



Government of Central Kalimantan



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Master Plan for the Rehabilitation and Revitalisation of the Ex-Mega Rice Project Area in Central Kalimantan



PRELIMINARY ASSESSMENT OF AVAILABILITY AND ACCURACY OF HYDROLOGICAL AND ELEVATION DATA IN THE EMRP AREA

Technical Review No. 3

MARCH 2009

Euroconsult Mott MacDonald and Deltares | Delft Hydraulics
in association with
DHV, Wageningen UR, Witteveen+Bos, PT MLD and PT INDEC

Master Plan for the Rehabilitation and Rehabilitation of the Ex-Mega Rice Project Area in Central Kalimantan

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Preliminary Assessment of Availability and Accuracy of Hydrological and Elevation data in the EMRP area

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Table of contents

List of abbreviations	Error! Bookmark not defined.
Summary	ii
1 Introduction	3
2 Rainfall Monitoring	5
2.1 Rainfall monitoring by PU and BMG	5
2.2 Rainfall monitoring by EMRP Master Plan project	11
2.3 Rainfall monitoring by CKPP	12
2.4 Rainfall monitoring by CIMTROP	12
2.5 Considerations for future improvements	Error! Bookmark not defined.
3 River Water Level Monitoring	15
3.1 River water level monitoring by PU	15
3.2 River and canal water level monitoring by Master Plan project	18
3.3 Water level monitoring by CKPP	19
4 Ground Water Depth Monitoring	20
4.1 Groundwater depth monitoring by Master Plan project	20
4.2 Groundwater depth monitoring by others	20
5 Elevation Data in the EMRP Area	22
5.1 Bakosurtanal elevation data	22
5.2 SRTM elevation data	26
5.3 CKPP elevation data (Peat Soil and Drainage Mapping project)	27
5.4 Master Plan project elevation data	29
5.5 Bina Karya elevation data	31
5.6 BPN elevation data	31
6 Summary and Recommendations	32
6.1 Summary of Data Collection	32
6.2 Preliminary recommendations	33
Annex I Notes on technical meeting with agencies on 22 January 2009	35
Annex II Metadata Master Plan Hydrological Monitoring	40

Summary

This review provides an overview of hydro-topographical data (precipitation, river and canal water levels, groundwater depth, elevation) and their locations, which has been collected by the Master Plan and made available in a comprehensive database to the government. Such data are necessary to address the major water management problems in the EMRP area.

Major deficiencies in the availability and accuracy of hydrological and elevation data exist and are discussed in this document. Recommendations include:

- improving daily rainfall monitoring in the EMRP area, where no accurate PU and BMG records are now available,
- add River water level measurement stations along Barito and Kapuas where there are flooding problems but no monitoring,
- improving the current benchmark system (which includes adding locations and proper referencing to mean sea level) so as to allow development of accurate elevation data for the area,
- relating river water levels to these benchmarks rather than producing 'relative water level' records as is now the case,
- monitoring groundwater depth in peatland as part of fire risk monitoring,
- evaluate and improve data collection and quality control protocols for all data types, and incorporate in the work methods of the respective agencies.

1 Introduction

Most problems in the EMRP area are related to hydrology and water management. Peatland fires occur because of unwise peatland drainage. Peatland subsidence, also caused by drainage, causes increasing inundation of peatlands. Peatland drainage enhances peak flows which contributes to downstream floods as well. River flooding is a problem especially along the Barito River. Tidal irrigation is only possible in part of the EMRP area, and has had limited success in much of the area so far.

To solve these problems in the EMRP area, we need to understand how the hydrological system functions and how this affects water management options and agricultural development options. This required sufficient and accurate data on system parameters, especially rainfall and water levels (surface water and ground water).

All hydro-topographical data available to the Master Plan project have been collected and brought together in a database. Data used come from administrative agencies such as PU, from peatland rehabilitation projects such as CKPP, and from monitoring carried out in the framework of the Master Plan project. This is the first time that all relevant hydro-topographical information has been integrated in a comprehensive database. However, major deficiencies in the availability and accuracy of hydrological and elevation data remain. These need to be dealt with, to allow progress on identifying and solving the water management problems in the EMRP area. When dealing with these data issues, the following questions need to be answered:

- What data are required to identify and solve the water management problems, and where and how do they need to be collected?
- What data are available now, and where and how are they collected?
- What is the quality and completeness of the data available now, what are the data collection and quality control standards, and is this sufficient to meet requirements in the future?
- Have data collected so far been used in analyses; have the appropriate data been used for decisions?
- If current data availability is insufficient, how can we improve this in the future?
- Can we think of better and more efficient ways of collecting data than the traditional methods?

The hydrological monitoring system in the EMRP area consists of many locations where precipitation, surface water level and groundwater levels are being monitored. Monitoring is done by the government and several NGO's who do not always easily share data. Data are difficult to obtain and if obtained are often full of gaps (partly due to lack of funds) and not quality controlled. This renders much of the data unsuitable for use. There is a need and wish to improve this as the area suffers from severe water management problems. To tackle these problems, rainfall, groundwater levels, river and canal water levels need to be measured at a sufficient number of locations and should be quality controlled and put into an easy accessible database.

The Master Plan project has made an effort by installing a hydrological monitoring system and setting up a hydrological database for the area, which is available to others. The hydrological data collection by Governmental Organizations as well as by the MP and by NGO's are briefly reviewed in this document with recommendations for strengthening and developing on-going work.

This report covers the following topics:

- Rainfall monitoring (Chapter 2)
- River water level monitoring (Chapter 3)
- Ground water level monitoring (Chapter 4)
- Elevation data in the EMRP area (Chapter 5)
- Summary and preliminary recommendations (Chapter 6)

2 Rainfall Monitoring

2.1 Rainfall monitoring by PU and BMG

Rainfall time series dating back to 1976 are available through 11 stations of PU and 6 of BMG (covering 14 unique locations) but not for all stations and data gaps occur. Their locations are shown in Figure 1. In Table 1 an overview is given of data coverage and quality. Only four stations had 100% data coverage over the last 8 years of which 2 stations were at the same location (Palangka Raya). To indicate quality of the data three qualifiers were used (1) can be used, (2) may be useful, and (3) can not be used. The quality of the data is further illustrated in Figure 2 where precipitation over the period January 2000 – April 2008 is cumulatively plotted grouped per geographic area. Locations which do not have data over the whole period of consideration but have slopes of cumulative precipitation which is similar for the other locations in the geographic area are labelled 'may be useful'. Locations which are labelled 'can not be used' in Table 1 have no data for the last 8 years, or have precipitation amounts which are too high (see double mass curve Figure 3) or too low.

Cumulative precipitation for both Buntok and Palangka Raya is plotted in Figure 4 and shows that precipitation measured at Buntok PU station is almost twice as high compared to the Palangka Raya measurements. Despite differences because of geographic location the measurements at Buntok are clearly too high with an average annual precipitation of 4565 mm over the period 2000 – 2007, and these data can therefore not be used.

In Table 2 annual precipitation totals are given for the PU and BMG measurement locations for years which have no data gaps. Some stations had annual precipitation totals which were below 1500 mm and are considered not reliable since these are too low, probably the result of writing down a zero when actually no data was available / no precipitation was measured. On the other hand very high annual precipitation totals in excess of 4500 mm were observed as well and are likewise not considered reliable. The high values may be the result of typing errors or measurement errors but remains speculative. Although both Palangka Raya stations appear to have good time series differences between year totals can be as high as 900 mm, with the BMG measurement station being higher than PU except for 2003 and 2005.

<i>Location</i>	<i>Source</i>	<i>From</i>	<i>Until</i>	Coverage data (%)				<i>Quality (last decade)</i>
				<i>Jan 76-Dec 80</i>	<i>Jan 81-Dec 90</i>	<i>Jan 91-Dec 00</i>	<i>Jan 00-Apr 08</i>	
Maliku	PU	1-Jul-84	30-Apr-08	n.a.	51	93	65	May be useful
Mandomai	PU	1-Jan-84	30-Apr-08	n.a.	59	90	100	May be useful, P too low over 2000 - 2003
Mantangai	PU	1-Nov-82	30-Apr-03	n.a.	73	94	32	May be useful
Tamiang Layang	BMG	1-Feb-96	5-Jul-07	n.a.	n.a.	39	89	Can not be used, P too low
Bereng Bengkel	PU	1-Apr-80	10-Sep-07	15	93	88	51	May be useful
Palangkaraya	PU	1-Jan-76	30-Apr-08	100	94	100	100	Can be used
Palangkaraya	BMG	1-Jan-78	20-May-08	60	100	100	100	Can be used
Kuala Kurun	PU	1-Jan-81	30-Apr-08	n.a.	98	100	100	Can be used
Tumbang Jutuh	PU	1-Jan-83	15-May-08	n.a.	77	99	88	May be useful
Timpah	PU	1-Nov-83	24-Apr-08	n.a.	67	95	98	Can be used
Pujon	PU	1-Jan-84	31-Mar-08	n.a.	62	97	82	May be useful
Buntok	BMG	1-Jan-02	30-Sep-07	n.a.	n.a.	61	81	May be useful
Buntok	PU	1-Jan-77	31-Mar-08	75	99	93	100	Can not be used, P too high
Muara Teweh	BMG	1-Jan-95	31-Dec-04	n.a.	n.a.	60	55	May be useful
Muara Teweh	PU	1-Feb-79	30-Apr-08	38	98	92	57	May be useful
Puruk Cahu	BMG	1-Jan-81	31-Oct-99	n.a.	94	80	n.a.	Can not be used, no data
Tampa	BMG	1-Jan-81	31-Aug-99	n.a.	64	77	n.a.	Can not be used, no data
Takaras	PU	1-Nov-83	30-Apr-08	n.a.	72	94	100	May be useful

Table 1 Precipitation monitoring locations, their data coverage (%), and quality n.a. is not applicable.

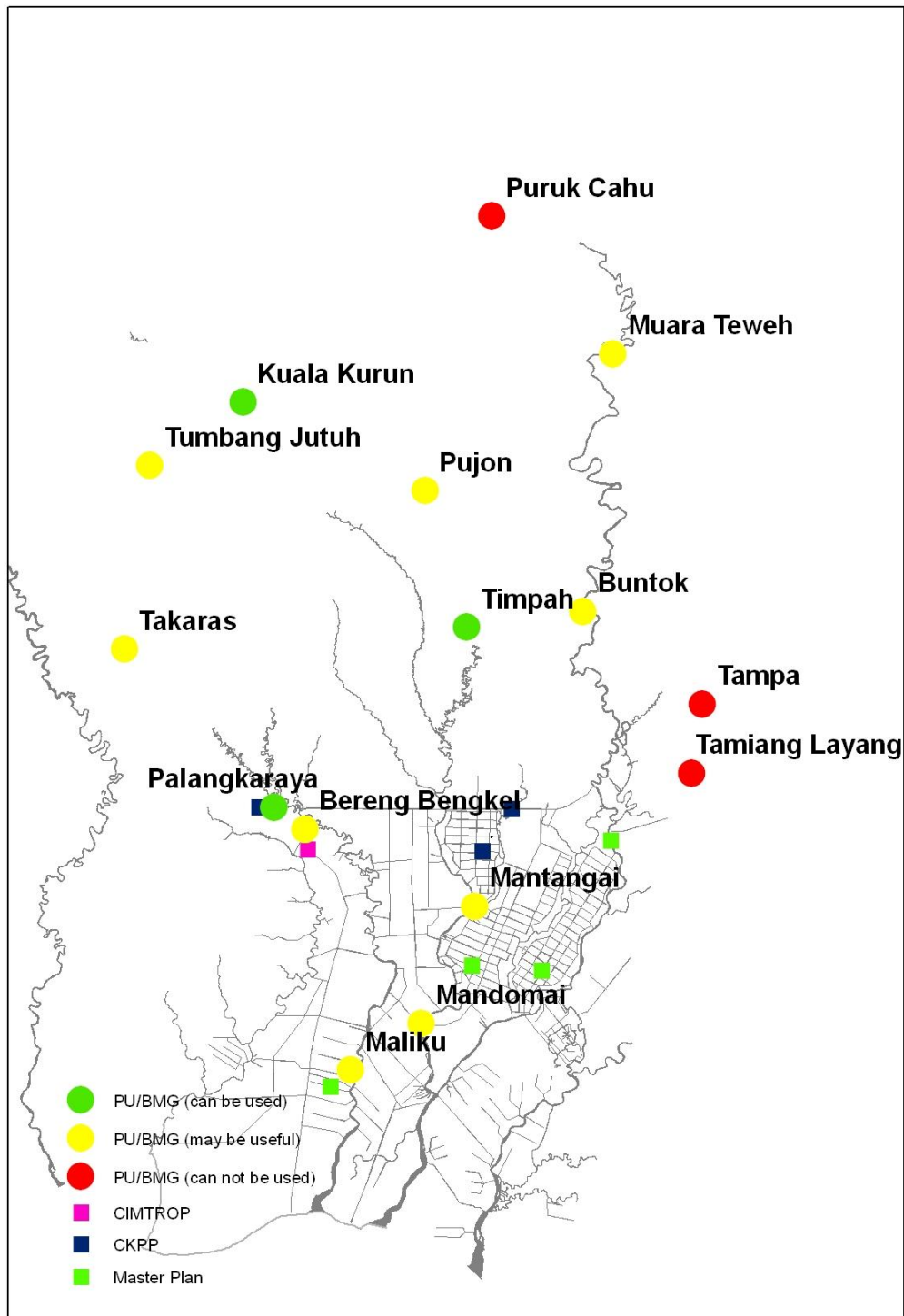
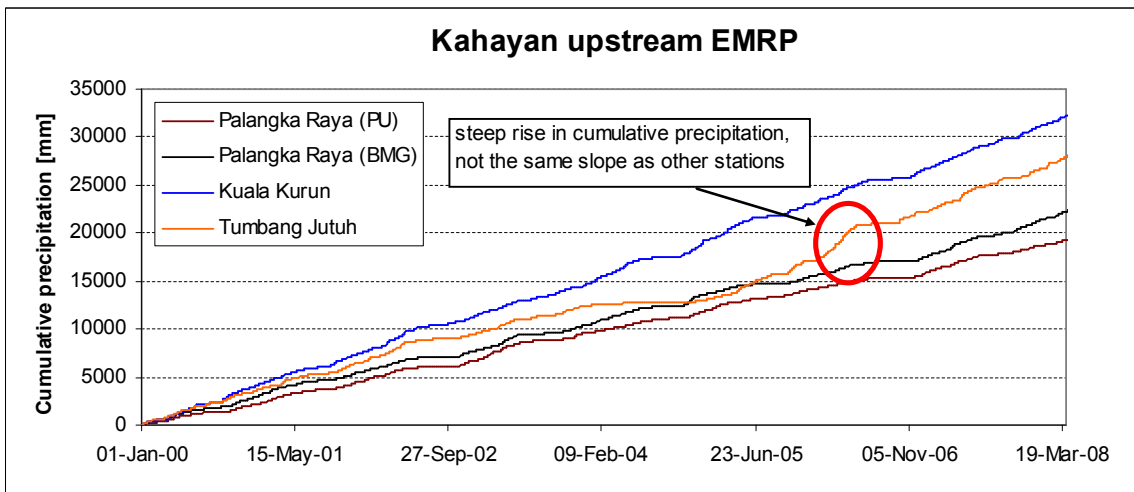
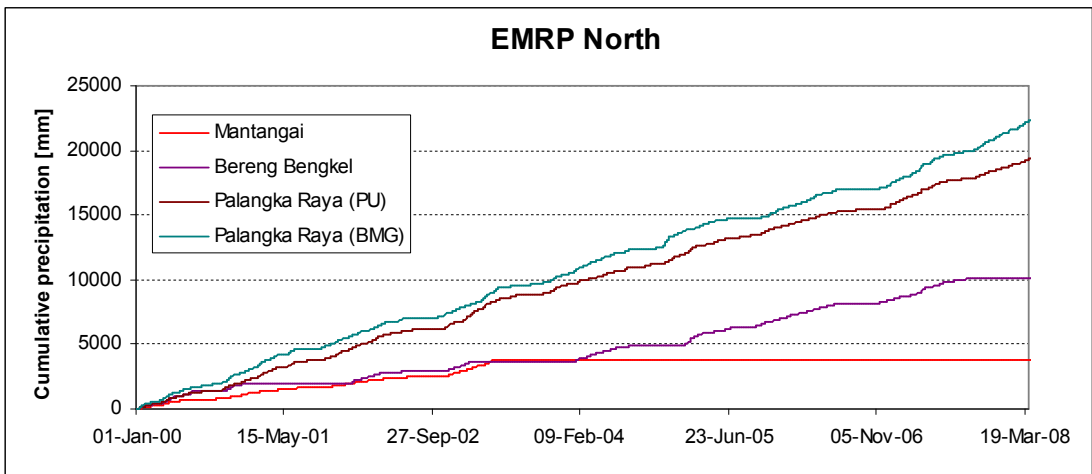
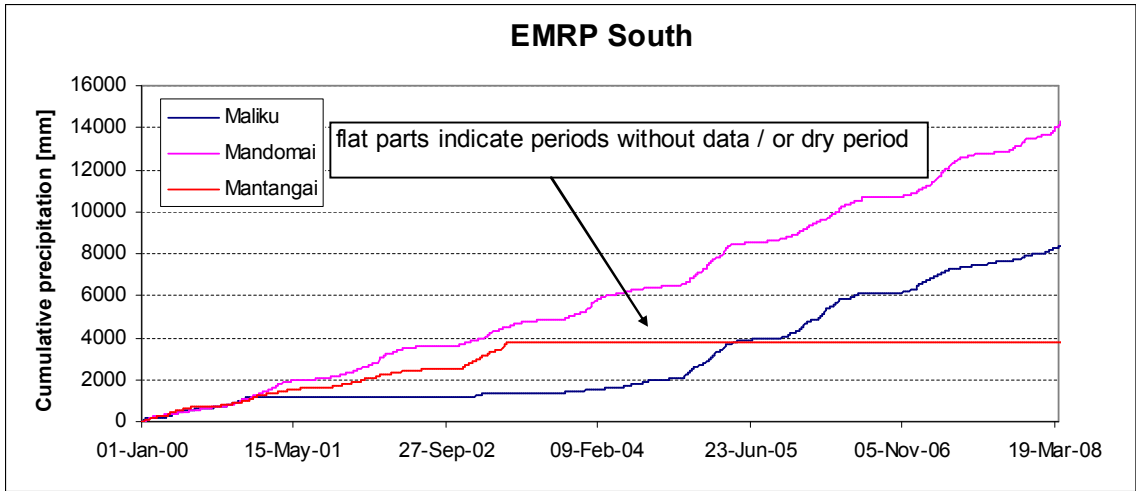


Figure 1 Precipitation monitoring locations in the EMRP area. PU / BMG data since 1977; CIMTROP since 2002; CKPP since 2004.



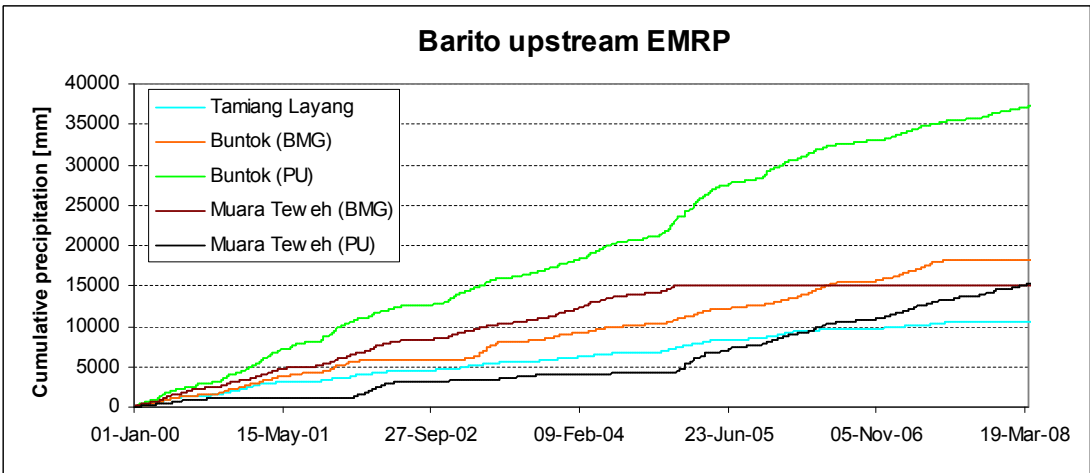
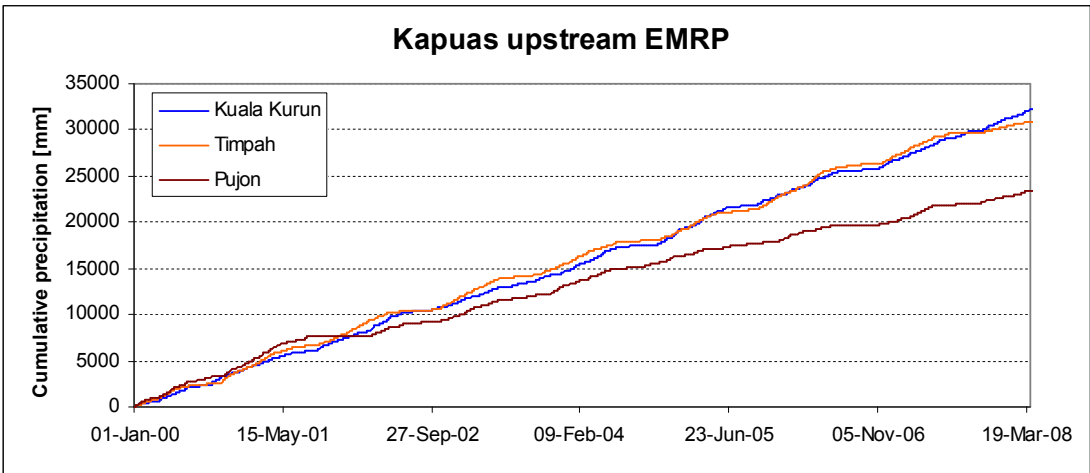
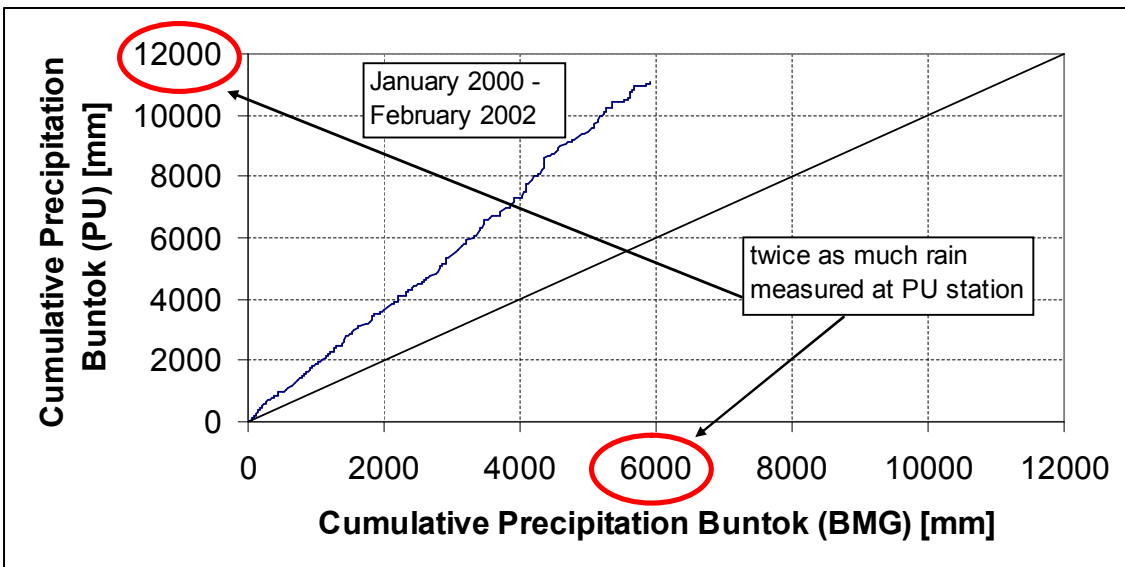


Figure 2 Cumulative precipitation of PU and BMG measurement locations over period January 2000 – April 2008. Each graph for different geographic region.



