DEPARTMENT OF MINERAL POLICY AND GEOHAZARD MANAGEMENT (DMPGM)
CONSERVATION AND ENVIRONMENT PROTECTION AUTHORITY (CEPA)
MINERAL RESOURCES AUTHORITY (MRA)
INDEPENDENT STATE OF PAPUA NEW GUINEA

THE PROJECT FOR CAPACITY DEVELOPMENT ON MINE WASTE MANAGEMENT IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA

FINAL REPORT

September 2018

Japan International Cooperation Agency (JICA)

Mitsubishi Materials Techno Corporation
Sumiko Resources Exploration & Development Co., Ltd

IL
JR
18-084

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List of Abbreviations

Abbreviation	Full Name
AER	Annual Environment Report
AMD	Acid Mine Drainage
ARD	Acid Rock Drainage
BAT	Best Available Techniques
BREFs	Best available techniques REFerence document
CDMWM	Capacity Development on Mine Waste Management
CEPA	Conservation and Environment Protection Authority
CIL	Carbon in Leach
C/P	Counterpart
DB	Database
DEC	Department of Environment and Conservation
DMPGM	Department of Mineral Policy & Geohazards Management
DNPM	Department of National Planning and Monitoring
EIA	Environmental Impact Assessment
EIP	Environment Improvement Program
EIR	Environment Inception Report
EIS	Environment Inception Statement
EMMP	Environment Management and Monitoring Plan
EMP	Environment Management Plan
EP	Environment Permit
EPW	Environment Protection Wing (CEPA)
EU	European Union
GIS	Geographical Information System
GSD	Geological Survey Database (MRA)
JICA	Japan International Cooperation Agency
JOGMEC	Japan Oil, Gas and Metals National Corporation
HDPE	High-Density Polyethylene
INCO	International Nickel Company
INS	Inspection
JCC	Joint Coordination Committee
LAN	Local Area Network
LMP	Lease for Mining Purposes

Abbreviation	Full Name
ML	Mining Lease
MRA	Mineral Resources Authority
MS	Microsoft
NAF	Non-Acid Forming
NAS	Network Attached Storage
N.T.U	Nephelometric Turbidity Unit
OJT	On-the-Job Training
OHT	Other
PDM	Project Design Matrix
PNG	Papua New Guinea
PO	Plan of Operation
QER	Quarterly Environment Report
R/D	Record of Discussions
ROD	Regulatory Operation Division (MRA)
SWG	Sub-Working Group
TSF	Tailings Storage Facility
WGM	Working Group Meeting

Chapter 1 Introduction

1.1 Outline of Project

This project aims to enhance the capacity of Papua New Guinea (PNG) Government and authorities to effectively regulate and monitor mine wastes in PNG, through implementing four major activities, such as (1) improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities, (2) establishment of an implementation regime for Mine Waste Management policies, (3) establishment of Mine Environmental Database and (4) discussion and implementation of Short-term training in Japan on Mine Waste Management.

The total five (5) batches of on-site works in PNG by JICA expert team and the two (2) times of the short-term training courses in Japan with Papua New Guinean trainees have been conducted as inputs by JICA, like for implementing the OJT of environmental survey and inspection of TSF (tailings storage facility).

Figure 1.1 Map of Papua New Guinea

1.2 Background

PNG is rich in mineral, energy resources such as copper, gold, oil, natural gas and geothermal heat etc. Since the independence, the mineral resources sector is the single largest revenue earning sector contributing over 70% of the total exports resulting from massive increase in mining investment within the last 10 years. Moreover, PNG's mining industry has a strong relationship with Japan as one of the biggest importer of PNG's mineral and energy resources.

The increase in global demand for mineral and energy resources has forced the PNG Government to introduce prudent institutional and legislative reforms to stimulate sustainable growth in the mineral and energy resources sector. Despite the introduction of strong reforms, PNG Government still lacks the capacity to enforce them effectively. This has resulted in PNG experiencing environmental challenges in the disposal of waste and tailings.

Reviews from Department of Mineral Policy and Geohazards Management (DMPGM) confirm that the PNG Government does not have a comprehensive mine waste management policy in place to guide the disposal of waste and tailings from the mines currently operating in PNG. Furthermore, Conservation and Environment Protection Authority (CEPA) and Mineral Resources Authority (MRA) still lack the technical and financial capacity to prevent pollution from mine waste.

Under such circumstances, PNG Government requested Government of Japan (GOJ) to assist the capacity development of DMPGM, CEPA, and MRA. Japan International Cooperation Agency (JICA), in response to the request, dispatched the Detailed Planning Survey Team from 15th to 20th March 2015 to collect necessary information. And also JICA discussed and agreed on the design of the Project with DMPGM, CEPA, MRA and other authorities concerned. Then, Record of Discussions (R/D) between JICA and CEPA was signed on 16th October 2015.

1.3 Objectives

This project aims to enhance the capacity of Papua New Guinea (PNG) Government and authorities such as DMPGM, CEPA, MRA and other relevant authorities, to effectively regulate and monitor mine wastes in PNG, through implementing activities, such as the improvement of existing Mine Waste Management Policy, the establishment of mine environmental database and the technical transfer and human resource development for mine waste management measures.

1.4 Duration and Major Items

1.4.1 Project Duration

Two years (from September 2016 until September 2018)

1.4.2 Major Items

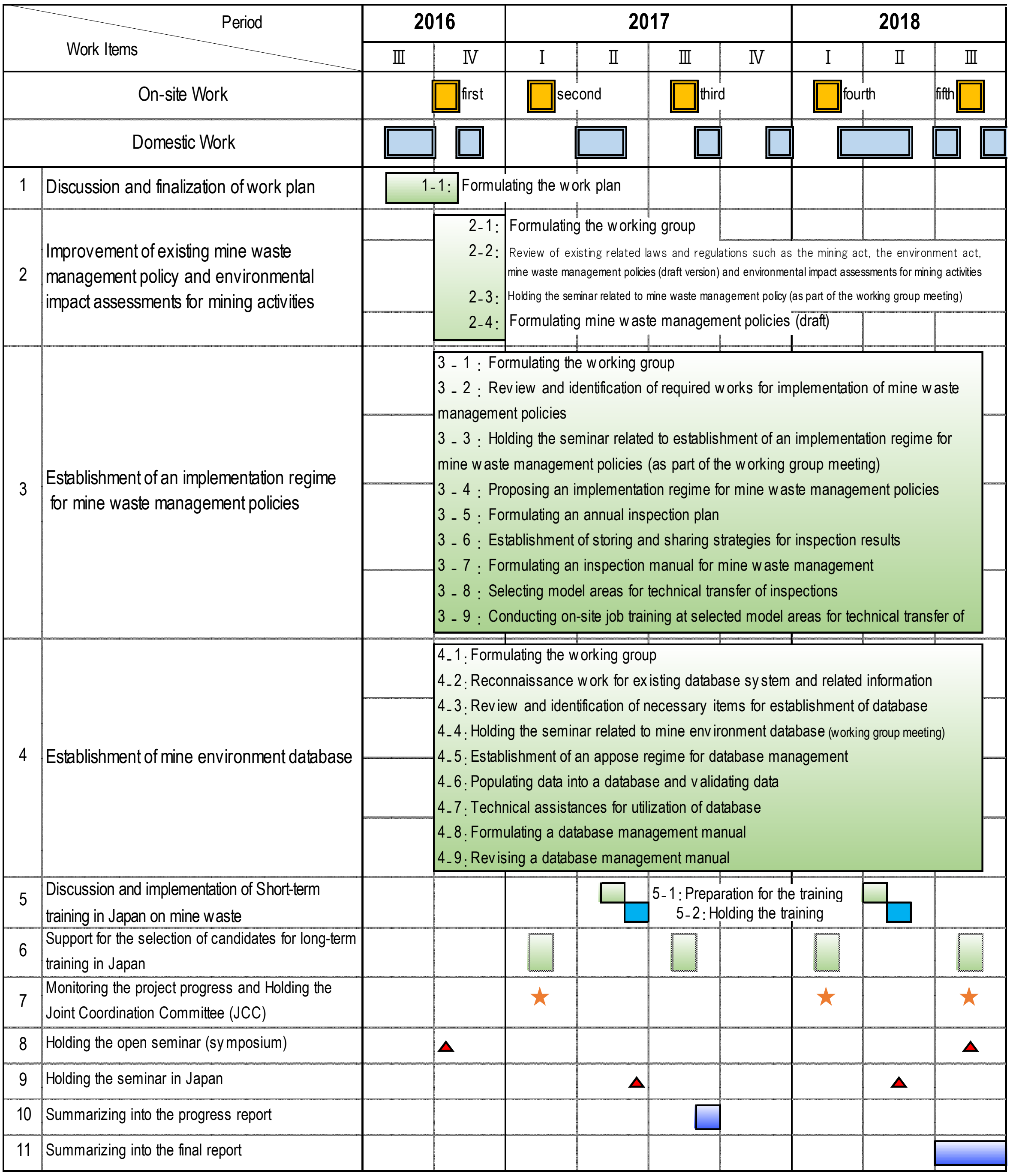
The major items of this project are as follows;

1) Improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities

2) Establishment of an implementation regime for Mine Waste Management policies
3) Establishment of Mine Environmental Database
4) Discussion and implementation of Short-term training in Japan on Mine Waste Management

1.5 Implementation Plan

Implementation plan for the project is shown as below. Plan of Operation (PO) and Project Design Matrix (PDM) are attached as Annex 1 and 2, respectively.



	Work Items	Activities
	On-site Work	first, second, third, fourth, fifth
	Domestic Work	
1	Discussion and finalization of work plan	1-1: Formulating the work plan
2	Improvement of existing mine waste management policy and environmental impact assessments for mining activities	2-1: Formulating the working group 2-2: Review of existing related laws and regulations such as the mining act, the environment act, mine waste management policies (draft version) and environmental impact assessments for mining activities 2-3: Holding the seminar related to mine waste management policy (as part of the working group meeting) 2-4: Formulating mine waste management policies (draft)
3	Establishment of an implementation regime for mine waste management policies	3－1：Formulating the working group 3－2：Review and identification of required works for implementation of mine waste management policies 3－3：Holding the seminar related to establishment of an implementation regime for mine waste management policies (as part of the working group meeting) 3－4：Proposing an implementation regime for mine waste management policies 3－5：Formulating an annual inspection plan 3－6：Establishment of storing and sharing strategies for inspection results 3－7：Formulating an inspection manual for mine waste management 3－8：Selecting model areas for technical transfer of inspections 3－9：Conducting on-site job training at selected model areas for technical transfer of
4	Establishment of mine environment database	4_1: Formulating the working group 4_2: Reconnaissance work for existing database system and related information 4_3: Review and identification of necessary items for establishment of database 4_4: Holding the seminar related to mine environment database (working group meeting) 4_5: Establishment of an appose regime for database management 4_6: Populating data into a database and validating data 4_7: Technical assistances for utilization of database 4_8: Formulating a database management manual 4_9: Revising a database management manual
5	Discussion and implementation of Short-term training in Japan on mine waste	5-1: Preparation for the training 5-2: Holding the training
6	Support for the selection of candidates for long-term training in Japan	
7	Monitoring the project progress and Holding the Joint Coordination Committee (JCC)	★ ★ ★
8	Holding the open seminar (symposium)	▲ ▲
9	Holding the seminar in Japan	▲ ▲
10	Summarizing into the progress report	
11	Summarizing into the final report	

Figure 1.2 Implementation plan for the Project

1.6 Project organizations in PNG

There are three main project organizations that administer the mining sector in PNG. Department of Mineral Policy and Geohazards Management (DMPGM), which was established in 2005 as a successor of Department of Mining (DoM) and is responsible for the development of mineral policies and legislations and to manage geological hazards including landslides, earthquakes, tsunamis, volcanic activities. Mineral Resources Authority (MRA), which was also established as a successor of DoM in 2005 and is responsible for licensing, monitoring, and enforcement of policies and legislations established by the Government for the mining industry. Conservation and Environment Protection Authority (CEPA), which was established as a successor of Department of Environment and Conservation (DEC) in 2015 and is responsible for environmental monitoring and enforcement of environmental safeguards and the sustainable use of the natural resources.

1.7 Implementation structure

Implementation structure, built and agreed by Joint Coordination Committee and/or Working Group Meeting under the R/D signed on 16th October 2015, and JICA team staffs are shown as below;

1.7.1 Joint Coordination Committee

Chairperson (Project Director): Mr. Gunther Joku, Managing Director of CEPA
Member (Project Manager): Mr. Michael Wau, Director of CEPA
Member (Sub-Project Manager): Mr. Asavi Kendua, Assis. Director of DMPGM
Member (Sub-Project Manager): Mr. Nathan Mosusu, Acting Managing Director of MRA
Member (Sub-Project Manager): Mr. Andrew Gunua, Chief Warden of MRA
Member (JICA PNG office): Mr. Takashi Toyama, Chief Representative of JICA PNG office
Member (JICA PNG office): Mr. Ryosuke Watanabe, Representative of JICA PNG office
Member (JICA team): Dr. Negishi Yoshimitsu, Chief Advisor
Member (JICA team): Dr. Kazuyuki Kadoshima, Assis. Chief Advisor
Member (JICA team): Mr. Yoshiaki Shibata
Member (JICA team): Mr. Hirohisa Kobayashi
Member (JICA team): Mr. Mitsuo Ohtake
Member (JICA team): Mr. Ippei Takeda

1.7.2 Working Group Meeting

Chairperson (Project Manager): Mr. Michael Wau, Director of CEPA
Member (Sub-Project Manager): Mr. Asavi Kendua, Assis. Director of DMPGM
Member (Sub-Project Manager): Mr. Nathan Mosusu, Acting Managing Director of MRA
Member (Sub-Project Manager): Mr. Andrew Gunua, Chief Warden of MRA
Member (Working Team Leader): Mr. Robert Sine, Manager of CEPA
Member (Working Team Leader): Mr. Pitzz Murphy, Principal Scientist of CEPA
Member (Working Team Leader): Mr. Gerard Natera, Manager of CEPA
Member (Project team): Ms. Margaret Aulda, Deputy Manager of MRA

Member (Project team): Mr. Wilfred Moi, GIS Expert of MRA
Member (Project team): Mr. Amukele Amukele, Mine Inspector of MRA
Member (Project team): Mr. Lars Kuri, Mine Warden of MRA
Member (Project team): Mr. Anderson Anjo, Scientist of CEPA
Member (JICA PNG office): Mr. Ryosuke Watanabe, Representative of JICA PNG office
Member (JICA PNG office): Mr. Masatake Harada, Assis. Representative of JICA PNG office
Member (JICA PNG office): Ms. Margaret George, Senior Programme Officer of JICA PNG office
Member (JICA team): Dr. Negishi Yoshimitsu, Chief Advisor
Member (JICA team): Dr. Kazuyuki Kadoshima, Assis. Chief Advisor
Member (JICA team): Mr. Yoshiaki Shibata
Member (JICA team): Mr. Hirohisa Kobayashi
Member (JICA team): Mr. Mitsuo Ohtake
Member (JICA team): Mr. Ippei Takeda

1.7.3 Sub-working group (Working team)

(1) Policy sub-group

Group Leader (Working Team Leader): Mr. Robert Sine, Manager of CEPA
Member (Working team): Mr. Pitzz Murphy, Principal Scientist of CEPA
Member (Working team): Mr. Asavi Kendua, Assis. Director of DMPGM
Member (Working team): Mr. Seymour Pok, Chief Policy Officer of DMPGM
Member (Working team): Ms. Margaret Aulda, Deputy Manager of MRA
Member (JICA team): Dr. Negishi Yoshimitsu, Chief Advisor
Member (JICA team): Mr. Hirohisa Kobayashi

(2) Inspection sub-group

Group Leader (Working Team Leader): Mr. Pitzz Murphy, Principal Scientist of CEPA
Member (Working team): Mr. Anderson Anjo, Scientist of CEPA
Member (Working team): Ms. Margaret Aulda, Deputy Manager of MRA
Member (Working team): Mr. Amukele Amukele, Mine Inspector of MRA
Member (Working team): Mr. Lars Kuri, Mine Warden of MRA
Member (JICA team): Mr. Yoshiaki Shibata
Member (JICA team): Mr. Mitsuo Ohtake

(3) Database sub-group

Group Leader (Working Team Leader): Mr. Gerard Natera, Manager of CEPA
Member (Working team): Mr. Pitzz Murphy, Principal Scientist of CEPA
Member (Working team): Mr. Anderson Anjo, Scientist of CEPA
Member (Working team): Mr. Wilfred Moi, GIS Expert of MRA
Member (Working team): Mr. Fiona Kaumu, GIS Expert of MRA
Member (JICA team)： Dr. Kazuyuki Kadoshima, Assis. Chief Advisor

Member (JICA team) : Mr. Ippei Takeda
Member (JICA team) : Mr. Kosuke Ishiyama

1.7.4 JICA team staffs

	Assignment	**Name**	**Affiliation**
1	Project Team Leader / Mine waste management and environmental impact assess A	Yoshimitsu Negishi	Mitsubishi Materials Techno Corp.
2	Assistant Team Leader / Mine waste management and environmental impact assess B	Kazuyuki Kadoshima	Mitsubishi Materials Techno Corp.
3	Mine waste management 1 (general matters)	Yoshiaki Shibata	Mitsubishi Materials Techno Corp.
4	Mine waste management 2A (general matters)	Hirohisa Kobayashi	Sumiko Resources Exploration & Development Co., Ltd.
5	Mine waste management 2B (TSF management technology)	Yukinobu Nakamura	Mitsubishi Materials Techno Corp.
6	Mine waste management 2C (inspection, regulatory affairs)	Mitsuo Ohtake	Mitsubishi Materials Techno Corp.
7	Database construction of mine environment A (general constr.)	Ippei Takeda	Mitsubishi Materials Techno Corp.
8	Database construction of mine environment B (DB utilization)	Kosuke Ishiyama	Mitsubishi Materials Techno Corp.

Chapter 2 Project Activity

The detail of project activities from the commencement of project in September 2016 until the end of August 2018 is shown below.

2.1 Project activities of on-site works in PNG

2.1.1 First dispatch (input) of JICA experts in October and November 2016

The main outcomes of the first batch of on-site work in PNG by JICA experts are listed below;

(1) Joint Seminar on the Project inception and project implementation meeting held at the MRA conference room on the October 6th, 2016

Project implementing partners (JICA, CEPA and MRA) with Department of National Planning and Monitoring (DNPM) as the monitoring agency shared information related to Mining industries and their Mine Waste Management practices in PNG and in Japan. The details of a successful project implementation were discussed in length during the inaugural meeting. Below is the list of the project papers that were presented during the Joint Seminar and the participants that attended the meeting.

<Presentation titles>

- JICA's activities in Mining Sector *presented by Dr. Yoshitaka Hosoi (JICA)*
- Outline of project for Capacity Development on Mine Waste Management in PNG *presented by Dr. Yoshimitsu Negishi (JICA Expert Team)*
- Mining prospective in PNG *presented by Mr. Andrew Gunua (MRA)*
- Project under JICA's technical assistance program *presented by Mr. Pitzz Murphy (CEPA)*
- Closed Mine Management in Japan *presented by Mr. Yoshiaki Shibata (JICA Expert Team)*

<Participants>

Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Philip Samar, Managing Director, MRA
Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
Mr. Arnold Lakamanga, Manager, GIS Mineral Information, MRA
Mr. Andrew Gunua, Chief Mine Warden, MRA
Mr. Dan Lyanda, Senior officer, Japan Desk, Aid Coordinate Division, DNPM
Dr. Yoshitaka Hosoi, Senior Advisor for Natural Resources, JICA
Mr. Yoshihiro Chujo, Senior Representative, PNG office, JICA
Mr. Akio Endo, Deputy Director, Energy and Mining Group, JICA
Ms. Margaret George, Senior Program Officer, PNG office, JICA
Dr. Yoshimitsu Negishi, Chief Advisor (Project Leader), JICA Expert team
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Yoshiaki Shibata, Expert, JICA Expert team

Mr. Mitsuo Ohtake, Expert, JICA Expert team

Mr. Hirohisa Kobayashi, Expert, JICA Expert team

Mr. Ippei Takeda, Expert, JICA Expert team

Photograph 2.1 Joint Seminar at MRA, October 6th 2016

(2) Site visit to the abandoned Mt. Sinivit Gold Mine, East New Britain Prov. conducted at its mine site from October 12th to 14th 2016

Site visit to Mt. Sinivit Gold Mine was conducted after strong recommendations by the MRA as a model site for On-the-Job Training (OJT) for Environmental survey / Inspection. The joint study team visited the abandoned mine site for conducting reconnaissance surveys and on-site quick testing of water qualities by "Pack Test" kits on October 13th 2016. The results were presented in a brief report titled; "Site visit report on Mt. Sinivit Gold Mine in East New Britain Province".

Photograph 2.2 Site visit to Mt. Sinivit Gold Mine

(3) Site visits to Ok Tedi Mine, Bige and Kiunga in Western Province from October 24th to 26th 2016

Site visit to Ok Tedi Mine was done as an On-the-Job Training (OJT) reconnaissance survey for Environmental surveys / Inspections. The joint study team visited the mine site, and other operation sites including sites in Kiunga and Bige. The results were presented in a brief report and at the Joint Coordination Committee as mentioned later.

Photograph 2.3 Site visit to Ok Tedi Mine

(4) First Working Group Meeting (WGM) held at MRA conference room in November 2nd 2016

WGM was held purposely to finalize the Work Plan for the project and to have some deliberations on the lessons learnt from the recent site visits and what needs to be done in terms of working forward. In addition, the pack test results and observations made at the abandoned Mt. Sinivit Gold Mine and the OkTedi Copper Mine was presented by the JICA Expert Team. The members of WGM and the Working Teams of the three major project components agreed to choose three model areas for the purposes of OJT aimed at technical transfer of knowledge on mine inspections. The list of WGM / Working Team members that participated in the first WGM and the model areas are:

<Participants>

Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Gerard Philip Natera, Manager, GIS division, CEPA
Mr. Philip Samar, Managing Director, MRA
Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
Ms. Margaret George, Senior Program Officer, PNG office, JICA
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Yoshiaki Shibata, Expert, JICA Expert team

<WGM members>

Mr. Robert Sine, Manager, Environment Protection Wing, CEPA
Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
Mr. Andrew Gunua, Chief Mine Warden, MRA
and JICA Experts

<Working Team members>

Policy Working Team (sub-group)

Dr. Yoshimitsu Negishi, Chief Advisor (Project Leader), JICA Expert team
Mr. Hirohisa Kobayashi, Expert, JICA Expert team

Inspection Working Team (sub-group)

Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Anderson Anjo, senior officer, Environment Protection Wing, CEPA
Ms. Margaret Aulda, Deputy Manager, Technical Assessment Branch, MRA
Mr. Lars Kuri, Mine Warden, Technical Assessment Branch, MRA
Mr. Yoshiaki Shibata, Expert, JICA Expert team
Mr. Mitsuo Ohtake, Expert, JICA Expert team

Database Working Team (sub-group)

Mr. Gerard Philip Natera, Manager, GIS division, CEPA
Ms. Fiona Kaumu, Geological Database Specialist, Geology Survey Division, MRA
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Ippei Takeda, Expert, JICA Expert team

<Model Areas>

(Model Area 1) Ok Tedi Mine (as a large-scale Cu-Au mine)
(Model Area 2) Mt. Sinivit Gold Mine (as an abandoned Au mine)
(Model Area 3) Hidden Valley Mine (as a modern Au mine) and surrounding ASMs

(5) Interviews for collecting information and discussions for consensus-building to create Work Plan with implementing partners

JICA Expert team conducted interviews and had discussions with relevant officers from MRA, CEPA and the DMPGM to gather and collate information to develop the Work Plan that is satisfactory to all implementing partners. In addition, certain unclear interpretations of relevant Acts and Regulations were also discussed with appropriate MRA and CEPA officers to gauge their views from a Regulator's point of view. This was done during the site visits and/or in the offices.

Photograph 2.4 Relationship-building Meeting with DMPGM

2.1.2 Second dispatch (input) of JICA experts from January to March 2017

The following list are outcomes of the Second batch of on-site work in PNG by JICA experts from January to March 2017;

(1) Second site visit to abandoned Mt. Sinivit Gold Mine, ENB Prov. conducted from January 25th to 28th 2017

2nd Site visit to Mt. Sinivit Gold Mine as the model of an abandoned mine site to conduct OJT for Environment survey / Inspection of Mine Wastes. The joint study team further conducted on-site quick water quality tests using the "Pack Test" kits on January 26th and 27th 2017, during rainy season. The results were presented in a short report titled; "2nd Site Visit Report of Mt. Sinivit Gold Mine in East New Britain Province".

Photograph 2.5 Second site visit to abandoned Mt. Sinivit Gold Mine

(2) Second WGM held at CEPA meeting room on February 1st 2017

2nd WGM was held to discuss the implementation items and their tentative action plan during the second batch of on-site work in PNG by JICA experts. The results and findings of the of 2nd site visit to Mt. Sinivit Gold Mine were also presented. The participants of this WGM were:

<Participants>

Mr. Andrew Gunua, Chief Mine Warden, MRA
Mr. Anderson Anjo, senior officer, Environment Protection Wing, CEPA
Mr. Yukihiro Kondo, Representative, PNG office, JICA
Ms. Margaret George, Senior Program Officer, PNG office, JICA
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Yoshiaki Shibata, Expert, JICA Expert team
Mr. Mitsuo Ohtake, Expert, JICA Expert team
Mr. Ippei Takeda, Expert, JICA Expert team

(3) Second site visit to Ok Tedi Mine, Western Prov. conducted from February 3rd to 6th 2017

2nd Site visit to Ok Tedi Mine as the model site of a large-scale Cu-Au mine was conducted for implementing the OJT for Environment survey / Inspection on Mine Wastes. The joint study team inspected several waste rock dumps at the mine site, and conducted quick on-site water quality tests using the “Pack Test” kits at the process plant at the mine site. Quick tests were also conducted at the dredging / dumping sites at Bige on the February 5th 2017. The results were presented in a short report (in Japanese) and at the Joint Coordination Committee as mentioned below.

Photograph 2.6 Second site visit to Ok Tedi Mine

(4) Site visit to Kainantu Gold Mine, Eastern Highlands Prov. conducted from February 13th to 15th 2017

Site visit to the Kainantu Mine as a model project operating a Talings dam was conducted for the purposes of implementing the OJT for Inspection of Mine Wastes. The joint study team checked the Tailing Storage Dam as a simulated inspection site by cross referencing the draft check sheet at the mine site, and also conducted on-site quick water quality tests using the “Pack Test” kits at the discharge points and the regulating ponds on February 13th and 14th 2017. The results were presented in a short report (in Japanese) and at the Joint Coordination Committee as mentioned below.

Photograph 2.7 Site visit to Kainantu Gold Mine

(5) First Joint Coordination Committee Meeting held at CEPA conference room on February 16th 2017

The first Joint Coordination Committee (JCC) meeting involving the Executives and senior members of the project implementing partners (JICA, CEPA and MRA) was held to update and provide project status report. Updates were provided on the three major objectives of the project and results of some site visits were also presented by the JICA expert team. After some lengthy discussions and question-and-answer sessions, the project's Way Forward Plans, Mine Waste Management Policy review comments, the ideal OJT procedures of Environmental Survey with different types of Environmental Criteria, the project implementation items and their detailed action plan were approved by the JCC members. The JCC's Agenda items and the meeting participants are as follows:

<Agenda items>

Title: Joint Coordination Committee Meeting for the Project for Capacity Development on Mine Waste Management.

Date: 10.00am to 11.30am, Thursday, 16th February 2017.

Venue: CEPA main conference room at B-mobile Building

Program: *Chairman: K. Michael Wau – CDMWM Project Manager*

[10:00] Opening and Welcome address by CEPA (K. Michael WAU, Director EP Wing and CDMWM Project Manager, and proxy Program Director on behalf of Managing Director)

[10:10] Remarks by MRA (Mr. Nathan MOSUSU, Executive Manager on behalf of Managing Director)

[10:20] Address by JICA Chief Representative: (Mr. Takashi TOYAMA)

[10:25] Presentation 1: Outline of the Project (Dr. NEGISHI, JICA Technical Team Leader)

[10:35] Presentation2: Status update of Database Construction (Mr. Ippei TAKEDA, JICA Technical Team)

[10:50] Presentation3: Brief Report on site visits, Sinivit Gold Mine/OkTedi Mine/Kainantu Mine (Mr. Yoshiaki SHIBATA, JICA Technical Team)

[11:10] Discussion time

[11:30] Closing address by CEPA (K. Michael Wau – Project Manager)

<Participants>

Mr. Michel Wau, Director, Environment Protection Wing, CEPA
Mr. Robert Sine, Manager, Environment Protection Wing, CEPA
Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Gerard Philip Natera, Manager, GIS division, CEPA
Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
Mr. Andrew Gunua, Chief Mine Warden, MRA
Mr. Takashi Toyama, Chief Representative, PNG office, JICA
Mr. Yukihiro Kondo, Representative, PNG office, JICA
Mr. Masatake Harada, Assistant Representative, PNG office, JICA
Ms. Margaret George, Senior Program Officer, PNG office, JICA
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Yoshiaki Shibata, Expert, JICA Expert team
Mr. Mitsuo Ohtake, Expert, JICA Expert team
Mr. Hirohisa Kobayashi, Expert, JICA Expert team
Mr. Ippei Takeda, Expert, JICA Expert team

Photograph 2.8 First Joint Coordination Committee Meeting

(6) Site visit to Hidden Valley Mine Morobe Prov. conducted from February 20th to 23rd 2017

Site visit to Hidden Valley Mine as the potential model site with TSF dam was conducted for implementing the OJT reconnaissance survey on TSF inspection. The joint study team inspected the Tailings dam for applicability of the OJT, and did on-site quick water quality testing using the "Pack Test" kits at the discharge outlet point on the February 21st. The joint study team then proceeded to the Small Scale Mining Training Center (SSMTC) at Wau to grasp and understanding of the current situation of the small scale mining activities around the Wau/Bulolo areas and of course, throughout PNG. The results and findings were reported in the short note (in Japanese).

Photograph 2.9 Site visit to Hidden Valley Mine

(7) Database (DB) WT (sub-group) Meeting held on a weekly basis on January 30th, February 7th and 13th 2017

The DB WT meetings were held by the WT members on a weekly basis since the January 30th, to discuss the DB basic concepts, the items and their content details, basic structures of data tables of the Prototype DB system which will be created at CEPA. It was agreed by the members that the first prototype database will be constructed and installed by the beginning of June, and will be reviewed by the members who will attend a short-term training in Japan around that time.

(8) Third WGM held at CEPA meeting room on March 2nd 2017

Third WGM was held to discuss about the tentative review comments of appropriate Acts and Regulations related to Mine Waste Management in PNG. The implementation items and their tentative action plans for the next batch of on-site work in PNG by JICA experts were agreed to by the WGM members. The project model sites for OJT inspection was amended and confirmed in this meeting. The participants of this WGM and the confirmed model areas are shown below;

<Participants>

Mr. Robert Sine, Manager, Environment Protection Wing, CEPA
Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Anderson Anjo, Scientist, Environment Protection Wing, CEPA
Mr. Lars Kuri, Mine Warden, Technical Assessment Branch, MRA
Dr. Yoshimitsu Negishi, Chief Advisor (Project Leader), JICA Expert team
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Hirohisa Kobayashi, Expert, JICA Expert team

<Model Areas>

(Model Area 1) Mt. Sinivit Gold Mine (as an abandoned Au mine)
(Model Area 2) Kainantu Mine (as a modern mine with TSF)
(Model Area 3) Hidden Valley Mine (as a modern Au mine with TSF) and surrounding ASMs

Photograph 2.10 Third Working Group Meeting

(9) Interviews for collecting information and discussions for consensus-building to update Plan of Operations with implementing partners.

JICA Expert team conducted interviews and had discussions to update on current project status and Plan of Operations and develop consensuses between CEPA and MRA who are the main implementing project agencies. In addition, other unclear interpretations of Acts and regulations were discussed with appropriate officers in MRA and CEPA to solicit their opinions from the Regulator’s point of view.

2.1.3 Third dispatch (input) of JICA experts from August to September 2017

The outputs during the third batch of on-site work in PNG by JICA experts are as follows;

(1) Third site visit to Mt. Sinivit Gold Mine, ENB Prov. conducted from Aug 30th to Sep 2nd 2017

3rd Site visit to Mt. Sinivit Gold Mine as the model site of an abandoned mine was conducted for implementing the OJT for Environment survey / Inspection of Mine Wastes. The joint study team conducted quick on-site water quality tests using the "Pack Test" kits on August 31st and September 1st 2017, during the height of dry season for comparing with previous results taken during wet season. The results were presented in a short note titled, "3rd Site Visit Report of Mt. Sinivit Gold Mine in East New Britain Province".

Photograph 2.11 Third site visit to Mt. Sinivit Gold Mine

(2) Demonstration of Pack Test kit held at the MRA Training room on the September 7th 2017

Demonstration of the on-site quick water quality testing Pack Test kit was conducted by JICA experts and Mr. Lars Kuri (Mine warden, MRA), who is one of the participants of the OJT Environment survey in response to a request by Mr. Philip Samar (Managing Director, MRA). Nine participants including the Executive Director attended the session and made a Q and A session to gauges views on the advantages and disadvantages of the quick test kit.

Photograph 2.12 Demonstration of the on-site quick water quality testing "Pack Test" kit

(3) Fourth WGM held at MRA conference room on September 12th 2017

The fourth WGM was held to report on the current progress by JICA expert team and the accomplishments of the short-term training by leading participants, Mr. Lars Kuri (MRA) and Mr. Pitzz Murphy (CEPA). The lists of Agenda items of this WGM and its participants are shown as below;

<Agenda items>

Title: Working Group Meeting for the Project for Capacity Development on Mine Waste Management.
Date: 14.00pm to 16.00pm, Tuesday, 12th September 2017.
Venue: MRA Conference Room at Mining Haus
Program: *Chairman: Robert Sine – CDMWM Sub-Project Manager*
Opening
[14:00] Opening and Welcome address by MRA (Mr. Nathan Mosusu, Executive Manager)
[14:05] Remarks by CEPA (Mr. Robert Sine on behalf of Mr. Michael Wau, Director EP Wing and CDMWM Project Manager)
Project Progress and Training Reports
[14:10] Item 1: Brief summary of project progress and current plan (Mr. Kadoshima, JICA Technical Team)
[14:20] Item 2: Short-term training in JAPAN (1): (Mr. Las Kuri, MRA)
[14:35] Item 3: Short-term training in JAPAN (2): (Mr. Pitzz Murphy, CEPA)
[14:50 – 15:00] Short break
Project Update and Discussions
[15:00] Item 4: Status update of Database Construction (Mr. Takeda, JICA Technical Team)
[15:20] Item 5: Brief Report on site visit, Sinivit Gold Mine (Mr. Kadoshima, JICA Technical Team)
[15:30] Item 6: Discussions on Inspection for TSF (Mr. Shibata, JICA Technical Team), MWM policy framework and others (Mr. Hirohisa Kobayashi).
Closing
[16:00] Closing address by CEPA (Mr. Robert Sine on behalf of Mr. Michael Wau – Project Manager)

<Participants>

Mr. Robert Sine, Manager, EPW, CEPA
Mr. Pitzz Murphy, Principal scientist, EPW, CEPA
Mr. Anderson Anjo, Scientist, EPW, CEPA
Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
Ms. Margaret Aulda, Deputy Manager, Technical Assessment Branch, ROD, MRA
Mr. Amukele Amukele, Mine Inspector, Regulatory Operation Division, MRA
Mr. Lars Kuri, Mine Warden, Technical Assessment Branch, ROD, MRA
Mr. Ryosuke Watanabe, Representative, PNG office, JICA
Mr. Masatake Harada, Assistant Representative, PNG office, JICA
Ms. Margaret George, Senior Program Officer, PNG office, JICA
Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
Mr. Yoshiaki Shibata, Expert, JICA Expert team
Mr. Mitsuo Ohtake, Expert, JICA Expert team

Mr. Hirohisa Kobayashi, Expert, JICA Expert team

Mr. Ippei Takeda, Expert, JICA Expert team

Photograph 2.13 Fourth Working Group Meeting

(4) Second site visit to Hidden Valley Mine Morobe Prov. conducted from September 13th to 16rd 2017

2nd Site visit to Hidden Valley Mine as the model site with TSF dam was conducted for implementing the OJT for Inspection of Mine Wastes. The joint study team inspected Tailing dam as a simulated inspection using the check sheet (revised second draft) at mine site, and did on-site quick water quality testing using the “Pack Test” kits at the discharge point on February 21st. After the Hidden Valley mine visit, the joint study team visited Small Scale Mining Training Center (SSMTC) the following day assess and get an overview of the current situation of the small scale mining activities around Wau areas and throughout PNG. The results were reported in the short note (in Japanese).

Photograph 2.14 Second site visit to Hidden Valley Mine

(5) DB WT (sub-group) Meeting held on a weekly basis on August 28th, September 5th and 11th 2017

The DB WT meetings were held by WT members on a weekly basis on August 28th, September 5th and 11th to discuss the procedures for data entry and maintenance of the DB, data items and their content details, data sharing measures, etc. The data entry by spread sheet in Microsoft Excel format and the data sharing measures by the newly installed Network Array Server (NAS) in EPW CEPA had been agreed to by the WT members. Requests are currently made for data entry in electronic format CEPA to mining companies.

(6) Interviews for collecting information and discussions for consensus-building to update Plan of Operations with implementing partners

JICA Expert team conducted interviews / discussions about current status and consensus-building to update Plan of Operations side by side with implementing partners such as CEPA and MRA. Certain unclear interpretations of Acts and regulations were also discussed with appropriate officers in MRA and CEPA to get their opinions/comments from a regulatory agency's point of view during the site visits and also in the offices.

2.1.4 Fourth dispatch (input) of JICA experts from February to March 2018

The main outcomes of the fourth batch of on-site work in PNG by JICA experts are listed below;

(1) Second Joint Coordination Committee Meeting held at CEPA conference room on February 22nd 2018

The second Joint Coordination Committee (JCC) meeting involving the Executives and senior members of the project implementing partners (JICA, CEPA and MRA) was held to update and provide project status report. Updates were provided on the three major objectives of the project and results of some site visits were also presented by the JICA expert team. After some lengthy discussions and question-and-answer sessions, the project's Way Forward Plans, Mine Waste Management Policy review comments, the ideal OJT procedures of Environmental Survey with different types of Environmental Criteria, the information sharing for the current situation of Reviewed Mining Act, the issues, the several flaws in Mixing Zone Concepts of allowing riverine tailings disposal, the project implementation items and their detailed action plan were approved by the JCC members. The JCC's Agenda items and the meeting participants are as follows:

<Agenda items>
Title: Joint Coordination Committee Meeting for the Project for Capacity Development on Mine Waste Management.
Date: 10.00am to 12.00am, Wednesday, 22nd February 2018.
Venue: CEPA main conference room on the 4th Floor of Dynasty Tower A, Savannah Heights
Program: *Chairman: K. Michael Wau – CDMWM Project Manager*
[10:00] Opening and Welcome address by CEPA (K. Michael WAU, Director EP Wing and CDMWM Project Manager, and proxy Program Director on behalf of Managing Director)
[10:15] Remarks by MRA (Mr. Nathan MOSUSU, Executive Manager on behalf of Managing Director)
[10:25] Remarks by DMPGM (Mr. Asavi Kendua, Assistant Director, Mineral Policy and Legislation Div.)
[10:35] Address by JICA Chief Representative: (Mr. Takashi TOYAMA)
[10:45] Presentation 1: Outline of the Project (Dr. NEGISHI, JICA Technical Team Leader)
[11:00] Presentation 2: Status update of Policy-Framework Review (Mr. Hirohisa KOBAYASHI, JICA Technical Team)
[11:15] Presentation 3: Status update of Establishment of Implementation Regime for MWM Policies (Mr. Yoshiaki SHIBATA, JICA Technical Team)

[11:30] Presentation 4: Status update of Database Construction (Mr. Ippei TAKEDA, JICA Technical Team)

[11:45] Discussion time

[12:00] Closing address by CEPA (K. Michael Wau – Project Manager)

<Participants>

Mr. Michel Wau, Director, Environment Protection Wing, CEPA
Mr. Robert Sine, Manager, Environment Protection Wing, CEPA
Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
Mr. Gerard Philip Natera, Manager, GIS division, CEPA
Mr. Anderson Anjo, Senior Scientist, Environment Protection Wing, CEPA
Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
Mr. Asavi Kendua, Assistant Director, Policy Advisory Branch, DMPGM
Mr. Seymour Pok, Chief Policy Officer, Policy Advisory Branch, DMPGM
Mr. Wakai Digine, Program Officer, Renewable, DNPM
Mr. Takashi Toyama, Chief Representative, PNG office, JICA
Mr. Masatake Harada, Assistant Representative, PNG office, JICA
Ms. Margaret George, Senior Program Officer, PNG office, JICA
Dr. Yoshimitsu Negishi, Chief Advisor, JICA Expert team
Dr. Kazuyuki Kadoshima, Assistant Chief Advisor, JICA Expert team
Mr. Yoshiaki Shibata, Expert, JICA Expert team
Mr. Hirohisa Kobayashi, Expert, JICA Expert team
Mr. Ippei Takeda, Expert, JICA Expert team
Mr. Kosuke Ishiyama, Expert, JICA Expert team

Photograph 2.15 Second Joint Coordination Committee Meeting

(2) Site visits to Lihir Gold Mine, New Ireland Prov. conducted at its mine site from February 27th to March 1st 2018

Site visit to Lihir Gold Mine was conducted after strong recommendations by CEPA as a model site for DSTP-related environment monitoring. The joint study team visited the some monitoring sites around Lihir Mine and discussed with the person in charge for Environmental Monitoring Survey Dept. for developing the format formatted spread sheets for data-submission to CEPA.

Photograph 2.16 Open pit of Lihir Gold Mine

(3) Site visits to Hidden Valley Mine Morobe Prov. conducted from February 26th to March 1st 2018

Site visit to Hidden Valley Mine as the model site with TSF dam was conducted for implementing the OJT of TSF inspection. The joint study team inspected the Tailings dam and Waste dump with the established inspection check lists on February 27th and 28th, respectively. The results and findings were noted and used for revising the check lists.

Photograph 2.17 The OJT for TSFs inspection in Hidden Valley Mine
(left: tailings dam, right: waste dump)

(4) DB SWG (sub-working group) Meeting held on a weekly basis on February 13th, 19th, 23rd, March 2nd and 6th 2018

The DB SWT meetings were held by SWT members on a weekly basis on February 13th, 19th, 23rd, March 2nd and 6th to discuss the data-sharing procedures and regimes between CEPA and MRA, data entry and maintenance of the DB, data collecting measures, etc. The data entry by spread sheet in Microsoft Excel format and the measures for data collecting from mining companies had been agreed to by the WT members. Requests for data entry were made by CEPA with the established format to mining companies.

(5) Demonstration of Utilizing Database held at the CEPA Meeting room on the February 23rd 2018

Demonstration of Utilizing Database was conducted by JICA experts and Mr. Anderson Anjo (Senior Scientist, CEPA), who is one of the DB SWG members in response to a request by Mr. Michael Wau (Director, CEPA). Ten participants including the Director attended the session and made a Q and A session to understand the views on the advantages with Database which has been established.

Photograph 2.18 Demonstration session of utilizing database by using a GIS software

(6) Policy SWG (sub-working group) Meeting held on February 15th, 20th and 22nd 2018

The Policy SWG meetings were held by SWT members on February 15th, 20th and 23rd to discuss the concerning points in accordance with the review of existing laws and legislations related to Mine Waste Management. And also the current situation of the revised Mining Act with some additional concepts on Mine Waste Management were shared among SWG members to have constructive discussions. The major concerning points discussed in Policy SWG meetings are as follows;

1. The clearer guidelines of safety / environment standards and financial assurances will be needed for the assessment of mine closure plan.
2. The technical guidelines for Tailings dam and Waste dump will be needed for pre-development assessment.
3. The regulation of the Environmental Protection Trust Fund will needed in favor of more certain financial assurances for environmental measures after mine closure.
4. The re-thinking of mixing zone concept which allows the riverine tailings disposal will be needed for health concerns of unwitting residents living in mixing zone.

Photograph 2.19 Sub-Working Group Meetings
(left: Inspection SWG, right: Policy SWG)

(7) Inspection SWG (sub-working group) Meeting held on February 14th and March 1st 2018

The Inspection SWG meetings were held by SWT members on February 14th and March 1st to discuss/establish the check lists of inspections for tailings dam and waste dump. And also the compiling the inspection Handbook with the check lists and some technical descriptions has been proposed and agreed in this meeting.

(8) Interviews for collecting information and discussions for consensus-building to update Plan of Operations with implementing partners

JICA Expert team conducted interviews / discussions about current status and consensus-building to update Plan of Operations side by side with implementing partners such as CEPA, MRA and DMPGM. Certain unclear interpretations of Acts and regulations were also discussed with appropriate officers in MRA and DMPGM to get their opinions/comments from a regulatory and policy advisory agency's point of view during the site visits and also in the offices.

2.1.5 Fifth dispatch (input) of JICA experts in July 2018

The following list are outcomes of the Fifth batch of on-site work in PNG by JICA experts in July 2018;

(1) The Open Seminar held at Holiday Inn Port Moresby in July 11th 2018

The Open Seminar was held purposely to disseminate the technical knowledges and skills obtained from the OJTs and the short-term training courses to colleagues and all industrial parties concerned in PNG. The attendee profiles and agenda items of the open seminar are as follows;

<Attendee profiles>

CEPA	8 people
MRA	5 people
DMPGM	1 person
DNPM	4 people
PNG Chamber of mines & petroleum	1 person
K92 Mining	2 people
Newcrest Mining	2 people
OkTedi Mining	1 person
Ramu Nico	1 person
Harmony	1 person
Simberi	1 person
Coffey	2 people
Pan Aust.	1 person
Geopacific	1 person
National Newspaper	1 person
Japanese Embassy in PNG	1 person
JICA	4 people
JICA Expert Team	4 people

(Total 41 people)

<Agenda items>

Title: Open Seminar for THE PROJECT FOR CAPACITY DEVELOPMENT ON MINE WASTE MANAGEMENT IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA

Date: 11th July, 2018

Location : Kumul Room Holiday Inn & Suites Port Moresby

Sponsored by : Japan International Cooperation Agency (JICA)

Program *Chairperson: Mr. Michael Wau – Director of Non-Renewable Division, CEPA*

9:30 – 9:40	Welcome & Opening Remarks Mr. Gunther Joku, Managing Director of CEPA
9:40 – 9:50	Opening Remarks and Introduction of the Project Mr. Takashi Toyama, Chief Representative of JICA Port Moresby office
9:50 – 10:10	JICA's Activities in the Mining Sector as the Introduction of this Seminar Dr. Yoshitaka Hosoi, Senior Advisor for Natural Resources, JICA
10:10 – 10:30	Implementation Structure of CDMWM Project Dr. Yoshimitsu Negishi, Team Leader of CDMWM Project / JICA Expert Team (MMTEC)
10:30 – 10:50	Coffee break
10:50 – 11:05	Recommendations for Mine Waste Management Policy and Related Regulations Mr. Hirohisa Kobayashi, Expert of CDMWM Project / JICA Expert Team (SRED)
11:05 – 11:20	Feedback on Recommendations for MWM Policy and Mine Waste Management Policy Initiatives for PNG Mining Sector Mr. Asavi Kendua, Assist. Director, Policy Advisory Branch, Mineral Policy and Legislation Div., DMPGM
11:20 – 11:35	Activities on Establishment of an Implementation Regime for MWM Policies Dr. Kazuyuki Kadoshima, Expert of CDMWM Project / JICA Expert Team (MMTEC)
11:35 – 11:50	Technical Knowledges Finalized / Published as the Handbook through the Inspection OJTs Mr. Amukele Amukele, Mine Inspector, Regulation Operation Div.(ROD), MRA
11:50 – 12:05	Database Construction for Mine Waste Management in CEPA Mr. Ippei Takeda, Expert of CDMWM Project / JICA Expert Team (MMTEC)
12:05 – 12:20	Outline of the Database for Mine Waste Management and its utilization Mr. Anderson Anjo, Senior Scientist, Environment Protection Wing, CEPA
12:20 – 13:00	Questions and Answers
13:00 – 13:10	Closing Remarks Mr. Nathan Mosusu, Acting Managing Director of MRA
13:10 – 13:50	Break off with lunch and refreshments

Photograph 2.20 Open seminar at Holiday Inn Hotel, July 11th 2018

(2) Fifth Working Group Meeting (WGM) held at CEPA in July 12th 2018

WGM was held purposely to wrap up the project and to review the concluding seminar of the previous day. It was reaffirmed by participants that the obtained technical knowledges / skills and constructed database will be utilized and strengthened by three recipient parties themselves in coming the post-project stage. The list of participants in the fifth WGM is as follows;

<Participants>

- Mr. Michael Wau, Director, Environment Protection Wing, CEPA
- Mr. Gabriel Luluaki, Principal Scientist, Environment Protection Wing, CEPA
- Mr. Rachel Kororo, Environment Protection Wing, CEPA
- Mr. Anderson Anjo, Senior Officer, Environment Protection Wing, CEPA
- Dr. Yoshitaka Hosoi, Senior Advisor for Natural Resources Development, JICA
- Mr. Masatake Harada, Assistant Representative, PNG Office, JICA
- Ms. Margaret George, Senior Program Officer, PNG office, JICA
- Dr. Yoshimitsu Negishi, Team Leader, JICA Team
- Dr. Kazuyuki Kadoshima, Assistant Team Leader, JICA Team
- Mr. Hirohisa Kobayashi, Technical Expert, JICA Team
- Mr. Ippei Takeda, Technical Expert, JICA Team

Photograph 2.21 Fifth Working Group Meeting

(3) Third Joint Coordination Committee (JCC) Meeting held at CEPA in July 18th 2018

JCC meeting was held purposely to wrap up the project and to discuss about reviewing of the draft final report and Inspection Handbook submitted by JICA Expert team. The list of participants and agenda items are as follows;

<Participants>

Mr. Michael Wau, Director, Environment Protection Wing, CEPA
Mr. Seymour Pok, Chief Policy Officer, Policy Advisory Branch, MPLD, DMPGM
Mr. Amukele Amukele, Mine Inspector, ROD, MRA
Mr. Gabriel Luluaki, Principal Scientist, Environment Protection Wing, CEPA
Mr. Gerard P. Natera, Manager, Spatial System & Data (GIS) Branch, ESID, CEPA
Mr. Anderson Anjo, Senior Officer, Environment Protection Wing, CEPA
Mr. Masatake Harada, Assistant Representative, PNG Office, JICA
Mr. Mitsuyuki Namiki, First Secretary, Embassy of Japan in PNG
Dr. Yoshimitsu Negishi, Team Leader, JICA Team
Dr. Kazuyuki Kadoshima, Assistant Team Leader, JICA Team
Mr. Ippei Takeda, Technical Expert, JICA Team

<Agenda items>

Title: Third Joint Coordination Committee (JCC) Meeting
Date: 10.00am to 11.30am, Wednesday, 18th July 2018.
Venue: CEPA main conference room on the 4th Floor of Dynasty Tower A, Savannah Heights
Tentative Program: *Chairperson: Mr. Michael Wau – CDMWM Project Manager, CEPA*
[10:00] Opening Remarks by CEPA (K. Michael WAU, Director of Non-Renewable Division and CDMWM Project Manager, and proxy Program Director on behalf of Managing Director)
[10:10] Remarks by MRA (Mr. Nathan MOSUSU, Acting Managing Director)
[10:20] Remarks by DMPGM (Mr. Asavi Kendua)
[10:30] Address by JICA Chief Representative: (Mr. Takashi TOYAMA)
[10:40] Discussion time for winding down the project
[11:30] Closing address by CEPA (K. Michael Wau – Project Manager)

Photograph 2.22 Third Joint Coordination Committee Meeting

2.2 Project activities of short-term training in Japan

2.2.1 First Short-term training in Japan from June 4th to 18th 2017

The first short-term training in Japan was conducted in June with 3 trainees from CEPA and another 3 from MRA. We had lectures in Akita University, site visits to Oppu Gold mine in Aomori Prefecture, Hosokura mine which used to be one of the largest lead and zinc mines in Japan. We also visited the Watarase Yusuichi (Watarase Pond) which is a control basin for settling mineral poisons derived from the Ashio Copper mine which was also one of largest copper mine in Japan at that time. The Ashio Copper mine is located in the far upper stream. There was information sharing with officers of Japan Oil, Gas and Metals National Corporation (JOGMEC), which is the main Mine Waste Management Regulating Authority in Japan. The trainees kindly presented lectures in Open seminar for Japanese investors and mining companies (approximately 40 participants) at the end of their stay. The list of participants, their schedule and agenda items of the open seminar in Tokyo are as below;

<Participants from PNG>

Mr. Robert Sine, Manager, Environment Protection Wing (EPW), CEPA
Mr. Pitzz Murphy, Principal scientist, EPW, CEPA
Mr. Anderson Anjo, Scientist, EPW, CEPA
Mr. Amukele Amukele, Mine Inspector, Regulatory Operation Division (ROD), MRA
Mr. Las Kuri, Mine Warden, Technical Assessment Branch, ROD, MRA
Mr. Samuel Leonhard, Training and Development Coordinator, ROD, MRA

<Agenda items of the Open Seminar in Tokyo>

Title: Open Seminar for the Overview of Mining Industry and the Environmental Regulatory Regimes of Mine Waste in the Independent State of Papua New Guinea (PNG)
Date: 15th June, 2017
Location: Conference Room Kiku-West, Kosai-Kaikan Bldg. (Kojimachi, Chiyoda-ku)
Sponsored by: Japan International Cooperation Agency (JICA)
Program:

14:00 – 14:15	Opening Remarks / JICA's Commitment in the Mining Sector and Introduction of this Seminar presented by Dr. Yoshitaka Hosoi, Senior Advisor for Natural Resources Development, JICA
14:15 – 14:25	Technical Cooperation Projects in the PNG's Mining Sector presented by Mr. Akio Endo, Deputy Director, Energy and Mining Group Industrial Development and Public Policy Department, JICA
14:25 – 14:50	Overview of Mining Industry in PNG presented by Mr. Amukele Amukele, Inspector of Mines, ROD, Mineral Resources Authority (MRA), PNG
14:50 – 15:10	Introduction of the PNG's Alluvial Mining Industry presented by Mr. Samuel Leonhard, Training and Development Coordinator, SSMB, ROD, MRA, PNG
15:10 – 15:30	Coffee Break
15:30 – 16:00	Overview of Environmental Regulatory System with Reference to the Mining Industry in PNG presented by Mr. Robert Sine, Manager-Mining Sector, Environment

Protection Wing, Non-Renewable Resource Div., CEPA

16:00 – 16:30 Mine Tailings Management Practices in PNG
presented by Mr. Pitzz Murphy, Principal Scientist, Environment Protection Wing, Non-Renewable Resource Div., CEPA
and by Mr. Anderson Anjo, Scientist, Environment Protection Wing, Non-Renewable Resource Div., CEPA

<Schedule>

Schedule for Short Term Training of Mine Waste Management Course F.Y. 2017

Day	Date	Time	Category	Learning Items	Event of Activity	Activated by	stage
1	4-Jun(Sun)				Arriving at Tokyo (Wellcome to JAPAN !!)		TIC (JICA Tokyo)
2	5-Jun(Mon)	1000-1200	Orientation		Briefing by JICA	JICA (JICA Tokyo, room[SR201])	TIC (JICA Tokyo)
		1300-1430 1430-1630	C.C. & Discussion		C.C. to JICA Head Office General Briefing and Discussions with MWM project team	JICA/MMTEC/SRED (JICA HQ, room[SR108]) MMTEC/SRED (JICA HQ, room[SR102])	
3	6-Jun(Tue)	AM			Travel from Tokyo (TIC) to Akita City		Akita City
		1400-1500	Lecture	Advanced Technology	Lecture by Dr.Hoshide	International Center for Research and Education on Mineral and Energy Resources, Akita University (Conference room1 at Faculty of International Resource Sciences Bldg.1)	
		1530-1630	Lecture	Advanced Technology	Lecture by Prof.Ishiyama		
4	7-Jun(Wed)	0930-1030	Lecture	Advanced Technology	Lecture by Assistant Prof. Bessho	International Center for Research and Education on Mineral and Energy Resources, Akita University (Conference room1 at Faculty of International Resource Sciences Bldg.1)	Hirosaki City
		1100-1200	Lecture	Advanced Technology	Lecture by Prof. Kawamura		
		PM			Travel from Akita City to Hirosaki City		
5	8-Jun(Thu)	0900-1600	Site tour	Practical Technology	Oppu mine (closed): Site visit for Mine Waste Storages and Water Treatment Facilities	Aomori Pref. Govern. and Shin Fukufune Co.,Ltd.	Hirosaki City
6	9-Jun(Fri)	AM			Travel from Hirosaki City to Kurihara City		Kurihara City
		1300-1630	Site tour	Practical Technology	Hosokura mine (closed): Site visit for Mine Waste Storages and Water Treatment Facilities	Mitsubishi Materials Corp. and Hosokura Metal Mining Co.,Ltd.	
7	10-Jun(Sat)	AM			Travel from Kurihara City to Watarase		TIC (JICA Tokyo)
		1030-1130	Site tour	Practical Technology	Watarase Yusuichi (Watarase Pond): Site visit for the control basin for impounding stormwater and settling mineral poison	MMTEC/SRED	
		PM			Travel from Watarase to Tokyo (TIC)		
8	11-Jun(Sun)				Holiday		TIC (JICA Tokyo)
9	12-Jun(Mon)	AM	Practice & Lecture	Database Technology	Practices and Lecture for Mine Waste Management database	MMTEC/SRED (MMTEC Saitama Office)	TIC (JICA Tokyo)
		PM	Practice & Discussion	Database Technology	Practices and Discussion for Mine Waste Management database	MMTEC/SRED (MMTEC Saitama Office)	
10	13-Jun(Tue)	1000-1100	C.C. & Info sharing		C.C. to PNG Embassy Tokyo	PNG Embassy Tokyo	TIC (JICA Tokyo)
		1400-1600	Lecture & Info sharing	Policy and Strategy	Lecture by Mr.Sasaki and Mr.Kubota, and Information sharing	JOGMEC (JOGMEC HQ, room[15AB])	
11	14-Jun(Wed)	1000-1200	Practice & Reporting		Practices and Reporting	MMTEC/SRED (MMTEC Tokyo (Kudan) Office)	TIC (JICA Tokyo)
		1300-1500	Practice & Reporting		Practices and Reporting	MMTEC/SRED (MMTEC Tokyo (Kudan) Office)	
		1500-1700	Discussion & info sharing	Practical Technology	Lecture by Dr. Tomiyama	MMTEC/SRED (MMTEC Tokyo (Kudan) Office)	
12	15-Jun(Thu)	AM	Practice & Reporting		Practices and Reporting	JICA (JICA Tokyo, room[SR401])	TIC (JICA Tokyo)
		1400-1630 1730-1930	Open Seminar Farewell party		Special seminar of Mining Perspective and Environmental Regulatory Regimes for Mine Waste in PNG Farewell party	CEPA/MRA/JICA (Kosai-kaikan Bldg, room["KIKU"-West]) MMTEC/SRED (Kosai-kaikan Bldg, room["KIKU"-East])	
13	16-Jun(Fri)	1000-1200 1200-1230			Presentation of Training Results Evaluation Meeting and Closing Ceremony	JICA (JICA Tokyo, room[SR401])	TIC (JICA Tokyo)
14	17-Jun(Sat)				Leaving for PNG		Flying Overnight
15	18-Jun(Sun)				Arriving at PNG		-

Photograph 2.23 First short-term training in Japan

2.2.2 Second Short-term training in Japan from May 19th to June 7th 2018

The Second short-term training in Japan was conducted in May and June with 1 trainee from CEPA, another 1 from MRA and the other 2 from DMPGM. We had lectures in Waseda University and some relevant companies in private sectors, and information sharing session with officers of JOGMEC, which is the main Mine Waste Management Regulating Authority in Japan. The site visits to Ikuno and Akenobe mines in Hyogo Prefecture. We also visited Watarase Yusuichi (Watarase Pond) which is a control basin for settling mineral poisons derived from the Ashio Copper mine which was also one of largest copper mine in Japan at that time, and also the Ashio Copper mine which is located in the far upper stream. The trainees kindly presented lectures in Open seminar for Japanese investors and mining companies (approximately 12 participants) at the end of their stay. The list of participants, their schedule and agenda items of the open seminar in Tokyo are as below;

<Participants from PNG>

Mr. Gabriel Luluaki, Principal scientist, EPW, CEPA
Mr. Philip Kae, Mine Inspector, Regulatory Operation Division (ROD), MRA
Mr. Asavi Kendua, Assistant Director, Mineral Policy and Legislation Div., DMPGM
Mr. Seymour Pok, Chief Policy Officer, Mineral Policy and Legislation Div., DMPGM

<Agenda items of the Open Seminar in Tokyo>

Title: Open Seminar for the Overview of Mining Industry and the Environmental Regulatory Regimes of Mine Waste in the Independent State of Papua New Guinea (PNG)
Date: 4th June, 2018
Location : Conference Room Aoi-East, Kosai-Kaikan Bldg. (Kojimachi, Chiyoda-ku)
Sponsored by : Japan International Cooperation Agency (JICA)
Program:

14:00 – 14:30	Opening Remarks / JICA's Activities in the Mining Sector and Introduction of this Seminar presented by Dr. Yoshitaka Hosoi, Senior Advisor for Natural Resources, JICA
14:30 – 14:40	Implementation Structure of CDMWM Project and Introduction of Speakers from PNG presented by Dr. Yoshimitsu Negishi, Team Leader of CDMWM Project / General

	Manager of Natural Resources Survey Dept., Natural Resources, Environment and Energy Division, Mitsubishi Materials Techno Corp.
14:40 – 15:00	Overview of PNG Mining Industry and Functions of MRA in the Industry presented by Mr. Philip Kae, Inspector of Mines, ROD, MRA
15:00 – 15:20	Coffee Break
15:20 – 15:40	Existing Environmental Regulatory Framework in PNG presented by Mr. Gabriel Luluaki, Principal Scientist, Environment Protection Wing, CEPA
15:40 – 16:10	Overview of revised Mining Act in PNG presented by Mr. Asavi Kendua, Assist. Director of Policy Advisory Branch, DMPGM
16:10 – 16:25	Questions and Answers
16:25 – 16:30	closing remarks by JICA

Photograph 2.24 Second short-term training in Japan

<Schedule>

Schedule for Short Term Training of Mine Waste Management Course F.Y. 2018

Day	Date	Time	Category	Learning Items	Event of Activity	Activated by	stage
1	19-May(Sat)				Arriving at Tokyo (Wellcome to JAPAN !!)		TIC (JICA Tokyo)
2	20-May(Sun)				Holiday		TIC (JICA Tokyo)
3	21-May(Mon)	1000-1200	Orientation		Briefing by JICA	JICA (JICA Tokyo, room[SR102])	TIC (JICA Tokyo)
		1430-1500	C.C. & Info sharing		C.C. to JICA Head Office	JICA/MMTEC/SRED (JICA Head Quator)	
		1500-1630	C.C. & Discussion		General Briefing and Discussions with CDMWM project team	MMTEC/SRED (JICA Head Quator)	
4	22-May(Tue)	1000-1030	Discussion & info sharing	Practical Technology	Brief Outline of MMTEC's Business Operation, presented by Mr. Shibata	MMTEC/SRED (MMTEC Saitama Office)	TIC (JICA Tokyo)
		1030-1200	Lecture	Practical Technology	Case Study on Mine Environment Management in Japan, presented by Mr. Shibata	MMTEC/SRED (MMTEC Saitama Office)	
		1300-1500	Lecture	Practical Technology	Case Study on Mine Waste Management in Japan, presented by Mr. Nakamura	MMTEC/SRED (MMTEC Saitama Office)	
		1500-1600	Collection Tour	Practical Geology	Tour of Mitsubishi Mineral Collection conducted by Mr. Shibata	MMTEC/SRED (MMTEC Saitama Office)	
5	23-May(Wed)	1000-1200	Practice & Lecture	Database Technology	Practices and Lecture for Mine Waste Management database, presented by Mr. Takeda	MMTEC/SRED (MMTEC Saitama Office)	TIC (JICA Tokyo)
		1300-1600	Lecture	Practical Technology	Practical Technoligy for Mine Environment Management in Japan, presented by Mr. Shibata	MMTEC/SRED (MMTEC Saitama Office)	
		1700-1930	Welcome Party		Welcome Party	MMTEC/SRED (MMTL Saitama Salon)	
6	24-May(Thu)	0940--1020	Lab Tour	Advanced Technology	Laboratory Tour for Mine Waste Water Treatment Techniques, presented by Technical Staffs in Prof. Tokoro's Lab.	Prof. Chiharu TOKORO, Laboratory of Environmental Purification and Resources Processing, Department of Resources and Environmental Engineerig, School of Creative Sciences and Engineering, Waseda University	TIC (JICA Tokyo)
		1040-1210	Lecture	Advanced Technology	Special Lecture "Resources and Environment" presented by Prof. Tokoro		
		1220-1330	Working Lunch & Info Sharing	Discussions	Information sharing with Prof. Tokoro and her staffs		
		1430-1630	Lecture	Practical Technology	Brief Outline of MMTEC's Business Operation around Mine Waste/Environment Management, presented by Mr. Ishiyama	MMTEC/SRED (MMTEC Kudan Head Office)	
7	25-May(Fri)	1100-1200	C.C. & Info sharing		C.C. to PNG Embassy Tokyo	PNG Embassy Tokyo	TIC (JICA Tokyo)
		1400-1600	Lecture & Info sharing	Policy and Strategy	Lecture presented by PIC officers and Information sharing	JOGMEC (JOGMEC HQ, room[****])	
8	26-May(Sat)	1030-1200	Site tour	Practical Technology	Watarase Yusuichi (Watarase Pond): Site visit for the control basin for impounding stormwater and settling mineral poison	MMTEC/SRED	TIC (JICA Tokyo)
		1400-1500	Site tour	Practical Technology	Ashio Cupper Mine: Site tour for the underground mine operated from the early modern to present-day eras, and caused some environment Issues	MMTEC/SRED	
9	27-May(Sun)				Holiday		TIC (JICA Tokyo)
10	28-May(Mon)	0830-1400			Travel from Tokyo (TIC) to Himeji City, Hyogo Pref.		Himeji City
		1500-1700	Site tour	Histrical culture	Himeji Castle: Site visit for the early modern castle built around 400 years ago (World Cultural Heritage and National Treasure)	MMTEC/SRED	
11	29-May(Tue)	0830-0950			Travel from Himeji City to Asago City, Hyogo Pref.		Asago City
		1000-1630	Site tour	Practical Technology	Ikuno mine (closed): Site visit and Inspection OJT for Mine Waste Storages and Water Treatment Facilities	Ikuno site office, Mitsubishi Materials Corp. (MMC) / MMTEC/SRED	
12	30-May(Wed)	0930-1530	Site tour	Practical Technology	Mikohata old mineral beneficiation plant site, Akenobe mine (closed): Site visit and Inspection OJT for Mine Waste Storages and Water Treatment Facilities	Akenobe site office, Eco-Management Corp. / MMTEC/SRED	Himeji City
		1540-1730			Travel from Asago City to Himeji City		
13	31-May(Thu)	1000-1130			Travel from Himeji City to Osaka City, Osaka Pref.		Kyoto City
		1330-1600	Lecture	Advanced Technology	Special lecture of Technology and Study for Mine Environment rehabilitation, and information sharing, presented/conducted by visiting Prof. Yamamoto, Kyoto University	Prof. Takaiku YAMAMOTO, Kyoto University, President of Northern Maestro Company Limited (NMCL)	
14	1-Jun(Fri)	0930-1030	Site tour	Practical Technology	Tanba Manganese Mine museum: Site visit for the underground mine operated from modern to present-day era.	MMTEC/SRED	TIC (JICA Tokyo)
		1230-1600	Site tour	Histrical culture	Hushimi Inari Shrine (Shinto shrine, Important Cultural Properties) and Toji Temple (World Heritage, National Treasure): Site visit for the late antiquity shrine and temple built around 1300 years ago	MMTEC/SRED	
		1630-2000			Travel from Kyoto to Tokyo (TIC)		
15	2-Jun(Sat)				Holiday		TIC (JICA Tokyo)
16	3-Jun(Sun)				Holiday		TIC (JICA Tokyo)
17	4-Jun(Mon)	1000-1200	Practice & Reporting		Practices and Reporting	JICA (JICA Tokyo, room[SR401])	TIC (JICA Tokyo)
		1400-1700	Open Seminar		Special seminar of Mining Perspective and Environmental Regulatory Regimes for Mine Waste in PNG	JICA/CEPA/MRA/DMPGM (Kosai-kaikan Bldg, room["Aoi"-East])	
		1730-1930	Farewell part		Farewell party	JICA/MMTEC/SRED (Kosai-kaikan Bldg, room["Aoi"-Center])	
18	5-Jun(Tue)	1000-1230			Presentation of Training Results and Evaluation Meeting and Closing Ceremony	JICA (JICA Tokyo, room[SR306])	TIC (JICA Tokyo)
19	6-Jun(Wed)				Leaving for PNG		Flying Overnight
20	7-Jun(Thu)				Arriving at PNG		-

Chapter 3 Improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities

3.1 Formulation of sub-working group

A new sub-working group for the improvement of the existing Mine Waste Management Policy and Environmental Impact Assessment for mining activities (hereto referred as the Policy sub-working group) was formed. The group includes Mr. Robert Sine and Mr. Pitzz Murphy from CEPA, Mr. Asavi Kendua and Mr. Seymour Pok from DMPGM, Ms. Margaret Aulda and Mr. Amukele Amukele from MRA, Dr. Yoshimitsu Negishi and Mr. Hirohisa Kobayashi from the Japanese expert team. (Table 3.1).

The first formal Policy sub-working group meeting was held on 15th February 2018 and many meetings were held for discussion since then.

Photograph 3.1 Policy sub-working group meeting.

Table 3.1 Members of sub-working group

Name	Organization	Position
Mr. Robert Sine	CEPA	Manager - EPW
Mr. Pitzz Murphy	CEPA	Principal Scientist - EPW
Mr. Asavi Kendua	DMPGM	Assistant Director
Mr. Seymour Pok	DMPGM	Chief Policy Officer (Technical)
Ms. Margaret Aulda	MRA	Deputy Manager - ROD
Mr. Amukele Amukele	MRA	Mine Inspector - ROD
Mr. Yoshimitsu Negishi	JICA TEAM	Team leader
Mr. Hirohisa Kobayashi	JICA TEAM	Team member

EPW : Environmental Protection Wing
ROD : Regulatory Operation Division

3.2 Review of existing Mining Laws and Regulations such as the Mining Act 1992, Environment Act 2000, Draft Mine Waste Management Policy Framework and Environmental Impact Assessments for mining activities

3.2.1 Regulatory Framework

(1) **Outline**

The key objective of the review process was focused mainly on reviewing the existing mining regulatory regime, especially Mining Act 1992, Mining (Safety) Act 1977 and the Environment Act 2000 and their Regulations.

The Mining Act 1992 was enacted purposely to regulate the extraction of minerals and to deal with other mining-related matters in PNG. This Act contains provisions that deal with specific matters relating to minerals and mining in the country. Section 41 of the Act specifies a Mining Lease Holder to deal with mine wastes in accordance with the Mining (Safety) Act 1977 and Regulations.

The Mining (Safety) Act 1977 was enacted to regulate safety of mine employees and to do inspection of mines and works, and other related matters. The Mining (Safety) Regulations prescribes certain procedures to comply with in accordance with the provisions of Mining (Safety) Act.

The Environment Act 2000 was enacted for the purposes of protecting the environment and regulating adverse environmental impacts from resource development activities. This Act is complemented with a set of environmental regulations. The Environment (Permits) Regulation and the Environment (Water Quality Criteria) Regulation (see Figure 3.1) regulate mine waste management.

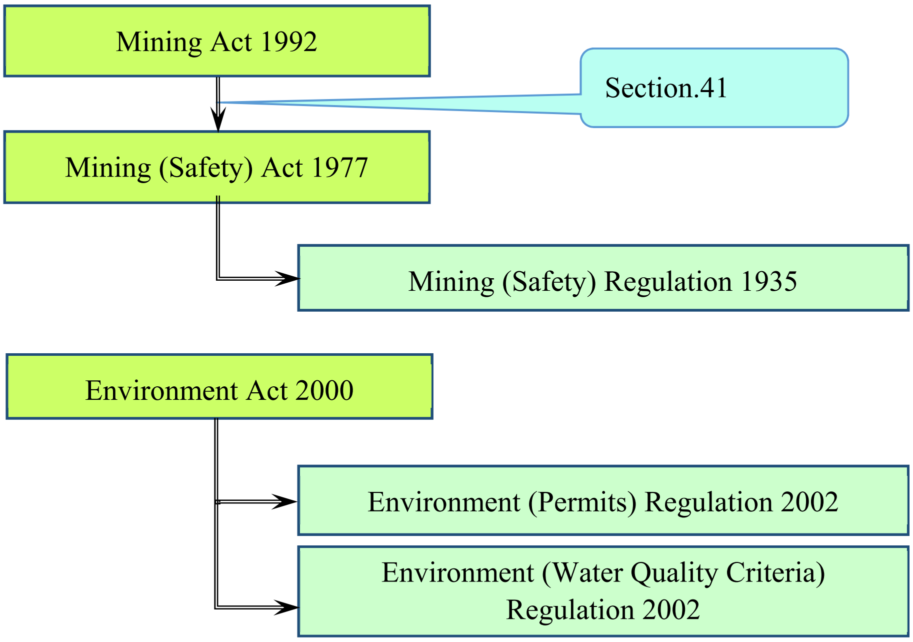


Figure 3.1 Framework and correlation of existing Laws and Regulations.

41. RIGHTS CONFERRED BY A MINING LEASE.

(1) A mining lease authorizes the holder, in accordance with the Mining (Safety) Act 1977 and any conditions to which the mining lease is subject, to–

(*a*) enter and occupy the land over which the mining lease was granted for the purpose of mining the minerals on that land and carry on such operations and undertake such works as may be necessary or expedient for that purpose;

and

(b) construct a treatment plant on that land and treat any mineral derived from mining operations, whether on that land or elsewhere, and construct any other facilities required for treatment including waste dumps and tailings dams;

and

(c) take and remove rock, earth, soil and minerals from the land, with or without treatment;

and

(d) take and divert water situated on or flowing through such land and use it for any purpose necessary for his mining or treatment operations subject to and in accordance with the Water Resources Act 1982;

and

(e) do all other things necessary or expedient for the undertaking of mining or treatment operations on that land.

Mining Act 1992.

(2) **Mining Act 1992**

1) General

The general principles and guidance for mining activities in PNG are specified in Mining Act 1992. Certain sections of the Act are related to the area of mine waste management. Section 5 of the Act reiterates that all minerals existing on, in or below the surface of any land in PNG are the property of the State. This indicates that the Independent State of PNG duly has the first right of ownership of all minerals in PNG. Under the Mining Act 1992, the following four (4) different leases are granted.

- *Mining Lease*
- *Alluvial Mining Lease*
- *Lease for Mining Purposes*
- *Mining Easemen*

> **5. MINERALS THE PROPERTY OF THE STATE.**
>
> (1) All minerals existing on, in or below the surface of any land in Papua New Guinea, including any minerals contained in any water lying on any land in Papua New Guinea, are the property of the State.
>
> (2) Nothing in Subsection (1) shall be construed as an additional acquisition of property in relation to Section 53 of the *Constitution* beyond that which prevailed under the repealed Acts and all previous Acts.
>
> ***Mining Act 1992.***

2) Mining Lease

Sections 38 to 47 of the Act deal with "Mining Lease" and sections 48 to 68 deal with the legal aspects of "Alluvial Mining Leases". Sections 69 to 79 and Sections 80 to 95 regulate "Lease for Mining Purposes" and "Mining Easement" respectively.

Section 41 of the Act states that a mining lease authorizes the holder, in accordance with the Mining (Safety) Act 1977 and any conditions to which the mining lease is subject, to do any mining activities in the Mining Lease area. One of the rights of a mining lease is that the Lease Holder legally owns all the minerals mined from that land.

Other rights of the Lease Holder are to construct facilities required for waste treatment, including waste dumps and tailings dams. This implies that the Lease Holder of the mining tenement can construct waste dumps and tailings dam subject to provisions of the Mining (Safety) Act. The details of the waste dumps and tailings dam are specified by the Mining (Safety) Act.

3) Others

The other section on mine wastes is section 152 which prescribes the removal of mining plant, ore, tailings, and other structures when the mining tenement expires. The person or mining company who had the tenement right may decommission and remove mining plants within the prescribed period. In the event that this is not complied with, the mining plants and structures can be sold at public auctions or public tenders, and the proceeds are retained by the State. This implies that the State also takes over the ownership of waste dumps or tailings storage facilities if they are abandoned in a similar manner.

The section 173 of the Mining Act mentions that the said Act shall not affect the provisions of the Mining (Ok Tedi Agreement) Act or the legal aspects and arrangements surrounding the OK Tedi Mine.

152. REMOVAL OF MINING PLANT, ORE, TAILINGS, ETC., ON EXPIRY, ETC., OF TENEMENT.

(3) When a tenement expires, is surrendered, cancelled, or any land the subject of the tenement is relinquished the person who was the holder of the tenement immediately prior to such expiry, surrender, cancellation or relinquishment may, within the prescribed period, remove from the land relating to the tenement any mining plant.

(4) Where mining plant is not removed in accordance with Subsection (3), the Director may arrange for the mining plant to be sold by public auction or public tender and removed, and the proceeds of such sale shall be retained by the State.

(5) Where, at the time a tenement expires, is surrendered, cancelled or any land the subject of the tenement is relinquished the holder of the tenement immediately prior to such expiry, surrender, cancellation or relinquishment–

(*a*) leaves upon the land any tailings, other materials or mined ore;

and

(*b*) does not, within the prescribed period, either remove or complete treatment of the tailings, other materials or mined ore,

such tailings, other materials and mined ore shall, at the expiration of the prescribed period, become the property of the State.

Mining Act 1992.

(3) **Mining (Safety) Act 1977**

The Mining (Safety) Act prescribes the specifications and operation of mines and methods of implementing inspections. The major sections of the Act related to mine waste management, are as follows:

- *Section 2. Interpretation.*
- *Section 42. Conditions relating to construction or alteration of dams.*
- *Section 43. Inspection of dams.*
- *Section 44. Dams about to be abandoned to be emptied, etc.*
- *Section 78. Regulations.*

A dam in this Act refers to a tailings dam and waste dumps because Section 2 of the Act defines a “dam” as (a) any natural or artificial depository of water; and (b) any dam for the retention of tailings and waste products of mining operations.

According to the descriptions of a dam from sections 42 to 44 of this Act, the Chief Inspector of Mines is authorized to approve the construction or modification of dams. The details of the plans and specifications of the dam must be submitted to the Chief Inspector in order to gain approval. These details are prescribed by the Regulations (Section 78).

An inspector may enter and inspect a dam at any time. When a dam is rendered unsafe and poses risks to human lives or properties, the inspector may request to stop its further use. Before abandoning the dam, the owner must empty or treat the dam in the manner as prescribed:

78. Regulations.

(1) The Head of State, acting on advice, may make regulations, not inconsistent with this Act, prescribing all matters that are necessary or convenient to be prescribed for carrying out or giving effect to this Act, and, in particular, prescribing matters providing for and in relation to—*snip*

(*n*) the details to be furnished in plans and specifications relating to the construction, alteration or enlargement of dams;

Mining (Safety) Act 1977.

(4) **Mining (Safety) Regulation 1935**

The Mining (Safety) Regulations have a number of stipulations about the safety of mining activities. The major sections relating to mine waste management are as follows;

- *Section 31. Waste.*
- *Section 39. Material to be used in filling.*
- *Section 286. Plans and specifications of dams.*
- *Section 287. Plans and Specifications.*
- *Section 288. Applications for approval for construction, etc., of dams.*
- *Section 289. Notice to repair dangerous dams.*
- *Section 290. Abandonment of dams.*

Section 31 requires “All wastes used, or for use, in cleaning machinery underground shall be kept in securely covered metal vessels.” However it is impossible to store all tailings and waste rock materials in securely covered metal containers.

Debris, refuse, or other materials that can be harmful to mine workers shall not be transferred for the purpose of filling up the excavations (Section 39).

The details of a dam are specified in sections 286 to 290. Sections 288 and 289 stipulate the application forms, information notices and so forth to be sent. In accordance with section 42 of the Mining (safety) Act, the required plans and specifications of the dam are prescribed in section 286 of this Regulation. An example of details of the dam specification to be described in the application form is shown below:

- *plans of vertical end and mid-section of the retaining-walls or weirs showing the position, size, and details of all sluices, gates, and spillways.*
- *details of the anchorage of the base and ends of the retaining-walls or weirs at, or to, the natural rock or other strata.*
- *particulars of–*
  - (A) the factors allowed in the strength of the retaining-walls or weirs; and
  - (B) the estimated capacity of the dam; and
  - (C) the estimated area of the catchment, or maximum known flood capacity of the river or stream on which the dam is to be constructed; and
  - (D) the average and maximum known rainfall; and
  - (E) the estimated discharge capacity of sluices, gates, and spillways

These details do not include the chemical or mineralogical composition and the results of the dissolution test of the tailings or waste rocks.

(5) **Environment Act 2000**

In order to promote sustainable development of natural resources, the Environment Act 2000 regulates the environmental impacts from the resource development projects. The Environment Act 2000 provides a regulatory framework necessary to manage and control pollution and environmental harm caused by economic activities such as mining, oil and gas production and other resource projects and developments projects.

Activities are generally divided into Levels 1 to 3 by this legal system depending on their level of impacts on the environment. Before commencement of any Level 2 or 3 activities, the project proponent needs to be granted an Environment Permit by the Director of Environment. This Act has a total of 140 sections and most of the sections, particularly sections 42 to 77 deals with Environment Permits.

The levels of the activities are defined in the Environment (Prescribed Activities) Regulation, and generally the Level 3 activities are activities that are envisaged to have major environmental impacts, whilst the Level 1 activities to have minor environmental impacts. All large-scale mining activities are categorized as Level 2 or 3 projects and the alluvial or mechanized alluvial activities fall under Level 2.

It is a requirement under the Act that Environment Impact Assessments (EIA) are carried out before granting of Environment permits of all level 3 activities. Level 2 (section 50) projects also go through similar regulatory process, however do not require an EIA. The following activities require an EIA:

- The activity involves an industrial or manufacturing process which has not previously been used in PNG
- The activity is specifically the subject of obligations under any international treaty, convention or instrument to which PNG has ratified
- The activity which poses a threat of serious environmental harm

Under the EIA process any mining company that wants to acquire a mining lease must inform the Government of PNG of their plans and methods to dispose of the tailings. The details of the EIA process are described in section 3-2-3 of this report.

Failure to fully comply with requirements of this EIA process may result in rejection of the granting of an Environment Permit (Section 62). In granting a permit, the Director of Environment (Managing Director of CEPA) shall specify the conditions which the Director considers are necessary or desirable requirements (Section 66) in the permit. The following 12 requirements are shown in the section as examples.

(a) installation and operation of certain plant or equipment within a certain time;
(b) the taking of certain action to minimise the risk of environmental harm;
(c) at the cost of the permit holder, installation of monitoring equipment, carrying out a specified monitoring programme and reporting on its progress;
(d) preparation and carrying out an environmental management programme;
(e) provision of reports on any matter specified by the Director;
(f) submission for approval and carrying out of an Environmental Improvement Plan;

(g) undertaking an audit at periodic intervals;
(h) preparation and lodgement of a plan for emergency response in relation to accidental release of contaminants or risk of other emergency;
(i) provision of information reasonably required by the Director for the administration and enforcement of the Act;
(j) lodgement of an environmental bond consistent with requirements established under Section 103;
(k) conducting baseline studies or surveys and reporting the results prior to commencing operations;
(l) rehabilitation of the affected area.

Every requirement in the permit is deemed important for the management of mine waste, especially item (l) which reiterates the importance of rehabilitating the affected area. After cessation of the mining activity, all mine waste will remain on the land and it may pollute the environment and its surroundings. It is important that the condition of the permit vividly describes how to rehabilitate the affected area. The other important requirement is item (j): deposits of an environmental bond consistent with requirements established under Section 103.

Section 97 describes Environmental Protection Trust Fund, and section 99 about Environmental Bonds. They both refer to the establishment of a trust fund to deal with post-closure mining activities, however the legal policy document to give effect to this is still in a draft form.

The Mining Act does not affect the provisions of the Mining (Ok Tedi Agreement) Act. On the other hand, section 3 of the Environment Act mentions that; “The provisions of this Act may apply to projects to which the Mining (Bougainville Copper Agreement) Act, Mining (Ok Tedi Agreement) Act and Petroleum (Gulf of Papua Agreement) Act apply to the extent that those Acts provide for the application of this Act”.

(6) **Environment (Permits) Regulation 2002**

The Environment (Permit) Regulation systematically describes the processes involved in granting an Environmental Permit. This includes the application forms, timeframe for assessment, ways for notification and publication, public consultations and so forth. In addition, the processes for permit renewals, permit surrender and permit amendment are also outlined.

(7) **Environment (Water Quality Criteria) Regulation 2002**

This regulation describes the water criteria and mixing zone of receiving waters. The water quality criteria standards are set for both fresh water and sea water. These water quality standards are shown in the table (schedule 1) of the regulation.

Section 3 of the Regulation describes a mixing zone. The terms and conditions of a permit may provide for a mixing zone where, after exploring all methods of waste avoidance and minimization, it is not viable or practicable to further reduce the level of waste prior to its discharge or emission. The application of the mixing zone as specified in the Environment Permit is limited. It only mentions the waste avoidance and waste minimization aspects and not so much on the terms and conditions of the size and location of the mixing zone. In addition, there is no mention of how and what methods shall be used to determine the distance of the mixing zone.

2. WATER QUALITY CRITERIA.

(1) The water quality criteria for protection of freshwater aquatic life are as specified in Column 2 of Table 1 in the Schedule.

(2) The water quality criteria for protection of marine aquatic life are as specified in Column 3 of Table 1 in the Schedule.

(3) The maximum permitted criteria of ammonia –nitrogen for protection of freshwater aquatic life are as specified in Table 2 in the Schedule 1.

(4) Unless otherwise permitted under this Regulation or the terms and conditions of a permit, a person shall not discharge into, or use, water where any such discharge, or use, shall cause a lowering of water quality below the prescribed water quality criteria.

Environment (Water Quality Criteria) Regulation 2002.

3. MIXING ZONE.

(1) The terms and conditions of a permit may provide for a mixing zone where, after exploring all methods of waste avoidance and minimization, it is not viable or practicable to further reduce the level of waste prior to its discharge or emission.

Environment (Water Quality Criteria) Regulation 2002.

3.2.2 Concerning Points relating to Laws and Regulations

(1) **Matters regarding Mining Act**

The most concern point is Section 152 of Mining Act 1992. From this section, after the mining lease expires, if the mine waste comprising tailings and acid rock drainage remain in the area where a mining lease was granted, these waste become the properties of PNG State. In this case, the State has the responsibility of managing the mine waste.

About the responsibility for environmental harm, the Environment Act legislates in section 9. The occupier or person who is in effective control of activities carried out at that place shall be responsible for the environmental harm or threatened environmental harm. From this article, when the contaminants ooze from mine waste after mining lease expiry, the State as the owner of the mine waste will be responsible for the environmental harm.

9. RESPONSIBILITY FOR ENVIRONMENTAL HARM.

(2) Where environmental harm is caused or threatened at any place used in connection with an industrial or commercial activity, the occupier or person who is in effective control of activities carried out at that place shall be responsible for the environmental harm or threatened environmental harm

Environment Act 2000

Definitely there is the legislation for the abandoning dam in the Mining (safety) Act 1977. It states that before abandoning the dam, the owner of the dam shall empty or treat the dam in the manner prescribed. However, it is also conceivable that the financial situation is not good for the mining company just before mine closure. In this case, the company may not empty or treat the dam before abandoning dam. In the worst case, the company had bankrupted before dam emptying.

There is a possibility that the waste discharge toxic water to the environment and it causes the environmental harm. It may continue the negative environmental impact from these wastes for long time after the mining activity, and also it will be considerably costly to take measures against mining pollution. It is not clear at the moment whether or not the PNG State is well prepared for these expenses and budgets.

> **44. DAMS ABOUT TO BE ABANDONED TO BE EMPTIED, ETC.**
>
> (1) Where the owner of any dam used for mining purposes intends to abandon it, he shall, before abandoning it, cause it to be emptied or to be treated in the manner prescribed.
>
> (2) Within 14 days after abandoning the dam the owner shall, in writing, notify the Chief Inspector of the abandonment.
>
> ***Mining (Safety) Act 1977.***

(2) **Dam specification for Tailings Storage Facilities (TSF) and Waste Rock Dumps**

In the Mining (Safety) Act, the mining lease holder shall lodge the specifications of the dam with the Chief Inspector before constructing the dam. These specifications of the dam are defined in the Mining (Safety) Regulations.

It seems that these specifications are good for the water dam, perhaps not be suitable for the tailings dam and waste dump. These specifications do not include chemical, mineralogical composition and the result of the dissolution test of the tailings or waste rocks.

(3) **Matters regarding Environment Act**

As the previous section tells, there is a possibility that the PNG State will manage the mine waste and it will require a lot of expenses and budgets for the treatment. Sections 97 and 99 of the Environment Act 2000 have provisions on the Environmental Protection Trust Fund and the Environmental Bonds respectively. These can be expected to be appropriated to budgets and expenses when managing the mine wastes by the State.

These sections of the Act specify the regulations for the Fund and Bonds. However, at the moment, the regulations are not established. There is some information, that CEPA is preparing the preliminary draft of the regulations of the Bonds.

The conditions of Environment Permit for mining activities, they use the system of mixing zone for the water discharge. Some Environment Permits for mining activities took the extensive mixing zones which are longer than 100km. Actually the mixing zone for the Hidden Valley Mine site is set about 14km downstream from the discharge point. Since several houses exist along the river in this mixing zone, there is concern about health damage caused by the waste water.

Currently it seems there is one activity in the same river system. But in future, if there are 2 or 3 activities in the same river system, it is difficult to apply the system of mixing zone. This is also a point for concern.

3.2.3 Environmental Impact Assessments for Mining Activities

The Environmental Impact Assessments is a requirement under the Environment Act 2000. Sections 47 to 69 are sections related to Environmental Impact Assessments and Sections 41 to 43 define the interpretation of the content of the applicable activity and its degree. The activities are divided into 3 levels by the Environment (Prescribed Activities) Regulation 2002.

The flow of the EIA summarized into Figure 3.2 of next page.

41. CARRYING OUT OF AN ACTIVITY.

(1) For the purposes of this Part, a person carried out an activity where he carries out –

(a) construction of works, land clearance, demolition, excavation or other works in relation to land or water; or

(b) installation, operation or maintenance of plant or equipment; or

(c) activities for the purpose of extracting or harvesting natural resources; or

(d) release of contaminants to air, land or water, in connection with any of the activities specified in Paragraph (a), (b) or (c).

(2) A person carries out an activity if he has effective control over that activity at the site at which the activity is carried out, and where a person has such effective control, no other person is regarded as carrying out the activity.

42. LEVEL 1, 2 AND 3 ACTIVITIES.

(1) Subject to Subsection (2), the Regulations shall prescribe activities to be level 1, 2 or 3 activities.

Environment Act 2000.

2. LEVEL 1 ACTIVITIES

Level 1 activities are all those activities that are not prescribed as Level 2 or Level 3 activities.

3. LEVEL 2 ACTIVITIES

The activities listed in Schedule 1 are prescribed as Level 2 activities for the purposes of the Act. Within Schedule 1, Level 2 activities are classified as Category A activities or Category B activities for the purposes of the Act and the Regulations to the Act.

4. LEVEL 3 ACTIVITIES

The activities listed in Schedule 2 are prescribed as Level 3 activities for the purposes of the Act.

Environment (Prescribed Activities) Regulation 2002.

