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TA – 6293 REG - INO
Balikpapan Sanitation Project:

Update and Review of Pre-Feasibility Study (PFS)

Final Revised PFS Report

FINAL REVISED PFS REPORT MARCH 2017

TA 6293 REG–INO: Balikpapan Sanitation Project PFS Review and Update

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Abbreviations & Acronyms

AAGR	Annual Average Growth Rate
ADB	Asian Development Bank
CBP	Capacity Building Program
CC	Climate Change
CDIA	Cities Development Initiative for Asia
DED	Detailed Engineering Design
DFR	Draft Final Report
DMF	Design and Monitoring Framework
EA	Executing Agency
EA	Environmental Assessment
EIA	Environmental Impact Assessment
HH	House holds
IA	Implementing Agency
IEE	Initial Environmental Examination
IFI	International Finance Institution
JICA	Japan International Cooperation Agency
KIKS	Kawasan Industri Kecil Somber (Somber small industrial area)
MECAF	Ministry of Environment Conservation and Forests
MHA	Ministry of Home Affairs
NECC	National Environmental Conservation Committee
PCU	Project Coordination Unit
PIU	Project Implementation Unit
PPP	Public Private Partnership
PPTA	Project Preparatory Technical Assistance
PU	Public Works
SPS	Safeguard Policy Statement
TA	Technical Assistance
UNDP	United Nations Development Programme
WW	Wastewater
wwt	Wastewater treatment
WWTP	Waste Water Treatment Plant

I. EXECUTIVE SUMMARY

i. Introduction

The Cities Development Initiative for Asia (CDIA) received a request for support from PT Sarana Multi Infrastruktur (PT SMI) to assist Balikpapan Municipal Government in reviewing an existing Pre-Feasibility Study (PFS) from 2014 relating to wastewater (WW) sector investment and enhance its technical, financial, institutional, environmental and social content.

The PFS describes the sanitation coverage expansion through increasing the capacity of the existing Margasari plant, and building new Wastewater Treatment Plants (WWTP) in other parts of the city i.e. Somber and Sepinggan (Perusda housing complex).

The existing PFS 2014 forms the basis of this Revised PFS Report March 2017.

ii. Socio-Economic

Based on the survey PFS 2014, 99% of community stated they are aware of sanitation issues, 93% stated that they are willing to connect to an off-site system and approximately 63% to 70% are willing to pay a connection fee (Rp. 100,000) and a volumetric tariff (Rp. 20,000/month/connection); however in the existing sub project Margasari (based on the catchment area) only 62% of the households are connected to the Waste Water Treatment Plant (WWTP).

For Margasari the population prognosis is 49,552 inhabitants in 2025 and 51,974 inh. in 2040. For Somber the population prognosis is 69,234 inhabitants in 2025 and 72,618 inh. in 2040. For Sepinggan the population prognosis is 110,061 inhabitants in 2025 and 115,440 inh. in 2040.

At Margasari it is not possible for further extension due to land issues. The existing Margasari WWTP is adjacent to a housing area.

Somber requires land acquisition, since 2,000 square meters is owned by the government, but the project needs 4,000 square meters more to implement the wastewater treatment plant.

At Sepinggan four alternatives were investigated of which Bendali 1 Sepinggan, an existing retention pond has been selected. This land belongs already to the Government.

Land acquisition for development of public interest less than 5 hectare can be conducted by direct transaction, based on Presidential Regulation No. 148/2015 Fourth Amendment of Presidential Regulation No. 71 of 2012 on Land Acquisition Implementation for Development in the Public Interest.

It is very important to establish a good relationship and mutual understanding between the project and the project beneficiaries, including affected persons. To achieve a good relationship and mutual understanding the project has to conduct meaningful consultation which should be indicated in a strategy, awareness programs and media communication plans.

iii. Environment

Balikpapan City has a Wastewater Sanitation program to improve the public services following the City's Cleaning Program (CCP). This is not covered by a decree, but covered by Balikpapan City Cleaning Program.

The existing WWTP Margasari is running at low capacity but there are no air pollution and community complaints. The waste water effluent quality is monitored by PDAM, but not reported to the Local Environmental Agency (BPLHD) of Balikpapan City. An Environmental

Management and Monitoring Implementation report of all Wastewater treatment plants is required.

The upgrade of the Margasari wastewater system and the implementation of the Wastewater treatment plants in Sepinggan and Somber will be based on the Government of Indonesia Regulation No.27 year 2012 concerning the Environmental Permit and Environmental Ministry Regulation No. 5 year 2015. They must comply with the environmental permit, EIA Study and the permit for waste water effluent.

All WWTPs in Balikpapan with effluent from domestic wastewater treatment should comply with the Ministry of Forestry and Environmental Regulation No P68 year 2016 concerning The Domestic Waste Water Effluent Standards.

Each new proposed WWTP requires an UKL/UPL as the AMDAL Study. Also they have to comply with the LARAP process.

Environmental issues of upgrading and new Wastewater Treatment Plants will mainly involve land use changes and potential environmental risks during construction, point source pollution at the treated effluent outlet and risk of water/soil contamination through uncontrolled sludge disposal.

iv. Technical

The PFS 2014 did not take into consideration the other locations as mentioned in the Master Plan 2012 with the 10 locations for WWTP city-wide. The three WWTPs are part of the whole city-wide concept and should have been included in the PFS.

The PFS noted that the site of the WW treatment plant in Sepinggan (Perusda) was not suitably located (adjacent to a residential area). However, the PFS did not propose alternative locations

The PFS used minimum sewerage pipe diameter of 90 mm. This is much too small; typically minimum diameter is 150 mm or 200 mm for reticulation pipes. The socio-economic survey in the PFS 2014 in Margasari mentioned that 13% of the respondents stated that they discharge wastewater to the sea because the wastewater network was blocked due to the too small diameter sewer pipes (90mm). For avoiding blockages and secure a consistent flow to the wastewater treatment plant, the sewer network will be upgraded by replacing the small sewer pipe diameters 90 mm and 100 mm to resp. 150 mm and 200 mm.

An Analysis was made of proposed new treatment technologies using the following parameters:

1) Area required, 2) technical aspects, 3) operational aspects, 4) staff required and 5) environmental aspects.

The best technology and most economic for Sepinggan and Somber is the UASB technology. The reasons for selecting UASB are: moderately simple to operate, medium investment costs for the technology compared to RAS, smaller area of land required than RAS, low to medium operational cost, and Biogas production which potential for energy generation. For Margasari service area the existing WWTP using an RAS system will be upgraded.

In Margasari it is recommended to replace all the pumping stations and to install new duty and standby pumps. After implementing of Margasari WWTP and network upgrading, the total percentage of sewerage coverage in Margasari service area will be 16% in 2019 - 2020, while the rest of the area 84% is still covered with on-site septic tanks.

In Sepinggan the WWTP location selected is the Retention pond area (0.5 ha). The location is at downstream area and has a large watercourse for effluent discharge and also has minimal social impact. The sewerage system pipes will have diameters vary from 150 – 400 mm. A flood protection program has to be included to secure flood problems in the nearby Sepinggan

Market. A Hydrological Survey and Assessment Report has to be provided of the area. After implementation of new sewerage system and wastewater treatment plant, the indicated Sepinggan Catchment area will cover about 33% of the population connected to the new off-site system and 67% still have on-site septic tanks (Phase I). However, related to the whole Sepinggan village area, only 17 % of the total population will be connected to a sewer system and 83% still have septic tanks.

In Somber the selected location WWTP is Industrial area. To construct the WWTP there is a need of approx. 0.6 ha of which currently 0.2 ha belongs to government and 0.4 ha to private owner. The location is downstream area and has a large watercourse for effluent discharge and also has minimal social impact. There is a future potential available land to expand up to 2 ha. The sewerage system will have pipe diameters vary from 150 – 700 mm. After implementation of new sewerage system and wastewater treatment plant, the indicated Somber Catchment area will cover about 19% of the population connected to the new off-site system and 81% still have on-site septic tanks (Phase I).

v. Institutional

The sanitation development in Balikpapan is supported by rules and laws, a/o the Regional Regulation (Perda) No. 08 year 2016 on Sanitation, and Mayor Regulation (Perwali) No. 24 year 2016 on Waste Water Management. Both regulations describe the procedures for management of sanitation and waste water, either through a centralized system (SPAL-T or off-site) or as localized system (SPAL-S or on-site).

The coordination and cooperation amongst BAPPEDA, Department of Health, Education, Public Works, Housing, Environment, Cooperatives and SMEs (Somber), Kecamatan and Kelurahan and PDAM are essential to achieving the target of 100% of sanitation access in 2019.

Regional Regulation (Perda) No. 10 Year 2014 concerning Regional Water Company or PDAM has set the task of PDAM as drinking water provider and also for the management of wastewater. Based on Perda the Wastewater operator in Balilkpapan is PDAM.

PDAM Technical Director is the supervisor of Division Head of Wastewater and responsible for operating and maintenance of the WWTP Margasari and its network.

The number of waste water connections is currently about 2,000 Households (Margasari only). The number of connections is expected to increase through the Margasari WWTP upgrading and construction of new WWTP in Somber and Sepinggan. PDAM challenges in waste water management is the increasing number of new customers (estimated 12,200 connections), the expansion of new service areas in Somber and Sepinggan, new technologies in wastewater treatment, and new tariff system, and to operate the new scheduled desludging services (L2T2 and L2T3) and the IPLT (sludge treatment plant).

In the future the organizational structure of PDAM needs to be changed. With the increasing number of customers and the complexity of wastewater services, it is proposed to set up the Directorate of Wastewater, which is responsible for all aspects of wastewater management, which covers technical planning, operational of WWTP, operational of wastewater per service zones, operational of on-site sanitation services (desludging services and sludge treatment plant), and general administration.

vi. Financial

The management of the existing WWT Sanitation in Margasari results in an operating gap of around mRp 1,095 which from the revenue only covers around 14.7% of its operating and maintenance cost. Starting from 2017 the city has decided to stop providing subsidy.

The Capital Expenditure (CAPEX) for 3 packages are estimated as follows:

	mIDR	USm$
Investment package 1 Margasari	83,487	6.184
Investment package 2 Sepinggan	236,382	17.510
Investment package 3 Somber	249,148	18.455

The annual Operating Expense (OPEX) for the proposed projects is estimated as follows:

Margasari:	m.IDR 2,039	(US$ 151.0 thousand)
Sepinggan:	m.IDR 2,925	(US$ 216.7 thousand)
Somber:	m.IDR 3,218	(US$ 238.4 thousand)

Financing:

City Gov. Of Balikpapan	72,470	5,368	12.7%
National grant (Gov.support)	170,705	12,645	30.0%
PDAM	97,752	7,241	17.2%
Loan	228,089	16,895	40.1%
Total	*569,017*	*42,149*	*100.0%*

The city government has capacity to support the development of waste water sanitation of around Rp 18.12 million a year according to its financial capacity. The National government is assumed to support 30% of the WWTP construction including sewer pipes, pumps and electrical mechanical equipment. The remaining 70% is assumed to be financed by debt from various institutions such as PT SMI, or ADB / World Bank, or other national/international institutions. The results are as follow:

vii. Result of Financial analysis:

	Business As usual	Overall System	Package1: Margasari	Package2: Sepinggan	Package3: Somber
Annual OPEX (Rp mio)	1,284	4,124	1,484	1,243	1,371
Annual Revenue (Rp mio)	479	2,435	472	952	1,025
Annual Operating Gap (Rp mio)	-805	-1,689	-1,012	-291	-347
Avg. Operating Ratio (OM cost: revenue)	2.68	1.69	3.14	1.31	1.34

It shows that all packages has still significant operating gap (indicated by their ratios are above 1) though with the project the ratio could be lowered to around 1.3 except for Margasari. However PDAM has proposed a decree (to be approved by DPRD) to stipulate ww tariff based on 20% (minimum) of water use price so it is expected able to cover not only OPEX but also to give sufficient return to sustain its services (as seen below).

	w/o applying 20% water sale tariff for PDAM connection house	w/ applying 20% water sale tariff for PDAM connection house*
Annual OPEX (Rp mio)	4,124	4,124
Annual Revenue (Rp mio)	2,435	17,394
Annual Operating Gap (Rp mio)	-1,689	13,270
Avg. Operating Ratio (OM cost: revenue)	1.69	0.24

NPV (@wacc 9.83%)	(199,324)	58,659
IRR	-6.04%	12.27%
Payback (yr)	-	14

***** *Assumed collecting rate of 30% (of all PDAM connection)*

With 20% of water use price and if just 30% collecting rate applied the revenue could sufficiently cover all cost of Capex and Opex that indicated by positive Net Present Value and IRR above its average cost of capital (12.27% > 9.83%).

Economic analysis is to analyze economic benefits and costs which cannot be included in the financial analysis. The benefit that taken into consideration are WTP (willingness to pay) of service fee, WTP of house connection fee, health saving estimate, polluter levy potential and effluent utilization potential and water processing saving cost and 20% of PDAM water use price.

The analysis shows that the EIRR for the whole project is 13.92% which exceeds the threshold of 12% (based on ADB/WB standard). The NPV is positive at IDR 64,535 million @ 12%. The Benefit to cost ratio is 1.15 which is above the threshold of 1. In summary, the project can be considered economically viable and generates net positive welfare to the society.

viii. Strategies and Scenarios

RPJMN 2015-2019 stated at the national level sanitation access target is to reach 100% in 2019, consisting of proper access (85%), and basic access (15%). Basic sanitation is improved sanitation, among which facilities that ensure hygienic separation of human excreta from human contact.

A Strategy for Wastewater Management is important, with a/o:

a) Need of a Long Term Strategy;
b) City Spatial Planning / Development Plans / Sanitation Plan;
c) City Wide Decision where and what to implement;
d) Environmental & Health Protection (black water & grey water);
e) Temporary Planning Priorities.

A Strategy Wastewater Systems to be developed, with a/o:

1) Network systems versus On-site systems;
2) Decentralized Wastewater Systems versus Centralized Wastewater Treatment System;
3) Analyses of Scenarios: Pro's and Contra's;
4) Short Term High Priorities (next 1 - 5 years);
5) Medium Term Implementations (5 – 15 years);
6) Transformational Stages and Measures;
7) Phasing and Modular Expansion

Further studies with the following Scenarios are essential:

Scenario I	Decentralized System with 10 waste water treatment plants (Master Plan 2012)
Scenario II	Decentralized + On-site System with 3 wastewater treatment plants and rest of city covered with septic tanks (PFS 2014)
Scenario III	Semi - Centralized System with maximal 5 Wastewater treatment plants
Scenario IV	Centralized System with 1 (or 2) Wastewater treatment plants for whole City.

ix. Conclusions and Recommendations

Conclusions

1. Technical perspective:
   a. Margasari service area: upgrade of the existing WWTP and improve the sewer network. Total of 2,222 house connections.
   b. Sepinggan service area: new WWTP in Sepinggan Retention pond area and a new sewer network. Total of 5,000 new house connections.
   c. Somber service area: new WWTP in KIKS Somber and a new sewer network. Total of 5,500 new house connections.
2. Economic: full cost recovery can be achieved:
   a. The budget for sanitation system development which achieves more than Rp. 68.3 billion (year 2016) or Rp.22.8 billion (assuming one third) for waste water development;
   b. Substantial capability to propose debt to finance parts of its needs to develop new infrastructure of around Rp 1,600 billion. There are several national and international institutions that could provide potential source for the financing;
   c. The waste water development is supported by National Government through a/o Grant from Indii/AusAid/sAIIG program which provide Rp 400 billion until 2019. Additional budget is required to realize 100% waste water sanitation covering and its sustainable development;
   d. The current collection through PDAM bill for Margasari connections is considered successful though not sufficient to cover its present cost. However, the new proposed project reduces operating cost and a new billing mechanism can cover future operating cost.
   e. Its economic benefit value is still higher than its economic cost.

Recommendations

1. to update Master Plan 2012;
2. to update the City Spatial Planning / City Development Plans / City Sanitation Plan;
3. to proceed with the proposed implementations:
   a. Margasari: Upgrading existing wastewater treatment plant, renovating existing sewerage system, extension with more household connections;
   b. Sepinggan: Implementation of a new wastewater treatment plant in Sepinggan and implementation of a new sewerage system in one catchment area;
   c. Somber: Implementation of a new wastewater treatment plant at KIKS and implementation of a new sewerage system in two catchment areas.
4. To implement the proposed Institutional arrangements with PDAM;
5. To introduce the proposed Tariff system through applying certain percentage (e.g. 20%) of water use price for each PDAM user;
6. Uses maximal available grants to support the investment cost for the proposed systems;
7. Gaining access to national financing institutions for speeding up infrastructure developments.

II. RINGKASAN EKSEKUTIF

i. Pengantar

Cities Development Initiative for Asia (CDIA) menerima permintaan untuk membantu PT Sarana Multi Infrastruktur (PT SMI) untuk membantu Pemerintah Kota Balikpapan dalam melakukan review terhadap Pra-Studi Kelayakan (PFS) tahun 2014 yang berkaitan dengan sektor investasi air limbah dan meningkatkan aspek teknis, keuangan, kelembagaan, sosial dan lingkungan.

PFS menjelaskan peningkatan cakupan sanitasi melalui perbaikan kinerja IPAL Margasari yang eksisting, dan membangun IPAL baru di lokasi lain yaitu Somber dan Sepinggan.

PFS 2014 menjadi dasar dalam pembuatan Laporan Revisi PFS March 2017.

ii. Sosial Ekonomi

Berdasarkan survei PFS 2014, 99% masyarakat menyatakan mereka menyadari masalah sanitasi, 93% menyatakan bahwa mereka bersedia menyambung ke sistem off-site (IPAL) dan sekitar 63% sampai 70% bersedia untuk membayar biaya sambungan (Rp 100.000,- per sambungan) dan tarif volumetrik (Rp 20.000,-); namun demikian kenyataannya dalam Sub Proyek Margasari yang ada *(existing)* berdasarkan *catchment area* hanya 62% dari rumah tangga yang terhubung ke IPAL.

Hasil proyeksi penduduk kelurahan-keluharan yang wilayahnya dilayani oleh Sub Proyek Margasari adalah 49.552 jiwa pada tahun 2025 dan 51.974 jiwa pada 2040. Sedangkan hasil proyeksi penduduk desa-desa yang wilayahnya dilayani oleh Sub Proyek Somber adalah 69.234 jiwa pada tahun 2025 dan 72.618 jiwa pada 2040. Sementara itu hasil proyeksi penduduk desa-desa yang wilayahnya dilayani oleh Sub Proyek Sepinggan 110.061 jiwa pada tahun 2025 dan 115.440 jiwa pada 2040.

Pada Sub Proyek Margasari tidak mungkin dilakukan perluasan karena terbatasnya lahan, mengingat lokasi IPAL berdekatan dengan wilayah pemukiman. Sub Proyek Somber membutuhkan pembebasan lahan, karena lahan yang ada *(existing)* milik pemerintah hanya 2.000 meter persegi, akan tetapi proyek membutuhkan tambahan lahan seluas 4.000 meter persegi lagi untuk melaksanakan instalasi pengolahan air limbah. Pada Sub Proyek Sepinggan Sepinggan ada empat alternatif yang dinilai dan Bendali 1 Sepinggan, sebuah kolam retensi milik pemerintah, direkomendasikan untuk membangun IPAL.

Pembebasan tanah untuk pembangunan kepentingan umum kurang dari 5 hektar dapat dilakukan dengan transaksi langsung, berdasarkan Peraturan Presiden Nomor 148/2015 Perubahan ke empat atas Peraturan Presiden Nomor 71 Tahun 2012 tentang Pelaksanaan Pengadaan Tanah bagi Pembangunan untuk Kepentingan Umum.

iii. Lingkungan

Sebagai pelaksanaan dari Program Kebersihan kota, Kota Balikpapan telah memiliki Program Sanitasi Air Limbah yang dapat meningkatkan pelayanan masyarakat umum.

Instalasi Pengelolaan air limbah Margasari yang ada saat ini dijalankan dengan kapasitas rendah , tetapi tidak menimbulkan polusi udara dan keluhan dari masyarakat. Pemantauan kualitas dari hasil buangan pengelolaan air limbah domestik yang ada di Margasari saat ini dilakukan oleh PDAM, namun hasil pemantauan tersebut tidak dilaporkan ke BPLHD Kota Balikpapan. Perlu adanya Laporan Pelaksanaan Pengelolaan dan Pemantauan seluruh Instalasi Pengelolaan Air Limbah.

Kegiatan pelaksanaan peningkatan Sistem IPAL di Persuda dan Somber, akan mengacu kepada Peraturan Pemerintah Indonesia No. 27 Tahun 2012 tentang Ijin Lingkungan dan Peraturan Menteri Lingkungan Hidup No. 5 tahun 2015 tentang standar kualitas air limbah . Studi AMDAL dan perijinan untuk pengelolaan air limbah domestic harus dilengkapi.
Seluruh pengelolaan air limbah domestik di IPAL di Balikpapan harus mengacu kepada Peraturan Menteri Kehutanan dan Lingkungan Hidup No. P68 tahun 2016 tentang Standard Kualitas Air Limbah Domestik.

Setiap pembangunan IPAL yang diusulkan perlu dilengkapi dengan AMDAL studi (UKL-UPL), Juga telah melengkapi proses Pengadaan Lahan (LARAP).

Isu lingkungan pada pembangunan dan peningkatan IPAL umumnya adalah perubahan penggunaan lahan dan dampak lingkungan selama konstruksi, sumber pencemaran pada saluran keluar IPAL dan resiko terkontaminasinva air /tanah melalui pembuangan lumpur yang tidak terkontrol.

iv. Teknis

PFS 2014 tidak mempertimbangkan lokasi lain seperti yang disebutkan dalam Master Plan 2012 dengan 10 lokasi untuk pelayanan keseluruhan kota. Tiga IPAL merupakan bagian dari konsep pelayanan kota keseluruhan dan harus dimasukkan dalam PFS.

PFS 2014 mencatat bahwa lokasi yang dipilih untuk IPAL di Sepinggan tidak memperlihatkan lokasi yang paling tepat karena berdekatan dengan area perumahan. Namun, PFS tidak mengusulkan lokasi alternatif.

PFS 2014 menggunakan diameter pipa air limbah minimal 90 mm. Ukuran ini terlalu kecil, biasanya diameter minimum adalah 150 mm atau 200 mm untuk pipa retikulasi. Survei sosial ekonomi dari PFS 2014 di Margasari menyebutkan bahwa 13% dari responden menyatakan bahwa mereka akhirnya membuang air limbah ke laut karena jaringan air limbah tersumbat dikarenakan ukuran pipa yang terlalu kecil (90 mm). Untuk menghindari penyumbatan dan menghasilkan aliran yang konsisten ke IPAL, jaringan perpipaan air limbah harus diperbaiki dengan mengganti pipa diameter 90 mm dan 100 mm menjadi diameter 150 mm dan 200 mm.

Analisis untuk pemilihan teknologi IPAL yang diusulkan telah dilakukan menggunakan parameter-parameter:

1) Kebutuhan lahan, 2) aspek teknis, 3) aspek operasional, 4) kebutuhan staf dan 5) aspek lingkungan

Akhirnya, teknologi UASB yang dipilih untuk wilayah pelayanan Somber dan Sepinggan sedangkan area pelayanan Margasari tetap menggunakan IPAL yang ada tetapi akan diperbaiki dan dioptimalkan.

Teknologi yang terbaik dan paling ekonomis untuk Sepinggan dan Somber adalah teknologi UASB. Alasan pemilihan teknologi karena pengoperasian sedikit lebih mudah, biaya investasi yang tidak terlalu tinggi jika dibanding dengan RAS, membutuhkan lahan lebih kecil dibanding dengan RAS, biaya operasional yang rendah ke menengah dan menghasilkan biogas yang berpotensi untuk memproduksi energi.

Di Margasari dianjurkan untuk mengganti semua pompa dan memasang pompa baru untuk operasi dan cadangan. Setelah mengimplementasikan peningkatan IPAL dan jaringan pipa air limbah di Margasari, maka persentase total cakupan pelayanan air limbah di wilayah Margasari akan menjadi 16% di tahun 2019-2020, sedangkan sisanya sekitar 84% masih dilayani dengan tangki septik.

Lokasi IPAL di Sepinggan dipilih di daerah Kolam Retensi (0,5 ha). Lokasinya terletak di daerah hilir dan memiliki badan air penerima yang cukup besar untuk pembuangan efluen dan juga memiliki dampak sosial yang minim. Sistem saluran air limbah akan membutuhkan pipa dengan diameter bervariasi dari 150-400 mm. Program pengendalian banjir harus tercakup untuk menghilangkan masalah banjir/genangan di Pasar Sepinggan. Laporan survey dan kajian Hidrologi perlu dibuat terhadap daerah ini. Setelah mengimplementasikan pembangunan sistem perpipaan air limbah baru dan IPAL, maka cakupan pelayanan di daerah tangkapan Sepinggan menjadi sekitar 33% dari populasi yang terhubung ke sistem *off-site* yang baru dan 67% sisanya masih menggunakan tangki septik (Tahap I). Namun, jika dilihat secara keseluruhan area Sepinggan hanya terlayani 17% dari total populasi yang terhubung ke sistem saluran pembuangan dan 83% masih menggunakan tangki septic.

