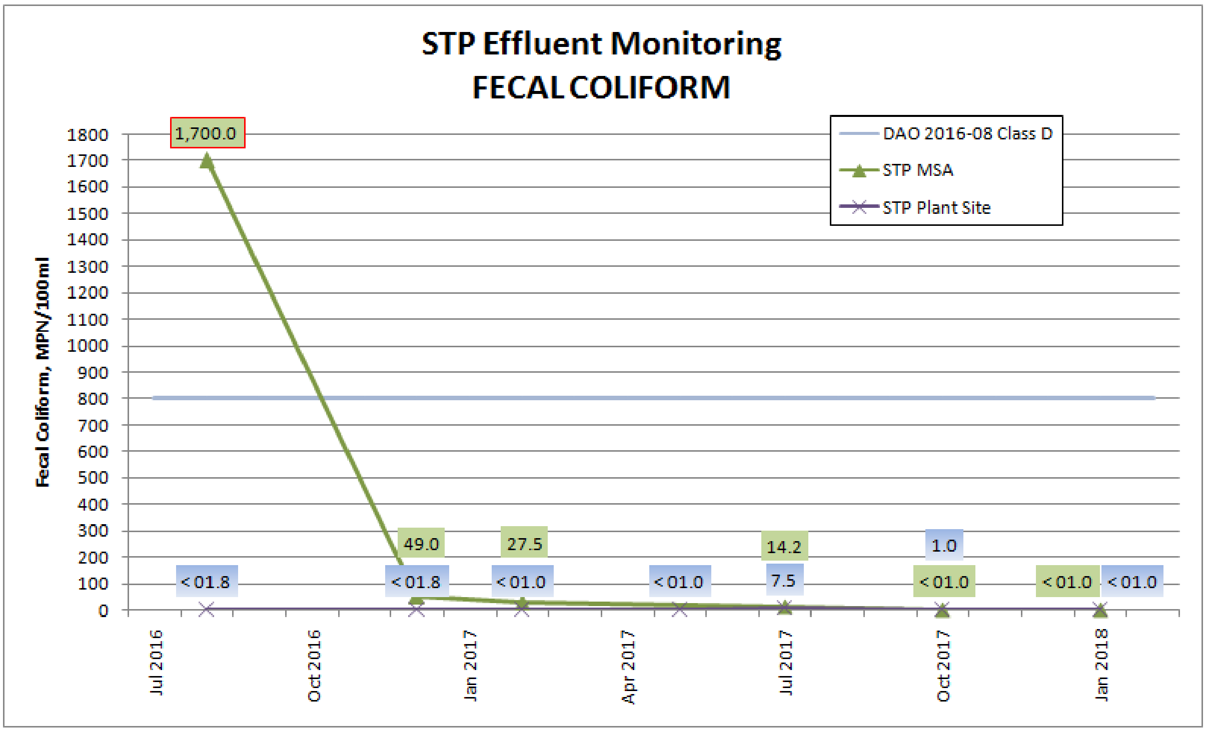


Figure 6-19: STP Plant Site and STP MSA Effluent Monitoring Trend for Fecal Coliform

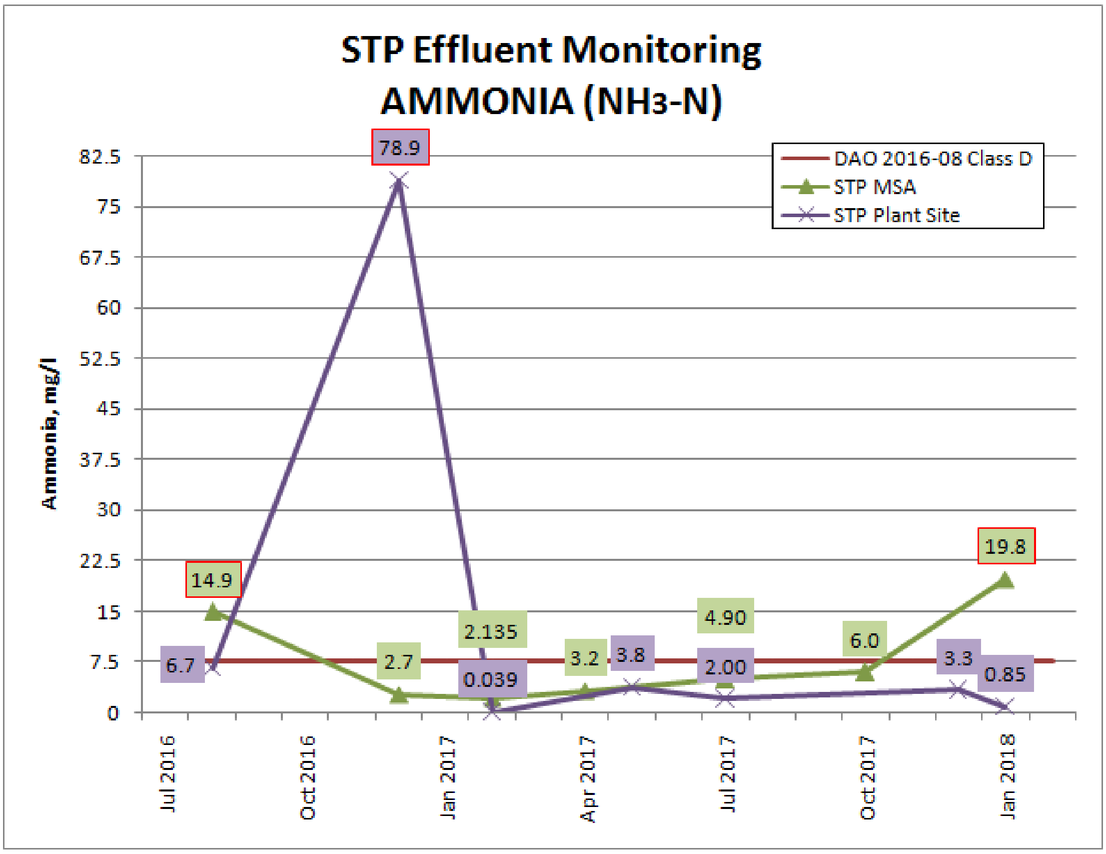


Figure 6-20: STP Plant Site and STP MSA Effluent Monitoring Trend for Ammonia

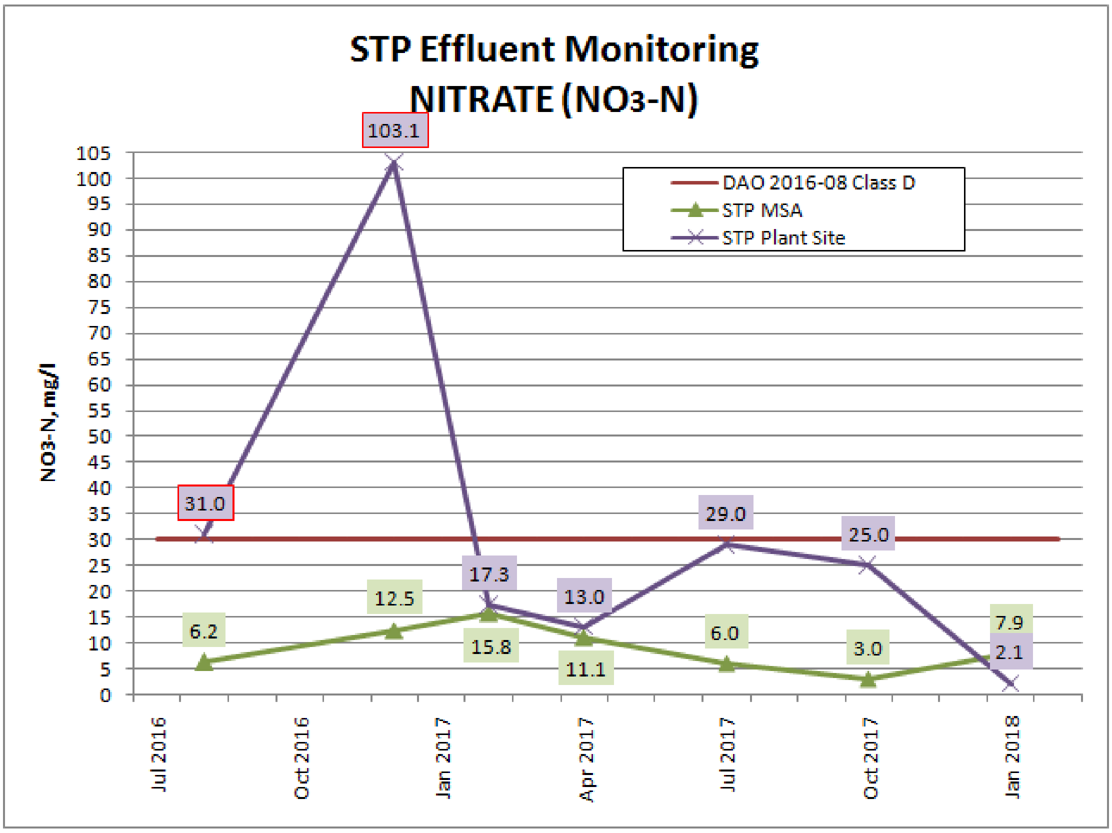


Figure 6-21: STP Plant Site and STP MSA Effluent Monitoring Trend for Nitrate

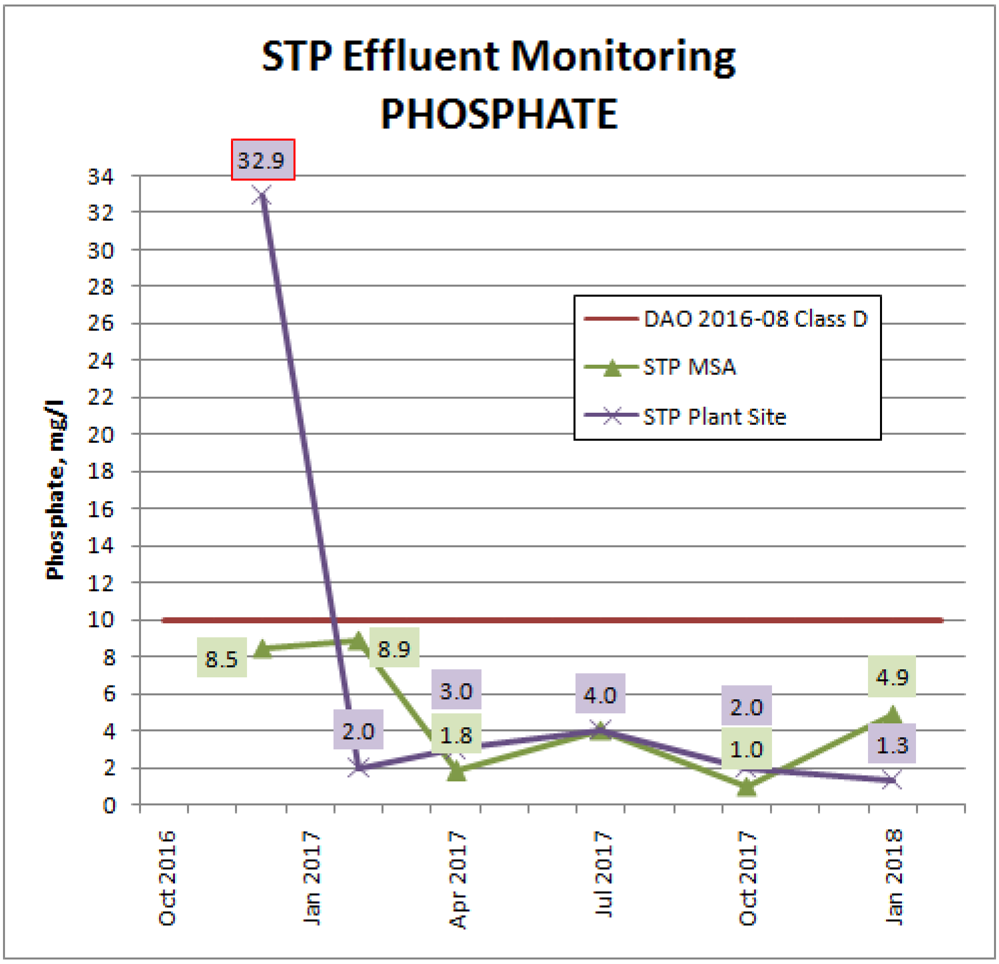


Figure 6-22: STP Plant Site and STP MSA Effluent Monitoring Trend for Phosphate

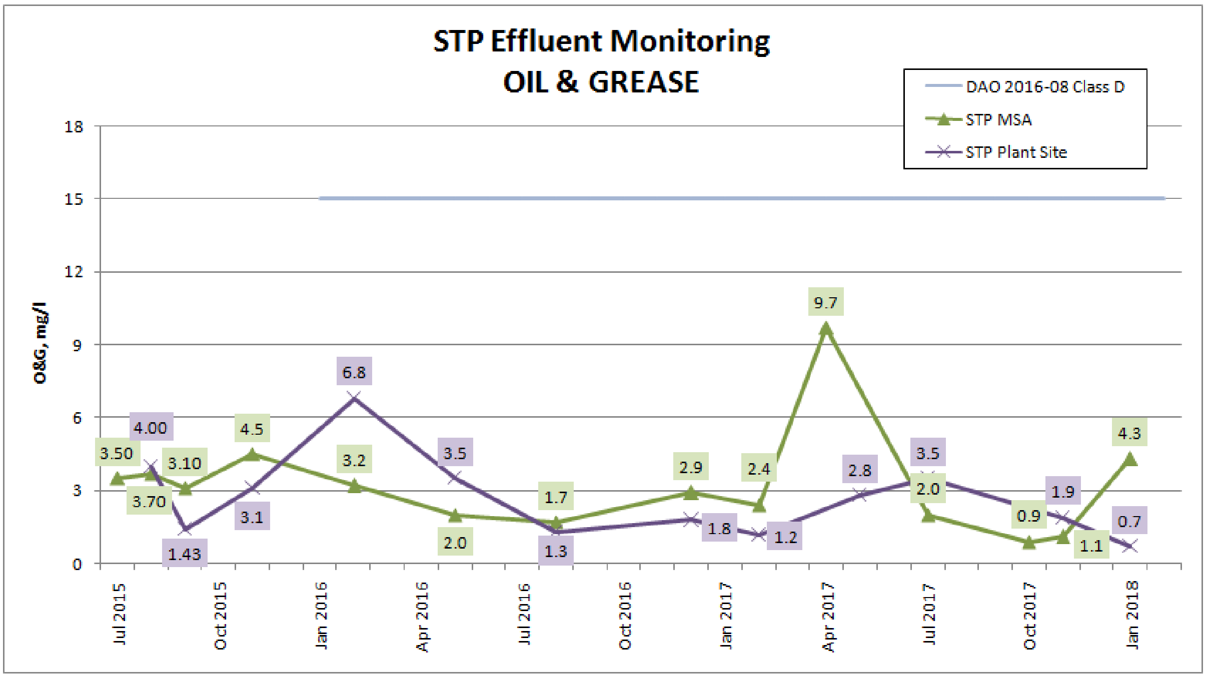


Figure 6-23: STP Plant Site and STP MSA Effluent Monitoring Trend for Oil and Grease

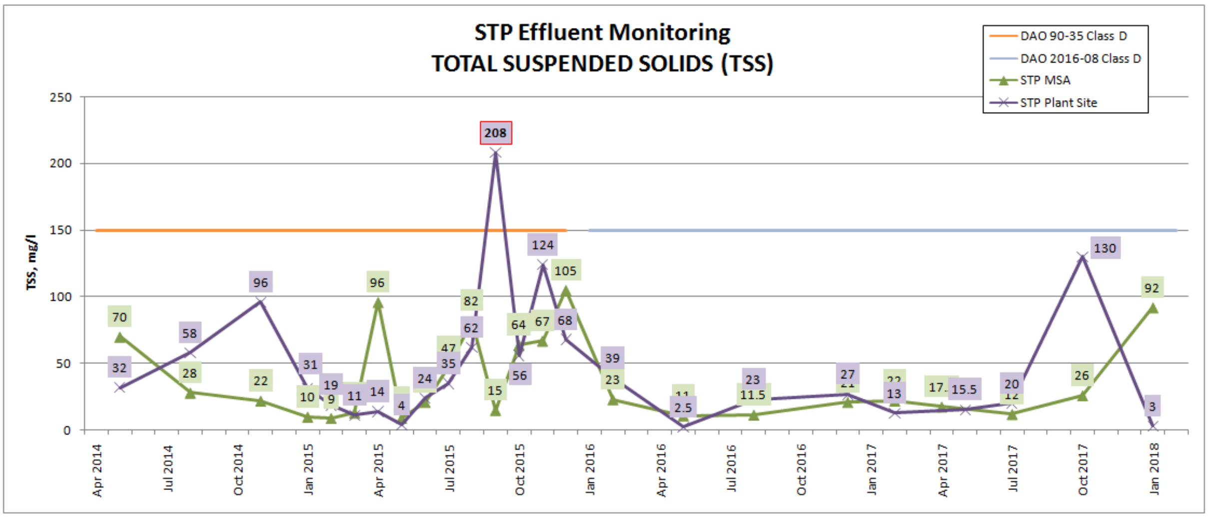


Figure 6-24: STP Plant Site and STP MSA Effluent Monitoring Trend for TSS

6.1.2.2.1.3 WASH BAYS

Effluent monitoring data for the Wash Bay Facilities are presented Table 6-9 to Table 6-11. Monitoring data per parameter were plotted in Figure 6-25 to Figure 6-33 to show possible trends in the results. Exceedances were observed in effluent samples collected during 4Q 2015 (Carwash Bay TSS = 214 mg/l), 1Q 2016 (HV Wash Bay – SP09 TSS = 192 mg/l) and 1Q 2018 (Carwash Bay BOD = 391 mg/l and MBAS = 46 mg/l). The rest of the effluent monitoring data were within the DENR effluent standards for Class D waters. High oil and grease concentrations were also observed in Carwash Bay effluent samples collected during 2Q and 3Q of 2015 with 26.8 mg/l and 19.7 mg/l, respectively. Although as per DAO 90-35, which is the applicable effluent standards in 2015, there is no effluent standard limit for oil and grease for Class D waters, the recorded values can be considered high since it exceeds the current Class D standards for oil and grease (15 mg/l) based on DAO 2016-08.

Table 6-9: Summary of Carwash Bay Effluent Monitoring Data

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Required in the Discharge Permit							
BOD (mg/l)	2Q 2014 – 1Q 2018	120 [a, b]	6	2.2 - 391	90.1	1	Exceedance observed in effluent sample collected during 1Q 2018 monitoring with BOD = 391 mg/l (Figure 6-25).
Total Suspended Solids* (mg/l)	2Q 2014 – 1Q 2018	150 [a, b]	16	7 - 214	68	1	Exceedance observed in effluent sample collected during 4Q 2015 monitoring (November 2015) with TSS = 214 mg/l. (Figure 6-26)
Oil and Grease* (mg/l)	2Q 2014 – 1Q 2018	15 [b]	16	<0.50 – 5.0	2.2	0	Compliant (Figure 6-27)
Surfactants* (MBAS) (mg/l)	2Q 2014 – 1Q 2018	30 [b]	15	<0.10 – 46.0	3.25	1	Exceedance observed in effluent sample collected during 1Q 2018 monitoring with MBAS = 46.0 mg/l. 11 out of 15 samples exhibited MBAS below MDL (< 0.10). (Figure 6-28)
Additional parameters analyzed							
pH*	4Q 2014 – 1Q 2016	5.5 – 9.5 [b]	5	7.09 – 8.78	8.16	0	Compliant (Figure 6-29)
Cadmium* (mg/l)	4Q 2014 – 1Q 2018	0.02 [b]	10	<0.01	<0.01	0	Compliant. All samples analyzed had Cd concentrations below MDL.
Lead* (mg/l)	4Q 2014 – 1Q 2016	0.2 [b]	9	<0.05	<0.05	0	Compliant. All samples analyzed had Pb concentrations below MDL.
Mercury* (mg/l)	4Q 2014 – 1Q 2016	0.008 [b]	10	<0.001 – 0.003	0.0012	0	Compliant. Hg in all samples were below MDL except for the effluent sample collected during 3Q 2016 with Hg level = 0.003 mg/l. (Figure 6-30)
Ammonia* as NH3-N (mg/l)	1Q 2017 – 1Q 2018	7.5 [b]	4	0.79 – 5.4	3.3	0	Compliant (Figure 6-31)
Benzo(a)pyrene* (µg/l)	1Q 2017 – 1Q 2018	6 [b]	4	<5	<5	0	Compliant. All samples analyzed had benzo(a)pyrene concentrations below MDL.
Color* (TCU)	1Q 2017 – 1Q 2018	300 [b]	4	5 – 96	37.3	0	Compliant (Figure 6-32)

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Nickel* (mg/l)	1Q 2017 – 1Q 2018	5 [b]	4	<0.1	<0.1	0	Compliant. All samples analyzed had Ni concentrations below MDL.
Nitrate*as NO3-N (mg/l)	1Q 2017 – 1Q 2018	30 [b]	4	<0.2 – 0.67	0.35	0	Compliant (Figure 6-33)

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for oil and water separators and maintenance and repair of vehicles as per DAO 2016-08

Table 6-10: Summary of HV Wash Bay (SP09) Effluent Monitoring Data

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Required in the Discharge Permit							
BOD (mg/l)	4Q 2014 – 1Q 2018	120 [a, b]	8	2.0 – 54.2	11.0	0	Compliant. (Figure 6-25)
Total Suspended Solids* (mg/l)	2Q 2014 – 1Q 2018	150 [a, b]	12	< 1 - 192	69	1	Exceedance observed in effluent sample collected during 1Q 2016 monitoring with TSS = 192 mg/l (Figure 6-26).
Oil and Grease* (mg/l)	4Q 2014 – 1Q 2018	15 [b]	16	< 0.5 – 26.8	4.9	0	Highest O&G concentrations were recorded during 2Q (26.8 mg/l) and 3Q (19.7 mg/l) of 2015 wherein there was no standard for O&G for Class D waters as per DAO 90-35. These values however, exceed the current Class D standards as per DAO 2016-08 which is 15 mg/l (Figure 6-27). According to OGPI, exceedances observed are possibly due to high influx of influent which may have resulted to low retention time of influent in the chambers. OGPI is continuously monitoring all of its pollution control facilities for evaluation and further improvement and is committed to take the necessary actions and adjustments to ensure compliance with the DENR effluent standards.

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Surfactants* (MBAS) (mg/l)	4Q 2014 – 2Q 2016	30[b]	14	< 0.1 – 0.19	0.11	0	Compliant. 12 out of 14 effluent samples exhibited MBAS below MDL (< 0.10). (Figure 6-28)
pH*	4Q 2014 – 2Q 2016	5.5 – 9.5[b]	6	8.05 – 8.80	8.56	0	Compliant (Figure 6-29)
Lead* (mg/l)	4Q 2014 – 1Q 2016	0.2[b]	13	<0.05	<0.05	0	Compliant. All samples analyzed had Pb concentrations below MDL.
Mercury* (mg/l)	4Q 2014 – 1Q 2016	0.008[b]	13	<0.001 – 0.002	0.0011	0	Compliant. Hg in all samples were below MDL except for the effluent sample collected during 3Q 2016 with Hg level = 0.002 mg/l. (Figure 6-30)
Additional parameters analyzed							
Cadmium* (mg/l)	4Q 2014 – 1Q 2018	0.02[b]	13	<0.01	<0.01	0	Compliant. All samples analyzed had Cd concentrations below MDL.
Ammonia* as NH_3-N (mg/l)	1Q 2017 – 1Q 2018	7.5[b]	5	0.35 – 1.1	0.6	0	Compliant (Figure 6-31)
Benzo(a)pyrene* (µg/l)	1Q 2017 – 1Q 2018	6[b]	5	<5	<5	0	Compliant. All samples analyzed had benzo(a)pyrene concentrations below MDL.
Color* (TCU)	1Q 2017 – 1Q 2018	300[b]	5	3 – 9	7.2	0	Compliant (Figure 6-32)
Nickel* (mg/l)	1Q 2017 – 1Q 2018	5[b]	5	<0.1 – 0.11	0.11	0	Compliant. 4 out of 5 effluent samples had Ni concentrations below MDL. Trace amounts of Ni (0.11 mg/l) was detected in effluent sample during 4Q 2017 (November).
Nitrate*as NO_3-N (mg/l)	1Q 2017 – 1Q 2018	30[b]	5	0.55 – 2.6	1.26	0	Compliant (Figure 6-33)

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for oil and water separators and maintenance and repair of vehicles as per DAO 2016-08

Table 6-11: : Summary of UG Wash Bay Effluent Monitoring Data

Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
Required in the Discharge Permit							
BOD (mg/l)	3Q 2017 – 1Q 2018	120 [a, b]	3	8.0 – 109.0	60.0	0	Compliant. (Figure 6-25)
Total Suspended Solids* (mg/l)	3Q 2017 – 1Q 2018	150[a, b]	3	10 - 45	28	0	Compliant (Figure 6-26)
Oil and Grease* (mg/l)	3Q 2017 – 1Q 2018	15[b]	3	<0.5 – 2.9	1.63	0	Compliant (Figure 6-27)
Surfactants* (MBAS) (mg/l)	3Q 2017 – 1Q 2018	30[b]	3	<0.1 – 0.38	0.25	0	Compliant (Figure 6-28)
Additional parameters analyzed							
pH*	3Q 2017 – 1Q 2018	5.5 – 9.5[b]	3	8.00 – 8.14	8.05	0	Compliant (Figure 6-29)
Cadmium* (mg/l)	3Q 2017 – 1Q 2018	0.02[b]	3	<0.01	<0.01	0	Compliant. All samples analyzed had Cd concentrations below MDL.
Lead* (mg/l)	3Q 2017 – 1Q 2018	0.2[b]	3	<0.05	<0.05	0	Compliant. All samples analyzed had Pb concentrations below MDL.
Mercury* (mg/l)	3Q 2017 – 1Q 2018	0.008[b]	3	<0.001	<0.001	0	Compliant. Hg in all samples were below MDL (Figure 6-30).
Ammonia* as NH_3-N (mg/l)	3Q 2017 – 1Q 2018	7.5[b]	3	0.3 – 3.2	1.6	0	Compliant (Figure 6-31)
Benzo(a)pyrene* (µg/l)	3Q 2017 – 1Q 2018	6[b]	3	<5	<5	0	Compliant. All samples analyzed had benzo(a)pyrene concentrations below MDL.
Color* (TCU)	3Q 2017 – 1Q 2018	300[b]	3	14 – 50	27	0	Compliant (Figure 6-32)
Nickel* (mg/l)	3Q 2017 – 1Q 2018	5[b]	3	<0.1	<0.1	0	Compliant. Ni in all samples were below MDL.
Nitrate*as NO_3-N (mg/l)	3Q 2017 – 1Q 2018	30[b]	3	<0.2 – 2.0	0.80	0	Compliant. Nitrate concentrations in 2 out of 3 monitoring data were below MDL. (Figure 6-33)

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for oil and water separators and maintenance and repair of vehicles as per DAO 2016-08

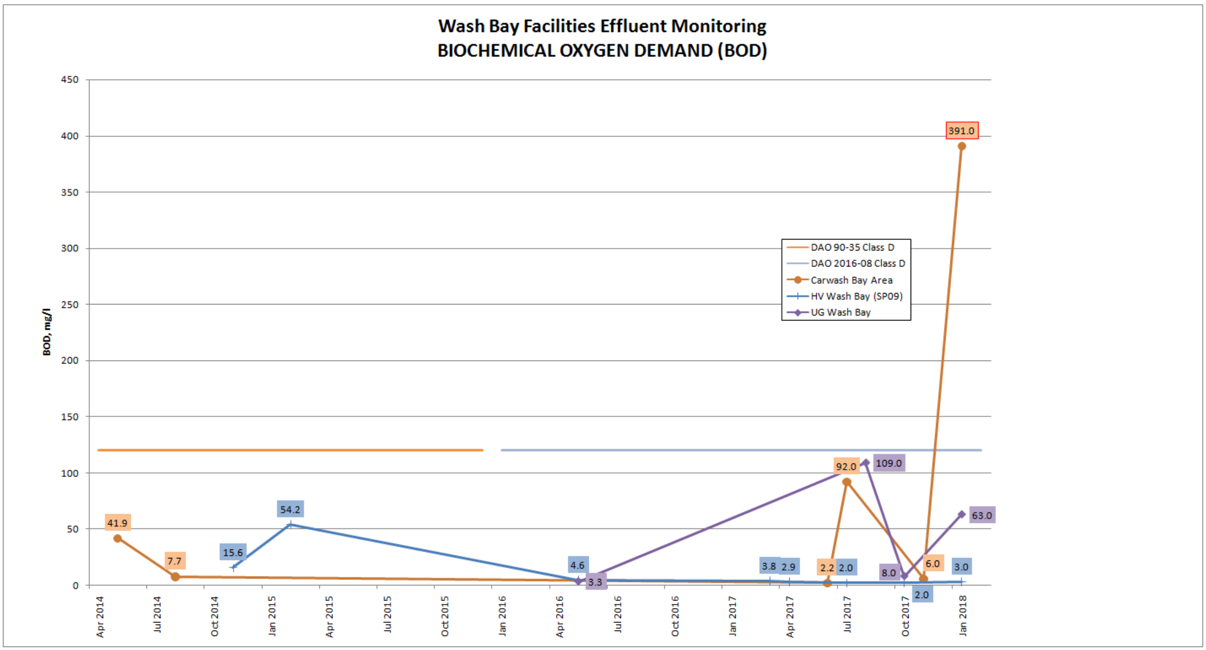


Figure 6-25: Wash Bay Facilities Effluent Monitoring Trend for BOD (Carwash Bay, HV Wash Bay, UG Wash Bay)

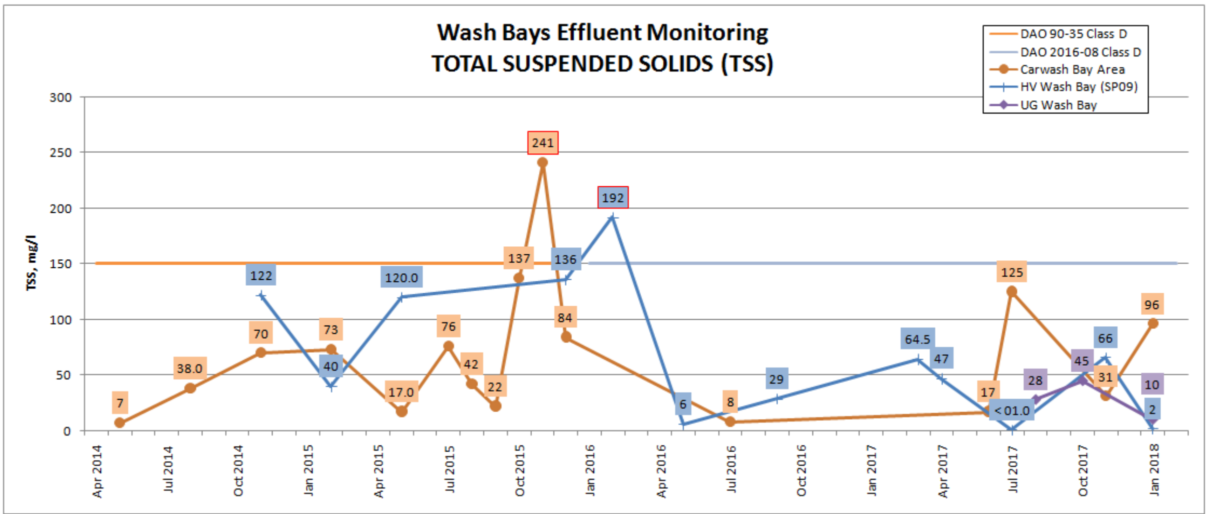


Figure 6-26: Wash Bay Facilities Effluent Monitoring Trend for TSS (Carwash Bay, HV Wash Bay, UG Wash Bay)

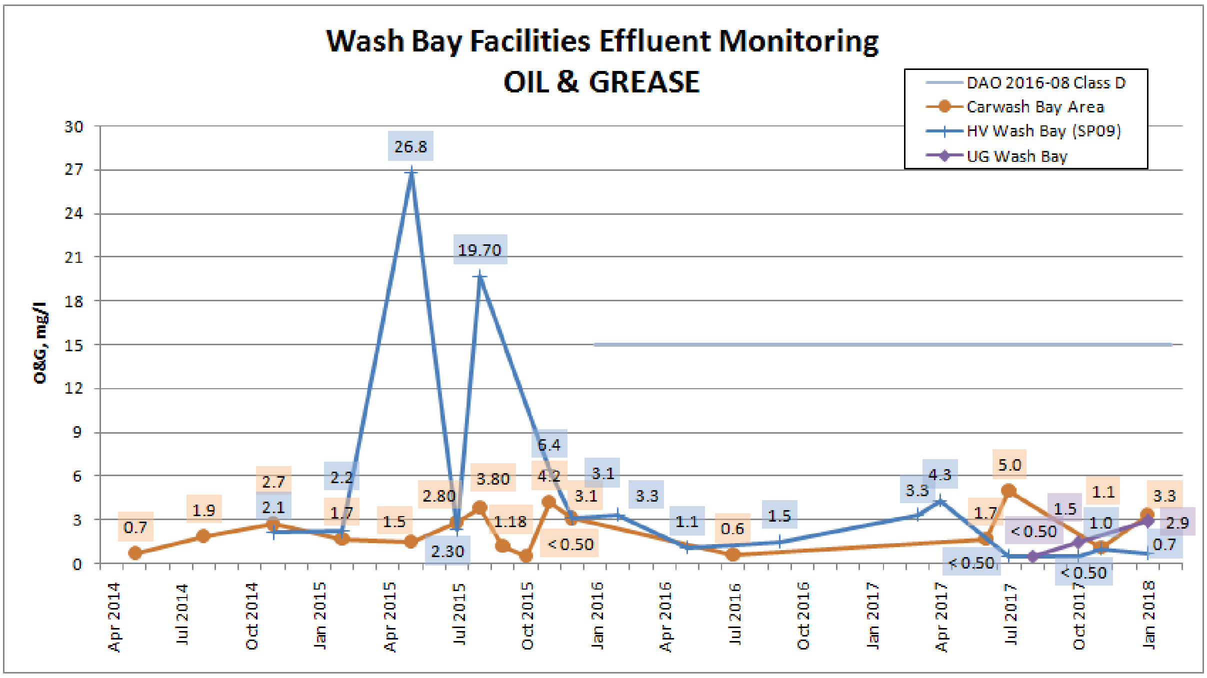


Figure 6-27: Wash Bay Facilities Effluent Monitoring Trend for O&G (Carwash Bay, HV Wash Bay, UG Wash Bay)

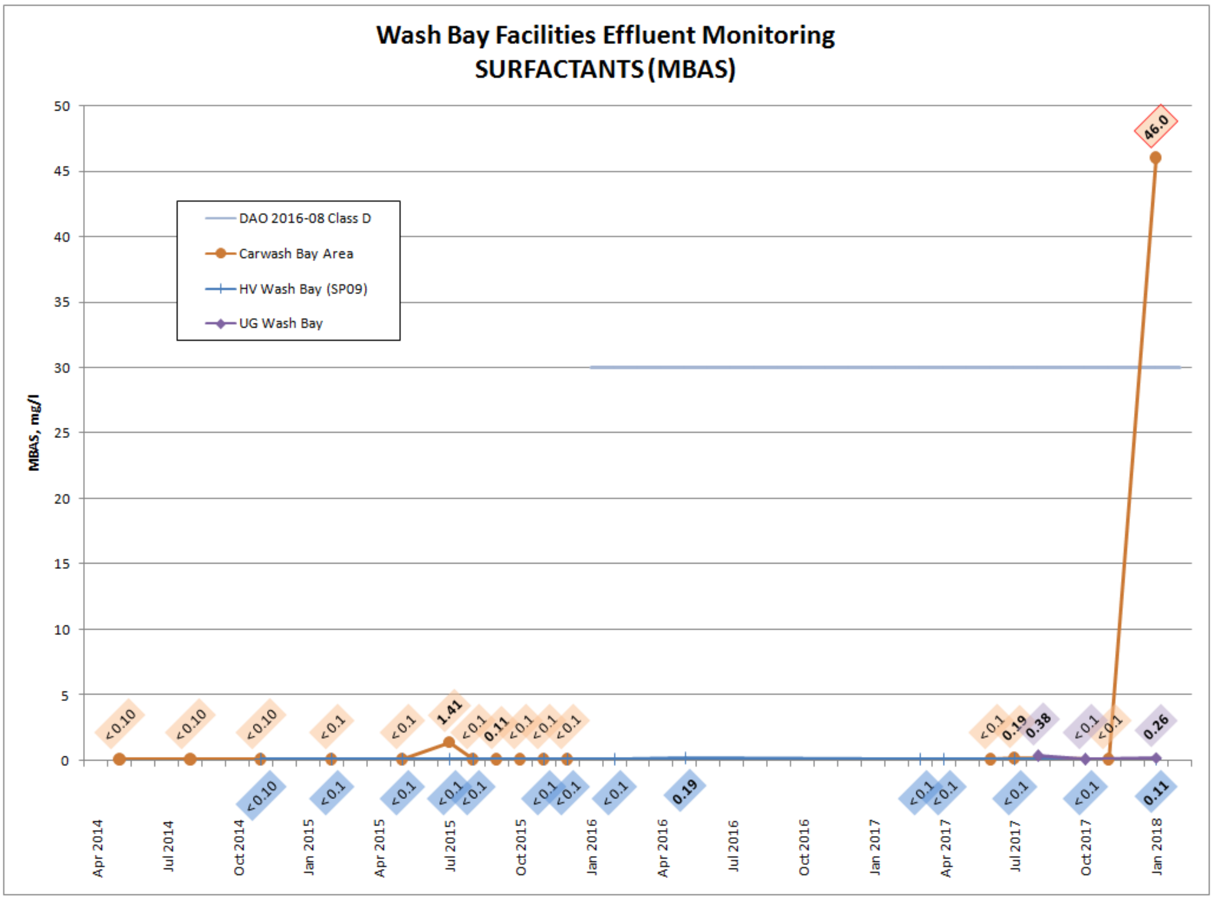


Figure 6-28: Wash Bay Facilities Effluent Monitoring Trend for Surfactants (Carwash Bay, HV Wash Bay, UG Wash Bay)

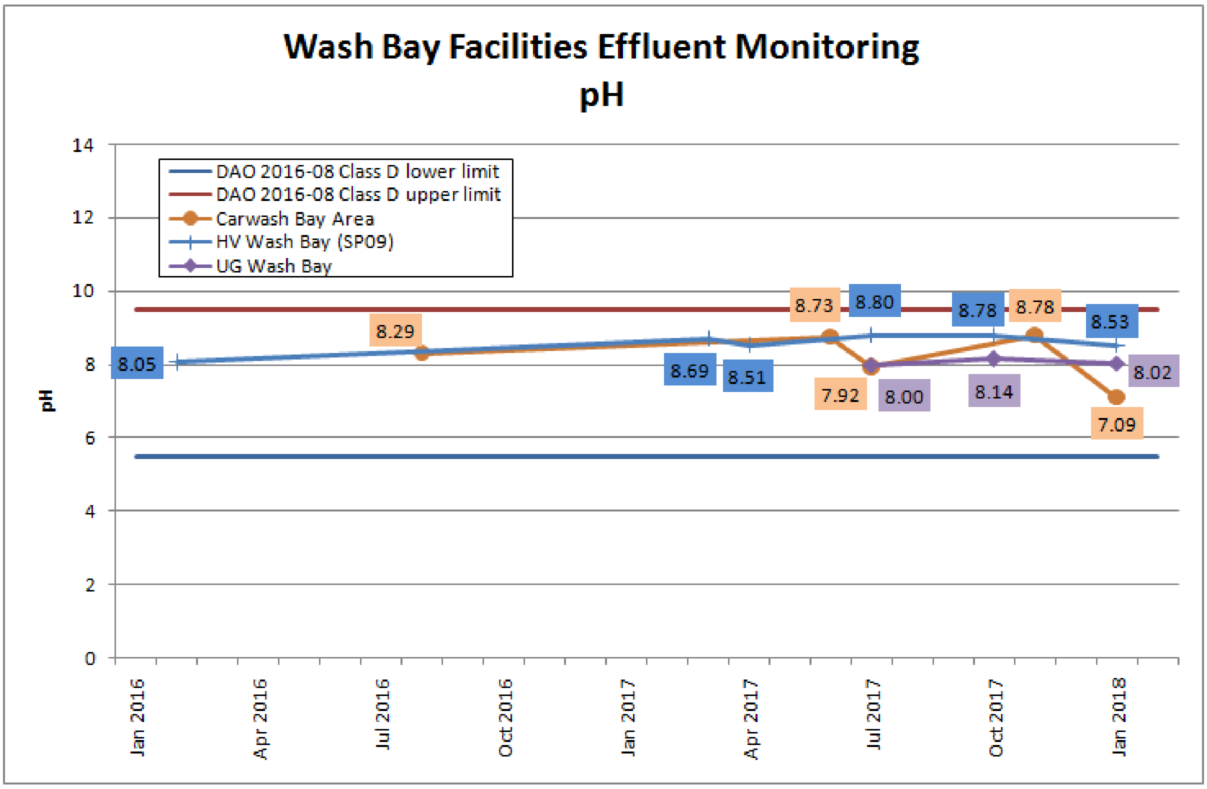


Figure 6-29: Wash Bay Facilities Effluent Monitoring Trend for pH (Carwash Bay, HV Wash Bay, UG Wash Bay)

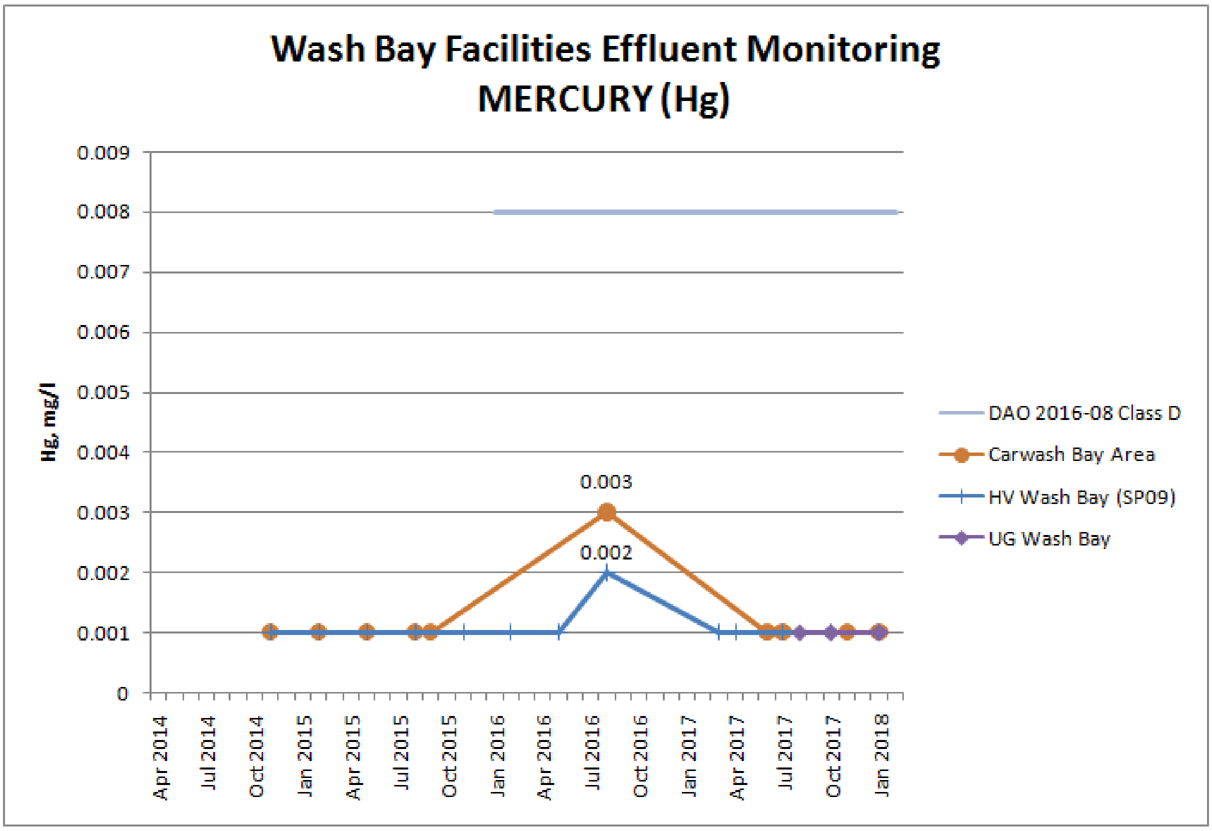


Figure 6-30: Wash Bay Facilities Effluent Monitoring Trend for Mercury (Carwash Bay, HV Wash Bay, UG Wash Bay)

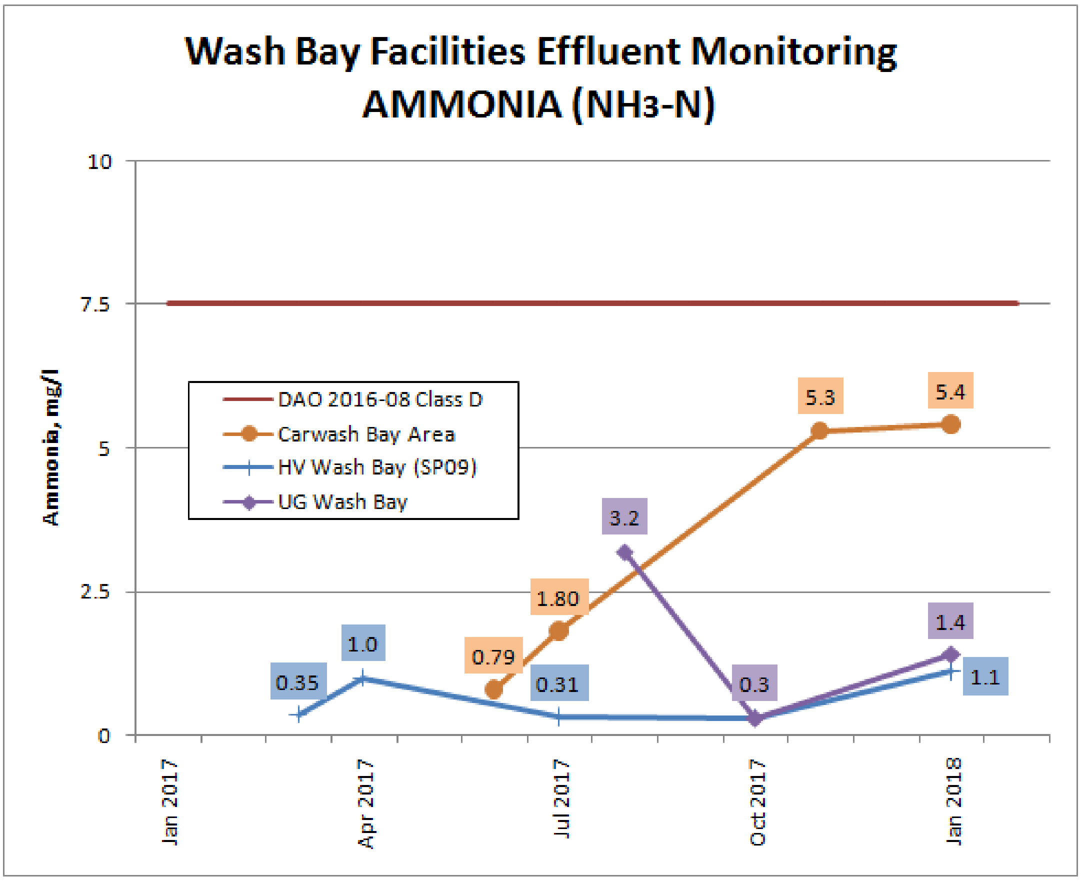


Figure 6-31: Wash Bay Facilities Effluent Monitoring Trend for Ammonia (Carwash Bay, HV Wash Bay, UG Wash Bay)

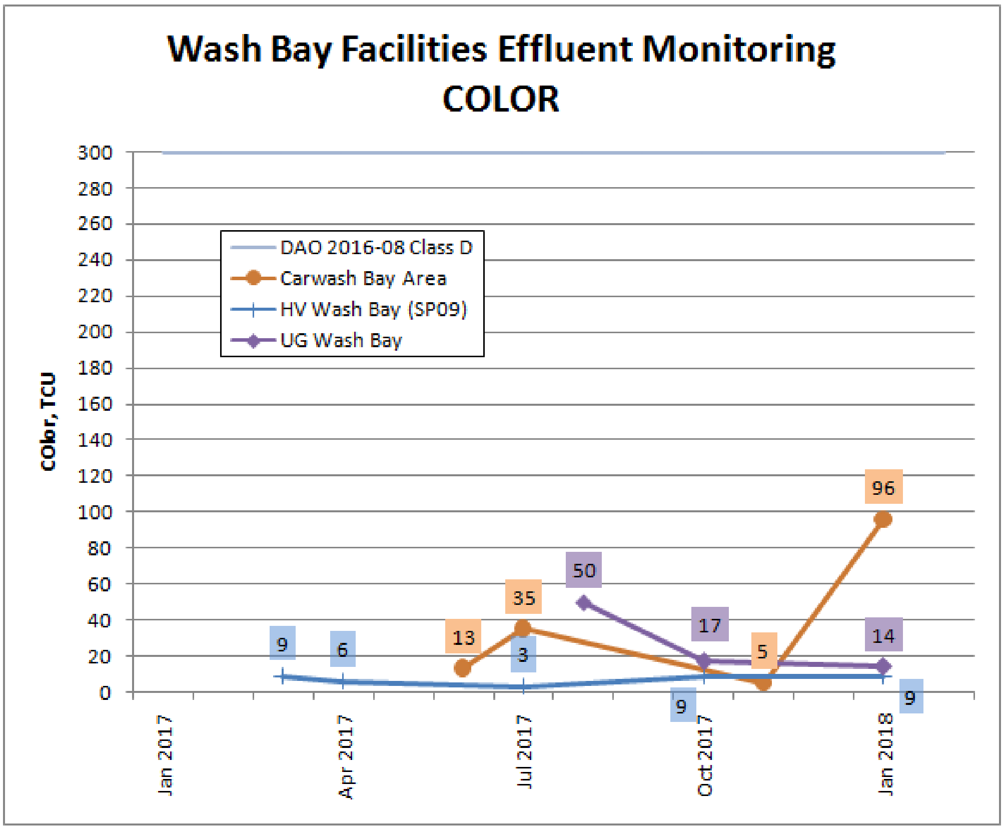


Figure 6-32: Wash Bay Facilities Effluent Monitoring Trend for Color (Carwash Bay, HV Wash Bay, UG Wash Bay)

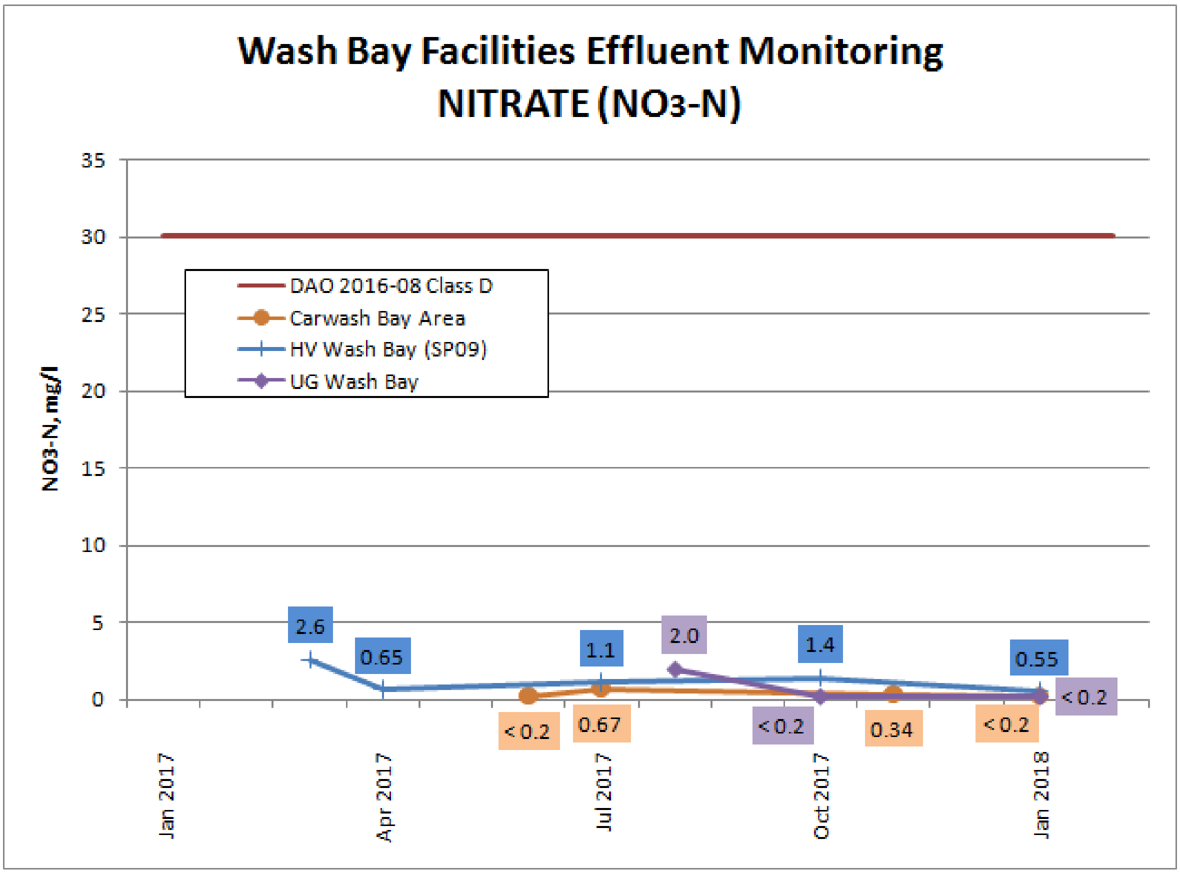


Figure 6-33: Wash Bay Facilities Effluent Monitoring Trend for Nitrates (NO3-N) (Carwash Bay, HV Wash Bay, UG Wash Bay)

6.1.2.2.1.4 Oil and Water Separators

Results of quarterly monitoring starting 4Q 2016 up to 1Q 2018 show no exceedances in DAO 2016-08 effluent standards for all parameters (refer to Table 6-12**,** Figure 6-35 to Figure 6-37) both for Fuel Farm OWS and Volatilization Pad OWS. It should be noted that there were no monitoring data yet for pH, lead and surfactants (for Volatilization Pad). It is therefore recommended that these parameters be included in parameters analyzed and reported in the SMR in compliance with the discharge permit conditions.