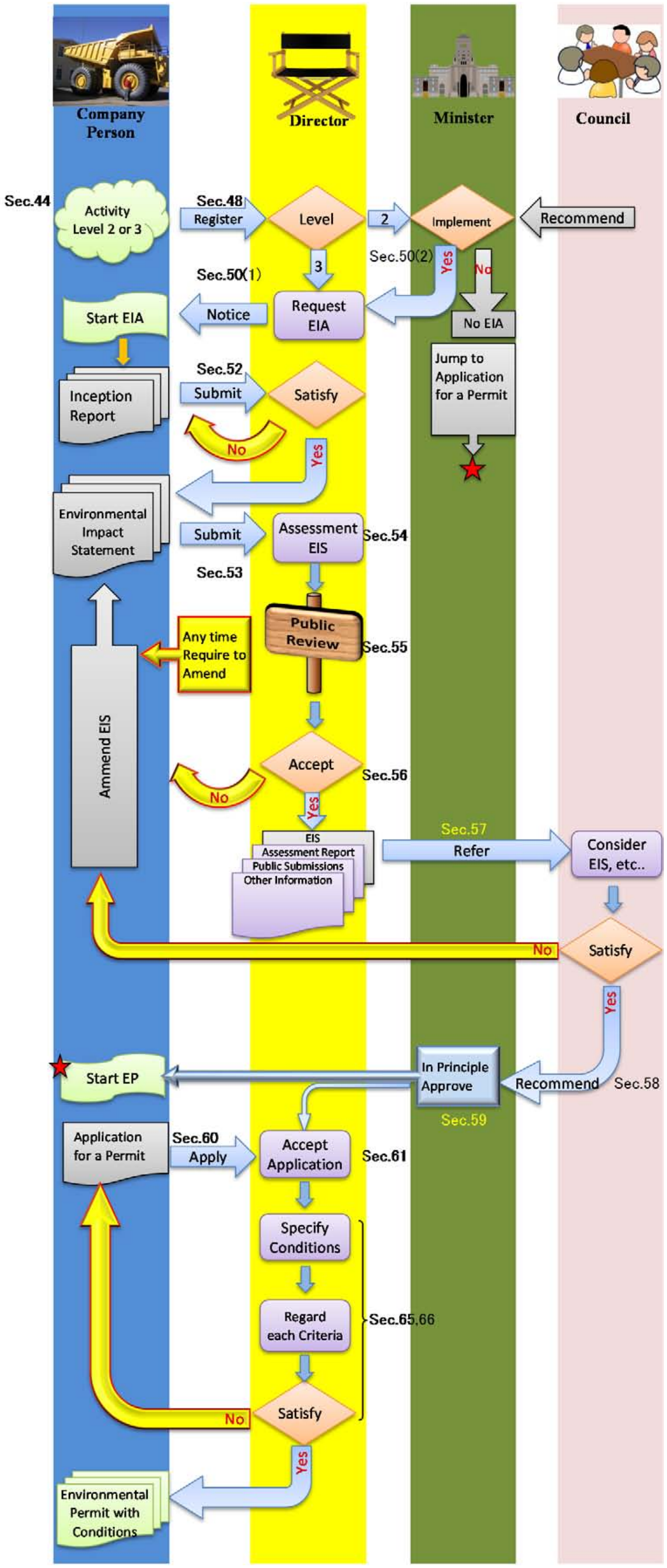


Figure 3.2 Flow chart of Environmental Impact Assessment

3.2.4 Draft Mine Waste Management Policy Framework

The objective of this document is to provide investors with precise information about policy and regulations applicable to mine waste disposal, which is favorable to attracting and retaining foreign investment that serves the interests and aspirations of the Government and the people of Papua New Guinea.

The particular word of the draft mine waste management policy framework is BAT, the Best Available Techniques. "Best Available Techniques" means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent.

BAT for a given industrial sector are described in BAT reference documents (BREFs). BREFs are the result of an exchange of information between European Union Member States, the industries concerned, non-governmental organizations promoting environmental protection and the European Commission pursuant to article 13 of the directive. The most important chapter of the BREFs, the BAT conclusions, is published as implementing decisions of the European Commission in the Official Journal of the European Union.

> **10 ENVIRONMENTAL MANAGEMENT OF MINE WASTE**
>
> **10.2.6 Disposal of Acid Rock Drainage and Acid Mine Drainage1 General**
>
> Neutralisation plants and ponds, sedimentation dams, etc. are the most commonly used methods of ARD and AMD disposal practices. However, the management of these sites needs to be carefully addressed in any mine closure plan, as these drainages may continue for a very long time and may require long term financing. The mine closure plan has to additionally provide for the funding of these long term treatments. The following points were raised and need to be addressed:
>
> i. Design and Management of waste dumps with a long term potential for ARD
> ii. Sealant against ground water contamination
> iii. Dam design
> iv. Storage of waste
> v. Catchment of drainage
> vi. Treatment of drainage
> vii. Long term funding for ARD management
>
> ***Mine Waste Management Policy Framework***
>
> ***Working Draft for Public Consultation 22.06.2011***

One of the important indicates is “Owners Pays” in the Document. To put it further, it is the responsibility of the discharger. The document pointed out that Legislation should provide that the owner or operator is responsible for execution and completion of successful reclamation activities to an appropriate technical standard.

The standard of reclamation is described that “wherever practicable”. On the other hand, it is stated that “this is in many cases not possible or cost prohibitive”. To fit these different requirements the document may recommend referring the BAT.

The other important indicate is “Exit Ticket” in the Document. The document pointed out that legislation should provide explicitly that at a certain moment the company can be relieved of future liabilities for the site.

11 REHABILITATION

11.5 Guidelines for Mining for Closure Framework Policies

11.5.1 Owner Pays

Legislation should provide that the owner or operator is responsible for execution and completion of successful reclamation activities to an appropriate technical standard. Where long-term care is involved, the operator is responsible to provide it until relieved of liability.

11.5.2 Standard of Reclamation

Return the mine site to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities. There should be measures to address and prevent on-going pollution from the site. However, there should not be a blanket requirement to return the site to its original conditioner to a condition permitting particular land uses, as this is in many cases not possible or cost prohibitive.

11.5.7 The Exit Ticket

It is reasonable to demand that Miners accept the costs and liability for environmental protection of the site during operations and for reclaimed the site upon closure. Where conditions such as acid mine drainage exist, it is reasonable that companies also accept the necessity of funding long term care and management. However, government legislation should provide explicitly that at a certain moment the company can be relieved of future liabilities for the site. In most cases, this relief would be given as soon as site reclamation has been successfully completed. In the case of acid drainage, it would be given as soon as necessary funding arrangements have been established for long-term care.

Mine Waste Management Policy Framework

Working Draft for Public Consultation 22.06.2011

3.3 Formulating mine waste management policies (Recommendations)

3.3.1 Responsible for mine waste management after expiring ML.

(1) **Matters regarding Mining Act**

The greatest concern stated in Section 152 of Mining Act is that State should take the responsibility of mine waste management after the expiry of Mining Lease.

[Suggestions under current Mining Act]

Based on the situation, the project would propose to take the following measures until making a re-examination of responsibility and revising Mining Act.

- Chief inspector shall not approve plans and specifications of the dam in the absence of Mine Waste Treatment plan submitted by the Mining Company.
- MRA shall make sure that inspections are carried out on mine waste treatment facilities before the expiry of the Mining Lease.

Because the chief inspector will lose authority after expiring Mining Lease, it is also necessary to ensure that inspection data on mining waste disposal and management is provided to the person in charge of the CEPA.

[Suggestions of amendment of the Mining Act]

The project propose that the Mining Act should clearly define the "responsibility of mine waste dischargers". However, it is not realistic for the discharger to have permanent responsibility. Therefore, clear safety standards for mine closure are required.

[Mining Act under revision]

Currently, the revision of Mining Act has been discussed and prepared constantly, and some information has been obtained as below;

- Under the revised Mining Act despite the expiry of the Mining Lease, the previous license tenement holder will still be responsible for implementing its final Mine Rehabilitation and Closure Plan (finalized 2 years prior to the expiry date of the license or cease of production, whichever comes first).
- The revised Mining Act prohibits the discharge of mine waste into river systems and surrounding environments.
- The Act also requires the developer to submit a Mine Rehabilitation and Closure Plan upfront as part of its proposals for mine development during the license application stage.
- It is also a requirement for the developer put in place financial assurance deposit upfront prior to the commencement of production.
- MRA and CEPA to develop checklist and audit criteria for environmental, safety and health under both mining and environmental legislations for post-closure relinquishment of Mining Lease.

(2) **Matters regarding Environment Act**

The project recommends that the submission of Mine Rehabilitation and Closure Plan as a condition of the environment permit at the same time to apply the Mining Lease should be clearly stipulated in Environment

Act as same as "Rehabilitation of the affected area", and also that CEPA would clearly take a role of the organization in charge to examine the applied plan.

3.3.2 Specifications of the tailings dam and waste dump.

(1) **Matters regarding Mining Act**

Suggestions under the current Mining Act and recommendations for revision of the Act are as follows

[Suggestions under current Mining Act]

- Chief inspector requests the tailings dam and waste dump specifications to include an Emergency Response Plan.
- Publish the guideline for the planning tailings dam and waste dump.

[Suggestions of amendment of the Mining Act]

It is one measure (policy) that specifications and plans of the tailings dam and waste dump which are suitable for them is added to Mine (Safety) Regulation section 286.

(2) **Matters regarding Environment Act**

- Request the specification of water treatment plant plan to EIS.
- Publish the guideline for the planning tailings dam and waste dump.

3.3.3 Expenses and Budgets for the Mine Waste Treatment after ML expire.

(1) **Matters regarding Mining Act**

It is one measure (policy) that the establishing “Mining damage prevention reserve fund” is added to Mining Act and develop its Regulation. When the company deposits (collects) mine waste in the Mining Lease area, the total countermeasure expenses are calculated according to its quality (risk) and quantity (volume or area) by simple formulas, and the Annual deposit money will be the total expenses divided by the planed mine life (years).

When the mining company commences the countermeasure of the waste, its cost is paid from the fund to the company depending on the amount of measures to be taken.

The accumulation of this fund is an increase of the burden on mining companies and there is a possibility of stagnating new mining activities. Generally for the mining company it is tough to finance during the first few years after commencing the operation. Therefore, if the mine life is the longer than 10 years, it will be one measure (policy) to set a temporary withdrawal measures for a few years.

[Mining Act under revision]

Currently, the revision of Mining Act has been discussed and prepared constantly, and some information has been obtained for establishing and stipulating “Mine Closure Financial Assurance” in revised Mining Act. This assurance covers all expenses for a countermeasure of mine waste treatment and rehabilitations after mine closure. This financial assurance does not overlap the Environment bond as required under the Environment Act.

In the relevant legislation under revised Mining Act, the calculation method for the total expenses for the countermeasure of mine closure by MRA would be clearly stipulated. The mining operator should pay some of them at the beginning of their operation.

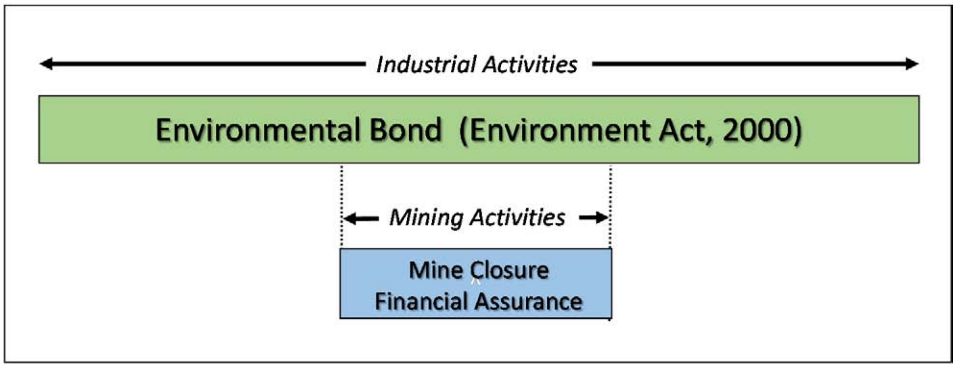


Figure 3.3 Coverage of the Mine Closure Financial Assurance

(2) **Matters regarding Environment Act**

The Establishments of "Environment Protection Trust Fund" and "Environmental Bond" are required by current Environment Act for supporting the rehabilitation and countermeasures for environment pollutions caused by Industrial and Mining activities. Nevertheless, these Fund and Bond have not yet been effective, because of lack of relevant regulations. Therefore, the calculation methods for the amount to be paid in these Bond and Fund, like the "Mine Pollution Prevention Reserve Fund" as mentioned above, should be also clearly defined at the same time with the enforcement of relevant regulations.

3.3.4 Manage the water quality of the river upstream of the compliance point.

The system of Mixing Zone can be used after exploring all methods of waste avoidance and minimization according to Environment (Water Quality Criteria) Regulation. This means that is desirable to achieve water quality criteria at discharge points. And then, if the system of Mixing Zone will be used, the size of Mixing Zone should be small and short as possible as they can.

Environment (Water Quality Criteria) Regulation does not show how to define the size of Mixing Zone. For the mining activities, it is one measure (policy) that the compliance point which is the boundary of Mixing Zone is set at the boundary of tenement area (ML&ME). For the future, for the preparing to some activities in same river system, it is desirable to bring the discharge water criteria system in Environment Act.

As a transitional measure, there is a method of setting provisional water quality criteria for discharged water. The first provisional water quality criteria for discharged water will be settled the current water quality of discharged water. Then a few years each, the provisional water quality criteria will be approximated to the original water criteria in the Environment (Water Quality Criteria) Regulation.

Chapter 4 Establishment of Implementation Regime for Mine Waste Management Policies

Governmental Organizations in charge of the management and inspection of mine waste are the Mines Safety Branch of the Regulatory Operations Division in MRA and the Environment Protection Wing in CEPA. On the other hand, DMPGM has the responsibility of law and policy development concerning mining and geoharzard activities. However there are no well establish administrative and inspection manuals used by these institutions to effectively carry out their work. Also personnel and budget pertaining to on-site inspections are limited in CEPA. In addition, there is a team for inspecting mine waste and its facilities from CEPA and MRA but they are still trying to strengthen the system and improve the technology.

Based on the above current situation, on-the-job training together with inspectors of the departments in charge for monitoring and inspection of mine waste and its facilities including nearby river waters around the mine sites are continuously performed, which the training should be implemented according to a procedure manual prepared in this study.

4.1 Formulating the sub-working group

The sub-working group is formed for the establishment of an implementation regime for mine waste management policies as shown in Table 4.1.

Table 4.1 Sub-working group member for the establishment of implementation regime

Organization	Name	Department
CEPA	Mr. Pitzz Murphy	Mining Branch
	Mr. Anderson Anjo	Mining Branch
MRA	Ms. Margaret Aulda	Technical Assessment Branch
	Mr. Lars Kuri	Technical Assessment Branch
	Mr. Amukele Amukele	Mines Safety Branch
JICA Study Team	Mr. Mitsuo Ohtake	
	Mr. Yoshiaki Shibata	

4.2 Mine Waste

In PNG, mine waste mainly consists of waste rock and tailings. Waste rock are mined along with ore when excavating the ore at a mine, or it is a host rock and a low grade ore without economic value that are excavated when excavating a shaft, a transport gallery, an exploration tunnel, etc. On the other hand, tailings are the remaining waste of fine materials after collecting useful mineral particles by floatation process.

There are neutralizing precipitates caused by neutralization treatment of mine wastewater and slag which is the residue after smelting other than waste rock and tailings, but in the PNG only a very small amount is generated at present.

4.3 Management method of mine waste

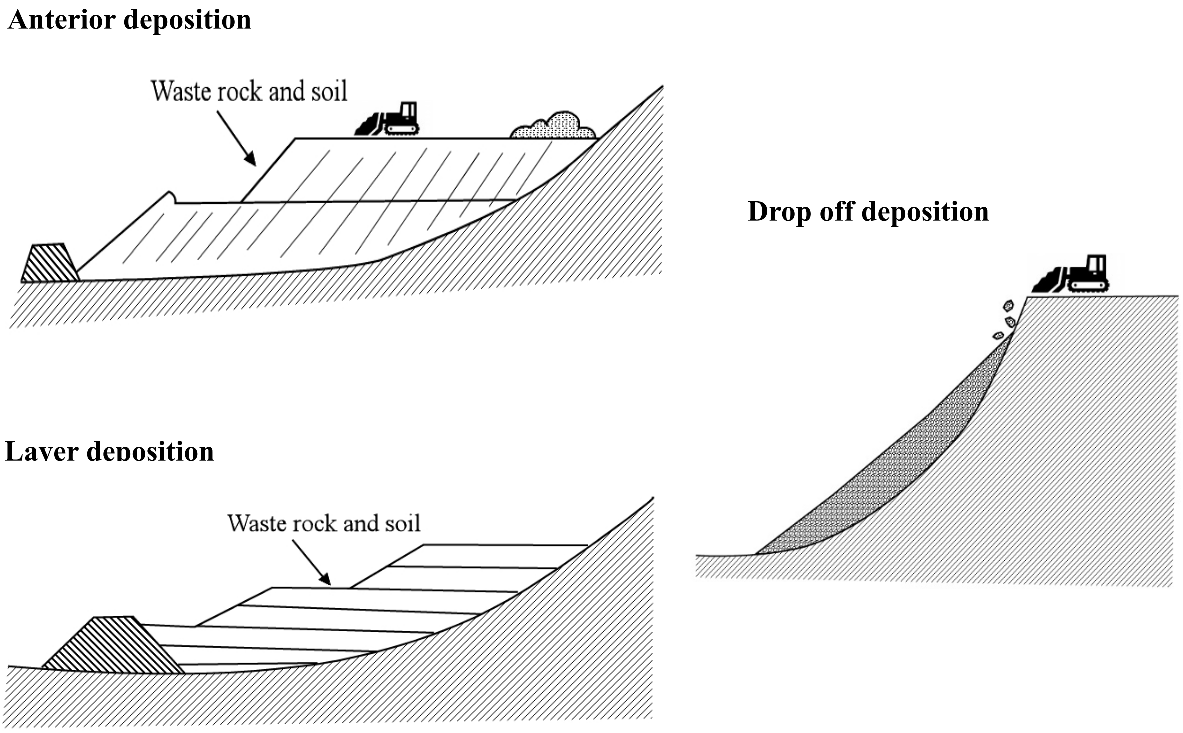
Management methods of waste rock and tailings are described below.

4.3.1 Management methods of waste rocks

The waste rock are transported to the dumping area and deposited after being carried away from the mining pits and the minehead. As shown in Figure 4.1, the deposition type of waste rock is mainly consist of layer deposition, anterior deposition and drop off deposition.

① Layer deposition type: Accumulation method for stacking waste rock horizontally
② Anterior deposition type: Method of spreading waste rock out laterally while maintaining the height of the loading surface
③ Drop off deposition type: Method of dropping waste rock down from a high position into recesses such as mining sites

Since some of the mining wastes contain sulfide minerals that may generate acidic wastewater, there are cases where they are kept separately for those containing sulfide minerals and those not containing sulfide minerals.



Anterior deposition

Drop off deposition

Layer deposition

Figure 4.1 Depositional method of waste rock

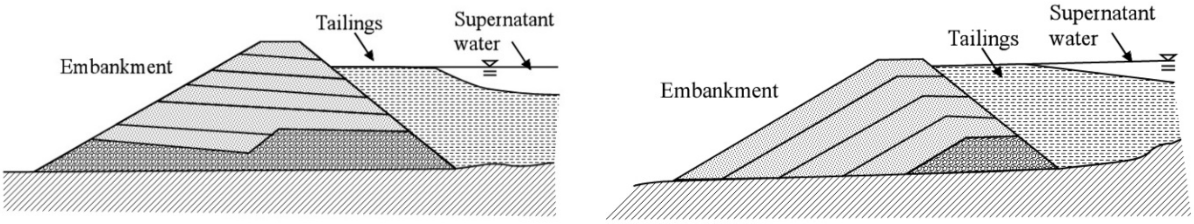
4.3.2 Management methods of tailings

Muddy slime containing heavy metals and harmful chemical substances generated by flotation and gold leaching (cyanidation) is stored in the tailings dam. And water (wastewater) and solid matter (tailings) are separated during long-term storage. Waste water is recycled and used as water for beneficiation, or pumped and drained, but the tailings are accumulated. As a wastewater may contain harmful components, it is often discharged to rivers via sedimentation ponds and /or notarization facilities.

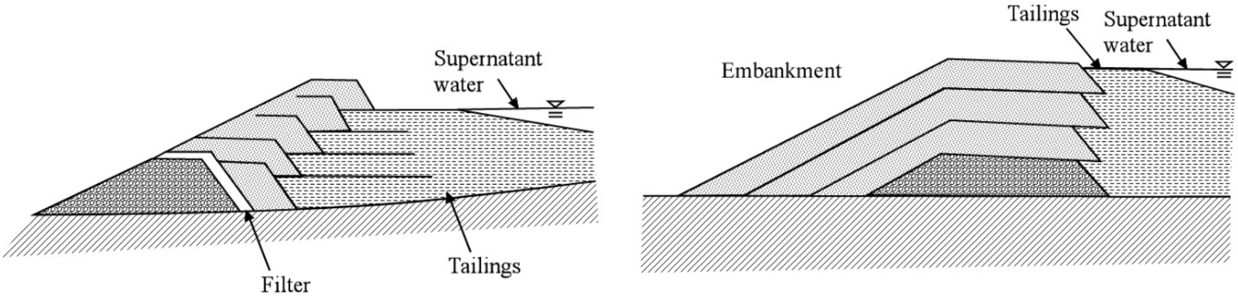
There are several types of tailings dam, as shown in Figure 4.2, from its construction style.
In PNG, two mines, the Kainantu Mine and the Hidden Valley Mine, have a tailing dam. Details of these dams will be described later.

In PNG, due to topographical or climatic restrictions, many mines take a method of discharging tailings directly to rivers and deep sea floor without constructing tailings dams. An example of such a typical mine is as follows.

- Mines directly discharging into rivers: Ok Tedi Mine, Porgera Mine
- Mines emitting to deep sea floor: Lihir Mine, Simberi Mine, Ramu Ni-Co Mine


Basic embankment type

Downstream tailings dam


Upstream tailings dam

Centerline tailings dam

Figure 4.2 Types of tailings dam

4.4 Responsible authority on mine waste management and its activities

The competent authorities on mine waste are the Non Renewables Section of the Environment Protection Wing at CEPA, the Mines Safety Branch and Technical Assessment Branch of the Regulatory Operation Division at MRA. In terms of jurisdictional distinction between CEPA and MRA, MRA is limited to activities within the mining lease area owned by the mine, whereas CEPA is essentially the environmental management outside the mining lease area.

4.4.1 Non Renewables Section of Environment Protection Wing, CEPA

When the organization was changed from DEC (Department of Environment and Conservation) to CEPA by the restructuring in 2013, the Environmental Protection Wing became the sector field oriented structure which is more functional from the work content oriented structure. The non-renewables section consists of two teams: mining and oil/gas. At present, the mining team consists of only four people, and it is short of manpower to manage the environment of the mines in the whole country.

4.4.2 Mines Safety and Technical Assessment Branchs of the Regulatory Operation Division, MRA

In the MRA, the Mines Safety Branch and the Technical Assessment Branch within the Regulatory Operation Division also include business related to the environment in the mine. The Mine Safety Branch provides guidance and control on mining safety in accordance with the Mining (Safety) Act (enacted in 1977). There were only two inspectors before 2014, but since 2014 the importance was recognized and it became an organization of 11 inspectors. According to the Mining Act (enacted in 1992), the Technical Assessment Branch conducts guidance for mines to development and evaluation of development plan, and also conducts evaluation and guidance on environmental conservation.

4.4.3 Current status of audit and inspection related to mine waste management by CEPA

(1) Audit by CEPA

Audits related to mine waste are conducted as part of CEPA’s regulatory obligations through undertaking environmental audits. Environmental audit covers various types of assessments and associated corrective actions to ensure that environmental compliance and management systems are being executed reliably according to permit conditions and the Environment Management & Monitoring Plan (EMMP). There are generally three (3) different types of environmental audits:

(a) Compliance audits
(b) Environmental management systems audits
(c) Independent environmental audits

Compliance Audits

- The normal CEPA compliance audits can be undertaken quarterly, bi-annually or annually. This is where CEPA officers go to the project site for normal compliance inspections of the permitted operations as per the permit conditions and requirements under the EMMP.
- On some occasion a compliance inspection maybe undertaken for a specific aspect of an operation, and/or maybe part of a permit amendment application.
- CEPA officers also review Quarterly and Annual Reports as part of the compliance activity and may undertake follow up site inspections or audit where non-compliance is noted.

Compliance audits are intended to review the company's legal compliance status in an operational context. Compliance audits generally begin with determining the applicable compliance requirements against which the operations will be assessed. This tends to apply permits conditions and EMMP.

Environmental Management Systems Audits.

Environmental Management systems audits are conducted by CEPA officers themselves, an external auditor and/or combined. These are audits done against the company’s operating systems, their facilities, Standard

Operating Procedures and a whole range of aspects of the mine to assess the effectiveness of these systems, procedures and instruments/facilities. Deficiencies or non-compliances are reported to the company management for remedial/corrective actions.

Independent Environmental Audits.

Independent Environmental Audits are conducted usually after three (3) years of project commencement. These audits can cover both operational and management systems. The audit covers environment permit conditions as well as the project EMMP, the management systems and the social and health aspects. It generally includes all facets of the mining operations, depending on the scope of the audit. A consultant is usually engaged to conduct such major audits.

(2) Site inspection

Site inspections are short site visits usually conducted by CEPA officers to project sites for any of the following reasons;

i. Incident on site resulting in environmental damage
ii. Inspections of installations of new equipment or facility
iii. Part of the assessment for permit amendment application

Such inspections are very specific and limited in scope to a pre-identified area.

4.4.4 Current status of audit and inspection related to mine waste management by MRA

MRA audits and inspections are carried out by the Mines Safety Branch. The audit is conducted only for the Safety Management System. The inspections are carried out for safety purposes, and they regularly conduct inspections at each mine quarterly.

4.5 Current status of mine waste management at abandoned mines and operating mines

Site visits for grasping the current status of mine waste management have been carried out at Mt. Sinivit Au Mine, Ok Tedi Cu Mine, Kainantu Au Mine and Hidden Valley Au Mine so far.

4.5.1 Mt. Sinivit Au Mine

This mine was suddenly stopped operation by New Guinea Gold Limited in July 2014, after which the mining right was canceled by Mining Minister, and there is no owner of the mining lease at this present.

Small scaled waste rock dumps are located in some places, which are mainly constructed as the drop off deposition type. The parts of anterior deposition type can be also seen in places.

Since Vat / Heap leaching and gold extraction by Carbon in Leach (CIL) method were carried out in this mine, no tailings can be seen. However, finely crushed ore after recovering gold is left intact in Vat / Heap and the wastewater containing cyanide remains in Vat / Heap although diluted by rainwater.

Photograph 4.1 Vat/Heap in Mt. Sinivit Mine

4.5.2 Ok Tedi Cu Mine

In the Ok Tedi Cu Mine, there are three waste rock dumps, Moscow, Vancouver and Taranaki, and the amount of waste rock reach to about 150 Mt per year. The method of deposition is the drop off type. The waste rock is dropped in the valley by the bulldozer immediately after being carried by the dump truck from the Pit.

Photograph 4.2 Moscow waste rock dump in Ok Tedi Mine

After the flotation process, the tailings is discharged directly to the Ok Ma River, which is a tributary of the Ok Tedi River, and then flows down the Ok Tedi River. In Bige which is about 140 km downstream from the mine, a dredging has been carried out since 1998 in order to prevent the river bed from rising in the downstream part, and the collected sands and gravels are piped to the dumping area on both sides of Ok Tedi River. There are two dumping areas, East Bank and West Bank, both of which are vast, East Bank has a size of 400 Ha, West Bank has a size of 600 Ha. The amount of sands and gravels dredged is 10 Mm 3 per year, which means that if the inflow from the upstream is 100%, the recovery rate is 85%.

In the processing plant, tailings from the Copper Concentrate Plant are fed into the Pyrite Flotation Plant, where pyrite is extracted as concentrate and sent to Bige Operation via a pipeline, while the final tailings are discharged into the river. In Bige a pond with a depth of 20m was constructed, first filled with pyrite, where the water depth reached 2m, it is then covered with sands and gravels to prevent oxidation of pyrite.

Photograph 4.3 Dredging in Ok Tedi River and East Bank dumping area

Regarding the water quality of the Ok Tedi River, a quick test was conducted at five locations downstream from Tabubil, and no component abnormality was observed. However, the turbidity reaches 880 N.T. U or more even in Bige, which is far beyond the water quality standard of 25 N.T.U, therefore it seems necessary to take some measures.

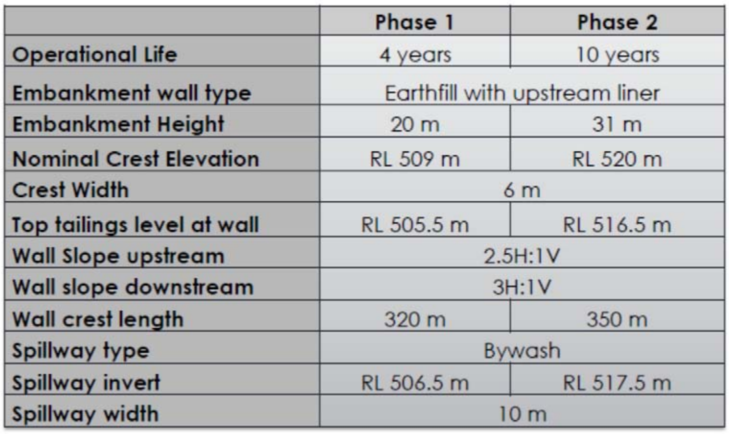
4.5.3 Kainantu Au Mine

In this mine, gold and silver concentrate is produced by the flotation process, and it is exporting to China as concentrate. Therefore cyanide is not used in this mine.

Because the waste rock is all used to fill the cavity after mining, there is no waste rock dump in this mine.

Process tailings after flotation is piped to the tailings dam and is deposited. The tailings dam in Kainantu Mine is the first tailings dam built in the PNG. The embankment is Earthfill type, and the water-impermeable sheet (High-density polyethylene (HDPE) liner) is laid on the upstream side. There are two settling ponds for purifying water accumulated inside the dam and draining it to the river.

Table 4.2 Specification of the tailings dam in Kainantu Mine



	Phase 1	Phase 2
Operational Life	4 years	10 years
Embankment wall type	Earthfill with upstream liner	
Embankment Height	20 m	31 m
Nominal Crest Elevation	RL 509 m	RL 520 m
Crest Width	6 m	
Top tailings level at wall	RL 505.5 m	RL 516.5 m
Wall Slope upstream	2.5H:1V	
Wall slope downstream	3H:1V	
Wall crest length	320 m	350 m
Spillway type	Bywash	
Spillway invert	RL 506.5 m	RL 517.5 m
Spillway width	10 m	

Photograph 4.4 Tailings dam in Kainantu Mine

4.5.4 Hidden Valley Au Mine

Because the tailings dam in Hidden Valley Mine is built in the ridge, there are embankments on both sides of the dam (Main Dam and Saddle Dam). No waterproof sheet is laid on the embankments of this dam, and it is structured to discharge the infiltrated water of embankments quickly. A rough filter material (sand etc.) is formed on the upstream side of the embankment, and large and small gravels on the downstream side, and it is partitioned by a fine grained filter material (Figure 4.3).

Wastewater and tailings from the floating and smelting plants are all discharged to this dam, and the supernatant water from the dam is mostly recycled as the water of the plants. About 10% of the supernatant water from the dam has been subjected to cyanide detoxification treatment and then released to the river in order to control the amount of water inside the dam. The INCO process is used as a method of detoxification treatment of cyanide, and Caro's Acid (Peroxymonosulfuric acid (H_2SO)) is used for treatment of the waste water from the tailings dam before treated water discharge into environment.

Photograph 4.5 Hamata tailings dam (Saddle dam in front, Main dam in the back）

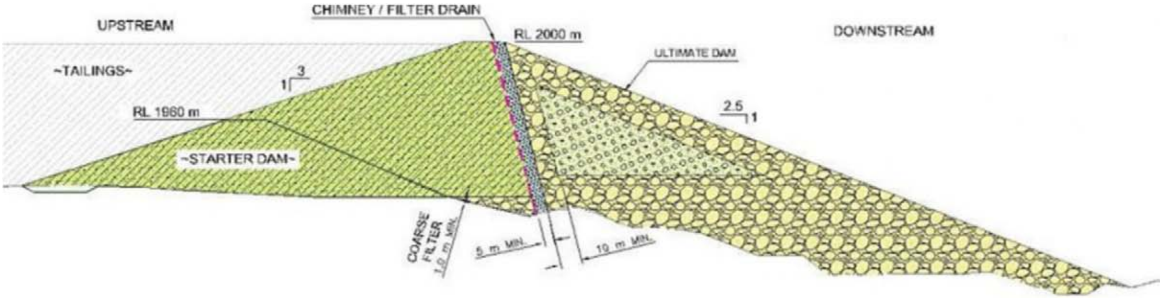


Figure 4.3 Schematic design of the embankment of Hamata tailings dam (Murray et al., 2010)

There are three waste dump areas in all, Hamata pit has Hamata dump, and Hidden Valley pit has two dump areas of Western Section and Neikwiye. At the Western Section and Neikwiye dump areas, as shown in Photograph 4.6, underdrains were constructed in order to drain the upstream fresh water that is not in contact with ore. These underdrain are made of fresh bulk rocks that have not been mineralized and spread over 5 m in thickness.

In addition, for the slope of old dumping area, re-vegetation was carried out in order to prevent erosion caused by rainwater.

Photograph 4.6 Underdrain cover by 5m thick NAF (non-acid forming)

Photograph 4.7 Re-vegetation of waste dump

4.6 Inspection of mine waste management facilities

It will be described below about the inspection of tailings dam and waste dump.

4.6.1 Preparation of inspection manual

In regard to the manual for conducting the inspection, the draft was prepared based on the experience in Japan as follows.

(A) General matters

(1) The general information of a tailings dam should be interviewed on the basis of license and/or statements etc. In addition, the current status of deposition should be comprehended on the drawing.

(2) The amount and disposal methods for each waste category should be interviewed and comprehended.

(3) Capacity and durable years for a dump / dam, and also future installation plan of a dump / dam, should be interviewed.

(4) If mine waste is to be located out of granted mining area, then the location should be granted lease for mining purposes (LMP).

(5) It should be confirmed that the appropriate disposal methods is applying on the basis of their categories and physical properties.

(6) It should be confirmed that the inspector for waste dump / tailing dam is secured on the safety management system.

(7) It should be confirmed that the appropriate disposal method is as approved by MRA and CEPA.

(B) Management conditions

The following items should be confirmed during the inspection.

(1) The inspection is conducted on a daily basis and the results are stated in the safety register.

(2) The frequency of inspections is increased during and after heavy rain or earthquake.

(3) The necessary emergency system is established and the training is continuously conducted.

(4) Maintenance and storage of first aid tools are appropriate.

(5) Rainfall is regularly measured.

(6) The measurement facilities for infiltration water level, displacement and water level of dam are appropriate and well maintained.

(7) The bottom conduit is periodically inspected.

(C) Document Management

The following items relating to document management should be confirmed during the inspection.

(1) The deposit amount of waste and tailings has been recorded chronologically.

(2) Various measurement records have been archived properly.

(3) The inspection records of a bottom conduit have been stored properly.

(4) The construction records of a waste dump and tailing dam have been archived.

(5) Records of any maintenance carried out on the waste dump associated facilities such as pipelines and processing facilities

Prior to the inspection, it is effective to compile the specification of the tailings dam in the form as shown in Table 4.3.

Table 4.3 Sample format of Specification of tailings dam

Specifications of Tailings Dams (____________ Mine)

Date: [/ /]

Name of dam		
Type		
Date of construction permit		
Starting date		
Catchment area		m^2
Dumping area for full capacity		m^2
Permitted volume		m^3 (t)
Accumulated volume		m^3 (as of)
Type and structure of embankment		
	Permitted height	
	Width of dam crest	
	Length of dam	
	Gradient of slope	[outer-slope] 1 : , [inner-slope] 1 :
Bottom set conduit for main stream	Type/Structure	
	Length	
Bottom set conduit for subsidiary stream	Type/Structure	
	Length	
Spare water exclusion facility	Type/Structure	
	Length	
Emergency facility	Type/Structure	
	Length	
Hillside channel	Type/Structure	
	Length	
Driftwood stop	Type/Structure	
	Height	
Designed reinfall intensity	100 year probable rainfall : mm/hr	
	200 year probable rainfall : mm/hr	
Remarks		

4.6.2 Checkpoints for waste dump and tailings dam

Concrete checkpoints in the inspection of the tailings dam and waste dump are listed based on the experiences in Japan as follows;

[Tailings dam]

(A) Measuring the amount of deposition

(1) The amount of tailings to be sent to the tailings dam has been measured in the dressing plant etc.
(2) The measurement method of above (1) is appropriate.
(3) Concentrations of tailings etc. to be sent to the tailings dam are periodically measured in the dressing plant etc.
(4) The measurement method of above (3) is appropriate.

(B) Tailings pipeline

(5) Inspection passage is provided along the tailings pipeline.
(6) There is no damage and leaking as well.
(7) Protective equipment are provided in places where there is a risk of damage to pipes due to external forces and falling rocks.
(8) There is the sign of location where the pipe is buried.

(C) Methodology of deposition

(9) The tailings pipeline is located along embankment properly.
(10) The discharging tailings is conducted towards upstream.
(11) The discharging of tailings is conducted evenly over the entire length of the embankment.
(12) The level of dam surface is uniform in entire field.
(13) There are no anomalies such as sinkhole, crack, etc. in the dam nearby embankment.

(D) Embankment

(14) In case of covering the internal slope surface with waterproof sheet, no damage or poor bonding is seen on the sheet.
(15) If the water impermeable sheet is not affixed to the internal slope embankment, and water and embankment are in direct contact with each other, a preventing layer of infiltration water such as clay is provided in embankment.
(16) There are no anomalies such as subsidence, crack, seepage etc. at the slope and top of embankment.
(17) There is no scouring along the slope of embankment by raining.
(18) Hydroseeding etc. is being carried out as a measure to prevent leakage by rainwater etc. on the external slope surface.
(19) Animals do not use as a nest after hydroseeding. There is no root excavation by animals.
(20) There is no land slide or swelling around edge of the slope.
(21) There are no changes on amount of seepage, water quality and turbidity.
(22) There is no breakage, deformation, etc. in the infiltration water level measuring pipe.
(23) Damage, deformation, etc. are not seen in the surveying pile and the displacement measuring

device.

(E) Drainage facilities for water outside the dam

(24) A safe inspection aisle is installed and maintained for open channel.

(25) There is no possibility that the open channels will be damaged by the collapse / outflow of the ground on which they are installed.

(26) Preventive measures are applied to places where there is a risk of clogging due to collapse and outflow of the slope on the upstream side of the open channel.

(27) Prevention measures are applied to places where there is a danger of scouring the open channel by hydraulic jump at steep slope.

(28) There is no anomaly such as fracture, damage, water leak, embedding, etc. in open channel.

(29) Open channel has been maintained without any disturbance by sand, soil, falling leaves, etc.

(30) In the conduit, driftwood and sediment stopping are provided upstream of the mouth.

(31) Driftwood and sediment stops have been maintained without leaving driftwood and sediment.

(F) Drainage facilities for water in the dam

(32) No abnormality is found in pumps and drain pipes of forced drainage facilities.

(G) Emergency drainage

(33) Emergency drainage can be operated at any time.

(34) Emergency drainage is installed in the rock. Alternatively, it is made of a material which is not scoured such as made of concrete.

[Waste rock dump]

(A) Embankment

(1) The embankment is constructed in accordance with the plan.

(2) Proper construction materials are used for embankment. (Rocks which are weathered easily and clay are not used)

(3) There is no anomalies such as subsidence, crack, etc. at the slope and top of embankment.

(4) There is no land slide or collapse around edge of the slope.

(5) There is no scouring along the slope of embankment by raining.

(B) Situation of deposition

(6) Deposition has been conducted properly.

(6-1) Thickness is properly adjusted in horizontal layered deposition.

(6-2) Proper compaction method is applied.

(7) Waste rocks with many gravels have been deposited on the downstream side, and those with less gravels has been deposited on the upstream side.

(8) The slope of deposition is formed in accordance with the plan. ex) dipping of slope, location and width of berm.

(9) There is no anomaly such as subsidence, crack, etc. at the slope of deposition.

(10) There is no water leakage or seepage at the slope of deposition.

(11) Planting in the waste dump is growing well.

(12) (If the drainage is prepared) There is no anomaly such as subsidence, crack, etc, in the drainage.

(13) (If the drainage is prepared) Deposition of soil and sand are not observed in the drainage.
(14) (If the monitoring system of displacement is prepared) The monitoring system of displacement is functioning normally.

4.6.3 Inspection OJT

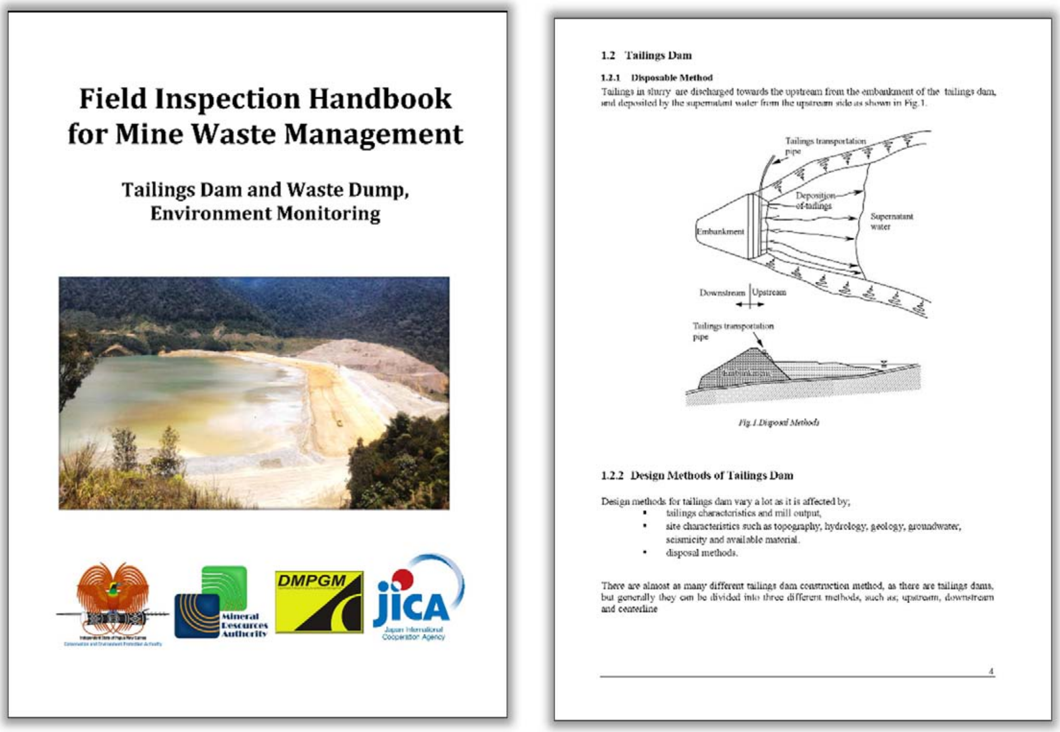
Using the draft version of the inspection manual and the checklist, Inspection OJT was conducted in Sinivit Au Mine, Ok Tedi Cu Mine, Kainantu Au Mine and Hidden Valley Au Mine in PNG, Oppu Cu Mine in Aomori Prefecture, Hosokura Zn Mine in Miyagi Prefecture and Ikuno Cu-Ag Mine and Akenobe Cu-Sn Mine in Hyogo Prefecture. The target person is mainly the person in charge of the Environmental Protection Wing of CEPA and the Regulatory Operation Division of MRA.

During OJT implementation, the manual and checklist of inspection were reviewed.

Photograph 4.8 OJT in Hidden Valley Mine

4.6.4 Preparation of field inspection handbook

The field inspection handbook is prepared to efficiently conduct onsite inspections and to educate new staff. This handbook contains inspection manuals, tailings dams and waste dump checklists, explanations of terms related to mine waste management facilities, and so on.



Field Inspection Handbook for Mine Waste Management

Tailings Dam and Waste Dump, Environment Monitoring

Mineral Resources Authority

DMPGM

JICA
Japan International Cooperation Agency

1.2 Tailings Dam

1.2.1 Disposable Method

Tailings in slurry are discharged towards the upstream from the embankment of the tailings dam, and deposited by the supernatant water from the upstream side as shown in Fig.1.

Fig.1 Disposal Methods

1.2.2 Design Methods of Tailings Dam

Design methods for tailings dam vary a lot as it is affected by;

- tailings characteristics and mill output,
- site characteristics such as topography, hydrology, geology, groundwater, seismicity and available material.
- disposal methods.

There are almost as many different tailings dam construction method, as there are tailings dams, but generally they can be divided into three different methods, such as; upstream, downstream and centerline

4

Figure 4.4 Field Inspection Handbook

4.6.5 Implementation system of inspection of mining waste management facility

As mentioned above, MRA and CEPA are conducting inspections related to mining waste. MRA is primarily responsible within the tenement area and CEPA is outside the mining area as the responsibility. MRA has 11 inspectors and regularly inspects every operating mine in PNG quarterly. On the other hand, there are only four persons in charge of inspection at CEPA, and since they also concurrently serve various tasks, sufficient inspections have not been carried out at present. For this reason, it is necessary for CEPA to conduct inspections including the patrol of the mixing zone in Figure 4.5, with the cooperation of MRA until the number of CEPA personnel is substantial.

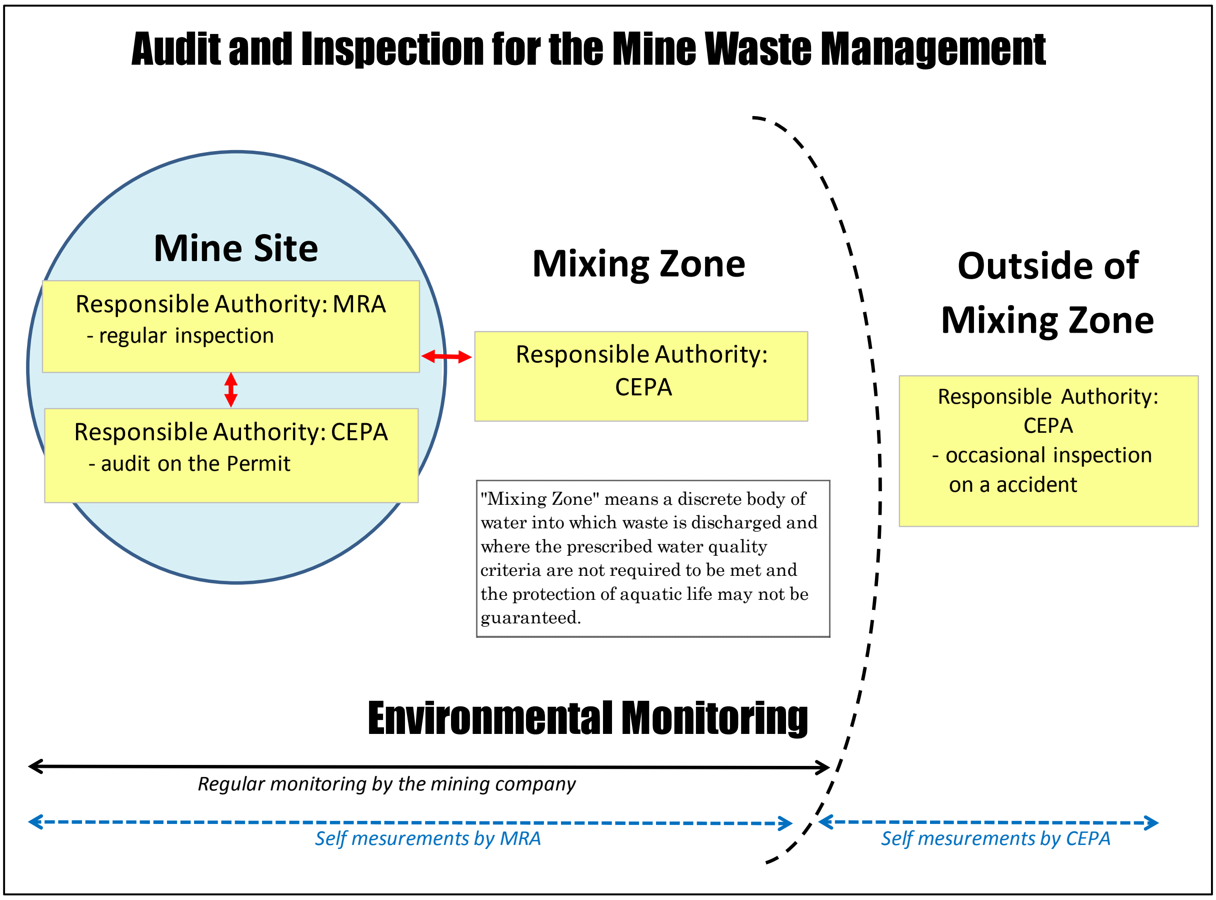


Figure 4.5 Current status of audit and inspection for the mine waste management

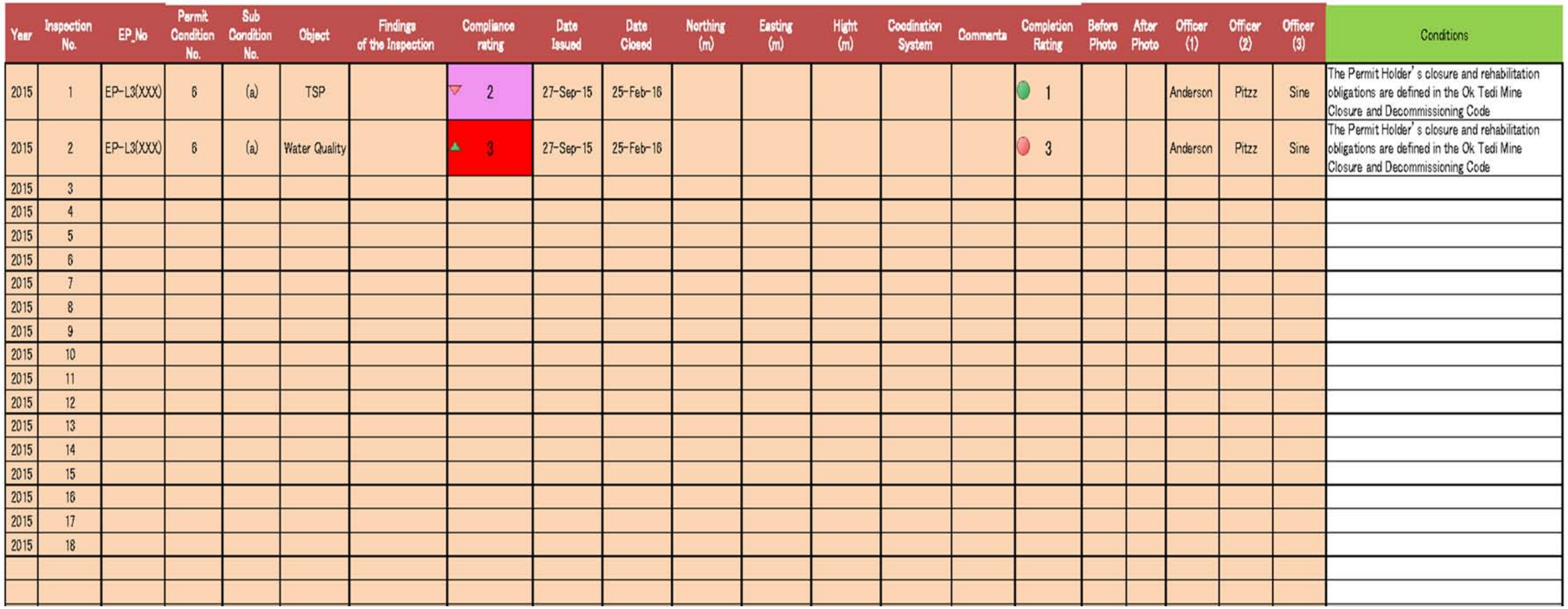
4.6.6 Annual plan of inspection of mining waste management facility

Since MRA inspects quarterly in the area of tenement, this is considered sufficient for the area. On the other hand, we propose that inspections be conducted twice to four times a year for any mine outside the mining area that CEPA is in charge of. It is also important to monitor the quality of water especially in the mixing zone and also recommend making a simple analysis by pack test at the time of inspection and trying to grasp pollution signs.

4.6.7 Storage and sharing system of inspection reports

In the MRA, inspection reports on mining facilities and operations compiled by inspectors are kept in the library as electronic files, but the systematic implementation of database of important matters of the inspection results and concerned matters are not systematically implemented yet. Meanwhile, the report prepared by CEPA is stored as a printed matter without being organized in a library, and it is not in a situation where anyone can easily browse it. Since the mine waste management database system constructed in this project has a menu to store the inspection results, we would like to recommend that we keep the inspection results in the database system in the future. The items to be entered in the database and the form are shown in Table 4.4.

Table 4.4 Table of data entry form for inspection results



Year	Inspection No.	EP_No	Permit Condition No.	Sub Condition No.	Object	Findings of the Inspection	Compliance rating	Date Issued	Date Closed	Northing (m)	Easting (m)	Hight (m)	Coodination System	Comments	Completion Rating	Before Photo	After Photo	Officer (1)	Officer (2)	Officer (3)	Conditions
2015	1	EP-L3(XXX)	6	(a)	TSP		▽ 2	27-Sep-15	25-Feb-16						● 1			Anderson	Pitzz	Sine	The Permit Holder's closure and rehabilitation obligations are defined in the Ok Tedi Mine Closure and Decommissioning Code
2015	2	EP-L3(XXX)	6	(a)	Water Quality		▲ 3	27-Sep-15	25-Feb-16						● 3			Anderson	Pitzz	Sine	The Permit Holder's closure and rehabilitation obligations are defined in the Ok Tedi Mine Closure and Decommissioning Code
2015	3																				
2015	4																				
2015	5																				
2015	6																				
2015	7																				
2015	8																				
2015	9																				
2015	10																				
2015	11																				
2015	12																				
2015	13																				
2015	14																				
2015	15																				
2015	16																				
2015	17																				
2015	18																				

4.7 Recommendation

Following five items are proposed on future efforts to establish the enforcement system of mine waste management.

1) Enhancement of inspection personnel of CEPA

The project recommends CEPA for placing 2 inspectors in each of the four provinces and implementing budgetary measures for that in order to manage the mine waste in mines scattered throughout the country and preserve the environment.

2) Establishment of a cooperative system between CEPA and MRA

Once environmental problems occur, it will be serious, so it is necessary to take measures to prevent such problems. For this purpose, close cooperation between CEPA and MRA is indispensable. Especially, it is necessary to conduct inspections including patrol of mixing zone with cooperation of MRA until personnel of CEPA is improved.

3) Implementation of Quick Water Quality Testing

It is important to monitor the quality of water especially in the mixing zone. It is recommendable to conduct a quick analysis by "PACKTEST" on site at the time of inspection and try to grasp pollution signs.

4) Annual plan of inspection of mining waste management system

Since MRA inspects quarterly for the tenement area, this is considered sufficient for the area. On the other hand, we propose that inspections be conducted twice to four times a year outside the mining areas that CEPA is in charge of.

Table 4.5 Implementation system of inspection

Object Area	Responsible Authority	Frequency (/year)
(1) Mine site and tenement area	MRA	Quarterly
(2) Mixing zone	CEPA (support from MRA is required until CEPA operates with full strength manpower and funding.	Quarterly
(3) Outer side of (1) and (2)	CEPA	Quarterly or twice

5) Storage of inspection report of CEPA in database system

Since the database system constructed in this project has a menu to store the inspection results, CEPA's inspection results will also be saved in the database system in the future.

6) Utilization of inspection manual and checklist

The inspection manual and the checklist prepared in this project are standard ones based on experience in Japan. The project propose to utilize them during inspections after revising or adjusting according to the circumstances of each mine.

Chapter 5 Development of the Mine Environment Database

5.1 Establishment of the Sub-Working Group

The Sub-working group was established to develop the Mine Environment Database (DB). The members comprises Officers from the EP Wing (EPW) and Policy Wing in CEPA (i.e Officers in charge of regulating Mines and the GIS Manager), relevant Officers from Geological Survey Division in MRA and JICA Experts as shown in Table 5.1 as below.

Table 5.1 Members of the sub-working group

Organization	Name
CEPA	Pitzz Murphy (Mr)
	Anderson Anjo (Mr)
	Gerard Natera (Mr)
	Lua Idau Marawa (Mr)
MRA	Wifred Moi (Mr)
	Fiona Kaumu (Ms)
JICA Technical Team	Kazuyuki Kadoshima (Mr)
	Ippei Takeda (Mr)
	Kosuke Ishiyama (Mr)

5.2 Review of existing DB system and relevant information

For the development of the Mine DB in CEPA, at first, the current status of managing various reports submitted by mining operators, their internal documents and various DBs had been investigated in CEPA and MRA. And also their current situations and needs of utilizing DBs were clarified for considering the issues to develop the Mine Environment DB in CEPA.

5.2.1 Status of Information Management in CEPA

(1) Status of Information Management in EPW

CEPA has been receiving environment assessment reports and annual (quarterly) environment reports submitted by the business operators, and storing and/or managing the audit reports of activities, environment permit (public documents) and relevant internal documents. These documents are basically paper-based information (some of data are stored as E-copy submitted by the companies). When a document is received from the business operators or other relevant organizations, the document is endorsed by stamp of reception for keeping a record and then passed to the responsible officer for filing. Currently, these documents have been stored in a designated storage room which is in a disorderly fashion.

Some of the issues faced here are that the electronic data accepted from clients or created by officers in charge is stored in personal computers dispersedly, so these kinds of data are not sharable at all. In addition, the reports submitted by clients to EPW are all slightly different in format from each other, and it has been one of long-standing and big challenges for EPW to manage so much information with the limited man-power and budget.

(2) Status of GIS in CEPA

GIS system is currently managed by Spatial System & Data Branch of Environmental Science & Information Division in Policy Coordination & Evaluation Wing, with limited manpower with Mr. Gerard Natera (as GIS Manager) and Mr. Joseph Jure (as Senior Officer - Sustainable Indicators Branch). Cooperative work with EPW is almost nil so far, but the team is ready to support EPW in terms of DB construction if requested.

- Hardware
  - Two servers, for GIS and Data storage respectively, are stored in Server room, awaiting installation of Windows Server2012 and ArcGIS Desktop Single-use Licenses (Advance, Basic with extensions Spatial Analyst, Data Interoperability and 3D View)
  - Workstation's Operation system is currently Windows XP or Windows 7
  - Tenement data (2009-2012) provided by MRA is held. The data transfer between CEPA and MRA is via physical storage, not online.
- ArcGIS
  - 4 licenses (Spatial Analyst, Advanced, 3D View and Arc View) are currently held.

5.2.2 Status of Information Management in MRA

(1) GSD & Tenements Management DB System

The GSD DB system consists of 3 layers, one is the Internal Local DB in each section of Geological Survey Division, the second one is on MRA intra-network powered by "ArcGIS for Server" on Intra servers (managed by IT Section) and the third one is on the Cloud computing external server (managed by ESRI).

This system was established by a System Development Firm based in South Africa through funding by EU. Maintenance works of System have been done remotely and occasionally by the same company in South Africa upon request via e-mail or Skype. Payment for such services are borne by MRA.

The GSD DB and Tenements management DB systems are both independent, because tenement information includes confidential matters (payment and taxation information etc.). So, the suitable information in the Tenements DB should be manually imported to GSD DB.

The GSD DB system consists of seven independent DBs and their spatial information is managed by ArcGIS for Server with seamless access capability. And, GSD DB system currently consists of seven DBs such as surface geology, geochemical, steam geochemistry, geothermal, hydrogeology and survey reports etc. Their DBs can be accessed via GSD frontend application, and maintained by SQL server.

Currently, surface geology and mining and mineral DBs are open for public, and other DBs are now developed or pending. In GSD, the result of geological survey were manipulated and digitized by ArcGIS, and uploading onto DB with the approval of responsible managers.

Tenements management system maintained by South African IT company records current status of mining activities in tenements, amount of production, taxation data, various reports and communications with company, without safety and inspection information. MRA personnel and company user access thought Frontend interface system, as Public Map & Online Transaction Portal on MRA website. The hardcopy reports are converted to PDF and/or Excel file etc.

Companies as mine operators can submit their applications and reports as hardcopy and/or E-copy. And the shape file data (polygon of tenement land shape etc.) is uploaded by company through Transaction Portal applied MRA. MRA can provide tenement details, production data and GIS data (as shape files and map data), except for confidential data (tax, payment etc.).

(2) Situation of information management in Library of MRA

MRA's library consists of 2 floors (1F: reports, aerial photographs, searching/printing service, 2F: various archives). Reports are stored in the box by project name. Reference numbers for each archive are put on them and shown on the box. Digitized reports were marked as "Scanned/PDF". Lots of reports have been already manipulated so far, and some remaining reports are serially scanning. The electric data is stored on the server. Recently, companies are submitting their reports both as hard- and electric-copies. Library has managed a biblio-DB operated by MS Access and already captured by FlexiCadaster system.

5.2.3 Task of database development

At First, it is necessary to recognize and classify various reports and documents thought the CEPA's working flow (environmental impact assessment, environment permit, environment management plan, environment management and monitoring plan). Mine environment DB is designed based on this identification and classification.

To establish the data management process (protocol) for handling and uploading the mine waste and environment data onto DB should be for proper and operator-friendly input/output works. And, it is necessary to establish a management system / procedure that can be managed and operated under the current situation of CEPA.

5.3 Reviewing and identification of necessary items for developing DB

The items, which should be registered onto mine environment DB, are decided based on work flow of mine environment regulatory system.

(1) EIA (Environment Impact Assessment)

- EIA-related documents

  Title, Document type (EIA, EIS, EIR, Other), Data created, Date of receipt, Comment, Electronic files
- EIA baseline data
  - Pre-development river water data of quality analyses

    Chemical analyses value, Sampling location (Easting, Northing, Height), Comments

(2) EP (Environment Permit)

- EP

  EP Number, Authorization date, expiration date, Permit, Electric files
- Condition

  Condition Number, Condition, Comments
- Discharge Condition

  Location name, Location information (Easting, Northing), Permit volume, Comments
- Extract Condition

  Location name, Location information (Easting, Northing), Permit volume, Comments
- Discharged water quality (Domestic, Fresh water, Seawater)

  Location name, Location information (Easting, Northing), Permit chemical analysis value, Comments
- ML

  ML Number, Comments.

(3) EMP (Environment Management Plan)

Title, Author, Data created, Date of receipt, Comment, Electric files

(4) EMMP (Environment Management Monitoring Plan)

- EMMP

  Title, Author, Data created, Date of receipt, Comment, Electric files
- Discharge Limit

  Location name, Location information (Easting, Northing), Limit volume, Comments
- Extract Limit

  Location name, Location information (Easting, Northing), Limit volume, Comments
- Discharge water quality limit (Domestic, Fresh water, Seawater)

  Location name, Location information (Easting, Northing), Limit chemical analysis value, Comments

(5) AER/QER (Annual/Quarter Environment Report)

Title, Author, Data created, Date of receipt, Comment, Electric files

(6) Environment Monitoring Data

- Water quality data

  Reference document name, Reference document type, EP condition, Monitoring point name, measurement date, pH, Concentration of chemical types, Comments
- Discharge Volume

  Reference document name, Reference document type, Monitoring point name, Period, Volume, Comments

- Waste dump volume

  Reference document name, Reference document type, Monitoring point name, Period, Volume, Comments
- Rainfall

  Monitoring point, Date, Rainfall, Comment
- Other monitoring information

  Reference document name, Reference document type, Monitoring point name, measurement date, Period, Value, Unit, Measurement name, Comments
- Monitoring location information

  Location name, Easting, Northing, Height, Zone, Comment
- Waste dump location information

  Waste dump location name, Easting, Northing, Height, Zone, Comment

(7) Audit (Environment Audit)

- Environment Audit Report

  Title, Date of receipt, Consultant, Comments, Electric files
- Internal documents

  Title, Date of receipt, Author, Comments, Electric files
- Other relative files

  Title, Date of receipt, Author, Comments, Electric files
- EIP

  Title, Date of receipt, Consultant, Comments, Electric files

(8) INS (Environment Inspection Reports)

- Environment inspection reports

  Title, Date of receipt, Author, Comments, Electric files
- Internal documents

  Title, Date of receipt, Author, Comments, Electric files
- Other relative files

  Title, Date of receipt, Author, Comments, Electric files
- Notification

  Title, Date of receipt, Author, Comments, Electric files
- Inspection List

  Inspection Number, Year, Relative EP No. and condition No., Find of inspection, Compliance Ratio, Date issued and closed, Location information, Comments, Completion Ratio, Officer, Before and After photos.

(9) General information of mines

- General information

  Operating status, Location area, Mine name, Overview, Easting, Northing, Commodity, Scale

- Other relative files

Title, Date of receipt, Author, Comments, Electric files

5.4 Holding the seminar related to mine environment DB (as part of the Sub-working group meeting)

It is showed implementation statue of the Sub-working group meeting for mine environment DB.

		Date	Contents
2nd on-site work in PNG	1st	2017/1/30	・Consideration to item of database
	2nd	2017/2/7	・Presentation prototype database and consideration to add items. ・Consideration the relation with GIS
	3rd	2017/2/13	・Consideration how to input/output database and management electronic files. ・To request test imputing for database and consideration how to discuss until next on-site work.
1st Short-term training in Japan		2017/6/12	・Introduction to overview of prototype database. ・Consideration to add items (Inspection and Audit) for database. ・Introduction how to input database and presentation the manual. ・Introduction how to relate GIS.
3rd on-site work in PNG	1st	2017/8/29	・Presentation and consideration prototype database and manual (Add Inspection and Audit) ・Consideration the database management (Person in charge, roles, and workflow)
	2nd	2017/9/5	・Decision database management (Person in charge and roles,) and work flow (Input/output data, restore, back up, updates). ・Consideration and decision the folder structure and permission on the NAS（Network Attached Storage） for database. ・Decision to install NAS on CEPA's LAN. ・Decision the way of input for Excel data sheet from person in charges.
	3rd	2017/9/11	・Reporting the set up NAS and database. ・Requesting the management of NAS and database for person in charge. ・Introduction data input sheet for mine officer and requesting data entry and consideration the forms. ・Request data entry for data sheet and send data sheet until next on-site work. ・Confirmation the work about consideration database and data sheet. ・Confirmation to request re-setup NAS after moving CEPA.
4th on-site work	1st	2018/2/13	・Check the working of DB construction and discuss about image of results at project completion

		Date	Contents
4th on-site work	2nd	2018/2/19	・Report to modify DB (Add environment monitoring data table and forms ,etc.) ・Report to entry environment monitoring data (Lihir mine). ・Lecture about how to entry environment data sheets. ・Extract data from DB for analysis and GIS use. ・Recommend to use QGIS for use by other section in CEPA.
	3rd	2018/2/23	・Report and discuss about DB construction and operation policy. ・Discuss to request about DB and operation of DB.
	4th	2018/3/6	・Collect and discuss geographical data. ・Discuss to maintain DB and continue to update DB after this project.
5th on-site work	1st	2018/7/4	・Check DB entry so far. ・Decide how to be DB entry by the casual. ・Discuss recommendation of DB and its management in final report.
	2nd	2018/7/13	・Discuss and decide inspection list data entry forms.

5.5 Establishment of an appose regime for DB management

5.5.1 DB structure

(1) Overview of Hardware

In EPW of CEPA, each mine regulatory officers have been keeping working data and e-copy documents on their own personal computers and their data is not shared properly. So, the NAS (Network Attached Storage) is installed and connected with CEPA's LAN.

Table 5.2 Specification table of NAS installed in CEPA

Model	TS-131P
Maker	QNAP
Data capacity	2TB

Photograph 5.1 Status of NAS set up in CEPA

(2) Software and structure of folders and files

DB has been built by MS-Access that is installed on PCs of officers in charge, CEPA. The data sheets for storing and processing environment data has been established by MS-Excel.

Figure 5.1 shows folder structure of DB. And Table 5.3 shows the permission status of NAS server. In the folder "01_MasterDB", main database file and electronic data that is classified by each project (mine) basis. This folder is configured to be able to read and write by IT/GIS Manager, Data Controller and Administrator.

The folder "02_ReferenceDB" is duplicate of the folder "01_MasterDB", the general user（EPW-user）can only read the files in this folder. The security of the main database files can be controlled by restriction of data access only to allow general users to read a duplicate database files.

The folder "03_Work files" is configured to be able to read and write by all users in order to save the data sheets and share the files among the mine officers.

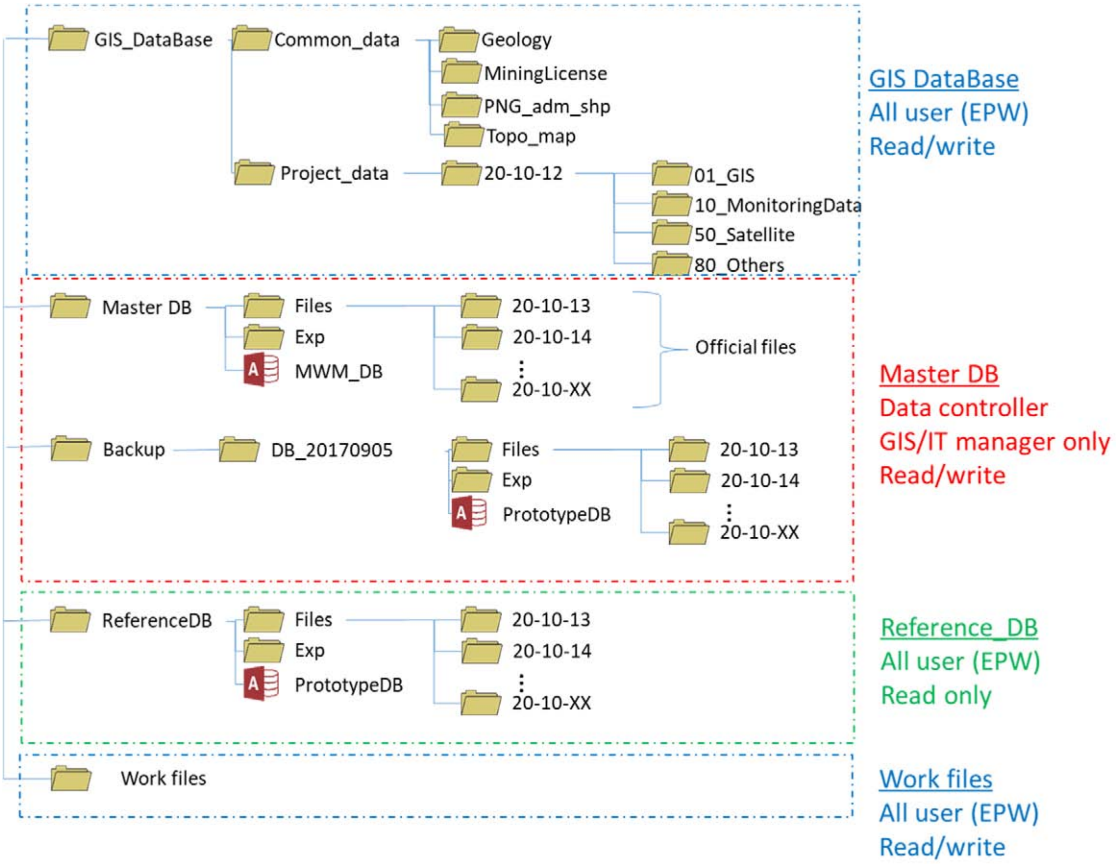


Figure 5.1 Folder structure of NAS server

Table 5.3 Permission statuses of folders on NAS server

User-Group	User ID	Password	01_MasterDB	02_ReferenceDB	03_Workfile	Backup
GIS_IT_manager	Gerard	gerard	R/W	R/W	R/W	R/W
Data_controller	Anderson	anderson	R/W	R/W	R/W	R/W
EPW-user	EPW-user1	epw-user1	×	R0	R/W	×
	admin	admin	R/W	R/W	R/W	R/W

* R/W : Read and Write access, RO : Read only, × : not allow to access files

Electric documents are stored in each project folders in “1_MasterDB¥Files” and their file names are changed by the following rules.

- The filename format is “20-10-##_@@@(2 to 4 digits)_(title or original file name)”
- "20-10-##" means the file number code for activities or project of mining sector, and is used in Sub-division ENFC, CEPA.
- "@@@" should be an abbreviation code as follows;
  EIA : Environment Impact Assessment
  EP : Environment Permit
  EMP : Environment Management Plan
  EMMP : Environment Management Monitoring Program
  AER : Annual Environment Report
  QER : Quarter Environment Report
  Audit : Environment Audit Report

5.5.2 Dedicated Personnel and the roles for database management

(1) Person in charge of mines

Person in charge of mine accept, check and evaluate annually/quarterly environment report and audit report from mines etc. And if the report is paper-based, it would be converted to electronic data. Person in charge of mine accept and check Environment Monitoring Datasheet that has been sent from mine operator. And Person in charge of mine (Officer) entries Inspection result datasheet.

Person in charge of mine send the filled datasheet with relevant electric files to Data Controller. The general user can access database and search information on database. If they need to add items etc., they can request Data Controller to do it.

(2) Data Controller

Data Controller can upload data sheets onto the database. And the electric document that is accepted from person in charge of mine would be registered database and stored in the predetermined folder by Data Controller too.

In the case to add items for database, Data Controller would consider and compile with requests made by general users and also by IT/GIS Manager sometimes. In the case of having a bug on database, Data Controller might have to request IT/GIS Manager to remove it and to fix it.

(3) IT/GIS Manager

IT/GIS Manager would make backup files and duplicates of the database, and fix a problem as restoring duplicates if necessary. And also the IT/GIS manager can improve the database upon receiving the request made by general users and/or Data Controller.

(4) Director

Director is the Administrator responsible for supervising the entire database system, and conducts business duties to personnel in charge of each mine and data controller. In addition, Director requests the IT/GIS administrator to appoint the data controller from members of relevant sections.

5.6 Populating data into a database and validating data

5.6.1 Data entry sheet

Data entry sheet is filled mainly with environment monitoring data (water quality, extract volume, tailing volume etc.) that are obtained from various reports of each project and audit results. And the sheet records sampling location information and referenced document information. By using this entry sheet, data entry operations of each person in charge of mine would be facilitated.

Inspection List Datasheet is filled with inspection result information (Findings of inspection, compliance ratio, comment etc.). By using this datasheet, data entry work of relevant officers would be facilitated too.

5.6.2 Database

Database is established for managing / manipulating various information derived from annual/quarter reports, internal and official documents, basic information of mine and environment monitoring data from data entry sheets. The database structure is shown at Figure 5.2.

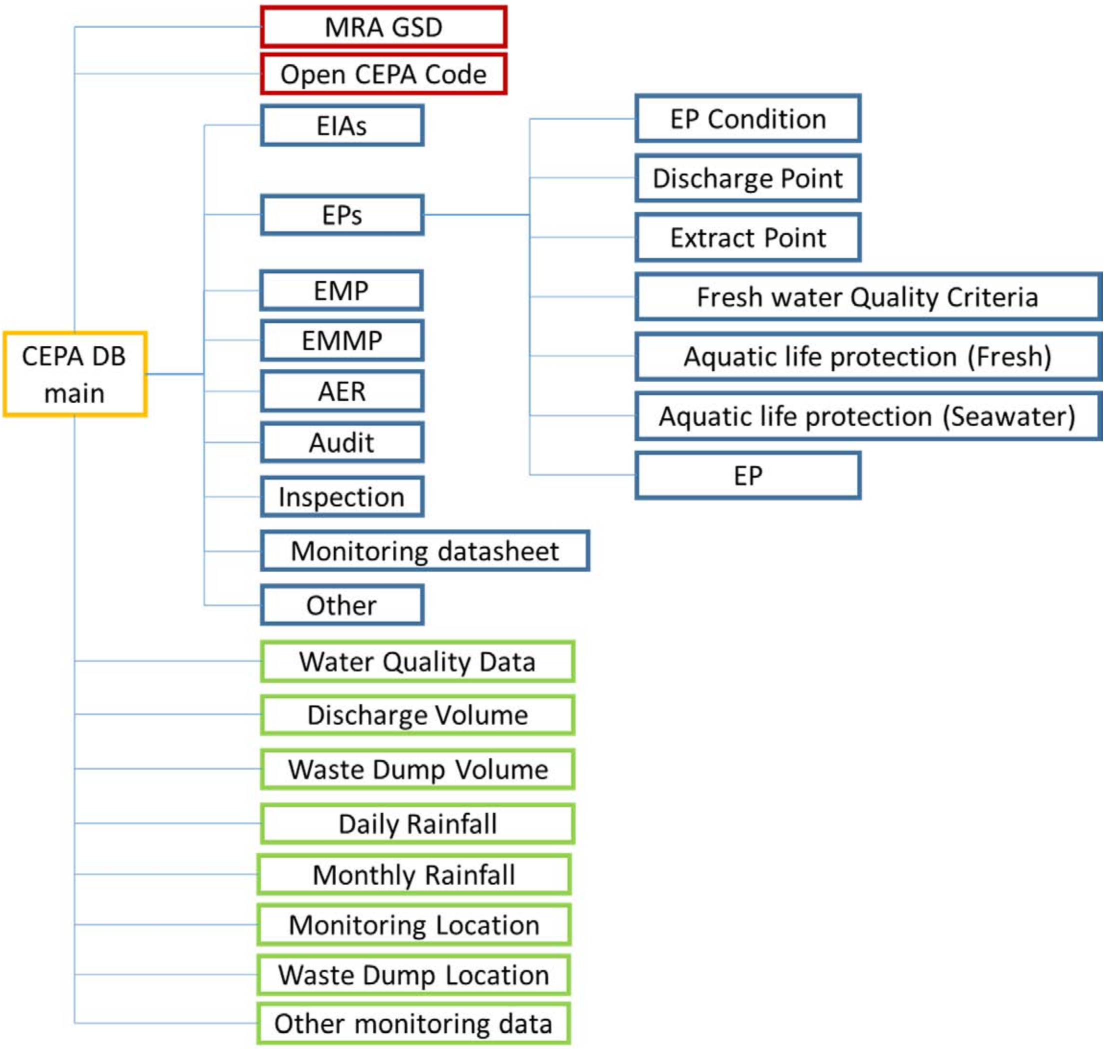


Figure 5.2 Database structure

5.6.3 Progress of data entry into a database

The data entry campaign for the information of mine wastes and environmental situations in each major mines has been started in CEPA since February 2018 when the data entry sheets had been established and agreed with SWG members. The current progress of data entry is shown on Table 5.4. Because of the limited manpower of the section in charge in CEPA, the project saw little progress in terms of completion of the data entry. In order to turn around the current situation for data entry works and utilizing DB, the proper arrangement of full-time staffs in CEPA has been eagerly expected.

In addition, CEPA has been trying to compile the data not only for major active and abundant mines but also the exploration projects and small scale mines. The selected projects for their compiling campaign are shown in Table 5.5.

Table 5.4 Progress of data entry for major mines

CEPA_CODE	Title	Mining operation information from MRA	EIA	EP (Environmental Permit)		EMP	EMMP	AER(QER)	Monitoring datasheet	Audit result	Inspection result
			Data Entry	PDF	Data Entry	Data Entry	Data Entry	Data Entry	Data Entry	Data Entry	Data Entry
Major Mines											
ENFC:20-10-03	OK Tedi Gold Mining Project	*received*	-	uploaded	completed 2 documents	-	-	working	-	-	-
ENFC:20-10-06	Porgera Project, Barric (Niugini) Ltd.	*received*	-	uploaded	completed 2 documents	-	-	working	completed 2016	-	-
ENFC:20-10-09	Ramu Chromite, Nickel and Cobalt	*received*	-	uploaded	working	-	-	working	-	-	-
ENFC:20-10-12	Lihir Island Gold	*received*	working	uploaded	completed 2 documents	working	working	working	completed 2015-2017	-	-
ENFC:20-10-16	Hidden Valley Gold Project(Morobe)	*received*	working	uploaded	working	working	-	working	-	-	-
ENFC:20-10-19	Tolukuma Project-Central Province	*received*	-	uploaded	working	-	-	-	-	-	-
ENFC:20-10-22	Simberi Gold Project Inception Report (New Ireland)	*received*	-	uploaded	working	-	-	working	-	-	-
ENFC:20-10-26	Kainantu Gold Project-EHP	*received*	-	uploaded	working	working	-	-	-	-	-
ENFC:20-10-50	Simberi Expansiton Mine-3.5 Mt/a Qxide Expansion Project Kavieng, New Ireland Province, St Barbara and Allied Gold	*received*	-	-	-	-	-	-	-	-	-
ENFC:20-10-68	Wafi-Golpu Mining Project, Wau-Bulolo District, Morobe Province, Morobe Mining Joint Venture (MMJV)	*received*	-	uploaded	working	-	-	working	completed 2017Q1	-	-
ENFC:20-10-42	Mt.Sinivit Gold Project ENB(New Guinea Gold Ltd.)	inquiring	working	uploaded	working	working	working	working	-	-	-

EP: Environmental Permit
EMP: Environmental Management Plan
EMMP: Environmental Management and Monitoring Plan
AER: Annual Environmental Report
(QER): Quarterly Environmental Report

Table 5.5 Progress of data entry for exploration projects and small scale mines

CEPA_CODE	Title	Activity information from MRA	EP (Environmental Permit)	
			PDF	Data Entry
Exploration and Small Scall Mining Activities				
ENFC:20-10-05	Frieda River Project (Xtrata Copper)	inquiring	uploaded	working
ENFC:20-10-10	Sand & Gravel Extraction - Goldie & Aiwick Rivers	inquiring	uploaded	working
ENFC:20-10-34	Solwara 1 Project, Bismark Sea, Nautilus Minerals	inquiring	uploaded	working
ENFC:20-10-40	Tamo Alluvial Mining Project - East Sepik Province,(National Gold (PNG) Ltd)	inquiring	uploaded	working
ENFC:20-10-62	Frotier Copper PNG Ltd., Mt. Andewa and Mt. Schrader, WNB Province	inquiring	uploaded	working
01-0001	AML 591 (Managed by Akin Soap Sion)	inquiring	uploaded	working
01-0002	AML 643 Mechanized Mining (Managed by Martin Kilimbi)	inquiring	uploaded	working
01-0003	AML 752 Mechanized Mining Project (Managed by Jimmy Kasumbi)	inquiring	uploaded	working
01-0004	AML 755 - 798, Angoram District of East Sepik Province (Managed by Kevin karika and Kenny Muwom)	inquiring	uploaded	working
01-0005	AML 768, 769, 770, 771, 772, 773 and 774 (Managed by Makru Alluvial Gold Mining Limited)	inquiring	uploaded	working
01-0006	AML 799-804 (Managed by Willie Lalai & Kila Muduka)	inquiring	uploaded	working
01-0007	Arume Prospect Area (Managed by Canopus No. 83 Limited)	inquiring	uploaded	working
01-0008	Black Cat Alluvial Mining Project (Managed by Levi Ileng)	inquiring	uploaded	working
01-0009	Black Cat Alluvial Mining Project (Managed by Migel Kumbe)	inquiring	uploaded	working
01-0010	Black Cat Alluvial Mining Project (Managed by Thomas Wana)	inquiring	uploaded	working
01-0011	Collingwood Drill Project (Managed by Niugini Nickel Limited)	inquiring	uploaded	working
01-0012	Edie Creek Alluvial Mining Project (Managed by Guwin Yanzing & Bunip Orok)	inquiring	uploaded	working
01-0013	EL 2313 (Managed by Harmony Gold (PNG) Exploration Limited)	inquiring	uploaded	working
01-0014	EL 497 (Managed by Harmony Gold (PNG) Exploration Limited)	inquiring	uploaded	working
01-0015	Kula Gold Project (Managed by O'Brien's Lawyers)	inquiring	uploaded	working
01-0016	ML 151 (Managed by Morobe Consolidated Goldfields Limited (1-12047))	inquiring	uploaded	working
01-0017	ML 278 and ML 242 (Managed by Kuranga Alluvial Mine Limited)	inquiring	uploaded	working
01-0018	Mongai River Alluvial Mining (Managed by Mr Amai Waimayoko)	inquiring	uploaded	working
01-0019	Mt Kare Quarry Project (Managed by Summit Development Limited)	inquiring	uploaded	working
01-0020	Nevera Prospect Project (Managed by Anomaly Limited)	inquiring	uploaded	working
01-0021	Northern Access Road project and associated activities (Managed by Wafi Mining Limited (50%) and Newcrest PNG 2 Limited (50%))	inquiring	uploaded	working
01-0022	Pine Top Alluvial Mining (Managed by Allwest Limited)	inquiring	uploaded	working
01-0023	Pomio Limestone Mining Project (Managed by Unichamp Jaquinot Bay Limited)	inquiring	uploaded	working
01-0024	Porgera Mine Projecy (Managed by Barrick (Niugini) Limited)	inquiring	uploaded	working
01-0025	Rouna Quarry (Managed by Monier Limited)	inquiring	uploaded	working
01-0026	Solwara 1 (Deep Seabed Mining Project) Seafloor Massive Sulphide Mining Project and ore stockpile operation (Managed by Nautilus Minerals Niugini	inquiring	uploaded	working
01-0027	Solwara 1 (Deep Seabed Mining Project) Seafloor Massive Sulphide Mining Project and ore stockpile operation (Managed by Placer Niugini Limited)	inquiring	uploaded	working
01-0028	Tauri River Mechanized Mining project (Managed by Hells Gate exploration)	inquiring	uploaded	working
01-0029	Upper Walwalibibi Alluvial Mining Project (Managed by Solomon M. Telepimo)	inquiring	uploaded	working
01-0030	Widubosh Alluvial Project (Managed by PNG Forest Products Limited)	inquiring	uploaded	working

5.7 Technical assistances for utilization of database

In order to promote more efficient and effective works related to the mining environment administration of CEPA, the technical guidances had been given as the methodology of utilizing information in the DB.

5.7.1 Utilizing monitoring data

The project had conducted guidances on methods for retrieving and consolidating of monitoring data on the DB. And also the project had provided guidances on effective method for displaying and possessing relevant data with applicable software (MS Excel etc.) for evaluation and examination of mining activities.

5.7.2 Utilizing GIS

It would be effective to use the geographical information system to evaluate and examine the relationship between the monitoring data and the surrounding environment such as mining related facilities and adjacent rivers in a spatial manner. So the project has adopted QGIS. QGIS is the free software used by many users globally, and also used by public institutions. In addition, QGIS has been used in the projects with other departments of CEPA. So the technical support expected by EPW might be easily acquired from them.

QGIS can handle shapefiles as same as other commercial software, like ArcGIS, and it is also possible to share relevant information from other organizations such as MRA.

For using QGIS, the project had assisted the development of compiling environment. First, the project had acquired the data set created by Papua New Guinea University as map information (topographic map, river map, state boundary / city border diagram etc), which is the base map of GIS. And Digitized maps and mining information (shapefile) were provided by MRA. Satellite image (ASTER images) had been gotten from National Institute of Advanced Industrial Science and Technology (AIST) in Japan.

- The suitable data had been extracted from the DB onto the form required by GIS operation, and some output examples and a series of procedures to display on GIS had been instructed. Also the project has suggested a procedure which shows how to compare the monitoring data with the values of criteria and how to accent the differences between them on GIS, and how to find out the environmental incidents of mining activities.

5.8 Establishment and revision of a database management manual

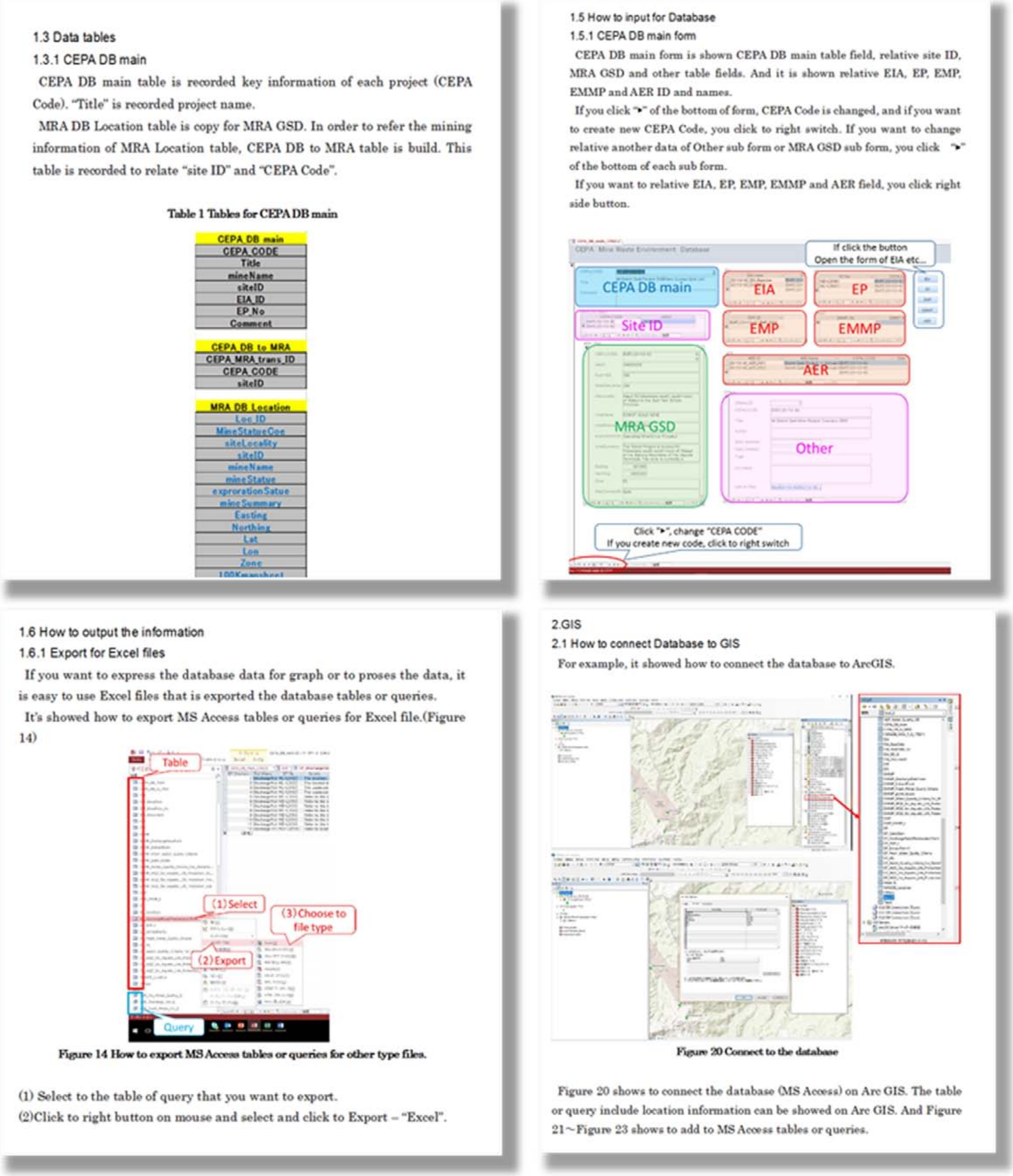
The database management manual for expert uses such as IT/GIS Manager and Data Controller has been established and continuously revised. And data entry manual has been established for the relevant officers too. The list of items in management manual is as follows;

1. Overview of Mine Waste DB
   1.1. System structure
2. Management of Mine Waste DB
   2.1. Role assignment of staff in charge of DB
   2.2. Folder structure in DB and Access control

- 2.2.1. Overview of configuration
- 2.2.2. The way of access control configuration
- 2.3. Workflow in DB
  - 2.3.1. Environment monitoring data
  - 2.3.2. Stored and management of each electronic files
  - 2.3.3. Viewing and output of DB
- 3. Main DB
  - 3.1. Overview
  - 3.2. The rule of folder structure and stored electronic files
  - 3.3. Form sequence
  - 3.4. How to enter data into the DB
    - 3.4.1. Entry from forms
    - 3.4.2. Use to import function
  - 3.5. Export data
    - 3.5.1. Export for Excel
    - 3.5.2. Extract information to use query
- 4. Using GIS
  - 4.1. Overview of GIS
  - 4.2. Import from DB

And, DB user's manual has been compiled and revised too. The list of items is as follows;

- 1. Overview of Mine Waste DB
- 2. Main DB
  - 2.1. Overview
  - 2.2. The rule of folder structure and stored electronic files
  - 2.3. Form sequence
  - 2.4. How to enter data into the DB
    - 2.4.1. Entry from forms
    - 2.4.2. Use to import function
  - 2.5. Export data
    - 2.5.1. Export for Excel
    - 2.5.2. Extract information to use query
- 3. Using GIS
  - 3.1. Overview of GIS
  - 3.2. Import from DB



1.3 Data tables

1.3.1 CEPA DB main

CEPA DB main table is recorded key information of each project (CEPA Code). "Title" is recorded project name.

MRA DB Location table is copy for MRA GSD. In order to refer the mining information of MRA Location table, CEPA DB to MRA table is build. This table is recorded to relate "site ID" and "CEPA Code".

Table 1 Tables for CEPA DB main

CEPA DB main
CEPA CODE
Title
mineName
siteID
EIA ID
EP No
Comment

CEPA DB to MRA
CEPA MRA trans ID
CEPA CODE
siteID

MRA DB Location
Loc ID
MineStatusCoe
siteLocality
siteID
mineName
mineStatue
exprorationSatue
mineSummary
Easting
Northing
Lat
Lon
Zone
100Kmapsheet

1.5 How to input for Database

1.5.1 CEPA DB main form

CEPA DB main form is shown CEPA DB main table field, relative site ID, MRA GSD and other table fields. And it is shown relative EIA, EP, EMP, EMMP and AER ID and names.

If you click "►" of the bottom of form, CEPA Code is changed, and if you want to create new CEPA Code, you click to right switch. If you want to change relative another data of Other sub form or MRA GSD sub form, you click "►" of the bottom of each sub form.

If you want to relative EIA, EP, EMP, EMMP and AER field, you click right side button.

1.6 How to output the information

1.6.1 Export for Excel files

If you want to express the database data for graph or to proses the data, it is easy to use Excel files that is exported the database tables or queries.

It's showed how to export MS Access tables or queries for Excel file.(Figure 14)

Figure 14 How to export MS Access tables or queries for other type files.

(1) Select to the table of query that you want to export.

(2)Click to right button on mouse and select and click to Export – "Excel".

2.GIS

2.1 How to connect Database to GIS

For example, it showed how to connect the database to ArcGIS.

Figure 20 Connect to the database

Figure 20 shows to connect the database (MS Access) on Arc GIS. The table or query include location information can be showed on Arc GIS. And Figure 21~Figure 23 shows to add to MS Access tables or queries.

Figure 5.3 Some of example pages extracted from database management manual for expert users

5.9 Recommendation

The project proposes the following remarks on DB operation.