Lokasi IPAL Somber dipilih di Kawasan industri Kecil Somber (KIKS). Untuk membangun IPAL diperlukan lahan dengan luas kira-kira. 0,6 ha dimana 0,2 ha milik pemerintah dan 0,4 ha milik pribadi. Lokasi IPAL berada di daerah hilir dan memiliki badan air penerima yang cukup besar untuk pembuangan efluen dan juga memiliki dampak social yang minimal. Di masa depan berpotensi untuk diperluas hingga 2 ha. Sistem saluran air limbah akan membutuhkan pipa air limbah dengan diameter bervariasi antara 150-700 mm. Setelah mengimplementasikan pembangunan sistem perpipaan air limbah dan IPAL yang baru, maka cakupan pelayanan di daerah tangkapan Somber menjadi sekitar 19% dan sisanya 81% masih menggunakan tangki septik (Tahap I).

v. Kelembagaan

Pembangunan sanitasi di Balikpapan telah didukung oleh peraturan dan perundangan, antara lain Peraturan Daerah Nomor 08 Tahun 2016 tentang Sanitasi, dan Peraturan Walikota No. 24 tahun 2016 tentang Pengelolaan Air Limbah. Kedua peraturan tersebut menjelaskan tata cara pengelolaan sanitasi dan air limbah, baik melalui sistem terpusat (SPAL-T atau off-site) atau sistem setempat (SPAL-S atau on-site).

Koordinasi dan kerjasama antara BAPPEDA, Dinas Kesehatan, Pendidikan, Pekerjaan Umum, Perumahan, Lingkungan, Koperasi dan UKM (Somber), Kecamatan dan Kelurahan, dan PDAM sangat penting dalam rangka mencapai target 100% akses sanitasi di tahun 2019.

Peraturan Daerah Nomor 10 Tahun 2014 tentang Perusahaan Daerah Air Minum atau PDAM telah menetapkan tugas PDAM sebagai penyedia air minum dan juga untuk pengelolaan air limbah. Berdasarkan Perda tersebut operator air limbah di Balilkpapan adalah PDAM.
Direktur Teknik PDAM membawahi Kepala Bagian Air Limbah dan bertanggung jawab untuk operasi dan pemeliharaan IPAL Margasari beserta jaringannya.

Jumlah sambungan air limbah saat ini sekitar 2.000 Rumah Tangga. Jumlah koneksi diperkirakan akan meningkat seiring dengan peningkatan Margasari IPAL dan pembangunan IPAL baru di Somber dan Sepinggan. Tantangan PDAM dalam pengelolaan air limbah di masa mendatang adalah meningkatnya jumlah pelanggan baru (diperkirakan 12.000 sambungan), perluasan area layanan baru di Somber dan Sepinggan, teknologi baru dalam pengolahan air limbah, sistem tarif baru, dan operasional layanan lumpur tinja terjadual (L2T2).

Perubahan struktur organiasasi PDAM tahap pertama adalah lingkungan Direktur Teknik dengan penambahan Kepala Bagian dan Sub-Bagian di bidang air limbah (*off-site* dan *on-site*). Perubahan tahap Kedua seiring meningkatnya jumlah pelanggan, maka akan dibentuk Direktorat Air Limbah dengan seorang Direktur dan beberapa Kepala Bagian. Studi lebih lanjut diperlukan sebelum ditetapkan sebagai Peraturan Daerah tentang PDAM.

vi. Keuangan

Pengelolaan instalasi air limbah IPAL Margasari mengalami kekurangan dana operasional yang mencapai Rp. 1 milyar lebih per tahun sedangkan rasio cakupan pelayanan oleh IPAL hanya 1.2%. Sebelumnya kekurangan ini ditutup dengan dana APBD tetapi sejak tahun 2017 telah dihentikan sehingga sangat memberatkan PDAM sebagai pengelola.

Saat ini pendapatan tariff hanya dapat menutup 14,7% biaya operasional dan pemeliharaan dimana sehingga sangat tidak mencukupi sedangkan bantuan dana selama ini mengandalkan dari Pemkot dan PDAM Balikpapan. PDAM saat ini sedang mengupayakan Surat Keputusan Direksi (yang masih perlu disetujui oleh DPRD) untuk meningkatkan penerimaan pelayanan air limbah melalui pengenaan 20% dari harga pemakaian air setiap sambungan.

Biaya Investasi untuk 3 Paket: Optimalisasi IPAL Margasari, Pembangunan IPAL Sepinggan dan Pembangunan IPAL Somber (termasuk biaya sosialisasi dan biaya tak terduga 15%)diperkirakan sebagai berikut:

Paket 1 Optimalisasi IPAL Margasari:	Rp 83,487 milyar (USD 6,184 juta).
Paket 2 Pengembanganj IPAL Sepinggan:	Rp 236,382 milyar (USD 17,510 juta).
Paket 3 Pengembangan IPAL Somber:	Rp 249,148 milyar (USD 18.455 juta).

Biaya Operasi dan Pemeliharaan diperkirakan sebagai berikut:

Margasari:	Rp 2,039 milyar/tahun,
Sepinggan:	Rp 2,925 milyar/tahun
Somber:	Rp 3,218 milyar/tahun.

Pemerintah Kota memiliki kemampuan keuangan untuk mendukung pengembangan sanitasi sistem air limbah sebesar Rp 18,12 milyar per tahun. Untuk keperluan analisis keuangan diasumsikan dana Grant dari Pusat dapat diperoleh sekitar 30% dari kebutuhan investasi dan sisanya didanai dari PDAM dan Pinjaman daerah dengan perbandingan 30:70. Dengan asumsi masa pembangunan konstruksi 4 tahun dan operasi 30 tahun maka hasil analisis keuangan ditunjukkan di bawah ini.

	Tanpa Projek	Seluruh Paket	Paket1: Margasari	Paket2: Sepinggan	Paket3: Somber
B. Operasi tahunan (Rp jt)	1.284	4.124	1.484	1.243	1.371
Pendapatan tahunan (Rp jt)	479	2.435	472	952	1.025
Gap biaya operasi (Rp jt)	-805	-1.689	-1.012	-291	-347
Rasio operasi rata2 (b.opr : pendapatan)	2,68	1,69	3,14	1,31	1,34

Hasil analisis menunjukkan dengan adanya proyek tetap terjadi kekurangan dana operasional tetapi dapat ditekan dari 2,68 menjadi1,69 (perbandingan biaya operasi terhadap pendapatan). Tetapi jika SK Direksi untuk biaya air limbah sebesar 20% dari harga pemakaian air disetujui dan diterapkan maka dengan minimal 30% pelanggan dapat tertagih maka dapat menutup biaya operasi maupun investasi secara signifikan.

	Tanpa penerapan 20% harga pemakaian air	Dengan penerapan 20% harga pemakaian air
B. Operasi (Rp jt/thn)	4.124	4.124
Pendapatan (Rp jt)	2.435	17.394
Gap biaya operasi (Rp jt)	-1.689	13.270

Rata2 Rasio Operasi	1,69	0,24
NPV (@wacc 9,83%)	(199.324)	58.659
IRR	-6,04%	12,27%
Periode pengembalian (thn)	-	14

Terlihat bahwa rasio sudah di bawah 1 (pendapatan dapat menutup seluruh biaya operasi) dan Nilai sekarang bersih (NPV) positif serta IRR projek telah melebihi biaya modal (12,27%>9,83%).

vii. Analisis Ekonomi Proyek

Digunakan untuk menganalisis manfaat dan biaya yang belum dimasukkan dalam analisis keuangan. Manfaat projek yang diperhitungkan adalah kemampuan bayar (WTP/*willingness to pay*) tarif bulanan, WTP untuk penyambungan, penghematan biaya kesehatan, pungutan pencemaran (*polluter levy*), nilai pemanfaatan effluent, penghematan biaya pengolahan untuk air bersih dan pengenaan 20% harga jual air pada setiap pelanggan PDAM.

Analisis menunjukkan EIRR (tingkat manfaat terhadap biaya) sebesar 13,92% melebihi batas 12% (standar ADB/WB), NPV positif Rp 64,3 milyar (@12%) dan rasio manfaat-biaya 1,15 sehingga projek ini dapat dianggap layak karena dapat memberikan manfaat lebih kepada masyarakat.

viii. Strategi dan Skenario

RPJMN 2015-2019 menetapkan bahwa pada tingkat nasional akses terhadap pelayanan sanitasi dapat mencapai 100% pada tahun 2019, yang terdiri dari akses normal (85%) dan akses dasar (15%). Sanitasi dasar adalah sanitasi yang telah ditingkatkan dimana fasilitas tersebut dapat memastikan pemisahan limbah dari kontak dengan manusia.

Strategi untuk pengelolaan Air Limbah adalah penting, dengan antara lain:

a) Perlu Strategi Jangka Panjang;
b) Rencana Tata Ruang/Perencanaan Pembangunan/Rencana Sanitasi;
c) Keputusan dimana dan apa yang harus diimplementasikan untuk sistem keseluruhan kota
d) Proteksi Kesehatan dan Lingkungan (black water & grey water);
e) Prioritas-prioritas perencanaan sementara.

Strategi Pengelolaan air limbah harus dibuat, dengan dan/atau:

1) Sistem *Off-site* vs Sistem*On-site*;
2) Sistem Air Limbah tidak terpusat vs Sistem Air Limbah terpusat;
3) Analisa atas skenario-skenario: Pro dan Kontra;
4) Prioritas tinggi jangka pendek (1 - 5 tahun ke depan);
5) Implementasi jangka menengah (5 – 15 tahun);
6) Tahap transformasi dan tindakan;
7) Pentahapan dan Ekspansi Modul

Kajian lebih lanjut mengenai Skenario-skenario berikut sangat penting untuk dilakukan:

Skenario I	Sistem Terdesentralisasi dengan pengembangan 10 unit Instalasi Pengolahan Air Limbah (Master Plan 2012)
Skenario II	Desentralisasi plus Sistem On-site dengan 3 unit IPAL dan sisanya dilayani dengan pelayanan tangki septik (PFS 2014)
Skenario III	Sistem Semi Terpusat dengan maksimum 5 IPAL
Skenario IV	Sistem Terpusat dengan 1 (atau 2) IPAL untuk seluruh kota.

ix. Kesimpulan dan Rekomendasi

Kesimpulan

1. Aspek Teknis:
   a. Area Pelayanan Margasari: meningkatkan IPAL eksisting dan memperbaiki jaringan perpipaan air limbah. Total sambungan rumah adalah 2,222 unit.
   b. Area Pelayanan Sepinggan: Pembangunan IPAL baru di area kolam retensi dan jaringan perpipaan air limbah . Total sambungan rumah baru adalah 5,000 unit.
   c. Area Pelayanan Somber: Pembangunan IPAL baru di area KIKS dan jaringan perpipaan air limbah. Total sambungan rumah baru adalah 5,500 unit.
2. Ekonomi/Keuangan:
   a. Anggaran untuk pengembangan sistem sanitasi Kota Balikpapan mencapai lebih dari Rp 68,3 milyar (pada tahun 2016 saja) atau sekitar Rp 22,8 milyar (asumsi 1/3 kali);
   b. Kemampuan Kota Balikpapan yang sangat memadai untuk mengajukan pinjaman daerah untuk mendanai kebutuhan investasi pembangunan infrastruktur baru (berbagai sektor) sebesar Rp 1.600 milyar;
   c. Pengembangan sistem pelayanan air limbah juga mendapatkan dukungan dari Pemerintah Pusat (melalui PPLP/Kem.PU) dengan adanya program hibah dari INDII/AusAid/sAIIG yang menyediakan dana sebesar Rp 400 milyar (untuk sambungan rumah) untuk mencapai target cakupan pelayanan 100% di tahun 2019 meskipun tetap diperlukan tambahan dana untuk komponen lainnya dan untuk kesinambungan pengembangan di masa depan;
   d. Sistem penagihan melalui tagihan air PDAM untuk sebagian pelanggan IPAL Margasari (yang terkoneksi dengan perpipaan PDAM) dapat dianggap jauh lebih berhasil (dibandingkan cara ‘door to door’) meskipun tetap belum dapat menutup biaya operasional. Meskipun demikian dengan adanya proyek sebagaimana diusulkan serta cara baru penagihan melalui persentase pemakaian air nantinya diharapkan dapat menutup secara signifikan seluruh biaya operasional.
   e. Hasil analisis ekonomi menunjukkan manfaat ekonomi yang tetap lebih besar dibandingkan biaya ekonominya.

Rekomendasi

1. Memperbaharui Master Plan 2012;
2. Memperbaharui Rencana Tata Ruang/Perencanaan Pembangunan/Rencana Sanitasi Kota;
3. Melanjutkan implementasi yang diusulkan dalam Revisi Laporan PFS 2017 ini:
   a. Margasari: Memperbaiki IPAL eksisting, memperbaiki sistem perpipaan air limbah yang ada, mengembangkan jaringan perpipaan air limbah untuk memperbanyak jumlah sambungan rumah;
   b. Perusda: Membangun IPAL baru dan jaringan perpipaan air limbah dalam satu daerah tangkapan.
   c. Somber: Membangun IPAL baru di area KIKS dan jaringan perpipaan air limbah dalam 2 area
4. Menerapkan susunan kelembagaan dengan PDAM sebagaimana yang diusulkan;
5. Menerapkan sistem penagihan tarif melalui persentase (misalkan 20%) dari harga pemakaian air bagi pelanggan PDAM;
6. Memanfaatkan secara maksimal dana hibah yang tersedia untuk mendukung biaya investasi sistem yang diusulkan;
7. Memanfaatkan akses pendanaan dari lembaga-lembaga keuangan yang ada untuk mempercepat pengembangan pembangunan infrastruktur public

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1 INTRODUCTION

1.1 Project Introduction

In September 2016 the Cities Development Initiative for Asia (CDIA) received a request for support from PT Sarana Multi Infrastruktur (PT SMI) to assist Balikpapan Municipal Government in reviewing an existing Pre-Feasibility Study (PFS) from 2014 relating to wastewater (WW) sector investment and enhance, as necessary, its technical, financial, institutional, environmental and social content.

On 16th January 2017, the Inception Report and Financial Assessment Report Balikpapan were submitted to Balikpapan Municipality, CDIA and PT SMI after the Inception Meeting held on 13th January 2017.

The 'Draft Revised PFS Report' was a continuation of the Inception Report.

The existing PFS 2014 forms the basis and this Final Report March 2017 and includes a/o: 1) the reviews, 2) the proposed updates of the project(s) and 3) conclusions and recommendations.

On the 13th of February 2017 a Workshop was held in Balikpapan to all Stakeholders to discuss this supplementary report and the proposed outcomes. After comments and remarks received the 'Draft Revised PFS Report' was submitted on the 21st of February 2017.

This presented Report is the "Final Report" including all comments and remarks received from all Stakeholders on the Draft version. This Final Report is developed as a Stand-alone Report.

1.2 Balikpapan Project Background

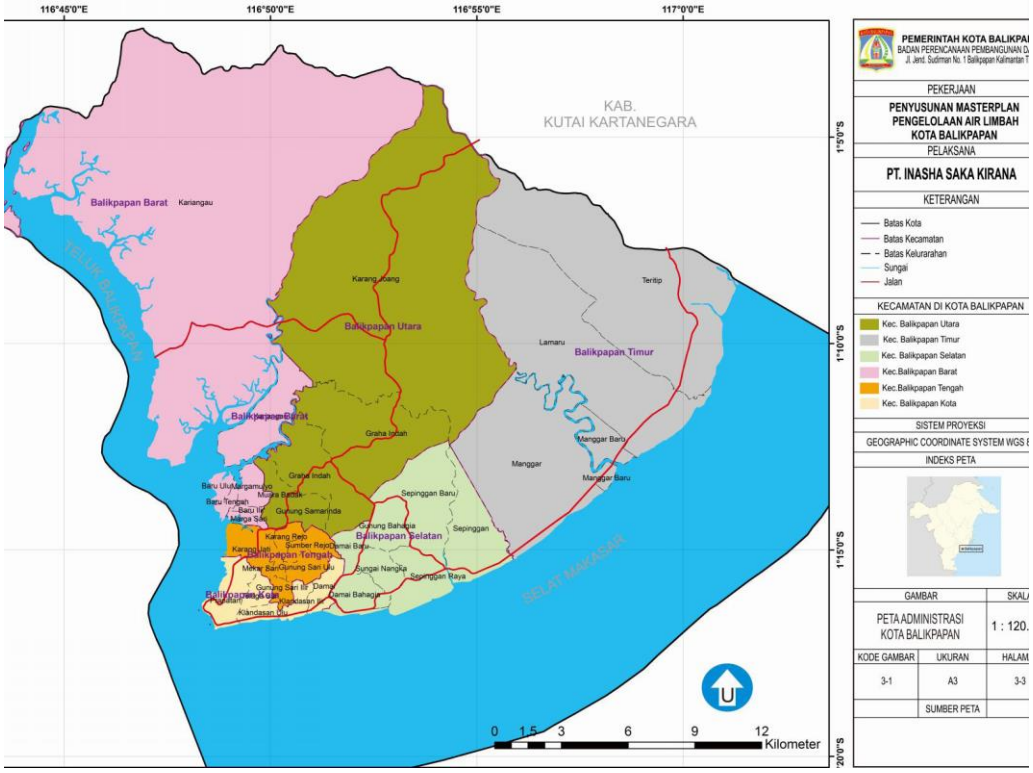
Balikpapan is one of the most developed cities in East Kalimantan, Indonesia, and has grown to become the economic and social center of the province. More than 650,000 inhabitants live in this coastal city but only a small fraction of these people have access to an effective waste water system.

In 2013, the city of Balikpapan received technical assistance from the World Bank to carry out a Pre-Feasibility Study (PFS) concerning the expansion of the city's wastewater (WW) system.

The original PFS for this expansion plan was carried out in 2013/2014 by Mott MacDonald. The PFS describes the sanitation coverage expansion through increasing the capacity of the existing Margasari plant, and building new treatment plants in other parts of the city i.e. Somber and Sepinggan.

Further it describes reference points for institutional arrangement for wastewater management and recommendations for a cost recovery system for the WW treatment plants based on local conditions and house connections.

Figure 1: Administration Map Balikpapan



An efficient operational Wastewater system is important not only to improve the health of Balikpapan's citizens but also to benefit the community through enhancing its environmental state and to provide job opportunities through the operation of its treatment plant and collection system.

In order to expand Wastewater treatment and service coverage in accordance with the goals set out in Balikpapan's City Sanitation Strategy, the Balikpapan Municipal government wishes to optimize its existing Wastewater treatment works at Margasari to enable it to operate at full capacity and, in addition, to construct two new WW treatment facilities in Sepinggan and at the Somber Industrial Estate.

For improvement and update of the PFS, necessary areas of examination include:

- In Somber as well in Sepinggan, additional work needs to be done to identify more appropriate sites to locate Wastewater treatment plants. The proposals put forward by the city with respect to Wastewater treatment expansion at Sepinggan and Somber need to be re-evaluated.
- More information on project background – it is presently unclear how it fits into the national sector strategy and the long term development strategy for sanitation services and exactly how the current Wastewater system is performing.
- Based on the results of an enhanced demand analysis, determine whether the city of Balikpapan really needs the addition of two sites at Sepinggan and Somber or might there be other, better options available.

- The Institutional section needs to be enhanced to identify external relationships with relevant organizations involved in Wastewater sector activities, organizational and human capacity for managing expanded Wastewater operations and necessary promotion and education activities.
- Strategies, policies and both push/pull measures will be needed to facilitate the utilization of the sanitation system to its full capacity.
- Additional project cost details (and associated assumptions) together with an assessment of viable project financing sources need to be included (including a tariff strategy). This will need to include an assessment of Land Acquisition and Resettlement costs.
- Support to ensure the sustainability and financial viability of the expanded Wastewater system.

2 SOCIO-ECONOMIC

2.1 Review of Socio-Report and PFS 2014

The important and strategic issues for WWTP management in relation to social safeguards potentially includes the people's general lack of knowledge and their low level of concern regarding the issue; that many of the urban population use contaminated well water for their supply; increasing water and land pollution from wastewater and the increasing regional negative impacts caused by insanitary wastewater management practices.

PFS 2014 collected data from approximately 5% of the number of proposed first phase households in the project areas (1,064 households) regarding information on the communities' attitudes and understanding towards the improvement of sanitation systems, prior to its implementation, was crucial so that it is possible to target improvements in awareness so the communities come to understand and appreciate the benefits that will be provided. It was important to understand the attitudes of the population, particularly with regards to the following parameters, including of:

i) the community's attitude towards the wastewater development programme; whether they agree with the programme will be fundamental to its success or otherwise;

ii) the community's willingness to connect to the sanitation system if the programme is implemented; and

iii) the community's willingness to pay for the service.

There was no new survey in 2017, only field visits during the inception mission in January 2017. Based on observation and fact findings in the field, some socio-economic conditions such as income level, head of household, house ownership, primary family income, gender issues, etc. are still valid as mentioned in the survey of PFS 2014.

Based on the above survey result and last field visit on Inception mission in January 2017, indicate that some conditions still reflected situation in the field as follows:

a) income levels in Somber and Sepinggan are similar, and both are significantly higher than those in Margasari.

b) The heads of households were mostly immigrants to the region: 45% from Central and East Java, 26% from South Kalimantan or Banjarmasin, 18% from South Sulawesi or Bugisnese and 11% from other Indonesia regions.

c) The housing in Margasari was dominated by semi-permanent timber housing (62%), much of which is built on stilts over the estuary. The housing in Sepinggan is better established and is dominated by permanent brick-built houses (86%) in residential complexes. In Somber, 60% of the housing is considered permanent and 34% semi-permanent.

d) The house ownership status across the three areas is 60% to 72% private.

e) The primary family income source was from private sector employment (almost 50%).

f) The largest income category in the three areas was Rp 2 to 3 million (29%). Second largest was > Rp 5 million/month.

g) Most of the population (approx. 58%) uses piped PDAM water for drinking and cooking purposes and 34% use bottled water. For bathing and washing and toilet purposes, 78% of respondents use piped PDAM water.

h) Around 99% of respondents stated that they had their own private toilets, only 8% stated that they never emptied their septic tank of sludge.

i) Most of the wastewater from toilets (80%) was disposed to septic tanks. Grey water from bathrooms and kitchens was mostly discharged to surface water drainage (83%).

j) The respondent willingness to connect to an off-site system, 93% stated that they would be willing. The remaining 7% were unwilling due to their opinion that there was no problem with their existing system of individual septic tanks and some complained about the existing off-site system saying the system was not comprehensive and that there was a poor response to complaints.

k) Almost all respondents (99%) said they were aware of and care about sanitation issues.

l) The percentage of respondents willing to pay a connection fee and a volumetric tariff was 70% and 63% respectively. The remaining 30% and 37% of respondents stated that they objected to paying as, in their opinion, sanitation management was the responsibility of government.

m) Gender issue, women have central role in the management of water resources and extend access to safe drinking water and adequate sanitation.

n) Land acquisition issue, there is no issue of land acquisition in Margasari sub project, since there is no any plan to extend. In Sepinggan sub project there are three options that the land belongs to the City Government of Balikpapan. Only in Somber, the existing government land only 2000 meter squares will need more land approximately 4000 meter squares from private land. For the long term maybe need more land up to 2 ha.

In the social survey report of PFS 2014 there is no information, whether survey also covered business entities or just households as respondent; however it is also important to clarify business' opinion regarding development plan of WPTP before project commencement.

2.2 Future Expectations and Planning Context

In response to the future expected growth, the following figure presents a prognosis of future population growth for Balikpapan City.

Since there is no data natality, mortality, migration, therefore this projection based on geometric formula:

$$Pn = P\ (1+ r)^n$$

with:

Pn = total population in year-n.
Po = total population in basic year (2016).
r = population growth in that interval.
n = number of interval.

The basic year is based on database of Population Report, Population and Civil Administration Agency, Balikpapan Municipality, 2016. During 2015 has been reported that population growth is 4.22%. However in this projection the study team uses less than 4.22% with assumption the population growth will decrease because of successful family planning. Since there is no data natality, mortality, migration, therefore we use assumption in 3 interval population growth, the longer declining, as follows:

- from 2016 – 2025: assumed growth percentage 3.5% per year

- from 2025 – 2034: assumed growth percentage 1.75% per year
- from 2034 – 2041: assumed growth percentage 1.5% per year.