Table 6-12: Summary of Fuel Farm and Volatilization Pad OWS Effluent Monitoring Data

Discharge Outlet	Parameter	Monitoring Period	Effluent Standard Class D	No. of Data	Range	Mean	No. of Exceedances	Remarks
FUEL FARM	Required in the Discharge Permit							
	pH*	4Q 2016 – 1Q 2018	5.5 – 9.5[b]	6	7.35 – 8.35	7.73	0	Compliant (Figure 6-34)
	Total Suspended Solids* (mg/l)	4Q 2016 – 1Q 2018	150[b]	6	4 – 108	30.6	0	Compliant (Figure 6-35)
	Oil and Grease* (mg/l)	3Q 2017 – 1Q 2018	15[b]	6	0.7 – 8.2	2.4	0	Compliant (Figure 6-36)
	Additional parameters analyzed							
	BOD (mg/l)	3Q 2017 – 1Q 2018	120 [b]	6	3.0 – 31.0	12.0	0	Compliant. (Figure 6-37)
VOLATILIZATION PAD**	Required in the Discharge Permit							
	pH*	4Q 2016 – 1Q 2018	5.5 – 9.5[b]	2	7.35 – 8.21	7.78	0	Compliant (Figure 6-34)
	Total Suspended Solids* (mg/l)	4Q 2016 – 1Q 2018	150 [b]	2	3 - 7	5	0	Compliant (Figure 6-35)
	Oil and Grease* (mg/l)	3Q 2017 – 1Q 2018	15[b]	2	0.9 – 1.1	1.0	0	Compliant (Figure 6-36)
	Lead (mg/l)	4Q 2016 – 1Q 2018	0.2[b]					No monitoring data
	Surfactants (MBAS) (mg/l)	4Q 2016 – 1Q 2018	30[b]					No monitoring data
	Additional parameters analyzed							
	BOD (mg/l)	3Q 2017 – 1Q 2018	120 [b]	2	1.9 – 4.0	3.0	0	Compliant. (Figure 6-37)

(a) DAO 90-35 Class D
(b) DAO 2016-08 Effluent Standard for Class D
* Significant effluent quality parameters for oil and water separators as per DAO 2016-08
** No discharge (4Q 2016; 2Q, 3Q 2017; 1Q 2018)

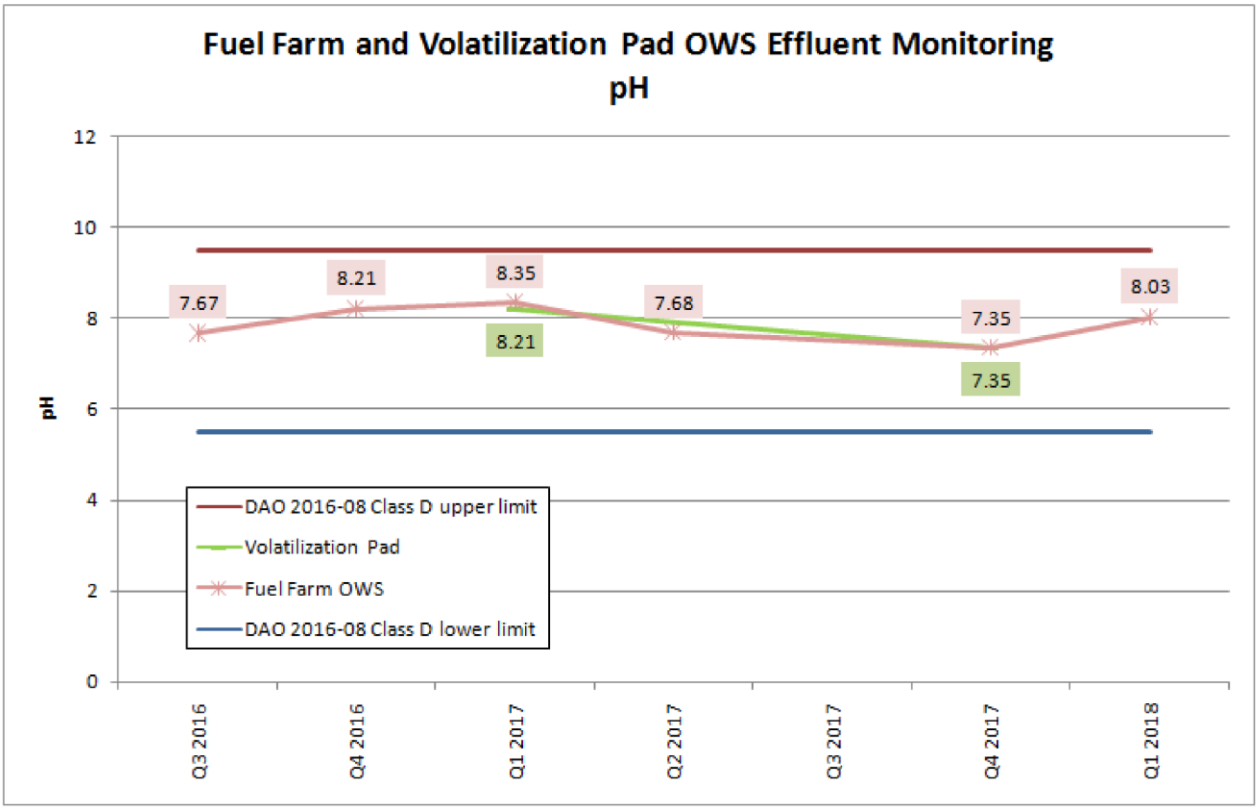


Figure 6-34: Fuel Farm and Volatilization Pad OWS Effluent Monitoring Trend for pH

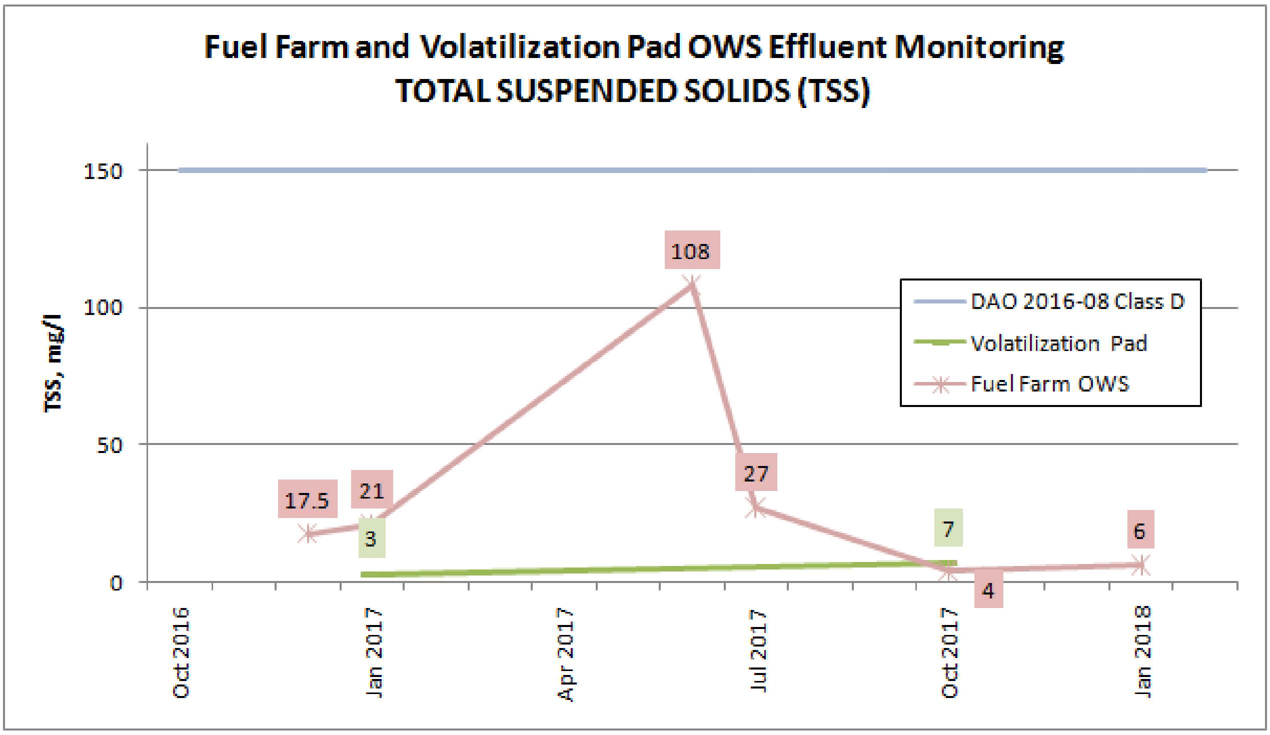


Figure 6-35: Fuel Farm and Volatilization Pad OWS Effluent Monitoring Trend for TSS

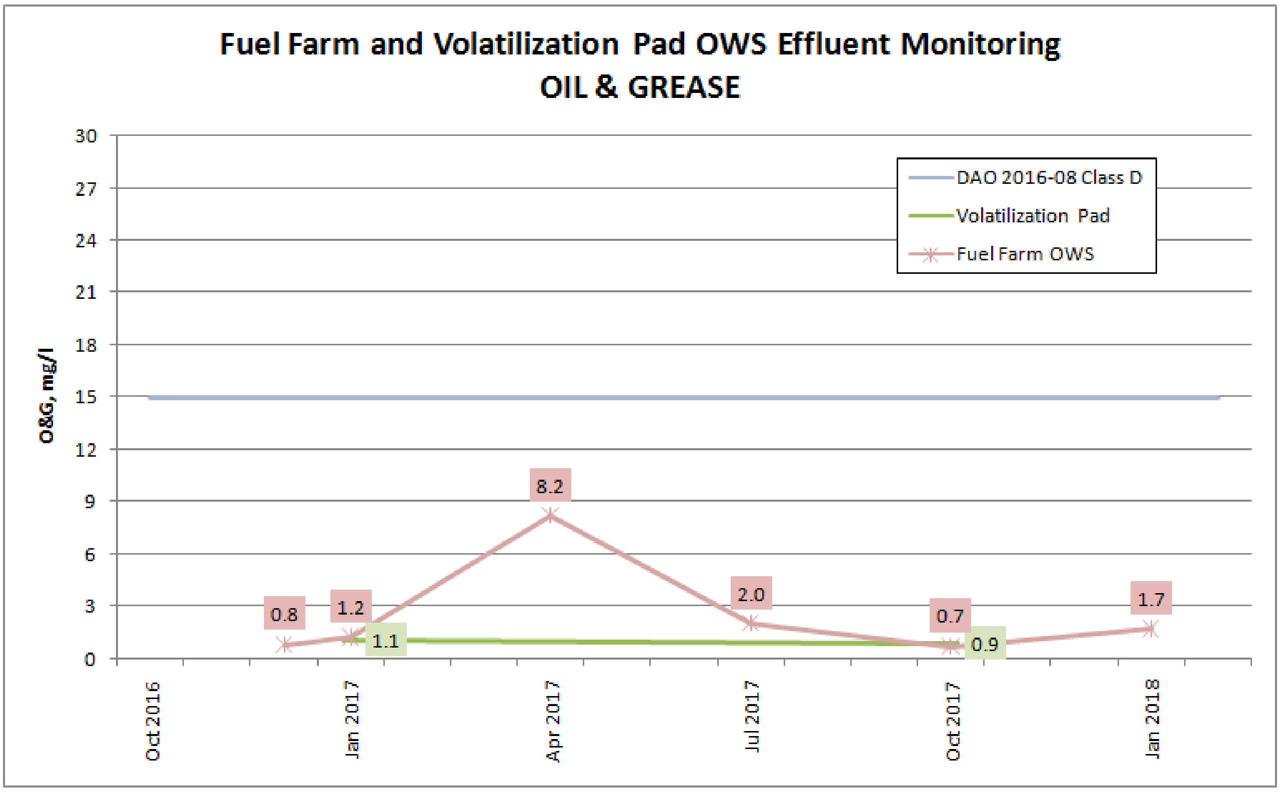


Figure 6-36: Fuel Farm and Volatilization Pad OWS Effluent Monitoring Trend for Oil and Grease

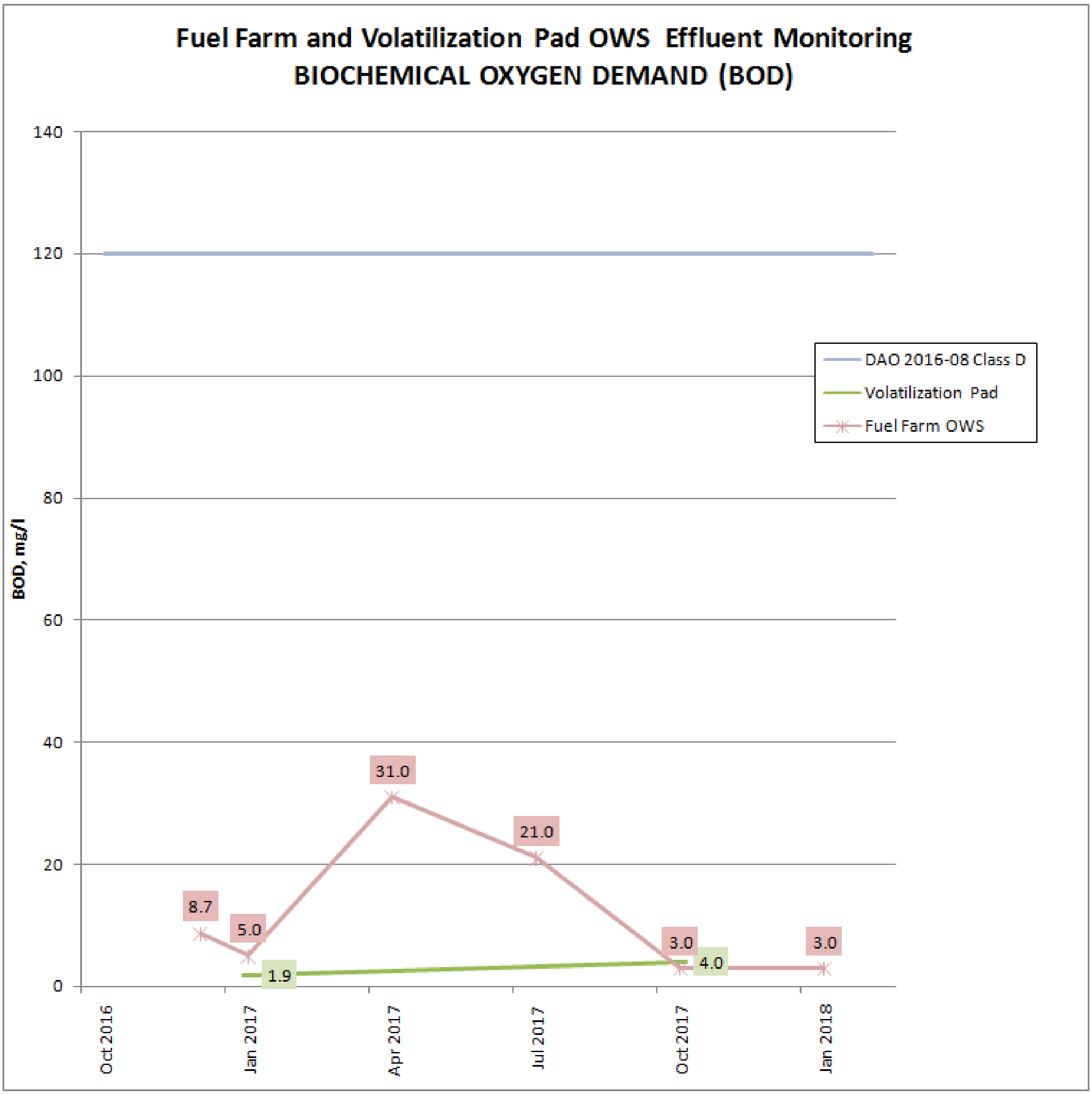


Figure 6-37: Fuel Farm and Volatilization Pad OWS Effluent Monitoring Trend for BOD

6.1.2.2.1.5 SEDIMENT PONDS

Results of effluent monitoring for SP06 are presented in Table 6-13. Effluent quality for all parameters complies with the DAO 2016-08 effluent standards. It is also recommended that parameters pH and oil and grease be analyzed and reported in the SMR in compliance with the discharge permit conditions for SP06.

For SP09, results are presented under HV Wash Bay (SP09) under the Wash Bay Facilities Section (Table 6-10, Figure 6-25 to Figure 6-33). SP09 sediment ponds were initially constructed to manage water from UG, LV/HV wash bay and surface runoff from Skyway 1. However, on December 2016 UG water discharge was diverted and only water from the LV/HV wash bay and surface runoff is now directed to these ponds. The water goes through a series of over topping walls and is treated with Magnasol, before release into the Dinauyan River. (OGPI Water Management Plan, 2018)

Table 6-13: Silt Pond 06 (SP06) Effluent Monitoring Data

Parameter	Monitoring Period		Effluent Standard (DAO 2016-08) Class D	Remarks
Required in the Discharge Permit	4Q 2017	1Q 2018		
pH	8.35	7.94	5.5 – 9.5	Compliant
Total Suspended Solids (mg/l)	119	2	150	Compliant
Oil and Grease (mg/l)			15	No monitoring data. To be included in the next monitoring of OGPI
Additional parameters analyzed				
BOD (mg/l)	5	3	120	Compliant
Cadmium (mg/l)	<0.01	<0.01	0.02	Compliant
Arsenic (mg/l)	0.054	0.039	0.08	Compliant
Lead (mg/l)	<0.05	<0.05	0.2	Compliant
Mercury (mg/l)	<0.001	<0.001	0.008	Compliant
Iron (mg/l)	2.9	0.34	35	Compliant
Zinc (mg/l)	<0.01	<0.01	8	Compliant
Dissolved Copper (mg/l)	<0.01	<0.01	0.08	Compliant
Nitrate as NO_3-N (mg/l)	2.4	2.9	30	Compliant
Sulfate (mg/l)	323	296	1,000	Compliant
Free Cyanide (mg/l)	<0.01	<0.01	0.4	Compliant

6.1.2.2.2 Surface Water Quality Monitoring

Didipio Mine monitors a total of fifteen (15) surface water quality stations which are all being reported in their quarterly Self-Monitoring Report (SMR) and semi-annual Compliance Monitoring Report (CMR) submitted to the DENR. To facilitate impact assessment using watershed approach, the15 surface water quality stations were grouped into three (3) categories: stations upstream of the project site (unaffected by the project), stations at surface water bodies directly receiving the effluent/runoff from the project area, and stations downstream of the project site.

Results of surface water quality monitoring of OGPI from 1st quarter 2013 to 1st quarter 2018 are presented in Table 6-14 and Figure 6-38 to Figure 6-88.

Table 6-14: Highlights of Surface Water Quality Monitoring

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
Primary Parameters							
BOD (mg/l) Figure 6-38 to Figure 6-40	1Q 2013 – 1Q 2018 DAO 90-34 = 10 DAO 2016-08 = 15	SWS 1 Range: <1.0 – 3.9 Mean: 1.64 SWS 15 Range: <1.0 – 4.6 Mean: 2.67 SWS 16 Range: <1.0 – 3.9 Mean: 2.47	SWS DP-Up Range: <1.0 – 2.2 Mean: 1.40 SWS DP-Down Range: <1.0 – 3.4 Mean: 1.38 SWS 12 Range: <1.0 – 6.9 Mean: 2.48	SWS 13 Range: <1.0 – 3.4 Mean: 1.82 SWS 14 Range: <1.0 – 8.4 Mean: 2.78 SWS 17 Range: <1.0 – 4.6 Mean: 2.04	SWS 18 Range: 1.1 – 6.9 Mean: 2.80 SWS 19 Range: <1.0 – 3.9 Mean: 1.9 SWS 20 Range: <1.0 – 4.3 Mean: 2.12	SWS 21 Range: <1.0 – 4.5 Mean: 2.40 SWS 22 Range: <1.0 – 4.1 Mean: 1.96 SWS 23 Range: <1.0 – 4.2 Mean: 2.22	Ambient BOD levels in all surface water stations were within the guideline value for DAO 2016-08 Class D waters.
Chloride (mg/l) Figure 6-41 to Figure 6-43	3Q 2016 – 1Q 2018 DAO 2016-08 = 400	SWS 1 Range: 0.89 – 2.20 Mean: 1.68 SWS 15 3Q 2016: 1.8 SWS 16 3Q 2016: 1.8	SWS DP-Up Range: 3.2– 10.52 Mean: 5.09 SWS DP-Down Range: 2.78 – 24.0 Mean: 7.07 SWS 12 Range: 24.2 – 94.9 Mean: 50.68	SWS 13 Range: <0.5 – 3.9 Mean: 1.71 SWS 14 Range: 11.0 – 60.1 Mean: 24.05 SWS 17 Range: 3.9 – 30.8 Mean: 17.40	SWS 18 Range: No sampling Mean: n/a SWS 19 Range: 1.6 – 2.4 Mean: 2.0 SWS 20 Range: No sampling Mean: n/a	SWS 21 Range: 8.2 – 22.0 Mean: 13.43 SWS 22 Range: 2.2 – 18.7 Mean: 6.40 SWS 23 Range: 1.3 – 13.2 Mean: 7.48	Ambient chloride concentrations were well within guideline values for DAO 2016-08 Class D waters. Results show that chloride levels were relatively higher at SWS 12 after SWS DP-Down where effluent coming from different pollution control facilities of OGPI is discharged which could be an indication that the Project may have contributed to the increase in chloride concentration. It should be noted however that ambient concentrations of chloride in all surface water bodies are still very low and are well within the DAO 2016-08 Class D guideline value. In addition, chloride concentrations analyzed from the WTP/TSF effluent were also well within the effluent standard (no exceedances).

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
Color (TCU) Figure 6-44 to Figure 6-46	3Q 2016 – 1Q 2018 DAO 2016-08 = 150	SWS 1 Range: 1 – 15 Mean: 6.4 SWS 15 3Q 2016: 6 SWS 16 3Q 2016: 4	SWS DP-Up Range: 1– 6 Mean: 2.9 SWS DP-Down Range: 1 – 4 Mean: 2.1 SWS 12 Range: 1– 6 Mean: 3.1	SWS 13 Range: 6 – 20 Mean: 11.9 SWS 14 Range: <1 – 8 Mean: 4.1 SWS 17 Range: <1 – 8 Mean: 4.6	SWS 18 *No sampling* SWS 19 Range: 4 – 10 Mean: 7.0 SWS 20 *No sampling*	SWS 21 Range: 4 – 10 Mean: 6.3 SWS 22 Range: 4 – 55 Mean: 19.3 SWS 23 Range: 4 – 24 Mean: 11.0	Color units were relatively higher along Camgat-Surong downstream (SWS 13), located downstream of small scale mining operations and OGPI Carwash Bay Discharge. Color units at SWS 14 slightly decrease, in general, probably due to dilution after Camgat-Surong (SWS 13) confluence with Dinauyan River (SWS 12). All samples collected in all stations during quarterly monitoring were within Class D guideline for color.
Dissolved Oxygen (mg/l) (minimum) Figure 6-47 to Figure 6-49	1Q 2015 – 3Q 2015 DAO 2016-08 = 3	SWS 1 Range: 5.4 – 7.63 Mean: 6.04 SWS 15 Range: 4.2 – 5.60 Mean: 4.84 SWS 16 Range: 5.3 – 6.44 Mean: 5.79	SWS DP-Up Range: 5.29 – 7.46 Mean: 6.38 SWS DP-Down Range: 5.2 – 6.80 Mean: 6.00 SWS 12 Range: 4.4 – 7.14 Mean: 5.67	SWS 13 Range: 4.6 – 6.92 Mean: 5.49 SWS 14 Range: 4.4 – 7.34 Mean: 5.62 SWS 17 Range: 4.4 – 7.40 Mean: 5.49	SWS 18 2Q 2015: 4.89 SWS 19 2Q 2015: 6.11 SWS 20 2Q 2015: 4.99	SWS 21 2Q 2015: 5.10 SWS 22 2Q 2015: 6.38 SWS 23 2Q 2015: 6.41	Dissolved oxygen levels in all stations were above the minimum guideline value for Class D waters. OGPI monitors DO on a daily or weekly basis for stations upstream of the Project and stations directly impacted by the Project (receiving water bodies). However, results were not reported in the quarterly SMRs or in the semi-annual CMRs. Since DO is considered as a primary water quality parameter, it is recommended that a summary (range, mean) of DO monitoring be included in the submitted reports to the DENR.
Total Coliform (MPN/100ml) Figure 6-50 to Figure 6-52	1Q 2013 – 1Q 2015 DAO 90-34 Class D = No guideline value DAO 90-34 Class C = 5,000	SWS 1 Range: 49 – 7,000 Mean: 1,591 SWS 15 Range: 2 – 9,200 Mean: 3,104 SWS 16	SWS DP-Up Not yet monitored SWS DP-Down Not yet monitored	SWS 13 Range: 240 – 92,000 Mean: 18,920 SWS 14 Range: 540 – 54,000 Mean: 9,938	SWS 18 Range: 23 – 17,000 Mean: 7,291 SWS 19 Range: 49 – 5,400 Mean: 1,510	SWS 21 Range: 1,600 – 390,000 Mean: 59,475 SWS 22 Range: 110 – 24,000 Mean: 3,575	There is no guideline value for Total Coliform count for Class D waters (DAO 90-34). For comparison purposes, results were compared to Class C guidelines. Almost all SW stations exhibited very high Total Coliform counts (relative to DAO 90-34 Class C guideline value = 5,000 MPN/100ml) except SWS 16 (Surong Creek, maximum recorded value =1,600 MPN/100 ml), SWS 12 (Dinauyan River, maximum recorded

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
	(for comparison purposes)	Range: 240 – 1,600 Mean: 920	SWS 12 Range: 1.8 – 1,600 Mean: 545	SWS 17 Range: 2 – 92,000 Mean: 20,150	SWS 20 Range: 33 – 16,000 Mean: 6,131	SWS 23 Range: 240 – 16,000 Mean: 3,892	value =1,600 MPN/100 ml) and SWS 19 (Alimit Creek, maximum recorded value =5,400 MPN/100 ml). Maximum recorded Total Coliform count in other SW stations ranged from 7,000 to as high as 390,000 MPN/100ml. Monitoring of Total Coliform in the effluent from STPs for the period 3Q 2014 – 2Q 2016 also revealed extremely high Total Coliform counts reaching values as high as 16,000,000 MPN/100ml for STP MSA (upstream of SWS 17) and 5,400,000 MPN/100 ml for STP Plant (discharges into Dinauyan River SWS 12). High Total Coliform counts can be generally observed along Camgat-Surong Creek down to Didipio River downstream. Possible contributors to the very high Coliform counts include the small scale mine operations discharging into Camgat-Surong Creek, OGPI's discharge of effluent coming from the STPs and/or sampling methodology/sample holding time since during these monitoring periods, samples were taken to SGS laboratory which is very far from the Project Site.
Fecal Coliform (MPN/100ml) Figure 6-53 to Figure 6-55	3Q 2016 – 1Q 2018 DAO 2016-08 = 400	SWS 1 Range: 23.3 – 920 *(3Q2016 – 1Q2017)* >2419.6 *(2Q2017-1Q2018)* SWS 15 3Q 2016: 9,200	SWS DP-Up 3.1 – 3,500,000 *(3Q2016 – 1Q2017)* >2419.6 *(2Q2017-1Q2018)* SWS DP-Down 100.8– 920 *(3Q2016 – 1Q2017)* >2419.6	SWS 13 816.4 – 5,400 *(3Q2016 – 1Q2017)* >2419.6 *(2Q2017-1Q2018)* SWS 14 172 – 24,000 *(3Q2016 – 1Q2017)* >2419.6	SWS 18 *No sampling* SWS 19 240 – 248.1 *(3Q2016 – 1Q2017)*	SWS 21 240 – 1,986.3 *(3Q2016 – 1Q2017)* >2419.6 *(2Q2017)* SWS 22 130 – 920.8	Exceedances in Fecal Coliform count as per DAO-2016-08 guideline value for Class D were recorded in all stations except in SWS 19, Alimit River (for its two quarterly monitoring data). Effluent monitoring from 3Q2016 - 1Q2018 revealed low Fecal Coliform counts (most samples had below MDL) for both STPs of OGPI but with one recorded exceedance in effluent standard in

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
		SWS 16 3Q 2016: 1,400	*(2Q2017-1Q2018)* SWS 12 7.5 – 1732.9 *(3Q2016 – 2Q2017)* >2419.6 *(3Q2017-1Q2018)*	*(2Q2017-1Q2018)* SWS 17 1,600 *(3Q2016 – 4Q2016)* >2419.6 *(1Q2017-1Q2018)*	SWS 20 *No sampling*	*(3Q2016 – 1Q2017)* >2419.6 *(2Q2017)* SWS 23 79 – 980.4 *(3Q2016 – 1Q2017)* >2419.6 *(2Q2017)*	STP MSA for the 3Q 2016 monitoring period)1,700 MPN/100ml > 800 MPN/100ml effluent standard). Downstream of STP MSA is SWS 17.
Nitrate (mg/l) Figure 6-56 to Figure 6-58	1Q 2016 – 1Q 2018 DAO 2016-08 = 15	SWS 1 Range: <0.2 – 0.98 Mean: 0.44 SWS 15 Range: <0.2 – 0.32 Mean: 0.24 SWS 16 Range: <0.2 – 0.299 Mean: 0.23	SWS DP-Up Range: 0.23 – 7.30 Mean: 3.07 SWS DP-Down Range: 0.88 – 6.60 Mean: 3.15 SWS 12 Range: 1.2 – 9.20 Mean: 4.18	SWS 13 Range: <0.2 – 2.60 Mean: 0.57 SWS 14 Range: 0.27 – 9.6 Mean: 2.58 SWS 17 Range: <0.2 – 4.30 Mean: 1.90	SWS 18 Range: 1.91 – 3.15 Mean: 2.53 SWS 19 Range: <0.2 – 0.441 Mean: 0.31 SWS 20 Range: 1.76 – 3.2 Mean: 2.48	SWS 21 Range: 0.53 – 3.90 Mean: 1.79 SWS 22 Range: <0.2 – 0.7 Mean: 0.36 SWS 23 Range: 0.42 – 2.50 Mean: 1.22	Nitrate levels in all surface water samples from all SW stations were within DAO 2016-08 Class D guidelines. Nitrate levels in stations located along receiving water bodies of the Project were relatively higher than those stations upstream and farther downstream of the Project but still very low when compared to the Class D guideline value.
pH (Range) Figure 6-59 to Figure 6-61	2Q 2013 – 1Q 2018 DAO 90-34: 6 - 9 DAO 2016-08: 6 - 9	SWS 1 Range: 6.58 – 8.68 Mean: 7.69 SWS 15 Range:7.06 – 8.47 Mean: 7.86	SWS DP-Up Range: 7.09 – 8.55 Mean: 7.74 SWS DP-Down Range: 7.13 – 8.30	SWS 13 Range: 6.50 – 8.82 Mean: 7.76 SWS 14 Range: 6.88 – 8.45	SWS 18 Range: 6.60 – 8.23 Mean: 7.39 SWS 19 Range: 6.60 – 8.64	SWS 21 Range: 7.23 – 8.67 Mean: 7.83 SWS 22 Range: 7.25 – 8.71	Surface water pH in all stations were within the guideline range for Class D waters. Mean pH levels per station ranged from 7.39 – 7.94.

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
		SWS 16 Range: 7.1 – 8.58 Mean: 7.70	Mean: 7.81 SWS 12 Range: 7.05 – 8.58 Mean: 7.88	Mean: 7.82 SWS 17 Range: 6.74 – 8.44 Mean: 7.73	Mean: 7.74 SWS 20 Range: 6.70 – 8.51 Mean: 7.54	Mean: 7.91 SWS 23 Range: 7.34 – 8.84 Mean: 7.94	
Phosphate (mg/l) Figure 6-62 to Figure 6-64	3Q 2016 – 1Q 2018 DAO 2016-08 = 5	SWS 1 Range: 0.052 – 0.210 Mean: 0.103 SWS 15 3Q 2016: 0.270 SWS 16 3Q 2016: 0.045	SWS DP-Up Range: 0.038 – 0.107 Mean: 0.070 SWS DP-Down Range: 0.038 – 0.116 Mean: 0.075 SWS 12 Range: 0.031 – 0.200 Mean: 0.086	SWS 13 Range: 0.037 – 0.234 Mean: 0.108 SWS 14 Range: 0.037 – 0.146 Mean: 0.079 SWS 17 Range: 0.039 – 0.310 Mean: 0.110	SWS 18 *No sampling* SWS 19 Range: 0.215 – 0.226 Mean: 0.211 SWS 20 *No sampling*	SWS 21 Range: 0.118 – 0.180 Mean: 0.159 SWS 22 Range: 0.146 – 0.290 Mean: 0.179 SWS 23 Range: 0.117 – 0.240 Mean: 0.168	Phosphate levels in all surface water stations were all below the 5 mg/l Class D guideline limit. Readings ranged from 0.031 mg/l to 0.310 mg/l.
Total Suspended Solids (mg/l) Figure 6-65 to Figure 6-67	1Q 2013 – 1Q 2018 DAO 90-34 = no guideline DAO 2016-08 = 110	SWS 1 Range: <1 - 1030 Mean: 61.94 SWS 15 Range:7 – 18,340 Mean: 3,336 SWS 16 Range: 7 – 3,080 Mean: 443.56	SWS DP-Up Range: 2 - 85 Mean: 16 SWS DP-Down Range: 4 - 950 Mean: 116 SWS 12 Range: 5 – 1,328 Mean: 189	SWS 13 Range: 100 – 34,840 Mean: 2,834 SWS 14 Range: 60 – 1,923 Mean: 662 SWS 17 Range: 63 – 1,664 Mean: 453	SWS 18 Range: 58 – 2,875 Mean: 718 SWS 19 Range: <1 - 435 Mean:48 SWS 20 Range: 45 – 1,211 Mean: 340	SWS 21 Range: 7 - 929 Mean: 221 SWS 22 Range: 4 - 58 Mean: 23 SWS 23 Range: 18 - 464 Mean: 110	Exceedances in TSS guideline value for Class D waters were observed in all stations except in SWS DP-Up (along Dinauyan River) and SWS 22 (Diduyon River). Comparing the mean TSS levels per station, SWS DP-Up (16 mg/l), SWS 22 (23 mg/l), SWS 19 (48 mg/l, Alimit River) and SWS 1 (61.94 mg/l, Luminag 1 – control) exhibited mean TSS concentrations below 100 mg/l. Top three (3) stations with high TSS levels are SWS 15 (3,336 mg/l, Camgat Creek), SWS 13(2,834 mg/l, Camgat-Surong Creek), and SWS 18 (718 mg/l, Didipio

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
							downstream). Highest recorded quarterly reading was detected in SWS 15 with TSS=34,840 mg/l. It can be inferred from the results that one of the major contributors of TSS in surface waters is the small scale mine operations located upstream of the Project site which drains into Camgat Creek (SWS 15), then to Camgat-Surong Creek (SWS 13) down to SWS 14, SWS 17 and SWS 18 along Diduyon River. These stations exhibited relatively higher TSS levels compared to the results from other SW stations. In relation to effluent discharge of OGPI's pollution control structures, TSS levels in the effluent are generally low with mean TSS levels per station ranging from 5 mg/l to 69 mg/l. Exceedances in TSS Class D effluent standard (150 mg/l) were observed STP Plant Site TSS = 208 mg/l (3Q 2015), Carwash Bay TSS = 214 mg/l (4Q 2015) and HV Wash Bay (SP09) TSS = 192 mg/l (1Q 2016).
Secondary Parameters - Inorganics							
Ammonia as NH_3-N (mg/l) Figure 6-68 to Figure 6-70	1Q 2016 – 1Q 2018 DAO 2016-08 = 0.75	SWS 1 Range: 0.036 – 0.260 Mean: 0.127 SWS 15 Range:0.043 – 0.163 Mean: 0.090 SWS 16	SWS DP-Up Range: 0.017 – 0.330 Mean: 0.132 SWS DP-Down Range: 0.014 – 0.400 Mean: 0.146 SWS 12	SWS 13 Range: 0.046 – 0.560 Mean: 0.223 SWS 14 Range: <0.01 – 0.800 Mean: 0.304 SWS 17	SWS 18 Range: <0.01 – 0.023 Mean: 0.017 SWS 19 Range: <0.01 – 0.380 Mean:0.156 SWS 20	SWS 21 Range: 0.016 – 0.500 Mean: 0.243 SWS 22 Range: <0.01 – 0.472 Mean: 0.208 SWS 23	Ammonia levels in surface waters upstream, within, and downstream of the Project Site follows the Class D guidelines during the entire monitoring period except for SWS 14 during 3Q 2017 monitoring with ammonia concentration = 0.80 mg/l. SWS 14 is located along Didipio River at a point directly after confluence of Dinauyan River and Camgat-Surong Creek. Potential significant point sources of ammonia are STP Plant Site (discharges to Dinauyan River) and

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
		Range: 0.030 – 0.062 Mean: 0.042	Range: <0.01 – 0.690 Mean: 0.200	Range: <0.01 – 0.46 Mean: 0.164	Range: <0.01 – 0.21 Mean: 0.110	Range: <0.01 – 0.550 Mean: 0.239	STP MSA (discharges to Didipio River in between SWS 14 and SWS 17). Exceedances in ammonia concentrations were observed from the effluent samples coming from these pollution control structures during 4Q 2016, and 3Q 2016 quarterly monitoring.
Sulfate (mg/l) Figure 6-71 to Figure 6-73	3Q 2016 – 1Q 2018 DAO 2016-08 = 500	SWS 1 Range: <0.1 – 7.5 Mean: 2.8 SWS 15 3Q 2016: 9.1 SWS 16 3Q 2016: 2.3	SWS DP-Up Range: 109.9 – 311.6 Mean: 170.5 SWS DP-Down Range: 138.1 – 551.8 Mean: 243.8 SWS 12 Range: 165.8 – 269.4 Mean: 226	SWS 13 Range: 3.6 – 272.8 Mean: 44 SWS 14 Range: 64.8 - 200 Mean: 117.8 SWS 17 Range: 16.2 – 150.3 Mean: 85.9	SWS 18 *No sampling* SWS 19 Range: 3.2 – 8.7 Mean: 6.0 SWS 20 *No sampling*	SWS 21 Range: 36.0 – 91.6 Mean: 70.5 SWS 22 Range: 8.0 – 10.4 Mean: 8.9 SWS 23 Range: 23.8 – 54.9 Mean: 39.7	Relatively higher sulfate levels were observed in stations within the project site specifically those located along Dinauyan River (SWS DP-Up, SWS DP-Down and SWS 12). Only one exceedance to the DAO 2016-08 sulfate guideline value was observed particularly in SWS DP-Down with sulfate = 551.8 mg/l during 1Q 2018 SW sampling.
Secondary Parameters - Metals							
Arsenic (mg/l) Figure 6-74 to Figure 6-76	1Q 2013 – 1Q 2018 DAO 90-34 = 0.01 DAO 2016-08 = 0.04	SWS 1 Range: <0.0010 – 0.0088 Mean: 0.0018 *18 out of 20 quarterly monitoring data is below MDL* SWS 15 Range: <0.0010 – 0.0111 Mean: 0.0056	SWS DP-Up Range: <0.0010 – 0.0021 Mean: 0.0019 *9 out of 12 quarterly monitoring data is below MDL* SWS DP-Down Range: <0.0010 – 0.0065	SWS 13 Range: <0.0010 – 0.0184 Mean: 0.0046 *Traces of As detected in 17 out of 19 quarterly monitoring SW samples* SWS 14	SWS 18 Range: 0.0013 – 0.0130 Mean: 0.0064 *Traces of As detected in 12 out of 13 quarterly monitoring SW samples* SWS 19	SWS 21 Range: 0.0010 – 0.0166 Mean: 0.0049 SWS 22 Range: <0.0010 – 0.0032 Mean: 0.0020 *8 out of 15 quarterly*	As values analyzed in the SW samples were all below the 0.04 DAO 2016-09 Class D guideline value. However, some of the results prior to 2016 exceeded the DAO 90-34 guideline value which is 0.01 mg/l. More than 50% of the monitoring data in stations SWS 1 (Luminag 1 - control), SWS 16 (Surong Creek), SWS DP-Up, SWS DP-Down, SWS 19 (Alimit River) and SWS 22 (Diduyon River).

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
		Traces of As detected in 7 out of 9 quarterly monitoring SW samples SWS 16 Range: <0.0010 – 0.0077 Mean: 0.0029 *6 out of 9 quarterly monitoring data is below MDL*	Mean: 0.0024 *7 out of 12 quarterly monitoring data is below MDL* SWS 12 Range: <0.0010 – 0.0377 Mean: 0.0141 *Traces of As detected in 18 out of 19 quarterly monitoring SW samples*	Range: 0.0024 – 0.0310 Mean: 0.0109 *Traces of As detected in all 20 quarterly monitoring SW samples* SWS 17 Range: <0.01 – 0.0320 Mean: 0.0088 *Traces of As detected in 18 out of 20 quarterly monitoring SW samples*	Range: <0.0010 – 0.0049 Mean: 0.0027 *9 out of 15 quarterly monitoring data is below MDL* SWS 20 Range: <0.0010 – 0.0106 Mean: 0.0048 *3 out of 18 quarterly monitoring data is below MDL*	*monitoring data is below MDL* SWS 23 Range: <0.0010 – 0.01 Mean: 0.0035 *Traces of As detected in 15 out of 16 quarterly monitoring SW samples*	
Cadmium (mg/l)	1Q 2013 – 1Q 2018 DAO 90-34 = 0.05 DAO 2016-08 = 0.01	SWS 1 All below MDL (<0.01) SWS 15 All below MDL (<0.01) SWS 16 All below MDL (<0.01)	SWS DP-Up All below MDL (<0.01) SWS DP-Down All below MDL (<0.01) SWS 12 All below MDL (<0.01)	SWS 13 All below MDL (<0.01) SWS 14 All below MDL (<0.01) SWS 17 All below MDL (<0.01)	SWS 18 All below MDL (<0.01) SWS 19 All below MDL (<0.01) SWS 20 All below MDL (<0.01)	SWS 21 All below MDL (<0.01) SWS 22 All below MDL (<0.01) SWS 23 All below MDL (<0.01)	Cadmium levels were below method detection limit (<0.01 mg/l) for all quarterly SW samples in all SW stations during the entire monitoring period (1Q 2013 – 1Q 2018).
Hexavalent Chromium (mg/l)	1Q 2013 – 1Q 2018	SWS 1 All below MDL (<0.001)	SWS DP-Up All below MDL (<0.001)	SWS 13 All below MDL (<0.001)	SWS 18 All below MDL (<0.001)	SWS 21 All below MDL (<0.001)	Chromium (hexavalent) levels were below method detection limit (<0.001 mg/l) for all quarterly SW samples in all SW stations during the

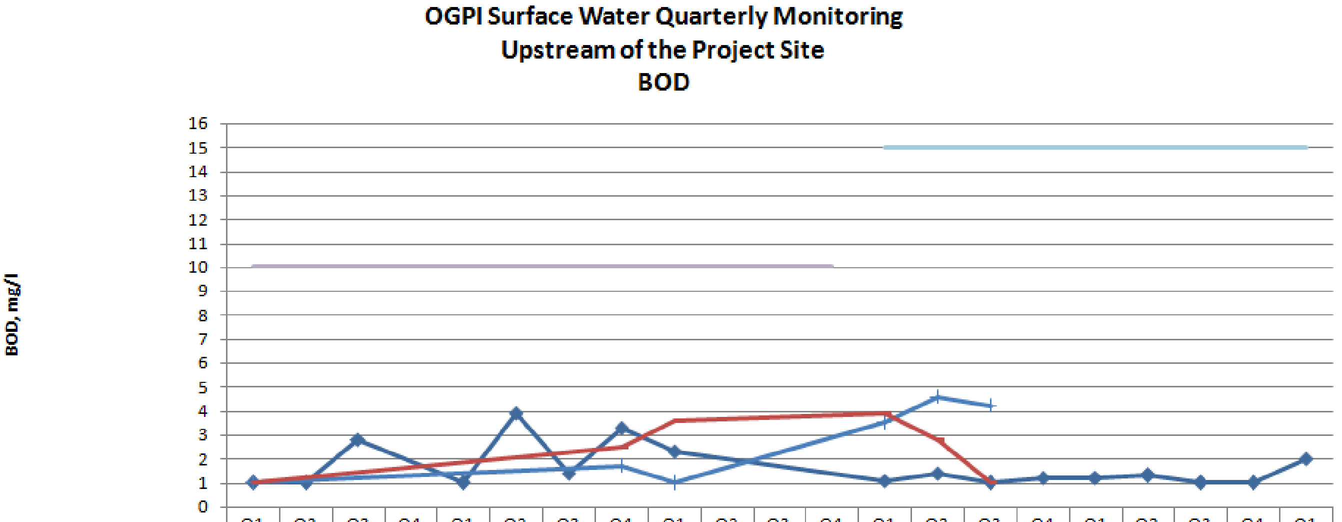
Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results: Stations upstream of the Project Site* *(unaffected by the Project)*	Summary of Results: Stations at surface water bodies receiving effluent/runoff from the Project		Summary of Results: Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		Remarks / Discussion
	DAO 90-34 = no guideline value DAO 2016-08 = 0.02	SWS 15 All below MDL (<0.001) SWS 16 All below MDL (<0.001)	SWS DP-Down All below MDL (<0.001) SWS 12 All below MDL (<0.001)	SWS 14 All below MDL (<0.001) SWS 17 All below MDL (<0.001)	SWS 19 All below MDL (<0.001) SWS 20 All below MDL (<0.001)	SWS 22 All below MDL (<0.001) SWS 23 All below MDL (<0.001)	entire monitoring period (1Q 2013 – 1Q 2018) except in SWS 13 (Camgat-Surong downstream) wherein 0.02 mg/l Cr^{6+} was detected in 2Q 2017.
Dissolved Copper (mg/l)	2Q 2013 – 4Q 2013 1Q 2017 – 1Q 2018 DAO 90-34 = no guideline value DAO 2016-08 = 0.04	SWS 1 All below MDL SWS 15 *No sampling* SWS 16 *No sampling*	SWS DP-Up All below MDL except Q1 2018 Cu=0.02 SWS DP-Down All below MDL SWS 12 All below MDL	SWS 13 Q3 2017 = 0.02 Q1 2018 = 0.024 SWS 14 All below MDL SWS 17 All below MDL	SWS 18 All below MDL (<0.001) SWS 19 All below MDL (<0.001) SWS 20 All below MDL (<0.001)	SWS 21 All below MDL SWS 22 All below MDL SWS 23 All below MDL	Dissolved Cu concentrations in all surface water samples comply with the Class D guidelines. Most of the samples had Cu levels below MDL.
Iron (mg/l) Figure 6-77 to Figure 6-79	1Q 2016 – 1Q 2018 DAO 2016-08 = 7.5	SWS 1 Range: <0.05 – 0.19 Mean: 0.07 SWS 15 Range: 35.98 – 397.5 Mean: 185.82 SWS 16 Range: 0.38 – 4.1 Mean: 1.7	SWS DP-Up Range: <0.05 – 0.63 Mean: 0.19 SWS DP-Down Range: <0.05 – 3.35 Mean: 0.53 SWS 12 Range: <0.05 – 1.15	SWS 13 Range: 2.56 – 67.92 Mean: 17.65 SWS 14 Range: 1.50 – 27.23 Mean: 7.67 SWS 17 Range: 1.42 – 21.62	SWS 18 Range: 4.41 – 8.95 Mean: 6.68 SWS 19 Range: <0.05 – 3.10 Mean: 0.90 SWS 20 Range: 3.31 – 4.7 Mean: 4.01	SWS 21 Range: 0.25 – 3.45 Mean: 1.17 SWS 22 Range: 0.23 – 2.92 Mean: 1.40 SWS 23 Range: 0.79 – 2.52	Exceedances were recorded in samples collected from SWS 15, SWS 13, SWS 14, SWS 17 and SWS 18. These stations are all located along Camgat Creek (SWS 15) down to Didipio River downstream (SWS 18). Note that the highest concentration of Fe was detected in SWS 15 2Q 2016 (397.5 mg/l) where small scale mine operations exist.

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
			Mean: 0.36	Mean: 5.43		Mean: 1.44	
Lead (mg/l)	1Q 2013 – 1Q 2018 DAO 90-34 = no guideline value DAO 2016-08 = 0.01	SWS 1 All below MDL (<0.05) SWS 15 All below MDL (<0.05) SWS 16 All below MDL (<0.05)	SWS DP-Up All below MDL (<0.05) SWS DP-Down All below MDL (<0.05) SWS 12 All below MDL (<0.05)	SWS 13 All below MDL (<0.05) SWS 14 All below MDL (<0.05) SWS 17 All below MDL (<0.05)	SWS 18 All below MDL (<0.05) SWS 19 All below MDL (<0.05) SWS 20 All below MDL (<0.05)	SWS 21 All below MDL (<0.05) SWS 22 All below MDL (<0.05) SWS 23 All below MDL (<0.05)	Monitoring data for Pb revealed that all surface water samples had Pb concentrations below MDL.
Mercury (mg/l) Figure 6-80 to Figure 6-82	1Q 2013 –1Q 2018 DAO 90-34 = 0.002 DAO 2016-08 = 0.004	SWS 1 Range: <0.0001 – 0.0035 Mean: 0.0011 *17 out of 20 quarterly monitoring data is below MDL* SWS 15 Range: <0.001 – 0.0148 Mean: 0.0024 *8 out of 9 quarterly monitoring data is below MDL* SWS 16 All below MDL	SWS DP-Up Range: <0.0001 – 0.0014 Mean: 0.0010 *13 out of 15 quarterly monitoring data is below MDL* SWS DP-Down Range: <0.0001 – 0.0012 Mean: 0.0010 *14 out of 15 quarterly monitoring data is below MDL* SWS 12 Range: <0.0001 – 0.0032	SWS 13 Range: <0.0001 – 0.0034 Mean: 0.0012 *15 out of 19 quarterly monitoring data is below MDL* SWS 14 Range: <0.0001 – 0.0025 Mean: 0.0012 *17 out of 20 quarterly monitoring data is below MDL* SWS 17 Range: <0.0001 – 0.0029	SWS 18 Range: <0.0001 – 0.0033 Mean: 0.0011 *13 out of 14 quarterly monitoring data is below MDL* SWS 19 Range: <0.0001 – 0.0027 Mean: 0.0011 *14 out of 15 quarterly monitoring data is below MDL* SWS 20 Range: <0.0001 – 0.0020	SWS 21 Range: <0.001 – 0.0024 Mean: 0.0011 *12 out of 15 quarterly monitoring data is below MDL* SWS 22 Range: <0.001 – 0.0019 Mean: 0.0011 *14 out of 15 quarterly monitoring data is below MDL* SWS 23 Range: <0.0001 – 0.0025	Highest recorded Hg concentration was from SWS 15 (downstream of small scale mine operations) with Hg = 0.0148 mg/l for the 3Q 2016. Only SWS 16 (Surong Creek) had Hg levels below MDL for the entire monitoring period. All the other SW stations had recorded traces of Hg but with at least 80% of the monitoring data below MDL. For the period 2013-2015, exceedances in DAO 90-34 Hg guideline value were recorded in stations SWS 13, SWS 17 and SWS 18. Values ranged from 0.0022 mg/l to 0.0033 mg/l exceeding the 0.002 mg/l guideline value (but still below the 0.004 mg/l Class D guideline as per DAO 2016-08).

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
			Mean: 0.0011 *18 out of 20 quarterly monitoring data is below MDL*	Mean: 0.0012 *16 out of 20 quarterly monitoring data is below MDL*	Mean: 0.0010 *12 out of 13 quarterly monitoring data is below MDL*	Mean: 0.0011 *14 out of 16 quarterly monitoring data is below MDL*	
Zinc (mg/l) Figure 6-83 to Figure 6-85	1Q 2016 –1Q 2018 DAO 2016-08 = 4	SWS 1 Range: <0.01 – 0.017 Mean: 0.011 *6 out of 9 quarterly monitoring data is below MDL* SWS 15 Range: 0.088 – 0.393 Mean: 0.200 SWS 16 Range: <0.01 – 0.023 Mean: 0.014	SWS DP-Up Range: <0.01 – 0.024 Mean: 0.013 *7 out of 9 quarterly monitoring data is below MDL* SWS DP-Down Range: <0.01 – 0.018 Mean: 0.011 *8 out of 9 quarterly monitoring data is below MDL* SWS 12 Range: <0.01 – 0.026 Mean: 0.014 *6 out of 9 quarterly monitoring data is below MDL*	SWS 13 Range: <0.01 – 0.073 Mean: 0.024 *3 out of 9 quarterly monitoring data is below MDL* SWS 14 Range: <0.01 – 0.688 Mean: 0.091 *5 out of 9 quarterly monitoring data is below MDL* SWS 17 Range: <0.01 – 0.039 Mean: 0.017 *4 out of 9 quarterly monitoring data is below MDL*	SWS 18 Range: 0.022 – 0.023 Mean: 0.023 SWS 19 Range: <0.01 – 0.029 Mean: 0.016 *2 out of 4 quarterly monitoring data is below MDL* SWS 20 Range: 0.018 – 0.026 Mean: 0.022	SWS 21 Range: <0.01 – 0.028 Mean: 0.015 *2 out of 6 quarterly monitoring data is below MDL* SWS 22 Range: <0.01 – 0.016 Mean: 0.012 *4 out of 6 quarterly monitoring data is below MDL* SWS 23 Range: <0.01 – 0.026 Mean: 0.017 *2 out of 6 quarterly monitoring data is below MDL*	All SW stations exhibited Zn levels below 4 mg/l compliant with the DAO 2016-08 Class D guideline.
Secondary Parameters - Organics							
Free Cyanide (mg/l)	1Q 2013 – 1Q 2018	SWS 1 2Q 2014 = 0.014	SWS DP-Up All below MDL	SWS 13 All below MDL	SWS 18 All below MDL	SWS 21 2Q 2014 = 0.01	All stations had free cyanide concentrations that comply with Class D guideline (<0.2 mg/l).

Parameter	Monitoring Period/ Water Quality Guideline (Class D)	Summary of Results					Remarks / Discussion
		Stations upstream of the Project Site* *(unaffected by the Project)*	Stations at surface water bodies receiving effluent/runoff from the Project		Stations downstream of the Project Site *(Approx. 2.4 - 4.6 km downstream of the Project Site)*		
	DAO 90-34 = no guideline value DAO 2016-08 = 0.2	All other data below MDL SWS 15 All below MDL SWS 16 All below MDL	SWS DP-Down All below MDL SWS 12 All below MDL	SWS 14 All below MDL SWS 17 All below MDL	SWS 19 2Q 2014 = 0.011 All other data below MDL SWS 20 All below MDL	All other data below MDL SWS 22 All below MDL SWS 23 All below MDL	
Oil and Grease (mg/l) Figure 6-86 to Figure 6-88	1Q 2013 – 1Q 2018 DAO 90-34 = 5 DAO 2016-08 = 5	SWS 1 Range: 0.41 – 1.6 Mean: 0.68 SWS 15 Range: <0.5 – 2.5 Mean: 1.11 SWS 16 Range: 0.44 – 1.2 Mean: 0.85	SWS DP-Up Range: <0.5– 1.4 Mean: 0.73 SWS DP-Down Range: <0.5 – 1.7 Mean: 0.72 SWS 12 Range: <0.5 – 1.3 Mean: 0.79	SWS 13 Range: <0.5 – 1.8 Mean: 0.78 SWS 14 Range: <0.5 – 2.4 Mean: 0.89 SWS 17 Range: <0.4 – 1.6 Mean: 0.82	SWS 18 Range: 0.43 – 2.3 Mean: 1.02 SWS 19 Range: 0.42 – 1.8 Mean: 0.88 SWS 20 Range: <0.4 – 2.1 Mean: 0.83	SWS 21 Range: <0.5 – 1.2 Mean: 0.79 SWS 22 Range: <0.5 – 1.5 Mean: 0.86 SWS 23 Range: <0.4 – 1.8 Mean: 0.92	All stations exhibited oil and grease concentrations that comply with Class D guideline (<5 mg/l).
Surfactants (MBAS) (mg/l)	4Q 2014, 3Q2016 – 1Q 2018 DAO 90-34 = no guideline value DAO 2016-08 = 3	SWS 1 All below MDL (<0.1) SWS 15 All below MDL (<0.1) SWS 16 All below MDL (<0.1)	SWS DP-Up All below MDL (<0.1) SWS DP-Down All below MDL (<0.1) SWS 12 All below MDL (<0.1)	SWS 13 All below MDL (<0.1) SWS 14 All below MDL (<0.1) SWS 17 All below MDL (<0.1)	SWS 18 All below MDL (<0.1) SWS 19 3Q 2016 = 0.10 All other data below MDL (<0.1) SWS 20 All below MDL (<0.1)	SWS 21 All below MDL (<0.1) SWS 22 All below MDL (<0.1) SWS 23 All below MDL (<0.1)	Surfactants in all stations were below MDL (<0.1) except for SWS 19 during 3Q 2016 with MBAS=0.10 mg/l.

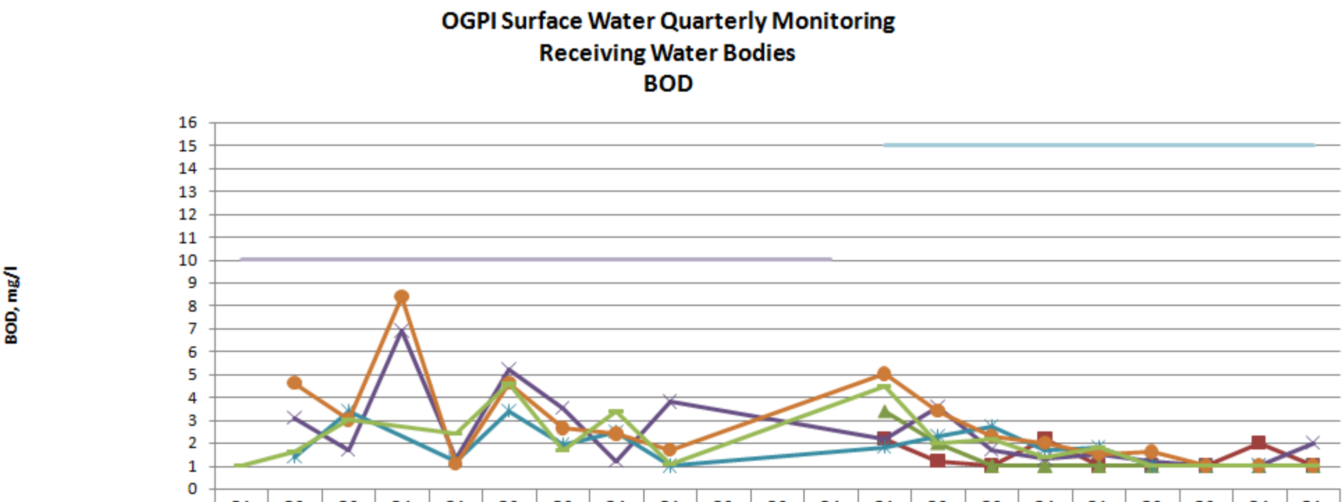
* Sampling at Stations SWS 15 and SWS 16 (upstream/outside the Project Area) was discontinued in 4Q 2016 due to conflict the small-scale mine operators discharging at Camgat-Surong Creek. OGPI was disallowed by the residents near the area to take surface water samples from Camgat and Surong Creeks.