5.9.1 Operational structure and staffing needs

CEPA needs appropriate personnel for maintaining the developed DBs. Currently, only four (4) officers in Environment Protection Wing are in charge of regulating the mine environments in whole state, and CEPA has been trying to secure the necessary and sufficient number of staffs. At least, one dedicated staff would be urgently needed to maintain the developed DB. Moreover, it is urgent to secure the sufficient budgets to adopt and/or nurture some staffs for the sustainable DB operations.

5.9.2 Improvement of data analysis technology

In this project, we have conducted the instruction of utilizing DB mainly, so it might be still unsatisfied situation in skill levels of relevant staffs for utilizing DB by themselves. Therefore, it is necessary for appropriate staffs to acquire the IT skills of using DB as IT tools with relevant software (e.g. Microsoft Access, Microsoft Excel and QGIS etc.). Since there are some sections of CEPA using QGIS for their business already, it is important to acquire cooperative supports from them temporally.

And the project recommends that it is effective for staffs to participate the training sessions of utilizing relevant software for developing their necessary skills, and/or to use the supporting program such as KIZUNA program for achieving the skills and knowledges in Japan.

5.9.3 Liaison of Inter-sectional DB development in CEPA

The developed DB dedicated for EPW in CEPA to regulate mine waste and mine environment could be also useful as a management tool in other sections by modifying its structure and/or items. It can be easily imagined that the operational skills and function of DBs will be further improved by liaising with other relevant departments which would be eager to develop the own DB system.

5.9.4 Development of a mechanism for collecting information of mine

Information provided by the mine operators is partially as electronic, but almost as paper-based. And the formats of submitted report documents are different from each mines, so it takes a lot of staffs to organize reports and manipulate relevant and suitable data on them for uploading onto DB.

Therefore, with regard to the information submitted by mine operators, it is desirable to establish a specific formats and to stipulate them in a relevant legislation for enforcing the submission by electronic files based on the specific formats.

5.9.5 Collaboration with other organization

It is important for administrating the mine environment policy that information of EP and environment counter-monitoring in CEPA would be shared between CEPA and other organization (MRA etc.). Currently thought the project, regular provision of mining activity information (shapefile) by MRA to CEPA is committed. And the relevant officers in MRA respectfully encourage to share the information of environment permits, the implementation status and results of inspection and audit by CEPA.

The developed DB has the common tables and key codes with DB of GSD in MRA, so it could be allowed to connect the DB with MRA's one and others strategically and organically.

5.9.6 Construction of a mechanism for collecting mining information

The developed DB has been currently stored in the NAS connected with LAN of CEPA. This NAS does not have a backup function, so CEPA should secure a file server with backup function and relocate relevant files onto a new server as soon as possible. And it might be useful that the DB would be accessible through the internet.

In the future, the DB currently developed with MS Access should be upgraded to more integrated and general-purpose DB. And it might be desirable that an advanced DB system like the MRA's mining DB would be developed ultimately in an agile manner, along with improving the capacity of the CEPA organization and relevant staffs.

5.9.7 Others

The developed DB currently stores information related to regulatory operations in CEPA, and at the next step, it is necessary to store information for corroborating to regulate with other organizations. For example, there is an idea that "environmental cost" might be stored in DB. In the future, it is desirable that CEPA, which is the DB usage entity, and relevant organizations would enhance mutual cooperation to expand the function of the DB and to promote efficient and sufficient regulatory operations for implementing mine waste management policies in PNG.

Chapter 6 Conclusion

6.1 Achievement

The main objective of the Capacity Development in Mine Waste Management project was to enhance the capacity of the Papua New Guinea (PNG) Government and the respective regulatory agencies/authorities to effectively regulate and monitor mine wastes in the country. This would be achieved through the following; (1) finalization of the draft Mine Waste Management Policy Framework and improvements to Environmental Impact Assessments for Mining Activities, (2) establishment of an effective implementation regime for Mine Waste Management in PNG, (3) establishment of the Mine Environmental Database and (4) undertaking Short-term and Long - term trainings in Japan on Mine Waste Management. The above major activities have been achieved through the implementation of the project since 2015 as per the Project Design Matrix (*refer to Appendix 1)*.

6.1.1 Finalization of draft Mine Waste Management Policy and Improvements to Environmental Impact Assessments for Mining Activities

The main points to consider in terms of making relevant improvements to the existing draft Mine Waste Management Policy have been noted and discussed in the Policy Sub-working group meetings, and the recommendations made were submitted to the DMPGM, CEPA and MRA for further deliberations. These reviews were presented during the Open Seminar and are also discussed in the main report. In addition, necessary reviews were also done to the existing procedures for assessing EIAs on Mining projects, resulting in the outcome of certain recommendations for improvements that were discussed and submitted to CEPA for further consideration. This project team recommends that the final mine waste management policy and the CEPA's EIA process considers these recommendations.

6.1.2 Establishment of an effective implementation regime for Mine Waste Management

Procedures for conducting inspections on mine waste disposal, tailings impoundments and waste rock dumps have been presented by the technical experts and further discussed in the Field Inspection Sub-working group meetings. The end product of the site inspections and the sub-group meetings was the production of the Inspection Manual Handbook called "Field Inspection Handbook for Mine Waste Management – Tailings Dam and Waste Dump, Environment Monitoring." *(attached as Appendix 6).* Through OJTs conducted at selected model mining project areas including Ok Tedi Mine, Hidden Valley Mine, K92 Mine and Mt. Sinivit Mine (abundant), relevant inspection skills and knowledge were imparted to mining inspectors and environmental auditors of CEPA, DMPGM and MRA to effectively perform their regulatory operations.

6.1.3 Establishment of Mine Environmental Database

The important variables to be included in the Database on Mine Waste Management have been considered and the corresponding forms for data entry have been prepared and discussed in the Database Sub-working group meetings.

The manuals for the management and operation of the Database for Mine Waste Management have been prepared and are attached here as *Appendix 4* and *Appendix 5* respectively. Through the five batches of on-site engagement in PNG by the JICA expert team and the short-term training courses in Japan, necessary and appropriate basic knowledge and skills for operating and maintaining the Database have been adequately transferred to the relevant officers at CEPA. Nevertheless, for the sustainable management and operation of the database, CEPA needs to train the suitable officers to be equipped with the appropriate software and database skills through in-house and also through training courses.

6.1.4 Implementation of Short-term training in Japan on Mine Waste Management

The relevant staff from DMPMG, CEPA and MRA attached to the project also attended short-term training programs in Japan in 2017 and 2018 and were introduced to technologies and academic knowledges on Mine Waste Management. It is anticipated that the participants of these short-term trainings will have disseminated their acquired knowledge and skills to other colleagues through their reports and/or presentations at Working Group Meetings and the Open Seminar.

6.2 Recommendations

The three major activities described in Chapter 3, 4 and 5 have already been implemented followed by respective recommendations for each. As a way going forward for the project, the following recommendations have been excerpted from each of the chapters.

Recommendations for
Improvement to draft Mine Waste Management Policy and Environment Impact Assessment for Mining Activities

(1) Post Mine Closure waste management responsibilities

1) Matters regarding Mining Act

The main concern stated in *Section 152 of Mining Act* is that the State should take responsibility of mine waste management after the expiry of Mining Lease. In addition, there is a prescript in the Environment Act 2000 (section 9) for the State to take responsibility over and management of environmental issues and pollutant spills from mine wastes after the expiry of Mining Lease. Given the above scenario, this project proposes the following recommendations for consideration in the revised Mining Act.

- Chief Mines Inspector shall not approve the construction plan and specifications of a tailings dam and/or waste rock dump without the Mine Waste Management plan submitted by the mining company.
- MRA shall carry out detailed inspections on the mine waste treatment facilities before the expiry of the Mining Lease, and confirm the its safety measures to prevent the unforeseen environment calamities.

In addition to alleviating the future financial burden on the PNG Government, this project recommends to stipulate all the appropriate measures and disposal of mine waste and related facilities at the time of mine closure by holders of mining rights in revised Mining Act.

Currently, the revised Mining Act has been through all discussion forums and is now before the NEC for approval and eventual gazettal. Some important information obtained from the revised Act are:

- The revised Mining Act prohibits the discharge of mine wastes into river systems and surrounding environment.
- The revised Mining Act requires the developer to submit a Mine Rehabilitation and Closure Plan upfront as a part of mine development proposal at the granting stage of Mining Leases.
- The Act also requires the developer to set aside the Financial Assurance Deposit prior to commencing the mining operation.
- MRA and CEPA jointly take responsibility to develop audit criteria and checklist of the environmental, safety and health conditions around the closed and abundant mines under both mining and environment legislations.

2) Matter regarding Environment Act 2000

This project recommends that the submission of the Mine Rehabilitation and Closure Plan is made a condition of the environment permit. Likewise, the Mining Lease should make mention of "Rehabilitation of the affected area" as it is articulated in the Environment Act and the expected roles of CEPA.

(2) Specifications of the tailings dam and waste dump.

1) Matters regarding Mining Act

This project proposes the following measures be considered and/or taken until the appropriate specifications and criteria related to tailings dam and waste dump are clearly stipulated in a policy guideline under revised

Mining Act.

- The Chief Mines Inspector requests for the inclusion of an Emergency Response Plan into the initial construction plan of tailings dam and/or waste dumps.
- MRA releases a guideline with clear approved criteria for the construction plan of tailings dam and waste dumps.

In addition, this project strongly recommends that the design and construction standards for tailings dam and waste dump in Section 286 of Mine (safety) Regulation be revised and updated as soon as convenient.

2) Matter regarding Environment Act 2000

This project further recommends to respective authorities to request the applicant of the Mining Leases to include the design specifications of water treatment plants which would be constructed with the tailings dam and/or waste dump and be built into the main EIS.

(3) Expenses and Budgets for the Mine Waste Treatment after Mining Lease expire.

1) Matters regarding Mining Act

The project CDMWM proposes to the relevant State authorities for the establishment of “Mine Pollution Prevention Reserve Fund” and to be flagged in a relevant legislative framework. The total cost of countermeasures would be calculated from its quality (risks) and quantity (volume or area) using simple formulas when mine wastes would be dumped and/or stored only within the Mining Lease, and the annual reserved amount would be calculated by dividing the total costs by the planned mine life (year). Once all post closure measures for mine waste treatment have commenced, the operator could get a refund proportionate to the operational size of the treatment and/or rehabilitation measures.

On the other hand, the accumulation of this Reserve Fund might exceed unproportioned limits and might become added costs to the mine operator, thus discouraging future development prospects and/or extension of existing mine life. Therefore, if the mine life is more than 10 years, it could be necessary to have a policy whereby the developer is only affected after several (maybe 5 years) of operation. This effectively gives the operator ample time to settle its loans/debts, and further to encourage new investments.

The current revised Mining Act stipulates a section on “Mine Closure Financial Assurance”. This assurance covers all expenses for counter-measure activities regarding mine waste treatment and post closure rehabilitation works. This financial assurance does not overlap the Environment bond as required under the Environment Act.
Relevant policies giving effect to the revised Mining Act should clearly articulate the calculation method for the mine closure and post mine closure counter-measures costs for MRA. The policy should also make mention that the mining operator pays part of the costs before commencement of the project.

2) Issues with Environment Act 2000

The Establishment of the "Environment Protection Trust Fund" and/or the "Environmental Bond" is a requirement in the current Environment Act 2000 for supporting rehabilitation and undertaking counter-measure environmental pollution activities caused by Industries or Resources Development projects such as Mining. Nevertheless, this Trust Fund has not been established yet, because of the lack of a guiding policy to drive the process. Similar to the "Mine Pollution Prevention Reserve Fund" the calculation procedures in terms of who should pay and by what percentage or how much should also be clearly articulated in the relevant legislation or policy guideline.

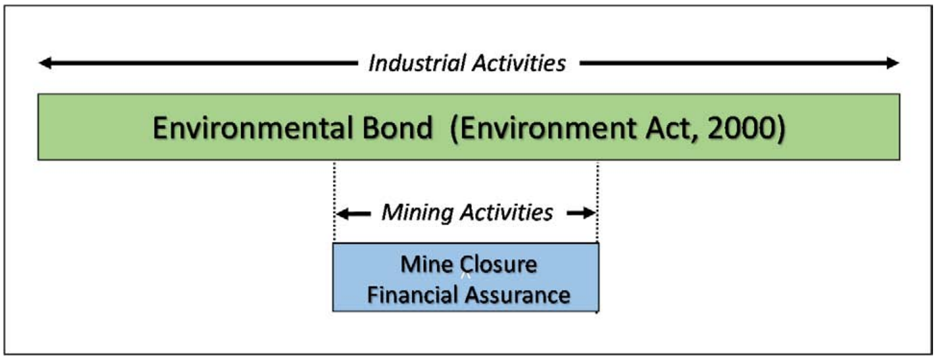


Figure 6.1 Coverage of the Mine Closure Financial Assurance

(4) Management of Water Quality Upstream Compliance Point.

The concept of Mixing Zone is only relevant in cases where no other measures are applicable after exploring all available methods of waste avoidance and minimization according to the *Environment Act (Water Quality Criteria) Regulation.* This means that the prescribed water quality standards are not met at the discharge point(s), but at the end of the Mixing Zone. Beyond the Mixing Zone or Compliance Point, it is expected that there is no exceedance in the Water Quality Criteria. However, the *Environment Act 2000 (Water Quality Criteria) Regulation* does not provide details on the size and length of the Mixing Zone, which in fact are site and project specific. The revised Mining Act disallows the discharge of mine wastes and tailings into riverine environment, however does not apply to current mines using the practice. For the purposes of good environmental stewardship, the CDMWM project recommends that Mixing Zones should be set at the boundaries of Mining Leases (ML), and that the concept of "Effluent Standards" be adopted in the Environment Act or other Environment legislations and policies in the future.

Recommendations for
Establishing Mine Waste Management Policy Implementation Regime

(1) Strengthening CEPA's Inspection Manpower

This project recommends that CEPA should have arrangements to have two (2) environmental inspectors in each of the four (4) regions with sufficient operational funds in order to regulate/monitor the proper management of mine wastes in the mines scattered throughout the country. CEPA will then fulfill its mandated responsibility in terms of protecting and preserving the natural environment and its rich, yet fragile biodiversity.

(2) Institutional Collaborative efforts of CEPA and MRA

In mining projects, environmental incidents or environmental related incidents do occur, of which some are serious in nature. It has been the practice that collaborative efforts are put into by both the MRA and CEPA in attending to such issues, and it is the recommendation of this project that such institutional arrangements be strengthen and maintained. It is also indispensable that collaborative efforts are put in place by both agencies for routine inspections at the mixing zones or compliance points to give some level of confidence to the State, local communities and other stakeholders regarding the operator's management and monitoring of the environment. Until the CEPA is in full strength in terms of manpower and funding capabilities, the MRA should come in a big way in terms of logistics and other necessary support.

(3) Implementation/Utilization of Rapid Testing for Water Quality

It is important to conduct on - site water quality testing, especially at the mixing zones. It is recommendable to conduct such rapid tests using the "PACK TEST" kit to detect any incidences of exceedance or anomalies in the water body or river system.

(4) Annual Plan for Inspection of Mine Waste Management Facilities

Since MRA inspects each of the tenement areas on a quarterly basis, this is considered to be quite sufficient in terms of regulating the areas themselves. However, the responsibilities of CEPA extend beyond the lease area (ML), hence this project recommends that environmental inspections for both within and outside ML by CEPA be done twice to four times a year.

Table 6.1 Inspection Implementation Program

Object Area	Responsible Authority	Frequency (/year)
(1) Mine site and tenement area	MRA	Quarterly
(2) Mixing zone	CEPA (support from MRA is required until CEPA operates with full strength manpower and funding).	Quarterly
(3) Outer side of (1) and (2)	CEPA	Quarterly or twice

(5) Storage of CEPA inspection reports in Database System

The development of the environmental mine waste database has been one of the main deliverables of the

CDMWM project. CEPA can now utilize this database system to download and store its inspection results and audit/inspection reports and have these information readily available to other officers, sections/divisions, other government agencies or even to external clients upon prior formal approval from the Project Manager.

(6) Utilization of Inspection Manual and Checklist

The inspection manual and the checklist prepared for this project was mainly based on extracts from experiences in Japan. It is envisaged that MRA mine inspectors and CEPA environmental auditors will utilize this helpful document in their routine inspections runs. The manual is generic and it is therefore recommended that inspectors consider site and project specifics, and to use the manual only as a guide.

Recommendations for Development of the Mine Environmental Database

(1) Operational Structure and Staffing needs

CEPA needs appropriate personnel to manage and operate the DB once fully developed and in operation. Currently, there are only four (4) officers in the Environment Protection Wing (EPW) taking charge of delivering Statutory regulatory operations for all the mining projects in the country. The division (EPW) will go into full strength once the organization becomes a full pledged authority. Further, a fully dedicated officer or contractor with appropriate credentials be engaged to manage the database, and to be supported by sufficient and continued funding.

(2) Improvement of Data Analysis Technology

Through the training programs conducted in this project, officers have only been introduced to the main concepts and general instructions in utilizing the DB, which essentially is not satisfactory. It is therefore recommended that relevant officers undergo in-house and/or other external IT trainings in, for example Microsoft Access, Microsoft Excel, QGIS or other softwares for them to acquire the appropriate IT skills required to operate and manage the DB. It is important to work closely with other units in CEPA that are currently using QGIS. This project also recommends that CEPA officers participate in training programs such as the KIZUNA that is offered by the Japanese government to further enhance their skills and knowledge.

(3) Liaison of Inter-Sectional DB Development in CEPA

The fully developed DB will be housed at the EP Wing of CEPA to store data, information and reports related to the regulation of mine wastes and for the protection of the environment. Initially, the database will serve mining related purposes only, however over time it will be modified and expanded to include other sectors such as oil and gas, forestry, fisheries, infrastructure etc... thus becoming a useful management tool for the CEPA. The CEPA will further liaise with other governmental institutions for example, MRA to have the DB linked to their systems. Individuals, private organizations and other public entities could also have access to the database upon approval from the project manager.

(4) Development of a mechanism for collecting mining related information

Nearly all the information provided by mine operators now is in hard copies except for a few that come in electronic form. Different mining companies have their own reporting standards and formats, and when submitted to CEPA, it becomes tedious and tough on officers to edit and have them formatted before downloading into the DB. It is therefore necessary to advise mine operators to have their reports and data provided to CEPA in a standard format that will be recommended to them by the regulator (CEPA) and have them submitted in electronic form. To enable the process to be more formal and legal, this requirement needs to become a condition of the Environment Permits for new projects, and further, necessary amendments will have to be made to existing EPs to flag this new requirement.

(5) Collaboration with other organizations

It is important that CEPA makes available information and data on their regulatory operations to other government agencies such as MRA, DMPGM and the general public for transparency purposes. This also includes any mining or environment policy matters. Currently, MRA has all the information regarding tenements, licenses, production data (shapefile) etc.… and are stored and kept in their CASTRE database, which CEPA could access. In addition, officers in the Regulatory Branch of MRA could also have access to and share information on Environment Permits, their implementation regimes and other audit and inspection information and results at CEPA. Most of the common tables and key codes in the currently developed database at CEPA are similar in function to those at MRA's GSD. They could strategically be linked up to each other, however with restrictions to certain confidential information, and further having in mind that they will be stand- alone DBs on their own rights.

(6) Construction of a mechanism for collecting mining information

The currently developed DB is stored in a NAS connected to a LAN at CEPA. The NAS does not have a backup function, hence CEPA should secure a file server with a backup function and relocate relevant files onto the new server as soon as they can. Further, it could be useful to have the DB accessed through the internet. It is envisaged that in future, the DB currently developed with MS Access should be upgraded to a more integrated, user - friendly and general-purpose DB. Ultimately, with improvements and upgrading of CEPA's staffing capacity and with adequate financial back – up, a more advanced DB system like the MRA's mining CASTRE DB would be developed.

(7) Way Forward

The developed DB currently stores data and information related to regulatory operations at CEPA, and information, data and reports provided by the mining companies. It is hoped that over time, and as the process gets advanced, information and data from other regulatory government organizations, including those involved in the implementation of mine waste management in PNG could also be uploaded into the system. For example, one might think of storing information related to *"environmental cost"* that is incurred in all facets of development activities in the DB. This kind of mutual understanding and cross-sectoral collaborative engagements are encouraged to give more effect to the growth and development of this country as a whole, including improvements in the area of mine waste management and its regulatory efforts.

Appendix

Appendix 1

Project Design Matrix (PDM)

Project Monitoring Sheet I (Revision of Project Design Matrix)

Version 3.0
Dated 18 July 2018

Project Title: The Project for Capacity Depelopment on Mine Waste Management

Implementing Agencies: Conservation and Environment Protection Authority (CEPA), Mineral Resources Authority (MRA) and Department of Mineral Policy and Geohazards Management (DMPGM)

Project Area/Location: Whole Country

Direct Beneficiaries: Staff of CEPA, MRA and DMPGM

Indirect Beneficiaries: Mineworkers and residents around mines in Papua New Guinea (PNG)

Project Period: From implementing the first input until September 2020

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Mine Waste Management is effectively regulated and managed in PNG	Mining pollution is reduced in PNG	1. Records of CEPA and MRA 2. Database Records	The Government and Mining Industry effectively and efficiently apply the Mine Waste Management Policy	1. Content and procedure for the environment monitoring to be managed according to the actual Law were established in CEPA and MRA. 2. Database was established based on the actual requirements for the Mine Waste Management.	2. Although actual data input is continuously required, relevant officers for the administration and entry works are insufficient in CEPA. On the other hand, several mining companies have not submited and renewed their data to CEPA in relation to the mine waste according to the operation, in spite of the continuous request by CEPA.
Project Purpose To enhance the capacity of CEPA, MRA and DMPGM to effectively regulate and monitor mine waste in PNG	1. Capacity building needs for the mine waste management of relevant staff of CEPA, MRA and DMPGM are identified and corresponding Capacity Building Plan is prepared. 2. Institutional strengthening needs for the mine waste management of CEPA, MRA and DMPGM are identified and corresponding Institutional Strengthening Plan is prepared.	1. Capacity Building Needs Analysis Report and corresponding Capacity Building Plan 2. Institutional Strengthening Analysis Report and corresponding Institutional Strengthening Plan 3. The periodical monitoring sheets of the Project	The counterpart personnel trained by the Project do not resign or frequently transferred.	1. Capacity building was performed based on the Work plan. 2. Institutional strengthening plan was created baesd on the Work plan.	2. CEPA needs to employ additional officers for the strengthening.
Outputs 1. Improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities	1-1 Possible measures for the improvement of existing Mine Waste Management Policy are identified and corresponding recommendations are prepared. 1-2 Possible measures for the improvement of existing procedures for Environmental Impact Assessments for Mining Activities are identified and corresponding recommendations are prepared. 1-3 Improved Mine Waste Management Policy is prepared. 1-4 Improved procedures for Environmental Impact Assessments for Mining Activities are prepared.	1. Records of Monitoring and Evaluation Reports on Mine Waste Management at the CEPA and MRA 2. Records of Environmental Impact Assessments for Mining Activities at the CEPA 3. The periodical monitoring sheets of the Project	1. Competent and experienced counterpart personnel allocated properly 2. Counterpart personnel actively participate in Project activities 3. Functions and linkages among implementing agencies do not change drastically 4. The operational cost for the Project assured appropriately	1-1. Recommendations based on the reviewing were submitted to DMPGM, CEPA and MRA. 1-2.&1-4. Recommendations on the improvement of existing procedures about EIA were submitted to CEPA. 1-3. Recommendations on the improvement of existing procedures about Policy were submitted to DMPGM.	1-1.,1-2.,1-3.&1-4. Policy and EIA with which recommendations should be reflected are still in draft version.
2. Establishment, operation, and maintenance of the Database for Mine Waste Management	2-1 Detailed items for the Database for Mine Waste Management are selected and corresponding forms for data are prepared 2-2 Knowledge and skills to the relevant staff of CEPA and MRA for establishing, operating, and maintaining the Database for Mine Waste Management is adequately transferred. 2-3 Manual of Operation and Maintenance of the Database for Mine Waste Management is prepared.	1. Database Records 2. Manual of Operation and Maintenance of the Database for Mine Waste Management 3. The periodical monitoring sheets of the Project		2-1.&2-3. Database and manuals of operation and maintenance with handbook were established in the CEPA. 2-2. In execution with using the external seminar for operating the suitable softwares.	2-2. CEPA needs to continue to participate the external trainig courses for the database.

Appendix 1

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
3. Enhancement of knowledge and skills and technology to regulate and manage mine waste disposal	3-1 Strengths and weaknesses of procedures for conducting reconnaissance field surveys for mine waste disposal are identified and Manual of Inspection for Mine Waste Management is prepared 3-2 Knowledge and skills for conducting reconnaissance field survey for mine waste disposal are adequately transferred to the Environment Officers 3-3 Number of staff from DMPMG, CEPA, and MRA for short-term training in Japan on mine waste management 3-4 All participants of short-term training in Japan on mine waste management disseminated the acquired knowledge and skills to other colleagues	1. Manual of Inspection for Mine Waste Management 2. Field Survey Reports for Mine Waste Disposal 3. Interviews with the participants for short-term training in Japan on mine waste management 4. The periodical monitoring sheets of the Project		3-1. Inspection manual with handbook was established in CEPA and MRA. 3-2. Trainings to enhance the knowledge and skills for conducting field inspection were performed in the actual mine sites. 3-3. Training in Japan was performed in June 2017 and June 2018, which CEPA, MRA and DMPGM were participated. 3-4. Participants have explained experiences of the training in Japan at Working Group Meeting and so on.	
4. Enhancement of academic knowledge of human resources of relevant organizations on mining environment	4-1 Number of staff from DMPMG, CEPA, and MRA for long-term training in Japan (study in graduate school of Japanese universities) on subjects related to mining 4-2 All participants of long-term training in Japan (study in graduate school of Japanese universities) on subjects related to mining disseminated the acquired knowledge and skills to other colleagues	1. Interviews with the participants for long-term training in Japan (study in graduate school of Japanese universities) on subjects related to mining 2. The periodical monitoring sheets of the Project		4-1. In execution with KIZUNA project organized by JICA PNG office 4-2. Participants of the long-term training are executing their study in Japan.	

Activities	Inputs		Important Assumption
<Improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities> 1-1 Formulate the working team for the improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities 1-2 Review and identify problems of the existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities 1-3 Prepare recommendations for the possible measures for the improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities <Establishment, operation, and maintenance of the Database for Mine Waste Management > 2–1 Formulate the working team for the establishment, operation, and maintenance of Database for Mine Waste Management 2–2 Review the existing database of CEPA and MRA 2–3 Define the detailed items of mine waste management information (such as mine site, deposit, operation, pollution, construction, monitoring and its results, etc.) to be included into the database 2–4 Define management system of database (CEPA and MRA assign staff in-charge of database and frequency of updates, etc.) and establish connectivity of database between CEPA and MRA 2–5 Input selected information into the database 2–6 Define the data items necessary to control and monitor mine waste management and explain how to use them	PNG Side 1. Counterpart personnel 2. Building(s), rooms and facilities - Office and necessary facilities for the Japanese experts - Buildings and space necessary for the equipment and facilities to be provided by JICA 3. Expenses - Cost for office space/ facilities (including cost for electricity, water, communication, etc.) - Necessary expenses for Counterpart personnel	Japanese Side 1. Dispatch of Experts –Short-term experts: 8 personnel ・Project Manager and Asst. Manager (Mine Waste Management Policy and Environmental Impact Assessments) ・Mine Waste Management Technology (4 experts) ・Database (Mine Waste Management) (2 experts) 2. Training in Japan –Long-term Training Program at Graduate School in Japan (Master or doctoral degree studies) –Short-term Training Program in Japan 3. Expenses - Necessary expenses for Japanese experts -Necessary expenses for field surveys	Pre-Conditions Cooperation among implementing agencies will be maintained appropriately Relevant information and necessary data will be provided by all implementing agencies Security conditions will not deteriorate drastically

Activities	Inputs		Important Assumption
2–7 Develop a Manual of Operation and Maintenance of the Database for Mine Waste Management 2–8 Train relevant staff for the establishment, operation, and maintenance of the database 2–9 Update the database as needed			
<Enhancement of knowledge and skills and technology to regulate and manage mine waste disposal> 3-1 Identify strengths and weaknesses of existing procedures for conducting reconnaissance filed surveys for mine waste disposal 3-2 Prepare the Manual of Inspection for Mine Waste Management 3-3 Study selected model area's conditions before conducting reconnaissance field survey for mine waste disposal 3-4 Conduct reconnaissance field survey for mine waste disposal in selected model areas with PNG Counterparts (C/P). (Virtual field survey will be mainly conducted by PNG C/P.) 3-5 Advice on the technology for mine waste disposal management and on the technology to prevent and reduce mine pollution from mine waste disposal in selected model areas 3-6 Transfer the knowledge and skills and technology of mine waste management to the Environment Officers during field surveys as on the job training (OJT) 3-7 Train trainers of CEPA for training Provincial Environment Officers 3-8 Define criteria for the selection of candidates and select the candidates for short-term training in Japan on mine waste management 3-9 Facilitate arrangements for dispatching selected candidates for short-term training in Japan on mine waste management 3-10 Ensure the staffs disseminate the knowledge and skills obtained from OJT and short-term training in Japan to other colleagues through workshop, etc. 3-11 Finalize the Manual of Inspection for Mine Waste Management			issues and countermeasures
<Enhancement of academic knowledge of human resources of relevant organizations on mining environment> 4-1 Define criteria for the selection of candidates and select the candidates for long-term training in Japan (study in graduate school of Japanese universities) on subjects related to mining 4-2 Facilitate arrangements for dispatching selected candidates for long-term training in Japan on subjects related to mining 4-3 Ensure the staffs disseminate the knowledge and skills obtained from long-term training in Japan to other colleagues through workshop, etc.			

Appendix 2

Plan of Operation (PO)

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 3.0
Dated 18 Jul 2018

Project Title: The Project for Capacity Development on Mine Waste Management

Inputs	Plan	2016				2017				2018				2019				2020				Remarks	Monitoring	
	Actual	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV		Issue	Solution
Expert																								
Short-term (Project Leader (Mine Waste Management Policy and Environmental Impact Assessments A))	Plan				■	■		■		■		■											-	-
	Actual				🟥	🟥				🟥	🟥	🟥												
Short-term (Asst. Leader (Mine Waste Management Policy and Environmental Impact Assessments B))	Plan				■	■		■				■											-	-
	Actual				🟥	🟥		🟥		🟥	🟥	🟥												
Short-term (Mine Waste Management Technology 1)	Plan				■	■				■		■											-	-
	Actual				🟥	🟥		🟥		🟥														
Short-term (Mine Waste Management Technology 2A)	Plan				■	■		■		■													-	-
	Actual				🟥	🟥		🟥		🟥		🟥												
Short-term (Mine Waste Management Technology 2B)	Plan					■																	-	-
	Actual																							
Short-term (Mine Waste Management Technology 2C)	Plan				■	■		■															-	-
	Actual				🟥	🟥		🟥		🟥														
Short-term (Database construction of Mine Waste Management (Mine environment A))	Plan				■	■				■		■											-	-
	Actual				🟥	🟥		🟥		🟥	🟥	🟥												
Short-term (Database construction of Mine Waste Management (Mine environment B))	Plan							■															-	-
	Actual							🟥		🟥														
Training in Japan																								
Short-term Training	Plan						■				■											The first Training has been conducted with 6 participants	The 2nd Training has been conducted with 4 participants	-
	Actual						🟥				🟥													
Long-term Training	Plan										■	■	■	■	■	■	■	■	■	■			under consideration with JICA and PNG side	-
	Actual																							

Activities		Plan	20146				2017				2018				2019				2020				Responsible Organization		Achievements	Issue & Countermeasures
	Sub-Activities	Actual	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	Japan	PNG		
Output 1: Improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities																										
1.1	Formulate the working team (subworking group) for the improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities	Plan				■																	PL, AL	PD, PM, SPM	The Policy working sub-group was established	-
		Actual				🟥	🟥		🟥		🟥															
1.2	Review of existing related laws and regulations such as the mining act, the environment act, mine waste management policies (draft version) and environmental impact assessments for mining activities	Plan				■																	PL, AL, MW2	WT	Recommendations were considered based on the review	-
		Actual				🟥	🟥	🟥	🟥		🟥	🟥														
1.3	Holding the seminar related to mine waste management policy (as part of the working team meeting)	Plan				■																	PL, AL, MW2	WT	Open Seminar was held on JUL 2018	-
		Actual				🟥	🟥	🟥	🟥		🟥	🟥	🟥													
1.4	Prepare recommendations for the possible measures for the improvement of existing Mine Waste Management Policy and Environmental Impact Assessments for Mining Activities	Plan				■																	PL, AL, MW2	WT	Recommendations were proposed to CEPA, MRA and DMPGM	-
		Actual				🟥	🟥	🟥	🟥		🟥	🟥	🟥													
Output 2: Establishment, operation, and maintenance of the Database for Mine Waste Management																										
2.1	Formulate the working team (subworking group) for the establishment, operation, and maintenance of Database for Mine Waste Management	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	PD, PM, SPM	The DB working sub-group was established	-
		Actual				🟥	🟥																			
2.2	Reconnaissance work for existing database system and related information	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	The DB in MRA was reviewed with WT	-
		Actual				🟥	🟥																			
2.3	Review and identification of necessary items for establishment of database	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	The DB in MRA was reviewed with WT	-
		Actual				🟥	🟥	🟥	🟥		🟥		🟥													
2.4	Holding the seminar related to mine environment database (as part of the working team meeting)	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	Open Seminar was held on JUL 2018	-
		Actual				🟥	🟥	🟥	🟥		🟥		🟥													
2.5	Establishment of an appose regime for database management	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	The framework was established with WT	CEPA needs to employ additional officers for the maintenance
		Actual				🟥	🟥		🟥		🟥		🟥													
2.6	Populating data into a database and validating data	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	Data entry sheets were created in CEPA	Data input work will be continued
		Actual				🟥	🟥	🟥	🟥		🟥		🟥													
2.7	Technical assistances for utilization of database	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	Technical assistances were performed in CEPA and MRA	-
		Actual				🟥	🟥		🟥		🟥		🟥													
2.8	Formulating a database management manual	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	The manual was created with WT	-
		Actual				🟥	🟥		🟥		🟥		🟥													
2.9	Revising a database management manual	Plan				■	■	▨	■	▨	■	▨	■										PL, AL, DB	WT	The manual was established in CEPA	-
		Actual				🟥	🟥		🟥		🟥	🟥	🟥													

Output 3: Establishment of an implementation regime for mine waste management policies

3.1	Formulate the working team (subworking group) for the Establishment of an implementation regime for mine waste management policies	Plan	PL, AL	PD, PM, SPM	The inspection working sub-group was established	-
		Actual				
3.2	Review and identification of required works for implementation of mine waste management policies	Plan	PL, MW1, MW2	WT	WT was reviewed and identified the required work	-
		Actual				
3.3	Holding the seminar related to establishment of an implementation regime for mine waste management policies (as part of the working team meeting)	Plan	PL, AL, MW1, MW2	PD, PM, SPM	Open Seminar was held on JUL 2018	-
		Actual				
3.4	Proposing an implementation regime for mine waste management policies	Plan	PL, MW1, MW2	WT	The regime was propsed with WT	-
		Actual				
3.5	Formulating an annual inspection plan	Plan	PL, MW1, MW2	WT	Inspection plan was created with WT	-
		Actual				
3.6	Establishment of storing and sharing strategies for inspection results	Plan	PL, MW1, MW2	WT	Pan for the storing and sharing was proposed	-
		Actual				
3.7	Formulating an inspection manual for mine waste management	Plan	PL, MW1, MW2	WT	Inspection manual was created with WT	-
		Actual				
3.8	Selecting model areas for technical transfer of inspections	Plan	PL, AL	PD, PM, SPM	The model areas was selected with WT	-
		Actual				
3.9	Conducting on-site job training at selected model areas for technical transfer of inspections	Plan	MW1, MW2	participants	The several site visits was conducted with WT	-
		Actual				
3.10	Revising and Finalize the inspection manual for Mine Waste Management	Plan	PL, MW1, MW2	PD, PM, SPM, participants	Inspection manual was finalized in relevant organization	-
		Actual				
3.11	Finalize the Manual of Inspection for Mine Waste Management	Plan	PL, AL, MW1, MW2	PD, PM, SPM, WT	Inspection manual was established in CEPA and MRA	-
		Actual				

Output 4: Enhancement of academic knowledge of human resources of relevant organizations on mining environment

4.1	Define criteria for the selection of candidates and select the candidates for long-term training in Japan (study in graduate school of Japanese universities) on subjects related to mining	Plan	PL, AL PNG office	PD, PM, SPM	under consideration with JICA and PNG side	-
		Actual				
4.2	Facilitate arrangements for dispatching selected candidates for long-term training in Japan on subjects related to mining	Plan	Head office PNG office	participants	under consideration with JICA and PNG side	-
		Actual				
4.3	Ensure the staffs disseminate the knowledge and skills obtained from long-term training in Japan to other colleagues through workshop, etc.	Plan	Head office PNG office	PD, PM, SPM, participants	under consideration with JICA and PNG side	-
		Actual				

Duration / Phasing

Plan
Actual

Monitoring Plan

Plan / Actual: 20146 (I, II, III, IV); 2017 (I, II, III, IV); 2018 (I, II, III, IV); 2019 (I, II, III, IV); 2020 (I, II, III, IV)

Monitoring Plan		Remarks	Issue	Solution
Monitoring				
Joint Coordinating Committee	Plan	First JCC convened on Feb 16, 2017	Second and Third JCC convened on Feb 22 and Jul 18 2018, respectively	-
	Actual			
Set-up the Detailed Plan of Operation	Plan	Version2.0 has been reviewed on Sep 2017	Version3.0 has been reviewed on Jul 2018	-
	Actual			
Submission of Monitoring Sheet	Plan	Version2.0 has been reviewed on Sep 2017	Version3.0 has been reviewed on Jul 2018	-
	Actual			
Monitoring Mission from Japan	Plan		The mission was made with first and fifth batch of experts	-
	Actual			
Joint Monitoring	Plan	Working Group Meeting convened as Joint Monitoring	5th Working Group Meeting convened on Jul 12 2018	-
	Actual			
Reports/Documents				
Progress Report	Plan		Progress Report was submitted on Oct. 2017	-
	Actual			
Project Completion Report	Plan		Draft Final Report was prepared and reviewed on Jul and Aug 2018	-
	Actual			
Public Relations				
Press Release	Plan		Media Release on Projet Commencement was made by CEPA on October 19 2016	-
	Actual			

PNG Side PD: Project Director, PM: Project Manager, SPM: Sub-Project Manager, WT: Working Team

Japan Side PL: Project Leader, AL: Asst. Leader, MW: Mine Waste Management Technology, DB: Database Construction

Appendix 3

Experts Performance Table with Staffing Plan

Experts Performance Table with Staffing Plan

The Project for Capacity Development on Mine Waste Management

1. On-site works in PNG

Assignment	Name		2016					2017												2018									
			8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Project Team Leader / Mine waste management and environmental impact assess A	Yoshimitsu NEGISHI	Original			18				21						21						14						14		
		Actual / Corrective			10/2-19 18				2/14-28 15	3/1-5 5											2/14-28 15					7/1-22 22			
Assistant Team Leader / Mine waste management and environmental impact assess B	Kazuyuki KADOSHIMA	Original			30	5			30	5					30	5										5	30		
		Actual / Corrective			10/2-10/31 30	11/1-11/5 5		1/21-31 11	2/1-28 28	3/1-5 5					8/26-31 6	9/1-29 29					2/3-28 26	3/1-7 7				7/1-22 22			
Mine waste management 1 (general matters)	Yoshiaki SHIBATA	Original			30	5			30	5											30	5				5	30		
		Actual / Corrective			10/2-10/31 30	11/1-11/5 5		1/21-31 11	2/1-17 17							9/2-9/22 21					2/3-28 26	3/1-3 3							
Mine waste management 2A (general matters)	Hirohisa KOBAYASHI	Original			28				28						28						30	5							
		Actual / Corrective			10/2-10/29 28				2/6-28 23	3/1-5 5						9/2-9/29 28					2/3-28 26					7/7-15 9			
Mine waste management 2B (TSF management technology)	Yukinobu NAKAMURA	Original							21																				
		Actual / Corrective																											
Mine waste management 2C (inspection, regulatory affairs)	Mitsuo OHTAKE	Original			18				21						21														
		Actual / Corrective			10/2-10/29 28			1/21-31 11	2/1-17 17							9/2-9/22 21					2/24-28 5	3/1-3 3							
Database construction of mine environment A (general constr.)	Ippei TAKEDA	Original			28				28												30	5					28		
		Actual / Corrective			10/2-10/29 28			1/21-31 11	2/1-17 17						8/26-31 6	9/1-9/15 15			12/2-12/9 8		2/10-28 19	3/1-7 7				7/1-20 20			
Database construction of mine environment B (DB utilization)	Kosuke ISHIYAMA	Original													30	5													
		Actual / Corrective													8/26-31 6	9/1-9/8 8					2/10-/24 15								

🟦 Origiral Plan ■ Actual ▬ Corrective Future Plan

2. Works in Japan

Assignment	Name		2016					2017												2018									
			8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Project Team Leader / Mine waste management and environmental impact assess A	Yoshimitsu NEGISHI	Original		5	2	2				2		2	9			4			2			2	2	9		3		4	
		Actual / Corrective		9/14, 16, 23, 29, 30 5	10/25, 26 2	11/17 1	12/12 1			3/14, 15 2													4/18 1	5/8-11 4	6/4-8, 15, 20, 25 8		8/1-3, 5-10 8	9/4-6, 18-20 6	
Assistant Team Leader / Mine waste management and environmental impact assess B	Kazuyuki KADOSHIMA	Original		5		3				2		2	7			2							2	7		2		3	
		Actual / Corrective		9/14, 15, 16, 27, 29 5		11/17 1	12/9, 12 2			3/14, 15 2	4/27 1	5/25 1	6/6-10, 12-16 10	7/28 1	8/24 1					1/9, 29 2		3/29 1	4/17, 18 2	5/9, 21-25 5	6/4, 5, 20, 25 4		8/1-3, 6, 7 5	9/18-20 2. 8	
Mine waste management 1 (general matters)	Yoshiaki SHIBATA	Original		4		2				2			5			2			2			2	2	5		2		3	
		Actual / Corrective		9/14, 16, 27, 28 4		11/17 1	12/12 1			3/14, 15 2	4/27 1	5/25 1	6/6-10, 12-16 10	7/28 1	8/24 1					1/9, 29 2		3/29 1	4/23, 24 2	5/7-9, 21-25, 28-30 11	6/4, 5, 20, 25 4		8/1-3, 6-9 7	9/18-20 3	
Mine waste management 2A (general matters)	Hirohisa KOBAYASHI	Original		4		3				2			5			2			2			2		5		2		3	
		Actual / Corrective		9/14, 23, 27, 28 4		11/17 1	12/12, 13 2			3/14, 15 2	4/27 1		6/12, 14, 15 3	7/28 1	8/24 1					1/15 1		3/29 1		5/7-9, 21, 23, 25 6	6/20, 25 2		8/1, 2 2	9/18-20 3	
Mine waste management 2B (TSF management technology)	Yukinobu NAKAMURA	Original		2						2			2											2					
		Actual / Corrective		9/16, 28 2									6/8, 9 1											5/29, 30 2					
Mine waste management 2C (inspection, regulatory affairs)	Mitsuo OHTAKE	Original		2		2				2			5			2			2				2	5		2			
		Actual / Corrective		9/14, 28 2		11/17 1	12/12 1			3/14, 15 2	4/27 1		6/7-9, 15 4	7/28 1	8/24 1							3/29 1		5/28-31 4				9/18 1	
Database construction of mine environment A (general constr.)	Ippei TAKEDA	Original		2						2			4						2			2		4		2		2	
		Actual / Corrective		9/14, 27 2						3/21, 22 2	4/27 1		6/12, 14, 15 3	7/28 1	8/24 1							3/29 1							
Database construction of mine environment B (DB utilization)	Kosuke ISHIYAMA	Original											2			2								2					
		Actual / Corrective												7/28 1	8/24 1														
Reporting				▲	▲											△												△	
			Planning		Work Plan											Progress Report											Final Report		

Appendix 3

Appendix 4

Mine Waste Database Management Manual

Mine Waste Database Management Manual

Contents

1. Overview of Mine Waste Database

1.1. System structure

The Mine Waste Database consist of Access Database files that records environment Monitoring Data, Environment Permit (EP), Environment Impact Assessment (AER), Environment Monitoring Management Program, Annual Environment Reports, Audit and Inspection.

All these electronic files and GIS (Geographical Information System) files do have separate folders and are stored in the NAS (Network Array Storage) device which is connected to CEPA's Local Area Network and shared by CEPA officer.

2. Management of Mine Waste Database

2.1. Role assignment of staff in charge of Database

(1) **Person in charge**

PIC (Person in charge) is in charge of Mine Waste Database in CEPA. PIC requests data from Project Officer and confirms receipt of data. And PIC access the data base as necessary and view the data

(2) **Data controller**

Data controller register the data received from each responsible Officer. Also, upon receiving a request from each person in charge, it outputs data in a required format. If there is a problem in the database, report it to the IT / GIS Administrator.

(3) **IT/GIS Manager**

IT/GIS Manager does backups of the database, restores or fixes problems where necessary. Also, the IT/GIS manager can also improve the database upon receiving the request.

(4) **Director**

Director is the Administrator responsible for supervising the entire database system, and conducts business duties to personnel in charge of each mine and data controller. In addition, Director requests the IT / GIS administrator to request the data controller, raised through the work organization.

2.2. Folder Structure in Database and Access Control

2.2.1. Overview of configuration

The folders of the database are roughly divided into the following folders.

Master_DB

The main file of the database and the electronic file stored in the folder sorted by CEPA project are saved.○Backup

Data in Master DB is saved for each backup.

ReferenceDB

It is duplicate of Master_DB.

Work_files

This is a duplicate of Master_DB that is used for business purposes and is a folder for storing data to be shared within CEPA。

GIS_Database

It is a folder to store data used by GIS. Data common to the project is saved in the Common_data folder. The data of each project is saved in the folder for each project.

For each folder, security restrictions are set for user types. The types of users are described below.

GIS/IT Manager

All folders and files are able to be read and written.

Data Controller

All folders and files are able to be read and written.

EPW_User

The folder "Work_files" and "GIS_database" are be able to be read and written. The folder "ReferenceDB" is able to read only.

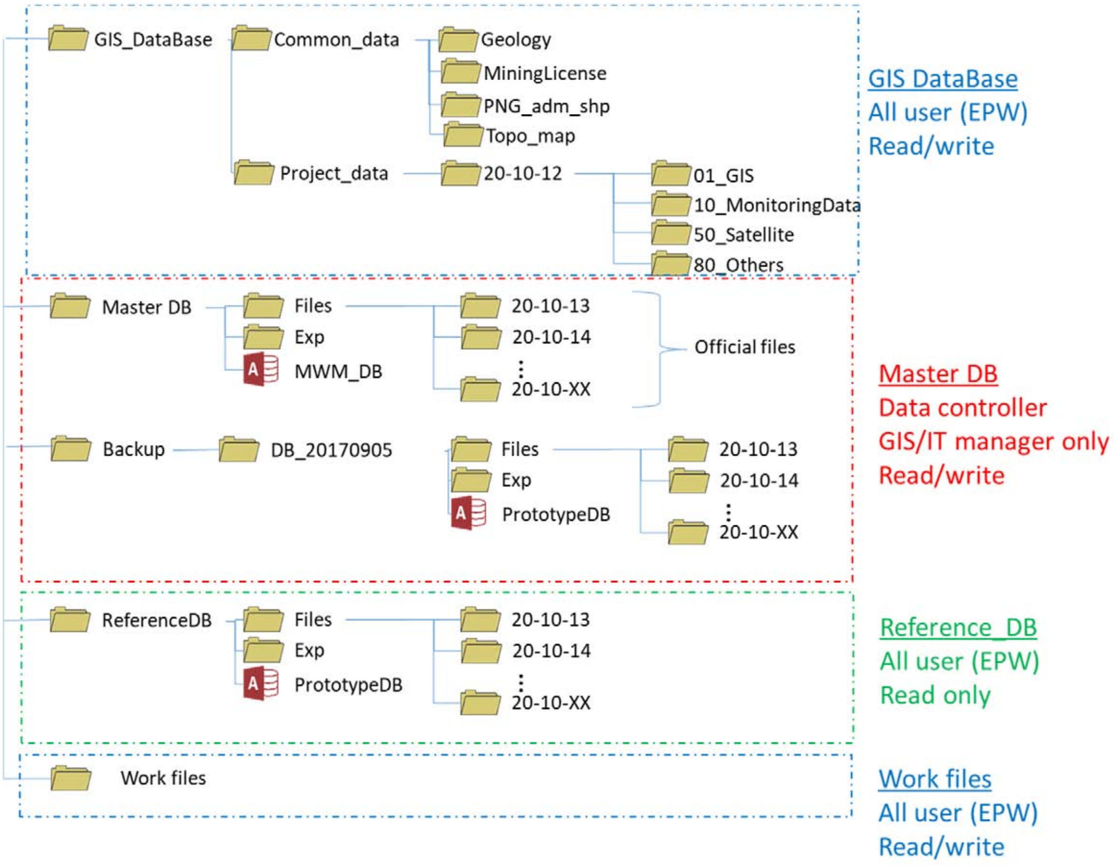


Figure 1　Folder structure in Database server

Table 1　User grope and user of permission of folders in server

User-Group	User ID	01_MasterDB	02_ReferenceDB	03_Workfile	Backup
GIS_IT_Manager	Gerard	R/W	R/W	R/W	R/W
Data_Controller	Anderson	R/W	R/W	R/W	R/W
EPW-user	EPW-user1	×	R0	R/W	×
	admin	R/W	R/W	R/W	R/W

2.2.2. The way of access control configuration

② Access to NAS to use browser and log in as “admin”.
③ Click to control panel.
④ Click to “share folder”.
⑤ If you want to change user, you click “User” or “User Group”.
⑥ If you want to change permit of folders, you click “Edit shared Folders Permission”

⑥Select to sub folder that you want to change and “Permission”

⑦If you want to create new user, you crick “Create”.

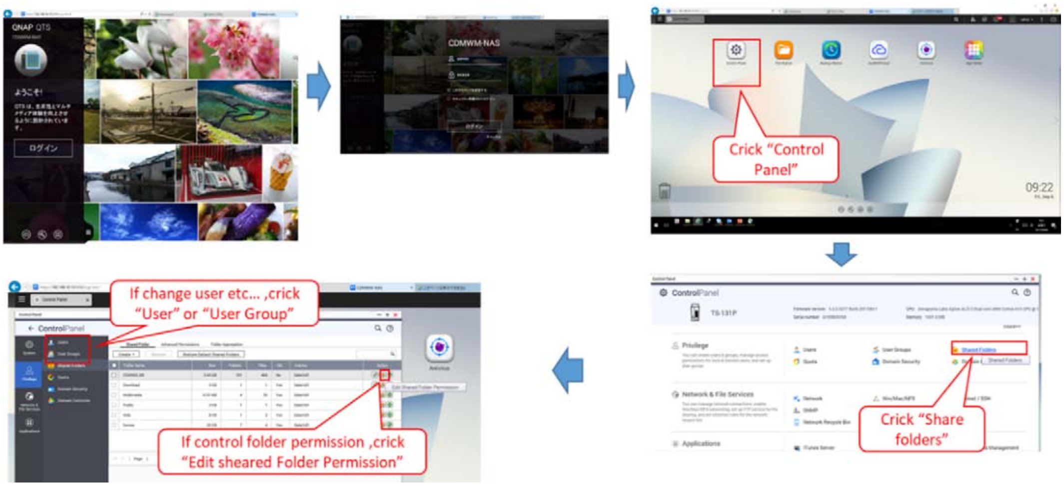
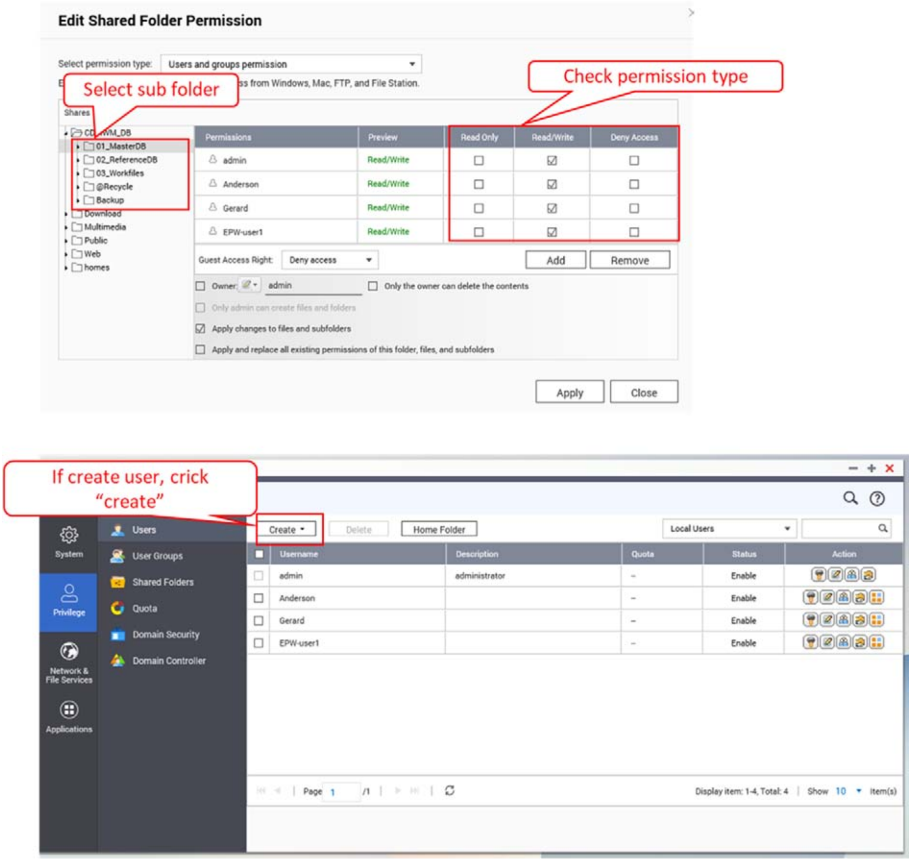


Figure 2 The way of configuration of folder permission(1)



Select sub folder

Check permission type

Edit Shared Folder Permission

Select permission type: Users and groups permission

E… ss from Windows, Mac, FTP, and File Station.

Permissions	Preview	Read Only	Read/Write	Deny Access
admin	Read/Write	☐	☑	☐
Anderson	Read/Write	☐	☑	☐
Gerard	Read/Write	☐	☑	☐
EPW-user1	Read/Write	☐	☑	☐

Guest Access Right: Deny access

☐ Owner: admin ☐ Only the owner can delete the contents

☐ Only admin can create files and folders

☑ Apply changes to files and subfolders

☐ Apply and replace all existing permissions of this folder, files, and subfolders

If create user, crick
“create”

☐	Username	Description	Quota	Status
☐	admin	administrator	–	Enable
☐	Anderson		–	Enable
☐	Gerard		–	Enable
☐	EPW-user1		–	Enable

Page 1 /1

Display item: 1-4, Total: 4 | Show 10 Item(s)

Figure 3 The way of configuration of folder permission (2)

2.3. Workflow in Database

2.3.1. Environment monitoring data

In order to facilitate input to the database, CEPA let the mining enterpriser enter data in a predetermined file (environmental monitoring datasheet). The person in charge of each mine in CEPA confirms the contents of the environmental monitoring data sheet of this file. If there is a problem, let the mining operator correct it. The confirmed environmental monitoring data sheet is sent to the data controller, and the data controller inputs to the database.

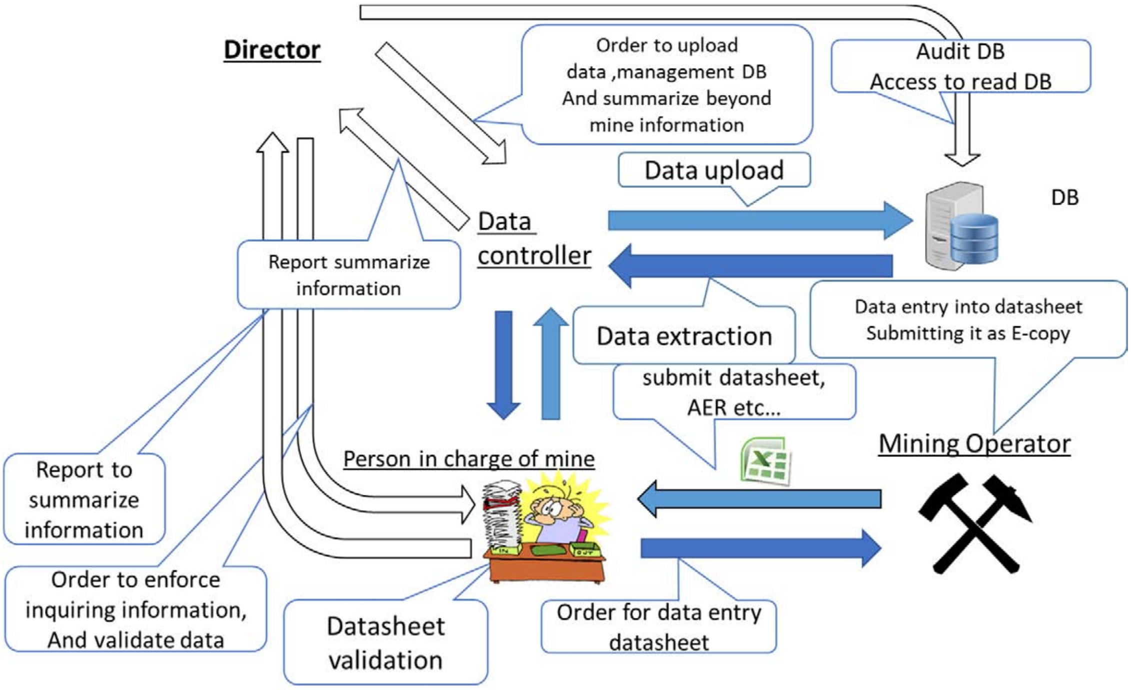


Figure 4 Workflow in Database

2.3.2. Stored and management of each electronic files

For files related to EIA, EMP, EMMP, AER and Audit, the person in charge at each mine receives it and confirms the contents, and requests the data controller to register to the database. The requested data controller registers in the database.

2.3.3. Viewing and output of Database

A general user such as a person in charge of each mine can access the duplicated database file and can search and output the data. When tabulating and outputting in a specific format, you output a query by combining it. In this case, the data controller or IT / GIS manager creates a query and outputs data.

2.3.4. Back up and restore of Database

Database backups are periodically performed by IT / GIS manager. First, copy the original database group (Master_DB) and paste it in the backup folder. Rename (DB_ date) the pasted one.

In case of restoring, first delete the current Master DB, copy the backed up folder group and attach it to the root. Rename the name of the pasted folder to Master_DB.

3. Main Database

3.1. Overview

Main Database consists of database files created by MS Access and electronic files grouped by folder for each project. The database file is composed of 10 groups of tables corresponding to the business flow of CEPA. Figure 5 is shown table relationship of database.

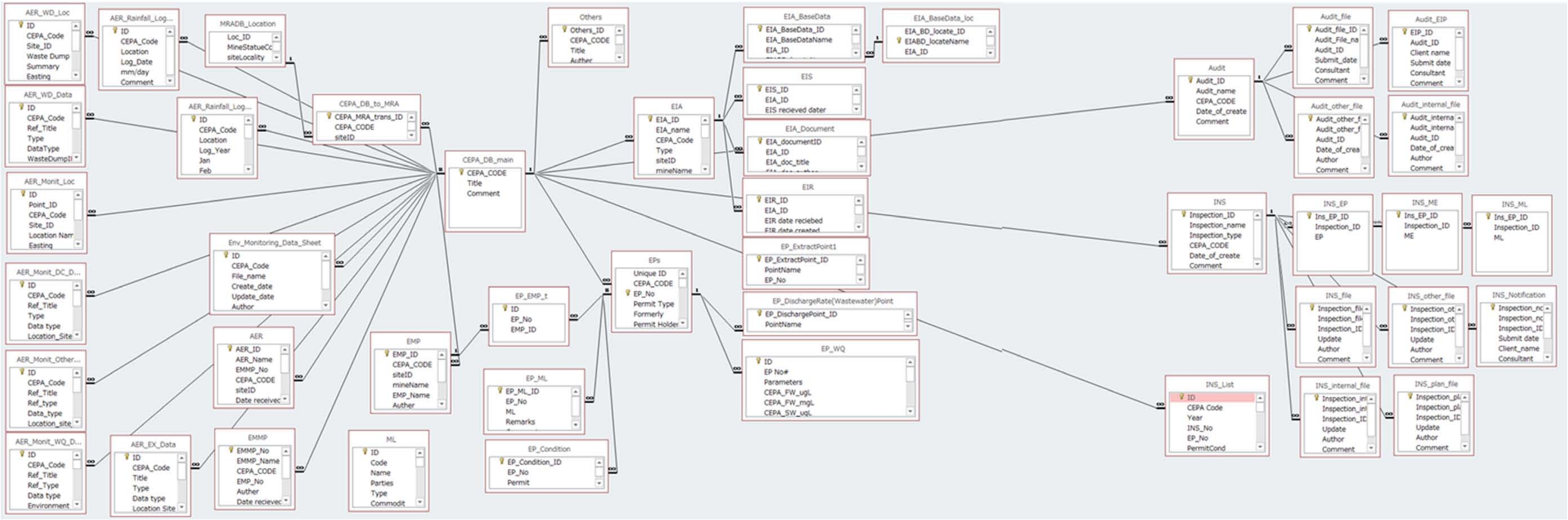


Figure 5 Table relationship

Main table

It is a table group forming the core of this database. “CEPA_DB_main” table is recorded “CEPA_CODE” and project names. “CEPA_CODE” is internal code in order to manage in CEPA EPW. There is managed whole database as a key of “CEPA_CODE”.

“MRADB_Location“table is recorded mine location, types, commodities and so on, that is inquiry GSD of MRA.

The table “CEPA_DB_to_MRA” is a table for combining the CEPA_DB_main table and the MRADB_Location table, in which CEPA_CODE and site_ID, which is the key of MRADB_Location, correspond to each other

Table 2 Table items and source related tables of “CEPA_DB_main”

Table	Field Name	Remarks	From	
CEPA_DB_main	CEPA_Code	CEPA internal Code of mine project in EPW	CEPA	Receptionnaly
	Title	Project name	CEPA	Receptionnaly
	Comment	Comment in order to remark	CEPA	PIC
CEPA_DB_to_MRA	CEPA_MRA_trans_ID	Unique ID of this table	Automatically	
	CEPA_Code	CEPA internal Code of mine project in EPW	CEPA	Receptionnaly
	SiteID	MRA-GSD siteID	MRA	GSD file
MRADB_Locaton	Loc_ID	Unique ID of this table	MRA	GSD file
	MineStatueCoe	Mine statue	MRA	GSD file
	siteLocality	Site Locality	MRA	GSD file
	siteID	Site ID	MRA	GSD file
	mineName	Mine name	MRA	GSD file
	mineStatue	Mine statue	MRA	GSD file
	exprorationSatue	Exproration Statue	MRA	GSD file
	mineSummary	Mine Summary	MRA	GSD file
	Easting	Mine Location of Easting	MRA	GSD file
	Northing	Mine Location of Northing	MRA	GSD file
	Lat	Mine Location of Latitude	MRA	GSD file
	Lon	Mine Location of Lontitude	MRA	GSD file
	Zone	Coodinate Zone	MRA	GSD file
	100Kmapsheet	100km map sheet Number	MRA	GSD file
	250Kmapsheet	250km map sheet Number	MRA	GSD file
	dateRecorded	Date Recorded	MRA	GSD file
	dateLastUpdate	Last updata date	MRA	GSD file
	locationMethod	Location method	MRA	GSD file
	Accuracy	Accurarcy	MRA	GSD file
	MainCommodity	Main Commodity	MRA	GSD file
	MainCommoditySize	Main Commodity size	MRA	GSD file
	WorkExtract	Work Exract	MRA	GSD file
	WorkExtractComment	Work Exract Comment	MRA	GSD file
	Geoscientistname	Geoscientist name of MRA	MRA	GSD file
	EnteredByName	Entered by Name of MRA	MRA	GSD file
	Perssonel	Personel	MRA	GSD file

EIA

EIA table grope is recorded environment impact assessment information that is based on published of environment permit. EIA table is recorded general information as EIA. The table “EIA_BaseData” is recorded predevelopment monitoring data, and the table “EIA_BaseData_Location” is recorded location information. The table “EIA_Document” is recorded relative EIA document information and link to file location.

Table 3 Table items and source related tables of EIA

Table	Field Name	Remarks	From
EIA	EIA_ID	Unique ID of EIA	EIA documents
	EIA_name	EIA name	EIA documents
	CEPA_Code	CEPA Code	CEPA_DB_main table
	Types	Documents type (EIA,EIR,EIS,Others)	EIA documents
	Client_name	Client name	EIA documents
	Client_adress	Client adress	EIA documents
	Submit date	Submit date	EIA documents
	Date created	Date created	EIA documents
	EIA_level	EIA Level	EIA documents
	Comment	Comment	EIA documents
	Consultant	Consultant	EIA documents
EIA_BaseData	EIA_BaseData_ID	Unique ID of EIA basedata (Automatically)	
	EIA_BaseDataName	EIA basedata name	EIA documents
	EIA_ID	EIA ID	EIA table
	EIABD_locateName	Base data loation name	EIA documents
	Chemical	Chemical (Ex. Cu, Zn etc)	EIA documents
	EIA_Chem_Unit	Unit (ex. Mg/L)	EIA documents
	EIA_chem_value	Value	EIA documents
	EIABD_Est_date	Establish date	EIA documents
	BD_Remarks	Remark	EIA documents/user
	Link to files	File location	User
EIA_BaseData_Location	EIA_BD_locate_ID	Unique ID of EIA basedata location table (Automatically)	
	EIABD_locateName	Location name of EIA Location data	EIA_BaseData
	EIA_ID	EIA ID	EIA table
	Easting	Location of Easting	EIA Documents
	Northing	Location of Northing	EIA Documents
	Zone	Coodinate and zone	EIA Documents
	Comments	Comment	EIA Documents/user
EIA_Document	EIA_documentID	EIA document ID (Automatically)	
	EIA_ID	EIA ID	EIA table
	EIA_doc_title	EIA Document Title	EIA documents
	EIA_doc_auther	Author	EIA documents
	EIA_doc_accept_date	Accept date to CEPA	CEPA
	EIA doc created date	Created date document	EIA documents
	Comment	Comment	EIA documents
	EIA_doc_file_link	File location	User

EPs

The “EPs” table grope is recorded the information of relative Environment Permits (EP). The table “EPs” is recorded basic information of EP (Permitted date, Location, Number, Level etc…) and link to file location.

The table “EP_Condition” is recorded permit conditions on EP.

The table “EP_DischargeRate_Point” is recorded permit volume of discharge and discharge location information.

The table “EP_EMP_t” is recorded the correspondence between relative Environment management plan and EP numbers.

The table “EP_ExtractPoint” is recorded permit volume of extract and extract point location informations.

The table “EP_ML” is the correspondence between EP number and Mining License numbers.

The table “EP_WQ” is recorded water quality criteria for fresh and sea water in CEPA,WHO and ANZ.

Table 4 Table items and source related tables of EP (1)

Table	Field Name	Remarks	From	
EPs	Unique ID	Unique ID of EPs	CEPA	EP List
	CEPA_CODE	CEPA Code	CEPA_DB_main table	
	EP_No	EP number	CEPA	EP List
	Permit Type	Permit type WE(Water Extract),WD(Water Discharge),EP(Environmet Permit)	CEPA	EP List
	Formerly	Formerly (New, Renew or Amendent, etc)	CEPA	EP List
	Permit Holder/Applicant	Permit Holder or Applicant	CEPA	EP List
	Address	The adress of Permit Holder or Applicant	CEPA	EP List
	Province	Location of Province	CEPA	EP List
	Districts	Location of Districts	CEPA	EP List
	Local Level Governments (LLGs)	Local Level Governments (LLGs)	CEPA	EP List
	Project Name	Project name	CEPA	EP List
	Project Description	Project Description	CEPA	EP List
	Prescribed Activity	Prescribed Activity	CEPA	EP List
	Activity Level	Activity Level	CEPA	EP List
	Sub-category	Sub-category	CEPA	EP List
	Sector	Sector (eg, Mining)	CEPA	EP List
	Comments	Comments	CEPA	EP List
	Concession Area	Concession Area (Mining License)	CEPA	EP List
	Type	Type	CEPA	EP List
	Total Area	Total Area	CEPA	EP List
	Location description	Location description	CEPA	EP List
	Annual Charge	Annual Charge	CEPA	EP List
	Date Issued	Date Issued	CEPA	EP List
	Commence	Commence	CEPA	EP List
	Amalgamation	Amalgamation	CEPA	EP List
	Term of Permit	Term of Permit	CEPA	EP List
	Expiry Date	Expiry Date	CEPA	EP List
	Date Amended	Date Amended	CEPA	EP List
	Date Renewal	Date Renewal	CEPA	EP List
	Transfer date	Transfer date	CEPA	EP List
	Status	Status	CEPA	EP List
	Premises	Premises	CEPA	EP List
	Easting	Easting	CEPA	EP List
	Southing/Northing	Southing/Northing	CEPA	EP List
	GPS polygon layer file name	GPS polygon layer file name	CEPA	EP List
	Managed by	Managed by	CEPA	EP List
	Link to file	File location	User	
	Title		CEPA	EP List
EP_Condition	EP_Condition_ID	EP condition ID (Automatically)		
	EP_No	EP No	EP table	
	Condition_No	Condition Np.	EP document	
	Condition	Condition	EP document	
	Comment	Comment	User	
EP_DischatgeRate Point	EP_DischargePoint_ID	EP Discharge Point ID (Automatically)		
	PointName	Point name	EP document	
	EP_No	EP No.	EP table	
	Details	Details	EP document	
	Easting	Point location of Easting	EP document	
	Northing	Point location of Northing	EP document	
	Zone	Point location of coodinate and zone	EP document	
	WasteWater	Case of Waste water, input "1"	EP document	
	Rainfall_Runoff	Case of Rainfall runoff water, input "1"	EP document	
	DischargeRate Liter/hr	Dischage rate (Liter/hr)	EP document	
	DischargeRate Hour/day	Dischage rate (Liter/hr)	EP document	
	Discharge day/month	Dischage rate (Liter/hr)	EP document	
	Discharge month/year	Dischage rate (Liter/hr)	EP document	
	Annual Discharge volume	Annal Discharge Volume	EP document	
	Comment	Comment	EP document/User	
EP_EMP_t	ID	Unique ID of EP_EMP table(Automatically)		
	EP_No	EP_No	EP table	
	EMP_ID	EMP_ID	EMP table	
EP_ExreactPoint	EP_ExtractPoint_ID	EP Extract Point ID (Automatically)		
	PointName	Extract point name	EP document	
	EP_No	EP No.	EP table	
	Details	Details	EP document	
	Easting	Point location of Easting	EP document	
	Northing	Point location of Northing	EP document	
	Zone	Point location of coodinate and zone	EP document	
	100Kmapsheet		EP document	
	250Kmapsheet		EP document	
	Extract Liter/hr	Extract volume (Liter/hr)	EP document	
	Extract Hour/day		EP document	
	Extract Day/month		EP document	
	Extract month/year		EP document	
	Annual Extract volume	Annual Extract volume	EP document	
	Comment	Comment	EP document/user	
EP_ML	EP_ML_ID	EP_MLID (Automatically)		
	EP_No	EP No.	EP table	
	ML	ML No.	ML table	
	Remarks	Remarks	User	
	Comment	Comment	User	

Table 5　Table items and source related tables of EP (2)

EP_WQ	ID	EP_WQ ID (Automatically)		
	EP No.	EP Number	EP document	
	Parameters	Parameters (ex. Arsenic, Oil, Iron,…)	EP document	
	CEPA_FW_ugL	Regulation value of fresh water in CEPA(μg/L)	EP document	
	CEPA_FW_mgL	Regulation value of fresh water in CEPA(mg/L)	EP document	
	CEPA_SW_ugL	Regulation value of Sea water in CEPA(μg/L)	EP document	
	CEPA_SW_mgL	Regulation value of Sea water in CEPA(mg/L)	EP document	
	WHO_FW_ugL	Regulation value of fresh water in WHO(μg/L)	EP document	
	WHO_FW_mgL	Regulation value of fresh water in WHO(mg/L)	EP document	
	WHO_SW_ugL	Regulation value of Sea water in WHO(μg/L)	EP document	
	WHO_SW_mgL	Regulation value of Sea water in WHO(mg/L)	EP document	
	ANZ_FW_ugL	Regulation value of fresh water in ANZ(μg/L)	EP document	
	ANZ_FW_mgL	Regulation value of fresh water in ANZ(mg/L)	EP document	
	ANZ_SW_ugL	Regulation value of Sea water in ANZ(μg/L)	EP document	
	ANZ_SW_mgL	Regulation value of Sea water in ANZ(mg/L)	EP document	

ML

The ML table is recorded Mining Licenses information provided by MRA.

Table 6 Table items and source related tables of ML

Table	Field Name	Remarks	From	
ML	ID	Unique of ID (Automatically)		
	Code	Mining License Code	MRA	MiningLicense
	Name	Mining License name	MRA	MiningLicense
	Parties	Parties name	MRA	MiningLicense
	Type		MRA	MiningLicense
	Commodit	Commodities	MRA	MiningLicense
	Status_G		MRA	MiningLicense
	Status		MRA	MiningLicense
	Applicat		MRA	MiningLicense
	Grant_Da		MRA	MiningLicense
	Expiry_D		MRA	MiningLicense
	Last_Ren		MRA	MiningLicense
	MAC_Date		MRA	MiningLicense
	Inactive		MRA	MiningLicense
	Last_Re1		MRA	MiningLicense
	Renewal_		MRA	MiningLicense
	Area_Nor		MRA	MiningLicense
	Normalis		MRA	MiningLicense
	Normali1		MRA	MiningLicense
	Area		MRA	MiningLicense
	Official		MRA	MiningLicense
	Officia1		MRA	MiningLicense
	Applica1		MRA	MiningLicense
	Map_Refe		MRA	MiningLicense
	guidShap		MRA	MiningLicense
	guidLice		MRA	MiningLicense
	PartName	Part name	MRA	MiningLicense

EMP & EMMP

The table group of “EMP & EMMP” recorded the information and electronic file location of Environment management plan (EMP) and Environment management program (EMMP).

Table 7 Table items and source related tables of EMP and EMMP

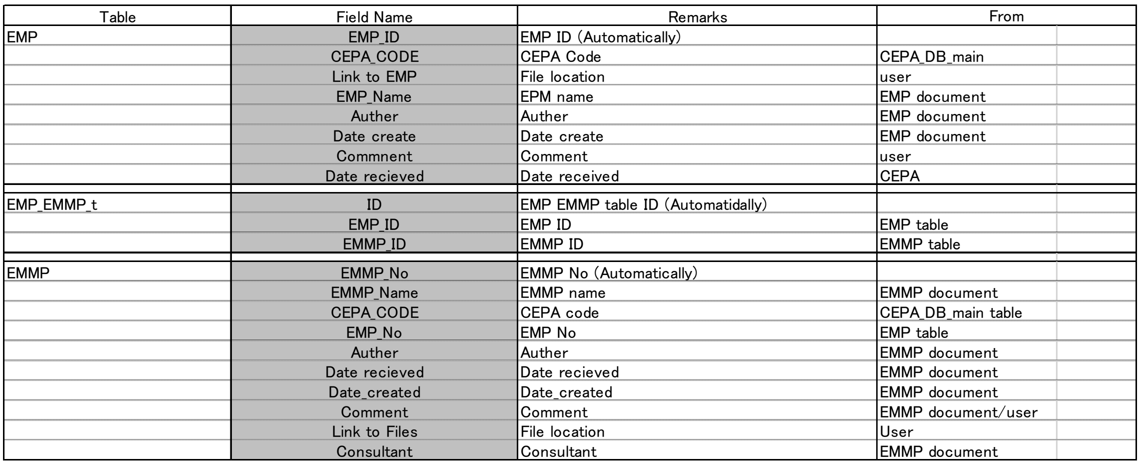


Table	Field Name	Remarks	From
EMP	EMP_ID	EMP ID (Automatically)	
	CEPA_CODE	CEPA Code	CEPA_DB_main
	Link to EMP	File location	user
	EMP_Name	EPM name	EMP document
	Auther	Auther	EMP document
	Date create	Date create	EMP document
	Commnent	Comment	user
	Date recieved	Date received	CEPA
EMP_EMMP_t	ID	EMP EMMP table ID (Automatidally)	
	EMP_ID	EMP ID	EMP table
	EMMP_ID	EMMP ID	EMMP table
EMMP	EMMP_No	EMMP No (Automatically)	
	EMMP_Name	EMMP name	EMMP document
	CEPA_CODE	CEPA code	CEPA_DB_main table
	EMP_No	EMP No	EMP table
	Auther	Auther	EMMP document
	Date recieved	Date recieved	EMMP document
	Date_created	Date_created	EMMP document
	Comment	Comment	EMMP document/user
	Link to Files	File location	User
	Consultant	Consultant	EMMP document

AER

AER table is recorded information and link to electronic file that is annual / quarterly environment report and environment monitoring datasheets.

The table “AER_EX_Data” is recorded extract volume and period.

The table “AER_Monit_DC_Data” is recorded discharge volume and period.

The table “AER_Monit_Loc” is recorded monitoring location information.

The table “AER_Monit_WQ_Data” is recorded water quality and monitoring date.

The table “AER_WD_Data” is recorded waste dumping volume for waste dumps.

The table “AER_WD_Loc” is recorded waste dump location information.

The table “AER_Monit_Other_Data” is recorded is monitoring values other than the above, period or measurement date.

The table “AER_Rainfall_Log_dialy” is recorded daily rainfall logs, and the table “AER_Rainfall_Loc_Monthly” is recorded monthly rainfall logs.

Table 8 Table items and source related tables of AER

Table	Field Name	Data type	Remarks	From	
AER	AER_ID		AER ID (Automatically)		
	CEPA_CODE		CEPA CODE	CEPA DB main table	
	Link to AER files		File location	User	
	AER_Name		AER name	AER documents	
	EMMP_No		EMMP no	EMMP table	
	Date received		Date received	AER documents	
	Created date		Created date	AER documents	
	Start of Date		Start of Date	AER documents	
	End of Date		End of Date	AER documents	
	Auther		Auther	AER documents	
	Consultant		Consultant	AER documents	
AER_EMMP_t	ID		AER EMMP t table ID (Automatically)		
	AER_ID		AER ID	AER table	
	EMMP_ID		EMMP ID	EMMP table	
AER_EX_Data	ID		AER EX ID (Automatically)		
	CEPA_Code		CEPA Code	Monitoring datasheet	Extract water
	Title		Basedata Title	Monitoring datasheet	Extract water
	Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Extract water
	Data type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Extract water
	Location Site ID		Location site ID	Monitoring datasheet	Extract water
	Location Name		Location name	Monitoring datasheet	Extract water
	Year		Monitoring Date(Year)	Monitoring datasheet	Extract water
	Quarter		Monitoring Date(Quater)	Monitoring datasheet	Extract water
	From		Moniroring period (From)	Monitoring datasheet	Extract water
	To		Moniroring period (To)	Monitoring datasheet	Extract water
	Volume_(m3)		Extraction Volume(m3)	Monitoring datasheet	Extract water
	Comment		Comment	Monitoring datasheet	Extract water
AER_Monit_DC_Data	ID		AER_Mont_DC_Data ID (Automatically)	Monitoring datasheet	Discharge water
	CEPA_Code		CEPA Code	Monitoring datasheet	Discharge water
	Ref_Title		Basedata Title	Monitoring datasheet	Discharge water
	Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Discharge water
	Data type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Discharge water
	Location_Site ID		Location site ID	Monitoring datasheet	Discharge water
	Location Name		Location name	Monitoring datasheet	Discharge water
	Year		Monitoring Date(Year)	Monitoring datasheet	Discharge water
	Quarter		Monitoring Date(Quater)	Monitoring datasheet	Discharge water
	From		Moniroring period (From)	Monitoring datasheet	Discharge water
	To		Moniroring period (To)	Monitoring datasheet	Discharge water
	Volume_(m3)		Discharge Volume(m3)	Monitoring datasheet	Discharge water
	Comment		Comment	Monitoring datasheet	Discharge water
AER_Monit_Loc	ID		AER_Monit_Loc ID (Automatically)	Monitoring datasheet	Monitoring Location information
	Point_ID		Point_ID	Monitoring datasheet	Monitoring Location information
	CEPA_Code		CEPA_Code	Monitoring datasheet	Monitoring Location information
	Site_ID		Site_ID	Monitoring datasheet	Monitoring Location information
	Location Name		Location Name	Monitoring datasheet	Monitoring Location information
	Easting		Easting	Monitoring datasheet	Monitoring Location information
	Northing		Northing	Monitoring datasheet	Monitoring Location information
	Altitude_(m)		Altitude_(m)	Monitoring datasheet	Monitoring Location information
	Coodinate _Zone		Coodinate _Zone	Monitoring datasheet	Monitoring Location information
	Comment		Comment	Monitoring datasheet	Monitoring Location information
AER_Monit_Other_Data	ID		AER_Monit_Other_ID	Monitoring datasheet	Other data
	CEPA_Code		CEPA_Code	Monitoring datasheet	Other data
	Ref_Title		Basedata Title	Monitoring datasheet	Other data
	Ref_type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Other data
	Data_type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Other data
	Location_site_ID		Location_site_ID	Monitoring datasheet	Other data
	Period_year		Period_year	Monitoring datasheet	Other data
	Period_Quater		Period_Quater	Monitoring datasheet	Other data
	From		From	Monitoring datasheet	Other data
	To		To	Monitoring datasheet	Other data
	Input_Data_title		Input_Data_title	Monitoring datasheet	Other data
	Item_name		Item_name	Monitoring datasheet	Other data
	Item Value		Item Value	Monitoring datasheet	Other data
	Item Unit		Item Unit	Monitoring datasheet	Other data
	Comment		Comment	Monitoring datasheet	Other data

Table 9 Table items and source related tables of AER (2)

AER_Monit_WQ_Data	ID		AER Mont WQ Data	Monitoring datasheet	Water Qualty data
	CEPA_Code		CEPA_Code	Monitoring datasheet	Water Qualty data
	Ref_Title		Basedata Title	Monitoring datasheet	Water Qualty data
	Ref_Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Water Qualty data
	Data type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Water Qualty data
	Environment Permit Condition		Environment Permit Condition	Monitoring datasheet	Water Qualty data
	EMMP Section		EMMP Section	Monitoring datasheet	Water Qualty data
	Location Name		Location Name	Monitoring datasheet	Water Qualty data
	Location Site ID		Location Site ID	Monitoring datasheet	Water Qualty data
	Year		Year	Monitoring datasheet	Water Qualty data
	Quarter		Quarter	Monitoring datasheet	Water Qualty data
	Measure Date		Measure Date	Monitoring datasheet	Water Qualty data
	Dissolved Oxygen (mg/L)		Dissolved Oxygen (mg/L)	Monitoring datasheet	Water Qualty data
	Turbidity_(NTU)		Turbidity_(NTU)	Monitoring datasheet	Water Qualty data
	pH		pH	Monitoring datasheet	Water Qualty data
	Conductivity_(μS/cm)		Conductivity_(μS/cm)	Monitoring datasheet	Water Qualty data
	Calcium (mg/L)		Calcium (mg/L)	Monitoring datasheet	Water Qualty data
	Amonia (NH3)		Amonia (NH3)	Monitoring datasheet	Water Qualty data
	Nitrates (mg/L)		Nitrates (mg/L)	Monitoring datasheet	Water Qualty data
	Nitrites (mg/L)		Nitrites (mg/L)	Monitoring datasheet	Water Qualty data
	Mn_(μg/L)		Mn_(μg/L)	Monitoring datasheet	Water Qualty data
	Total Dissolved Solids (mg/L)		Total Dissolved Solids (mg/L)	Monitoring datasheet	Water Qualty data
	Temperature (° C)		Temperature (° C)	Monitoring datasheet	Water Qualty data
	Oxygen		Oxygen	Monitoring datasheet	Water Qualty data
	Oil_Grease		Oil_Grease	Monitoring datasheet	Water Qualty data
	Fat		Fat	Monitoring datasheet	Water Qualty data
	As_(μg/L)		As_(μg/L)	Monitoring datasheet	Water Qualty data
	Cd_(μg/L)		Cd_(μg/L)	Monitoring datasheet	Water Qualty data
	Cr6+_(μg/L)		Cr6+_(μg/L)	Monitoring datasheet	Water Qualty data
	Cu_(μg/L)		Cu_(μg/L)	Monitoring datasheet	Water Qualty data
	Cn-(Free)_(μg/L)		Cn-(Free)_(μg/L)	Monitoring datasheet	Water Qualty data
	Cn-(Total)_(μg/L)		Cn-(Total)_(μg/L)	Monitoring datasheet	Water Qualty data
	Pb_(μg/L)		Pb_(μg/L)	Monitoring datasheet	Water Qualty data
	Hg_(μg/L)		Hg_(μg/L)	Monitoring datasheet	Water Qualty data
	Ag_(μg/L)		Ag_(μg/L)	Monitoring datasheet	Water Qualty data
	Zn_(μg/L)		Zn_(μg/L)	Monitoring datasheet	Water Qualty data
	Ba_(μg/L)		Ba_(μg/L)	Monitoring datasheet	Water Qualty data
	Bo_(μg/L)		Bo_(μg/L)	Monitoring datasheet	Water Qualty data
	Cl_(μg/L)		Cl_(μg/L)	Monitoring datasheet	Water Qualty data
	Co_(μg/L)		Co_(μg/L)	Monitoring datasheet	Water Qualty data
	Fe_(μg/L)		Fe_(μg/L)	Monitoring datasheet	Water Qualty data
	F_(μg/L)		F_(μg/L)	Monitoring datasheet	Water Qualty data
	Ni_(μg/L)		Ni_(μg/L)	Monitoring datasheet	Water Qualty data
	Na_(μg/L)		Na_(μg/L)	Monitoring datasheet	Water Qualty data
	Se_(μg/L)		Se_(μg/L)	Monitoring datasheet	Water Qualty data
	N(NO3- NO2-)_(μg/L)		N(NO3- NO2-)_(μg/L)	Monitoring datasheet	Water Qualty data
	Sulfate(SO4 2-)_(μg/L)		Sulfate(SO4 2-)_(μg/L)	Monitoring datasheet	Water Qualty data
	Sulfide(HS-)_(μg/L)		Sulfide(HS-)_(μg/L)	Monitoring datasheet	Water Qualty data
	Phenols		Phenols	Monitoring datasheet	Water Qualty data
	Pesiticides		Pesiticides	Monitoring datasheet	Water Qualty data
	Radioactivitiy		Radioactivitiy	Monitoring datasheet	Water Qualty data
	Tars		Tars	Monitoring datasheet	Water Qualty data
	Taste		Taste	Monitoring datasheet	Water Qualty data
	Insoluble residuces		Insoluble residuces	Monitoring datasheet	Water Qualty data
	Toxicants(miscelleneous)		Toxicants(miscelleneous)	Monitoring datasheet	Water Qualty data
	E_col(per100ml)		E_col(per100ml)	Monitoring datasheet	Water Qualty data
	Color		Color	Monitoring datasheet	Water Qualty data
	Odor		Odor	Monitoring datasheet	Water Qualty data
	Total_Soilds(mg/L)		Total_Soilds(mg/L)	Monitoring datasheet	Water Qualty data
	Supended_Solids_(mg/L)		Supended_Solids_(mg/L)	Monitoring datasheet	Water Qualty data
	Comment		Comment	Monitoring datasheet	Water Qualty data

Table 10　Table items and source related tables of AER (3)

AER_WD_Data	ID		AER_WD_Data ID	Monitoring datasheet	Waste Dump Volume
	CEPA_Code		CEPA_Code	Monitoring datasheet	Waste Dump Volume
	Ref_Title		Basedata Title	Monitoring datasheet	Waste Dump Volume
	Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Waste Dump Volume
	DataType		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Waste Dump Volume
	WasteDumpID		WasteDumpID	Monitoring datasheet	Waste Dump Volume
	Period_Year		Period_Year	Monitoring datasheet	Waste Dump Volume
	Quater		Quater	Monitoring datasheet	Waste Dump Volume
	From		From	Monitoring datasheet	Waste Dump Volume
	To		To	Monitoring datasheet	Waste Dump Volume
	Initial Capacity		Initial Capacity	Monitoring datasheet	Waste Dump Volume
	Used Capacity		Used Capacity	Monitoring datasheet	Waste Dump Volume
	Rest of Capacity		Rest of Capacity	Monitoring datasheet	Waste Dump Volume
	Comment		Comment	Monitoring datasheet	Waste Dump Volume
AER_WD_Loc	ID		AER_WD_Loc ID (Automatically)	Monitoring datasheet	Monitoring Location information
	CEPA_Code		CEPA_Code	Monitoring datasheet	Monitoring Location information
	Site_ID		Site_ID	Monitoring datasheet	Monitoring Location information
	Waste Dump Name		Waste Dump location name	Monitoring datasheet	Monitoring Location information
	Summary		Summary	Monitoring datasheet	Monitoring Location information
	Easting		Easting	Monitoring datasheet	Monitoring Location information
	Nothting		Northing	Monitoring datasheet	Monitoring Location information
	Altitude_(m)		Altitude_(m)	Monitoring datasheet	Monitoring Location information
	Coodinate _Zone		Coodinate _Zone	Monitoring datasheet	Monitoring Location information
	Comment		Comment	Monitoring datasheet	Monitoring Location information
AER_Rainfall_Log_dialy	ID		AER_Lainfall_Log_dialy ID (Automatically)	Monitoring datasheet	Rainfall Log (Dialy)
	CEPA_Code		CEPA_Code	Monitoring datasheet	Rainfall Log (Dialy)
	Location		Location	Monitoring datasheet	Rainfall Log (Dialy)
	Log_Date		Log_Date	Monitoring datasheet	Rainfall Log (Dialy)
	mm/day		mm/day	Monitoring datasheet	Rainfall Log (Dialy)
	Comment		Comment	Monitoring datasheet	Rainfall Log (Dialy)
AER_Rainfall_Loc_Monthly	ID		AER Rainfall Log Monthly (Automatically)	Monitoring datasheet	Rainfall Log (Monthly)
	CEPA_Code		CEPA_Code	Monitoring datasheet	Rainfall Log (Monthly)
	Location		Location	Monitoring datasheet	Rainfall Log (Monthly)
	Log_Year		Log_Year	Monitoring datasheet	Rainfall Log (Monthly)
	Jan		Jan	Monitoring datasheet	Rainfall Log (Monthly)
	Feb		Feb	Monitoring datasheet	Rainfall Log (Monthly)
	Mar		Mar	Monitoring datasheet	Rainfall Log (Monthly)
	Apr		Apr	Monitoring datasheet	Rainfall Log (Monthly)
	May		May	Monitoring datasheet	Rainfall Log (Monthly)
	Jun		Jun	Monitoring datasheet	Rainfall Log (Monthly)
	Jul		Jul	Monitoring datasheet	Rainfall Log (Monthly)
	Aug		Aug	Monitoring datasheet	Rainfall Log (Monthly)
	Sep		Sep	Monitoring datasheet	Rainfall Log (Monthly)
	Oct		Oct	Monitoring datasheet	Rainfall Log (Monthly)
	Nov		Nov	Monitoring datasheet	Rainfall Log (Monthly)
	Dec		Dec	Monitoring datasheet	Rainfall Log (Monthly)

Audit

The “Audit” tables grope are recorded audit relative information. The table “Audit_file” is recorded Audit electronic file information and its file location. The table “Audit_internal_file” is internal document electronic file information and its file location. The table “Audit_EIP” is recorded EIP (Environmental improvement plan) electronic file information and its file location.

Table 11 Table items and source related tables of Audit

Table	Field Name	Remarks	From
Audit	Audit ID	Audit ID (Automatically)	
	Audit name	Audit name	User
	CEPA_CODE	CEPA Code	CEPA main table
	Date_of_create	Date of create	User
	Comment	Comment	User
Audit file	Audit file ID	Audit File ID (Automatically)	
	Audit file name	Audit document file name	Audit documents
	Audit ID	Audit ID	Audit table
	submit date	submit date	Audit documents
	consultant	consultant	Audit documents
	comment	comment	Audit documents/User
	file to link	File location	User
Audit intern	Audit internal file ID	Audit internal file ID (Automatically)	
	Audit internal file title	Audit internal file title	Audit internal documents
	Audit ID	Audit ID	Audit table
	Author	Author	Audit internal documents
	Date_of_create	Date_of_create	Audit internal documents
	comment	comment	Audit internal documents/User
	file to link	File location	User
Audit other	Audit other file ID	Audit other file ID (Automatically)	
	Audit other file title	Audit other file title	Audit other documents
	Audit ID	Audit ID	Audit tables
	Author	Author	Audit other documents
	Date_of_create	Date_of_create	Audit other documents
	comment	comment	Audit other documents/User
	file to link	File location	User
Audit_EIP	EIP ID	EIP ID (Automatically)	
	Audit ID	Audit ID	Audit table
	Client name	Client name	EIP documents
	submit date	submit date	EIP documents
	consultant	consultant	EIP documents
	comment	comment	EIP documents/User
	file to link	File location	User

Inspection

“Inspection” tables grope are recorded Inspection relative information. The “Inspection_EP” table is recorded number of the environmental permit corresponding to inspection. The table “Inspection_ML” is recorded number of the environmental permit corresponding to Mining License. The “Inspection_file” table is recorded inspection relative electronic file information and its file location. The table “Inspection_internal_file” is recorded inspection internal document electronic file information and its file location.