Table 1: Population prognosis till the year 2041

No	Area	Village/ Kelurahan	Total	Percentage of population[1]	Current (2016)	Population prognoses		
						2025	2034	2040
1	Margasari	Baru Ilir	22,487	100%	22,487	30,647	30,729	32,145
		Marga Sari	13,871	100%	13,871	18,905	18,955	19,829
				Total	**36,358**	**49,552**	**49,684**	**51,974**
2	Somber	Batu Ampar	37,061	60%	22,237	30,306	30,387	31,787
		Muara Rapak	35,353	40%	14,141	19,273	19,324	20,215
		Margo Mulyo	16,024	90%	14,422	19,655	19,708	20,616
				Total	**50,799**	**69,234**	**69,419**	**72,618**
3	Sepinggan	Sepinggan	34,743	100%	34,743	47,351	47,477	49,665
		Gn. Bahagia	23,717	90%	21,345	29,091	29,169	30,513
		Sepinggan Barru	30,834	80%	24,667	33,619	33,708	35,262
				Total	**80,756**	**110,061**	**110,355**	**115,44**
	TOTAL		**214,09**			**228,848**	**348,561**	**364,624**

Note:
Growth Percentage of 2016 – 2025: 3,50% per year
Growth Percentage of 2026 – 2034: 1,750% per year
Growth Percentage of 2035 – 2040: 1,50% per year

2.3 WWTP Locations from a Social Perspective

Margasari

Margasari is located in nearby Pandan Sari market, Margasari Village, West Balikpapan Sub District. It covered two villages, Baru Ilir and Marga Sari. The Margasari Sub Project has a very high density population and there is no space anymore to extend the existing WWTP.

The positive thing is people getting benefit from the existing WWTP, namely they use the treated effluent water for car washing, watering flower garden, etc.. However some people lack awareness to connect to the WWTP, since they are feeling free to throw away grey water out site their house.

Based on the capacity, Margasari sub project is able to cover 2,222 household connections, however only 1,384 households are connected to WWTP. Therefore, it is needed to conduct a good awareness program to increase people awareness to connect to the WWTP.

[1] The coverage of project is not always 100% of the villages; it depends on topographical situation of the catchment area(s) (see further the Technical Section for details on catchment areas). The project population is based on percentage of project coverage in each village.

Somber

Somber is located in small industry center of tofu-tempe area, Somber Village, Balikpapan. This sub project covers three villages: Batu Ampar, Muara Rapak and Margo Mulyo, all in North Balikpapan.

The positive of this sub project is there is an industry tofu-tempe that has an existing industrial WWTP, so the people have a good awareness to connect WWTP. The WWTP will be established next to the existing industrial WWTP of tofu-tempe waste. Part of the site, 2,000 meter squares - , belongs to Balikpapan City. More land is required, approx. additional 4,000 meter squares from private land. For the long term in case extension is required, more land up to approx. 2 ha is required. A Land acquisition procedure should be in line with the existing Laws and Regulations.

Sepinggan

The proposed wastewater treatment plant Sepinggan will be located in a residential area, in Sepinggan Village, South Balikpapan with four options for location, namely;

(i) Resident Area in Sepinggan;

(ii) Existing soccer field (SMP 18) Sepinggan;

(iii) Bendali 1 Sepinggan, and,

(iv) Nearby SLB *(Ex Post Office and Village Head Office)*.

Re. (i): The resident area in Persuda is not recommended because it has potential social impact to the community since it in the residential area and negative perception of people that WWTP will result site impacts (e.g. bad smell).

Re. (ii): the existing soccer field in Sepinggan (ii) is not recommended because it requires replacement land to build a new soccer field.

Re. (iii): this option Bedali 1 Sepinggan (iii) is the best option from social perspective because the location is far from the resident area and has a good access road; this will avoid social impact. Technically there is a requisite to change or modify the function from retention pond for flood control to new location of wastewater treatment plant.

Re. (iv): this option is nearby SLB *(Ex Post Office and Village Head Office).* This option is not recommended since even though there is available potential land 4,000 meter squares, only a part of this belongs to Balikpapan city, the other part is private land has to be acquired. This land is also in the resident area with most likely potential objections from people because their negative perspective towards a WWTP.

The following table summarizes the advantages and disadvantages for each site.

Table 2: Alternatives WWTP locations from Social Perspective

No	Area	Alternative of WWP Site	Advantage	Disadvantage	Remark
1	Margasari	Nearby Pandan Sari Market	People getting benefit from the existing WWTP (effluent for car washing, watering flower garden, etc.)	Some people have lack awareness to connect to WWTP, since they are free to throw away domestic waste.	Need a good awareness program

2	Somber	WWTP Kopti Tahu Tempe	Small industry center of tofu and tempe need of WWTP	The limited available land (only 2000 meter squares), need land acquisition approx. 2 ha.	Land acquisition should be in line with government regulations
3	Sepinggan	Resident Area in Sepinggan	Land belong to Balikpapan city and People can take benefit from the effluent	Potential social impact to the community during construction.	Not recommend
		Soccer Field (SMP 18) Sepinggan	Land belong to government city and near by the river and good access so less social impact during construction	Existing land for soccer field, need to be replace with other land for Soccer field.	Not recommend
		Retention Pond Bendali I Sepinggan Nearby SLB *(Ex Post Office and Village Head Office)*	In downstream and far from resident area, a good access road will avoid social impact. The available potential land around 4000 meter squares, a part of belong to Balikpapan city and the remaining private land.	Change the function from flood control to WWTP In the resident area and need more land acquisition. Potential objection because negative perspective of people that WWTP will result side impact a bad smell.	Recommended from social perspective. Not Recommended

2.4 Related Laws and Regulations for Land Acquisition

Potential land acquisition will be conducted in Somber Sub Project from existing land 2,000 meter square, need additional land of 4,000 meter square in the coming period. For future extension there is a need of approx. 2 ha.

Based on the Presidential Regulation No. 148/2015, Fourth Amendment of Presidential Regulation No. 71 of 2012 on Land Acquisition Implementation for Development in the Public Interest, point 17, land acquisition less than 5 ha can be conducted by direct transaction. However this must be in line with the regional spatial planning and price must be based on independent appraisal.

Further related laws and regulations on land acquisition process is presented in the following list:

1. Law No 2/2012 on Land Acquisition for Development for Public Interest.
2. Presidential Regulation (PerPres) No. 71/2012 nn the Implementation of Land Acquisition for Development in the Public Interest.
3. Presidential Regulation No. 40/2014 First Amendment to Presidential Regulation No. 71 of 2012 on the Implementation of Land Acquisition for Development in the Public Interest.
4. Presidential Regulation No. 99/2014 Second Amendment of Presidential Regulation No. 71 of 2012 on Land Acquisition Implementation for Development in the Public Interest.
5. Presidential Regulation No. 30/2015 Third Amendment of Presidential Regulation No. 71 of 2012 on Land Acquisition Implementation for Development in the Public Interest

6. Presidential Regulation No. 148/2015 Fourth Amendment of Presidential Regulation No. 71 of 2012 on Land Acquisition Implementation for Development in the Public Interest.
7. Head of BPN Regulation No. 5/2012 on Technical Guidance on Land Acquisition.
8. Head of BPN Regulation No. 6/2015 Amendment of Head of BPN Regulation No. 5/2012 on Technical Guidance on Land Acquisition.
9. Head of BPN Regulation No. 22/2015 Second amendment of Head of BPN Regulation No 5 of 2012 on Technical Guidance on Land Acquisition.
10. Minister of Finance Regulation No. 13/PMK.02/2013 on Operating Costs and supporting cost of the Implementation of land acquisition for Development in the Public Interest funded from the state budget.
11. Minister of Finance Regulation No. 06/PMK.02/2016 Amendment of Minister of Finance Regulation No. 13/PMK.02/2013 on Operating Costs and supporting cost of the Implementation of land acquisition for Development in the Public Interest funded from the state budget.
12. Regulation of the Minister of Internal Affairs No. 72/2012 On Operating Costs and supporting cost of the Implementation of land acquisition for Development in the Public Interest funded from the regional budget.
13. Instruction of the Minister of Agrarian and Spatial Planning/Head of National Land Agency. No. 2/Ins/VIII/2016 on the Acceleration of the implementation of Land Acquisition in the Public Interest for National Strategic Projects.
14. Supreme Court Regulation No. 2/2016 Guidance for Proceeding in Location Dispute Settlement for Development in the Public Interest at the Administrative Courts.
15. Supreme Court Regulation No. 3/2016 Objection Filing Procedures and Compensation Custody to the District Court in the Land Acquisition for Development in the Public Interest.

In case the project will be funded by an international donor, other social safeguards have to be applied. The following are some international social safeguards to be referred to:

1. ADB Safeguard Policy Statement (2009).
2. World Bank Operational Policy (World Bank Operational Policy 4.12 - Involuntary Resettlement).
3. JICA's Guideline for Environmental and Social Consideration (April 2010).

Other donors normally refer to one of the above safeguards.

2.5 Communication Plan

It is important to prepare a communication plan for improving awareness of people to participate in the all project circles. Consultation to the people must be conducted with the meaningful consultation principles. The project has to conduct meaningful consultation with project beneficiaries and affected persons.

Meaningful consultation should conduct as follow:

(i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;

(ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;

(iii) undertaken in an atmosphere free of intimidation or coercion;

(iv) gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and

(v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

It is suggested to the Balikpapan City Government to conduct a communication plan to further convince the project acceptance from communities or project beneficiaries. The following table indicates some activities regarding to community consultation plan.

Table 3: Strategy and Media Communication Plan

Type/Strategy	Media/Technique	Time frame
In form	• Brochures • Pamphlet • Big Banner • Local government website • Information stands	• Monthly • Incidentally
Consult	• Public consultation meetings (PCM) • Focus group discussion (FGD)	• In all project circle (project preparation stage, planning, implementation, monitoring and evaluation).
Involve	• Workshops • Study tours and field trips	• Annually • Incidentally
Collaborate	• Advisory group • Focus group discussion (FGD)	• Annually

It is very important to conduct focus group discussions or consultation meetings to absorb community aspiration to improving the sense of belonging of the project from project beneficiaries' side. Normally by involving project beneficiaries during construction of a project will improve a sense of belonging of project beneficiaries also.

In Annex 1 an Outline of a Resettlement Plan is presented.

3 ENVIRONMENT

3.1 Climate and Precipitation in Balikpapan

The climate of Balikpapan is tropic, and has two seasons which are dry season and rain season. Dry season is usually happened on May until October, while rainy season is happened on November until April. This condition is happened every year that alternated by change of season on certain months. However, in the recent years, the condition of season in Balikpapan is indefinite occasionally. In the rainy season, supposed to fall rain, it was no rain. On the contrary, in the dry season, supposed no rain, it rains in a long time. (*Balikpapan in Figures, 2015).*

Normally, temperature in a place is determined by its high or low of sea surface level and its distance from the beach. Generally, Balikpapan area is hot climate by temperature in 2013 is between 22,0^{0}C up to 34,7^{0}C. Its humidity is high on the average between 78-86 percent. (*Balikpapan in Figures, 2015)*

The rainfall of Balikpapan varies by month. The highest and lowest average rainfall in 2014 measured in the Meteorology Station of Balikpapan in the amount of 12,2 mm and 421.9 mm respectively. During 2014, the wind velocity in Balikpapan is in between 4.5 knot to 6.3knot. (*Balikpapan in Figures, 2015)*

During 2014 the duration of sunshine is between 38,0 - 52,5 percent and the average of atmospheric pressure was 1,011.0 Mbs with min to max pressure between 1,010.0 Mbs and1,011.9 Mbs.(*Balikpapan in Figures , 2015)*

Table 4: Climate in Balikpapan 2015

Climate data for Balikpapan, East Kalimantan, Indonesia													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	29.9 (85.8)	30.2 (86.4)	30.2 (86.4)	30.2 (86.4)	30.1 (86.2)	29.5 (85.1)	29.0 (84.2)	29.5 (85.1)	29.6 (85.3)	30.3 (86.5)	30.2 (86.4)	30.1 (86.2)	29.9 (85.83)
Daily mean °C (°F)	26.5 (79.7)	26.6 (79.9)	26.6 (79.9)	26.8 (80.2)	26.9 (80.4)	26.5 (79.7)	26.1 (79)	26.4 (79.5)	26.5 (79.7)	27.0 (80.6)	26.9 (80.4)	26.7 (80.1)	26.62 (79.93)
Average low °C (°F)	23.1 (73.6)	23.0 (73.4)	23.1 (73.6)	23.4 (74.1)	23.7 (74.7)	23.6 (74.5)	23.2 (73.8)	23.4 (74.1)	23.5 (74.3)	23.7 (74.7)	23.4 (74.1)	23.3 (73.9)	23.37 (74.07)
Average precipitation mm(inches)	187 (7.36)	172 (6.77)	249 (9.8)	196 (7.72)	223 (8.78)	265 (10.43)	244 (9.61)	230 (9.06)	221 (8.7)	140 (5.51)	177 (6.97)	235 (9.25)	2,539 (99.96)
Average precipitation days	15	15	18	17	17	17	17	14	15	15	14	19	193
Average relative humidity (%	74	72	72	74	76	75	75	72	70	71	73	70	72.8

Source #1: Climat-Data.org (average temperature)

Source #2: Danish Meteorological Institute (precipitation and humidity)

Table 5: Rain fall by month in Balikpapan 2015

Month	Rain Fall(mm)
January	267,9
February	329,1
March	182,8
April	220,5
May	199,7
June	509,8
July	114,5
August	69,1
September	-
October	37,5
November	111,8
Desember	112,7

Source: Meteorology Station, Balikpapan

Table 6: Total rainfall 2004 -2014

Years	*Wind Velocity* (Knot)	*Rainfalls* (Mm)	*Duration of Sunshine* (%)
(1)	(2)	(3)	(4)
2004	5,8	2 458,3	44,4
2005	5,3	2 384,4	47,0
2006	6,3	2 887,1	46,9
2007	5,1	2 823,1	40,0
2008	5,0	3 785,0	38,0
2009	5,0	2 212,8	47,7
2010	6,0	2 998,0	52,5
2011	4,8	2 953,0	45,83
2012	4,5	2 914,4	52,42
2013	4,2	2 906,3	47,17
2014	4,2	2 401,0	50,1

Source: Balikpapan in Figure, 2015

The typical of the soil is prone to erosion, making it easy to form grooves meandering. The

slope is steep in the upland and hilly areas producing high speed (critical) flow added with the development of the city by land clearing and cutting the hills for settlement. This will increase surface erosion and cause increasing river sedimentation transport. Furthermore, the sediment deposition resulting in siltation of rivers and nature channels, so it can no longer accommodate the runoff of rain. The great rivers in Balikpapan City are as shown in the following table.

Table 7: List of main rivers in Balikpapan

No	River	Location	Length (m)
1	S. Wain	Balikpapan Barat	11.200
2	S. Somber	Balikpapan Barat	7.100
3	S. Klandasan Kecil	Balikpapan Selatan	3.800
4	S. Klandasan Besar / Ampal	Balikpapan Selatan	4.900
5.	S. Sepinggan	Balikpapan Selatan	5.600
6.	S. Batakan Kecil	Balikpapan Timur	5.100
7.	S. Batakan Besar	Balikpapan Timur	9.500
8.	S. Manggar Kecil	Balikpapan Timur	7.200
9.	S. Manggar Besar	Balikpapan Timur	19.400
10.	S. Lamaru	Balikpapan Timur	2.300
11.	S. Ajiraden	Balikpapan Timur	2.100
12.	S. Teritip	Balikpapan Timur	4.200
13.	S. Selok Api	Balikpapan Timur	6.700

3.2 Environmental Assessment Process

Any infrastructure facilities construction project may involve detrimental effects on the physical, natural or human environment: generation of air or water pollution, alteration of the existing land use with potential detrimental impacts on the biodiversity and livelihood of the concerned population. To reduce these risks, countries and International Finance Institutions (IFIs) have developed various environmental and social safeguards to be considered during project preparation. The backbone of the system is represented by the process of Environmental Impact Assessment (EIA).

The target of the EIA process is threefold:

1. To provide information on possible environmental ,health and safety consequences of the project with possible corrective measures to the attention of decision makers at the right time in the decision making process;
2. To promote environmentally sound and sustainable development through the identification of appropriate mitigation and enhancement measures;
3. To provide tools to effectively control environmental risks during project preparation, construction and operation.

International good practice dictates that the EIA process takes place throughout the project cycle. To satisfy this principle, the EIA process implies various stages or activities, adapted to each stage of the project preparation:

Screening: At the early stage of project alternative options proposal, the EIA will "screen" potential beneficial and detrimental impacts for each option in order to provide environmental criteria for the selection of the most preferable option, together with technical, economic and social criteria.. Due to the Balikpapan city proposed 4 (four) IPAL alternatives, so the screening was carried out

Scoping and EA report preparation: Analysis of the most significant potential impacts of selected options and identification of corrective measures to be considered during the technical feasibility study stage of the project components. The EA report also provides operational tools for environmental risk control through the Environmental Management Plan and Environmental Monitoring Plan (EMPs). This is not part of this project for Review and update of the PFS.

Stakeholder analysis and consultation: Objective is (i) to seek opinion, suggestions and concerns from government or civil organizations as well as from affected or beneficial population to be considered in the EIA studies and (ii) to present the results of the EIA studies and get comments before the report is finalized. This is also not part of this project for Review and update of the PFS.

3.3 Applicable Environmental Safeguards

The EIA process must comply with the Indonesian National Safeguards, which are Ministry of Environmental Regulation No. 5 year 2012 on covering the regulations of the Environmental Impact Study Requirement and the environmental permit for each business activity should be completed based on the Indonesia Government Regulation No, 27 year 2012.

Table 8: Applicable Environmental Regulations

National Level:	Government of Indonesia Regulation, Ministry of Environment and Forestry
Province Level	Province Environmental Agency / East Kalimantan
Regency / City:	Regency / City Environmental Agency / Balikpapan City

Background of Laws and Regulations

Indonesia (Country Regulation) and Balikpapan has already significant legislations and regulations which are the major environment-related laws and regulations. They are summarized in following table.

Table 9: Applicable Environmental Regulations

Laws and Regulations	Year	Purpose/Description
Indonesia Country Regulation		

Environmental Conservation Law	1990 2009	Law No 5 Concerning Conservation of natural resources and the ecosystem Law No 32 concerning to protection and management of the environment
Conservation of Water Resources and Rivers Law	2004 2011 2014	Law No 7 concerning Water Resources Government Regulation No 38 concerning to River Law No 37 concerning Soil and Water Conservation
Water Quality	2001 2002	Government Regulation concerning Water Quality Management and Pollution Control No. 82 Decree No. 907, concerning Term and Condition on Monitoring Drinking Water
Air Quality	1996 1999	Decree No. 48 concerning Noise Standard Level Government Regulation No. 41 concerning Air Pollution Control
Waste Water	2003 2006	Decree No. 112 concerning Domestic Waste Water Standard Government Regulation No. 12 concerning Permit Water Disposal at Sea
Forest Law	1999 2013 2014	Law No 41 concerning Forestry Law No 18 concerning to Prevention and Combating Deforestation Law No 37 concerning Soil and Water Conservation
Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law	2007 2011	The Ministry of Forestry No 10 concerning Germination of Forest Government Regulation No 28 concerning management of nature reserves and conservation areas
National Environmental Policy	1997 2007 2009 2012 2015 2016 2016	Law No 23 concerning Environmental Management Government Regulation No 27 on Environmental Impact Assessment Law No 32 concerning Environment Government of Indonesia regulation No.27 concerning the Environmental Permit Ministry of Environmental Regulation No. 5 concerning the Type of Activity require AMDAL (EIA) Study Ministry of Forestry and Environmental Regulation No, P.68/Menlhk/Setjen/Kum.1/8/2016 concerning Domestic Waste Water Effluent Standard Ministry of Environmental and Forestry Regulation No. P.102/MENLHK/SETJEN/KUM.1/12 year 2016 concerning the Guidance of AMDAL Document for the Business and/or Activity which is has the Business permit and/or the Environmental Document is not Complied
The Underground Water	2015	Government Regulation No 121 concerning Water Resources
Public Health Law	2014 2014	Government Regulation No 66 concerning Environment Health Regulation of health Minister No 3 concern to Community-Based Total Sanitation

Prevention and Control of Communicable Diseases Law (1995) (Revised in 2011)	2011 2014	Presidential Decree No 30 Concern to Control the Zones The Ministry of Health Decree No 82 concern to Eradication of Infectious Diseases
Environmental Conservation and Cleaning Rules & Regulations, Balikpapan City Development Council		
City Cleaning	2004	Regional Regulation of Balikpapan City No 12 concern description of duties and functions of the department cleanliness, landscaping, and municipal cemetery Balikpapan
Sanitation	2016 2004	Balikpapan City Regulation No. 8 concerning Sanitation Management Regional Regulation of Balikpapan City No 10 concerning waste management
Waste Water	2004	Balikpapan City Regulation No. 7 concerning The Permit of Waste Water Disposal

Environmental Wastewater Effluent Quality Standards

Based on the updated regulation concerning the domestic waste water effluent standards, the WWTP Balikpapan City should comply with the requirements of the Ministry of Forestry and Environmental Regulation No P68 from the year 2016 as shown in the following table.

There are two regulations with different standards: from the Ministry of Forestry and Environment and from the Governor of East Kalimantan. The strictest parameters will be followed for designing the wastewater treatment facilities.

Table 10: Waste water effluent Quality Standards by Ministry and Governor

No	Regulation	Parameter	Standard Quality
1	Ministry of Forestry and Environmental Regulation No, P.68/Menlhk/Setjen/Kum.1/8/2016 concerning Domestic[2] Waste Water Effluent Standard	BOD	30(mg/L)
		COD	100 (mg/L)
		TSS	30(mg/L)
		Oil & Fat	5 (mg/L)
		Ammonia	10 (mg/L)
		Total Coliform	3,000 (total/100 ml
		Debit	100 (L/person/day)
		pH	6-9
2	Governor East Kalimantan	BOD	100 (mg/L)

[2] From houses, flats, hostels, dormitory, health services, institutions education, office, commercial, markets, restaurants, meeting halls , recreation arenas, residential, industrial, regional WWTP, settlement WWTP, urban WWTP, ports, airports, train stations, fire stations, terminals and jails.

	Regulation No. 02 year 2011 concerning Effluent Quality Management and Monitoring (Domestic Wastewater Effluent)	COD	150 (mg/L)
		TSS	100 (Mg/L)
		Oil & Fat	10 (mg/L)
		Ammonia (NH3-N)	10 (mg/L)
		E-Coli	10,000 MPN/100 ml
		pH	6-9

The permits for waste water effluent in Balikpapan City are stipulated by the Mayor of Balikpapan Regulation No. 7 year 2004 concerning Waste Water Effluent Permit, and Article (2,(2)) the Environmental Impact Assessment Study (*AMDAL/UKL-UPL/SPPL*) have to be provided by the Project owner.

3.4 Implementation of Wastewater Effluent Regulation

Reported by Balikpapan City Environmental Agency (BLHD), in 2015, total of 15 permits of Wastewater Effluent from the businesses in Balikpapan City have been issued. The implementation of waste water effluent regulation by business sector in Balikpapan City reported that properly implemented is 57%. Moreover, 7 riverbanks (upstream, midstream, and downstream) or 21 river sections have been closely monitored.

3.5 Possible Potential Impacts

The potential impacts listed refer only to those which may possibly occur if no preventive or corrective measure is implemented. This preliminary evaluation intends only to provide an early overview of the issues which may be further addressed and analyzed in the present EA or IEE.

The column dedicated to the risk introduces the main issues/events which may severely affect the appropriate operation of the facility or result in major threat for the environment.

Table 11: Potential Impacts - Wastewater Components

Potential Project Components	Potential Impacts	Corrective Measures	Risks
Individual treatment facilities (septic tanks)	Surface and underground water pollution if inappropriate design (capacity) and operation Contamination of superficial aquifer Pollution risk if inappropriate sludge management, and ground water contamination	Enforcement of typical design and capacities Appropriate management of services for tanks maintenance (manage by Balikpapan City Sludge management services in PDAM Balikpapan City) Appropriate management of pumped sludge (by PDAM Balikpapan City)	Ground Water contamination; Public health risk if superficial aquifer used for drinking water
Interceptors, sewers, connections	Land acquisition, resettlement, Construction: nuisances Reduced urban drainage water pollution	Avoid/Minimize(selection of appropriate route) Good construction practices	Inappropriate solid waste management (clogging of network)

	Improved health & quality of life Improved environmental quality		
WW Treatment Plant (Conventional type)	Construction: nuisances; Improved surface and underground water quality; Sludge production; Point source pollution at outlet of treated effluent	Minimize (selection of appropriate area) Good construction practices Sludge management or reuse Good design and location of discharge point	Industrial toxic pollution; Overflow if inoperative (pollution at discharge point)
WW Treatment Plant (Lagoon type)	Construction: nuisances, flora and fauna Improved surface and ground water quality; sedimentation	Minimize (selection of appropriate area) Good construction practices	Industrial toxic pollution
Pumping stations	Construction: nuisances; flora and fauna Operation noise, smells,	Minimize (selection of appropriate area) Good construction practices Confined design	Overflow if inoperative

The main negative impacts of sewers rehabilitation or extension results from construction activities.

Waste Water Treatment Plant (WWTP) will mainly involve land requirement, related land use changes and potential risks during operation: point source pollution at treated effluent outlet and risk of water/soil contamination by sludge if polluted by industrial effluents.

Regarding the proposed plan from Bappeda Balikpapan City, which the three locations proposed for WWTP Balikpapan City, the environmental safeguards have to consider as shown in the following table.