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													15	15	15	15	15	15	15	15	15
DAO 90-34 Class D	10	10	10	10	10	10	10	10	10	10	10	10									
SWS 1	1	<1.0	2.8		<1.0	3.9	1.4	3.3	2.3				1.1	1.4	<1.0	1.20	1.20	1.3	1.0	1.0	2.0
SWS 15	<1.0							1.7	1.0				3.5	4.6	4.20						
SWS 16	<1.0							2.5	3.6				3.9	2.8	<1.0						

Monitoring Period

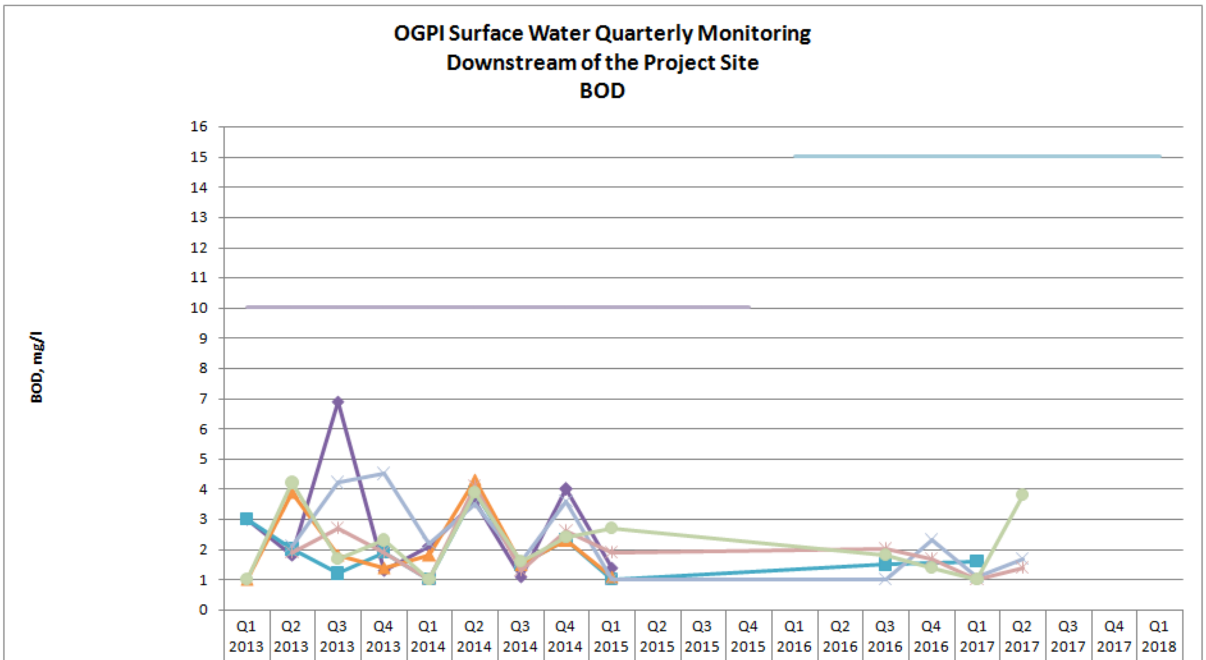
Figure 6-38: Plot of BOD monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													15	15	15	15	15	15	15	15	15
DAO 90-34 Class D	10	10	10	10	10	10	10	10	10	10	10	10									
SWS DP-Up													2.2	1.2	<1.0	2.20	<1.0	<1.0	<1.0	2	<1
SWS DP-Down													3.4	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SWS 12		3.1	1.7	6.9	1.3	5.2	3.53	1.2	3.8				2.2	3.6	1.70	1.30	1.5	1.2	<1.0	<1.0	2.0
SWS 13		1.4	3.4		1.2	3.4	1.9	2.5	1.0				1.8	2.3	2.70	1.70	1.8	<1.0	1.0	<1.0	<1
SWS 14		4.6	3.0	8.4	1.1	4.6	2.63	2.4	1.7				5	3.4	2.30	2.00	1.5	1.6	<1.0	1.0	1.0
SWS 17	1	1.6	3.0		2.4	4.6	1.7	3.4	1.1				4.5	2	2.20	1.40	1.8	<1.0	<1.0	<1.0	<1

Monitoring Period

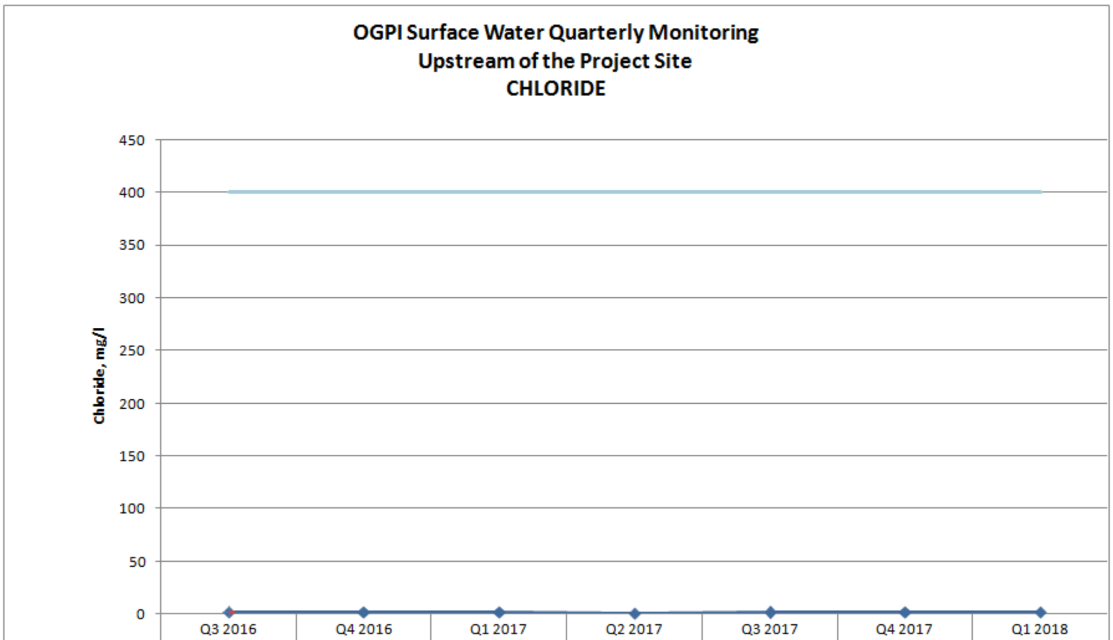
Figure 6-39: Plot of BOD monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													15	15	15	15	15	15	15	15	15
DAO 90-34 Class D	10	10	10	10	10	10	10	10	10	10	10	10									
SWS 18	3	1.8	6.9	1.3	2.1	3.6	1.1	4	1.4												
SWS 19	3	2.0	1.2	1.9	<1.0	3.9	1.5	2.3	1.0						1.50		1.6				
SWS 20	<1.0	3.9	1.8	1.4	1.8	4.3	1.5	2.3	1.1												
SWS 21		2.1	4.2	4.5	2.2	3.5	1.6	3.6	1.0						<1.0	2.30	1.1	1.7			
SWS 22		1.9	2.7	1.9	<1.0	4.1	1.3	2.6	1.9						2.00	1.70	<1.0	1.4			
SWS 23	1	4.2	1.7	2.3	1	3.9	1.6	2.4	2.7						1.80	1.40	<1.0	3.8			

Monitoring Period

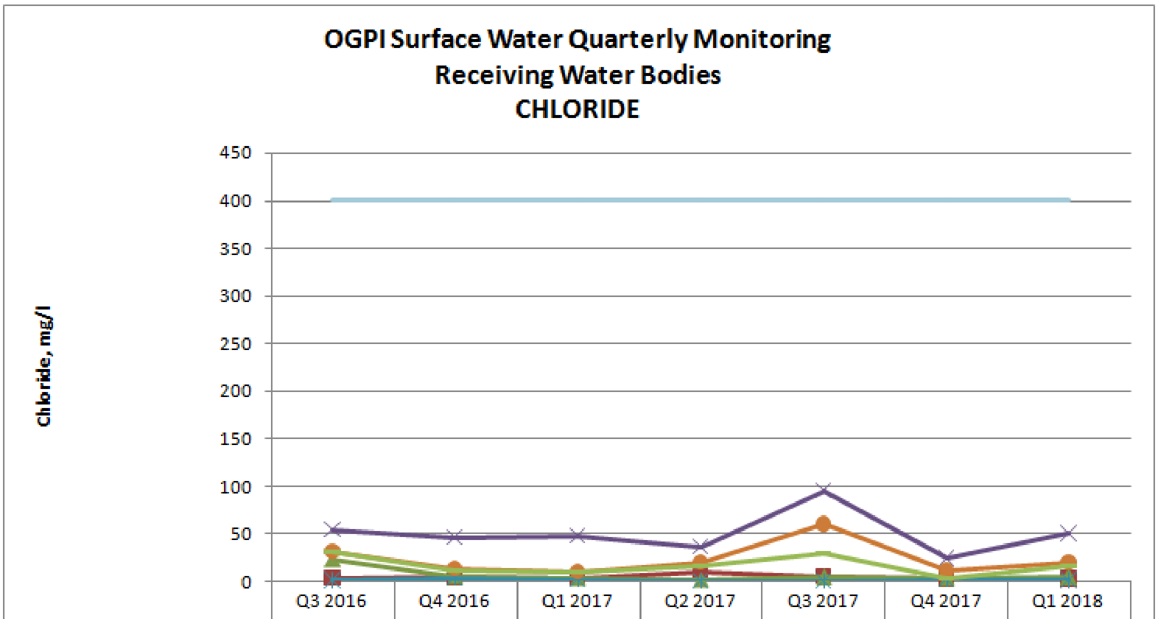
Figure 6-40: Plot of BOD monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	400	400	400	400	400	400	400
SWS 1	2.1	2.20	1.6	0.89	1.3	1.8	1.9
SWS 15	1.8						
SWS 16	1.8						

Monitoring Period

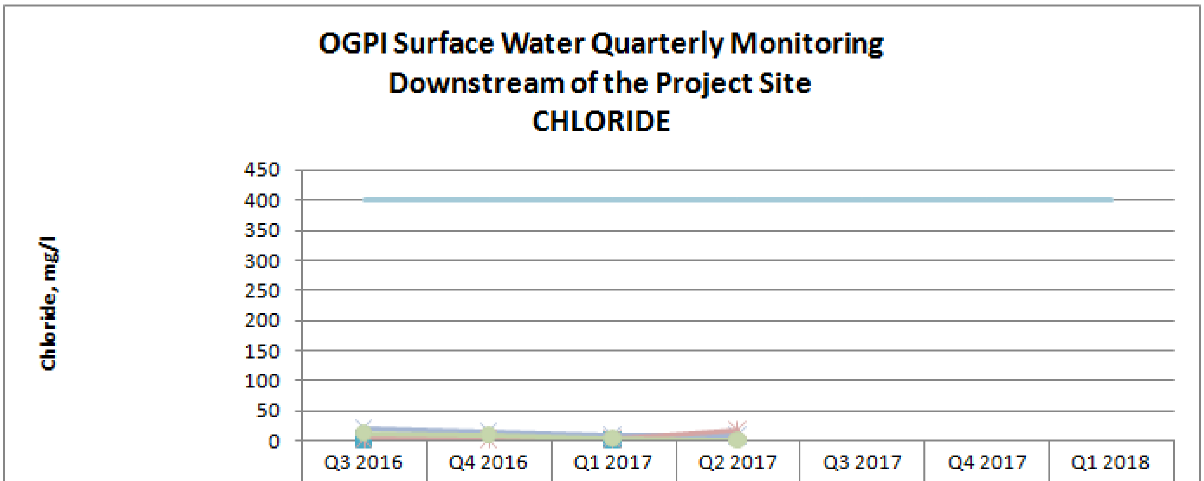
Figure 6-41: Plot of Chloride monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	400	400	400	400	400	400	400
SWS DP-Up	4.3	4.90	4.1	10.52	5.3	3.2	3.3
SWS DP-Down	24.0	6.10	3.9	2.78	4.6	3.5	4.6
SWS 12	54.9	46.70	47.7	36.13	94.9	24.2	50.2
SWS 13	1.5	3.90	2.3	0.6	<0.5	1.8	1.4
SWS 14	31.6	14.00	11.0	20.05	60.1	11.4	20.2
SWS 17	30.8	12.00	10.7	17.47	29.7	3.9	17.2

Monitoring Period

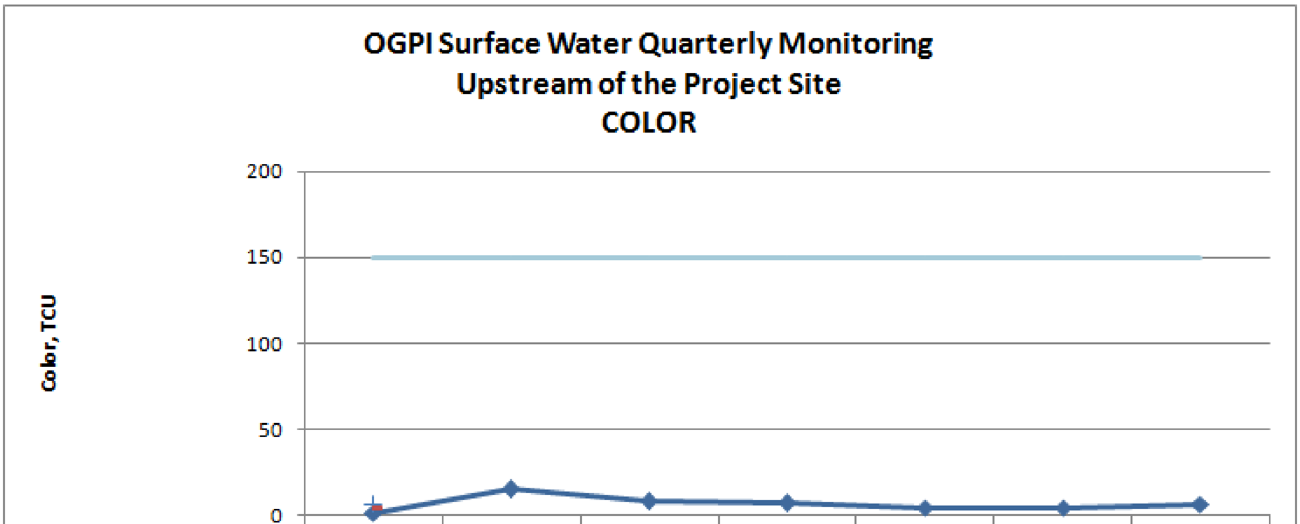
Figure 6-42: Plot of Chloride monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	400	400	400	400	400	400	400
SWS 18							
SWS 19	2.4		1.6				
SWS 20							
SWS 21	22.0	14.70	8.2	8.8			
SWS 22	2.4	2.20	2.3	18.7			
SWS 23	13.2	10.50	4.9	1.3			

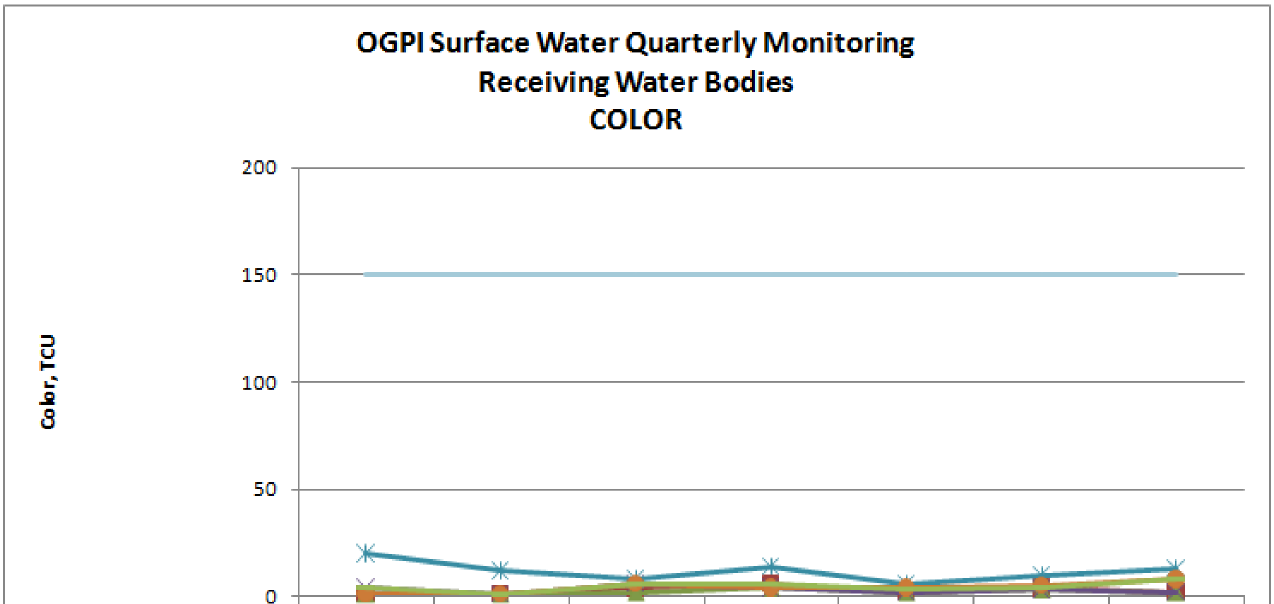
Monitoring Period

Figure 6-43: Plot of Chloride monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



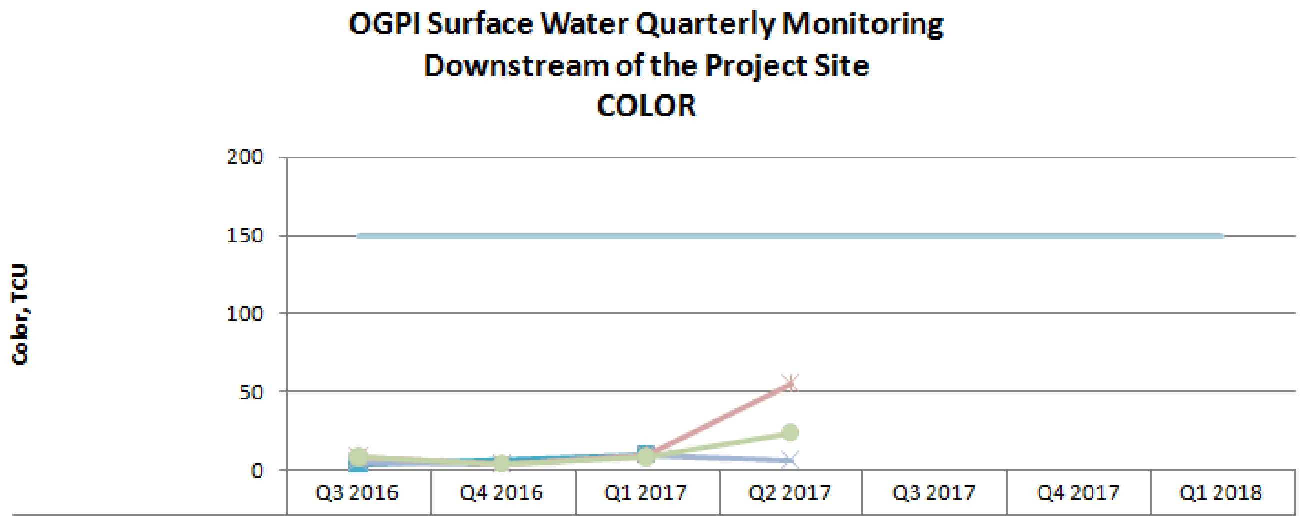
	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	150	150	150	150	150	150	150
SWS 1	1	15	8	7	4	4	6
SWS 15	6						
SWS 16	4						

Figure 6-44: Plot of Color monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	150	150	150	150	150	150	150
SWS DP-Up	1	1	4	6	2	4	2
SWS DP-Down	1	1	2	4	2	3	2
SWS 12	4	1	6	4	2	3	2
SWS 13	20	12	8	14	6	10	13
SWS 14	1	<1	6	4	4	5	8
SWS 17	4	<1	6	6	3	4	8

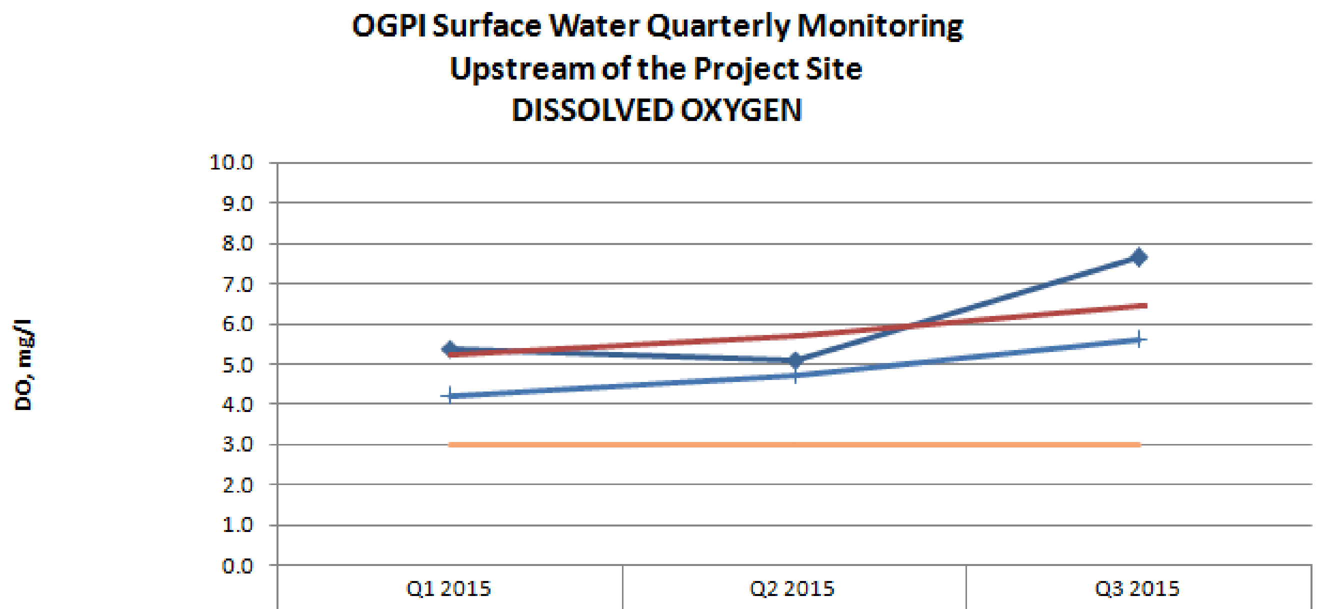
Figure 6-45: Plot of Color monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	150	150	150	150	150	150	150
SWS 18							
SWS 19	4		10				
SWS 20							
SWS 21	5	4	10	6			
SWS 22	8	4	10	55			
SWS 23	8	4	8	24			

Monitoring Period

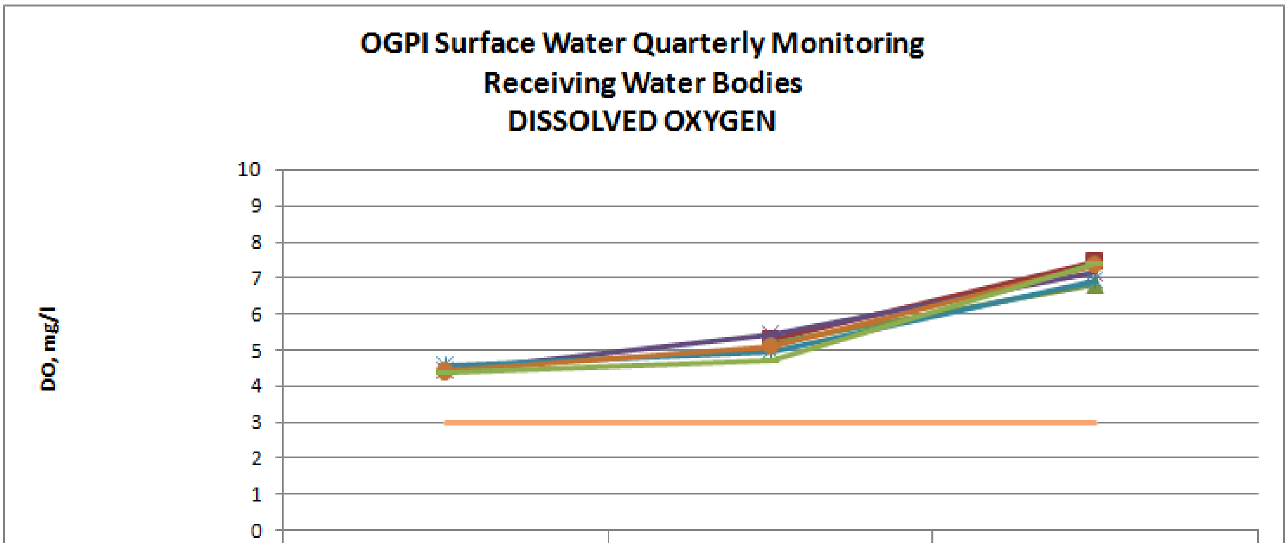
Figure 6-46: Plot of Color monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2015	Q2 2015	Q3 2015
SWS 1	5.4	5.11	7.63
SWS 15	4.2	4.71	5.60
SWS 16	5.3	5.68	6.44
DAO 90-34 Class D	3	3	3

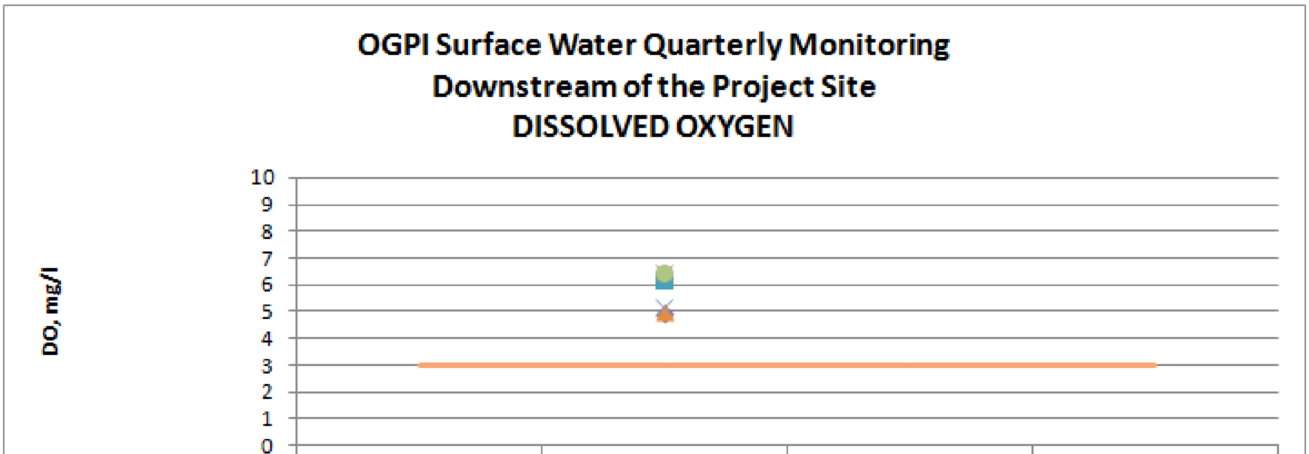
Monitoring Period

Figure 6-47: Plot of DO monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



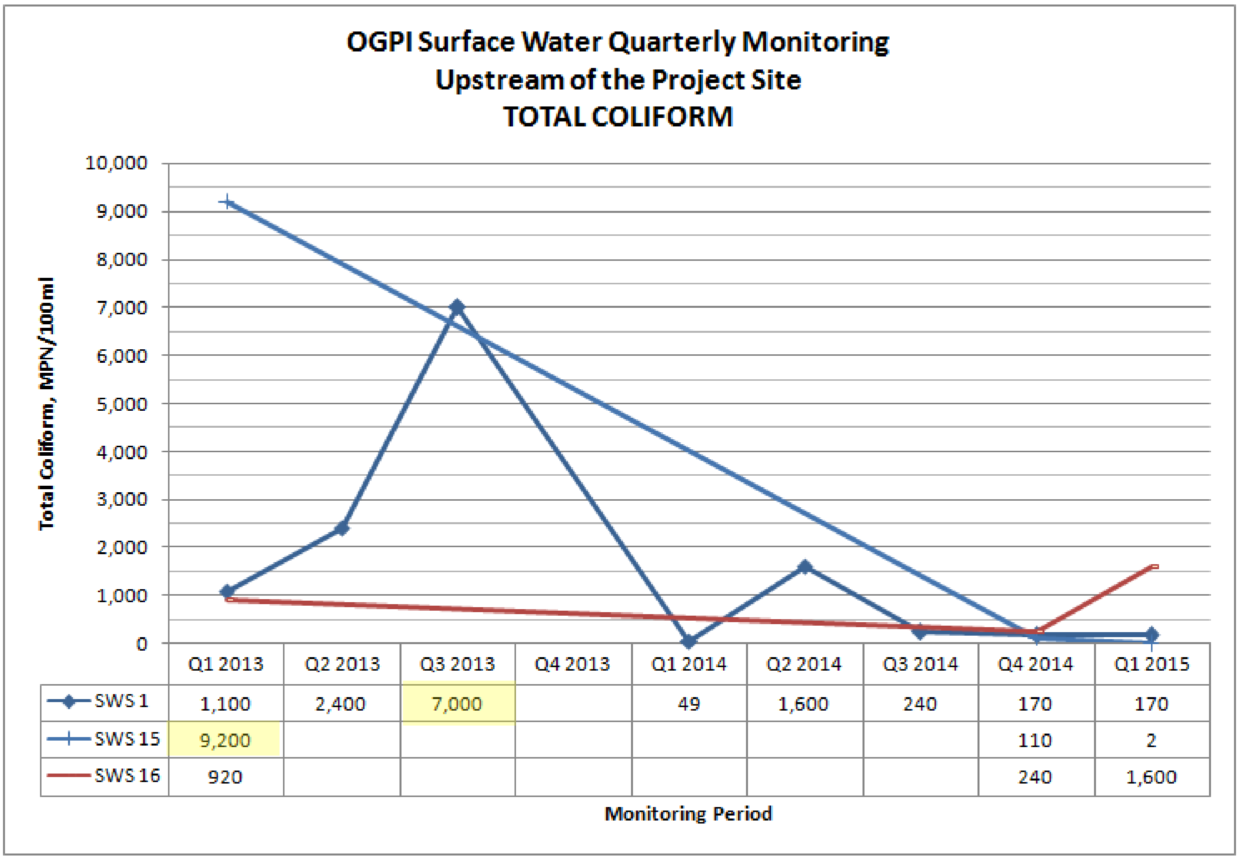
	Q1 2015	Q2 2015	Q3 2015
SWS DP-Up		5.29	7.46
SWS DP-Down		5.20	6.80
SWS 12	4.4	5.43	7.14
SWS 13	4.6	4.96	6.92
SWS 14	4.4	5.10	7.34
SWS 17	4.4	4.69	7.40
DAO 90-34 Class D	3	3	3

Figure 6-48: Plot of DO monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



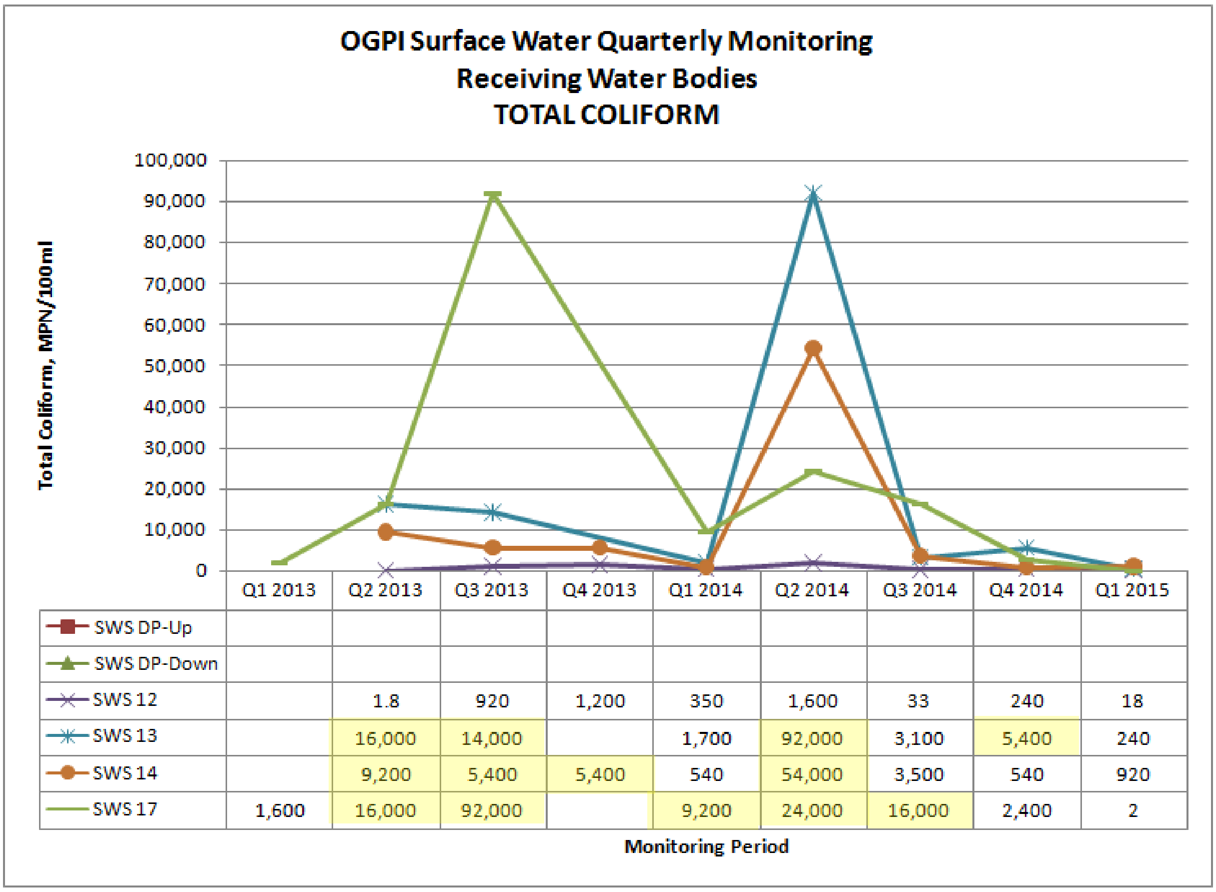
	Q1 2015	Q2 2015	Q3 2015	Q4 2015
SWS 18		4.89		
SWS 19		6.11		
SWS 20		4.99		
SWS 21		5.10		
SWS 22		6.38		
SWS 23		6.41		
DAO 90-34 Class D	3	3	3	3

Figure 6-49: Plot of DO monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



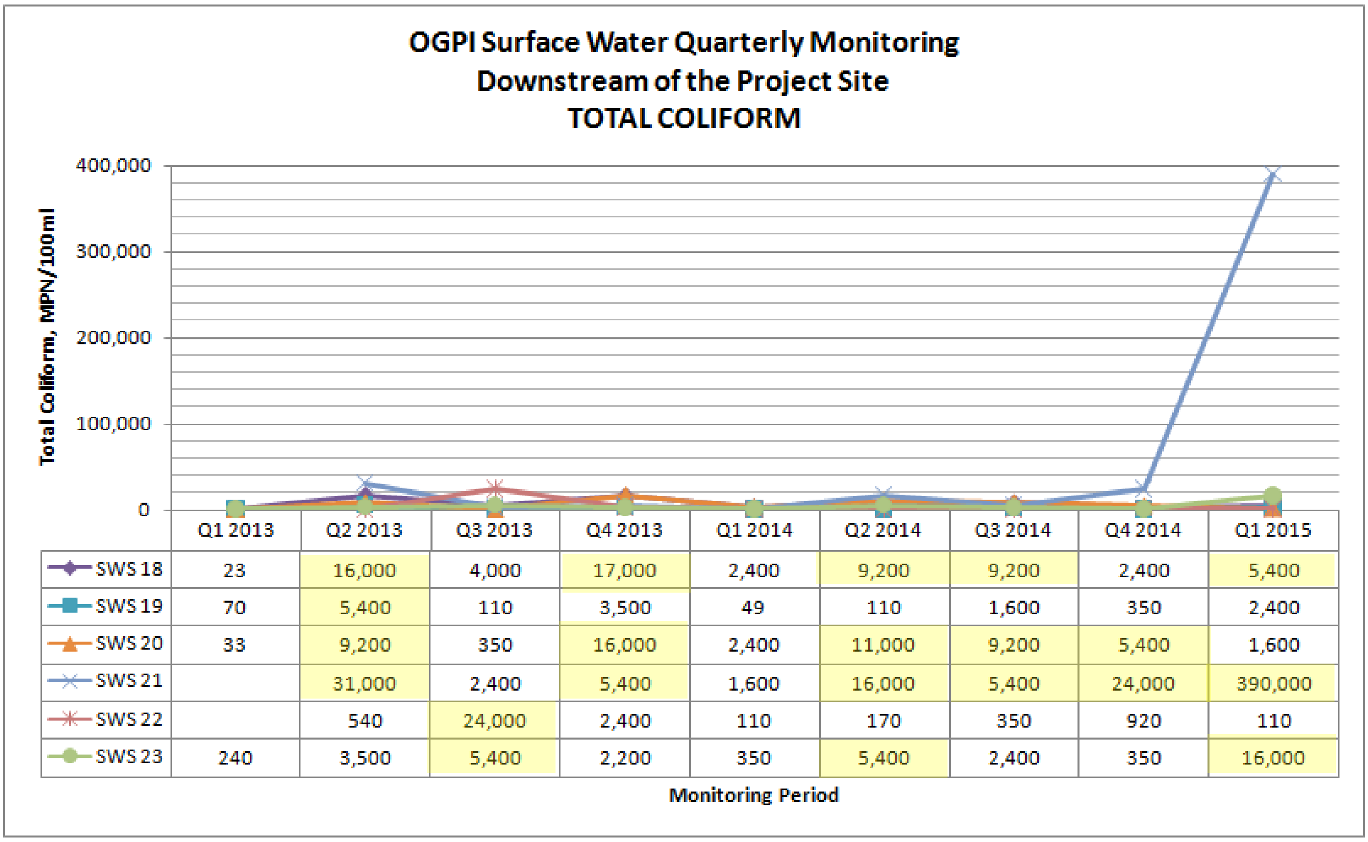
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015
SWS 1	1,100	2,400	7,000		49	1,600	240	170	170
SWS 15	9,200							110	2
SWS 16	920							240	1,600

Figure 6-50: Plot of Total Coliform monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



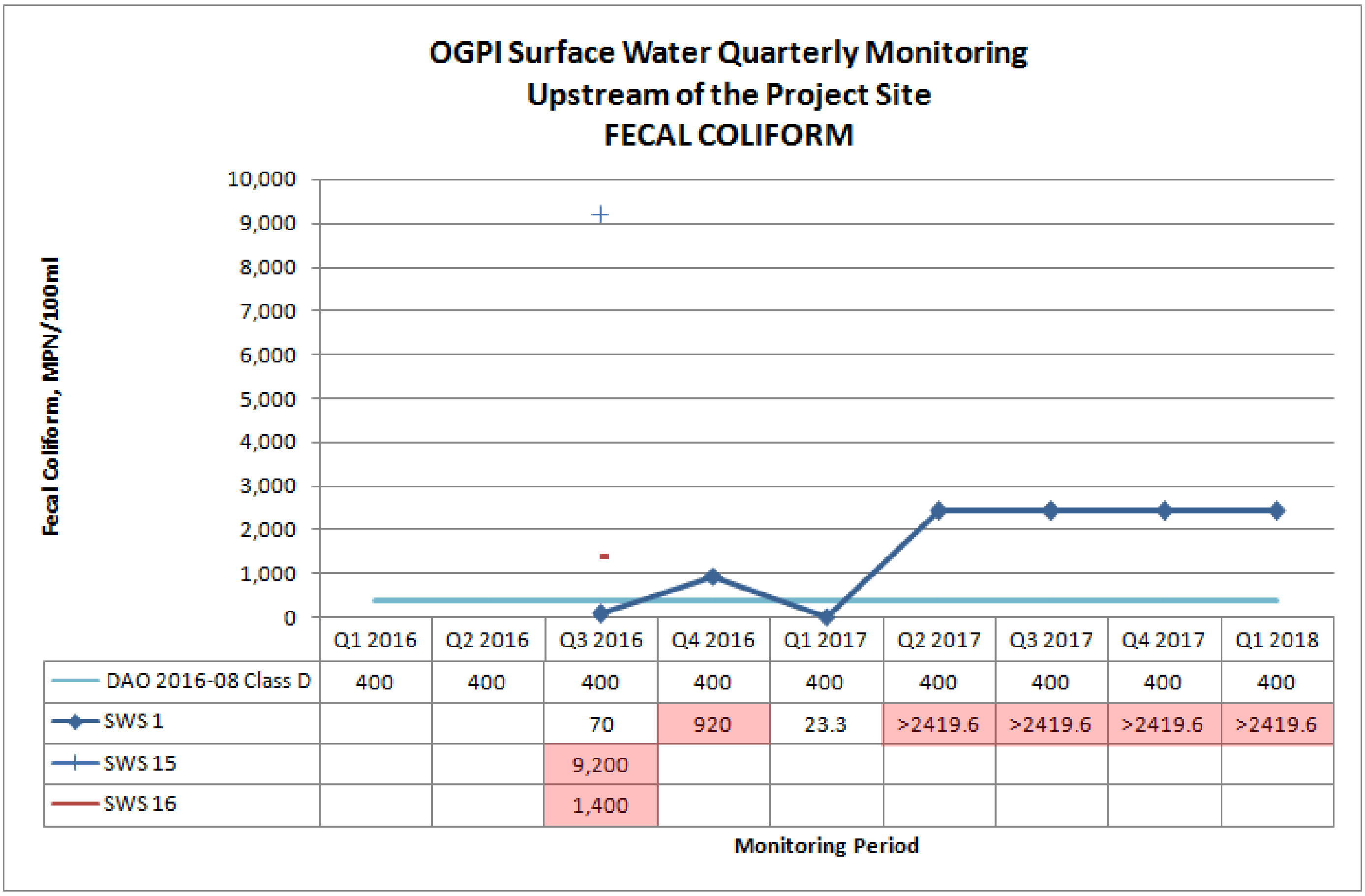
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015
SWS DP-Up									
SWS DP-Down									
SWS 12		1.8	920	1,200	350	1,600	33	240	18
SWS 13		16,000	14,000		1,700	92,000	3,100	5,400	240
SWS 14		9,200	5,400	5,400	540	54,000	3,500	540	920
SWS 17	1,600	16,000	92,000		9,200	24,000	16,000	2,400	2

Figure 6-51: Plot of Total Coliform monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



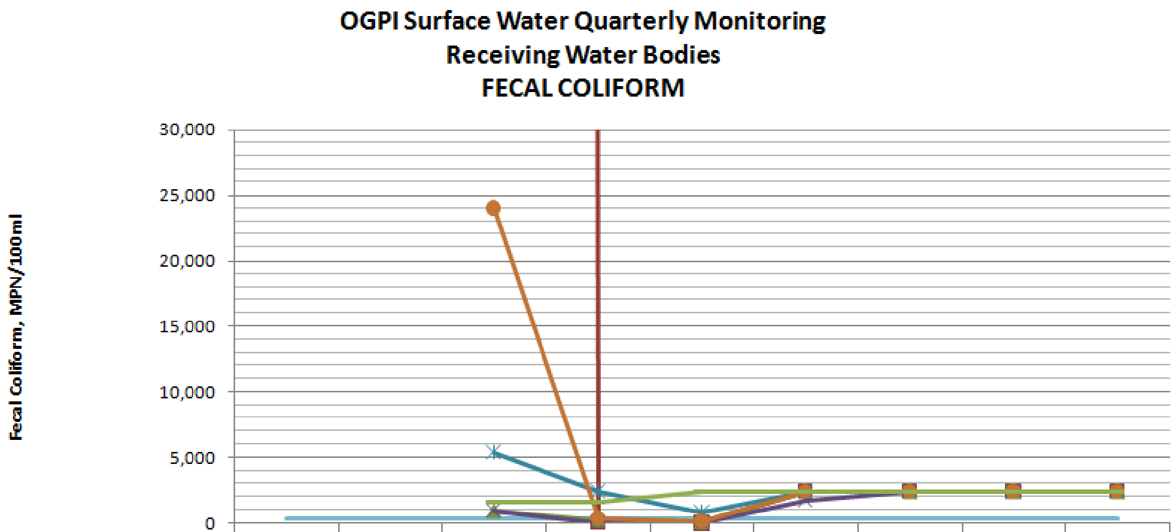
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015
SWS 18	23	16,000	4,000	17,000	2,400	9,200	9,200	2,400	5,400
SWS 19	70	5,400	110	3,500	49	110	1,600	350	2,400
SWS 20	33	9,200	350	16,000	2,400	11,000	9,200	5,400	1,600
SWS 21		31,000	2,400	5,400	1,600	16,000	5,400	24,000	390,000
SWS 22		540	24,000	2,400	110	170	350	920	110
SWS 23	240	3,500	5,400	2,200	350	5,400	2,400	350	16,000

Figure 6-52: Plot of Total Coliform monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	400	400	400	400	400	400	400	400	400
SWS 1			70	920	23.3	>2419.6	>2419.6	>2419.6	>2419.6
SWS 15			9,200						
SWS 16			1,400						

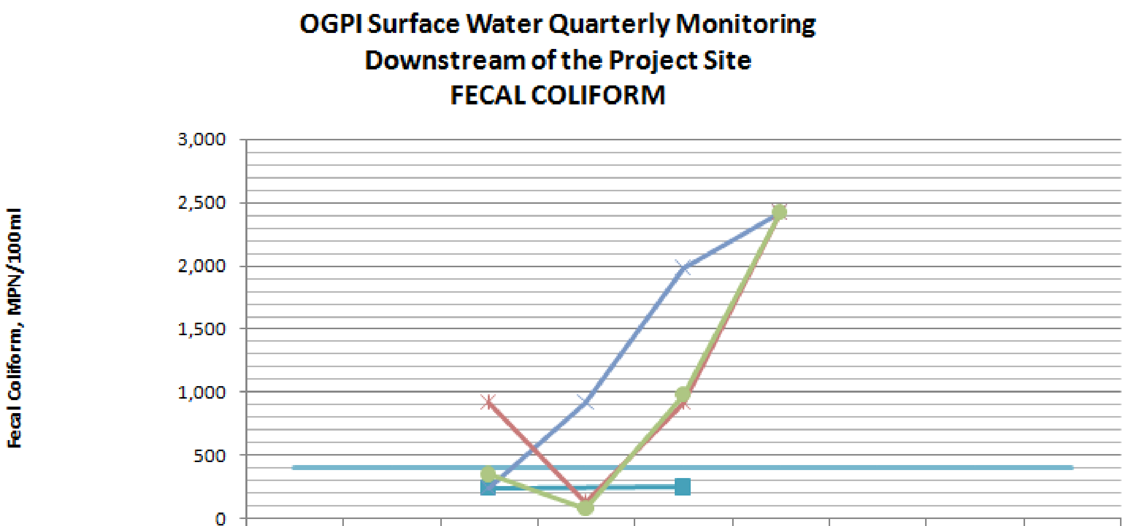
Figure 6-53: Plot of Fecal Coliform monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	400	400	400	400	400	400	400	400	400
SWS DP-Up			3,500,000	11	3.1	>2419.6	>2419.6	>2419.6	>2419.6
SWS DP-Down			920	240	100.8	>2419.6	>2419.6	>2419.6	>2419.6
SWS 12			920	79	7.5	1732.9	>2419.6	>2419.6	>2419.6
SWS 13			5,400	2,400	816.4	>2419.6	>2419.6	>2419.6	>2419.6
SWS 14			24,000	350	172	>2419.6	>2419.6	>2419.6	>2419.6
SWS 17			1,600	1,600	>2419.6	>2419.6	>2419.6	>2419.6	>2419.6

Monitoring Period

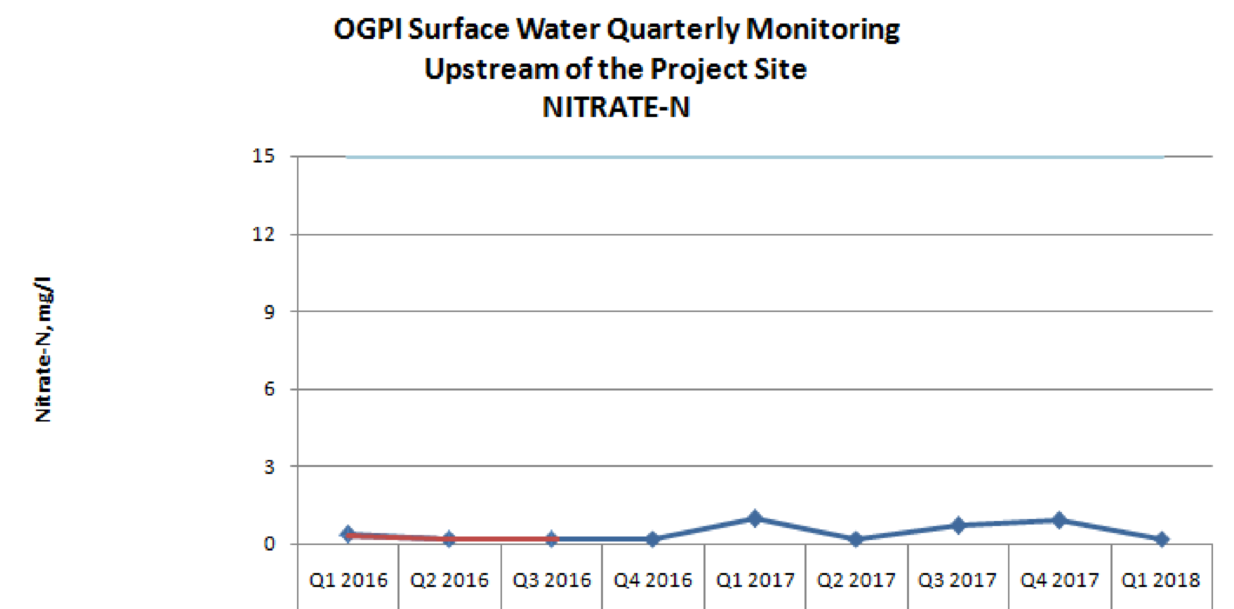
Figure 6-54: Plot of Fecal Coliform monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	400	400	400	400	400	400	400	400	400
SWS 18									
SWS 19			240		248.1				
SWS 20									
SWS 21			240	920	1986.3	>2419.6			
SWS 22			920	130	920.8	>2419.6			
SWS 23			350	79	980.4	>2419.6			

Monitoring Period

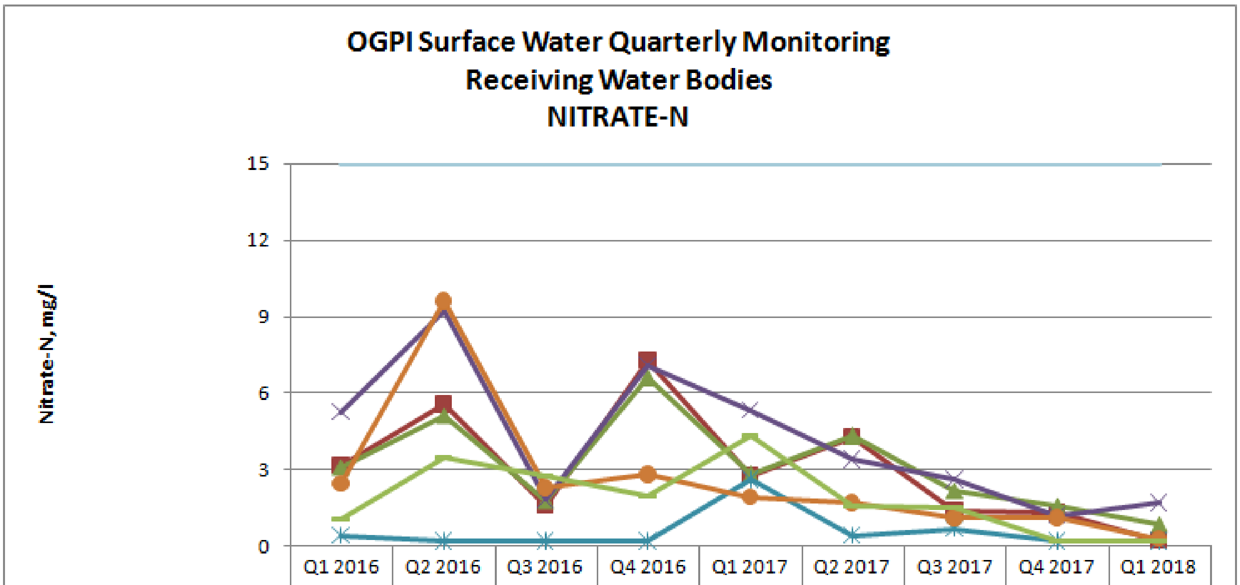
Figure 6-55: Plot of Fecal Coliform monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	15	15	15	15	15	15	15	15	15
SWS 1	0.356	< 0.2	< 0.2	< 0.2	0.98	< 0.2	0.70	0.90	<0.2
SWS 15	0.32	0.2	< 0.2						
SWS 16	0.299	< 0.2	< 0.2						

Monitoring Period

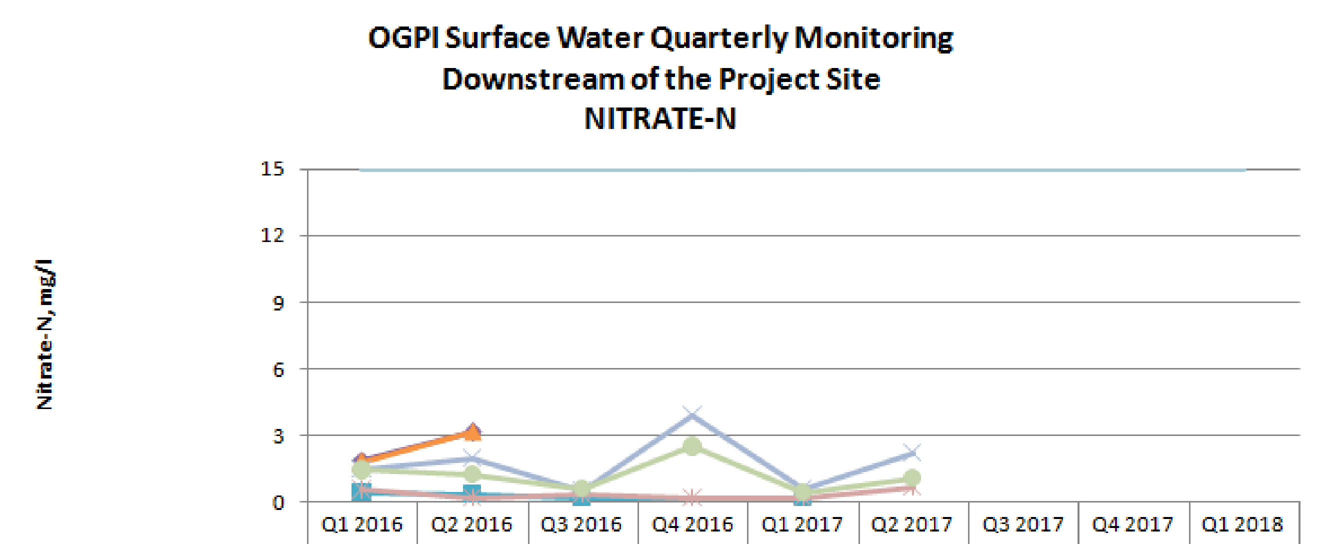
Figure 6-56: Plot of Nitrate monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	15	15	15	15	15	15	15	15	15
SWS DP-Up	3.18	5.55	1.60	7.30	2.79	4.29	1.40	1.30	0.23
SWS DP-Down	3.09	5.12	1.80	6.60	2.80	4.3	2.20	1.60	0.88
SWS 12	5.27	9.2	1.83	7.10	5.30	3.39	2.60	1.20	1.70
SWS 13	0.426	< 0.2	< 0.2	< 0.2	2.60	0.41	0.70	< 0.2	<0.2
SWS 14	2.44	9.6	2.27	2.80	1.91	1.7	1.10	1.10	0.27
SWS 17	1.05	3.51	2.76	2.00	4.30	1.61	1.50	< 0.2	<0.2

Monitoring Period

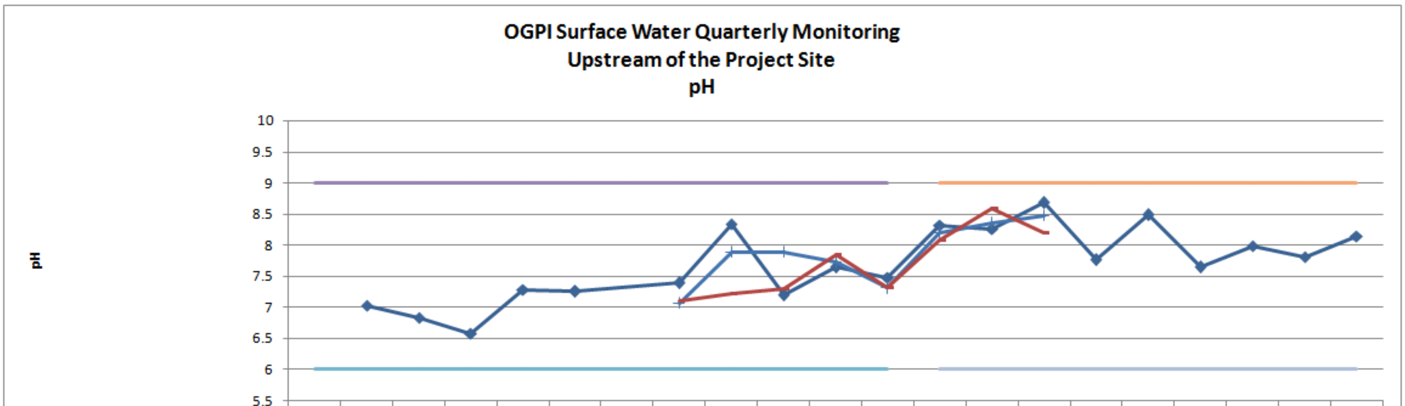
Figure 6-57: Plot of Nitrate monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	15	15	15	15	15	15	15	15	15
SWS 18	1.91	3.15							
SWS 19	0.441	0.36	< 0.2		0.22				
SWS 20	1.76	3.2							
SWS 21	1.5	1.98	0.53	3.90	0.61	2.24			
SWS 22	0.545	< 0.2	0.33	< 0.2	< 0.2	0.7			
SWS 23	1.44	1.26	0.59	2.50	0.42	1.11			

Monitoring Period

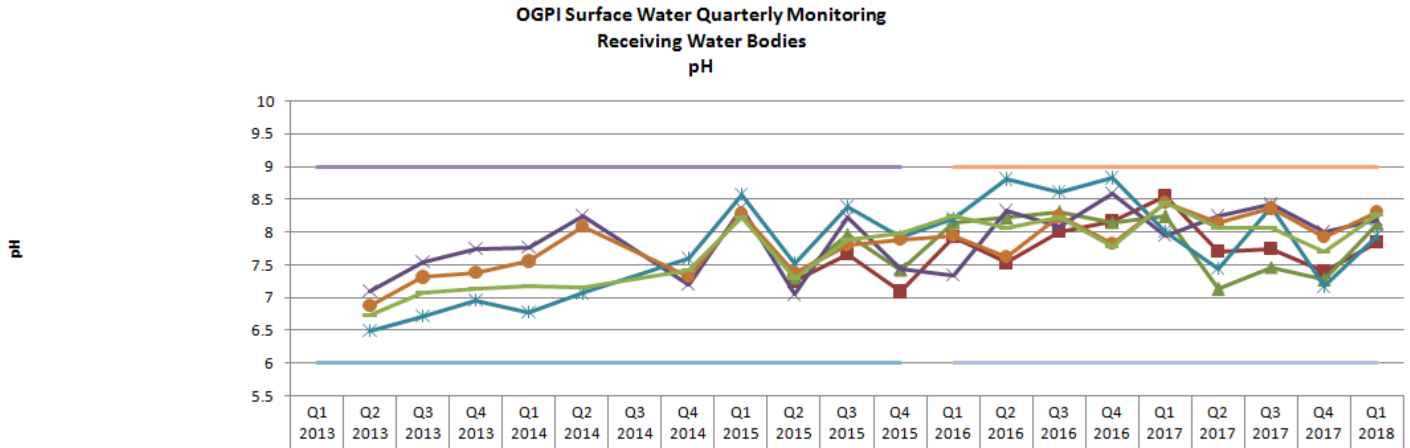
Figure 6-58: Plot of Nitrate monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D upper limit	9	9	9	9	9	9	9	9	9	9	9	9									
DAO 2016-08 Class D upper limit													9	9	9	9	9	9	9	9	9
SWS 1		7.03	6.83	6.58	7.28	7.25		7.39	8.33	7.19	7.64	7.47	8.32	8.26	8.68	7.76	8.48	7.64	7.98	7.81	8.14
SWS 15								7.06	7.88	7.88	7.72	7.31	8.2	8.36	8.47						
SWS 16								7.1	7.21	7.29	7.85	7.31	8.08	8.58	8.19						
DAO 90-34 Class D lower limit	6	6	6	6	6	6	6	6	6	6	6	6									
DAO 2016-08 Class D lower limit													6	6	6	6	6	6	6	6	6

Monitoring Period

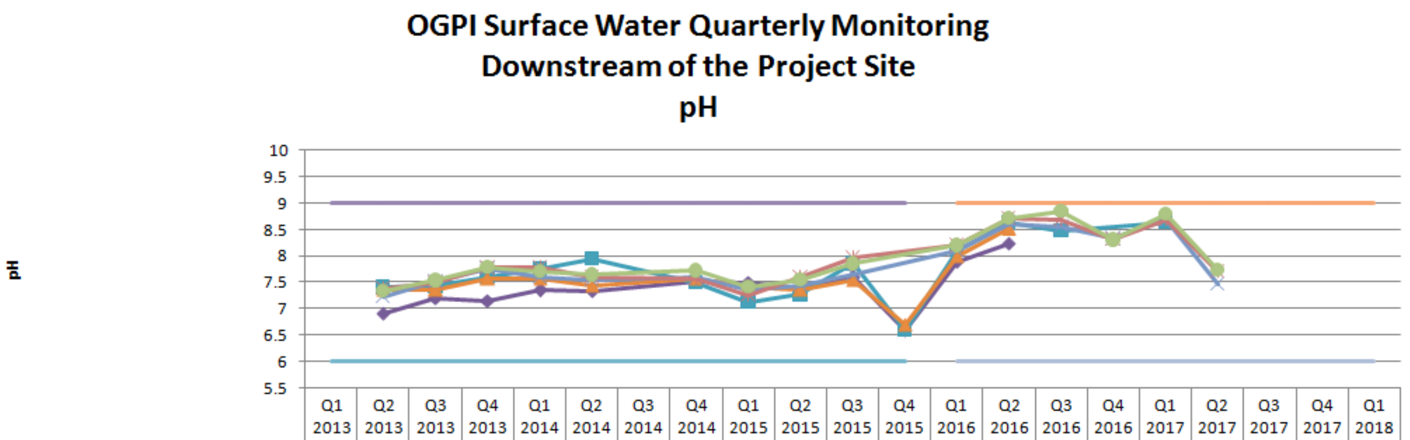
Figure 6-59: Plot of pH monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D upper limit	9	9	9	9	9	9	9	9	9	9	9	9									
DAO 2016-08 Class D upper limit													9	9	9	9	9	9	9	9	9
SWS DP-Up										7.25	7.66	7.09	7.93	7.53	8.00	8.16	8.55	7.70	7.75	7.39	7.85
SWS DP-Down										7.30	7.97	7.42	8.15	8.22	8.30	8.15	8.24	7.13	7.46	7.27	8.13
SWS 12		7.10	7.54	7.74	7.77	8.25		7.20	8.36	7.05	8.23	7.44	7.34	8.32	8.08	8.58	7.94	8.24	8.42	8.01	8.19
SWS 13		6.50	6.71	6.96	6.78	7.07		7.59	8.57	7.51	8.38	7.92	8.20	8.80	8.61	8.82	8.01	7.44	8.39	7.17	7.94
SWS 14		6.88	7.31	7.38	7.55	8.08		7.32	8.28	7.38	7.80	7.88	7.95	7.62	8.24	7.82	8.45	8.14	8.36	7.92	8.31
SWS 17		6.74	7.07	7.13	7.18	7.16		7.42	8.22	7.29	7.89	7.98	8.25	8.06	8.22	7.78	8.44	8.06	8.06	7.69	8.27
DAO 90-34 Class D lower limit	6	6	6	6	6	6	6	6	6	6	6	6									
DAO 2016-08 Class D lower limit													6	6	6	6	6	6	6	6	6