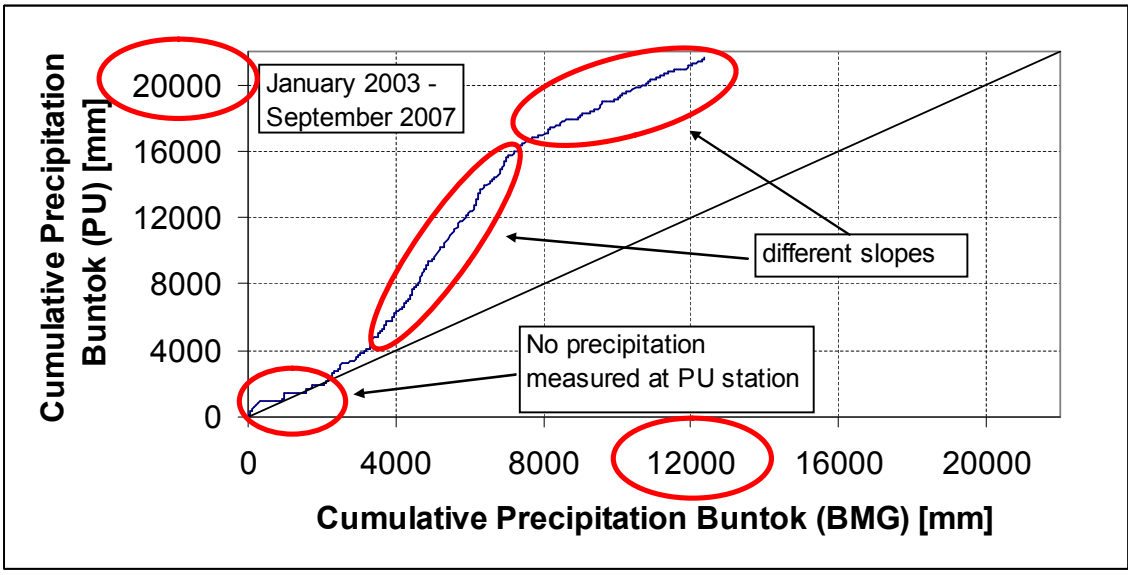


Figure 3 (top panel) Cumulative precipitation measured at Buntok by both PU and BMG for January 2000 – February 2002. Measurements by PU are twice as high compared to BMG measurements. The black line shows expected relationship. (lower panel) shows similar trend for period January 2003 – September 2007, but in addition different slopes.

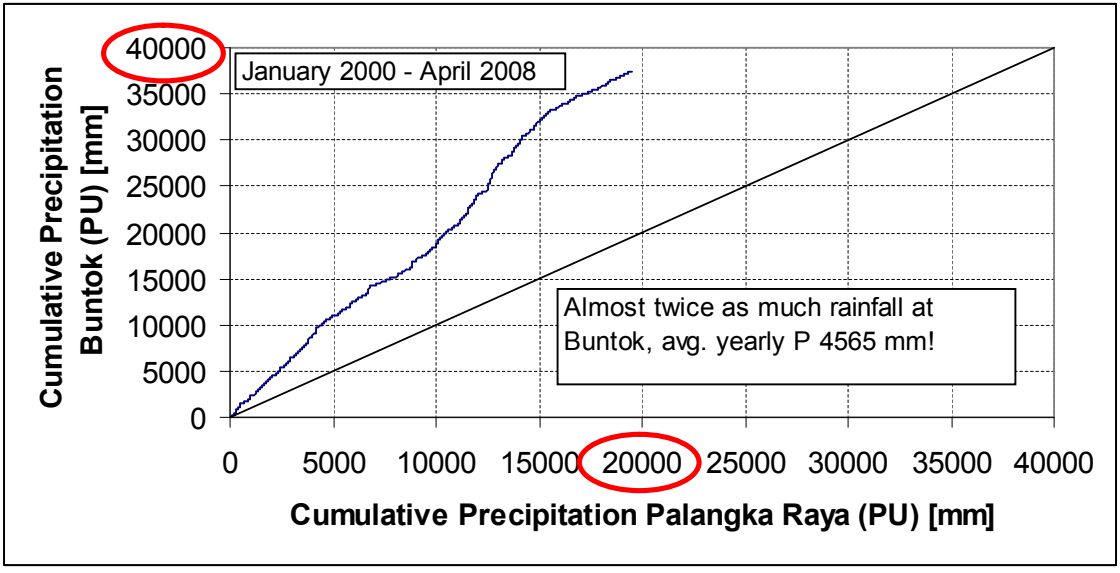


Figure 4 Cumulative precipitation measured by PU at Buntok and Palangka Raya for January 2000 – April 2008. The black line shows expected relationship.

Location	Source	2000	2001	2002	2003	2004	2005	2006	2007
Maliku	PU	1188	n.a.	n.a.	n.a.	1158	2105	1778	1414
Mandomai	PU	1178	1419	1263	1421	1760	2244	1765	2421
Mantangai	PU	1116	888	898	n.a.	n.a.	n.a.	n.a.	n.a.
Tamiang Layang	BMG	2235	1506	1055	1263	1256	1783	739	n.a.
Bereng Bengkel	PU	2006	n.a.	n.a.	n.a.	n.a.	2166	n.a.	n.a.
Palangka Raya	PU	2091	2577	2106	2858	2181	2371	1677	2739
Palangka Raya	BMG	2876	2762	2166	2660	3089	2016	1968	3613
Kuala Kurun	PU	3949	3753	3717	3343	4150	4149	3643	4285
Tumbang Jutuh	PU	3438	3305	2874	2852	n.a.	n.a.	n.a.	n.a.
Timpah	PU	3995	4306	3598	3722	3297	4192	4005	3094
Pujon	PU	n.a.	n.a.	n.a.	3194	n.a.	n.a.	n.a.	2654
Buntok	BMG	2446	3083	n.a.	3090	1760	2503	2788	n.a.
Buntok	PU	4448	6048	3512	3842	5374	6922	3289	3086
Muara Teweh	BMG	3318	3190	2616	2711	3208	n.a.	n.a.	n.a.
Muara Teweh	PU	n.a.	n.a.	n.a.	n.a.	n.a.	4371	2750	3165
Takaras	PU	2228	2157	1976	2105	2088	4112	3260	2559

Table 2 Annual precipitation totals for PU and BMG stations measured over the years 2000 - 2007. N.a. not applicable (no full year of data available), colour codes indicate range of precipitation (in bold red <1500, green background 1500-3000 mm, blue background 3000-4000 mm, red background >4000 mm).

2.2 Rainfall monitoring by EMRP Master Plan project

Four rain gauges were installed during the Master Plan project (Figure 1) and are continued to be measured until the end of January 2009 by local people. One additional gauge is equipped with a diver automatically measuring rainfall at 1 hour intervals. Despite the short period of measurements (February 2008 – now), periods without measuring occurred. Such data gaps in rainfall series of course seriously limits use of the data and in future should be avoided. Additionally, measuring procedures should be improved (time of measurement, instruments used, placement of gauges not too close to house, trees etc.). These aforementioned shortcomings can be overcome when measurements are undertaken by a government party

which can ensure daily measuring according to proper procedures ensuring data of high quality.

2.3 Rainfall monitoring by CKPP

The CKPP project installed a number of rain gauges in the EMRP area since 2004 (Figure 1) which are continued to be measured. The rainfall data is measured by different partners in the CKPP project and the Master Plan only obtained data from Wetlands International. Wetlands International operates three rain gauges, of which two are measured on a daily and one on a bi-weekly basis. Data from other partners (CARE, WWF, UNPAR) which may have rainfall data, were not obtained but could potentially contain interesting data so an effort should be made to retrieve these data and use them in future analysis.

2.4 Rainfall monitoring by CIMTROP

CIMTROP measured precipitation at bi-weekly intervals in the north of Block C but these measurements stopped in April 2007 due to lack of funds. Rainfall is continued to be measured by a meteorological tower but data are held by a Japanese research group who no longer wants to share their data.

2.5 Use of satellite data: TRMM

An independent check on the reliability of the current datasets is possible with satellite based precipitation observations using TRMM data available since February 2002. This is illustrated in Figure 5 where a comparison between measured cumulative precipitation and observed precipitation by the TRMM satellite is shown for Palangka Raya and Buntok. The Palangka Raya comparison gives us confidence in both manual measurements as well as the use of satellite data. From Figure 5 the following conclusions can be made. For the Palangka Raya comparison dry periods are clearly observed for all three datasets. The slopes of both PU measurements and TRMM observations are similar, while the slope of the BMG measurements is steeper, explaining the difference in annual totals with PU (up to 900 mm) as was already observed in Section 2.1.1. In 2005 a longer dry period is observed by BMG while similar for PU and TRMM observations. For the Buntok comparison the dry periods are observed as well. The slopes of measured precipitation are much steeper compared to TRMM observations, but as it was already concluded in Section 2.1.1 (Figure 3, Table 1 and Table 2) the Buntok data measured by PU are not reliable.

Spatial variability of rainfall is very high as is shown in Figure 6 showing remotely sensed rainfall data at 28 x 28 km resolution as observed by the TRMM satellite. Daily variability is high and as such to capture most of this variation many rainfall gauges would be necessary. The variability is also apparent when comparing cumulative precipitation for three locations where rainfall is measured by PU and BMG (Figure 7). Dry periods are clearly observed in all three datasets and precipitation is higher in Kuala Kurun compared to Palangka Raya and Buntok.

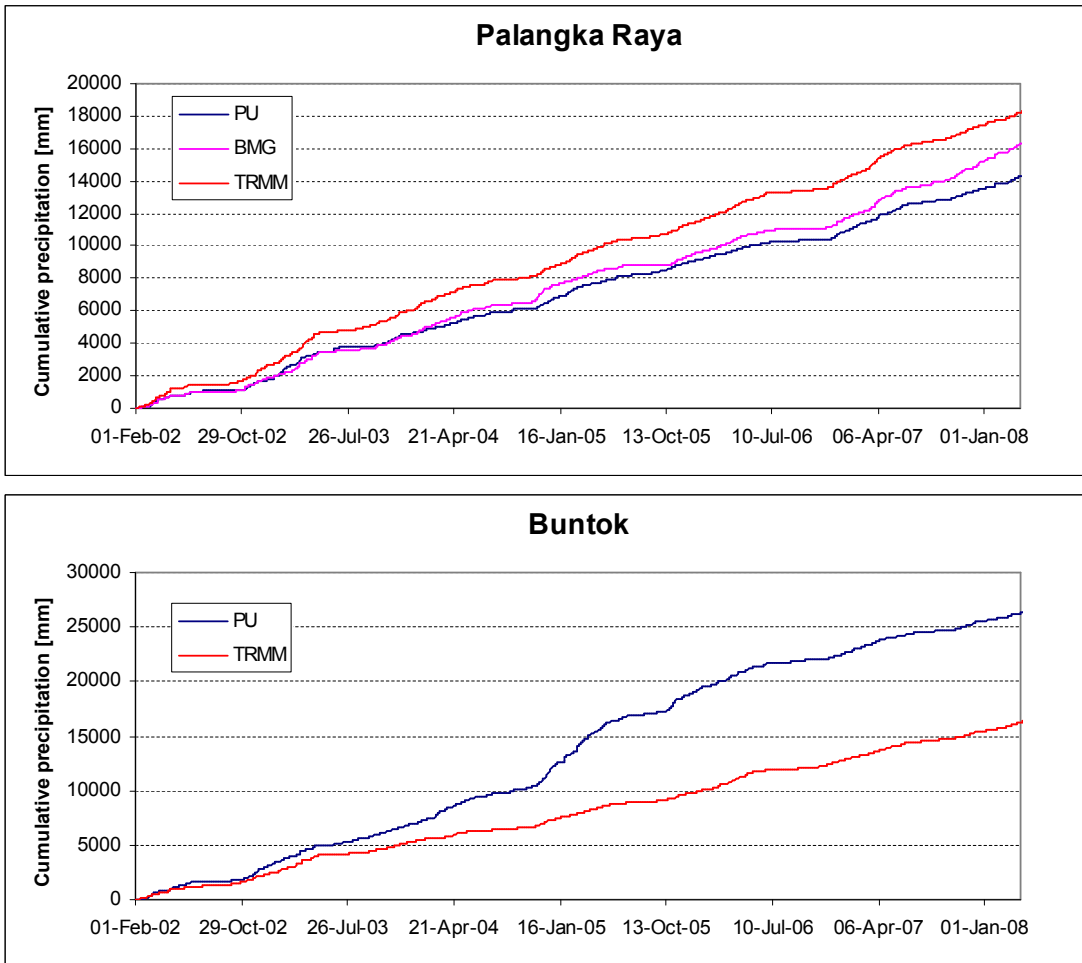


Figure 5 Cumulative precipitation for Palangka Raya (upper panel) and Buntok (lower panel) over the period 1 February 2002 – 30 April 2008 as measured by PU (blue line), BMG (purple line) and observed by TRMM (orange line).

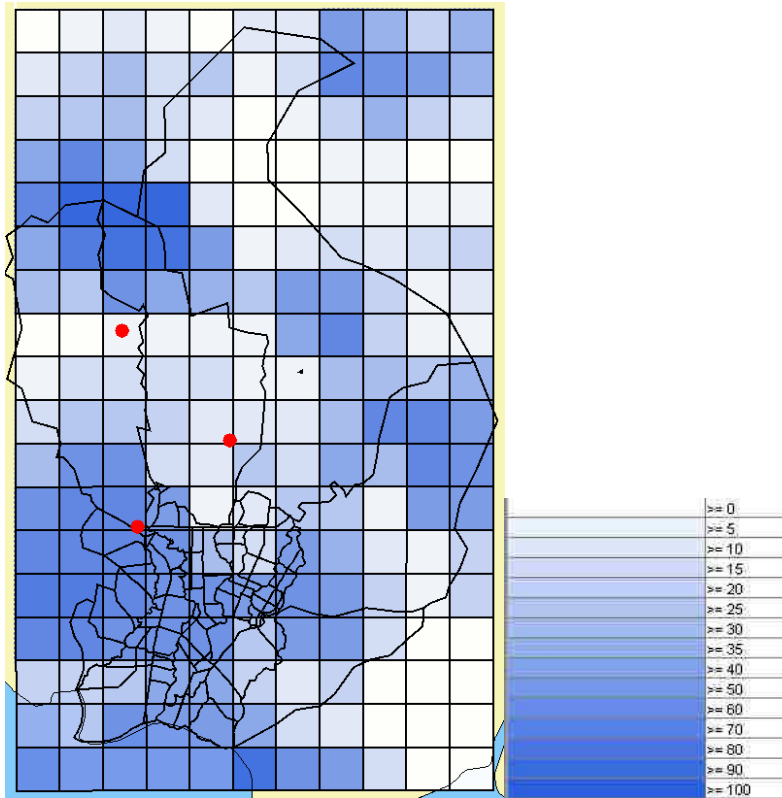


Figure 6 Precipitation map of the EMRP catchment area for 19 November 2004 as observed by TRMM. Here the localized nature of precipitation in the area is clearly demonstrated. Scale in mm. Red dots are locations of reliable PU and BMG measurement stations as indicated in Table 1 and Figure 1. Clearly, rainfall patterns in the area can not be identified by the current ground monitoring system.

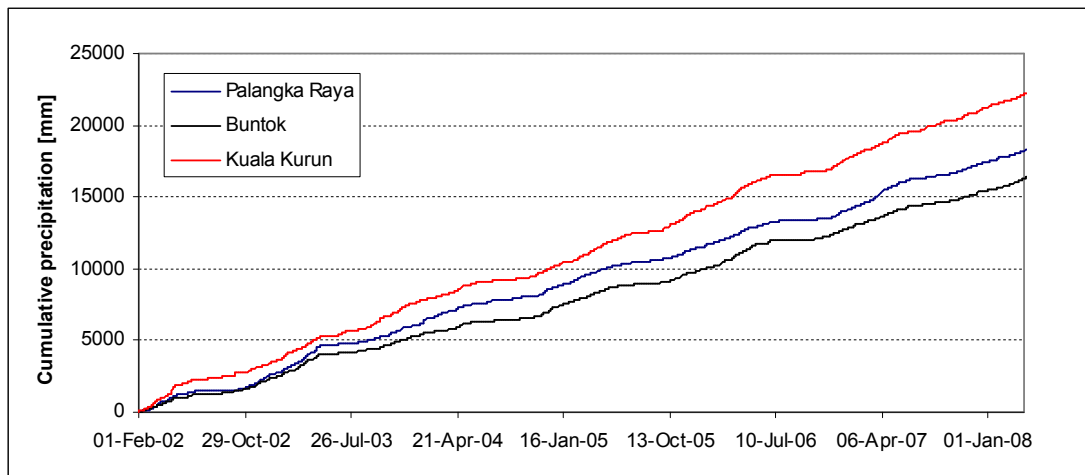


Figure 7 Cumulative rainfall for Palangka Raya, Buntok and Kuala Kurun over the period 1 February 2002 – 30 April 2008 as observed by TRMM.

3 River Water Level Monitoring

3.1 River water level monitoring by PU

River water level time series dating back to 1979 are available for 5 PU stations, but many data gaps occur (Table 3). Only two of the stations were located in the EMRP area, the other three were north of the area. None of the water levels were referenced to mean Sea level, an important condition if one wants to use the water levels in assessing flood and tidal dynamics with a model. Referencing to mean Sea level is not possible due to the lack of accurate elevation information for the EMRP area.

<i>No. Station</i>	<i>Station ID</i>	<i>Main river</i>	<i>Period*</i>
1	Muara Teweh	03-027-00-01 Barito	1977-2008
2	Pujon	03-028-00-02 Kapuas	1996-2008
3	Palangka Raya	03-029-00-01 Kahayan	1980-2008
4	Kuala Kurun	03-029-00-02 Kahayan	1979-2008
5	Mentaren [#]	- Kahayan	1999-2008

* No continuous data set for any of the stations

[#] Tidal area, not in the Kahayan River, but close to the weir at Mentaren village.

Table 3 Stations for which water level data were available. Stations 1 to 4 daily interval, station 5, water level measurement at 7:00, 12:00 and 18:00. Data for each of the stations shown in Figure 9.

PU only has stations on the Kahayan River, whereas the greatest need for water level information exists on the Barito River where flooding problems and opportunities for tidal irrigation are greatest. PU does not measure water levels away from rivers, in peatlands.

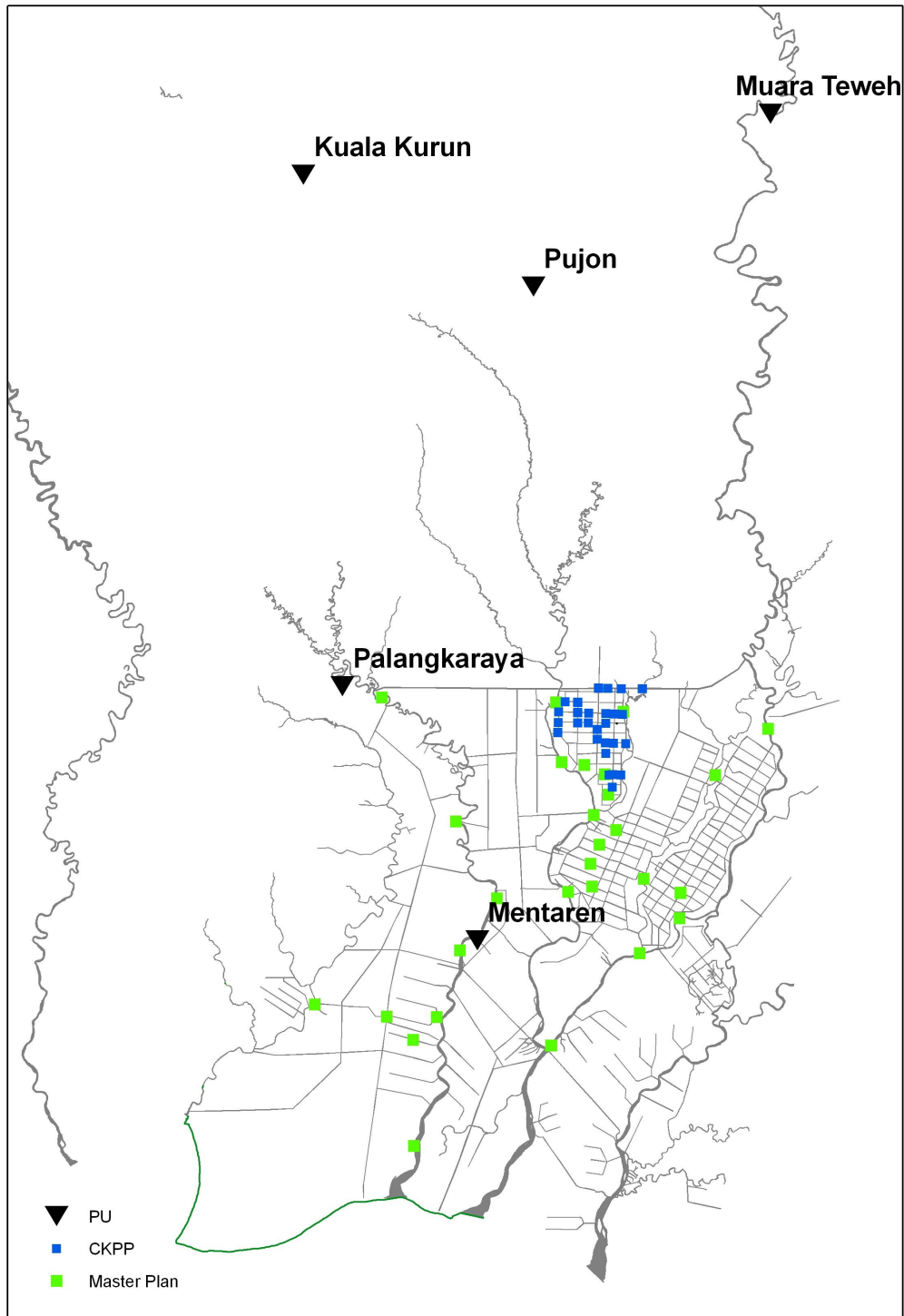


Figure 8 Locations of water level measurements in the EMRP area. PU from 1977; CKPP since December 2004.

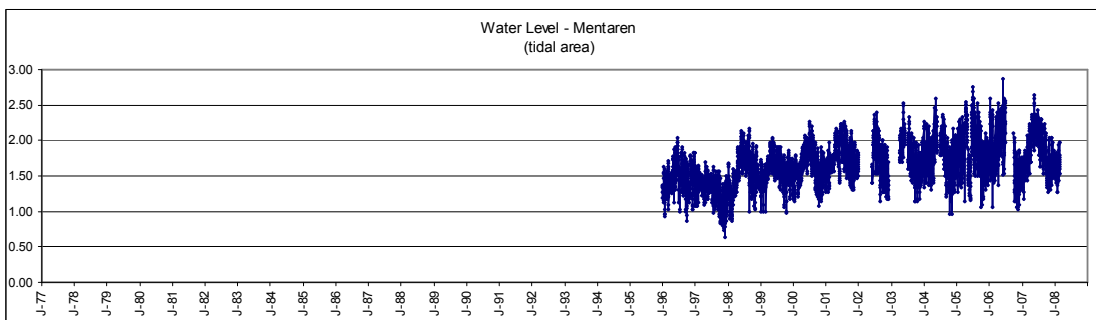
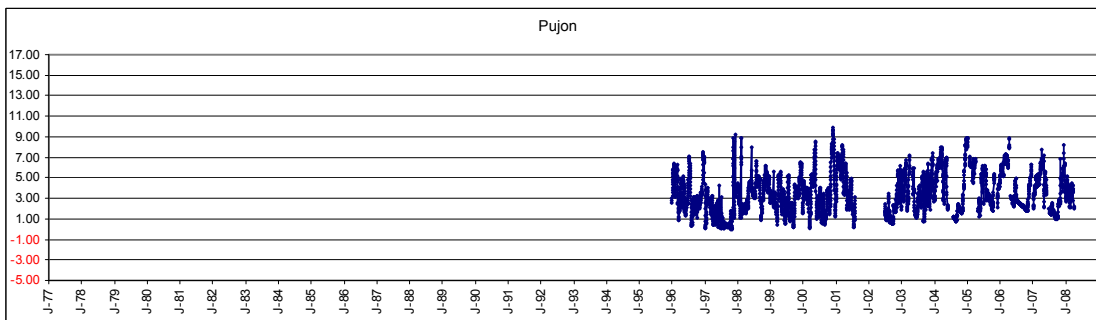
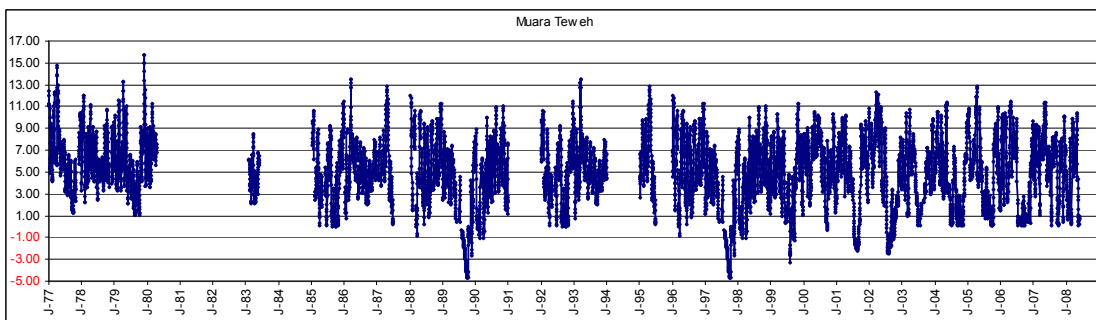
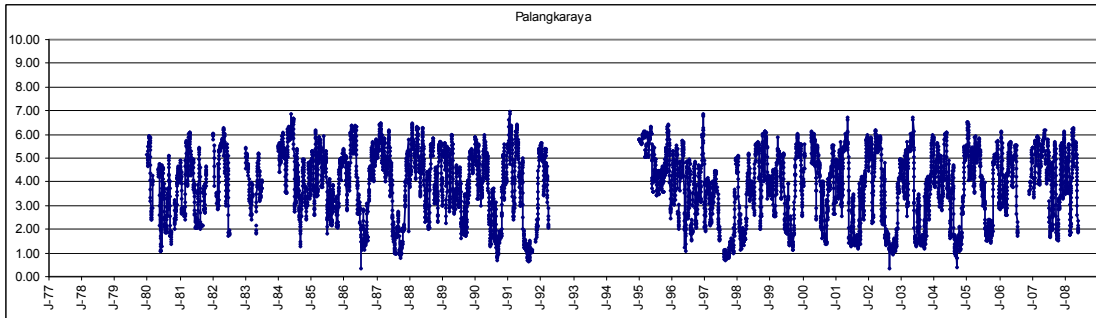
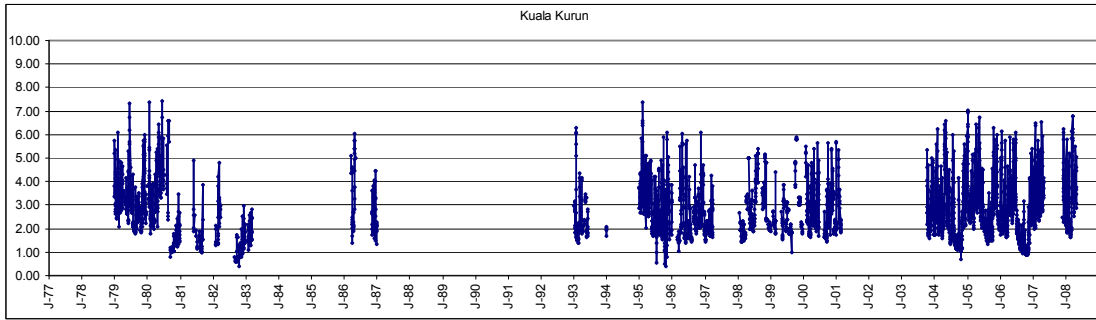


Figure 9 Water level data from PU monitoring stations.