Table 12: Environmental Safeguards recommendations- Wastewater Treatment locations

No	Location WWTP	Administration	Existing Condition	Environmental Safeguards Recommendation	Remarks
1	Megasari	Balikpapan Barat	1) The waste water treatment plant operated since 2003, located closed to traditional market and housing, no air pollution (smell)is found and PDAM carried out the monitoring of waste water quality effluent, as well the anaerobic process is delivered the flash water for gardening, cleaning etc. 2) The HSE board signs are completed 3) No Complain from the Community	1) Periodic Monitoring Report of the existing WWTP operation 2) Environmental Management Plan and Environmental Monitoring Plan for the proposed improvement WWTP 3) Environmental Permit	Coordination with Local Environmental Agency/BPLHD Balikpapan City, Socialization of the proposed project activity

2	Somber	Balikpapan Utara	1) The proposed land is closed to the existing waste water plant of Tempe/Tofu Industry (Somber Industry are) 2) The land cover consist of wet land vegetation, dry land vegetation 3) The proposed land is closed with the settlement area	1) Environmental Impact Assessment (EIA/UKL-UPL) 2) Environmental Permit 3) Waste Water Effluent Permit 4) Socialization	Coordination with BPLHD Balikpapan City and Balikpapan City Spatial Plan, Socialization the propose project activity
3	Sepinggan	Balikpapan Selatan	**Alternative I**: 10,000 m^2 1) The proposed location is local government /*Pemda* Land and closed with the housing complex, and the existing access use the housing complex as well the drainage channel capacity is serve only for housing complex. 2) The housing complex drainage channel will not enough capacity to receive the effluent from the WWTP	Environmental Impact Assessment 1) Environmental Permit 2) Waste Water Effluent Permit 3) Socialization for the propose WWTP Plan	Coordination with BPLHD Balikpapan City and Balikpapan City Spatial Plan, Socialization the propose project activity
			Alternative II: 7,000 m^2 1) The proposed location is located in local government/*Pemda* land, and currently used for the public facility (soccer field), closed with School, and settlement. 2) The proposed location is close with the river 3) The local government has to find the substitute land to constructed as the substitute soccer field	1) Environmental Impact Assessment (EIA/UKL-UPL) 2) Environmental Permit Waste Water Effluent Permit 3) Socialization for the WWTP Plan	Coordination with BPLHD Balikpapan City and Balikpapan City Spatial Plan, Socialization the propose project activity
			Alternative III: Retention Pond 5,000 m^2 1) The proposed location is in the retention pond or as the flood control dam (*Bendali I),* closed with the settlement area. 2) The outlet of the *Bendali* I flood control is to the river without treatment, and on the dry season the condition of water flood in the dam is black water. And the air condition has foul smell. 3) Most of the Bendali I flood control dam function is for manage the overflow drainage from some traditional markets around the Bendali I, especially on the rainy season and on the tide water river. 4) The cause of the foul smell mostly caused by the presence volatile material, dissolved gases, a byproduct of the decomposition of organic material from microorganisms in the retention pond. So It is needs the waste water treatment integrated with the	1) Environmental Impact Assessment (EIA/UKL-UPL) 2) Environmental Permit 3) Waste Water Effluent Permit 4) Socialization for the WWTP plan	Coordination with BPLHD Balikpapan City and Balikpapan City Spatial Plan, Socialization the propose project activity

			flood control system in the retention pond/*Bendali I*		
			Alternative IV: SDLB/Jl. Perkutut , 4000 m^2 1) The proposed location is local government land, and located closed with the settlement. 2) Land were used by village office, and post office 3) Drainage channel are required	1) Environmental Impact Assessment (EIA/UKL-UPL) 2) Environmental Permit 3) Waste Water Effluent Permit 4) Socialization for the WWTP plan	Coordination with BPLHD Balikpapan City and Balikpapan City Spatial Plan, Socialization the propose project activity

Source: CDIA Team, 2017

The upgrade of the Margasari wastewater system and the implementation of the Wastewater treatment plants in Sepinggan and Somber will be based on the Government of Indonesia Regulation No.27, year 2012 concerning the Environmental Permit and Environmental Ministry Regulation No. 5 year 2015. They must comply with the environmental permit, EIA Study and the permit for waste water effluent.

The EIA Persuda WWTP plan document have been approved by Balikpapan City Mayor on 15 December 2011 through the Decree of Balikpapan City Mayor No. 024/Komdal/XII/2011, but regarding the Government of Indonesia Regulation No. 27 year 2012, concerning Environmental Permit, article 50 (2.e) the AMDAL document will expired when the project activity delayed for 3 (three) years, and Persuda WWTP construction is not starting yet up to no , so the AMDAL Persuda WWTP is require to update the AMDAL Document, and based on Ministry of Environmental and Forestry Regulation No. P.102/MENLHK/SETJEN/KUM.1/12 year 2016 concerning the Guidance of AMDAL Document for the Business and/or Activity which is has the Business permit and/or the Environmental Document is not Complied, Article 3(1d) is required DPLH (Environmental Management Document) document. The further coordination to Balikpapan City Environmental Agency on completing the DPLH document is needed carried out by the Persuda WWTP Project Owner.

The KA-ANDAL/EIA TOR document for these projects was approved by the Mayor of Balikpapan as the Head of the AMDAL Committee of Balikpapan City on 20 November, 2011 through the Decree of Balikpapan Mayor No. 021/Komdal/XI/2011. The ANDAL, RKL and RPL documents were approved on 15 December 2011 through the Decree of Balikpapan Mayor No. 024/Komdal/XII/2011. Regarding the Government of Indonesia Regulation No. 27 year 2012, concerning Environmental Permit, article 50 (2.e) the AMDAL document will expired when the project activity delayed for 3 (three) years, and Persuda WWTP construction is not starting yet up to no , so the AMDAL Persuda WWTP is require to update the AMDAL Document, and based on Ministry of Environmental and Forestry Regulation No. P.102/MENLHK/SETJEN/KUM.1/12 year 2016 concerning the Guidance of AMDAL Document for the Business and/or Activity which is has the Business permit and/or the Environmental Document is not Complied, Article 3(1d) is required DPLH (Environmental Management Document) document. The further coordination to Balikpapan City Environmental Agency on completing the DPLH document is mandatory carried out by the Persuda WWTP Project Owner.

3.6 Climate Change Issues in Indonesia

Indonesia signed the UNFCC Convention on 11/06/1992 and ratified the convention on 25/11/1994. The country also ratified the Kyoto Protocol in 2003.

Due to its location in SE Asia and the length of its coastline, Climate Change (CC) is certainly a major concern for Indonesia. On the basis of the latest Climate Risk Index (period 1993-2012)

ranking system, Indonesia is reported as one of the most threatened countries by climate change.

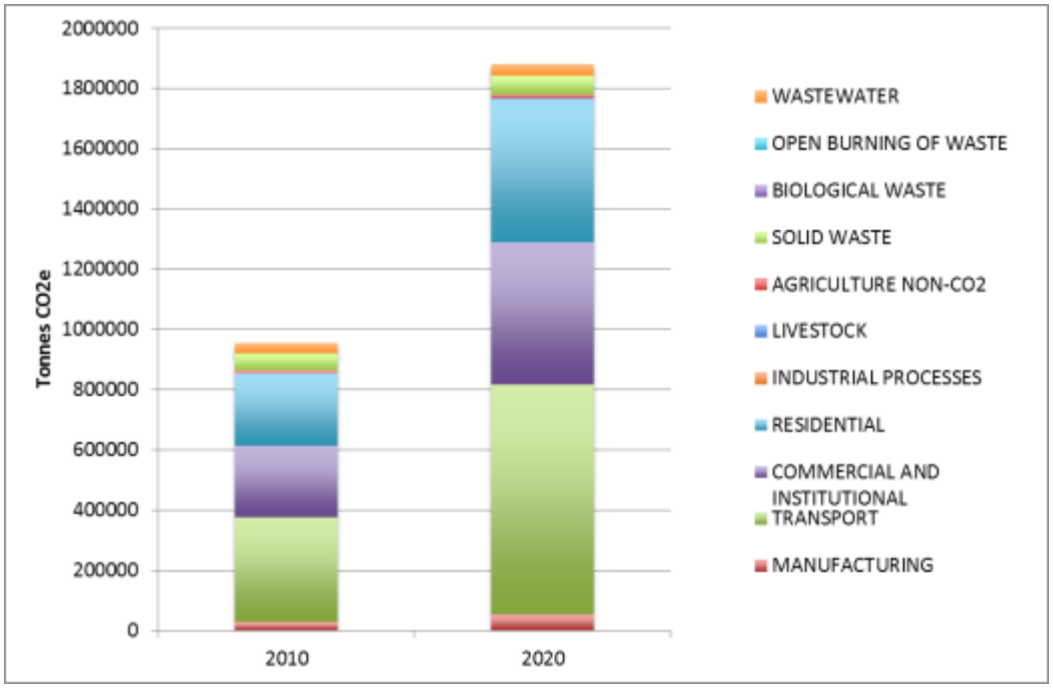
However, the country is observing progressive climate changes which threat particularly water resources and food security: Rise in temperature and change in rainfall distribution and quantity.

Available information on climate change forecasts in Indonesia for period 2001 to 2020 anticipates:

- Slight warming of +0.5°c from June to November (rainy season) is anticipated in the whole country. During the dry season, warming will be more significant (+ 0.7 to +1.2°c) over the country.
- Only 5% increase of precipitation is forecasted for the period March-November in the whole country. During the dry season, which contributes to only 5-10% to the annual rainfall, the deficit may reach 45%.

The 2015 Report on the Carbon Climate Registry (CCR) of Balikpapan City shows that Balikpapan City has the baseline scenario (BAU) for Green House Gases (GHG) reduction target for 15.6% by 2020. As reported by Balikpapan City-Urban LEDS 2014, the waste water accommodates 3.5 % on the GHG emission, see the figure of GHG emission in Balikpapan City below.

Figure 2: GHG emissions in Balikpapan 2014



Source: Initial Analysis GRK Kota Balikpapan ICLEI, 2014

The Environmental Impact Study will further elaborate with the climate change issues, as well on the ESMS (Environmental and Social Management System) and ESMP (Environmental and Social Management Plan) and GHG designs.

4 TECHNICAL

4.1 PFS Review

There are several issues of concern from the PFS 2014, of which most important issues are mentioned below, whereas other issues will be further addresses in detail in the subsequent paragraphs.

Some of the main concerns of the PFS 2014 are:

- The PFS 2014 did not take into consideration the other locations as mentioned in the Master Plan 2012 with the 10 locations for WWTP city-wide. Since the three WWTPs are part of the whole city-wide concept, this should have been included in the PFS including an overview of all the city's future sanitation projects and indicate the part of the PFS three WWTPs in particular. Then it had been clearly revealed how difficult it would be to introduce this Master Plan concept due to site location problems.
- The PFS calculated the number of persons/household at 5 persons. Based on the report from civil administration agency, it is much lower, namely 3 persons/household. This has a significant influence on the wastewater flow calculations, the capacity of the WWTP and the number of household connections;
- There were insufficient details about catchment areas, which are the first data required to design sewer systems and to locate the treatment facilities;
- The PFS noted that the site which was selected for the WWTP in Sepinggan does not appear to be suitably located because it is adjacent to a residential area; it would discharge into a very small watercourse and is not located at the lowest point in the catchment. However, the PFS did not propose alternative locations;
- No options were presented for different treatment technologies, only a treatment technology similar as the Margasari Plant for all. The argument that introducing new technologies will be too difficult is incorrect as today's young engineers/operators are eager to learn more; the other argument about spare parts is also incorrect, as spare parts of all well-known suppliers in the waste water industry can easily be ordered on-line and be on site in one day, no need to keep spare parts on the shelf. Besides this, in the Tender Documents most predictable spare parts for 2 years can be included to provide by the Contractor. Therefore new technology options should be investigated.
- The PFS uses minimum sewerage pipe diameter of 90 mm. This is much too small and will result in blockages and is also not common in Indonesia (or other parts of the world). Typically the minimum diameter is 150 mm or 200 mm for reticulation pipes.

Currently, the Municipality did not follow up any recommendation or proposal mentioned in the PFS 2014 due to, a/o changing of Staff in Departments, political changes, financial issues and other unidentified causes.

4.2 Present Situation in the City

Margasari Area: The only existing municipal domestic sanitation system in Balikpapan is situated in Margasari although the system is not functioning as originally planned. It comprises 1,512 house connections, 36 km of collection pipework, 10 pumping stations and an activated sludge treatment plant. The maximum capacity for the Margasari wastewater treatment plant is 5,000 house connections. An ongoing housing expansion in the area means that there are

approximately 500 new house connections that need to be connected and plans for managing this expansion formed an important element of the PFS.

Sepinggan Area: there is no sewerage system, all houses have on-site septic tanks and grey water is discharged directly in open drainage channels. A new waste water treatment plant and new house connections are planned in this area. The logical place for the wastewater treatment works would be close to where the flows come together to the south of the area. However, a suitable location has yet to be identified because there is also a rejection from the neighborhood due to their concerns on the smell from the treatment plant that could be disturbing.

Somber Area: there is no sewerage system, all houses have on-site septic tanks and grey water is discharged directly in open drainage channels. The Somber Industrial Estate, which is a self-contained community dedicated to small cottage industries, has a communal septic tank wastewater system. It is proposed to implement a new wastewater treatment plant at this site to deal with domestic wastewater. However, the proposed area for improved sanitation is much larger and outside of the Somber Industrial Estate; an option could be to locate the proposed wastewater treatment plant near the housing development, or to install some pumping stations. The terrain is complex and does not provide a centralized location to which all the flows can drain only by gravity.

Other areas of the city: this covers the majority of the population of Balikpapan and these parts of the city are covered with on-site septic tanks. These septic tanks should be emptied on a regular basis, once every 4 – 5 years. The sludge is collected by a vacuum tanker truck and transported to a Fecal Sludge Treatment facility.

The Fecal Sludge Treatment facility is located at Manggar, Kecamatan Balikpapan Timur. This facility was especially constructed to treat the sludge from septic tanks. The private vacuum truck who desludges the septic tanks from the houses delivers the sludge to the treatment facility.

The city of Balikpapan has one vacuum truck but it is not operational anymore.

There is another treatment plant in Manggar which is only used to treat the leachate from the solid waste landfill site.

4.3 Site Visit Information

On 20th December 2016 a site visit was executed to the 3 locations for waste water treatment plants. This visit was accompanied by representative of PT. SMI and BAPPEDA.

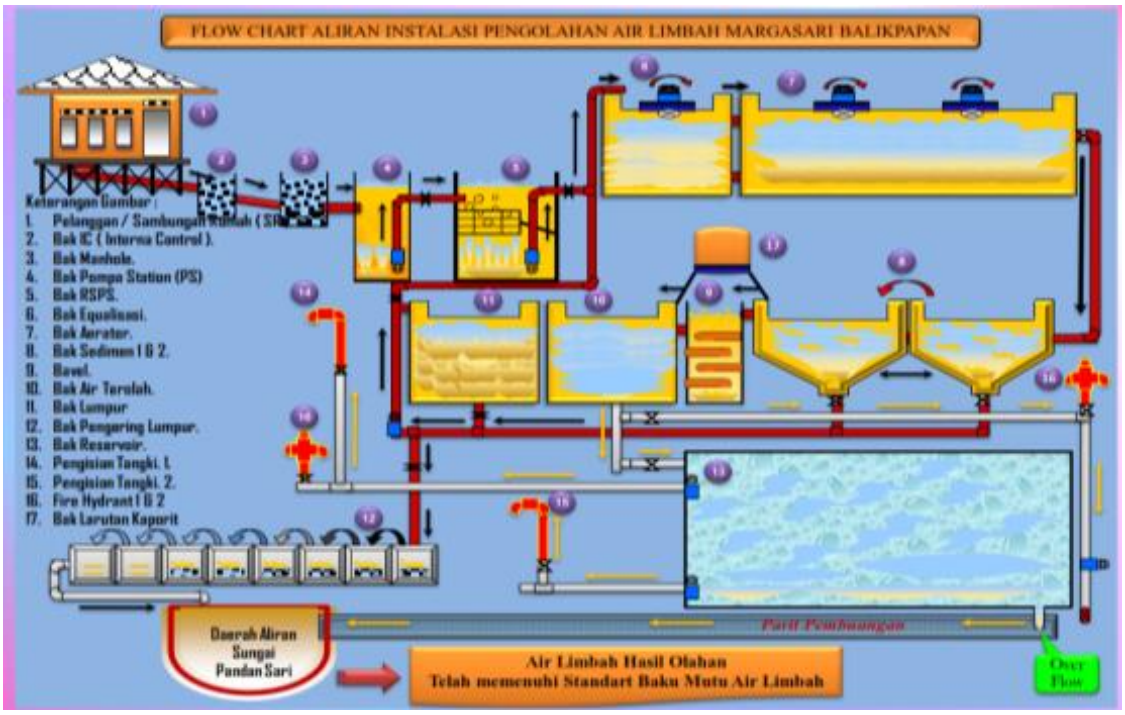
The purpose of the visit is to improve the understanding of the proposed service area which was mentioned in the previous Balikpapan Waste Water PFS. The proposed service areas are Sepinggan, Somber and Margasari.

Existing Margasari WWTP: The Margasari WWTP is located close to dense residential and commercial/market area. The Topography in the service area of Margasari is relatively flat.

The WWTP site area space is small, approximately 1,800 m2. (35m x 50m) The total workers at the WWTP are 12 persons: 4 operators and 8 cleaning labor.

The technology used is Extended Surface Aerators with return sludge. There are 3 aerators of which one is broken for a long time. The pump on the inlet chamber is manually operated by the operator based on the reference level of wastewater (i.e 3.25 m). When the level is higher than the reference level, then the inlet pump will be manually operated. This operation has to be improved as the system is not working efficiently and use unnecessary more electricity.

Figure 3: Margasari existing WWTP process flow chart



The operator explained that the existing waste water flow is only 30% from the design capacity. There is no more space on the site for expansion of the WWTP. The equalization tank is to make equal and similar waste water load. The compact sized waste water treatment plant is constructed with several concrete chambers. No automation system (e.g. SCADA) was found.

The treated waste water is further treated with liquid chlorine dosing; they use a chlorine tank and pump with manual operation. The effluent is conveyed to the underground reservoir and reused for cleaning the site, flushing and watering the gardens in the site and the city. The overflow is discharged to the river. The observable quality of the effluent has no odor and has low turbidity. The sludge is conveyed to drying beds; however this is a very small area. The water on adjacent river is of bad quality which indicates that still many houses are not connected to the sewer.

Figure 4: Margasari existing WWTP pictures

Only1 aerator was operated in aerator chamber	Bad quality of water of adjacent river

PDAM confirmed that many customers disconnect the grey water pipe and discharge directly to the sea or adjacent open drainage channel due to odor problems. Hence only black water was conveyed to the sewerage system.

The odor problem is due to the pumps are not operating continuously (or are not operational anymore), therefore the waste water is trapped in the manholes and sewer pipes. Principally the pumps needs to be operate automatically when the level in the pump station rises. When regular pumping occurs, the waste water in the sewer pipes will flow continuously and there will be no odor problem.
According to PDAM, the pumps are not automatically started, because the level control device in the pump stations was corroded due to the corrosive waste water (which due to influx in the sewerage system was also mixed with sea water).
It is emphasized that level controls should be made of corrosion resistant materials.

Sepinggan area: this includes four villages: Kelurahan of Sepinggan, Sepinggan Village, Gunung Bahagia and Gunung Samarinda. The topography is a hilly profile. According to the PFS 2014, it focuses initially on the areas within the catchment to avoid pumping costs. The pilot scheme for the 2,000 house connections focuses on the areas of Gunung Bahagia and Sepinggan. Based on field investigated the number of household is more than 2000 units.

The original “first” WWTP site - as indicated in the PFS 2014 in Kelurahan Sepinggan -, was visited. The land is empty without settlement and belongs to the Local Government. However, the Local Government plans to build a school at this site consequently this site for WWTP has to be abandoned. BAPPEDA explains that there is another site for the WWTP site downstream. The proposed location site is empty but there is one adjacent temporary house very close to the location (see following figures).

Figure 5: Sepinggan location pictures

The "new" WWTP site with adjacent temporary house in Sepinggan Service Area	Small channel/river for WWTP effluent discharge

The size of the proposed new WWTP site is approximately 1 hectare (based on the layout of housing site plan). The site is adjacent to a small river/channel for the effluent discharge. The capacity of channel seems too small for receiving the WWTP effluent in the future and will need further investigation.

Somber Service Area: This area under the Somber scheme includes the villages of Batu Ampar, Muara Rapak, Graha Indah, Baru Ulu, Baru Tengah, KarangJoang, Margomulyo, BaruIlir and KarangJati. The Somber area comprises several catchment areas.

The KIKS (Kawasan Industri Kecil Somber/Somber small industrial area) has a communal small industrial waste water treatment facility which is located at the lowest area in KIKS area. It was smelly and seems that the treatment is not working properly. The proposed WWTP site is next to this existing industrial waste water treatment facility. This site seems feasible since the land belongs to the government and is located at the lowest area. The effluent discharge would be on the adjacent watercourse downstream of the site. Since the industrial wastewater comprises mainly of organic waste it could be possible to be treated on the proposed new WWTP (however this has to be confirmed). The topography on the KIKS site is very hilly and it seems possible to flow the wastewater by gravity.

Figure 6: Somber location pictures

The existing small industrial WWTP site at Somber Small Industrial Area. The planned original WWTP site is next to this treatment plant.	The Small industry of Tofu and Tempeh.

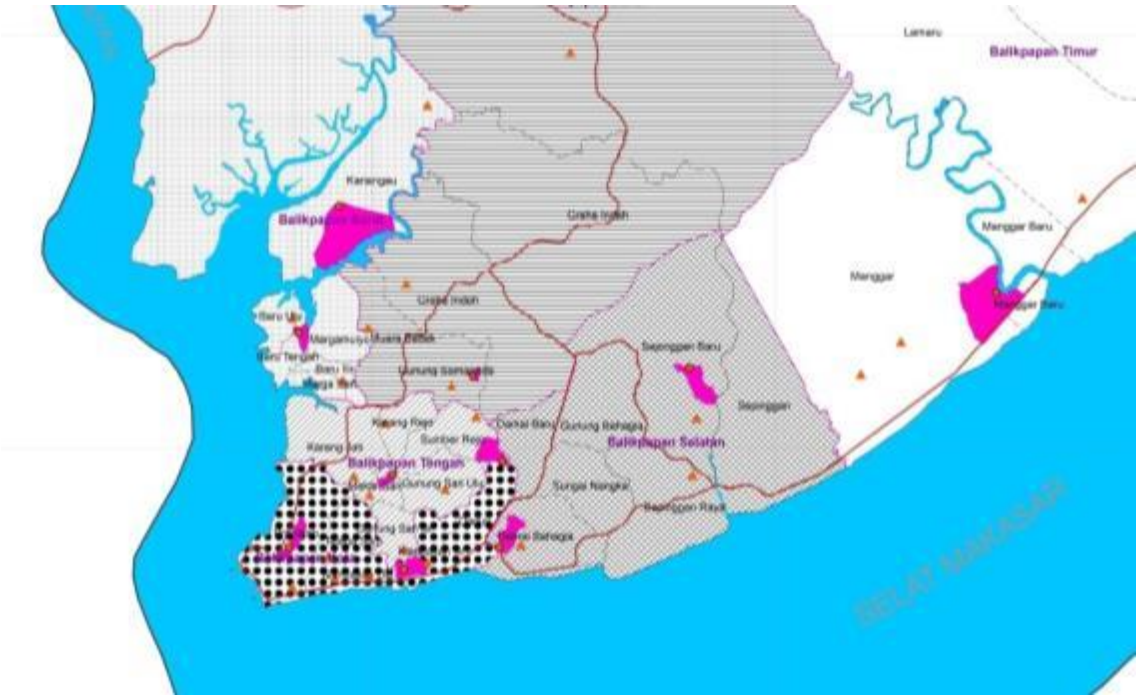
4.4 Sanitation Master Plan 2012

According to Balikpapan's 2012 Sanitation Master Plan, WW treatment plants are proposed to be built at 10 (ten) locations: 1) Manggar, 2) Karianggau, 3) Sepinggan/Sepinggan, 4) Klandasan, 5)Prapatan, 6) Mekar Sari, 7) Sumber Rejo, 8) Damai Bahagia, 9) Gunung Samarinda and 10)Baru Ulu.

Meanwhile, the PFS 2014 proposed that new WW treatment plants should to be built only in Sepinggan and at a new location in Somber. Somber is not mentioned in Balikpapan's 2012 Sanitation Master Plan, but was selected in the PFS due to the easiness for implementation (especially the land acquisition of planned WWTP which belongs to the Local Government).

The Master Plan 10 locations are indicated in the map below.

Figure 7: Master Plan 2012 proposed WWTP locations



In the PFS 2014 these 10 locations are not mentioned in relation to the 3 new proposed locations. In this Final Revised PFS 2014 Report, the locations indicated in the Master Plan 2012 are not further investigated because an update of this Master Plan is required with more emphasis on accurate locations for WWTPs.