Table 12 Table items and source related tables of Inspection

Table	Field Name	Remarks	From
Inspection	Inspection ID	Inspection ID (Automatically)	
	Inspection name	Inspection name	User
	Inspection type (usual or incident)	Inspection type (usual or incident)	User
	CEPA_CODE	CEPA_CODE	CEPA DB main
	Date	Date	User
	Comment	Comment	User
Inspection EP	INS_EP_ID	INS_EP_ID (Automatically)	
	Inspection ID	Inspection ID	Inspection table
	EP	EP	EP table
Inspection ML	INS_ML_ID	INS_ML_ID	
	Inspection ID	Inspection ID	Inspection table
	ML	ML ID	ML table
Inspection plan file	Inspection plan file ID	Inspection plan file ID (Automatically)	
	Inspection plan file name	Inspection plan file name	Inspection plan documents
	Inspection ID	Inspection ID	Inspection table
	Update date	Update date	Inspection plan documents
	Author	Author	Inspection plan documents
	comment	comment	Inspection plan documents/User
	file to link	File location	User
Inspection file	Inspection file ID	Inspection file ID (Automatically)	
	Inspection file name	Inspection file name	Inspection documents
	Inspection ID	Inspection ID	Inspection table
	Update date	Update date	Inspection documents
	Author	Author	Inspection documents
	comment	comment	Inspection documents/User
	file to link	File location	User
Inspection internal file	Inspection internal file ID	Inspection internal file ID (Automatically)	
	Inspection internal file title	Inspection internal file title	Inspection internal documents
	Inspection ID	Inspection ID	Inspection table
	Author	Author	Inspection internal documents
	date	date	Inspection internal documents
	comment	comment	Inspection internal documents/User
	file to link	File location	User
Inspection other file	Inspection other file ID	Inspection other file ID (Automatically)	
	Inspection other file title	Inspection other file title	Inspection other documents
	Inspection ID	Inspection ID	Inspection table
	Author	Author	Inspection other documents
	date	date	Inspection other documents
	comment	comment	Inspection other documents/User
	file to link	File location	User
Notification	Notification ID	Notification ID (Automatically)	
	Inspection ID	Inspection ID	Inspection table
	Client name	Client name	Notification documents
	submit date	submit date	Notification documents
	consultant	consultant	Notification documents
	comment	comment	Notification documents/User
	file to link	File location	User
INS_List	ID	Inspectio list ID (Automatically)	
	CEPA Code	CEPA_CODE	CEPA DB main
	Year	Year	Inspection List
	INS_No	Inspection Number	Inspection List
	EP_No	EP Number	Inspection List
	PermitCond	Permit Condition Number	Inspection List
	SubCond	Permit Condition Sub-Number	Inspection List
	Object	Object (ex.TSP,Plant,water qualty…)	Inspection List
	Fin_of_Ins	Find of Inspection	Inspection List
	Compliance_r	Compliance Ratio	Inspection List
	Date_Issued	Date Issued	Inspection List
	Date_Closed	Date Closed	Inspection List
	Northing	Northing (Location information)	Inspection List
	Easting	Easting (Location information)	Inspection List
	Hight	Height (Location information)	Inspection List
	Coodinate	Coodinate (Location information)	Inspection List
	Comments	Comments	Inspection List
	Completion_r	Completion Rate	Inspection List
	Before_Photo	Before Photo (Hypelink)	Inspection List
	After_Photo	After Photo (Hyperlinks)	Inspection List
	Officer (1)	Offier name	Inspection List
	Officer (2)	Offier name	Inspection List
	Officer (3)	Offier name	Inspection List
	Before_OLE	Before Photo (OLE)	User (bmp)
	After_OLE	After Photo (OLE)	User (bmp)

3.2. The rule of folder structure and stored electronic files

Each project folders are stored in “Files”, and there name are CEPA internal code indicating the project.

Just below that, various files classified into the folder type "EIA, EP, EMP, EMMP, AER, IMS, Audit, Other" are stored as file types. Attached file is various document and electronic files. Following is the rule of naming file names.

File name：○○_@@@(2-4 words)_(original file name or subjects)

“○○” is project code. Mainly it means CEPA internal code.

For "@@@", abbreviations of the file types shown below are described.

・EIA：EIA relative documents（EIA,EIR etc…）
・EP：EP（Environment Permit） documents
・EMP：EMP（Environment management plan） documents
・EMMP：EMMP(Environment monitoring management program) document
・AER：AER(Annual environment report) document（Add the relevant year next to the code）
・QER：QER(Quarterly environment report) document（Add the relevant quarter next to the code）
・Audit：Audit（Audit report） relative document
・INS：INS(Inspection) relative document
・OTH：Other document

3.3. Form Sequence

When you start the database file, the form of "CEPA DB main" is displayed. This form is a form for collecting various kinds of information. Linked to various forms from this form. In "Open CEPA Code List", a list of projects recorded in this database is displayed

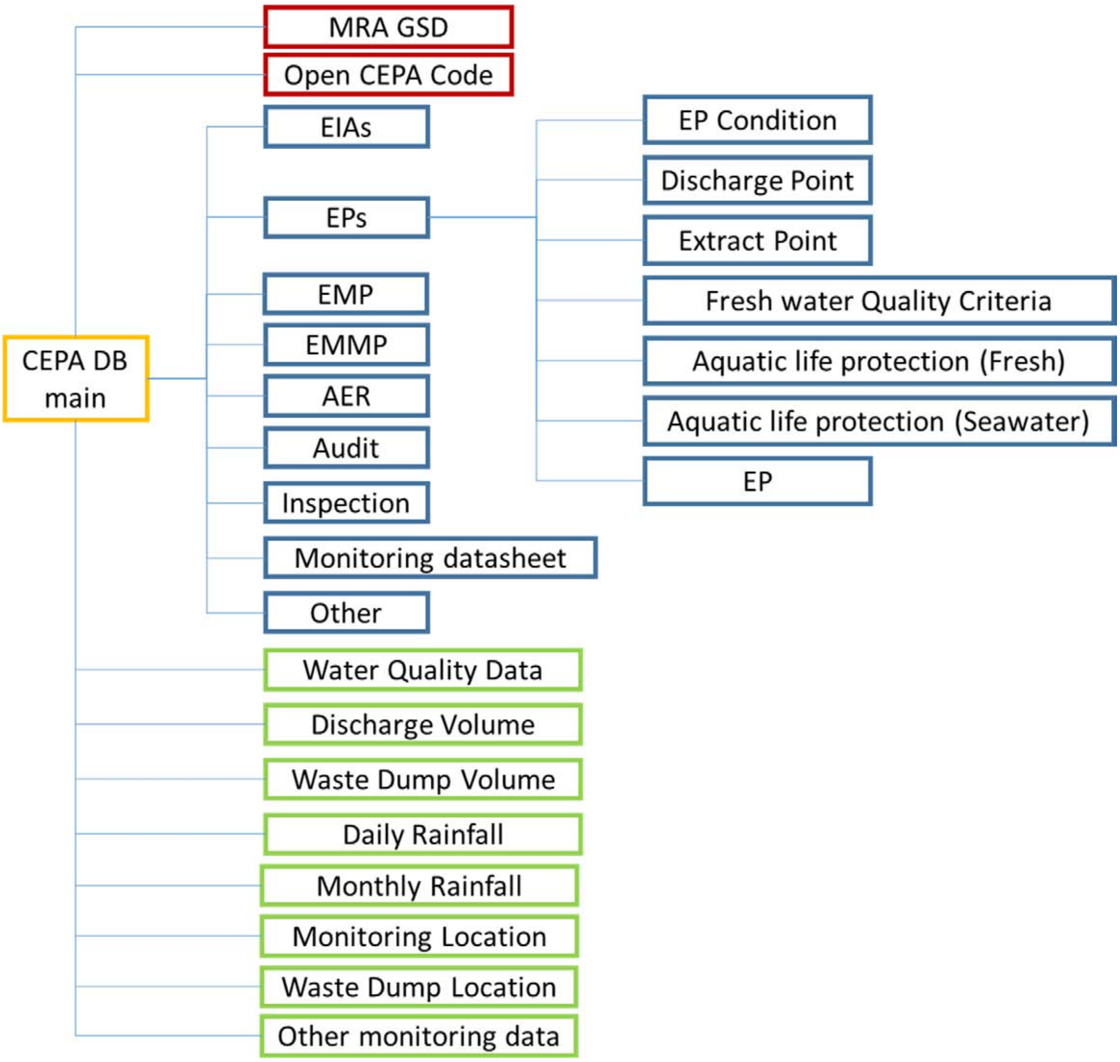


Figure 6 Database form relationship diagram

3.4. How to enter data into the database

3.4.1. Entry from Forms

3.4.1.1. CEPA DB main Form

In the CEPA DB main Form, together with the items in the CEPA DB main table, the name or management number in each item of the site ID, MRA GSD, EIA, EPs, EMP, EMMP, AER, Audit, Inspection and Monitoring Datasheet of the MRA DB table is displayed.

You can change "CEPA_CODE" by clicking "▶" in the lower left by clicking the button on the left side, new input becomes possible. (Figure 7)

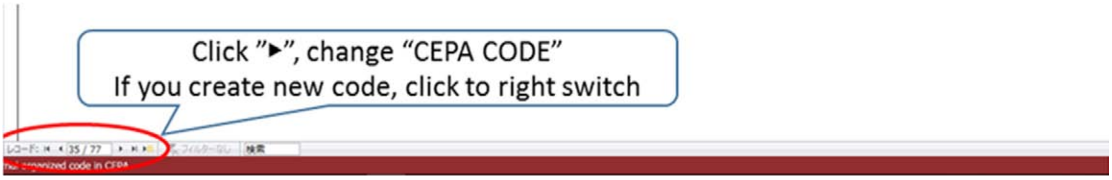


Figure 7 Change CEPA_CODE

In this form, you enter CEPA_CODE to be registered, project title, and comments as necessary.

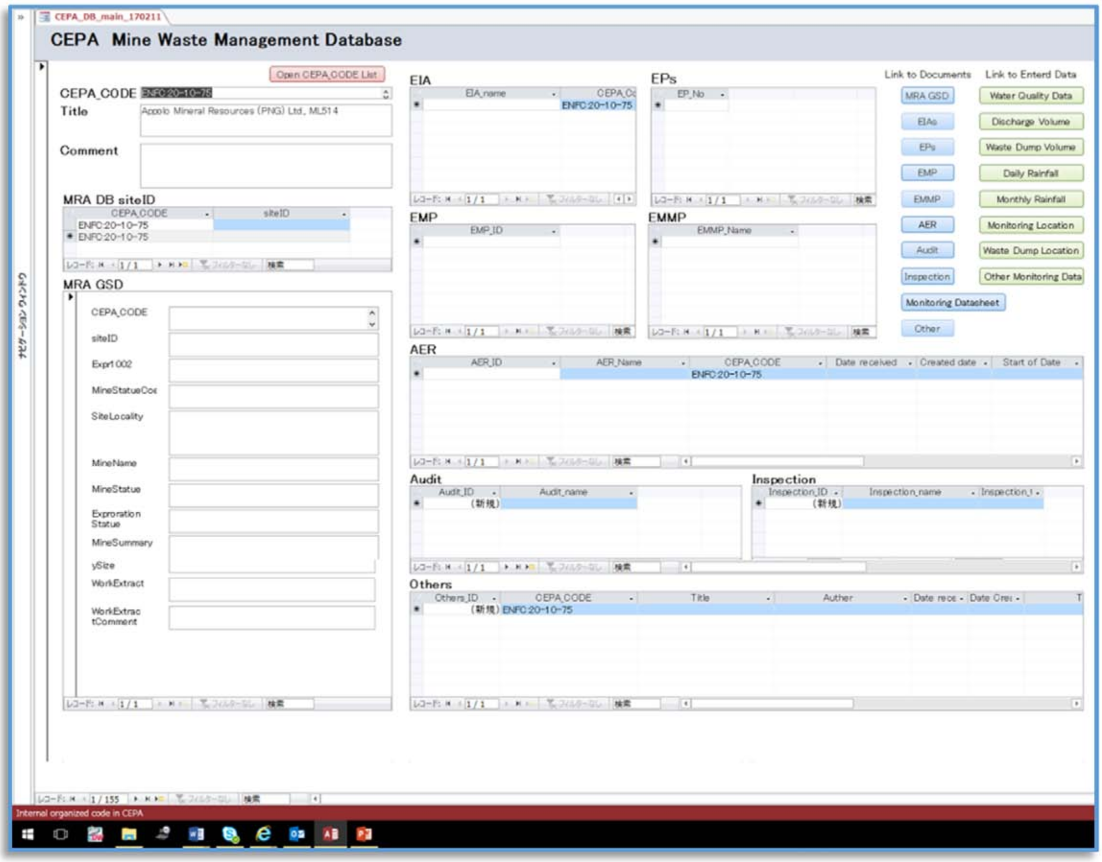
For "SiteID", you enter the "SiteID" of MRA GSD corresponding to this project.

For EIA 's "EIA name", you enter the name of the EIA corresponding to this project.

In the "EP_No" of EP, you enter the EP number corresponding to this project. For EMP and EMMP, you enter the name respectively. For AER, you enter the name of AER corresponding to this project and an arbitrary ID. For Audit's "Audit_name", you enter the name of Audit corresponding to this project.

In the "Monitoring Datasheet File_name", you enter the name of Monitoring Datasheet to be saved.

Here, we will describe how to store electronic files. First, the electronic file to be saved is saved in the aforementioned folder. Next, right click on the item "Link_to_Files" and click "Box of Linked to File" - "Edit Hyperlink". Select the corresponding folder from the displayed window and select the target file. Click the "OK" button. You use the above method to link to Monitoring Datasheet file. For "Other", enter the name of the other file corresponding to this project and the link destination of the file.



CEPA_CODE ENFC20-10-75

Title Appolo Mineral Resources (PNG) Ltd., ML514

MRA DB siteID

CEPA_CODE	siteID
ENFC20-10-75	
ENFC20-10-75	

EIA: CEPA_Co ENFC20-10-75

AER: CEPA_CODE ENFC20-10-75

Audit: Audit_ID (新規)

Inspection: Inspection_ID (新規)

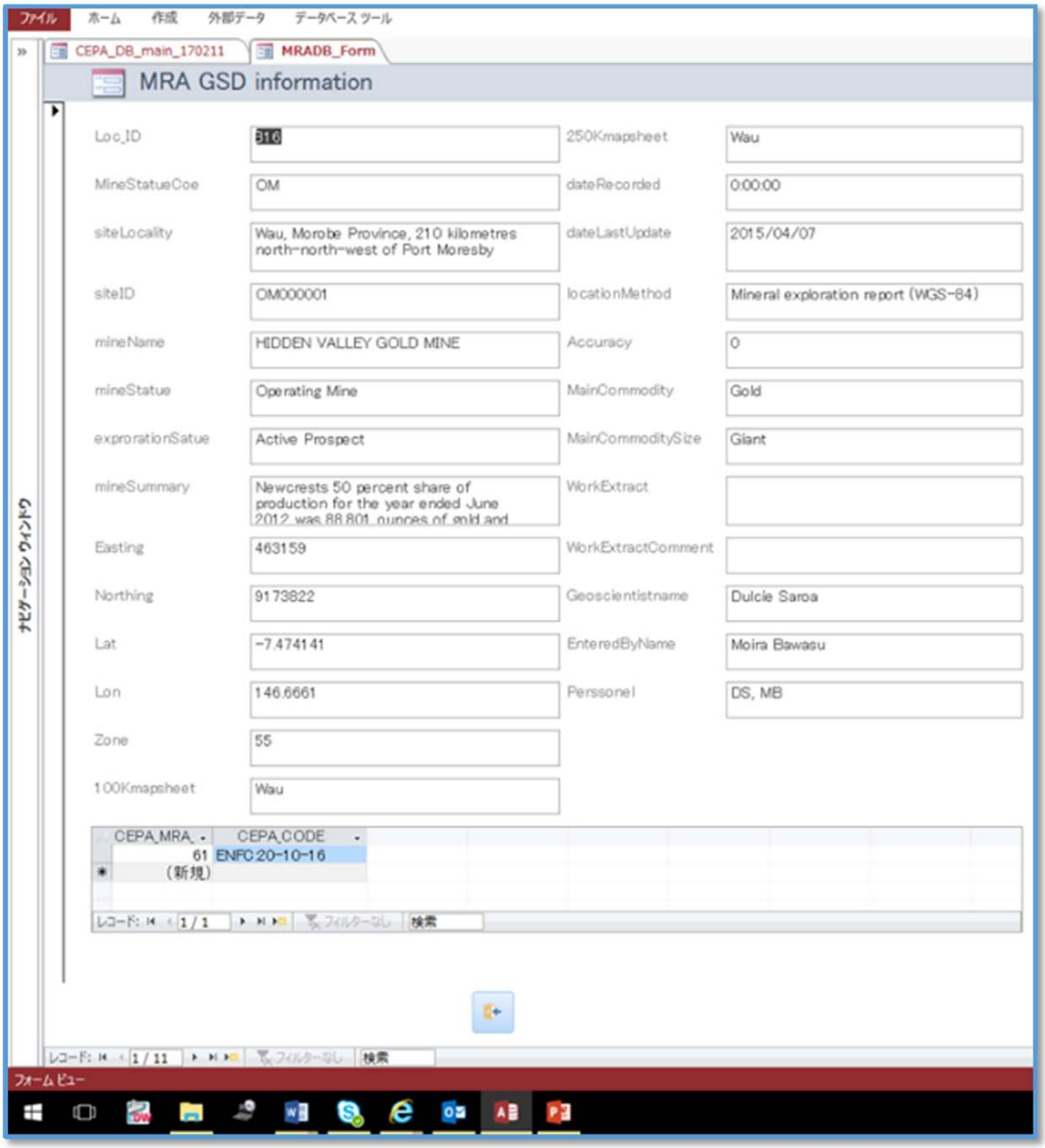
Others: Others_ID (新規) CEPA_CODE ENFC20-10-75

Internal organized code in CEPA

Figure 8 CEPA DB main Form

3.4.1.2. MRA GSD

In this form, you enter the information of GSD obtained from MRA. Also, you enter "CEPA_Code" corresponding to "SiteID" in the table below.



MRA GSD information

Loc_ID	316	250Kmapsheet	Wau
MineStatueCoe	OM	dateRecorded	0:00:00
siteLocality	Wau, Morobe Province, 210 kilometres north-north-west of Port Moresby	dateLastUpdate	2015/04/07
siteID	OM000001	locationMethod	Mineral exploration report (WGS-84)
mineName	HIDDEN VALLEY GOLD MINE	Accuracy	0
mineStatue	Operating Mine	MainCommodity	Gold
exprorationSatue	Active Prospect	MainCommoditySize	Giant
mineSummary	Newcrests 50 percent share of production for the year ended June 2012 was 88,801 ounces of gold and	WorkExtract	
Easting	463159	WorkExtractComment	
Northing	9173822	Geoscientistname	Dulcie Saroa
Lat	-7.474141	EnteredByName	Moira Bawasu
Lon	146.6661	Perssonel	DS, MB
Zone	55		
100Kmapsheet	Wau		

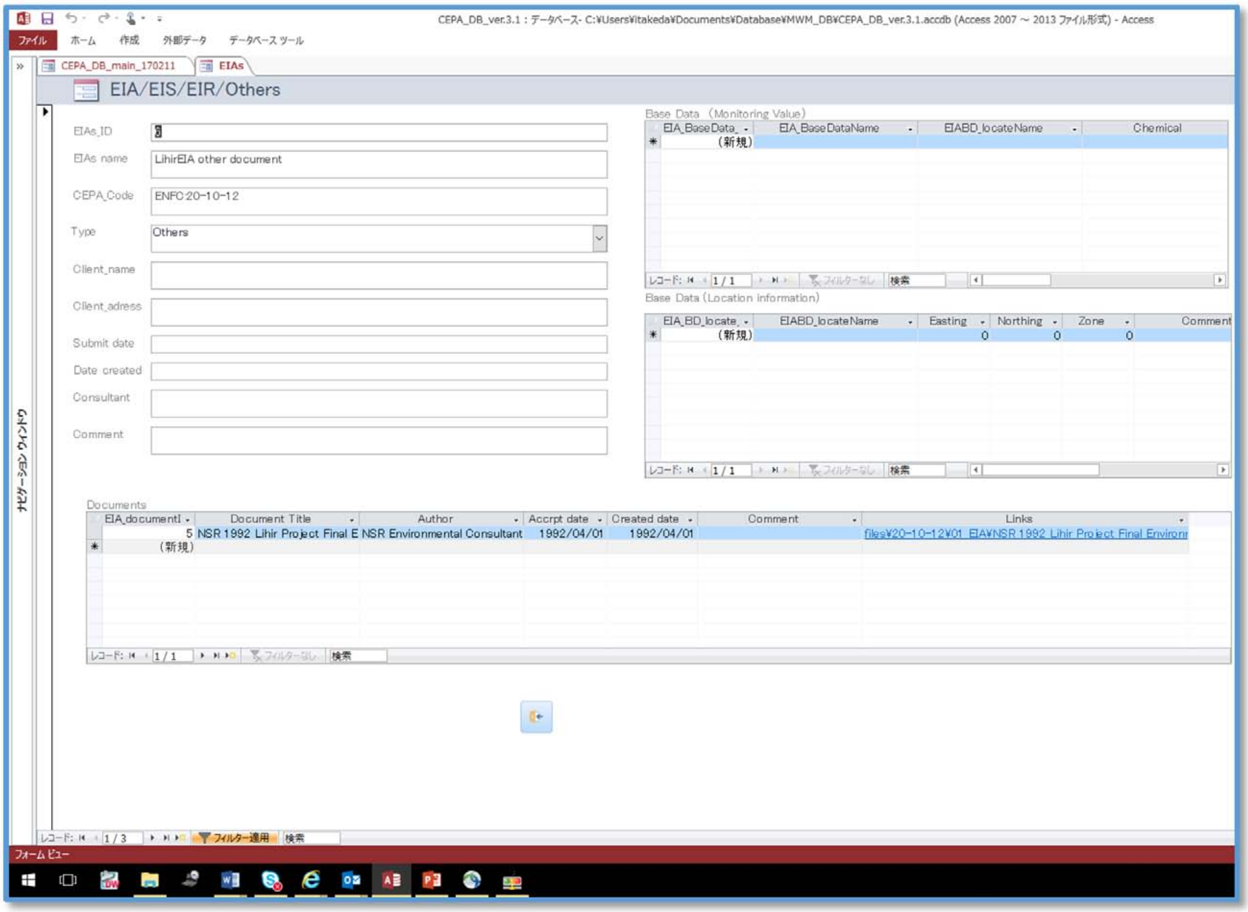
CEPA_MRA_	CEPA_CODE
61	ENFC 20-10-16
(新規)	

Figure 9 MRA GSD form

3.4.1.3. EIA

In the form, you enter information of EIAs (EIA, EIS, EIR, others). In the upper left field, you enter the name, creation date, business name and address, receipt date, consultant and comment. For Type, you select the type (EIA, EIS, EIR, etc.).

For “Base Data” (Monitoring Value), you enter the name, location name, chemical species, unit, numerical value of Base data. In Base Data (Location information), location information corresponding to the above-mentioned place name is input. In “Documents”, you enter the name of the document, the author, etc. In addition, you input the link destination of the file.



EIAs_ID: 3

EIAs name: LihirEIA other document

CEPA_Code: ENFC 20-10-12

Type: Others

Client_name:

Client_adress:

Submit date:

Date created:

Consultant:

Comment:

Base Data (Monitoring Value)

	EIA_BaseData_	EIA_BaseDataName	EIABD_locateName	Chemical
*	(新規)			

Base Data (Location information)

	EIA_BD_locate_	EIABD_locateName	Easting	Northing	Zone	Comment
*	(新規)		0	0	0	

Documents

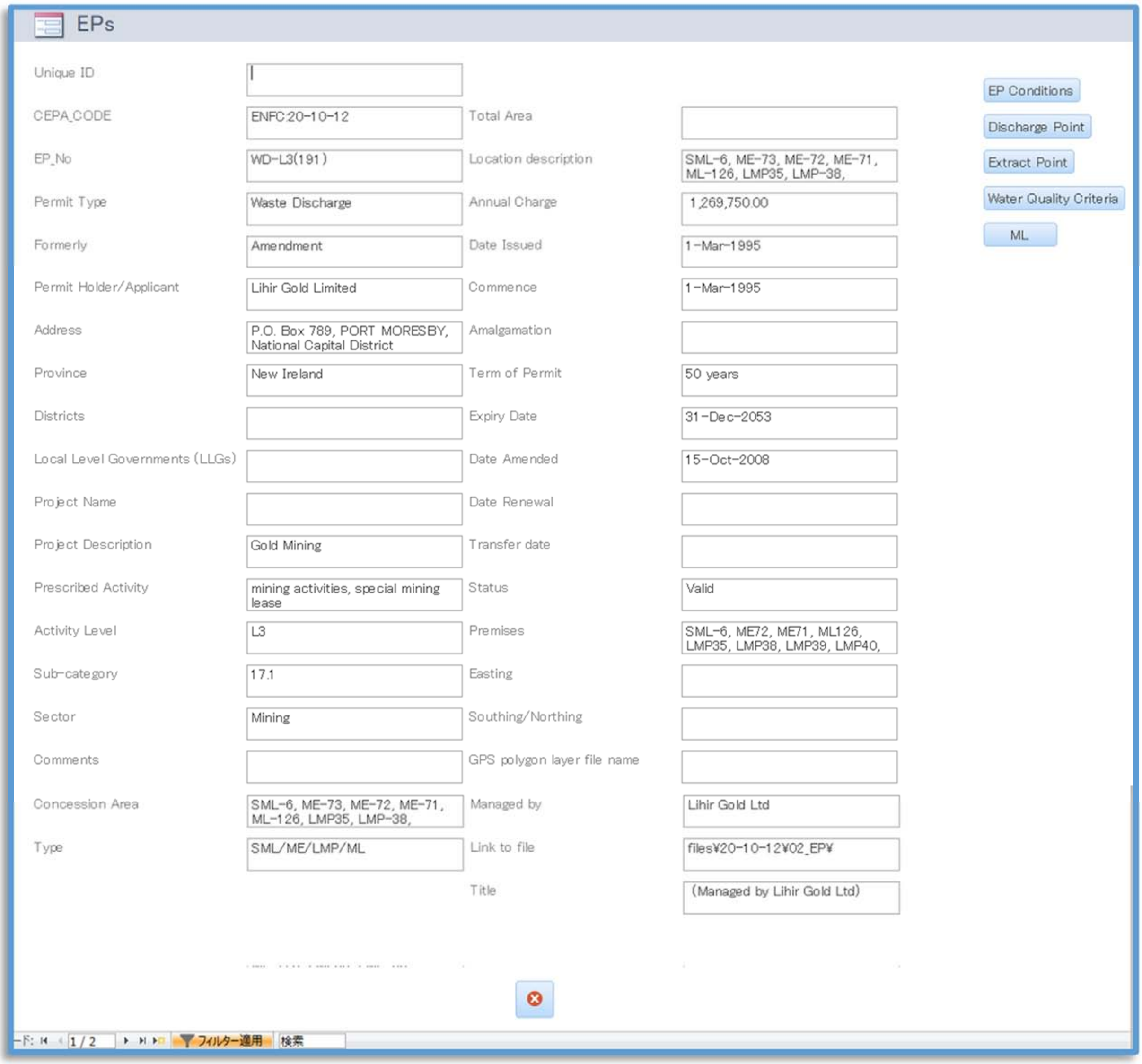
	EIA_documentI	Document Title	Author	Accrpt date	Created date	Comment	Links
	5	NSR 1992 Lihir Project Final E	NSR Environmental Consultant	1992/04/01	1992/04/01		files¥20-10-12¥01_EIA¥NSR 1992 Lihir Project Final Environ
*	(新規)						

Figure 10 EIA relative form

3.4.1.4. EP

(1)Main

In the form, information on EP is input.



Unique ID			
CEPA_CODE	ENFC20-10-12	Total Area	
EP_No	WD-L3(191)	Location description	SML-6, ME-73, ME-72, ME-71, ML-126, LMP35, LMP-38,
Permit Type	Waste Discharge	Annual Charge	1,269,750.00
Formerly	Amendment	Date Issued	1-Mar-1995
Permit Holder/Applicant	Lihir Gold Limited	Commence	1-Mar-1995
Address	P.O. Box 789, PORT MORESBY, National Capital District	Amalgamation	
Province	New Ireland	Term of Permit	50 years
Districts		Expiry Date	31-Dec-2053
Local Level Governments (LLGs)		Date Amended	15-Oct-2008
Project Name		Date Renewal	
Project Description	Gold Mining	Transfer date	
Prescribed Activity	mining activities, special mining lease	Status	Valid
Activity Level	L3	Premises	SML-6, ME72, ME71, ML126, LMP35, LMP38, LMP39, LMP40,
Sub-category	17.1	Easting	
Sector	Mining	Southing/Northing	
Comments		GPS polygon layer file name	
Concession Area	SML-6, ME-73, ME-72, ME-71, ML-126, LMP35, LMP-38,	Managed by	Lihir Gold Ltd
Type	SML/ME/LMP/ML	Link to file	files¥20-10-12¥02_EP¥
		Title	(Managed by Lihir Gold Ltd)

Figure 11 EP form

(2)EP Condition

In this form, you enter the condition of approval of EP.

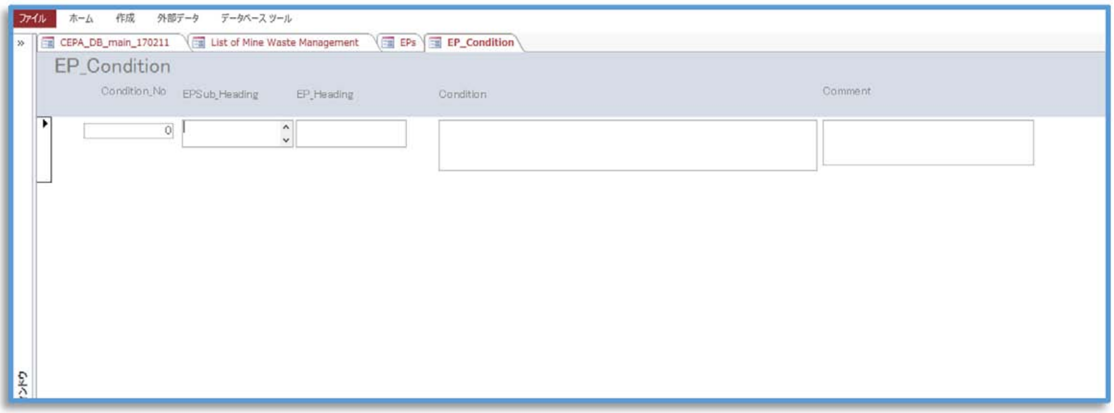


Figure 12　EP Condition form

(3)EP Extract Point ＆ EP Discharge Point

In this form, you input the approved emission amount / collection amount and position information respectively.

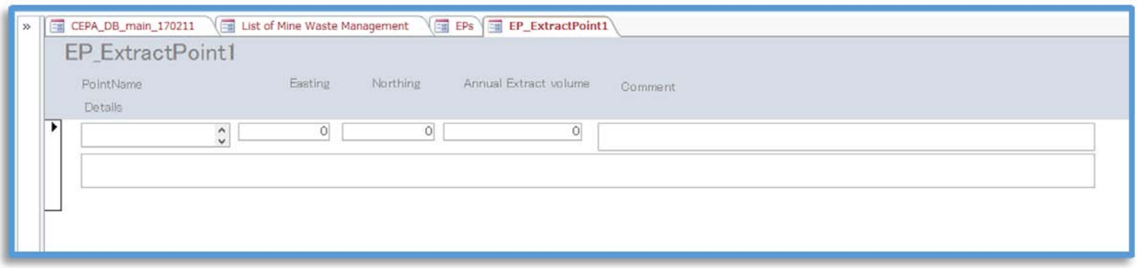
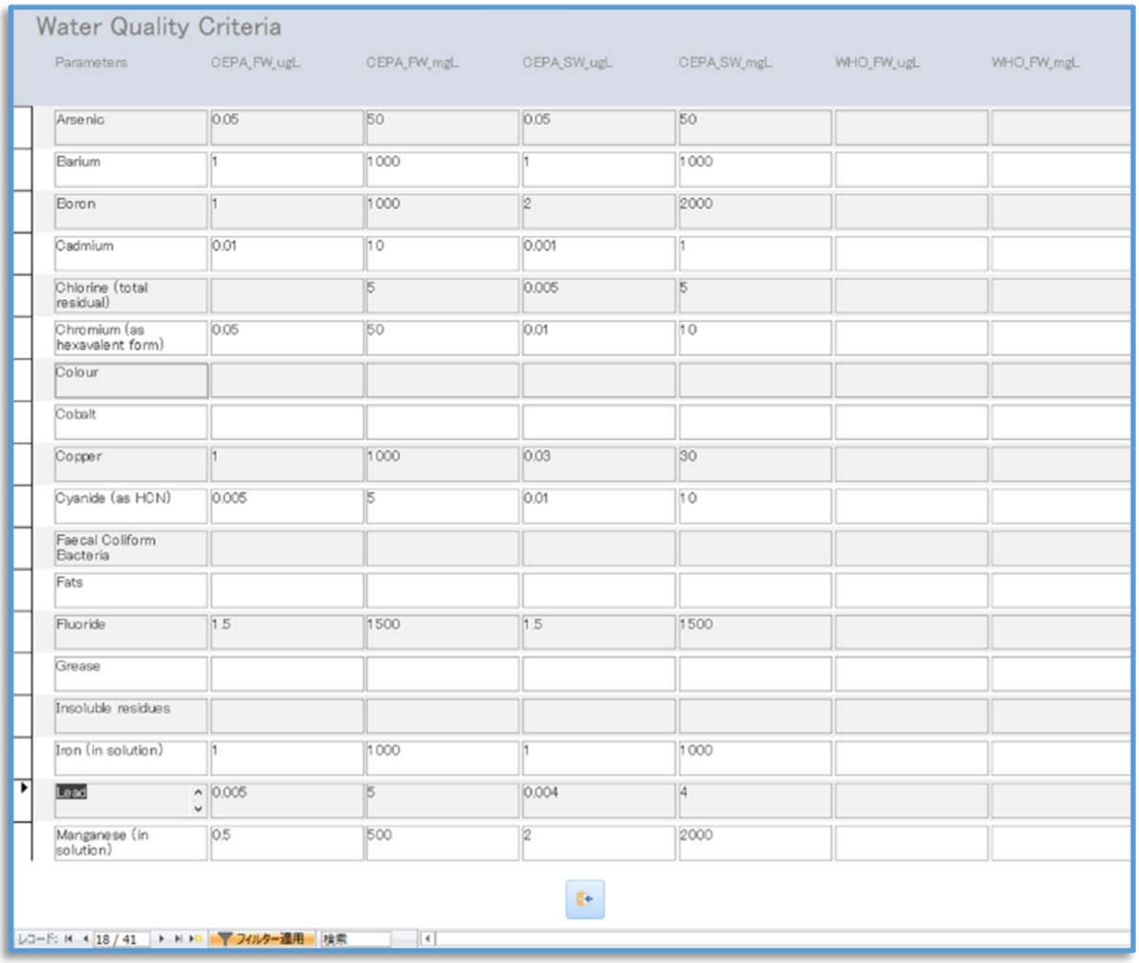


Figure 13　EP Extract Point Form

Figure 14　Discharge Pint form

(3)Water Quality Criteria

For these forms, you enter the regulation value specified in EP.



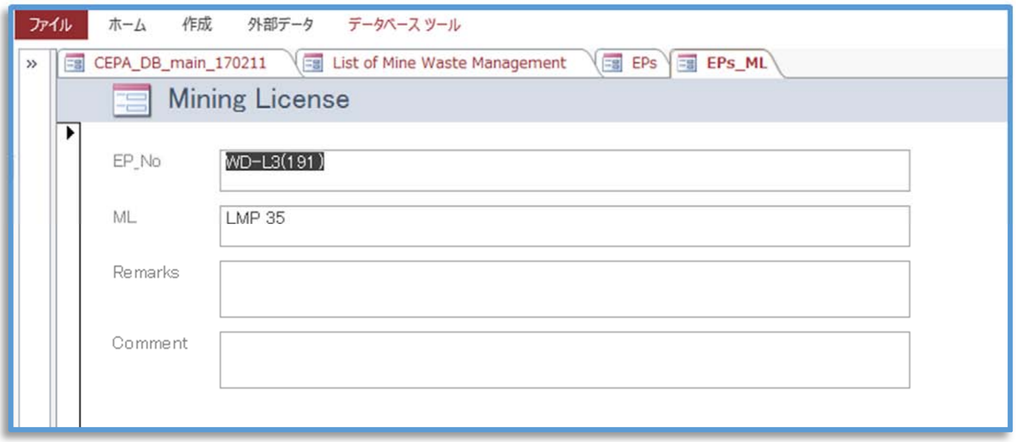
Water Quality Criteria

Parameters	CEPA_FW_ugL	CEPA_FW_mgL	CEPA_SW_ugL	CEPA_SW_mgL	WHO_FW_ugL	WHO_FW_mgL
Arsenic	0.05	50	0.05	50		
Barium	1	1000	1	1000		
Boron	1	1000	2	2000		
Cadmium	0.01	10	0.001	1		
Chlorine (total residual)		5	0.005	5		
Chromium (as hexavalent form)	0.05	50	0.01	10		
Colour						
Cobalt						
Copper	1	1000	0.03	30		
Cyanide (as HCN)	0.005	5	0.01	10		
Faecal Coliform Bacteria						
Fats						
Fluoride	1.5	1500	1.5	1500		
Grease						
Insoluble residues						
Iron (in solution)	1	1000	1	1000		
Lead	0.005	5	0.004	4		
Manganese (in solution)	0.5	500	2	2000		

Figure 15　EP Water Quality Criteria form

(4) Mining License

In this form, the Mining License number related to this EP is recorded.



EP_No: WD-L3(191)

ML: LMP 35

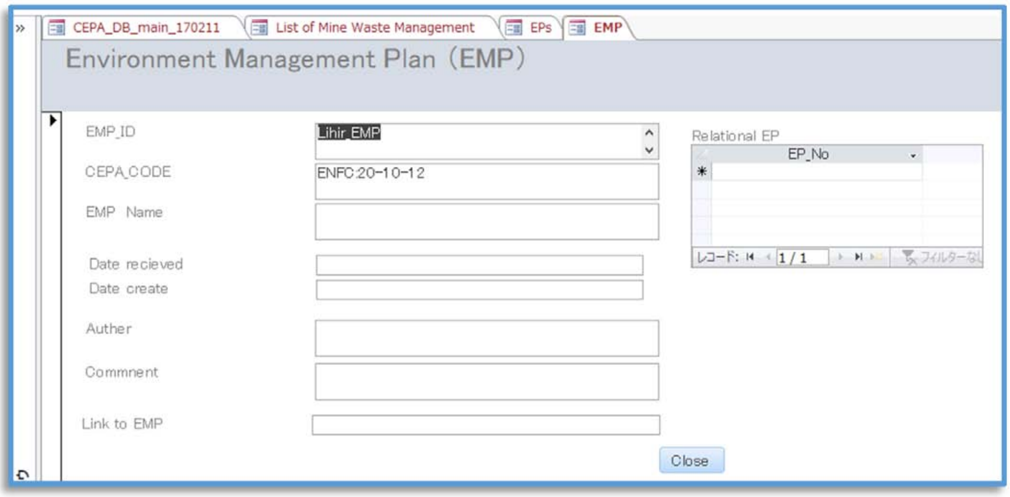
Remarks:

Comment:

Figure 16　Mining License form

3.4.1.5. EMP

In this form, information on the electronic file of EMP is input. Also, enter EP numbers related to EMP in the table on the right.



EMP_ID: Lihir_EMP

CEPA_CODE: ENFC20-10-12

EMP Name:

Date recieved:

Date create:

Auther:

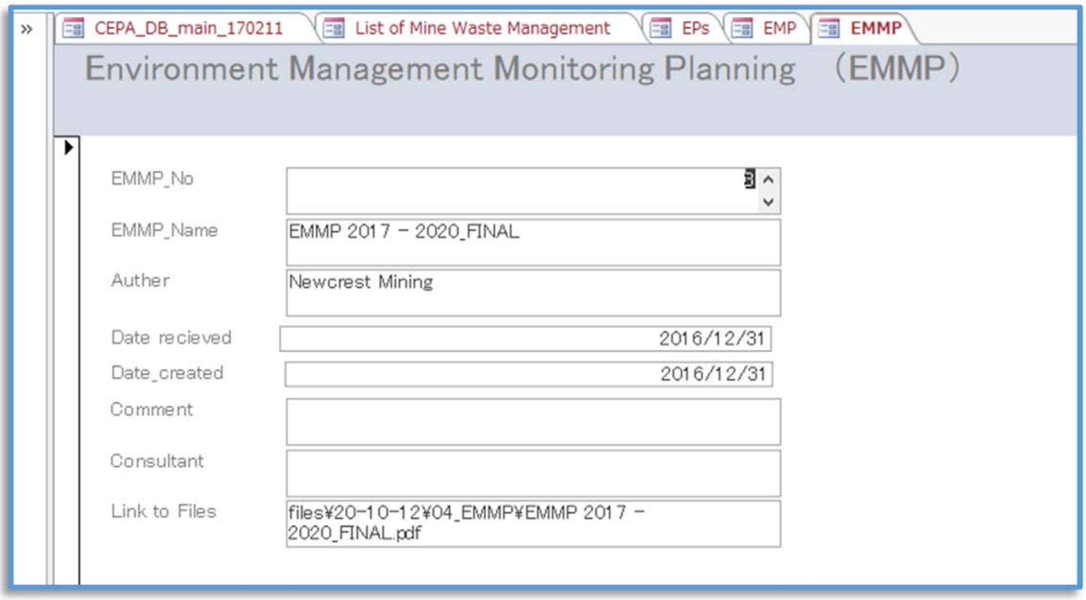
Commnent:

Link to EMP:

Figure 17　EMP　form

3.4.1.6. EMMP

In this form, information on the EMMP electronic file is input.



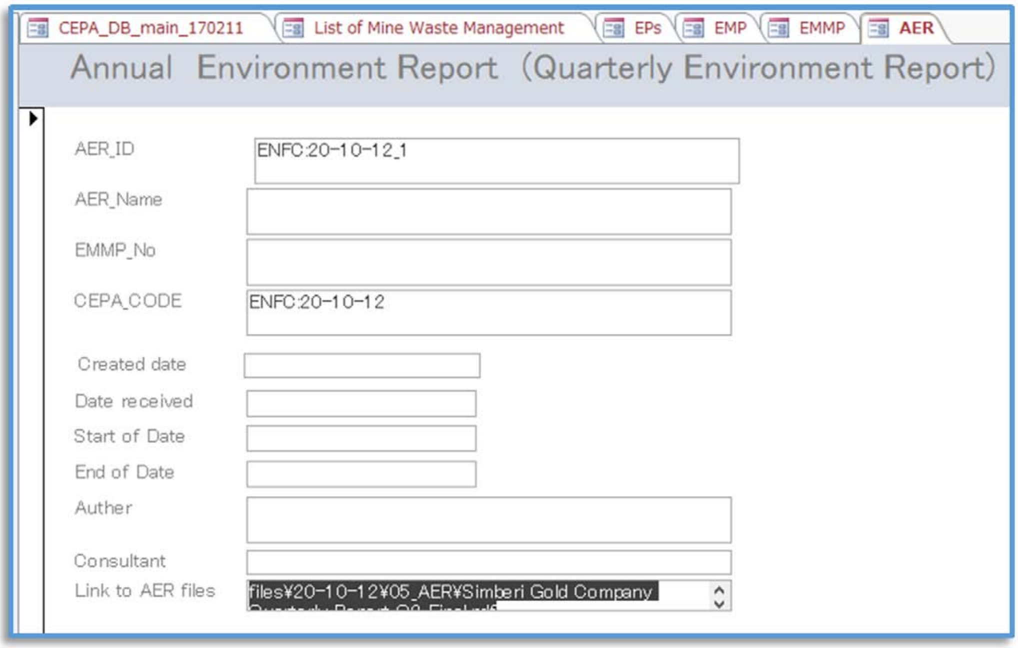
Environment Management Monitoring Planning （EMMP）

EMMP_No	
EMMP_Name	EMMP 2017 – 2020_FINAL
Auther	Newcrest Mining
Date recieved	2016/12/31
Date_created	2016/12/31
Comment	
Consultant	
Link to Files	files¥20-10-12¥04_EMMP¥EMMP 2017 – 2020_FINAL.pdf

Figure 18 EMMP form

3.4.1.7. AER

In this form, you enter information on AER and QER electronic files.



Annual Environment Report（Quarterly Environment Report）

AER_ID	ENFC:20-10-12_1
AER_Name	
EMMP_No	
CEPA_CODE	ENFC:20-10-12
Created date	
Date received	
Start of Date	
End of Date	
Auther	
Consultant	
Link to AER files	files¥20-10-12¥05_AER¥Simberi Gold Company

Figure 19 AER form

3.4.1.8. Audit

In the table on the upper left, you enter the information on the EIP and the link destination of the electronic file. In the table on the right, you enter information on Audit's electronic file. In the table at the bottom left, you enter the information of the electronic file concerning the internal document relating to Audit. In the table in the lower right, you enter information on other related files related to Audit.

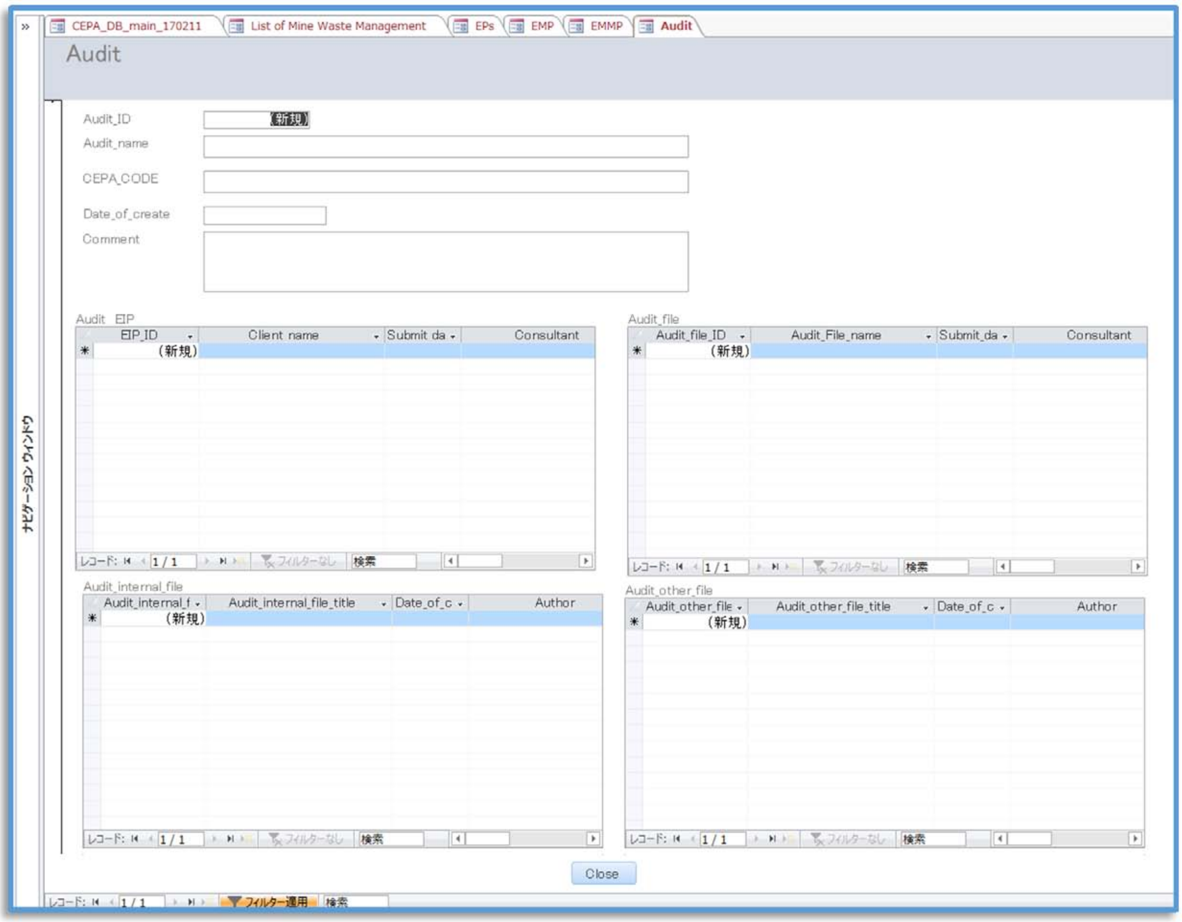


Figure 20 Audit form

3.4.1.9. Inspection

In the upper left table, you enter the EP number and Mining License number related to Inspection. In the table below the middle row, you enter the implementation plan of Inspection, Inspection, internal document, other related files, and electronic file information on Notification.(Figure 21)

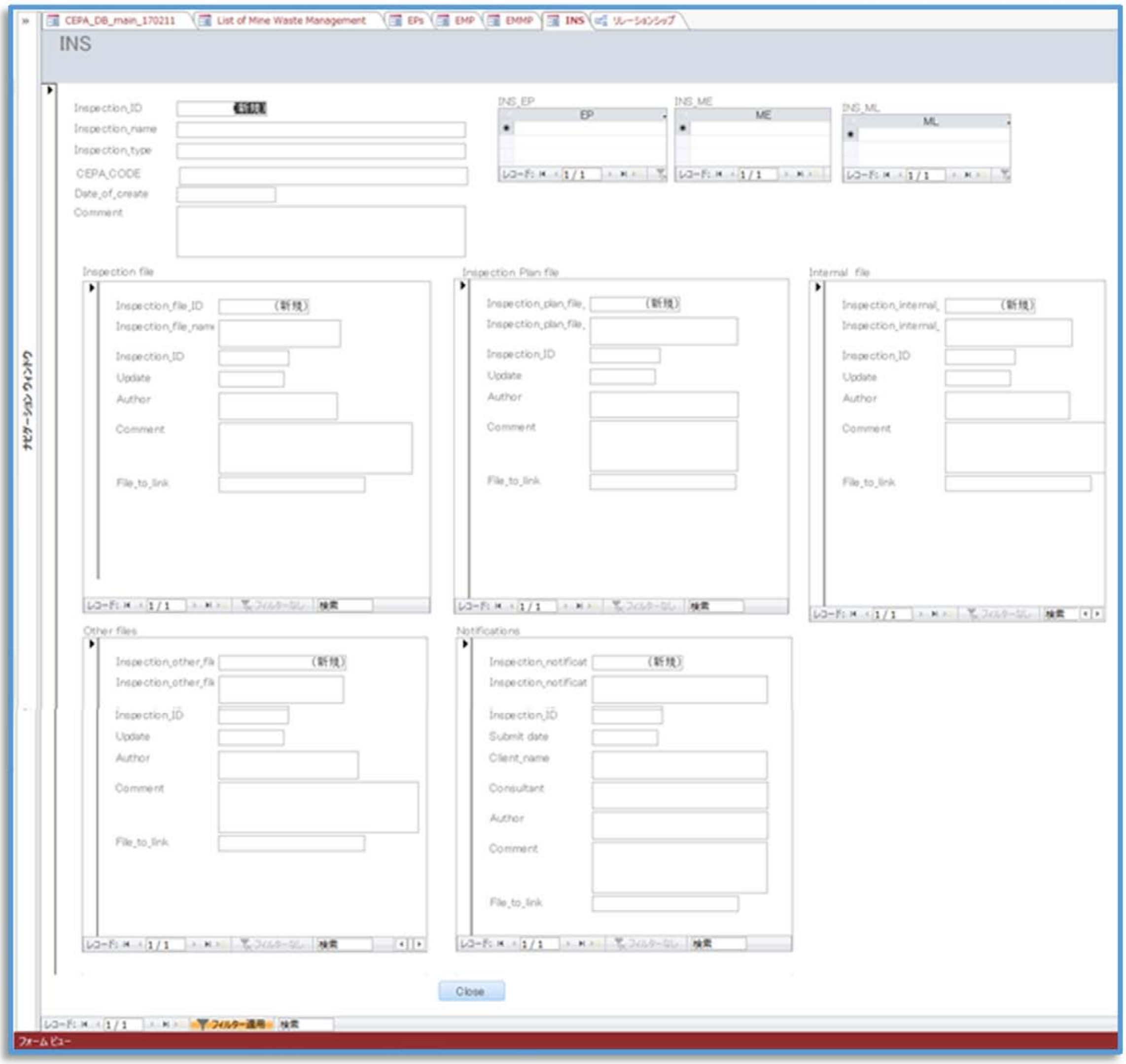
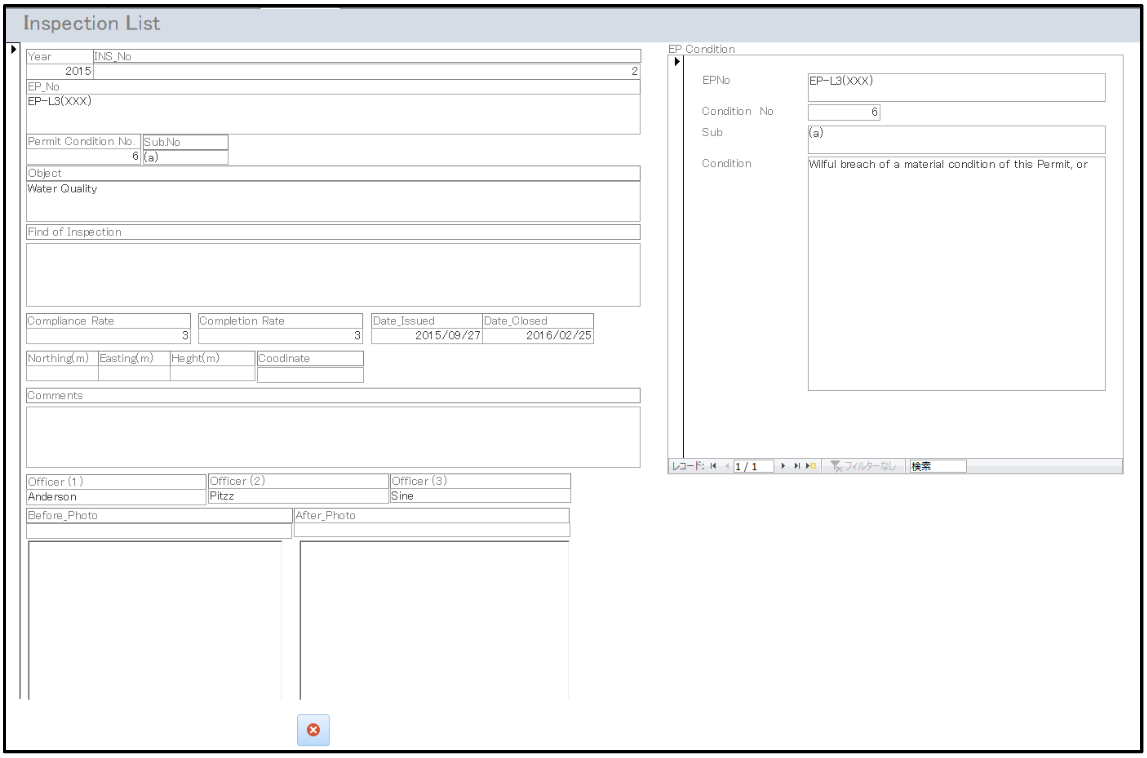


Figure 21 Inspection form

Inspection List form is recorded inspection result for spread sheet of Inspection list that is managed by Mining Unit, EPW CEPA. Inspection list can be entered via this spread sheet.

This form is showed about inspection result (Find of inspection, compliance ratio, completion ratio and comment) and relative EP conditions.(Figure 22)



Inspection List

Year	2015
INS_No	2
EP_No	EP-L3(XXX)
Permit Condition No.	6
Sub.No	(a)
Object	Water Quality
Find of Inspection	
Compliance Rate	3
Completion Rate	3
Date_Issued	2015/09/27
Date_Closed	2016/02/25
Northing(m)	
Easting(m)	
Heght(m)	
Coodinate	
Comments	
Officer (1)	Anderson
Officer (2)	Pitzz
Officer (3)	Sine
Before_Photo	
After_Photo	

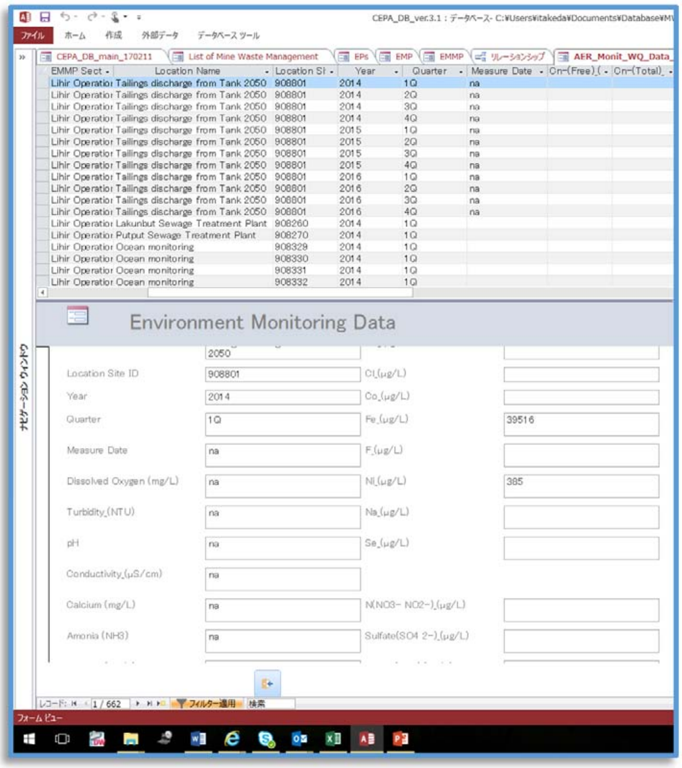
EP Condition

EPNo	EP-L3(XXX)
Condition No	6
Sub	(a)
Condition	Wilful breach of a material condition of this Permit, or

Figure 22 Inspection list form

3.4.1.10. Environment monitoring datasheet

Data in the environmental monitoring data sheet can be entered via the form.

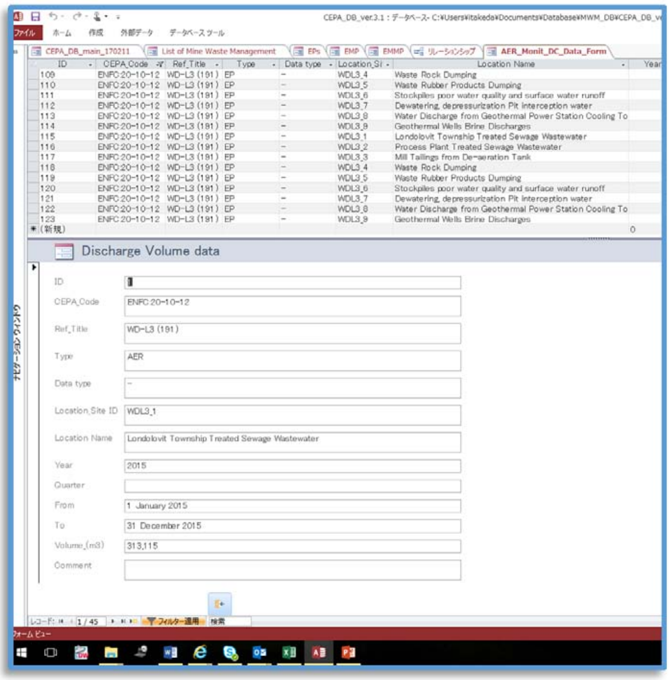


EMMP Sect	Location Name	Location SI	Year	Quarter	Measure Date	Cn-(Free)(	Cn-(Total)_
Lihir Operatior	Tailings discharge from Tank 2050	908801	2014	1Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2014	2Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2014	3Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2014	4Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2015	1Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2015	2Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2015	3Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2015	4Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2016	1Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2016	2Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2016	3Q	na		
Lihir Operatior	Tailings discharge from Tank 2050	908801	2016	4Q	na		
Lihir Operatior	Lakunbut Sewage Treatment Plant	908260	2014	1Q			
Lihir Operatior	Putput Sewage Treatment Plant	908270	2014	1Q			
Lihir Operatior	Ocean monitoring	908329	2014	1Q			
Lihir Operatior	Ocean monitoring	908330	2014	1Q			
Lihir Operatior	Ocean monitoring	908331	2014	1Q			
Lihir Operatior	Ocean monitoring	908332	2014	1Q			

Environment Monitoring Data

	2050		
Location Site ID	908801	Cl_(µg/L)	
Year	2014	Co_(µg/L)	
Quarter	1Q	Fe_(µg/L)	39516
Measure Date	na	F_(µg/L)	
Dissolved Oxygen (mg/L)	na	Ni_(µg/L)	385
Turbidity_(NTU)	na	Na_(µg/L)	
pH	na	Se_(µg/L)	
Conductivity_(µS/cm)	na		
Calcium (mg/L)	na	N(NO3- NO2-)_(µg/L)	
Amonia (NH3)	na	Sulfate(SO4 2-)_(µg/L)	

Figure 23　Environment monitoring data form

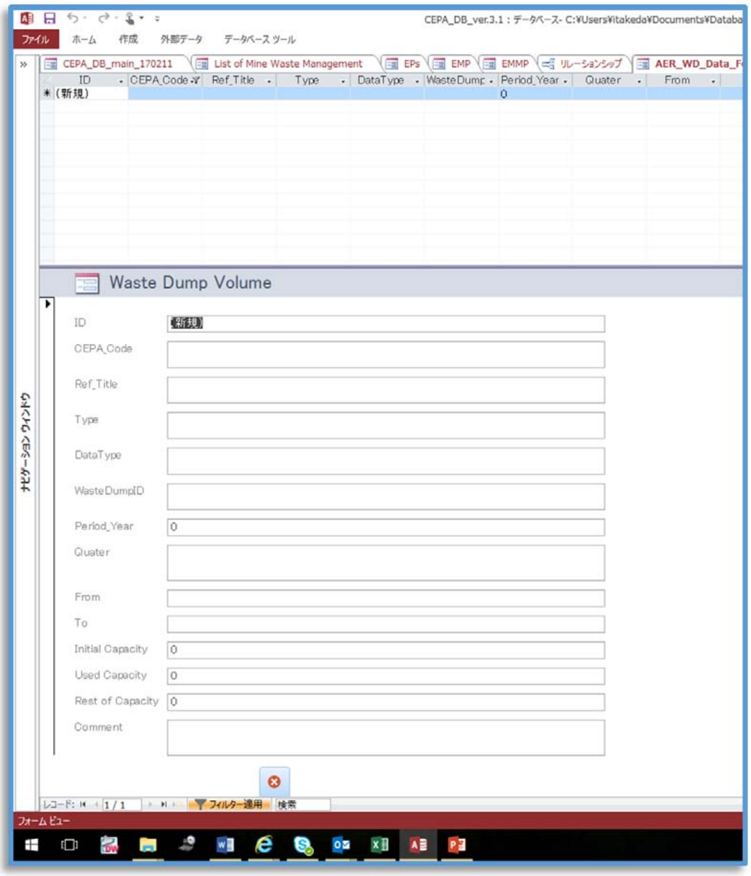


ID	CEPA_Code	Ref_Title	Type	Data type	Location_Si	Location Name	Year
109	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_4	Waste Rock Dumping	
110	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_5	Waste Rubber Products Dumping	
111	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_6	Stockpiles poor water quality and surface water runoff	
112	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_7	Dewatering, depressurization Pit interception water	
113	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_8	Water Discharge from Geothermal Power Station Cooling To	
114	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_9	Geothermal Wells Brine Discharges	
115	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_1	Londolovit Township Treated Sewage Wastewater	
116	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_2	Process Plant Treated Sewage Wastewater	
117	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_3	Mill Tailings from De-aeration Tank	
118	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_4	Waste Rock Dumping	
119	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_5	Waste Rubber Products Dumping	
120	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_6	Stockpiles poor water quality and surface water runoff	
121	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_7	Dewatering, depressurization Pit interception water	
122	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_8	Water Discharge from Geothermal Power Station Cooling To	
123	ENFC 20-10-12	WD-L3 (191)	EP	-	WDL3_9	Geothermal Wells Brine Discharges	
(新規)							0

Discharge Volume data

ID	1
CEPA_Code	ENFC 20-10-12
Ref_Title	WD-L3 (191)
Type	AER
Data type	-
Location_Site ID	WDL3_1
Location Name	Londolovit Township Treated Sewage Wastewater
Year	2015
Quarter	
From	1 January 2015
To	31 December 2015
Volume_(m3)	313,115
Comment	

Figure 24　Discharge volume data form

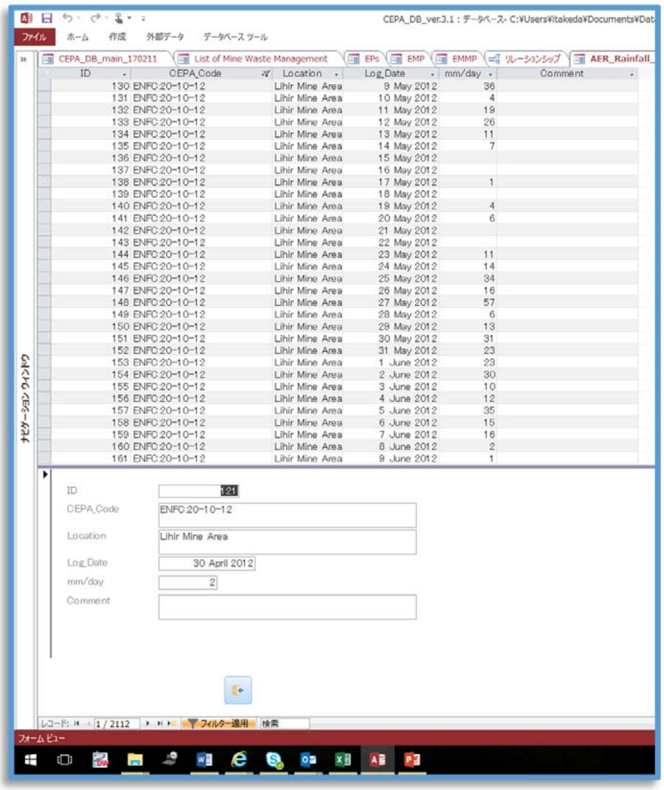


ID	CEPA_Code	Ref_Title	Type	DataType	WasteDump	Period_Year	Quater	From
(新規)						0		

Waste Dump Volume

ID	(新規)
CEPA_Code	
Ref_Title	
Type	
DataType	
WasteDumpID	
Period_Year	0
Quater	
From	
To	
Initial Capacity	0
Used Capacity	0
Rest of Capacity	0
Comment	

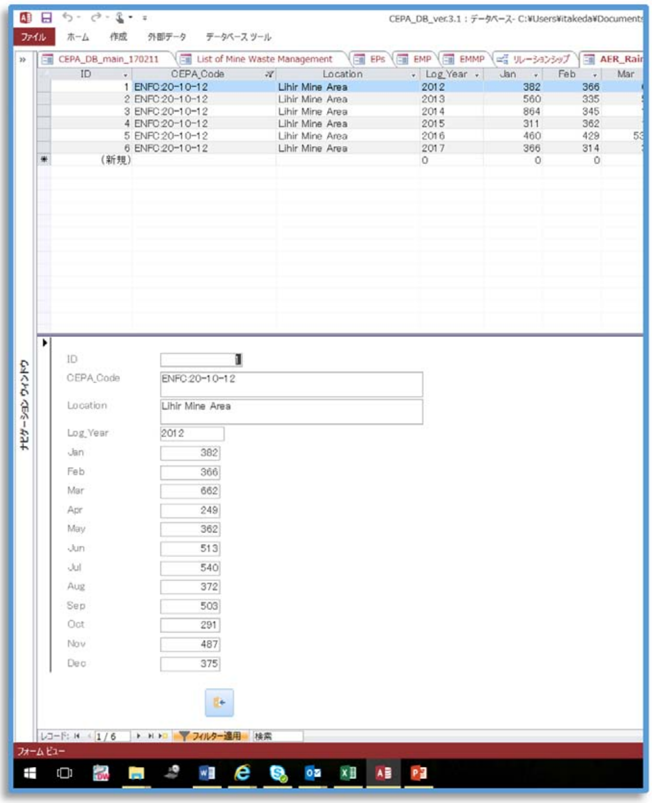
Figure 25 Waste Dump Volume form



ID	CEPA_Code	Location	Log_Date	mm/day	Comment
130	ENFC:20-10-12	Lihir Mine Area	9 May 2012	36	
131	ENFC:20-10-12	Lihir Mine Area	10 May 2012	4	
132	ENFC:20-10-12	Lihir Mine Area	11 May 2012	19	
133	ENFC:20-10-12	Lihir Mine Area	12 May 2012	26	
134	ENFC:20-10-12	Lihir Mine Area	13 May 2012	11	
135	ENFC:20-10-12	Lihir Mine Area	14 May 2012	7	
136	ENFC:20-10-12	Lihir Mine Area	15 May 2012		
137	ENFC:20-10-12	Lihir Mine Area	16 May 2012		
138	ENFC:20-10-12	Lihir Mine Area	17 May 2012	1	
139	ENFC:20-10-12	Lihir Mine Area	18 May 2012		
140	ENFC:20-10-12	Lihir Mine Area	19 May 2012	4	
141	ENFC:20-10-12	Lihir Mine Area	20 May 2012	6	
142	ENFC:20-10-12	Lihir Mine Area	21 May 2012		
143	ENFC:20-10-12	Lihir Mine Area	22 May 2012		
144	ENFC:20-10-12	Lihir Mine Area	23 May 2012	11	
145	ENFC:20-10-12	Lihir Mine Area	24 May 2012	14	
146	ENFC:20-10-12	Lihir Mine Area	25 May 2012	34	
147	ENFC:20-10-12	Lihir Mine Area	26 May 2012	16	
148	ENFC:20-10-12	Lihir Mine Area	27 May 2012	57	
149	ENFC:20-10-12	Lihir Mine Area	28 May 2012	6	
150	ENFC:20-10-12	Lihir Mine Area	29 May 2012	13	
151	ENFC:20-10-12	Lihir Mine Area	30 May 2012	31	
152	ENFC:20-10-12	Lihir Mine Area	31 May 2012	23	
153	ENFC:20-10-12	Lihir Mine Area	1 June 2012	23	
154	ENFC:20-10-12	Lihir Mine Area	2 June 2012	30	
155	ENFC:20-10-12	Lihir Mine Area	3 June 2012	10	
156	ENFC:20-10-12	Lihir Mine Area	4 June 2012	12	
157	ENFC:20-10-12	Lihir Mine Area	5 June 2012	35	
158	ENFC:20-10-12	Lihir Mine Area	6 June 2012	15	
159	ENFC:20-10-12	Lihir Mine Area	7 June 2012	16	
160	ENFC:20-10-12	Lihir Mine Area	8 June 2012	2	
161	ENFC:20-10-12	Lihir Mine Area	9 June 2012	1	

ID	121
CEPA_Code	ENFC:20-10-12
Location	Lihir Mine Area
Log_Date	30 April 2012
mm/day	2
Comment	

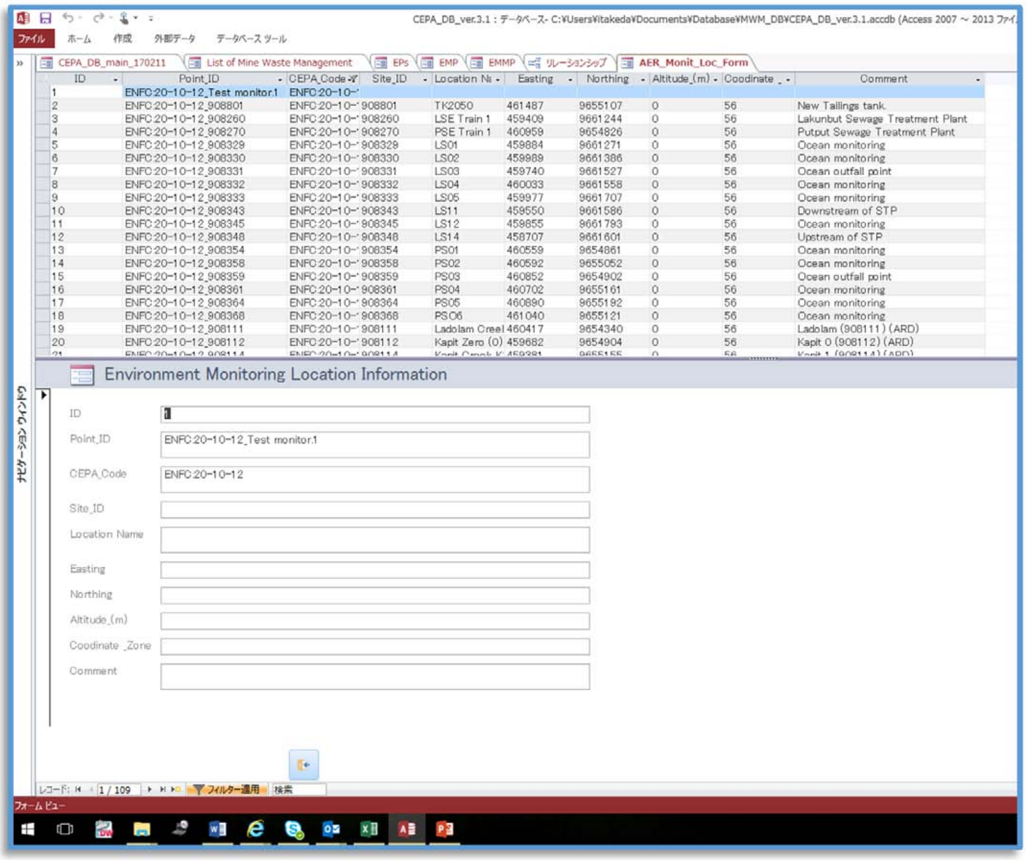
Figure 26　Daily rainfall log form



ID	CEPA_Code	Location	Log_Year	Jan	Feb	Mar
1	ENFC:20-10-12	Lihir Mine Area	2012	382	366	
2	ENFC:20-10-12	Lihir Mine Area	2013	560	335	
3	ENFC:20-10-12	Lihir Mine Area	2014	864	345	
4	ENFC:20-10-12	Lihir Mine Area	2015	311	362	
5	ENFC:20-10-12	Lihir Mine Area	2016	460	429	
6	ENFC:20-10-12	Lihir Mine Area	2017	366	314	
(新規)			0	0	0	

ID	1
CEPA_Code	ENFC:20-10-12
Location	Lihir Mine Area
Log_Year	2012
Jan	382
Feb	366
Mar	662
Apr	249
May	362
Jun	513
Jul	540
Aug	372
Sep	503
Oct	291
Nov	487
Dec	375

Figure 27　Monthly rainfall log form



ID	Point_ID	CEPA_Code	Site_ID	Location N	Easting	Northing	Altitude_(m)	Coodinate_	Comment
1	ENFC:20-10-12_Test monitor.1	ENFC:20-10-							
2	ENFC:20-10-12_908801	ENFC:20-10-	908801	TK2050	461487	9655107	0	56	New Tailings tank.
3	ENFC:20-10-12_908260	ENFC:20-10-	908260	LSE Train 1	459409	9661244	0	56	Lakunbut Sewage Treatment Plant
4	ENFC:20-10-12_908270	ENFC:20-10-	908270	PSE Train 1	460959	9654826	0	56	Putput Sewage Treatment Plant
5	ENFC:20-10-12_908329	ENFC:20-10-	908329	LS01	459884	9661271	0	56	Ocean monitoring
6	ENFC:20-10-12_908330	ENFC:20-10-	908330	LS02	459989	9661386	0	56	Ocean monitoring
7	ENFC:20-10-12_908331	ENFC:20-10-	908331	LS03	459740	9661527	0	56	Ocean outfall point
8	ENFC:20-10-12_908332	ENFC:20-10-	908332	LS04	460033	9661558	0	56	Ocean monitoring
9	ENFC:20-10-12_908333	ENFC:20-10-	908333	LS05	459977	9661707	0	56	Ocean monitoring
10	ENFC:20-10-12_908343	ENFC:20-10-	908343	LS11	459550	9661586	0	56	Downstream of STP
11	ENFC:20-10-12_908345	ENFC:20-10-	908345	LS12	459855	9661793	0	56	Ocean monitoring
12	ENFC:20-10-12_908348	ENFC:20-10-	908348	LS14	458707	9661601	0	56	Upstream of STP
13	ENFC:20-10-12_908354	ENFC:20-10-	908354	PS01	460559	9654861	0	56	Ocean monitoring
14	ENFC:20-10-12_908358	ENFC:20-10-	908358	PS02	460592	9655052	0	56	Ocean monitoring
15	ENFC:20-10-12_908359	ENFC:20-10-	908359	PS03	460852	9654902	0	56	Ocean outfall point
16	ENFC:20-10-12_908361	ENFC:20-10-	908361	PS04	460702	9655161	0	56	Ocean monitoring
17	ENFC:20-10-12_908364	ENFC:20-10-	908364	PS05	460890	9655192	0	56	Ocean monitoring
18	ENFC:20-10-12_908368	ENFC:20-10-	908368	PSO6	461040	9655121	0	56	Ocean monitoring
19	ENFC:20-10-12_908111	ENFC:20-10-	908111	Ladolam Creel	460417	9654340	0	56	Ladolam (908111) (ARD)
20	ENFC:20-10-12_908112	ENFC:20-10-	908112	Kapit Zero (0)	459682	9654904	0	56	Kapit 0 (908112) (ARD)

Environment Monitoring Location Information

ID: 1

Point_ID: ENFC:20-10-12_Test monitor.1

CEPA_Code: ENFC:20-10-12

Site_ID:

Location Name:

Easting:

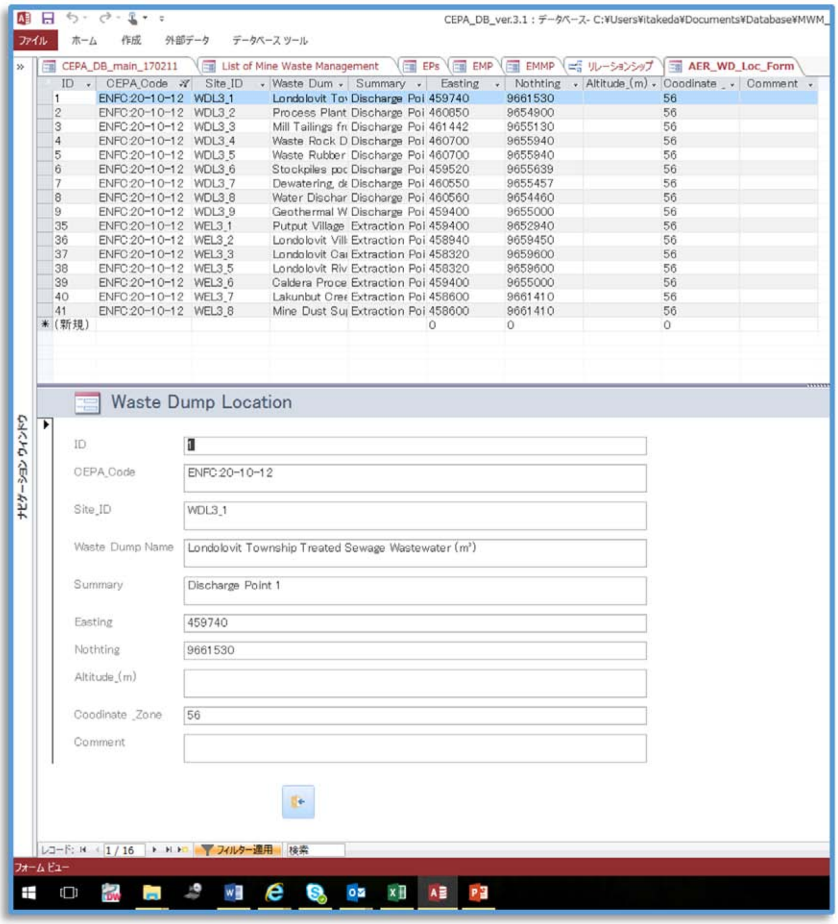
Northing:

Altitude_(m):

Coodinate _Zone:

Comment:

Figure 28 Monitoring location information form

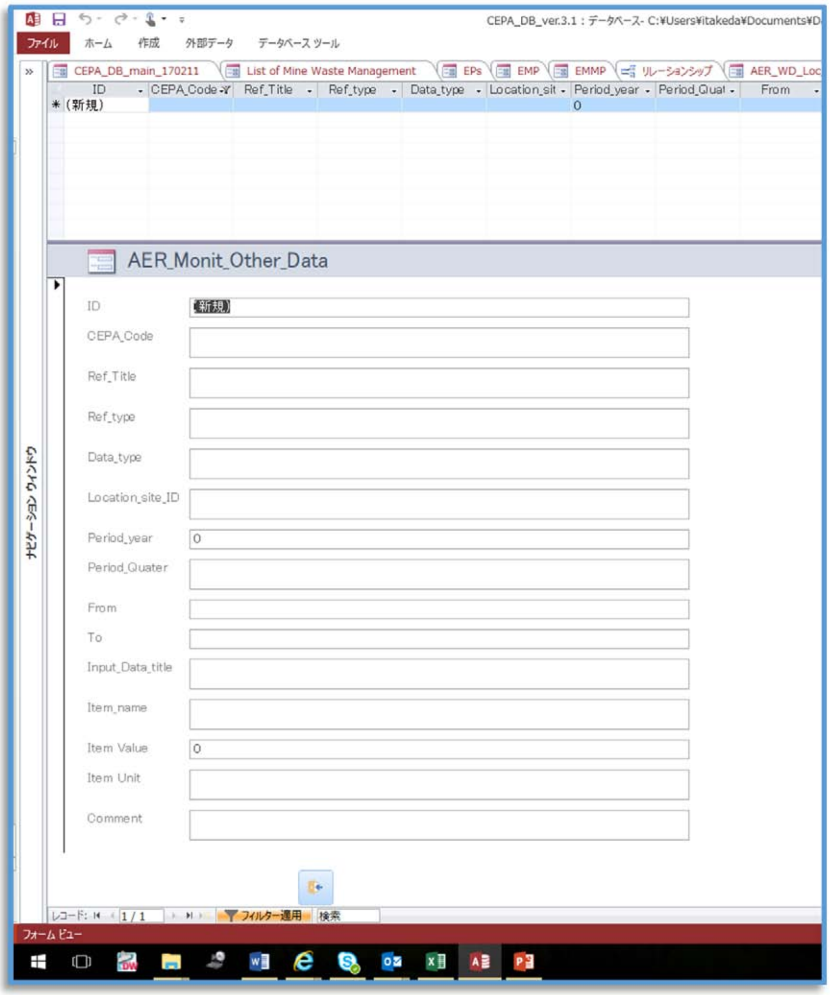


ID	CEPA_Code	Site_ID	Waste Dum	Summary	Easting	Nothting	Altitude_(m)	Coodinate _	Comment
1	ENFC:20-10-12	WDL3_1	Londolovit To	Discharge Poi	459740	9661530		56	
2	ENFC:20-10-12	WDL3_2	Process Plant	Discharge Poi	460850	9654900		56	
3	ENFC:20-10-12	WDL3_3	Mill Tailings fr	Discharge Poi	461442	9655130		56	
4	ENFC:20-10-12	WDL3_4	Waste Rock D	Discharge Poi	460700	9655940		56	
5	ENFC:20-10-12	WDL3_5	Waste Rubber	Discharge Poi	460700	9655940		56	
6	ENFC:20-10-12	WDL3_6	Stockpiles poc	Discharge Poi	459520	9655639		56	
7	ENFC:20-10-12	WDL3_7	Dewatering, de	Discharge Poi	460550	9655457		56	
8	ENFC:20-10-12	WDL3_8	Water Dischar	Discharge Poi	460560	9654460		56	
9	ENFC:20-10-12	WDL3_9	Geothermal W	Discharge Poi	459400	9655000		56	
35	ENFC:20-10-12	WEL3_1	Putput Village	Extraction Poi	459400	9652940		56	
36	ENFC:20-10-12	WEL3_2	Londolovit Vill	Extraction Poi	458940	9659450		56	
37	ENFC:20-10-12	WEL3_3	Londolovit Ca	Extraction Poi	458320	9659600		56	
38	ENFC:20-10-12	WEL3_5	Londolovit Riv	Extraction Poi	458320	9659600		56	
39	ENFC:20-10-12	WEL3_6	Caldera Proce	Extraction Poi	459400	9655000		56	
40	ENFC:20-10-12	WEL3_7	Lakunbut Cre	Extraction Poi	458600	9661410		56	
41	ENFC:20-10-12	WEL3_8	Mine Dust Su	Extraction Poi	458600	9661410		56	
＊(新規)					0	0		0	

Waste Dump Location

ID	1
CEPA_Code	ENFC:20-10-12
Site_ID	WDL3_1
Waste Dump Name	Londolovit Township Treated Sewage Wastewater (m³)
Summary	Discharge Point 1
Easting	459740
Nothting	9661530
Altitude_(m)	
Coodinate _Zone	56
Comment	

Figure 29 Waste Dump information form



ID	CEPA_Code	Ref_Title	Ref_type	Data_type	Location_sit	Period_year	Period_Qual	From
＊(新規)						0		

AER_Monit_Other_Data

ID	(新規)
CEPA_Code	
Ref_Title	
Ref_type	
Data_type	
Location_site_ID	
Period_year	0
Period_Quater	
From	
To	
Input_Data_title	
Item_name	
Item Value	0
Item Unit	
Comment	

Figure 30　Other data form

3.4.1.11. Others

For the original file of the environmental monitoring data sheet and other related files, input file information from Monitoring Datasheet and Other form.

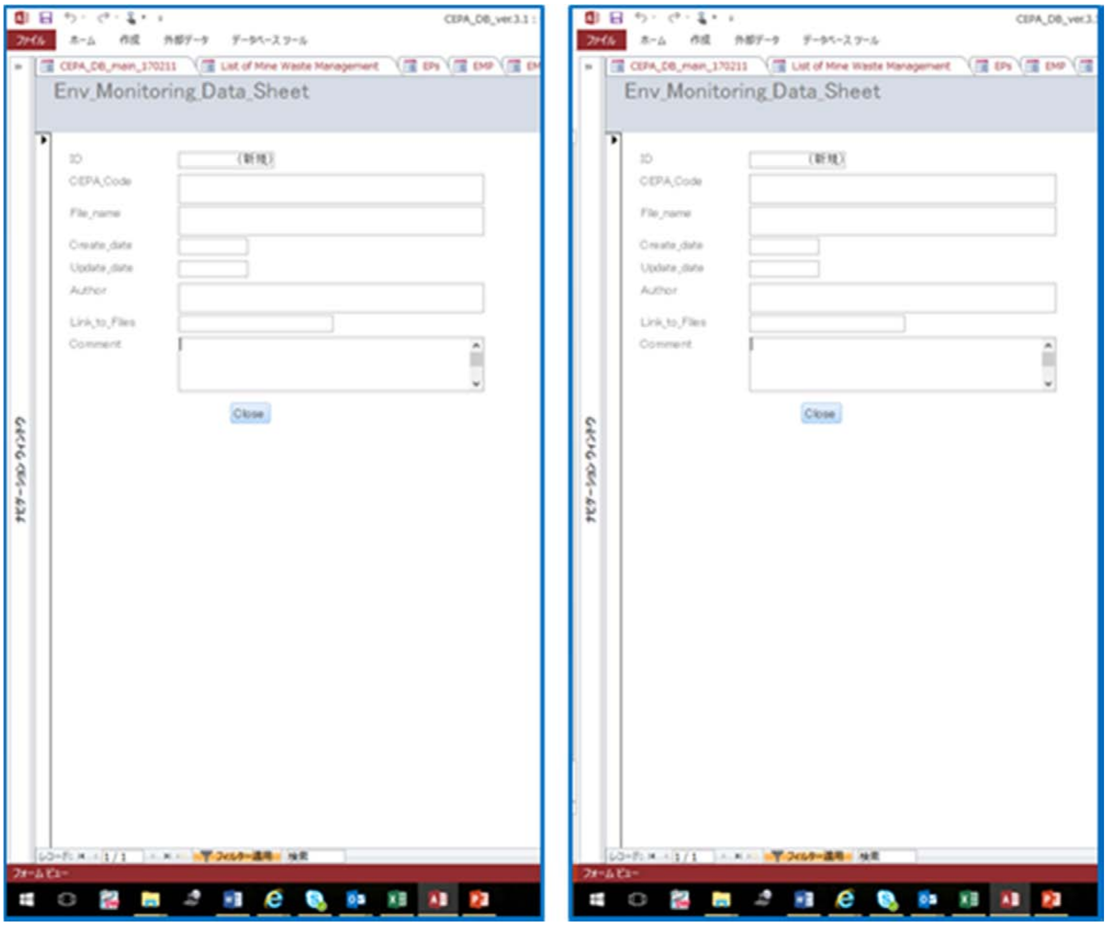


Figure 31 Environment monitoring datasheet (left) and other data management (right) form

3.4.2. Use to Import Function

3.4.2.1. Case of Environment monitoring datasheet

①Copy the updated data on the data sheet of the environmental monitoring data sheet and paste it on the sheet marked "EXP_" in the environmental monitoring data sheet.(See Figure 32)
If data is “WaterQuality”, you choose “EXP_WaterQuality”)

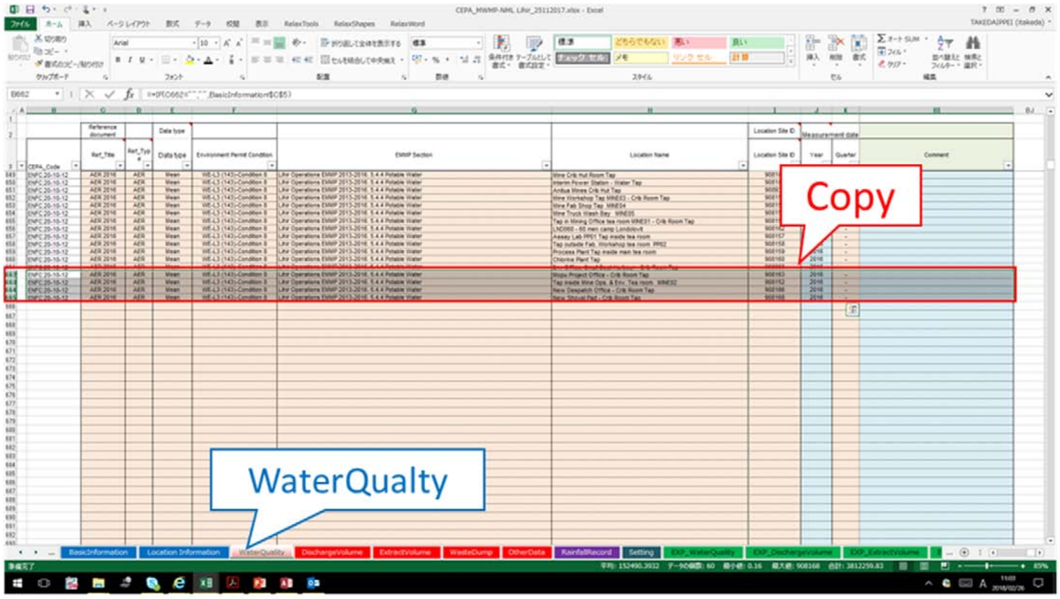
②Save and close “Environment monitoring datasheet”

③Open Database and click “External data- Excel”

④Select the database file.(See Figure 33)

⑦ Select database table.(See Table 13 & Figure 34)

⑥Select database sheets and click “OK”



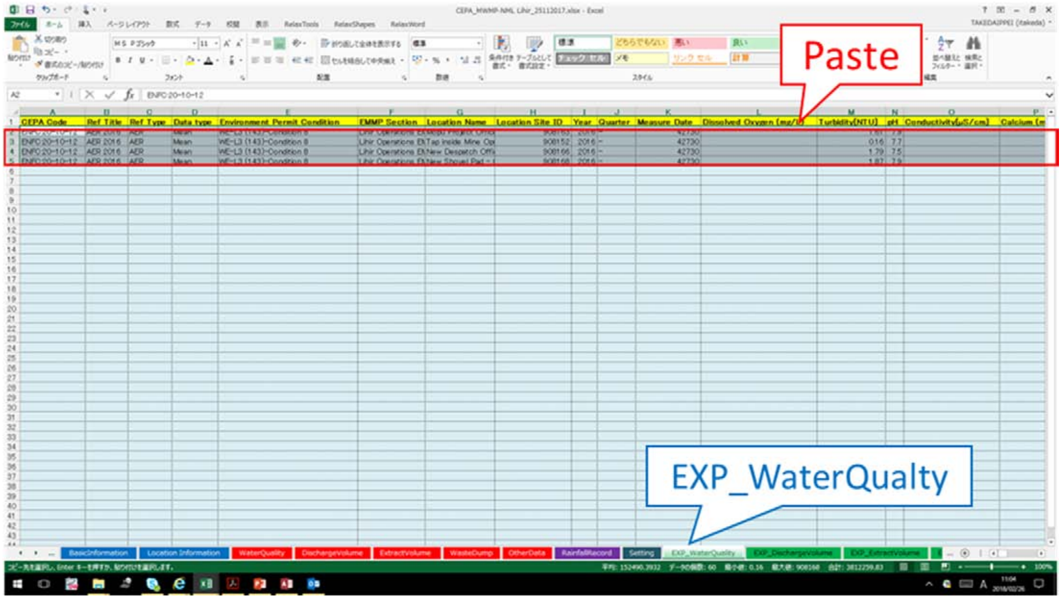
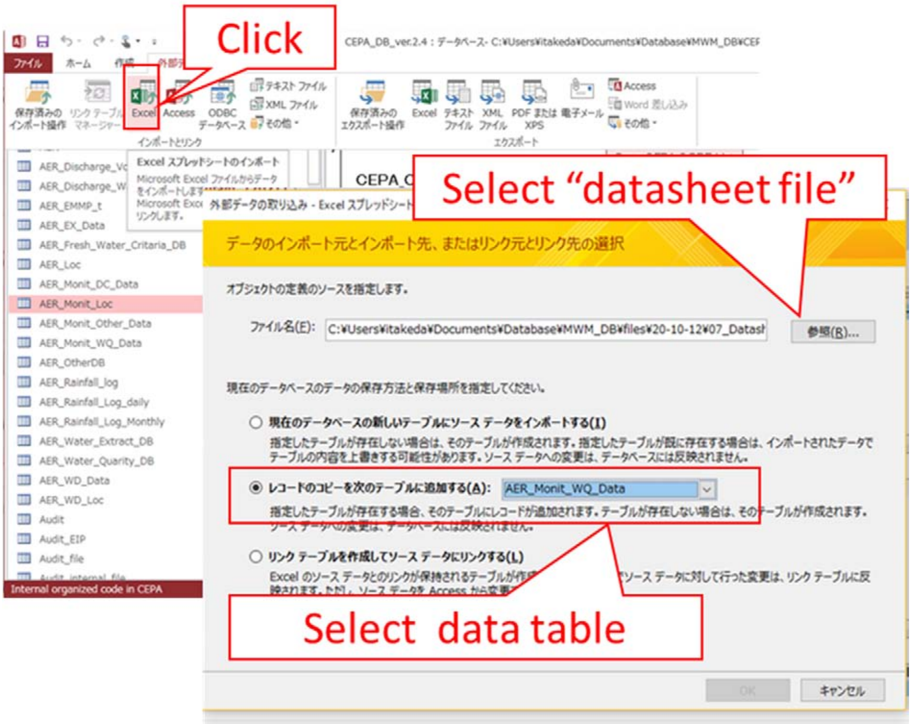


Figure 32　Processing on Excel for import (1)



外部データの取り込み - Excel スプレッドシート

データのインポート元とインポート先、またはリンク元とリンク先の選択

オブジェクトの定義のソースを指定します。

ファイル名(F): C:¥Users¥itakeda¥Documents¥Database¥MWM_DB¥files¥20-10-12¥07_Datasł

現在のデータベースのデータの保存方法と保存場所を指定してください。

○ 現在のデータベースの新しいテーブルにソース データをインポートする(I)
指定したテーブルが存在しない場合は、そのテーブルが作成されます。指定したテーブルが既に存在する場合は、インポートされたデータでテーブルの内容を上書きする可能性があります。ソース データへの変更は、データベースには反映されません。

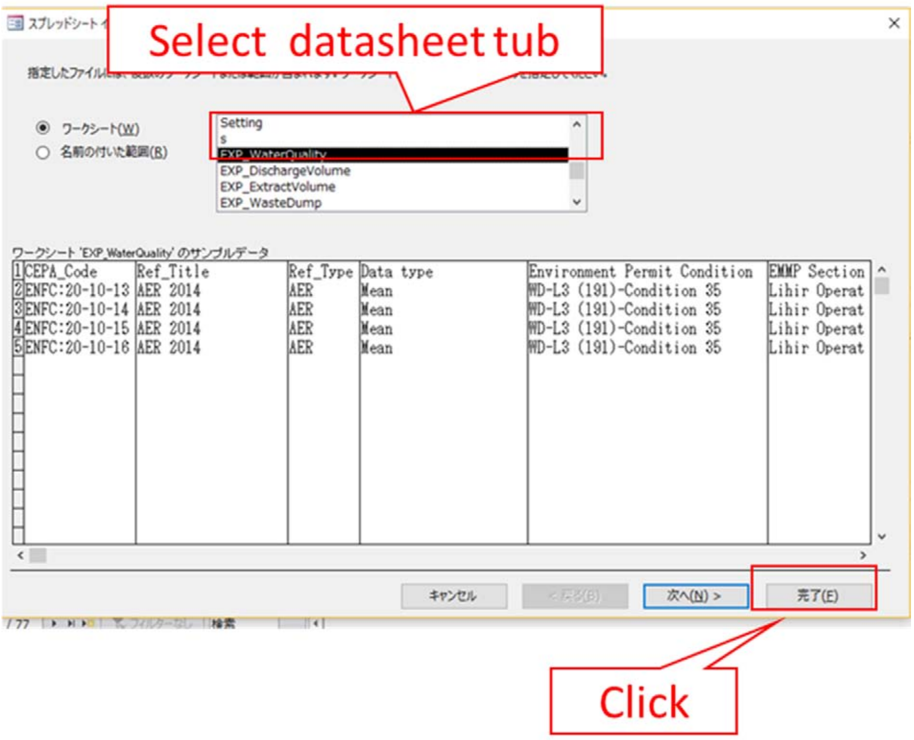
● レコードのコピーを次のテーブルに追加する(A): AER_Monit_WQ_Data
指定したテーブルが存在する場合、そのテーブルにレコードが追加されます。テーブルが存在しない場合は、そのテーブルが作成されます。ソース データへの変更は、データベースには反映されません。

○ リンク テーブルを作成してソース データにリンクする(L)

Figure 33　Processing on Excel for import (2)

Table 13　Relationship between the items of the table of the environmental monitoring data sheet and the items of the DB table of the database

Datasheet tab	DB table
EXP_WaterQualty	AER_WQ_Data
EXP_DischargeVolume	AER_Monit_DC_Data
EXP_ExtractVolume	AER_EX_Data
EXP_OtherData	AER_Monit_Other
EP_WasteDump	AER_WD_Data
EXP_MonitoringLocationInfo	AER_Monit_Loc
EXP_WasteDumpLocationInfo	AER_WD_Loc
EXP_RainfallRecordDaily	AER_Rainfall_Log_daily
EXP_RainfallRecordMonthly	AER_Rainfall_Log_Monthly



ワークシート 'EXP_WaterQuality' のサンプルデータ

1	CEPA_Code	Ref_Title	Ref_Type	Data type	Environment Permit Condition	EMMP Section
2	ENFC:20-10-13	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat
3	ENFC:20-10-14	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat
4	ENFC:20-10-15	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat
5	ENFC:20-10-16	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat

Figure 34　Processing on Excel for import (3)

3.4.2.2. The case of using Mining License data from MRA

①Open the "*. Dbf" file in Excel from the Mining License GIS file group.