3.2 River and canal water level monitoring by Master Plan project

During the Master Plan project 27 staff gauges were installed to measure river and canal water levels (Figure 8,

Table 4) and are continued to be measured 3 times a day (6:00, 12:00 and 18:00) until the end of January 2009 by local people. Next to the manual read water levels 16 of these locations were equipped with an additional diver automatic recording water levels at 1 hour intervals. In general the divers performed well although a rather large number (6) ceased to function within one year of operation. The reason for this breakdown is currently being investigated by the manufacturer. Four divers were stolen and one did not function from the start and was replaced. Due to these problems only 8 divers are currently operational. As with the rainfall measurements, data gaps occurred in manual water level measurements as well. After inspecting the data retrieved from the field it was apparent that some locations needed more staff gauges as the installed staff gauges did not cover the whole range of occurring water levels. Some of the divers and staff gauges were tentatively referenced to mean sea level (MSL), whereas most of them were not. A comparison between diver (hourly values) and staff gauge readings (daily at 6:00, 12:00 and 18:00) at the locations where both are available is provided in Annex I together with all metadata of each of the measurement locations. This Annex should be revised each time after data retrieval as part of proper data quality control.

Table 4: Locations of MP water level measurements in the EMRP area with staff gauges (SG) and divers (D).

SG / D	Location	Start Date	Latitude	Longitude
SG67 / D1	Bahaur	30-Jan-08 / 24-Sep-07	-3.237841	114.098908
SG65	Bereng Bengkel	02-Feb-08	-2.250278	114.031194
SG39 / D19	BOS Camp Release	29-Jan-08 / 28-Jan-08	-2.282810	114.559260
SG71 / D21	Buntoi	24-Dec-07 / 09-Aug-07	-2.806951	114.200324
SG69 / D11	Dadahup	30-Jan-08 / 29-Jan-08	-2.650580	114.603111
SG70 / D7	Dadahup A5	30-Jan-08 / 12-Aug-07	-2.681720	114.683822
SG79 / D20	Dusun Bakuta	29-Jan-08 / -	-2.422833	114.760343
SG63	Gohong	01-Feb-08	-2.692833	114.282222
SG73 / D2	Hampatung	01-Feb-08 / 10-Aug-07	-3.017179	114.400510
SG64	Jabiren	01-Feb-08	-2.523802	114.192197
SG38 / D10	Jalur Katimpun	01-Feb-08 / 01-Feb-08	-2.399260	114.473780
SG41	Jalur Kelumpang	28-Jan-08	-2.420650	114.518600
SG42	Jalur Plehud	28-Jan-08	-2.465580	114.526750
SG72 / D14	Jl. Maluku-Pangkoh km. 14	23-Jan-08 / 23-Jan-08	-2.952472	114.039750
SG46 / D18	Katunjung	20-Dec-07 / 28-Jan-08	-2.261533	114.411717
SG77	Lamunti Blok A2-D	31-Jan-08	-2.616889	114.487361
SG76	Lamunti Blok A4	31-Jan-08	-2.575250	114.506528
SG75	Lamunti Blok B5	31-Jan-08	-2.543006	114.543006
SG57 / D6	Lamunti Blok C3	31-Jan-08 / 12-Aug-07	-2.667647	114.490436
SG74	Maliku Lama	24-Jan-08	-2.953944	114.149472
SG58 / D8	Manusup	23-Dec-07 / 28-Jan-08	-2.679138	114.438094
SG59	Mentangai Hilir	18-Jan-08	-2.509540	114.494064
SG60	Muara Dadahup	30-Jan-08	-2.814634	114.593886
SG62 / D13	Pangkoh B3	24-Jan-08 / 10-Aug-07	-3.004444	114.098028
SG61 / D4	Rangga Ilung	30-Jan-08 / 11-Aug-07	-2.320611	114.876306
SG68 / D17	Rantau Bamban	30-Jan-08 / 29-Jan-08	-2.737928	114.681709
SG66 / D15	Sebangau	23-Jan-08 / 23-Jan-08	-2.925616	113.882548

3.3 Water level monitoring by CKPP

The CKPP project installed 56 staff gauges in the EMRP area, measuring canal water levels and which are continued to be measured by Wetlands International at bi-weekly intervals.

4 Ground Water Depth Monitoring

No groundwater depth monitoring system is maintained by Government organizations. However, groundwater depth monitoring in peatlands is a key element in peatland rehabilitation projects.

4.1 Groundwater depth monitoring by Master Plan project

In total 24 groundwater monitoring tubes (dipwells) were installed at 4 locations, 3 transects of 7 dipwells each in peat and 1 transect with 3 dipwells in mineral soil. At the beginning and end of each dipwell transect a staff gauge was installed to measure surface water levels. Locations of the dipwells are shown in Figure 10. Monitoring frequency is once a week for the dipwells installed in the south of Block C in Pangkoh and Block A in Lamunti Block C3 while bi-weekly in the NW of Block A. The monitoring system performed well until recently staff gauges monitoring the surface water levels at the dipwell transects in the NW of Block A and wooden poles (serving as local benchmarks) were removed by local people to mark their newly claimed land. The local benchmarks were installed because it was foreseen that staff gauges would be removed and they would help reference newly installed staff gauges. Currently the water levels are thus not referenced any more and need to be if future dipwell data are to be of use.

4.2 Groundwater depth monitoring by others

The CKPP project monitors groundwater depth with 68 dipwells in 8 transects all located in the Block A NW area. Locations of the dipwells are shown in Figure 10. At the beginning and end of each dipwell transect a staff gauge measures surface water levels. Monitoring frequency is bi-weekly.

CIMTROP measured groundwater depth in 3 transects in the north of Block C between June 2004 – April 2007 using 66 dipwells. Currently an additional transect is being monitored using 22 dipwells. Unfortunately, CIMTROP groundwater levels can not be related to surface water levels.

Dipwell transects appear to have been installed by SarVision in Block E, but data are not available yet. As part of the CKPP project WWF and CARE are understood to also monitor groundwater depth and rainfall, but the Master Plan project has not been able to obtain these data.

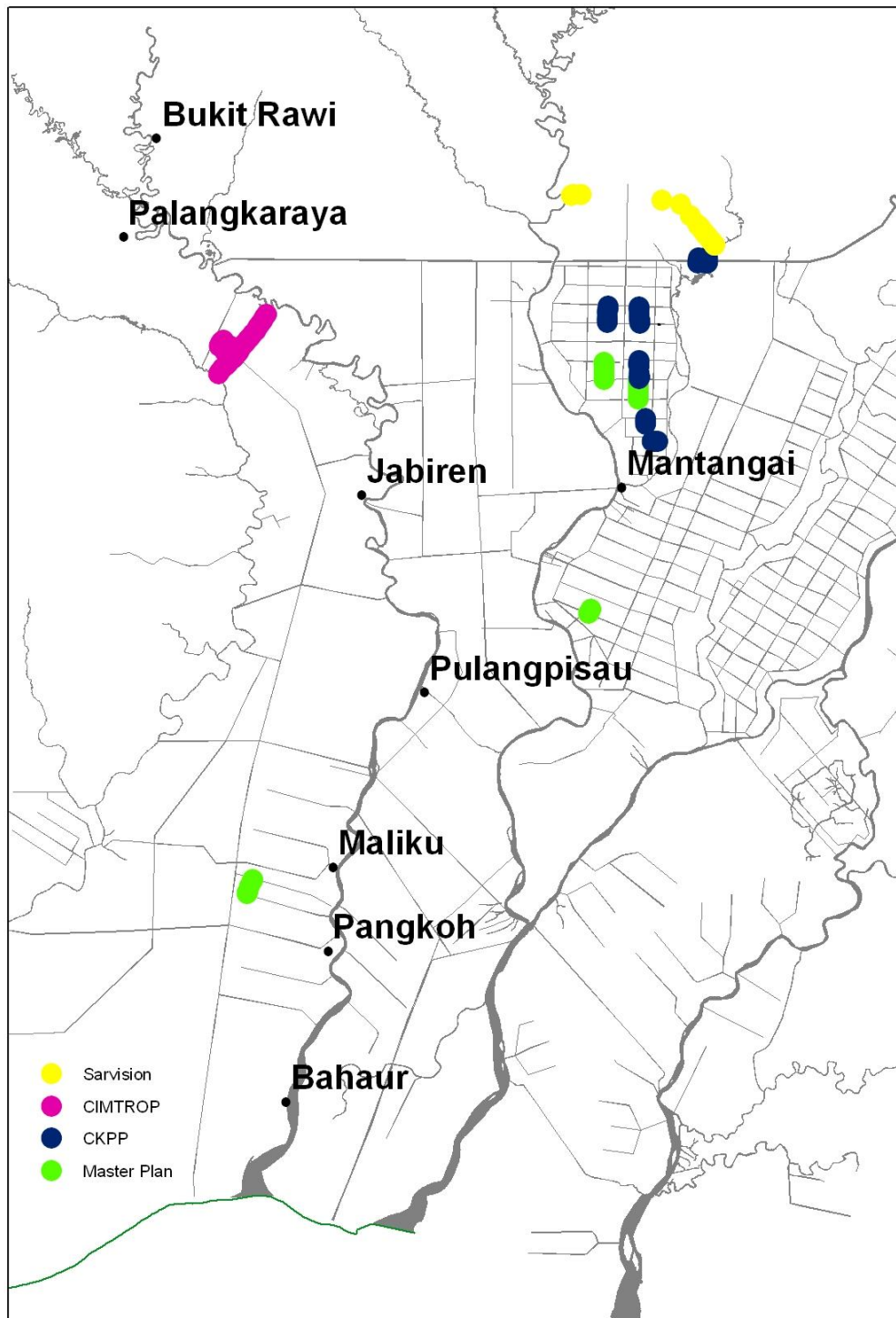


Figure 10 Locations of groundwater measurements with dipwells in the EMRP area. SarVision data since 2006(?); CIMTROP since June 2004; CKPP since 2007.

5 Elevation Data in the EMRP Area

5.1 Bakosurtanal elevation data

Elevation data available from Bakosurtanal for the EMRP area consists of two data sets:

1. Digital Rupabumi map 1:50.000
2. DGPS survey 2008

5.1.1 Digital Rupabumi map

The Digital Rupabumi map is not yet officially released but a 'beta version' was obtained for the CKPP Peatland Soil and Drainage Mapping project. The digital map consists of multiple maps each having a unique ID (Figure 11). Each map then has multiple directories containing spatial information on topography and elevation. Part of the elevation data was found in directory E with a vertical resolution of 1 m and part of it in directory T having a very high vertical resolution (cm) and spatial resolution (data points at 1.5 – 2 km intervals).

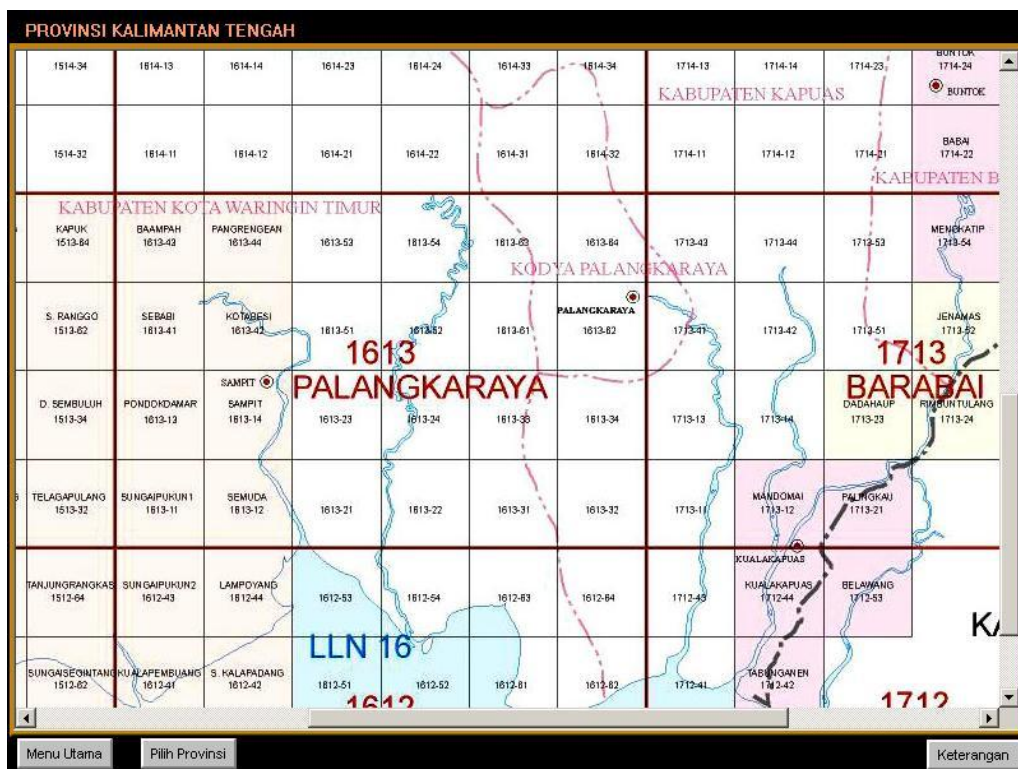
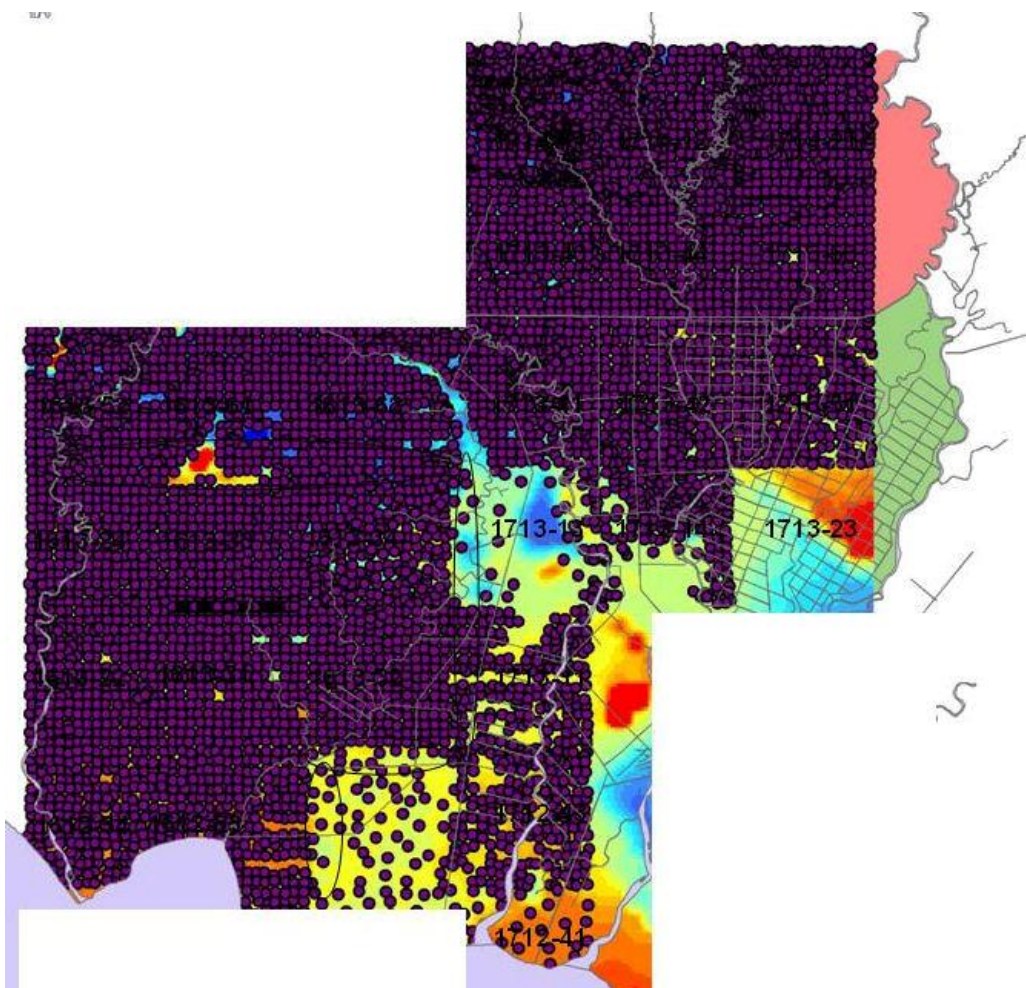


Figure 11 Screenshot from the Bakosurtanal information program. Shown here are the map id's which represent a part of Central Kalimantan.

In an attempt to obtain metadata of the digital map (i.e. how the elevation was measured, how the spot heights were corrected for mean sea level, when the heights were measured) a few hardcopies were purchased as well. It was determined from the hardcopies that the elevations contained within directory E of the digital files were obtained from stereoscopy

having a resolution of 1 m and could therefore not be used for the creation of the DEM. Rupabumi 1:250.000 hardcopies showed that the elevation spot heights were derived from the SRTM satellite image of 2000, but it is not known how and/or if this image has been corrected for vegetation.

The source and metadata of the high resolution elevation data (contained within the T-directory) was never obtained. The project was told these data were in fact measured by radar but no specifications could be obtained. It may well be that the spot heights were extracted from SRTM as was done for the Rupabumi 1:250,000 map. In Figure 12 an interpolation of all high resolution spot heights is shown. Indicated with the black ellipsoid lines are elevation jumps between tiles. Bakosurtanal was contacted about these jumps and according to them there have been attempts to correct for this but without success. Note: different consultants processed the elevation data at different periods on different map ID's.



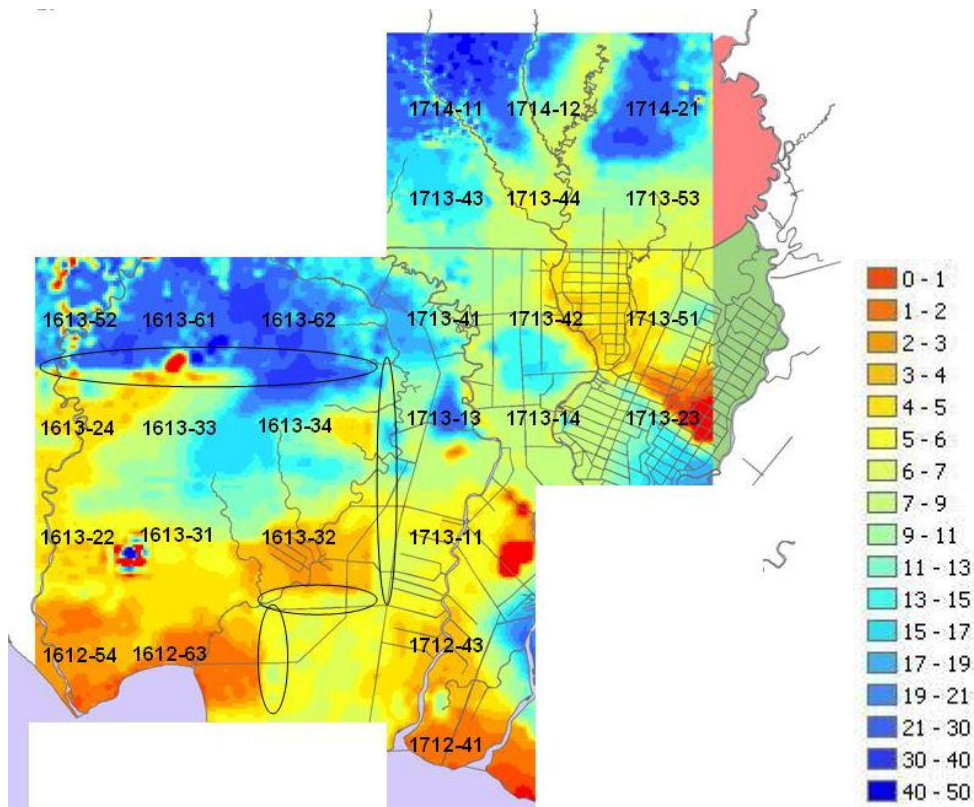


Figure 12 top: Bakosurtanal elevation points (from T-directory); bottom: spline interpolation of Bakosurtanal spot heights. The elevation does not accurately reflect actual topography in the area. ID's for the separate tiles are indicated. Black ellipsoid lines indicate some major elevation jumps. Legend in meters.

Altogether the Bakosurtanal elevation spot height data could not be used for creating a DEM for the area.

5.1.2 Bakosurtanal DGPS survey

As part of the field survey during the PSDM-CKPP project in September 2007, elevation data collection in the EMRP area using a Differential Global Positioning System (DGPS) was carried out by a team from Bakosurtanal. During this survey 36 benchmarks were installed. The elevation heights resulting from the DGPS survey already raised many questions during the development of the DEM for the EMRP area. During the Master Plan project the reliability of the dataset was tested by carrying out land-based topographical surveys connecting DGPS benchmarks. It turned out that the elevation of DGPS benchmarks were inaccurate by several meters.

Coincidentally further errors were encountered after talking to Bpk. Kitso Kutsin from CIMTROP who was involved in an elevation survey carried out in April - May 2008 in the south of Blok C (Pangkoh area). The CIMTROP team made photographs of the BMs they encountered during their survey and found that the BM Id's were different from the data that were supplied by the EMRP team.

The CIMTROP findings initiated a comparison of documents and files supplied by Bakosurtanal. Bakosurtanal supplied a report with BM descriptions together with an additional dataset which included all measured points. After comparing the metadata contained within

the BM description report with the dataset it was found that a total of 10 BM Id's were at the wrong location and consequently also had a different elevation (Figure 13).