4.5 Catchment Areas

A Catchment area is an extent or an area of land where all surface water from rain, converges to a single point at a lower elevation, usually the exit of the basin, where the waters join another body of water, such as a river, lake, reservoir, estuary, wetland, sea, or ocean. Thus if a tributary stream joins a brook that in turn joins a small river which is a tributary of a larger river, there is a series of successively larger (and lower elevation) drainage basins.

The catchment areas and the flow direction of the Balikpapan city are shown on the following picture. Principally, the sewerage system flow has to follow the natural flow direction to avoiding the use of pumps and deep trench excavation. There is a close relation of the natural flow and the sewerage system flow. The best location of the WWTP is anticipated to be at the lowest area of the catchment. Pumping stations will only be used when waste water has to be transferred to another catchment area with a WWTP.

Figure 8: Catchment Areas in Balikpapan

In relation to the Master Plan locations of 10 wastewater treatment plants, the catchment areas should have been into account.

4.6 National Wastewater Sector Strategy

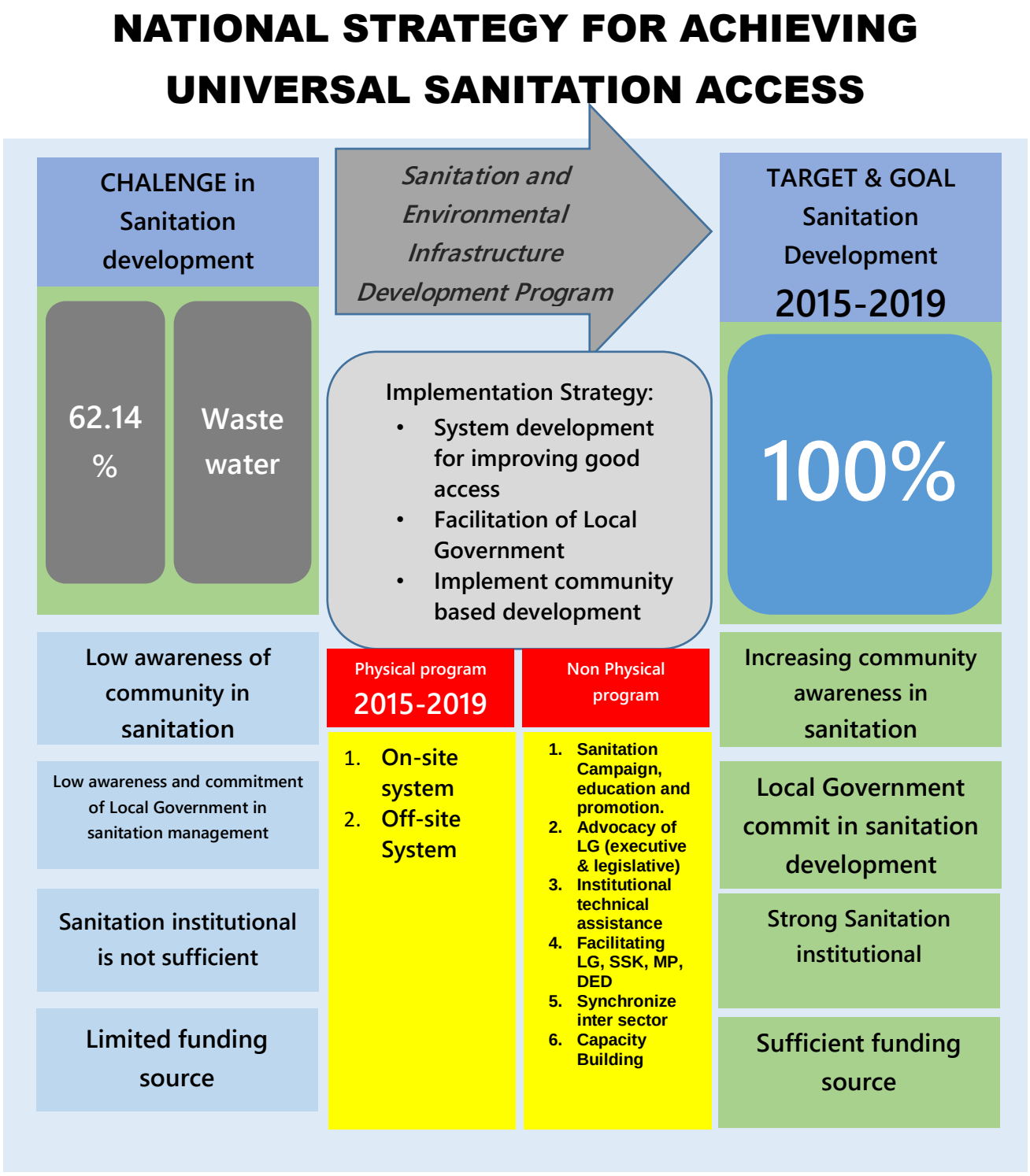
The National Wastewater Strategy for achieving 100% Universal Access of Sanitation is developing the combination of Off-site systems (city scale, neighborhood scale, communal scale) and On-site systems (with regular desludging / septage management).

Since the Off-site sewerage system is expensive to implement and problematic in planning in the short term, it is recommended to start in the beginning with mainly On-site system (with regular desludging / septage management).

However, it should be noted that On-site systems potentially will pollute the groundwater; therefore in the future On-site systems should be eliminated or reduced while simultaneously increasing of Off-site systems with sewers and wastewater treatment plants.

The following figure shows the National Strategy for achieving universal sanitation access.

Figure 9: National Strategy for Wastewater in Indonesia



As the follow up and implementation of the national strategy, the waste water infrastructure development program for the years 2015-2019 is presented in the table below.

Table 13: National Strategy Wastewater infrastructure Development Program

Program	Output	Target 2015-2019	Potential Outcome	Potential Access improvement
City scale centralized waste water infrastructure development	City/Regional sewerage	12 Cities/Kabupaten	650,000 persons	0.26%
Neighbourhood scale centralized waste water infrastructure development	Neighbourhood Sewerage	150 cities/kabupaten	807,500 persons	0.32%
Communal scale centralized waste water infrastructure development	Communal Sewerage	438 cities/kabupaten	1,870,000 persons	0.74%
On-site waste water infrastructure development	Septage Treatment Plant	222 cities/kabupaten		
Founding and Supervision	Non-Physical activities	507 cities/kabupaten	95,950,000 persons	37.63%

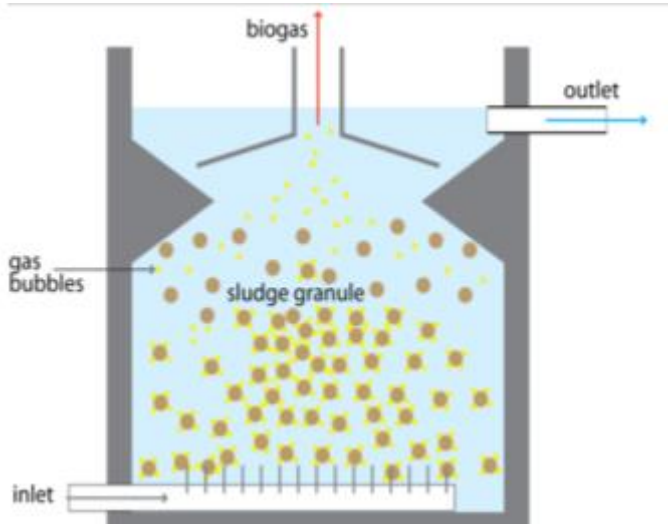
4.7 Wastewater Treatment Options

This paragraph will show the different technologies for wastewater treatment, especially because several of these technologies are already in use in Indonesia. The following presents several possible options for Balikpapan city with their advantages and disadvantages. It is important to know the specific elements of all these technologies, to make a shortlist of options related e.g. to the site location (esp. land availability).

Overview of Wastewater Treatment technologies possible for Balikpapan City:

1. **Upflow Anaerobic Sludge Blanket reactor (UASB)** is a single tank process. Wastewater enters the reactor from the bottom, and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it.

Figure 10: UASB

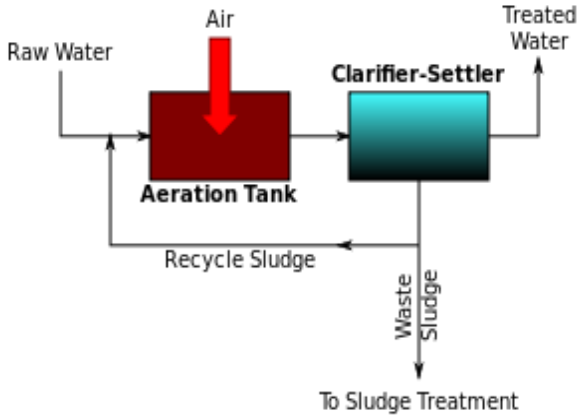


The following advantages and disadvantages are summarized of the UASB Reactor:

Advantages	Disadvantages
High reduction in organics	Difficult to maintain proper hydraulic conditions (upflow and settling rate must be balanced).
Can withstand high organic loading rates (up to 10kg BOD/m3/d) and high hydraulic loading rates	Long start up time.
Low production sludge (and thus, no frequent desludging required).	Treatment may be unstable with variable hydraulic and organic loads.
Biogas can be used for energy (usually requires scrubbing first).	Constant source of electricity is required.
	Not all parts and materials may be available locally
	Requires expert design and trained staff

2. **Activated Sludge** process (with RAS / Return Activated Sludge) is a process for treating sewage and industrial wastewaters using air and a biological floc composed of bacteria and protozoa.

Figure 11: Activated Sludge with RAS

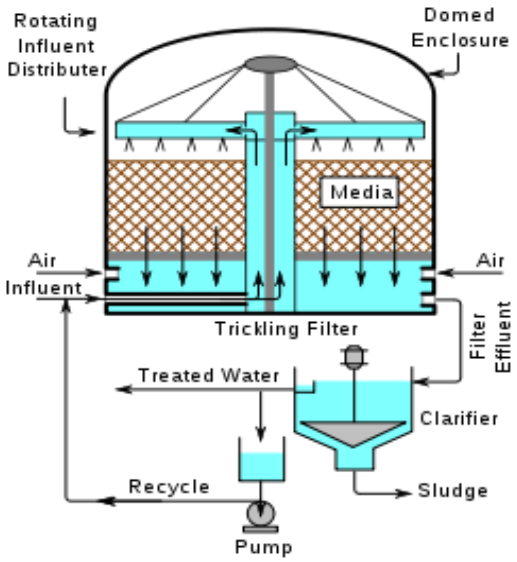


This is roughly the process as used in the Margasari Wastewater treatment Plant but they use a basic treatment which should be upgraded to a standard process. The following table presents the advantages and disadvantages of the Activated Sludge system with RAS.

Advantages	Disadvantages
Resistant to organic and hydraulic shock loads	energy consumption high, constant source of electricity is required
Can be operated at a range of organic and hydraulic loading rates	Capital investment cost high
High reduction of BOD and pathogens (up to 99%) after secondary treatment	Requires operation and maintenance by skilled personnel
High nutrient removal possible	Prone to complicated chemical and microbiological problems
High effluent quality	Not suitable for application on small community level
Little land required compared to extensive natural system (e.g. waste stabilization ponds)	Requires expert design and construction
Can be modified to meet specific discharge limits	Sludge requires further treatment and/or appropriate discharge
Biogas option possible	

3. **Trickling filter** is a type of wastewater treatment system consists of a fixed bed of rocks, lava, coke, gravel, slag, polyurethane foam, sphagnum peat moss, ceramic, or plastic media over which sewage or other wastewater flows downward and causes a layer of microbial slime (biofilm) to grow, covering the bed of media. Aerobic conditions are maintained by splashing, diffusion, and either by forced-air flowing through the bed or natural convection of air if the filter medium is porous.

Figure 12: Trickling Filter



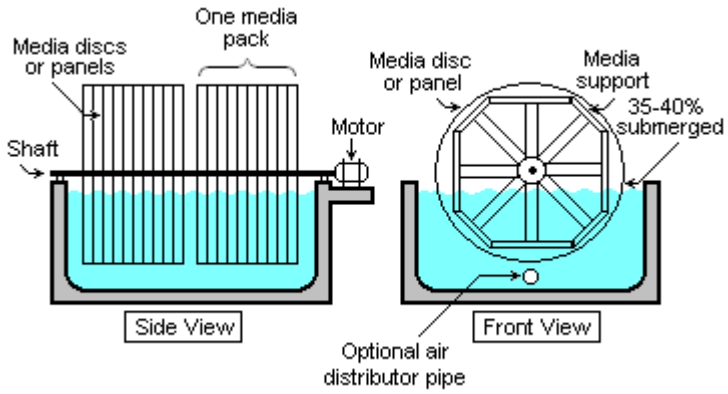
The following table presents the advantages and disadvantages of the Trickling Filter system

Advantages	Disadvantages
Can be operated at a range of organic and hydraulic loading rates	High capital cost
Resistant to shock loadings	Requires expert design and construction, particularly, the dosing system
Efficient nitrification (ammonium oxidation)	Requires operation and maintenance by skilled personnel
High effluent quality in terms of BOD and suspended solids removal; in combination with a primary and tertiary treatment also in terms of pathogen	Requires a constant source of electricity and constant wastewater flow
Small land area required compared to constructed wetlands	Flies and odors are often problematic
	Pre-treatment and treatment of excess sludge required
	Risk of clogging, depending on pre- and primary treatment

4. **Rotating Biological Contactor** (**RBC)** is a biological treatment process used in the treatment of wastewater following primary treatment. The primary treatment process removes the grit and other solids through a screening process followed by a period of settlement. The RBC process involves allowing the wastewater to come in contact with a biological medium in order to remove pollutants in the wastewater before discharge of the treated wastewater to the environment. A rotating biological contactor is a type of secondary treatment process. It consists of a series of closely spaced, parallel discs mounted on a

rotating shaft which is supported just above the surface of the waste water. Microorganisms grow on the surface of the discs where biological degradation of the wastewater pollutants takes place.

Figure 13: RBC

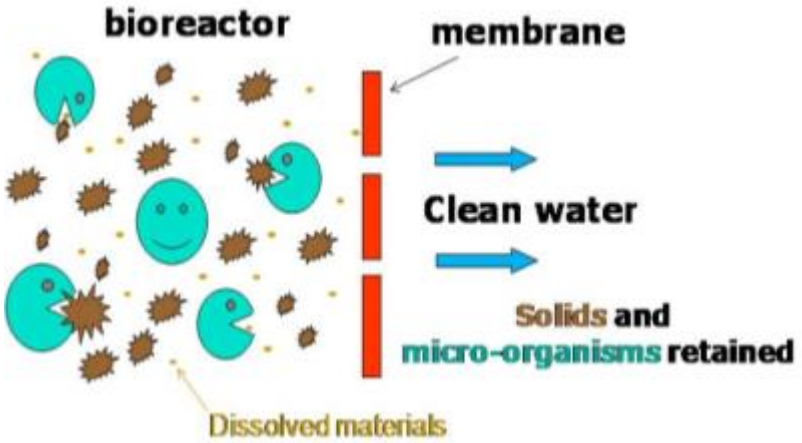


The following table presents the advantages and disadvantages of RBC system

Advantages	Disadvantages
High contact time and high effluent quality (both BOD and nutrients)	Continuous electricity supply required (but uses less energy than trickling filters or activated sludge processes for comparable degradation rates)
High process stability, resistant to shock hydraulic or organic loading	Contact media not available at local market
Short contact periods are required because of the large active surface	High investment as well as operation and maintenance costs
Little space requirement	Must be protected against sunlight, wind and rain
Well drainable excess sludge collected in clarifier	Odour problems may occur
Process is relatively silent compared to dosing pumps for aeration	Requires permanent skilled technical labour for operation and maintenance
No risk of channeling	
Low sludge production	

5. **Membrane bioreactor** (**MBR**) is the combination of a membrane process like microfiltration or ultrafiltration with a suspended growth bioreactor, and is now widely used for municipal and industrial wastewater treatment with plant sizes up to 80,000 population equivalent.

Figure 14: MBR

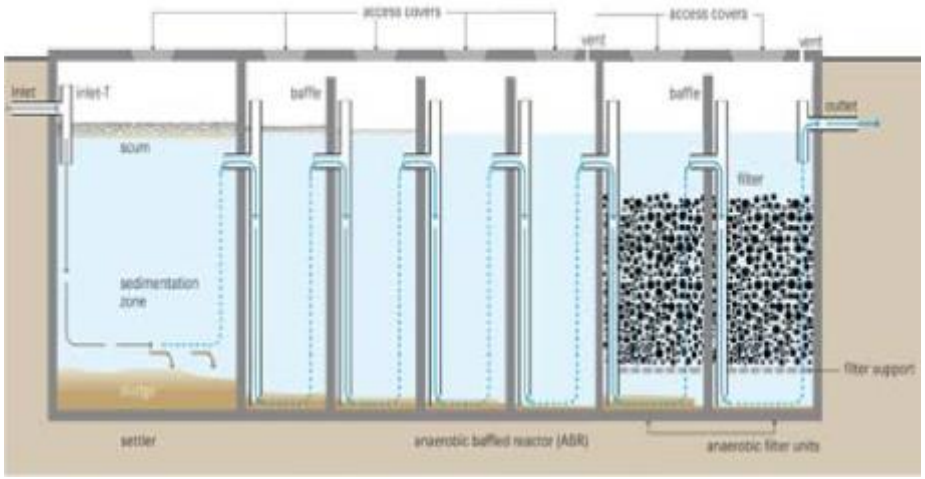


The following table presents the advantages and disadvantages of the MBR system

Advantages	Disadvantages
Secondary clarifiers and tertiary filtration processes are eliminated, thereby reducing plant footprint. Little land area required.	High operation and capital costs (membranes)
Can be designed to prolong sludge age, hence lower sludge production	Membrane complexity and fouling, they must be imported
High loading rate capability	High Energy costs
	Highly skilled operators required

6. **Anaerobic Baffled Reactor** (ABR) is an improved Septic Tank with a series of baffles under which the wastewater is forced to flow.

Figure 15: ABR

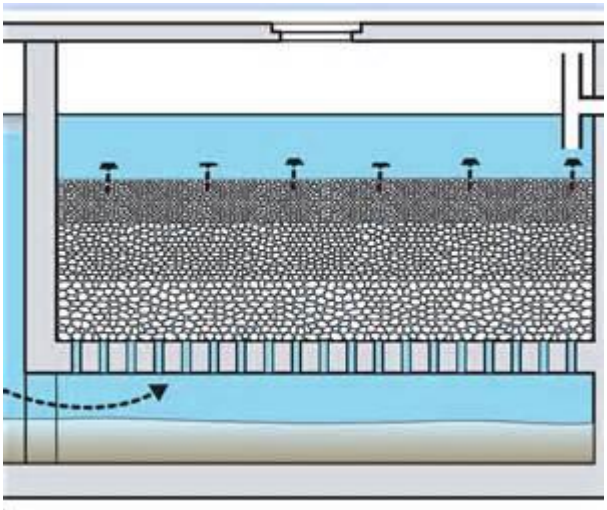


The ABR system is not suitable for large size population coverage. Mostly used on decentralized local locations, e.g. small housing complex or apartment blocks. The following table presents the advantages and disadvantages of the ABR system.

Advantages	Disadvantages
Resistant to organic and hydraulic shock loads	Long start-up phase
No electrical energy is required	Requires expert design and construction
Low operating costs	Low reduction of pathogens and nutrients
Long service life	Effluent and sludge require further treatment and/or appropriate discharge
High reduction of BOD	Needs strategy for faecal sludge management (effluent quality rapidly deteriorates if sludge is not removed regularly)
Low sludge production; the sludge is stabilized	Needs water to flush
Moderate area requirement (can be built underground)	Not suitable to treat large quantities of waste water, only small volumes.
Simple to operate	

7. **Anaerobic filter** is a fixed-bed biological *reactor* with one or more filtration chambers in series. As wastewater flows through the filter, particles are trapped and organic matter degraded by the active biomass that is attached to the surface of the filter material. Anaerobic filters are widely used as secondary treatment in household black- or grey water systems and improve the solid removal compared to septic tanks or anaerobic baffled reactors.

Figure 16: Anaerobic Filter



The Anaerobic Filter system is not suitable for large size population coverage. Mostly used on decentralized local locations, e.g. small housing complex or apartment blocks. The following table presents the advantages and disadvantages of the Anaerobic Filter system.

Advantages	Disadvantages
Resistant to organic and hydraulic shock loadings	Low reduction of pathogens and nutrients
No electrical energy is required	Effluent and sludge require further treatment and/or appropriate discharge
Low operating costs	Only suitable for low-density housing in areas with low water table and not prone to flooding
Long service life	Long start-up time
High reduction of BOD and solids	Risk of clogging, depending on pre- and primary treatment
Low sludge production; the sludge is stabilized	Removing and cleaning the clogged filter media is difficult
Low reduction of nutrients, thus outflow adapted for reuse in agriculture	
Moderate area requirement (can be built underground)	

8. **Stabilization ponds** (also called **lagoons**) use a natural process for wastewater treatment that employs a combination of macrophytic plants, substrates and microorganisms in a more or less artificial pond to treat wastewater. The technique is frequently used to treat municipal wastewater, industrial effluent, municipal run-off or storm water. After treatment, the effluent may be returned to surface water or reused as irrigation water (or reclaimed water) if the effluent quality is high enough. Large area of land will be required.

Figure 17: Stabilization Ponds /Lagoons

The following table presents the advantages and disadvantages of the Stabilization Ponds.

Advantages	Disadvantages
Resistant to organic and hydraulic shock loadings	Requires large land area
High reduction of solids, BOD and pathogens	Investment capital cost very low, however depends on the price of land
High nutrient removal if combined with aquaculture	De-sludging (normally every 5 -10 years)
Very Low Operating and Maintenance cost	Mosquito control required
No electrical energy required	
Simple operation & maintenance, less operators required.	
No problems with flies or odors if designed and maintained correctly	
Can be built and repaired with locally available materials	
Effluent can be reused in aquaculture or for irrigation in agriculture	

Analysis of the proposed treatment techniques according to following parameters:

- Area: small is positive 5 points; large is negative 1 point
- Technical: in case simple technique 5 points, very specific is 1 point
- Operational aspects: simple operation 5 points, difficult 1 point
- Staff required: less staff is 5 points, more staff is 1 point
- Environmental: minimal problems 5 points, many problems 1 point
  - (possible smell, related to land, surroundings)
- Price: low investment 5 points, high investment 1 point
- Total score: the highest score is the best option.

The table below presents the total score. It is noted that this analysis **main purpose** is to eliminate certain techniques pre-emptive and to emanate with 2 or 3 alternatives for each location in the Balikpapan Sanitation project.

Table 14: Analyses Total Score of Techniques for Wastewater Treatment

Technique	area	technic	operation	staff	environ	Price	Total score
1 UASB	3	2	4	3	3	3	18
2 RAS	2	4	4	4	3	3	19
3 Trickling filter	3	2	3	3	4	2	17
4 RBC	3	2	3	3	3	2	16

5 MBR	3	1	3	3	5	1	16
6 ABR *	4	4	4	4	2	4	22
7 Anaerob filters*	4	4	4	4	2	4	22
8 Stab. Ponds	1	5	5	5	4	1-3**	20 -23**

Notes: * ABR and Anaerobic Filters can only be used for small volumes, not applicable for Balikpapan Project, however possible for other parts of the city;

** Stabilization Ponds (Lagoons) depend highly on price of the land purchase.

Conclusion:

1) Although the ABR (6) and Anaerobic Filter (7) Systems have the highest scores, they are not suitable for the 3 project locations Margasari, Sepinggan and Somber due to the volume of Wastewater to be treated. However they are well suitable for small housing complexes or apartment blocks.
2) Stabilization Ponds / Lagoons (8), they are very effective and very economical in operation and maintenance cost, but they require a large area of land which is not available at the three project locations.
3) The Trickling Filter (3), the RBC (4) and MBR (5), these are low ranked mainly because the investment costs, required high skilled personnel and their sophisticated techniques. However, a simple Trickling filter is very efficient to use as Post-Treatment system, which is simpler to operate and with no clogging risks.
4) The best options to proceed in the Balikpapan Sanitation project case are option UASB (1) and option Activated Sludge with RAS (2). These two options will be further detailed for each of the 3 locations.

4.8 Climate Change Designs

Climate change is inevitable, and therefore engineering designs should consider energy efficient designs, re-use of materials and discharges/emissions (water, gas, electricity-power); this to reduce the GHG emissions. Resilience is the capacity to adapt to changing conditions. In relation with climate change, resilience involves adaptation to the wide range of regional and localized impacts that are expected with a warming planet: e.g. more intense storms, greater precipitation, flooding, longer and more severe droughts in some areas, warmer temperatures, higher sea level, etc.