Monitoring Period

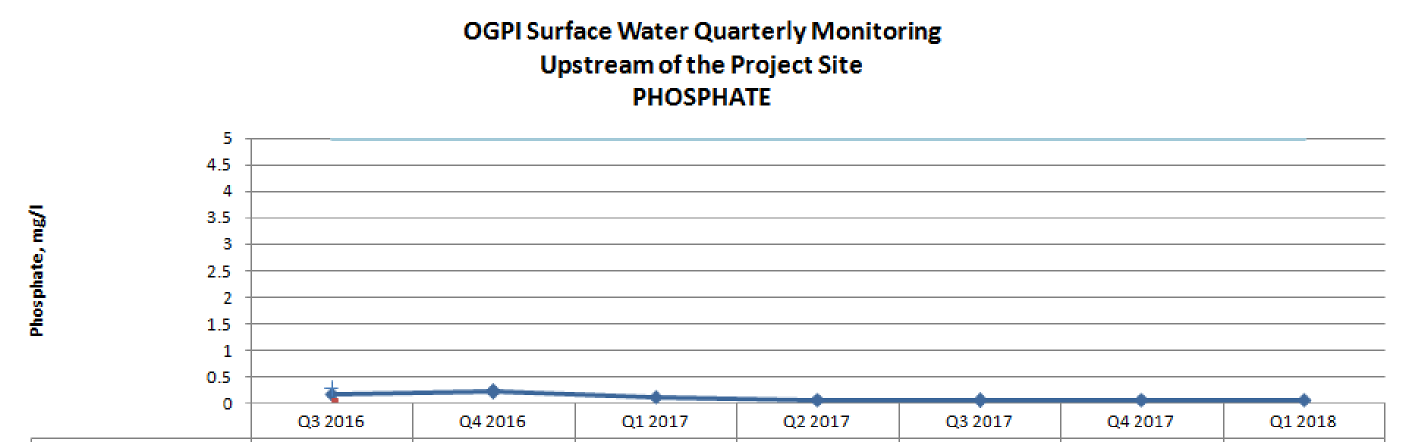
Figure 6-60: Plot of pH monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D upper limit	9	9	9	9	9	9	9	9	9	9	9	9									
DAO 2016-08 Class D upper limit													9	9	9	9	9	9	9	9	9
SWS 18		6.91	7.21	7.15	7.35	7.34		7.51	7.49	7.38	7.59	6.60	7.90	8.23							
SWS 19		7.40	7.43	7.60	7.75	7.94		7.50	7.12	7.27	7.85	6.60	8.10	8.62	8.48		8.64				
SWS 20		7.36	7.36	7.57	7.57	7.45		7.57	7.42	7.36	7.55	6.70	8.00	8.51							
SWS 21		7.23	7.52	7.76	7.60	7.54		7.59	7.36	7.44	7.66		8.10	8.61	8.55	8.33	8.67	7.47			
SWS 22		7.39	7.50	7.77	7.79	7.60		7.57	7.25	7.60	7.96		8.20	8.71	8.68	8.31	8.69	7.70			
SWS 23		7.34	7.53	7.78	7.70	7.64		7.72	7.41	7.55	7.85		8.20	8.71	8.84	8.30	8.79	7.74			
DAO 90-34 Class D lower limit	6	6	6	6	6	6	6	6	6	6	6	6									
DAO 2016-08 Class D lower limit													6	6	6	6	6	6	6	6	6

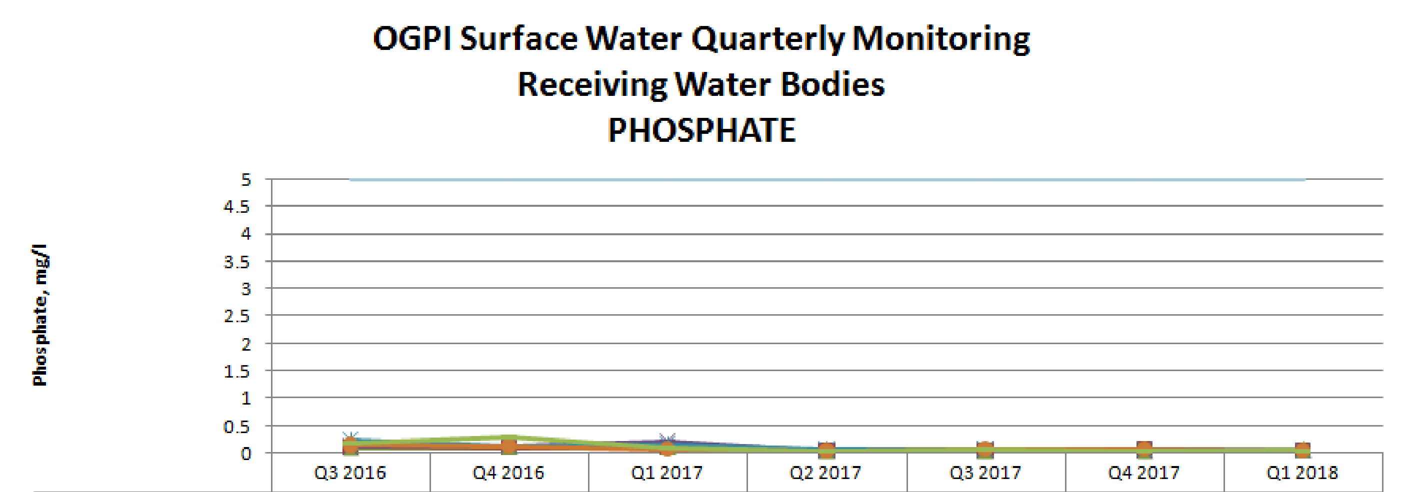
Monitoring Period

Figure 6-61: Plot of pH monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



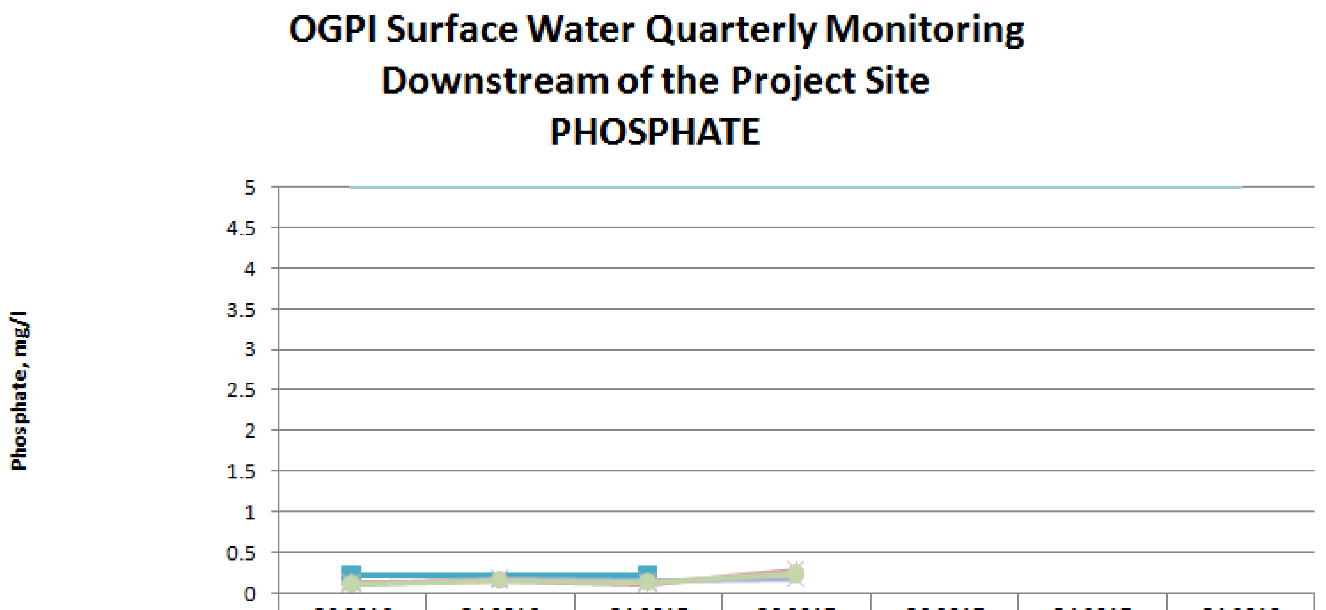
	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	5	5	5	5	5	5	5
SWS 1	0.164	0.210	0.125	0.055	0.052	0.060	0.055
SWS 15	0.270						
SWS 16	0.045						

Figure 6-62: Plot of Phosphate monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	5	5	5	5	5	5	5
SWS DP-Up	0.107	0.106	0.100	0.042	0.038	0.053	0.044
SWS DP-Down	0.103	0.116	0.111	0.038	0.047	0.049	0.058
SWS 12	0.116	0.136	0.200	0.031	0.054	0.034	0.031
SWS 13	0.234	0.136	0.151	0.062	0.068	0.068	0.037
SWS 14	0.146	0.119	0.077	0.04	<0.07	0.063	0.037
SWS 17	0.177	0.310	0.095	0.046	<0.05	0.049	0.039

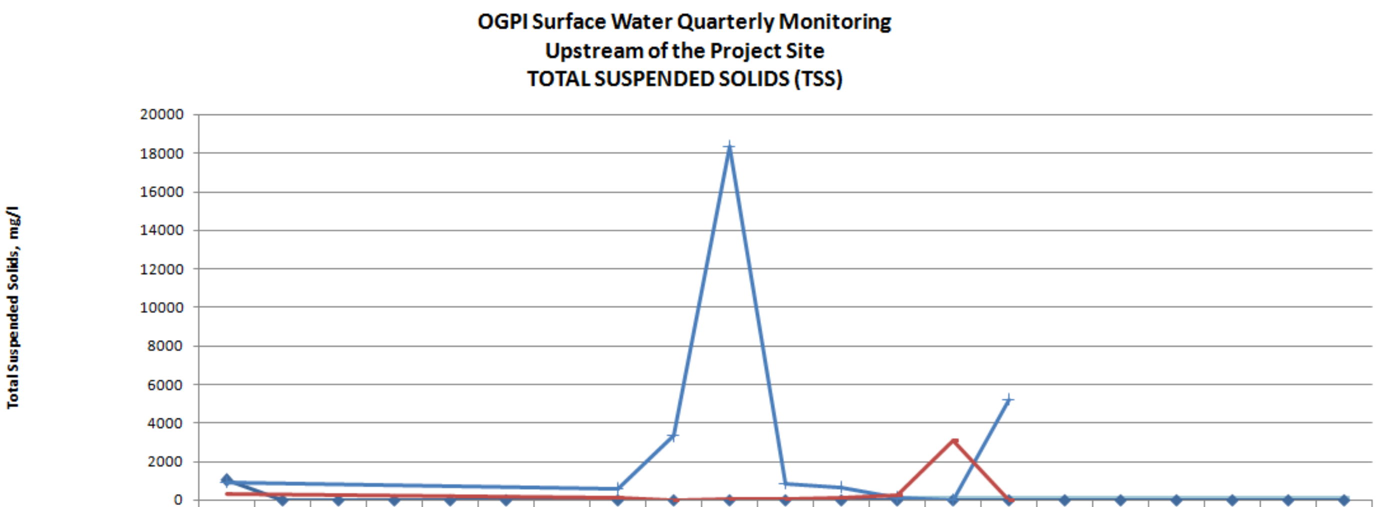
Figure 6-63: Plot of Phosphate monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	5	5	5	5	5	5	5
SWS 18							
SWS 19	0.226		0.215				
SWS 20							
SWS 21	0.118	0.185	0.154	0.18			
SWS 22	0.146	0.159	0.119	0.29			
SWS 23	0.117	0.168	0.145	0.24			

Monitoring Period

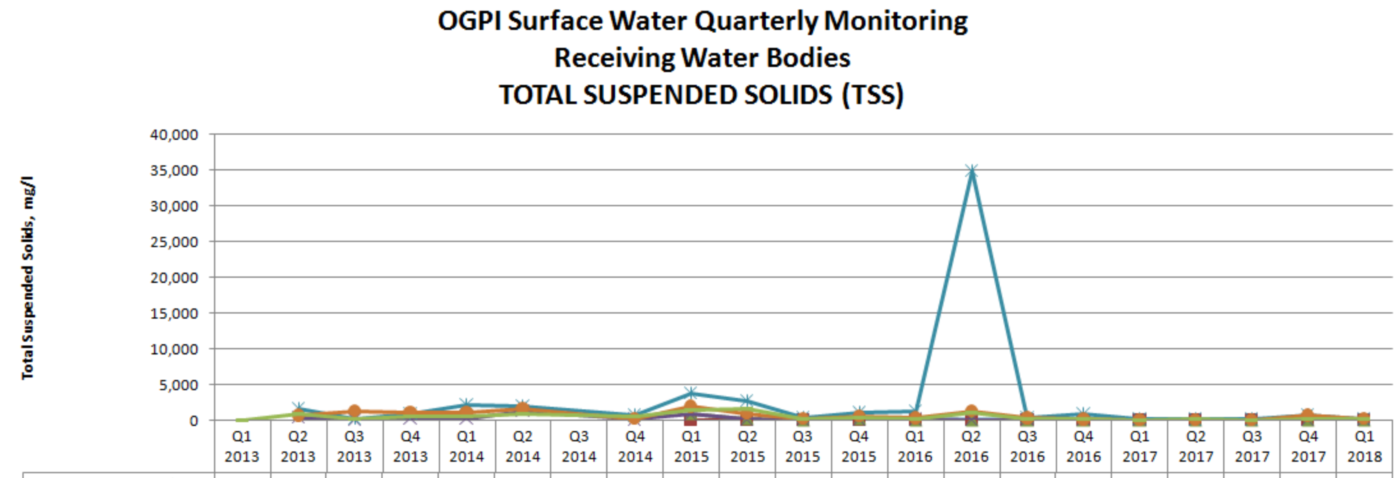
Figure 6-64: Plot of Phosphate monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													110	110	110	110	110	110	110	110	110
SWS 1	1030	0	3.5	3.5	13	2		1	2	13	5	2	0	3	0	10	4	3	7	6	8
SWS 15	903							602	3,330	18,340	838	672	108	7	5,220						
SWS 16	345							94	7	22	45	133	252	3,080	14						

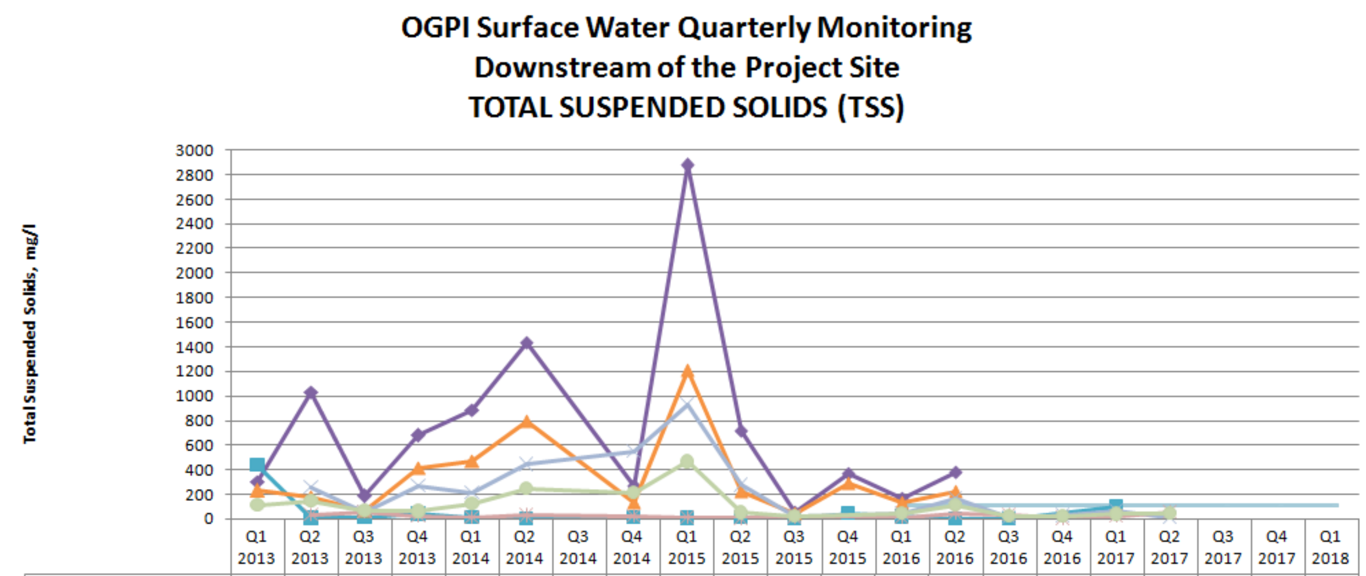
Monitoring Period

Figure 6-65: Plot of TSS monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



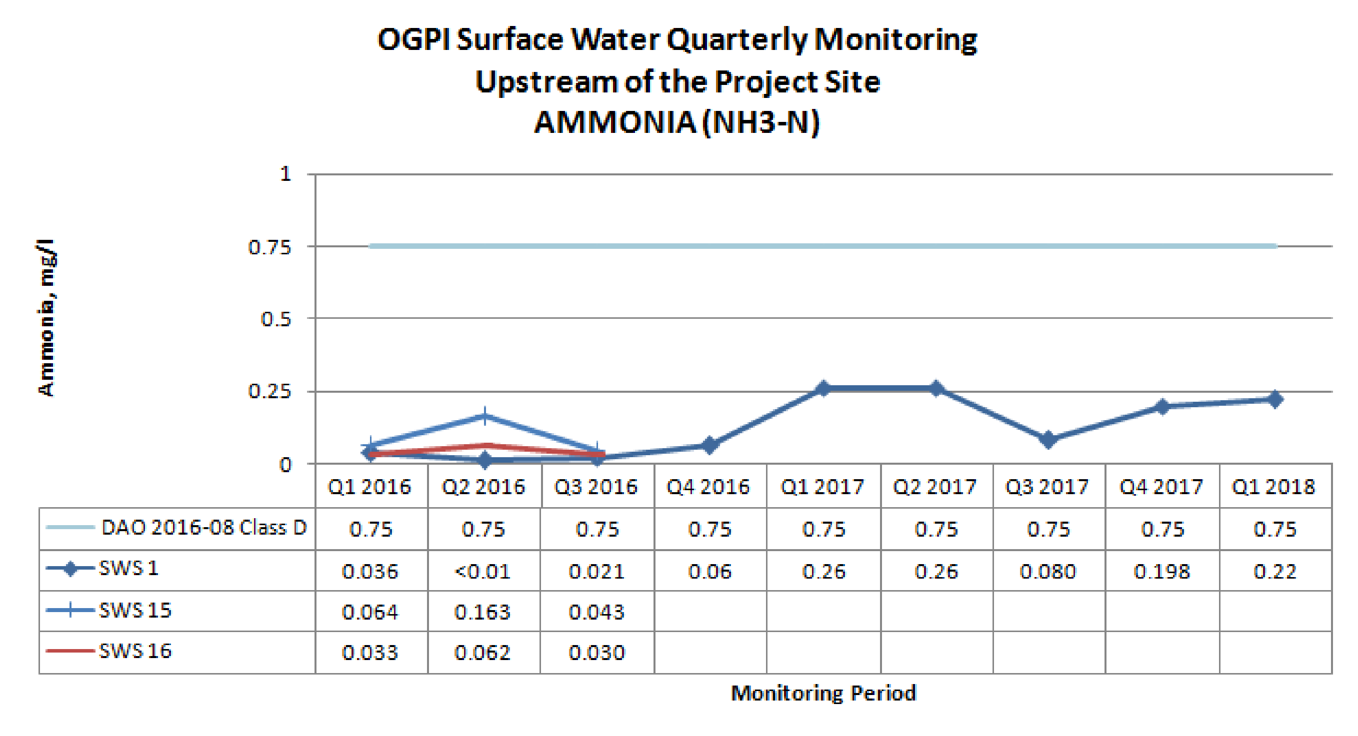
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													110	110	110	110	110	110	110	110	110
SWS DP-Up									39	17	11	85	2	20	5.5	2	10	7	2	4	6.0
SWS DP-Down									950	212	11	202	9	6	12	4	4	9	74	4	12.0
SWS 12		335	32	150	258	1,328		136	820	91	24	139	102	52	5	8	16	41	10	12	36.0
SWS 13		1,617	160	927	2,125	1,986		673	3,720	2,664	327	978	1,298	34,840	425	808	175	138	100	700	179.0
SWS 14		650	1,220	1,100	1,115	1,676		249	1,923	890	259	544	265	1,300	263	115	68	60	71	644	170.0
SWS 17	63	816	160	604	492	936		458	1,367	1,664	145	277	137	1,132	184	111	82	102	46	103	187.0

Figure 6-66: Plot of TSS monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



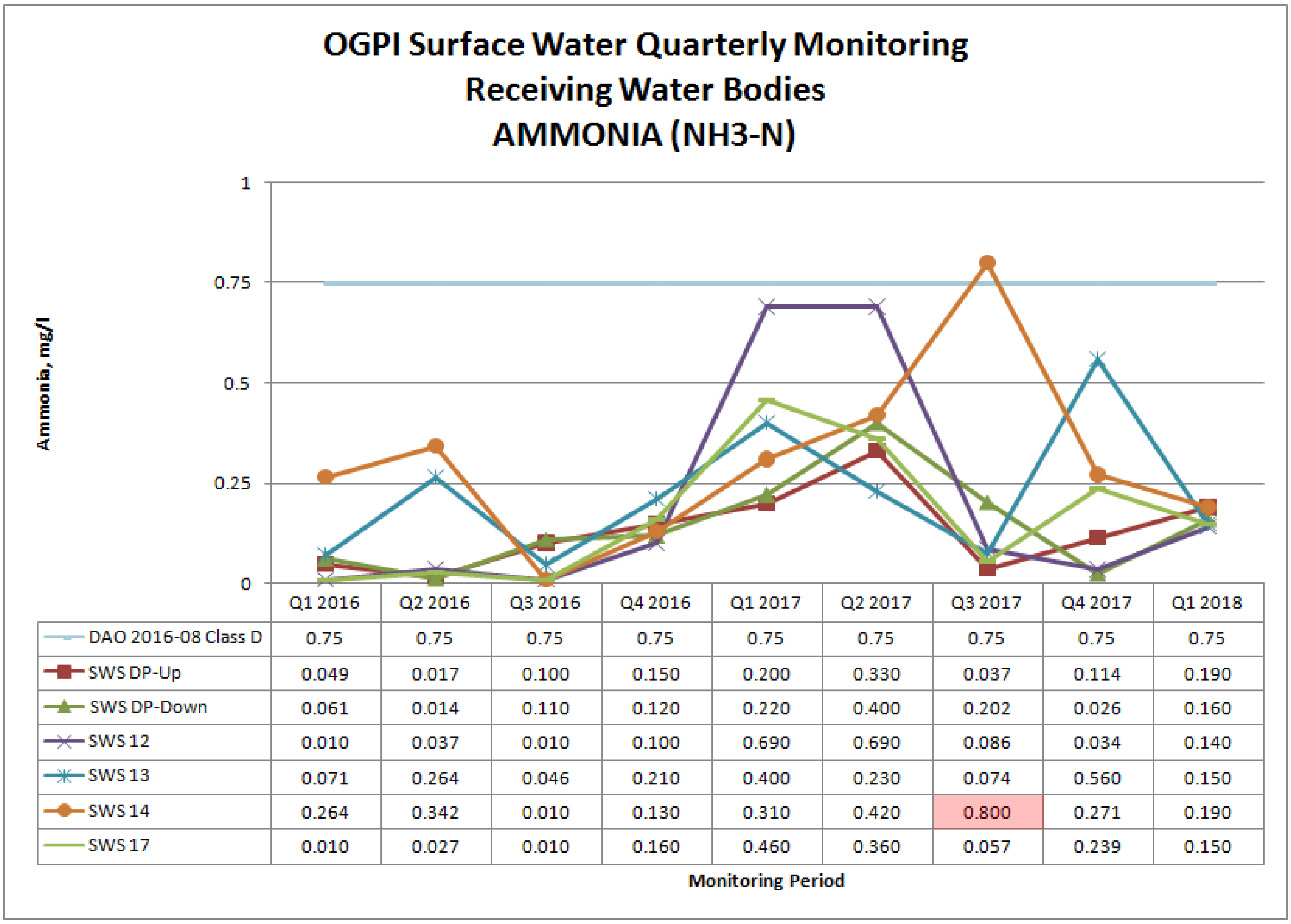
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D																					
DAO 2016-08 Class D													110	110	110	110	110	110	110	110	110
SWS 18	299	1,027	184	678	888	1,434		262	2,875	718	58	370	163	378							
SWS 19	435	2.5	7	37	10	2		13	3	8	1	40	15	2	0		98				
SWS 20	228	180	68	410	468	798		135	1,211	226	45	288	135	224							
SWS 21		256	58	264	213	440		551	929	274	19		42	170	9	26	64	7			
SWS 22		30	55	18	9	27		18	8	4	12		9	42	34	5	18	58			
SWS 23	111	146	64.5	60	123	244		209	464	50	18		40	107	19	21	38	46			

Figure 6-67: Plot of TSS monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



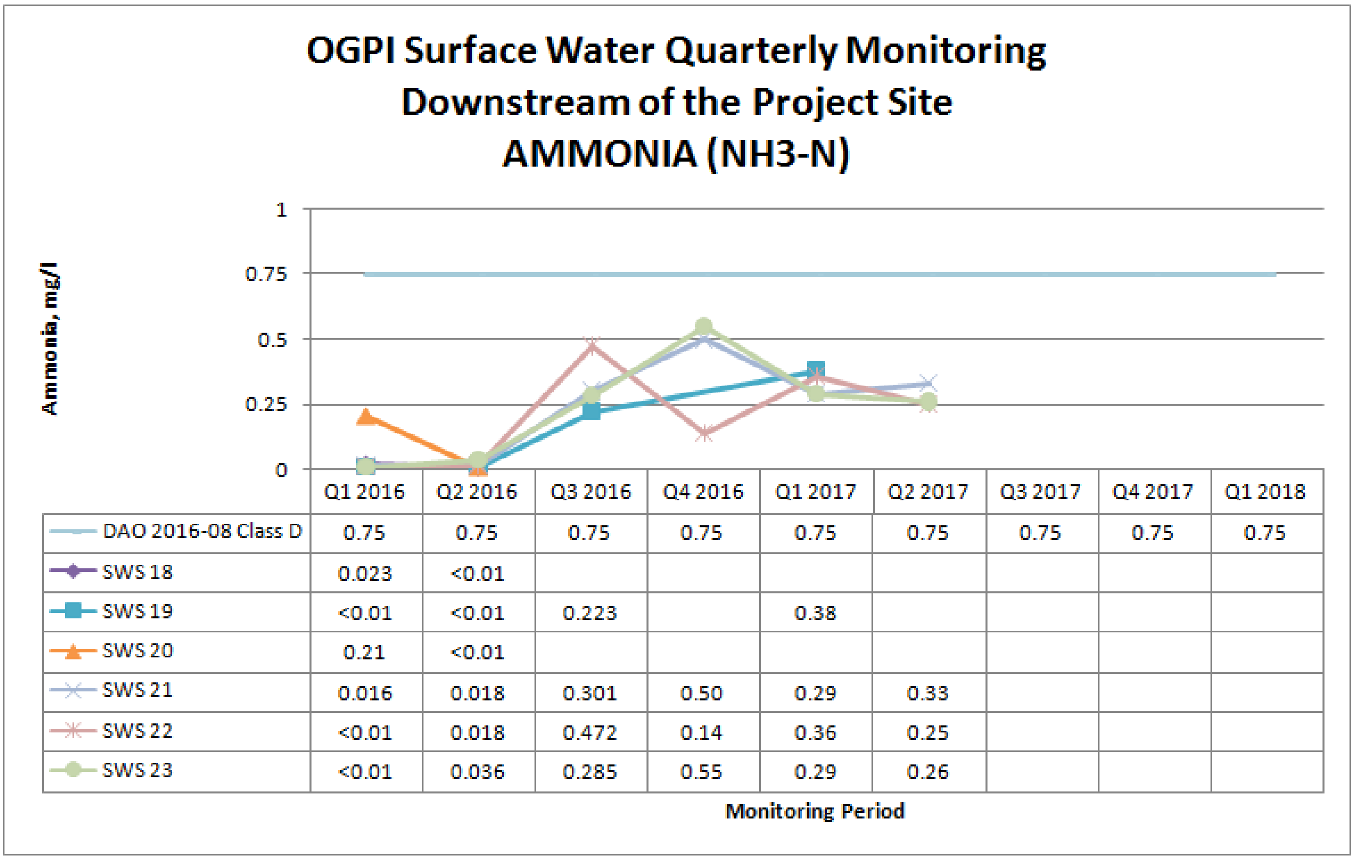
	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
SWS 1	0.036	<0.01	0.021	0.06	0.26	0.26	0.080	0.198	0.22
SWS 15	0.064	0.163	0.043						
SWS 16	0.033	0.062	0.030						

Figure 6-68: Plot of Ammonia monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



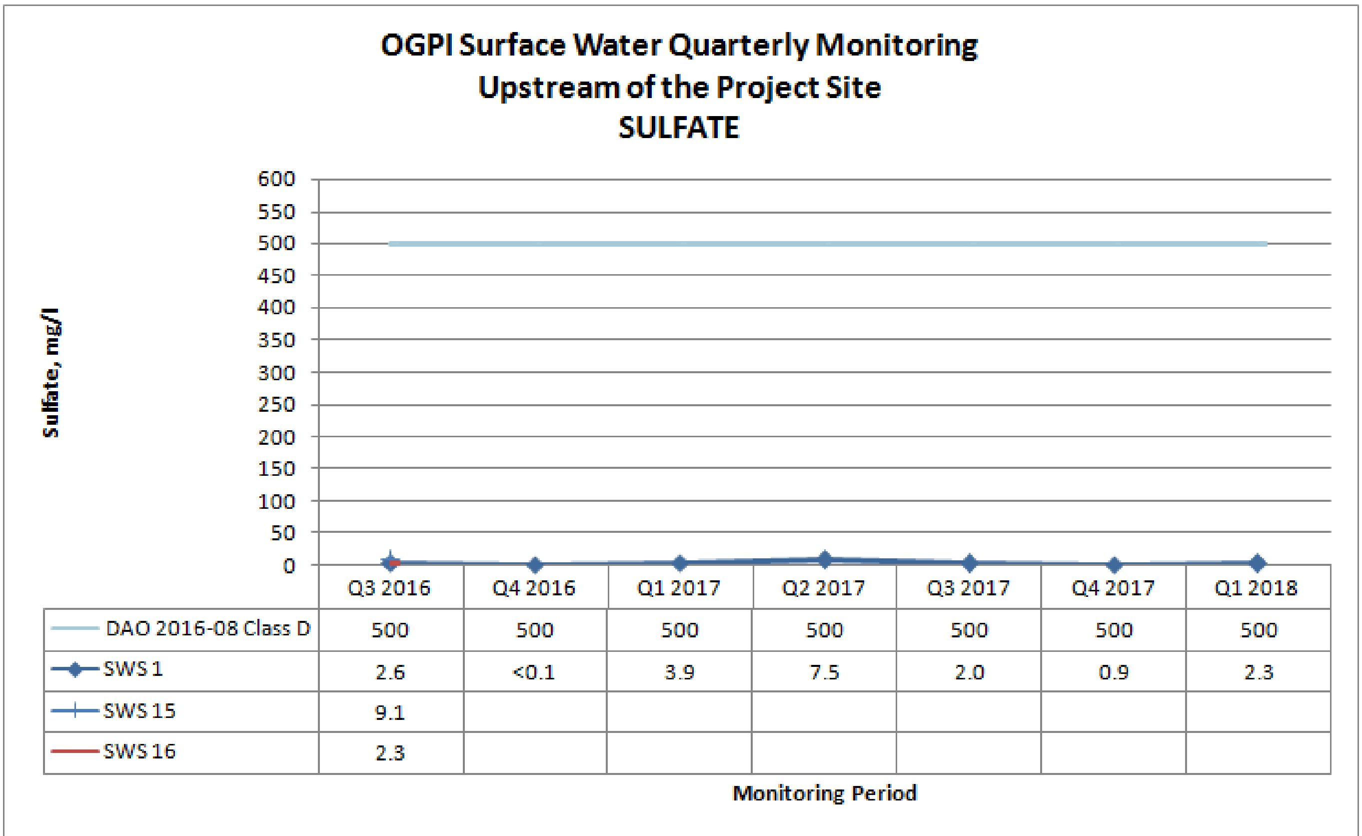
	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
SWS DP-Up	0.049	0.017	0.100	0.150	0.200	0.330	0.037	0.114	0.190
SWS DP-Down	0.061	0.014	0.110	0.120	0.220	0.400	0.202	0.026	0.160
SWS 12	0.010	0.037	0.010	0.100	0.690	0.690	0.086	0.034	0.140
SWS 13	0.071	0.264	0.046	0.210	0.400	0.230	0.074	0.560	0.150
SWS 14	0.264	0.342	0.010	0.130	0.310	0.420	0.800	0.271	0.190
SWS 17	0.010	0.027	0.010	0.160	0.460	0.360	0.057	0.239	0.150

Figure 6-69: Plot of Ammonia monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



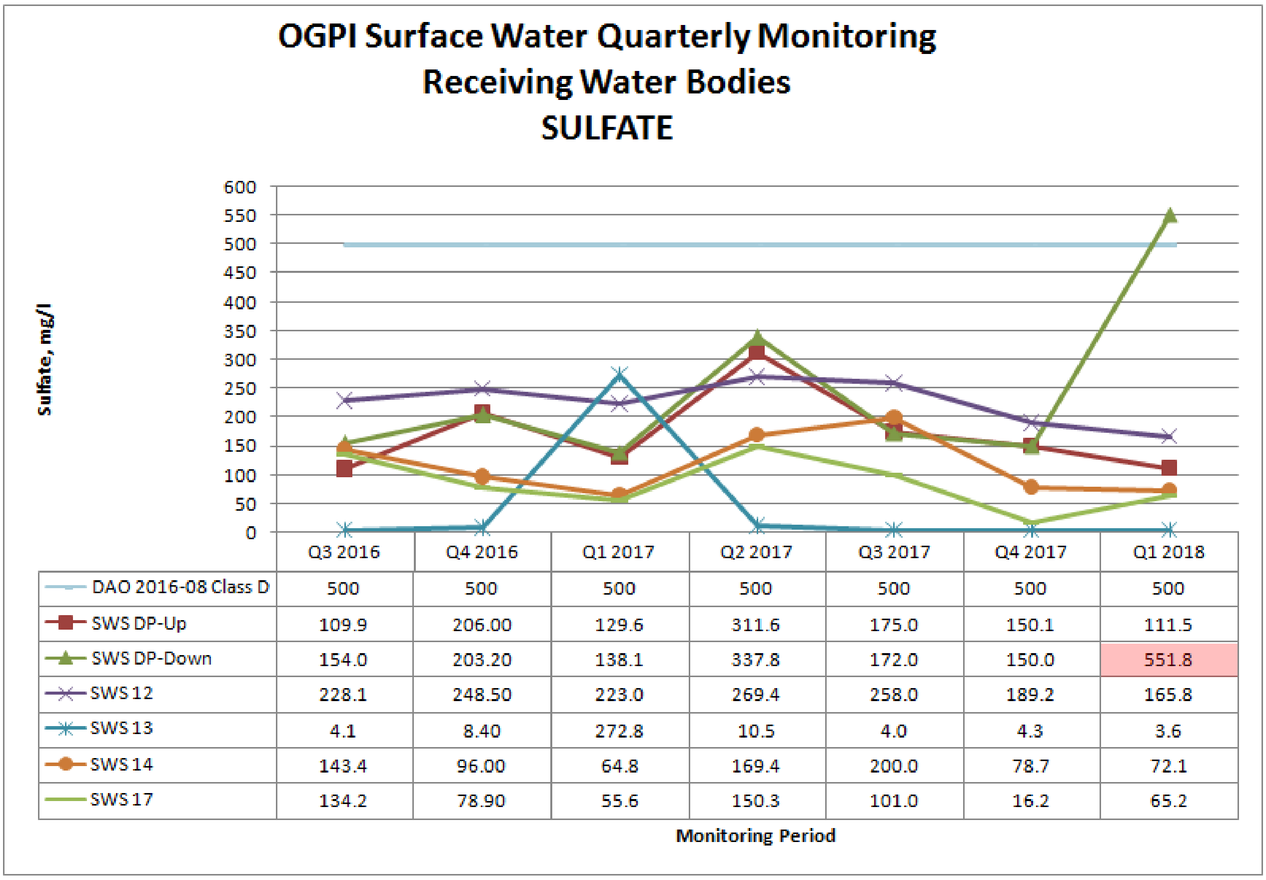
	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
SWS 18	0.023	<0.01							
SWS 19	<0.01	<0.01	0.223		0.38				
SWS 20	0.21	<0.01							
SWS 21	0.016	0.018	0.301	0.50	0.29	0.33			
SWS 22	<0.01	0.018	0.472	0.14	0.36	0.25			
SWS 23	<0.01	0.036	0.285	0.55	0.29	0.26			

Figure 6-70: Plot of Ammonia monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



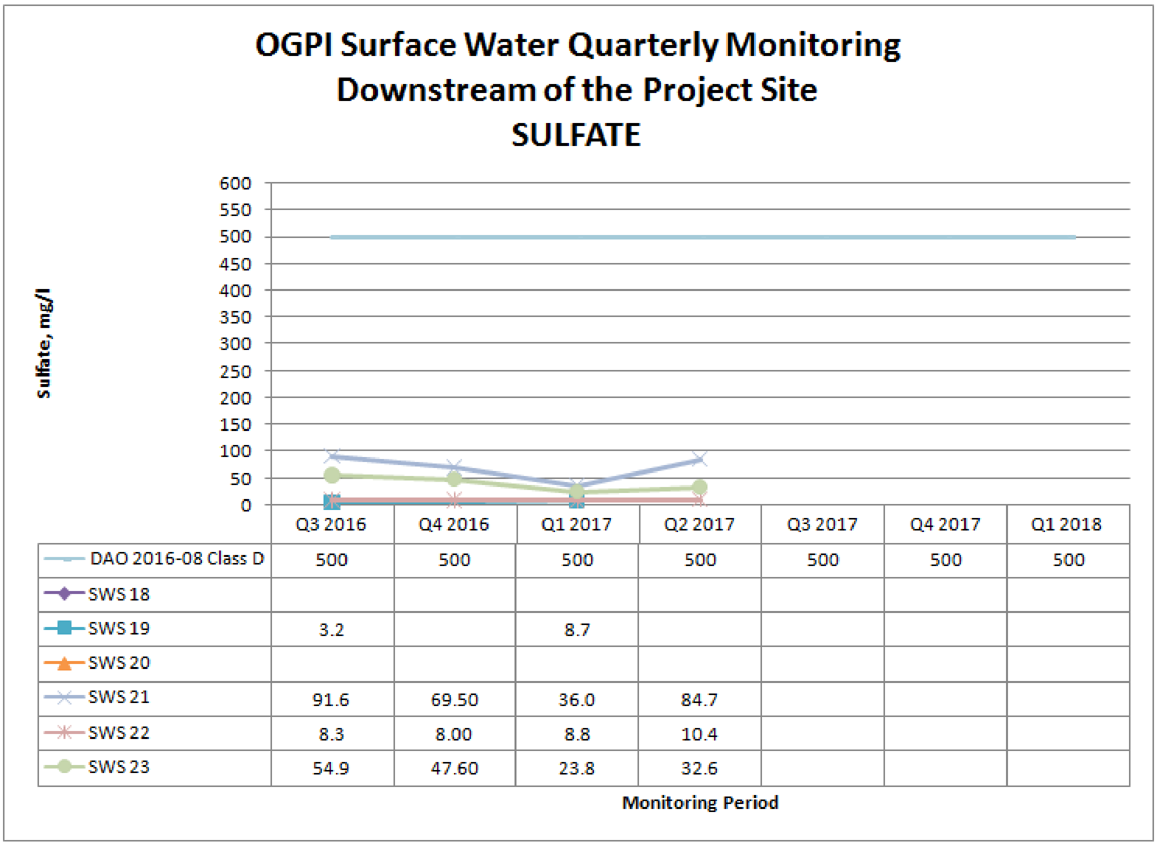
	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	500	500	500	500	500	500	500
SWS 1	2.6	<0.1	3.9	7.5	2.0	0.9	2.3
SWS 15	9.1						
SWS 16	2.3						

Figure 6-71: Plot of Sulfate monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



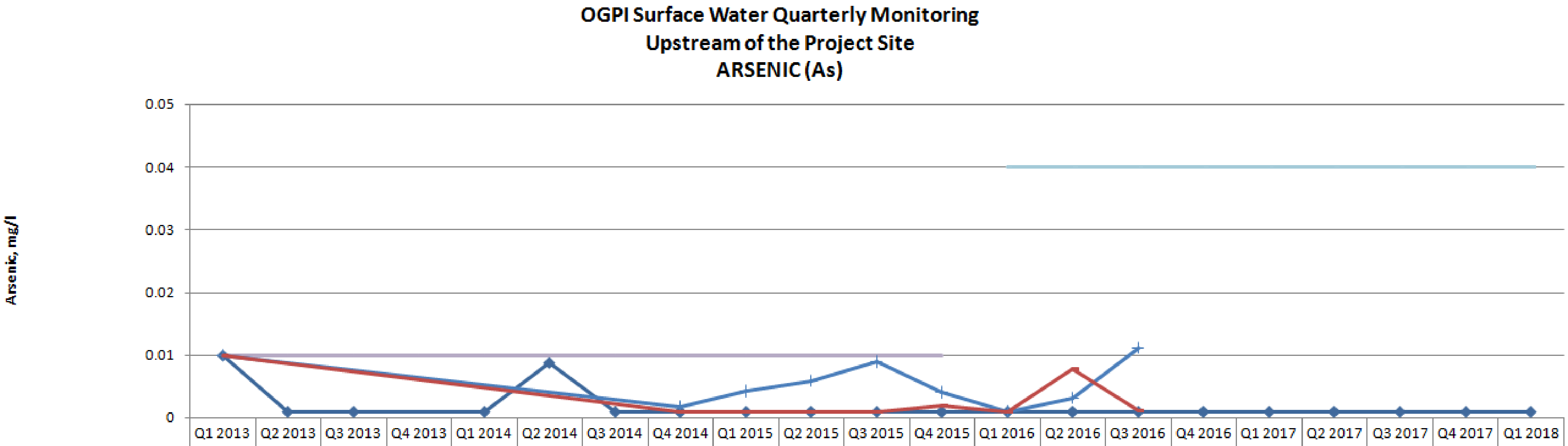
	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	500	500	500	500	500	500	500
SWS DP-Up	109.9	206.00	129.6	311.6	175.0	150.1	111.5
SWS DP-Down	154.0	203.20	138.1	337.8	172.0	150.0	551.8
SWS 12	228.1	248.50	223.0	269.4	258.0	189.2	165.8
SWS 13	4.1	8.40	272.8	10.5	4.0	4.3	3.6
SWS 14	143.4	96.00	64.8	169.4	200.0	78.7	72.1
SWS 17	134.2	78.90	55.6	150.3	101.0	16.2	65.2

Figure 6-72: Plot of Sulfate monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	500	500	500	500	500	500	500
SWS 18							
SWS 19	3.2		8.7				
SWS 20							
SWS 21	91.6	69.50	36.0	84.7			
SWS 22	8.3	8.00	8.8	10.4			
SWS 23	54.9	47.60	23.8	32.6			

Figure 6-73: Plot of Sulfate monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)

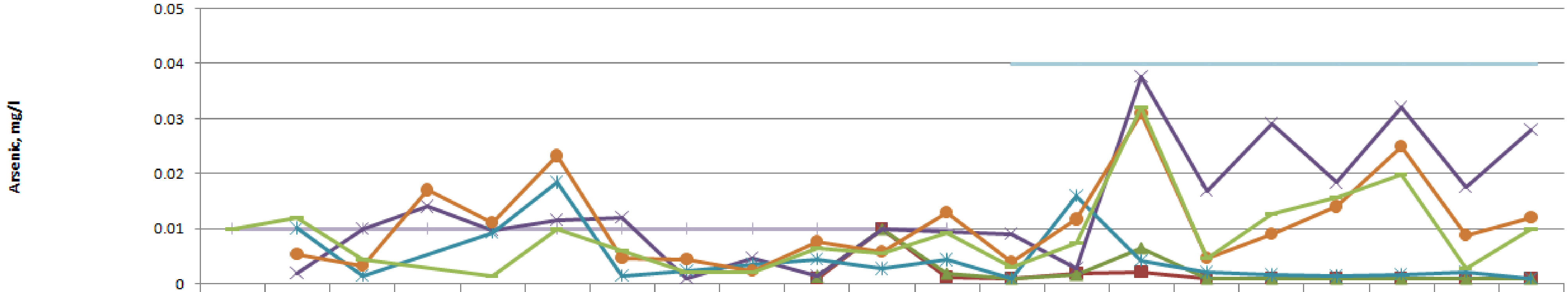


	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
DAO 90-34 Class D	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01									
SWS 1	< 0.01	< 0.001	< 0.001		< 0.001	0.0088	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	<0.001
SWS 15	< 0.01							0.0018	0.0042	0.0059	0.0089	0.004	< 0.001	0.0031	0.0111						
SWS 16	< 0.01							< 0.001	0.001	< 0.001	< 0.001	< 0.002	< 0.001	0.0077	0.0012						

Monitoring Period

Figure 6-74: Plot of Arsenic monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)

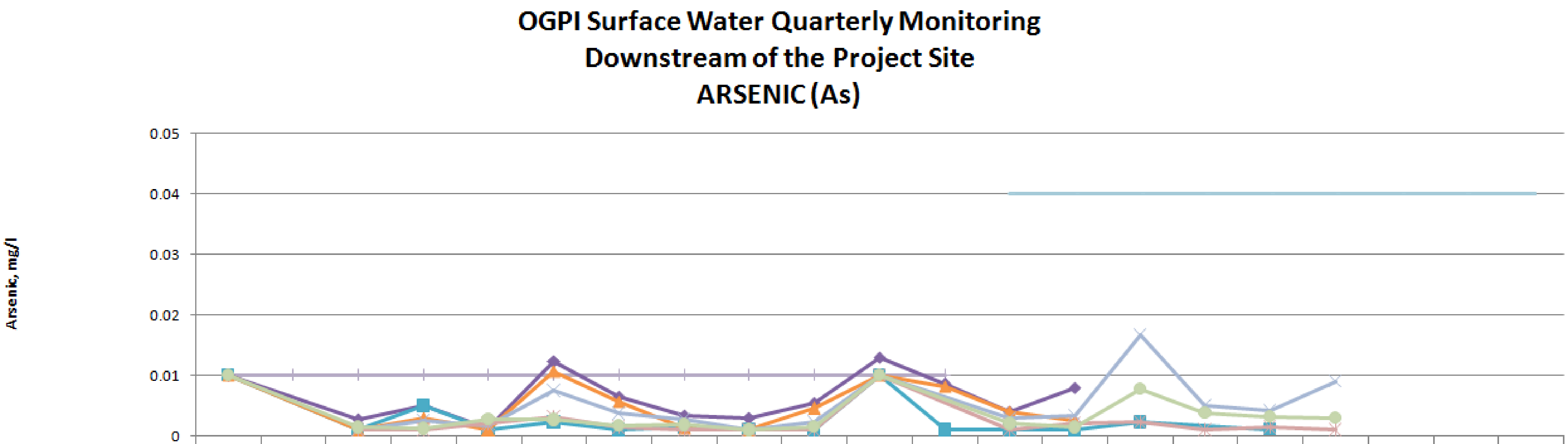
OGPI Surface Water Quarterly Monitoring
Receiving Water Bodies
ARSENIC (As)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
DAO 90-34 Class D	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01									
SWS DP-Up										< 0.001	< 0.01	0.001	< 0.001	0.0018	0.0021	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001
SWS DP-Down										0.0013	< 0.01	0.0019	< 0.001	0.0016	0.0065	< 0.001	0.0010	< 0.001	< 0.001	< 0.001	<0.001
SWS 12		0.0018	0.010	0.0140	0.0097	0.0115	0.0120	< 0.001	0.0047	0.0014	0.01		0.009	0.0028	0.0377	0.0168	0.0290	0.0184	0.0320	0.0176	0.0280
SWS 13		0.0101	0.0014		0.0092	0.0184	0.0014	0.0024	0.0034	0.0044	0.0027	0.0043	< 0.001	0.0159	0.0042	0.0020	0.0015	0.0013	0.0016	0.0021	<0.001
SWS 14		0.0054	0.0033	0.0170	0.0111	0.0232	0.0046	0.0044	0.0024	0.0077	0.0058	0.0130	0.004	0.0117	0.0310	0.0047	0.0090	0.0140	0.0250	0.0088	0.0120
SWS 17	< 0.01	0.0120	0.0044		0.0014	< 0.01	0.0059	0.002	0.0021	0.0064	0.0055	0.0092	0.003	0.0073	0.0320	0.0046	0.0126	0.0156	0.0199	0.0028	0.0100

Monitoring Period

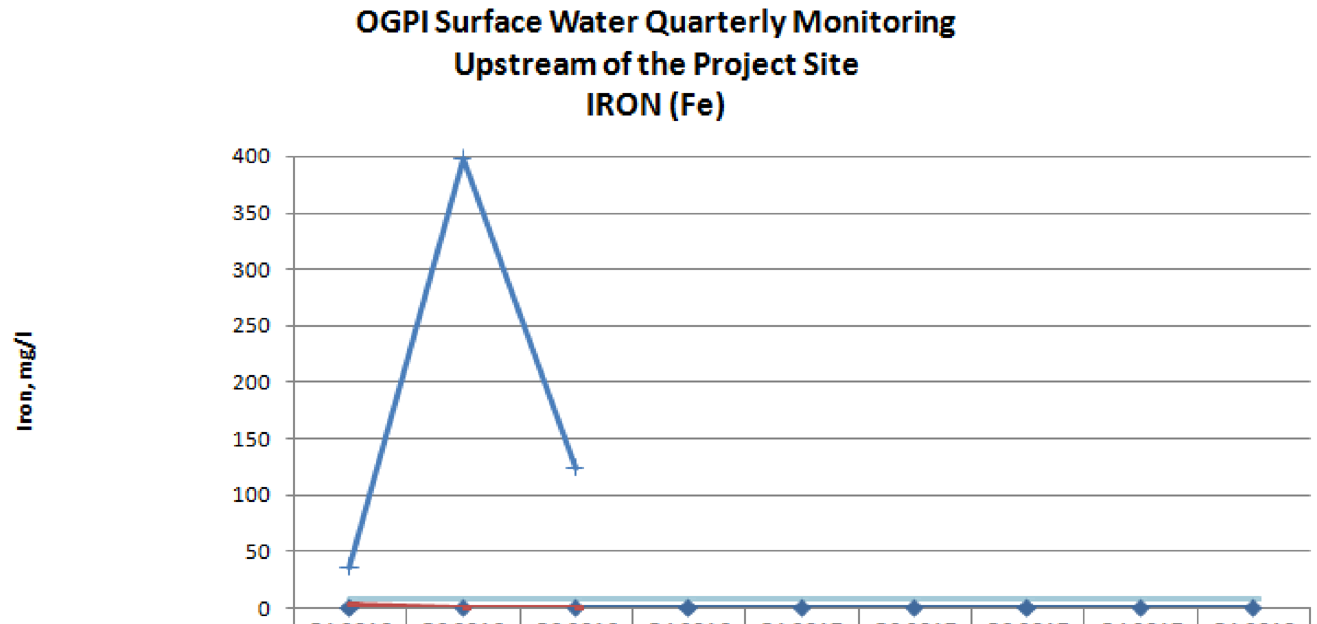
Figure 6-75: Plot of Arsenic monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01									
DAO 2016-08 Class D													0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
SWS 18	< 0.01		0.0027	0.0049	0.0013	0.0124	0.0065	0.0034	0.0029	0.0055	0.013	0.0085	0.004	0.008							
SWS 19	< 0.01		< 0.001	0.0049	< 0.001	0.0022	< 0.001	0.0014	0.001	< 0.001	< 0.01	< 0.001	< 0.001	< 0.001	0.0022		0.0011				
SWS 20	< 0.01		< 0.001	0.003	< 0.001	0.0106	0.0057	0.0013	0.001	0.0045	0.01	0.0081	0.004	0.0025							
SWS 21			0.001	0.0024	0.0016	0.0074	0.0037	0.0027	0.001	0.0022	0.01		0.003	0.0034	0.0166	0.005	0.0041	0.009			
SWS 22			< 0.001	< 0.001	0.002	0.0032	0.0014	< 0.001	0.001	< 0.001	< 0.01		< 0.001	0.0021	0.0022	< 0.001	0.0014	< 0.001			
SWS 23	< 0.01		0.0014	0.0012	0.0028	0.0026	0.0017	0.0018	0.001	0.0015	0.01		0.002	0.0014	0.0078	0.0038	0.0032	0.003			

Monitoring Period

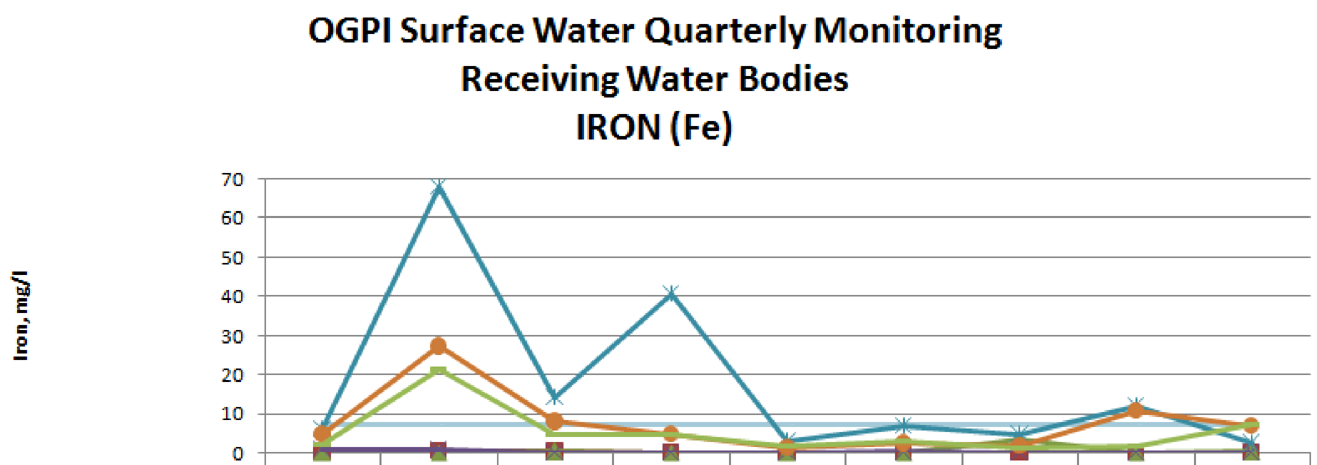
Figure 6-76: Plot of Arsenic monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
SWS 1	<0.05	<0.05	<0.05	0.19	0.07	<0.05	<0.05	<0.05	0.09
SWS 15	35.98	397.41	124.07						
SWS 16	4.1	0.38	0.61						

Monitoring Period

Figure 6-77: Plot of Iron monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)

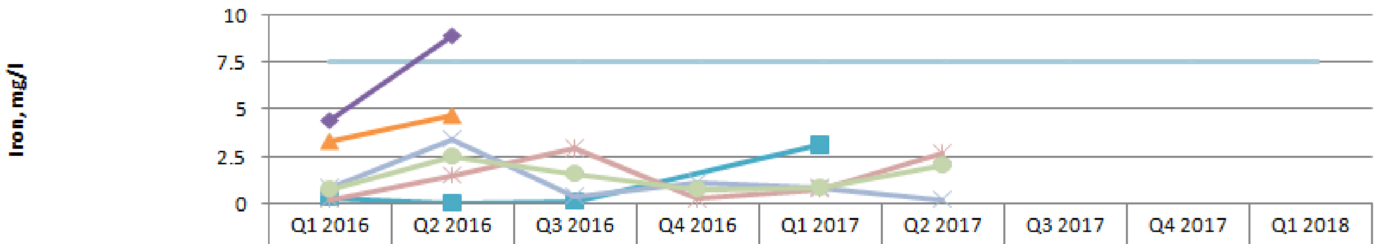


	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
SWS DP-Up	<0.05	0.63	0.33	<0.05	0.18	0.18	<0.05	0.14	0.14
SWS DP-Down	<0.05	0.29	0.39	0.10	0.05	0.16	3.350	0.05	0.37
SWS 12	1.15	1.09	0.23	0.10	0.14	0.42	<0.05	0.05	<0.05
SWS 13	6.27	67.92	14.16	40.68	3.18	7.13	4.920	12.06	2.56
SWS 14	4.93	27.23	8.01	5.00	1.50	2.57	1.82	10.86	7.14
SWS 17	2.39	21.62	4.81	4.76	1.73	3.16	1.420	1.79	7.23

Monitoring Period

Figure 6-78: Plot of Iron monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)

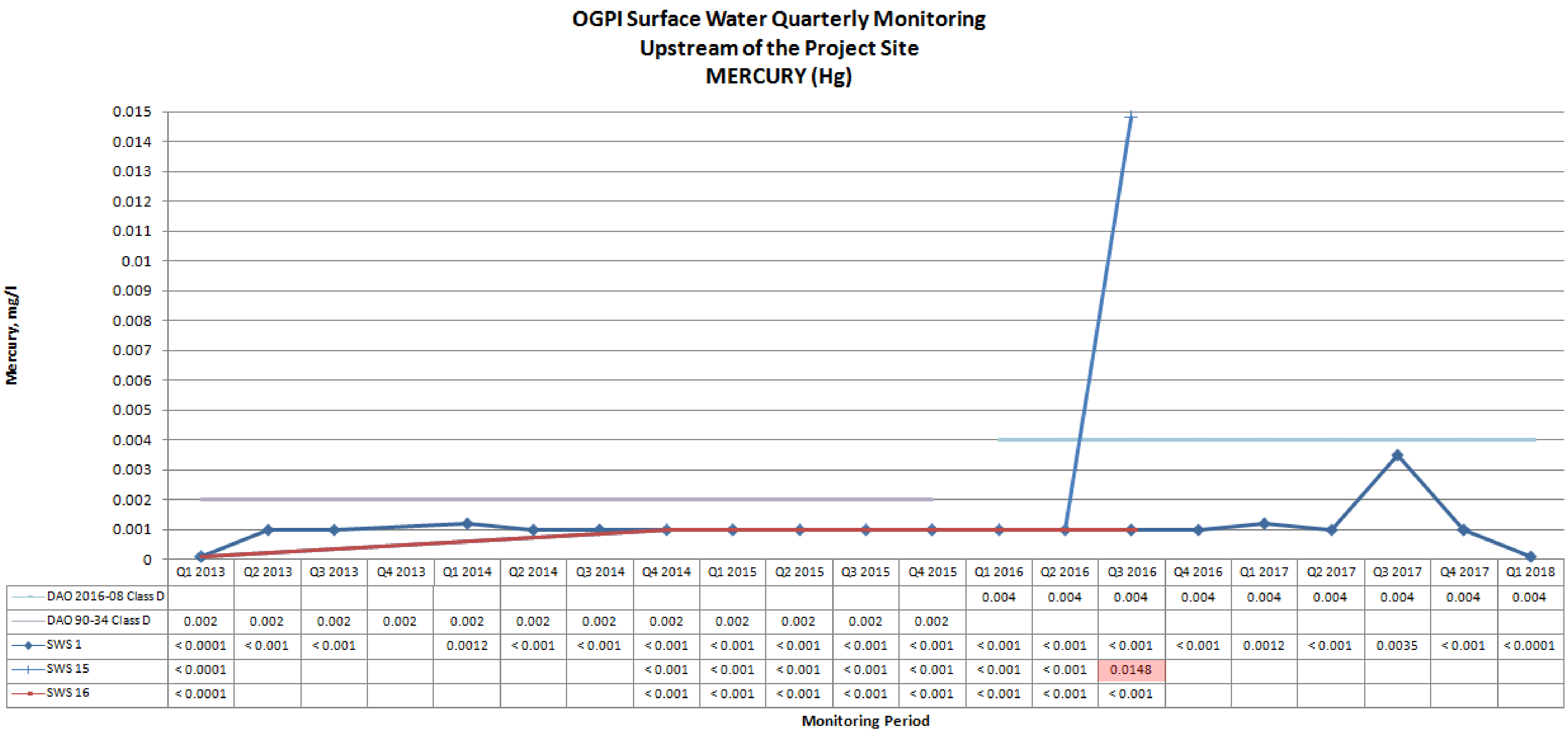
OGPI Surface Water Quarterly Monitoring Downstream of the Project Site IRON (Fe)