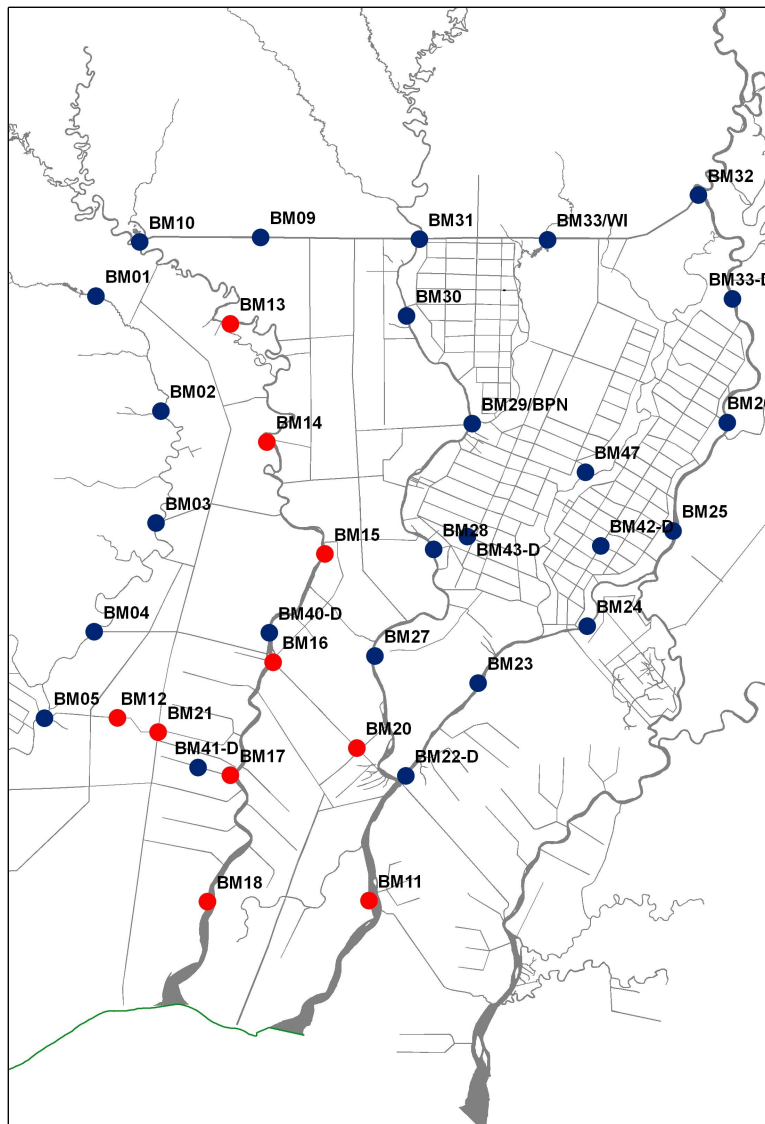


Figure 13 DGPS BM locations. The red dots indicate mistaken BM Id's (and consequently also wrong elevation).

Unfortunately, these findings did not provide answers for most of the benchmark elevation errors found area. It remains unclear whether other DGPS measuring locations (where no benchmarks were installed) were also affected by these mistakes.

An example of the effect of the uncertain elevation of the benchmarks is given in Section 2.5.2.3 where two benchmarks were tied by land-based elevation surveys (Figure 18).

Apart from the uncertainty in elevation of the DGPS benchmarks it was observed in the field that some of the benchmarks were placed on peat and sinking, which would render these benchmarks useless. Most benchmarks were not placed deeply anchored in solid mineral subsoil. Furthermore, the benchmarks were installed too close to the river. Consequently,

during cross section measurements in December 2007 surveyors found it difficult to find them as they were flooded.

5.2 SRTM elevation data

An elevation source which is often being referred to and used is SRTM (Shuttle Radar Topography Mission, 1999). This satellite data is freely available at a vertical resolution of 1 m and a spatial resolution of 90 m. Note that 30 m resolution SRTM data exist as well but was not available to the project.

A DEM has been created from SRTM data by Delft Hydraulics, testing several methods to filter out cells where elevation is overestimated (vegetated areas), as well as erroneous values which occur especially near water, along the coast and rivers. The result of this effort is shown in Figure 14. From this figure the vegetation effect is clearly visible. The method used was not able to filter out all vegetation effects. Apart from the vegetation effect, the low vertical resolution and the lack of reference to MSL are reasons not to use this source for detailed landscape features such as gradients within drainage schemes, the shape of river levees etc.

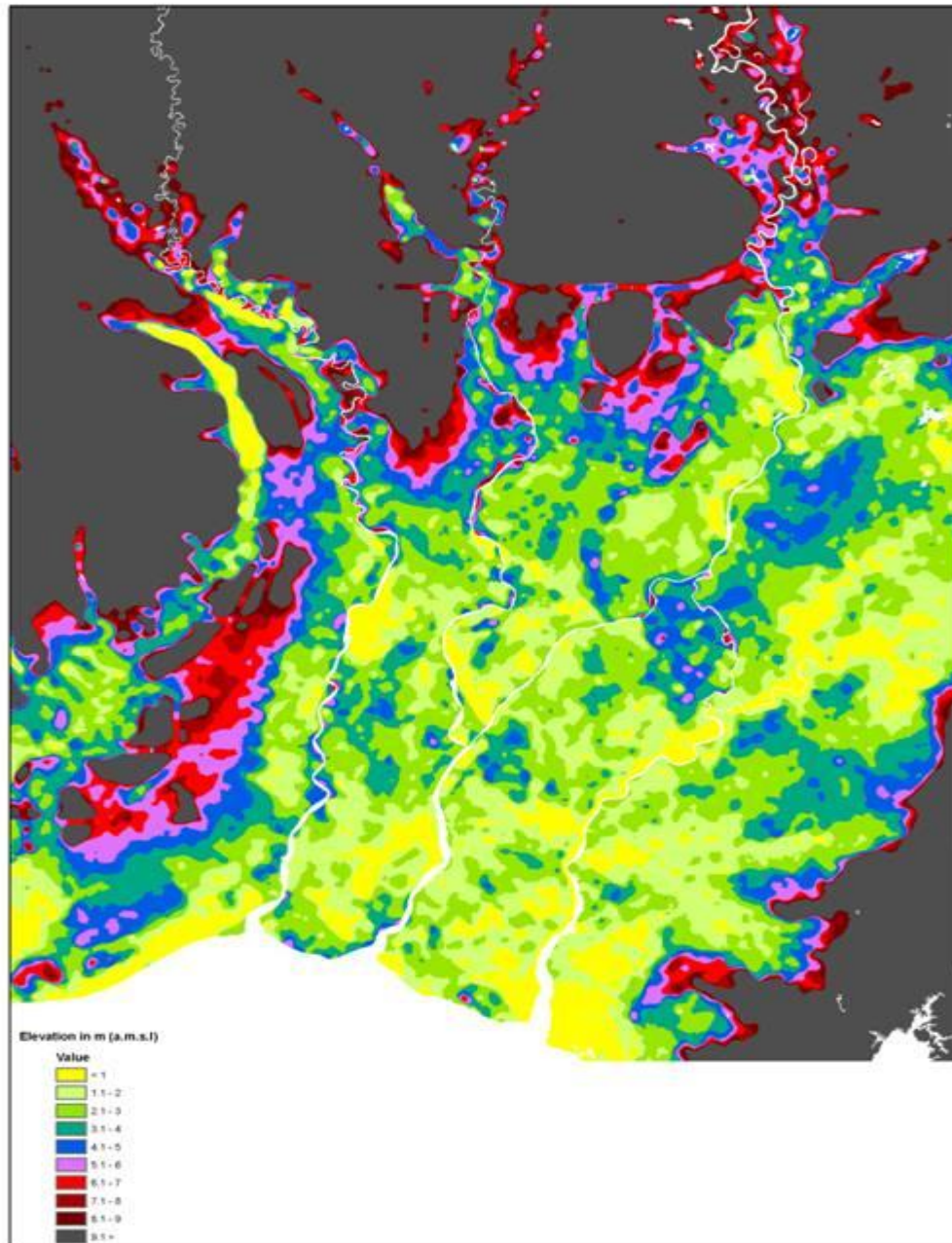


Figure 14 Processed SRTM data using 10x10 minimum and 20x20 median windows.

5.3 CKPP elevation data (Peat Soil and Drainage Mapping project)

During the Peat Soil and Drainage Mapping project (PSDM-CKPP) an extensive land-based elevation survey (of approximately 1,350 km transect length) was carried out. Survey elevation data from other surveys was also gathered, namely the CKPP elevation survey of Block A and Restorpeat elevation surveys in Block C. During the PSDM-CKPP project laser altimetry data obtained during an airplane flight above Block E, A, B, and C became available. All data points available during the project are shown in Figure 15.

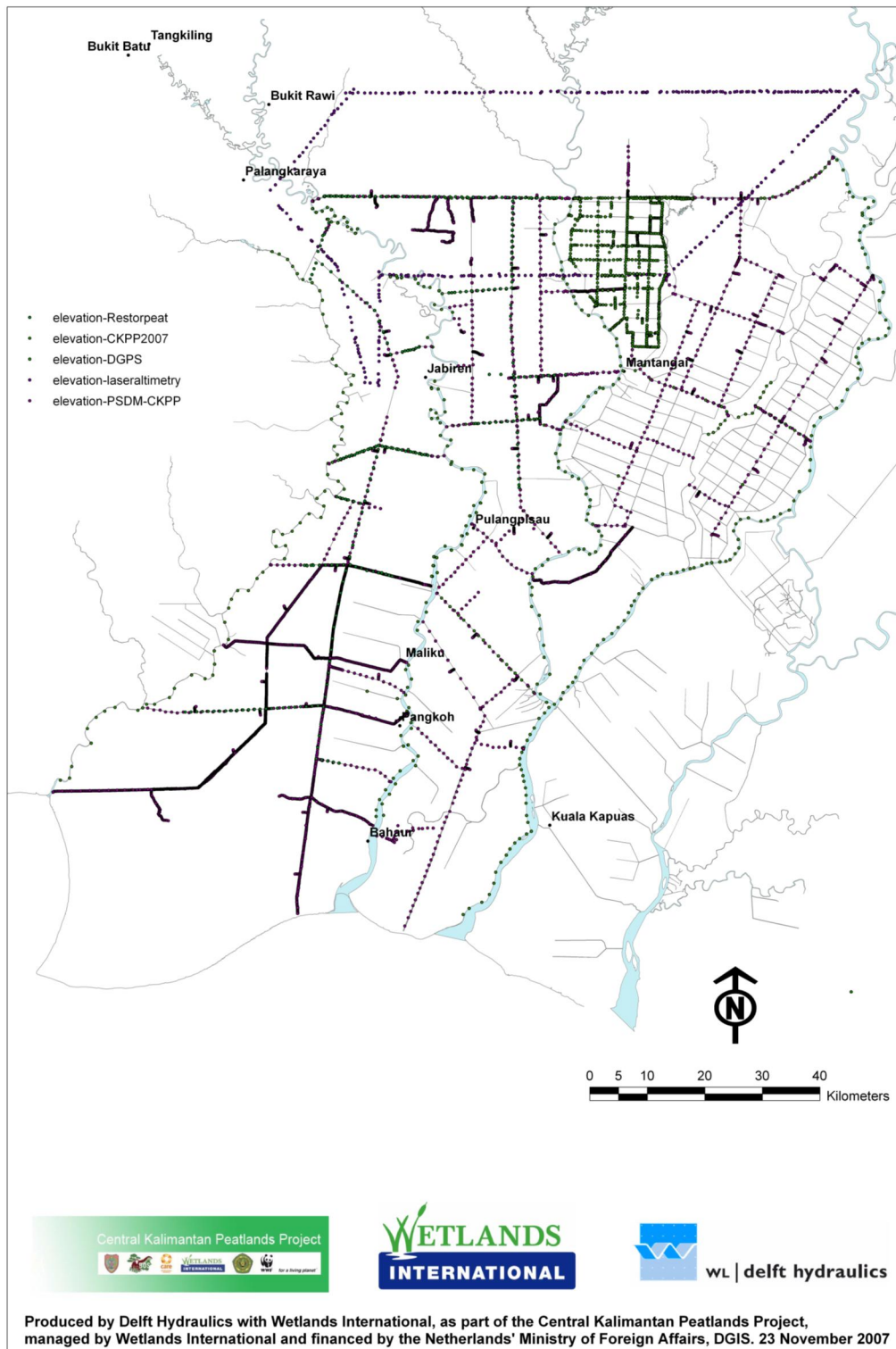


Figure 15 All elevation points available during the PSDM-CKPP project.

5.4 Master Plan project elevation data

During the Master Plan project approximately 220 km of land-based elevation surveys were carried out. Individual transects of the land-based elevation survey started and ended at a benchmark installed by Bakosurtanal during the DGPS survey (Figure 16).

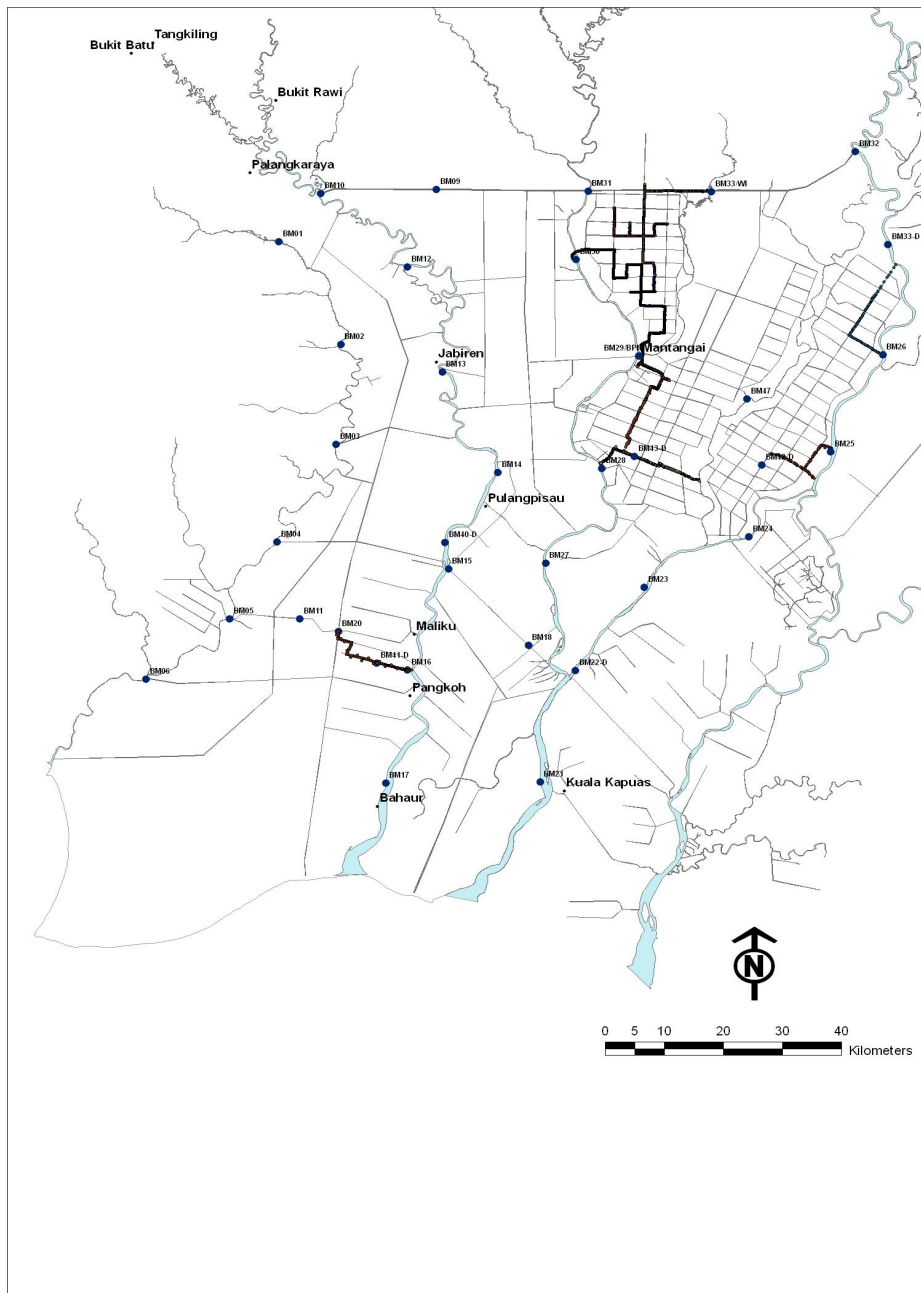


Figure 16 Elevation survey points carried out during the MP project.

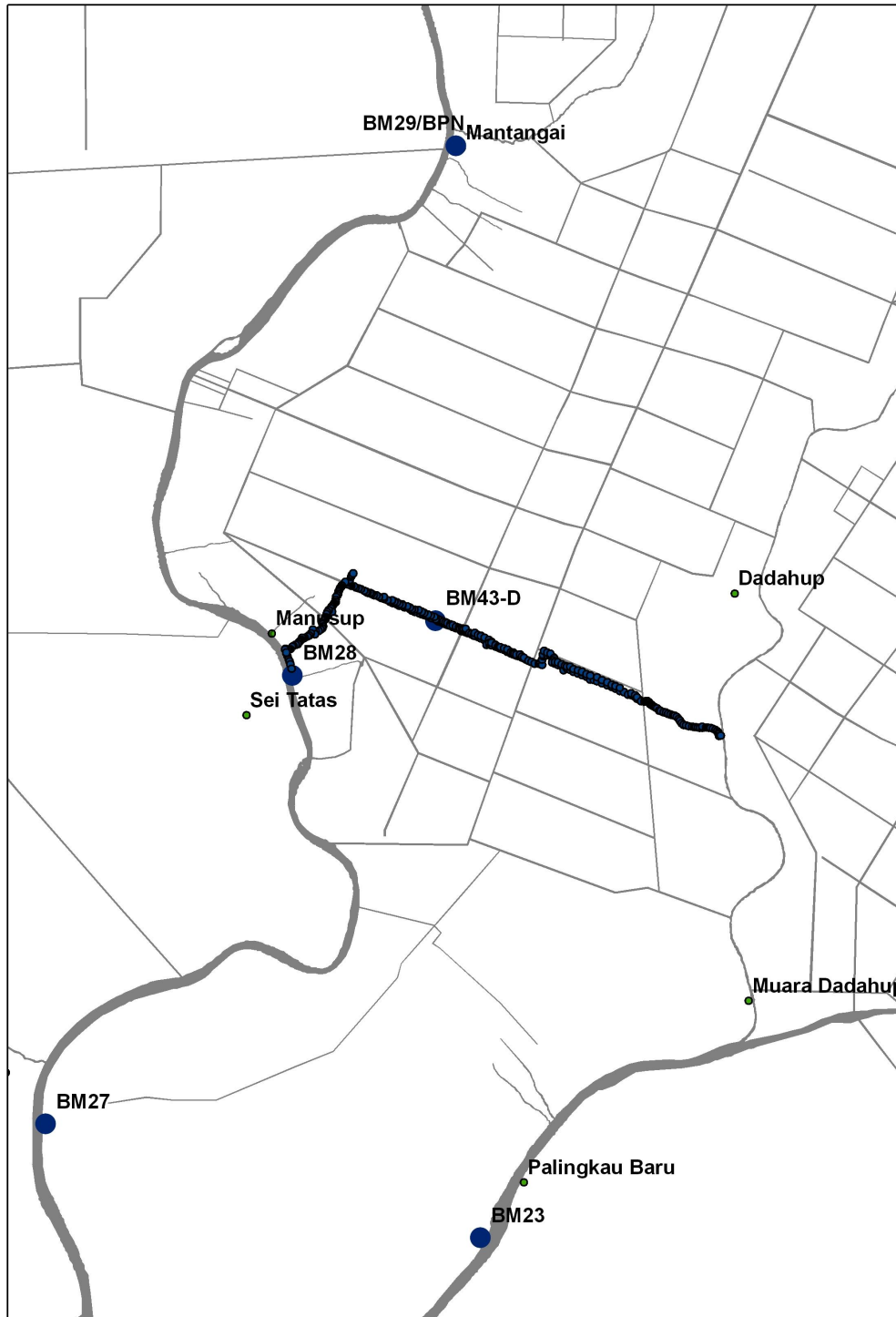


Figure 17 Location of land-based elevation survey transect carried out during the Master Plan project. Profile of transect shown in Figure 18.

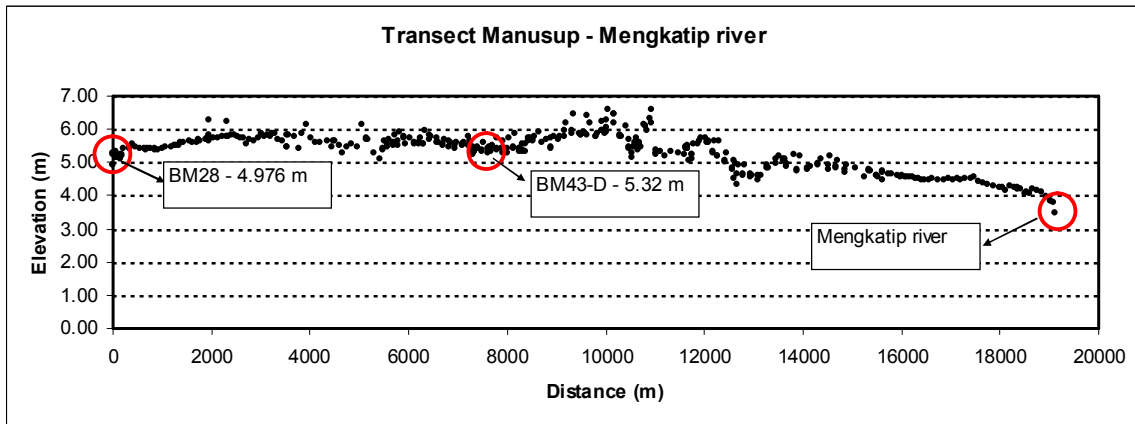


Figure 18 Profile of elevation transect from Manusup in the West and the Mengkatip river in the East starting at DGPS benchmark BM28 via BM43-D to the Mengkatip river as indicated in Figure 17.

According to the land-based elevation survey shown in Figure 18 height difference between the two benchmarks is approximately 40 cm's (5.32 - 4.976 m), whereas the official DGPS BM43-D height is 8.356 m resulting in an elevation difference of 3.38 m.

5.5 Bina Karya elevation data

Consultants of PT. Bina Karya carried out an elevation survey for PU in the Dadahup area (Blok A) early 2008. Although requests were made several times with support of PU and delivery of the data was promised by PT. Bina Karya, the data have not been made available.

5.6 BPN elevation data

At the moment a DGPS survey is carried out by PT. Kapima Rencana Tama, coordinated by Bakosurtanal for BPN Jakarta encompassing the area south of Kuala Kapuas, anjir Banjar, and the transmigration area near anjir Banjar.

6 Summary and Recommendations

6.1 Summary of Data Collection

An overall assessment of data collection by Indonesian Government organizations is as follows:

- **Daily rainfall** data are collected in 13 stations in and upstream of the EMRP area, by PU and BMG, but only a few of those can be used as most have too many data gaps and show poor data quality when cross validated. Moreover, distribution of stations over the area is limited, with only few near the coast and in the mountains. It is therefore not possible to quantify droughts or peak rainfall events from the data available.
- **River water level** data for the EMRP lowland area are collected by PU in 2 stations along the Kahayan River. No water level data are collected along the Barito and Kapuas Rivers, where they are much more needed because that is where problems with flooding occur and where there is a need for tidal irrigation. Moreover, existing River level data are not referenced to Sea level for lack of elevation data.
- **Groundwater level** data are not collected by Gol organizations. Especially in peatlands, this is urgently needed because groundwater depth is the best indicator of fire risk, subsidence and CO₂ emission.
- **Water quality data** are collected only sporadically, and are insufficient to help identify key problems such as saline intrusion or acidification in agricultural areas.
- **Elevation data** for the EMRP area, as provided by Bakosurtanal, are highly inaccurate and can not be used. Errors of several metres are common, which does not allow applications such as flood mapping, hydrological modelling or design of drainage / irrigation schemes. Major errors also exist in the elevation data for Bakosurtanal benchmarks.
- **Soil type and peat depth data** have been collected only in Blocks A, B and C, and are inadequate for determining the presence of deep peat or potential acid sulphate soils.

It is clear that significant improvement in collection of all the above data types will be needed for thorough analyses.

In the Master Plan project, and in other projects in the EMRP area, all these data types have been collected to fill the most problematic data gaps and to allow the analyses needed for those projects. While this has generated a significant amount of data, such efforts are not sustainable in the long term due to the short duration of these projects. Data collection in the area, in support of rehabilitation efforts, must ultimately be the responsibility of Gol organizations like PU and BMG.

6.2 Preliminary recommendations

Rainfall

Considering the high spatial variability of rainfall in the EMRP area, reliable rainfall data should be collected at more locations in the EMRP area than is currently the case. Suggested locations for improved permanent stations for daily monitoring are Pulang Pisau, Kuala Kapuas and Mentangai, at a minimum. At other stations, monthly data may suffice.

In addition, the use of TRMM (and other) satellite rainfall data should be considered. While conventional rainfall recording will still be needed (if only for verification and in case satellite data would no longer be available), only satellite data can provide the spatial coverage and reliability required for analysis of droughts and river floods.