Some objectives of Climate Resilient Designs in relation with waste water are:

1. Taking into account more heavy rainfall in shorter time span; this requires e.g. calculation of additional pump capacity;
2. Taking into account flooding: more discharge flow of drainage water is required;
3. During long dry periods with low flow rates in the sewerage system, stagnant wastewater may damage the concrete and also cause foul odors; measure could be correct velocity calculations and sewerage gradient designs, and/or including flushing options of the system

On the other site, efficient use of electricity helps reducing GHG emissions, e.g.:

a. using solar panels for source of electricity for pumps and other electrical and mechanical devices in waste water treatment plants;

b. using of biogas which was produced in the treatment process and convert to generate electricity;

c. using of automation systems for reducing the electricity consumption;

d. composting the sludge for re-use;

e. Re-use the WWTP effluent for gardening, flushing and firefighting.

4.9 Design Parameters

The technical calculations all comply to the Draft of Ministry of Public Works, Annex 2 regarding Technical Guidance for Wastewater system development.

Sewer Mains design must take into account a population growth with a 25-years projection time. In this design stage, it was designed up to year 2041.

The Design flow is calculated with a peak hourly flow and peak infiltration allowance for the entire service area. The Peak flows must always be utilized for the design of gravity sewers.

The following components are used for calculation the design flows.

Average Dry Weather Flow (ADWF) - includes average daily sewage flows from domestic and commercial/industrial activities and groundwater infiltration GWI. ADWF is the basis for calculation of PDWF. Normally it is expressed in m3/day or l/s.

The daily average dry weather flow to be conveyed by the sewage system is therefore:

ADWF = ADWFdom + ADWFcom/ind + GWI

ADWFdom is the waste water coming from domestic area and ADWFcom/ind is the waste water coming from commercial and industrial area.

The GWI depends on the level of groundwater level table. For Balikpapan, it is estimated 10% x ADWF (refers to Draft of Regulation Ministry of Public Works).

PDWF) - The peak dry weather flow is a measure of the daily peaks that occur (i.e. early morning hours or evening hours when people are bathing or cooking), and the groundwater infiltration / inflow (GWI). This is indicated in diurnal flow; fluctuation of flows over a 24 hour period.

The PDWF is normally determined by multiplying the Average Dry Weather Flow by the peak factor. The peak factor is generally higher for smaller populations as variations in flow are more noticeable. This can be calculated by Babbit formula as expressed below:

Peak Factor = 5/(P/1000)^0.2

P is number of population

The daily maximum domestic wastewater flow, occurring typically in the morning or domestic Peak Dry Weather Flow (PDWFdom) is calculated:

PDWF = Peak Factor x ADWF.

Minimum Velocity and Slope - A minimum velocity enables the sewage flow to self-cleanse the nominal amount of silt carried through the sewers, and helps to minimize sewer blockage as

a result of siltation and grease accumulation. The self-cleansing can also relieve the problems of septicity due to siltation.

Self-cleansing for small diameter sewers of diameter less than 300mm can generally be achieved by ensuring either that a velocity of at least 0.7m/s occurred daily. Strict requirements for bedding and accurate laying of the pipes are essential to achieve self-cleaning conditions in Sewers with low gradient.

The usual practice is to design the slope for sanitary sewers to ensure a minimum velocity of 0.6 m/s with flow at one half - full or full depth. Allowable minimum sewer line slope grades, number of connection and population served are presented follows:

Table 15: Diameter, grades and capacity of sewer pipes designing

Dia (mm)	Self cleansing minimum grade	Nr. of Connections served	Nr. of Population Served
150	0.005	500	1,500
200	0.004	1,200	3,600
250	0.0032	2,200	6,600
300	0.0024	3,300	9,900
350	0.0019	4,500	13,500
400	0.0016	6,500	19,500
500	0.0012	11,000	33,000
600	0.001	19,000	57,000
700	0.0009	30,000	90,000
800	0.0008	43,000	129,000
900	0.0008	65,000	195,000
1000	0.0008	85,000	255,000

Where a system is to be developed in phases, considerations should be given to the likely lower flow than design flow, which may happen at the initial stage of commissioning. The minimum velocity shall be determined to avoid the septic and odor problems. Computations for velocity of flows will be based on the Manning formula for velocity (v) of flow.

The Manning Formula for velocity flow:

$$v = R^{2/3} S^{1/2}/n$$

R = hydraulic Radius in m (R=a/P is area of water flowing in sewer divided by wetted perimeter)

S =Slope (is fall h / length, m/m)

n = Manning's Roughness Coefficient

Maximum Velocity- The maximum velocity at peak flow shall be limited to 3 m/s but this can be relaxed to 6 m/s in special cases, e.g. rising pressure mains. In general, maximum mean velocities of 2.5 to 3.3 m/s at the design depth of flow will not damage the sewer.

Pumping station - Wastewater Pump Stations are facilities designed to move (lift) wastewater from lower to higher elevation, particularly where the elevation of the source is not sufficient for gravity flow and/or when the use of gravity conveyance will result in excessive excavation depths and high sewer construction costs.

4.10 Proposed Options

4.10.1 Margasari

Presently, the number of connection covers 1,512 units and another 500 extra connections are under construction through sAIIG (Ausaid) program. By reading the flow meter record, it is calculated that the WWTP Margasari is receiving approximately 216 m3/d leaving an idle capacity of 584m3/d (= 70% from design capacity of 800m3/day). The amount of flow being received is substantially less than expected from the 1,512 house connections.

Reasons for the significant difference are:

1. There are less than five people per household – the household survey suggests this may be nearer to three. Based on the data from civil administration agency is estimated 3 person per household, therefore the calculated flow rate should be 544 m3/d.
2. PDAM confirmed that some customers disconnect the grey water pipe and discharge to adjacent drainage canals due to odor problem. Hence only black water is conveyed to the sewer pipes.
3. The high chloride content of the influent wastewater indicates infiltration of 'brackish' groundwater, so it is expect that there are many leakages in the sewerage system. Leakages have to be repaired; firstly to avoid infiltration (which cause higher influx flows) and secondly to avoid exfiltration which will cause groundwater contamination. Further investigation is required to confirm and calculate the flow-rate of leakage.

The service area of Margasai is presented in the figure below.

Figure 18: Service Area of Margasari WWTP

The present Wastewater flow in Margasari is calculated and presented in the table below.

Table 16: Present Wastewater flow rate analysis Margasari WWTP (2017)

Parameter	Unit	Value
Number of existing Connections	unit	1,512
person/household		3
waste water flow rate	lpcd	120
Flow rate per connection (with 3 persons)	m3/day	0.36
Estimated percentage of black water in waste water		30%
Estimated percentage connections with black water pipe only		85%
Number of Connection with black and grey water pipes		227
Number of Connection with black water pipe only		1,285
Flow rate of black water per connection (3 x120 L. x30%)	m3/day	0.108
Total Flow rate of black water only (1,285 x 0.108)	m3/day	139
Total Flow rate of black water and grey water (227 conn x 3 pers x 120 L)/1000	m3/day	81
Estimated outflow (leakage) in sewer system (no infiltration at	m3/day	- 4

present because the pumps are not working)		
Total Flow rate received at Margasari WWTP (black water 139 m3 +black/grey water 81 m3 minus outflow 4 m3)	m3/day	216
Idle capacity wastewater treatment plant today (800 – 216)	m3/day	584

The grey water pipes should be repaired and reconnected to the sewerage system. It is unacceptable that grey water still pollutes the environment and will cause health problems (esp. for children playing in drainage channels), while there is a sewerage pipe system in front of their houses.

Therefore, it is essential to repair and reconnect all the grey water pipes.

Once the grey water pipes are reconnected, the waste water flow rate increases and the idle capacity of the wwtp will be **256 m3/day**. This means the potential for additional connections of 710 HH, of which 500 HH will be connected through the sAIIG/AusAid program and the remaining 210 households will be connected in this project as presented on the following table.

Table 17: Additional household connections incl. grey water flow Margasari WWTP

Parameter	Unit	Value
Number of existing Connections	unit	1,512
Nr. of person/household		3
Waste water flow rate (80% of water supply)	lpcd	120
Flow rate per household connection (3 persons)	m3/d	0.36
Total flow rate per day if all houses are connect to sewers (1,512 hh)	m3/d	544
Idle capacity once all grey water connections are repaired (800 – 544)	m3/d	**256**
Additional nr. of household served (optimizing the idle capacity) (256 m3 /0.36 m3 = 710 HH)	HH	710
a) Household connections from sAIIG/AusAid program installed	HH	500
b) Number of additional households to be connected in 2018	**HH**	**210**

The existing Margasari WWTP site area is approx. 1,800 m2. On the site several existing sludge drying beds are constructed, however the size of these sludge drying beds is much too small and there is no more space available for further expansion.

Proposed Improvements for wastewater treatment plant:

Some processes have to be upgraded in WWTP Margasari. The following should be replaced, removed or implemented:

- Using air blowers with nozzle pipes at the bottom of the aeration tanks is more effective to distribute and mixing the air with the wastewater rather than the use of surface aerators on the water surface. This will need a blower pump with total of capacity 22 kW (ref. from previous PFS, needs to be validated in DED).

- The function of the equalization tank seems not effective because the domestic wastewater characteristic is fairly homogeneous. An option could be to optimize this tank as an additional aeration tank.
- The inlet pumping station currently has a single pump with a capacity of 20 l/s. The estimated peak flow when the design flow is realized requires a pump capacity calculated of 32.6 l/s. A new pump and a stand-by pump will be installed including level control and spare capacity.
- Process monitoring equipment including dissolved oxygen and mixed liquor suspended solids monitors are required to better control the treatment processes.
- Installation of water flow meters / working hour meters at all the pumps and a water meter on the effluent discharge pipe.

Furthermore it is recommended to replace pumps in all the pumping stations and to install new duty and standby pumps in the three pumping stations which have no pumps at all. The replacement should include the provision of automated control devices of the pumps by appropriate level sensors (adapted to wastewater contamination components and protection from corrosion due to sea water intrusion in the system) and metering on the discharge. Some pumps may still be operational; however they need to be refurbished and included of a stand-by pump.

From the PFS 2014's socio-economic survey it is mentioned that 13% of the respondents stated that they continued to discharge wastewater to the sea because the wastewater network was blocked or broken. The blockage was probably caused by rubbish which is disposed by customers into the sewer.

It is understood that the existing sewer pipe diameter is too small. Based on the data from PDAM, the sewer pipe diameter is at present 90 mm (68% of total) and 100 mm diameter (20%), see table below.

Table 18: Existing diameter sewer pipes in Margasai service area

Pipe Dia (mm)	Length (m)	% of Total
250	323	0.9
200	587	1.6
150	3,483	9.6
100	7,221	20
90	24,696	68
Total	**36,310**	**100**

The sewer network has to be upgraded by replacing the small sewer pipe diameter 90 mm and 100 mm to 150 mm and 200 mm with total length of 31,907 m (88% from total) for avoiding the blockages and secure a consistent flow to the wastewater treatment plant.

By replacing the too small pipe diameters with bigger pipe diameters, it is expected the households will be encouraged to reconnect their grey water connection; this should be enforced by regulation if they are reluctant to reconnect. This in turn will lead to a better environment and healthier surrounding. It increases also the willingness to pay of the population.

The planned expansion of the domestic sanitation program will begin in 2018 with the existing process capacity of 800 m^3/day and a target of a total of 2,222 house connections in Margasari, for both black water and grey water, an improvement of **57%**. This number comes from 1,285 hh divided by 2,222 hh. The population projection in 2020 is 41,772 inh., which means the coverage will be 16% house connections with a total of 6,700 persons.

After implementing of the mentioned measures the total percentage of sewerage coverage in Margasari service area will be **16% in 2019 - 2020**, while the rest of the area 84% is still covered with on-site septic tanks.

The flow to the WWTP have to be monitored while improvements are made to the collection system and additional connections are made to ensure the wastewater treatment plant will operate effectively according to the maximum design capacity.

Table 19: Long Term population Prognosis Margasari service area and wastewater quantities

Parameter	Year			Unit	Remarks
	2025	2034	2040		
Population Equivalent (PE) Served	49,552	49,684	51,973	Inh.	
Average occupancy per property	3.0	3.0	3.0	person	civil administration data
Number of properties served	16,517	16,561	17,324	HH	households
Water Use	150	150	150	lpcd	(PDAM Data)
Waste water flow	120	120	120	l/d	80% of water use
Average wastewater flow	5,946	5,962	6,237	m3/d	
WWTP Design capacity			6,900	m3/d	including 10% infiltration
Existing Capacity			800	m3/d	
Additional Capacity (new WWTP)			**6,100**	**m3/d**	
Babbit Peak Factor	2.3	2.3	2.3		
Peak Dry Weather Flow	164.53	164.88	171.00	l/s	
Estimated Length / connection			6	m/HH conn	
Total sewer length			171,006	m	
Nr. of Pump Stations			8	unit	

While there is no space for any expansion in Margasari, it is impossible to cover the whole area with a sewerage system. Therefore for the medium and long term, another solution should be studied to be able to connect 100% of the population in the long term. Several scenarios are presented in the Chapter 7 of this Report.

In Appendix 2 the proposed Implementation Plan is presented for this project.

4.10.2 Sepinggan

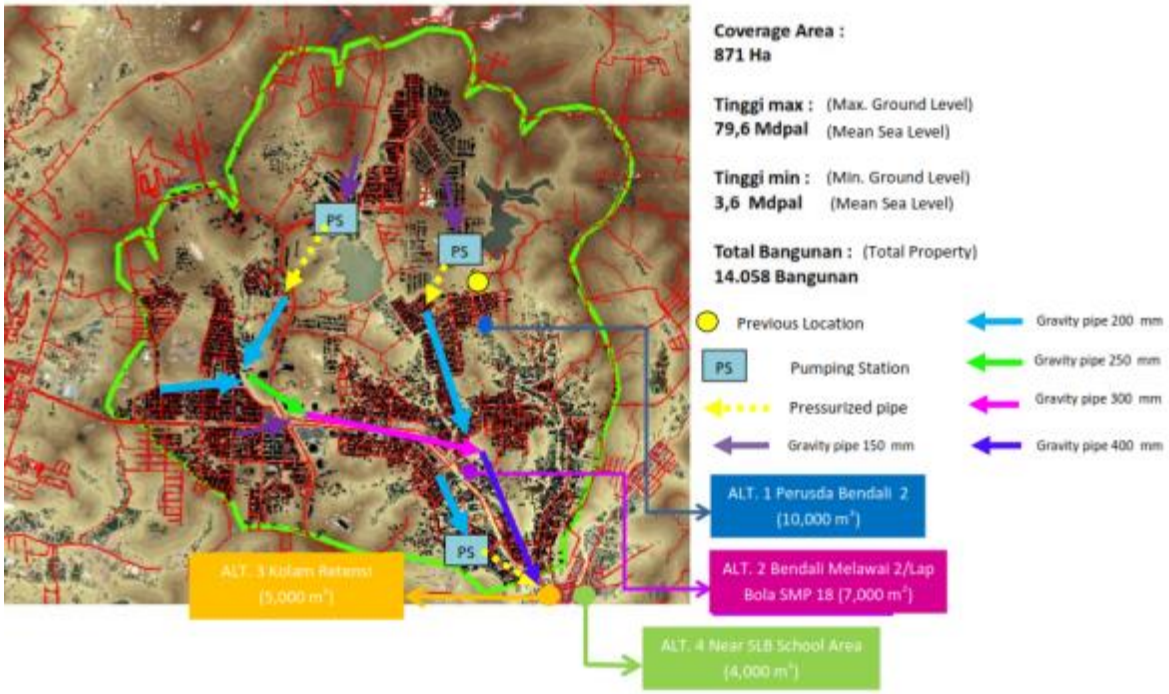
In Sepinggan, the villages that will be covered by the proposed wastewater are: Batu Ampar, Manggar, Gunung Samarinda, Damai, Sepinggan and GunungBahagia (Kecamatan Balikpapan

Selatan). Only the villages which fall in a single catchment area will be included in a new sewerage system.

A key characteristic of the Sepinggan area is that several settlements conveniently fall within a single catchment basin which drains to an estuary discharging to the sea just to the east of the airport; therefore most of the wastewater can be collected by gravity when the wastewater treatment plant can be implemented close to the lowest end of the catchment.

This single catchment area includes the villages of: Sepinggan, Sepinggan Baru and Gunung Bahagia. This catchment area is about 871 ha and can cover approximately 14,000 households. See figure below.

Figure 19: Sepinggan Catchment area and WWTP location options



The Municipality has changed the WWTP location as proposed by PFS 2014 to another location. However this new location is also near a housing complex. Four alternatives for a WWTP location were studied during this revised study:

- Alternative 1: Sepinggan housing complex (Bendali 2) with area of approximately 10,000 m2. This land belongs to government and has been agreed by surrounding community. Need a simple resettlement for 1 house. However, there is small watercourse for effluent discharge.
- Alternative 2: Bendali Melawai 2/Lapangan SMP18 with area of approximately 7,000 m2. This land belongs to government and is presently used for soccer field. The location is lower than alternative 1 to the downstream area. There is large watercourse for effluent discharge.
- Alternative 3: Sepinggan Retention Pond near the estuary with area of approximately 5,000 m2. This land belongs to government and has no social impact and has been agreed by surrounding community. There is a large watercourse for effluent discharge.

- Alternative 4: Near SLB School area, about 4,000 m2, some existing buildings on the site and close to a school.

In the following table an overview is presented of all alternatives and their advantages and disadvantages.

Table 20: Overview Alternatives Location Sepinggan - advantages and disadvantages

Sepinggan Location	Advantages	Disadvantages
Alt. 1: Bendali 2, housing complex, 10,000 m2	- Large size	- Located at upstream area. Need pump stations - Small water course for effluent discharge
Alt. 2: Soccer field SMP 18 7000 m2	- Larger size - Large water course for effluent discharge	- Located at upstream area. Need pump stations - Need implementation of a new Soccer field as substitution
Alt. 3: Sepinggan Retention Pond, 5000 m2	- Located at downstream area - Remove the odour on the retention pond site - The existing pond could be improved to be aerobic pond. - Large water course for effluent discharge	- Need land preparation (earth fill) for UASB construction - Requires extra measures for flood protection in Sepinggan Market. Need of the waste water treatment integrated with the flood control system in the retention pond/*Bendali*
Alt. 4: Near SLB School, 4000 m2	- No need of flood protection	- Smaller size than retention pond. - Has to demolish some existing buildings - Need 200 m of effluent pipe. - Near existing school

After deliberate investigations, site-visits, meetings, discussions with BAPPEDA and PU (Public Works), it was concluded that Alternative no. 3 Location is the preferred option and further selected to be developed into a wastewater treatment location.

Technically, the location is at the downstream area and has a large watercourse for effluent discharge. Currently, the retention pond cause odor at surrounding community. If the retention pond will be upgraded to be WWTP area, the odour problems will be solved and provide benefit for the surrounding community. This location has also minimal social impact.

Presently, the function of the retention pond is a temporary reservoir to collect the storm water when the river tide (sea tide influence) is high and heavy rain happens simultaneously. Based on interview with the operator and Public Works Agency, this usually happens only 2-3 times per year. There are four pumps to discharge the storm water to the river and they are operated manually.

The figure below shows the potential flood zone in the area of the proposed Sepinggan wastewater treatment plant location, in case no actions are taken.

Figure 20: Potential flood zone at Sepinggan retention pond area and market

The proposed solution to this flood prone area is as follows:

- Direct pumping of the storm water to the adjacent river with pump automatization level controls. During the rainy season as soon as the levels raises in the pump station pits, the first pump starts followed by the other 3 pumps in case the water level still rises.
- Additional a sedimentation trap with coarse bar screen should be implemented upstream of the market area. In the dry season the black water from the market can be treated in the new WWTP.
- A By-pass storm water channel or By-pass storm water pipe will be installed outside of the proposed wastewater treatment location.

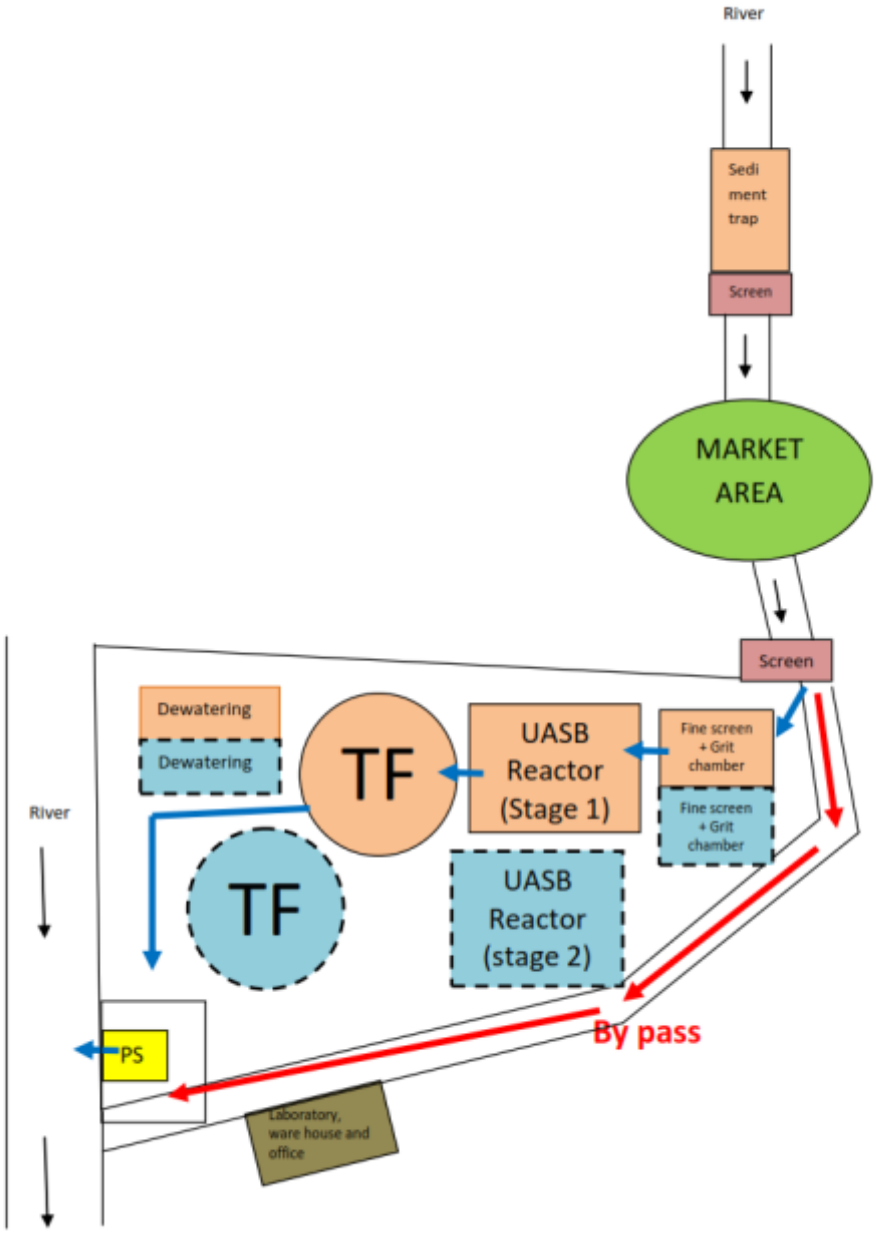
After discussion with the Public Work Agency, they agree with this solution, however they require a hydrological study to confirm the minimum required capacity of the pump-pits and the capacity/pump flowrate Q of the installed pumps. Also they require one Stand-by pump.

As safety measure for the wastewater treatment plant, especially during the rainy season, a By-Pass drainage will be constructed directly from the Market drainage to the Pump Station. The pump Station will pump the storm water directly into the river.

The following schematic figure shows the flood protection measures and the indicative Lay-out of the wastewater treatment plant on the proposed retention pond area.

Note: *UASB Upflow Anaerobic Sludge Blanket (see table 23)*
TF Trickling Filter (as post-treatment)
PS Pump Station (existing)

Figure 21: Schematic Lay-out of Sepinggan Retention pond site with Flood protection measures



Further study is required to assess the impact of the construction of the wastewater treatment plant at the site of the Retention Pond with emphasis on flood protection of the market.

A Hydrological Expert needs to conduct a comprehensive assessment of the area, e.g. for the calculation of the storm water flow rates from the market catchment area, calculating the By-pass diameter, calculation of the minimum size of the pump station sump and for determining

the pump size and the automatic level controls. The Hydrological data collection and interpretations, including hydrological calculations have to be conducted by a third party/ consultant. This is in accordance with the policy of Public Works Agency and Code of ethics.

Technical Design Data

The average waste water flow is 1,800 m3/day plus 10% infiltration to determine the WWTP design capacity of 2,000 m3/day. The Babbit peak factor is used for calculating the peak flow for determining the sewer size. The total sewer length is calculated by estimate the distance between house connections of 12 m divided by 2 because the sewer will be installed in the middle of the road and can serve 2 houses both sides.

The following table shows the technical calculations for the Sepinggan wastewater treatment plant in the indicated catchment area. These calculations are required to establish the wastewater dimensions.