②Save as “.xlsx”

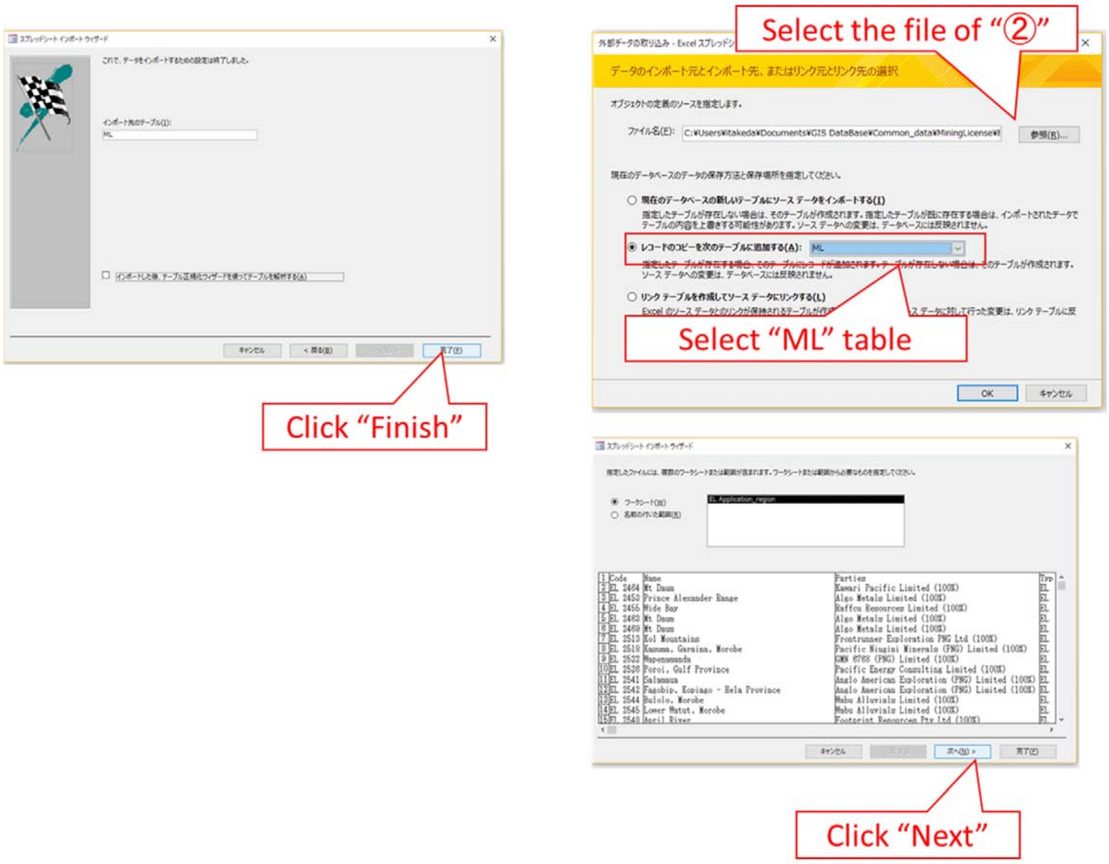
③Open database file.

④Select and crick “External data‐Excel”

⑤Open the file created in ②.(See Figure 35)

⑥Select data table.(See Table 13)

⑦Crick “Next” and “Finish”



これで、データをインポートするための設定は終了しました。

インポート先のテーブル(I): ML

☐ インポートした後、テーブル正規化ウィザードを使ってテーブルを解析する(A)

データのインポート元とインポート先、またはリンク元とリンク先の選択

オブジェクトの定義のソースを指定します。

ファイル名(F): C:¥Users¥itakeda¥Documents¥GIS DataBase¥Common_data¥MiningLicense¥

現在のデータベースのデータの保存方法と保存場所を指定してください。

○ 現在のデータベースの新しいテーブルにソース データをインポートする(I)
指定したテーブルが存在しない場合は、そのテーブルが作成されます。指定したテーブルが既に存在する場合は、インポートされたデータでテーブルの内容を上書きする可能性があります。ソース データへの変更は、データベースには反映されません。

● レコードのコピーを次のテーブルに追加する(A): ML
指定したテーブルが存在する場合、そのテーブルにレコードが追加されます。テーブルが存在しない場合は、そのテーブルが作成されます。ソース データへの変更は、データベースには反映されません。

○ リンク テーブルを作成してソース データにリンクする(L)
Excel のソース データとのリンクが保持されるテーブルが作成 … ス データに対して行った変更は、リンク テーブルに反

指定したファイルには、複数のワークシートまたは範囲が含まれます。ワークシートまたは範囲から必要なものを指定してください。

● ワークシート(W)
○ 名前の付いた範囲(R)

EL_Application_region

1	Code	Name	Parties	Typ
2	EL 2464	Mt Daum	Kawari Pacific Limited (100%)	EL
3	EL 2453	Prince Alexander Range	Algo Metals Limited (100%)	EL
4	EL 2455	Wide Bay	Raffcu Resources Limited (100%)	EL
5	EL 2463	Mt Daum	Algo Metals Limited (100%)	EL
6	EL 2469	Mt Daum	Algo Metals Limited (100%)	EL
7	EL 2513	Kol Mountains	Frontrunner Exploration PNG Ltd (100%)	EL
8	EL 2518	Kamuma, Garaina, Morobe	Pacific Niugini Minerals (PNG) Limited (100%)	EL
9	EL 2522	Mapenamanda	GMN 6788 (PNG) Limited (100%)	EL
10	EL 2526	Poroi, Gulf Province	Pacific Energy Consulting Limited (100%)	EL
11	EL 2541	Salamaua	Anglo American Exploration (PNG) Limited (100%)	EL
12	EL 2542	Fagobip, Kopiago - Hela Province	Anglo American Exploration (PNG) Limited (100%)	EL
13	EL 2544	Bulolo, Morobe	Mabu Alluvials Limited (100%)	EL
14	EL 2545	Lower Watut, Morobe	Mabu Alluvials Limited (100%)	EL
15	EL 2548	April River	Footprint Resources Pty Ltd (100%)	EL

Figure 35　Processing on Excel for import (4)

3.4.2.3. Case of Inspection result list datasheet

①Copy the updated data on the data sheet of the environmental monitoring data sheet and paste it on the sheet marked "MasterData_Ex" in the Inspection result list data sheet.(See Figure 32)

②Save and close “Inspection result list datasheet”

③Open Database and click “External data- Excel”

④Select the database file.(See Figure 33)

⑤Select database “MasterData_Ex”table.(Figure 34)

⑥Select database sheets and click “OK”

3.5. Export data

3.5.1. Export for Excel

In processing or graphing data in the database, it is easier if the data is output to an Excel file and processed in Excel. The following shows how to output MS Access tables or queries to Excel files.

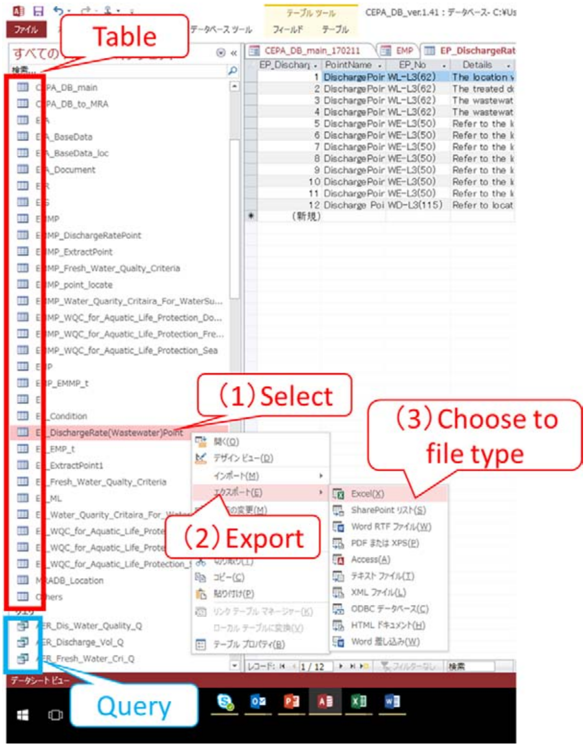


Figure 36 Steps for exporting from Access

①Select the table or query you want to output.

②Right click, select "Export-Excel" and click.

3.5.2. Extract information to use query

If you want to output data that aggregates or concatenates data between tables, you need to construct queries. A method of outputting data combining position information and chemical analysis value data is exemplified below.

(See Figure 37~Figure 41)

①Crick “Query design”

②Select the table with the necessary items and click "Add".

③Drag and drop items on the table side to be linked to items on the table side to be linked.

④When displaying the table of the created query, drag and drop items of each table to be displayed in the query to be created to the table at the bottom.

⑤Enter the extraction condition in the table.

⑥Right-click on the tab of the query and select "Datasheet View".

⑦Right-click on the tab of the query and select "Close". Enter the query name in the popup and click "OK".

⑧According to the method in 3.5.1, export the created query.

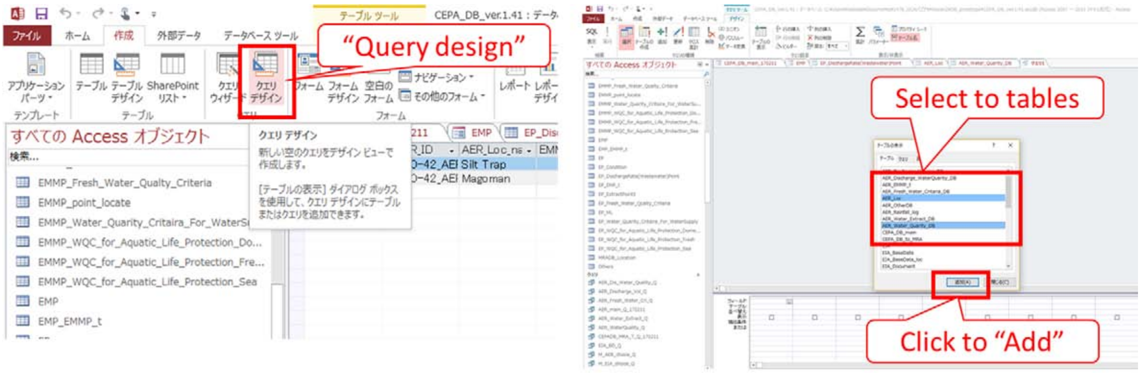
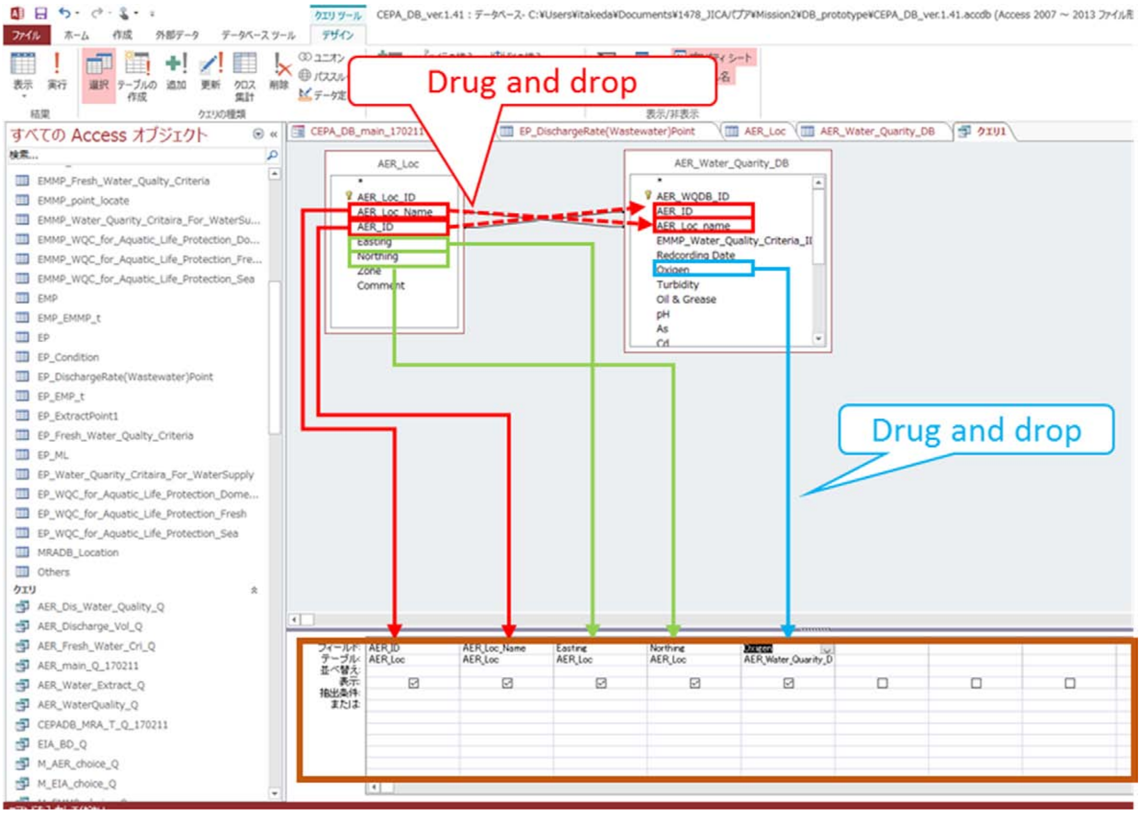
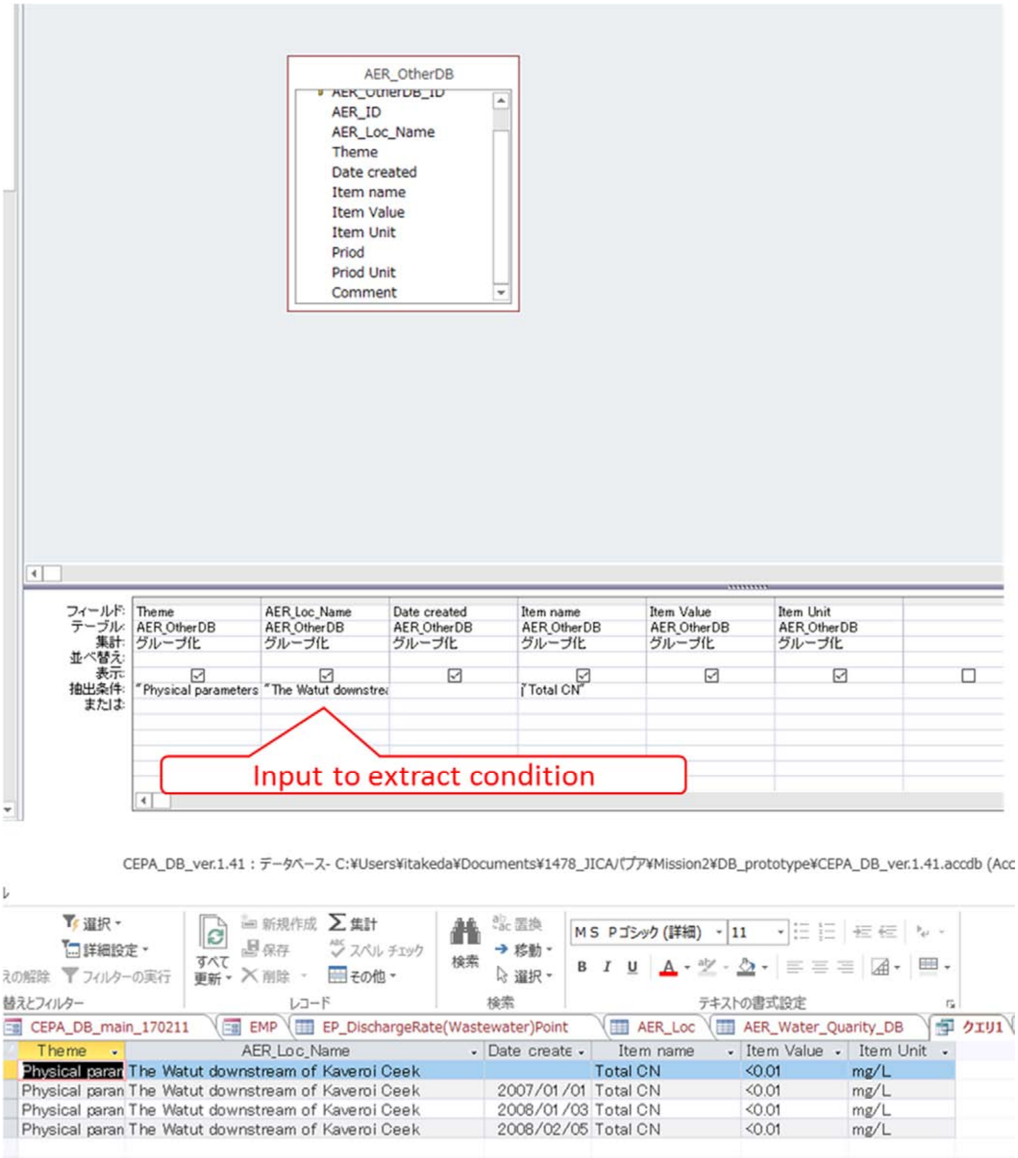


Figure 37　Query creation procedure on Access (1)



フィールド:	AER_ID	AER_Loc_Name	Easting	Northing	Oxigen			
テーブル:	AER_Loc	AER_Loc	AER_Loc	AER_Loc	AER_Water_Quarity_D			
並べ替え:								
表示:	☑	☑	☑	☑	☑	☐	☐	☐
抽出条件:								
または:								

Figure 38　Query creation procedure on Access (2)



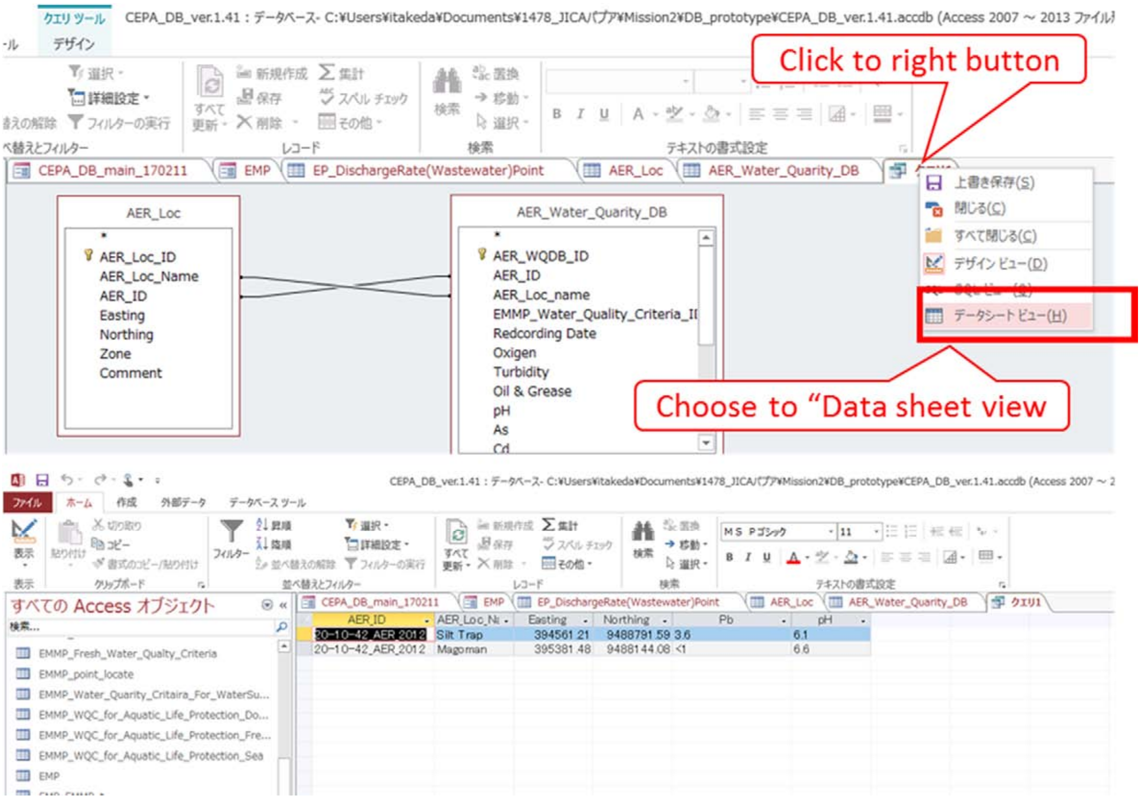
フィールド:	Theme	AER_Loc_Name	Date created	Item name	Item Value	Item Unit	
テーブル:	AER_OtherDB	AER_OtherDB	AER_OtherDB	AER_OtherDB	AER_OtherDB	AER_OtherDB	
集計:	グループ化	グループ化	グループ化	グループ化	グループ化	グループ化	
並べ替え:							
表示:	☑	☑	☑	☑	☑	☑	☐
抽出条件:	"Physical parameters	"The Watut downstrea		"Total CN"			
または:							

Input to extract condition

CEPA_DB_ver.1.41 : データベース- C:¥Users¥itakeda¥Documents¥1478_JICA¥パプア¥Mission2¥DB_prototype¥CEPA_DB_ver.1.41.accdb (Acc

Theme	AER_Loc_Name	Date create	Item name	Item Value	Item Unit
Physical paran	The Watut downstream of Kaveroi Ceek		Total CN	<0.01	mg/L
Physical paran	The Watut downstream of Kaveroi Ceek	2007/01/01	Total CN	<0.01	mg/L
Physical paran	The Watut downstream of Kaveroi Ceek	2008/01/03	Total CN	<0.01	mg/L
Physical paran	The Watut downstream of Kaveroi Ceek	2008/02/05	Total CN	<0.01	mg/L

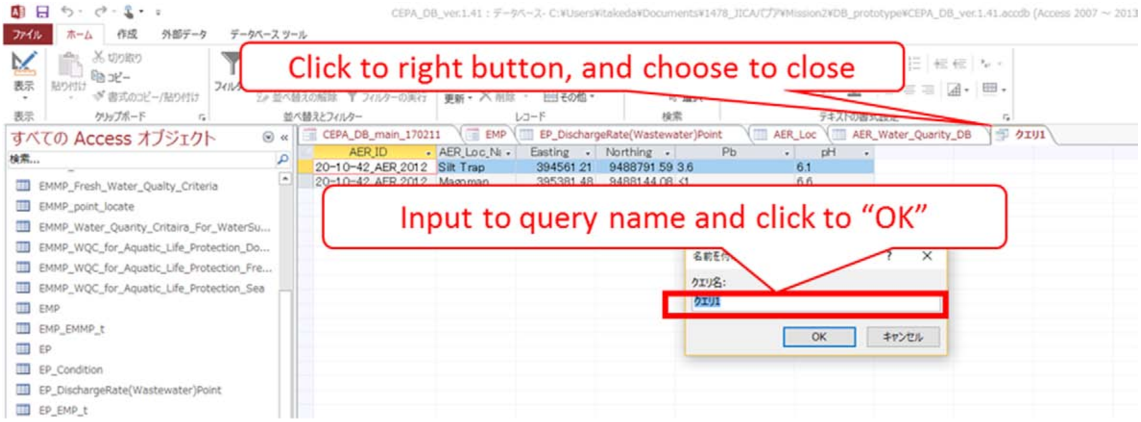
Figure 39　Query creation procedure on Access (3)


Click to right button

Choose to "Data sheet view

AER_ID	AER_Loc_Na	Easting	Northing	Pb	pH
20-10-42_AER_2012	Silt Trap	394561.21	9488791.59	3.6	6.1
20-10-42_AER_2012	Magoman	395381.48	9488144.08	<1	6.6

Figure 40 Query creation procedure on Access (4)


Click to right button, and choose to close

Input to query name and click to "OK"

Figure 41 Query creation procedure on Access (5)

4. Using GIS

4.1. Overview of GIS

Geographical information system (GIS) uses comprehensive management and processing of data (spatial data) with information on position by using geographical position as a clue, visual display, and advanced analysis and rapid. It is a technology that enables judgment. By using GIS, it becomes possible to make operations in CEPA more sophisticated and efficient.

Various software is available to GIS regardless of charge or free of charge. In this project, we will use QGIS which is freeware. QGIS has been selected for use in many departments inside CEPA and also because information can be obtained on the Internet as well.

4.2. Import from database

Here, a method of outputting information from a database file and displaying it on the QGIS will be exemplified.

①Prepare a query containing location information.

②Output the query from ① to the Excel file and save it in the GIS project folder (01_MonitoringData).

③Save the file of ② as ".csv" file.

④Start up QGIS and open the project file.

⑤Click "Add Delimited text layer" and select the CSV file of ③.(See Figure 42)

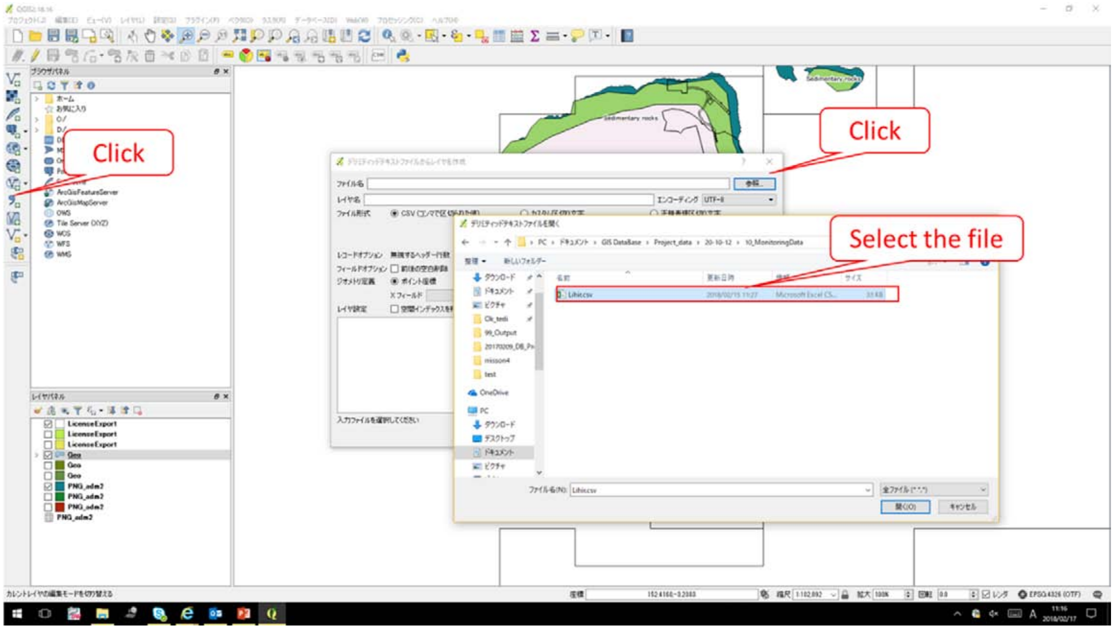


Figure 42 Import to CSV data

⑥Select the X, Y fields.(See Figure 43)

⑦Select spatial reference information. (At the Lihir mine, WGS 86 UTM zone 56 S is used)

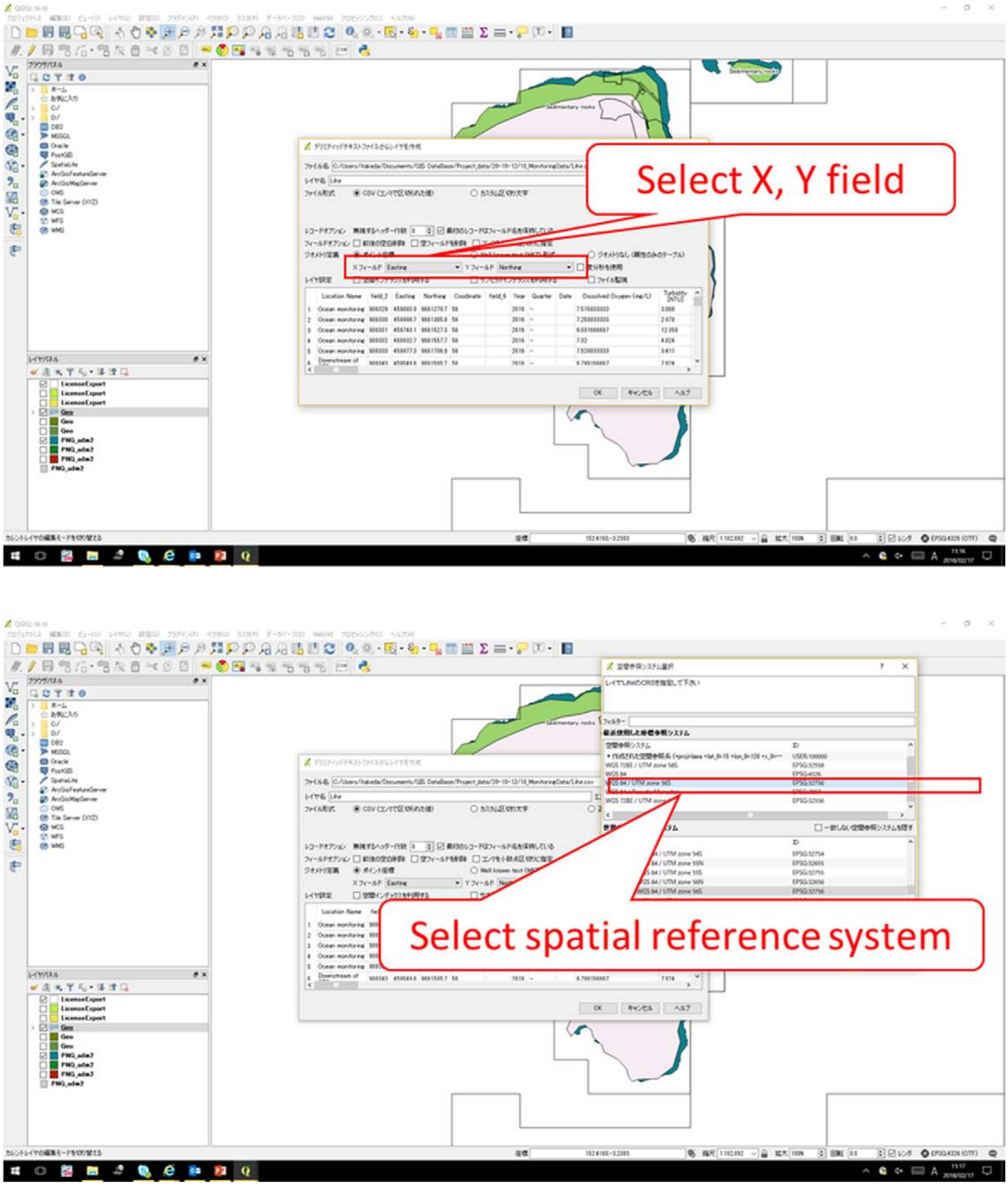


Figure 43 Reading of coordinate values and setting of geographic coordinate system.

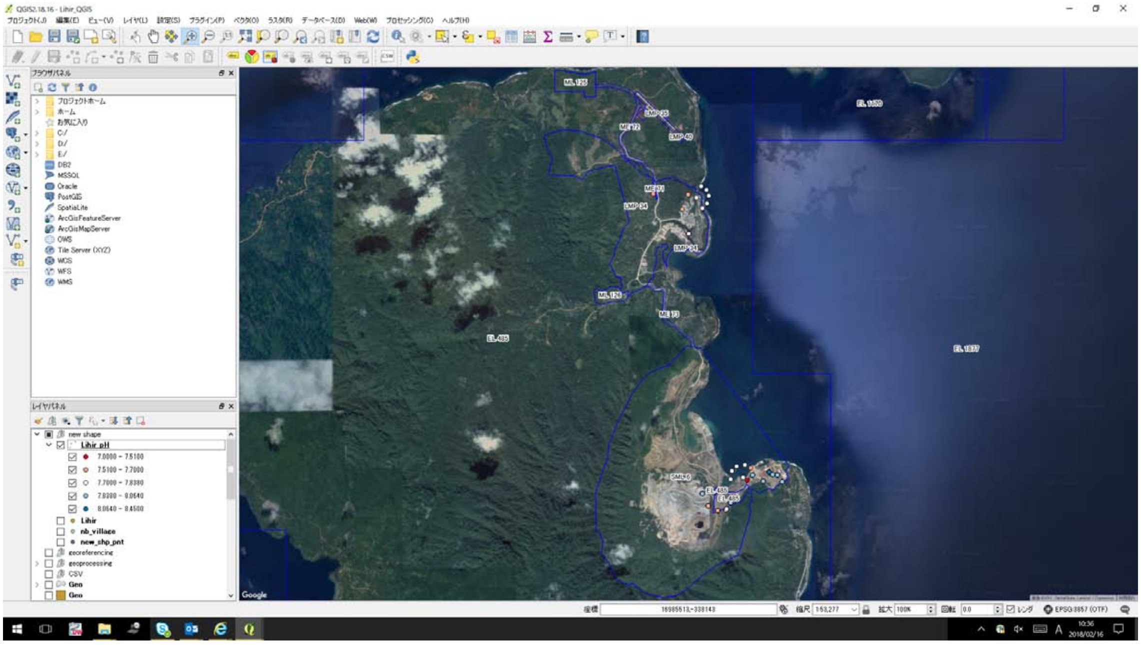


Figure 44 Illustration of display on QGIS (base map: satellite image point: pH)

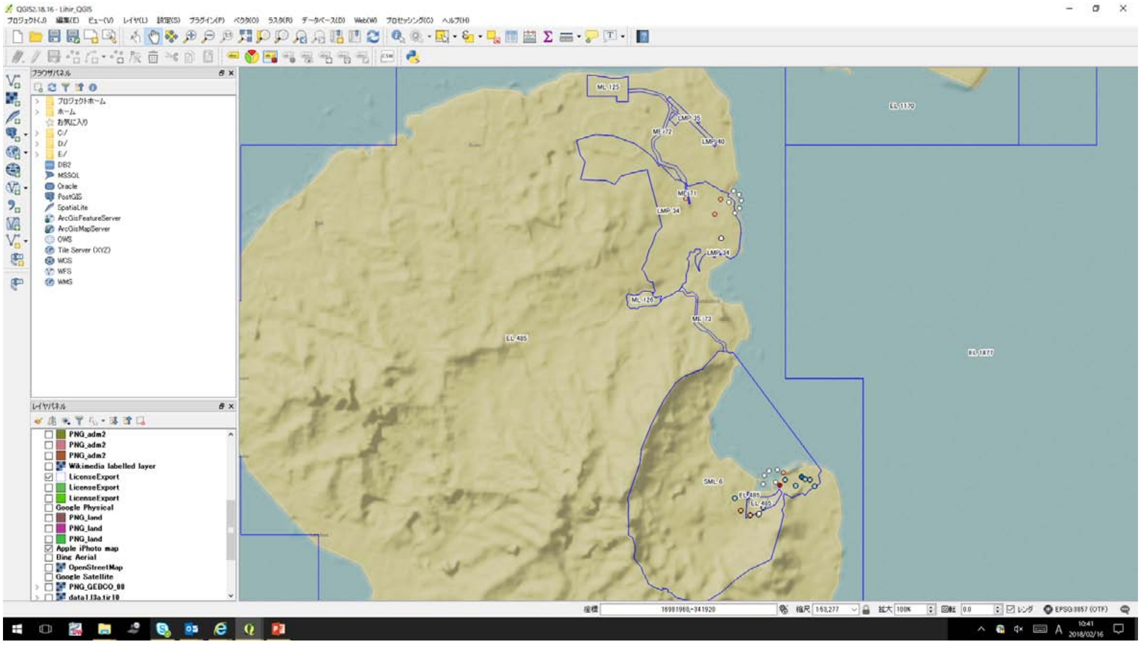


Figure 45 Illustration of display on QGIS (base map: topological map point: pH)

Conservation and Environment Protection Authority **CEPA**
Mineral Resources Authority **MRA**
Dept. Mineral Policy and Geohazard Management **DMPGM**
Japan International Cooperation Agency **JICA**

Mine Waste Database Management Manual

THE PROJECT FOR CAPACITY DEVELOPMENT
ON MINE WASTE MANAGEMENT
IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA

Supported by Japan International Cooperation Agency
In September 2018

Appendix 5

Mine Waste Database User's Manual

Mine Waste Database User's Manual

Contents

1. Overview of Mine Waste Database

1.1. System structure

The Mine Waste Database consist of Access Database files that records environment Monitoring Data, Environment Permit (EP), Environment Impact Assessment (AER), Environment Monitoring Management Program, Annual Environment Reports, Audit and Inspection.

All these electronic files and GIS (Geographical Information System) files do have separate folders and are stored in the NAS (Network Array Storage) device which is connected to CEPA's Local Area Network and shared by CEPA officer.

2. Main Database

2.1. Overview

Main Database consists of database files created by MS Access and electronic files grouped by folder for each project. The database file is composed of 10 groups of tables corresponding to the business flow of CEPA. Figure 1 is shown table relationship of database.

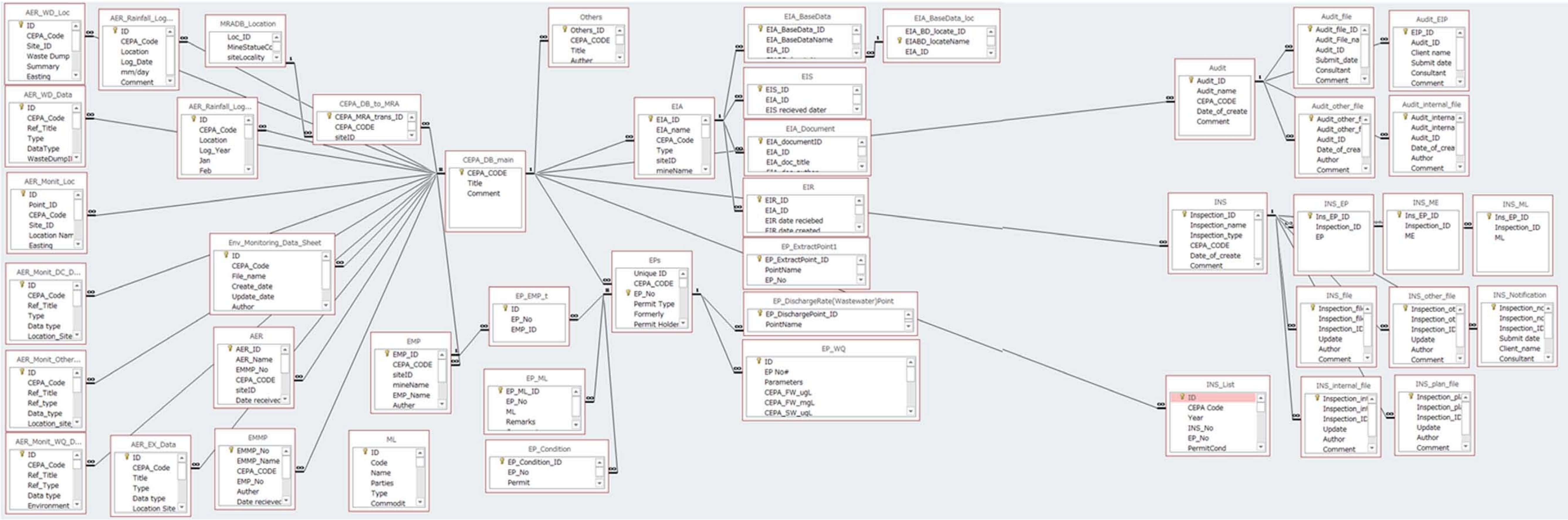


Figure 1 Table relationship

Main table

It is a table group forming the core of this database. “CEPA_DB_main” table is recorded “CEPA_CODE” and project names. “CEPA_CODE” is internal code in order to manage in CEPA EPW. There is managed whole database as a key of “CEPA_CODE”.

“MRADB_Location“table is recorded mine location, types, commodities and so on, that is inquiry GSD of MRA.

The table “CEPA_DB_to_MRA” is a table for combining the CEPA_DB_main table and the MRADB_Location table, in which CEPA_CODE and site_ID, which is the key of MRADB_Location, correspond to each other

Table 1 Table items and source related tables of “CEPA_DB_main”

Table	Field Name	Remarks	From	
CEPA_DB_main	CEPA_Code	CEPA internal Code of mine project in EPW	CEPA	Receptionnaly
	Title	Project name	CEPA	Receptionnaly
	Comment	Comment in order to remark	CEPA	PIC
CEPA_DB_to_MRA	CEPA_MRA_trans_ID	Unique ID of this table	Automatically	
	CEPA_Code	CEPA internal Code of mine project in EPW	CEPA	Receptionnaly
	SiteID	MRA-GSD siteID	MRA	GSD file
MRADB_Locaton	Loc_ID	Unique ID of this table	MRA	GSD file
	MineStatueCoe	Mine statue	MRA	GSD file
	siteLocality	Site Locality	MRA	GSD file
	siteID	Site ID	MRA	GSD file
	mineName	Mine name	MRA	GSD file
	mineStatue	Mine statue	MRA	GSD file
	exprorationSatue	Exproration Statue	MRA	GSD file
	mineSummary	Mine Summary	MRA	GSD file
	Easting	Mine Location of Easting	MRA	GSD file
	Northing	Mine Location of Northing	MRA	GSD file
	Lat	Mine Location of Latitude	MRA	GSD file
	Lon	Mine Location of Lontitude	MRA	GSD file
	Zone	Coodinate Zone	MRA	GSD file
	100Kmapsheet	100km map sheet Number	MRA	GSD file
	250Kmapsheet	250km map sheet Number	MRA	GSD file
	dateRecorded	Date Recorded	MRA	GSD file
	dateLastUpdate	Last updata date	MRA	GSD file
	locationMethod	Location method	MRA	GSD file
	Accuracy	Accurarcy	MRA	GSD file
	MainCommodity	Main Commodity	MRA	GSD file
	MainCommoditySize	Main Commodity size	MRA	GSD file
	WorkExtract	Work Exract	MRA	GSD file
	WorkExtractComment	Work Exract Comment	MRA	GSD file
	Geoscientistname	Geoscientist name of MRA	MRA	GSD file
	EnteredByName	Entered by Name of MRA	MRA	GSD file
	Perssonel	Personel	MRA	GSD file

EIA

EIA table grope is recorded environment impact assessment information that is based on published of environment permit. EIA table is recorded general information as EIA. The table “EIA_BaseData” is recorded predevelopment monitoring data, and the table “EIA_BaseData_Location” is recorded location information. The table “EIA_Document” is recorded relative EIA document information and link to file location.

Table 2　Table items and source related tables of EIA

Table	Field Name	Remarks	From
EIA	EIA_ID	Unique ID of EIA	EIA documents
	EIA_name	EIA name	EIA documents
	CEPA_Code	CEPA Code	CEPA_DB_main table
	Types	Documents type (EIA,EIR,EIS,Others)	EIA documents
	Client_name	Client name	EIA documents
	Client_adress	Client adress	EIA documents
	Submit date	Submit date	EIA documents
	Date created	Date created	EIA documents
	EIA_level	EIA Level	EIA documents
	Comment	Comment	EIA documents
	Consultant	Consultant	EIA documents
EIA_BaseData	EIA_BaseData_ID	Unique ID of EIA basedata (Automatically)	
	EIA_BaseDataName	EIA basedata name	EIA documents
	EIA_ID	EIA ID	EIA table
	EIABD_locateName	Base data loation name	EIA documents
	Chemical	Chemical (Ex. Cu, Zn etc)	EIA documents
	EIA_Chem_Unit	Unit (ex. Mg/L)	EIA documents
	EIA_chem_value	Value	EIA documents
	EIABD_Est_date	Establish date	EIA documents
	BD_Remarks	Remark	EIA documents/user
	Link to files	File location	User
EIA_BaseData_Location	EIA_BD_locate_ID	Unique ID of EIA basedata location table (Automatically)	
	EIABD_locateName	Location name of EIA Location data	EIA_BaseData
	EIA_ID	EIA ID	EIA table
	Easting	Location of Easting	EIA Documents
	Northing	Location of Northing	EIA Documents
	Zone	Coodinate and zone	EIA Documents
	Comments	Comment	EIA Documents/user
EIA_Document	EIA_documentID	EIA document ID (Automatically)	
	EIA_ID	EIA ID	EIA table
	EIA_doc_title	EIA Document Title	EIA documents
	EIA_doc_auther	Author	EIA documents
	EIA_doc_accept_date	Accept date to CEPA	CEPA
	EIA doc created date	Created date document	EIA documents
	Comment	Comment	EIA documents
	EIA_doc_file_link	File location	User

EPs

The “EPs” table grope is recorded the information of relative Environment Permits (EP). The table “EPs” is recorded basic information of EP (Permitted date, Location, Number, Level etc…) and link to file location.

The table “EP_Condition” is recorded permit conditions on EP.

The table “EP_DischargeRate_Point” is recorded permit volume of discharge and discharge location information.

The table “EP_EMP_t” is recorded the correspondence between relative Environment management plan and EP numbers.

The table “EP_ExtractPoint” is recorded permit volume of extract and extract point location informations.

The table “EP_ML” is the correspondence between EP number and Mining License numbers.

The table “EP_WQ” is recorded water quality criteria for fresh and sea water in CEPA,WHO and ANZ.

Table 3　Table items and source related tables of EP (1)

Table	Field Name	Remarks	From	
EPs	Unique ID	Unique ID of EPs	CEPA	EP List
	CEPA_CODE	CEPA Code	CEPA_DB_main table	
	EP_No	EP number	CEPA	EP List
	Permit Type	Permit type WE(Water Extract),WD(Water Discharge),EP(Environmet Permit)	CEPA	EP List
	Formerly	Formerly (New, Renew or Amendent, etc)	CEPA	EP List
	Permit Holder/Applicant	Permit Holder or Applicant	CEPA	EP List
	Address	The adress of Permit Holder or Applicant	CEPA	EP List
	Province	Location of Province	CEPA	EP List
	Districts	Location of Districts	CEPA	EP List
	Local Level Governments (LLGs)	Local Level Governments (LLGs)	CEPA	EP List
	Project Name	Project name	CEPA	EP List
	Project Description	Project Description	CEPA	EP List
	Prescribed Activity	Prescribed Activity	CEPA	EP List
	Activity Level	Activity Level	CEPA	EP List
	Sub-category	Sub-category	CEPA	EP List
	Sector	Sector (eg, Mining)	CEPA	EP List
	Comments	Comments	CEPA	EP List
	Concession Area	Concession Area (Mining License)	CEPA	EP List
	Type	Type	CEPA	EP List
	Total Area	Total Area	CEPA	EP List
	Location description	Location description	CEPA	EP List
	Annual Charge	Annual Charge	CEPA	EP List
	Date Issued	Date Issued	CEPA	EP List
	Commence	Commence	CEPA	EP List
	Amalgamation	Amalgamation	CEPA	EP List
	Term of Permit	Term of Permit	CEPA	EP List
	Expiry Date	Expiry Date	CEPA	EP List
	Date Amended	Date Amended	CEPA	EP List
	Date Renewal	Date Renewal	CEPA	EP List
	Transfer date	Transfer date	CEPA	EP List
	Status	Status	CEPA	EP List
	Premises	Premises	CEPA	EP List
	Easting	Easting	CEPA	EP List
	Southing/Northing	Southing/Northing	CEPA	EP List
	GPS polygon layer file name	GPS polygon layer file name	CEPA	EP List
	Managed by	Managed by	CEPA	EP List
	Link to file	File location	User	
	Title		CEPA	EP List
EP_Condition	EP_Condition_ID	EP condition ID (Automatically)		
	EP_No	EP No	EP table	
	Condition_No	Condition Np.	EP document	
	Condition	Condition	EP document	
	Comment	Comment	User	
EP_DischatgeRate Point	EP_DischargePoint_ID	EP Discharge Point ID (Automatically)		
	PointName	Point name	EP document	
	EP_No	EP No.	EP table	
	Details	Details	EP document	
	Easting	Point location of Easting	EP document	
	Northing	Point location of Northing	EP document	
	Zone	Point location of coodinate and zone	EP document	
	WasteWater	Case of Waste water, input "1"	EP document	
	Rainfall_Runoff	Case of Rainfall runoff water, input "1"	EP document	
	DischargeRate Liter/hr	Dischage rate (Liter/hr)	EP document	
	DischargeRate Hour/day	Dischage rate (Liter/hr)	EP document	
	Discharge day/month	Dischage rate (Liter/hr)	EP document	
	Discharge month/year	Dischage rate (Liter/hr)	EP document	
	Annual Discharge volume	Annal Discharge Volume	EP document	
	Comment	Comment	EP document/User	
EP_EMP_t	ID	Unique ID of EP_EMP table(Automatically)		
	EP_No	EP_No	EP table	
	EMP_ID	EMP_ID	EMP table	
EP_ExreactPoint	EP_ExtractPoint_ID	EP Extract Point ID (Automatically)		
	PointName	Extract point name	EP document	
	EP_No	EP No.	EP table	
	Details	Details	EP document	
	Easting	Point location of Easting	EP document	
	Northing	Point location of Northing	EP document	
	Zone	Point location of coodinate and zone	EP document	
	100Kmapsheet		EP document	
	250Kmapsheet		EP document	
	Extract Liter/hr	Extract volume (Liter/hr)	EP document	
	Extract Hour/day		EP document	
	Extract Day/month		EP document	
	Extract month/year		EP document	
	Annual Extract volume	Annual Extract volume	EP document	
	Comment	Comment	EP document/user	
EP_ML	EP_ML_ID	EP_MLID (Automatically)		
	EP_No	EP No.	EP table	
	ML	ML No.	ML table	
	Remarks	Remarks	User	
	Comment	Comment	User	

Table 4　Table items and source related tables of EP (2)

EP_WQ	ID	EP_WQ ID (Automatically)		
	EP No.	EP Number	EP document	
	Parameters	Parameters (ex. Arsenic, Oil, Iron,…)	EP document	
	CEPA_FW_ugL	Regulation value of fresh water in CEPA(μg/L)	EP document	
	CEPA_FW_mgL	Regulation value of fresh water in CEPA(mg/L)	EP document	
	CEPA_SW_ugL	Regulation value of Sea water in CEPA(μg/L)	EP document	
	CEPA_SW_mgL	Regulation value of Sea water in CEPA(mg/L)	EP document	
	WHO_FW_ugL	Regulation value of fresh water in WHO(μg/L)	EP document	
	WHO_FW_mgL	Regulation value of fresh water in WHO(mg/L)	EP document	
	WHO_SW_ugL	Regulation value of Sea water in WHO(μg/L)	EP document	
	WHO_SW_mgL	Regulation value of Sea water in WHO(mg/L)	EP document	
	ANZ_FW_ugL	Regulation value of fresh water in ANZ(μg/L)	EP document	
	ANZ_FW_mgL	Regulation value of fresh water in ANZ(mg/L)	EP document	
	ANZ_SW_ugL	Regulation value of Sea water in ANZ(μg/L)	EP document	
	ANZ_SW_mgL	Regulation value of Sea water in ANZ(mg/L)	EP document	

ML

The ML table is recorded Mining Licenses information provided by MRA.

Table 5 Table items and source related tables of ML

Table	Field Name	Remarks	From	
ML	ID	Unique of ID (Automatically)		
	Code	Mining License Code	MRA	MiningLicense
	Name	Mining License name	MRA	MiningLicense
	Parties	Parties name	MRA	MiningLicense
	Type		MRA	MiningLicense
	Commodit	Commodities	MRA	MiningLicense
	Status_G		MRA	MiningLicense
	Status		MRA	MiningLicense
	Applicat		MRA	MiningLicense
	Grant_Da		MRA	MiningLicense
	Expiry_D		MRA	MiningLicense
	Last_Ren		MRA	MiningLicense
	MAC_Date		MRA	MiningLicense
	Inactive		MRA	MiningLicense
	Last_Re1		MRA	MiningLicense
	Renewal_		MRA	MiningLicense
	Area_Nor		MRA	MiningLicense
	Normalis		MRA	MiningLicense
	Normali1		MRA	MiningLicense
	Area		MRA	MiningLicense
	Official		MRA	MiningLicense
	Officia1		MRA	MiningLicense
	Applica1		MRA	MiningLicense
	Map_Refe		MRA	MiningLicense
	guidShap		MRA	MiningLicense
	guidLice		MRA	MiningLicense
	PartName	Part name	MRA	MiningLicense

EMP & EMMP

The table group of “EMP & EMMP” recorded the information and electronic file location of Environment management plan (EMP) and Environment management program (EMMP).

Table 6 Table items and source related tables of EMP and EMMP

Table	Field Name	Remarks	From
EMP	EMP_ID	EMP ID (Automatically)	
	CEPA_CODE	CEPA Code	CEPA_DB_main
	Link to EMP	File location	user
	EMP_Name	EPM name	EMP document
	Auther	Auther	EMP document
	Date create	Date create	EMP document
	Commnent	Comment	user
	Date recieved	Date received	CEPA
EMP_EMMP_t	ID	EMP EMMP table ID (Automatidally)	
	EMP_ID	EMP ID	EMP table
	EMMP_ID	EMMP ID	EMMP table
EMMP	EMMP_No	EMMP No (Automatically)	
	EMMP_Name	EMMP name	EMMP document
	CEPA_CODE	CEPA code	CEPA_DB_main table
	EMP_No	EMP No	EMP table
	Auther	Auther	EMMP document
	Date recieved	Date recieved	EMMP document
	Date_created	Date_created	EMMP document
	Comment	Comment	EMMP document/user
	Link to Files	File location	User
	Consultant	Consultant	EMMP document

AER

AER table is recorded information and link to electronic file that is annual / quarterly environment report and environment monitoring datasheets.

The table “AER_EX_Data” is recorded extract volume and period.

The table “AER_Monit_DC_Data” is recorded discharge volume and period.

The table “AER_Monit_Loc” is recorded monitoring location information.

The table “AER_Monit_WQ_Data” is recorded water quality and monitoring date.

The table “AER_WD_Data” is recorded waste dumping volume for waste dumps.

The table “AER_WD_Loc” is recorded waste dump location information.

The table “AER_Monit_Other_Data” is recorded is monitoring values other than the above, period or measurement date.

The table “AER_Rainfall_Log_dialy” is recorded daily rainfall logs, and the table “AER_Rainfall_Loc_Monthly” is recorded monthly rainfall logs.

Table 7 Table items and source related tables of AER

Table	Field Name	Data type	Remarks	From	
AER	AER_ID		AER ID (Automatically)		
	CEPA_CODE		CEPA CODE	CEPA DB main table	
	Link to AER files		File location	User	
	AER_Name		AER name	AER documents	
	EMMP_No		EMMP no	EMMP table	
	Date received		Date received	AER documents	
	Created date		Created date	AER documents	
	Start of Date		Start of Date	AER documents	
	End of Date		End of Date	AER documents	
	Auther		Auther	AER documents	
	Consultant		Consultant	AER documents	
AER_EMMP_t	ID		AER EMMP t table ID (Automatically)		
	AER_ID		AER ID	AER table	
	EMMP_ID		EMMP ID	EMMP table	
AER_EX_Data	ID		AER EX ID (Automatically)		
	CEPA_Code		CEPA Code	Monitoring datasheet	Extract water
	Title		Basedata Title	Monitoring datasheet	Extract water
	Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Extract water
	Data type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Extract water
	Location Site ID		Location site ID	Monitoring datasheet	Extract water
	Location Name		Location name	Monitoring datasheet	Extract water
	Year		Monitoring Date(Year)	Monitoring datasheet	Extract water
	Quarter		Monitoring Date(Quater)	Monitoring datasheet	Extract water
	From		Moniroring period (From)	Monitoring datasheet	Extract water
	To		Moniroring period (To)	Monitoring datasheet	Extract water
	Volume_(m3)		Extraction Volume(m3)	Monitoring datasheet	Extract water
	Comment		Comment	Monitoring datasheet	Extract water
AER_Monit_DC_Data	ID		AER_Mont_DC_Data ID (Automatically)	Monitoring datasheet	Discharge water
	CEPA_Code		CEPA Code	Monitoring datasheet	Discharge water
	Ref_Title		Basedata Title	Monitoring datasheet	Discharge water
	Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Discharge water
	Data type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Discharge water
	Location_Site ID		Location site ID	Monitoring datasheet	Discharge water
	Location Name		Location name	Monitoring datasheet	Discharge water
	Year		Monitoring Date(Year)	Monitoring datasheet	Discharge water
	Quarter		Monitoring Date(Quater)	Monitoring datasheet	Discharge water
	From		Moniroring period (From)	Monitoring datasheet	Discharge water
	To		Moniroring period (To)	Monitoring datasheet	Discharge water
	Volume_(m3)		Discharge Volume(m3)	Monitoring datasheet	Discharge water
	Comment		Comment	Monitoring datasheet	Discharge water
AER_Monit_Loc	ID		AER_Monit_Loc ID (Automatically)	Monitoring datasheet	Monitoring Location information
	Point_ID		Point_ID	Monitoring datasheet	Monitoring Location information
	CEPA_Code		CEPA_Code	Monitoring datasheet	Monitoring Location information
	Site_ID		Site_ID	Monitoring datasheet	Monitoring Location information
	Location Name		Location Name	Monitoring datasheet	Monitoring Location information
	Easting		Easting	Monitoring datasheet	Monitoring Location information
	Northing		Northing	Monitoring datasheet	Monitoring Location information
	Altitude_(m)		Altitude_(m)	Monitoring datasheet	Monitoring Location information
	Coodinate _Zone		Coodinate _Zone	Monitoring datasheet	Monitoring Location information
	Comment		Comment	Monitoring datasheet	Monitoring Location information
AER_Monit_Other_Data	ID		AER_Monit_Other_ID	Monitoring datasheet	Other data
	CEPA_Code		CEPA_Code	Monitoring datasheet	Other data
	Ref_Title		Basedata Title	Monitoring datasheet	Other data
	Ref_type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Other data
	Data_type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Other data
	Location_site_ID		Location_site_ID	Monitoring datasheet	Other data
	Period_year		Period_year	Monitoring datasheet	Other data
	Period_Quater		Period_Quater	Monitoring datasheet	Other data
	From		From	Monitoring datasheet	Other data
	To		To	Monitoring datasheet	Other data
	Input_Data_title		Input_Data_title	Monitoring datasheet	Other data
	Item_name		Item_name	Monitoring datasheet	Other data
	Item Value		Item Value	Monitoring datasheet	Other data
	Item Unit		Item Unit	Monitoring datasheet	Other data
	Comment		Comment	Monitoring datasheet	Other data

Table 8 Table items and source related tables of AER (2)

AER_Monit_WQ_Data	ID		AER Mont WQ Data	Monitoring datasheet	Water Qualty data
	CEPA_Code		CEPA_Code	Monitoring datasheet	Water Qualty data
	Ref_Title		Basedata Title	Monitoring datasheet	Water Qualty data
	Ref_Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Water Qualty data
	Data type		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Water Qualty data
	Environment Permit Condition		Environment Permit Condition	Monitoring datasheet	Water Qualty data
	EMMP Section		EMMP Section	Monitoring datasheet	Water Qualty data
	Location Name		Location Name	Monitoring datasheet	Water Qualty data
	Location Site ID		Location Site ID	Monitoring datasheet	Water Qualty data
	Year		Year	Monitoring datasheet	Water Qualty data
	Quarter		Quarter	Monitoring datasheet	Water Qualty data
	Measure Date		Measure Date	Monitoring datasheet	Water Qualty data
	Dissolved Oxygen (mg/L)		Dissolved Oxygen (mg/L)	Monitoring datasheet	Water Qualty data
	Turbidity_(NTU)		Turbidity_(NTU)	Monitoring datasheet	Water Qualty data
	pH		pH	Monitoring datasheet	Water Qualty data
	Conductivity_(µS/cm)		Conductivity_(µS/cm)	Monitoring datasheet	Water Qualty data
	Calcium (mg/L)		Calcium (mg/L)	Monitoring datasheet	Water Qualty data
	Amonia (NH3)		Amonia (NH3)	Monitoring datasheet	Water Qualty data
	Nitrates (mg/L)		Nitrates (mg/L)	Monitoring datasheet	Water Qualty data
	Nitrites (mg/L)		Nitrites (mg/L)	Monitoring datasheet	Water Qualty data
	Mn_(µg/L)		Mn_(µg/L)	Monitoring datasheet	Water Qualty data
	Total Dissolved Solids (mg/L)		Total Dissolved Solids (mg/L)	Monitoring datasheet	Water Qualty data
	Temperature (° C)		Temperature (° C)	Monitoring datasheet	Water Qualty data
	Oxygen		Oxygen	Monitoring datasheet	Water Qualty data
	Oil_Grease		Oil_Grease	Monitoring datasheet	Water Qualty data
	Fat		Fat	Monitoring datasheet	Water Qualty data
	As_(µg/L)		As_(µg/L)	Monitoring datasheet	Water Qualty data
	Cd_(µg/L)		Cd_(µg/L)	Monitoring datasheet	Water Qualty data
	Cr6+_(µg/L)		Cr6+_(µg/L)	Monitoring datasheet	Water Qualty data
	Cu_(µg/L)		Cu_(µg/L)	Monitoring datasheet	Water Qualty data
	Cn-(Free)_(µg/L)		Cn-(Free)_(µg/L)	Monitoring datasheet	Water Qualty data
	Cn-(Total)_(µg/L)		Cn-(Total)_(µg/L)	Monitoring datasheet	Water Qualty data
	Pb_(µg/L)		Pb_(µg/L)	Monitoring datasheet	Water Qualty data
	Hg_(µg/L)		Hg_(µg/L)	Monitoring datasheet	Water Qualty data
	Ag_(µg/L)		Ag_(µg/L)	Monitoring datasheet	Water Qualty data
	Zn_(µg/L)		Zn_(µg/L)	Monitoring datasheet	Water Qualty data
	Ba_(µg/L)		Ba_(µg/L)	Monitoring datasheet	Water Qualty data
	Bo_(µg/L)		Bo_(µg/L)	Monitoring datasheet	Water Qualty data
	Cl_(µg/L)		Cl_(µg/L)	Monitoring datasheet	Water Qualty data
	Co_(µg/L)		Co_(µg/L)	Monitoring datasheet	Water Qualty data
	Fe_(µg/L)		Fe_(µg/L)	Monitoring datasheet	Water Qualty data
	F_(µg/L)		F_(µg/L)	Monitoring datasheet	Water Qualty data
	Ni_(µg/L)		Ni_(µg/L)	Monitoring datasheet	Water Qualty data
	Na_(µg/L)		Na_(µg/L)	Monitoring datasheet	Water Qualty data
	Se_(µg/L)		Se_(µg/L)	Monitoring datasheet	Water Qualty data
	N(NO3- NO2-)_(µg/L)		N(NO3- NO2-)_(µg/L)	Monitoring datasheet	Water Qualty data
	Sulfate(SO4 2-)_(µg/L)		Sulfate(SO4 2-)_(µg/L)	Monitoring datasheet	Water Qualty data
	Sulfide(HS-)_(µg/L)		Sulfide(HS-)_(µg/L)	Monitoring datasheet	Water Qualty data
	Phenols		Phenols	Monitoring datasheet	Water Qualty data
	Pesiticides		Pesiticides	Monitoring datasheet	Water Qualty data
	Radioactivitiy		Radioactivitiy	Monitoring datasheet	Water Qualty data
	Tars		Tars	Monitoring datasheet	Water Qualty data
	Taste		Taste	Monitoring datasheet	Water Qualty data
	Insoluble residuces		Insoluble residuces	Monitoring datasheet	Water Qualty data
	Toxicants(miscelleneous)		Toxicants(miscelleneous)	Monitoring datasheet	Water Qualty data
	E_col(per100ml)		E_col(per100ml)	Monitoring datasheet	Water Qualty data
	Color		Color	Monitoring datasheet	Water Qualty data
	Odor		Odor	Monitoring datasheet	Water Qualty data
	Total_Soilds(mg/L)		Total_Soilds(mg/L)	Monitoring datasheet	Water Qualty data
	Supended_Solids_(mg/L)		Supended_Solids_(mg/L)	Monitoring datasheet	Water Qualty data
	Comment		Comment	Monitoring datasheet	Water Qualty data

Table 9　Table items and source related tables of AER (3)

AER_WD_Data	ID		AER_WD_Data ID	Monitoring datasheet	Waste Dump Volume
	CEPA_Code		CEPA_Code	Monitoring datasheet	Waste Dump Volume
	Ref_Title		Basedata Title	Monitoring datasheet	Waste Dump Volume
	Type		Basedata type (AER,EP,EMP,EMMP,Audit)	Monitoring datasheet	Waste Dump Volume
	DataType		Data type (Raw,Average,Max,Min Std)	Monitoring datasheet	Waste Dump Volume
	WasteDumpID		WasteDumpID	Monitoring datasheet	Waste Dump Volume
	Period_Year		Period_Year	Monitoring datasheet	Waste Dump Volume
	Quater		Quater	Monitoring datasheet	Waste Dump Volume
	From		From	Monitoring datasheet	Waste Dump Volume
	To		To	Monitoring datasheet	Waste Dump Volume
	Initial Capacity		Initial Capacity	Monitoring datasheet	Waste Dump Volume
	Used Capacity		Used Capacity	Monitoring datasheet	Waste Dump Volume
	Rest of Capacity		Rest of Capacity	Monitoring datasheet	Waste Dump Volume
	Comment		Comment	Monitoring datasheet	Waste Dump Volume
AER_WD_Loc	ID		AER_WD_Loc ID (Automatically)	Monitoring datasheet	Monitoring Location information
	CEPA_Code		CEPA_Code	Monitoring datasheet	Monitoring Location information
	Site_ID		Site_ID	Monitoring datasheet	Monitoring Location information
	Waste Dump Name		Waste Dump location name	Monitoring datasheet	Monitoring Location information
	Summary		Summary	Monitoring datasheet	Monitoring Location information
	Easting		Easting	Monitoring datasheet	Monitoring Location information
	Nothting		Northing	Monitoring datasheet	Monitoring Location information
	Altitude_(m)		Altitude_(m)	Monitoring datasheet	Monitoring Location information
	Coodinate _Zone		Coodinate _Zone	Monitoring datasheet	Monitoring Location information
	Comment		Comment	Monitoring datasheet	Monitoring Location information
AER_Rainfall_Log_dialy	ID		AER_Lainfall_Log_dialy ID (Automatically)	Monitoring datasheet	Rainfall Log (Dialy)
	CEPA_Code		CEPA_Code	Monitoring datasheet	Rainfall Log (Dialy)
	Location		Location	Monitoring datasheet	Rainfall Log (Dialy)
	Log_Date		Log_Date	Monitoring datasheet	Rainfall Log (Dialy)
	mm/day		mm/day	Monitoring datasheet	Rainfall Log (Dialy)
	Comment		Comment	Monitoring datasheet	Rainfall Log (Dialy)
AER_Rainfall_Loc_Monthly	ID		AER Rainfall Log Monthly (Automatically)	Monitoring datasheet	Rainfall Log (Monthly)
	CEPA_Code		CEPA_Code	Monitoring datasheet	Rainfall Log (Monthly)
	Location		Location	Monitoring datasheet	Rainfall Log (Monthly)
	Log_Year		Log_Year	Monitoring datasheet	Rainfall Log (Monthly)
	Jan		Jan	Monitoring datasheet	Rainfall Log (Monthly)
	Feb		Feb	Monitoring datasheet	Rainfall Log (Monthly)
	Mar		Mar	Monitoring datasheet	Rainfall Log (Monthly)
	Apr		Apr	Monitoring datasheet	Rainfall Log (Monthly)
	May		May	Monitoring datasheet	Rainfall Log (Monthly)
	Jun		Jun	Monitoring datasheet	Rainfall Log (Monthly)
	Jul		Jul	Monitoring datasheet	Rainfall Log (Monthly)
	Aug		Aug	Monitoring datasheet	Rainfall Log (Monthly)
	Sep		Sep	Monitoring datasheet	Rainfall Log (Monthly)
	Oct		Oct	Monitoring datasheet	Rainfall Log (Monthly)
	Nov		Nov	Monitoring datasheet	Rainfall Log (Monthly)
	Dec		Dec	Monitoring datasheet	Rainfall Log (Monthly)

Audit

The “Audit” tables grope are recorded audit relative information. The table “Audit_file” is recorded Audit electronic file information and its file location. The table “Audit_internal_file” is internal document electronic file information and its file location. The table “Audit_EIP” is recorded EIP (Environmental improvement plan) electronic file information and its file location.

Table 10 Table items and source related tables of Audit

Table	Field Name	Remarks	From	
Audit	Audit ID	Audit ID (Automatically)		
	Audit name	Audit name	User	
	CEPA_CODE	CEPA Code	CEPA main table	
	Date_of_create	Date of create	User	
	Comment	Comment	User	
Audit file	Audit file ID	Audit File ID (Automatically)		
	Audit file name	Audit document file name	Audit documents	
	Audit ID	Audit ID	Audit table	
	submit date	submit date	Audit documents	
	consultant	consultant	Audit documents	
	comment	comment	Audit documents/User	
	file to link	File location	User	
Audit inter	Audit internal file ID	Audit internal file ID (Automatically)		
	Audit internal file title	Audit internal file title	Audit internal documents	
	Audit ID	Audit ID	Audit table	
	Author	Author	Audit internal documents	
	Date_of_create	Date_of_create	Audit internal documents	
	comment	comment	Audit internal documents/User	
	file to link	File location	User	
Audit other	Audit other file ID	Audit other file ID (Automatically)		
	Audit other file title	Audit other file title	Audit other documents	
	Audit ID	Audit ID	Audit tables	
	Author	Author	Audit other documents	
	Date_of_create	Date_of_create	Audit other documents	
	comment	comment	Audit other documents/User	
	file to link	File location	User	
Audit_EIP	EIP ID	EIP ID (Automatically)		
	Audit ID	Audit ID	Audit table	
	Client name	Client name	EIP documents	
	submit date	submit date	EIP documents	
	consultant	consultant	EIP documents	
	comment	comment	EIP documents/User	
	file to link	File location	User	

Inspection

“Inspection” tables grope are recorded Inspection relative information. The “Inspection_EP” table is recorded number of the environmental permit corresponding to inspection. The table “Inspection_ML” is recorded number of the environmental permit corresponding to Mining License. The “Inspection_file” table is recorded inspection relative electronic file information and its file location. The table “Inspection_internal_file” is recorded inspection internal document electronic file information and its file location.

Table 11 Table items and source related tables of Inspection

Table	Field Name	Remarks	From
Inspection	Inspection ID	Inspection ID (Automatically)	
	Inspection name	Inspection name	User
	Inspection type (usual or incident)	Inspection type (usual or incident)	User
	CEPA_CODE	CEPA_CODE	CEPA DB main
	Date	Date	User
	Comment	Comment	User
Inspection EP	INS_EP_ID	INS_EP_ID (Automatically)	
	Inspection ID	Inspection ID	Inspection table
	EP	EP	EP table
Inspection ML	INS_ML_ID	INS_ML_ID	
	Inspection ID	Inspection ID	Inspection table
	ML	ML ID	ML table
Inspection plan file	Inspection plan file ID	Inspection plan file ID (Automatically)	
	Inspection plan file name	Inspection plan file name	Inspection plan documents
	Inspection ID	Inspection ID	Inspection table
	Update date	Update date	Inspection plan documents
	Author	Author	Inspection plan documents
	comment	comment	Inspection plan documents/User
	file to link	File location	User
Inspection file	Inspection file ID	Inspection file ID (Automatically)	
	Inspection file name	Inspection file name	Inspection documents
	Inspection ID	Inspection ID	Inspection table
	Update date	Update date	Inspection documents
	Author	Author	Inspection documents
	comment	comment	Inspection documents/User
	file to link	File location	User
Inspection internal file	Inspection internal file ID	Inspection internal file ID (Automatically)	
	Inspection internal file title	Inspection internal file title	Inspection internal documents
	Inspection ID	Inspection ID	Inspection table
	Author	Author	Inspection internal documents
	date	date	Inspection internal documents
	comment	comment	Inspection internal documents/User
	file to link	File location	User
Inspection other file	Inspection other file ID	Inspection other file ID (Automatically)	
	Inspection other file title	Inspection other file title	Inspection other documents
	Inspection ID	Inspection ID	Inspection table
	Author	Author	Inspection other documents
	date	date	Inspection other documents
	comment	comment	Inspection other documents/User
	file to link	File location	User
Notification	Notification ID	Notification ID (Automatically)	
	Inspection ID	Inspection ID	Inspection table
	Client name	Client name	Notification documents
	submit date	submit date	Notification documents
	consultant	consultant	Notification documents
	comment	comment	Notification documents/User
	file to link	File location	User
INS_List	ID	Inspectio list ID (Automatically)	
	CEPA Code	CEPA_CODE	CEPA DB main
	Year	Year	Inspection List
	INS_No	Inspection Number	Inspection List
	EP_No	EP Number	Inspection List
	PermitCond	Permit Condition Number	Inspection List
	SubCond	Permit Condition Sub-Number	Inspection List
	Object	Object (ex.TSP,Plant,water qualty…)	Inspection List
	Fin_of_Ins	Find of Inspection	Inspection List
	Compliance_r	Compliance Ratio	Inspection List
	Date_Issued	Date Issued	Inspection List
	Date_Closed	Date Closed	Inspection List
	Northing	Northing (Location information)	Inspection List
	Easting	Easting (Location information)	Inspection List
	Hight	Height (Location information)	Inspection List
	Coodinate	Coodinate (Location information)	Inspection List
	Comments	Comments	Inspection List
	Completion_r	Completion Rate	Inspection List
	Before_Photo	Before Photo (Hypelink)	Inspection List
	After_Photo	After Photo (Hyperlinks)	Inspection List
	Officer (1)	Offier name	Inspection List
	Officer (2)	Offier name	Inspection List
	Officer (3)	Offier name	Inspection List
	Before_OLE	Before Photo (OLE)	User (bmp)
	After_OLE	After Photo (OLE)	User (bmp)

2.2. The rule of folder structure and stored electronic files

Each project folders are stored in “Files”, and there name are CEPA internal code indicating the project.

Just below that, various files classified into the folder type "EIA, EP, EMP, EMMP, AER, IMS, Audit, Other" are stored as file types. Attached file is various document and electronic files. Following is the rule of naming file names.

File name : ○○_@@@(2-4 words)_(original file name or subjects)

“○○” is project code. Mainly it means CEPA internal code.

For "@@@", abbreviations of the file types shown below are described.

・EIA : EIA relative documents（EIA,EIR etc…）
・EP : EP（Environment Permit） documents
・EMP : EMP（Environment management plan） documents
・EMMP : EMMP(Environment monitoring management program) document
・AER : AER(Annual environment report) document（Add the relevant year next to the code）
・QER : QER(Quarterly environment report) document（Add the relevant quarter next to the code）
・Audit : Audit（Audit report） relative document
・INS : INS(Inspection) relative document
・OTH : Other document

2.3. Form Sequence

When you start the database file, the form of "CEPA DB main" is displayed. This form is a form for collecting various kinds of information. Linked to various forms from this form. In "Open CEPA Code List", a list of projects recorded in this database is displayed

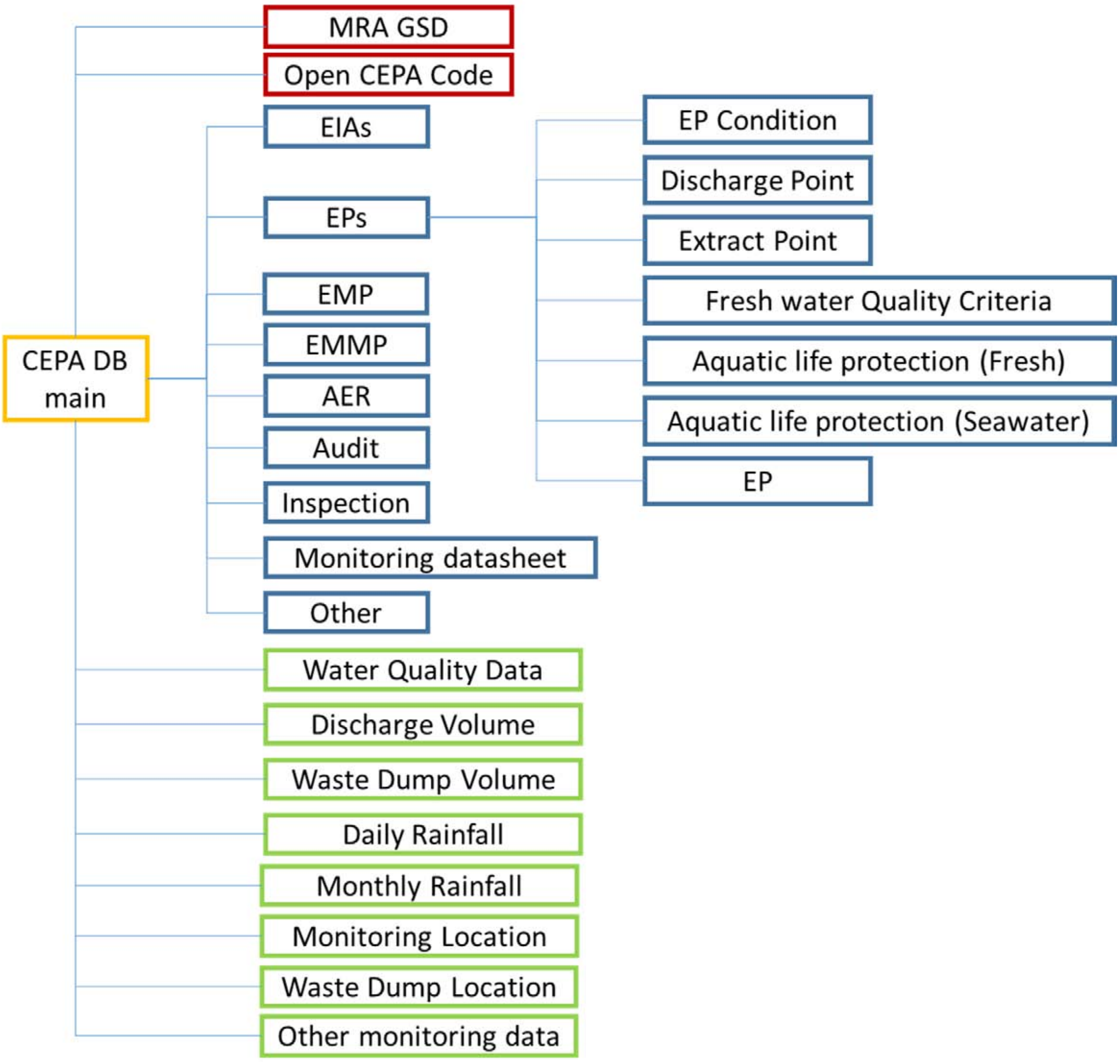


Figure 2　Database form relationship diagram

2.4. How to enter data into the database

2.4.1. Entry from Forms

2.4.1.1. CEPA DB main Form

In the CEPA DB main Form, together with the items in the CEPA DB main table, the name or management number in each item of the site ID, MRA GSD, EIA, EPs, EMP, EMMP, AER, Audit, Inspection and Monitoring Datasheet of the MRA DB table is displayed.
You can change "CEPA_CODE" by clicking "▶" in the lower left by clicking the button on the left side, new input becomes possible. (Figure 3)

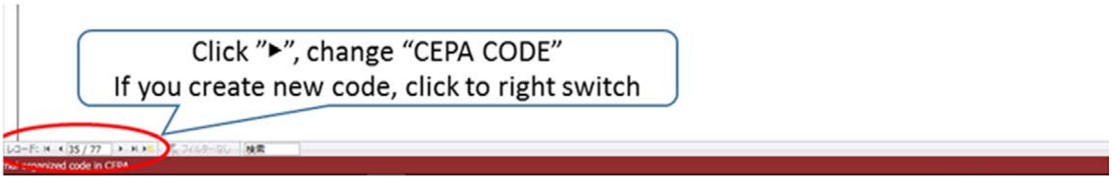
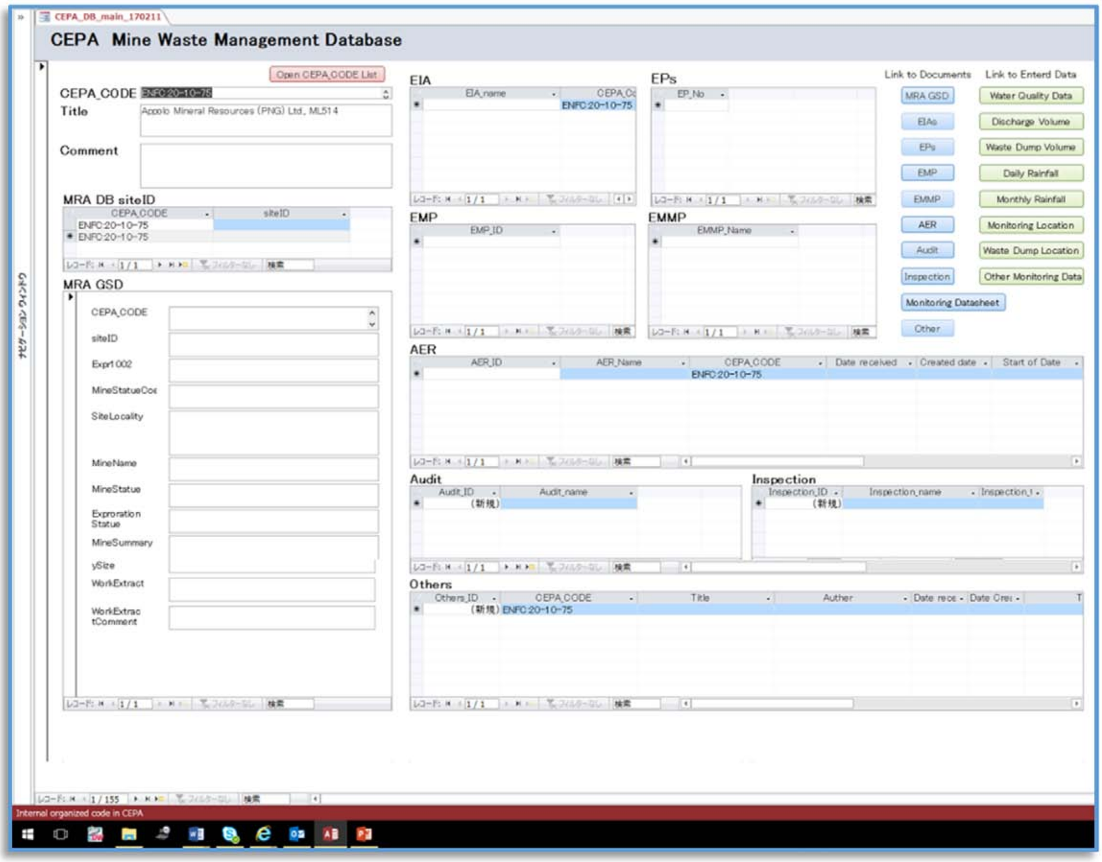

Click "▶", change "CEPA CODE"
If you create new code, click to right switch

Figure 3 Change CEPA_CODE

In this form, you enter CEPA_CODE to be registered, project title, and comments as necessary.
For "SiteID", you enter the "SiteID" of MRA GSD corresponding to this project.
For EIA 's "EIA name", you enter the name of the EIA corresponding to this project.
In the "EP_No" of EP, you enter the EP number corresponding to this project. For EMP and EMMP, you enter the name respectively. For AER, you enter the name of AER corresponding to this project and an arbitrary ID. For Audit's "Audit_name", you enter the name of Audit corresponding to this project.
In the "Monitoring Datasheet File_name", you enter the name of Monitoring Datasheet to be saved.
Here, we will describe how to store electronic files. First, the electronic file to be saved is saved in the aforementioned folder. Next, right click on the item "Link_to_Files" and click "Box of Linked to File" - "Edit Hyperlink". Select the corresponding folder from the displayed window and select the target file. Click the "OK" button. You use the above method to link to Monitoring Datasheet file. For "Other", enter the name of the other file corresponding to this project and the link

destination of the file.



CEPA Mine Waste Management Database

CEPA_CODE ENFC20-10-75

Title Appolo Mineral Resources (PNG) Ltd., ML514

Comment

MRA DB siteID

CEPA_CODE	siteID
ENFC20-10-75	
ENFC20-10-75	

MRA GSD

CEPA_CODE
siteID
Expr1002
MineStatueCoc
SiteLocality
MineName
MineStatue
Exproration Statue
MineSummary
ySize
WorkExtract
WorkExtractComment

EIA

EIA_name	CEPA_Co
	ENFC20-10-75

EPs

EP_No

EMP

EMP_ID

EMMP

EMMP_Name

AER

AER_ID	AER_Name	CEPA_CODE	Date received	Created date	Start of Date
		ENFC20-10-75			

Audit

Audit_ID	Audit_name
(新規)	

Inspection

Inspection_ID	Inspection_name	Inspection_t
(新規)		

Others

Others_ID	CEPA_CODE	Title	Auther	Date rece	Date Crea	T
(新規)	ENFC20-10-75					

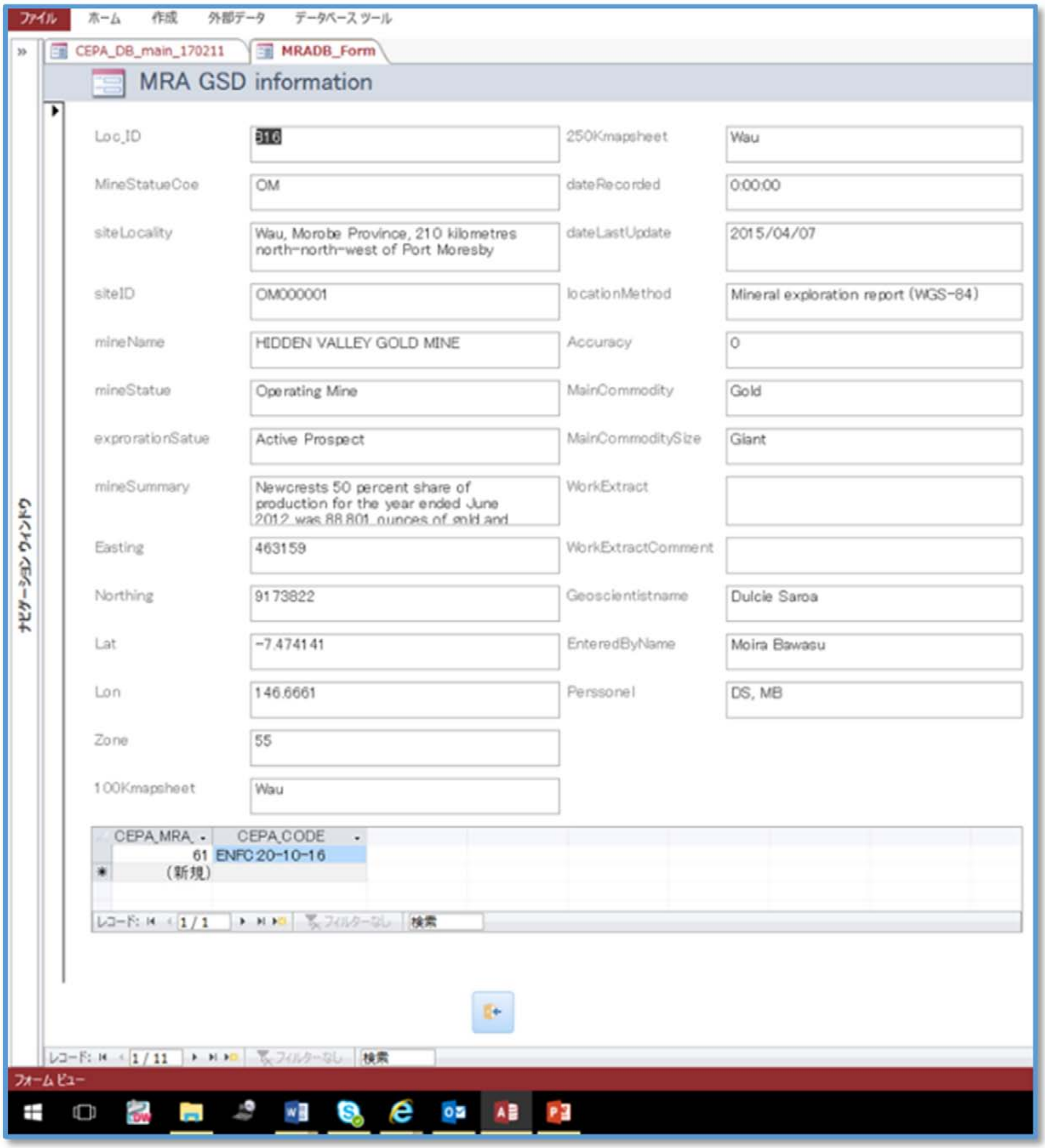
レコード: 1 / 155

Internal organized code in CEPA

Figure 4　CEPA DB main Form

2.4.1.2. MRA GSD

In this form, you enter the information of GSD obtained from MRA. Also, you enter “CEPA_Code” corresponding to “SiteID” in the table below.