	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
SWS 18	4.41	8.95							
SWS 19	0.31	<0.05	0.13		3.10				
SWS 20	3.31	4.7							
SWS 21	0.88	3.45	0.41	1.15	0.89	0.25			
SWS 22	0.23	1.53	2.92	0.28	0.80	2.66			
SWS 23	0.79	2.52	1.61	0.80	0.89	2.04			

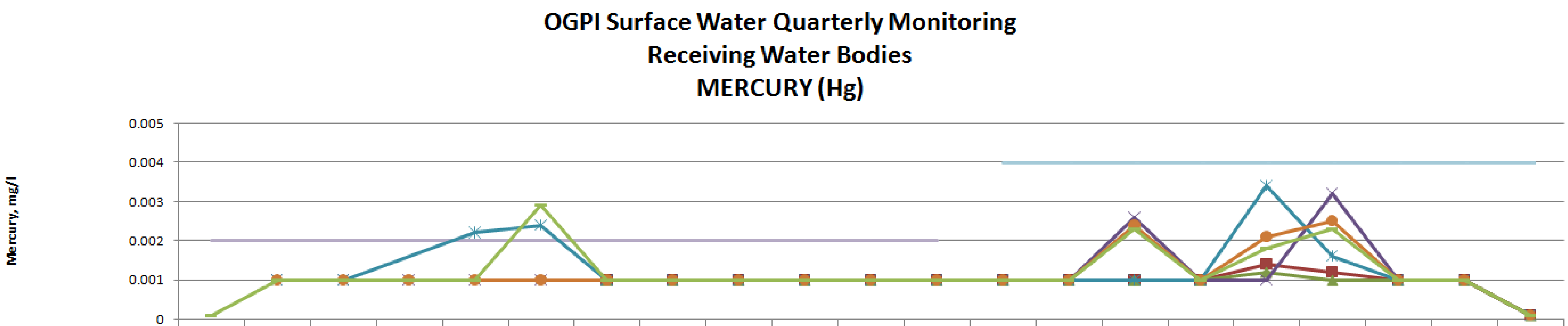
Monitoring Period

Figure 6-79: Plot of Iron monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
DAO 90-34 Class D	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002									
SWS 1	< 0.0001	< 0.001	< 0.001		0.0012	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0012	< 0.001	0.0035	< 0.001	< 0.0001
SWS 15	< 0.0001							< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0148						
SWS 16	< 0.0001							< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001						

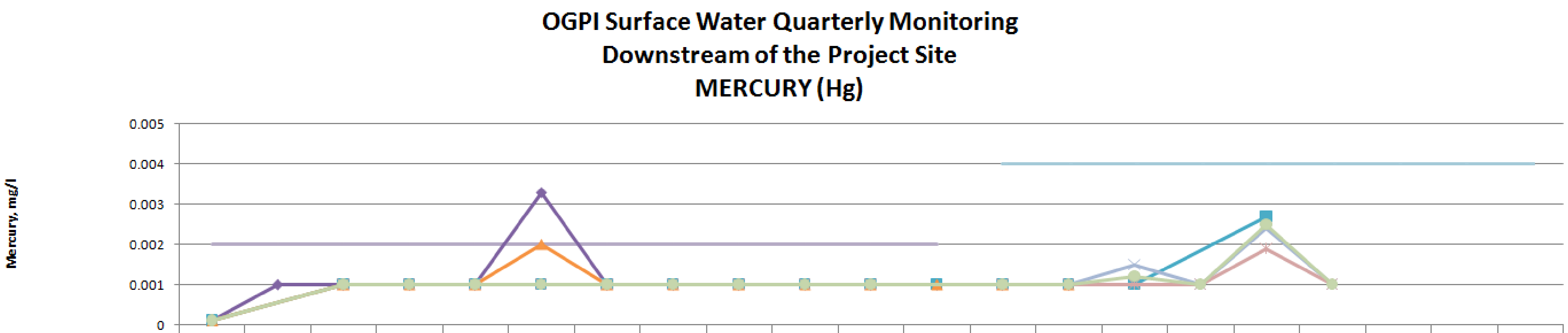
Figure 6-80: Plot of Mercury monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
DAO 90-34 Class D	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002									
SWS DP-Up							< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0014	0.0012	< 0.001	< 0.001	< 0.0001
SWS DP-Down							< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0012	< 0.001	< 0.001	< 0.001	< 0.0001
SWS 12		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0026	< 0.001	< 0.001	0.0032	< 0.001	< 0.001	< 0.0001
SWS 13		< 0.001	< 0.001		0.0022	0.0024	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0034	0.0016	< 0.001	< 0.001	< 0.0001
SWS 14		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0024	< 0.001	0.0021	0.0025	< 0.001	< 0.001	< 0.0001
SWS 17	< 0.0001	< 0.001	< 0.001		< 0.001	0.0029	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0023	< 0.001	0.0018	0.0023	< 0.001	< 0.001	< 0.0001

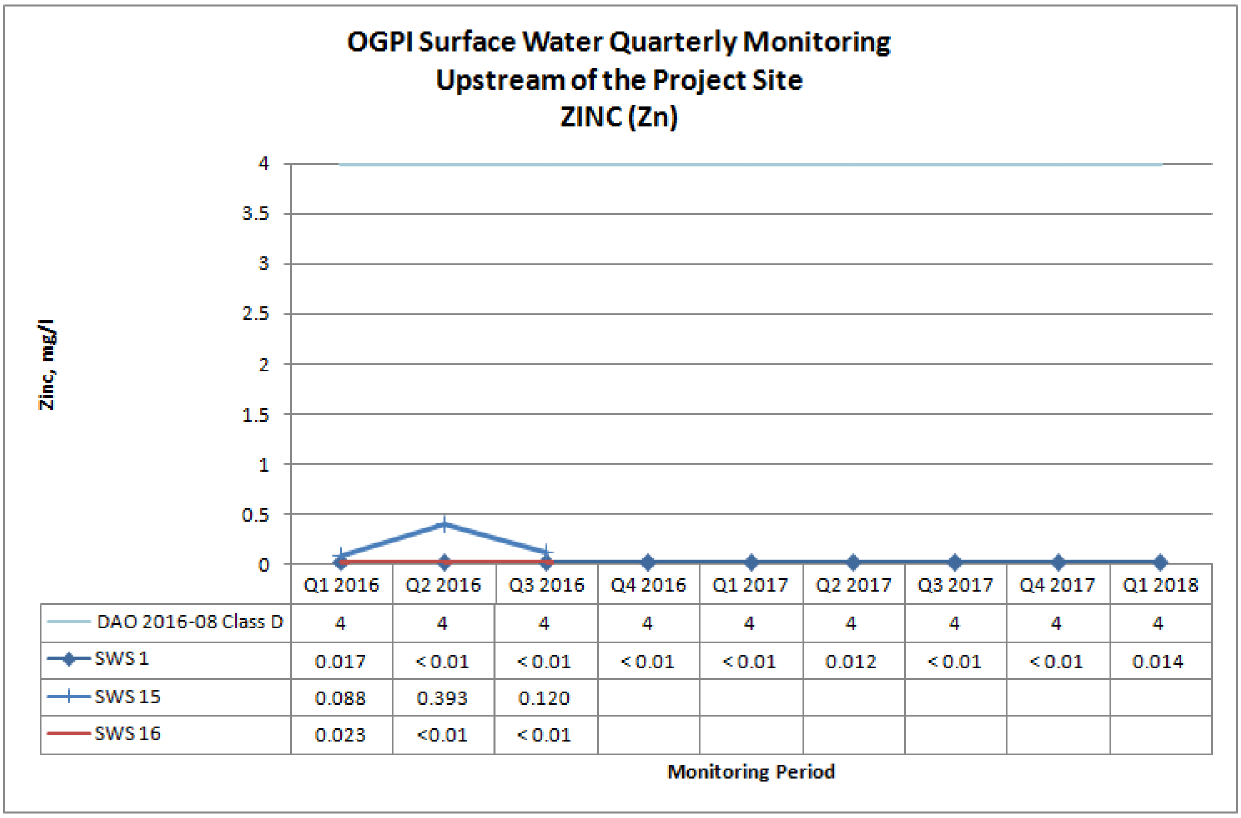
Monitoring Period

Figure 6-81: Plot of Mercury monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



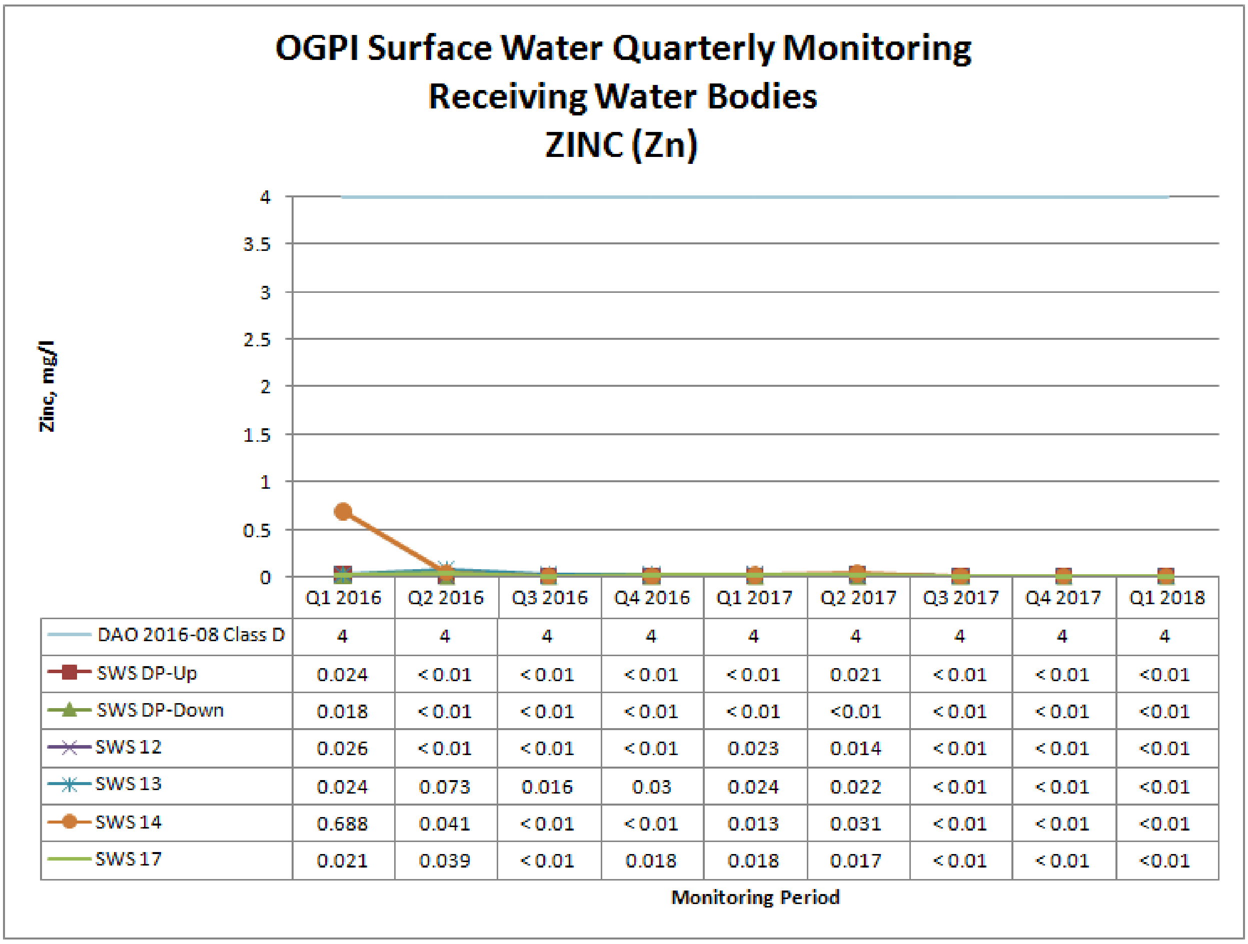
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D													0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
DAO 90-34 Class D	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002									
SWS 18	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	0.0033	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001							
SWS 19	< 0.0001		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		0.0027				
SWS 20	< 0.0001		< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001							
SWS 21			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	0.0015	< 0.001	0.0024	0.001			
SWS 22			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	< 0.001	< 0.001	0.0019	< 0.001			
SWS 23	< 0.0001		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	0.0012	< 0.001	0.0025	< 0.001			

Figure 6-82: Plot of Mercury monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



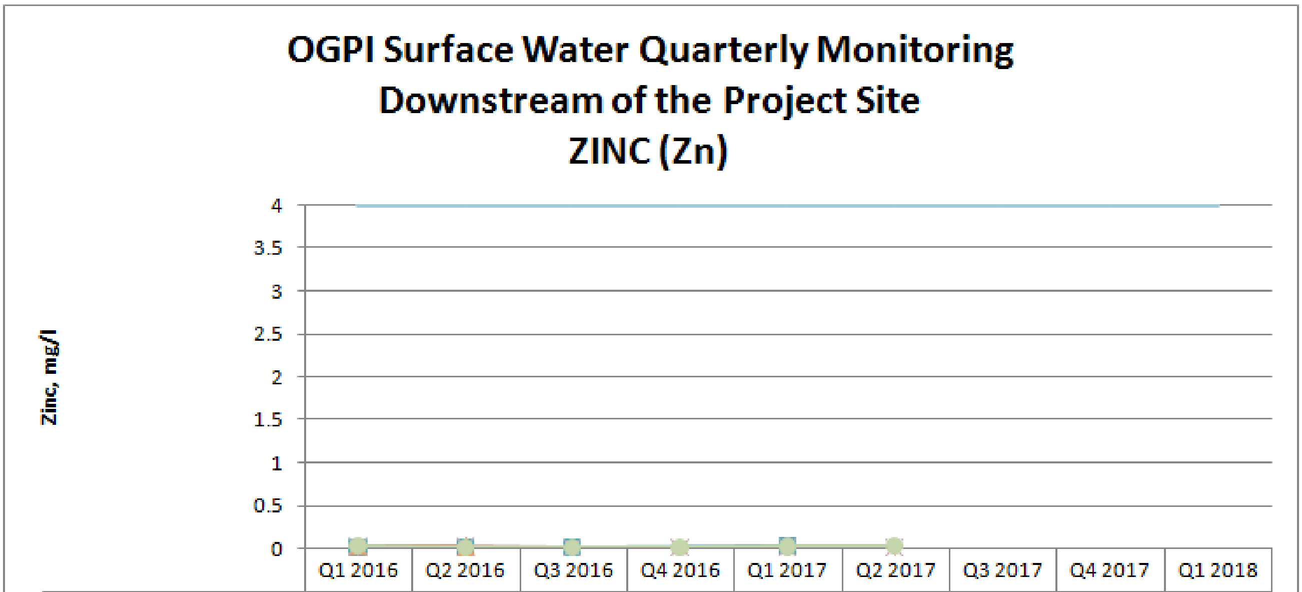
	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	4	4	4	4	4	4	4	4	4
SWS 1	0.017	< 0.01	< 0.01	< 0.01	< 0.01	0.012	< 0.01	< 0.01	0.014
SWS 15	0.088	0.393	0.120						
SWS 16	0.023	<0.01	< 0.01						

Figure 6-83: Plot of Zinc monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



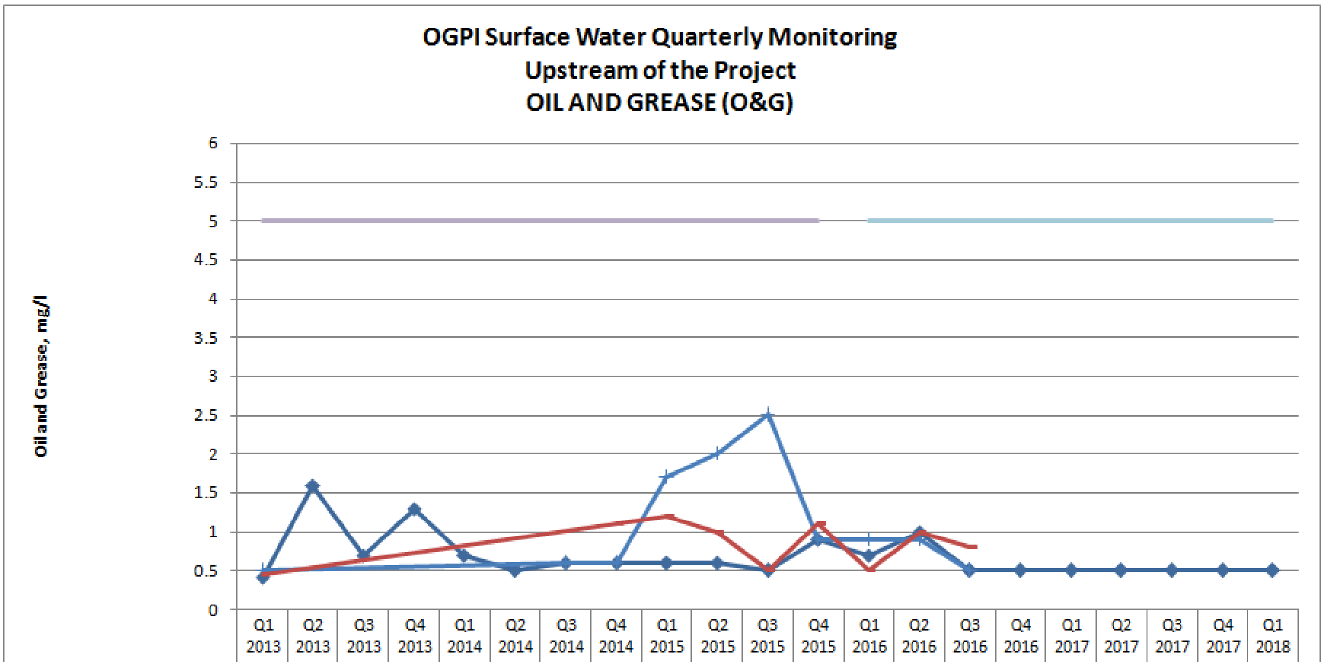
	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	4	4	4	4	4	4	4	4	4
SWS DP-Up	0.024	< 0.01	< 0.01	< 0.01	< 0.01	0.021	< 0.01	< 0.01	<0.01
SWS DP-Down	0.018	< 0.01	< 0.01	< 0.01	< 0.01	<0.01	< 0.01	< 0.01	<0.01
SWS 12	0.026	< 0.01	< 0.01	< 0.01	0.023	0.014	< 0.01	< 0.01	<0.01
SWS 13	0.024	0.073	0.016	0.03	0.024	0.022	< 0.01	< 0.01	<0.01
SWS 14	0.688	0.041	< 0.01	< 0.01	0.013	0.031	< 0.01	< 0.01	<0.01
SWS 17	0.021	0.039	< 0.01	0.018	0.018	0.017	< 0.01	< 0.01	<0.01

Figure 6-84: Plot of Zinc monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



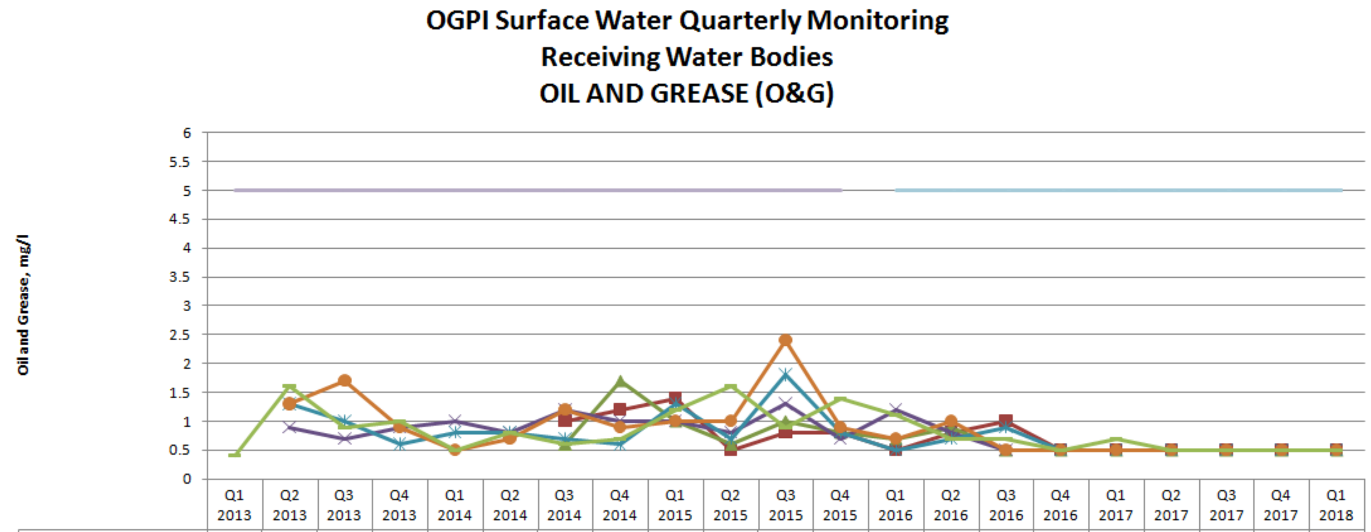
	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 2016-08 Class D	4	4	4	4	4	4	4	4	4
SWS 18	0.023	0.022							
SWS 19	0.015	< 0.01	< 0.01		0.029				
SWS 20	0.026	0.018							
SWS 21	0.028	0.012	< 0.01	< 0.01	0.014	0.015			
SWS 22	< 0.01	0.016	< 0.01	< 0.01	< 0.01	0.015			
SWS 23	0.022	0.013	< 0.01	< 0.01	0.019	0.026			

Figure 6-85: Plot of Zinc monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D	5	5	5	5	5	5	5	5	5	5	5	5									
DAO 2016-08 Class D													5	5	5	5	5	5	5	5	5
SWS 1	0.41	1.6	0.7	1.3	0.7	0.5	0.6	0.6	0.6	0.6	0.5	0.9	0.7	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
SWS 15	0.51						0.6	0.6	1.7	2	2.5	0.9	0.9	0.9	< 0.5						
SWS 16	0.44							1.1	1.2	1	0.5	1.1	< 0.5	1	0.8						

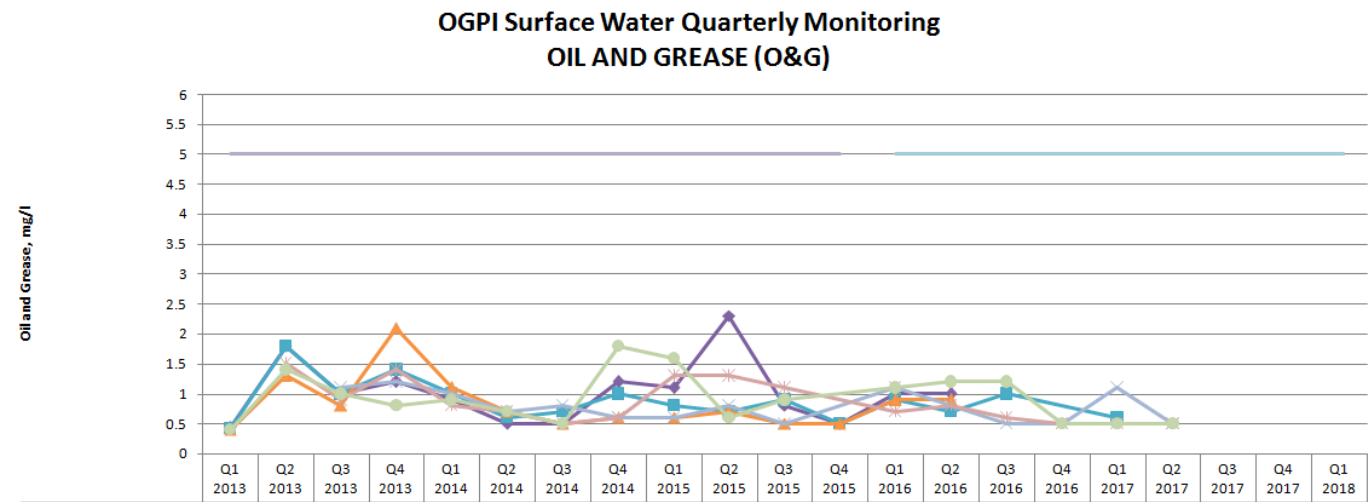
Figure 6-86: Plot of Oil and Grease monitoring data for surface water bodies upstream of the Project (SW1, SW15, and SW16)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D	5	5	5	5	5	5	5	5	5	5	5	5									
DAO 2016-08 Class D													5	5	5	5	5	5	5	5	5
SWS DP-Up							1	1.2	1.4	< 0.5	0.8	0.8	< 0.5	0.8	1.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
SWS DP-Down							0.6	1.7	1	0.6	1	0.8	0.7	0.9	< 0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5
SWS 12		0.9	0.7	0.9	1	0.8	1.2	1	1	0.8	1.3	0.7	1.2	0.8	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
SWS 13		1.3	1.0	0.6	0.8	0.8	0.7	0.6	1.3	0.7	1.8	0.8	< 0.5	0.7	0.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
SWS 14		1.3	1.7	0.9	0.5	0.7	1.2	0.9	1	1	2.4	0.9	0.7	1	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
SWS 17	< 0.4	1.6	0.9	1	0.5	0.8	0.6	0.7	1.2	1.6	0.9	1.4	1.1	0.7	0.7	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5

Monitoring Period

Figure 6-87: Plot of Oil and Grease monitoring data for ambient water quality monitoring stations located at the receiving surface water bodies of the Project (SWS DP-Up, SW DP-Down, SWS 12, SWS 13, SWS 14 and SW17)



	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018
DAO 90-34 Class D	5	5	5	5	5	5	5	5	5	5	5	5									
DAO 2016-08 Class D													5	5	5	5	5	5	5	5	5
SWS 18	0.43	1.8	1	1.2	0.9	0.5	0.5	1.2	1.1	2.3	0.8	< 0.5	1.0	1							
SWS 19	0.42	1.8	1	1.4	1	0.6	0.7	1	0.8	0.7	0.9	< 0.5	0.9	0.7	1.0		0.6				
SWS 20	< 0.4	1.3	0.8	2.1	1.1	0.7	0.5	0.6	0.6	0.7	0.5	< 0.5	0.9	0.9							
SWS 21			1.1	1.2	1	0.7	0.8	0.6	0.6	0.8	0.5		1.1	0.8	< 0.5	< 0.5	1.1	< 0.5			
SWS 22		1.5	0.9	1.4	0.8	0.7	0.5	0.6	1.3	1.3	1.1		0.7	0.8	0.6	< 0.5	< 0.5	< 0.5			
SWS 23	< 0.4	1.4	1	0.8	0.9	0.7	0.5	1.8	1.6	0.6	0.9		1.1	1.2	1.2	< 0.5	< 0.5	< 0.5			

Monitoring Period

Figure 6-88: Plot of Oil and Grease monitoring data for ambient water quality monitoring stations located downstream and outside the Project area (SWS 18 – SWS 23)

6.1.3 Air and Noise

6.1.3.1 Air Quality

The primary impact expected from OGPI's operations in terms of air quality is the increase in fugitive dust emissions in various areas in the mine site due to mine operations and heavy equipment movement. In order to mitigate the possible impacts to air quality, the following measures are being implemented:

- Implementation of road moistening or water spraying
- Slowing down of vehicles especially during dusty conditions
- Where possible, areas around the mine site are revegetated so that trees may act as screens that can significantly reduce particulate matter dispersion
- Wetting of crushed ore materials coming out from the crusher
- Conduct of regular maintenance of equipment and vehicles to ensure efficient operation
- Implementation of Greenhouse Gas Management Plan

Monthly monitoring of TSP is undertaken by OGPI to assess the existing air quality of areas in the vicinity of the project. Until the year 2015, TSP was being monitored in eight monitoring stations, namely:

- Didipio Elementary School
- Process area
- Near the environment laboratory
- TSF office
- TSF crusher
- Accommodation camp
- WRD 6 (landfill area)
- Mine haul road

However, due to the shift in OGPI's operation from open pit mining to underground mining in 2015, a significant decrease in dust emissions is expected.

Air quality is currently being monitored in two stations, namely in the accommodation camp and in the community area. The ambient air quality parameters measured are evaluated using the standards from the Philippine Clean Air Act of 1999 (RA 8749) or CAA and its implementing rules and regulations (DAO 2000-81). Concentrations of TSP measured over a 1-hr averaging period were compared against the National Ambient Air Quality Standards for Source Specific Air Pollutant (NAAQSSAP).

The results of the air quality monitoring are summarized in Figure 6-89 and Table 6-15. Analysis indicates that in general the air quality in the vicinity of the project site remains within the standard.

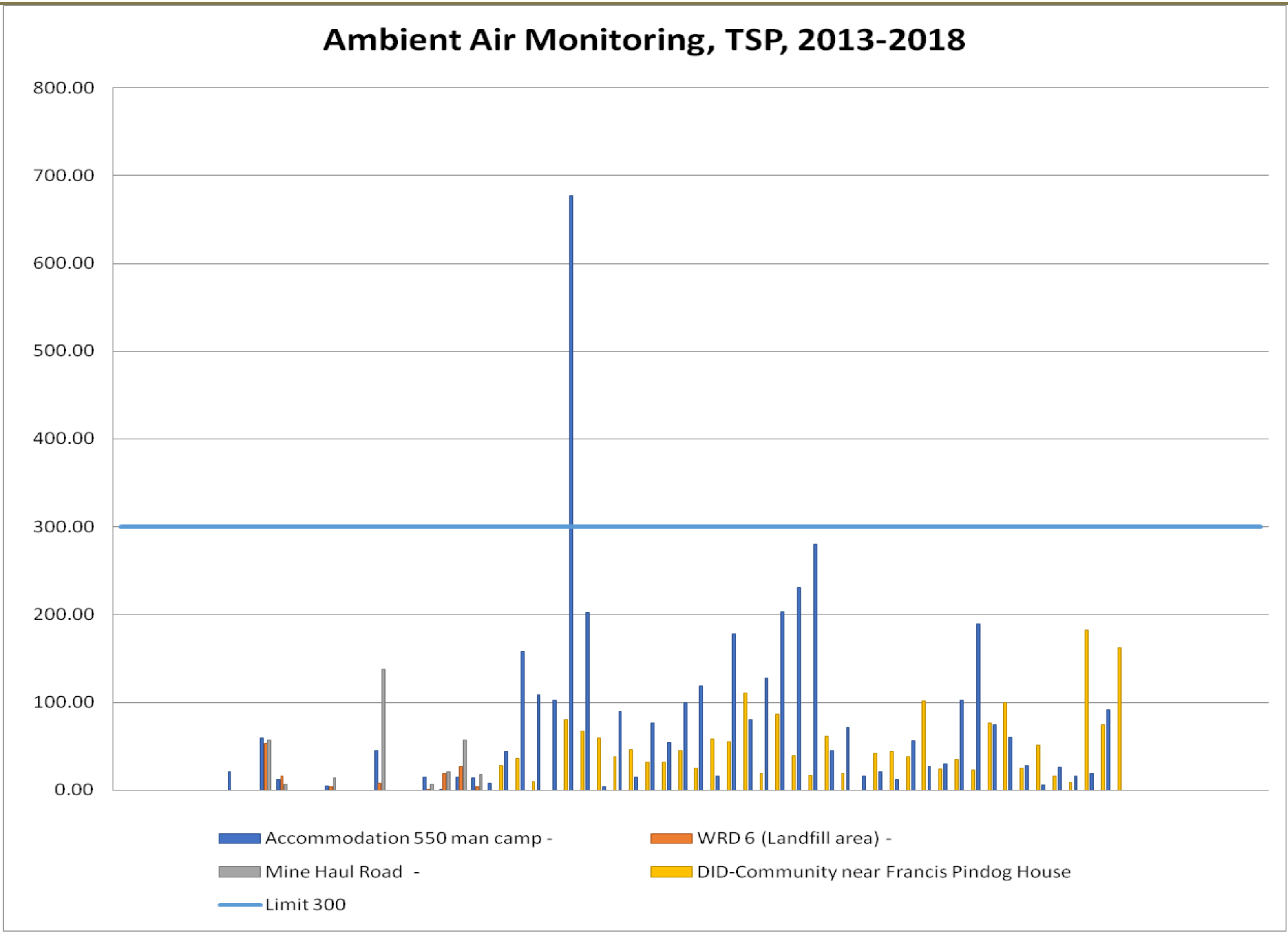


Figure 6-89: Ambient Air Quality Monitoring, TSP (2013-2018)

Table 6-15: Ambient Air Quality Monitoring, TSP (2013-2018)

Year	Month	Didipio Elementary School	Process Area	Near Environment Laboratory	TSF Office	TSF Crusher	Accommodation 550 man camp	WRD 6 (Landfill area)	Mine Haul Road	DID-Community near Francis Pindog House	Limit
2013	January	-	-	-	-	-	-	-	-	-	300
	February	-	-	-	-	-	-	-	-	-	300
	March	-	-	-	-	-	-	-	-	-	300
	April	-	-	-	-	-	-	-	-	-	300
	May	-	-	-	-	-	-	-	-	-	300
	June	-	-	-	-	-	-	-	-	-	300
	July	-	-	-	-	-	-	-	-	-	300
	August	-	-	-	-	-	-	-	-	-	300
	September	15.43	21.44	10.79	34.17	110.38	20.54	-	-	-	300
	October	-	-	-	-	-	-	-	-	-	300
	November	49.50	63.90	48.00	56.20	57.50	59.00	53.00	57.10	-	300
	December	11.76	16.20	1.85	10.89	60.80	11.33	16.12	6.70	-	300
2014	January	-	-	-	-	-	-	-	-	-	300
	February	-	-	-	-	-	-	-	-	-	300
	March	14.95	4.53	4.33	24.76	104.17	4.40	3.74	13.74	-	300
	April	-	-	-	-	-	-	-	-	-	300
	May	-	-	-	-	-	-	-	-	-	300
	June	14.00	60.96	77.74	21.98	26.71	45.34	7.95	137.69	-	300
	July	-	-	-	-	-	-	-	-	-	300
	August	-	-	-	-	-	-	-	-	-	300
	September	5.73	10.49	41.67	1.59	-	14.93	1.40	7.35	-	300
	October	5.80	7.29	14.43	46.05	-	0.64	18.97	21.21	-	300
	November	39.94	2.36	62.02	22.09	-	14.99	27.13	57.22	-	300
	December	4.61	34.88	14.91	51.36	-	13.72	4.36	18.15	-	300
2015	January	-	-	-	-	-	7.37	-	-	28.19	300
	February	-	-	-	-	-	44.32	-	-	36.32	300
	March	-	-	-	-	-	157.43	-	-	9.84	300
	April	-	-	-	-	-	108.29	-	-		300
	May	-	-	-	-	-	102.20	-	-	80.28	300
	June	-	-	-	-	-	68.3	-	-	67.83	300
	July	-	-	-	-	-	201.80	-	-	59.76	300
	August	-	-	-	-	-	3.95	-	-	38.49	300

Year	Month	Didipio Elementary School	Process Area	Near Environment Laboratory	TSF Office	TSF Crusher	Accommodation 550 man camp	WRD 6 (Landfill area)	Mine Haul Road	DID-Community near Francis Pindog House	Limit
	September	-	-	-	-	-	88.93	-	-	46.25	300
	October	-	-	-	-	-	14.83	-	-	31.95	300
	November	-	-	-	-	-	76.46	-	-	31.95	300
	December	-	-	-	-	-	54.40	-	-	45.22	300
2016	January	-	-	-	-	-	99.69	-	-	25.25	300
	February	-	-	-	-	-	118.99	-	-	58.67	300
	March	-	-	-	-	-	15.26	-	-	55.05	300
	April	-	-	-	-	-	178.36	-	-	111.32	300
	May	-	-	-	-	-	80.15	-	-	18.90	300
	June	-	-	-	-	-	128.09	-	-	86.92	300
	July	-	-	-	-	-	203.73	-	-	39.37	300
	August	-	-	-	-	-	230.70	-	-	17.02	300
	September	-	-	-	-	-	279.97	-	-	61.00	300
	October	-	-	-	-	-	44.99	-	-	19.07	300
	November	-	-	-	-	-	70.99	-	-	-	300
	December	-	-	-	-	-	16.26	-	-	41.93	300
2017	January	-	-	-	-	-	20.65	-	-	44.82	300
	February	-	-	-	-	-	11.27	-	-	37.95	300
	March	-	-	-	-	-	56.04	-	-	101.99	300
	April	-	-	-	-	-	27.06	-	-	24.58	300
	May	-	-	-	-	-	29.89	-	-	35.29	300
	June	-	-	-	-	-	102.75	-	-	23.52	300
	July	-	-	-	-	-	189.19	-	-	76.95	300
	August	-	-	-	-	-	74.36	-	-	99.88	300
	September	-	-	-	-	-	60.07	-	-	25.03	300
	October	-	-	-	-	-	27.47	-	-	51.68	300
	November	-	-	-	-	-	5.63	-	-	16.18	300
	December	-	-	-	-	-	26.00	-	-	9.34	300
2018	January	-	-	-	-	-	16.01	-	-	182.71	300
	February	-	-	-	-	-	19.23	-	-	74.95	300
	March	-	-	-	-	-	91.68	-	-	162.18	300

6.1.3.2 Noise

The generation of noise is expected from the project through the operation of underground mining activities such as drilling and blasting, as well as the operation of gensets, crusher, and heavy equipment. The potential impacts on the environment in terms of noise generation are mitigated through the following measures:

- Mufflers are properly maintained in noisy equipment
- Gensets are enclosed with metal clad
- Crusher is barricaded with rock materials to serve as noise barriers
- Trees are planted in bund areas to serve as noise barriers
- Noise-generating activities (i.e. blasting, rock breaking, hauling) are restricted at night
- Provision of personal protective equipment (i.e. earplugs) to workers
- Noise is monitored at the site boundary, at the nearest or most effected and in response to any complaints received.

Noise is monitored monthly at the nearest or most impacted residences, and if complaints are received from the community, in areas identified by the complainants. The results of the noise monitoring area evaluated based on the Noise Quality and Emission Standards of the National Pollution Control Commission (NPCC).

The results of the noise monitoring are shown in Figure 6-90 to Figure 6-93, and in Table 6-16. The results of the monitoring indicate that in general, the noise in the vicinity of the project site remains within the standard, except four instances recorded in June 2015 (Diclihon residence, morning and evening) and August 2015 (Malanta residence and Batolbatol residence). The recorded exceedances were attributed to passing civilian vehicles in the sampling station.

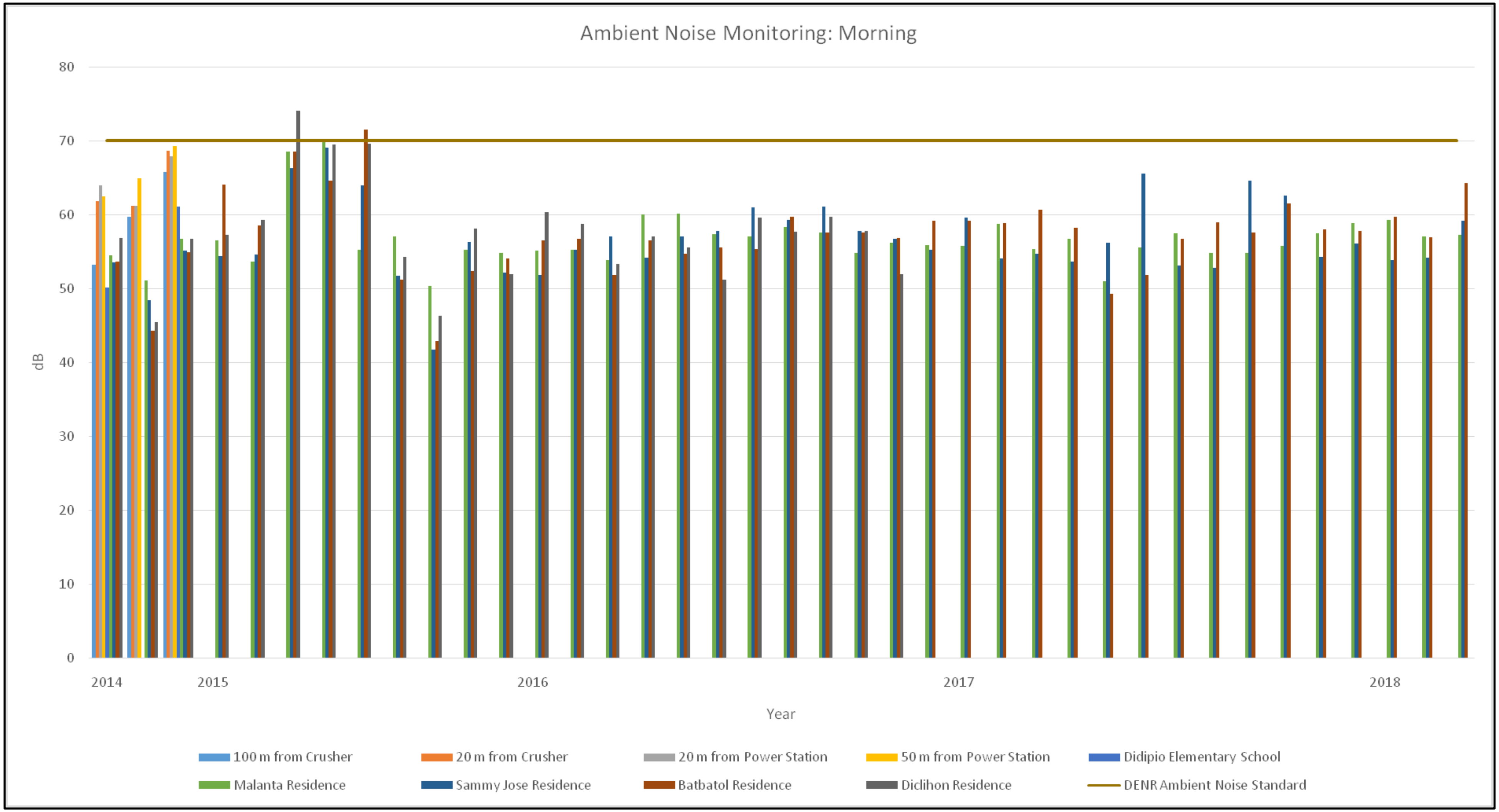


Figure 6-90: Ambient Noise Monitoring, Morning (2014-2018)

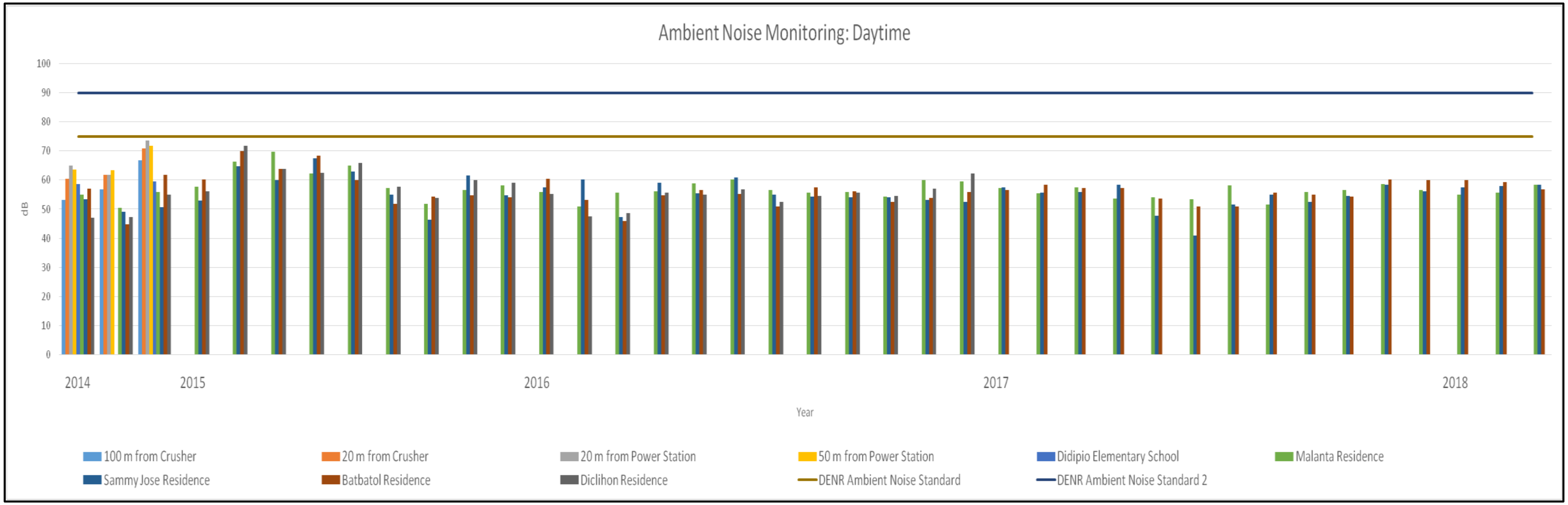


Figure 6-91: Ambient Noise Monitoring, Daytime (2014-2018)

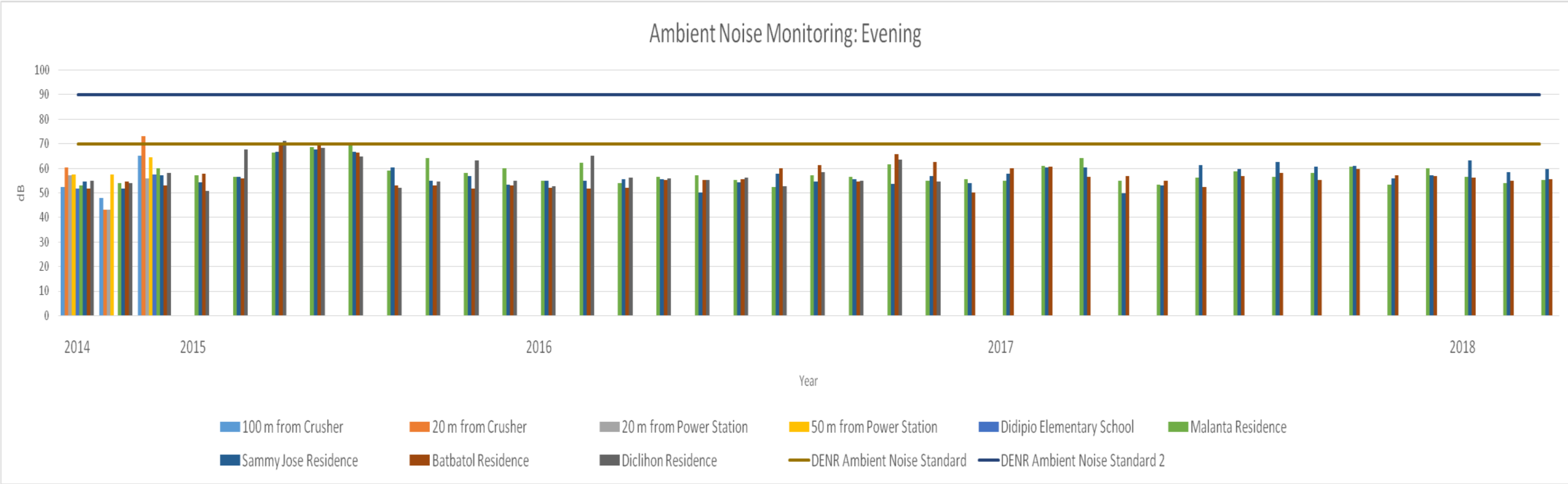


Figure 6-92: Ambient Noise Monitoring, Evening (2014-2018)

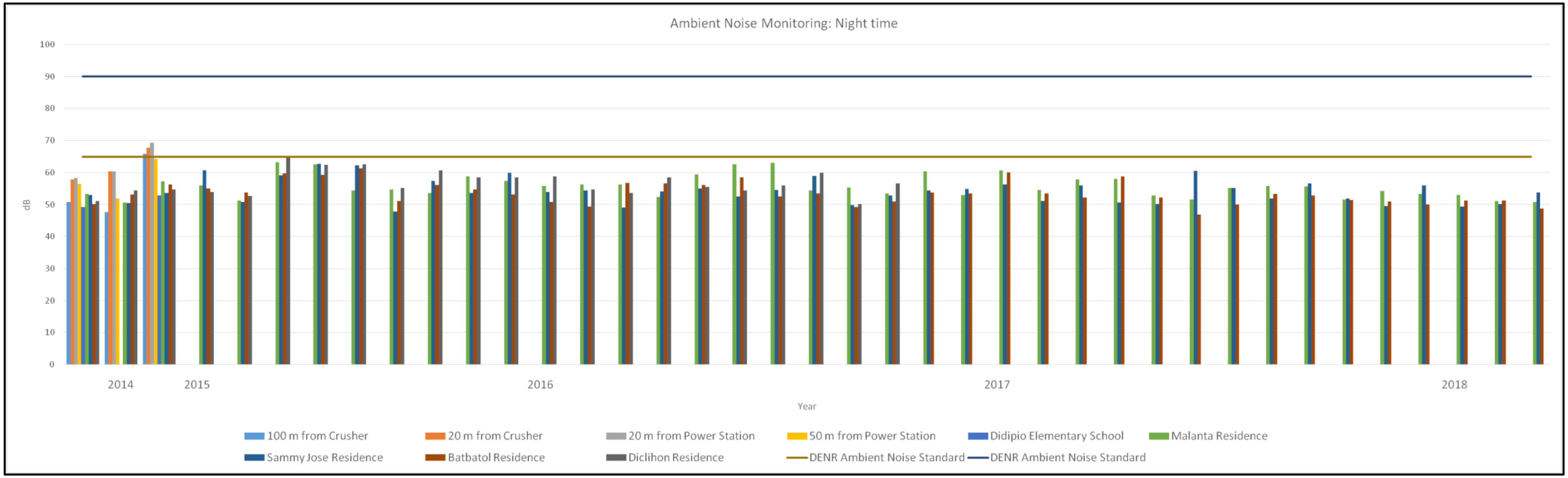


Figure 6-93: Ambient Noise Monitoring, Night time (2014-2018)

Table 6-16: Results of Noise Monitoring (2014-2018)

Year	Month	Monitoring station	Morning	Daytime	Evening	Nighttime
2014	October	20 m from Power Station**	64	65.1	57.1	58.4
		50 m from Power Station**	62.5	63.6	57.6	56.5
		100 m from Crusher**	53.2	53.2	52.4	50.8
		Malanta Residence	54.5	54.9	52.9	53.3
		Sammy Jose Residence	53.5	53.5	54.7	53
		Batbatol Residence	53.6	57.1	51.8	50.3
		Diclihon Residence	56.8	47	54.8	51.1
		20 m from Crusher	61.8	60.4	60.4	58
		Didipio Elementary School	50.1	58.7	51.6	49.3
	November	20 m from Power Station**	61.2	61.8	43.2	60.4
		50 m from Power Station**	64.9	63.3	57.5	51.9
		100 m from Crusher**	59.7	56.8	48	47.8
		Malanta Residence	51.1	50.5	53.9	50.7
		Sammy Jose Residence	48.4	49.1	51.8	50.5
		Batbatol Residence	44.3	44.7	54.7	53.2
		Diclihon Residence	45.5	47.2	53.9	54.4
		20 m from Crusher	61.2	61.8	43.2	60.4
		Didipio Elementary School				
	December	20 m from Power Station**	67.9	73.7	55.8	69.4
		50 m from Power Station**	69.3	71.8	64.5	64.3
		100 m from Crusher**	65.8	66.8	65.3	65.9
		Malanta Residence	56.7	55.8	60.1	57.3
		Sammy Jose Residence	55.1	50.6	57.1	53.7
		Batbatol Residence	54.9	61.9	53.1	56.3
		Diclihon Residence	56.7	54.9	58.3	54.8
		20 m from Crusher	68.6	71	73.1	67.8
		Didipio Elementary School	61.1	59.6	57.5	52.9
2015	January	Malanta Residence	56.5	57.7	57.2	56.1
		Sammy Jose Residence	54.4	52.9	54.2	60.7
		Batbatol Residence	64.1	60.2	57.8	55.1
		Diclihon Residence	57.3	56.2	50.7	54
	May	Malanta Residence	53.7	66.4	56.7	51.3
		Sammy Jose Residence	54.6	64.8	56.6	50.8
		Batbatol Residence	58.5	69.9	55.8	53.9
		Diclihon Residence	59.3	71.9	67.6	52.8
	June	Malanta Residence	68.5	69.8	66.3	63.2
		Sammy Jose Residence	66.3	60.1	66.9	59.2
		Batbatol Residence	68.5	63.8	70	59.8
		Diclihon Residence	74.1	63.8	71.1	64.7
	July	Malanta Residence	69.9	62.3	68.8	62.6
		Sammy Jose Residence	69.1	67.6	67.8	62.8
		Batbatol Residence	64.6	68.3	70	59.3
		Diclihon Residence	69.5	62.4	68.4	62.5

Year	Month	Monitoring station	Morning	Daytime	Evening	Nighttime
	August	Malanta Residence	55.2	64.9	70.2	54.4
		Sammy Jose Residence	64	63	66.7	62.3
		Batbatol Residence	71.5	60.1	66.3	61.4
		Diclihon Residence	69.6	66	64.7	62.6
	September	Malanta Residence	57	57.2	59.2	54.8
		Sammy Jose Residence	51.7	55.1	60.4	47.9
		Batbatol Residence	51.2	51.9	53.1	51.2
		Diclihon Residence	54.3	57.7	52.1	55.2
	October	Malanta Residence	50.4	51.8	64.1	53.7
		Sammy Jose Residence	41.7	46.3	55	57.4
		Batbatol Residence	42.9	54.4	52.9	56.2
		Diclihon Residence	46.3	53.9	54.7	60.8
	November	Malanta Residence	55.2	56.5	58.1	58.9
		Sammy Jose Residence	56.3	61.6	57	53.7
		Batbatol Residence	52.4	54.8	51.7	54.8
		Diclihon Residence	58.1	60	63.4	58.5
	December	Malanta Residence	54.8	58.2	60.1	57.5
		Sammy Jose Residence	52.2	54.8	53.3	60
		Batbatol Residence	54.1	54.2	53.1	53.2
		Diclihon Residence	51.9	59.2	55	58.5
2016	January	Malanta Residence	55.1	55.8	54.9	55.9
		Sammy Jose Residence	51.8	57.6	54.9	54
		Batbatol Residence	56.5	60.5	52.2	50.9
		Diclihon Residence	60.3	55.3	52.8	58.9
	February	Malanta Residence	55.2	51	62.2	56.3
		Sammy Jose Residence	55.2	60.3	54.9	54.5
		Batbatol Residence	56.7	53.2	51.7	49.5
		Diclihon Residence	58.7	47.6	65.2	54.8
	March	Malanta Residence	53.9	55.6	54	56.4
		Sammy Jose Residence	57	47.3	55.5	49.1
		Batbatol Residence	51.8	46	52.2	56.8
		Diclihon Residence	53.3	48.7	56.1	53.7
	April	Malanta Residence	60	56.2	56.5	52.5
		Sammy Jose Residence	54.2	59.2	55.7	54.2
		Batbatol Residence	56.5	54.8	55.3	56.6
		Diclihon Residence	57	55.6	55.8	58.6
	May	Malanta Residence	60.1	58.8	57.1	59.5
		Sammy Jose Residence	57.1	55.35	50.1	55.15
		Batbatol Residence	54.75	56.65	55.3	56.25
		Diclihon Residence	55.55	55.09	55.35	55.6
	June	Malanta Residence	57.4	60.2	55.3	62.6
		Sammy Jose Residence	57.8	60.9	54.2	52.6
		Batbatol Residence	55.6	55.2	55.5	58.6
		Diclihon Residence	51.2	56.9	56.2	54.5

Year	Month	Monitoring station	Morning	Daytime	Evening	Nighttime
	July	Malanta Residence	57	56.6	52.3	63.1
		Sammy Jose Residence	61	54.9	57.9	54.7
		Batbatol Residence	55.3	50.8	60	52.6
		Diclihon Residence	59.6	52.6	52.8	56
	August	Malanta Residence	58.3	55.7	57.3	54.5
		Sammy Jose Residence	59.3	54.3	54.7	59.1
		Batbatol Residence	59.7	57.5	61.5	53.5
		Diclihon Residence	57.7	54.6	58.6	59.9
	September	Malanta Residence	57.6	56	56.7	55.4
		Sammy Jose Residence	61.1	54.2	55.5	49.9
		Batbatol Residence	57.6	56.2	54.5	49.3
		Diclihon Residence	59.7	55.7	55	50.3
	October	Malanta Residence	54.8	54.3	61.6	53.6
		Sammy Jose Residence	57.8	54.05	53.7	52.95
		Batbatol Residence	57.6	52.6	65.85	51
		Diclihon Residence	57.8	54.65	63.5	56.7
	November	Malanta Residence	56.2	60.1	55	60.5
		Sammy Jose Residence	56.75	53.25	57	54.4
		Batbatol Residence	56.8	53.8	62.7	53.85
		Diclihon Residence	51.9	57	54.5	
	December	Malanta Residence	55.9	59.5	55.7	53
		Sammy Jose Residence	55.2	52.55	54.05	55
		Batbatol Residence	59.2	56	50.05	53.5
		Diclihon Residence		62.3		
2017	January	Malanta Residence	55.8	57.3	54.9	60.8
		Sammy Jose Residence	59.6	57.5	57.9	56.3
		Batbatol Residence	59.2	56.7	60	60.1
	February	Malanta Residence	58.8	55.5	61.1	54.6
		Sammy Jose Residence	54.1	55.6	60.3	51.2
		Batbatol Residence	58.9	58.5	60.7	53.5
	March	Malanta Residence	55.3	57.4	64.1	57.9
		Sammy Jose Residence	54.7	56	60.5	56.1
		Batbatol Residence	60.7	57.2	56.5	52.3
	April	Malanta Residence	56.7	53.6	55.1	58.1
		Sammy Jose Residence	53.6	58.3	49.8	50.7
		Batbatol Residence	58.2	57.2	56.9	58.9
	May	Malanta Residence	51	54.2	53.5	52.9
		Sammy Jose Residence	56.2	47.8	53.1	50.2
		Batbatol Residence	49.3	53.7	55.1	52.3
	June	Malanta Residence	55.6	53.3	56.1	51.6
		Sammy Jose Residence	65.5	40.9	61.2	60.6
		Batbatol Residence	51.8	50.8	52.3	46.9
	July	Malanta Residence	57.5	58.2	58.8	55.2
		Sammy Jose Residence	53.1	51.7	59.9	55.3

Year	Month	Monitoring station	Morning	Daytime	Evening	Nighttime
		Batbatol Residence	56.7	50.8	56.9	50.1
	August	Malanta Residence	54.8	51.7	56.7	55.9
		Sammy Jose Residence	52.8	55.1	62.7	52
		Batbatol Residence	59	55.7	58	53.3
	September	Malanta Residence	54.8	55.8	58.3	55.8
		Sammy Jose Residence	64.6	52.4	60.7	56.6
		Batbatol Residence	57.6	55	55.4	52.9
	October	Malanta Residence	55.8	56.6	60.7	51.7
		Sammy Jose Residence	62.6	54.6	61	51.9
		Batbatol Residence	61.5	54.3	59.7	51.5
	November	Malanta Residence	57.5	58.6	53.3	54.3
		Sammy Jose Residence	54.3	58.3	55.8	49.6
		Batbatol Residence	58	60.3	57.1	51
	December	Malanta Residence	58.9	56.5	60	53.4
		Sammy Jose Residence	56.1	56.2	57.2	56.1
		Batbatol Residence	57.8	60	56.9	50.1
2018	January	Malanta Residence	59.3	55	56.7	53.1
		Sammy Jose Residence	53.9	57.5	63.1	49.4
		Batbatol Residence	59.7	59.9	56.1	51.4
	February	Malanta Residence	57.1	55.7	53.9	51.2
		Sammy Jose Residence	54.2	57.9	58.5	50.3
		Batbatol Residence	56.9	59.4	55	51.4
	March	Malanta Residence	57.3	58.3	55.2	50.9
		Sammy Jose Residence	59.2	58.3	59.7	53.8
		Batbatol Residence	64.3	56.9	55.6	48.8
Limit 1*			70	75	70	65
Limit 2**			90	90	90	90

*Limit 1 is for Class C areas

**Limit 2 is for Class 1 construction activities

6.1.4 Complaints Management Mechanism

In compliance with OGPI's ISO 14001:2001 certification, a grievance redress mechanism is part of OGPI's Environmental Management System (EMS). This mechanism establishes the procedures for receiving, documenting, and responding to communications from external interested parties, i.e. handling of community issues and concerns. All complaints received by OGPI are documented in their Grievance Registry. OGPI is committed in promoting positive interaction with the community and ensures that all issues are resolved in a professional and timely manner.