River water levels

River water levels should be monitored along stations along the Barito and Kapuas Rivers. As a start, some of the temporary stations set up by the MP project could be handed over and continued. These stations use electronic 'Diver' water level recorders rather than the traditional recorders that are much costlier and less reliable. The use of Divers may be considered by PU. Suggested locations for improved permanent stations are Rangka Ilung, Dadahup, Mentangai, Kuala Kapuas, Buntoi and Bahaur.

All River water level recorders should be referenced to mean sea level.

Groundwater depths

It would be good if PU or another Gol organization would start monitoring of groundwater depths in selected peatlands in the EMRP area, to provide input to a peatland drought and fire risk monitoring system.

Water quality

It would be good if PU or another Gol organization would start monitoring of water quality in tidal agricultural areas, to provide input to assessments of irrigation improvements required to deal with acidity (and possibly salinity) problems.

Elevation

In order to reduce the error of the Digital Elevation Model over the entire area the following needs to be done:

- Installation of new permanent benchmarks on mineral soil and above high watermark level
- DGPS survey starting in Banjarmasin (where there is a permanent Bakosurtanal station with proper reference to MSL) using 10 km intervals at most between base stations to reduce measurement errors, and including measuring all benchmarks which were installed in September 2007 as well as new benchmarks.
- Relate DGPS elevations of benchmarks in the tidal area to water level measurements at a nearby station in order to check the reference to MSL.
- Linkage of all elevation land-surveys to date, including those conducted in the CKPP and MP projects (more than 1500 km), to the benchmarks once accurate elevations

are available for those. Also link existing laser-altimetry data. Reassessment of quality of all data to date, as a basis for further land-based surveys.

Contrary to common practice, Space Shuttle radar (SRTM) data can not be used for DEM development in the EMRP area (or in any other lowland area), at least not for purposes requiring an accuracy within a few metres. This because SRTM data not only A) have a vertical resolution of 1m, B) need to be corrected for actual Sea water level, but most importantly C) the fact that SRTM data do not represent the land surface elevation. Rather, they represent some level between the vegetation elevation and the land surface elevation which results of errors well over a metre in shrubland, and over 10 metres in forest areas.

Peat depth

Peat depth surveys are urgently needed in the EMRP area, especially in Blocks C and E where surveys have been especially limited to date. Even where there have been surveys already, larger-scale and more accurate new surveys are needed not only because all surveys to date have large error margins but also because peat depths have been reduced over the last 10 years, because of fires and subsidence.

Parallel to the peat depth survey, peat characteristics also need to be sampled, especially bulk density, carbon content and ash content.

General

Data collection and data quality protocols should be evaluated and/or drafted for all data collection types. At present, data quality control is weak and it is unclear what data are being used for. Also, data are too often not available to those who need them.

Annex I Notes on technical meeting with agencies on 22 January 2009

At 22 January 2009 a technical meeting was held at the Bappeda office in Kalimantan about the hydro-topographical data needs for implementation of the EMRP Master Plan and the handing over the ongoing monitoring system installed by the Master Plan to the agencies. This memo is a summary of this meeting. In the table below the list of participants can be found.

No.	Name
	Balai Rawa
1.	Arfini
2.	Maruddin F.M.
3.	Surya D
4.	Zainal
	Balai Wilayah Sungai Kalimantan II
5.	M. Bahrani Pulungan
6.	Otang Sumantri
	Bappeda
7.	Pontas
	BMG
8.	Anton Budiyo
9.	Ferdy P.
10.	F. Roby T.
11.	Meldan
12.	Rena T.
	Dinas PU
13.	Fery Maun Her
14.	Free Vynou
	Team Master Plan
15.	Arnoud Haag
16.	Nasrul Ischan
17.	Nick Mawdsley
18.	Marnix van der Vat
19.	Ronald Vernimmen

Introduction

After the official opening of the meeting by Mr. Pontas, the team leader of the Master Plan (Nick Mawdsley) briefly introduces the Master Plan including the goal, a map with adapted management zones as they are identified by the Master Plan (protection zone, limited development, development and coastal zone) and some possible interventions.

Hydro-topographical monitoring questions

Hydro-topographical monitoring is important to answer questions related to:

1. Flooding
2. CO₂ emission from peat lands
3. Peat land fires
4. Water quality in (limited) development zone (acidity and salinity)
5. Drainage, water supply/irrigation, of settlement areas and agricultural lands

To address the questions a hydrological monitoring system is required. To get a general idea where and what is being measured, the locations of the current monitoring system of both BMG, Dinas PU and the Master Plan is shown on maps and includes measurements of precipitation, water levels (in both rivers and canals) and ground water depth.

BMG points out that in the whole of Central Kalimantan it has 54 precipitation stations (some of which are climatic stations which also include measurements of temperature, windspeed, radiation) of which at the moment 17 are operational. The other stations have rain gauges which are broken. Five of the 17 stations (Muara Teweh, Buntok, Palangka Raya, Sampit and Pangkalanbun) are being operated by BMG staff, the remainder by BPPTPH. Data from the 5 synoptic stations of BMG are being automatically recorded (on paper, not digitally) and results are being written down at three hours intervals.

As the Master Plan is finishing soon, it is necessary that the instruments and knowledge is being transferred to the agencies responsible for monitoring. This knowledge transfer includes how to operate the automatic water level recorders (divers) and the hydrological database. This knowledge transfer task will be mainly carried out by Ischan.

Discussion

The discussion focuses on the following 3 points:

1. What are the views on incorporation of the Master Plan monitoring system into the current system of PU and BMG
2. Can people be allocated for the transfer phase and how
3. Future monitoring system and the responsibility, which includes maintenance and accessibility of the database

The following problems with the current monitoring and data collection are identified:

1. Different agencies measure the same parameter. Both PU and BMG measure precipitation, but precipitation is also measured by BPPTPH (Pertanian), sometimes at the same location.

Data at the same location is often different. The need for one hydrology department is expressed.

2. Measurements are often carried out by local people (and not by staff of the respective agencies), which can be the head of a village or even school kids.
3. Data accessibility and transfer is poor. For example BMG has often difficulties in obtaining precipitation data from BPPTPH which are measuring with gauges provided by BMG.
4. The lack of mean sea level reference points (benchmarks).

No problems are foreseen in the transfer of equipment and knowledge once it is explained what is going to be transferred and some photos are shown of the divers and briefly explained how these are installed (in PVC tubes).

The discussion continues around the 3 main problems facing the monitoring:

1. Type of instruments
2. Who is responsible
3. Finance

Discussion focuses on the financial aspect. No decisions can be made during this meeting and the issue of financing the monitoring system for the future should be addressed to the provincial government (PEMDA).

In order to convince the provincial government for allocating extra funds for hydrological monitoring in the near future the agencies should indicate why monitoring is important, where monitoring should take place and how much money would be needed.

Nick points out that there is a close interaction between the Implementation of the Master Plan / provincial government needs, hydrological monitoring and hydrological modelling. None of the three 'parties' can do without each other.

Conclusions

It is agreed during this meeting that there is no problem in transferring the instruments and data to the respective organizations, although it remains to be specified which instruments are being transferred to which agency. Allocating of funds for future monitoring should be addressed to the provincial government.

The following issues need to be addressed in a follow up technical meeting:

1. maintenance of the database
2. accessibility of the database in the future (through the internet?)
3. user friendliness, make it clearer where you can find what?

Recommendations from the Master Plan

1. a plan for the future should be drafted which includes the locations and required measurements needed to be able to implement the Master Plan. This plan should then be communicated to the provincial government.
2. revitalize precipitation stations which have broken rain gauges.

Final remarks

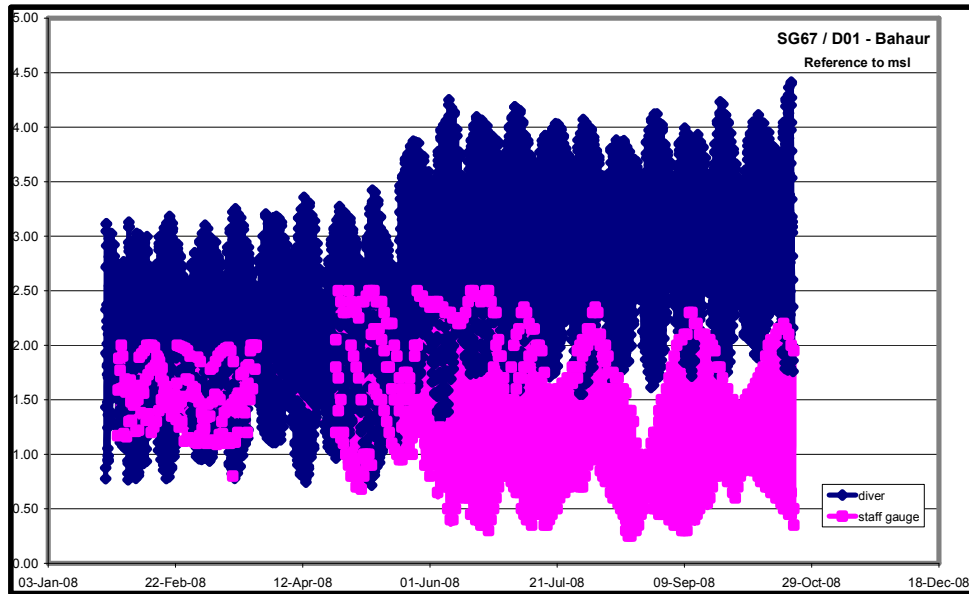
After the official closure of the meeting the hydrological database (including the Technical Report of Cluster 3 and the metadata of all measuring locations) as it was compiled by the Master Plan has been transferred to the Balai Rawa and BMG. Representatives of the Dinas PU will be collecting the data from the Master Plan office.

Annex II Metadata Master Plan Hydrological Monitoring

Instrument Monitoring

Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Bahaur
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG67 Diver D01 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1381), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -3.237841, 114.098908 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Supomo
Telepon Seluler	: +628134933327
Alamat	: Pelabuhan Dermaga Bahaur, Bahaur Tengah, Kec. Kahayan Kuala, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver:24-Sep-07; WL-Staff Gauge: 28-Okt-08
Tanggal Update terakhir Data	: WL-Diver: 30-Jan-08; WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 2 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	: Water lever manual dan Water Level Diver



10. **Masalah dan Solusi**

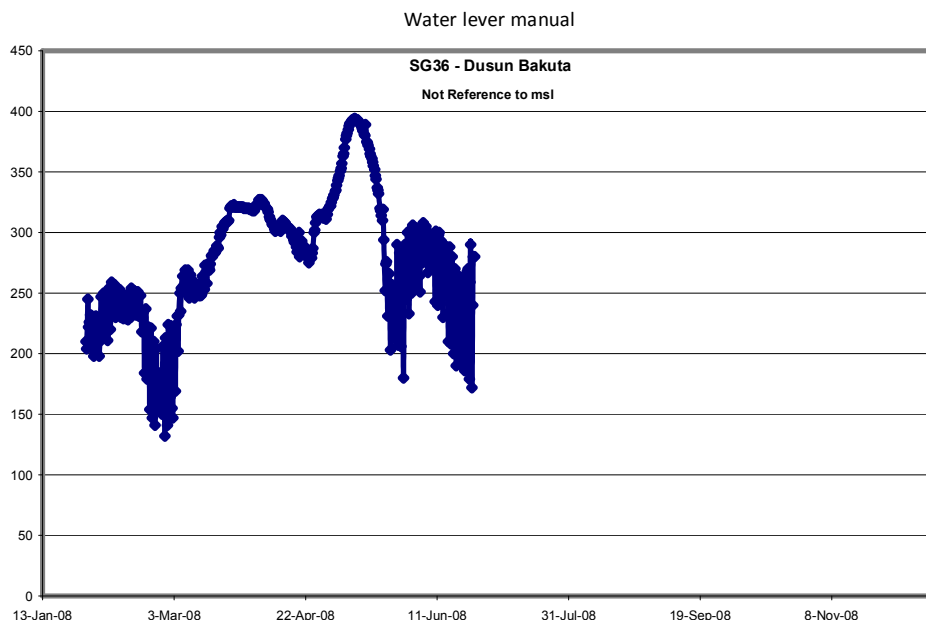
- Masalah :
- Penahan pipa Diver rusak, tutup pipa hilang
 - Staff Gauge mulai mengalami pelapukan dan marka sulit dibedakan (Cat ditutupi lumut)
 - Pengamat tidak terlalu memperhatikan pengamatan dan kondisi diver yang terpasang, mungkin karena kesibukan
- Solusi :
- Perlu perbaikan Penahan pipa Diver dan pemberian tutup pipa
 - Perlu Penggantian/perbaikan Staff Gauge
 - Perlu dipikirkan penggantian pengamat

11. Tanggal Update factsheet : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Bakuta
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG79 Diver D020 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1465), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.422833, 114.760343 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Indra Gunawan
Telepon Seluler	: Tidak Ada
Alamat	: Dusun Bakuta, Kec. Dusun Hilir, Kab. Barito Selatan
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: - ; WL-Staff Gauge: 29-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 23-Oct-08; WL-Staff Gauge: 23-Oct-08
Kualitas Data	: WL – Staff Gauge 2 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Tiang penahan pipa Diver patah dan rusak (kunjungan lapangan 17 – 25 Oktober 2008 hanya perbaikan seperlunya) - Staff Gauge mulai mengalami pelapukan dan marka sulit dibedakan - Diver mengalami kerusakan
---------	---

Solusi : - Perlu penggantian dan perbaikan penahan pipa Diver
 - Perlu Penggantian/perbaikan Staff Gauge
 - Diver rusak sudah diganti pada tanggal 23 Oktober 2008

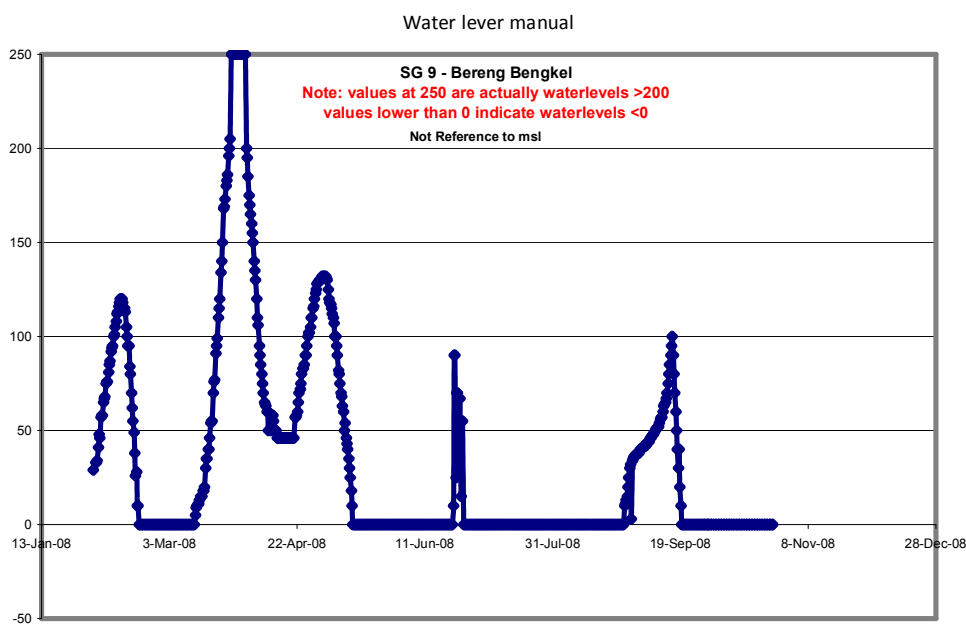
11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Bereng Bengkel
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG65 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.250718, 114.031496 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Yanto
Telepon Seluler	: +6281349174675
Alamat	: Bereng Bengkel, Kec. Jabiren Raya, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 02-Peb-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 25-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -

09. Grapik Data :



10. **Masalah dan Solusi**

Masalah

- : – Ukuran Staff gauge kurang panjang
- Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur
- Posisi Staff Gauge dipindahkan oleh pengamat dari posisi awal karena kejauhan dan untuk memudahkan pengamatan

Solusi

- : – Perlu menambah Ukuran Staff gauge menjadi 400cm
- Perlu Penggantian/perbaiki Staff Gauge
- Perlu evaluasi ulang posisi staff gauge

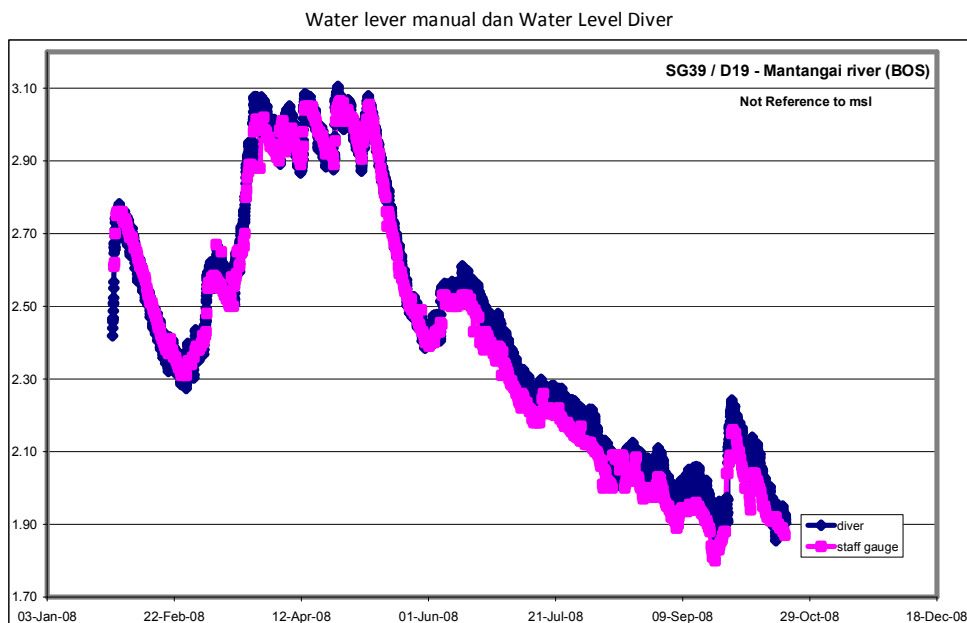
11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring

Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: BOS Camp Release
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG39 Diver D19 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1472), Pengukuran Surface Water level Automatis - Staff Gauge, Pengukuran Surface Water level manual
05. Koordinate	: Diver / Staff Gauge -2.282810, 114.559260 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Udin & Rudy
Telepon Seluler	: +6285249146251 (Udin); +6285248294715 (Rudy)
Alamat	: Sungai Mantangai, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 28-Jan-08; WL-Staff Gauge: 28-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 19-Oct-08; WL-Staff Gauge: 19-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Tempat peletakan Diver sering mendapat gangguan dari kapal yang berlabuh - Staff Gauge mengalami pelapukan dan tulisan angka mulai sulit dilihat
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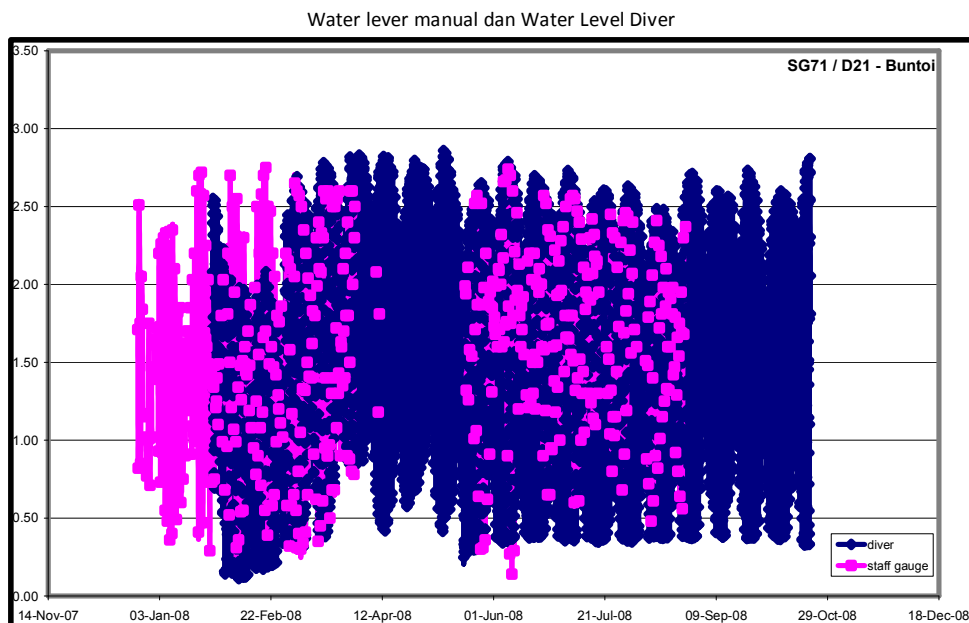
Solusi : – Perlu pemasangan pelindung disekitar posisi tiang diver
– Perlu Penggantian/perbaikan Staff Gauge

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Buntoi
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG71 Diver D021 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C0355), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.806951, 114.200324 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Franztika P. Dewel
Telepon Seluler	: Tidak ada
Alamat	: Buntoi, Kec. Kahayan Hilir, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 26-Jan-08; WL-Staff Gauge: 24-Dec-07
Tanggal Update terakhir Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 23-Oct-08
Kualitas Data	: WL – Staff Gauge 2 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Pengamat tidak terlalu serius dengan kegiatan pengamatan yang dilakukan, sering tidak melakukan pengukuran tanpa penjelasan apapun. - Posisi Diver sering mengalami gangguan dari kapal yang ingin berlabuh dan tiang penahan Diver tidak terlalu kuat
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- Staff Gauge mulai mengalami pelapukan dan cat mulai sulit untuk dilihat

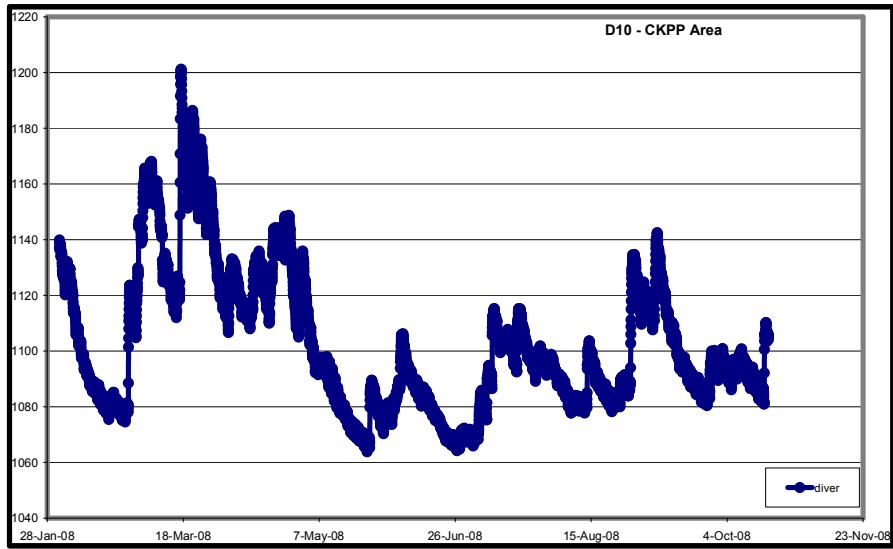
Solusi :
 - Perlu menekankan pentingnya pengukuran kepada pengamat, dengan pemikiran bahwa penggantian pengamat sebagai pilihan terakhir.
 - Perlu memberikan penguatan posisi staff gauge dan perlindungan pada tiang staff gauge
 - Perlu penggantian/perbaikan Staff Gauge

11. Tanggal Update : Selasa, 13 November 2008

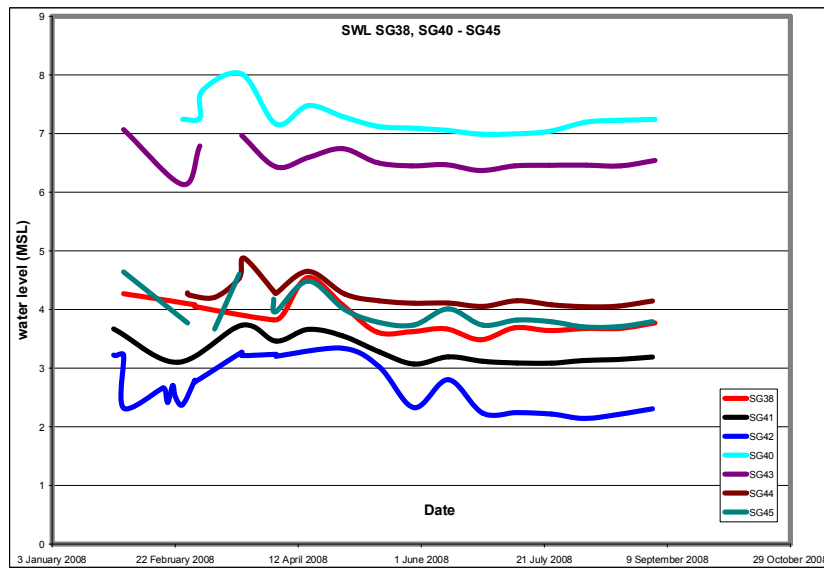
Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