Table 21: Technical calculations of Sepinggan service area 2018

Parameter	Year	Unit	Remark
	2018		
Population Equivalent (PE) Served	15,000	inh.	
Average occupancy per property	3.0	Person	civil administration data
Number of properties served	5,000	HH	
Water Use	150	Lpcd	(PDAM Data)
Waste water flow	120	l/d	
Average flow	1,800	m3/d	
WWTP Design capacity	2,000	m3/d	including 10% infiltration
Babbit Peak Factor	2.9		
Peak Dry Weather Flow	62.69	l/s	
Estimated Length/connection	6	m/HH conn	
Total sewer length	30,000	m	
Nr. Of Pump Stations	3.0	Unit	

Three Pump stations are required in the Sepinggan catchment area at this first stage to transfer the wastewater from one catchment to the other catchment and also one for crossing the river.

In the designated catchment area are a total of about 14,000 households; however in this first project stage only 5,000 new households will be connected serving 15,000 inhabitants.

The first phase implementation is projected for 2018. At the new wastewater treatment location, it is possible to extend the treatment plant in the future through Phase 2, to serve e.g. 10,000 households in total, whereas also double sewerage system has to be implemented. As a staged approach is promoted to get the PDAM management and staff more involved and also to get the population used to and accepted a sewerage systems, it is recommended to implement the second phase at medium term, e.g. year 2025. The following table presents the future scenario for Sepinggan.

Table 22: Long Term population Prognosis Sepinggan service area and wastewater quantities

Parameter	Year			Unit	Remarks
	2025	2034	2040		
Population Equivalent (PE) Served	110,061	110,354	115,440	Inh.	
Average occupancy per property	3.0	3.0	3.0	person	civil administration data
Number of properties served	36,687	36,785	38,480	HH	
Water Use	150	150	150	lpcd	(PDAM Data)
Waste water flow	120	120	120	l/d	80% of water use
Average flow	13,207	13,242	13,853	m3/d	
WWTP Design capacity			15,200	m3/d	including 10% infiltration
Babbit Peak Factor	2.0	2.0	1.9		
Peak Dry Weather Flow	313.79	314.46	326.15	l/s	
Estimated Length/connection			12	m/HH conn	
Total sewer length			230,880	m	
Nr. of Pump station	3	5	8	unit	

The following table presents the required land area for the two WWTP options.

Table 23: Estimated land required for WWTP options Sepinggan

Type of WWTP	Land required 2017 (m2)
Activated Sludge	5,000
Upflow Anaerobic Sludge Blanket	4,800

The selected appropriate WWTP technology option for Sepinggan is UASB (Upflow Anaerobic Sludge Blanket Reactor. The reason to choose this technology is as follows:

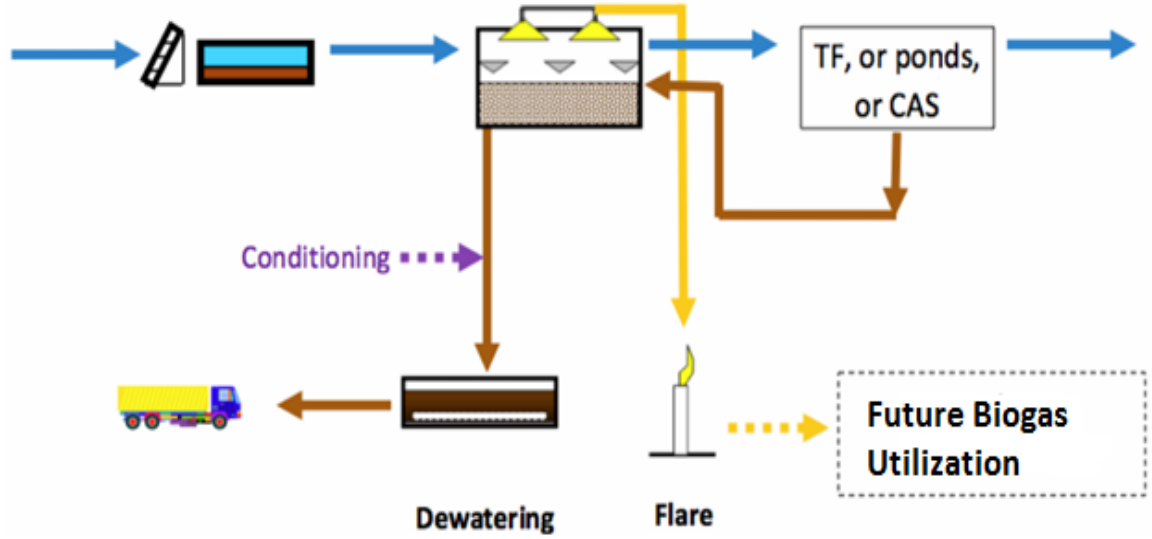
- Moderately simple and low cost technology
- Operational cost not too high.
- Biogas production and potential for energy generation (20-30% energy conservation)
- High removal of organics and solids (*BOD* and *TSS*) with low production of sludge
- Smaller area of land required than Activated Sludge plant with RAS.
- Can be constructed with locally available material but requires skilled staff for construction, maintenance and operation.

The following items will be constructed for an Upflow Anaerobic Sludge Blanket plant:

1. Site preparation and earth fill
2. Pre-treatment (bar screens, grit and grease trap)
3. Concrete construction of UASB unit
4. Trickling filter for post treatment (simple filter as post treatment only, can also be aeration pond but needs much more land area)
5. Sludge thickening facilities
6. Mechanical and Electrical Works.
7. Biogas facility system
8. Offices, workshop and small laboratory.

The schematic of process is presented on the following figure.

Figure 22: Sepinggan UASB treatment plant - schematic



After implementation of mentioned sewerage system and wastewater treatment plant, the indicated Sepinggan Catchment area will cover about 35% of the population connected to the new off-site system and 65% still have on-site septic tanks (Phase I). However, related to the whole Sepinggan village area, only 17 % of the total population will be connected to a sewer system and 83% still have septic tanks.

It is possible in the medium term to establish a second phase wastewater treatment plant on the same location which may double the capacity and also may double the number of house connections (Phase II).

In Appendix 2 the proposed Implementation Plan is presented for this project.

4.10.3 Somber

The whole Somber Area consists of the following villages: Batu Ampar, Muara Rapak, Margo Mulyo, Baru Ulu, Baru Tengah, Barullir, Karang Jati, Karang Rejo, Sumber Rejo and Gunung Samarinda.

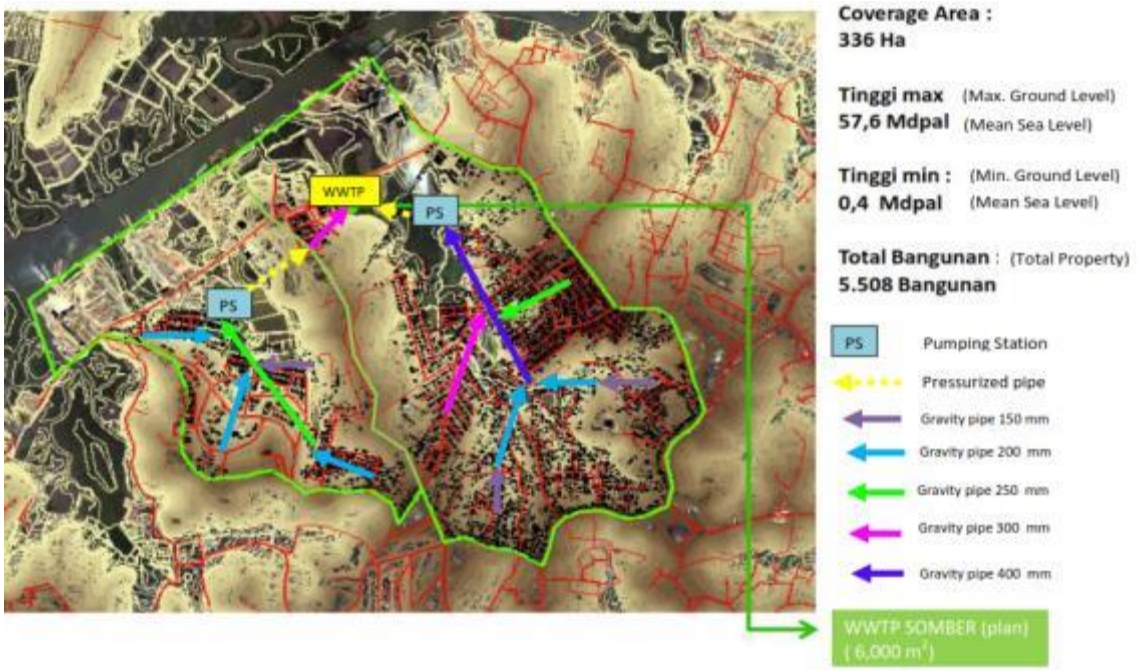
For the Somber area two catchment areas are selected for implementation in this project. The two catchment areas cover 336 ha with about 5,500 properties and covers part of the villages of: Margo Mulyo, Muara Rapak and Batu Ampar.

Based on current investigation it was decided the location of WWTP in Somber will be next to the existing Industrial WWTP with an area of approx. 6,000 m2.

Part of this land belongs to government, approx. 2,000 m2, the rest belongs to private owner, approx. 4,000 m2. The land is now empty and also there is much more land in the same area to be used for future expansion, total approx. 2.0 ha.

The sewerage system requires one pumping station to convey wastewater from one catchment to another catchment area. The Pumping Station will be located at the lowest point in the catchment area. The wastewater will be pumped in a pressure pipe line to the top of the hill and then flow by gravity to the WWTP as shown on the figure below.

Figure 23: Somber Catchment area



Technical Design Data

The following table shows the technical calculations for the Somber wastewater treatment plant in the indicated catchment areas. These calculations are required to establish the wastewater dimensions.

Table 24: Technical calculations of Somber Catchment area 2018

Parameter	Year	Unit	Remark
	2018		
Population Equivalent (PE) Served	16,500	inh.	
Average occupancy per property	3.0	person	civil administration data
Number of properties served	5,500	HH	
Water Use	150	lpcd	(PDAM Data)
Waste water flow	120	l/d	
Average flow	1,980	m3/d	16,500 inh.x120l/d:1,000=1,980 m3/day
WWTP Design capacity	2,200	m3/d	including 10% infiltration
Babbit Peak Factor	2.9		
Peak Dry Weather Flow	67.70	l/s	
Estimated Length/connection	6	m/HH conn	
Total sewer length	33,000	m	
Nr. Of Pump Station	1	unit	

The following table presents a prognosis for the long term, until 2040 of the 3 villages in the 2 catchment areas in Somber.

Table 25: Long Term population Prognosis Somber service area and wastewater quantities

Parameter	Year			Unit	Remarks
	2025	2034	2040		
Population Equivalent (PE) Served	69,234	69,419	72,618	Inh.	
Average occupancy per property	3.0	3.0	3.0	person	civil administration data
Number of properties served	23,078	23,140	24,206	HH	
Water Use	150	150	150	lpcd	(PDAM Data)
Waste water flow	120	120	120	l/d	80% of water use
Average flow	8,308	8,330	8,714	m3/d	
WWTP Design capacity			9,600	m3/d	including 10% infiltration
Babbit Peak Factor	2.1	2.1	2.1		
Peak Dry Weather Flow	215.63	216.09	224.11	l/s	
Estimated Length / connection			6	m/HH conn	
Total sewer length			145,236	m	
Nr. of Pump Stations		4	8	unit	

The pump stations are required to transfer the wastewater from one catchment to the other catchment and also one PS for crossing the river.

The table below indicates the land requirements for the two wastewater treatment plant options.

Table 26: Estimated land required for WWTP options Somber Phase I

Type of WWTP	Land required 2017 (m2)
Activated Sludge	5,500.0
Upflow Anaerobic Sludge Blanket	5,280.0

Similar like Sepinggan, the selected appropriate wastewater treatment technology for Somber is UASB because of the following reasons:

- moderate operational cost and investment;

- The biogas generation could be used for energy conversion (20-40% energy conservation)

- High removal of *organics* and solids (*BOD* and *TSS*) with low production of *sludge*

- relative small area of land required.

- Can be constructed with locally available material but requires skilled staff for construction, maintenance and operation.

The following items will be constructed for an Upflow Anaerobic Sludge Blanket plant:

1. Site preparation and earth fill
2. Pre-treatment (bar screen, grit and grease trap)
3. Concrete construction of UASB unit
4. Simple Trickling Filter for post treatment or aeration pond (depends on land availability)
5. Sludge thickening facilities
6. Mechanical and Electrical Work.
7. Biogas facility system
8. Offices, workshop and small laboratory

After implementation of mentioned sewerage system and wastewater treatment plant, the two indicated Somber Catchment areas will cover 19% of the population connected to the new off-site system and 81% have still on-site septic tanks (Phase I).

It is possible in the medium term to establish a second phase wastewater treatment plant on the same Somber Industrial Zone location which may double the capacity and also may double the number of house connections (Phase II).

In the long term, this location may be seriously considered to be one of the locations of the scenario for maximum of 5 WWTPs for whole city. This is further described in Chapter 7, Strategy and Scenarios.

In Appendix 2 the proposed Implementation Plan is presented for this project.

4.11 Project Cost Estimation

This Cost estimate calculation is based on references as the Draft Regulation of the Ministry of Public Work Annex 2 Book 4, World Bank study and ADB-MSMIP for comparison.

4.11.1 Margasari

The Implementation Work consists of optimizing the existing Margasari Wastewater treatment plant, Pump Stations and upgrading and extension of the sewer network. In the table below, the cost estimation is presented for the Margasari Implementation Works in the short term period (2018 / 2019).

The depth of the sewer will vary between 0.8 – 4 meter depth, however during this stage the rate per meter length of sewer pipe will be calculated for an average depth of 2.5 m. During the next stage in the Detailed Engineering Design (DED) more details of cost for each sewer diameter and depth will be calculated.

The total cost estimate for Margasari upgrading of the wastewater treatment plant and network improvement incl. pump stations and house connections is shown in the table below.

Table 27: Cost Estimate Margasari upgrading WWTP and network improvement

Description	Amount (ref. table 19)	Rate Rp000/unit	Total IDR m
Replace sewer pipe dia 90 mm to 150 mm (m)	24,696	1,966	48,565
Replace sewer pipe dia 100 mm to 150 mm (m)	7,221	1,966	14,200
WWTP improvement and automatisation	1	3,766	3,766
Pump procurement and installation with level controls (unit)	20	50,000	1,000
Reconnected grey water pipes with Household connections (works and pipes)	1,285	900	1,157
Additional House connections (HH conn.)	210	6,000	1,261
Detailed design preparation	1	2,784	2,784
Total			**72,747**

The total CAPEX for Margasari project is **72,747 mIDR** (5.6 mUSD)

4.11.2 Sepinggan

The Implementation Work in Sepinggan consists of construction of a new Wastewater treatment plant, Pump Stations and implementation of a sewer network. In the table below, the cost estimation is presented for the Sepinggan Implementation Works in the short term period (2018 / 2019).

The depth of the sewer will vary between 0.8 – 4 meter depth, however during this stage the rate per meter length of sewer pipe will be calculated for an average depth of 2.5 m. During the next stage in the Detailed Engineering Design (DED) more details of cost for each sewer diameter and depth will be calculated.

Table 28: Cost estimate of sewer pipes base year 2017

Pipe Dia	Estimated % of	Length	Rate	Total

(mm)	total	(m)	Rp 000/m	Rp million
400	6%	2,800	2,314	6,480
350	10%	3,000	2,243	6,729
300	13%	3,900	2,173	8,474
250	18%	5,400	2,103	11,358
200	20%	6,000	2,034	12,207
150	33%	9,900	1,966	19,468
	100%	**31,000**		**64,715**

In the table below the cost estimate for manholes and pump stations is presented.

Table 29: Cost estimate manholes and pump stations

Description	Number	Rate Rp000/unit	Total IDR m
Manhole	620	12,000	7,440
Pipe Bridge	1	2,500,000	2,500
Pump Stations	3	3,000,000	9,000
House connections	5,000	6,000	30,000
Total			**48,940**

The total cost estimate for Sepinggan construction of a new wastewater treatment plant and network implementation incl. pump stations and house connections is shown in the table below.

Table 30: Cost Estimate Sepinggan new UASB - WWTP and network implementation

Description	Amount	Rate Rp000	Total IDR m
Site Preparation and earth fill (m2)	4,800	2,500	12,000
WWTP construction (m3/day)	2,000	14,625	29,250
Trickling Filter (unit)	1	20,000,000	20,000
Biogas system+ pre-treatment (unit)	1	3,120,000	3,120
Electrical and Mechanical Work	1	4,387,500	4,388
Facility Building and site works	1	8,666,667	8,667
Total			**77,424**

Further a cost estimate is prepared for the flood protection measures in Sepinggan Market. This estimate may change depending on the outcome of the Hydrological Study.

Table 31: Cost Estimate Flood Protection measures Sepinggan market

Description	Amount	Rate Rp000	Total IDR m
Hydrological Survey and Study	1	500,000	500

Sediment trap (unit)	1	5,893,333	5,893
Bar Screen	1	200,000	200
By pass channel (m)	170	5,500	935
Pump and automatisation system	4	500,000	2,000
Total			**9,528**

The following table presents an overview of all costs involved in the Sepinggan project;

Table 32: Total Cost Estimate Sepinggan new UASB-wwtp and sewerage works

Description	Total in mIDR	Total in mUSD
Sewer Pipes	64,715	4.98
Manhole, Pump Station, house connections	48,940	3.76
WWTP construction	77,424	5.96
Flood Protection Program	9,528	0.73
DED Preparation	8,024	0.62
Total	**208,632**	**16.05**

The total CAPEX for Sepinggan project including Flood Protection measures is 208,632 m IDR (16.05 mUSD)

4.11.3 Somber

The Implementation Works in Somber consist of construction of a new Wastewater treatment plant, Pump Stations and implementation of a sewer network. In the table below, the cost estimation is presented for the Somber Implementation Works in the short term period (2018 / 2019).

The depth of the sewer will vary between 0.8 – 4 meter depth, however during this stage the rate per meter length of sewer pipe will be calculated for an average depth of 2.5 m. During the next stage, DED Detailed Engineering Design more details of cost for each sewer diameter and depth will be calculated.

Table 33: Cost estimate of sewer pipes base year 2017

Pipe Dia (mm)	Estimated % of total	Length (m)	Rate Rp 000/m	Total mIDR
700	3%	1,452	2,757	4,003
600	5%	2,179	2,606	5,677

500	9%	3,631	2,459	8,927
400	4%	1,650	2,314	3,818
350	6%	2,310	2,243	5,181
300	11%	4,290	2,173	9,321
250	16%	6,600	2,103	13,881
200	21%	8,250	2,034	16,785
150	25%	9,900	1,966	19,468
	100%	**40,262**		**87,063**

The main trunk with diameters of 500 mm, 600 mm and 700 mm needs to be constructed in year 2017 to anticipate the increasing flow in the future due to extension of the services and also due to population growth. The design for the sewerage system is based on the year 2040 capacity.

In the table below the cost estimate for manholes and pump stations is presented.

Table 34: Cost estimate manholes and pump stations

Description	Number	Rate Rp000/unit	Total mIDR
Manhole	805	12,000	9,663
Pipe Bridge	1	2,500,000	2,500
Pump Stations	2	3,000,000	6,000
House connections	5,500	6,000	33,000
Total			**51,163**

The cost estimate for Somber construction of a new wastewater treatment plant is shown in the table below.

Table 35: Cost Estimate Somber new UASB - WWTP

Description	Amount	Rate Rp000	Total mIDR
Land acquisition (m2)	3,280	1,500	4,920
Site preparation and earth fill (m2)	5,280	1,500	7,920
WWTP construction (m3/day)	2,200	14,625	32,175
aerobic pond (unit)	1	9,533,333	9,533
Biogas system+ pre-treatment (unit)	1	3,432,000	3,432
Electrical and Mechanical Works	1	4,826,250	4,826
Facility Building and site works	1	9,533,333	9,533
Total			**72,340**

The total cost estimate for Somber construction of a new wastewater treatment plant and network implementation incl. pump stations and house connections is shown in the table below.

Table 36: Total Cost Estimate Somber WWTP and network implementation

Description	Total in mIDR	Total in mUSD
Sewer Pipe	87,063	6.70
Manhole, Pump Station, house connection	51,163	3.94
WWTP construction	72,340	5.56
DED Preparation	8,423	0.65
Total	**218,988**	**16.85**

The total CAPEX for Somber project is 218,988 m**IDR** (16.85 mUSD)

4.12 Overview Total Investment Costs

In the Table below the total investment costs for the three projects are presented:

Table 37: Overview Total Investment Costs for the three projects, base year 2017

Location	Total investment in IDR	Total in USD	Nr. of HH Connections	Cost /conn. in IDR
Margasari	72,746,614,323	5,595,893	2,222	32,735,976
Sepinggan	208,632,044,817	16,048,619	5,000	41,726,409
Somber	218,987,874,470	16,845,221	5,500	39,815,977
Total	**500,366,533,610**	**38,489,733**	**12,722**	**39,330,121**

For comparison of the cost/connection, there are some standards from other projects:

1. PFS World Bank 2014: IDR 20,000,000/connection
2. ADB MSMIP Jambi and Pekanbaru: IDR 53,000,000/connection
3. ADB MSMIP Makasar: IDR 46,000,000/connection

4.13 Operational Costs

4.13.1 OPEX Margasari

Operational costs Margasari after improvement works.

Table 38: Operational Costs Margasari after implementation

Parameter	Year 2017	
	Total Annual OPEX in IDR	Total in USD

Annual Power Cost	856,565,657	65,890
Annual Civil, E&M maintenance cost	265,127,465	20,394
Annual recurring cost (chemicals, etc.)	387,493,987	29,807
Annual Overhead	203,944,204	15,688
Annual manpower O&M cost	326,310,726	25,101
Total Annual O&M Cost	**2,039,442,039**	**156,880**

4.13.2 OPEX Sepinggan

Operational costs Sepinggan after improvement works.

Table 39: Operational Costs Sepinggan after implementation

Parameter	Year 2017	
	Total Annual OPEX in IDR	Total in USD
Annual Power Cost	179,227,941	13,787
Annual Civil, E&M maintenance cost	931,985,294	71,691
Annual recurring cost (chemicals, etc.)	430,147,059	33,088
Annual Non-recurring cost (7 years for E&M item)	1,168,566,176	89,890
Annual manpower O&M cost	215,073,529	16,544
Total Annual O&M Cost	**2,925,000,000**	**225,000**

4.13.3 OPEX Somber

Operational costs Somber after improvement works.

Table 40: Operational Costs Somber after implementation

Parameter	Year 2017	
	Total Annual OPEX in IDR	Total in USD
Annual Power Cost	197,150,735	15,165
Annual Civil, E&M maintenance cost	1,025,183,824	78,860
Annual recurring cost (chemicals, etc.)	473,161,765	36,397
Annual Non-recurring cost (7 years for E&M item)	1,285,422,794	98,879
Annual manpower O&M cost	236,580,882	18,199
Total Annual O&M Cost	**3,217,500,000**	**247,500**

Further Financial issues are presented in the Financial Sections of this Report.

5 INSTITUTIONAL

5.1 Review of PFS 2014

Preparation of PFS in 2014 was based on the targets of RPJMN period 2009-2014. The review and updating the PFS 2014 is using the targets RPJMN period 2015-2019 as a reference. As other cities, Balikpapan also has a target to achieve the Universal Access for Water, Slum Housing and Sanitation known as **100-0-100**. To reach the target, it takes a number of strategies and programs, both in technical aspects and non-technical (regulatory, institutional & capacity building, financing, preparation of the communities, etc.).

Preparation of PFS 2014 was based on a number of regulations (Local Regulation and Major Decree) in effect at that time. Since 2014-2016 a number of new regulations were approved and are very supportive for wastewater management, such as legislation on sanitation and wastewater management. The review and update report will use these new rules such as Major Decree (Perwali or *Peraturan Walikota*) and Regional Regulation (Perda or *Peraturan Daerah*) as basic consideration in the development of institutional and wastewater management.

Since 2014 a number of new regulations have been set up in detail of sanitation aspects and wastewater management, either a centralized system (*off-site*) as well as the localized system (*on-site*). This means, management of wastewater in the city of Balikpapan has received legal protection and strong support from the City Government. This was not discussed in the PFS 2014.

With the Perda No. 10 of 2014 a number of options regarding the institutional and management arrangement concerning PDAM such as the Technical Services Unit (UPT) and the Public Service Board (BLUD), are not options anymore. In the Perda 10 of 2014 it has been set forth that the PDAM core business is not only drinking water but also wastewater, both for centralized and localized system (off site and on-site).

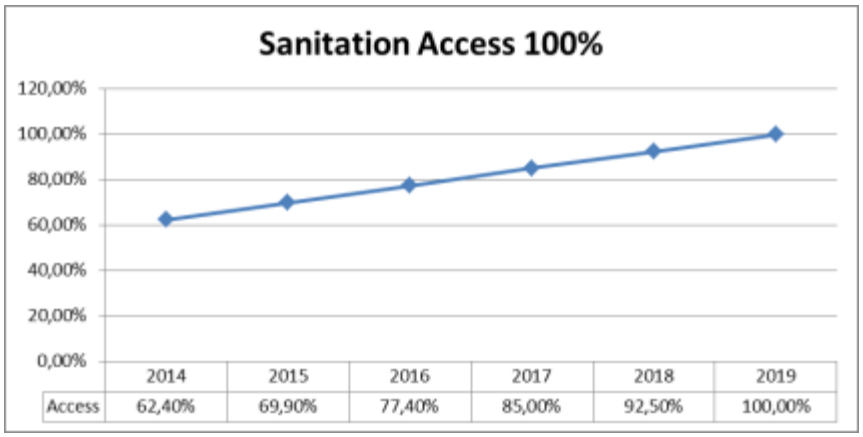
5.2 National Strategy in Wastewater Sector Indonesia

The National Long Term Development Plan (RPJPN, 2005-2025) mandates that the development and supply of drinking water and sanitation is directed to realize the basic needs of society. RPJPN will be then elaborated and implemented gradually in the National Medium Term Development Plan (RPJMN).