To date, a total of 69 complaints have been registered in OGPI's Grievance Registry. These complaints are related to issues on land (83%), environment (16%), and employment (1%) (Figure 6-94). Out of these 69 complaints, 30 complaints or 43 percent of the recorded complaints have been closed out, while 39 complaints or 57 percent of the recorded complaints are still open and are currently being resolved (Figure 6-95).

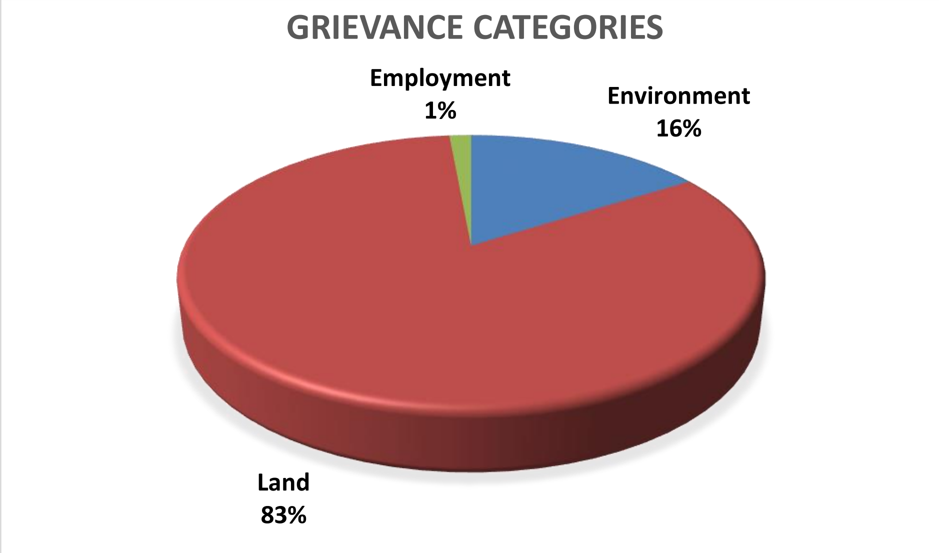


Figure 6-94: Category of Grievances

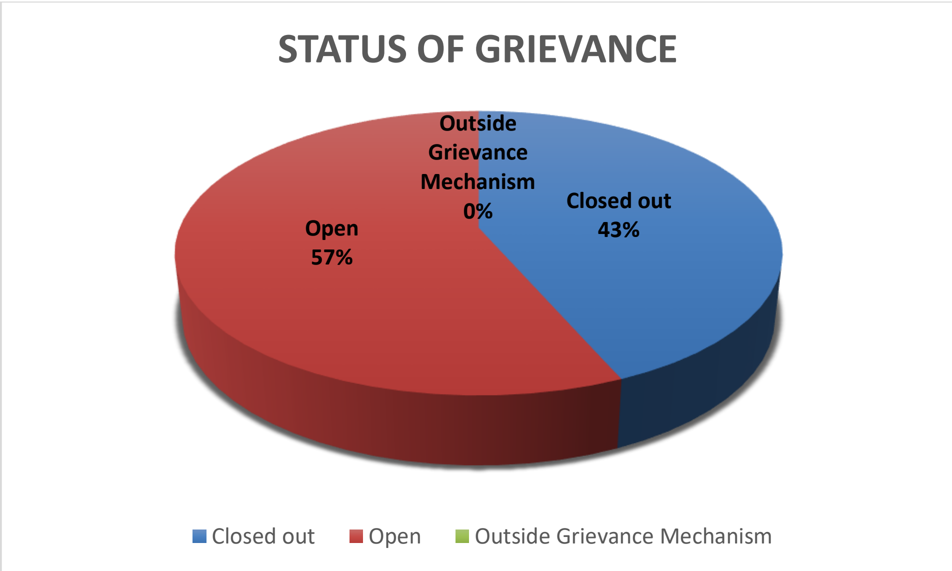


Figure 6-95: Status of Grievances

Table 6-17: Major Grievances and Actions Taken by OGPI

Major Grievances	Updates/Actions
1. **Madadag Claims**	- 4 remaining unsettled out of 31 claimants due to overlapping claims - Continuous engagement
2. **Magazine Claims**	- Provided road for Magazine Claimants
3. **Rice Field Rehabilitation (Pablo Lunag Section)**	- Ongoing Rehabilitation
4. **SAPAKMMI** (Samahang Pangkarapatan ng Katutubong Magsasaka at Manggagawa, Inc.) - 21 complainants	- July 16, 2018 Meeting with SAPAKMMI and barangay council (to conduct weekly grievance committee meeting – every monday and wednesday) - July 25, 2018, first meeting with the Barangay Council of Didipio and five (5) SAPAKMMI members to discuss individual issues and concerns. They want GM Dave to appear on the next meeting.

	- August 2, 2018, second meeting with GM David Way (proposal is to form a group or panel of arbitrators such as Mine Rehabilitation Fund Committee to arbitrate or to give decision what is right and wrong). That he does not want OGPI to become a jurisdictional body. - As to the barangay council, they did not trust DENR/MGB so they want to put in their hands with OGPI the decision making. - Barangay council made a resolution to suspend mining operation and submitted to Sangguniang Panlalawigan. - August 28, 2018. CENRO and PENRO personnel visited OGPI to investigate individual complaint. - Copy furnished of the ff: 1. Summary of Complaints 2. Individual response letters from OGPI. 3. Minutes of Meetings - September 18, 2018, CENRO/PENRO visited CRC to get copies of Agreements previously executed with the landowners. - Copy furnished to MGB(individual response letter from OGPI) - November 6, 2018. Meeting with Representative from Provincial Legal Office, MLGU Kasibu, BLGU Didipio and SAPAKKMMI at Training Center, Poblacion, Kasibu. States company's willingness to resolve SAPAKKMMI – to form Panel of Arbitrator (MRFC) to decide what is wrong and what is right.

6.1.5 Awards and Recognition

Sustainability is fundamental to the way OGPI operates. OGPI is committed to ensuring the health and safety of its people, the wellbeing of its local host communities, and upholding the highest standards in environmental and sustainability practices. Through its company values, OGPI aims to shape the culture and character of its company, and reflect these beliefs in its operations. Below are the core values of OGPI:

- Respect - We value our people, cultural diversity, communities and environment.
- Integrity - We are true to ourselves and do what is right.
- Teamwork - We collaborate and value the power of teams.
- Innovation - We challenge ourselves and others to improve.
- Action - We move effectively from concept to implementation.
- Accountability - We take ownership of our decisions and actions.

OGPI is committed to strengthen its sustainability performance with a focus on a deeper understanding of its operational impacts, and greater consistency in the execution of its sustainability policies and practices in its operations.

Environment

The Didipio Operations Environmental Management System ("EMS") ISO 14001:2015 was recertified under the Integrated Management System ("IMS") with OSHAS 18001:2007 in December 2015 by the Certification International Philippines, Inc. ("CIP")

Table 6-18: Some of OGPI's Environment-Related Awards and Recognitions from 2014-2017

Award	Contest / Awarded by	Year
2017 Awards		
Best Practice in Minerals Processing	1st ASEAN Minerals Awards	2017
Platinum Achievement Award	2017 Presidential Mineral Industry Environmental Awards (PMIEA) under Surface Mining Operation Category	2017
1st Runner Up	Best Mining Forest Contest under Metallic Mining Category	2017
2016 Awards		
3rd Runner Up	Best Mining Forest Contest under Metallic Mining Category	2016
2015 Awards		
Pusong Minero Award	Pusong Minero Awards for OGPI Emergency Response Team and Delta Mining (Contractor)	2015
Finalist	PCCI E3 Awards	2015
Mother Nature Award	Pollution Control Association of the Philippines Incorporated (PCAPI)	2015
Success Story Award – 1st Place	PCAPI	2015
Outstanding Pollution Control Officers	PCAPI	2015
Bronze	Best Environmental Excellence Award – PCAPI	2015
Global CSR Summit and Awards	Indonesia	2015
2014 Awards		
Platinum Achievement Award	PMIEA Surface Mining Category	2014
Plaque of Recognition	DENR-Environmental Management Bureau Regional Office No. 2 - Plaque of Recognition as National Entry to the 2013 Philippine Environmental Partnership Program (PEPP)	2014

Figure 6-96: Awards and Recognitions given to OGPI

Health and Safety

OGPI has been consistently performing and winning the safest mines award during the Annual National Mine Safety and Environment Award for the last four (4) years.

Table 6-19: Some of OGPI's Health and Safety-Related Awards and Recognitions from 2014-2017

Award	Contest / Awarded by	Year
2017 Awards		
Best Practice in Minerals Processing	1st ASEAN Minerals Awards	2017
Winner	Safest Mines Award under Surface Mining Category	2017
2016 Awards		
Winner	PMIEA Safest Mines Award under Surface Mining Category	2016
Winner	PMIEA Safest Mines Award, Safest Mineral Processing – Concentrator Category Award	2016
2015 Awards		
Winner	PMIEA Safest Mines Award under Surface Mining Category	2015
Pusong Minero Award	Pusong Minero Awards for OGPI Emergency Response Team and Delta Mining (Contractor)	2015
Global CSR Summit and Awards	Indonesia	2015
Certificate of Recognition to OGPI's Emergency Response Team	Local Government Unit of the Province of Nueva Ecija	2015
2014 Awards		
Winner	PMIEA Safest Mines Award under Surface Mining Category	2014

6.2 Self-Monitoring Plan

6.2.1 Monitoring Program of OGPI[2]

Monitoring program is an integral part of the Didipio Mine's operations and is being implemented by OGPI in all stages of its operations including the closure/abandonment phase of the project. The following outlines the purpose of OGPI's Monitoring Program:

- The primary purpose of the monitoring program is to determine compliance with both statutory limits and with company goals;
- The second purpose of the monitoring program is to identify problems early, using trend analysis, so that problems can be rectified before a non-compliance or adverse environmental impact occurs;
- The third purpose of the monitoring program is to identify and track environmental improvement and degradation on and off site; The fourth purpose of monitoring is to improve the effectiveness of environmental and social programs; and
- The final propose of the monitoring program is to provide data for reporting. This reporting will include corporate, compliance and regulatory, community and public reports.

The maintenance and monitoring program describes the overall activities to be implemented over the course of construction, operation, and finally at the abandonment or closure phase. The monitoring program in project phases prior to the abandonment and closure stages are an integral part of entire maintenance and monitoring

[2] Source: 2018 Interim Annual EPEP of OGPI

plan. Monitoring results from the early stages will serve as areas of comparison by which monitoring activities in the abandonment and closure stages may be assessed.

The monitoring programs presented in this section are consistent with OGPI's 2018 AEPEP and are intended to act as the foundation for further detailed program development as more data is gathered as the project progresses. Data gathered during the previous monitoring periods will be used to identify any changes or revisions in the program to better monitor those components and parameters of specific interest to the project.

Monitoring programs include water quality and quantity, watershed management, air quality, noise level, vegetation, monitoring of biodiversity that encompasses both terrestrial and aquatic ecosystems, and finally monitoring of major structures constructed that significantly changed the geomorphology or topography of the area.

The monitoring program is continuously being updated to comply with the recommendations of the Environmental Management Bureau Regional Office No. 2. Monitoring program stated below is subject to annual review and modification and is reflected in the Annual Environmental Protection and Enhancement Program.

6.2.1.1 LAND

6.2.1.1.1 VEGETATION MONITORING

Monitoring vegetation consist of inventory and compilation of the disturbance and vegetation loss resulting from mine activities. This is done in conjunction with the watershed management monitoring activities. The frequency of monitoring is continuous throughout all phases of the project.

The second area of vegetation monitoring focuses on reclamation and rehabilitation activities. This type of monitoring program is an ongoing operation to ensure the reclamation program is successful. Monitoring begin with the implementation of the nursery program through transplanting to final landform re-vegetation. Survival rates of the different vegetation species are monitored as well as growth rates, density, seed germination and propagation. This is reported semi-annually in the Mining Forest Program which is also being verified by the Mines and Geosciences Bureau (MGB) Region 2. Figure 6-97 illustrates the permanent biodiversity monitoring stations of OGPI.

6.2.1.1.2 CONSERVATION VALUES

Conservation values pertaining to the biodiversity encompass the wildlife, aquatic, and terrestrial ecosystem as identified during the ecological assessment undertaken by the University of the Philippines Los Baños (UPLB) and the Nueva Vizcaya State University (NVSU). A biodiversity monitoring is conducted annually to monitor biodiversity resources from various ecosystems which will then be the basis for establishing sustainable management plans to ensure biodiversity conservation and enhancement on the surrounding areas of the Didipio operations. Table 6-20 summarizes this monitoring program for the above conservation values.

Table 6-20: Summary of Conservation Values Monitoring Plan

Component	Location	Methods	Parameters	Frequency
Terrestrial Ecology (vegetation and wildlife)	▫ Identified permanent biodiversity monitoring stations	Biodiversity measurement via Flora and Fauna inventory	▫ Sampling Program ▫ Measurement Program ▫ Biodiversity survey	Annual
	▫ Reclamation area ▫ Nursery	▫ Tree Planting ▫ Bio-solutions for soil stabilization	Visual examination	Continuous
Aquatic Ecology	▫ Dinauyan River	▫ Visual inspection	▫ Water quality impacts	Annual

Component	Location	Methods	Parameters	Frequency
	▫ Camgat River ▫ Surong River ▫ Didipio River	▫ Sample of live species via Flora and Fauna inventory study	▫ Species numbers and diversity	

6.2.1.2 Water

6.2.1.2.1 Water Flow Monitoring

This task consisted of operations monitoring to identify and record the amount of water used, treated, and discharged during each project phase activity. The objective of this task is to quantify the project water balance. Meters located within the different processing plant phases were installed to record water usage, meters on pump systems will record discharge to the tailings storage facility and flow measurement equipment will monitor flows at different locations in the Dinauyan River, Didipio River, Camgat River, Surong Creek, and the Diduyon River. Additional flow measurement data are collected at the open pit.

6.2.1.2.2 Groundwater Monitoring

Monitoring of groundwater levels are also done using installed of piezometers at boreholes strategically located within the project area. Figure 6-98 shows the location of the monitoring bores installed as of 2014. In addition, an online PI System was set-up and is currently being used to capture all the data generated from the flow meter devices, this is an upgrade to the conventional manual recording to ensure all records are centralized and logged accurately to the system.

6.2.1.2.3 Water Quality Monitoring

Water quality monitoring consist of sampling and testing the water quality within the natural streams and watercourses as well as the various mining operation components conforming with DAO No. 2016-08 Water Quality Guidelines and General Effluent Standards of 2016. Permanent water quality monitoring stations are established on the Dinauyan River, Didipio River, and Camgat. It is worth noting that these water bodies were identified to be heavily impacted by ongoing rampant and unregulated small-scale mining activities which are adjacent to Didipio Mine's operations and such activities resulted to the increase of siltation of rivers/creeks particularly during heavy rainfall. These stations are constantly being monitored, documented, and reported to regulatory bodies.

Furthermore, there are also permanent stations established at the tailings storage facility, open pit, and the drainage tunnel portal.

Sampling frequencies and parameters will vary throughout the year and will be a function of the mining activities and hydrologic conditions of the rivers and watersheds. This extensive monitoring program will require constant review and revision as data is collected and analyzed. It is likely the program will be revised several times over the course of the project to better-fit actual conditions and changing data needs.

Water quality monitoring data, including all other environmental data, is imported in the database management system called the INX InViron Software which is currently being used for the Didipio's extensive monitoring program. This database ensures effective management of data for long-term use and efficient tools for reporting needs.

Water quality monitoring stations of OGPI are presented in Figure 6-99 to Figure 6-101.

6.2.1.2.4 Sediment Monitoring

Sediments samples from water quality monitoring stations are subject for metal analysis similar with water quality monitoring parameters. The purpose of this monitoring is to provide indicative results for potential accumulation of metals in sediments and migration metals from the project site. Results of sediment quality analysis are compared with baseline data since DENR has no standard or guideline values for sediment quality. The frequency of monitoring is on a quarterly basis.

6.2.1.2.5 Freshwater Ecology

Freshwater ecology monitoring that closely follow the water quality monitoring program. An inventory of Freshwater species is made during the water quality sampling program at each of the rivers and creeks sampled. Freshwater species (fish, crustaceans, and benthic organisms) are collected and tissue samples tested for a variety of parameters. The frequency of sampling shall be once every year simultaneous with the conduct of the Flora and Fauna study. Freshwater ecology sampling stations are shown in Figure 6-102.

6.2.1.3 Air

6.2.1.3.1 Meteorological Monitoring

A second component of this task is the meteorological monitoring which consists of installed hydro meteorological monitoring stations located at the Processing Plant and Administration building. It records temperature, wind speed, precipitation, humidity, and evaporation data which are then captured in the PI system. These data will be used to further evaluate the project water balance characteristics and optimize management of the Tailings Disposal Dam.

6.2.1.3.2 Air Quality

Locations of air quality monitoring are shown in Figure 6-103. The air quality monitoring program of OGPI focused on ambient air quality monitoring to determine impact of project operation to nearby residents. Air quality monitoring equipment, high volume sampler, is used to monitor total suspended particulates (TSP). Photo of the high-volume sampler is shown in Photo 6-19.

Photo 6-19: High-volume sampler for Total Suspended Particulates (TSP)

Specific gases coming from the 14-unit power generator sets undergoes annual stack sampling or as per permit requirements. Small stationary generator sets will be monitored for smoke emission using Ringelmann chart.

Monitoring stations close to dust sources are monitored using dust deposition gauges which is analysed monthly. A dust deposition gauge is stationary dust collecting equipment for particulate matter that rapidly settles from the air. Deposited dust is assessed as insoluble solids as defined by Standards Australia, 2003, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited

Matter - Gravimetric Method. The standard has a maximum limit of total deposited dust level of no more than 4g/m^2/month. An example of dust gauge is shown in Photo 6-20.

Photo 6-20: Dust Deposition Gauge (DDG)

6.2.1.3.3 Noise Monitoring

Noise monitoring stations of OGPI are presented in Figure 6-104. The noise monitoring program is focused on ambient noise level to determine whether nearby residents are being affected by the noise generation coming from the project. From 2015 noise monitoring at working areas are excluded from this program since this is part of the health and safety program.

Noise data are collected at the following nearby residences namely: Jose, Malanta and Batbatol. The frequency of monitoring is fortnightly. Frequency of monitoring may be increase as required. Data are also being collected at the OGPI accommodation and Didipio Elementary School fortnightly. Sampling is conducted in accordance with the time frames as per Philippine Ambient Noise standard.

Portable noise monitoring equipment is used to take noise level measurements at different stations. Photo of the monitoring activity is presented in Photo 6-21 and Photo 6-22.

Photo 6-21: Ambient Noise Monitoring Activity

Photo 6-22: Noise level meter

6.2.1.3.4 Vibration Monitoring

Vibration monitoring will only be confined into the UG operation as the open pit already concluded last July 2017. Vibration monitoring stations are shown in Figure 6-105.

6.2.1.4 People

6.2.1.4.1 Heritage and Cultural Values

On November 21, 2003, the National Museum issued a Certification to the project that the Partial DMPF area was inspected for possible archaeological remains by the Archaeological, Cultural and Environmental Consultancy, Inc. The finding was that the area has no visible archaeological resources based on the over-all negative result of the archaeological assessment survey. OGPI was likewise mandated to report to the National Museum should archaeological materials be found in earth-moving activities. At present, no archaeological materials found or reported.

6.2.1.4.2 Social Issues

During the operation stages of the project, the following socio-economic parameters are monitored:

- composition of workforce to ensure that qualified locals are given priority employment opportunities; and
- the progress of skills trainings designed for residents.

Monitoring of the causes of morbidity and mortality is also being implemented since the mine became operational. Monitoring of social issues is covered under the Social Development and Management Plan (SDMP).

6.2.1.5 Structural Integrity Evaluation

This monitoring program focuses on inspection of the structures constructed as part of the project. Items requiring a defined monitoring program are the tailings storage facility, waste rock dump, open pit, sediment ponds, diversion channels, and roadway culverts. Monitoring activities consist of visual examination of embankments, slopes and structures and collection of geotechnical related data from instrumentation such as piezometers, inclinometers, and fixed survey points. Table 5-1 presents the summary of structural evaluation monitoring plan.

Table 6-21: Summary of structural evaluation monitoring plan

Component	Phase	Locations	Method	Parameters	Frequency
Sediment Ponds	▫ Construction ▫ Operation ▫ Closure (Abandonment)	▫ Open Pit ▫ Waste Rock Dumps ▫ Process Plant ▫ ROM Area	▫Grab samples of water ▫Depth of sediment measurements	▫ Turbidity ▫ Total Suspended Solids	▫ Varies
				▫ Depth of sediment	▫ Monthly
				▫ Discharge estimates	▫ Daily
Tailings Disposal Dam and Impoundment	▫ Construction ▫ Operation ▫ Closure (Abandonment)	▫ Dam embankment ▫ Tailings pond ▫ Decant system ▫ Spillway ▫ Open water reservoir	▫Decant discharge measurement ▫Spillway discharge measurement ▫Grab samples of water	▫ Settlement	▫ Monthly
				▫ Standing Water Level in Piezometer and Inclinometer Data	▫ Monthly
				▫ Discharge volume at decant outlet and spillway	▫ Daily
				▫ Tailings Storage volume	▫ Monthly
				▫ Turbidity ▫ pH ▫ Total suspended solids ▫ Total dissolved solids ▫ Metals	▫ Varies
Potable Water Supply	▫ Operation	▫ Water Storage Tank ▫ Kitchen ▫ Drinking water taps	▫ Grab Sample	▫ Total Dissolved Solids ▫ Metals ▫ Fecal Coliforms	▫ Varies
Process Wastewater	▫ Operation	▫ Process Plant ▫ Tailings impoundment ▫ Tailings Impoundment Discharge	▫ Grab Sample	▫ Metals ▫ Total Dissolved Solids ▫ pH	▫ Varies
Dinauyan River and Open Pit	▫ Pre-construction ▫ Construction ▫ Operation ▫ Closure (Abandonment)	▫ Upstream of Tailings Impoundment Discharge ▫ Downstream of Tailings Impoundment Discharge ▫ Near Confluence Didipio and Surong River Within Mine Area	▫ Grab Sample ▫ Flow Measurement Station ▫ Survey of River ▫ Survey of River Characteristics ▫ Photographs	▫ Turbidity ▫ pH ▫ Total Suspended Solids ▫ Total Dissolved Solids ▫ Metals	▫ Varies
				▫ Stream Discharge	▫ Continuous
				▫ Geomorphologic Characteristics	▫ Preconstruction period
				▫ Flow ▫ Turbidity ▫ Total Suspended Solids	▫ Varies

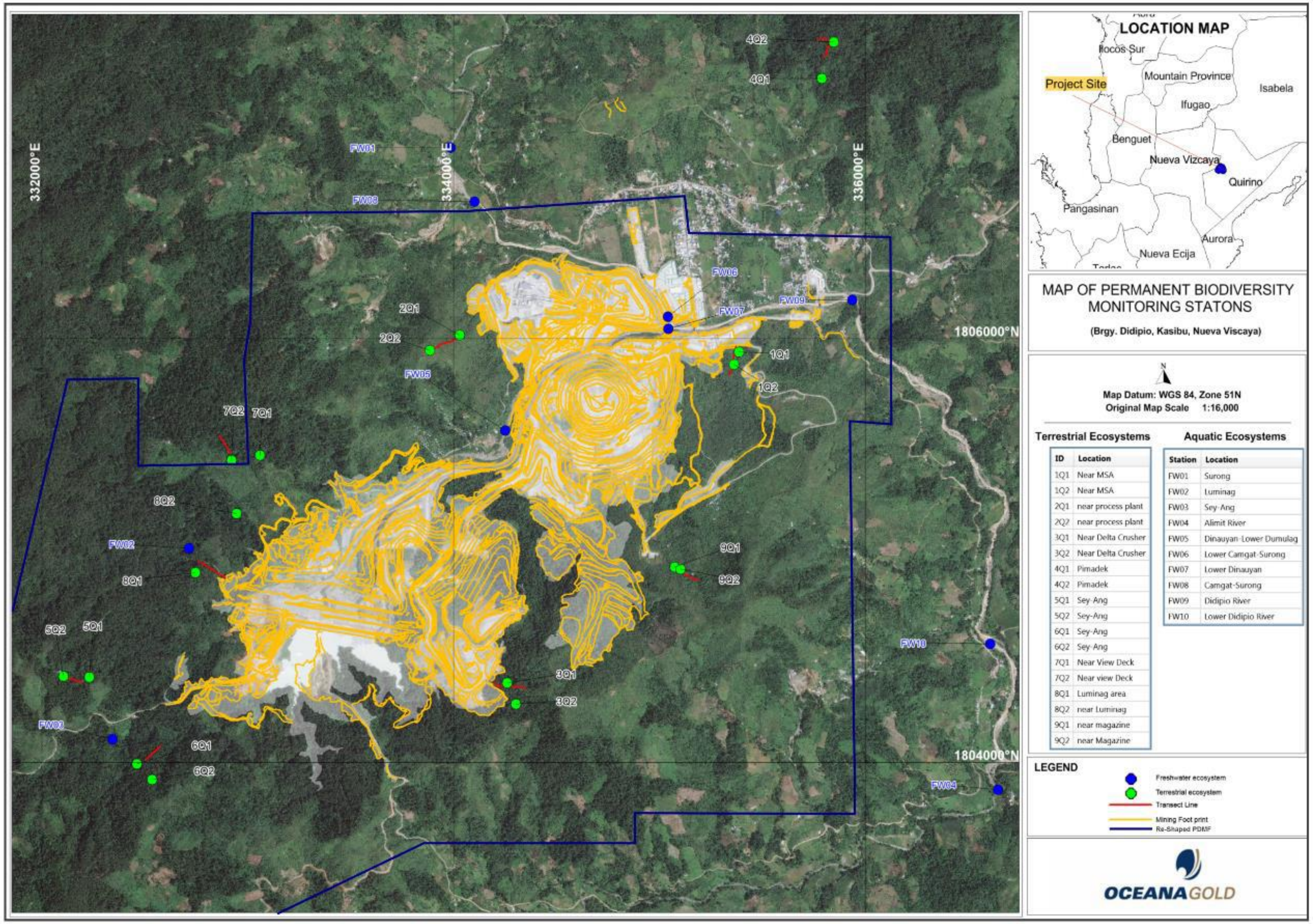


Figure 6-97: Map of Permanent Biodiversity Monitoring Stations

Source: OGPI Interim Annual EPEP for 2018

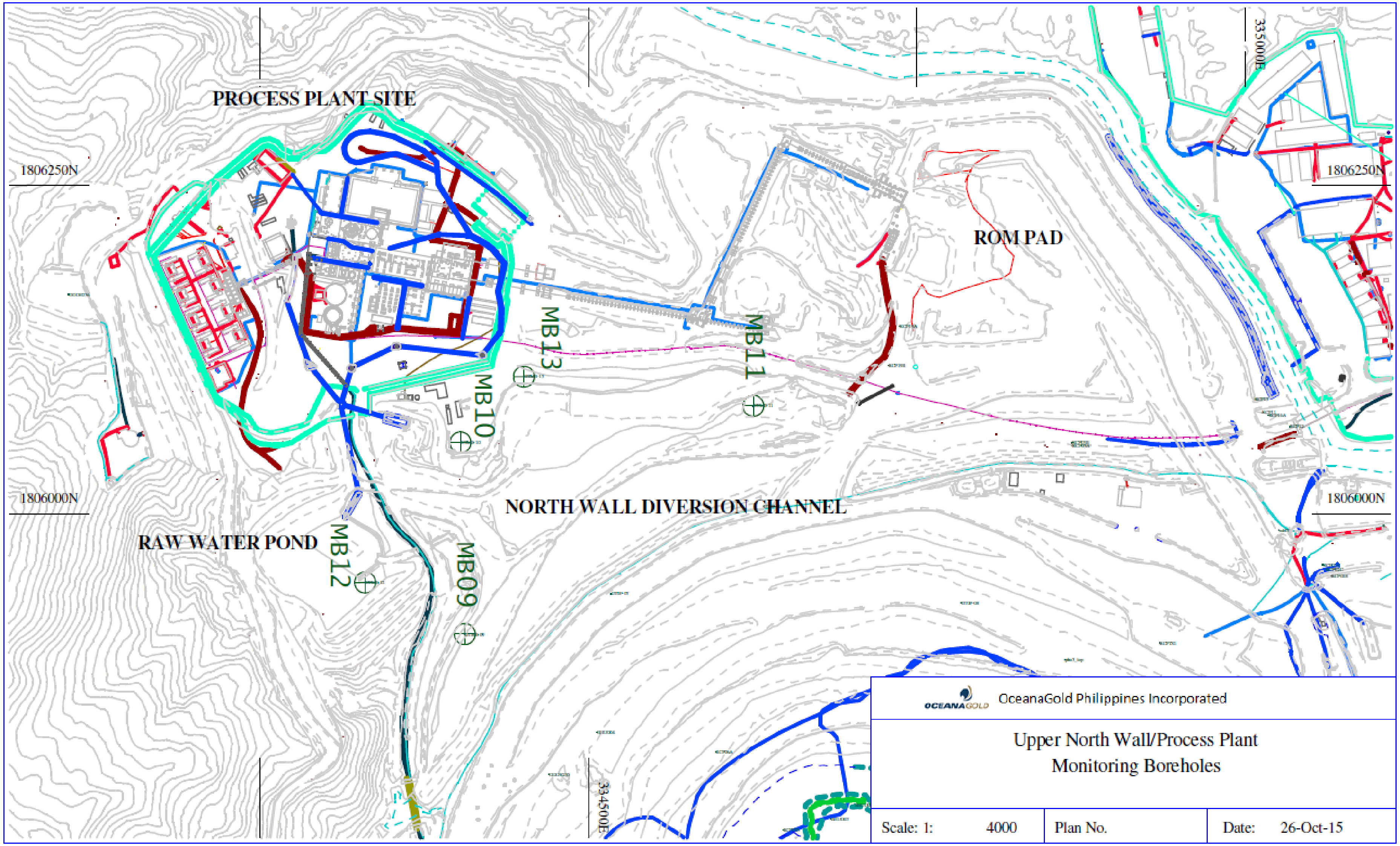


Figure 6-98: Groundwater Monitoring Boreholes of OGPI
Source: OGPI Interim Annual EPEP for 2018

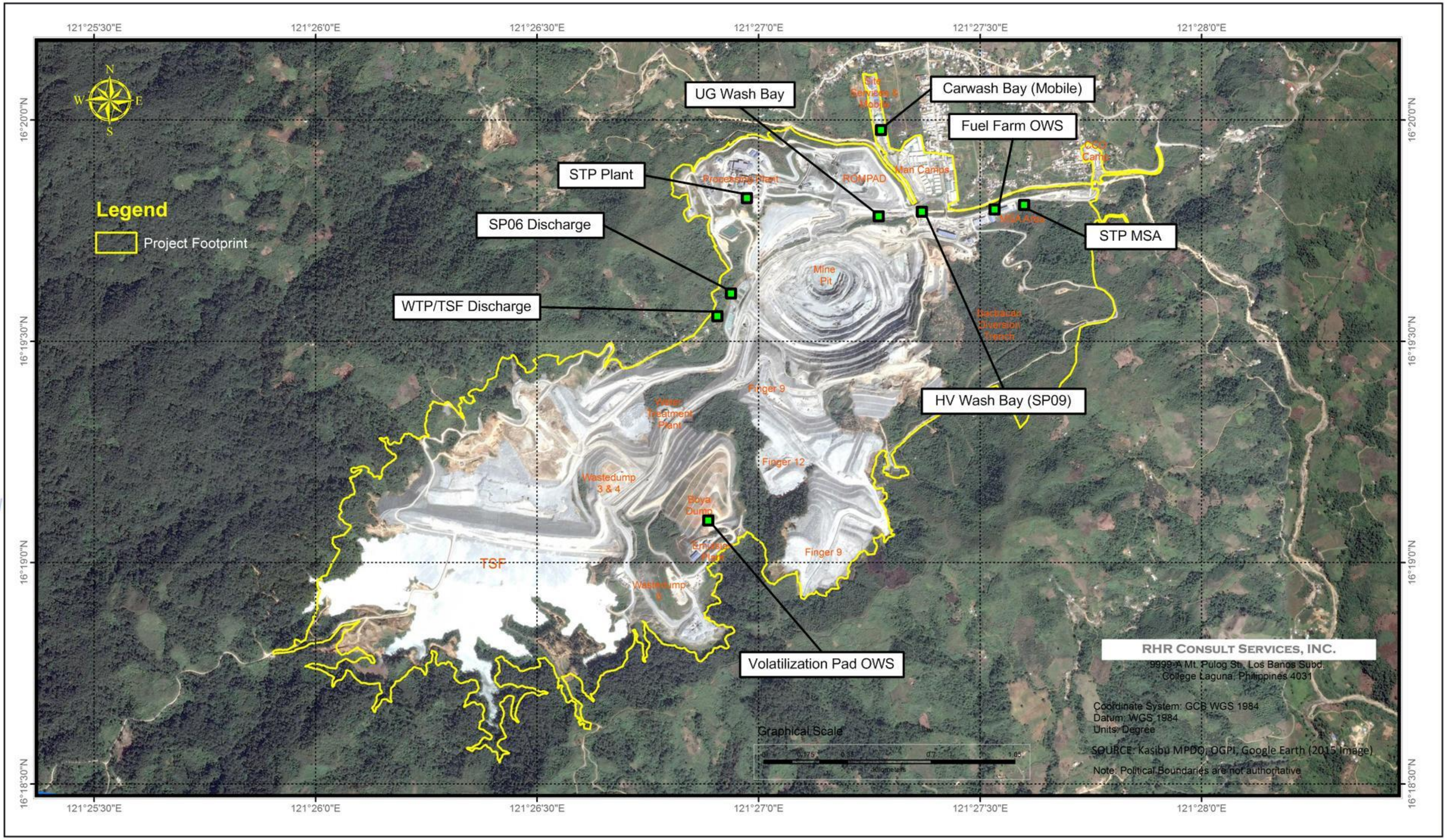


Figure 6-99: Effluent Quality Monitoring Stations of OGPI

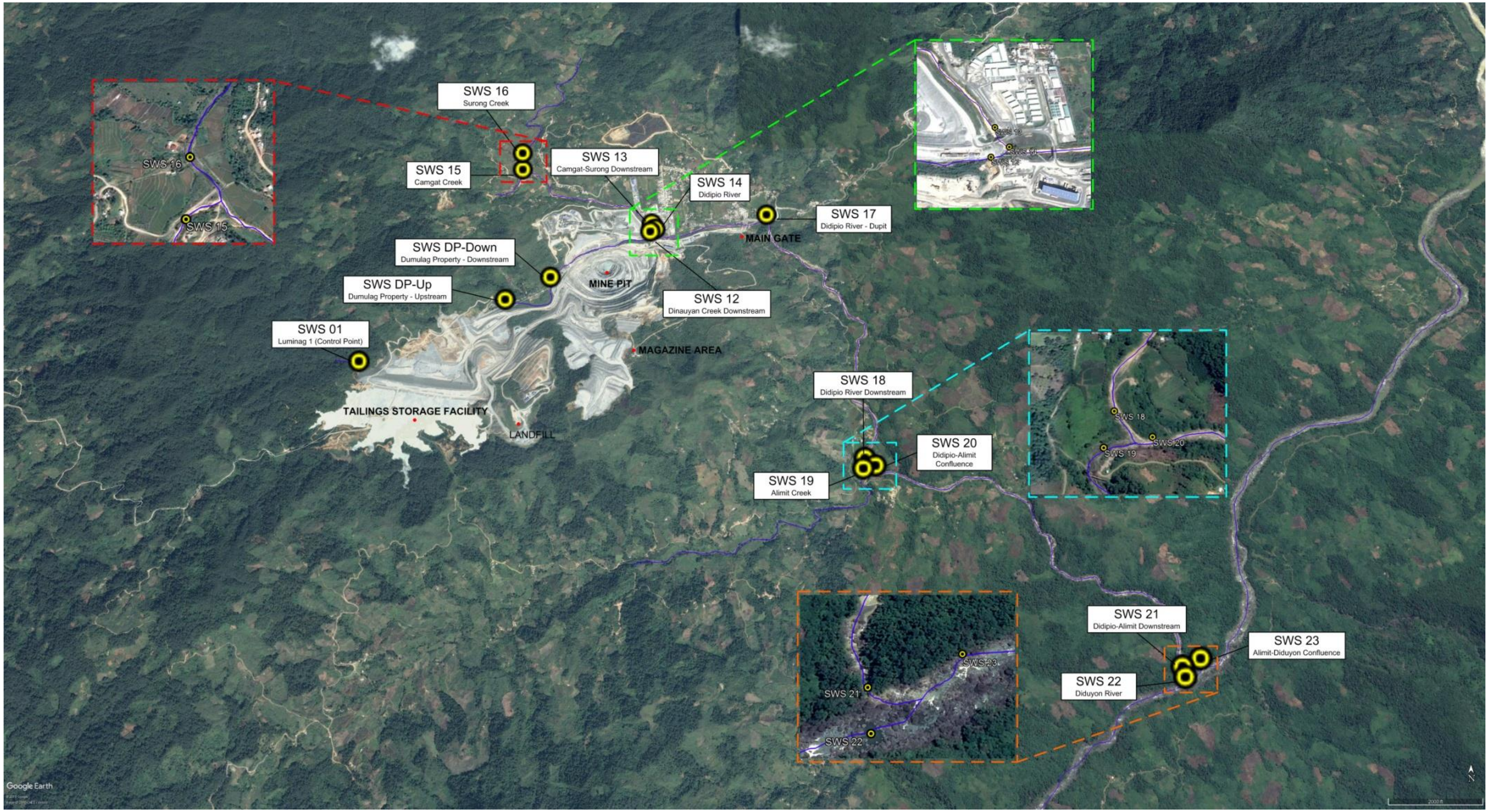
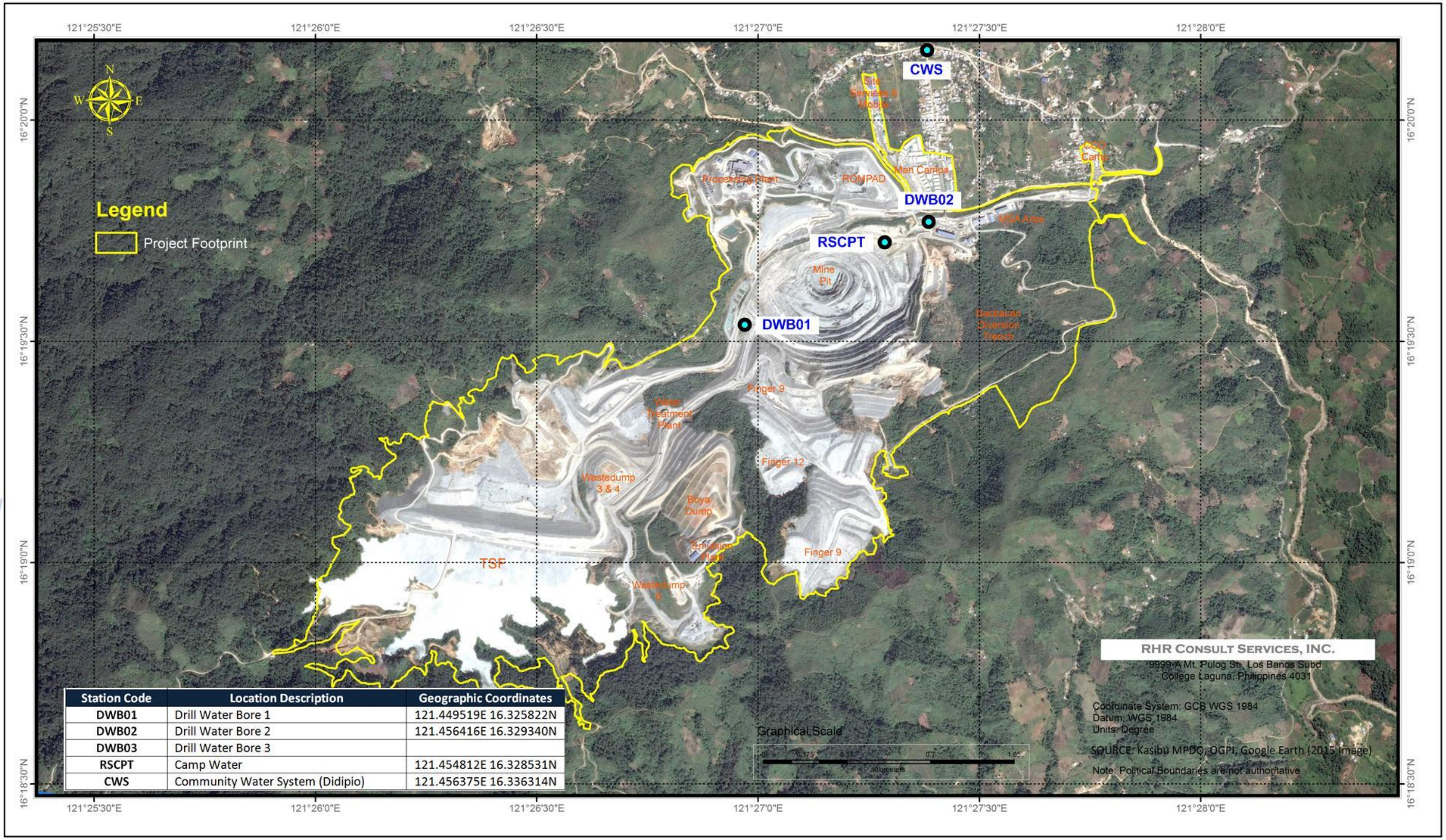


Figure 6-100: Surface Water Quality Monitoring Stations of OGPI



Station Code	Location Description	Geographic Coordinates
DWB01	Drill Water Bore 1	121.449519E 16.325822N
DWB02	Drill Water Bore 2	121.456416E 16.329340N
DWB03	Drill Water Bore 3	
RSCPT	Camp Water	121.454812E 16.328531N
CWS	Community Water System (Didipio)	121.456375E 16.336314N

Figure 6-101: Groundwater Quality Monitoring Stations of OGPI

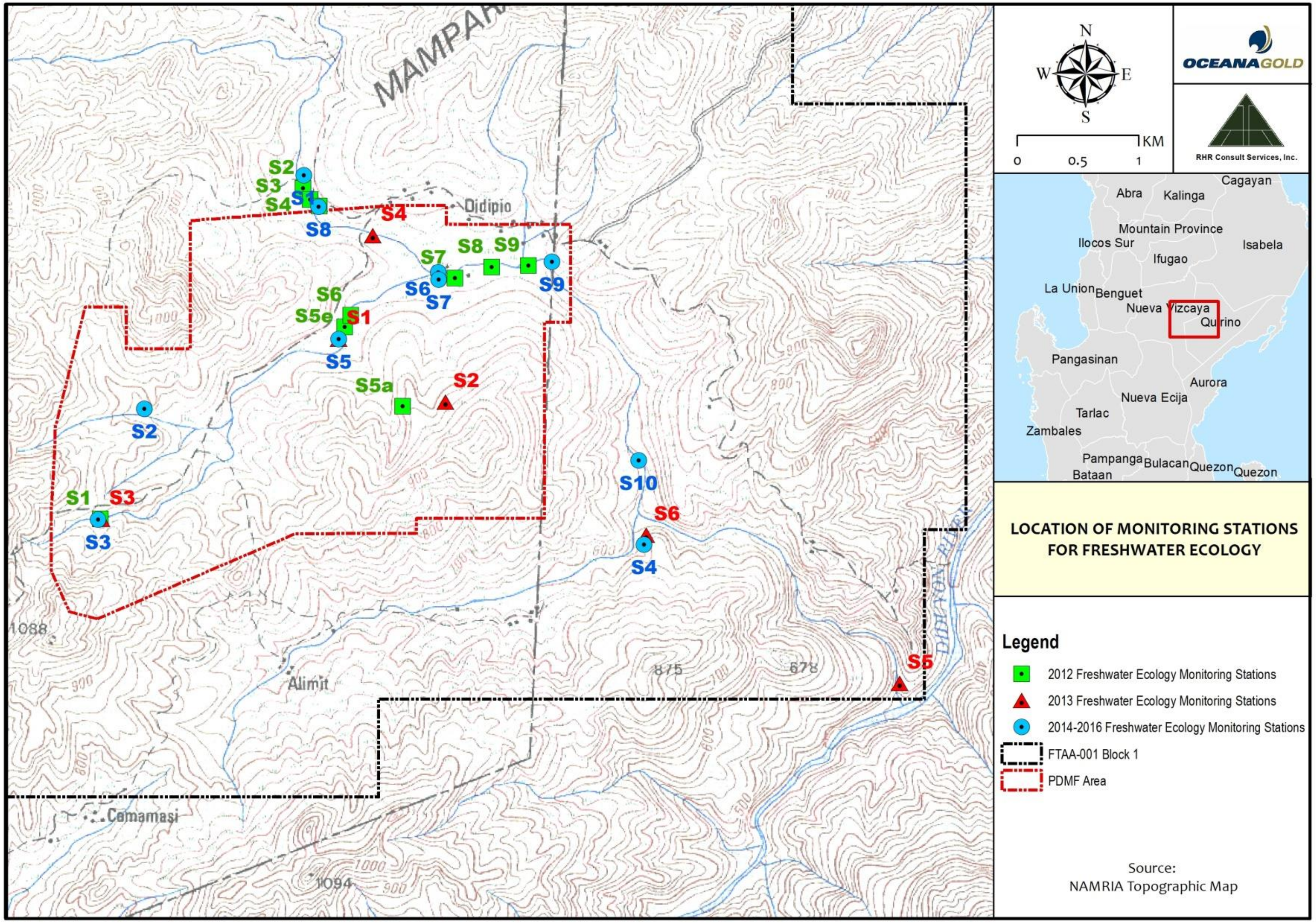
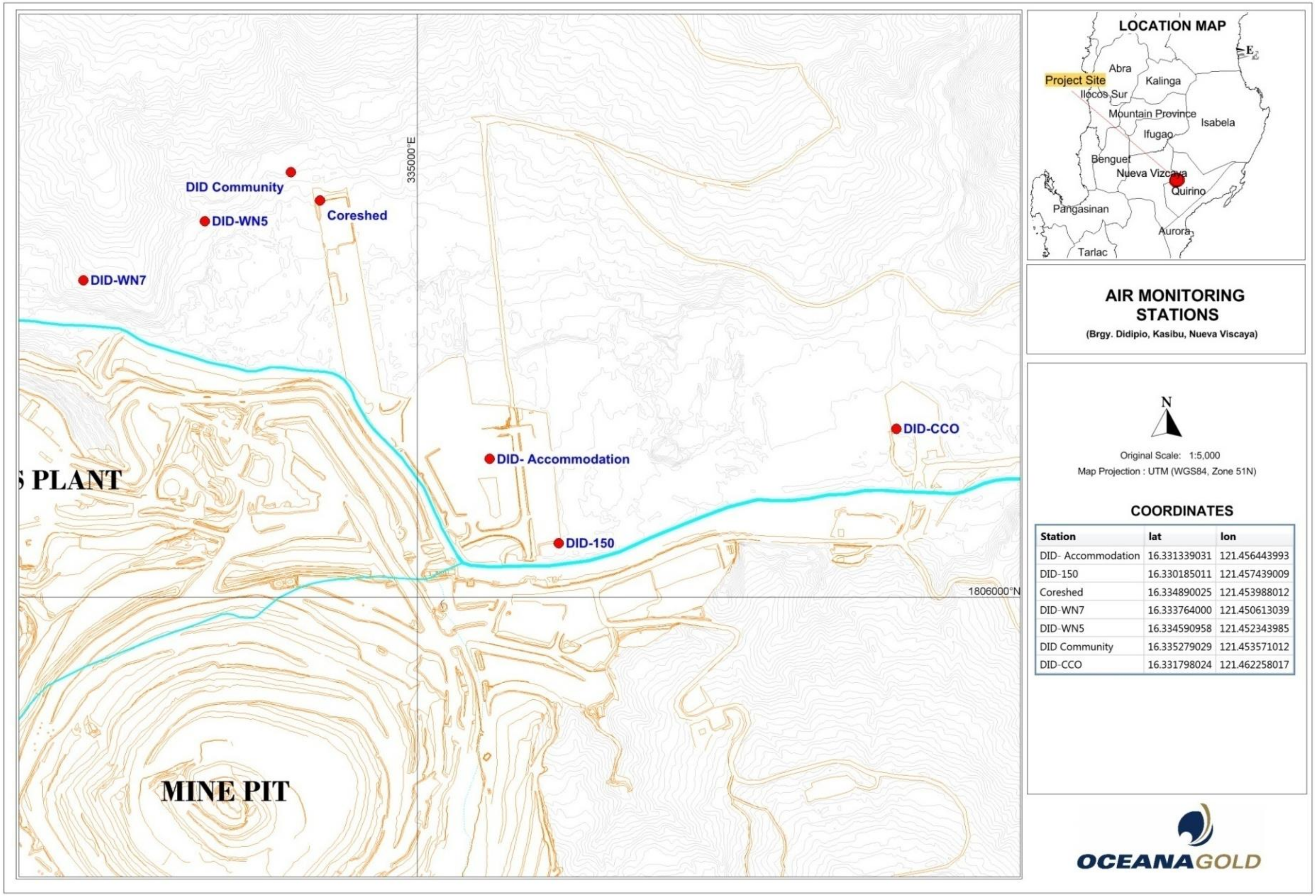
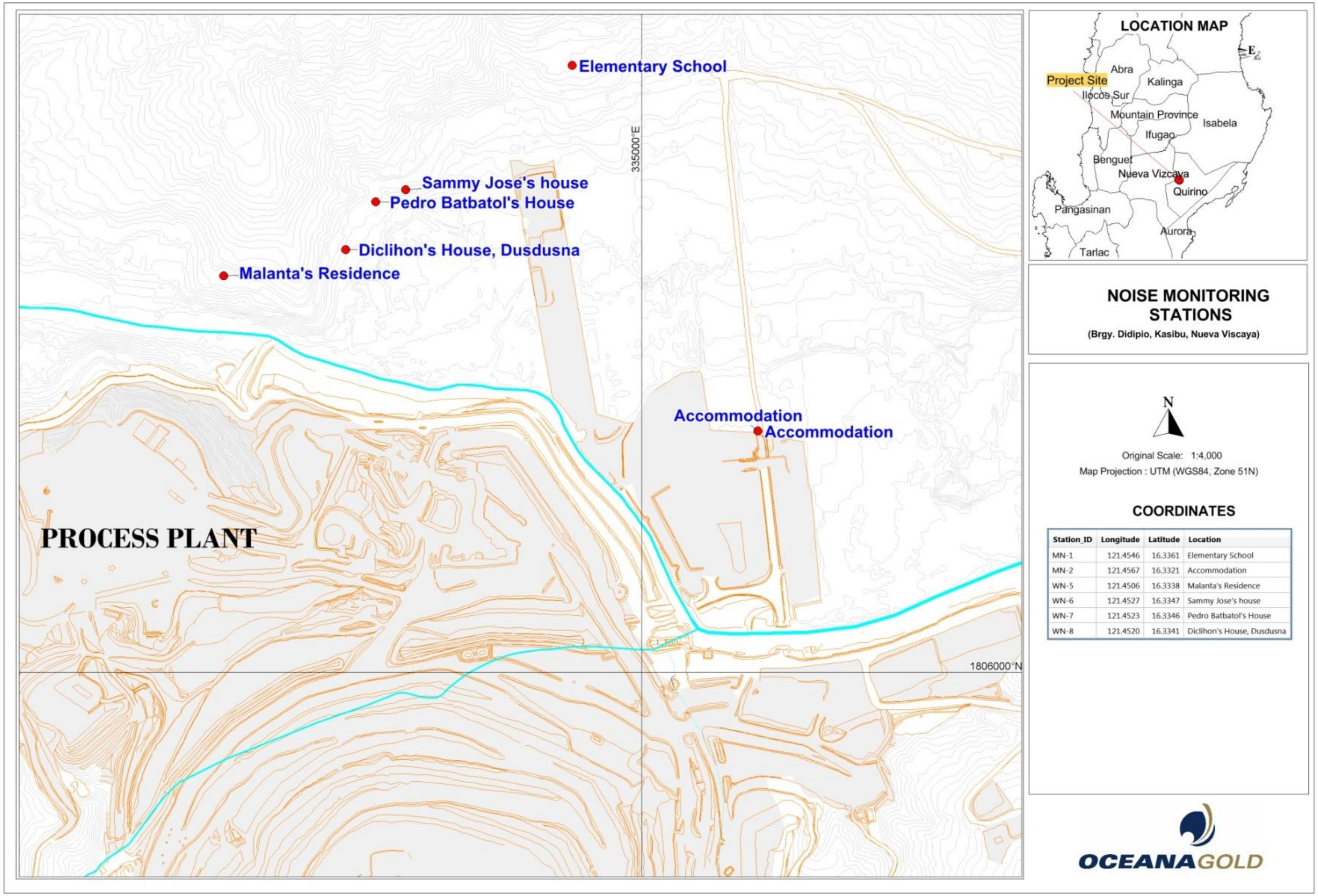


Figure 6-102: Freshwater ecology sampling stations surveyed for the studies conducted from 2012 to 2016



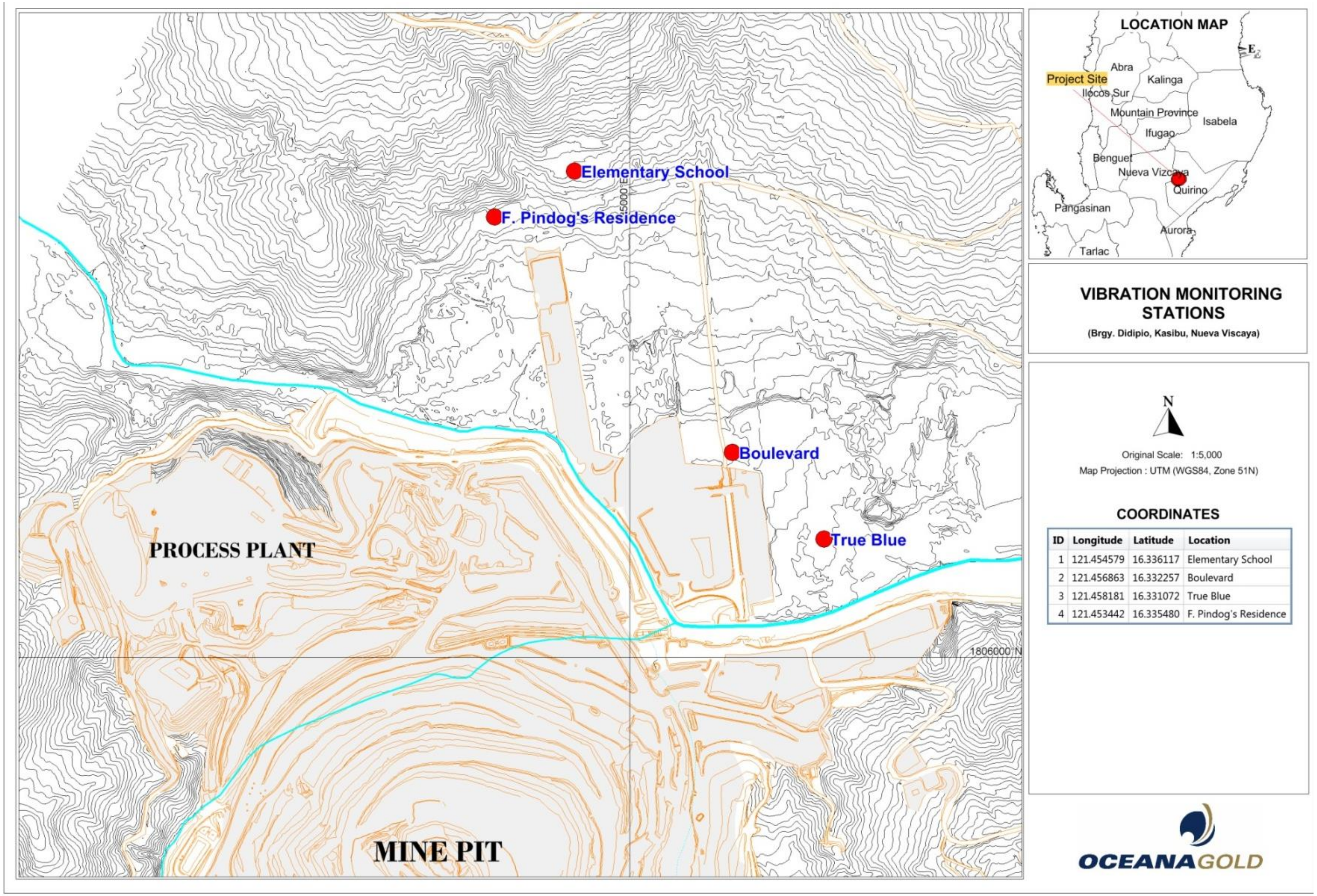
Station	lat	lon
DID- Accommodation	16.331339031	121.456443993
DID-150	16.330185011	121.457439009
Coreshed	16.334890025	121.453988012
DID-WN7	16.333764000	121.450613039
DID-WN5	16.334590958	121.452343985
DID Community	16.335279029	121.453571012
DID-CCO	16.331798024	121.462258017

Figure 6-103: Air Monitoring Stations of OGPI



Station_ID	Longitude	Latitude	Location
MN-1	121.4546	16.3361	Elementary School
MN-2	121.4567	16.3321	Accommodation
WN-5	121.4506	16.3338	Malanta's Residence
WN-6	121.4527	16.3347	Sammy Jose's house
WN-7	121.4523	16.3346	Pedro Batbatol's House
WN-8	121.4520	16.3341	Diclihon's House, Dusdusna

Figure 6-104: Noise Monitoring Stations of OGPI



ID	Longitude	Latitude	Location
1	121.454579	16.336117	Elementary School
2	121.456863	16.332257	Boulevard
3	121.458181	16.331072	True Blue
4	121.453442	16.335480	F. Pindog's Residence

Figure 6-105: Vibration Monitoring Stations

6.2.2 ENVIRONMENTAL MONITORING PLAN (EMOP)

The effective monitoring of environmental performance of the project requires both self-managed programs and multi-sectoral involvement. The environmental monitoring plan for the project is provided in Table 6-22. This EMoP is based on the existing monitoring plan of OGPI, which has been improved over the course of its operation, as needed.