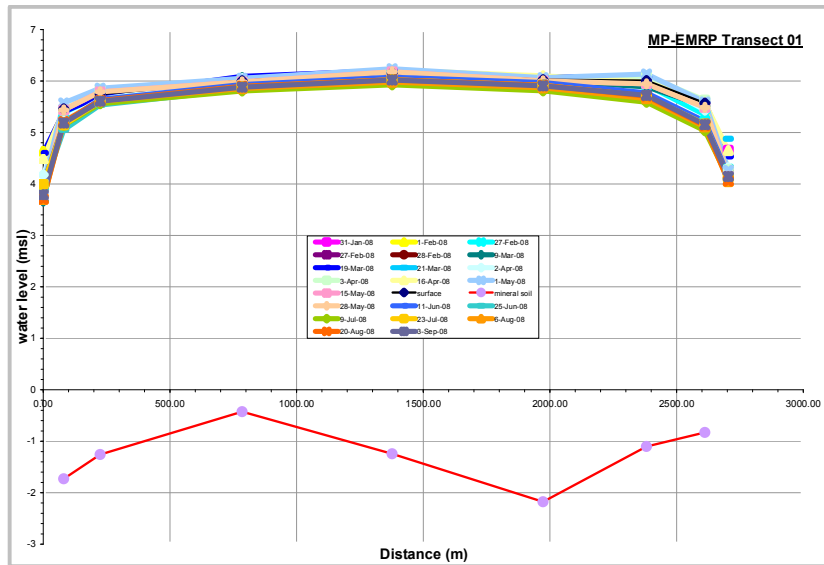
01. Lokasi	: CKPP Area
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level <input checked="" type="checkbox"/> Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG 40 -45 Diver D10 Rain Gauge - Dipwell MP01 & MP02 (1-7)
04. Deskripsi Instrument	: - Minidiver (C1410), Pengukuran Surface Water level Automatis - Staff Gauge, Pengukuran Surface Water level manual - Dipwell; 2 Transect ; 14 dipwell : : :
05. Koordinate	: Diver / Staff Gauge D10(C1410): -2.399260, 114.473783; SG38 : -2.399260, 114.473780; SG41 : -2.420650, 114.518600; SG42 : -2.465580, 114.526750; SG45 : -2.398070, 114.521620; SG43 : -2.374990, 114.478660; SG40 : -2.352990, 114.478560 : Dipwell MP0101 : -2.397330, 114.519760; MP0102 : -2.396030, 114.519760; MP0103 : -2.391040, 114.520050; MP0104 : -2.385690, 114.519590; MP0105 : -2.380340, 114.519730; MP0106 : -2.376670, 114.519730; MP0107 : -2.374600, 114.519720; SG44 : -2.373760, 114.520190; MP0201 : -2.374260, 114.478660; MP0202 : -2.372950, 114.478610; MP0203 : -2.368330, 114.478640; MP0204 : -2.363850, 114.478620; MP0205 : -2.359410, 114.478820; MP0206 : -2.354880, 114.478600; MP0207 : -2.353600, 114.478590
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Rahmat & Dendy
Telepon Seluler	: +6285251567372 (Rahmat); +6281349301153 (Dendy)
Alamat	: Mantangai Hulu, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 1 kali per 2 Minggu, WL – Diver: per jam, Dipwell - Transect: 1 kali per 2 Minggu
Tanggal Awal Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08; Dipwell: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08; Dipwell: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell 1
09. Grapik Data	: WL – Diver CKKP Area



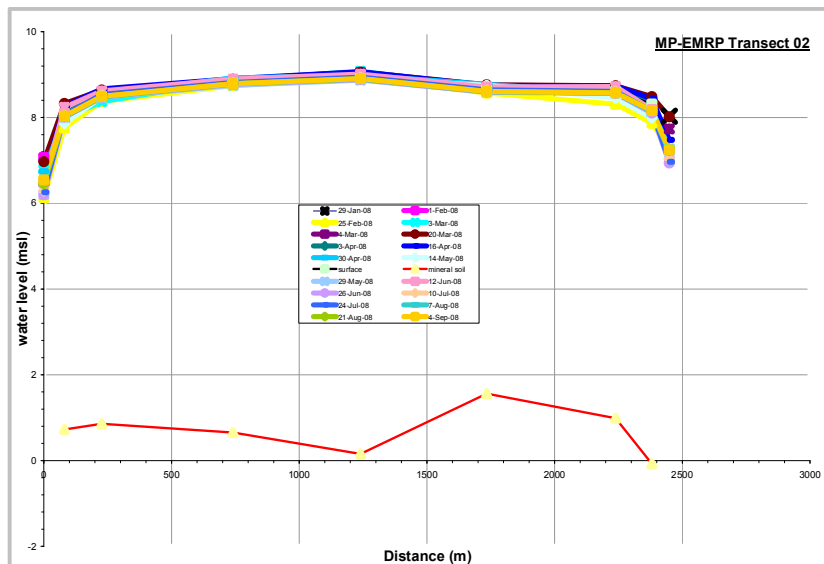
WL – Staff Gauge CKKP Area



Groun Water Level – CKPP Area (MP – EMRP Transect 01)



Groun Water Level – CKPP Area (MP – EMRP Transect 02)



10. Masalah dan Solusi

Masalah

- : – Peralatan monitoring sering mengalami gangguan perusakan, seperti perusakan dan pencurian
- : – Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur (Perusakan terakhir diketahui pada saat pengukuran pada minggu ke dua bulan September 2008), pada SG38 & SG42
- : – Titik referensi dirusak/dipindah, (perkiraan kejadian pada minggu ke dua bulan September 2008)

Solusi

- : – Perlu menyiapkan persediaan peralatan sehingga monitoring tidak perlu terhenti
- : – Perlu dipikirkan tindakan yang bisa menyelesaikan permasalahan dasar (gangguan dari masyarakat), salah satu pilihan: sosialisasi yang lebih luas mengenai kegiatan monitoring yang dilakukan.
- : – Perlu Penggantian/perbaikan Staff Gauge
- : – Perlu penggantian, penentuan ulang titik ketinggian referensi.

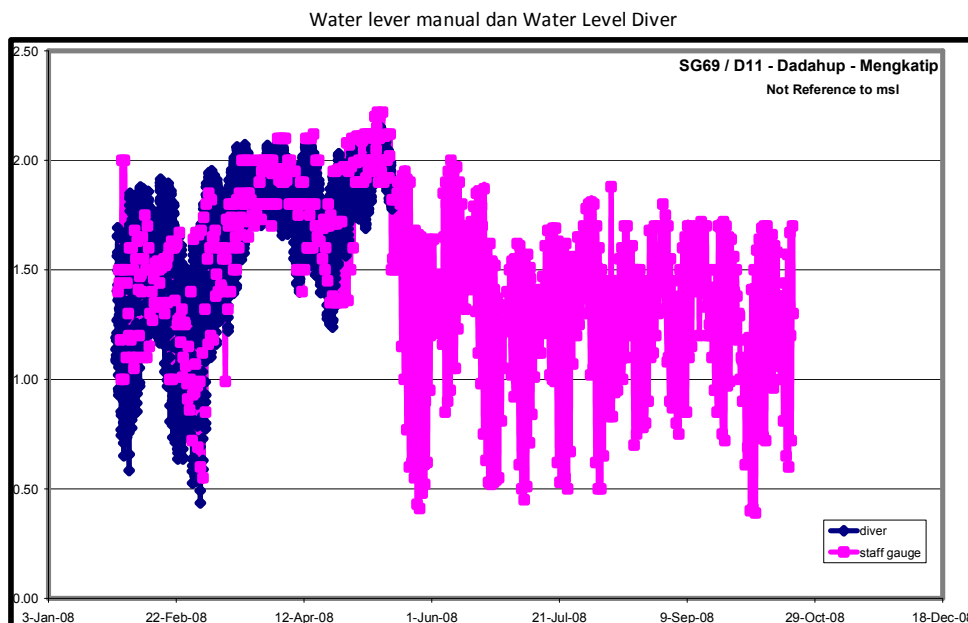
11. Tanggal Update

: Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Dadahub
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG69 Diver D11 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C0210), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.650580, 114.603111 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Bendi Ebe & Teli
Telepon Seluler	: +6281349444788 (Bendi Ebe)
Alamat	: Dadahub, Kec. Kapuas Murung, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jamT
Tanggal Awal Data	: WL-Diver: 29-Jan-08; WL-Staff Gauge: 30-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 16-Mei-08; WL-Staff Gauge: 20-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Diver rusak, untuk sementara diver diambil untuk pengecekan - Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur
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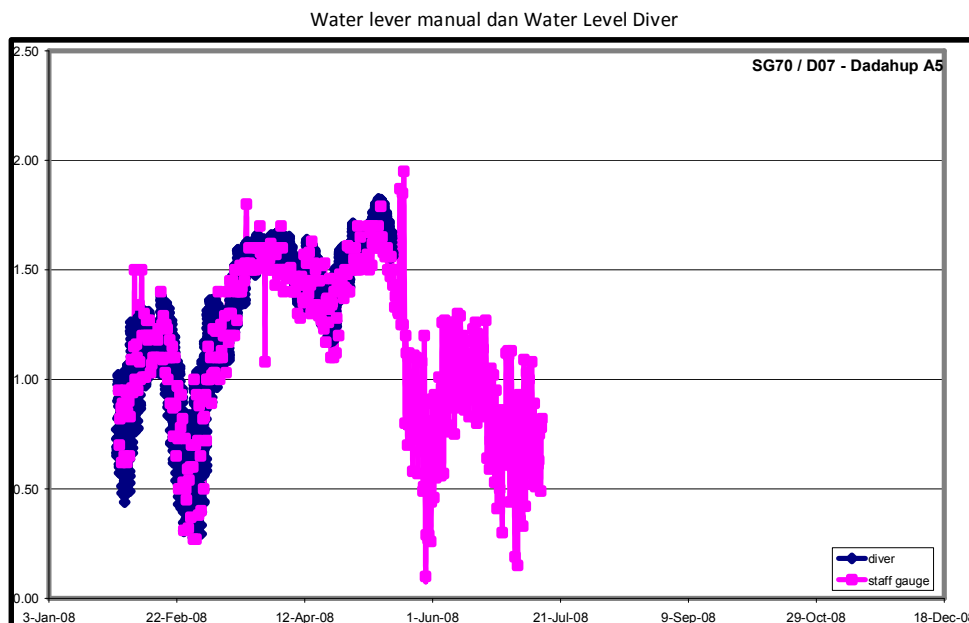
Solusi :
- Perlu penggantian Diver
- Perlu Penggantian/perbaikan Staff Gauge
- Perlu memperpanjang ukuran staff gauge menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

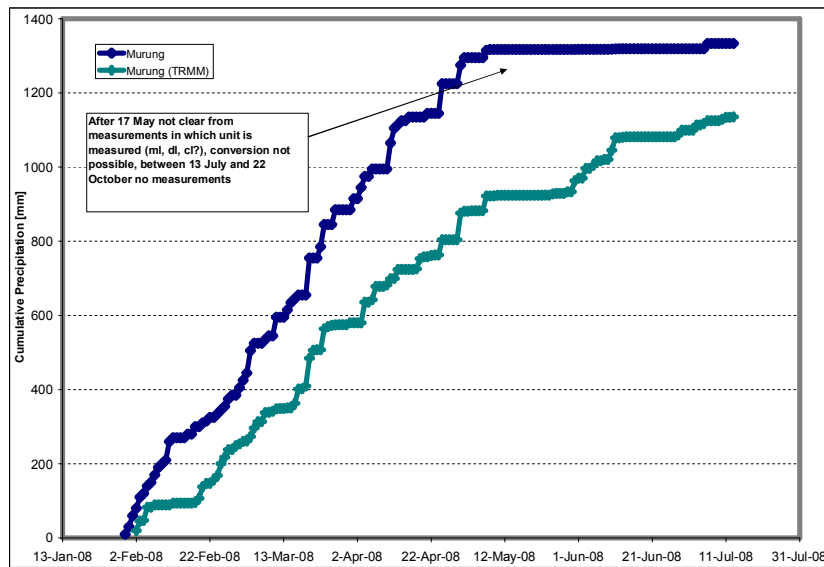
Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Dadahub A5
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level <input checked="" type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG10 Diver D07 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (A6248), Pengukuran Surface Water level Automatis - Staff Gauge, Pengukuran Surface Water level manual - Rain Gauge, Pengukuran curah hujan manual : :
05. Koordinate	: Diver / Staff Gauge -2.681720, 114.683822 : : Rain Gauge - : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Sakar & Frans
Telepon Seluler	: +6285248665652 (Khatmat-suami Sinuka Sekdes Dadahub)
Alamat	: Dadahub A5/Bentuk Jaya, Kec. Kapuas Murung, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam, P – Rain Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Diver: 29-Jan-08; WL-Staff Gauge: 30-Jan-08; Rain Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: 16-Mei-08; WL-Staff Gauge: 24-Oct-08; Rain Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 2 WL – Diver 2 Precipitation 2 Dipwell -
09. Grapik Data	:



Precipitation – Rain Gauge Manual



10. Masalah dan Solusi

Masalah

- : – Penahan, pipa dan Diver rusak, untuk sementara diver diambil untuk pengecekan
- : – Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur

Solusi

- : – Perlu perbaikan penahan, pipa dan penggantian Diver
- : – Perlu Penggantian/perbaikan Staff Gauge

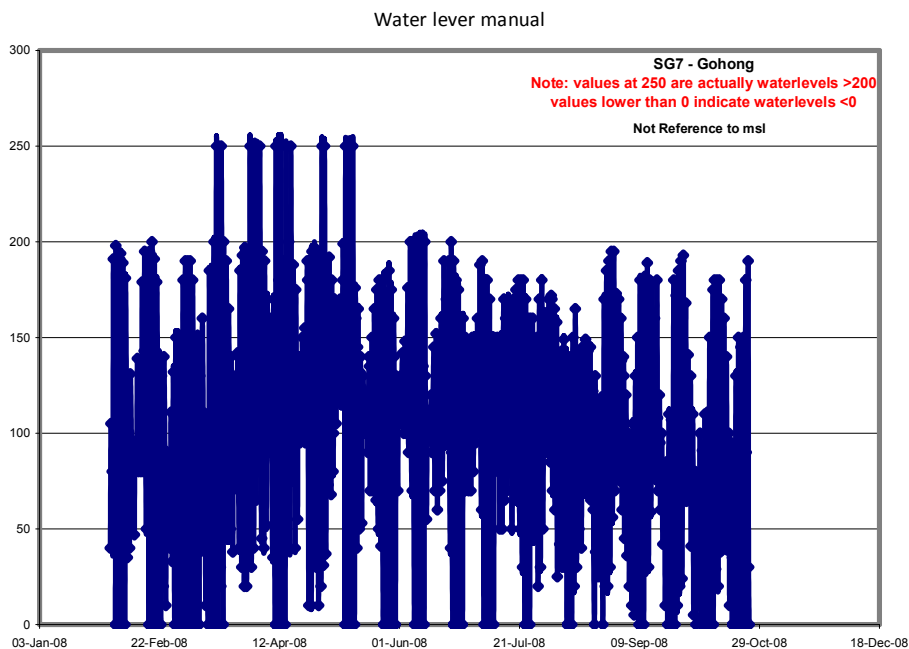
11. Tanggal Update

: Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Gohong
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG63 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.692274, 114.282354 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak <input type="checkbox"/>
07. Pengamat	
Nama	: Demie
Telepon Seluler	: +6285238198532
Alamat	: Gohong, Kec. Kahayan Hilir, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 01-Peb-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 24-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : – Staff gauge kurang panjang
– Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur

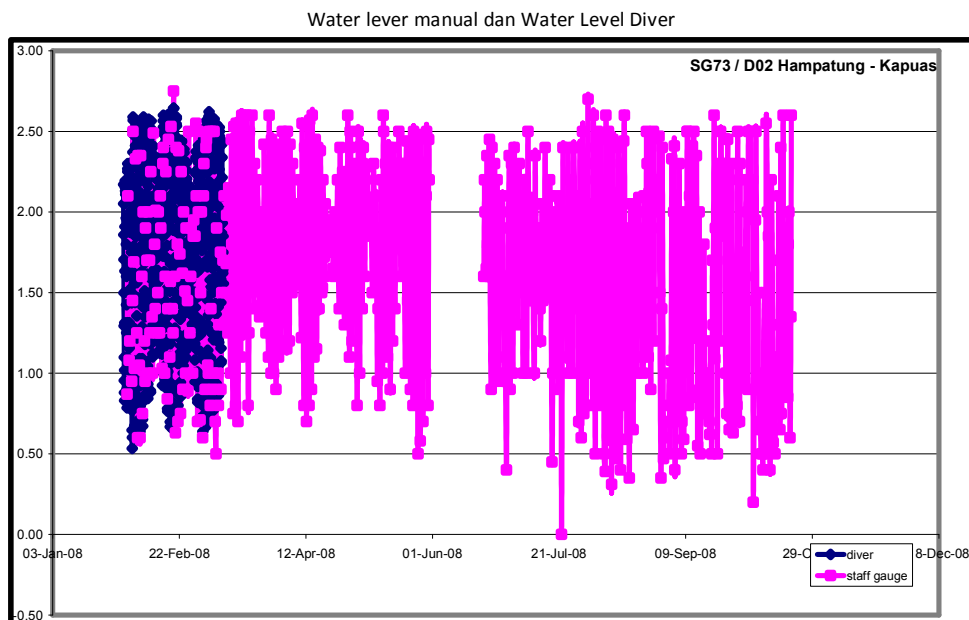
Solusi : – Perlu Penggantian/perbaiki Staff Gauge dan memperpanjang ukuran staff gauge menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik, 2=Cukup, 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Hampatung
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG73 Diver D02 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (A6084), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : : :
05. Koordinate	: Diver / Staff Gauge -2.807869, 114.20225 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak <input type="checkbox"/>
07. Pengamat	
Nama	: John Kopter
Telepon Seluler	: +6285248747941
Alamat	: Desa Hampatung, Kec. Pulau Petak, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 01-Jan-08; WL-Staff Gauge: 01-Peb-08
Tanggal Update terakhir Data	: WL-Diver: 10-Mar-08; WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 2 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Penahan pipa dan Diver rusak, untuk sementara diver diambil untuk pengecekan : - Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur : - Tanggal, 3 desember 2008, Holdiansyah melaporkan pipa tempat diver, hilang dicuri.
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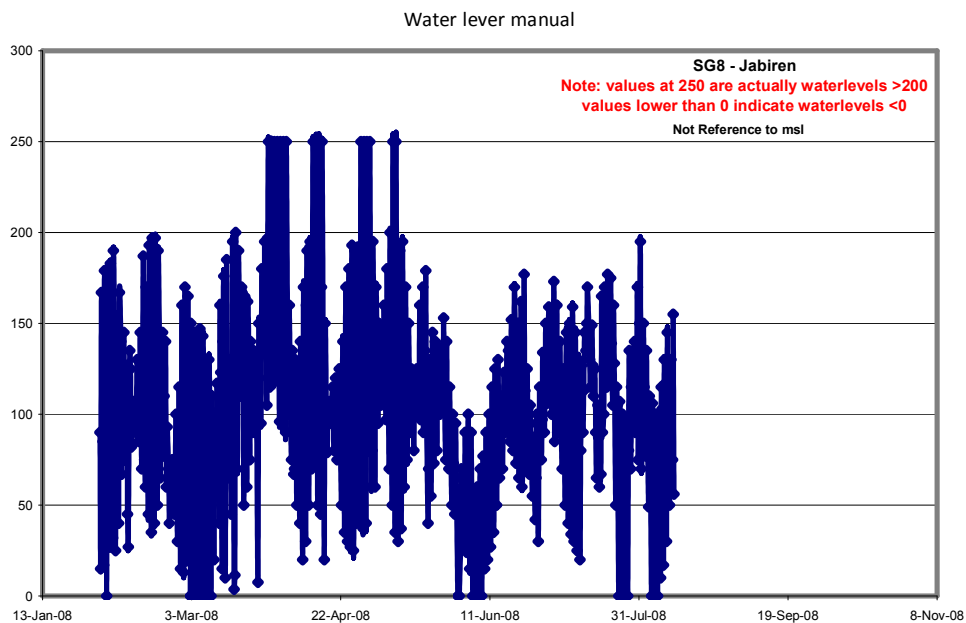
Solusi :
- Perlu perbaikan penahan pipa dan penggantian Diver
- Perlu Penggantian/perbaikan Staff Gauge
- Perlu menyiapkan pipa baru dan pemasangan ulang

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Jabiren
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG64 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.523802, 114.192197 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Hermana
Telepon Seluler	: +6281392046247
Alamat	: Jabiren, Kec. Jabiren Raya, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 01-Peb-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 24-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Staff Gauge kurang panjang - Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur
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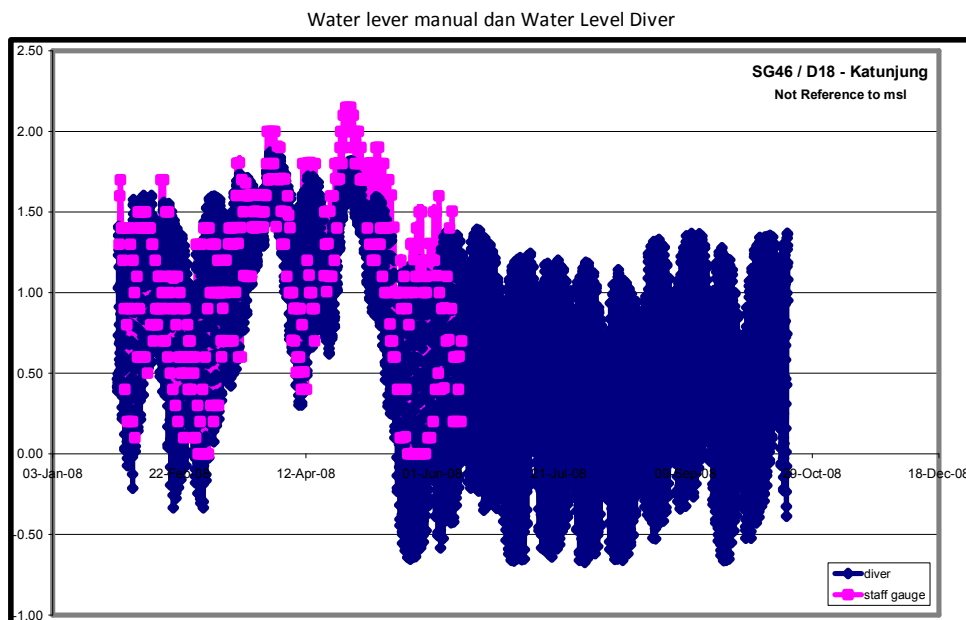
Solusi : – Perlu Penggantian/perbaikan dan memperpanjang ukuran staff gauge menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Katunjung
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG46 Diver D18 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1478), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.2615333, 114.411717 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Achmadi
Telepon Seluler	: +6281348555056
Alamat	: Katunjung, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 24-Oct-08; WL-Staff Gauge: 29-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 19-Oct-08; WL-Staff Gauge: 19-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : - Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur

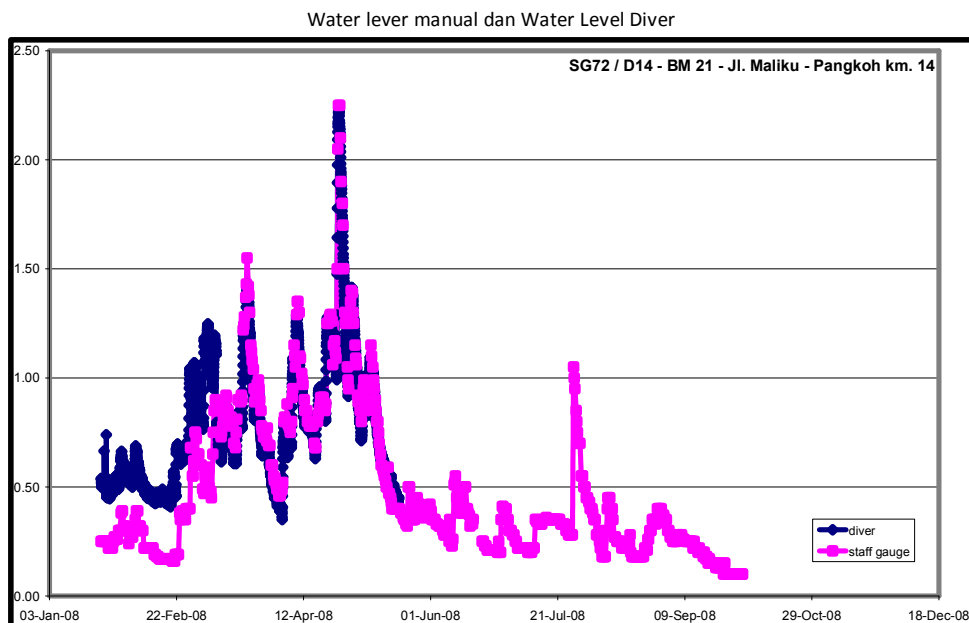
Solusi : — Perlu Penggantian/perbaikan Staff Gauge dan memperpanjang ukuran menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Km14 Sebangau
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG72 Diver D14 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C0523), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.932089, 113.981102 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Tuman
Telepon Seluler	: -
Alamat	: Jl. Sebangau km 14 Blok C (Pangkoh V), Kec. Kahayan Kuala, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 23-Jan-08; WL-Staff Gauge: 23-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 19-Mei-08; WL-Staff Gauge: 26-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : - Diver hilang

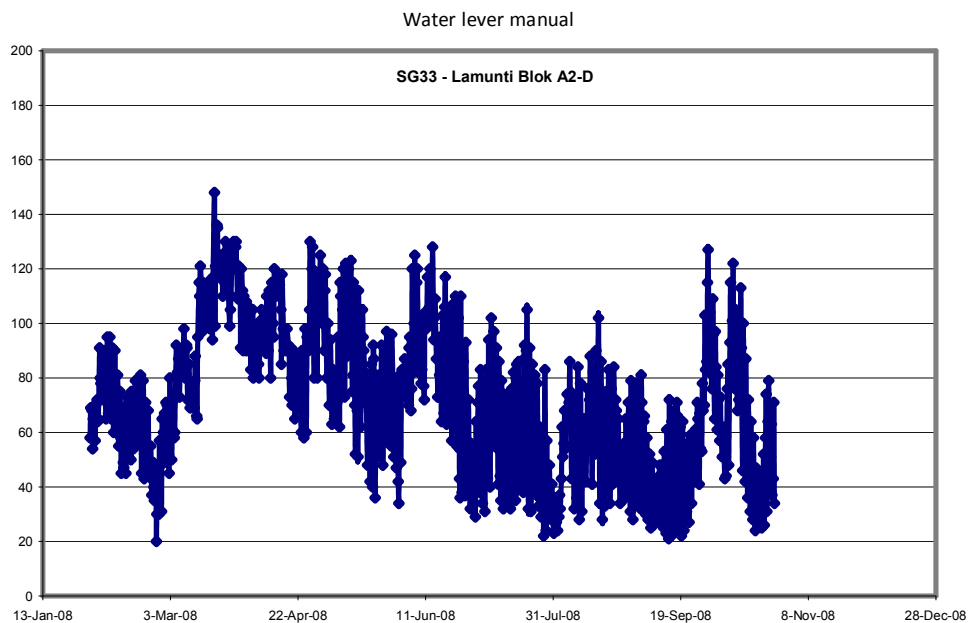
Solusi : – Perlu penempatan diver baru dan memastikan kejadian kehilangan ini tidak terulang lagi
– Dipandang perlu untuk penempatan ulang posisi Staff Gauge /diver pada lokasi yang lebih aman sebagai pilihan terakhir

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Lamunte Blok A2-D
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG77 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.617000, 114.486993 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Supendi
Telepon Seluler	: +6281351532505 (Orang tua Supendi)
Alamat	: Lamunte Blok A2-D, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 31-Jan-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 25-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : - Staff Gauge patah, mengalami pelapukan/kerusakan dan warna terlihat kabur

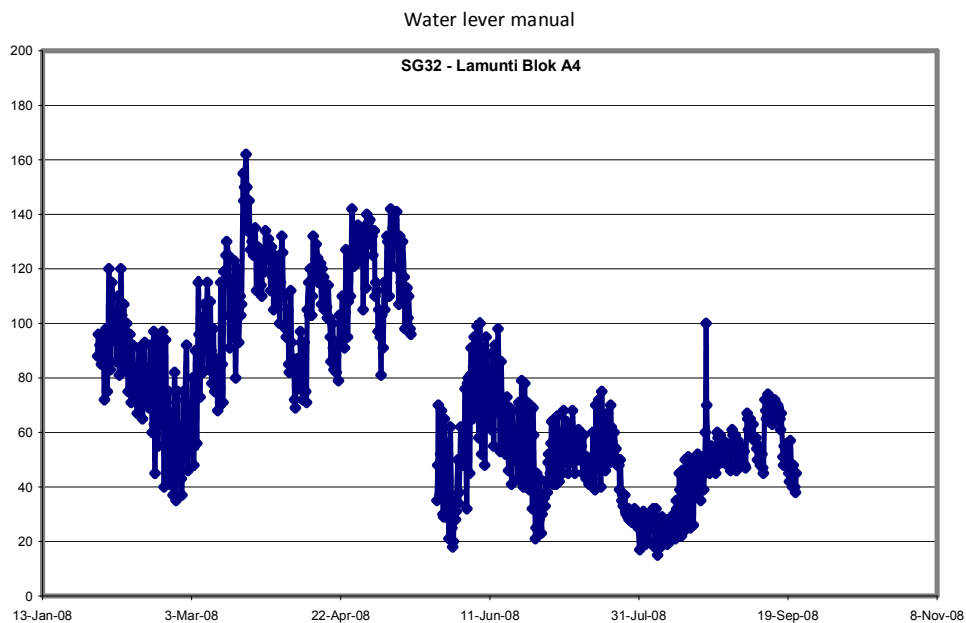
Solusi : – Perlu Penggantian Staff Gauge

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Lamunte Blok A4
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG76 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.616976, 114.487314 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Atak
Telepon Seluler	: -
Alamat	: Lamunte Blok A4, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 31-Jan-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 20-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : - Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur

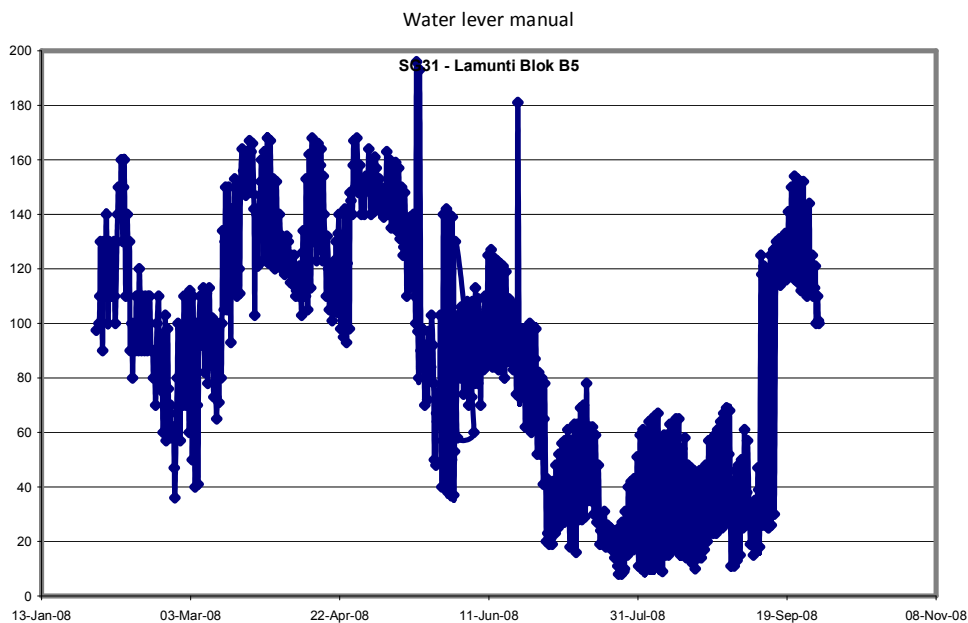
Solusi : — Perlu Penggantian Staff Gauge

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Lamunte Blok B5
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG75 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.543005, 114.543006 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak <input type="checkbox"/>
07. Pengamat	
Nama	: Saikoni
Telepon Seluler	: +6281349799388 (Sumardjo, tetangga Saikoni)
Alamat	: Lamunte Blok B5, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 31-Jan-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 20-Oct-08
Kualitas Data	: WL – Staff Gauge 2 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : - Staff Gauge patah, mengalami pelapukan/kerusakan dan warna terlihat kabur

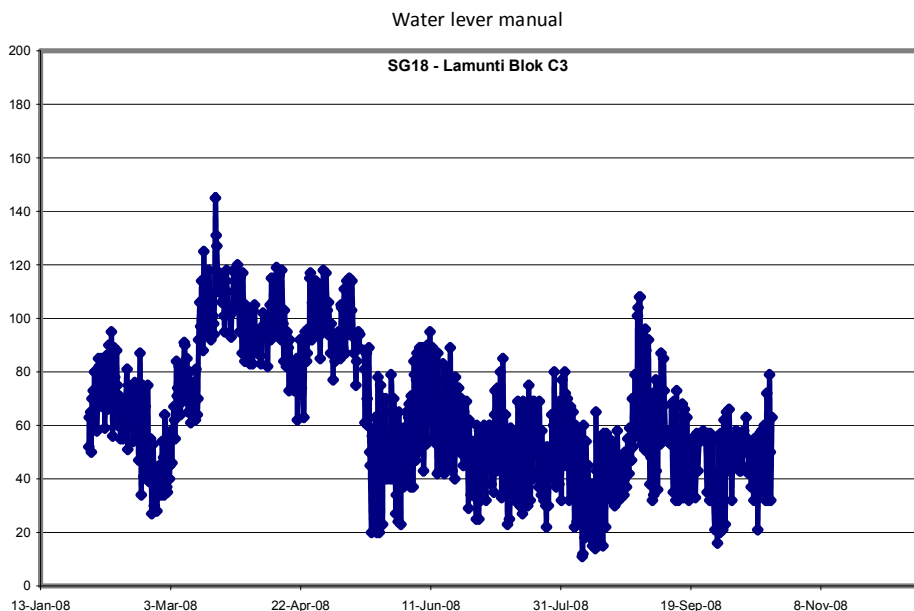
Solusi : — Perlu Penggantian Staff Gauge

11. Tanggal Update : Selasa, 13 November 2008

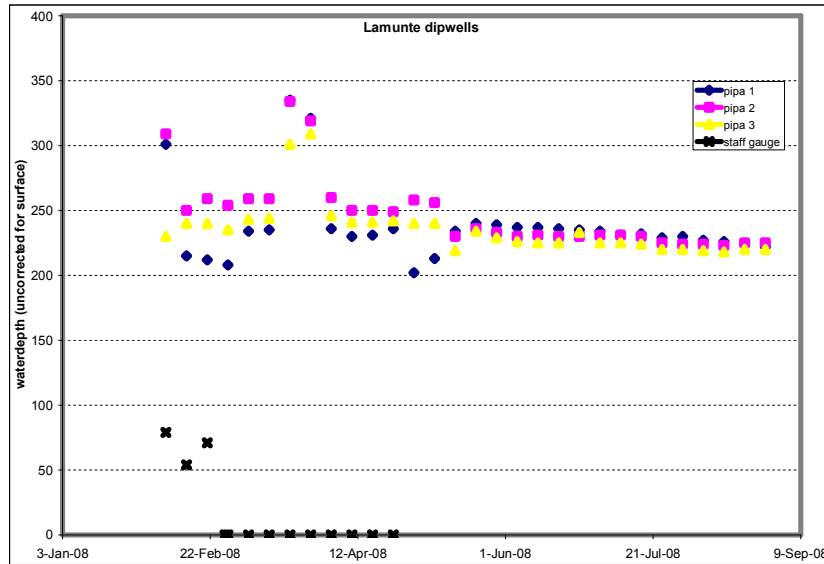
Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Lamunte Blok C2
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level <input checked="" type="checkbox"/> Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG78 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : - Dipwell: 1 Transect ; 3 Dipwell : : :
05. Koordinate	: Staff Gauge -2.972005, 114.059225 : Dipwell 1=-2.654934, 114.460188; 2=-2.653378, 114.461148; 3-2.649160, 114.463222 :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Dehen & Wawan
Telepon Seluler	: -
Alamat	: Lamunte Blok C2, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, Dipwell – Transect: 1 kali per minggu
Tanggal Awal Data	: WL-Staff Gauge: 22-Peb-08; Dipwell: 22-Peb-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 22-Peb-08; Dipwell: 22-Peb-08
Kualitas Data	: WL – Staff Gauge 2 WL – Diver - Precipitation - Dipwell 2
09. Grapik Data	:



Dipwell – Transect MP04



10. Masalah dan Solusi

Masalah

- : – Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur
- : – Staff gauge kurang panjang

Solusi

- : – Perlu Penggantian/perbaikan dan memperpanjang ukuran Staff Gauge menjadi 400cm

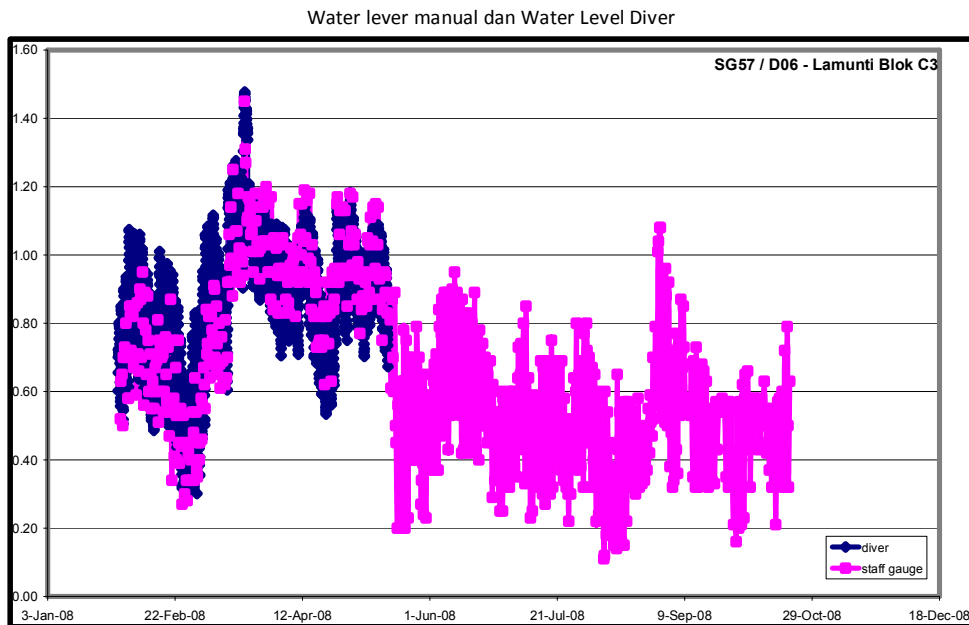
11. Tanggal Update

: Selasa, 13 November 2008

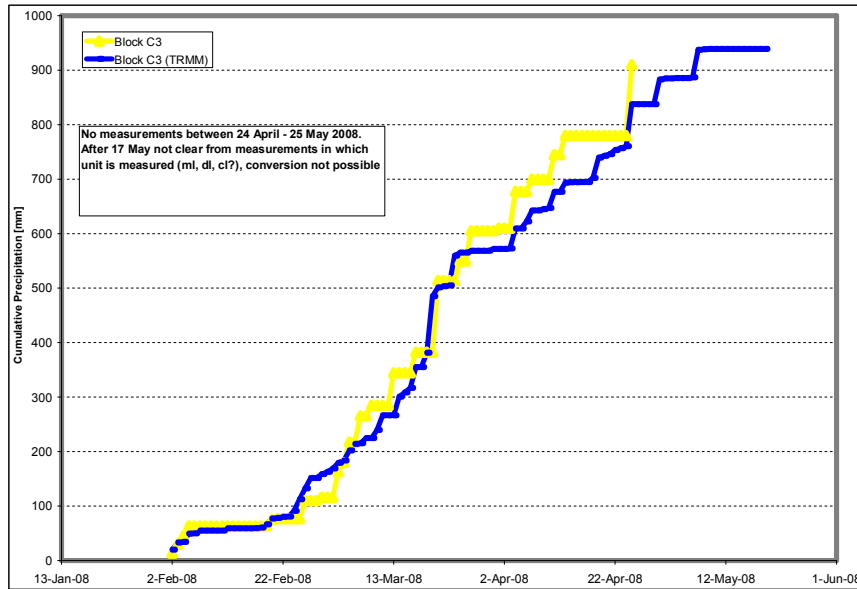
Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Lamunte Blok C3
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level <input checked="" type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG57 Diver D06 Rain Gauge RG10 Dipwell -
04. Deskripsi Instrument	: - Minidiver (A6040), Pengukuran Surface Water level Automatis - Staff Gauge, Pengukuran Surface Water level manual - Rain Gauge (C1385), Pengukuran curah hujan otomatis menggunakan minidiver - Rain Gauge, Pengukuran curah hujan manual :
05. Koordinate	: Diver / Staff Gauge -2.667647, 114.490436 : Rain Gauge - :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Holdiansyah
Telepon Seluler	: +6285281564609; +6281348044491
Alamat	: Lamunte Blok C3, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08; Rain Gauge: 22-Oct-08; Dipwell: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08; Rain Gauge: 22-Oct-08; Dipwell: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation 1 Dipwell -
09. Grapik Data	: : Water lever manual dan Water Level Diver



Precipitation – Rain Gauge Manual



10. Masalah dan Solusi

Masalah

- : – Penahan pipa dan Diver rusak, untuk sementara diver diambil untuk pengecekan
- Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur
- Diver sering terganggu dari hilir mudik kapal dan kapal yang berlabuh

Solusi

- : – Perlu perbaikan Penahan pipa dan penggantian Diver
- Perlu Penggantian/perbaikan Staff Gauge
- Perlu memasang pelindung dari kemungkinan terganggu oleh kapal yang lewat

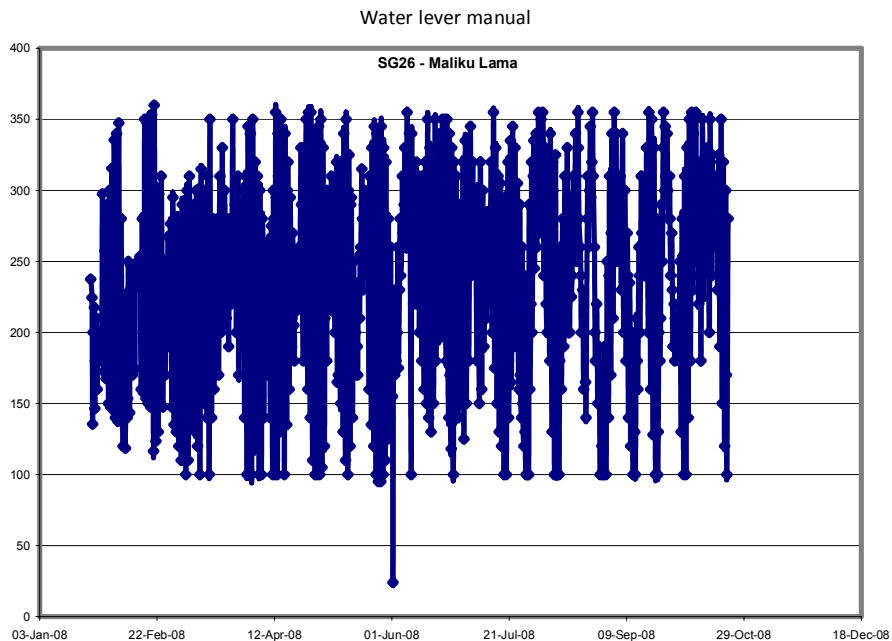
11. Tanggal Update

: Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Maluku Lama
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG74 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.954108, 114.149401 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Andek
Telepon Seluler	: +6285247823125
Alamat	: Maluku Lama, Kec. Maluku, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah : – Staff Gauge kurang panjang
– Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur

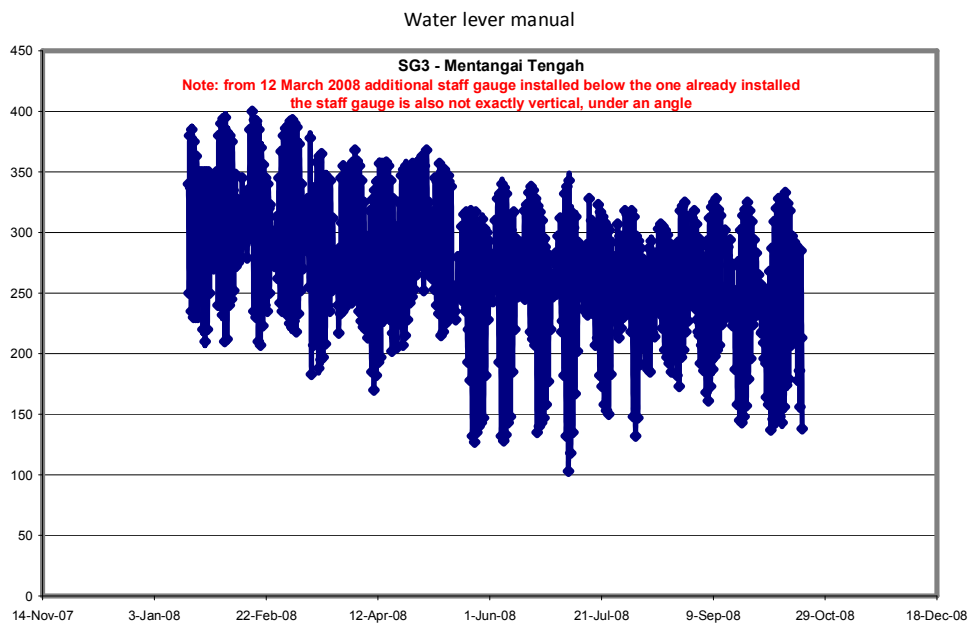
Solusi : – Perlu Penggantian/perbaikan dan memperpanjang ukuran Staff Gauge menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik, 2=Cukup, 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Mantangai Tengah
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG59 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.509540, 114.494064 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak <input type="checkbox"/>
07. Pengamat	
Nama	: Deni
Telepon Seluler	: +6285251492070 (Istri Deny)
Alamat	: Mantangai Tengah, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Staff Gauge mengalami pelapukan/kerusakan dan warna terlihat kabur - Posisi staff gauge miring
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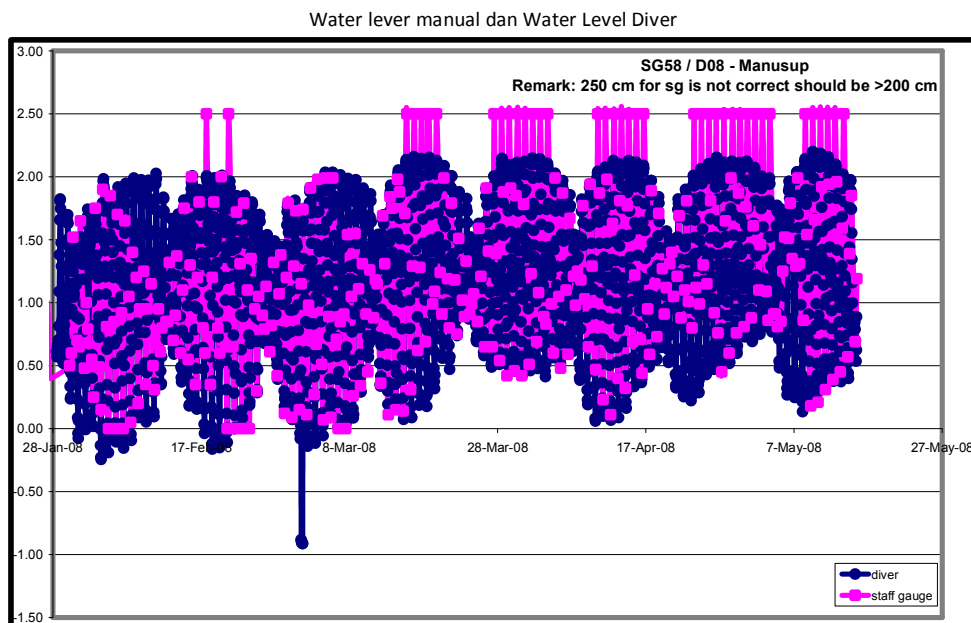
Solusi : – Perlu Penggantian/perbaikan Staff Gauge dan memastikan posisi staff gauge tegak lurus

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Manusup
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG58 Diver D08 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1290), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.679138, 114.438094 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Cuncun
Telepon Seluler	: +6285251715933
Alamat	: Manusup, Kec. Mantangai, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Staff gauge rusak dan Diver hilang - Sejak Field visit Oktober 2008, Manusup belum memiliki pengamat
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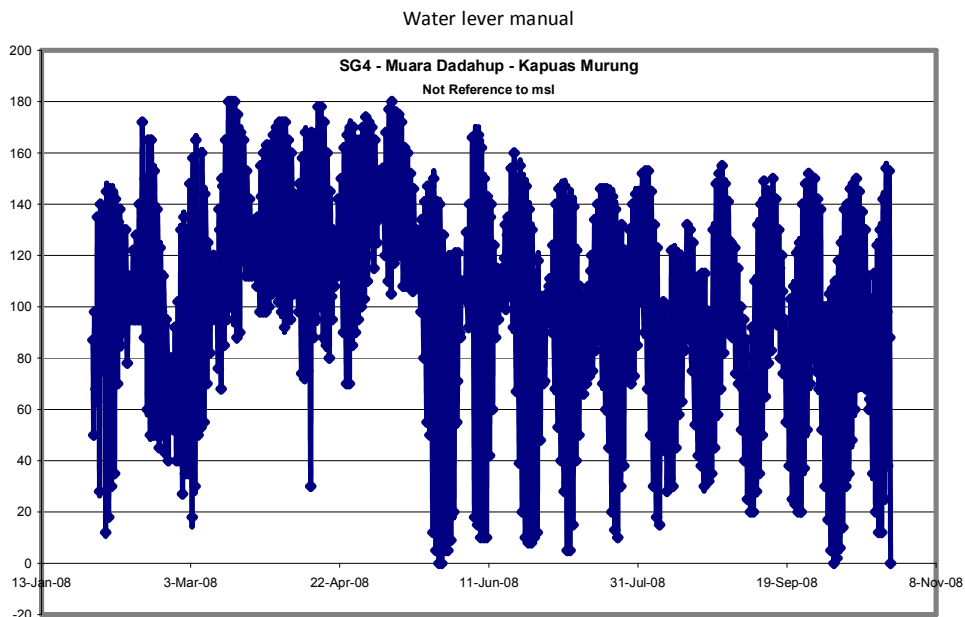
Solusi :
 - Perlu pemasangan ulang staff gauge dan Diver
 - Mencari pengamat baru dan menyelesaikan masalah yang ditimbulkan akibat kesalahan pengamat sebelumnya.