MRA GSD information

Loc_ID	316	250Kmapsheet	Wau
MineStatueCoe	OM	dateRecorded	0:00:00
siteLocality	Wau, Morobe Province, 210 kilometres north-north-west of Port Moresby	dateLastUpdate	2015/04/07
siteID	OM000001	locationMethod	Mineral exploration report (WGS-84)
mineName	HIDDEN VALLEY GOLD MINE	Accuracy	0
mineStatue	Operating Mine	MainCommodity	Gold
exprorationSatue	Active Prospect	MainCommoditySize	Giant
mineSummary	Newcrests 50 percent share of production for the year ended June 2012 was 88,801 ounces of gold and	WorkExtract	
Easting	463159	WorkExtractComment	
Northing	9173822	Geoscientistname	Dulcie Saroa
Lat	-7.474141	EnteredByName	Moira Bawasu
Lon	146.6661	Perssonel	DS, MB
Zone	55		
100Kmapsheet	Wau		

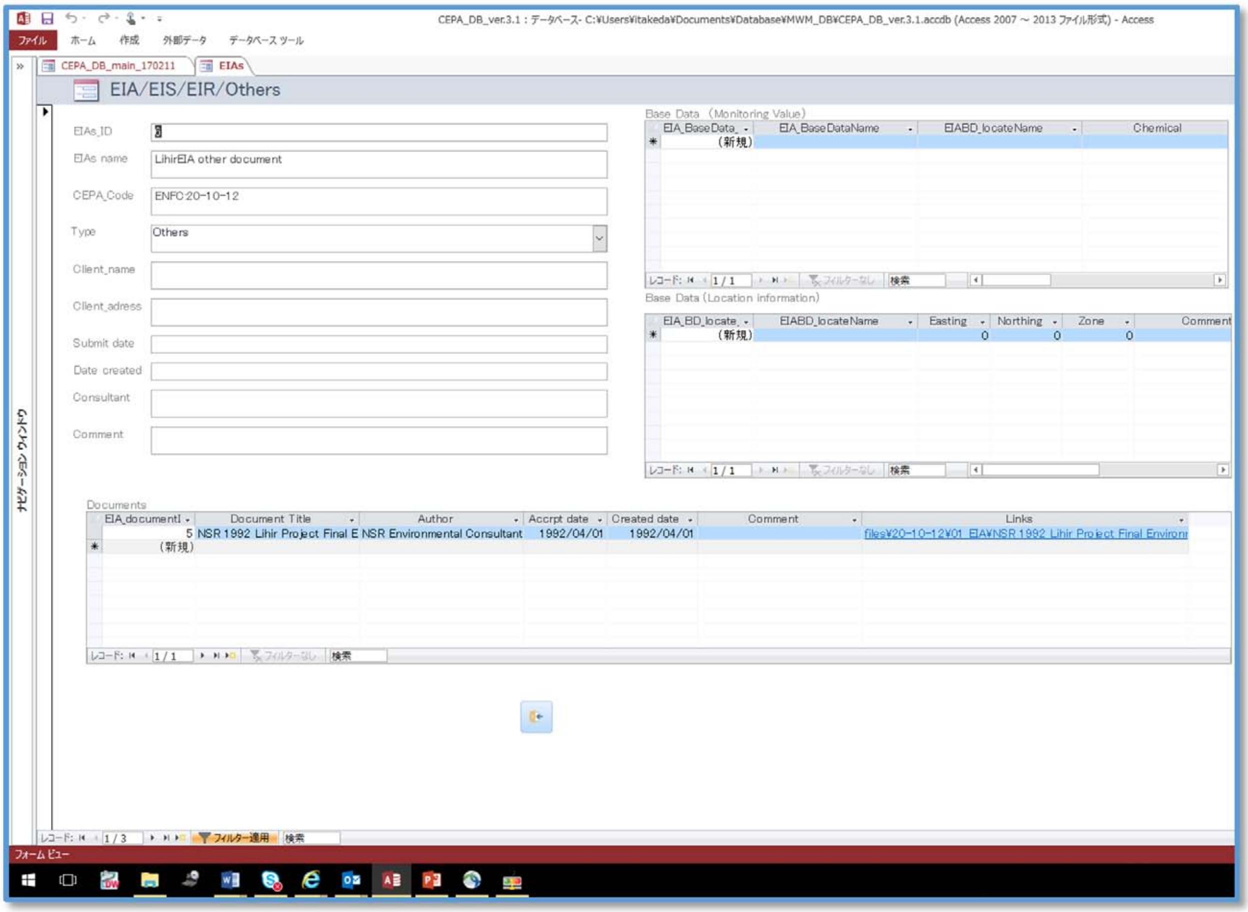
CEPA_MRA	CEPA_CODE
61	ENFC 20-10-16
(新規)	

Figure 5 MRA GSD form

2.4.1.3. EIA

In the form, you enter information of EIAs (EIA, EIS, EIR, others). In the upper left field, you enter the name, creation date, business name and address, receipt date, consultant and comment. For Type, you select the type (EIA, EIS, EIR, etc.).

For "Base Data" (Monitoring Value), you enter the name, location name, chemical species, unit, numerical value of Base data. In Base Data (Location information), location information corresponding to the above-mentioned place name is input. In "Documents", you enter the name of the document, the author, etc. In addition, you input the link destination of the file.



EIA/EIS/EIR/Others

EIAs_ID: 3
EIAs name: LihirEIA other document
CEPA_Code: ENFC 20-10-12
Type: Others
Client_name:
Client_adress:
Submit date:
Date created:
Consultant:
Comment:

Base Data (Monitoring Value)

EIA_BaseData_	EIA_BaseDataName	EIABD_locateName	Chemical
(新規)			

Base Data (Location information)

EIA_BD_locate_	EIABD_locateName	Easting	Northing	Zone	Comment
(新規)		0	0	0	

Documents

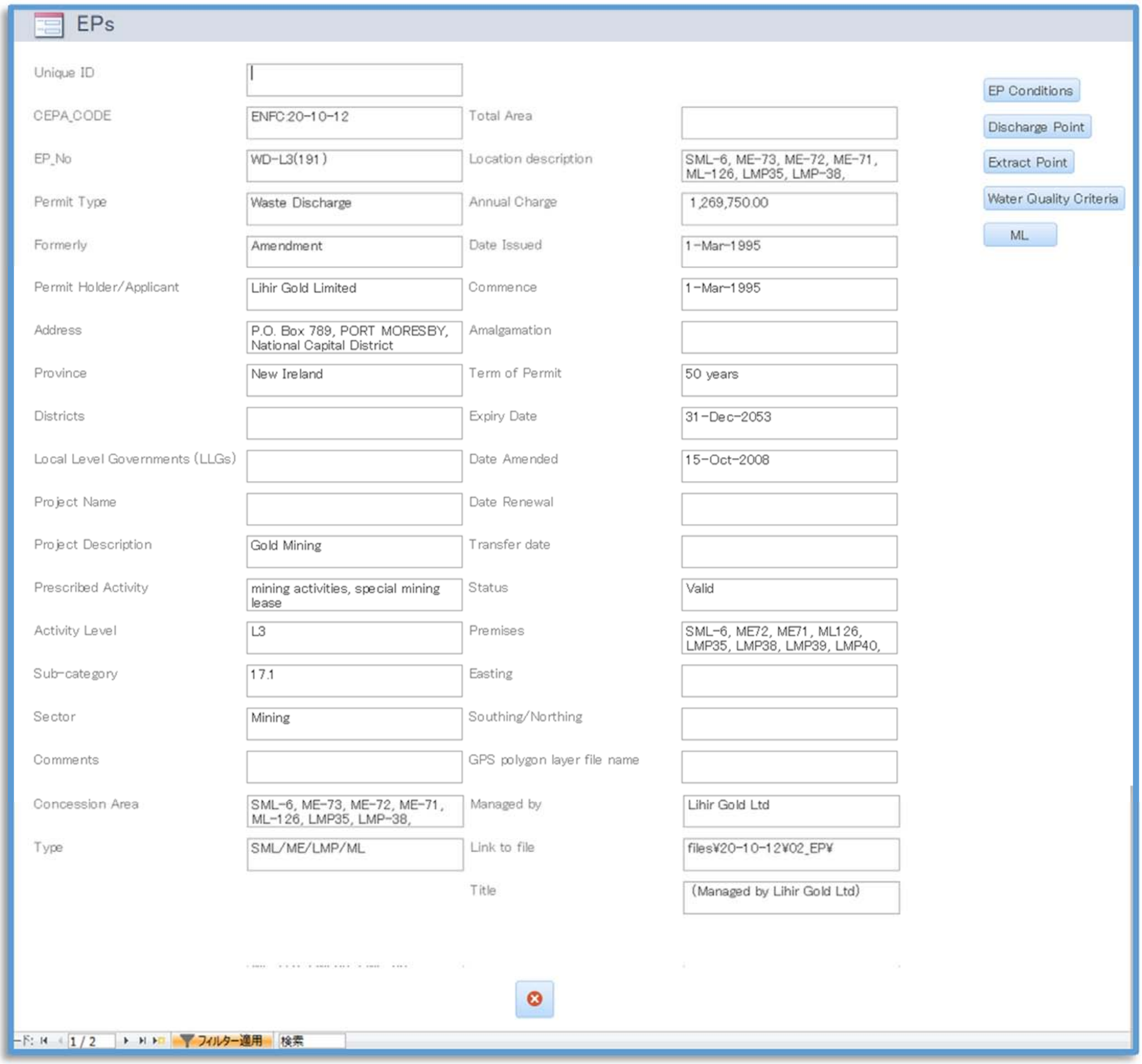
EIA_documentI	Document Title	Author	Accrpt date	Created date	Comment	Links
5	NSR 1992 Lihir Project Final E	NSR Environmental Consultant	1992/04/01	1992/04/01		files¥20-10-12¥01_EIA¥NSR 1992 Lihir Project Final Environ
(新規)						

Figure 6 EIA relative form

2.4.1.4. EP

(1)Main

In the form, information on EP is input.



Unique ID			
CEPA_CODE	ENFC20-10-12	Total Area	
EP_No	WD-L3(191)	Location description	SML-6, ME-73, ME-72, ME-71, ML-126, LMP35, LMP-38,
Permit Type	Waste Discharge	Annual Charge	1,269,750.00
Formerly	Amendment	Date Issued	1-Mar-1995
Permit Holder/Applicant	Lihir Gold Limited	Commence	1-Mar-1995
Address	P.O. Box 789, PORT MORESBY, National Capital District	Amalgamation	
Province	New Ireland	Term of Permit	50 years
Districts		Expiry Date	31-Dec-2053
Local Level Governments (LLGs)		Date Amended	15-Oct-2008
Project Name		Date Renewal	
Project Description	Gold Mining	Transfer date	
Prescribed Activity	mining activities, special mining lease	Status	Valid
Activity Level	L3	Premises	SML-6, ME72, ME71, ML126, LMP35, LMP38, LMP39, LMP40,
Sub-category	17.1	Easting	
Sector	Mining	Southing/Northing	
Comments		GPS polygon layer file name	
Concession Area	SML-6, ME-73, ME-72, ME-71, ML-126, LMP35, LMP-38,	Managed by	Lihir Gold Ltd
Type	SML/ME/LMP/ML	Link to file	files¥20-10-12¥02_EP¥
		Title	(Managed by Lihir Gold Ltd)

Figure 7　EP form

(2)EP Condition

In this form, you enter the condition of approval of EP.

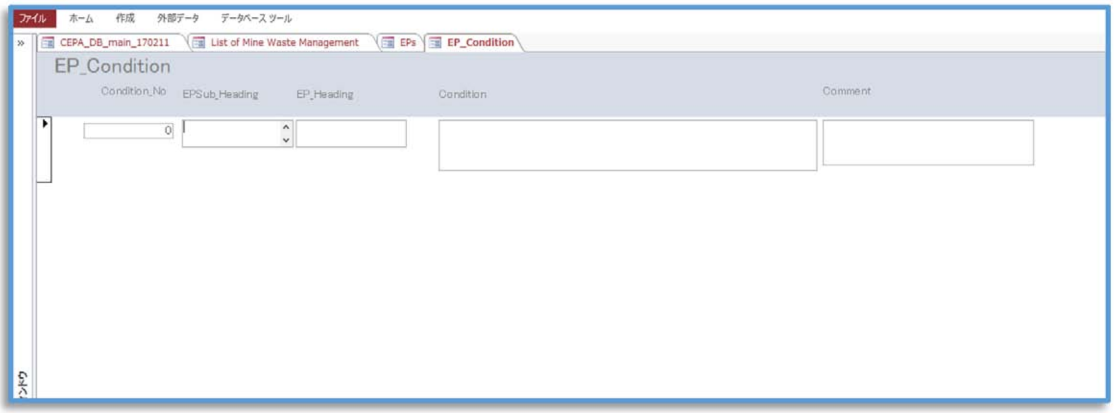


Figure 8　EP Condition form

(3)EP Extract Point ＆ EP Discharge Point

In this form, you input the approved emission amount / collection amount and position information respectively.

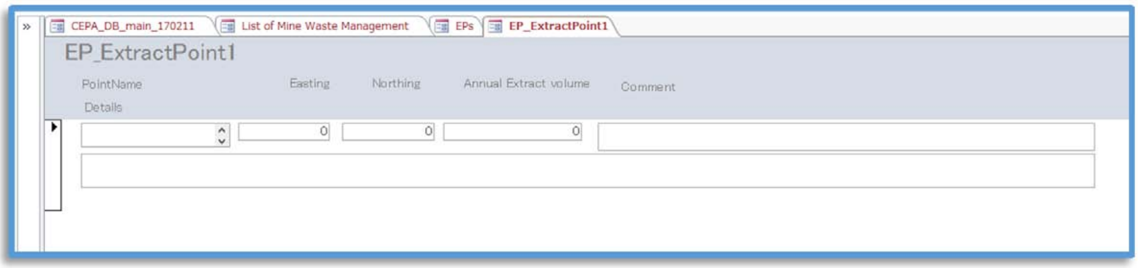
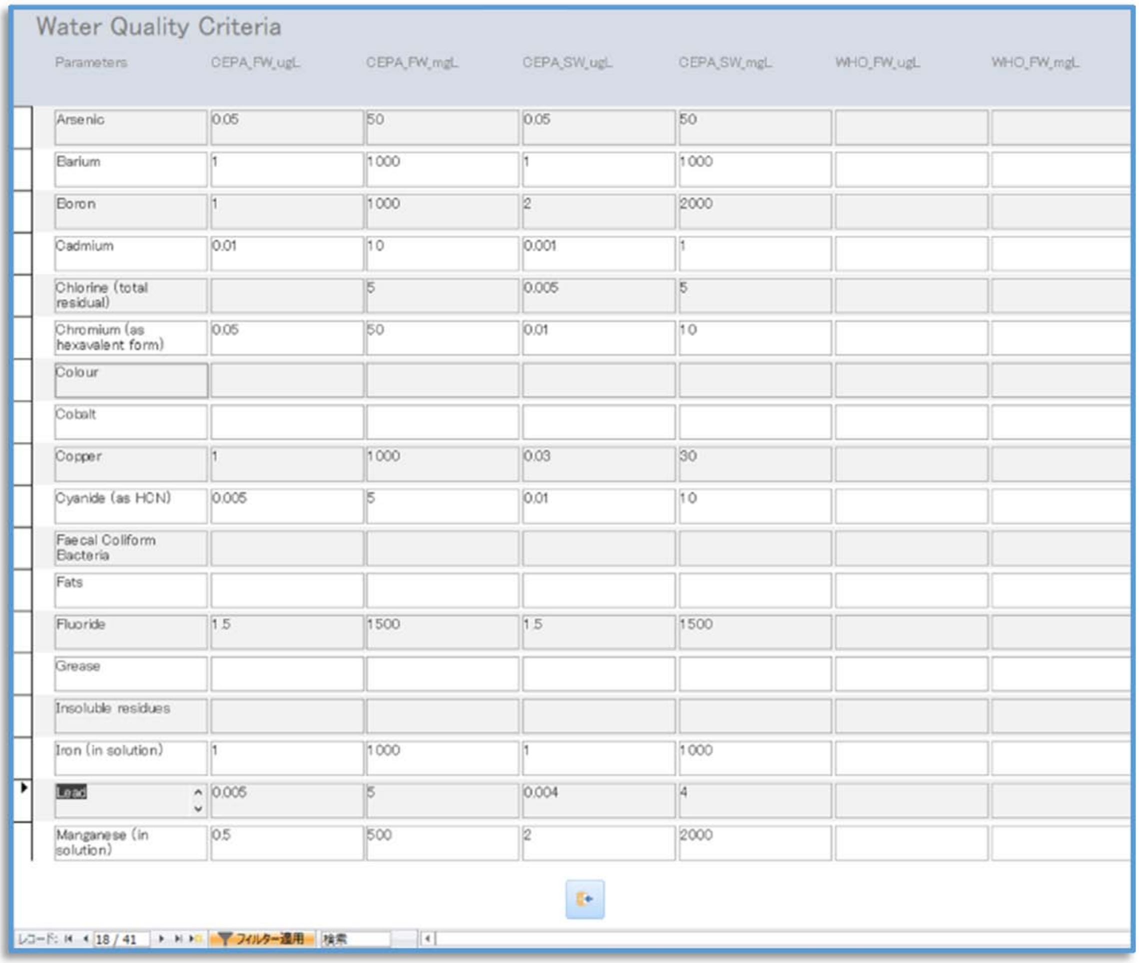


Figure 9　EP Extract Point Form

Figure 10　Discharge Pint form

(3)Water Quality Criteria

For these forms, you enter the regulation value specified in EP.



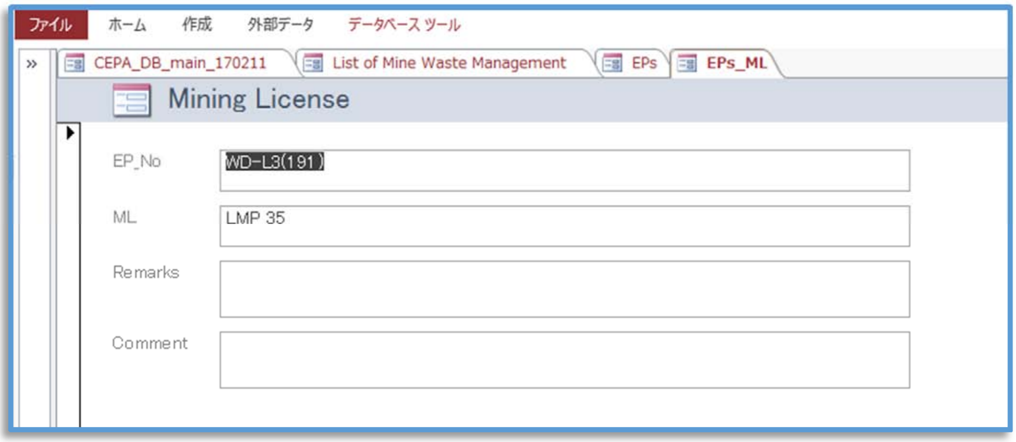
Water Quality Criteria

Parameters	CEPA_FW_ugL	CEPA_FW_mgL	CEPA_SW_ugL	CEPA_SW_mgL	WHO_FW_ugL	WHO_FW_mgL
Arsenic	0.05	50	0.05	50		
Barium	1	1000	1	1000		
Boron	1	1000	2	2000		
Cadmium	0.01	10	0.001	1		
Chlorine (total residual)		5	0.005	5		
Chromium (as hexavalent form)	0.05	50	0.01	10		
Colour						
Cobalt						
Copper	1	1000	0.03	30		
Cyanide (as HCN)	0.005	5	0.01	10		
Faecal Coliform Bacteria						
Fats						
Fluoride	1.5	1500	1.5	1500		
Grease						
Insoluble residues						
Iron (in solution)	1	1000	1	1000		
Lead	0.005	5	0.004	4		
Manganese (in solution)	0.5	500	2	2000		

Figure 11　EP Water Quality Criteria form

(4) Mining License

In this form, the Mining License number related to this EP is recorded.



EP_No WD-L3(191)

ML LMP 35

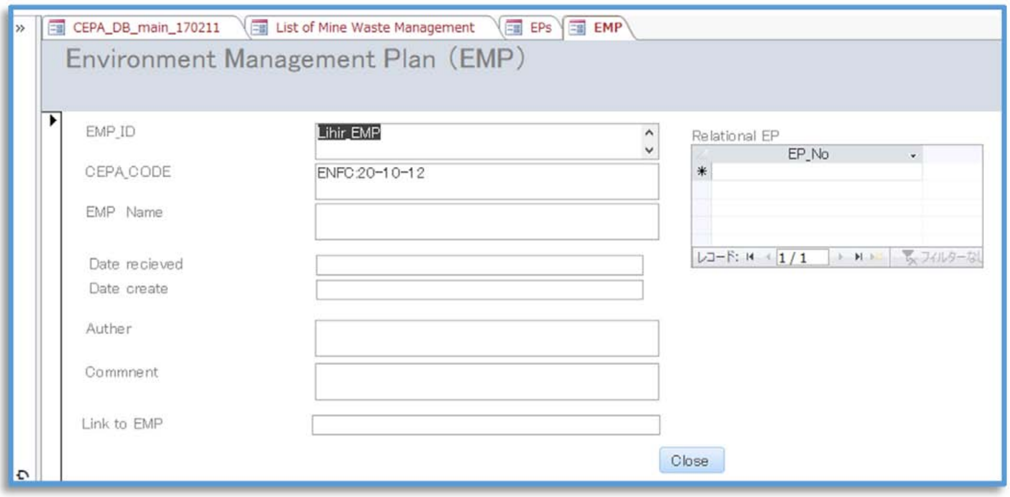
Remarks

Comment

Figure 12　Mining License form

2.4.1.5. EMP

In this form, information on the electronic file of EMP is input. Also, enter EP numbers related to EMP in the table on the right.



EMP_ID Lihir_EMP

CEPA_CODE ENFC20-10-12

EMP Name

Date recieved

Date create

Auther

Commnent

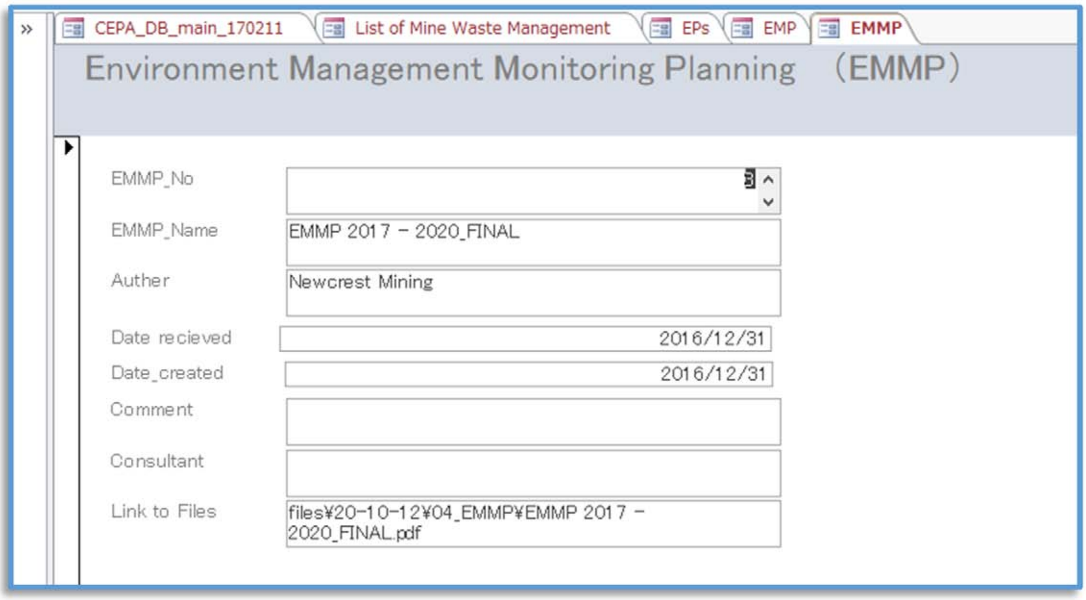
Link to EMP

EP_No

Figure 13　EMP　form

2.4.1.6. EMMP

In this form, information on the EMMP electronic file is input.



Environment Management Monitoring Planning （EMMP）

EMMP_No

EMMP_Name: EMMP 2017 – 2020_FINAL

Auther: Newcrest Mining

Date recieved: 2016/12/31

Date_created: 2016/12/31

Comment

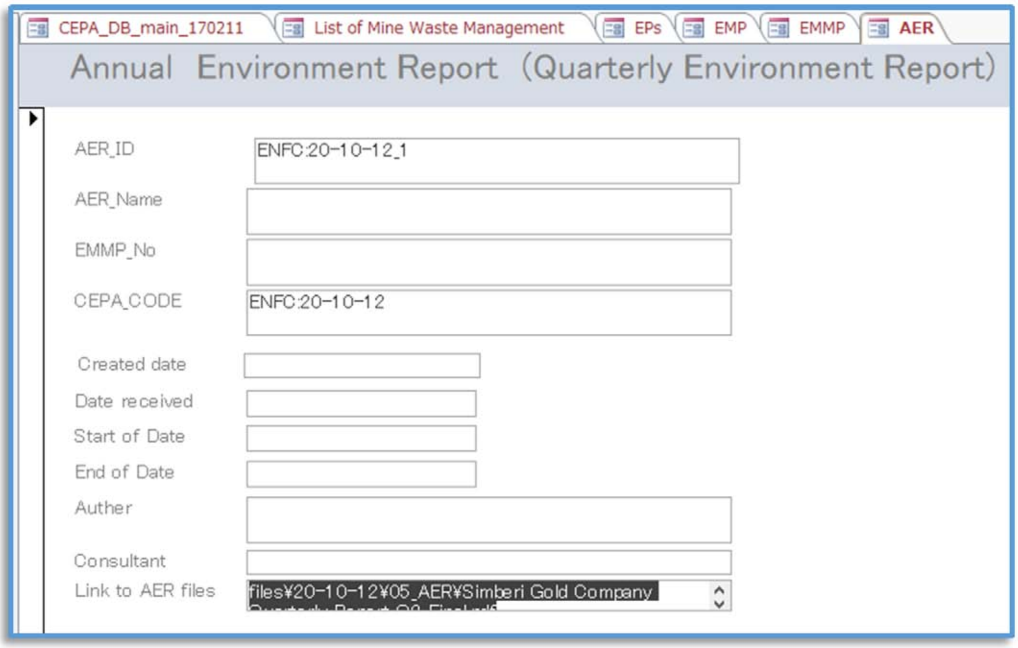
Consultant

Link to Files: files¥20-10-12¥04_EMMP¥EMMP 2017 – 2020_FINAL.pdf

Figure 14 EMMP form

2.4.1.7. AER

In this form, you enter information on AER and QER electronic files.



Annual Environment Report（Quarterly Environment Report）

AER_ID: ENFC:20-10-12_1

AER_Name

EMMP_No

CEPA_CODE: ENFC:20-10-12

Created date

Date received

Start of Date

End of Date

Auther

Consultant

Link to AER files: files¥20-10-12¥05_AER¥Simberi Gold Company

Figure 15 AER form

2.4.1.8. Audit

In the table on the upper left, you enter the information on the EIP and the link destination of the electronic file. In the table on the right, you enter information on Audit's electronic file. In the table at the bottom left, you enter the information of the electronic file concerning the internal document relating to Audit. In the table in the lower right, you enter information on other related files related to Audit.

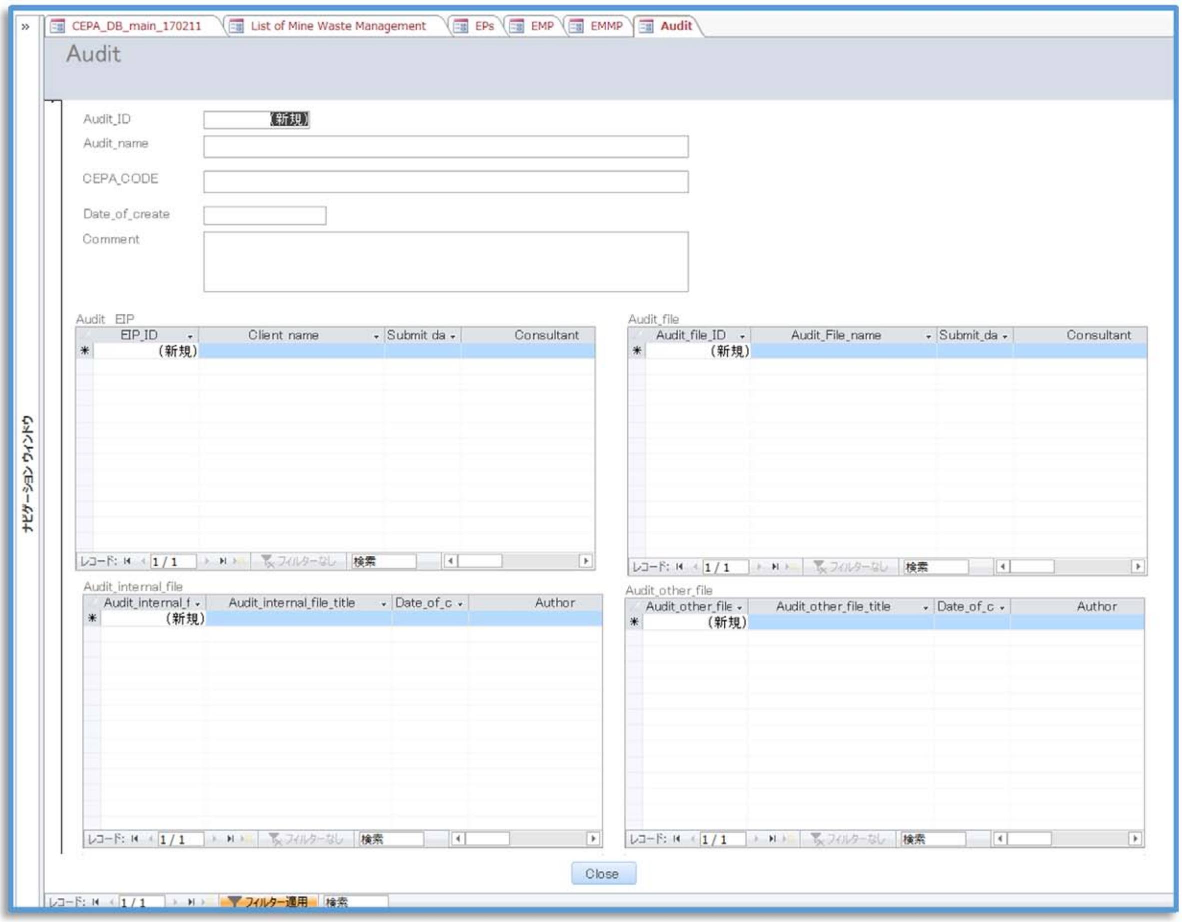


Figure 16 Audit form

2.4.1.9. Inspection

In the upper left table, you enter the EP number and Mining License number related to Inspection. In the table below the middle row, you enter the implementation plan of Inspection, Inspection, internal document, other related files, and electronic file information on Notification.(Figure 17)

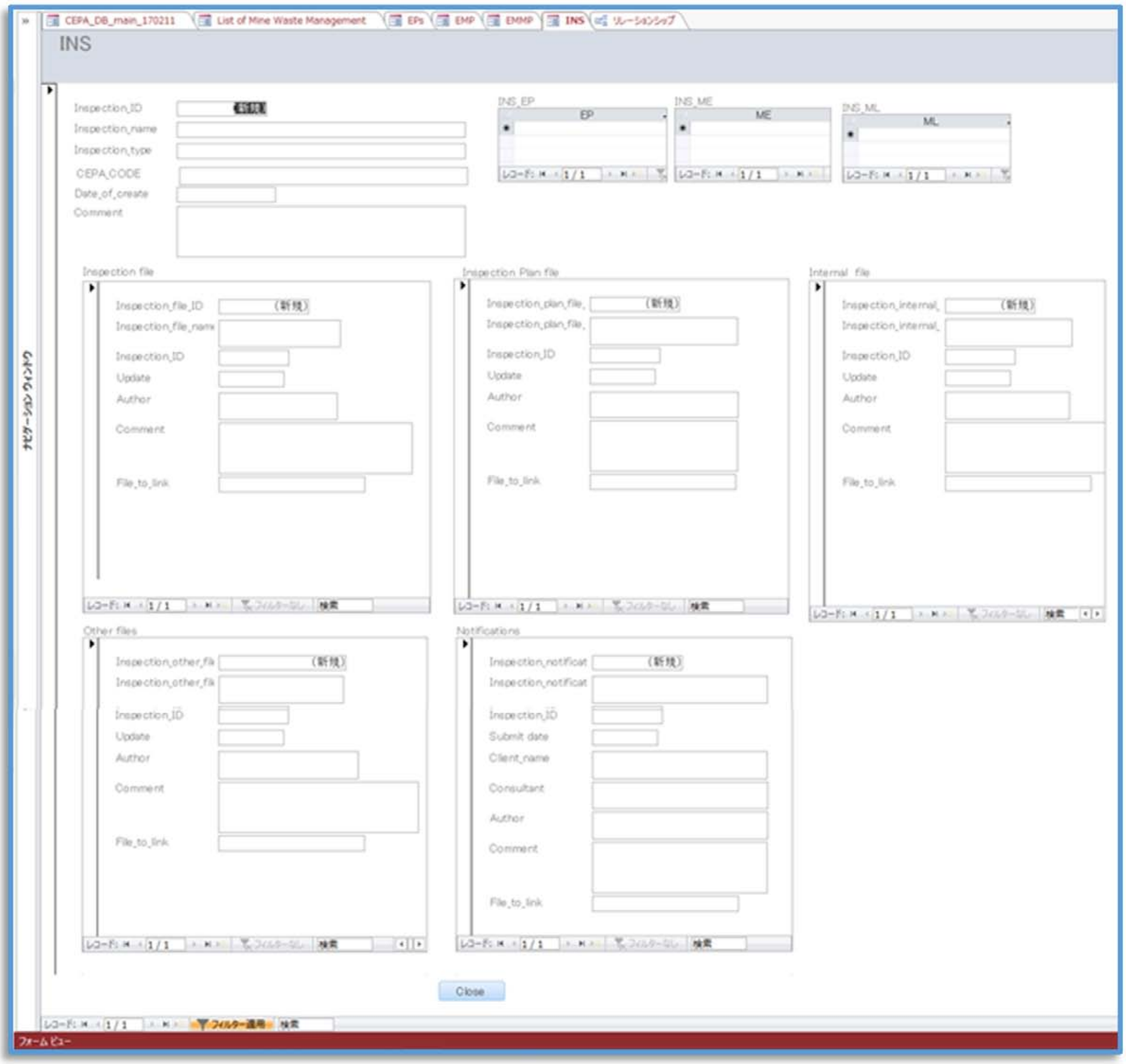
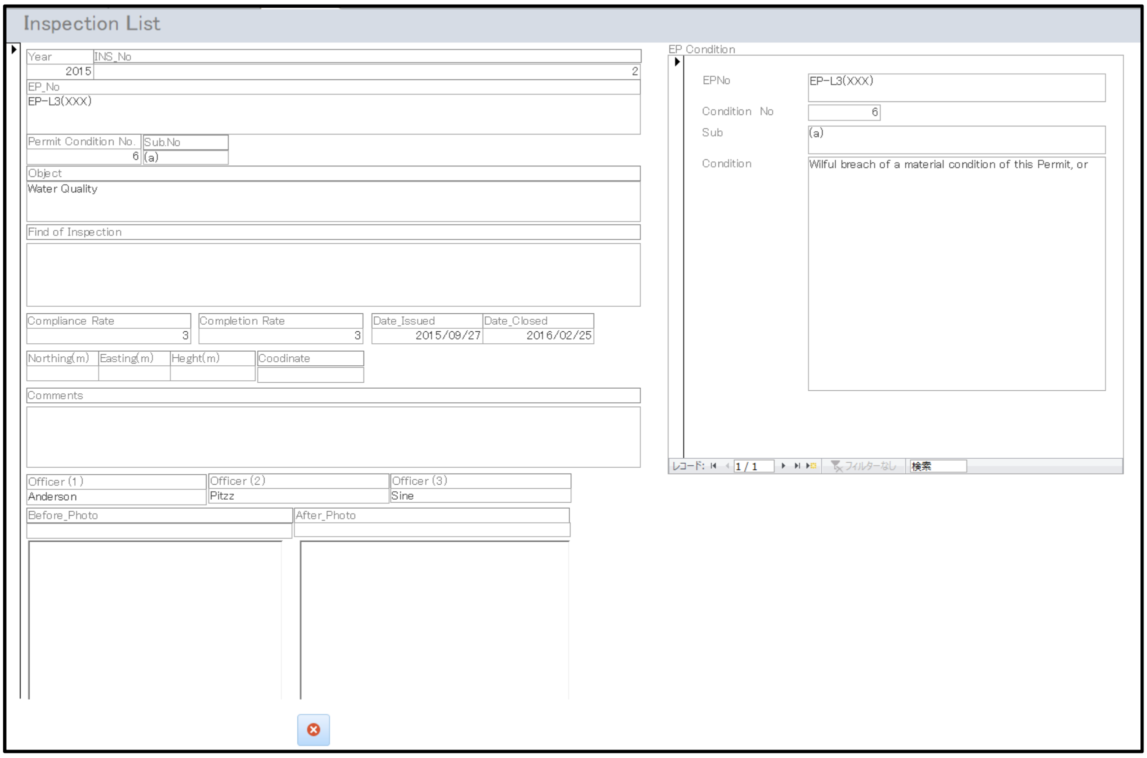


Figure 17　Inspection form

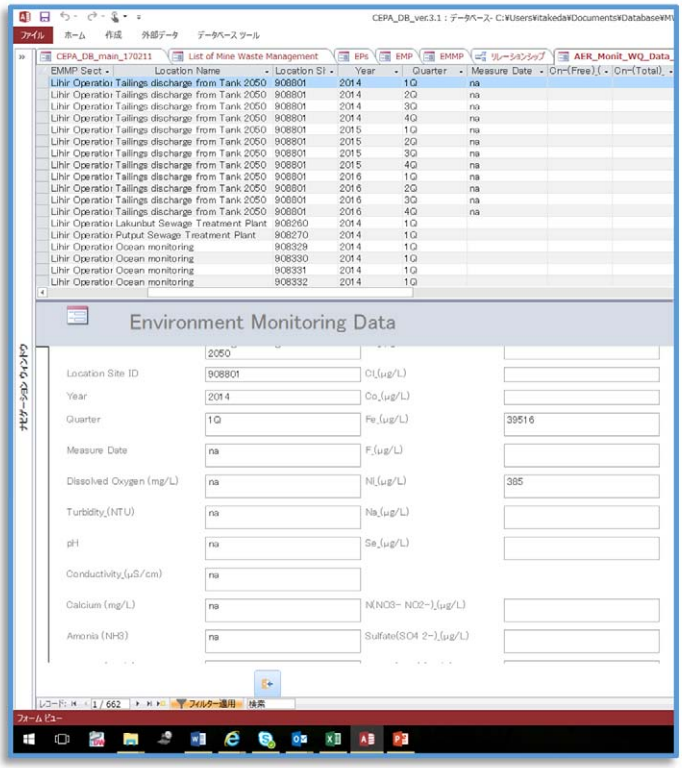
Inspection List form is recorded inspection result for spread sheet of Inspection list that is managed by Mining Unit, EPW CEPA. Inspection list can be entered via this spread sheet.

This form is showed about inspection result (Find of inspection, compliance ratio, completion ratio and comment) and relative EP conditions.(Figure 18)



2.4.1.10. Environment monitoring datasheet

Data in the environmental monitoring data sheet can be entered via the form.

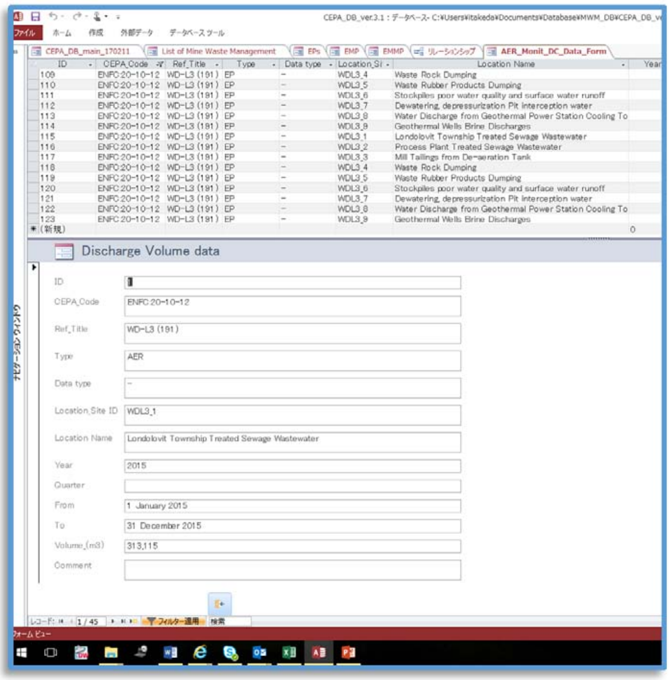


EMMP Sect	Location Name	Location Si	Year	Quarter	Measure Date	On-(Free)(	On-(Total)_
Lihir Operatio	Tailings discharge from Tank 2050	908801	2014	1Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2014	2Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2014	3Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2014	4Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2015	1Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2015	2Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2015	3Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2015	4Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2016	1Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2016	2Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2016	3Q	na		
Lihir Operatio	Tailings discharge from Tank 2050	908801	2016	4Q	na		
Lihir Operatio	Lakunbut Sewage Treatment Plant	908260	2014	1Q			
Lihir Operatio	Putput Sewage Treatment Plant	908270	2014	1Q			
Lihir Operatio	Ocean monitoring	908329	2014	1Q			
Lihir Operatio	Ocean monitoring	908330	2014	1Q			
Lihir Operatio	Ocean monitoring	908331	2014	1Q			
Lihir Operatio	Ocean monitoring	908332	2014	1Q			

Environment Monitoring Data

	2050		
Location Site ID	908801	Cl_(μg/L)	
Year	2014	Co_(μg/L)	
Quarter	1Q	Fe_(μg/L)	39516
Measure Date	na	F_(μg/L)	
Dissolved Oxygen (mg/L)	na	Ni_(μg/L)	385
Turbidity_(NTU)	na	Na_(μg/L)	
pH	na	Se_(μg/L)	
Conductivity_(μS/cm)	na		
Calcium (mg/L)	na	N(NO3- NO2-)_(μg/L)	
Amonia (NH3)	na	Sulfate(SO4 2-)_(μg/L)	

Figure 19 Environment monitoring data form

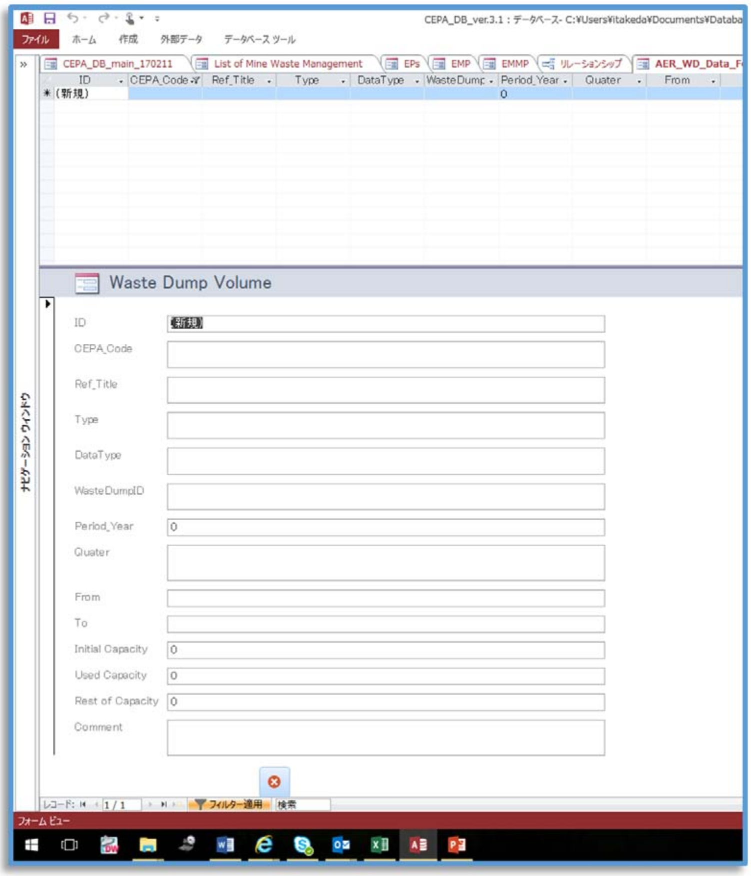


ID	CEPA_Code	Ref_Title	Type	Data type	Location_Si	Location Name	Year
109	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_4	Waste Rock Dumping	
110	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_5	Waste Rubber Products Dumping	
111	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_6	Stockpiles poor water quality and surface water runoff	
112	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_7	Dewatering, depressurization Pit interception water	
113	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_8	Water Discharge from Geothermal Power Station Cooling To	
114	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_9	Geothermal Wells Brine Discharges	
115	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_1	Londolovit Township Treated Sewage Wastewater	
116	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_2	Process Plant Treated Sewage Wastewater	
117	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_3	Mill Tailings from De-aeration Tank	
118	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_4	Waste Rock Dumping	
119	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_5	Waste Rubber Products Dumping	
120	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_6	Stockpiles poor water quality and surface water runoff	
121	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_7	Dewatering, depressurization Pit interception water	
122	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_8	Water Discharge from Geothermal Power Station Cooling To	
123	ENFC20-10-12	WD-L3 (191)	EP	–	WDL3_9	Geothermal Wells Brine Discharges	
* (新規)							0

Discharge Volume data

ID	
CEPA_Code	ENFC20-10-12
Ref_Title	WD-L3 (191)
Type	AER
Data type	–
Location_Site ID	WDL3_1
Location Name	Londolovit Township Treated Sewage Wastewater
Year	2015
Quarter	
From	1 January 2015
To	31 December 2015
Volume_(m3)	313,115
Comment	

Figure 20 Discharge volume data form

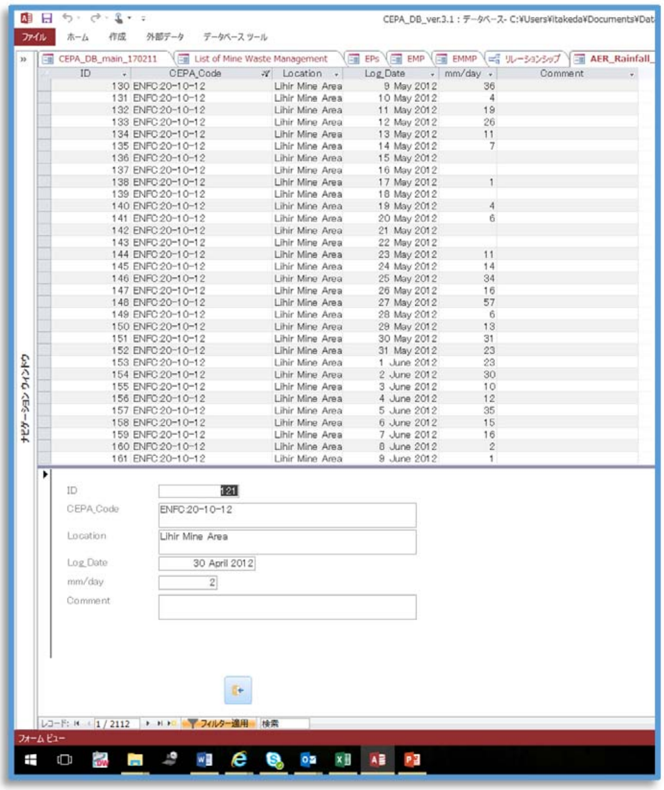


ID	CEPA_Code	Ref_Title	Type	DataType	WasteDump	Period_Year	Quater	From
(新規)						0		

Waste Dump Volume

ID: (新規)
CEPA_Code:
Ref_Title:
Type:
DataType:
WasteDumpID:
Period_Year: 0
Quater:
From:
To:
Initial Capacity: 0
Used Capacity: 0
Rest of Capacity: 0
Comment:

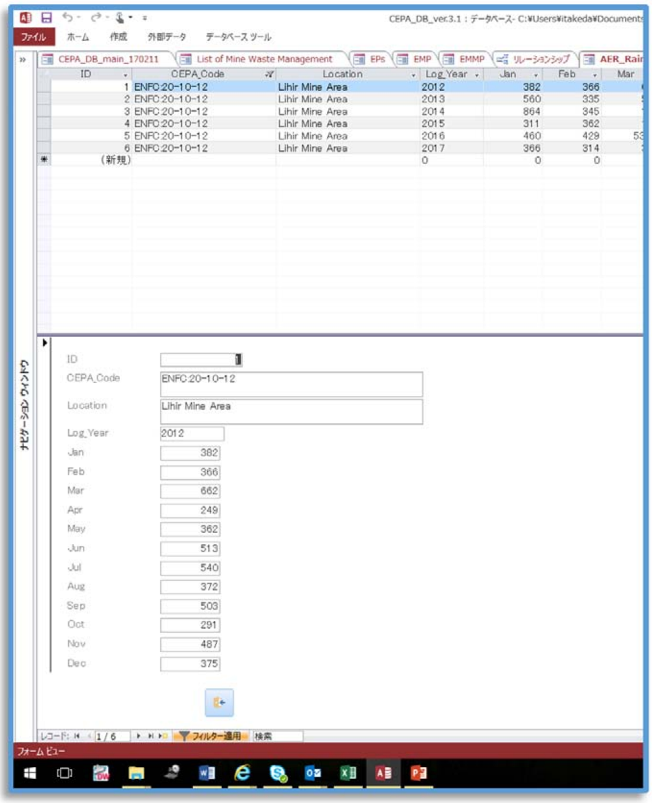
Figure 21 Waste Dump Volume form



ID	CEPA_Code	Location	Log_Date	mm/day	Comment
130	ENFC20-10-12	Lihir Mine Area	9 May 2012	36	
131	ENFC20-10-12	Lihir Mine Area	10 May 2012	4	
132	ENFC20-10-12	Lihir Mine Area	11 May 2012	19	
133	ENFC20-10-12	Lihir Mine Area	12 May 2012	26	
134	ENFC20-10-12	Lihir Mine Area	13 May 2012	11	
135	ENFC20-10-12	Lihir Mine Area	14 May 2012	7	
136	ENFC20-10-12	Lihir Mine Area	15 May 2012		
137	ENFC20-10-12	Lihir Mine Area	16 May 2012		
138	ENFC20-10-12	Lihir Mine Area	17 May 2012	1	
139	ENFC20-10-12	Lihir Mine Area	18 May 2012		
140	ENFC20-10-12	Lihir Mine Area	19 May 2012	4	
141	ENFC20-10-12	Lihir Mine Area	20 May 2012	6	
142	ENFC20-10-12	Lihir Mine Area	21 May 2012		
143	ENFC20-10-12	Lihir Mine Area	22 May 2012		
144	ENFC20-10-12	Lihir Mine Area	23 May 2012	11	
145	ENFC20-10-12	Lihir Mine Area	24 May 2012	14	
146	ENFC20-10-12	Lihir Mine Area	25 May 2012	34	
147	ENFC20-10-12	Lihir Mine Area	26 May 2012	16	
148	ENFC20-10-12	Lihir Mine Area	27 May 2012	57	
149	ENFC20-10-12	Lihir Mine Area	28 May 2012	6	
150	ENFC20-10-12	Lihir Mine Area	29 May 2012	13	
151	ENFC20-10-12	Lihir Mine Area	30 May 2012	31	
152	ENFC20-10-12	Lihir Mine Area	31 May 2012	23	
153	ENFC20-10-12	Lihir Mine Area	1 June 2012	23	
154	ENFC20-10-12	Lihir Mine Area	2 June 2012	30	
155	ENFC20-10-12	Lihir Mine Area	3 June 2012	10	
156	ENFC20-10-12	Lihir Mine Area	4 June 2012	12	
157	ENFC20-10-12	Lihir Mine Area	5 June 2012	35	
158	ENFC20-10-12	Lihir Mine Area	6 June 2012	15	
159	ENFC20-10-12	Lihir Mine Area	7 June 2012	16	
160	ENFC20-10-12	Lihir Mine Area	8 June 2012	2	
161	ENFC20-10-12	Lihir Mine Area	9 June 2012	1	

ID	121
CEPA_Code	ENFC20-10-12
Location	Lihir Mine Area
Log_Date	30 April 2012
mm/day	2
Comment	

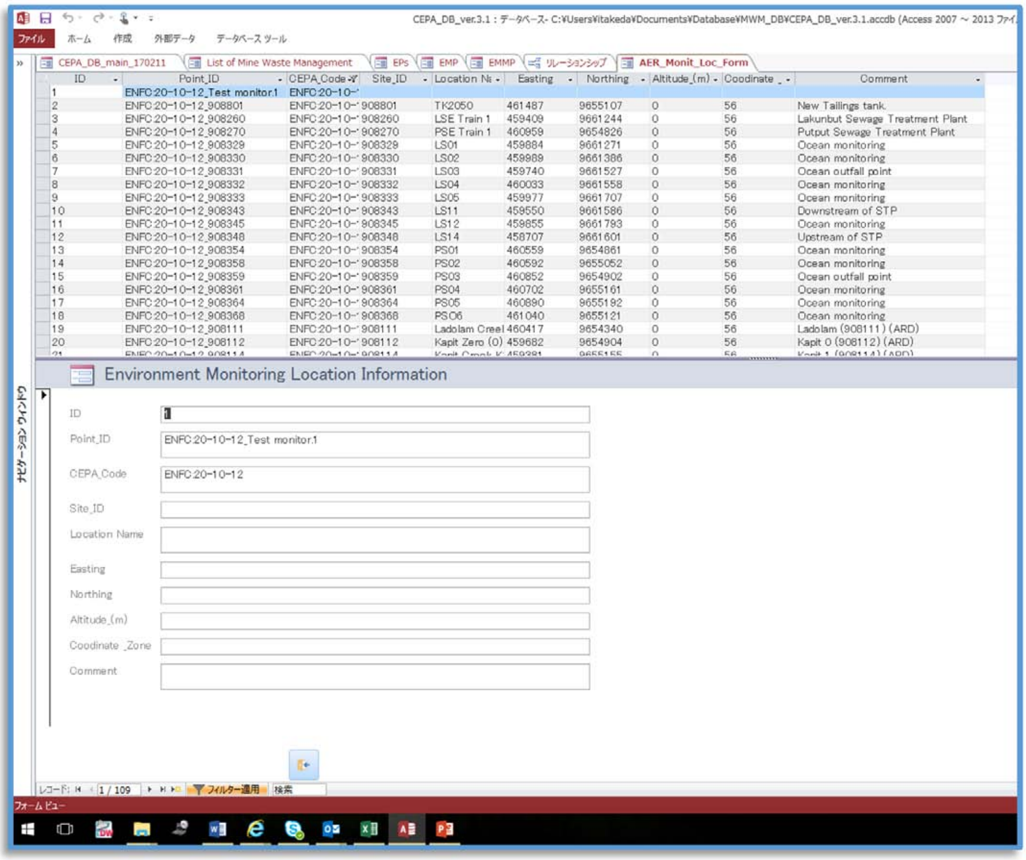
Figure 22　Daily rainfall log form



ID	CEPA_Code	Location	Log_Year	Jan	Feb	Mar
1	ENFC20-10-12	Lihir Mine Area	2012	382	366	
2	ENFC20-10-12	Lihir Mine Area	2013	560	335	
3	ENFC20-10-12	Lihir Mine Area	2014	864	345	
4	ENFC20-10-12	Lihir Mine Area	2015	311	362	
5	ENFC20-10-12	Lihir Mine Area	2016	460	429	53
6	ENFC20-10-12	Lihir Mine Area	2017	366	314	
(新規)			0	0	0	

ID	1
CEPA_Code	ENFC20-10-12
Location	Lihir Mine Area
Log_Year	2012
Jan	382
Feb	366
Mar	662
Apr	249
May	362
Jun	513
Jul	540
Aug	372
Sep	503
Oct	291
Nov	487
Dec	375

Figure 23　Monthly rainfall log form

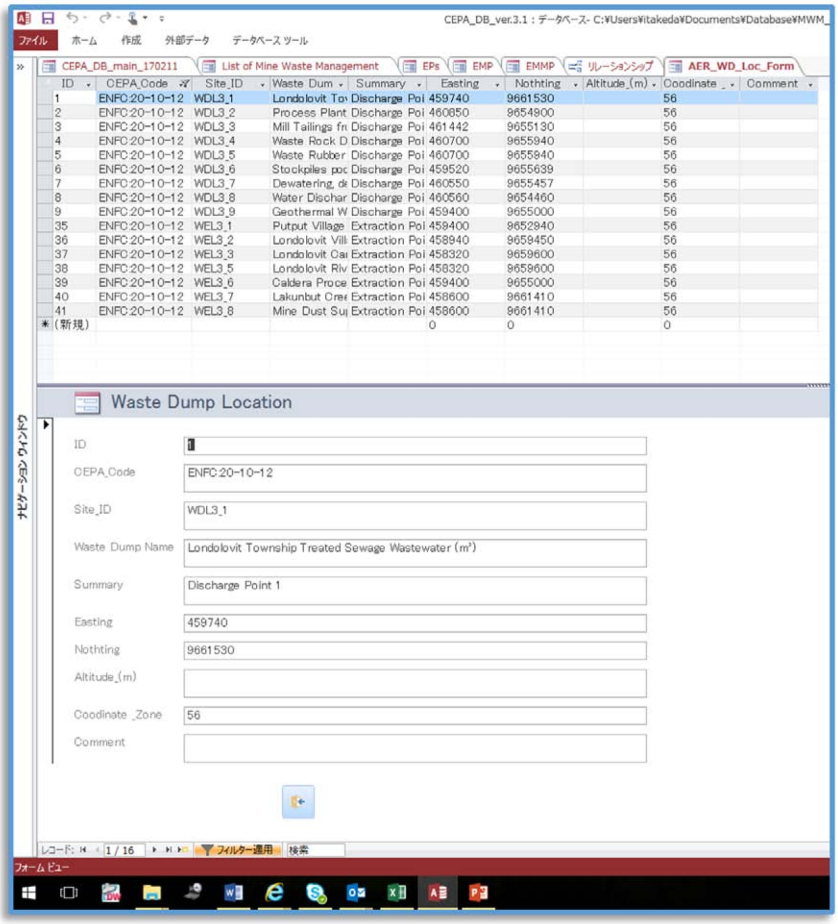


ID	Point_ID	CEPA_Code	Site_ID	Location N	Easting	Northing	Altitude_(m)	Coodinate_	Comment
1	ENFC:20-10-12_Test monitor.1	ENFC:20-10-							
2	ENFC:20-10-12_908801	ENFC:20-10-	908801	TK2050	461487	9655107	0	56	New Tailings tank.
3	ENFC:20-10-12_908260	ENFC:20-10-	908260	LSE Train 1	459409	9661244	0	56	Lakunbut Sewage Treatment Plant
4	ENFC:20-10-12_908270	ENFC:20-10-	908270	PSE Train 1	460959	9654826	0	56	Putput Sewage Treatment Plant
5	ENFC:20-10-12_908329	ENFC:20-10-	908329	LS01	459884	9661271	0	56	Ocean monitoring
6	ENFC:20-10-12_908330	ENFC:20-10-	908330	LS02	459989	9661386	0	56	Ocean monitoring
7	ENFC:20-10-12_908331	ENFC:20-10-	908331	LS03	459740	9661527	0	56	Ocean outfall point
8	ENFC:20-10-12_908332	ENFC:20-10-	908332	LS04	460033	9661558	0	56	Ocean monitoring
9	ENFC:20-10-12_908333	ENFC:20-10-	908333	LS05	459977	9661707	0	56	Ocean monitoring
10	ENFC:20-10-12_908343	ENFC:20-10-	908343	LS11	459550	9661586	0	56	Downstream of STP
11	ENFC:20-10-12_908345	ENFC:20-10-	908345	LS12	459855	9661793	0	56	Ocean monitoring
12	ENFC:20-10-12_908348	ENFC:20-10-	908348	LS14	458707	9661601	0	56	Upstream of STP
13	ENFC:20-10-12_908354	ENFC:20-10-	908354	PS01	460559	9654861	0	56	Ocean monitoring
14	ENFC:20-10-12_908358	ENFC:20-10-	908358	PS02	460592	9655052	0	56	Ocean monitoring
15	ENFC:20-10-12_908359	ENFC:20-10-	908359	PS03	460852	9654902	0	56	Ocean outfall point
16	ENFC:20-10-12_908361	ENFC:20-10-	908361	PS04	460702	9655161	0	56	Ocean monitoring
17	ENFC:20-10-12_908364	ENFC:20-10-	908364	PS05	460890	9655192	0	56	Ocean monitoring
18	ENFC:20-10-12_908368	ENFC:20-10-	908368	PSO6	461040	9655121	0	56	Ocean monitoring
19	ENFC:20-10-12_908111	ENFC:20-10-	908111	Ladolam Creel	460417	9654340	0	56	Ladolam (908111) (ARD)
20	ENFC:20-10-12_908112	ENFC:20-10-	908112	Kapit Zero (0)	459682	9654904	0	56	Kapit 0 (908112) (ARD)

Environment Monitoring Location Information

ID	1
Point_ID	ENFC:20-10-12_Test monitor.1
CEPA_Code	ENFC:20-10-12
Site_ID	
Location Name	
Easting	
Northing	
Altitude_(m)	
Coodinate _Zone	
Comment	

Figure 24　Monitoring location information form

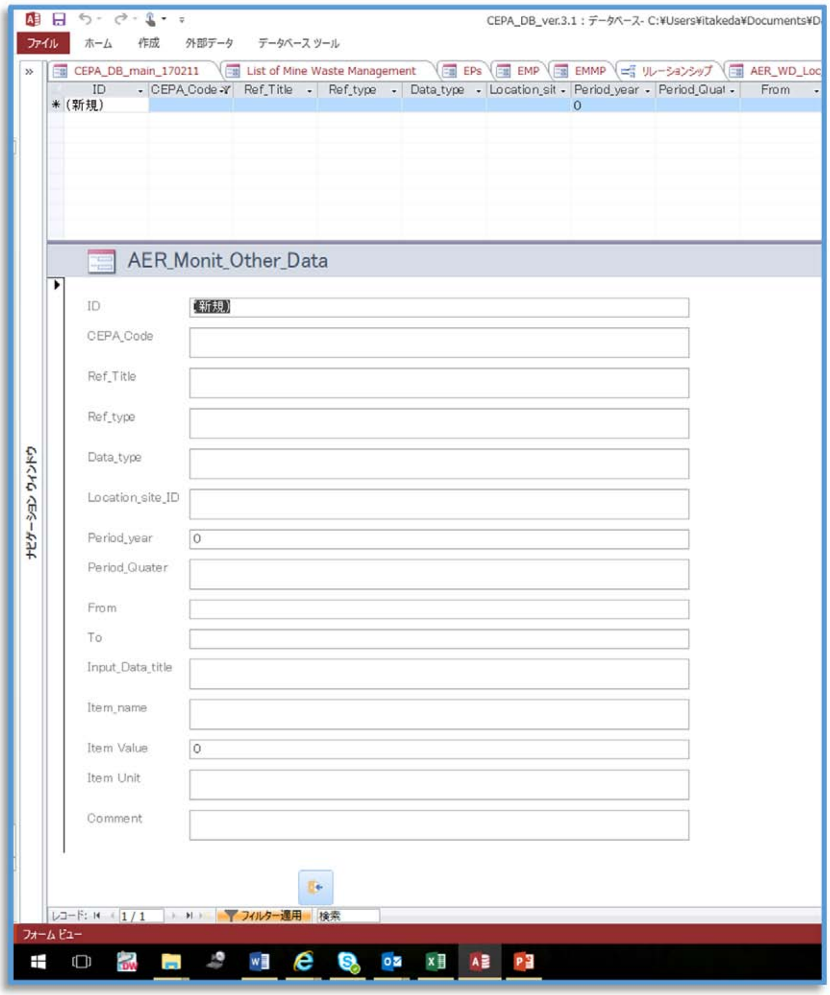


ID	CEPA_Code	Site_ID	Waste Dum	Summary	Easting	Nothting	Altitude_(m)	Coodinate _	Comment
1	ENFC:20-10-12	WDL3_1	Londolovit To	Discharge Poi	459740	9661530		56	
2	ENFC:20-10-12	WDL3_2	Process Plant	Discharge Poi	460850	9654900		56	
3	ENFC:20-10-12	WDL3_3	Mill Tailings fr	Discharge Poi	461442	9655130		56	
4	ENFC:20-10-12	WDL3_4	Waste Rock D	Discharge Poi	460700	9655940		56	
5	ENFC:20-10-12	WDL3_5	Waste Rubber	Discharge Poi	460700	9655940		56	
6	ENFC:20-10-12	WDL3_6	Stockpiles poc	Discharge Poi	459520	9655639		56	
7	ENFC:20-10-12	WDL3_7	Dewatering, de	Discharge Poi	460550	9655457		56	
8	ENFC:20-10-12	WDL3_8	Water Dischar	Discharge Poi	460560	9654460		56	
9	ENFC:20-10-12	WDL3_9	Geothermal W	Discharge Poi	459400	9655000		56	
35	ENFC:20-10-12	WEL3_1	Putput Village	Extraction Poi	459400	9652940		56	
36	ENFC:20-10-12	WEL3_2	Londolovit Vill	Extraction Poi	458940	9659450		56	
37	ENFC:20-10-12	WEL3_3	Londolovit Ca	Extraction Poi	458320	9659600		56	
38	ENFC:20-10-12	WEL3_5	Londolovit Riv	Extraction Poi	458320	9659600		56	
39	ENFC:20-10-12	WEL3_6	Caldera Proce	Extraction Poi	459400	9655000		56	
40	ENFC:20-10-12	WEL3_7	Lakunbut Cre	Extraction Poi	458600	9661410		56	
41	ENFC:20-10-12	WEL3_8	Mine Dust Su	Extraction Poi	458600	9661410		56	
＊(新規)					0	0		0	

Waste Dump Location

ID	1
CEPA_Code	ENFC:20-10-12
Site_ID	WDL3_1
Waste Dump Name	Londolovit Township Treated Sewage Wastewater (m³)
Summary	Discharge Point 1
Easting	459740
Nothting	9661530
Altitude_(m)	
Coodinate _Zone	56
Comment	

Figure 25 Waste Dump information form



ID	CEPA_Code	Ref_Title	Ref_type	Data_type	Location_sit	Period_year	Period_Qual	From
(新規)						0		

AER_Monit_Other_Data

ID (新規)
CEPA_Code
Ref_Title
Ref_type
Data_type
Location_site_ID
Period_year 0
Period_Quater
From
To
Input_Data_title
Item_name
Item Value 0
Item Unit
Comment

Figure 26 Other data form

2.4.1.11. Others

For the original file of the environmental monitoring data sheet and other related files, input file information from Monitoring Datasheet and Other form.

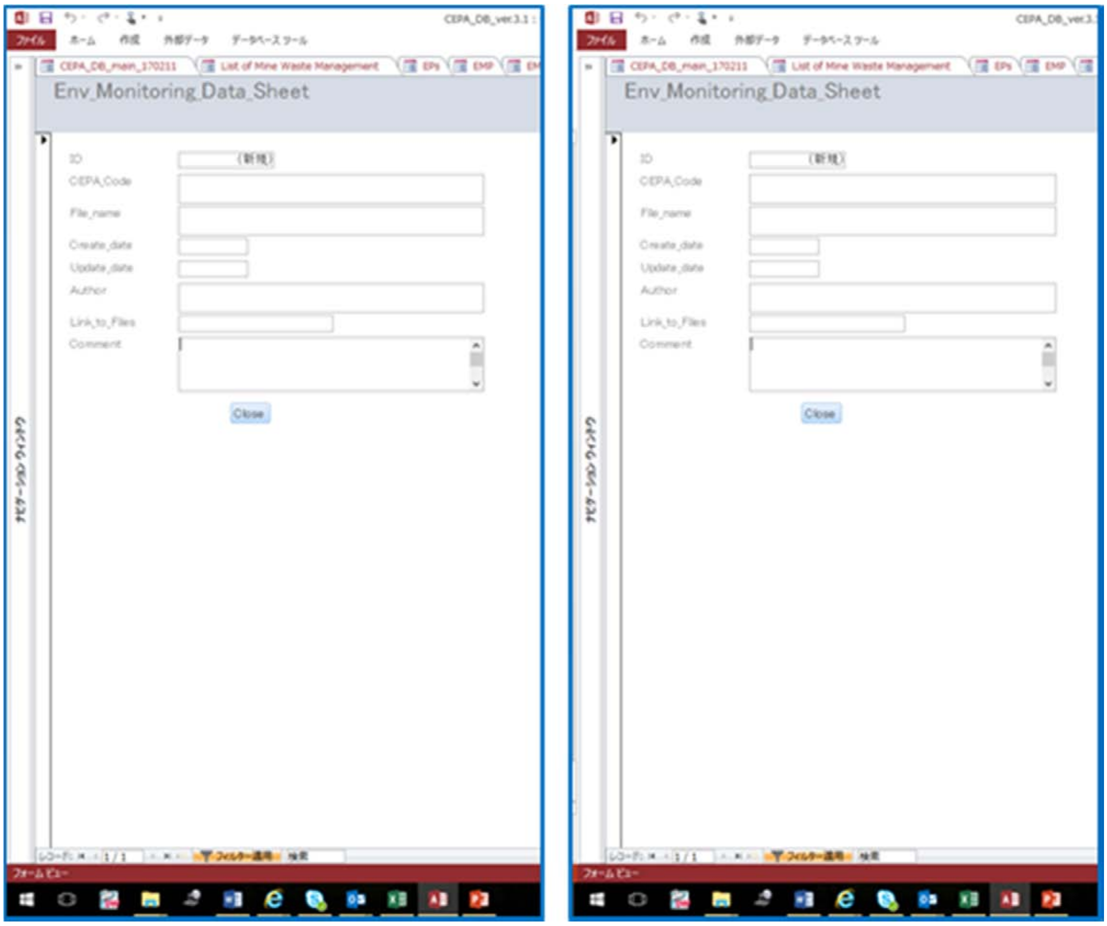


Figure 27　Environment monitoring datasheet (left) and other data management (right) form

2.4.2. Use to Import Function

2.4.2.1. Case of Environment monitoring datasheet

①Copy the updated data on the data sheet of the environmental monitoring data sheet and paste it on the sheet marked "EXP_" in the environmental monitoring data sheet.(See Figure 28)

If data is “WaterQuality”, you choose “EXP_WaterQuality”)

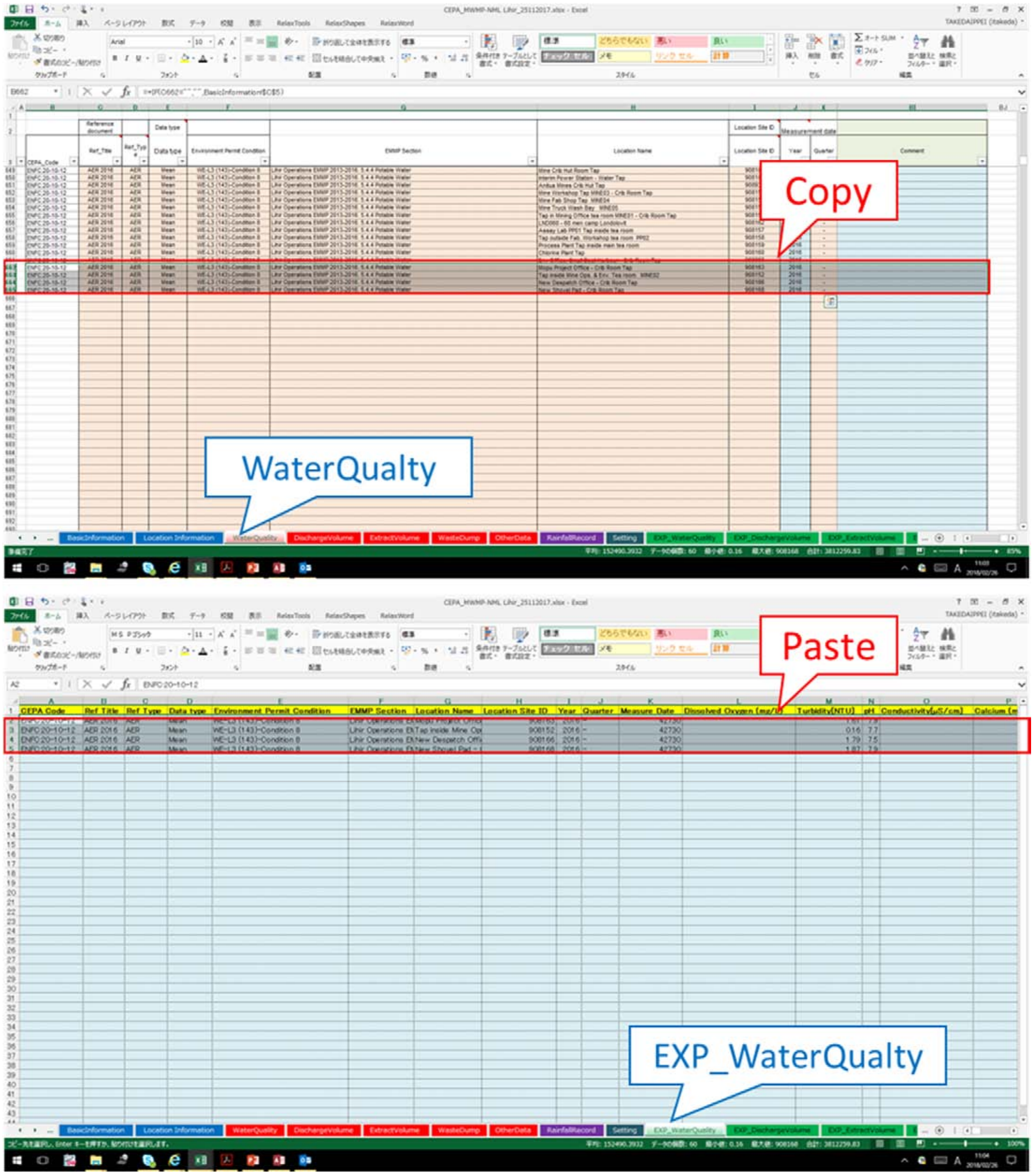
②Save and close “Environment monitoring datasheet”

③Open Database and click “External data- Excel”

④Select the database file.(See Figure 29)

② Select database table.(See Table 12 & Figure 30)

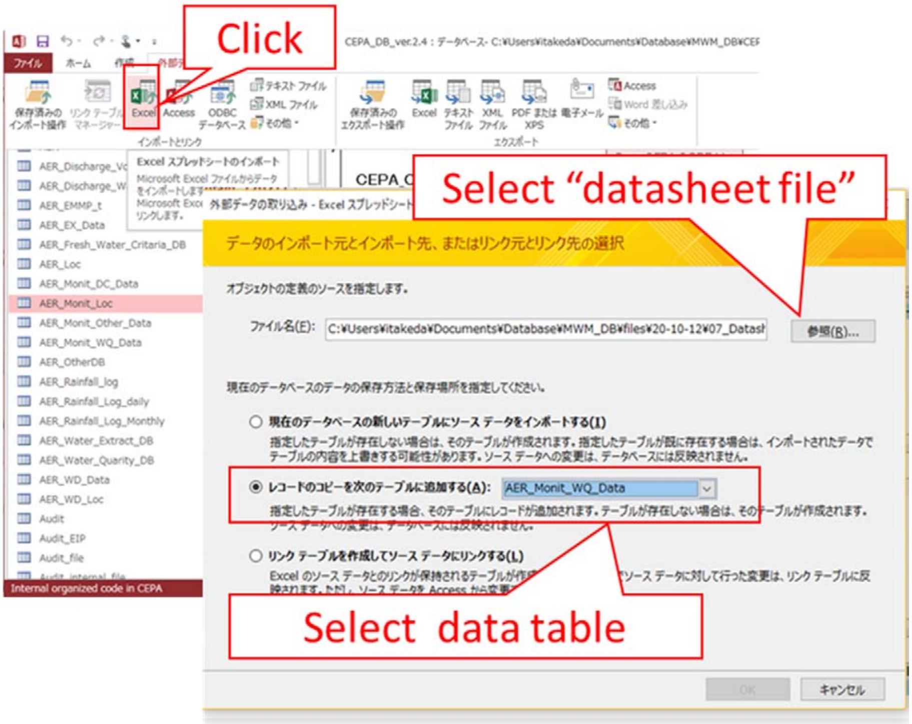
⑥Select database sheets and click “OK”



A2 ENPC 20-10-12

CEPA Code	Ref Title	Ref Type	Data type	Environment Permit Condition	EMMP Section	Location Name	Location Site ID	Year	Quarter	Measure Date	Dissolved Oxygen (mg/l)	Turbidity(NTU)	pH	Conductivity(μS/cm)	Calcium (m
[illegible]	AER 2016	AER	Mean	WE-L3 (143)-Condition 8	Lihir Operations EM	Mopu Project Offic	908163	2016	-	42730		1.61	7.9		
ENPC 20-10-12	AER 2016	AER	Mean	WE-L3 (143)-Condition 8	Lihir Operations EM	Tap inside Mine Op	908152	2016	-	42730		0.16	7.7		
ENPC 20-10-12	AER 2016	AER	Mean	WE-L3 (143)-Condition 8	Lihir Operations EM	New Despatch Offi	908166	2016	-	42730		1.79	7.5		
ENPC 20-10-12	AER 2016	AER	Mean	WE-L3 (143)-Condition 8	Lihir Operations EM	New Shovel Pad -	908168	2016	-	42730		1.87	7.9		

Figure 28 Processing on Excel for import (1)


Click

Select “datasheet file”

Select data table

外部データの取り込み - Excel スプレッドシート

データのインポート元とインポート先、またはリンク元とリンク先の選択

オブジェクトの定義のソースを指定します。

ファイル名(F): C:¥Users¥itakeda¥Documents¥Database¥MWM_DB¥files¥20-10-12¥07_Datas

現在のデータベースのデータの保存方法と保存場所を指定してください。

○ 現在のデータベースの新しいテーブルにソース データをインポートする(I)

指定したテーブルが存在しない場合は、そのテーブルが作成されます。指定したテーブルが既に存在する場合は、インポートされたデータでテーブルの内容を上書きする可能性があります。ソース データへの変更は、データベースには反映されません。

● レコードのコピーを次のテーブルに追加する(A): AER_Monit_WQ_Data

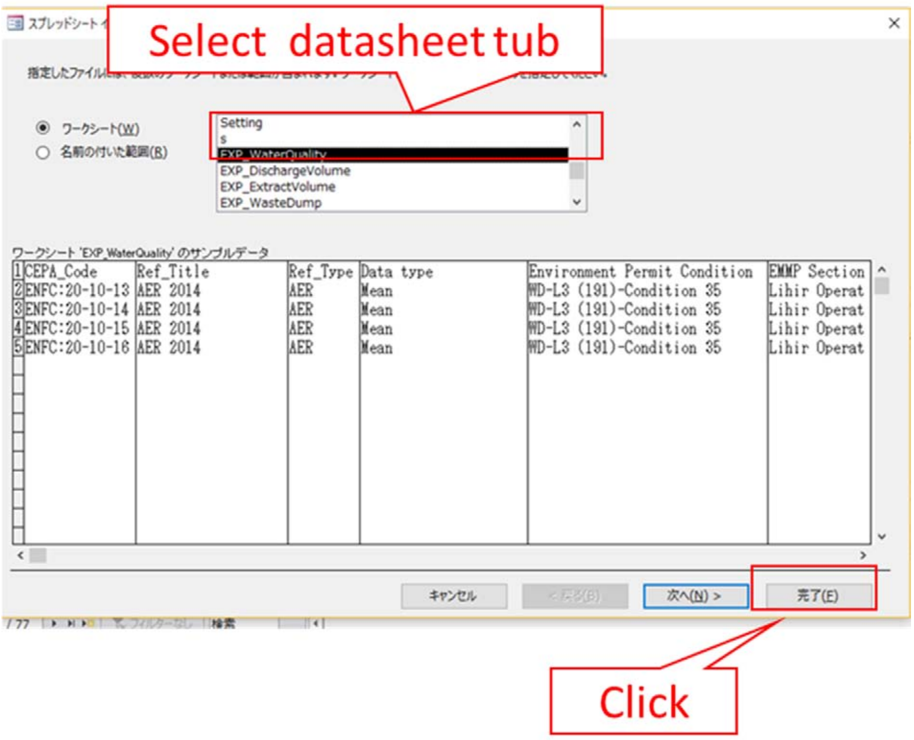
指定したテーブルが存在する場合、そのテーブルにレコードが追加されます。テーブルが存在しない場合は、そのテーブルが作成されます。ソース データへの変更は、データベースには反映されません。

○ リンク テーブルを作成してソース データにリンクする(L)

Figure 29 Processing on Excel for import (2)

Table 12 Relationship between the items of the table of the environmental monitoring data sheet and the items of the DB table of the database

Datasheet tab	DB table
EXP_WaterQualty	AER_WQ_Data
EXP_DischargeVolume	AER_Monit_DC_Data
EXP_ExtractVolume	AER_EX_Data
EXP_OtherData	AER_Monit_Other
EP_WasteDump	AER_WD_Data
EXP_MonitoringLocationInfo	AER_Monit_Loc
EXP_WasteDumpLocationInfo	AER_WD_Loc
EXP_RainfallRecordDaily	AER_Rainfall_Log_daily
EXP_RainfallRecordMonthly	AER_Rainfall_Log_Monthly



ワークシート 'EXP_WaterQuality' のサンプルデータ

1	CEPA_Code	Ref_Title	Ref_Type	Data type	Environment Permit Condition	EMMP Section
2	ENFC:20-10-13	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat
3	ENFC:20-10-14	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat
4	ENFC:20-10-15	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat
5	ENFC:20-10-16	AER 2014	AER	Mean	WD-L3 (191)-Condition 35	Lihir Operat

Select datasheet tub

Click

Figure 30 Processing on Excel for import (3)

2.4.2.2. The case of using Mining License data from MRA

①Open the "*. Dbf" file in Excel from the Mining License GIS file group.

②Save as “.xlsx”

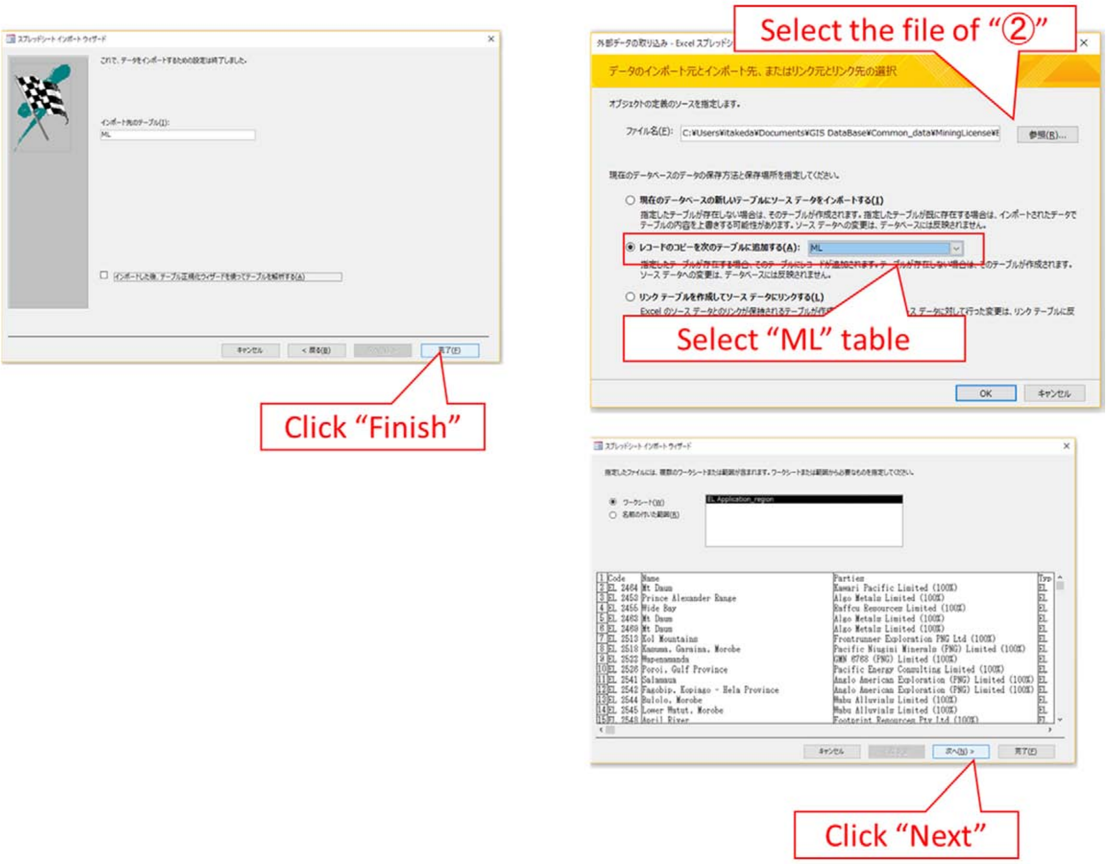
③Open database file.

④Select and crick “External data - Excel”

⑤Open the file created in ②.(See Figure 31)

⑥Select data table.(See Table 12)

⑦Crick “Next” and “Finish”



これで、データをインポートするための設定は終了しました。

インポート先のテーブル(I): ML

☐ インポートした後、テーブル正規化ウィザードを使ってテーブルを解析する(A)

データのインポート元とインポート先、またはリンク元とリンク先の選択

オブジェクトの定義のソースを指定します。

ファイル名(F): C:¥Users¥itakeda¥Documents¥GIS DataBase¥Common_data¥MiningLicense¥E

現在のデータベースのデータの保存方法と保存場所を指定してください。

○ 現在のデータベースの新しいテーブルにソース データをインポートする(I)
指定したテーブルが存在しない場合は、そのテーブルが作成されます。指定したテーブルが既に存在する場合は、インポートされたデータでテーブルの内容を上書きする可能性があります。ソース データへの変更は、データベースには反映されません。

● レコードのコピーを次のテーブルに追加する(A): ML
指定したテーブルが存在する場合、そのテーブルにレコードが追加されます。テーブルが存在しない場合は、そのテーブルが作成されます。ソース データへの変更は、データベースには反映されません。

○ リンク テーブルを作成してソース データにリンクする(L)
Excel のソース データとのリンクが保持されるテーブルが作成 ス データに対して行った変更は、リンク テーブルに反

指定したファイルには、複数のワークシートまたは範囲が含まれます。ワークシートまたは範囲から必要なものを指定してください。

● ワークシート(W)
○ 名前の付いた範囲(R)

EL_Application_region

1	Code	Name	Parties	Typ
2	EL 2464	Mt Daum	Kawari Pacific Limited (100%)	EL
3	EL 2453	Prince Alexander Range	Algo Metals Limited (100%)	EL
4	EL 2455	Wide Bay	Baffcu Resources Limited (100%)	EL
5	EL 2463	Mt Daum	Algo Metals Limited (100%)	EL
6	EL 2469	Mt Daum	Algo Metals Limited (100%)	EL
7	EL 2513	Kol Mountains	Frontrunner Exploration PNG Ltd (100%)	EL
8	EL 2518	Kasuma, Garaina, Morobe	Pacific Niugini Minerals (PNG) Limited (100%)	EL
9	EL 2522	Wapenamanda	GMN 6788 (PNG) Limited (100%)	EL
10	EL 2526	Poroi, Gulf Province	Pacific Energy Consulting Limited (100%)	EL
11	EL 2541	Salamaua	Anglo American Exploration (PNG) Limited (100%)	EL
12	EL 2542	Fagobip, Kopiago - Hela Province	Anglo American Exploration (PNG) Limited (100%)	EL
13	EL 2544	Bulolo, Morobe	Wabu Alluvials Limited (100%)	EL
14	EL 2545	Lower Watut, Morobe	Wabu Alluvials Limited (100%)	EL
15	EL 2548	April River	Footprint Resources Pty Ltd (100%)	EL

Figure 31 Processing on Excel for import (4)

2.4.2.3. Case of Inspection result list datasheet

①Copy the updated data on the data sheet of the environmental monitoring data sheet and paste it on the sheet marked "MasterData_Ex" in the Inspection result list data sheet.(See Figure 28)

②Save and close “Inspection result list datasheet”

③Open Database and click “External data- Excel”

④Select the database file.(See Figure 29)

⑤Select database “MasterData_Ex”table.(Figure 30)

⑥Select database sheets and click “OK”

2.5. Export data

2.5.1. Export for Excel

In processing or graphing data in the database, it is easier if the data is output to an Excel file and processed in Excel. The following shows how to output MS Access tables or queries to Excel files.

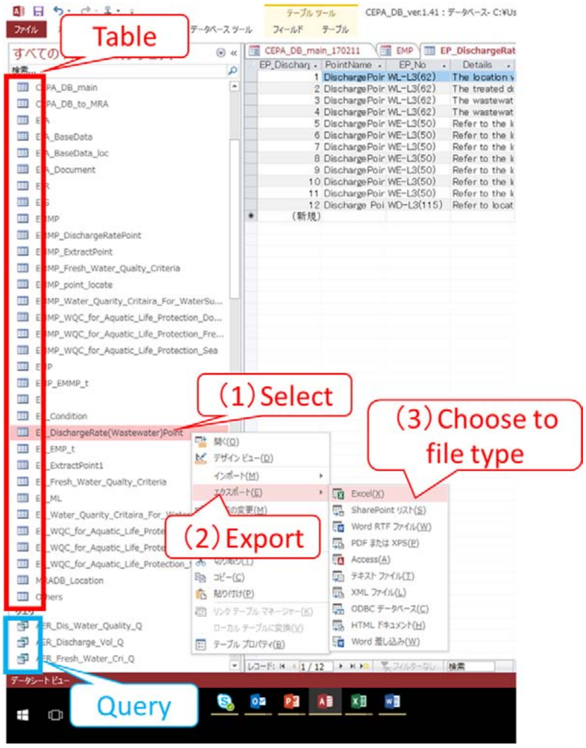


Figure 32 Steps for exporting from Access

①Select the table or query you want to output.

②Right click, select "Export-Excel" and click.

2.5.2. Extract information to use query

If you want to output data that aggregates or concatenates data between tables, you need to construct queries. A method of outputting data combining position information and chemical analysis value data is exemplified below.

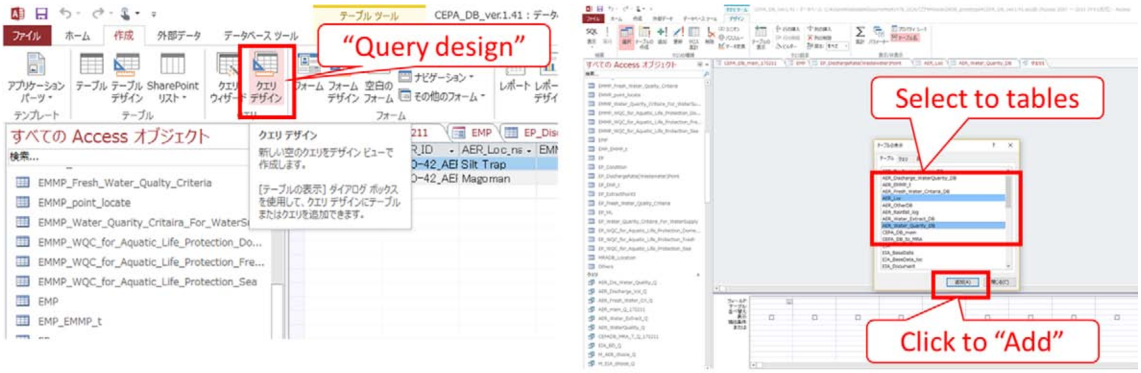
(See Figure 33~Figure 37)

①Crick “Query design”

②Select the table with the necessary items and click "Add".

③Drag and drop items on the table side to be linked to items on the table side to be linked.