Table 6-22: Environmental Monitoring Plan

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
	Ambient Water Quality[b]	Temperature (max rise)[e]	In-situ using portable water tester	Daily	DP Up DP Down SWS 12 SWS 13 SWS 14	Envi Lab	1,825.00	27.5-29.5°C	26.0-31.0°C	25.0-32.0°C	Investigate the source and identify possible pollutant sources	Investigate the source If the problem is within the operation area, conduct adjustments/ appropriate corrective action at identified pollutant source Reconduct sampling / water quality monitoring	Temporarily stop activities contributing to the pollutant load Evaluate existing mitigation measures for possible need for additional mitigation measures If the source is not related to the project, inform MMT regarding possible source for the group's investigation and coordination with LGU
		pH (range) [e]					1,825.00	6.6-8.4	6.1-6.5 ;8.5-8.9	6.0-9.0			
		Dissolved Oxygen (minimum) [e]					1,825.00	2.4 mg/L	2.3 mg/L	2.0 mg/L			
		Temperature (max rise)	In-situ using portable water tester	Weekly	SWS 1 SWS 17 SWS 16B2	Envi Lab	156.00	27.5-29.5°C	26.0-31.00C	25°C- 32"C			
		pH (range)					156.00	6.6-8.4	6.1-6.5;8.5-8.9	6.0-9.0			
		Dissolved Oxygen (minimum)					156.00	2.4 mg/L	2.3 mg/L	2.0 mg/L			
		Total Suspended Solids	Grab sampling and Lab analysis	Monthly	SWS 1 DP Up DP Down SWS 12 SWS 13 SWS 14 SWS 17 SWS 16B2	Envi Lab	960.00	88 mg/L	99 mg/L	110 mg/L			
		BOD					1,920.00	12.8 mg/L	13.5 mg/L	15 mg/L			
		Chloride					1,152.00	320 mg/L	360 mg/L	400 mg/L			
		True Color					576.00	120 TCU	135 TCU	150 TCU			
		Fecal Coliform					1,920.00	320 mg/L	360 mg/L	400 mg/L			
		Nitrate as N03-N					1,056.00	12.0 mg/L	13.5 mg/L	15 mg/L			
		Phosphate as P					1,152.00	4.4 mg/L	4.5 mg/L	5 mg/L			
		Ammonia as NH3-N	Grab sampling and Lab analysis	Quarterly	SWS 1 DP Up DP Down SWS 12 SWS 13 SWS 14 SWS 17 SWS 16B2	Envi Lab	512.00	0.60 mg/L	0.68 mg/L	0.75 mg/L			
		Boron					928.00	2.4 mg/L	2.7 mg/L	3 mg/L			
		Fluoride					1,312.00	1.6 mg/L	1.8 mg/L	2 mg/L			
		Selenium					1,312.00	0.032 mg/L	0.036 mg/L	0.04 mg/L			
		Sulfate					384.00	400 mg/L	450 m/L	500 mg/L			
		Arsenic					1,312.00	0.032 mg/L	0.035 mg/L	0.04 mg/L			
		Barium					384.00	3.2 mg/L	3.6 mg/L	4 mg/L			
		Cadmium					384.00	0.008 mg/L	0.009 mg/L	0.01 mg/L			
		Hexavalent Chromium					512.00	0.016 mg/L	0.018 mg/L	0.02 mg/L			
		Dissolved Copper					928.00	-	(a)	0.04 mg/L			
		Iron					384.00	6.0 mg/L	6.75mg/L	7.5 mg/L			
		Lead					384.00	0.08 mg/L	0.09mg/L	0.1 mg/L			
		Manganese					384.00	1.6 mg/L	1.8 mg/L	2.0 mg/L			
		Mercury					1,152.00	0.0036 mg/L	0.0038mg/L	0.004 mg/L			
		Nickel					384.00	0.8 mg/L	0.9 mg/L	1.0 mg/L			
		Zinc					384.00	3.2 mg/L	3.6 mg/L	4 mg/L			
		Free Cyanide					736.00	1.6 mg/L	1.8 mg/L	0.2 mg/L			
		Oil and grease					640.00	4.4 mg/L	4.5 mg/L	5 mg/L			
		Surfactants (MBAS)					896.00	2.4 mg/L	2.7 mg/L	3.0 mg/L			
		Temperature	Grab sampling and Lab analysis	Semi-annual	SWS 18 SWS 19 SWS 20 SWS 21 SWS 22	Envi Lab	12.00	27.5-29.5oC	26.0-31.0oC	25.0-32.0oC			
		pH (range)					12.00	6.6-8.4	6.1-6.5; 8.5-8.9	6.0-9.0			
		Dissolved Oxygen (minimum)					12.00	2.4 mg/L	2.3 mg/L	2.0 mg/L			

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		Total Suspended Solids (e)			SWS 23		120.00	88 mg/L	99 mg/L	110mg/L			
		Ammonia as NH3-N					192.00	0.60 mg/L	0.68 mg/L	0.75 mg/L			
		Boron					348.00	2.4 mg/L	2.7 mg/L	3 mg/L			
		Fluoride					492.00	1.6 mg/L	1.8 mg/L	2 mg/L			
		Selenium					492.00	0.032 mg/L	0.036 mg/L	0.04 mg/L			
		Sulfate					144.00	400 mg/L	450 m/L	500 mg/L			
		Arsenic					492.00	0.032 mg/L	0.035 mg/L	0.04 mg/L			
		Barium					144.00	3.2 mg/L	3.6 mg/L	4 mg/L			
		Cadmium					144.00	0.008 mg/L	0.009 mg/L	0.01 mg/L			
		Hexavalent Chromium					192.00	0.016 mg/L	0.018 mg/L	0.02 mg/L			
		Dissolved Copper					348.00	-	(a)	0.04 mg/L			
		Iron					144.00	6.0 mg/L	6.75mg/L	7.5 mg/L			
		Lead					144.00	0.08 mg/L	0.09mg/L	0.1 mg/L			
		Manganese					144.00	1.6 mg/L	1.8 mg/L	2.0 mg/L			
		Mercury					432.00	0.0036 mg/L	0.0038 mg/L	0.004 mg/L			
		Nickel					144.00	0.8 mg/L	0.9 mg/L	1.0 mg/L			
		Free Cyanide					276.00	1.6 mg/L	1.8 mg/L	0.2 mg/L			
		Oil and Grease					240.00	4.4 mg/L	4.5 mg/L	5 mg/L			
		Surfactants (MBAS)					336.00	2.4 mg/L	2.7 mg/L	3.0 mg/L			
	Effluent[b] Water Quality	pH	In situ using portable water tester	Weekly	SWS 2 WTP Discharge	Envi Lab	24.00	6.1-8.9	5.6-6.0 ;9.0-9.4	5.5-9.5	Investigate the source and identify possible pollutant sources	Investigate the source If the problem is within the operation area, conduct adjustments/ appropriate corrective action at identified pollutant source Reconduct sampling / water quality monitoring	Temporarily stop activities contributing to the pollutant load Evaluate existing mitigation measures for possible need for additional mitigation measures If the source is not related to the project, inform MMT regarding possible source for the group's
		pH	In situ using portable water tester	Quarterly	SWS2 WTP Discharge SP06 Discharge Carwash Bay Fuel Farm Volatilization Pad	Envi Lab	24.00	6.1 ; 8.9	5.6-6.0 ;9.0-9.4	5.5-9.5			
		Oil and Grease	Grab sampling and Lab analysis	Weekly	SP09 Discharge/HV Wash bay UGWash Bay	Envi Lab	2,080.00	12 mg/L	13.5 mg/L	15 mg/L			
		Oil and Grease	Grab sampling and Lab analysis	Monthly	SWS2 WTP Discharge STP MSA STP Plant site Carwash Bay SP09 Discharge/HV Wash bay UG Wash Bay Fuel Farm Volatilization Pad	Envi Lab	2,160.00	12 mg/L	13.5 mg/L	15 mg/L			
		Arsenic	Grab sampling and Lab analysis	Monthly	SWS2 WTP Discharge	Envi Lab	984.00	0.064 mg/L	0.072 mg/L	0.08 mg/L			

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		Dissolved Copper	Grab sampling and Lab analysis	Monthly	SWS2 WTP Discharge SP06 Discharge	Envi Lab	1,044.00	0.064 mg/L	0.072 mg/L	0.08 mg/L			investigation and coordination with LGU
		Surfactants (MBAS)					1,044.00	24 mg/L	27 mg/L	30 mg/L			
		Fecal Coliform	Grab sampling and Lab analysis	Monthly	Carwash Bay	Envi Lab	240.00	640 MPN/100mL	720 MPN/100mL	800 MPN/100mL			
		Fecal Coliform	Grab sampling and Lab analysis	Quarterly	STP MSA STP Plant site	Envi Lab	160.00	640 MPN/100mL	720 MPN/100mL	800 MPN/100mL			
		Surfactants (MBAS)	Grab sampling and Lab analysis	Quarterly	SWS2 WTP Discharge UG Wash Bay STP MSA STP Plant site	Envi Lab	560.00	24 mg/L	27 m/L	30 mg/L			
		Chloride	Grab sampling and Lab analysis	Quarterly	SWS2 WTP Discharge SP09 Discharge/HV Wash bay UG Wash Bay	Envi Lab	192.00	400 mg/L	450 mg/L	500 mg/L			
		COD		Quarterly	SWS2 WTP Discharge	Envi Lab	160.00	160 mg/L	180 mg/L	200 mg/L			
		Hexavalent Chromium					128.00	0.032 mg/L	0.036 mg/L	0.04 mg/L			
		Phenol & Phenolic Substances					400.00	4 mg/L	4.5 mg/L	5 mg/L			
		Boron					232.00	9.6 mg/L	10.8 mg/L	12 mg/L			
		Free Cyanide					184.00	0.32 mg/L	0.36 mg/L	0.4 mg/L			
		Iron		Quarterly	SWS2 WTP Discharge SP06 Discharge	Envi Lab	144.00	28 mg/L	31.5 mg/L	35 mg/L			
		Zinc					144.00	6.4 mg/L	7.2 mg/L	8 mg/L			
		Sulfate					144.00	800 mg/L	900 mg/L	1,000 mg/L			
		Lead					144.00	0.16 mg/L	0.18 mg/L	0.2 mg/L			
		Mercury		Quarterly	SWS2 WTP Discharge SP06 Discharge Carwash Bay SP09 Discharge/HV Wash bay UG Wash Bay	Envi Lab	864.00	0.0064 mg/L	0.0072 mg/L	0.008 mg/L			
		Phosphate as P					288.00	8 mg/L	9 mg/L	10 mg/L			
		Ammonia as NH3-N		Quarterly	SWS2 WTP Discharge STP MSA STP Plantsite UGWash Bay	Envi Lab	320.00	6.00 mg/L	6.75 mg/L	7.5 mg/L			
		Cadmium		Quarterly	SWS2 WTP Discharge Carwash Bay	Envi Lab	240.00	0.016 mg/L	0.018 mg/L	0.02 mg/L			
		Nitrate as N03-N					220.00	24 mg/L	27 mg/L	30 mg/L			

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
					SP09 Discharge/HV Wash bay UGWash Bay								
		Total Suspended Solids		Quarterly	SWS2 WTP Discharge STP MSA STP Plantsite SP06 Discharge Carwash Bay SP09 Discharge/HV Wash bay UG Wash Bay	Envi Lab	352.00	120 mg/L	135 mg/L	150 mg/L			
		Nickel		Quarterly	SWS2 WTP Discharge STP MSA STP Plantsite Carwash Bay SP09 Discharge/HV Wash bay UGWash Bay Fuel Farm Volatilization Pad	Envi Lab	432.00	4 mg/L	4.5 mg/L	5.0 mg/L			
		BOD		Quarterly	SWS2 WTP Discharge STP MSA STP Plantsite Carwash Bay SP09 Discharge/HV Washbay UGWash Bay Fuel Farm Volatilization Pad STP MSA Influent STP Plantsite Influent	Envi Lab	440.00	96 mg/L	108 mg/L	120 mg/L			
		True Color		Quarterly	Carwash Bay SP09 Discharge/HV Washbay UGWash Bay	Envi Lab	72.00	240 TCU	270 TCU	300 TCU			
		Zinc		Quarterly	Carwash Bay SP09 Discharge/HV	Envi Lab	144.00	6.4 mg/L	7.2 mg/L	8 mg/L			

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
					Wash bay UG Wash Bay								
	Ground Water[b] Quality	Temperature		Weekly	DWB01 DWB02 RSCPT1	Envi Lab	156.00	27.5-28.5"C	27.0-29.0"C	26"C- 30"C	Investigate the source and identify possible pollutant sources	Investigate the source If the problem is within the operation area, conduct adjustments/ appropriate corrective action at identified pollutant source Reconduct sampling / water quality monitoring	Temporarily stop activities contributing to the pollutant load Evaluate existing mitigation measures for possible need for additional mitigation measures If the source is not related to the project, inform MMT regarding possible source for the group's investigation and coordination with LGU
		pH (Range)					156.00	7.1;7.9 6-	6.7;8-8.	4 6.5-8.5			
		BOD		Monthly	DWB01 DWB02 RSCPT1	Envi Lab	720.00	4 mg/L	4.5 mg/L	5 mg/L			
		Total Suspended Solids		Quarterly	DWB01 DWB02 RSCPT1	Envi Lab	120.00	52 mg/L	58.5 mg/L	65 mg/L			
		Chloride					144.00	200 mg/L	225 mg/L	250 mg/L			
		True Color					72.00	40 mg/L	45 mg/L	50 mg/L			
		Fecal Coli form					240.00	80 MPN/100mL	90 MPN/100mL	100 MPN/100mL			
		Nitrate as NO3					132.00	5.6 mg/L	6.3 mg/L	7 mg/L			
		Phosphate as P					144.00	0.4 mg/L	0.45 mg/L	0.5 mg/L			
		Ammonia as NH3-N					228.00	0.04 mg/L	0.045 mg/L	0.05 mg/L			
		Boron					240.00	0.4 mg/L	0.45 mg/L	0.5 mg/L			
		Fluoride					288.00	0.8 mg/L	0.9 mg/L	1 mg/L			
		Selenium					288.00	0.008 mg/L	0.009 mg/L	0.01 mg/L			
		Sulfate					144.00	200 mg/L	225 mg/L	250 mg/L			
		Arsenic					432.00	0.008 mg/L	0.009 mg/L	0.01 mg/L			
		Barium					288.00	0.56 mg/L	0.63 mg/L	0.7 mg/L			
		Cadmium					144.00	-	(a)	0.003 mg/L			
		Hexavalent Chromium					192.00	0.008 mg/L	0.009 mg/L	0.01 mg/L			
		Dissolved Copper					348.00	0.016 mg/L	0.018 mg/L	0.02 mg/L			
		Iron					144.00	0.8 mg/L	0.9 mg/L	1 mg/L			
		Lead					144.00	0.008 mg/L	0.009mg/L	0.01 mg/L			
		Manganese					144.00	0.16 mg/L	0 .18 mg/L	0.2 mg/L			
		Mercury					432.00	0.0008 mg/L	0.0009 mg/L	0.001 mg/L			
		Nickel					144.00	0.032 mg/L	0.036 mg/L	0.04 mg/L			
		Zinc					144.00	1.6 mg/L	1.8 mg/L	2 mg/L			
		Free Cyanide					276.00	0.056 mg/L	0.063 mg/L	0.07 mg/L			
		Oil and Grease					240.00	0.8 mg/L	0 .9 mg/L	1 mg/L			
		Surfactants (MBAS)					336.00	0.24 mg/L	0.27 mg/L	0.3 mg/L			
	Air Quality[c]	Total Suspended Particulates		Monthly (1Hour)	Accommodation 150 Mancamp 280 Malanta's Residence F. Pindog's Residence CCO	Envi Lab	1.00	280 ug/Ncm	285 ug/Ncm	300 ug/Ncm			
				Monthly (24Hours)	Batbatol's Residence	Envi Lab	1.00	210 ug/Ncm	220 ug/Ncm	230 ug/Ncm			
		Dust Deposition		Monthly	CCO 150 Mancamp	Envi Lab	1.00	3.2 g/m2/month	3.6 g/m2/month	4.0 g/m2/month			

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
					Boulevard Area Visitors Center Emulsion Plant Explosive Magazine Magazine Area Road Wangal Road Exit								
	Noise Monitoring [c]	Noise Level		Fortnightly	WN-5 WN-6 WN-7	Envi Lab	-	5AM-9AM=65dB; 9AM-6PM=70dB; 6PM-10PM=65dB; 10PM-5AM=60dB	5AM-9AM=68dB; 9AM-6PM=73dB; 6PM-10PM=68dB; 10PM-5AM=63dB	5AM-9AM=70dB; 9AM-6PM=75dB; 6PM-10PM=70dB; 10PM-5AM=65dB			
				Monthly	MN-1 MN-2	Envi Lab	-	5AM-9AM=65dB; 9AM-6PM=70dB; 6PM-10PM=65dB; 10PM-5AM=60dB	5AM-9AM=68dB; 9AM-6PM=73dB; 6PM-10PM=68dB; 10PM-5AM=63dB	5AM-9AM=70dB; 9AM-6PM=75dB; 6PM-10PM=70dB; 10PM-5AM=65dB			
	Vibration Monitoring [f]	Peak velocity		Monthly	Boulevard Gate	Envi Lab	-	4.0 mm/s	4.5 mm/s	5 mm/s			
		Noise over pressure		Monthly	Boulevard Gate	Envi Lab	-	110 dBL	112 dBL	115 dBL			
	Terrestrial fauna (birds, mammals, amphibians and reptiles) Terrestrial flora	Species richness, abundance, diversity, evenness, dominance and presence of endemic and threatened species	Transect survey, netting, trapping Transect/quadrat sampling	Annual	Transects surveyed in the annual ecological assessment	PCO/Environmental Officer / Biodiversity Superintendent		10% decline in baseline species richness and abundance	30% decline in baseline species richness and abundance	50% decline in baseline species richness and abundance	Investigate whether the decline is project-related or non-project related	If project-related then inform concerned department/ project management If not project-related, then inform MMT. LGU and DENR.	If project related, evaluate existing mitigation measures being implemented. Implement a more effective mitigation measure as necessary. If not project-related, then inform MMT. LGU and DENR for

Key Environmental Impacts per Project Phase	Potential Impacts Per Envt'l Sector	Parameter to be Monitored	Sampling and Measurement Plan			Lead Person	Annual Estimated Cost (USD)	EQPL Management Scheme					
								EQPL RANGE			Management Measures		
			Method	Frequency	Location ID			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
													proper action.

Notes:

(a) Limit is the same as equipment detection limit
(b) Method: Grab Sampling; RA 9275 Lab analysis method
(c) Method using High Volume Air Sampler
(d) Method Using Sound Level Meter
(e) Daily In-house analysis
(f) Method using Vibration Meter

6.2.3 Monitoring Stations

Table 6-23: Description and Coordinates of sampling stations

Sampling Point	Location ID	Description	Coordinates	Remarks
Ambient Water	SWS 1	Luminag 1	N16.31949; E121.43531	Control Point
	DP Up	Dumulag Property-Upstream	N16.32426; E121.44581	Below the established flow through
	DP Down	Dumulag Property-Downstream	N16.32543; E121.44853	Downstream of SSM
	SWS 12	Dinauyan Downstream	N16.32991; E121.45584	Mixing Zone
	SWS 13	Camgat-Surong Downstream	N16.33028; E121.45564	
	SWS 14	Didipio River	N16.33104; E121.46309	Upstream
	SWS 16B2	Camgat-Surong Upstream	N 16.33297; E 121.45111	
	SWS 17	Dupit River	N16.33114; E121.46355	
	SWS 18	Didipio River Downstream	N16.311972; E121.470815	
	SWS 19	Alimit River	N16.311365; E121.470614	
	SWS 20	Didipio-Alimit Confluence	N16.311444; E121.471512	
	SWS 21	Didipio-Alimit Downstream	N16.19552; E121.27000	
	SWS 22	Diduyon River	N16.17533; E12129263	
	SWS 23	Alimit Diduyon Confluence	N16.17526; E121.29243	
Effluent Water	STP MSA	STP MSA Discharge	N16.33012; E121.45979	Outfall of STP MSA
	STP PS	STP Plant site Discharge	N16.33030; E121.44936	Outfall of STP Plant site
	Carwash Bay	Carwash Bay Discharge	N16.19368; E121.26568	Outfall of Light Vehicle wash bay
	SP09 Discharge/ HV Washbay	Silt pond with Heavy Vehicle Wash bay Discharge	N16.19458; E121.27210	Outfall of Heavy Vehicle wash bay
	SWS2	TSF (Header Tank)	N16.31634; E121.44458	
	WTP	Water Treatment Plant Discharge	N16.32211; E121.49658	Outfall of water treatment plant
	Fuel Farm	Fuel Farm Oil Water Separator	N 16.32986; E 121.45888	
	Volatilization Pad	Volatilization Pad	N 16.31805; E 121.44805	
	UG Wash Bay	UG Wash Bay	N 16.32977; E 121.45472	
	SP06 Discharge	Silt Pond 06 Discharge	N16.19368; E121.26567	Out fall of polishing pond
Groundwater	DWB01	Drill Water Bore 01	N16.325822; E121.449519	
	DWB02	Drill Water Bore 02	N16.32934; E121.456416	
	RSCPT1	Camp Water	N16.328531; E121.454812	
Air	Accommodation	Accommodation 550 Mancamp	N16.33134; E121.45644	
	150 Mancamp	150 Mancamp	N16.33018; E121.45744	

	Malanta's Residence	Malanta's Residence	N16.33376; E121.45061	
	Batbatol's Residence	Batbatol's Residence	N16.33459; E121.45235	
	CCO	CCO Camp	N16.33180; E121.46226	
	Community	F. Pindog's House	N16.33528; E121.45357	
	Boulevard Area	Boulevard Area	N16.332117; E121.456572	
	Visitor's Center	Visitor's Center	N16.329878; E121.447623	
	Coreshed Perimeter	Core shed Perimeter	N16.335091; E121.453975	
	Emulsion Plant	Emulsion Plant	N16.317643; E121.448597	
	Explosive Magazine	Explosive Magazine	N16.320456; E121.455034	
	Magazine Area Road	Magazine Area Road	N16.325833; E121.462599	
	Wangal Road Exit	Wangal Road Exit	N16.313298; E121.431449	
Noise	MN-2	Accommodation	N16.33134; E121.45644	
	WN-5	Malanta's Residence	N16.33376; E121.45061	
	WN-6	Sammy Jose's Residence	N16.33459; E121.45235	
	WN-7	Batbatol's Residence	N16.3347; E121.4527	
	MN-1	Elementary School	N16.3354; E121.4533	
Vibration and Noise over pressure	Tuguinay Store	Boulevard Area-Tuguinay Store	N16.19556; E121.27367	

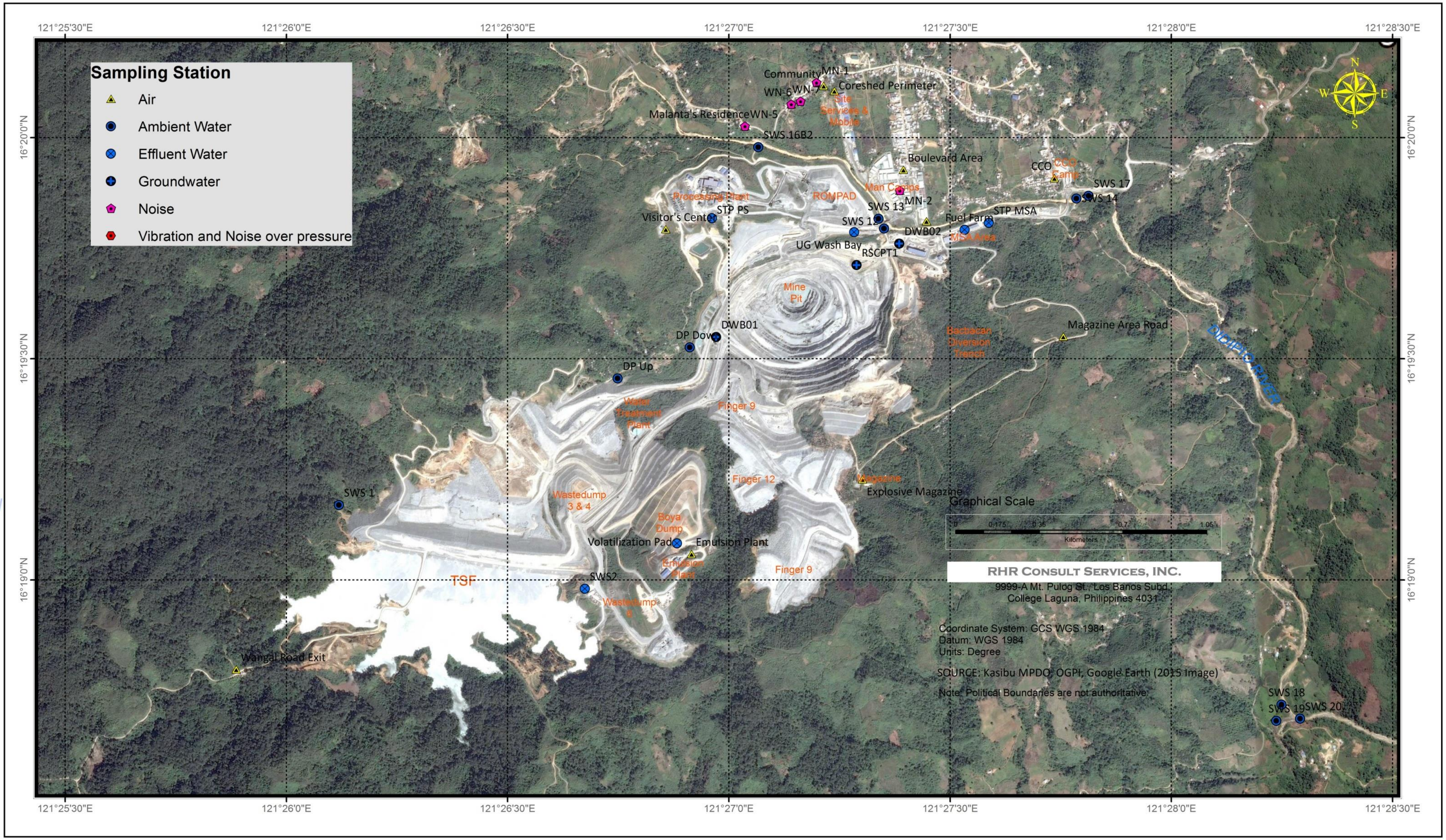


Figure 6-106: Consolidated Environmental Monitoring Map

6.3 MULTI-SECTORAL MONITORING FRAMEWORK

The project has an operational Multi-Partite Monitoring Team established and organized to, consistent with the provisions of DAO 2003-30, to regularly monitor the activities and undertakings of the company's project. The MMT, as an independent entity whose membership represents the stakeholders / public, is expected to add credibility by being open and transparent in monitoring environmental impacts and compliances of the company to all relevant environmental laws, rules, and regulations, especially the Philippine EIS System requirements. Consistent with the existing DENR Administrative Order No. 2017-15, the MMT for the Didipio Gold-Copper Project shall have the following specific functions:

- Conduct quarterly ocular site visit to validate the proponent's compliance with the ECC conditions and the Environmental Management and Monitoring Plan including the requirement to conduct self-monitoring and submit corresponding reports regularly. The MMT may observe sampling activities conducted by the company.
- Prepare and submit its report to EMB-Central Office and EMB-Regional Office No. 2 using the EMB prescribed format at least semi-annually, not later than July 30 for the first semester report and January 30 for the second semester report.
- Institute an environmental emergency and complaints receiving and management mechanism which shall include systems for transmitting recommendations for necessary regulatory action to EMB in a timely manner to prevent adverse environmental impacts.

The composition of the MMT should be in accordance with the requirements of DAO 2017-17, which shall be the representative of relevant stakeholders groups. For the Didipio Gold-Copper Project, the MMT shall be composed of the following stakeholders:

- Representative from the Municipal Environment and Natural Resources (MENRO) of all Municipalities within the Direct Impact Areas (DIA);
- Representative from the Provincial Government ENRO of all Provinces within the DIA;
- All concerned Barangay Chairmen within the DIA;
- The Rural Health Unit (RHU) Chief from all Barangays within the DIA;
- Representative from the LGU-accredited local Non-Government Organizations (NGO) with mission/s specifically related to environmental management;
- Representatives from Locally recognized community leaders who can represent vulnerable sectors including indigenous populations, women, and senior citizen;
- Representative from the Mines and Geosciences Bureau Regional Office No. 2
- Representative from DENR Regional Office No. 2
- Provincial ENRO of all Provinces within the DIA
- Community ENRO all municipalities within the DIA

Consistent with DAO 2017-15, the company and the EMB shall no longer be member of the MMT in order to provide a truly independent third party entity. However, the EMB shall, having the regulatory expertise and know how, shall provide oversight guidance to the MMT and consider its reports and recommendations I its impact and compliance evaluation. The company's role is to ensure that sufficient and adequate monitoring funds are provided on-time for the MMT activities based on the Annual Work and Financial approved by the EMB.

The existing MMTs for the project shall be reconstituted in accordance to the requirements and provisions of DAO 2017-15.

6.4 ENVIRONMENTAL FUNDS

The Philippine Mining Act (1995 and its IRR) requires for the establishment of the Contingent Liability and Rehabilitation Fund (CLRF) which is the financial mechanism for the multi-partite monitoring,progressive mine rehabilitation and compensation for claims and damages. The CLRF ensures just and timely compensation for damages and progressive and sustainable rehabilitation for any adverse effect a mining operation or related-activity may cause. The CLRF is broken-down in three (3) forms such as the Mine Rehabilitation Fund (MRF), Mine Wastes and Tailings Fund (MWTF), and Final Mine Rehabilitation and Decommissioning Plan (FMRDP).

The MRF is established and maintained by each operating mine as sufficient environmental deposit to ensure the availability of funds for the satisfactory compliance and implementation of its Environmental Protection and Enhancement Program (EPEP). The MRF is utilized for the regular monitoring of mining operations, physical rehabilitation of mining affected areas and research on the technical and preventive aspects of rehabilitation. The MRF is further broken down into:

- Monitoring Trust Fund (MTF) – This fund covers the expenses incurred by the Multi-partite Monitoring Team (MMT) and Mine Rehabilitation Fund Committee (MRFC) for the monitoring activities. The expenses include costs for travel, accommodation, laboratory expenses, among others;
- Rehabilitation Cash Fund – This fund covers the actual expenses/budget for the implementation of the EPEP activities amounting to 10% of the total EPEP amount or Php 5 million, whichever is lower. AS of end of 2015, OGPI's RCF, deposited in a government depository bank, amounted to 6.048 million pesos. and
- Environmental Trust Fund (ETF) - Allocated as compensation for damages other than those caused by mine wastes and tailings. OGPIs ETF, as of end of 2015, amount to 109,104.92 pesos.

MWTF is a fund collected semi-annually from each operating mining company as fees based on the amount of mine waste and tailings generated for the said period. The fund is reserved for payment of compensation for damages caused by mine wastes and tailings. OGPI consistently pays the corresponding fee for generated mine wastes as a result of the mining activity, and the generated mill tailings as the result of the processing operation. The payment is made directly to the office of the Mines and Geosciences Bureau Central Office.

The FMRDF is established by each operating mining company to ensure the implementation of the approved Final Mine Rehabilitation and Decommissioning Plan. The FMRDF is accrued before the end of the operating life of the mine and is deposited in a Government depository bank for the sole purpose of FMR/DP implementation. Based on the submitted FMRDP of OGPI, the total FMRDF amounts to USD10.2 million or an equivalent to about 510million pesos. The FMRDF annual lodging started on the 4th year of operation and will end on the 14th year of operation.

Figure 6-107 shows the structure of the CLRF.

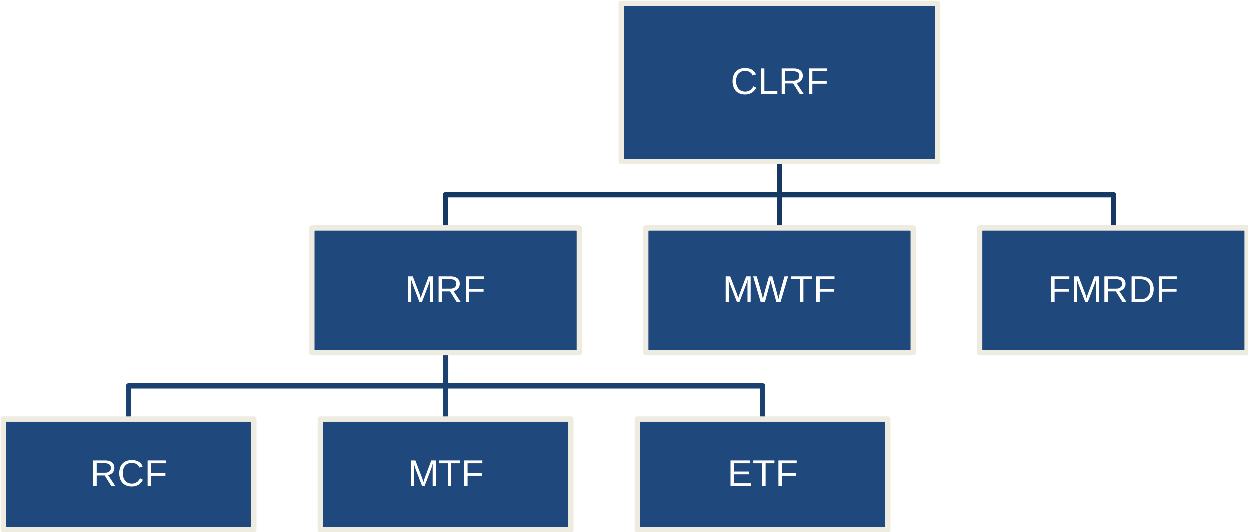


Figure 6-107. Structure of the Contingent Liability Rehabilitation Fund (CLRF)

7 DECOMMISSIONING / ABANDONMENT / REHABILITATION POLICY

This Chapter discusses the Final Mine Rehabilitation and/or Decommissioning Plan (FMRDP) of OceanaGold (Philippines), Inc. (OGPI) for the Didipio Gold/Copper Project. The objective of the FMRDP is to provide a description of the expected and considered acceptable rehabilitation prior and after the life of mine based on best practice in environmental management in mining. With the proposed increase in the project's throughput rate, no changes is perceived by OGPI with the currently approved FMRDP.

7.1 MINE CLOSURE PLAN

7.1.1 OBJECTIVES OF MINE CLOSURE

Mine closure happens at a time when the economic extraction of minerals ceases. However, the overall mine decommissioning process is integrated with the overall mine operation planning process. Factors which generally contribute to the end of mining activities include the following:

- Depletion of mineable reserves;
- Changes in market conditions;
- Financial viability of the company; or
- Adverse environmental or political conditions.

In some cases mining may only be suspended for a period of time and the project is placed under care and maintenance. In circumstances where it is clear that economic or other limits of the operations have been reached, decommissioning and final closure is required (2006, DITR).

The general objective of mine closure is to provide long-term stabilization of the geochemical and geotechnical conditions of the disturbed mining areas to protect public health, and minimize and prevent any additional or ongoing environmental degradation (Nazari, 2000). More specific objectives based on international best practice include the following:

- Future public health and safety are not compromised;
- Environmental resources are not subject to physical and chemical deterioration;
- The post-mining use of the site is beneficial and sustainable in the long term;
- Any adverse socio-economic impacts are minimized; and
- The opportunity is taken to maximize socio-economic benefits (2006, DITR).

For the case of the Didipio Mine, the overall mine life will be approximately 16 years, with 5 years of open pit production (from the commencement of operations), and the remaining mine life comprising of ore feed from the underground mine supplemented with stockpiled low-grade ore. Progressive rehabilitation will be done throughout the life of the mine as applicable until eventual decommissioning and closure at the end of the mine life. If areas for progressive rehabilitation within the mine development area are limited, assisted reforestation and rehabilitation will be conducted within the mine buffer and identified off-site rehabilitation areas. The six main objectives that will be focused on in the closure of the project are the following:

- To ensure that the tailings are safely and securely stored;
- To store all potentially acid generating materials in a manner that will prevent or minimize the potential for oxidation;
- To safely route and convey surface water runoff and stream flows through the tailings impoundment;
- To ensure that water quality of all affected surface water and groundwater are of good quality;
- To ensure that the surfaces of the waste rock dump are secure; and
- To ensure that water control structures like the Tailings Storage Facility and Diversion Channels are developed into stable landforms.

7.1.2 Final Land Uses for Major Project Components

The DENR Administrative Order 1996-40, as amended, states that in the determination of a post-mining land use:

> *"Minesite decommissioning and rehabilitation shall aim to establish a land use capability that is functional and proximate to the land use prior to the disturbance of the mine area, unless other more beneficial land uses are predetermined and agreed in partnership with local communities and Local Government Units"*

The general intent of the Final Land Use Plan is, at a minimum, to revert the conditions of the land to its general condition before this was mined. However, it is anticipated that key mine facilities such as the Open Pit, Tailings Storage Facility and Waste Rock Stack will permanently change the land use and topography of the area. If the final land use will not be similar to or be reverted to the baseline land use, formulation of a final land use plan in consultation with the LGUs and stakeholders, allows for the determination of a more applicable and beneficial land use achievable for the project site. The process of arriving at the Final Land Use Plan should include citizen participation through the appropriate government-mandated bodies established for this purpose. It is necessary for a broad range of community stakeholders to be informed in the Final Land Use Plan. Aside from the general community, the following government bodies should be actively consulted and their views factored in the final product: (a) Municipal Development Council; (b) Municipal Council, particularly the land-use and / or environment committees, if there are any, (c) Office of the Mayor, (d) Municipal Planning and Development Office, (d) barangay government, and (e) other agencies with a presence in the locality whose sectors or areas of concern will be affected by the Final Land Use Plan. It is necessary that the Final Land Use Plan of the mined areas is incorporated with the Comprehensive Land Use Plan (CLUP) of the Municipality of Kasibu. These two documents should be mutually consistent and this can be achieved through a series of consultation undertaken periodically and / or reasonably ahead of rehabilitation and reforestation activities of the land.

It is the commitment of OGPI to undertake a continuous regular community consultation in determining an agreed final land use for the various components of the project. On the determination of this, each of the facilities or services can be ownership transferred, donated, divested, decommissioned or removed. This process is to be progressively planned throughout the life of the operation, with a review intended every two years.

Critical features to the project that will be consequently be reclaimed by the proponent are described below:

7.1.2.1 Waste Dumps

At closure, the waste rock stack will be rehabilitated in accordance with the agreed outcomes through the mine closure planning process. At this stage the concept is to apply soil and to establish forest species on the completed lift of the waste rock stack. The waste rock stack will be progressively rehabilitated during the life of the projects as the production schedule allows.

7.1.2.2 Open Pit

The pit will be fenced off and a safety berm installed at the top of the pit and will be allowed to fill with water. The pit will become a lake and the perimeter of the pit will be made safe in accordance with standards agreed with the EMB and MGB. This may eventually be used for domestic and irrigation water supply if the water quality of the impounded water allows for it. Aquaculture can also be one of the potential future uses based on the suggestions during the consultation conducted. Those areas of the pit that will not be flooded will be contoured and planned in accordance with the closure plan. The current concept is to plant the surrounding areas with indigenous native species.

7.1.2.3 Tailings Dam

At this stage of the project, the foreseen closure is to create dry beaches and establish a river channel along one edge of the tailings impoundment. These dry beaches will then have top soil added and be available for agriculture, it is believed at this stage that the tailings will be benign and pose no significant health or environmental risk. As part of the closure planning process, the tails will be regularly tested to determine the leachability of the metals contained in the tails.

Trial plots will be established to determine if plants of agricultural value will grow in the tails and to see if this is a viable option for the communities, if so, this may be used by capping the inundated area with inert waste and stockpiled soil and rock and returned to the inhabitants of the Didipio Valley as farmland. Another option would be to utilize the inundated area as a water reservoir, maintain the wet cover of the tails, for hydropower as raised during the stakeholder consultation for the final land use.

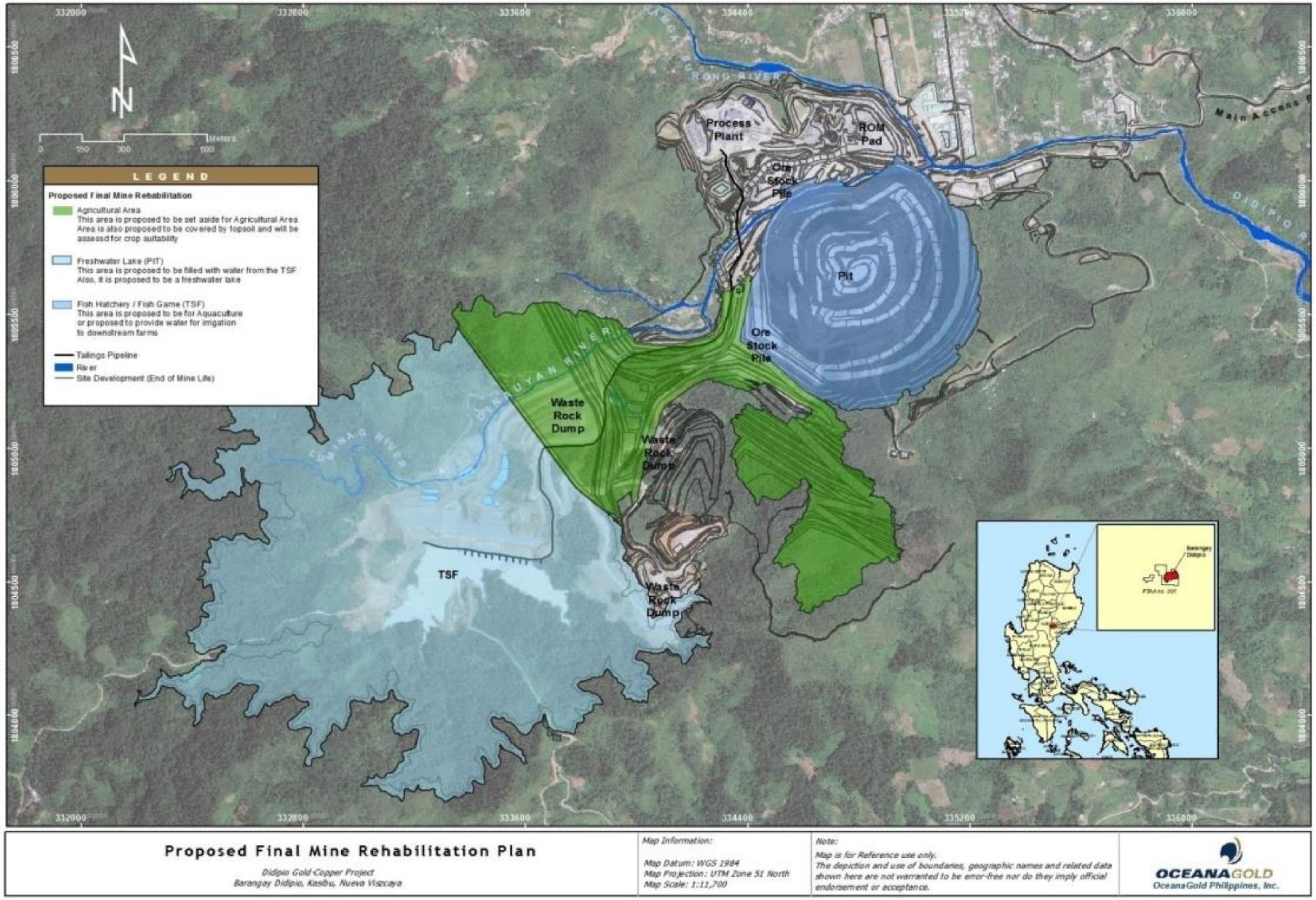


Figure 7-1: Proposed Final Mine Rehabilitation Plan with the TSF Maintained with a Wet Cover

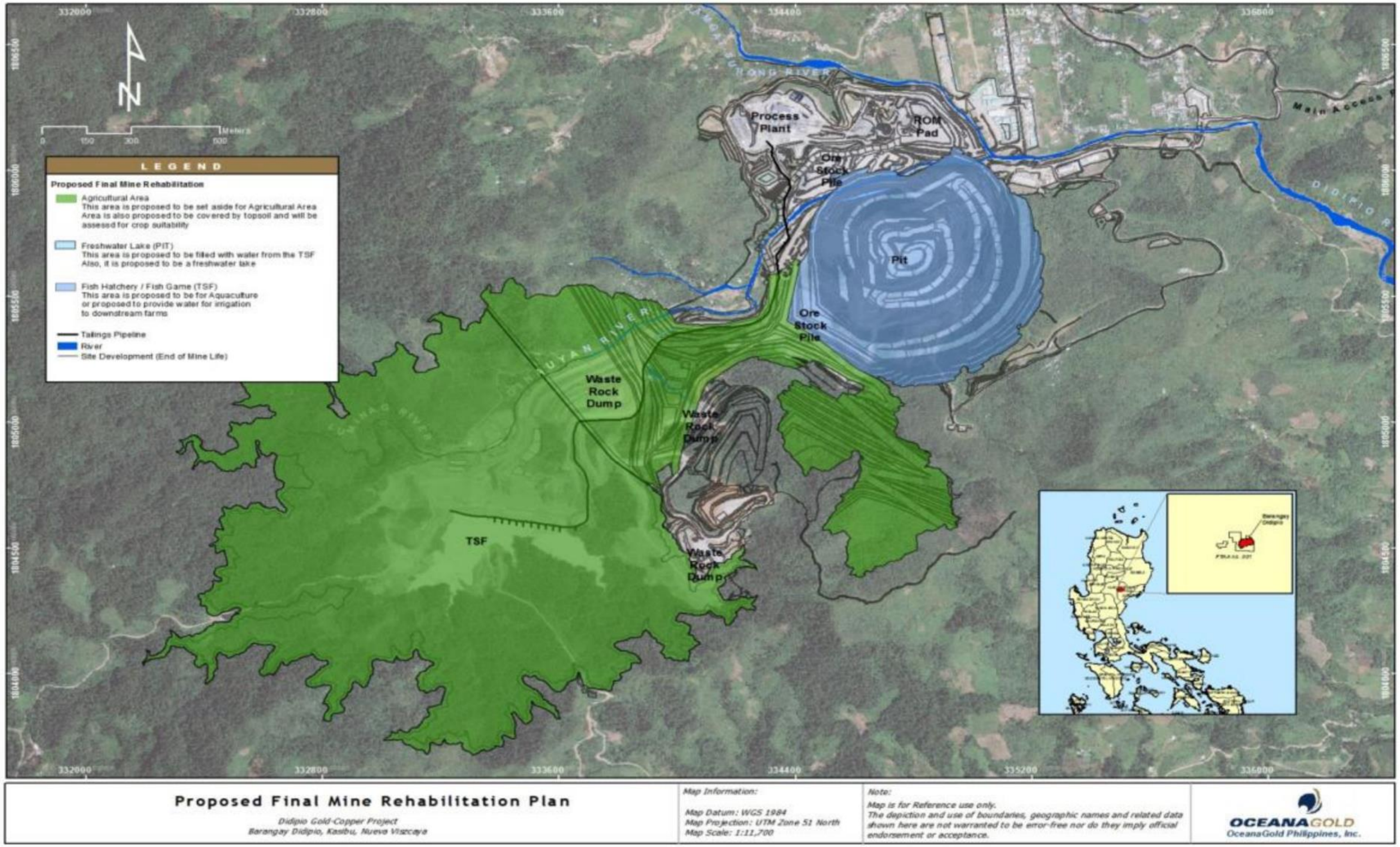


Figure 7-2: Proposed final land use with the TSF maintained as a dry cover/marsh

7.1.2.4 Site Roads

Site roads will remain for use by the local inhabitants.

7.1.2.5 Buildings

Those that are not dismantled or removed from the site will remain for use by the local inhabitants. At this stage, the conceptual rehabilitation and decommissioning plan sees the accommodation village and associated infrastructure being transferred to the community for their use. The actual outcome for the accommodation village will depend on a number of things, including the condition of the village at closure, and the closure planning process and associated negotiations.

7.1.2.6 Process Plant facilities

At closure the process plant and the power station and associated facilities such as the fuel storage, haul roads, pipeline and power line corridors will be decommissioned and removed from site. These areas will then be ripped to create a suitable subsoil and topsoil applied to these areas which will then be planted, in accordance with the closure plan. At this stage the concept is to plant forest species and establish forests in these areas. The process plant components will be sold off and the proceeds from the sale will be used to offset the cost of rehabilitation to the site. Anticipated proceeds from the sale of the process plant components however, are not included in the FMRDP cost presented at the end of this document.

7.1.3 Mine Closure Criteria and Performance Standards

Closure criteria and performance standards (Table 7-1) will serve as parameters by which the success of meeting the closure objectives will be measured

There are six standard completion criteria recommended by the Australian EPA, which are being adopted in this plan. The criteria listed below have the primary goal of reinstating the visual appearance of sites and preventing unreasonable future management costs, or risks to land owners and the public:

7.1.3.1 Safety, Stability, Sustainability and Suitability

The overall health and safety of the community, soil stability, landforms and hydrology, long-term sustainability without additional management inputs, and suitability for agreed land uses are always required for areas to be rehabilitated. These apply to all components that are to be rehabilitated. Suitability for agreed land uses is required to ensure that the economic value of sites is retained. The long-term sustainability of sites avoids intergenerational inequity.

7.1.3.2 Visual Amenity and Heritage

Recovering visual amenity is normally a key objective of rehabilitation. Visual amenity is defined by community expectations. The reclamation activities will mimic the process of forest succession whereby the structure and composition of the vegetation will change over time. Permanent changes to visual amenity have been considered. This includes a formation of a lake out of the decommissioned open pit.

7.1.3.3 Pollution

Pollution in rehabilitated areas (e.g. acid drainage) will be managed to prevent environmental impacts in accordance with regulatory processes. Groundwater and surface water quality monitoring will be conducted to ensure that rehabilitation strategies are effective in meeting the water quality criteria.

7.1.3.4 Off-Site Impacts

Significant adverse off-site impacts will be avoided. These include any biotic or abiotic process occurring at a rehabilitated site with the potential to have substantial adverse impacts on adjacent lands or waterways. These include monitoring of vegetation succession.

7.1.3.5 Hydrology

Flows and availability of surface and groundwater will be measured if there are major changes to hydrology. Appropriate hydrology is required for effective establishment of vegetation and to ensure site stability.

7.1.3.6 Soils

Maintenance of soil properties is a key aspect of rehabilitation, as soil profiles and structures must ensure vegetation establishment and resistance to erosion. Soil components that vary with depth include texture, bulk density and chemical properties and these soil properties will be used to set measurable completion criteria concerning soil structure and function. Effective topsoil and subsoil management is essential to ensure adequate plant growth and normal root distribution patterns. Direct-returning topsoil can be the most effective way of maximizing plant diversity, and will be utilized in the rehabilitation.

Table 7-1: Specific Post-Mining Land Uses and Closure Criteria

Project Components	Specific Post-Mining Land Use	Closure Criteria
Mine Pit	• Open pit will be allowed to fill with water, becoming a new lake. • Access to the pit will be restricted with a rock bund or safety berm for public safety. • Open pit diversion will be removed and the Dinauyan River will continue its natural flow into Didipio River through the new lake. • The new lake can be used as a source of irrigation water for agriculture or as an aquaculture site.	• No mass wasting within the original pit is observed and the pit lake remains stable. • The final footprint of the mine pit will be a lake. To address visual impact, the boundaries of the pit lake (buffer zone) will be secured and revegetated to match the surrounding landscape.
Process Plant and Crusher	• Process Plant will be decommissioned and dismantled. The land will be stripped of hard ground and regraded. The land will be planted with indigenous forest species to mimic a natural forest. • The final land use can also be reverted to agriculture where fruit trees, coffee or other viable commercial crops may be planted.	• Unused chemicals, fuel/ hydrocarbons, solid and hazardous wastes properly hauled out of the area. • Equipment, tanks, cables, pipes, roofing, walls and associated structures removed. • Soil and groundwater quality assessment shows no indication of contamination.
Tailings Storage Facility • Tailings Dam • Tailings Discharge and Return Pipelines	• Discharge and return pipelines will be decommissioned and dismantled. The tailings in the TSF will be contoured to establish a creek. • The Spillway on the main embankment will be modified and lowered to allow the creek to discharge. The modified spillway will be designed and built to safely pass the maximum probable flood and not to erode the embankment wall. • The tailings beach will be planted with agricultural crop, such as coffee, to provide a source of income for the community. The ultimate choice of crop will depend on planting studies and consultation with the stakeholder on their wants and needs.	• There are no indications of erosion and slope instability within the final tailings dam and embankment. • Water discharged from the TSF, combined with the surface runoff water, is dilute enough to enter the natural environment with no adverse effects. • Water retention in the TSF, along with the revegetated surrounding areas, would mimic a natural creek and forest or orchard setting for visual acceptance as applicable.

Project Components	Specific Post-Mining Land Use	Closure Criteria
Waste Rock Stack	• The Flow-through Drain under the waste rock stack will be maintained. • The top of the Waste Rock Stack will be contoured to form a floodway for the Dinauyan River. • The Waste Rock Stack will be planted with indigenous forest species to replicate a natural forest.	• There are no indications of erosion and slope instability in the WRS. • Surface runoff has no elevated metal concentrations and contaminants present.
Onsite Infrastructures	• Authority properly handed to proper agencies / stakeholders, for infrastructures that will be turned-over to stakeholders or LGUs. An example of infrastructure that may be turned over for use by the host community and LGU is the Accommodation Camp. The Accommodation Camp may be converted into a local school or housing compound by the host community. The mine office may be converted to a livelihood/ training center by the host community • Facilities that will not be turned-over to the LGUs and stakeholders will be decommissioned and completely dismantled, with the hardground regraded to match the surrounding landform.	• Sites have been cleared of hydrocarbons and contaminants. • Groundwater does not contain elevated levels of contaminants. • Site assessment of soils indicates absence of contaminants or concentrations within background levels.
Offsite Infrastructures	• Offsite infrastructures may be surrendered to the LGUs and stakeholders.	• Authority properly handed to proper agencies/bodies.
Underground Mine Workings	• All underground mine facilities and infrastructures will be removed and be transported into other Company's project and other excess usable facilities and equipment will be sold by the company. The stopes and ore drives will be progressively back-filled during the operation stage. The portal will be flooded with water along with the open pit that will be developed into an aquaculture lake.	• Underground mine workings are cleared with from contaminants. • All facilities and infrastructures are removed and transported into other project areas or sold. • All potentially harmful chemicals are removed and transported by an accredited DENR treater.

7.1.4 Details of Decommissioning Plan

7.1.4.1 Areas and Equipment that require Decommissioning

The areas that will require decommissioning are listed as follows:

- Waste Rock Storage
- Tailings Storage Facility
- Decant Water Control System and Spillway at the Tailings Disposal Dam
- Open Pit
- Underground Mine Workings
- Mill, Processing Plant and ROM Areas

- Administration Facilities
- Roads and Utility Corridors
- Diversion Channels and Sediment Ponds
- Camp Accommodations

Each of these areas will be rehabilitated on a progressive basis throughout the mine operations, followed by final rehabilitation and closure upon completion of mining activities. As such, expenditures will be continuous and will be defined individually as part of the Annual Environmental Protection and Enhancement Program (AEPEP).

7.1.4.2 Decommissioning Strategy, Timing, Techniques and Environmental Mitigation Strategies Following Planned Closure

The decommissioning schedule is targeted to occur over a period of 12 months. The majority of decommissioning activities will take place immediately following shutdown of the Process Plant. The rehabilitation of the Tailings Dam will take the longest period with an estimated 12-18 month program.

The Process Plant will be disassembled for sale or salvage. All scrap will either be sold. All concrete structures will be broken and buried. The Process Plant site area will be re-contoured, topsoil applied and planted with vegetation.

Upon completion of open cut mine, fencing will restrict access to the pit, but the cut off drains around the pit will be maintained to minimize surface water flow through the base of the open-cut into the underground cave zone. All underground waste will be dumped back into the pit.

At this stage the waste dumps and tailings dam wall will have reached full height at RL 2820, but the tailings beach will still be at RL2816 as it could still accommodate underground ore tailings. The Dinauyan River diversion dam will continue to rechannel water before it reaches the tailings beach. Any other runoff, spring or direct rainfall water will tend to accumulate at the western end of the tailings beach. Tailings are expected to settle well so the discharge water should not present any toxicity or sediment problems. The tailings sand will also provide a good surface for future agricultural use. The rehabilitation will result to an additional 50% fertile agricultural land suitable for the cultivation of rice and other high value primary agricultural crops.

By the middle of Year 4, there will be a substantial flat area on top of the final waste dump at RL2760. Topsoil harvested and stored will be reclaimed and spread over this area. Options for long-term land use include re-establishment of natural vegetation or cultivation, possibly with rice.

From Year 5 to Year 10, the low grade stockpile will be reclaimed off the eastern face of the Madadag valley, leaving the final faces available for rehabilitation. The final waste dump face configuration allows for 18m-wide berms and stone-pitched 10 m-high faces at 1 vertical in 2 horizontal. This design will allow cultivation of rice or citrus, on the berms. As the low grade ore is mined this will allow for the surface to be rehabilitated. This in turn can then be rehabilitated with vegetation or at a later date used for community projects. Drainage can be set up to accommodate the chosen form of cultivation.

In Year 3 of the underground operations, the top sublevel cave lift will mine out almost the entire floor of the pit and part of the southern wall. Progressive extraction of the underground ore through Year 14 will further undercut the base of the pit and cause the lower sections of the pit walls to collapse into the cave zone. During this period, the cut off drains around the pit, the Dinauyan River, and the tailings dam wall and waste dump will ensure that the only surface water entry to the cave zone will be from direct rainfall on the pit.