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Muara Dadahub
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG60 Diver - Rain Gauge - Dipwell -
03. Kode Alat	: Staff Gauge 60 Diver - Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Staff Gauge -2.814634, 114.593886 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Imis
Telepon Seluler	: +6285248653504
Alamat	: Muara Dadahub, Kec. Kapuas Murung, Kab. Kuala Kapuas
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari
Tanggal Awal Data	: WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah :
: – Staff Gauge kurang panjang
– Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur

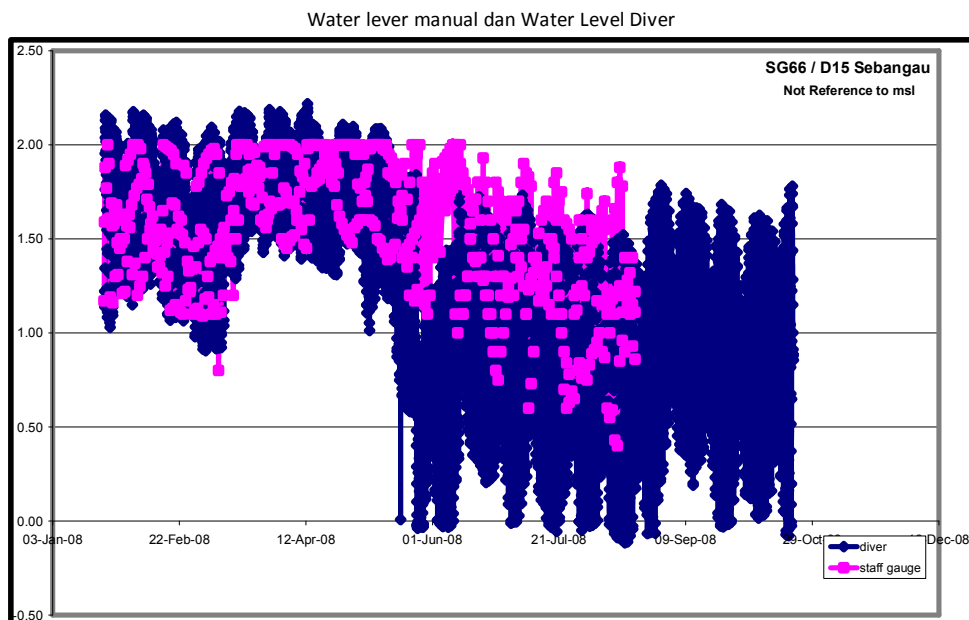
Solusi :
: – Perlu Penggantian/perbaiki Staff Gauge dan memperpanjang ukuran staff gauge menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik,; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Muara Sebangau
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG66 Diver D15 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C0178), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.925616, 113.882548 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Amat & Isna
Telepon Seluler	: +6285821024660
Alamat	: Muara Sebangau, Kec. Kahayan Kuala, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Staff gauge kurang panjang : - Staff Gauge mulai mengalami pelapukan/kerusakan dan warna terlihat kabur
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Solusi : — Perlu Penggantian/perbaiki Staff Gauge dan memperpanjang ukuran staff gauge menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring

Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Palangka Raya
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge - Diver D09 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C0445), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge - : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: -
Telepon Seluler	: -
Alamat	: Kec. Palangka Raya, Kota Palangka Raya
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: - ; WL-Staff Gauge: -
Kualitas Data	: WL – Staff Gauge - WL – Diver - Precipitation - Dipwell -
09. Grapik Data	:
10. Masalah dan Solusi	
Masalah	: - Diver Hilang, Data tidak pernah didownload

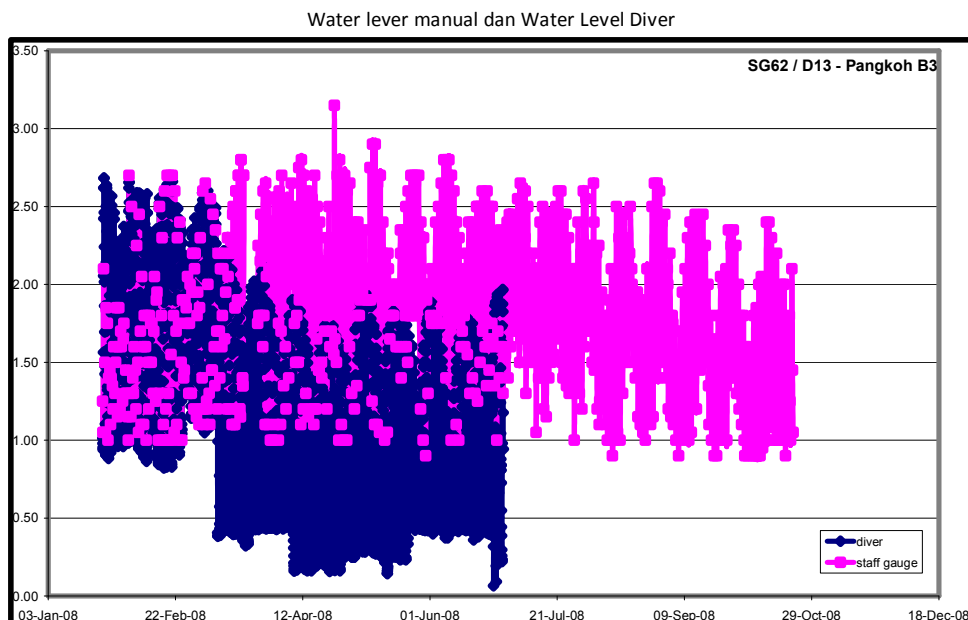
Solusi : — Perlu Pemasangan kembali Diver dan Staff Gauge

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Pangkoh III B
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level - Precipitation
03. Kode Alat	: Staff Gauge SG62 Diver D13 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1201), Pengukuran Surface Water level Automatis : - Staff Gauge, Pengukuran Surface Water level manual : : :
05. Koordinate	: Diver / Staff Gauge -2.952657, 114.039689 : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Nurbaya
Telepon Seluler	: +6281348698509 (Nurbaya); +6285248779988 (Zainal Wangsa – Sekdes)
Alamat	: Jl. Pangkoh III Kantan Dalam Blok B, Desa Kantan Dalam, Kec. Pandih Batu, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Tanggal Update terakhir Data	: WL-Diver: 21-Oct-08; WL-Staff Gauge: 22-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 2 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Diver rusak, Data tidak merekam data sejak 29 Juni 2008, walaupun terlihat dalam kondisi baik dan bisa didownload, diver tetap pada lokasi pemasangan - Pada kunjungan lapangan 22 Oktober 2008, Info Ibu Nurbaya, Staff Gauge diketahui patah dan disambung sementara dengan menggunakan bahan seadanya dan warna masih terlihat kabur walaupun sudah
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dilakukan pengecatan ulang oleh pengamat.

Solusi :
- Perlu penggantian Diver
- Perlu Penggantian Staff Gauge

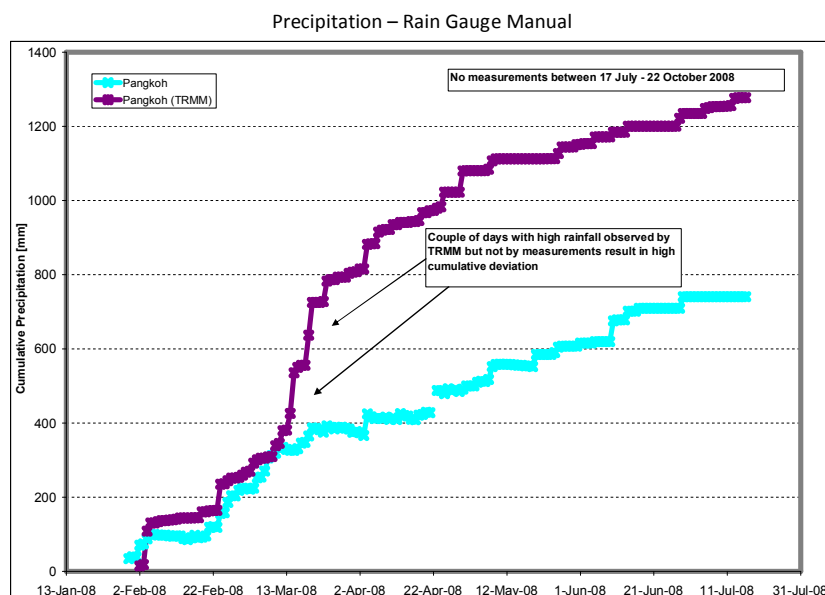
11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik, 2=Cukup, 3=Buruk

Instrument Monitoring

Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Pangkoh III B
02. Tipe Pengukuran	: - Surface Water Level - Ground Water Level <input checked="" type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge - Diver - Rain Gauge RG11 Dipwell -
04. Deskripsi Instrument	: - Rain Gauge, Pengukuran curah hujan manual : : :
05. Koordinate	: Rain Gauge Tidak Ada : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Machfudin
Telepon Seluler	: +6281348328647
Alamat	: Jl. Pangkoh III Kantan Dalam Blok B, Desa Kantan Dalam, Kec. Pandih Batu, Kab. Pulang Pisau
08. Data	
Frekuensi Pengukuran	: P – Rain Gauge: 3 kali per hari
Tanggal Awal Data	: Rain Gauge: 24-Jan-08
Tanggal Update terakhir Data	: Rain Gauge: 30-Oct-08
Kualitas Data	: WL – Staff Gauge - WL – Diver - Precipitation 1 Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Tiang tempat pemasangan Rain Gauge mengalami kerusakan (dilakukan perbaikan seadanya pada kunjungan lapangan tanggal 22 Oktober 2008) - Alat pengukur air menggunakan alat seadanya
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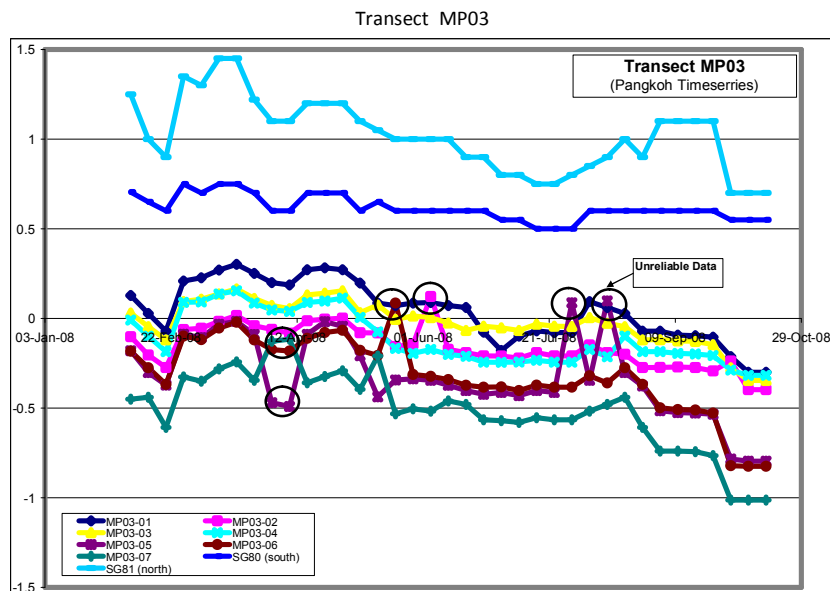
Solusi : – Perlu perbaikan Rain Gauge
– Pemberian alat pengukur baru

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Pangkoh III B Block B		
02. Tipe Pengukuran	: √ Surface Water Level	√ Ground Water Level	- Precipitation
03. Kode Alat	: Staff Gauge SG(80-81) Diver	- Rain Gauge	- Dipwell MP03-(1 – 7)
04. Deskripsi Instrument	: - Staff Gauge, Pengukuran Surface Water level manual : - Dipwell: 1 Transect ; 7 Dipwell : : :		
05. Koordinate	: Staff Gauge	81 = -2.972006, 114.059225; 80=-2.990539, 114.050915	
	: Dipwell	1=-2.989616, 114.051847; 2=-2.988735, 114.052155, 3=-2.987105, 114.052948;	
	:	4=-2.981158, 114.055459; 5=-2.974946, 114.057882; 6=-2.973096, 114.058719;	
	:	7=-2.972611, 114.058939	
06. Referensi ke dpl (msl)	: Ya	√ Tidak	-
07. Pengamat			
Nama	: Sugiono		
Telepon Seluler	: +6285821211531		
Alamat	: Jl. Pondasi 5 No.196 RT.10 RW.2, Desa Wono Agung, Kec. Pandih Batu, Kab. Pulang Pisau		
08. Data			
Frekuensi Pengukuran	: WL – Staff Gauge & Dipwell – Transect: 1 kali per minggu		
Tanggal Awal Data	: WL-Staff Gauge: 22-Oct-08; Dipwell: 22-Oct-08		
Tanggal Update terakhir Data	: WL-Staff Gauge: 22-Oct-08; Dipwell: 22-Oct-08		
Kualitas Data	: WL – Staff Gauge	1	WL – Diver - Precipitation - Dipwell 1
09. Grapik Data	:		



10. Masalah dan Solusi

Masalah : - Pengukuran Staff Gauge dibulatkan ke angka puluhan terdekat, sehingga data kurang akurat

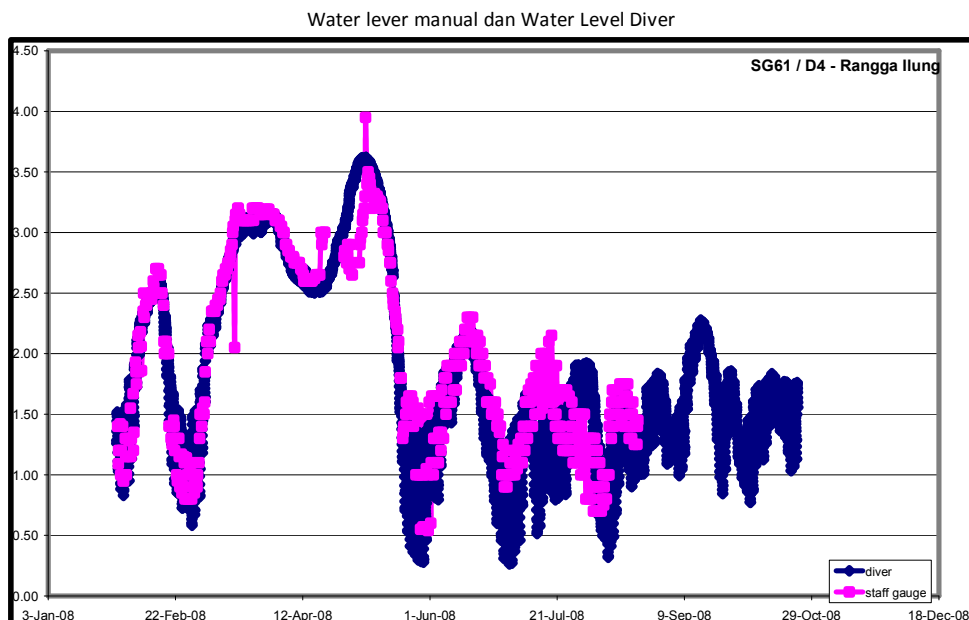
Solusi : - Untuk selanjutnya pengukuran tidak akan dibulatkan dan akan diukur dengan menggunakan meteran.

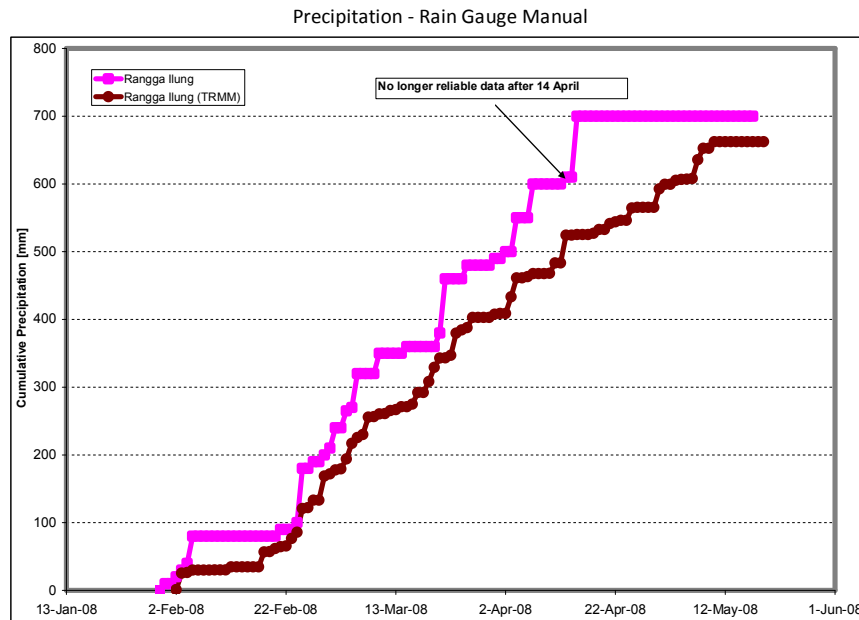
11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Rangka Ilung
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - Ground Water Level <input checked="" type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG61 Diver D04 Rain Gauge RG08 Dipwell -
04. Deskripsi Instrument	: - Minidiver (A6099), Pengukuran Surface Water level Automatis - Staff Gauge, Pengukuran Surface Water level manual - Rain Gauge, Pengukuran curah hujan manual : : :
05. Koordinate	: Diver / Staff Gauge -2.320315, 114.875992 : Rain Gauge - : :
06. Referensi ke dpl (msl)	: Ya <input checked="" type="checkbox"/> Tidak -
07. Pengamat	
Nama	: Bachrudin
Telepon Seluler	: +6281348221445
Alamat	: Desa Rangka Ilung, Kec. Jenamas, Kab. Barito Selatan
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam, P – Rain Gauge= 3 Kali per hari
Tanggal Awal Data	: WL-Diver: 11-Agu-07; WL-Staff Gauge: 30-Jan-08; Rain Gauge: 30-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 27-Oct-08; WL-Staff Gauge: 29-Oct-08; Rain Gauge: 29-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation 1 Dipwell -
09. Grapik Data	:





10. Masalah dan Solusi

- Masalah :
- Letak Rain Gauge tidak sesuai dengan syarat penempatan rain gauge
 - Pipa, tali penggantung diver dan pengikat pipa pada tiang Dermaga mengalami kerusakan
 - Cat pada Staff Gauge terlihat kabur
 - Takaran air (milliliter) diragukan

- Solusi :
- Perlu penempatan ulang Rain Gauge sehingga sesuai dengan persyaratan.
 - Perlu penggantian/perbaikan Pipa, tali penggantung diver dan pengikat pipa pada tiang Dermaga
 - Penggantian/perbaikan Staff Gauge dan rain gauge
 - Pemberian takaran air baru,

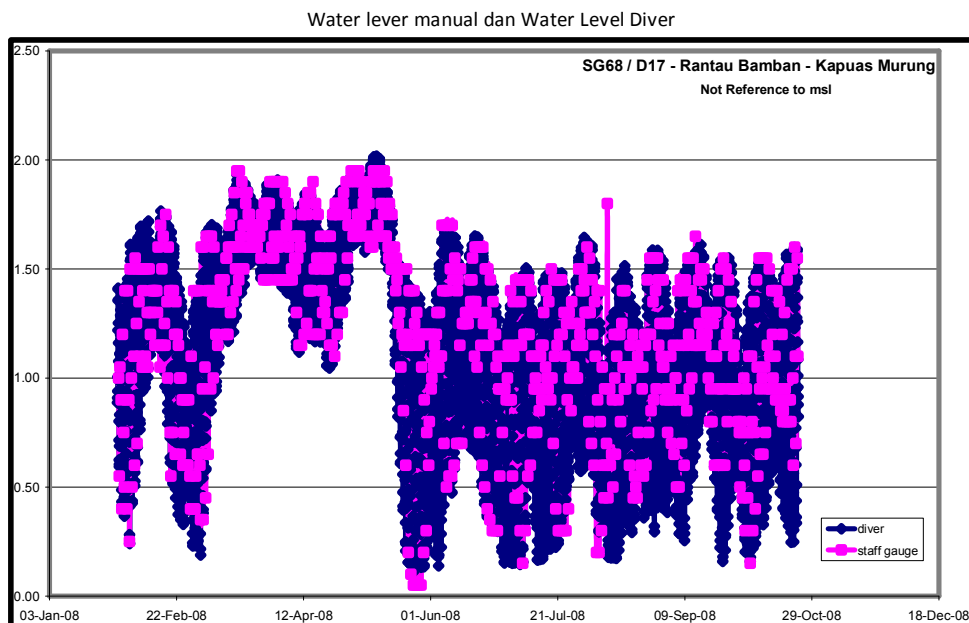
11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk

Instrument Monitoring

Master Plan Ex Mega Rice Project - Kalimantan Tengah

01. Lokasi	: Rantau Bamban
02. Tipe Pengukuran	: <input checked="" type="checkbox"/> Surface Water Level - <input type="checkbox"/> Ground Water Level - <input type="checkbox"/> Precipitation
03. Kode Alat	: Staff Gauge SG68 Diver D17 Rain Gauge - Dipwell -
04. Deskripsi Instrument	: - Minidiver (C1518), Pengukuran Surface Water level Automatis - Staff Gauge, Pengukuran Surface Water level manual
05. Koordinate	: Diver / Staff Gauge -2.737928, 114.681709 : :
06. Referensi ke dpl (msl)	: Ya - Tidak <input checked="" type="checkbox"/>
07. Pengamat	
Nama	: Samidri
Telepon Seluler	: +6281250896960
Alamat	: Desa Rantau Bamban, Kec. Jenamas, Kab. Barito Selatan
08. Data	
Frekuensi Pengukuran	: WL – Staff Gauge: 3 kali per hari, WL – Diver: per jam
Tanggal Awal Data	: WL-Diver: 30-Jan-08; WL-Staff Gauge: 30-Jan-08
Tanggal Update terakhir Data	: WL-Diver: 23-Oct-08; WL-Staff Gauge: 23-Oct-08
Kualitas Data	: WL – Staff Gauge 1 WL – Diver 1 Precipitation - Dipwell -
09. Grapik Data	:



10. Masalah dan Solusi

Masalah	: - Staff gauge kurang panjang - Staff Gauge mengalami pelapukan dan tulisan angka mulai sulit dilihat
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Solusi : — Perlu Penggantian/perbaikan Staff Gauge dan memperpanjang ukuran menjadi 400cm

11. Tanggal Update : Selasa, 13 November 2008

Catatan : Kualitas Data : 1=Baik; 2=Cukup; 3=Buruk



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