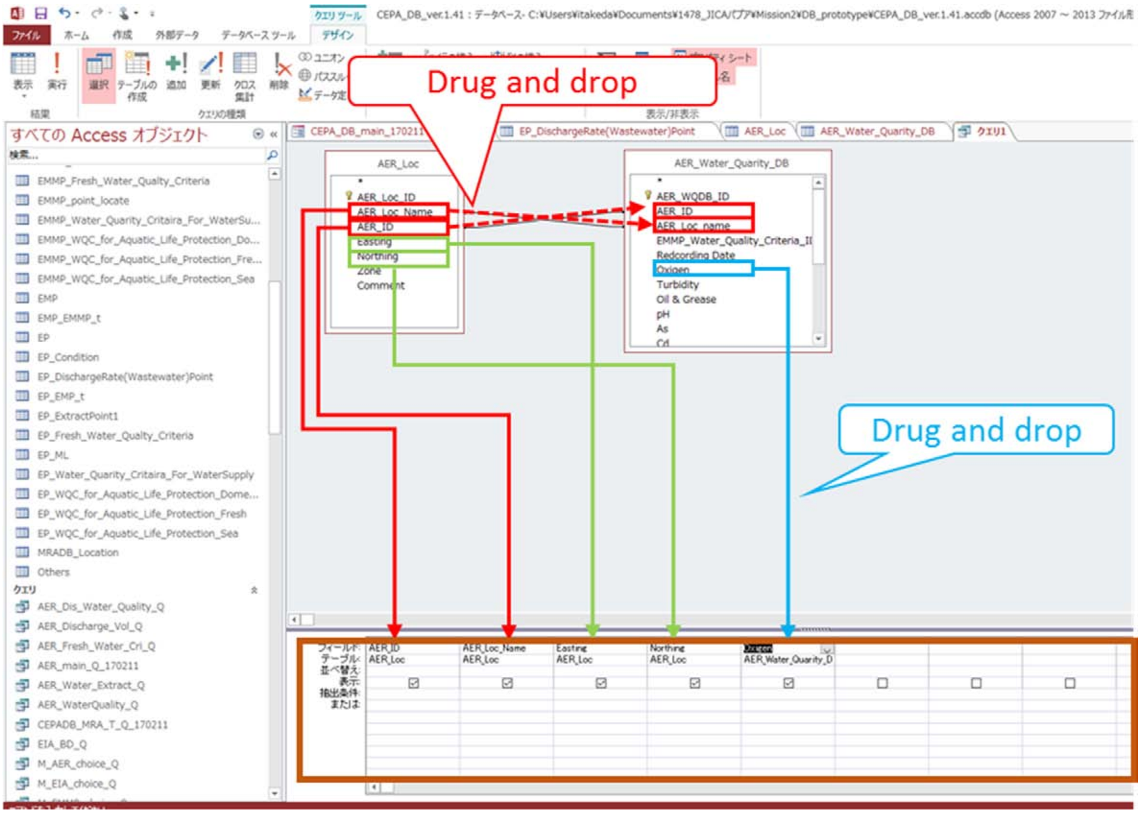
④When displaying the table of the created query, drag and drop items of each table to be displayed in the query to be created to the table at the bottom.
⑤Enter the extraction condition in the table.
⑥Right-click on the tab of the query and select "Datasheet View".
⑦Right-click on the tab of the query and select "Close". Enter the query name in the popup and click "OK".
⑧According to the method in 3.5.1, export the created query.


"Query design"

Select to tables

Click to "Add"

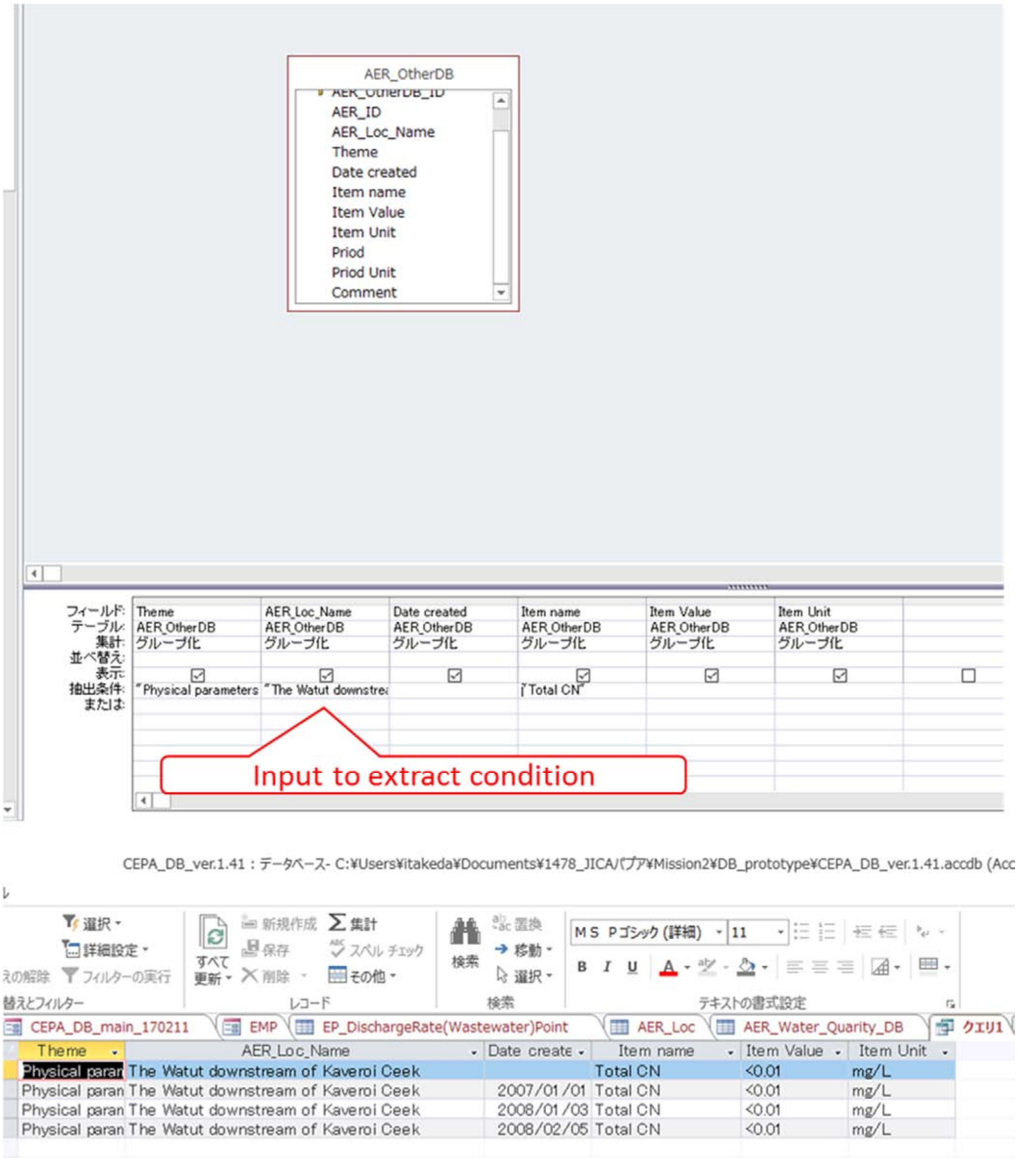
Figure 33 Query creation procedure on Access (1)


Drug and drop

Drug and drop

フィールド:	AER_ID	AER_Loc_Name	Easting	Northing	Oxigen			
テーブル:	AER_Loc	AER_Loc	AER_Loc	AER_Loc	AER_Water_Quarity_D			
並べ替え:								
表示:	☑	☑	☑	☑	☑	☐	☐	☐
抽出条件:								
または:								

Figure 34 Query creation procedure on Access (2)

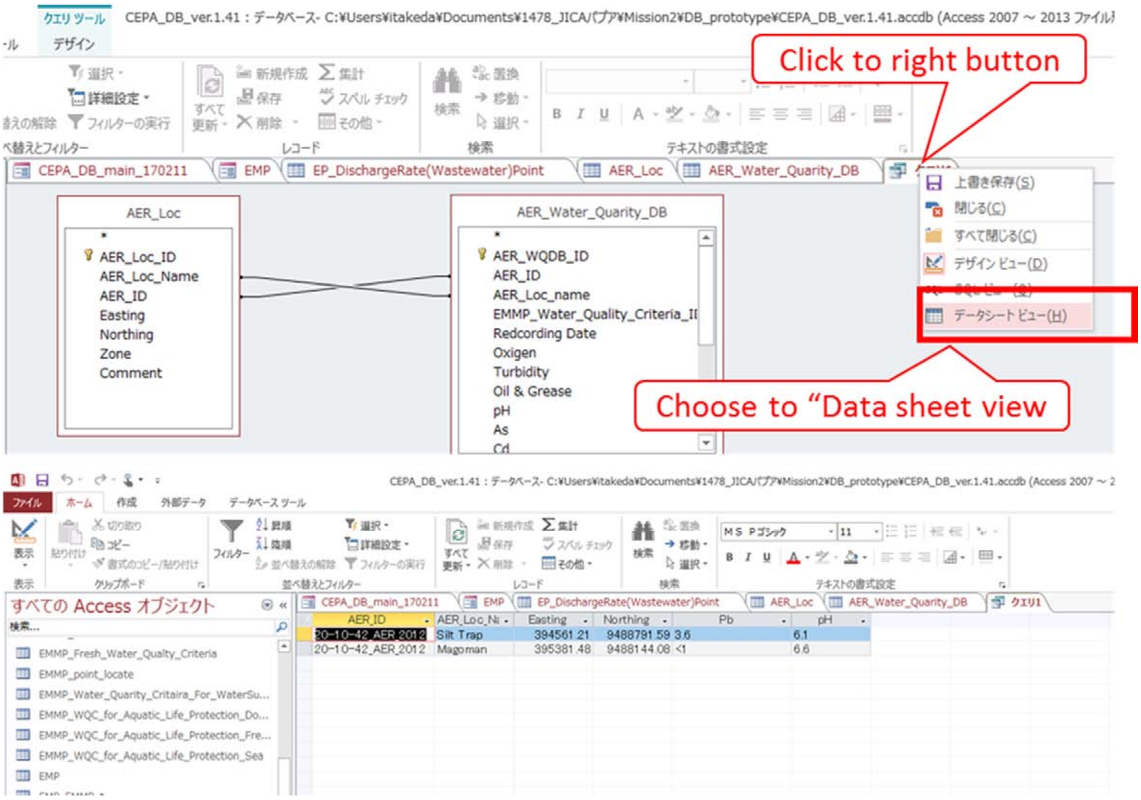


フィールド:	Theme	AER_Loc_Name	Date created	Item name	Item Value	Item Unit	
テーブル:	AER_OtherDB	AER_OtherDB	AER_OtherDB	AER_OtherDB	AER_OtherDB	AER_OtherDB	
集計:	グループ化	グループ化	グループ化	グループ化	グループ化	グループ化	
並べ替え:							
表示:	☑	☑	☑	☑	☑	☑	☐
抽出条件:	"Physical parameters	"The Watut downstrea		"Total CN"			
または:							

CEPA_DB_ver.1.41 : データベース- C:¥Users¥itakeda¥Documents¥1478_JICA¥パプア¥Mission2¥DB_prototype¥CEPA_DB_ver.1.41.accdb (Acc

Theme	AER_Loc_Name	Date create	Item name	Item Value	Item Unit
Physical paran	The Watut downstream of Kaveroi Ceek		Total CN	<0.01	mg/L
Physical paran	The Watut downstream of Kaveroi Ceek	2007/01/01	Total CN	<0.01	mg/L
Physical paran	The Watut downstream of Kaveroi Ceek	2008/01/03	Total CN	<0.01	mg/L
Physical paran	The Watut downstream of Kaveroi Ceek	2008/02/05	Total CN	<0.01	mg/L

Figure 35　Query creation procedure on Access (3)

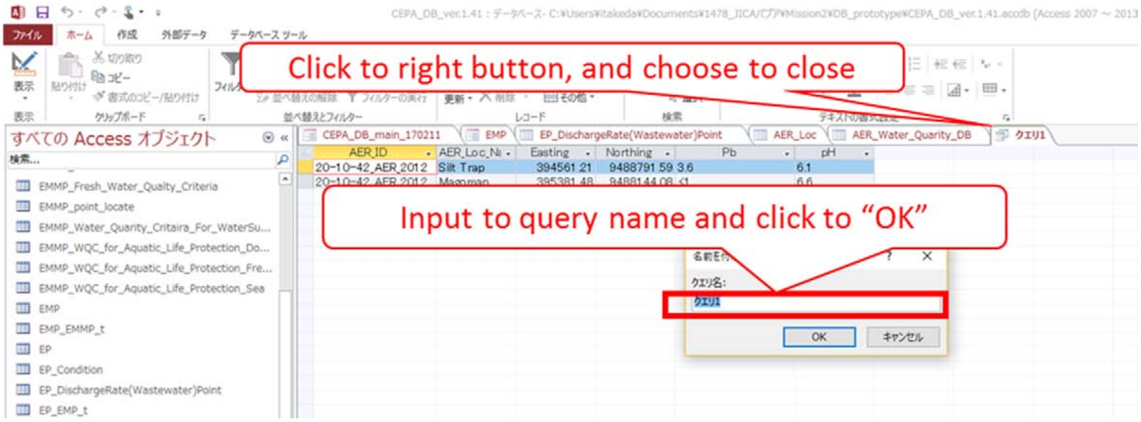


Click to right button

Choose to “Data sheet view

AER_ID	AER_Loc_Na	Easting	Northing	Pb	pH
20-10-42 AER 2012	Silt Trap	394561.21	9488791.59	3.6	6.1
20-10-42 AER 2012	Magoman	395381.48	9488144.08	<1	6.6

Figure 36 Query creation procedure on Access (4)



Click to right button, and choose to close

Input to query name and click to “OK”

クエリ名: クエリ1

Figure 37 Query creation procedure on Access (5)

3. Using GIS

3.1. Overview of GIS

Geographical information system (GIS) uses comprehensive management and processing of data (spatial data) with information on position by using geographical position as a clue, visual display, and advanced analysis and rapid. It is a technology that enables judgment. By using GIS, it becomes possible to make operations in CEPA more sophisticated and efficient.

Various software is available to GIS regardless of charge or free of charge. In this project, we will use QGIS which is freeware. QGIS has been selected for use in many departments inside CEPA and also because information can be obtained on the Internet as well.

3.2. Import from database

Here, a method of outputting information from a database file and displaying it on the QGIS will be exemplified.

①Prepare a query containing location information.

②Output the query from ① to the Excel file and save it in the GIS project folder (01_MonitoringData).

③Save the file of ② as ".csv" file.

④Start up QGIS and open the project file.

⑤Click "Add Delimited text layer" and select the CSV file of ③.(See Figure 38)

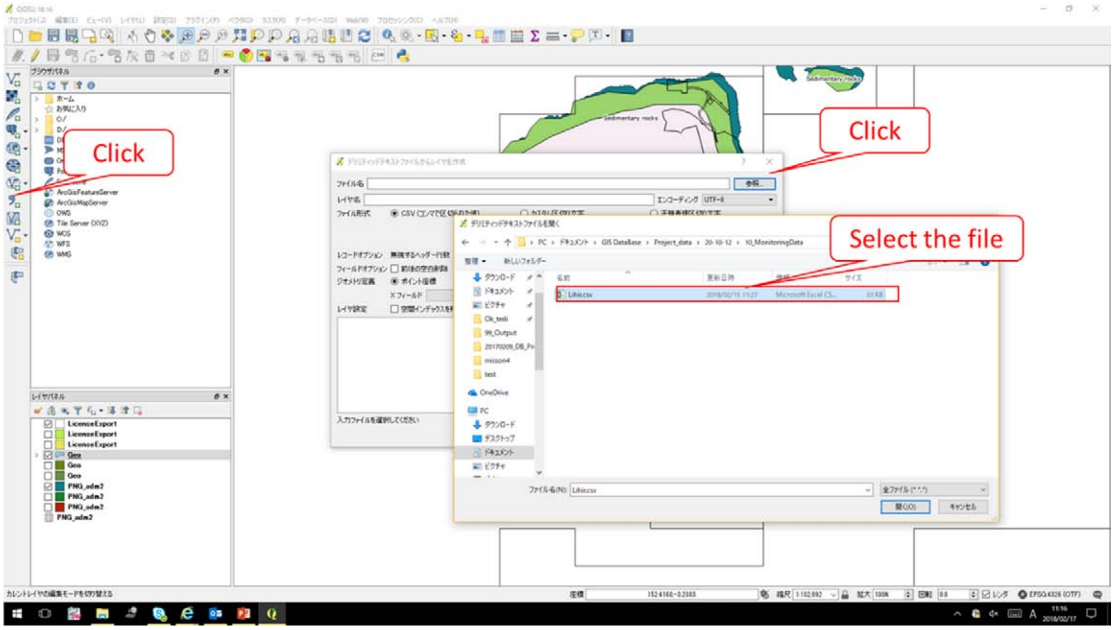
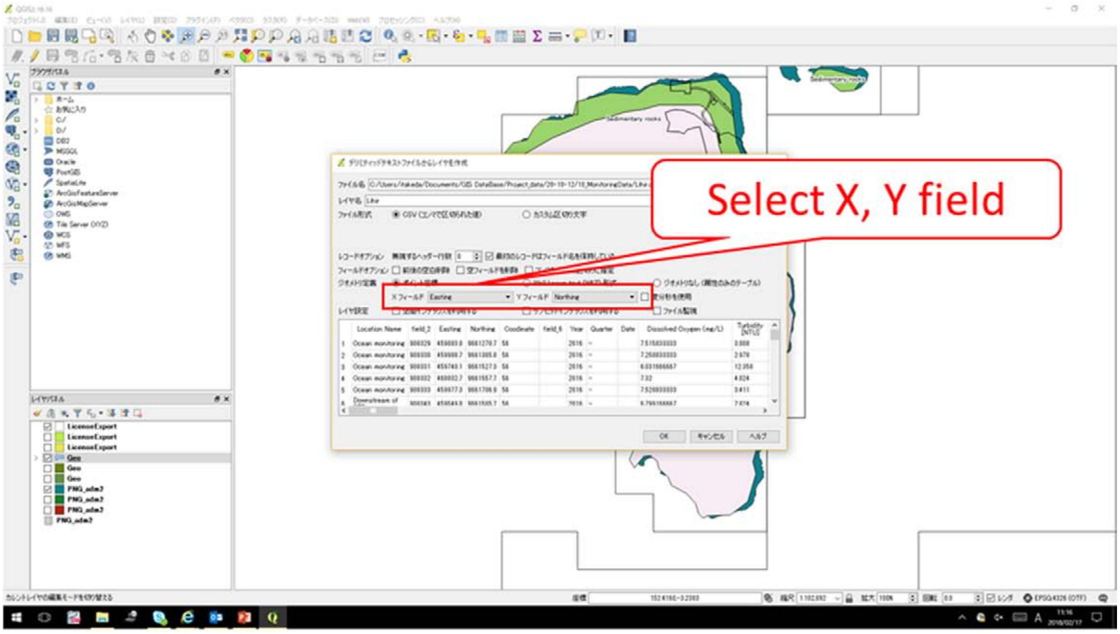


Figure 38 Import to CSV data

⑥Select the X, Y fields.(See Figure 39)

⑦Select spatial reference information. (At the Lihir mine, WGS 86 UTM zone 56 S is used)



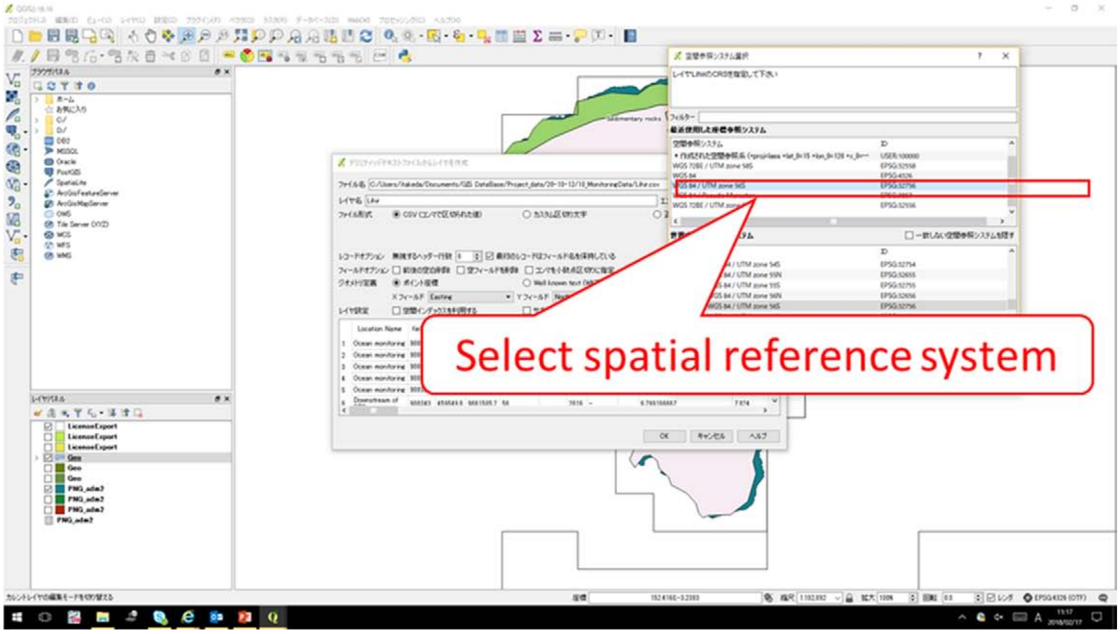


Figure 39　Reading of coordinate values and setting of geographic coordinate system.

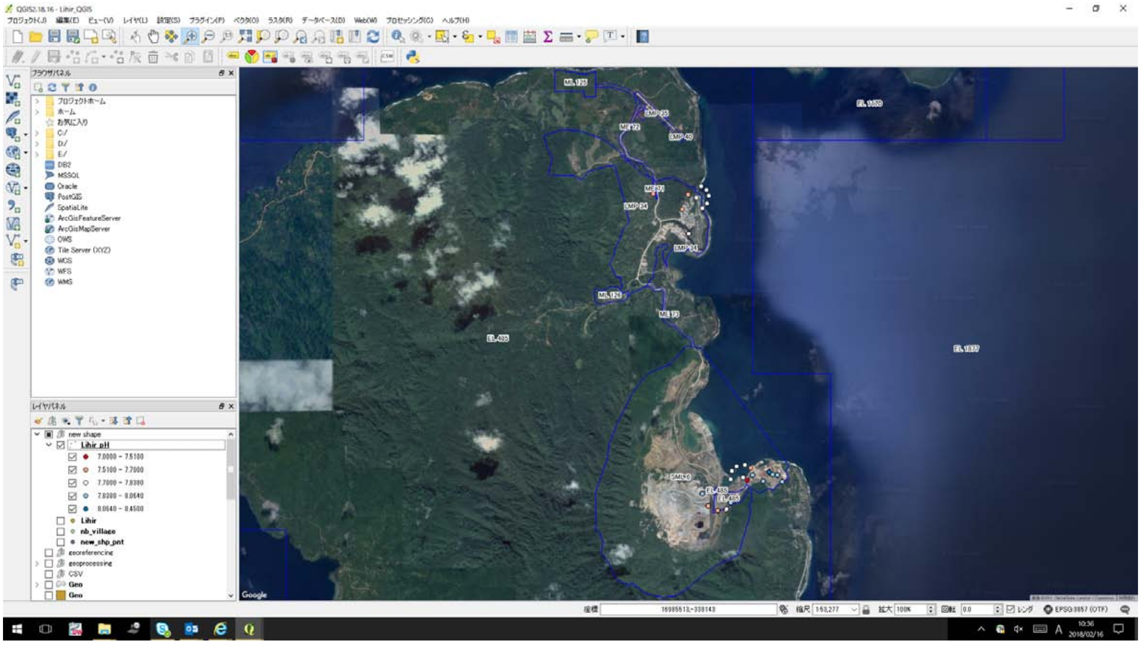


Figure 40 Illustration of display on QGIS (base map: satellite image point: pH)

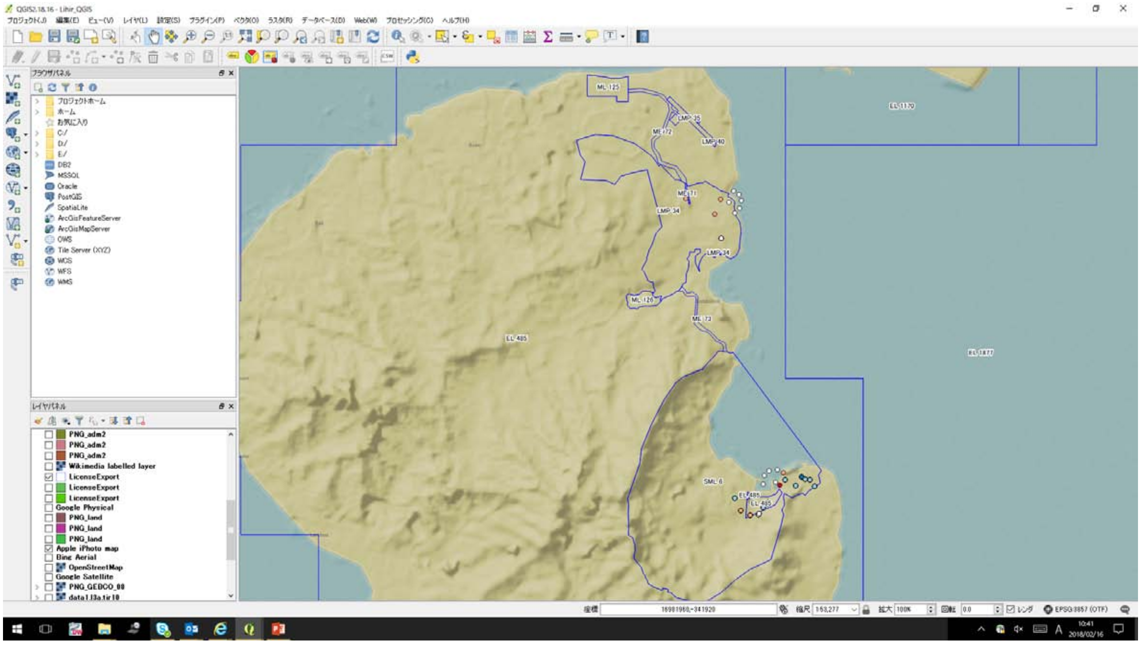


Figure 41 Illustration of display on QGIS (base map: topological map point: pH)

Conservation and Environment Protection Authority **CEPA**
Mineral Resources Authority **MRA**
Dept. Mineral Policy and Geohazard Management **DMPGM**
Japan International Cooperation Agency **JICA**

Mine Waste Database User's Manual

THE PROJECT FOR CAPACITY DEVELOPMENT
ON MINE WASTE MANAGEMENT
IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA

Supported by Japan International Cooperation Agency
In September 2018

Appendix 6

Inspection Manual for Waste Dump and Tailings Dam

Field Inspection Handbook for Mine Waste Management

Tailings Dam and Waste Dump, Environment Monitoring

Independent State of Papua New Guinea
Conservation and Environment Protection Authority

Mineral Resources Authority

DMPGM
Department of Mineral Policy & Geohazards Management

JICA
Japan International Cooperation Agency

Contents

FOREWORD

This Field Inspection handbook for Mine Waste Management should be used as a guide to specifically manage the disposal of land based tailings and waste rocks. The Riverine and Deep Sea Disposal system of tailings are not included in this handbook for regulatory inspections under the Mining (Safety) Act 1977 and Regulation 1935 and the Environment Act 2000 for all operating mines in the Independent State of Papua New Guinea.

Moreover, other mine wastes including hydrocarbons, aerial emissions, scrap metals and rubbers etc. are not included in this handbook.

GUNTHER JOKU
Managing Director
Conservation and Environment Protection Authority

NATHAN MOSUSU
Acting Managing Director
Mineral Resources Authority

INTRODUCTION

The Independent State of Papua New Guinea (PNG) hosts some of the world class mines. The mining industry alone accounts for more than 70% of the country's export revenue due to the increase in mining investment in the last 10 years.

The mining sector is expected to lead the economic developments of PNG in the future, but in order to carry out sustainable mine developments; it is necessary to strengthen the management of mining wastes and harmonize with the economic developments.

Based on these circumstances, with the aim of strengthening administrative capacity to appropriately grasp and manage the current situation of mining waste in PNG, "The Capacity Development of Mine Waste Management Project" was supported by Japan International Corporation Agency (JICA) and was conducted from September 2016 to September 2018.

This handbook was prepared in collaboration with the Japanese Study Team, Mineral Resources Authority (MRA), Conservation and Environment Protection Authority (CEPA) and Department of Mineral Policy and Geohazard Management (DMPGM) as part of this project and is a basic procedure for inspection of mine waste management in PNG.

1. DEFINITION OF TERMS

1.1 Mine Waste

Cake - Tailings, slags or sludge dehydrated by dehydrator or filter press.

Gangue – Unwanted portion of an ore.

Mine Waste - Substances that currently have little or no economic value that are derived from mining activities such as; overburden, waste rock, tailings, slags, mine water and water treatment slags.

Mine Waste Dump - Area within the mine where materials below the ore cut off grades or materials containing insufficient minerals to process economically are disposed.

Overburden - Soil and rock covering a mineral ore deposit, that is removed to gain access to the ore body.

Slags - Residue material left after the smelting process.

Sludge - Solid material from neutralization of mine water or waste water.

Tailings - Materials left over after the process of separating the valuable fraction from the uneconomic fraction of an ore.

Tailings Dam - An earth-fill embankment dam used to store by-products (tails) of mining operations after separating the ore from the gangue.

Photo 1: Tailings discharge into a dam

1.2 Tailings Dam

1.2.1 Disposable Method

Tailings in slurry are discharged towards the upstream from the embankment of the tailings dam, and deposited by the supernatant water from the upstream side as shown in Fig.1.

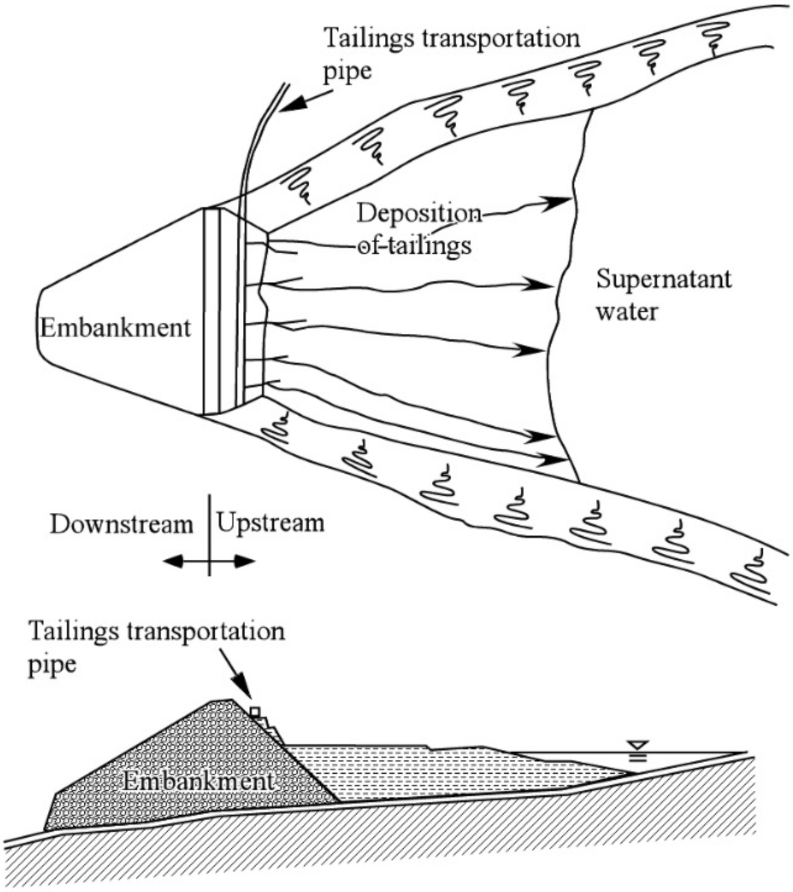


Fig.1.Disposal Methods

1.2.2 Design Methods of Tailings Dam

Design methods for tailings dam vary a lot as it is affected by;

- tailings characteristics and mill output,
- site characteristics such as topography, hydrology, geology, groundwater, seismicity and available material.
- disposal methods.

There are almost as many different tailings dam construction methods, as there are tailings dams, but generally they can be divided into three different methods, such as; upstream, downstream and centerline

1.2.2.1 Upstream Embankment Design

With the upstream method as shown in (Fig.2), the crest of the dam moves progressively upstream as the impoundment is raised. The method requires tailings with a coarse fraction large enough to form a stable foundation for the next raise. Economically the upstream method results in relatively low costs, as the material volumes needed are low. The weakness of this method is it's relative sensitivity to construction method and seismicity.

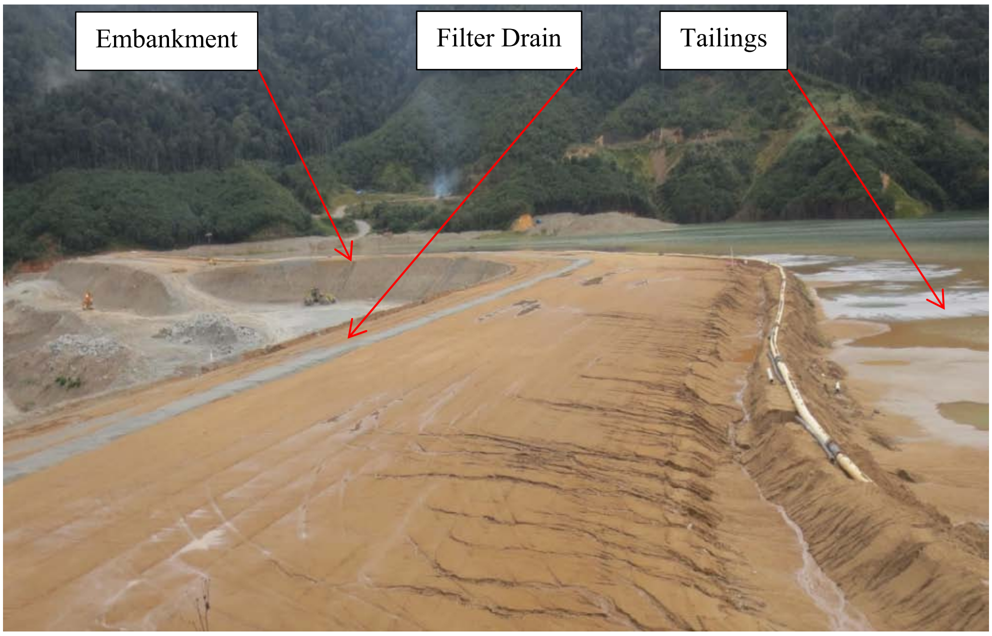


Photo 2: Upstream method used at Hidden Valley Mine, Morobe Province

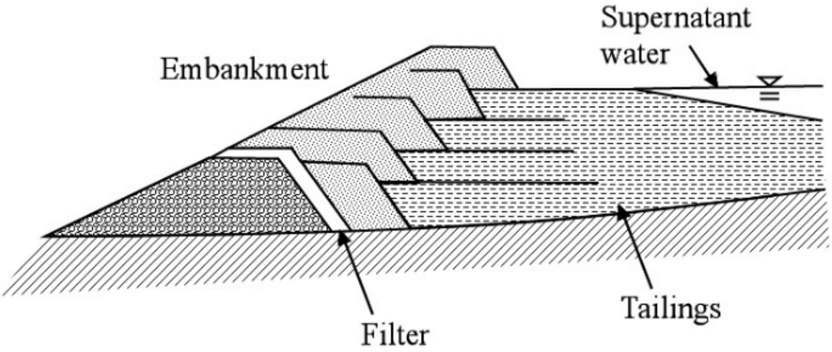


Fig.2 Upstream Tailings Dam

1.2.2.2 Downstream Embankment Design

Using the downstream technique as shown in (Fig.3) the crest of the dam wall moves progressively downstream as the impoundment is raised. For each raise the volume of material needed will increase exponentially, which will result in relatively high construction costs. The footprint area will successively increase as well. The downstream dam is not as sensitive as the upstream dam as the dam is built on "hard ground" instead of deposited tailings.

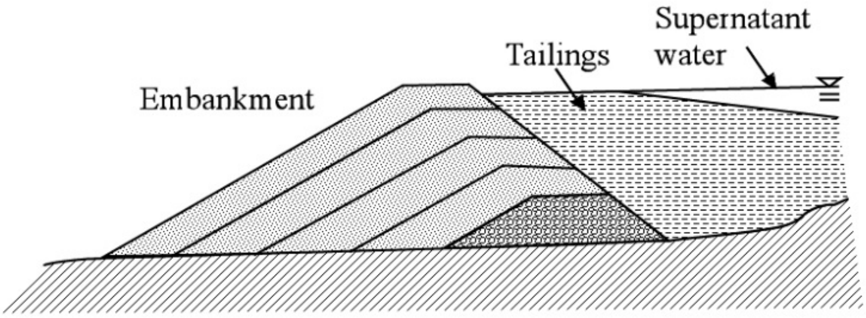


Fig.3 Downstream Tailings Dam

1.2.2.3 Centerline Embankment Design

The centerline method as shown in Fig 4, the crest remains in a constant position in plan. The method is basically a combination of the upstream and downstream method and all qualities are in-between the qualities of the upstream and downstream method.

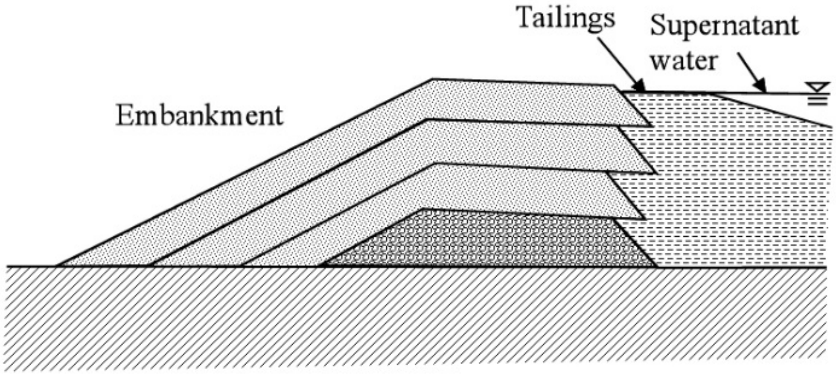


Fig.4. Centerline Tailings Dam

1.2.3 Materials for Dam Embankment

Stone embankment – It is mainly made of gravel.

Sand embankment – It is mainly made of sand grain of tailings and slag.

Fine embankment – It is mainly made of mixture of clay and silt exclusive of tailings and slags.

Concrete embankment – It is mainly made of concrete.

Combine embankment – The main material is formed by more than two kinds of materials.

1.3 Waste Rock/Soil Dump Deposition

1.3.1 Drop off deposition

This is where overburden and waste rocks are dropped off from a higher place to pitfall (e.g. vacant mining pit or natural cliffs). See Fig 5.

Photo 3: Dozer pushing waste rocks over natural cliff at Ok Tedi Mine, Western Province

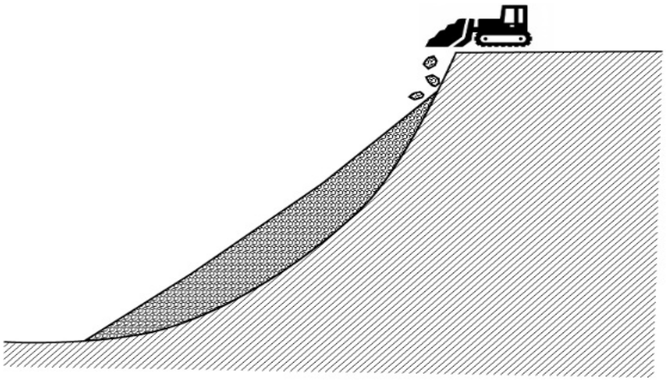
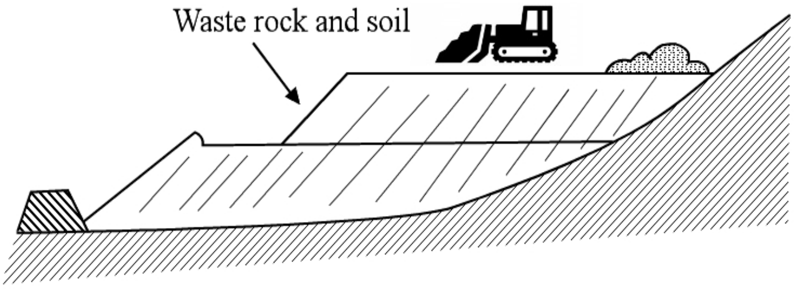


Fig.5. Anterior deposition

1.3.2 Anterior deposition

This is where overburden and waste rocks are heaped up by horizontal extension as shown in Fig.5.



1.3.3 Layer deposition

This is where overburden and waste rocks are deposited making horizontal layers. See Fig.6.

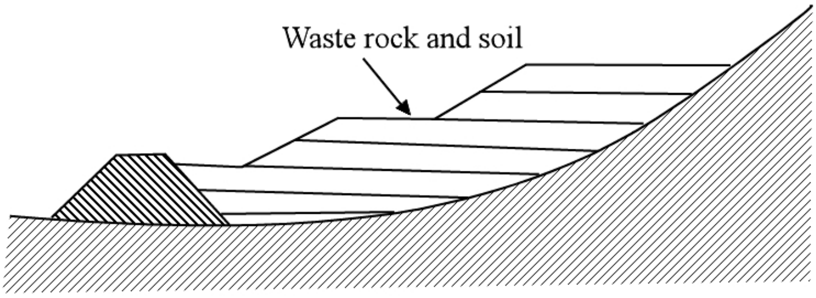


Fig.7. Layer deposition

1.4 Drainage Facility

External water

This refers to rain and creek water which may flow into tailings dam and waste dumps.

Internal water

This consists of various kinds of water such as;

- rain water falling in the dam and dump.
- spring water flowing into the dam and dump.
- water which are discharged into the tailings dam together with tailings.

External water exclusion facilities

These are facilities which guides and excludes water to the downstream of the Dams or Dumps.

Hillside channel

It is one of external water exclusion facilities. The channel is settled between natural slopes and the Dumps or settled in the upstream natural slopes.

Exclusion channel for creek water

It is the channel which excludes creek and river water to the downstream of the Dumps.

Internal water exclusion facility

It is the facility which guides and excludes internal water to the downstream of the Dumps promptly.

Bottom set culvert (Conduit)

For guiding and excluding of the internal and external water to the downstream of the Dumps, the culvert is settled under the Dumps.

Channel of bank slope

It is the channel which guides and excludes rain water over downstream slopes.

Emergency facility

It is a facility that will be effective for emergencies when the ordinary water exclusion facility has lost it's effect. See Photo 5.

Photo 4: Diversion drain channeling access water into the Tailings dam at Hidden Valley Mine, Morobe Province

Photo 5: Emergency Facility – Shaft for water drainage in tailings dam

Catchment area

It is an area where rain water is accumulated to the area of dumps.

1.5 Others

Stability Analysis for Embankment Slope

It is the ratio calculation of the movement caused by the internal driving forces of a slope compared to the forces resisting the slope failure. If resisting forces are greater than driving forces, the slope is assumed stable. The ratio calculation is generally done by "Swedish Slip Circle Method of Analysis".

Soil Liquefaction

It is a phenomenon whereby the embankment materials which are composed of dump deposits or tailings, sand and silt lose their shear strength between soil particles, with the occurrence of excess pore water pressure due to the seismic force.

2. INSPECTION COMPONENT OF WASTE DUMP & TAILINGS DAM

2.1 General Matters

- The general information of a tailings dam should be interviewed on the basis of license and/or statements etc. In addition, the current status of deposition should be comprehended on the drawing.
- The amount and disposal methods for each waste category should be interviewed and comprehended.
- Capacity and durable years for a dump / dam, and also future installation plan of a dump / dam, should be interviewed.
- If mine waste is to be located out of granted mining area, then the location should be granted Lease for Mining Purposes (LMP).
- It should be confirmed that the appropriate disposal methods is applied on the basis of their categories and physical properties.
- It should be confirmed that the person inspecting the waste dump / tailing dam is familiar with the safety management system.
- It should be confirmed that the appropriate disposal method had been approved by MRA and CEPA.

2.2 Management Conditions

During the inspection the following items should be confirmed with the mine management;

- The inspection is conducted on a daily basis and the results are stated in the safety register.
- The frequency of inspections is increased during and after heavy rain or earthquake.
- The necessary emergency system is established and the training is continuously conducted.
- Maintenance and storage of first aid tools are appropriate.
- Rainfall is regularly measured.
- The measurement facilities for infiltration water level, displacement and water level of dam are appropriate and well maintained.
- The bottom conduit is periodically inspected.

2.3 Document Management

The following items relating to document management should be confirmed during the inspection;

- The deposit amount of waste and tailings has been recorded chronologically.
- Various measurement records have been archived properly.
- The inspection records of a bottom conduit have been stored properly.
- The construction records of a waste dump and tailings dam have been archived.
- Records of any maintenance carried out on the waste dump associated facilities such as pipelines and processing facilities.

Photo 6: Tailings Pipeline Facilities

3. SPECIFICATION OF TAILINGS DAM

Prior to an inspection of a Tailings Dam, it is effective to compile the specification of the dam. The form shown below is an example of one that can be used.

Specification of Tailings Dam (______________________________________Mine)

Date [/ /]

Name of Dam					
Type					
Date of construction					
Starting date					
Catchment area				m^2	
Dumping area for full capacity				m^2	
Permitted volume				m3 (t)	
Accumulated volume				m^3 (as of)	
Type and structure of embankment					
	Permitted height				
	Width of dam crest				
	Length of dam				
	Gradient of slope	[Outer-slope] 1:		[inner-slope] 1:	
Bottom set conduit for main stream	Type/Structure				
	Length				
Bottom set conduit for subsidiary stream	Type/Structure				
	Length				
Spare water exclusion facility	Type/Structure				
	Length				
Emergency facility	Type/Structure				
	Length				
Hillside channel	Type/Structure				
	Length				
Driftwood stop	Type/Structure				
	Height				
Design rainfall intensity	100 years probable rainfall:		mm/hr		
	200 years propable rainfall:		mm/hr		
Remarks					

4. TAILING DAM & WASTE DUMP INSPECTIONS CHECKLIST

4.1 Tailings Dam

Item and Criteria		Yes	No	Comments
1. TAILINGS DAM				
1.1 Design Criterior				
(1)	Tailings Dam design and specifications in place.			
(2)	Tailings material specifications or characteristics provided			
(3)	Tailings Dam emergency management plan in place.			
(4)	Tailings Dam closure plan in place for end of mine life or after the design capacity is reached.			
1.2 Measuring the amount of deposition				
(5)	The amount of tailings to be sent to the tailings dam has been measured in the dressing/processing plant etc.			
(6)	The measurement method of above (1) is appropriate.			
(7)	Concentrations of tailings etc. to be sent to the tailings dam are periodically measured in the dressing/processing plant etc.			
(8)	The measurement method of above (3) is appropriate.			
(9)	Toxic chemicals in the tailings are treated and diluted to acceptable standards or legal obligations prior to release into tailings dam.			
1.3 Tailings pipeline				
(10)	Inspection passage is provided along the tailings pipeline.			
(11)	There is no damage and leaking on the tailings pipeline.			
(12)	Integrity test conducted on tailings pipeline			
(13)	Protective equipment are provided in places where there is a risk of damage to pipes due to external forces and falling rocks.			
(14)	There is a sign indicating the location where the pipe is buried.			
1.4 Methodology of deposition				
(15)	The tailings pipeline is located along embankment properly.			
(16)	The discharging tailings is conducted towards upstream.			
(17)	The discharging of tailings is conducted evenly over the entire length of the embankment.			
(18)	The level of dam surface is uniform in entire field.			
(19)	Deposited tailings are kept under water and not exposed to atmosphere.			
(20)	Fine slimes settling effectively.			
(21)	There are no anomalies such as sinkholes, cracks, etc. in the dam nearby embankment			
1.5 Embankment				
(22)	In case of covering the internal slope surface with waterproof sheet, no damage or poor bonding should be found on the sheet.			
(23)	If the water impermeable sheet is not affixed to the internal slope embankment, and water and embankment are in direct contact with each other, a preventing layer of infiltration water such as clay is provided in embankment.			

(24)	There are no anomalies such as subsidence, crack, seepage etc. at the slope and top of embankment.			
(25)	There is no scouring along the slope of embankment by rain.			
(26)	Hydroseeding etc. is being carried out as a measure to prevent erosion/leakage by rainwater etc. on the external slope surface.			
(27)	Animals do not use as a nest after hydroseeding. There is no root excavation by animals.			
(28)	There is no land slide or swelling around edge of the slope.			
(29)	There are no changes on amount of seepage, water quality and turbidity.			
(30)	There is no breakage, deformation, etc. in the infiltration water level measuring pipe.			
(31)	Damage, deformation, etc. are not seen in the surveying pile and the displacement measuring device.			
1.6 Drainage facilities				
1.6.1 Drainage facilities for water outside the dam				
(32)	A safe inspection aisle is installed and maintained for open channel.			
(33)	There is no possibility that the open channels will be damaged by the collapse / outflow of the ground on which they are installed.			
(34)	Preventive measures are applied to places where there is a risk of clogging due to collapse and outflow of the slope on the upstream side of the open channel.			
(35)	Prevention measures are applied to places where there is a danger of scouring the open channel by hydraulic jump at steep slope.			
(36)	There is no anomaly such as fracture, damage, water leak, embedding, etc. in open channel.			
(37)	Open channel has been maintained without any disturbance by sand, soil, falling leaves, etc.			
(38)	In the conduit, driftwood and sediment stopping are provided upstream of the mouth.			
(39)	Driftwood and sediment stops have been maintained without leaving driftwood and sediment.			
1.6.2 Drainage facilities for water in the dam				
(40)	No abnormality is found in pumps and drain pipes of forced drainage facilities.			
1.6.3 Emergency drainage				
(41)	Emergency drainage can be operated at any time.			
(42)	Emergency drainage is installed in the rock. Alternatively, it is made of a material which is not scoured such as material made of concrete.			

4.2 Waste Dump

Item and Criteria		Yes	No	Comments
2. WASTE DUMP				
2.1 Embankment				
(1)	The embankment is constructed in accordance with the plan.			
(2)	Proper construction materials are used for embankment. (Rocks which are weathered easily and clay are not used)			
(3)	There is no anomalies such as subsidence, crack, etc. at the slope and top of embankment.			
(4)	There is no landslide or collapse around edge of the slope.			
(5)	There is no scouring along the slope of embankment by rain.			
2.2 Situation of deposition				
(6)	Deposition has been conducted properly.			
(7)	Thickness is properly adjusted in horizontal layered deposition.			
(8)	Proper compaction method is applied.			
(9)	Waste rocks with many gravel have been deposited on the downstream side, and those with less gravel has been deposited on the upstream side.			
(10)	The slope of deposition is formed in accordance with the plan. E.g.) dipping of slope, location and width of berm.			
(11)	There is no anomaly such as subsidence, crack, etc. at the slope of deposition.			
(12)	There is no water leakage or seepage at the slope of deposition.			
(13)	Planting in the waste dump is growing well.			
(14)	There is no anomaly such as subsidence, crack, etc, in the drainage.			
(15)	Deposition of soil and sand are not observed in the drainage.			
(16)	The monitoring system of displacement is functioning normally.			

Photo 7: Waste Dump Underdrainage at Hidden Valley Mine, Morobe Province.

5. ENVIRONMENT INSPECTION CHECKLIST

Questions		Yes	No	Comments
(1)	Has there been a clearly identified individual(s) charged with overall environmental responsibilities for the audit site, for the period of operation under present ownership?			
(2)	Does the site have a fully complete Environmental Policy which has been signed and dated by senior management (director/board level)?			
(3)	Does the site have a fully documented environmental management system?			
(4)	Does the site document all the operating procedures?			
(5)	Does the management carry out regular inspections of all areas of the site and are these documented in any way, so that proper housekeeping can be identified?			
(6)	Is there a fully functioning quality management/assurance system operating at the project site?			
(7)	Does the site have a documented training policy, is this signed and dated by senior management and reviewed regularly?			
(8)	Are all staffs given an initial EHS induction course before they can work at the facility?			
(9)	Are staff dealing with key environmental operational aspects of site management given additional environmental training specific to their roles, on or offsite?			
(10)	Have any external Environmental Audits been undertaken on site?			
(11)	Have any internal Environmental Audits been undertaken on site?			
(12)	Are all accidents fully reported, and is the system for reporting these documented and regularly reviewed by senior management?			
(13)	Is there are fully documented set emergency procedures concerning not just the mining operations, but including external risks (e.g. flooding, fire, earthquakes, sea sedges etc.)?			
(14)	Are the management aware of staff turnover levels at the site and the key drivers affecting this?. Does management have an active involvement in trying to reduce/control turnover rates?			
(15)	Are all staff on site required to have a regular, formalized health check by a competent health specialist either on site, or from off-site?			
(16)	Does the site operator carry out a health assessment/inventory of the surrounding settlements on a regular basis (i.e. annually) to detect adverse effects on human health?			
(17)	Is there a formal liaison procedure, committee or other structured process by which local communities and external healthcare organizations can report adverse health or environmental issues directly to the management?			

(18)	Has the operator fully conducted "public awareness" programs at no less than six (6) months intervals, or as directed by the Director of Environment in PNG, in all riparian communities and/or communities within mining lease?			
(19)	Has the operator fully evaluated the riparian communities and/mine affected communities within the mine lease area, and does the evaluation provide adequate information in terms of population, demographics of the communities, exposure routes to pollution and other potential polluters in the environment?			

Photo 8: Tailings Dam in Kainantu Mine, Eastern Highlands Province

6. RAPID PACKTEST – QUICK ON SITE WATER QUALITY TEST

For the purpose of understanding the water quality at monitoring point(s), especially at discharge point(s) or at a desired spot within an area of mining activity, "PACKTEST" will be a useful on site water quality testing tool during field inspection(s), as it (PACKTEST) gives water quality analysis results of desired element(s) on the spot.

KYORITSU CHEMICAL-CHECK Lab.,Corp.

Photo 9: Overview of the PACKTEST

(Photo was provided by KYORITSU CHEMICAL-CHECK Lab.,Corp.)

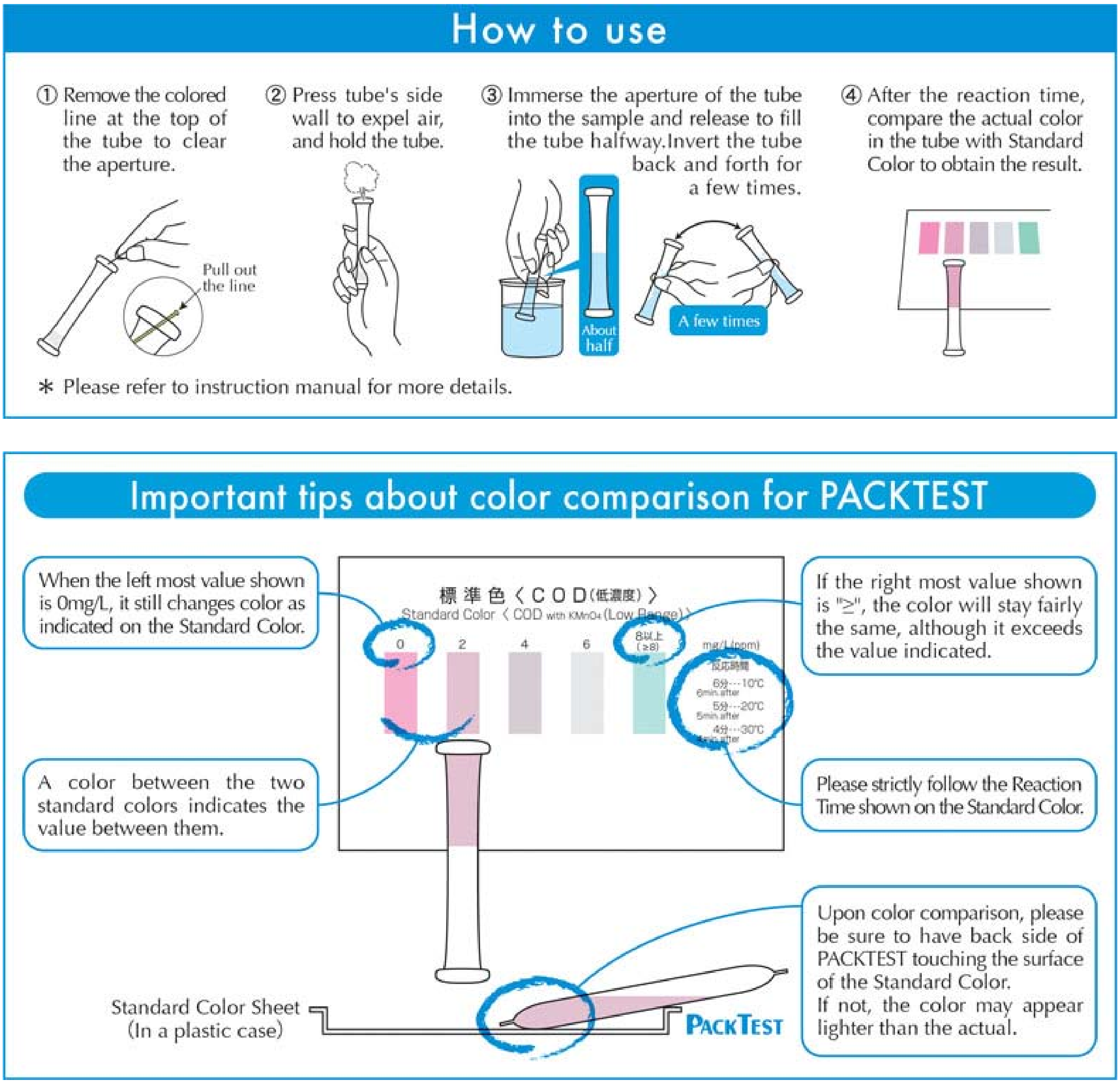
"PACKTEST" is the most simplified analysis instrument for water quality check. Most of the PACKTEST utilize absorptiometry from corresponding Japanese official method (i.e. JIS K 0102) for its reaction principle.

In other cases, there is no absorptiometry set under the official method, meaning that there is no ideal reagent available with high sensitivity and selectivity of objective substance, so we came up with our own ingenuity to add masking and other technique.

The PACKTEST uses the same principle as the official method, the interference from co-existing substances will be similar. Removing the interference by utilizing the pre-treatment under JIS, may be necessary prior to the measurement.

For more further information about the PACKTEST, please see the Web Site of the KYORITSU CHEMICAL-CHECK Lab.,Corp.
(https://www.kyoritsu-lab.co.jp/english/)

The method for utilization of the "PACKTEST" is shown in the following figures.



How to use

① Remove the colored line at the top of the tube to clear the aperture.

② Press tube's side wall to expel air, and hold the tube.

③ Immerse the aperture of the tube into the sample and release to fill the tube halfway.Invert the tube back and forth for a few times.

④ After the reaction time, compare the actual color in the tube with Standard Color to obtain the result.

＊ Please refer to instruction manual for more details.

Important tips about color comparison for PACKTEST

When the left most value shown is 0mg/L, it still changes color as indicated on the Standard Color.

A color between the two standard colors indicates the value between them.

If the right most value shown is "≥", the color will stay fairly the same, although it exceeds the value indicated.

Please strictly follow the Reaction Time shown on the Standard Color.

Upon color comparison, please be sure to have back side of PACKTEST touching the surface of the Standard Color.
If not, the color may appear lighter than the actual.

(Figure and explanation were provided by KYORITSU CHEMICAL-CHECK Lab.,Corp.)

Fig.8. How to use PACKTEST

Photo 10: Water sampling st a discharge point

Photo 11: Water testing using the PACKTEST at site

Conservation and Environment Protection Authority **CEPA**
Mineral Resources Authority **MRA**
Dept. Mineral Policy and Geohazard Management **DMPGM**
Japan International Cooperation Agency **JICA**

Field Inspection Handbook for Mine Waste Management

Tailings Dam and Waste Dump, Environment Monitoring

THE PROJECT FOR CAPACITY DEVELOPMENT
ON MINE WASTE MANAGEMENT
IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA

Supported by Japan International Cooperation Agency
In August 2018

THE PROJECT FOR CAPACITY DEVELOPMENT ON MINE WASTE MANAGEMENT IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA

Independent State of Papua New Guinea
Conservation and Environment Protection Authority

Mineral Resources Authority

DMPGM
Department of Mineral Policy & Geohazards Management

JICA
Japan International Cooperation Agency

Appendix 7

Site Visit Report on Mine Waste Management

1st Site Visit Report

of

Hidden Valley Gold Mine in Morobe Province

17th September 2017

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

1st Site Visit Report
of
Hidden Valley Gold Mine in Morobe Province

17 September 2017

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

1. Introduction

On September 14, 2017, the study team visited Hidden Valley gold mine and gathered information on environmental preservation countermeasures, disposal and management of mine waste, and conducted a simple inspection OJT on the tailings dam.

In September 2010, Hidden Valley Mine began operations by Morobe Mining which is a JV (50:50) company of Newcrest Mining and Harmony Gold Mining. However in October 2016 Newcrest Mining Company withdrew completely, Harmony Gold Mining became sole owner of Hidden Valley Mine.

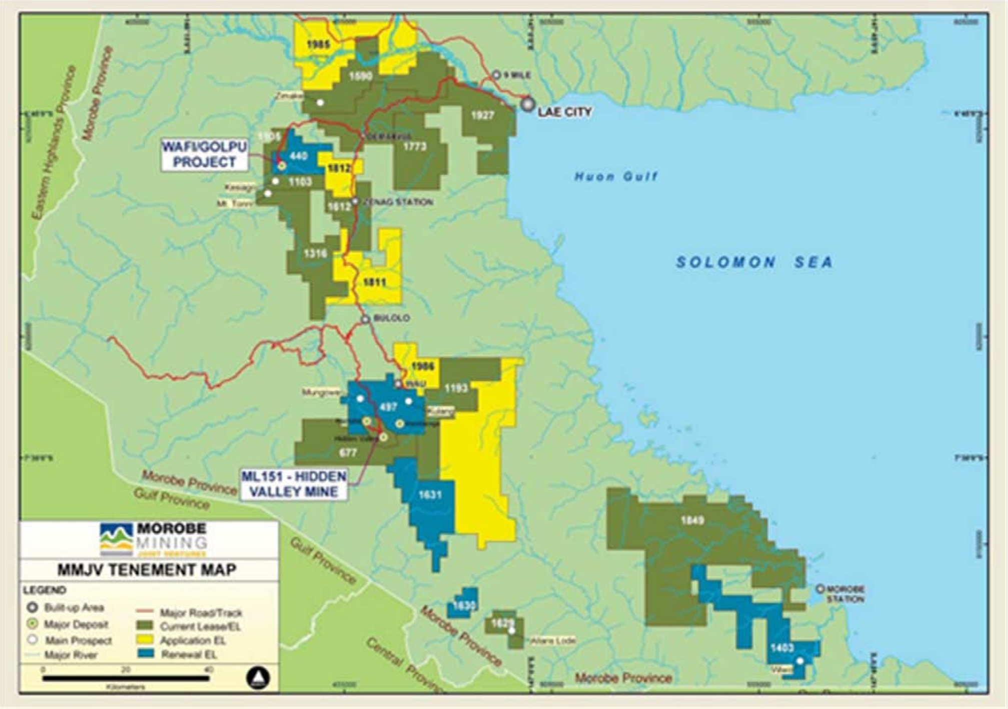


Fig.1 Location map of Hidden Valley Gold Mine

2. Schedule

Sept.13:

- Move to Lae from Port Moresby by air
- Visit UNITEC in order to receive water sampling bottles
- Move to Bulolo from UNITEC for 3 hours by car

Sept.14:

- Move to Hidden Valley Mine from Bulolo
- Visit the discharge point of waste water derived from Tailings dam, and conduct quick measurement of water quality
- Visit Hamata Pit (Because of maintenance of processing plant, no mining work has been done in this pit)
- OJT of inspection of tailing dam
- Visit Hidden Valley Pit

Sept.15: (In addition, alluvial mining sites in Wau were visited)

- Move to Wau from Bulolo
- Visit Small Scale Mining Training Center(SSMTC) of MRA
- Visit Koranga alluvial mining site
- Conduct quick measurement of water quality at Bulolo River and Watut River

Sept.16:

- Back to Port Moresby

3. Participants

1) Mr. Anderson Anjo: CEPA
2) Mr. Robert Sine: CEPA
3) Ms. Margaret Aulda: MRA
4) Mr. Amukele Amukele：MRA
5) Mr. Lars Kuri: MRA
6) Mr. Mitsuo Otake: JICA Study Team
7) Mr. Yoshiaki Shibata: JICA Study Team
8) Mr. Kazuyuki Kadoshima: JICA Study Team
9) Mr. Hirohisa Kobayashi: JICA Study Team

4. Implemented Works and Results

4-1 Outline of Mine operation

- The improvement and maintenance of processing plant are currently conducted and it will re-start operation in December, 2017.
- In the initial plan, Mine life has been 14 years.

- Although the number of employees is usually about 2,000 people, it is presently about 1,200 people because of maintenance and improvement break of the plant.

Geology of mining area and current operation status (information via the internet)

The deposits is made up of two structural zones, Hidden Valley Zone and the Kaveroi Creek Zone. Both zones are classified as a low-sulphidation epithermal gold-silver system. The mine is bounded and structurally controlled by a series of north-west to north-north-west striking fauls in Morobe Granodiorite and the basal contact of Kaindi Metamorphic rocks.

Mineralization is associated with coarse grained pyrite-hematite-magnetite-quartz fracture fill veins with sericite alteration.

Hidden Valley Mine comprises two main pits, located approximately 5km apart, exploiting three main ore bodies named Hamata, Hidden Valley and Kaveroi. The smaller pit exploits the Hamata ore body, whereas the larger pit exploits Hidden Valley and Kavroi gold and silver ore bodies.

Production volume of each year is as follows;

2015	Volumes milled: 1,825,000t, Gold produced: 2,943kg, (Average grade:1.61g/t)
2016	Volumes milled: 1,729,000t, Gold produced: 2,257kg, (Average grade:1.31g/t) Because of disaster due to heavy rain etc., the production was lower than the previous year, as well as the grade.

4-2 Tailings Storage Facility

- Because the tailings dam in Hidden Valley Mine is built in the ridge, there are embankments on both sides of the dam (Main Dam and Saddle Dam).
- No waterproof sheet is laid on the embankments of this dam, and it is structured to discharge the infiltrated water of embankments quickly as shown in Fig.2.
- An open channel is built around the dam on the mountain side.
- Since the construction of the raising of the dam is currently under way, we could not get down to the embankment, and the inspection OJT could not be conducted sufficiently.
- Wastewater and tailings from the floating and smelting plants are all discharged to this dam, and the supernatant water from the dam is mostly recycled as the water of the plants.

Fig.1　Hamata tailings dam (Saddle dam in front, Main dam in the back)

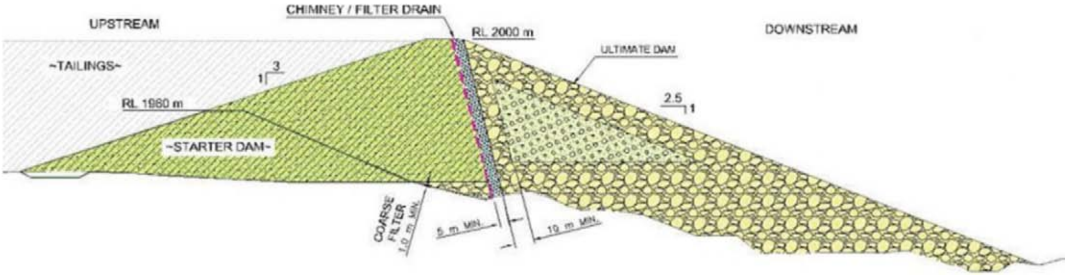


Fig. 2　Schematic design of the embankment of Hamata tailings dam (Murray et al., 2010)

Fig. 3　Construction for heightening of embankment of Main dam

4-3 Quick water quality measurement

- For the waste water from the tailing dam, quick water quality measurement was carried out by “PACKTEST” at the discharge point. The results are shown in Table 1 below. In order to ascertain the accurate value of cyanide compound, we asked UNITEC 's analytical laboratory to analyze the same samples.

Table 2 Results of quick water quality measurements

		UTN coordinate		pH-EC meter			Rapid testing by Pack Test							
Sample number	Sampling location	East	South	pH	EC (ms/m)	Temp (deg C)	Total Metal (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	TCr (mg/l)	CN- (mg/l)	F (mg/l)
KW01	Tailing dam	0377346 m E	9324973 m S	7.63	27.5	25.0	0	<0.5	<0.5	0.1	<0.5	<0.5	<0.02	0
KW02	No.1 settling pond	0377306 m E	9325148 m S	7.58	22.7	25.0	0	<0.5	<0.5	0.1	<0.5	<0.5	<0.02	0
KW03	No.2 settling pond	0377371 m E	9325249 m S	7.62	22.0	25.0	0	<0.5	<0.5	0.1	<0.5	<0.5	<0.02	0
KW04	Kumian Creek, beside of the main office	0376850 m E	9324764 m S	7.42	13.8	25.0	0	<0.5	<0.5	0	<0.5	<0.5	<0.02	0
KW05	Waste water treatment facility nearby mine head	0374371 m E	9320403 m S	3.54	71.8	22.7	>5	5	5	>5	<0.5	<0.5	<0.02	0
KW06	Monitoring point at the river discharged from waste water treatment facility	0374414 m E	9320624 m S	5.76	14.6	24.2	0.5	0.5	<0.5	1	<0.5	<0.5	<0.02	0

5. Summary

- Since it took a while to get permission to enter the mine this time, it was 11 am arriving at the mine office. So we could not have enough time to visit interested facilities for inspection OJT.
- Also, because the embankment of the tailings dam was undergoing raising construction, we could not get down to the embankment for inspection.
- It is necessary to visit the mine once more for conducting inspection OJT again.
- Since the structure of the tailing dam is completely different from that of the Kainantu mine, it is necessary to understand it before conducting an inspection.
- As for the wastewater from the tailing dam, 2 mg / L of cyanide was detected as a result of quick water quality measurement by PAKTEST at the discharge point. We brought same samples to UNITEC's laboratory and analyzed it. As a result, cyanide of 83 μg / L was detected although the value was low.
- Also, in the quick water quality test conducted in the Bulolo River and the Watut River, no abnormality was found in the metal components, but the turbidity was fairly high.

2nd Site Visit Report

of

Hidden Valley Gold Mine in Morobe Province

03 March 2018

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

2nd Site Visit Report
of
Hidden Valley Gold Mine in Morobe Province

03 March 2018

JICA Study Team
(The Project for Capacity Development on Mine Waste Management)

1. Introduction

On February 27th and 28th, 2018, the study team visited Hidden Valley gold mine again and conducted an inspection OJT on the tailings dam and waste dump.

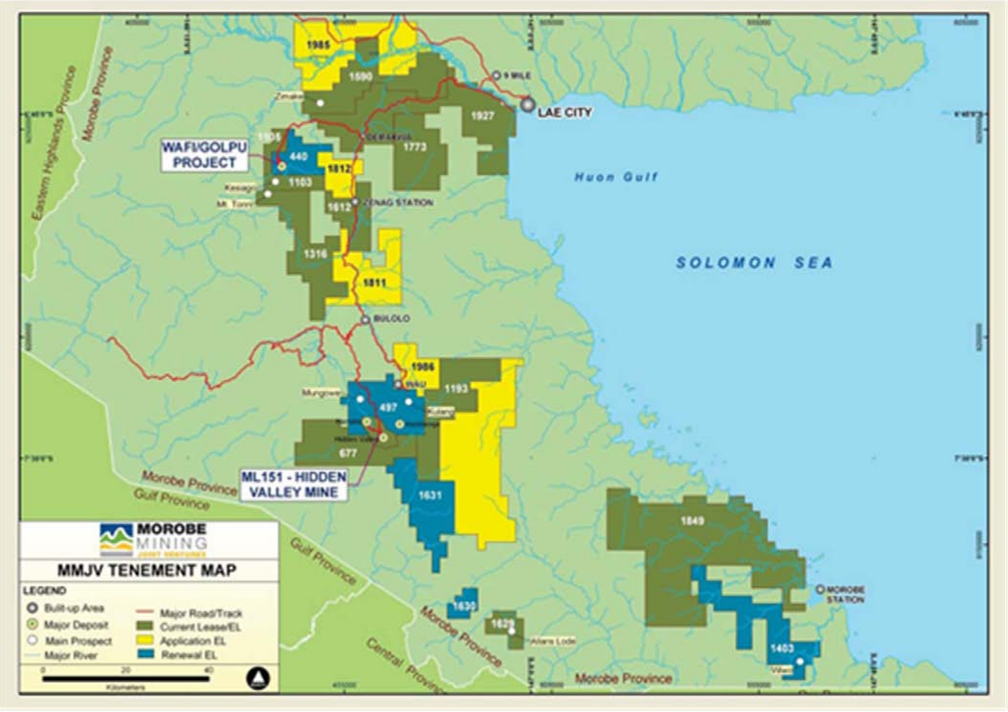


Fig.1　Location map of Hidden Valley Gold Mine

2. Schedule

February 26:

- Move to Lae from Port Moresby by air
- Move to Bulolo from Lae for 3 hours by car

February 27:

- Move to Hidden Valley Mine from Bulolo
- Brief explanation of mine operation by Mr. Douglas Suk, Mining operation manager.
- Detailed explanation of tailings dam and waste dump by Mr. Christian Atkinson, Klohn Crippen Berger (KCB).
- At the Main dam of the tailing dam, we conducted an inspection OJT mainly on the downstream side of the dam.
- At the other Saddle dam, we conducted an inspection OJT on the top of the embankment and the tailings pipeline, and checked also the deposition situation inside the dam.

February 28:

- Visit the Neikwiye and Western Section dumps and conduct inspection OJT.

March 1:

- Move to Lae Airport from Bulolo
- Back to Port Moresby

3. Participants

1) Mr. Anderson Anjo: CEPA
2) Mr. Pitzz Murphy: CEPA
3) Mr. Amukele Amukele: MRA
4) Mr. Asavi Kendua: DMPGM
5) Mr. Seymour Pok: DMPGM
6) Mr. Mitsuo Otake: JICA Study Team
7) Mr. Yoshiaki Shibata: JICA Study Team

4. Implemented Works and Results

4-1 Outline of Mine operation

- Improvement work and maintenance of the plant were conducted during the previous visit. Construction was completed and resumed operation of the plant last December.
- About 2,000 employees at this present, including subcontractors.

Current operation status (information via the internet)

Production volume of each year is as follows;

2015 Volumes milled: 1,825,000t, Gold produced: 2,943kg, (Average grade:1.61g/t)

2016 Volumes milled: 1,729,000t, Gold produced: 2,257kg, (Average grade:1.31g/t)

Because of disaster due to heavy rain etc., the production was lower than the previous year, as well as the grade.

2017 Volumes milled: 2,889,000t, Gold produced: 2,965kg, (Average grade:1.07g/t)

During FY2017, the mine processed ore from the Hamata pit and stockpiles until June 2017 which resulted in the 18% decrease in grade year on year to 1.07g/t.

4-2 Tailings Storage Facility

- Designed capacity of Hamata tailings dam is 34.1 Mt, the accumulation amount up to the present is 22 Mt, therefore the possible depositional amount in the future is 12 Mt.
- For this reason, a construction to increase the capacity to 51 Mt is under planning.
- The structure of the embankment is shown in Fig. 2. Weathering stones are used on the upstream side, fresh rocks are used on the downstream side. Chimney drain is provided in the center of the top of the bank, where the infiltration water from the upstream side is collected and drained to the downstream side.

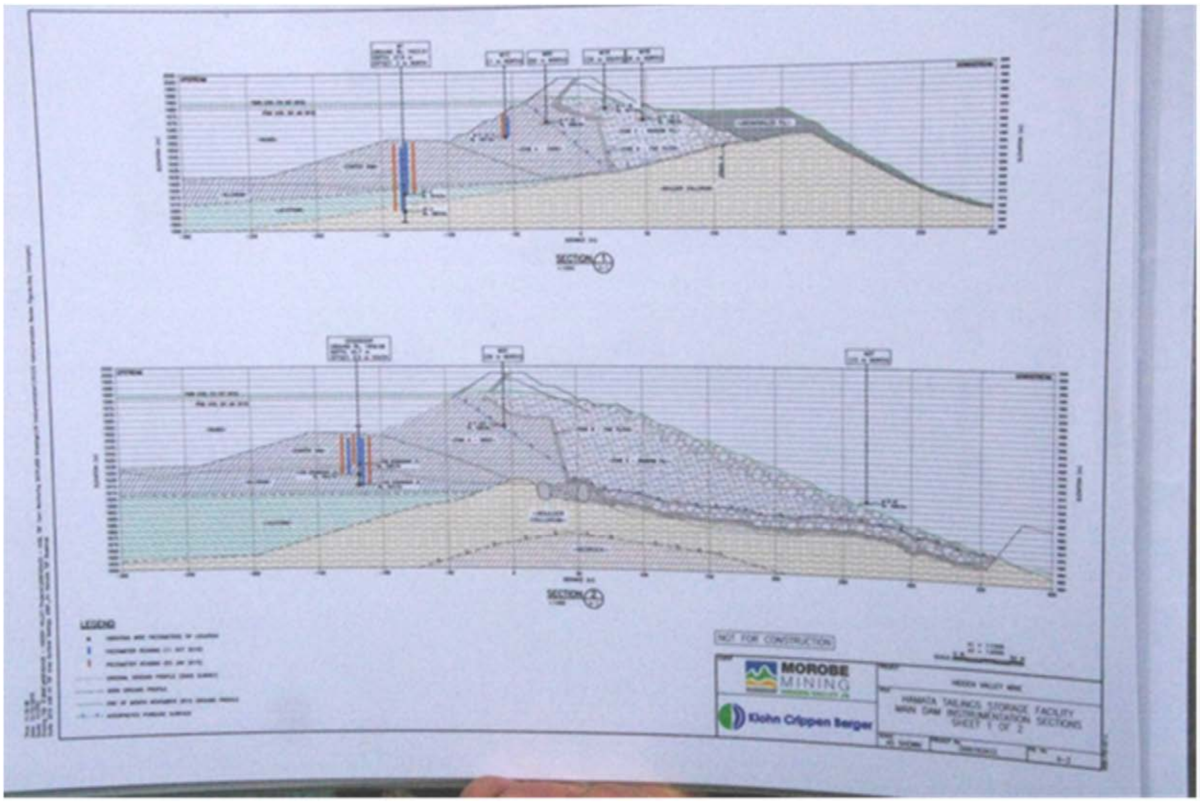


Fig.2 Design of the embankment of Hamata tailings dam

- About 10% of the supernatant water from the dam has been subjected to cyanide detoxification treatment and then released to the river in order to control the amount of water inside the dam. The INCO process is used as a method of detoxification treatment of cyanide, and Caro's Acid (Peroxymonosulfuric acid (H2SO)) is used for treatment of the waste water from the tailings dam before treated water discharge into environment.
- Piezometer, survey mark, and inclinometer were installed in order to monitor the embankment regularly.

Fig.3 Discharging of tailings at the Suddle dam

4-3 Waste dump

- We conducted an inspection OJT at Neikwiye dump and Western Section dump depositing waste rock and soil from Hidden Valley pits.
- After viewing the whole of the two dumps from a high place, we went down to the downstream and conduct an inspection of a conduit underdrain at the tip.
- As shown in Fig.4, underdrains were constructed in order to drain the upstream fresh water that is not in contact with ore. These underdrain are made of fresh bulk rocks that have not been mineralized and spread over 5 m in thickness.
- For the slope of old dumping area, re-vegetation was carried out in order to prevent erosion caused by rainwater.

Fig.4 Underdrain cover by 5m thick NAF (non-acid forming)

5. Summary

- The structure of embankment of the tailing dam is quite different from that of the Kainantu mine.
- In the Kainantu mine, a waterproof sheet is attached to the upstream side of the

embankment so that water does not infiltrate into the embankment, whereas In the Hamata tailing dam, it permits the infiltration of the water inside the embankment on the upstream side, collecting it by the chimney drain, and draining it downstream from the drainage system at the lower part of the embankment (a massive rocky permeable layer).

- Because the structure of the tailings dam is different depending on the mine, it is necessary to inspect it with a good understanding of the structure.
- Thanks to the cooperation of the mine, we could carry out an effective inspection OJT of the tailings dam and the waste dump.

Site Visit Report

of

Kainantu Gold Mine in Eastern Highlands Province

20th February 2017

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

Site Visit Report
of
Kainantu Gold Mine in Eastern Highlands Province

20 February 2017

JICA Study Team
(The Project for Capacity Development on Mine Waste Management)

1. Introduction

In order to carry out the technical transfer of knowledge on inspection of mine wastes and its management, the Kainantu Gold Mine was selected as a model project area accompanying tailings dam. The study team visited the mine site on 13th and 14th Feb. 2017.

Highlands Pacific Limited (HPL) started mining operations on the Irumafimpa deposit in 2005. Barrick (Kainantu) Limited purchased the tenement package from HPL in late 2007 and concentrated on increasing the resources and discovering economic porphyry Cu-Au mineralization. After that, Kainantu Mining Inc. purchased all rights from Barrick (Kainantu) Limited in 2015 and is now preparing for development for commencement of commercial production in 2017. At the same time, mineral exploration of new ore body is being conducted aiming to secure the ore reserve.

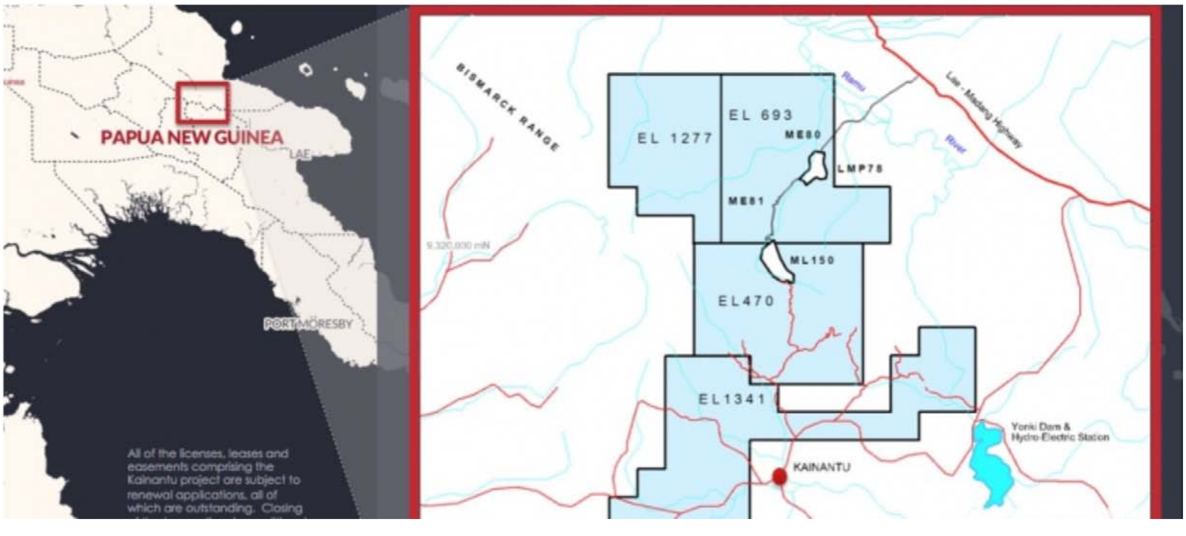


Fig. 1　Location map of Kainantu Gold Mine

2. Schedule

Feb.13:

- Move to Lae from Port Moresby by air
- Safety Induction and general explanation at the office of Kainantu Mining Inc.
- Introduction of this JICA project
- Visit to the tailing dam

Feb.14:

- OJT of inspection of tailing dam
- Quick measurement of water quality in settling pond
- Visit to waste rock dump and waste water treatment facility
- Quick measurement of water quality in waste water treatment facility and downstream of river

Feb.15:

- Back to Port Moresby

3. Participants

1) Mr. Anderson Anjo: CEPA
2) Mr. Pitzz Murphy: CEPA
3) Mr. Bobby Yavi：MRA
4) Mr. Mitsuo Otake: JICA Study Team
5) Mr. Yoshiaki Shibata: JICA Study Team

4. Implemented Works and Results

4-1 Outline of Mine operation

- In the Kainantu mine, gold and silver concentrates are produced by flotation and the concentrate is exported to China and smelted there. Currently it is in the stage of conducting trial operation.
- Therefore, cyanide is not used in this mine.
- The recovery rate by flotation is 97.5 to 98.5%, and the grade of the concentrate is 180 g / t Au.
- Currently mining is conducted to the remainder of the Irumafimpa vein, but it is planning to continue mining by extending the tunnel to the newly developed Kora vein.

Geology of mining area

The K92 mine is located in New Guinea Thrust Belt and consists of metamorphic sedimentary rocks of the early Miocene Bena Bena Formation, the Miocene sedimentary rocks and mild volcanic rocks covering it inconsistently. These strata have intruded by the Akuma intrusive rocks of the Middle Miocene.

The mineral deposits consist mainly of gold, silver and copper bearing vein type of epithermal deposit, but there are also porphyry type copper and gold deposits.

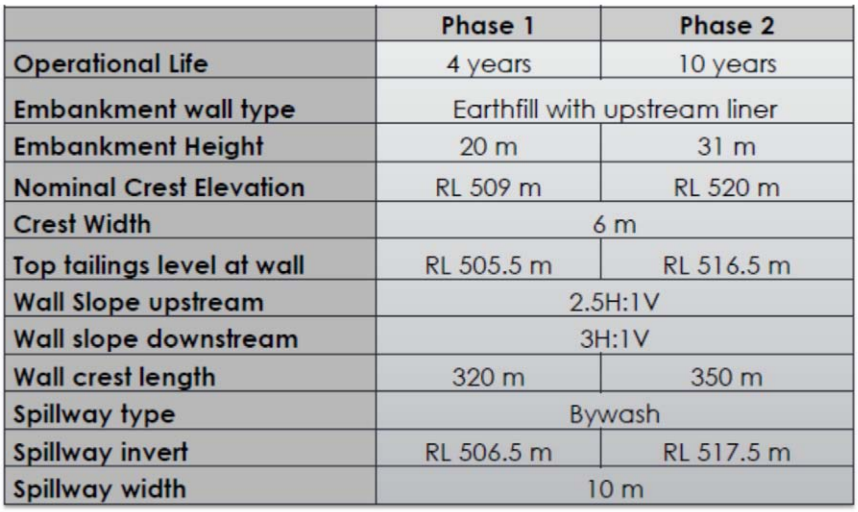
4-2 Environmental protection

- The Kainantu mine inherits the two permits of water collection and wastewater drainage of WE-L3 (13) and WD-L3 (34) of Barrick (Kainantu) Limited.
- Water quality monitoring is carried out monthly as planned.
- Samples of water are collected at the discharge point and the monitoring point and sent to external analysis laboratories (SGS and ALS) for analysis.

4-3 Tailings Storage Facility

- The tailings dam in Kainantu Mine is the first tailings dam built in the PNG in 2005.
- It was designed based on AS (Australian Standard), ASTM (American Society for Testing and Materials) and ANCOLD (Australian National Committee for Large Dams).
- Capacity of the dam is 600,000 m3 and the surface area is 7 ha.
- 95% of the ore used for beneficiation is sent to the dam as tailings.
- The embankment is Earthfill type, and the water-impermeable sheet (High-density polyethylene (HDPE) liner) is laid on the upstream side.
- There are two settling ponds for purifying water accumulated inside the dam and draining it to the river.
- To prepare for heavy rain during operation, an emergency waterway of 10 m width is attached, which also enables continuous drainage after closing

Table 1 Specification of the tailings dam in Kainantu Mine



	Phase 1	**Phase 2**
Operational Life	4 years	10 years
Embankment wall type	Earthfill with upstream liner	
Embankment Height	20 m	31 m
Nominal Crest Elevation	RL 509 m	RL 520 m
Crest Width	6 m	
Top tailings level at wall	RL 505.5 m	RL 516.5 m
Wall Slope upstream	2.5H:1V	
Wall slope downstream	3H:1V	
Wall crest length	320 m	350 m
Spillway type	Bywash	
Spillway invert	RL 506.5 m	RL 517.5 m
Spillway width	10 m	

Fig. 2 Tailings dam in Kainantu Mine under construction

Fig. 3 Current Tailings dam in Kainantu Mine

4-4 Results of quick water quality measurements

- Quick water quality measurements were carried out on the tailings dam and adjacent settling ponds, the water treatment plant for wastewater from the wellhead and the river after it was discharged by “Packtest”.
- The results are shown in Table 2, and no abnormality was observed.

Talbe 2 Results of quick water quality measurements in Kainantu Mine

		UTN coordinate		pH-EC meter			Rapid testing by Pack Test							
Sample number	Sampling location	East	South	pH	EC (ms/m)	Temp (deg C)	Total Metal (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	TCr (mg/l)	CN- (mg/l)	F (mg/l)
KW01	Tailing dam	0377346 m E	9324973 m S	7.63	27.5	25.0	0	<0.5	<0.5	0.1	<0.5	<0.5	<0.02	0
KW02	No.1 settling pond	0377306 m E	9325148 m S	7.58	22.7	25.0	0	<0.5	<0.5	0.1	<0.5	<0.5	<0.02	0
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KW04	Kumian Creek, beside of the main office	0376850 m E	9324764 m S	7.42	13.8	25.0	0	<0.5	<0.5	0	<0.5	<0.5	<0.02	0
KW05	Waste water treatment facility nearby mine head	0374371 m E	9320403 m S	3.54	71.8	22.7	>5	5	5	>5	<0.5	<0.5	<0.02	0
KW06	Monitoring point at the river discharged from waste water treatment facility	0374414 m E	9320624 m S	5.76	14.6	24.2	0.5	0.5	<0.5	1	<0.5	<0.5	<0.02	0

5. Summary

- We received full cooperation from Kainantu mine for this site visit and got a detailed explanation about the operation situation and the approach to the environment.
- The tailing dam was regularly managed such as conducting regular observation of infiltration water level and displacement amount, and no problem was found in any place.
- The mine conduct periodic water quality measurements at sedimentation ponds and monitoring points of rivers, and it has been working on environmental initiatives.
- The waste water discharged from the mine was considerably acidic, and the water in the river was weakly acidic (pH 5.76) even at the downstream monitoring point after draining into the river although it was neutralized by lime. Therefore, careful neutralization by a more reliable facility is desired.

1st Site Visit Report

of

Ok Tedi Mine in Western Province

29th October 2016

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

1st Site Visit Report
of
Ok Tedi Mine in Western Province

29 October 2016

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

1. Introduction

We visited the Ok Tedi mine in Western Province and its related facilities for three days from October 24 to 26, 2016. Site visit was conducted at the Ok Tedi mine of Tabubil, the dredging and dumping area of Bige, and the shipping port of Kiunga in order to gather the information such as the mine operation status, the environmental conservation measures and the disposal and management situation of mine waste.

Ok Tedi mine had been managed by PNG Sustainable Development Program (PNG SDP) and PNG government with a capital ratio of 63.4% and 36.6% respectively after the complete withdrawal of BHP in 2002. However, a revised bill with 100% ownership by the PNG government was passed in September 2013. Operation of the mine is carried out by Ok Tedi Mining Limited (OTML). The employee's own nationality ratio is as high as 97%.

Fig.1 Location map of Ok Tedi Mine

2. Schedule

Oct.24:

- Move to Tabubil from Port Moresby by air
- Visit Mine office. Brief explanation of mine operation and safety induction.
- Visit monitoring points in the Ok Tedi River around Tabubil and conduct quick water quality measurement.

Oct.25: Unfortunately the weather was bad, the mine was not visible in the fog at all.

- Move to Ok Tedi Mine from Tabubil, approx. 1 hour drive, altitude difference about 1,000m
- Safety induction and explanation of mine operations
- Visit pit site and pyrite concentrator
- Move to Bige from Ok Tedi Mine by the charter flight (17 minutes, 3 hours if traveling by car).
- Outline explanation about Bige operations and safety induction
- Visit dredging site in Ok Tedi River and East Bank dumping Area. (did not have enough time to visit to the West bank)
- Move to Kiunga from Bige (about 1 hour by car).

Oct.26: Kiunga is a town along the Fly River, the center of North Fly District of Western Province

- Outline explanation about Kiunga operations and safety induction
- Visit Copper concentrate loading facility, dehydration plant, water quality monitoring well
- Back to Port Moresby

3. Participants

1) Mr. Anderson Anjo: CEPA
2) Mr. Pitzz Murphy: CEPA
3) Mr. Albert Lokalyo: MRA
4) Mr. Mitsuo Otake: JICA Study Team
5) Mr. Yoshiaki Shibata: JICA Study Team
6) Mr. Kazuyuki Kadoshima: JICA Study Team
7) Mr. Hirohisa Kobayashi: JICA Study Team
8) Mr. Ippei Takeda: JICA Study Team

4. Implemented Works and Results

4-1 Outline of mine operation

- 5,000 to 6,000 people live in the center of the Tabubil town, and if the periphery is combined, the population is about twice that.
- The number of mine employees was 2,535 in 2013, but 1,500 as of 2016. It gradually

recovered employment of employees, and International School will resume soon.

- Since the rainfall was low in 2015(especially in August), the water level of the Fly River declined and it was not possible to carry copper concentrate out by ship. So from mid August 2015 until February 2016 the operation of the mine was stopped and it resumed on March 1, 2016.
- 80% of the electricity of the mine is covered by hydraulic power generation (by Ok Menga power station), and the remainder is supplemented with thermal power. As a result, stoppage of operation was due not only to the fall of the Fly River's water level but also to a decrease in the amount of electricity generated. In addition, there is no dam for hydroelectric power generation.
- Production in 2016 is expected 335,000 tons of copper concentrate with copper grade of 25% and gold content of 26 g / t.
- A plan to extend the operation of the mine until 2025 was approved by the government.
- The mine regularly conduct water quality tests by setting 14 monitoring points from the mine to the downstream of the Ok Tedi River.