The major mine closure phase will occur at the completion of underground mining and ore processing in Year 14. At this time the tailings beach will have reached full capacity at RL2812. The following mine closure actions will be taken in Year 14:

- A rock-lined overflow channel will be formed across the top of the waste dump to connect with a spillway to be cut into the hillside north of the pit.
- The surface and groundwater flow into the pit and underground workings will eventually flood the pit to the level of the water table, which should be at or close to the lowest point on the pit crest at RL2695. The pit will become a permanent lake and sediment trap for water flowing over the tailings dam area. The perimeter of the lake will be lined with trees and bushes. Likewise, the lake shall be stocked with fish fingerlings of commercial importance. It will be turned over to the local community or the Didipio Community Development Council. Overflows from the pit will be directed to the Dinauyan River.
- The slight beach angle of the tailings will mean that the final tailings area will be partly covered by a shallow lake. Since there are no toxic chemicals in the tailings, the rest of the surface area is available for revegetation or cultivation. A channel will be formed to direct the Dinauyan River flow across tailings to the waste dump overflow channel, and this water will be available for the long-term land use of the tailings beach surface.
- The process facility, work shops and offices will be removed, and the areas will be cleaned and ripped, in preparation for either revegetation or cultivation.

7.1.4.3 Decommissioning Strategy, Timing, Techniques and Environmental Mitigation Strategies Following Temporary Closure (Care and Maintenance)

Temporary closure or care and maintenance occur when the mining operations temporarily cease due to economic or operational constraints. Temporary closure is normally planned and would entail the immediate preparation and implementation of a Care and Maintenance Program, taking into account the resumption of project operations. The program would contain key components that require continuous monitoring such as ongoing environmental and social programs that are originally programmed into the company's environmental management plan during normal operations.

If the mine were to transition into a Care and Maintenance Phase, the facilities that will be subjected to the Care and Maintenance program will include the Process Plant, TSF and WRS. As the mine will only go into temporary closure, buildings and general surface facilities will not be demolished, but the following activities will apply:

- All mechanical, electrical, and hydraulic systems, including those of the Process Plant and the TSF pumps, and general mine facilities will be left in a "no-load" condition to ensure safety and effective isolation;
- All pipes, sumps and ponds will be drained;
- All fuel and chemicals will be removed from site;
- Contaminated materials will be removed from site and disposed of by an accredited hazardous waste collection or remediation company;
- All buildings except for the mine office and accommodation for the skeleton crew will be sealed, secured and locked;
- All mobile equipment, except those that will be used for rehabilitation and reforestation efforts and care and maintenance, will be removed from site;
- Fences/barriers will be constructed as required to restrict access to the location of specific areas within the site;
- The appropriate government authorities will be notified of the temporary closure;
- Contact person(s) will be designated for authorized access to the site;
- Establish a program for roadway maintenance to ensure access to the site is maintained; and
- Monitoring reports will be continuously submitted during the Care and Maintenance Phase.

7.1.4.4 Decommissioning Strategy, Timing, Techniques and Environmental Mitigation Strategies Following Unplanned Closure (8 Years into the Mine Life)

Sudden or unplanned closure occurs when mining suddenly ceases due to financial constraints. Unplanned closure also occurs if the operation is instructed to close due to non-conformance/s with regulatory requirements. For the purpose of this plan, a scenario of the half the mine life or 8 years from commencement of mining has been used as basis for the formulation of the decommissioning strategy.

In the unlikely event of an unplanned closure, the following activities will be carried out:

- All mechanical, electrical, and hydraulic systems, including those of the Process Plant, TSF pumps and general mine facilities will be left in a “no-load” condition to ensure safety and effective isolation;
- All pipes, sumps and ponds will be drained ;
- All fuel and chemicals will be removed from site;
- Contaminated materials will be removed from site and disposed of by an accredited hazardous waste collection or remediation company;
- All buildings will be sealed, secured and/or locked;
- All mobile equipment, except those that will be used for rehabilitation and reforestation activities, will be removed from site;
- Fences/barriers will be constructed as required to restrict access to the location of specific areas within the site;
- Contact person(s) will be designated for authorized access to the site; and
- A program for roadway maintenance will be established to ensure access to the site is maintained.

7.1.5 Details of Final Mine Rehabilitation Plan

7.1.5.1 Description of the Rehabilitation Strategy, Timing and Techniques Chosen to Meet the Rehabilitation Success, and Closure Criteria

7.1.5.1.1 Tailings Disposal Dam

The Tailings Disposal Dam and impoundment will be located in the Dinauyan Valley and will cover an area of approximately 65 ha. The dam is currently at 2770 level, further constructed stages beginning with a 10m lift followed by 5m lifts using the downstream construction method. The height of the dam will be 100m and the final elevation of the tailings will be 4m below the dam crest.

Approximately 1.5 km of the Dinauyan River and valley will be filled with waste rock and tailings. This will result in a permanent change of topography. Construction of the dam will require excavation and soil removal, thereby increasing the potential for soil loss by erosion.

The Tailings Disposal Dam can impound approximately 50,000,000 tonnes of tailings produced during the whole mine operation. A dam has been built across the Dinauyan River using waste rock from the Open Pit excavation. This has been done with the initial starter dam being constructed prior to mining start-up activities. Subsequent construction is ongoing and is a function of the available waste rock and tailings production. The final dam height is approximately 100 meters high, with slope of 2 horizontal to 1 vertical, and a downstream slope of 3 horizontal to 1 vertical.

The area of the Tailings Disposal Dam will be rehabilitated, and excavated slopes will be stabilized. Catch drains and bund-walls will be built to intercept and divert surface water runoff from disturbed areas and undisturbed areas. The Dinauyan River will be re-established across the tailings surface in a manner that mimics a natural stream course. The re-established river corridor will be directed to a constructed spillway at the Tailings Disposal Dam for discharge downstream of the toe. The spillway will be an uncontrolled structure with a hydraulic design capacity to convey the Probable Maximum Flood Event.

Table 7-2 provides a summary of the criteria in the design of the dam. This assures its stability.

Table 7-2: Design Criteria for Tailings Dam

Feature	Criteria
• Hydrologic design storm event • Storage Volume of Tailings Dam	• 100-year, 24-hour event plus maximum operating volume
• Hydrologic storm event for spillway design at reclamation and closure	• 5,000-year, 6-hour, 18-hour and 72-hour rainfall intensities
• Water control during operations	• Partial under drain and basin drain gravity system into lined reclaim solution collection pond • Supernatant pumping by barge to plant
• General construction and operation dam	• Upstream deposition changing to cross valley prior to closure • Minimum freeboard of 2.0 m plus 100-year, 72-hr storm event • Supernatant pond maintained upstream of dam • Upstream toe cutoff key and drain • Zoned starter embankment constructed of random fill with a filter, drain and seal zone on the upstream face. • Random fill with toe drain and upstream face drain for annual raises using modified centerline construction • Crest width of 10 m for each raise
• Construction materials dam	• Undercut-unsuitable foundation soils from entire embankment footprint for use as drainage material, seal or random fill • Drainage material from undercut, borrow or mine waste • Random fill of mine waste rockfill • Seal materials from borrow pits within and nearby the impoundment

7.1.5.1.2 Water Channel Bund

The Water Channel Bund is proposed to reduce the amount of seepage into the Biak Shear and provide flood protection for the Open Pit. The channel will be approximately 1 km in length and will be designed for multi-purpose use by the local community. These will include water requirements and for solar drying of grain during low flows. The channel location and design will be within the same alluvial floodplain of the existing river and will thus not disrupt the overall geomorphology of the river.

7.1.5.1.3 Process Plant Facilities

The plant site has been constructed on the north western region of the pit environs. Underground portal location has preliminary position determined on the eastern side of the open pit, this could be relocated in the future when further geotechnical and hydrology studies currently underway are completed. Preference at present is at Sitio Bacbacan. Other sites are being considered. Detailed site studies indicate that the site at Bacbacan would provide better foundation conditions and reduced construction costs. In preferring the Bacbacan site, the project economics were improved with regard to ore handling and transport by placing the decline portal and concentrator in a shorter, safer and more cost-effective decline to the underground works. Reclamation within the area will be continuous throughout the project period. Slope stabilization by regrading and introduction of natural plants and vegetation is being performed during all stages of mining operations. An Accommodation Village has been constructed to serve as residential quarters for the employees. This is located east of the

Process Plant Site and North of the proposed Decline Portal. After the mining operations, the use of the village will be handed over to the community.

7.1.5.1.4 Open Pit and Underground Workings

After the mining operation, reclamation of the Open Pit and Underground Workings entails a planned rehabilitation program and associated environmental monitoring. This will include topsoil management and establishment of a plant nursery. Local species of flora indigenous to the area will be used as much as possible for revegetation. A buffer zone will surround the pit to act as natural barrier. The final void will be backfilled with overburden stockpiled from the previous open pit mine and the remaining Dinkidi Hill. Ultimately, the Open Pit void will form a small lake when the mining operations are completed.

7.1.5.1.5 Ventilation Ducts / Fans

After the mining operation, the ventilation ducts/fans will be sealed and closed permanently.

7.1.5.1.6 Decline Portal

After the mining operation, the portal will be sealed and closed permanently.

7.1.5.1.7 Access Roads and Utility Corridors

Towards the end of the mining operations, consultations will be held with the local communities and relevant local agencies to identify which access roads shall be maintained and which will be reclaimed and/or revegetated. Utility corridors will also be subject to regrading and revegetation activities during reclamation and closure. Bunds and pipe bridges/supports will be removed, and the areas regarded, to allow surface drainage to natural watercourses.

7.1.5.2 Reforestation/ Rehabilitation

The OceanaGold Sustainable Agroforestry, Inc. (OGSAI) is the department within OGPI responsible for the off-site reforestation and initiatives in relation to the National Greening Program to alleviate the disturbance of the mining operation on a hectare-to-planted trees basis.

In the first few years of operation, there are limited areas of the site that will be available for rehabilitation, however, there will be opportunities for rehabilitation virtually from the start of construction and these areas will be rehabilitated. Areas that will be rehabilitated early include: batters on roads; batters on the ROM pad; batters on the process and power plants and areas around the accommodation camps and camp infrastructure.

As permanent structures are constructed, temporary structures such as maintenance areas and temporary power will be removed and these areas will be rehabilitated if not required for another purpose. This early rehabilitation will involve establishing a suitable seed bed and planting indigenous species or other species approved by the EMB.

At approximately year three of mining the first lift of the waste rock stack will be complete and the second lift commenced. The second lift will be set back approximately 10 meters from the face of the first lift. Once the first lift is complete, the exposed face will be available for rehabilitation. Rehabilitation will consist of preparing the face for drainage and planting. At this stage what will be planted is not decided as this will require consultation with the community, local governments and the EMB as part of the closure planning process. The current concept is to use native species for a forested area. As each lift on the waste rock stack is completed the available faces will be rehabilitated.

Based on the mine development plan, the areas applicable for progressive rehab are at elevation greater than or equal to 2,810 masl only. As such, areas available for progressive rehabilitation and reforestation are limited. OGPI, in anticipation of this limitation, has tasked OGSAI to conduct offsite reforestation, rehabilitation, and assisted natural regeneration for fragmented forests.

7.1.5.3 Description of the Objectives and Methodology of Any Research or Rehabilitation Trials to be Conducted

The following revegetation and rehabilitation methods will be mainly applied in the offsite reforestation and rehabilitation areas. Due to limitations in soil cover, onsite rehabilitation and assisted reforestation will be limited.

Research for tailings rehabilitation using vetiver grass and usage of WTP water in fish propagation is being currently undertaken. If successful this will be recommended for the final rehabilitation.

7.1.5.3.1 Land resources - Tailings rehabilitation

The objective of this program is to identify methods and vegetation that can provide the best rehabilitation program for the project site and surrounding area. Research topics include the following:

a. Trial plots of different types of tailings to determine what if any plants will grow directly in tailings from different part of the ore body. The trial plots will test both forest species and species of high and moderate economic value.
b. Trial plots of the most productive tailings types to determine metals uptake into agricultural crops. It is so a good understanding is developed of the type and quantity of metals that are taken up into food crops from the tailings.
c. Floating vetivers as potential bioremediation species

7.1.5.3.2 WTP discharge - Fish Pond Project

The objective of this research is to determine the viability of the treated water from the Water Treatment Plant, which treats wastewater coming from the tailings storage facility, as a source for the Fish Pond to cultivate various types of fishes. OGPI also envisioned promoting fish farming as alternative livelihood to nearby residents if the WTP/TSF processed water is found suitable for large scale fish production. Ponds were also proposed to be constructed near Dinauyan Creek to demonstrate to company visitors that discharge water is ecologically safe and can support aquatic life. The research is ongoing with three (3) types of fish species currently being studied which includes Tilapia, Koi, and Catfish.

7.1.5.3.3 Revegetation Methods

Its main objective therefore is to ensure that the most suitable plant species and most appropriate techniques are used in the revegetation in accordance with pre-determined strategies and goals for progressive and final rehabilitation.

This is governed by the following management principles such as: 1) the return of disturbed land to a stable, productive and self-sustaining condition; 2) the extent and type of revegetation and the selection of species should be determined by the proposed end land use; and 3) an expert's advice should be obtained in relation to the suitability of proposed preparation works, species selection, establishment methods and maintenance.

Normally, the implementing strategies would include:

- Species Selection;
- Surface Preparation;
- Fertilization;
- Sowing and Cultivation;
- Tree Establishment; and
- Maintenance

7.1.5.3.4 Plant Species Selection

Plant species to be used in reclamation depend on the location of the terrain to be reclaimed. The species designated in this section for reclamation use and experimentation have all existed in the locality prior the development of the project. They have been chosen primarily on the basis of abundance and occurrence in a relatively wide range of sites. Such species are expected to have wider ecological tolerances than many other species found in the project area. Some species that have been widely observed to colonize disturbed areas (tree fall gaps, logged areas and landslide clearings) are small, relatively short-lived herbs, shrubs or trees. In order to restore the original forest structure and species composition, longer-lived species that compose the majority of the present mature forest canopy will also be planted.

Some of the designated long-lived tree species were observed in a variety of ecological settings, including some disturbed sites. These species will be useful components of the reclamation plantings. Nursery and field experimentation are needed to identify other long-lived tree species that are practical to use for reclamation of the project area. Most of the species of herbs and grasses to be used for broadcast seeding will need to be identified and collected throughout the duration of the project. Seed material of these species will be multiplied in cultivated plots.

7.1.5.3.5 Sowing and Germination

A type of treatment applied to seeds after sowing influences their germination, development and survival. This treatment includes mulching, watering and shading. Mulching protects the seeds from intense heat, strong wind and the impacts of raindrops. It also prevents rapid evaporation of soil moisture. Decomposed mulch also increases the fertility of the seedbed. Mulching materials to be used include chopped grass and rice straw, rice hull, compost, decomposed saw dust, fine sand, wood chips and chopped bark.

The seedbeds or transplant beds must be kept moist at all times. Watering is best done in the morning or mid-afternoon but never at midday, as it will scorch the seedlings raised on open beds. The common methods of watering are flooding, furrow irrigation and sprinkling. Misting could also be employed with the aid of pipes with small side holes installed along the seedbeds. When germinating fine seeds in seedbed, they should be placed in a flat basin or tub partially filled with water, until the medium is moist. In case the soil over the seed bed has hardened, it should be cultivated, taking extra care not to injure the seedlings. Always check whether the soil is moist at the root zone. Very young seedlings are susceptible to sun scorch. Shade materials capable of excluding 50-75% of direct sunlight must be provided. Seedlings should also be protected from heavy rain by plastic sheeting (0.003 to 0.004 gauge) attached to a light frame.

Currently, the project utilizes two seeds germination methods such as sexual reproduction and asexual reproduction through macrosomatic propagation.

7.1.5.4 Nursery

To ensure a higher degree of success in revegetation, young plants raised in a nursery, as opposed to seeds directly planted on the ground, have greater chances of survival. Considerations in setting-up a nursery is based on five factors; location, site conditions, size, facilities, and operations. The nursery will be the center for project revegetation and reclamation activities. The nursery will provide seedlings and seeds for transplanting, experimentation/evaluation of planting techniques, and selection of the most appropriate revegetation species. The nursery will be needed in order to prepare a variety of plant materials prior to the construction phase of the project.

7.1.5.4.1 Location and Site Conditions

At this time, a nursery is proposed to be located near the Accommodations Area. Other locations are also being considered, such as areas accessible from the Plant Site and Accommodations Area. An access road will be constructed adjacent to the nursery to facilitate hauling of materials, day-to-day operations and protection against fire. The topography of the site is sloping, and terracing will be done to maximize the planting area, enhance operational activities, and allow for separation of plant species. The latter is important in resisting and controlling plant diseases. Local soils will be used as much as possible for the seeding matrix. Fertilizers and soil amendments will be added as needed and will be evaluated with respect to transplanting needs.

7.1.5.4.2 Size

The size of the nursery depends on the area to be revegetated, operational needs and length of time the seedling remain in the nursery. A minimum recommended size is 450 m^2 per 100,000 seedlings or 450 m^2 per 33 hectares of reclaimed area. Using a reclamation area of approximately 155 hectares, the minimum nursery area required is approximately 2100 m^2. However, since less than 155 ha will be under active revegetation and assuming only 50% of the total reclamation will occur at one time, the minimum nursery size is approximately 1100 m^2. An allowance should likewise be made to include additional buildings and other collection; phenological observations of flowering, seed set, and seed ripening; and plant establishment. To improve tree seed and seedling quality, a set of about 20 to 30 seed trees will be identified for seed collection and planting in the nursery. Germination tests will be conducted to evaluate seed requirements and methods of germination enhancement. In the first two years of the project, most efforts will be concentrated on a relatively small number of grasses, bushes and tree species (probably 12 to 15 species in total). Specific activities to be performed at the nursery consist of germination and sowing of seeds, transplanting, cultivation, and hardening off. Following these activities, the plants are introduced to the field.

7.1.5.4.3 Facilities

The proposed nursery facility will have an area of approximately 2000 to 2500 m^2. Structures and facilities to be constructed as part of the nursery include roofed buildings with screened walls for potting, transplanting, hardening, and composting. The roof will be constructed of translucent materials, and screens will be provided to exclude birds and insects. An office will be built for the nursery staff, and storage facilities will be provided for chemicals and tools.

Water will be obtained from the Didipio River. A diversion structure and pump system will be constructed, as well as surface and spray irrigation systems. A well may also be installed near the nursery to supplement the water supply during the dry season. Facility construction will occur in phases as the mining project progresses. The first phase will correspond to initial construction activities and will include a 10 X 20 m plant propagation building, office facilities and storage areas. The following year, additional plant propagation buildings (15 X 25 m) will be constructed, as well as seeding beds with shade cloth. A laboratory will also be constructed with weighing balances, drying ovens and other equipment to facilitate experimentation. Initial nursery staff will consist of a forester as the manager, and 2 to 3 laborers. This will expand in subsequent years to a staff of 6 to 10 laborers and one or two foresters. At a minimum, two pickup trucks or flatbed trucks will be needed to facilitate the nursery and field operations. These vehicles will be used to identify and collect plant materials for nursery propagation, to facilitate nursery construction and maintenance, and to transport supplies and materials to the field for planting.

7.1.5.4.4 Operations

Nursery activities will be closely combined with field collection activities that involve identification of plant species and individual plants for seed and vegetative cultivation.

Weeds will compete with the seedlings for nutrients, water and light. "Root weeds" have underground stems from rhizomes, which sprout again when not removed. "Seed weeds" on the other hand grow from seeds. They are easier to control since their root systems die after the stem is cut. Weeding is the removal of this unwanted vegetation. Measures to control weeds include a thorough preparation of the soil before sowing, the use of sowing media and fertilizers that are free of weed seeds, removal of all growing weeds inside and within the vicinity of the nursery with wind- or water-dispersible seeds, mulching, and sterilization by heat or chemical treatment.

Fertilizer application before transplanting may be done in the seedbed or seed box, in conjunction with watering. This is done by dissolving complete fertilizer (14 - 14 - 14) or (15 - 15 - 15) at the rate of 10 gallons per liter of water.

Fertilizer may also be applied at the time of transplanting. After filling the pot with soil, a pinch (approximately 0.25 g) of complete fertilizer is dropped at the hole where the seedling is transplanted.

For reforestation species that can be out-planted bare root, root pruning is carried out while the seedlings are still growing in the nursery bed. The lower part of the root system, particularly the tap root, is cut. Root pruning is done both in seedbed (when the seedlings are not to be transplanted) and in the transplanted bed. Root pruning stimulates the development of a lateral root system that is compact and fibrous rather than long and thin. Root pruning retards shoot growth, thus minimizing production of succulent seedlings, which may die if planted out in the field. Root pruned seedlings are also drought-resistant.

7.1.5.4.5 Hardening Off

Hardening off is the treatment given to seedlings still in the nursery, by gradually exposing them to more adverse conditions experienced in the field. Sudden exposure should be avoided. Seedlings ready to be planted should have sturdy, well-balanced top-root ratio. Fertilizer should not be applied during the hardening period, especially two months before field planting. This will prevent the development of succulent tissues. After being transplanted or potted, seedlings are shaded by giving them half-light. But as soon as transplants have recovered and commenced growth, they are progressively exposed to more light. At least one month before outplanting, they should be exposed to full sunlight. They should not be returned to a shady place.

7.1.5.4.6 Planting Program

The planting program component consists of the introduction of the seedlings to the disturbed area. Referred to as out-planting, this program consists of several techniques depending on the condition of the seedling. These consist of bare rooted seedlings, potted seedlings, and stumped seedlings. All three methods will be used throughout the reclamation program. Each is discussed below along with planting methods.

- Bare Root Seedlings: some species are commonly planted by bare root using the dibble method or the hole method. The dibble method consists of using a dagger shaped tool (dibble) to dig a hole in the soil into which the seedling is inserted. The soil is packed and leveled around the hole roots with the hands. This method should only be used with clay loam soils.
- Under the hole method, the transplant is held by the root collar and shaken to spread the root system. It is then set into a hole 20 to 25 cm. deep, which is then filled by hand. The remainder of the topsoil is placed in and around the hole by hand or planting hoe.
- Potted Seedlings: Potted seedlings are always planted by the hole method. The seedling is removed from the container along with the earth-ball. When setting the seedling into the planting hole, the upper part of the earth-ball must be level or slightly deeper than the edge of the hole. Soil is then filled into the spaces and firmly tamped.
- Stumped Seedlings: A stump is produced from seedlings 2 to 3 cm. high. The stem is cut above the root collar. Long lateral roots, which are taproots are shortened.

7.1.5.4.7 Spacing and Location

Depending on the seedlings used, the spacing varies from 1 X 1 m to 10 X 10 m. Species with a natural tendency to branch, such as Agoho (*Casuarina equisetifolia*) and narra (*Pterocarpus indicus* Willd). They must be planted closely if grown for commercial purposes. This will include formation of long cylindrical bores. If not for commercial purposes, the spacing can be wider. A spacing of 2 X 2 m is best suited for reclamation. Location of species to be planted is also an important factor. Recent practices have recommended the separation of species to prevent large-scale destruction by pests or diseases. For benched or terraced areas, a single primary species should be planted on one bench, while a different primary species is planted on a different bench.

7.1.5.4.8 Planting Schedule

Out-planting can be started as early as a few weeks into the rainy season, when a depth of 18 cm of soil is already moist. Planting should not be made after the middle of the rainy season since this will not give seedlings enough time to become established.

7.1.5.4.9 Maintenance

Replanting should be done to replace dead seedlings to maintain the required density or spacing or when the mortality rate is more than 30 %. Ring weeding operations are performed during the first year. Cut weeds are piled at the base of the plants to serve as mulch. This will help prevent soil moisture evaporation and rapid weed growth. Weeding operations should however not be carried out during the latter part of the rainy season to the end of the dry season.

Following out-planting, fertilization of the seedlings is needed. Appropriate fertilizers will be applied in 3 drills around the seedlings directly below the crown periphery. Fertilizers may also be applied during planting. Most soil investigations have found that nitrogen and phosphorus are commonly deficient. Fertilizers with these elements are recommended. The recommended amount is 13 to 15 grams per seedling.

Table 7-3 are some consideration on the final rehabilitation.

Table 7-3: Other considerations in the final rehabilitation

Item	Description
Planting materials	Use of larger planting materials whenever possible and use of bio-fertilizer with active microorganisms like mycorrhiza for faster site development
Planting design	Mixed planting of different endemic plant species instead of monoculture
Maintenance	Continuous maintenance after establishment to include fertilizer application, replacement of dead seedlings and ring weeding if needed
Species diversity	Naturally occurring vegetation whether grass, vines, herbs and lesser known tree species shall be allowed to grow and reproduce. Any forms of naturally occurring vegetation will not be removed unless they become threat to the health and growth of the preferred plant species
Monitoring of planted seedlings	Periodic monitoring will be conducted to determine which among the species is the best suited at mine site

7.1.5.4.10 Monitoring Method

Monitoring is a critical element of reclamation activities and will occur both during and after mining activities. Development of a Biodiversity Management Plan (BMP) for surface preparation will require a monitoring program that evaluates the effects of treatments on successful revegetation. Such a program includes two main components, namely:

- An edaphic sampling program, in which root zone materials are not only analyzed for physical and chemical properties, but are also archived for future reference; and
- A plant observation and measurement program, in which seedling survival, health and growth are the main components of management interest. Patterns of both aboveground growth and root growth are critical to the main assessment of plant performance.

7.1.5.5 Details of Social Plan

7.1.5.5.1 Retrenchment Package

The 476 workers envisioned to be hired by the Company pertain to all categories of employees (executive management, administration and engineering) during the operations stage. Sub-contractors to be engaged are expected at a minimum, to comply with applicable local labor laws. Production and corresponding outputs are expected to decelerate at the onset of around Year 10 by about 50%. Corresponding reduction in the workforce will take place by that year and the succeeding years.

Current regulations regarding lay-offs, including retrenchment, as embodied in the Labor Code of the Philippines provide that retrenched employees shall be entitled to separation pay. The Company will consider applicable labor laws and regulations in retrenchment plans.

7.1.5.5.2 Labor Support Policies and Programs

It is expected that the number of workers required would correspondingly decrease, and that retrenchment measures would have to be instituted. A "locals first" hiring policy by the Company in its mine site will provide job opportunities to persons during the economically active age (15-64 years old); in practice, the affected age bracket would be younger — early 20s to early 40s. These jobs, however, will only be good during the life of the mine, and even then, their availability would be variable, depending on the annual operations. The workforce is estimated to be 476, of which 264 (55.46%) are envisioned to be locally hired and 212 (44.54%) sourced from the outside. For either hiring or retrenchment, the general impact on local economy, particularly in terms local employment, is bound to be significant, because the mineworkers are most likely to be the principal wage earners of households. The loss a steady source of income due to retrenchment would be the most telling impact. Labor support policies and programs that prepare workers and their families for the eventuality of lay-offs because of decreasing production and mine closure, would mitigate the immediate and long-term effects of retrenchment.

The Company's approach to community and social development, including assistance to its local stakeholders, is to design programs and projects that would eventually be "autonomous" in character and in operations. That is, such undertakings should not be so much thought of as company-run, but as company-assisted "autonomous" activities. Such functions like job placement, re-tooling, job information, etc., should be part of the regular functions of the appropriate organization (in this instance, the local government through its Public Service Employment Office [PESO]), with the Company providing assistance to the latter in capacitating it through logistics, training and networking, for example.

7.1.5.5.2.1 Job Search, Skills Training, Enterprise Awareness, and Counselling

The quest for jobs is triggered by both the individual's desire for work and by the availability of information on job opportunities. In keeping with the Company's philosophy of configuring community assistance programs that would eventually be autonomous and self-sustaining, it is envisioned that OceanaGold assists the local government of Kasibu in making the Public Service Employment Office (PESO) a fully-functional unit with the capacity to carry out its mandate under the law.

RA 8759, also known as the PESO Act of 1999, established a community-based multi-service employment facility in all major towns, key cities and other strategic communities in the country. The PESO is largely maintained by the local government with support from other entities like the NGOs. The PESO is linked to the network of offices of the Department of Labor and Employment.

Available information indicates the presence of a PESO in the municipality of Kasibu. The general objective of the PESO is "to ensure the prompt, timely and efficient delivery of employment service and provision of information on the other DOLE programs". Its specific objectives include:

- Provide a venue where people could explore simultaneously various employment options and actually seek assistance they prefer;

- Serve as referral and information center for the various services and programs of DOLE and other government agencies in the area;
- Provide clients with adequate information on employment and labor market situation in the area; and
- Network with other PESOs in the region on employment for job exchange purposes.

An examination of the functions of the PESO will reveal how these address the intent of the Social Plan, especially with respect to the impact of mine closure to workers and local employment.

Assistance by the Company to the local PESO will have the double effect of helping the local government capacitate itself in employment generation and facilitation, and creating partnership between the mining management and the local government in addressing problems of common interest. This should include the constituency of locally-hired workers, as well as employees from outside of Kasibu, who mutually contributed to local economic development. The nature and character of the program of assistance to the local PESO will be determined jointly by the mining management and the local government.

7.1.5.5.3 Transfer of Social Assets and Services

Social assets and services are described in the EIA Study and the Social Development Management Plan (SDMP). These consist of community infrastructure and services sponsored by the Company throughout the life of the mine. Of particular relevance to the turnover at the mine closure is community infrastructure. Community infrastructure under the SDMP includes the following:

- Public roads;
- Barangay facilities (e.g., barangay hall, sports center, etc.);
- School facilities;
- Health facilities;
- Electric power;
- Communication system;
- Sewerage / garbage disposal system; and
- Water supply system.

Some of these, for example, the public roads and communication system, admittedly serve the mining operations but nonetheless also benefit the community and its residents. The others, primarily if not wholly, are for the benefit of the community.

The Company's approach in sponsoring community infrastructure is to undertake this in partnership with the community, through the appropriate local institutions, principally the Barangay Development Council. As much as possible, it is envisioned that the community infrastructure project (e.g., water supply system) becomes "autonomous" and self-sustaining in the soonest possible time after its construction. The Company does not intend to administer these projects beyond their installation. This, however, does not imply that the company support for these projects ceases; support will be given to promote the self-sustainability of these infrastructures. One way to achieve this is through training of the local community, specifically local institutions like beneficiaries' or users' associations, to maintain and administer these community infrastructure projects. The Company's approach to community infrastructure would allow for community ownership and for beneficiaries to develop a stake into the projects. At the onset, expectations are set that the projects are for the community, and that the community is responsible for their sustainability.

Memoranda of Agreement have been entered into by the Company and the project-affected communities regarding community projects. Areas of responsibility have been indicated and delineated among the parties concerned. The Company has received the Certificate of Approval of its SDMP, and is obliged to undertake the projects specified therein according to plan. Modifications are allowed on condition that MGB Regional Office is informed, and its approval obtained.

7.1.5.5.4 Social Development Management Program

Part of the social commitment of OGPI is their social development plan which includes projects that will be implemented jointly with the community. The implementation and progress of SDMP projects will serve as a gauge in the success of the rehabilitation process after the mine closure. This ensures sustainability to help the locals develop their quality of living in the community. The SDMP is a separate document which lists the SDMP projects that were consulted with the community.

7.1.5.5.4.1 Assistance to Community Infrastructure

Activities consist of maintenance and rehabilitation of existing roads and water systems, improvement of the barangay multipurpose hall and day care center, and the establishment of the new Didipio to Kasibu road. Stakeholders involved in these activities include residents of the host community.

7.1.5.5.4.2 Educational Assistance

Educational assistance consists mainly of salaries for teachers of the Didipio day care center, Didipio elementary school and the Didipio Green Valley Institute. Educational scholarships up to college are also provided to families who sold their lands and selected students who needed assistance within the host community. The goal of this activity is to alleviate poverty through education and achievement of primary universal education.

7.1.5.5.4.3 Health Assistance

Medical missions are regularly conducted within the municipalities of Kasibu and Cabarroguis. These medical missions provide medical, ophthalmological and dental services to communities within these municipalities. Oral hygiene kits and anti-malarial tools are also distributed to health centers. The health assistance programs aim to improve the host communities' and surrounding barangays' access to medical goods (medicine) and services, as well as to promote and maintain good health habits.

7.1.5.5.4.4 Alternative Livelihood and Skills Training

Activities are mainly geared towards the training of the Didipio Women's Movement for Community Development (DWMCD). Trainings provided include accounting, bookkeeping and audit training, garbage recycling and junk shop, and the operation of market stalls for livelihood.

7.1.5.5.4.5 Assistance to Environmental Management

Environmental management assistance consists of provisions for IEC materials, road and safety signs, and dissemination of environmental monitoring results to promote the community's environmental awareness.

7.1.5.5.4.6 Assistance to Culture and Sports

Financial assistance is given by OGPI for the conduct of sportsfests, cultural fairs and building rehabilitation for churches within the host barangay.

7.1.5.5.4.7 Assistance to Agriculture

Financial assistance is given to farmers in Didipio for the procurement of seeds and fertilizers. The goal of this endeavor is to alleviate poverty and hunger by encouraging farming activities in available arable land. Expenditures accorded for the aforementioned SDMP activities amount to approximately PhP 3,000,000.00 to PhP 4,000,000.00 a year.

7.1.5.6 Details of Maintenance and Monitoring Plan

OceanaGold (Philippines), Inc. is committed to implement an environmental management program in full accordance with industry best practices. This program is aimed at achieving a series of predetermined environmental targets and objectives, and maintains compliance with government regulations. The program outlined below details OGPI's responsibilities for the various requirements, and addresses both short-term and long-term targets and objectives.

7.1.5.6.1 Mining Activities/Infrastructures

These are divided into five distinct activities, each of which is described below.

7.1.5.6.2 Water Quantity and Quality Management

During the Closure Phase, most water quality monitoring stations established in the EPEP/AEPEP will no longer be sampled, taking into consideration that the decommissioning and rehabilitation of the mine facilities are carried out successfully. Initially, surface water and groundwater stations will be retained during the decommissioning phase of key project facilities, to assess if the environmental criteria for closure are met. Once these parameters are satisfied, the water quality monitoring stations will be reduced, retaining only stations from the natural streams draining the project site namely, Dinauyan River, Didipio River, Camgat River and Surong Creek.

Sampling frequencies and parameters to be tested will vary throughout the year and will be a function of the decommissioning and rehabilitation activities being conducted. A general summary table of the water quantity and quality program is presented in Table 7-4 and ground water monitoring is presented in Table 6-5. Similar to the AEPEP, the FMRDP monitoring program will require constant review as data is collected and analyzed. It is likely the monitoring program will be revised and reduced as the closure criteria are met. Table 7-4 and

Table 7-5 were prepared as a starting point for this program and present a more detailed and site specific framework of sampling and testing.

Table 7-4: Summary of Environmental Monitoring Program for Mining Activities-Water Quality and Quantity

Component	Project Phase	Locations	Method	Parameters	Frequency
Dinauyan River	Closure (Abandonment)	Surface water monitoring stations downstream of the TSF, along the waste dumps, and just before the confluence of Surong and Dinauyan River	Grab Sampling	pH, TSS, EC, DO, Turbidty, Dissolved Cu, Zn, As, Fe, Hg, Cr+6, Pb, Cd.	Quarterly
Surong River	Closure (Abandonment)	Upstream of Confluence with Dinauyan River	Grab Sampling		
Didipio River	Closure (Abandonment)	Upstream and Downstream of Confluence of Alimit Creek	Grab Sampling		
Diduyon River	Closure (Abandonment)	Upstream and Downstream of Confluence Didipio River	Grab Sampling		

Table 7-5: Summary of Environmental Monitoring Program for Mining Activities - Groundwater Quantity and Quality

Component	Phase	Locations	Method	Parameters	Frequency
Groundwater	Closure (Abandonment)	Downstream Tailings Impoundment	Grab Sampling	Microbiology: Fecal Coliform, Total Coliform, HPC pH, EC, Dissolved Cu, As, Boron, As, Cd, Pb, B, NO_3, Benzene, Color, Turb, Fe, Mn, Cl-, Sulfate, Zn, Hg, Cr+6, Al, Na, Sb, Mn, Ni, Ba, Se, Total CN, Ca Hardness, F-, NO_2, NO_3, Taste, H_2S, NH_3	Semi-annual

7.1.5.6.3 Structural Integrity

This monitoring program (Table 7-6) will focus on inspection of the structures constructed as part of the project. During the Operations Phase, the facilities that require detailed monitoring programs in terms of structural stability assessment include the Tailings Dam, Waste Rock Storage, Open Pit, Underground Mine Workings, Sediment Ponds, Diversion Channels and Roadway Culverts. During the Closure Phase, the underground mine access will be sealed off, and the sediment ponds, diversion channels and roadway culverts have been decommissioned. The facilities that will be monitored for stability and integrity during the FMRDP stage are the residual rehabilitation and closure activities for the open pit, tailings disposal dam and waste rock storage. Monitoring activities will consist of visual examination of embankments, slopes and structures, and collection of geotechnical data from instrumentation such as piezometers, inclinometers and fixed survey points. Specific structures, monitoring items and frequency of monitoring are shown in. The monitoring frequency will also be reduced as the closure criteria are met.

7.1.5.6.4 Vegetation Monitoring

Monitoring of vegetation (Table 7-7) will consist of inventory and assessment of the survival rate of planted species and the success of the rehabilitation program. Monitoring begins with the implementation of the nursery program during the Operations Phase. The vegetation monitoring covered under the FMRDP period is the final landform revegetation. Survival rates of the different vegetation species will be monitored, as well as growth rates, density, seed germination and propagation. The monitoring frequency will be constant throughout the FMRDP stage or until such time that the success of the reclamation and rehabilitation program is established.

7.1.5.6.5 Wildlife Monitoring

Monitoring of wildlife (Table 7-7) will consist primarily of visual observations and audio cataloguing of different species. This activity is continuous throughout the project life. During the Closure Phase, monitoring will be limited to quarterly field trips within the project area and outside the main activity zone to determine fauna that will begin to inhabit the rehabilitated areas post-closure.

Table 7-6: Summary of Environmental Monitoring Program for Mining Activities - Structural Evaluation

Component	Phase	Locations	Method	Parameters	Frequency
Tailings Disposal Dam and Impoundment	Closure (Abandonment)	• Dam Embankment • Tailings Pond • Spillway	• Water Discharge Measurement • Spillway Discharge Measurement • Grab Samples of Water	• Settlement • Piezometer and Inclinometer Data • Discharge and Spillway • Tailings Storage	Quarterly

Table 7-7: Summary of Environmental Monitoring Program for Mining Activities - Conservation Values

Component	Phase	Purpose	Locations	Method	Parameters	Frequency
Vegetation	Closure (Abandonment)	• Reclamation	• Reclaimed Disturbed Areas	• Visual Examination • Sampling Program • Biodiversity Monitoring System (BMS) • Measurement Program	• Plant Survival • Population Density • Root Zone • Species Diversity • Conservation Status	Annual
Wildlife	Closure (Abandonment)	• Species Monitoring	• Throughout FTAA Area and buffer zone	• Visual Sighting • Audible Recording • Biodiversity Monitoring System (BMS)	• Population Density • Species Diversity • Conservation Status	Annual

Component	Phase	Purpose	Locations	Method	Parameters	Frequency
Aquatic Ecology	Closure (Abandonment)	• Water Quality Impacts • Species Numbers and Diversity	• Dinauyan River before the confluence with Surong River • Camgat River • Surong River • Didipio River • Diduyon River	• Visual Inspection • Sampling of Live Species	• Number and Diversity • Tissue Sampling	Annual

8 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

8.1 ENVIRONMENT POLICY OF OCEANAGOLD

OceanaGold (OGC) is committed to responsible environment management across all of its business activities including Exploration, all stages of Project Development Cycle, Operations and Closure.

OceanaGold aims to contribute to the conservation of biodiversity by respecting designated protected areas, sharing information and practices on biodiversity management, and supporting, developing and implementing inclusive and transparent procedures for integrated land use.

OceanaGold's commitment to responsible environmental management will be achieved through the implementation of a management system and structure focused on:

- Assessing and monitoring the positive and negative, direct and indirect, as well as the cumulative environmental impacts of all its activities;
- Supporting the protection of biodiversity and integrated approaches to land use;
- Complying with all host country environmental laws as a minimum;
- Implementing companywide environmental performance standards consistent with Internationally-accepted Standards and Conventions;
- Committing to the efficient use of resources to minimize waste and prevent pollution;
- Designing and planning all operations to ensure adequate resources for rehabilitation and mine closure to meet post mining land use and requirements;
- The provision of safe storage and disposal of al residual waste and process residues;
- Providing all necessary training, education, equipment and information to its employees and contractors ensure greater environmental performance associated with its Business activities; and
- Continuously reviewing and improving its environmental management and performance to establish environmental objectives and targets to minimize, mitigate or off-set its environmental impacts.

OGPI's Mine Environment and Protection Enhancement Office (MEPEO)/ Environment and Compliance Team leads in the implementation of the Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and the Environmental Protection and Enhancement Program (EPEP) of OGPI. The Community Relations and Communications Team, on the other hand, is the lead group in the implementation of OGPI's Social Development and Management Program (SDMP) which includes the Information, Education and Communication (IEC) Programs. OGPI also has its Occupational Health and Safety (OHS) Team that leads in the implementation of health and safety management systems and risk management strategy of the Company.

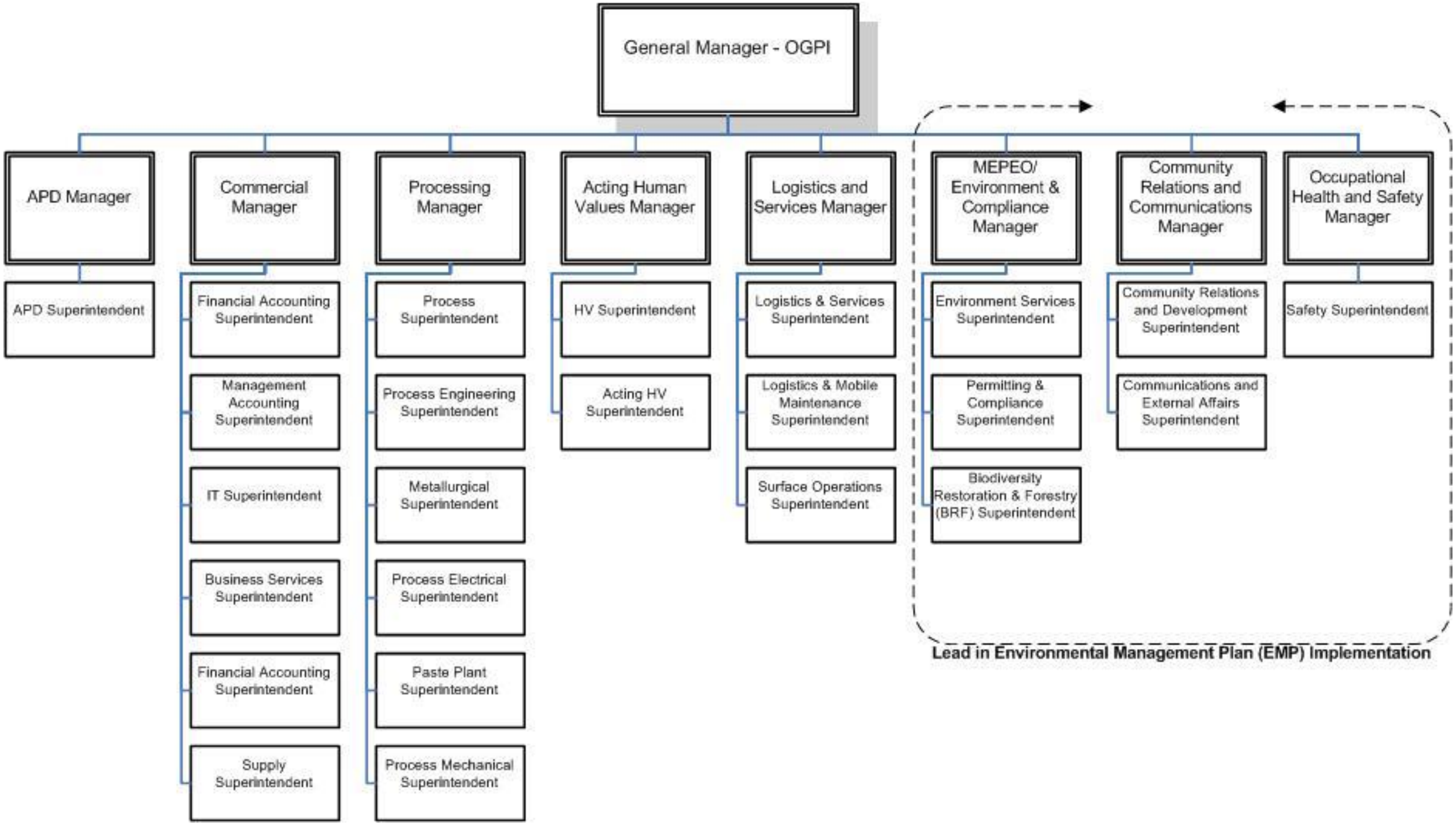


Figure 8-1: OGPI - Management Team Table of Organization

8.1.1 DUTIES AND FUNCTIONS OF MINE ENVIRONMENTAL PROTECTION AND ENHANCEMENT OFFICE (MEPEO)/ ENVIRONMENT & COMPLIANCE

Figure 8-2 below shows the organizational chart of MEPEO / Environment & Compliance Team

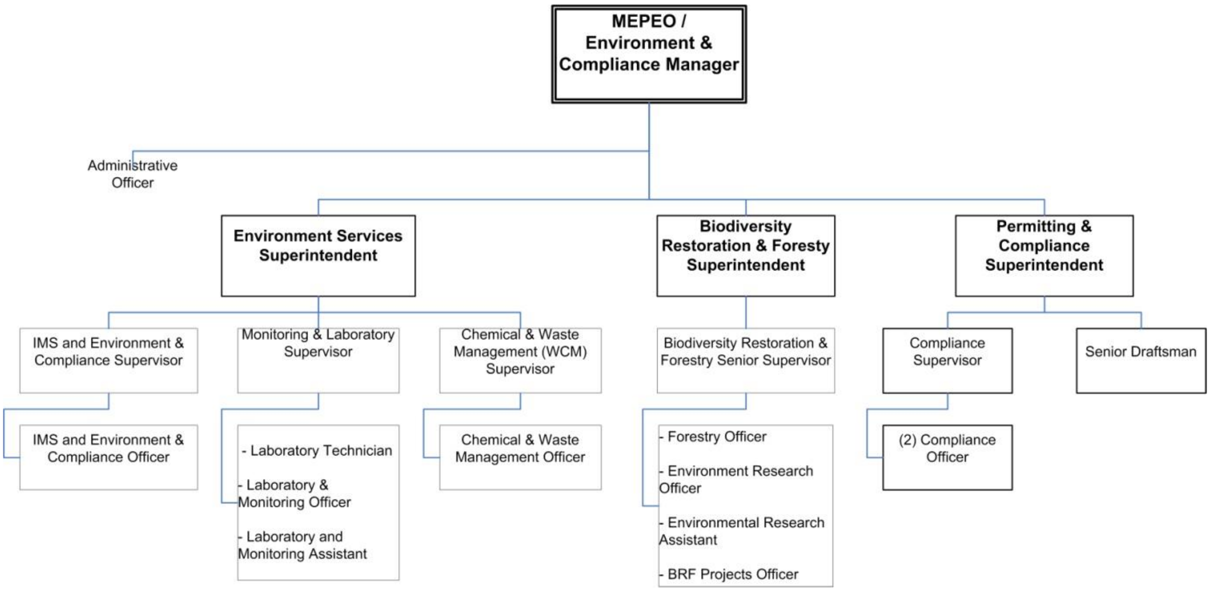


Figure 8-2: MEPEO / Environment & Compliance Organizational Chart

Presented below are the duties and functions of key positions under the MEPEO / Environment & Compliance Team.

8.1.1.1 MEPEO/ENVIRONMENT & COMPLIANCE MANAGER

Environmental Management

1. Leading and carrying out impact assessments to identify, assess and reduce the organization's environmental risks;
2. Developing and implementing environmental strategies and action plans that ensure Didipio Mines' sustainable development;
3. Leading the implementation of environmental policies, practices, and special programs;
4. Coordinating all aspects of pollution control, waste management, recycling, environmental health, conservation and renewable energy;
5. Ensuring compliance with the OGC Corporate Compliance Standards as well as all relevant environmental legislation including keeping up to date with Philippines, and international regulation and legislation;
6. Promotes environmentally sensitive culture that advocates sustainability through individual commitment and volunteerism;
7. Liaising with relevant bodies such as local authorities, public bodies and competent bodies;
8. Auditing, analyzing and reporting environmental performance to internal and external clients and regulatory bodies;
9. Promoting and raising awareness, at all levels of an organization, of the impacts of emerging environmental issues, whether legislative or best practice, on corporate, ethical and social responsibility;
10. Developing and implementing environmental management systems to continually reduce the impact of the organization on the environment;

11. Coordinating public hearings and consultations on environmental matters;
12. Managing relations with the board of directors, senior management and internal staff;
13. Training staff at all levels in environmental issues and responsibilities;
14. Participating in environmental education and research;
15. Negotiating environmental service agreements and managing associated costs and revenues;
16. Writing environmental reports, and assuming the lead responsibility with the company;
17. Being proactive about corporate social responsibility issues and taking action to ensure these are met;
18. Setting organizational sustainability targets, and developing plans to meet those targets and oversee their delivery;
19. Fostering a culture of continuous improvement in environmental management with a commitment to setting a high environmental benchmark via best practices, and
20. Pursue recognition in responsible environmental management.

Permitting and Government Compliance

1. Managing, developing, and reviewing strategies and compliance monitoring tools on timely processing of government permits
2. Forging social and functional engagement with government stakeholders
3. Engaging and communicating with government agencies on permits and other compliances requirements.

Safety Compliance

1. Lead the achievement of safety targets & objectives, and in the application of procedures, permits and instructions;
2. Comply and promote compliance with company safety policies and practices.
3. Demonstrate safety leadership at all times;
4. Communicate HSE practices as a core part of company culture;
5. Take immediate action to correct at-risk behavior or conditions;
6. Swiftly initiate new and approved HSE initiatives;
7. Perform work safely, and immediately reports unsafe situations;
8. Regularly inspects workplace and ensures it is in safe condition;
9. Actively participate in incident investigations, health, safety and environment programs, activities, audits and industrial hygiene studies as required, and
10. Ensure attendance of department personnel to SHE's mandatory;

8.1.1.2 Environment Services Superintendent

Responsible Environmental Management

1. Conducting environmental impact assessments to identify, assess and reduce the organization's environmental risks;
2. Developing and implementing environmental strategies and action plans that ensure Didipio Mine's sustainable development;
3. Developing and implementing environmental policies, practices, and special programs;
4. Coordinating all aspects of pollution control, waste management, recycling, environmental health and renewable energy;
5. Ensuring compliance with environmental legislation and keeping up to date with the Philippines, and international regulation and legislation;
6. Ensuring promotion of environmentally sensitive culture that advocates sustainability through individual commitment and volunteerism;
7. Liaising with relevant regulatory agencies and other stakeholders;

8. Ensuring that finding of audits and analysis of environmental performance are reported to internal, external clients and regulatory bodies;
9. Promoting and contributing in raising awareness, at all levels of the organization, of the impact of emerging environmental issues, whether legislative or best practice, on corporate, ethical and social responsibility;
10. Ensuring implementation of environmental management systems to continually improve the impact of the organization on the environment;
11. Attending to public hearings and consultations on environmental matters;
12. Maintaining positive relationships with senior management and internal staff;
13. Providing training to staff at all levels regarding various environmental topics, issues and responsibilities;
14. Developing and participating in environmental education and research;
15. Proactively responds to corporate social responsibility issues and acts to ensure these are met;
16. Ensuring that the organizational sustainability targets and plans are delivered based on schedule; and,
17. Fostering a culture of continuous improvement in environmental management with a commitment to setting a high environmental benchmark via best practices.

8.1.1.3 Biodiversity Restoration and Forestry Superintendent

Biodiversity Conservation Programs Management

1. Alignment of biodiversity conservation and management programs of the company to the existing government regulations;
2. Development and implementation of biodiversity conservation and management programs, researches, and studies in collaboration with government, non-government, and academic institutions;
3. Preparation, acquisition, and implementation of gratuitous permit application and submission of necessary terminal reports;
4. Close collaboration with MLGU and DENR-CENRO in the implementation of Bantay-Gubat program;
5. Development and review of company's biodiversity management policies and procedures in line with the existing government laws and regulations; and
6. Participation in government and non-government organized biodiversity conservation and management groups to highlights and be recognized especially the best practices of the company in regards with biodiversity conservation and management.

Onsite and Offsite Revegetation & Forestry Management

1. Development and implementation of onsite and offsite revegetation and forestry programs;
2. Ensure that regular maintenance and protection activities are implemented within the established revegetation and reforestation areas onsite and offsite;
3. Preparation, acquisition, and implementation of tree cutting permit application and submission of necessary terminal reports;
4. Development and review of company's revegetation and reforestation policies and procedures in line with the existing government laws and regulations; and
5. Ensure compliance with the provisions under the approved tree cutting and logs transport permits.

Sustainable Agroforestry Programs Management

1. Ensure successful implementation of commercial plantation program;
2. Facilitation of organic agriculture related trainings for farmers beneficiaries;
3. Facilitation of land tittle annotation for commercial plantation beneficiaries;
4. Ensure continuous production of various forest and agroforestry seedlings; and

5. Collaboration with partner government and non-government institutions in the implementation of sustainability related projects and programs.

MFP, NGP, TCP, & GP Reports Management

1. Ensure timely submission of Mining Forest Program (MFP), National Greening Program (NGP), Tree Cutting Permit (TCP), and Gratuitous Permit (GP) compliance reports; and
2. Participate in the annual best MFP contest.

Engagement with Government and Non-government Stakeholders

1. Developing/reviewing strategies to increase social and functional engagement with government and non-government stakeholders; and
2. Liaising and communicating with government agencies and non-government partners institutions for matters related to biodiversity, mine rehabilitation, forestry, and sustainable agroforestry.

8.1.2 Duties and Functions of Occupational Health and Safety (OHS)

Figure 8-3 below shows the organizational chart of MEPEO / Environment & Compliance Team

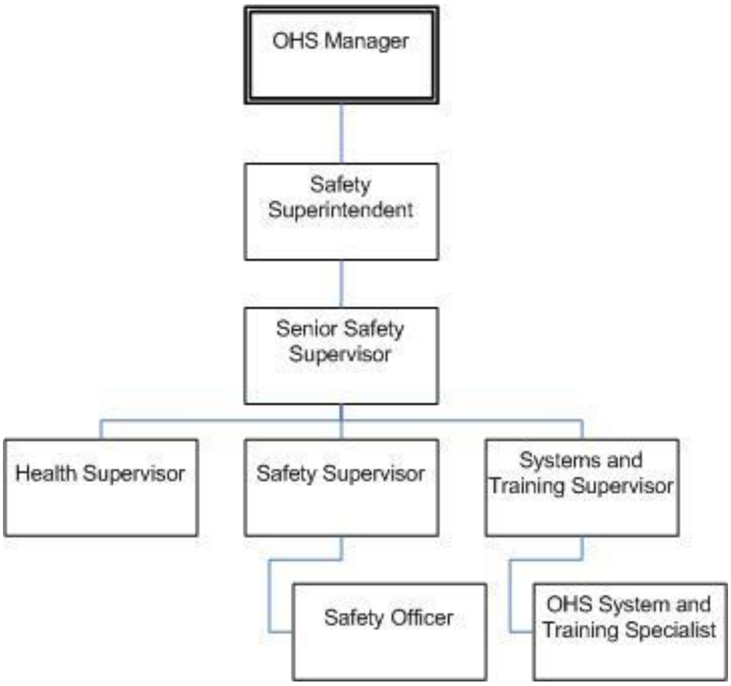


Figure 8-3: OHS Organizational Chart

Presented below are the duties and functions of key positions under the OHS Team.

8.1.2.1 OHS Manager

Health and Safety Management

1. Leading the OHSC team in OHS compliance (regulatory and internal programs) through ongoing audits and inspections, focusing on continuous improvement per the OGPI's common systems framework.
2. Promote health, safety and environmental awareness to prevent injuries and/or damages
3. Lead in the development, implementation and coordination of the organization's risk management strategy
4. Implement, support and audit relevant health and safety management systems across the organization

5. Conduct Regular Department meeting/briefings
6. Ensure all OHS members duly participate in performance management
7. Facilitate and review of incident investigation using ICAM methodology
8. Lead and coach OHS leaders to deliver an effective and interactive service to the operation
9. Provide direction and guidance to the management team and employees on Health and Safety issues.
10. Lead by example and promote best practice at all times with regards to safety at work in all areas
11. Develop cost-effective approaches to implement Health and Safety Programs onsite.
12. Ensure the development and maintenance of hygiene programs such as noise surveys, continuous atmosphere monitoring, ventilation and light surveys and other areas as identified throughout the operation.
13. Develop and maintain medical monitoring programs for employees.
14. Investigate health-related complaints, and inspect facilities to ensure that they comply with public health legislation and regulations.
15. Recommend and/or order suspension of activities that pose threats to workers' health and safety.
16. Ensures that new-employees are provided with health and safety orientations, and materials provided for these presentations.
17. Recommend measures to help protect workers from potentially hazardous work methods, processes, or materials.

Engagement with Government Stakeholders

1. Creates communication key linkages with local government units and other stakeholders
2. Liaises with government agencies to ensure compliance with regulatory requirements
3. Produce statistical reports on safety performance in line with company and statutory requirements

Secure Government Awards and Recognitions

1. Inspect and evaluate workplace environments, equipment, and practices, in order to ensure compliance with health and safety standards and government regulations.
2. Ensure participation and coordination to secure OHS and other government related permits, awards and recognitions
3. Creates a bridge plan to facilitate ease in operations through availability of permits and necessary documents for established supply/delivery routes
4. Produce statistical reports on safety performance in line with company and statutory requirements
5. Plan, review, recommend and implement health and safety management systems and practices across the organization in line with prevailing legislation

8.1.2.2 SAFETY SUPERINTENDENT

Safety Management

1. Leading the Safety team in OHS compliance (regulatory and internal programs) through ongoing audits and inspections, focusing on continuous improvement per the OGPI's safety management system.
2. Promote health, safety and environmental awareness in order to prevent injuries and/or damages
3. Assist in the development, implementation and coordination of the organization's risk management strategy
4. Implement, support and audit relevant health and safety management systems across the organization
5. Conduct Regular Department – Safety Section meeting/briefings
6. Ensure all OHSC members under Safety Section duly participate in performance management
7. Facilitate and review of incident investigation using ICAM methodology

8. Lead and coach a team of safety professionals to deliver an effective and interactive service to the operation
9. Provide direction and guidance to the management team and employees on Health and Safety issues.
10. Lead by example and promote best practice at all times with regards to safety at work in all areas

Engagement with Government Stakeholders

1. Creates communication key linkages with local government units and other stakeholders
2. Liaises with government agencies to ensure compliance with regulatory requirements
3. Produce statistical reports on safety performance in line with company and statutory requirements

Secure Government Awards and Recognitions

1. Ensure participation and coordination to secure OHS and other government related permits, awards and recognitions
2. Creates a bridge plan to facilitate ease in operations through availability of permits and necessary documents for established supply/delivery routes
3. Produce statistical reports on safety performance in line with company and statutory requirements
4. Plan, review, recommend and implement health and safety management systems and practices across the organization in line with prevailing legislation