4-2 Bige operations: dredging

- Since 1998, the Ok Tedi Mine have set up places of 800 m (L) × 250 m (W) × 15 to 20 m (H) in the Ok Tedi River and dredging has been done. The dredged material is placed in stockpiles alongside the river on what are known as the East and West bank stockpiles. East Bank is 400 Ha in size and West Bank is 600 Ha in size.
- The amount of collected materials is 10 Mm^3 per year and the recovering rate of materials is 85% assuming the inflow from the upstream as 100%. The remaining 15% has flowed to the downstream; mainly they are fine sand and mud.
- Downstream river bed level began to decrease due to this dredging, which is approaching the level before the mining development.
- It is planned to conduct a re-vegetation after the stockpile reaches the planned height. As a first step, re-vegetation about 50 ha of East Bank is already in progress.
- The Ok Tedi mine have been conducting research on vegetable species suitable for sandy lands, and how to nurture them, in cooperation with external organizations.
- In the mine, separation and extraction of pyrite from tailings is carried out by flotation in order to reduce environmental impact, and separated pyrite concentrate is sent to Bige by pipeline. In Bige, digging a pond with a depth of 20 m, pyrite is first filled in it, and after the water depth reaching 2 m, it is covered by dredged materials for preventing oxidation of pyrite.
- A monitoring well for groundwater observation is installed in the stockpile, and water quality measurements are carried out on a regular basis.
- At Bige, 318 people including 23 employees of Ok Tedi Mine and 134 employees of Dresco Company doing dredging are engaged.

4-3 Kiunga operation center: shipping

- Kiunga is located along the Fly River. (This river joins the Ok Tedi River downstream)
- Copper concentrate is transported to Kiunga with a pipeline of 157 km from the mine.
- Concentrate with higher moisture content for pipeline transportation is lowered in moisture content (8.5%) by dehydration plant (by filter press) and loaded on ship.
- Concentrate loaded in Kiunga is transported to Port Moresby, where it is transferred to a transport carrier and exported to each country. About 40,000 tons are exported to Japan annually (Japan imports 1 million tons of copper concentrate annually from overseas).
- All goods including diesel used at Ok Tedi Mine are landed at this port and transported to the mine by truck. Kiungha Port is operated by Ok Tedi Mining Company and is an international port where Customs is established.
- Since it deals with copper concentrate and oil, there are monitoring points for water quality inspection of 2 places in the Fly river and 3 places (well) in the plant site.

4-4 Quick water quality measurement

- Quick water quality measurements by “PAKTEST” were carried out at monitoring points in the Ok Tadi River, Ok Menga River, and monitoring wells in Kiunga operation center. The results are shown in the following table, and no abnormality was observed. .

Table 1 Results of quick water quality measurements in Tabubil area (in Ok TediRiver and Ok Menga River)

Sample No	Site Name	Lat	Lon	Elevation (m)	pH	EC (ms/m)	Temp (℃)	Total M (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	TCr (mg/l)	CN− (mg/l)	F (mg/l)
OT−01 W01	Lower OK Tedi Bridge (Ok Tedi River)	−5.29427	141.23244	404	8.06	27.3	23.2	0.5	<0.5	<0.5	0.2−0.5	<0.5	<0.5	<0.02	0
OT−01 W02	Ok Menga Bridge (Ok Tedi River)	−5.36998	141.29454	288	8.17	26.7	24.9	0.5	<0.5	0.5−1	0.5	<0.5	<0.5	<0.02	<0.4
OT−01 W03	Ok Menga River	−5.37125	141.29628	288	8.19	21.9	25.6	0.2	<0.5	<0.5	0.2	<0.5	<0.5	<0.02	0

Table 2 Results of quick water quality measurements at Kiunga Operation Center

Sample No	Site Name	Lat	Lon	Elevation (m)	pH	EC (ms/m)	Temp (℃)	Total M (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	TCr (mg/l)	CN− (mg/l)	F (mg/l)
KN−01 W01	Kiunga Operation Center	−6.12405	141.29623	17	6.69	103.5	25.0	0	<0.5	<0.5	0.2	<0.5	<0.5	<0.02	0

5. Summary

- We got full cooperation from the Ok Tedi Mine.
- The Ok Tedi mine has regularly monitored by setting monitoring points in various places, and we felt the circumstance that the mine is seriously facing environmental conservation measures.
- The mine is located where the limestone with an altitude of approximately 1,700 m shows a steep terrain and the surrounding area is a heavy rain area with annual rainfall exceeding 10,000 mm (even in Yakushima, where annual precipitation is the largest in Japan 5,000 to 6,000 mm). For this reason, it seems quite difficult to manage mine waste materials by means of a tailings dam.
- The mine has been studying and implementing environmental measures in cooperation with Australian and American organizations in the past, and would like to respond positively to the introduction of new technologies in the future.
- It is thought that the Ok Tedi Mine is suitable as a test site for technology transfer to CEPA because of various observation sites in terms of environment.
- The mine is also hoping to exchange the idea with CEPA, and we would like to hope that this project will be utilized in that respect as well.

Photographs

Group picture in the fog at Ok Tedi mine

Confluence of Ok Tedi R. and Ok Menga R.

Copper concentrate pipeline (left) and a larger pyrite concentrate pipeline (right) at the Ok Menga bridge

Kiunga's pipeline terminal part where copper concentrate reaches

Dredger at Bige

Stockpile in Bige : re-vegetation in progress

Monitoring wells installed at the Bige stockpile

Monitoring wells installed at the Kiunga operation center

Filter press at the Kiunga operation center

Dehydrated copper concentrate is carried to this storage warehouse

2nd Site Visit Report

of

Ok Tedi Mine in Western Province

10th February 2017

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

2nd Site Visit Report
of
Ok Tedi Mine in Western Province

10 February 2017

JICA Study Team
(The Project for Capacity Development on Mine Waste Management)

1. Introduction

We visited the Ok Tedi mine in Western Province and its related facilities again for four days from February 3 to 6, 2017. Site visit was conducted at the Ok Tedi mine site, the dredging and dumping area of Bige, and the shipping port of Kiunga.

Ok Tedi mine had been managed by PNG Sustainable Development Program (PNG SDP) and PNG government with a capital ratio of 63.4% and 36.6% respectively after the complete withdrawal of BHP in 2002. However, a revised bill with 100% ownership by the PNG government was passed in September 2013. Operation of the mine is carried out by Ok Tedi Mining Limited (OTML).

Fig.1 Location map of Ok Tedi Mine

2. Schedule

Feb.3:

- Move to Tabubil from Port Moresby by air
- Visit Mine office. Brief explanation of mine operation and safety induction.
- Visit Moscow, Vancouver and Taranaki waste dump areas.

Feb.4:

- Conduct quick water quality measurement of waste water containing tailings at the beneficiation plant and quick water quality measurement together with turbidity measurement on wastewater from the Pit and in river.
- Conduct turbidity measurement and quick water quality measurement at various points of Ok Tedi River on the way to move to Kiunga.

Feb.5:

- Conduct survey at Bige on a day trip from Kiunga.
- Visit West Bank stockpile and conduct quick water quality measurements at various places

Feb.6:

- Conduct quick water quality measurement together with turbidity measurement in Fly river
- Back to Port Moresby

3. Participants

1) Mr. Anderson Anjo: CEPA
2) Mr. Lars Kuri: MRA
3) Mr. Albert Lokalyo: MRA
4) Mr. Mitsuo Otake: JICA Study Team
5) Mr. Yoshiaki Shibata: JICA Study Team
6) Dr. Kazuyuki Kadoshima: JICA Study Team
7) Mr. Yukihiro Kondo: JICA PNG office

4. Implemented Works and Results

4-1 Site visit of waste dump areas

- We visited Moscow, Vancouver and Taranaki waste dump areas.
- The amount of waste rock reaches about 150 Mt per year. The deposition method is a drop off deposition type.
- The waste rock is dropped in the valley by the bulldozer, immediately after being carried by dump truck from the Pit.

Fig. 1 Moscow waste rock dump in Ok Tedi Mine

4-2 Quick water quality measurement of waste water from the Pit and in Ok Tedi River

- The water accumulated in the Pit is dropped into the underground drainage channel and is released without any treatment to the Ok Tedi River. The result of quick water quality measurement shows pH 5.73.
- However, the measurement result of Ok Ningi Creek (tributary of Ok Tedi River) after the discharge point of Pit wastewater shows pH 8.13.
- As a result of quick water quality measurement at five locations on the Ok Tedi River downstream from the Tabubil, no component abnormality was observed, but the turbidity was more than 880 N.T.U even near Bige, It was far beyond the standard 25 N.T.U. For Fly River in Kiunga measured for reference, it was 0 to 12 N.T.U.

Table 1　Results of quick water quality measurement

					pH-EC meter		Turbidity meter		rapid testing by Pack Test							
sample number	Site Name	East	South	elevation (m)	pH	EC (ms/m)	Turbidity	Temp (deg C)	Total Metal (mg/l)	Mn (mg/l)	Cu (mg/l)	Zn (mg/l)	Ni (mg/l)	TCr (mg/l)	CN- (mg/l)	F (mg/l)
OW01	Pyrite process plant	516947.88 m E	9424462.17 m S	1638	10.11	187.2	>880	26.1	0.1	<0.5	<0.5	0	<0.5	<0.5	0.02 to 0.05	0.8
OW02	OkNingi creek	520898.03 m E	9423373.96 m S	906	8.13	13.5	22	20.2	0.2	<0.5	<0.5	0.2	<0.5	<0.5	<0.02	0
OW03	Entrance of Tunnel to Center Pit	518867.53 m E	9423794.68 m S	1234	5.73	110.9	231	24.1	>5	2	0.5	>5	<0.5	<0.5	<0.02	1.5 to 3
OW04	Broken bridge	525742.90 m E	9414760.02 m S	405	8.08	30.5	>880	21.9	0	<0.5	<0.5	0.2	<0.5	<0.5	<0.02	0
OW05	OkMenga river	532580.17 m E	9406328.81 m S	287	-	-	3.5	20.7	-	-	-	-	-	-	-	-
OW06	JCT with OkMenga river	532394.11 m E	9406228.97 m S	286	-	-	770 to 870	21.5	-	-	-	-	-	-	-	-
OW07	Ningerum footbridge	517560.49 m E	9375374.67 m S	82	8.12	25.7	>880	25.0	0.2	<0.5	<0.5	0.2	<0.5	<0.5	<0.02	0
OW08	Pit 3	512475.26 m E	9341322.29 m S	32	10.32	87.4	nearly 0	32.4	0	<0.5	<0.5	0.2	<0.5	<0.5	<0.02	0
OW09	Center of Pit 3 (Feeding Pipe)	512286.60 m E	9340992.47 m S	31	10.52	90.6	nearly 0	31.9	0	<0.5	<0.5	0	<0.5	<0.5	<0.02	0
OW10	northern part of SLOT	514037.00 m E	9342424.00 m S	25	-	-	>880	25.9	-	-	-	-	-	-	-	-
OW11	Dome	512031.47 m E	9345970.46 m S	31	8.12	19.2	>880	25.2	0	<0.5	<0.5	0	<0.5	<0.5	<0.02	0
OW12	Fly river	533142.00 m E	9322773.00 m S	24	7.14	9.2	0 to 12	26.0	-	-	-	-	-	-	-	-

4-3 Sit visit of West Bank stockpile in Bige and quick water quality measurement

- In the mine, extraction of pyrite from the tailings is carried out by flotation in order to reduce environmental impact, and pyrite concentrate is sent to Bige by pipeline.
- In Bige, digging a pond with a depth of 20 m, pyrite is first filled in it, and after the water depth reaching 2 m, it is covered by dredged materials for preventing oxidation of pyrite.
- As a result of quick water quality measurement at Pit-3 filling pyrite concentrate currently, although no component abnormality was observed, the pH is 10 or more, which is almost the same value as the wastewater at the beneficiation plant.

Fig. 2　Deposition of pyrite concentrate in Pit-3 at Bige

5. Summary

- In Ok Tedi Mine, Moscow, Vancouver and Taranaki waste rock dumps are located. The amount of waste rock reaches about 150 Mt per year. The deposition method is a drop off deposition type.
- Waste rocks are dropped in the valley by the bulldozer, immediately after being carried by dump truck from the Pit.
- As a result of quick water quality measurement at five locations on the Ok Tedi River downstream from the Tabubil, no component abnormality was observed. But the turbidity was more than 880 N.T.U even near Bige, It was far beyond the standard 25 N.T.U.
- It is too irresponsible to just say that only wastewater is discharged into the river and diluted without any treatment other than separating pyrite. It will also leave problems in the future due to accumulation of precipitates containing heavy metals on the river bottom and the ocean.
- Therefore, we recommend setting future targets for water quality improvement in mine site and implementing countermeasures.

1st Site Visit Report

of

Mt. Sinivit Gold Mine in East New Britain Province

28th October 2016

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

1st Site Visit Report
on Mt. Sinivit Gold Mine in East New Britain Province

28 October 2016

JICA Study Team
(The Project for Capacity Development on Mine Waste Management)

1. Introduction

In order to carry out the technical transfer of knowledge on inspection of mine wastes and its management, it is necessary to select model project areas where on-site job training shall be conducted. The Mt. Sinivit Gold Mine was recommended by the MRA as a good choice for an abandoned model project area. The study team visited the mine site on 13th Oct. 2016.

2. Location

The Mt. Sinivit Gold Mine is located SSW of Kokopo in the Baining Mountains of the Gazelle Peninsula, East New Britain Province. It is about 52kms by road from Kokopo and can be reached in about 2 hours by vehicle.

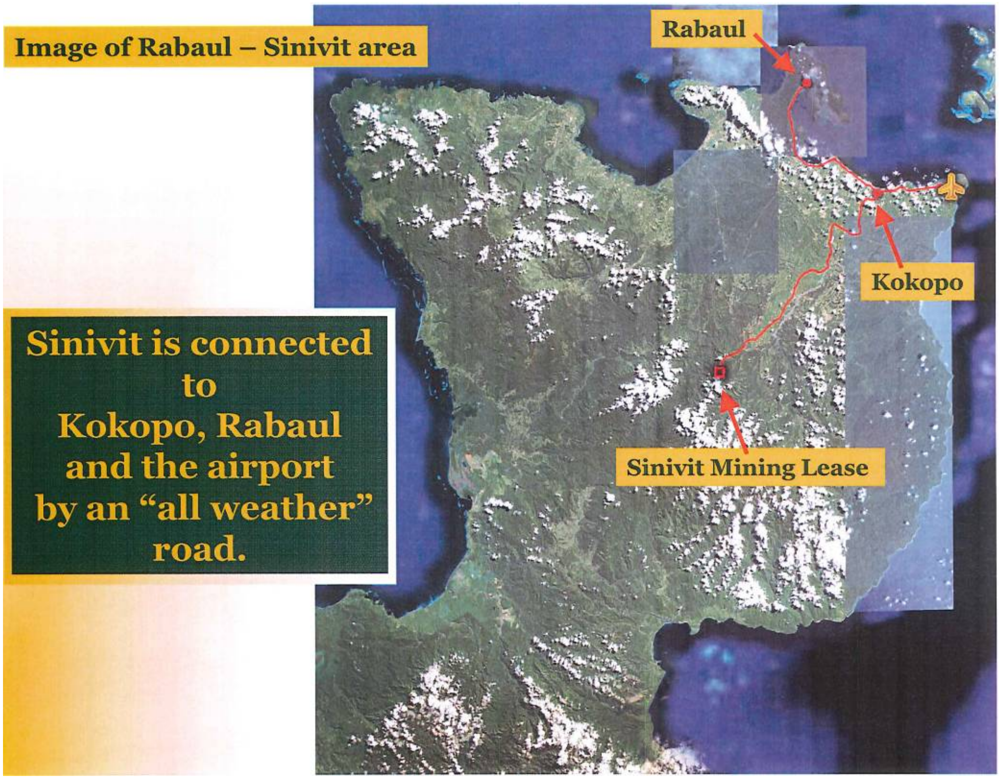

Fig.1 Location map of Mt. Sinivit Gold Mine

The topography of the mine site is very steep and ranges from an elevation of approximately 850m to 1,000m. Flat areas are generally limited to the tops of ridges.

3. Overview of the Gold Mine Project

3-1 Mineralization

The auriferous quartz vein mineralization (Wild dog oxide gold mineralization) lies along a ridge in the headwaters of the Nengmutka and Rapmarina Rivers. The mineralization is hosted by a flat-lying sequence of sandstone, conglomerate and lesser mudstone of volcanic origin.

3-2 Mine development overview

Below is a chronological order of events that happened at Mt. Sinivit:

- **2005:** New Guinea Gold Limited (NGG), a PMG incorporated corporate company and wholly owned subsidiary of New Guinea Gold Corporation took over from Macmin (PNG) as operator and manager of the Sinivit project.
- **2006:** The construction of mine facilities started.
- **2007:** Mining and processing commenced and the first gold was produced. A total of 448.9 ounces of gold and 31.79 ounces of silver were produced from three vats that had been constructed and used for ore processing. These vats were Vat 1, 1A and 1C.
- **2008:** Full production phase of the project commenced with a total of 6,753.18 ounces of gold and 1,173.96 ounces of silver produced during the year. A total of six vats were undergoing leaching and these were Vats 1, 1A, 1C, 2, 3 and 4. Three (3) vats including vats 1, 1A and 1C got completely leached out. Eventually vats 1 and 1A were decommissioned and detoxified. Vat 4 was then constructed overlying all previous vats..
- **2009:** Production continued with a total of 6,359.98 ounces of gold and 968.2 ounces of silver produced for the year. A total of nine vats were under leaching while three more vats (2, 4 and A) finished leaching during that year. The remaining vats in B, C, D, H, I, J, K, M and N continued.
- **2010:** Mining continued with a total production of 5,892.53 ounces of gold and 826.87 ounces of silver produced during the year. By this year, there were a total of 11 vats and 2 heaps under leaching. Five new vats and two heaps were further constructed also in the same year. These vats were Vats 5, E, F, L, G and Heaps I and 3.
- **2011: Mining** continued with a total production of 6,400 ounces of gold and 2,222 ounces of silver. By 2011,a total of seven vats and seven heaps were under leaching.
- **2012:** Mining continued with a total production of 1,163.66 ounces of gold and 1,110.99 ounces of silver produced so far until the end of June 2012.

Statistics and total production to the end of June 2012 is as follows:

- Gold : 27,018.25 ounces
- Silver : 6,333.81 ounces
- Ore Mined : 518,125 tones with 3.91 g/t Au
- Waste Mined : 1,086,201 tones
- Total Number of Vats : 23
- Total Number of Heaps : 11

The mine abruptly closed in July 2014; however no statistics/data is available between then and back to the end of June 2012.

3-3 Gold Extraction Method Used.

The extraction method applied to retrieve gold was the Heap leaching – CIC (Carbon In Column) process. The flow sheet shown in Figure 2 shows the CIC process that was used at Mt. Sinivit Gold Mine..

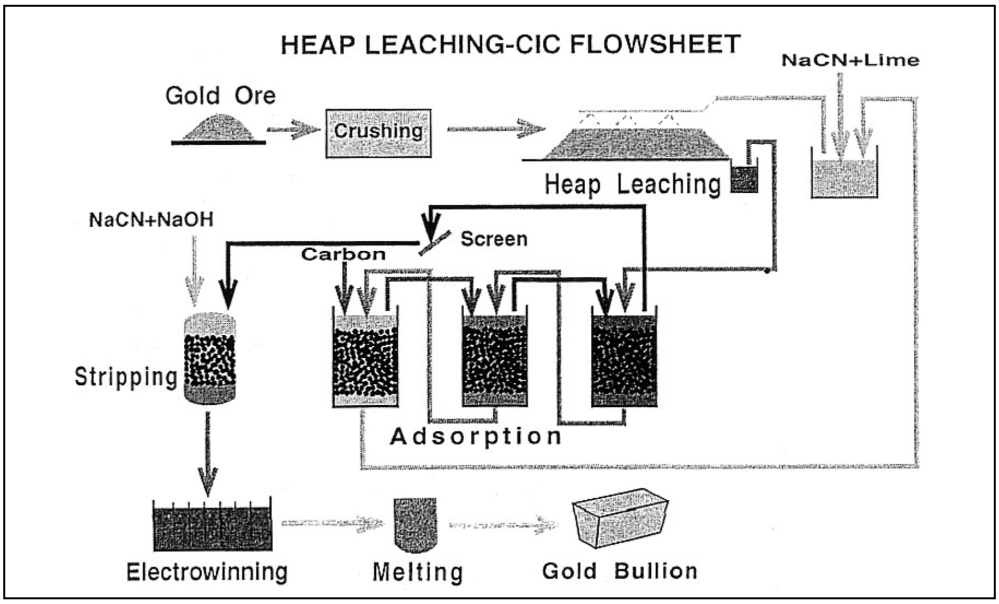

Fig. 2 Flow sheet showing Heap Leaching-CIC(Carbon In Column) process

Cyanide in solution was pumped to the top of the heaps (or vats) by pipes and sprayed onto the ore by using sprinklers. This is the most conventional method of extracting gold and it is called the "Heap Leaching Process". The pregnant solution from the heap (and vat) is collected and the gold and silver in the pregnant solution are recovered by absorption in columns packed with carbon. This method is called "Carbon In Column (CIC)". Gold and silver are stripped from the carbon with a hot alkaline cyanide solution in the stripping process. In order to shorten the reaction time, the stripping operation is carried out at high pressure.

The layout of the Mt. Sinivit Gold Mine is shown in Fig. 3 and the photograph of vat construction is shown in Fig. 4.

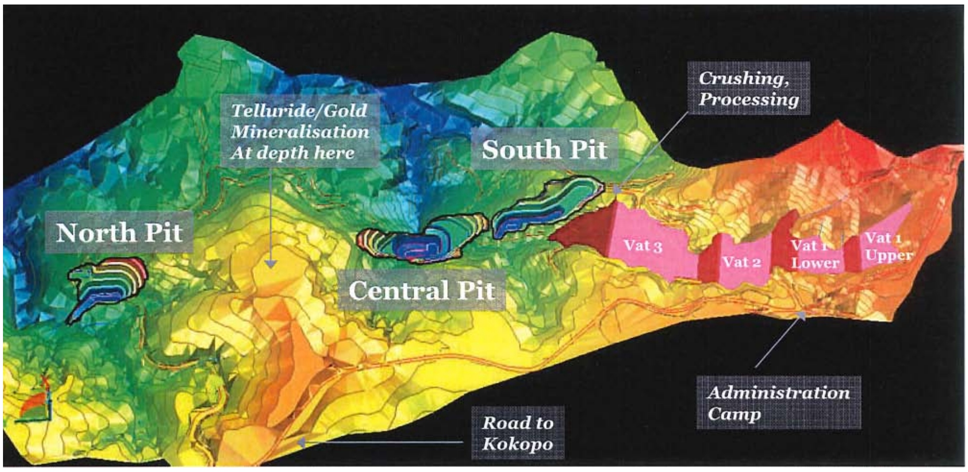

Fig.3 Layout of Mt. Sinivit Gold Mine

Fig. 4 Vat construction

4. Objectives of site visit

The preliminary survey was conducted In order to select model project areas where on-site job training for inspection of mine wastes and it's management is carried out. We further intended to have the abandoned facilities and neglected refuse and mine wastes tested and checked..

5. Results

It took about 2 hours by road from Kokopo to site with the easement section of the road very rough. We were further compounded by heavy downfall in the afternoon which reduced the survey team's inspection work on site to about less than an hour. Spot-on water quality measurements were conducted in one of the heap-vat facilities (photo 1) using the Mobile Pack Testing Kit.

The analytical results of the Pack Test revealed that seepage beside the heap (photos 3 and 4) is rather acidic and contains lots of cyanide and high concentrations of heavy metals such as copper as shown in Table 1.

Photo. 1 Heap and Vat

Photo. 2 Pumping well of pregnant solution

Photo. 3 Seepage beside of Heap

Photo. 4 Quick measurement by Pack Test

Other quick measurements were also carried out at the small retention pond at the mine site and further at the confluence of the Rapmarina Creek and the Worangoi River about 10kms downstream of the mine site.

As shown in table 1, the results from the seepage pond and water at Warangoi confluence are both nearly neutral and are well below the detection limits of cyanide and copper. The results at the heap and vat areas however, show acidic conditions with cyanide level @ 0.3mg/L and copper more than 10mg/L.

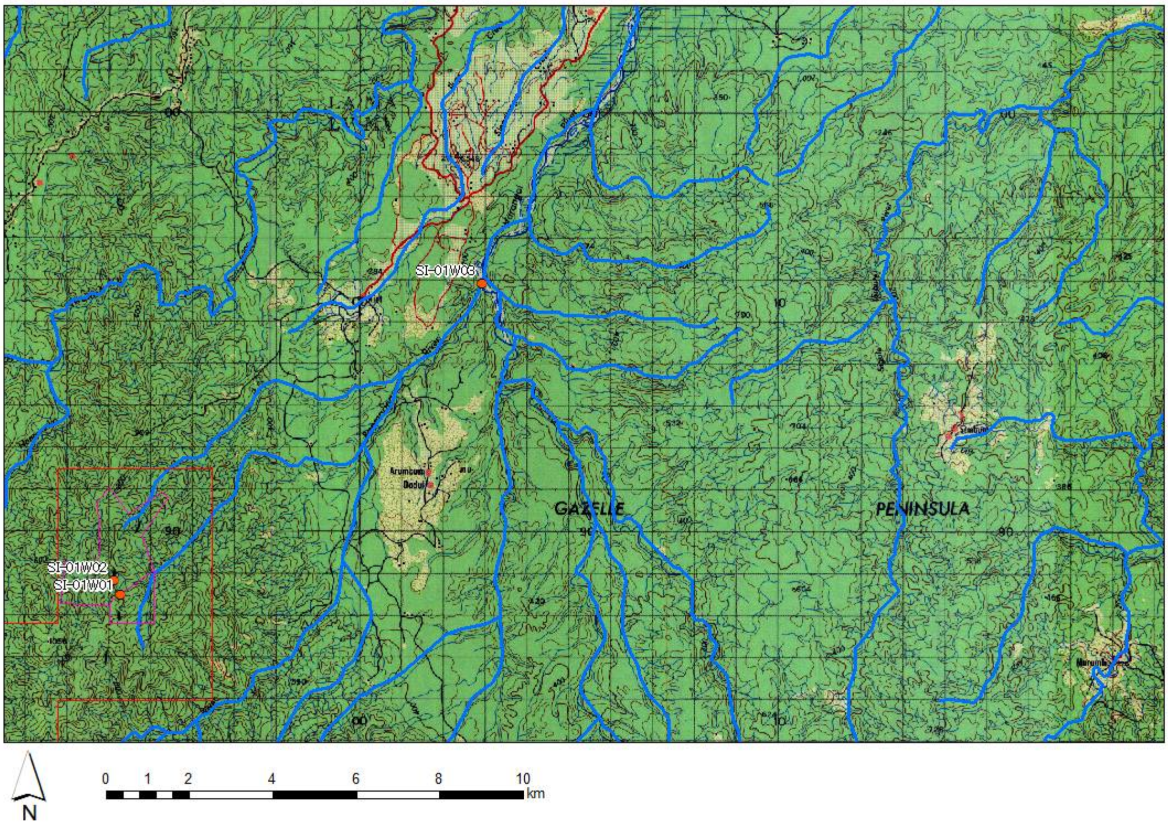

Fig. 5　Location map of quick measurement by Pack Testing Kit

Table 1　Results of quick measurement on site

Sample No	**Site Name**	**Lat. (deg S)**	**Lon. (deg W)**	**pH**	**EC (ms/m)**	**Temp (deg C)**	**ME mg/l**	**Mn mg/l**	**Cu mg/l**	**Zn mg/l**	**Ni mg/l**	**TCr mg/l**	**CN- mg/l**	F mg/l
SI-01W01	Beside of Heap	-4.6267697	152.046740	3.80	162.2	27.7	5<	5	10<	5	<0.5	<0.5	0.3	0.2
SI-01W02	Small retension pond	-4.6242489	152.04540	6.69	21.30	23.2	0.3	<0.5	<0.5	0.5	<0.5	0.5	<0.02	0
SI-01W03	Confluence of the Rapmarina Cr. and the Warangoi R.	-4.5595426	152.124883	7.60	10.53	25.0	0.1	<0.5	<0.5	0.1	<0.5	<0.5	<0.02	0

- pH, EC and Temp were measured by a potable measurement equipment.

- Elements were measured by the "Pack Test".

-ME : total metal

6. Future Plan

- Mt. Sinivit Gold Mine is abandoned with some of the heaps and vats sprayed upon or filled with cyanide solution and are still remaining there without proper decommissioning and rehabilitation. Locals living around the mine site should therefore be cautious and keep away from having close contact with chemicals such as cyanide.
- CEPA and MRA should take responsibility to educate people accordingly.
- Since the provincial government was quite cooperative and the road access is not too bad, it is recommendable for the project team to take Mt. Sinivit Gold Mine area as one of the model project areas for on-site job training for inspection of mine wastes and mine wastes management.
- During the next visit to PNG in February 2017, the survey team will involve actual transfer of skills and technical knowledge in the area of mine waste management and delineate the anomalous zone around the mine site after further quality checking of water and soil.

2nd Site Visit Report

of

Mt. Sinivit Gold Mine in East New Britain Province

10th February 2017

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

2nd Site Visit Report of Mt. Sinivit Gold Mine in East New Britain Province

10 February 2017

JICA Study Team
(The Project for Capacity Development on Mine Waste Management)

1. Introduction

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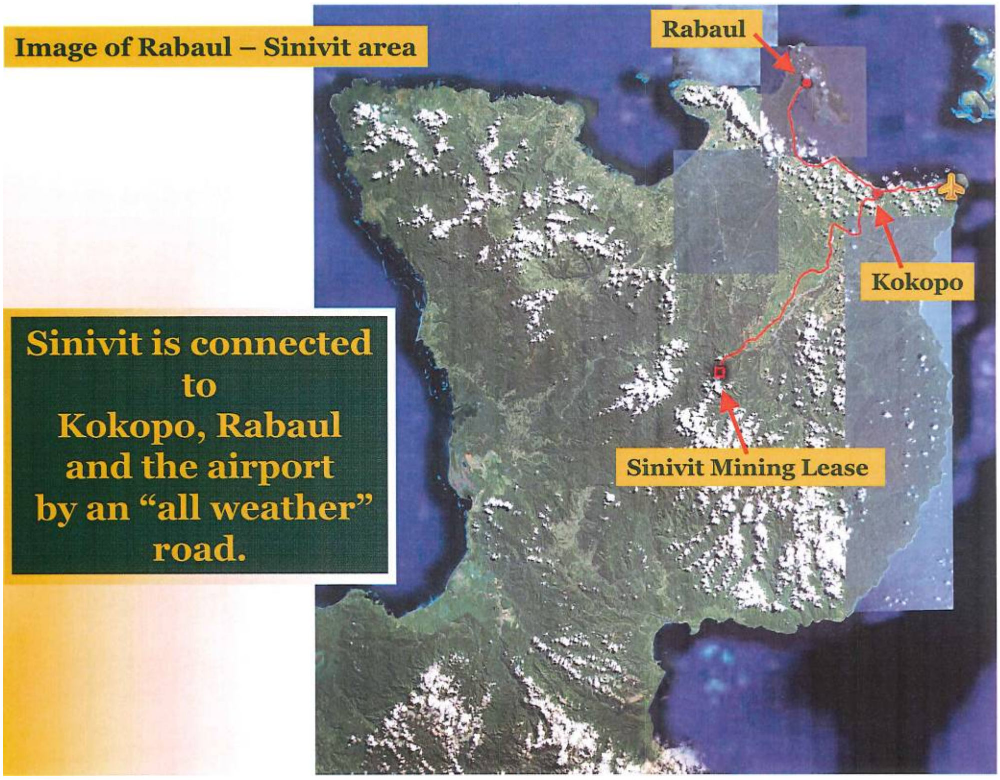

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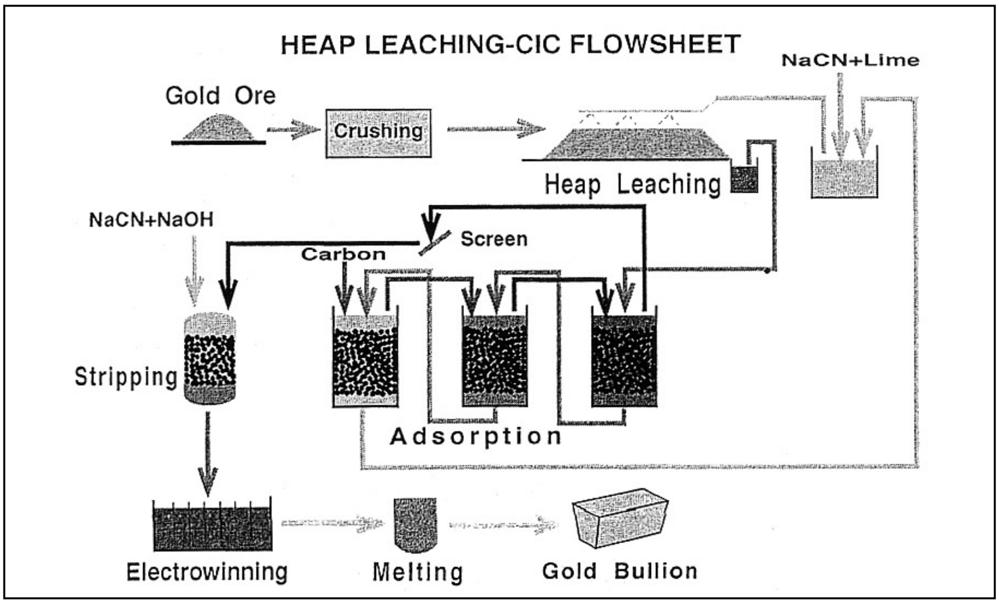

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The layout and overview of the Mt. Sinivit Gold Mine are shown in Fig. 3 and Fig. 4 respectively.

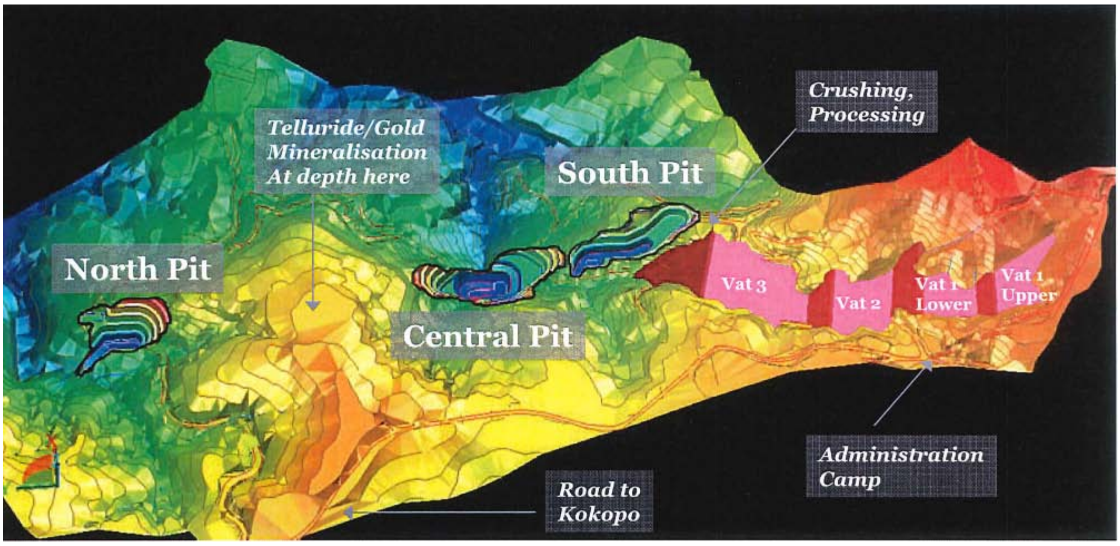


Fig.3 Layout of Mt. Sinivit Gold Mine

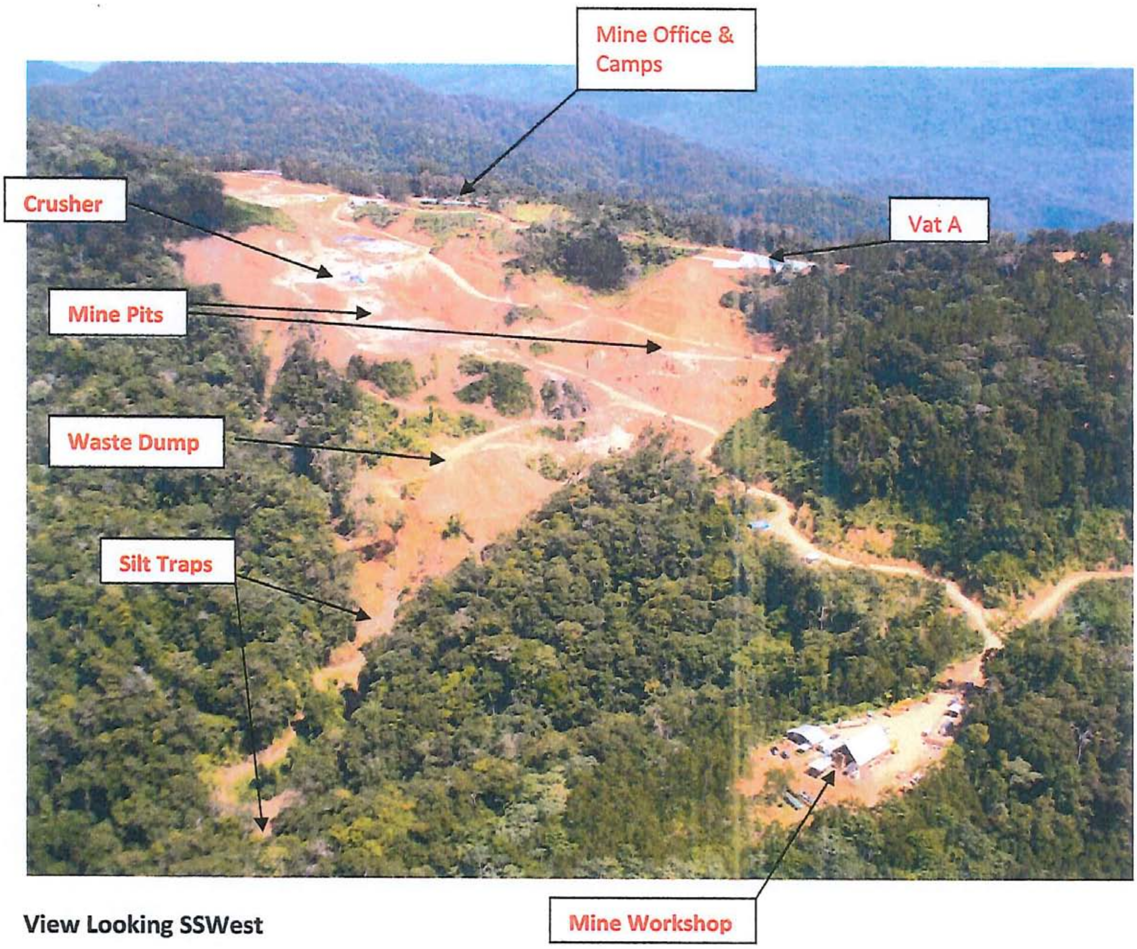
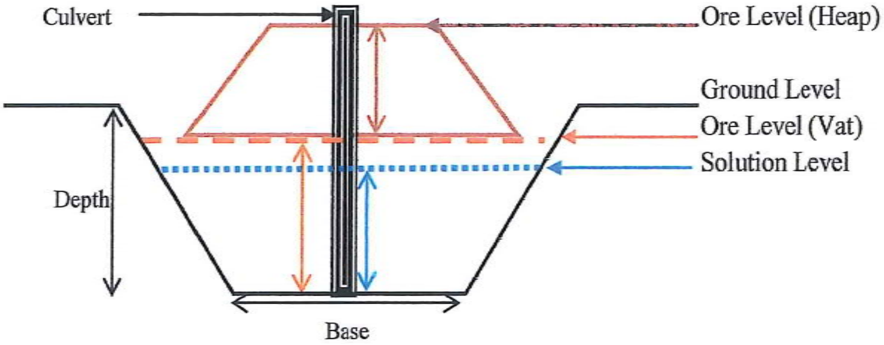


Fig. 5 Overview of Mt.Sinivit Gold Mine; Looking SSWest

Photographs showing a vat under construction (Fig 5) and the schematic model of Vat/Heap (Fig 6). .

Fig. 5 Vat construction



1. Solution level indicated is for vats only
2. For heaps built on vats, solution level can be in line with ground level

Fig. 6 Schematic model of Vat/Heap

4. Objectives of site visit

Last year's investigation of the Sinivit mine was limited by bad weather, hence the survey team's main aim of the present visit was to cover the mine area as much as possible, conducting water quality measurements, sampling of waste water and monitoring of the river flows. The survey was also intended to take measurements of mine wastes at different locations of the project site, including down the river system purposely for comparison purposes.

5. Implemented Works and Results

5-1 Mine site observation

(1) Vat/Heap

According to local residents, a total of seventeen (17) Vats/Heaps are located in the mine. During the recent visit, only seven (7) Vats/Heaps were observed and measurements taken. This includes vats E, F, G, 2, 5, H and K. Each Vat/Heap has 3 to 4 wells for pumping up the leachate . This leachate is pumped up through the wells and passes through sheets of carbon columns where the gold is absorbed. As seen in the photos below, pools of water can be seen within the vats and around the Heap areas.

Photo 1: Vat/(Heap) G

Photo 2: Pumping well of leachate in Vat E

Photo3: Seepage pool besides Vat/(Heap) E

Photo 4: Abandoned carbon columns

(2) Containment ponds for detoxification

Two containment ponds were constructed for the detoxification of cyanide solution. The Big pond is located below the crushing plant area and the Small pond is located below the Vat/Heap H and K, as shown in Photos 5 and 6 respectively.

Photo 5: Big pond

Photo6: Small pond

(3) Open pit

Overview of open pit is shown in Photos7 and 8.

Photo 7: Main pit

Photo8: Main pit.

5-2 Quick measurement by “Pack Test” Kit

Spot-on water quality measurements were conducted in and around the Vat/Heap facilities and in selected creeks using the Mobile Pack Testing Kit. pH and conductivity measurements were also taken using the pH meter. The locations where the measurements were taken are shown in Figures 5 and 6. Table 1 shows the analytical results of the Pack Test.

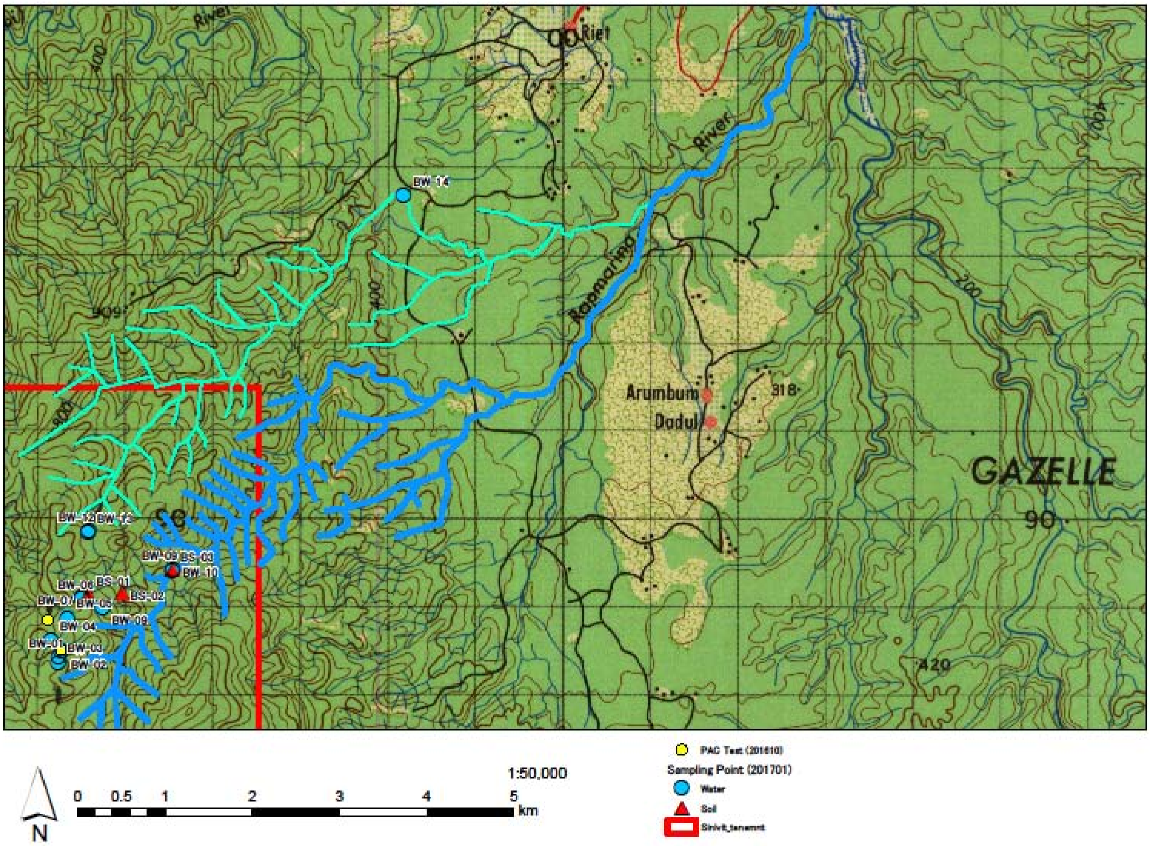


Fig. 6: Location map of quick measurement by “Pack Test” Kit around mine site

Table 1　Results of quick measurement on site

Sample No	Site Name	East (m)	South (m)	Height (m)	pH	Temp (℃)	EC (ms/m)	CN^- (mg/l)	TCr (mg/l)	Zn (mg/l)	F (mg/l)	Ni (mg/l)	Mn (mg/l)	Cu (mg/l)	Total M (mg/l)
BW-01	Vat E (Extraction well #3)	394236.19	9488407.11	1059	4.5	23.7	30.8	<0.02	<0.5	>5	0.4	<0.5	<0.5	1	>5
BW-02	Vat E (pool beside vat E)	394270.46	9488493.05	1044	3.88	30.6	15.55	<0.02	<0.5	1	0	<0.5	<0.5	2	2
BW-03	Vat G (pool beside vat G)	394231.16	9488349.06	1056	6.7	27.2	42	0.03	<0.5	0.2	0	<0.5	<0.5	<0.5	0.2
BW-04	Vat 2 (pool beside vat 2)	394145.62	9488606.42	1014	6.62	27.2	65.6	0.03	<0.5	0.5	0.4	<0.5	<0.5	1	1
BW-05	Big Pond	394337.64	9488857.86	960	6.6	26.1	7.7	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0
BW-06	Discharged water from Small Pit	394494.00	9489073.00	892	4.9	23.5	14.81	<0.02	<0.5	0.5	0	<0.5	<0.5	<0.5	1
BW-07	Interfluent small creek into Pit	394501.95	9489090.02	892	7.3	22.9	18.4	<0.02	<0.5	0.5	0	<0.5	<0.5	<0.5	0.4
BW-08	Foot of Waste Dump	394739.61	9488969.39	837	6.66	23.1	20.1	<0.02	<0.5	0.3	0	<0.5	<0.5	<0.5	0.5
BW-09	Velelka Creek	395532.00	9489402.00	700	7.68	22.2	9.38	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0.2
BW-10	Magaman Creek (after junction)	395544.00	9489408.00	700	7.74	21.9	11.47	<0.02	<0.5	0.3	0	<0.5	<0.5	<0.5	0.2
BW-11	Magaman Creek (before junction)	395545.42	9489378.29	700	7.83	21.8	11.78	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0.1
BW-12	VAT H	394582.91	9489847.19	989	6.93	23.8	60.3	-	-	-	-	-	-	-	-
BW-13	Small Pond	394569.29	9489833.68	989	6.44	24.8	2.03	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0.2
BW-14	Mandiu Creek	398172.00	9493681.00	318	7.72	23.6	14.87	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0

- pH, EC and Temp were measured by a potable measurement equipment.

- Elements were measured by the "Pack Test" kit.

-Total M : total metal

Photo. 9: Quick spot measurements by using the Pack Test

Photo.10 Measurement in Ivaram Creek

Photo.11 Measurement in Ivaram Creek (foot of waste rock dump)

Photo.12 Measurement in Mandiu Creek

According to the results of the quick measurements done on site by using the Pack Test Kit, the following observations were made:

1) Cyanide was detected in the pool of water at only two locations; that is at Vat/Heaps G and 2. (BW-03 and Bw-04 in Table 1)
2) The pool besides Vat/Heap E had a cyanide reading of 0.3mg/l during the previous visit, however was under detection limit during the current visit. (Refer to BW-1 in Table 1)
3) Main reason for the above results is due to the wet season which had a dilution effect on the results.
4) The two containment ponds show no anomalous features in the water quality results apart from the slightly lower pH values.
5) Discharged water from the pit (BW-06) are rather acidic, however the Ivaram Creek at the foot of Waste Rock Dump did not show any value which is of concern to the aquatic life forms and for human health.
6) Measurements taken at the Magaman Creek (BW-10, 11) and Mandiu Creek (BW-14) indicate natural water quality conditions with normal pH of between 6 – 7. No cyanide was detected.
7) Generally, the water quality results in the surveyed areas are of no real concern because the samplings were done during a wet season. However, the sites within the immediate vicinity of mine do pose some level of threats to humans.
8) From the site inspections, it was noted that the wells in the Vat/Heaps are rather big in diameter. It is therefore recommended that they should be buried..

5-3 Chemical analysis of soil samples

Three soil samples were collected for chemical analysis in and around mine site areas as shown in Fig.5. These samples were sent to UNITEC's NATSL for chemical analysis.

Photo.13 Soil sampling

6. Future Plan

- Mt. Sinivit Gold Mine is abandoned with some of the heaps and vats sprayed upon or filled with cyanide solution and are still remaining there without proper decommissioning and rehabilitation. Locals living around the mine site should therefore be cautious and keep away from having close contact with chemicals such as cyanide.
- CEPA and MRA should take responsibility to educate people accordingly.
- Since the provincial government was quite cooperative and the road access is not too bad, it is recommendable for the project team to take Mt. Sinivit Gold Mine area as one of the model project areas for on-site job training for inspection of mine wastes and mine wastes management.
- Since the trip was taken during a wet season, it is recommended that the next visit and samplings will be done during a dry season.

Appendix Participant List for 2nd Site Visit of Sinivit Gold Mine

affiliation	name	title
JICA Study Team	Mr. Yoshiaki Shibata	Team Representative, Technical Expert – MWM inspection
JICA Study Team	Dr. Kazuyuki Kadoshima	Assistant Leader – Database Construction
JICA Study Team	Mr. Mitsuo Ohtake	Technical Expert – MWM inspection
JICA Study Team	Mr. Ippei Takeda	Technical Expert – Database Construction
CEPA	Mr. Pitzz Murphy	Principal Scientist
CEPA	Mr. Anderson Anjo	Senior Scientific Officer
MRA	Mr. Lars Kuri	Compliance / Technical Assessment Officer
MRA	Mr. James Larry Norum	Project Coordinator – Sinivit Mine
Landowner Association	Mr. David Joseph	Chairman – Sinivit Landowner Association
Landowner Association	Mr. Ephraim Bali Rupen	Vice Chairman – Sinivit Landowner Association
Landowner Association	Mr. Mesack Panu	Committee Member – Sinivit Landowner Association
Landowner Association	Mr. Alois Kivuna	Treasurer – Sinivit Landowner Association
East New Britain Provincial Government	Ms. Jane Larme	Environmental Health & Safety Officer
East New Britain Provincial Government	Ms. Sharon Tubal	DPI Officer
East New Britain Provincial Government	Mr. Hosea Kunat	Commerce & Industry Business Development Officer
Kokopo Police Station	Mr. Essau Narapal	Senior Sergeant
Kokopo Police Station	Mr. Charles Sila	Senior Constable
Kokopo Police Station	Mr. Andrew Nasaza	Senior Constable
Kokopo Police Station	Mr. Steven Marita	Senior Constable

3rd Site Visit Report

of

Mt. Sinivit Gold Mine in East New Britain Province

27th September 2017

JICA Study Team

(The Project for Capacity Development on Mine Waste Management)

3rd Site Visit Report
of Mt. Sinivit Gold Mine in East New Britain Province

27 September 2017

JICA Study Team
(The Project for Capacity Development on Mine Waste Management)

1. Introduction

In order to carry out the technical transfer of knowledge on inspection of mine wastes and its management, the Mt. Sinivit Gold Mine was selected as a good choice for an abandoned model project area. We have conducted survey trips to the mine site on two occasions; once in October 2016 and the other in January 2017 (cf. Appendix 2 “2nd Site Visit Report of Mt. Sinivit Gold Mine in East New Britain Province”). During field assessments in the previous visits free-cyanide was detected at several points around Vat/Heap areas, although was not detected at points around the detoxification ponds and creeks running through and/or drain out from this area..

The study team (cf. Appendix 1) re-visited the abandoned mine site on the 31st August and 1st September 2017 to confirm the situation in/around mine site during the height of dry season for comparing with results of the previous visits which were done during the wet moonson period. .

2. Current situation

2-1 Vat/Heap

The schematic model of Vat/Heap facility is shown in Figure 1. As previously reported, according to local residents, a total of seventeen (17) Vat/Heap facilities are located in the mine area. During the previous visits, only seven (7) Vats/Heaps which includes E, F, G, 2, 5, H and K, were observed. Each Vat/Heap has 3 to 4 wells for pumping up the leachate. This leachate is pumped up through the wells and passing through sheets of carbon columns where the gold is absorbed.

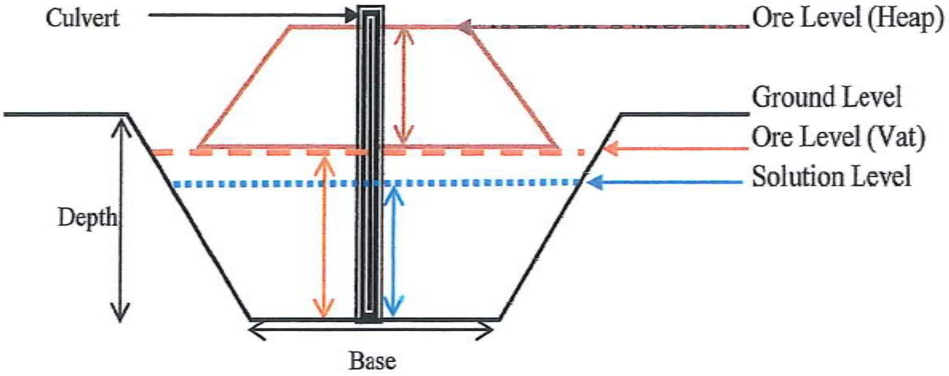


Figure 1 Schematic model of Vat/Heap facility

The water levels (the depth from top of heap indicated as “Ore Level (Heap)” in Figure 1 to water level shown as “Solution Level” in Figure 1) are slightly lower in VAT G and 2 and almost same in VAT E (e.g. Table 1, photo 1).

Table 1　Water level and depth of culvert

water level and depth of curbert			top to water level (m)	top to base (m)	Zone	Easting (mE)	Southing (mS)	height (m)
VAT G	Well 1	Jan-17	3.0	4.3	56M	394236.19	9488407.11	1059
		Sep-17	3.1	4.5				
	Well 2	Jan-17	3.0	4.3	56M	394231.44	9488390.52	1059
		Sep-17	3.0	4.2				
VAT 2	Well 1	Jan-17	4.2	5.7	56M	394128.32	9488599.66	1018
		Sep-17	4.4	5.5				
	Well 2	Jan-17	4.2	5.2	56M	394116.45	9488604.84	1018
		Sep-17	4.8	5.2				


January 2017

September 2017

Photo 1　Water Level measurement at Vat/Heap E

2-2 **Detoxification Containment Ponds.**

Two containment ponds were constructed for the purposes of detoxifying the cyanide solution. The “Bigger pond” is located below the crushing plant area and the “Smaller one” is located just below the Vat/Heaps H and K, as shown in the two respective photos below. The water levels are almost the same between January and September in both the Big pond and Small ponds..

Photo 2 Big pond

Photo 3 Small pond

2-3 Creek

The water levels of creeks such as the Velelka and Magaman that emanate from/around the mine site are almost same as that of the previous visit, but the water current is slower than January's. Further, the average turbidity of the creeks is quite lower than that in January.

Photo 4 Water flow of the Magaman Creek

3. Water Quality testing

3-1 Quick measurement by “Pack Test” Kit

On - the - Spot water quality measurements were conducted in and around the Vat/Heap facilities and in selected creeks using the Mobile Pack Testing Kit. The pH and conductivity measurements were also taken using the pH meter. The locations where the measurements were taken are shown in Figure 2. The analytical results of the Pack Test done in January and September 2017 are shown in Table 2. In addition, the water samples collected from the mine site were dispatched to the NATSL of UNITECH (National Analysis Testing Service Ltd. of Papua New Guinea University of Technology). The water quality analytical results are shown in Table 3 below. The Quick measurements taken using the “Pack Test” kit are als provided in Table 2 below..

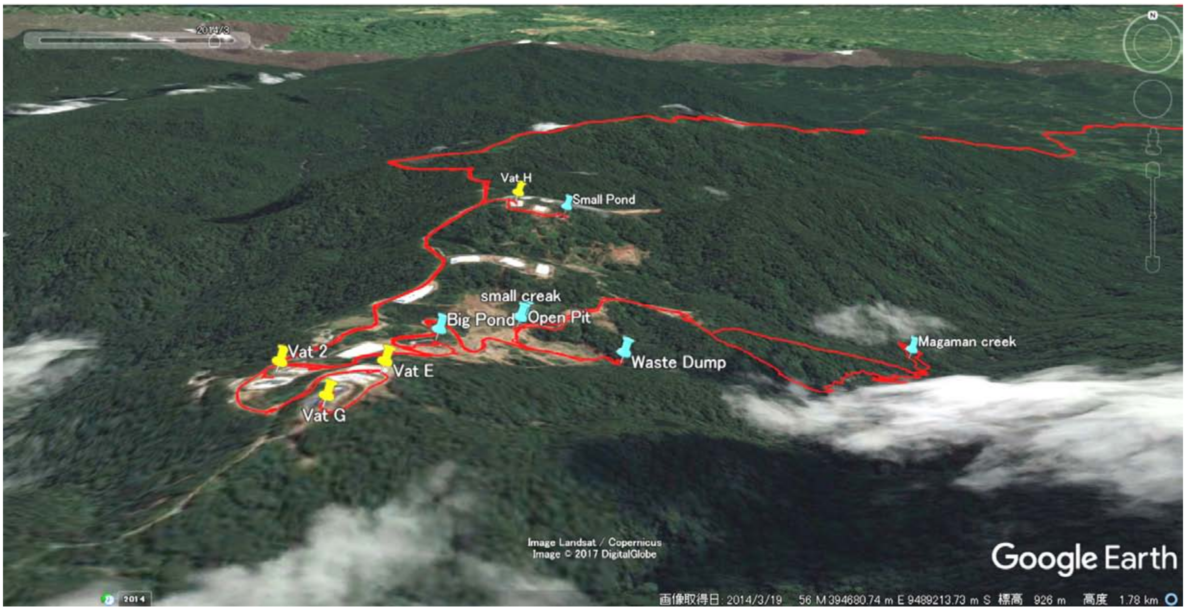


Figure 2: Location map of quick measurement by “Pack Test” Kit around mine site

(Free-cyanide was detected at the points shown as yellow pin, and not detected at the points shown as blue pin.)

Table 2 Results of quick measurement on site

Sample No	Site Name		East (m)	South (m)	height (m)	pH	Temp (deg C)	EC (ms/m)	CN$^-$ (mg/l)	TCr (mg/l)	Zn (mg/l)	F (mg/l)	Ni (mg/l)	Mn (mg/l)	Cu (mg/l)	Total M (mg/l)	Turbi rity	Date
BW-01	Vat E (Extraction well #3)	Jan-17	394,236.19	9,488,407.11	1,059	4.50	23.7	30.8	<0.02	<0.5	>5	0.4	<0.5	<0.5	1.0	>5	29.0	2017/1/26 10:53
		Sep-17	394,277.64	9,488,512.52	1,052	4.63	24.6	25.5	<0.02	<0.5	>5	0	<0.5	<0.5	<0.5	>5	19.4	2017/8/31 11:49
BW-02	Vat E (pool beside vat E)	Oct-16				3.80	27.7	162.2	0.30	<0.5	>5	0.2	<0.5	5.0	>10	>5	-	2016/10/13 11:00
		Jan-17	394,270.46	9,488,493.05	1,044	3.88	30.6	15.6	<0.02	<0.5	1.0	0	<0.5	<0.5	2.0	2.0	8.0	2017/1/26 11:23
		Sep-17	394,273.56	9,488,497.37	1,049	3.68	38.1	96.6	<0.02	<0.5	>5	0	<0.5	2.0	>10	>5	0.5	2017/8/31 11:46
BW-03	Vat G (pool beside vat G)	Jan-17	394,231.16	9,488,349.06	1,056	6.70	27.2	42.0	0.03	<0.5	0.2	0	<0.5	<0.5	<0.5	0.2	3.6	2017/1/26 11:45
		Sep-17	394,229.60	9,488,351.38	1,058	6.80	31.8	36.3	<0.02	<0.5	0.5	0	<0.5	<0.5	<0.5	0.5	1.0	2017/8/31 12:10
BW-04	Vat 2 (pool beside vat 2)	Jan-17	394,145.62	9,488,606.42	1,014	6.62	27.2	65.6	0.03	<0.5	0.5	0.4	<0.5	<0.5	1.0	1.0	25.7	2017/1/26 12:32
		Sep-17	394,147.28	9,488,607.64	1,013	4.94	32.7	56.4	0.05	<0.5	0.5	0	<0.5	<0.5	5.0	>5	2.8	2017/8/31 13:28
BW-05	Big Pond	Oct-16				6.69	23.2	21.3	<0.02	<0.5	0.5	0	<0.5	<0.5	<0.5	0.3	-	2016/10/13 13:00
		Jan-17	394,337.64	9,488,857.86	960	6.60	26.1	7.7	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0	7.1	2017/1/26 13:12
		Sep-17	394,341.52	9,488,859.74	959	6.86	31.8	7.2	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0	0.5	2017/8/31 14:11
BW-06	Discharged water from Small Pit	Jan-17	394,494.00	9,489,073.00	892	4.90	23.5	14.8	<0.02	<0.5	0.5	0	<0.5	<0.5	<0.5	1.0	65.3	2017/1/26 13:40
		Sep-17	394,500.64	9,489,075.31	890	6.87	26.8	19.9	<0.02	<0.5	1.0	0	<0.5	<0.5	0.5	2.0	6.5	2017/8/31 14:45
BW-07	Interfluent small creek into Pit	Jan-17	394,501.95	9,489,090.02	892	7.30	22.9	18.4	<0.02	<0.5	0.5	0	<0.5	<0.5	<0.5	0.4	33.5	2017/1/26 14:00
		Sep-17	394,506.50	9,489,086.71	891	7.31	24.9	23.9	<0.02	<0.5	0	0	<0.5	<0.5	<0.5	0	0.0	2017/8/31 14:53
BW-08	Foot of Waste Dump	Jan-17	394,739.61	9,488,969.39	837	6.66	23.1	20.1	<0.02	<0.5	0.3	0	<0.5	<0.5	<0.5	0.5	98.0	2017/1/26 14:46
		Sep-17	394,737.70	9,488,989.73	843	6.78	23.0	25.7	<0.02	<0.5	2.0	0	<0.5	2.0	<0.5	2.0	40.0	2017/9/1 15:29
BW-09	Velelka Creek	Jan-17	395,532.00	9,489,402.00	700	7.68	22.2	9.4	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0.2	34.0	2017/1/27 11:35
		Sep-17	395,531.97	9,489,402.04	726	7.60	22.4	11.3	<0.02	<0.5	0	0	<0.5	<0.5	<0.5	0	4.3	2017/9/1 13:32
BW-10	Magaman Creek (after junction)	Jan-17	395,544.00	9,489,408.00	700	7.74	21.9	11.5	<0.02	<0.5	0.3	0	<0.5	<0.5	<0.5	0.2	35.0	2017/1/27 11:45
		Sep-17	395,543.94	9,489,408.02	725	7.80	22.3	13.2	<0.02	<0.5	0	0	<0.5	<0.5	<0.5	0	5.0	2017/9/1 13:35
BW-11	Magaman Creek (before junction)	Jan-17	395,545.42	9,489,378.29	700	7.83	21.8	11.8	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0.1	50.8	2017/1/27 11:55
		Sep-17	395,544.98	9,489,378.07	726	7.90	22.3	13.9	<0.02	<0.5	0	0	<0.5	<0.5	<0.5	0	9.4	2017/9/1 13:30
BW-12	VAT H	Jan-17	394,582.91	9,489,847.19	989	6.93	23.8	60.3									12.1	2017/1/27 15:00
		Sep-17	394,436.00	9,489,895.00	1,028	7.38	23.5	70.5	0.10	<0.5	0.5	0	<0.5	<0.5	<0.5	0.5	5.4	2017/8/31 15:41
BW-13	Small Pond	Jan-17	394,569.29	9,489,833.68	989	6.44	24.8	2.0	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0.2	23.2	2017/1/27 14:32
		Sep-17	394,588.47	9,489,837.25	979	6.69	27.0	2.0	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0	15.3	2017/8/31 16:02
BW-14	Mandiu Creek	Jan-17	398,172.00	9,493,681.00	318	7.72	23.6	14.9	<0.02	<0.5	0.2	0	<0.5	<0.5	<0.5	0	6.4	2017/1/27 16:18

pH, EC and Temp were measured by a potable measurement equipment. Elements were measured by the "Pack Test" kit. Total M : total metal

Table 3 Water Quality Analytical Results by NATSL of UNITECH with quick measurement result on site

Sample No	Site Name	East (m)	South (m)	height (m)	pH	Temp (deg C)	EC (ms/m)	Turbirity		CN^- (mg/l)	TCr (mg/l)	Zn (mg/l)	Mn (mg/l)	Cu (mg/l)	As (mg/l)	Cd (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (mg/l)	F (mg/l)	Ni (mg/l)	Total M (mg/l)	Date
BW-01	Vat E (Extraction well #3)	394,277.64	9,488,512.52	1,052	4.63	24.6	25.5	19.4	PACK TEST	<0.02	<0.5	>5	<0.5	<0.5	-	-	-	-	-	0	<0.5	>5	2017/8/31 11:49
									NATSL	*<10 μg/L*	*<0.0002*	*4.37*	*0.82*	*0.26*	*<0.0002*	*<0.0001*	*1.3*	*<0.0002*	*<0.0002*	-	-	-	
BW-02	Vat E (pool beside vat E)	394,273.56	9,488,497.37	1,049	3.68	38.1	96.6	0.5	PACK TEST	<0.02	<0.5	>5	2.0	>10	-	-	-	-	-	0	<0.5	>5	2017/8/31 11:46
									NATSL	*<10 μg/L*	*<0.0002*	*0.347*	*6.8*	*16*	*<0.0002*	*<0.0001*	*1.4*	*<0.0002*	*<0.0002*	-	-	-	
BW-03	Vat G (pool beside vat G)	394,229.60	9,488,351.38	1,058	6.80	31.8	36.3	1.0	PACK TEST	<0.02	<0.5	0.5	<0.5	<0.5	-	-	-	-	-	0	<0.5	0.5	2017/8/31 12:10
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*0.11*	*0.18*	*<0.0002*	*<0.0001*	*0.077*	*<0.0002*	*<0.0002*	-	-	-	
BW-04	Vat 2 (pool beside vat 2)	394,147.28	9,488,607.64	1,013	4.94	32.7	56.4	2.8	PACK TEST	0.05	<0.5	0.5	<0.5	5.0	-	-	-	-	-	0	<0.5	>5	2017/8/31 13:28
									NATSL	*<10 μg/L*	*<0.0002*	*0.0029*	*0.78*	*5.1*	*<0.0002*	*<0.0001*	*0.20*	*<0.0002*	*<0.0002*	-	-	-	
BW-05	Big Pond	394,341.52	9,488,859.74	959	6.86	31.8	7.2	0.5	PACK TEST	<0.02	<0.5	0.2	<0.5	<0.5	-	-	-	-	-	0	<0.5	0	2017/8/31 14:11
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*0.022*	*<0.0002*	*<0.0002*	*<0.0001*	*0.11*	*<0.0002*	*<0.0002*	-	-	-	
BW-06	Discharged water from Small Pit	394,500.64	9,489,075.31	890	6.87	26.8	19.9	6.5	PACK TEST	<0.02	<0.5	1.0	<0.5	0.5	-	-	-	-	-	0	<0.5	2.0	2017/8/31 14:45
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*1.4*	*0.56*	*<0.0002*	*<0.0001*	*1.6*	*<0.0002*	*<0.0002*	-	-	-	
BW-07	Interfluent small creek into Pit	394,506.50	9,489,086.71	891	7.31	24.9	23.9	0.0	PACK TEST	<0.02	<0.5	0	<0.5	<0.5	-	-	-	-	-	0	<0.5	0	2017/8/31 14:53
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0001*	*0.20*	*<0.0002*	*<0.0002*	-	-	-	
BW-08	Foot of Waste Dump	394,737.70	9,488,989.73	843	6.78	23.0	25.7	40.0	PACK TEST	<0.02	<0.5	2.0	2.0	<0.5	-	-	-	-	-	0	<0.5	2.0	2017/9/1 15:29
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*1.3*	*0.29*	*<0.0002*	*<0.0001*	*2.7*	*<0.0002*	*<0.0002*	-	-	-	
BW-09	Velelka Creek	395,531.97	9,489,402.04	726	7.60	22.4	11.3	4.3	PACK TEST	<0.02	<0.5	0	<0.5	<0.5	-	-	-	-	-	0	<0.5	0	2017/9/1 13:32
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0001*	*0.19*	*<0.0002*	*<0.0002*	-	-	-	
BW-10	Magaman Creek (after junction)	395,543.94	9,489,408.02	725	7.80	22.3	13.2	5.0	PACK TEST	<0.02	<0.5	0	<0.5	<0.5	-	-	-	-	-	0	<0.5	0	2017/9/1 13:35
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0001*	*0.20*	*<0.0002*	*<0.0002*	-	-	-	
BW-11	Magaman Creek (before junction)	395,544.98	9,489,378.07	726	7.90	22.3	13.9	9.4	PACK TEST	<0.02	<0.5	0	<0.5	<0.5	-	-	-	-	-	0	<0.5	0	2017/9/1 13:30
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0001*	*0.24*	*<0.0002*	*<0.0002*	-	-	-	
BW-12	VAT H	394,436.00	9,489,895.00	1,028	7.38	23.5	70.5	5.4	PACK TEST	0.10	<0.5	0.5	<0.5	<0.5	-	-	-	-	-	0	<0.5	0.5	2017/8/31 15:41
									NATSL	*66 μg/L*	*<0.0002*	*0.503*	*0.28*	*0.29*	*<0.0002*	*<0.0001*	*0.47*	*<0.0002*	*<0.0002*	-	-	-	
BW-13	Small Pond	394,588.47	9,489,837.25	979	6.69	27.0	2.0	15.3	PACK TEST	<0.02	<0.5	0.2	<0.5	<0.5	-	-	-	-	-	0	<0.5	0	2017/8/31 16:02
									NATSL	*<10 μg/L*	*<0.0002*	*<0.00005*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0001*	*0.14*	*<0.0002*	*<0.0002*	-	-	-	

Elements were measured by the "PACK TEST" kit and analyzed by “NATSL” NationalAnalytical & Testing Services Ltd.

pH, EC and Temp were measured by a potable measuring equipment in-situ. Total M : total metal

4. Discussion

According to the quick measurement results done on site by using the Pack Test Kit and the other physical parameter readings such as water levels and water-quality indexes (pH, EC and turbidity), the environmental status of the derelict mining site including Vat/Heap facilities would be generally considered as follows:

1) The acidic water with the lower pH level around Vat/Heap facilities and ex- open pit indicates ongoing acid forming reactions associated with the oxidization of sulfide minerals contained within the ores and waste rocks.
2) The natural water in the mine site is almost neutral with a pH level of (around 6.7 to 7.3) but pH slightly increasing (becoming alkaline; up to about 7.8) as distance increases away from the mine site.
3) The metal components such as copper, iron, manganese and zinc in water formed by the leaching process due to acid forming reactions within ores and waste rocks, are progressively diluted and/or precipitated in natural water with distance.
4) Free-cyanide detected in/around several Vat/Heap facilities could have been formed by the combination of these ongoing acid forming reactions and their dilution processes within the Vat/Heap facilities, and it has “sporadically” overflowed when the Vat/Heaps get filled during heavy rainfall.
5) Free-cyanide in the water released from Vat/Heap seems to be detoxified by sunlight or atmospheric conditions and/or gets diluted by rain water. Nevertherless, water containing free-cyanide is still remains around the Vat/Heap facilities and are gradually/slowly going through the dilution process.
6) Generally, the water quality of creeks in the surveyed area is of no serious concern and threat to the health and livelihood of the local residents even in dry seasons, although in certain localized zones within the immediate vicinity of the Vat/Heap facilities there is of course, some level of threat to humans.

5. Recommendations

Mt. Sinivit Gold Mine is abandoned, however there are still some facilities such as open pits, waste rock dumps and gold extraction Vat/Heaps still remaining in the abandoned site without any attention given by any form of authority. In some Vat/Heap facilities detectable levels of free-cyanide solutions are still evident and sporadically overflowing with swollen Vat/Heap water caused by heavy rainfall.

- It is therefore advisable that if no decommissioning / rehabilitating efforts of the Vat/Heap facilities is forthcoming in the near future, the land owners and neighboring residents around the mine site should be cautious and keep away from having any close contact with water containing free-cyanide and metals especially in/around Vat/Heap facilities.
- It is strongly and URGENTLY recommended that the culverts (extraction wells) of the Vat/Heap facilities should be back filled as soon as possible.
- CEPA, MRA and the ENB Provincial Government should take a collective approach to re-educate the local people accordingly and on a continual basis.

Appendix 1 Participant List for 3rd Site Visit of Sinivit Gold Mine

affiliation	name	title
JICA Study Team	Dr. Kazuyuki Kadoshima	Team Representative, Assistant Leader – Database Construction
JICA Study Team	Mr. Ippei Takeda	Technical Expert – Database Construction
JICA Study Team	Mr. Kosuke Ishiyama	Technical Expert – Database Construction
CEPA	Mr. Pitzz Murphy	Principal Scientist
MRA	Mr. Lars Kuri	Compliance / Technical Assessment Officer
Landowner Association	Mr. David Joseph	Chairman – Sinivit Landowner Association
Landowner Association	Mr. Issaiah August	Local casual – Sinivit Landowner Association
Landowner Association	Mr. Praede Aloise	Local casual – Sinivit Landowner Association
East New Britain Provincial Government	Mr. Charles Lapim	Environmental Health & Safety Officer
East New Britain Provincial Government	Mr. David Larme	Environmental Health & Safety Officer
East New Britain Provincial Government	Ms. Venessa John	Environmental Health & Safety Officer
Kokopo Police Station	Mr. Brendan Solomon	Senior Sergeant
Kokopo Police Station	Mr. Ludger Maibogu	Senior Constable
Kokopo Police Station	Mr. Andy Tanda	Senior Constable

Appendix 8

Joint Coordination Committee Meeting Summary

1st JCC Meeting Summary

Place: CEPA Office, Savanah Heights Dynasty Tower 4th Floor
Date: 16th February, 2017
Meeting Start Time: 10:00am

Attendees

1. Mr. Michel Wau, Director, Environment Protection Wing, CEPA
2. Mr. Robert Sine, Manager, Environment Protection Wing, CEPA
3. Mr. Pitzz Murphy, Principal scientist, Environment Protection Wing, CEPA
4. Mr. Gerard Philip Natera, Manager, GIS division, CEPA
5. Mr. Nathan Mosusu, Executive Director, Geological Survey Division, MRA
6. Mr. Andrew Gunua, Chief Mine Warden, MRA
7. Mr. Takashi Toyama, Chief Representative, PNG office, JICA
8. Mr. Yukihiro Kondo, Representative, PNG office, JICA
9. Mr. Masatake Harada, Assistant Representative, PNG office, JICA
10. Ms. Margaret George, Senior Program Officer, PNG office, JICA
11. Dr. Kazuyuki Kadoshima, Vice-chief Advisor, JICA Expert team
12. Mr. Yoshiaki Shibata, Expert, JICA Expert team
13. Mr. Mitsuo Ohtake, Expert, JICA Expert team
14. Mr. Hirohisa Kobayashi, Expert, JICA Expert team
15. Mr. Ippei Takeda, Expert, JICA Expert team

Meeting Minutes

1. The first Joint Coordination Committee (JCC) meeting involving the Executives and senior members of the project implementing partners (JICA, CEPA and MRA) was held to update and provide project status report. Updates were provided on the three major objectives of the project and results of some site visits were also presented by the JICA expert team.

   The JCC's Agenda items and the meeting participants are as follows:

   Program: *Chairman: K. Michael Wau – CDMWM Project Manager*

[10:00]	Opening and Welcome address by CEPA (K. Michael WAU, Director EP Wing and CDMWM Project Manager, and proxy Program Director on behalf of Managing Director)
[10:10]	Remarks by MRA (Mr. Nathan MOSUSU, Executive Manager on behalf of Managing Director)
[10:20]	Address by JICA Chief Representative: (Mr. Takashi TOYAMA)
[10:25]	Presentation 1: Outline of the Project (Dr. NEGISHI, JICA Technical Team Leader)
[10:35]	Presentation2: Status update of Database Construction (Mr. Ippei TAKEDA, JICA Technical Team)

[10:50] Presentation3: Brief Report on site visits, Sinivit Gold Mine/OkTedi Mine/Kainantu Mine (Mr. Yoshiaki SHIBATA, JICA Technical Team)

[11:10] Discussion time

[11:30] Closing address by CEPA (K. Michael Wau – Project Manager)

2. Mr. Andrew Gunua, Chief Mine Warden, MRA, asked about any similarities between OK Tedi mine and the results observed in other areas.
(Answer by Mr. Shibata) In principle we did not find any anomalies, but in one case we detected Cyanide in waste water in Pyrite concentrate of OK Tedi Mine.

3. Mr. Nathan Mosusu, Execuive Director, MRA , asked about the criteria that can be used to work with different environments.
(Answer by Mr. Shibata) We still need to collect more information to clarify the adequate criteria on different environments.

4. Mr. Andrew Gunua, Chief Mine Warden, MRA, asked about the influence of the riverine tailing disposal.
(Answer by Mr. Shibata) To understand the influence of the riverine tailing disposal, it is important to get involved in activities such as, monitoring along the river, construction of an adequate data base and analysis of all of this information.

5. Mr. Yukihiro Kondo, Representative, PNG Office, JICA
(Comment)
   - Mr. Kondo emphasized the need to make all the efforts to work in coordination with all the organization involved in this project; CEPA, MRA and DMPGM.
   - He also emphasized in the assembly of this process so that the results should be based on the preparation for the data base and taking into account that those outcomes are going to be used not by experts, but by Officials and Officers working in separate management.
   - He welcomed the eagerness of the attendees to use databases because they can apply them to the use of the System in MRA.
   - Human resources are very important for the success of this project.

6. After some lengthy discussions and question-and-answer sessions, the project's Way Forward Plans, Mine Waste Management Policy review comments, the ideal OJT procedures of Environmental Survey with different types of Environmental Criteria, the project implementation items and their detailed action plan were approved by the JCC members.

Close of Meeting Time: 11:30pm

2nd JCC Meeting Summary

Place: CEPA Office, Savanah Heights Dynasty Tower 4th Floor
Date: 22nd February, 2018
Meeting Start Time: 10:32am

Attendees

1. Mr. Mr. Michael Wau, Director; Non-Renewables and Project Manager, CEPA
2. Mr. Asavi Kendua : Assistant Director, DMPGM
3. Mr. Seymour Pok : Chief Policy Officer, DMPGM
4. Mr. Wakai Digine : Program Officer, DNPM
5. Mr. Robert Sine : Manager, CEPA
6. Mr. Pitzz Murphy : Principal Scientific, CEPA
7. Mr. Gerard Neterata : GIS Manager, CEPA
8. Mr. Anderson Anjo : Senior Scientific Officer, CEPA
9. Mr. Nathan Mosusu : Executive Director, MRA
10. Mr. Amukele Amukele : Mine Inspector, MRA
11. Mr. Takashi Toyama: Chief Representative, JICA PNG Office
12. Mr. Masatake Harada : Assistant Representative, JICA PNG Office
13. Ms. Margaret George : Senior Program Officer, JICA PNG Office
14. Dr. Yoshimitsu Negishi : JICA Expert Team
15. Dr. Kazuyuki Kadoshima : JICA Expert Team
16. Mr. Yoshiaki Shibata : JICA Expert Team
17. Hirohisa Kobayashi : JICA Expert Team
18. Mr. Ippei Takeda : JICA Expert Team
19. Mr. Kosuke Ishiyama : JICA Expert Team

Meeting Minutes

1. Welcome and opening remarks by Chairman of the JCC Meeting **Mr. Michael Wau**, Director-Nonrenewable Division of Conservation and Environment Protection Authority (CEPA).
    - He welcomed representative from Department of Mineral Policy Geohazard Management (DMPGM), Mineral Resources Authority (MRA), National Planning (NP), the local news reporters, and importantly the Japanese International Agency Cooperation (JICA) representatives who presented in the meeting.

    - Mr. Wau, gave the floor for Mr. Nathan Mususu, from MRA to do few remarks.

2. Mr. Mususu, thanked the participation on behalf of the Managing Director (MD) of MRA.
    - He once again thank JICA for the Mine Waste Management Program (MWMP). He said that the mining industry in Papua New Guinea (PNG) is one of the major contributor to the economy of the country. However, the associated mine and environmental problems with this sector which

needs to be addressed. He said "the waste derived from the mining industry has to be controlled and managed properly". He make mention that the mining is a Global Development and as a Global citizen, we shall all work together to manage mine waste to safe guide the environment and the citizens.

- Next, Mr. Wau, gives time for Mr. Seymour Pok from DMPGM to make few remarks.

3. Mr. Pok addresses that it is his first time to be in a JCC Meeting, and he thanks the MWMP Team, the JCC Members for finally being together.
    - He thanks JICA for opportunity for training and coordination towards the MWMP. He says that he will support from DMPG in terms of providing guidance towards policy creations and others for the program.

    - Mr. Wau, gives the opportunity for JICA representative to make some remarks in the meeting.

4. The JICA Chief Representative, Mr. Takashi Toyama, thanks the Chair and makes few remarks. • He says, that the MWMP is a combination of project to combat climate change. Thus, mine waste management program is a genuine project. He says that he is glad that DMPGM has finally come on board.
    - He thank the CEPA Team for taking the project on board despite so many other projects.
    - He added that JICA is committed to support Mine Waste Management in Papua New Guinea.

    - Mr. Wau, gives the opportunity for JICA Project Technical Team to do their presentation.

5. Dr. Negeshi, JICA Technical Team Leader introduces the program and outline their presentation.
    - He gives a brief background of the project, which started in mid-2006 and the active program ends late 2018 with final report, however he says the long-term training continues through to 2020.
    - He once again thanks DMPGM for finally coming to the program.
    - He give a brief rundown of the active programs undertaken by the project team. This includes the sites visits to several Mining Sites in PNG, On-the-job training by the JICA on CEPA, MRA and also on DMPGM Officers.
    - He gives the major objectives of the MWMP, which includes the Policy Framework for the Mine Waste Management in the country, the mine environment database, on-the-job training, as well as the short-term training in Japan experienced by PNG Government Officers.

6. Mr. Hirohisa Kobayashi gave the status update of the Policy Framework Review.
    - He emphasizes on the works done as per the three (3) laws that he was focusing on, which were; *Environment Act 2000, Mine Safety Act 1977,* and the *Mining Act 1992.*
    - He raised the concern of mine waste management especially with waste dump and mine waste tailings and some similarities and confusions along with the waste dump and waste dam.
    - He stressed that it is still a difficult job to come up with a comprehensive policy framework to take into consideration all types of waste management including deep-sea tailings placement.

- However, highlighted the way forward to come up with a policy framework that can be set to capture all mine waste management in the country.

7. Mr. Yoshiaki Shibata of JICA Technical Team updated about the status of Establishment of Implementation Regime for MWM Policies.
   - He presented on the status update on the Mine Waste Management Program.
   - He presented about the Mine Waste Management “Inspection manual” that will be complied for CEPA and MRA Officers to use whilst doing compliance inspection and audits at operating mines sites.
   - He also stressed a bit on the confusion of the mixing zone, who address issues after the mixing zone, the location of the mixing zone, in relation to MRA and CEPA laws.
   - He gave a brief on the success of Pack Test training, on-the-job training of which the Government of PNG Officials are being aware of including the Officers from DMPGM.

8. Mr. Ippei Takeda of JICA Technical team talked about the status update of the Mine Environment Database development.
   - He stressed about the key issues, the requirements for an operational database and the current status of the mine environment database.
   - He presented current status of the mine environment database which included mining and environmental data from seven (7) operating mining in the country.
   - He talked about the importance of collecting the mine environment data in a user friendly way and compiling these important data into the database. The database links relevant data from MRA with relevant data from CEPA for more clear management of mine and environmental related projects and programs.
   - He also showed the technical skills involved in displaying the database to the QGIS Software for enhanced user friendly assessment of reports.

9. Mr. Wau thanked all the presenters from the JICA Technical Experts Project Team.
   - He made a specific mention that the Mine Environment Database will help CEPA in a long way. It has the potential that it can further be developed to capture all other operational sector in CEPA and become a major database for CEPA.
   - He also commented that under the new mining act, the riverine disposal system of tailings will be done away with.
   - He also supported the presentation of the JICA Technical Expert Team that the concept of the mixing zone needs to be clearly understood especially in the deep sea tailing placement, and how the MRA and CEPA work on this has to be clarified.
   - The Team from DMPGM also adds that the concern on mixing zone and compliance point needs to be clearly articulated in the laws to be enforced properly.

10. Ms. Margaret George from PNG JICA Office raises few good and important points in relation to the presentations and the meeting.
    - She raises concern of the tailings dam and mine waste after mine closure, which as stipulated in the laws, they become a prosperity of the state.

  - She comments that if the Chief Inspector of Mines is invited in the next JCC meeting, then it would be appreciated as the Chief Inspector of Mines can clarify on some of the liability that mine operators will left to the State of PNG.
  - She also comments to clarify on the Bonds, and who should be the right organization to manage these mine cleanup bonds and what time these bonds should be accessed from a trust account to exercise on any clean up orders.
  - Mr. Wau, supports Ms. George comments with the example of Misima (Closed) Mines and the Sinivit Mine (abandoned).

11. Mr. Pok representing DMPGM comes into make few comments regarding Ms. George's concern.
    - He responds that it will require both technical grounds and regulatory ground to address these issues of mine waste and mine liabilities becoming property of the State of PNG.
    - He stresses that under the new mining law, it will be a requirement of the companies or developer to submit upfront a conceptual mine closure plan.
    - He also states that; the companies and new developers have to show their financial capabilities before granting of any license or permit.

12. Mr. Wau states in respond to the above discussion that, the bond system has to be discussed properly with the State and the company.
    - He mentions that right now it is a challenge. Because, otherwise it might be seemed as another levy by the companies. Moreover, he raises the concern that the bond might be parked someway overseas that it might be very difficult to access this funds during its time of use.
    - Thus, he states that the Bond systems has to be carefully thought out and set.

13. Mr. Mususu from MRA added that Tailings Dam is a challenge for Chief Inspector of Mines as the Chief Inspector of Mines engages consultants to assess Tailings Dam before it is built and after it is built during operation.

14. Mr. Pok clarifies that two (2) years before the closure of mine the company make sure the environment, safety of mining infrastructures, and any other concerns be addressed before the company relinquished the permits and licenses back to the State.

15. The Chairman of the JJC Meeting, Mr. Wau closes the meeting.

Close of Meeting Time: 12:40pm

3rd JCC Meeting Summary

Place: CEPA Office, Savannah Heights, Dynasty Tower 4th Floor
Date: 18th July, 2018
Meeting Start Time: 10:28am

Attendees

1. Mr. Mr. Michael Wau, Director; Non-Renewables and Project Manager, CEPA
2. Mr. Seymour Pok : Chief Policy Officer, DMPGM
3. Mr. Gabriel Luluaki: Principal Scientific, CEPA
4. Mr. Gerard Neterata : GIS Manager, CEPA
5. Mr. Anderson Anjo : Senior Scientific Officer, CEPA
6. Mr. Amukele Amukele : Mine Inspector, MRA
7. Mr. Mitsuyuki Namiki : First Secretary, Embassy of Japan
8. Mr. Masatake Harada : Assistant Representative, JICA PNG Office
9. Dr. Yoshimitsu Negishi : JICA Expert Team
10. Dr. Kazuyuki Kadoshima : JICA Expert Team
11. Mr. Ippei Takeda : JICA Expert Team

Meeting Minutes

- Mr. Michael Wau, Director Non-Renewables and the Chairperson and Project Director welcomes important delegates to the third JCC Meeting.
    - After making the opening remarks, he give opportunity for MRA Representative Mr. Amukele to make few remarks.

- Mr. Amukele, thanks the JICA for this project. Commends on the new policy that has been identified. Acknowledges that it is a grey area for CEPA and MRA and it's good that this is been highlighted by this project. Also he commends on the field inspection booklet that was crated which will be a very useful tool to use after this project and going forward.

- Mr. Wau next gave opportunity for DMPGM Representative Mr. Seymour Pok to make few remarks.

- Mr. Seymour Pok thanks the opportunity. He mentions that "the project was a very relevant project that CEPA and State had taken on board. It was very useful that this produce some of the useful objectives, in term of policy, database, and on the job training".
    - Further he mentioned that "there are still more to be done, in terms of policy and guideline to better regulate the mine waste management in the country. This project has shown the way forward and the state team should take on board and move forward with new skills and techniques, and better policies to catch up with other counties on how they regulate mining".

    - The training that we have taken has upgraded our standard, skills to better do our job, the database is a positive which CEPA can use to digitize the reporting system.

  - Thank the Japan Government and the tax payers of Japan, for bring and implementing this project through the bilateral aid and diplomatic process.

- Mr. Wau thanks DMPGM for the remarks. He supports DMPGM, and make mansions that the project has come a long way, setting some bench mark, and further strength what has been done, come up with the mine waste policy for MRA, and CEPA, other as well as implementing the other four project outputs. He further stress on the following points;

  - "In terms of policy-CEPA has not been able to complete that task, state team will provide an update on this. DMPGM, national planning and MRA will make sure to complete this part".

  - "In terms of compliance monitoring and inspection, we have successfully come up with the handbook, again this has to be further improved and strengthen to include the riverine, DSTP, waste dump and other waste streams coming from the mining and do more on this in regards to the mining act, mine safety act, and the environment act".

  - "Output on database, with the assistance of this project we have created this database. Again there is lot of work needs to be done on that area of Database. The technologies in the mining are being upgraded very fast, hence state has to be proactive and become aware of this trend and improve ourselves. The database will be made mandatory to get data from the mining companies. With the database, one of the primary database will be to capture data from the conceptual, planning, to construction, to operation to closure and post closure. So that all life span of a mining is capture".

  - He thanked the JICA for the two officer having long term training who can bring back knowledge to manage mine waste in PNG.

- Mr. Wau now give the opportunity for the JICA Expert Team Leader Dr. Negishi to make some remark.

- Dr. Negishi, explains about the draft final report. Also discussers on the draft inspection manual and ask to input comment on these two drafts.

- Mr Wau, ask if there is an e-copy or work document. The final reports due on September, however, they will be in Japan to communicate.

- Mr Wau, ask for the soft copy, and ask for give a time frame so MRA and DMPGM can take section of the report and make their input to any particular issues or anything that we do not understand in the report. Also supported by Mr. Pok to review each relevant section by each agency.

- Mr Amukele mentioned that the inspection manual has been reviewed with comments raised from the seminar. The inspectorate branch has gone thru and reviewed, however other agencies have to give their input.

- Mr. Wau ask if it will be possible to put in the tailings discharge criteria, for certain chemical, metals, especially the key parameters. This is to act as a guide for officers from MRA and CEPA going into site. If a test kit is used that it will add more value.

- Mr. Pok asked if this guideline can have an introduction to how this guideline should be use, or the purpose of the guideline so that other stakeholders can understand, especially a forward, etc., guiding to other instruments. MRA MD and CEPA MD can sign off on it. This forward will give reference to the mining act, mine safety act and the environment act and to give more clarity to the purpose of the inspection manual.

- Dr. Negishi monitoring sheet from JICA. Discusses on the time frame. Which was agreed by all.

- Dr. Negishi also asked for a Certificate of completion. He made the request to the State, which CEPA MD and MRA MD can sign off on it.

- JICA also want a press release, which state also wants a press for all concern stakeholders to know.

- For the manual and the report, the feedback from the state has to be given on the following day (**19th July 2018**)

- Mr. Mitsuyuki Namiki, First Secretary from the Embassy of Japan in PNG, made few remarks that Japan Government acknowledges the mine waste management is very important to the people of PNG. He says that Japanese Government and PNG Government will work together to do such project.

- Dr. Negishi thanks once again on behalf on of JICA and JICA expert team.

- Mr Wau finally thank for the project has come this far. Make mention that we will also get approval from Department of National Planning and Monitoring to finalize some of this work in advancing the project forward. This will be written by CEPA and sent to DNPM.

Meeting Close 12:015pm