Implementation of the National Medium Term Development Plan (RPJMN 2010-2014) in the field of wastewater has been completed. In 2010, sanitation access nationally was 55.53% and in 2014 has increased to 62.14% (PPLP Directorate, Ministry PUPR). This figure is relatively close to the target MDG sanitation (62.41% in 2015). Through the Program PPSP (Settlements Sanitation Development Acceleration) during this period has also drawn Sanitation Strategy Regency / City (SSK) in over 500 districts / cities. This document contains strategies and medium-term sanitation development programs, as well as indicative financing. SSK is prepared by the Sanitation Working Group (WG) in each district / city.

The RPJMN 2015-2019 declares the target of universal access in sanitation. At the national level sanitation access is targeted to reach 100% in 2019, consisting of proper access (85%), and basic access (15%), and there are no longer people who defecation in-the-open (BAB Sembarangan). The target is translated in updating the SSK by the respective Sanitation Working Groups at each districts / cities and provinces to suit local conditions and capabilities.

Figure 24: National Level of Sanitation Access 2019



Source: Directorate of PPLP, DG of Human Settlements, Ministry of Public Works & Housing

Some of the challenges in achieving these targets among others are how to increase the attention and commitment of regional governments and legislators to the sanitation sector, increasing public awareness to behave clean and healthy (PHBs), seeking financing alternatives (cannot completely rely on the state and local budgets), and compliance readiness criteria such as Detailed Engineering Design (DED), Land Acquisition, etc. for sanitation infrastructure (PPLP Directorate, Ministry of Public Works).

Physical development in the wastewater sector is directed at developing a Centralized Wastewater Treatment Systems (SPAL-T or Off-site system) and the Localized Wastewater Treatment System (SPAL-S or On-site system), while the non-physical program is socialization and sanitation education to the communities, advocacy to local government (legislatives and executives), updating the City Sanitation Strategy (SSK), and institutional development, capacity building and training.

To reach the Sanitation Universal Access (100% in 2019) requires high costs and large investments. Given the financial constraints the government (at Central, provincial and cities) it is necessary to look for other financing alternatives such as Sarana Multi Infrastruktur (SMI), foreign grants (AusAID), or e.g. loans (ADB or World Bank).

5.3 Local Regulation and PDAM Management

Some Local Regulations or Perda, passed in 2014-2016 which have an influence on the management of wastewater in the city of Balikpapan and can be grouped into two, which is associated with sanitation and water supply.

5.3.1 Related to Sanitation

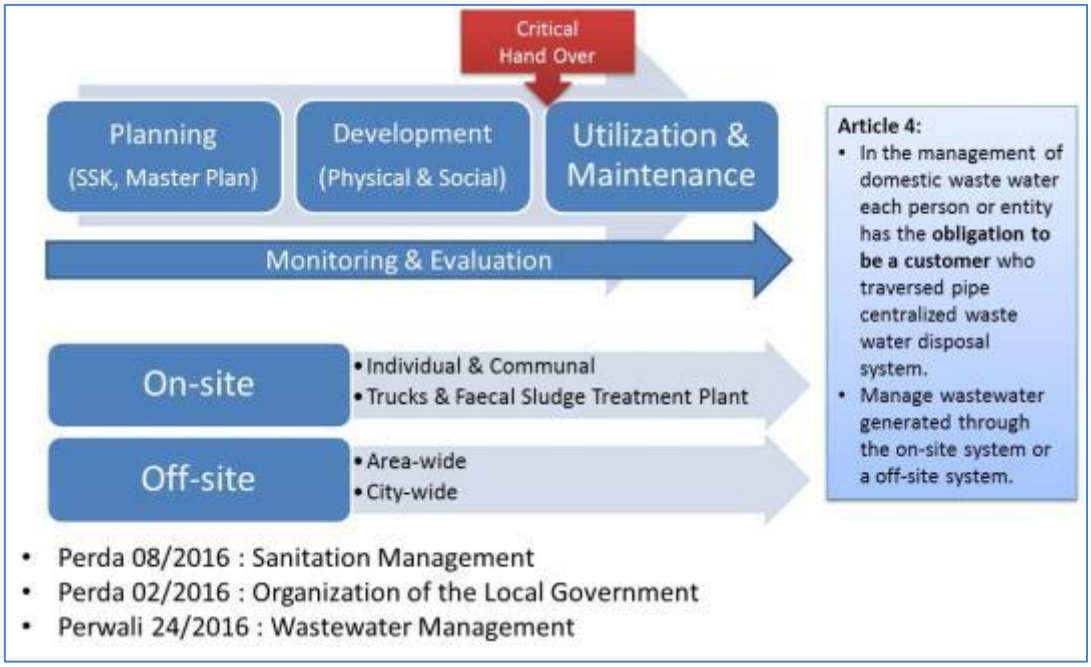
Perda No. 08 Year 2016 on the Management of Sanitation explain about (a) the duties and authority of local governments, (b) the implementation of sanitation, (c) the policy and strategy of sanitation management, (d) research and development of sanitation technology, (e) the rights, obligations and participation society, (f) services and compensation, (g) cooperation, (h) construction, and (i) financing.

Perda on Sanitation Management (Article 7) explain all phases of activities consisting of (a) planning, (b) construction, (c) utilization and maintenance, and (d) monitoring and evaluation. It is also stated the department or agencies responsible for each of these stages such as

Sanitation Working Group (WG), BAPPEDA (planning), Department of Public Works (sanitation planning and construction supervision), Department of Housing and Settlement (sanitation for slums areas), Department of Environment (environmental protection and management), and others in accordance with the duties respectively as elaborated in Perda No. 02 Year 2016 on Organizational Structure and Management of Local Government.

Perda No. 08 Year 2016 also establishes the role of local communities, community groups and the private sector or business entities in the implementation of sanitation and wastewater management, particularly for community-based sanitation (public toilets, MCK, or IPAL Communal). Private sector participation is in the provision of sludge trucks or as investor for IPAL (WWTP). For an overview see figure.

Figure 25: Overview how to manage a wastewater system



Mayor Regulation No. 24 Year 2016 on the Management of Wastewater, Articles 3 and 4 stipulating the rights and obligations of any person and organization. Any person has the obligation to be a customer when the residence is traversed by the wastewater pipe of a centralized system. These rules can encourage people who live along the wastewater network should be a customer of PDAM. These regulations may increase the number of PDAM's wastewater customers.

Article 5 establishes that the wastewater management in the city of Balikpapan will be implemented through localized wastewater treatment system (SPAL-S or On-site) and centralized (SPAL-T or Off-site).

Article 12 has been established that PDAM responsible for the management of domestic wastewater management. PDAM is required to meet wastewater quality standards in accordance with the provisions of the legislation.

Perda No. 02 Year 2016 on the Local Government Organization (SOTK) is the basis for the division of tasks and coordination among departments/agencies on the management of

sanitation and wastewater in the city of Balikpapan. In general the job description of each department/agencies in supporting wastewater management is as follows:

Table 41: Department duties to support Sanitation

No.	Department/Agencies	Duties to Support Sanitation
1	Dept. of Education	Education and training in the field of sanitation to students
2	Dept. of Health	Socialization for clean and healthy behavior (PHBS) to local communities
3	Dept. of Public Works	Planning and construction supervision for sanitation infrastructures (including wastewater) and urban drainage
4	Dept. of Environment	Environmental protection and management, impact assessment and monitoring the water quality
5	Dept. of Land and Spatial Planning	Accommodate sanitation infrastructure on City Master Plan and land allocation for sanitation infrastructures
6	Dept. of Housing and Settlements	Planning and construction supervision for sanitation infrastructure, especially for slums areas or low income settlements.
7	Dept. of Social	Increasing the social welfare of poor communities (wastewater project areas)
8	Dept. of Communication and Informatics	Provide information related to sanitation, wastewater, and healthy behavior (PHBS) and broadcast it using television, radio, newspapers, billboard, seminars, and online media.
9	Agency of Local Financial Management	To manage the financial and local government assets such as IPAL, IPLT, sludge trucks, etc.
10	Agency of Development Planning (BAPPEDA)	Coordination in planning, budgeting, and monitoring & evaluation on sanitation infrastructure development.
11	Dept. of Cooperatives and Small Scale Industries	Coordination and supports in Somber small scale industrial areas,
12	Kecamatan (6)	Coordination on public service and community service at kelurahan level.
13	Kelurahan	To support the Camat and implement part of kecamatan tasks in the Kelurahan

5.3.2 Related to PDAM

Perda No. 10 Year 2014, Article 6(3) stipulated that PDAM in addition to the drinking water supply for the needs of the community can also do business on wastewater management with emphasis on health and environment.

The scope of duties and responsibilities of PDAM in managing domestic wastewater has been regulated in Mayor Regulation Perwali No. 24 of 2016 (Article 24), as follows:

a. Plan and organize the registration procedure of the on-site and off-site units

b. Plan and organize Sludge Scheduled Service (L2T2) and Sludge Not Scheduled Service (L2T3).

c. Develop and execute standard operating procedures, both in terms of technical and non-technical aspects such as good customer services, operational and financial aspects.

d. Plan and implement a management information system for wastewater management

e. Plan and implement a control system of sludge transportation system

f. Report the results of testing the quality of wastewater discharged into the environment.

g. Conduct socialization of wastewater management both locally (on-site) and centrally (off-site) system together with the Local Government

h. Ensuring safety and health siphoning operation, transportation, and processing of sludge

i. Providing service to public complaints

j. Reports the implementation of wastewater management to the Mayor

Thus the task of PDAM is to manage the centralized systems such as WWTP Margasari but will also be responsible for managing the on-site system which includes the sewage systems and transport of faecal waste, including processing the sludge at the waste treatment plant (IPLT or Faecal Sludge Treatment Installation). In the transportation of sludge PDAM can cooperate with qualified private companies.

5.4 Existing PDAM Organization

5.4.1 Existing Organization

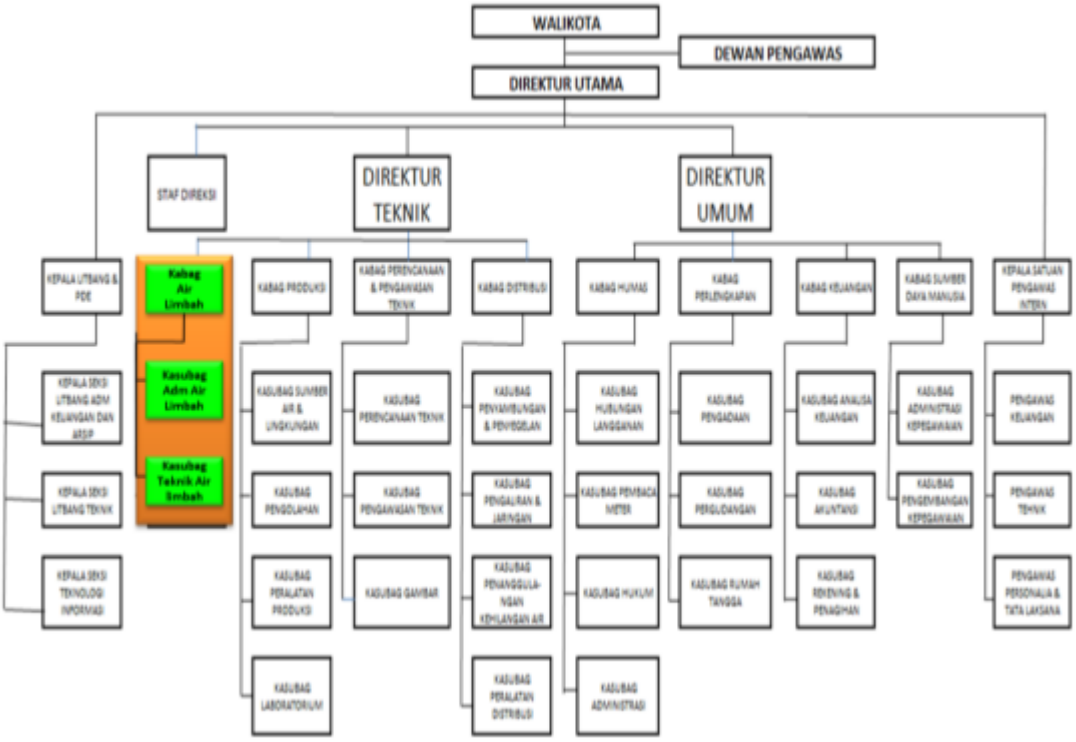
PDAM is Regional-Owned Enterprises (BUMD). PDAM established with a goal as one source of revenue (PAD) and capital and is part of the wealth of separated areas.

PDAM management arrangement consists of the Mayor as owner, Supervisory Board and the Board of Directors. The task of the Supervisory Board is to carry out monitoring, control and guidance to the organization and management of PDAM. Supervisory Board is authorized to assess the Directors performance in managing local water companies and inquire the Directors regarding the management and development of PDAM.

PDAM Directors task is to lead and control all activities of water supply, plan and develop annual work plans and 5 (five) years plans, and prepare a Work Plan and Annual Budget conform the annual specifications of the Business Strategy Plan.

PDAM organizational structure consists of three (3) Directors. For details see the picture below.

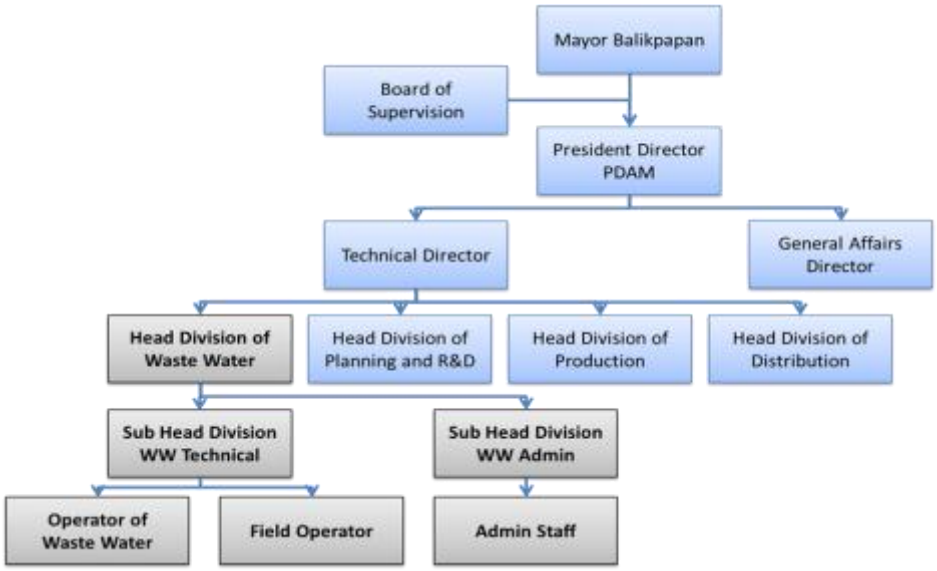
Figure 26: Existing organization structure PDAM Balikpapan



5.4.2 Existing Division of Wastewater

The Technical Director oversees the Head Division of Water and Wastewater Division. Head Division of Wastewater is assisted by Sub-Division of Technical and Sub-Division of Administration. Sub Division of Wastewater Technical is supported by 4 (four) WWTP operators and field operators (outsourcing). For details see the image below.

Figure 27: Existing PDAM Wastewater Division



Based on organization guidelines (SOTK) PDAM, the tasks of Head of Wastewater are as follows:

a. Preparing work plan for Wastewater Division
b. Coordinating and controlling the activities of and wastewater treatment and management that meets the standards continuously and sustainably
c. Coordinate activities for channel and the wastewater treatment plant maintenance
d. Planning for the development of wastewater production and services based on technological development potential
e. Evaluate the activity of wastewater
f. Perform calculations and efficiency and be accountable for the operational costs and maintenance in the environment Section Wastewater.
g. Managing and operating wastewater management system.
h. Collecting of wastewater retribution payments in accordance with prevailing regulations.

Detailed tasks, responsibilities, authorities and working relationship for each job position can be seen in the Annex III.

The number of personnel at the Wastewater Division is 11 (eleven) people, that is the Head of Wastewater, Sub-Head of Engineering, Sub-Head of Administration, the administrative staff, the operator of the WWTP (4 staff), field officer maintenance (2 staff), and a night watchman. Permanent staff of PDAM as many as 7 people and outsourced to third parties (field operator and night watchman).

Job Position:

No,	Position	Total
1	Division Head of Waste Water	1
2	Sub Division Head of Technical WW	1
3	Sub Division Head of Administration WW	1
4	Administration Staf	1
5	Operator	4
6	Field Worker for Maintenance	2
7	Security	1
	Total	**11**
Source : PDAM Balikpapan		

Status of Employment

No,	Status of Employment	Total
1	PDAM Permanent Staff	7
2	PDAM Cooperative Staff (Outsourcing)	2
3	Contractor Staff (Outsourcing)	2
	Total	**11**
Source : PDAM Balikpapan		

Margasari WWTP is processing in accordance with the Integrated Management ISO 9001-2008, which include: wastewater collection, preventive maintenance, new connections, Withdrawal levy wastewater, and withdrawal of subsidy. Documenting carried out regularly, although still manual. Archives and documents managed.

For testing lab is based on ISO 17025: 2005 on the testing laboratory. The scheduled testing at the laboratory used to conduct routine inspections to monitor, both for Raw Water Treatment, Water and Sludge Processed results in the Laboratory PDAM Balikapan.

5.5 Institutional Analysis

5.5.1 Stakeholder Analysis

Stakeholder of PDAM Wastewater among others:

a. Customer
b. Society in general and communities surroundings the IPAL
c. Local Parliament (DPRD) of Balikpapan
d. Mayor of Balikpapan as the owner
e. Department/Institutions/Agency related to sanitation, such as BAPPEDA (Planning Agency), Dinas Pekerjaan Umum (Public Works), Dinas Kesehatan (Health), Dinas Lingkungan (Environment), Kecamatan and Kelurahan Office, etc.
f. Board of Directors of PDAM
g. Manager and staff of PDAM
h. Supplier and partner of PDAM PDAM such as construction services (consultant, contractor and supplier), financial and banking services, and desludging trucks.

5.5.2 Business Analysis

The existing and future development of PDAM is determined at least by four perspectives that are:

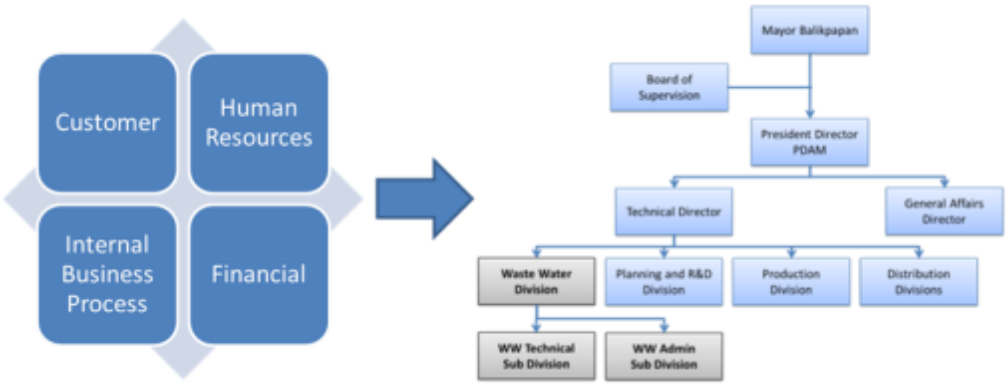
a. Customer: number of customers, social conditions, and willingness to connect and to pay.

b. Internal business process: the availability and the implementation of quality management standards (ISO), operation and maintenance activities, technology options, etc. (see also Chapter 4).

c. Human resources development: number of staff, qualifications of staff, training and capacity building program, etc.

d. Financial: financial performance (see Chapter 6 – 9).

Figure 28: Customer relations to PDAM organization



5.6 Future PDAM Organization

5.6.1 Phase 1: Directorate of Technical

The problems faced today and the next few years in order to wastewater management, among others:

- Awareness of the community to become customers (willingness to connect) to the wastewater system is still low
- Public awareness to pay the levy (willingness to pay) of wastewater, either through PDAM account or through door-to-door, but it needs to be improved.
- Still necessary to improve customer satisfaction
- Still required speed and accuracy in handling customer complaints
- Training to the staff and the WWTP operator for the last 3 years is relatively less and needs to be improved in accordance with the latest technological developments.

- Coordination with other parts such as Customer Relations, Customer Service, Supply Chain (ISC), QHSE (especially labs), information systems, and finance still needs to be improved.
- Coordination with offices / instances associated with the construction of the wastewater still needs to be improved.

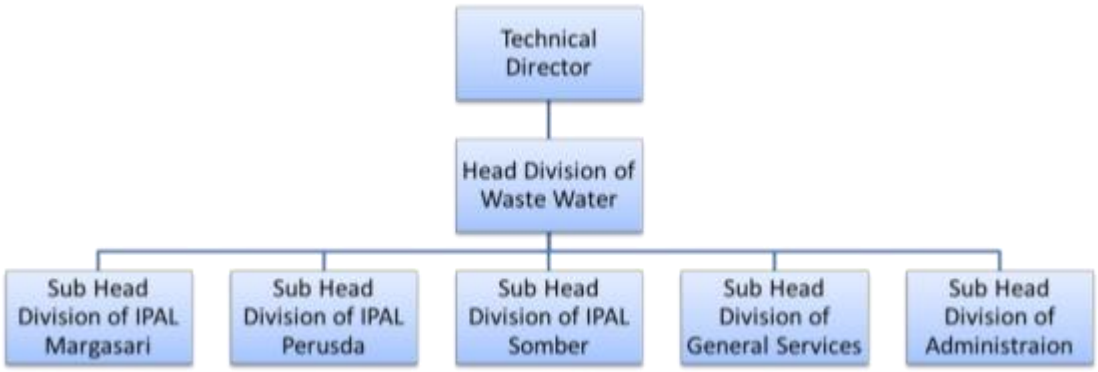
While the opportunities and challenges that will be faced in the next few years in order to wastewater management, among others:

- Plans to build two new WWTP in Sepinggan and Somber, certainly needs to be supported by the Planning Team (in-house) that are reliable for preparing Detail Engineering Design (DED) and also supervised the WWTP constructions.
- PDAM will provide desludging services (scheduled or not scheduled or L2T2 / L2T3), which includes emptying septic tank and transport of sludge by truck to the IPLT location at TPA Manggar.
- PDAM will manage and operate the Sludge Treatment Installation (IPLT)

Based on the above problems and challenges, it is necessary to restructure the organization of the Directorate of Technical as follow:

- In order to improve and facilitate wastewater services, either through a Centralized System or Localized System it is necessary to re-organization within the Directorate of Technics, especially in the Division of Wastewater.
- Directorate of Technics remains in charge of Wastewater and Drinking Water Sector
- Division Head of Wastewater in charge of 5 Sub-Divisions, namely: (1)) Sub Division of IPAL Margasari, (2) Sub Division of IPAL Sepinggan (3) Sub Division of IPAL Somber, (4) Sub Division of General Services (L2T2, L2T3 and IPLT, and (5) Sub Division Administration.
- Sub Division of IPAL will be responsible for planning, construction supervision, operation and maintenance of the WWTP, networks and other facilities.
- Sub Division of General Services will be responsible for preparing customer database, desludging services (L2T2 and L2T3) and sewerage treatment plant (IPLT) operation.
- Sub Administration oversees the Administration Section, and Marketing Section.

Figure 29: Proposed Organization with Technical Director



5.6.2 Phase 2: Directorate of Wastewater

Challenges to be faced in this phase among others:

- Number of wastewater customers is increasing and very demanding on excellent service with affordable (low cost) tariff.
- PDAM will operate and maintain 3 (three) WWTP: Margasari, Sepinggan and Somber, and require adequate technical and administrative supports.
- There is a need for expansion and / or the addition of several new WWTP.
- The numbers of customer of desludging services will increase and require more trucks and maybe need partnerships with the private sector (owner of desludging trucks).
- Sludge Treatment Plant (IPLT) at Manggar is already optimal and need necessary expansion and / or the addition of new sludge treatment plant on the outskirts of the city.
- Proceeds from the sale of services are increasing and make reasonable profits.

5.6.3 Proposed organization structure

- Directorate of Technics will be split into two new directorates. Thereby PDAM will have 4 (four) Directors, the President Director, Director of Drinking Water, Director of Wastewater and Director of General Affairs and Finance.
- Director of Wastewater will be in charge of 5 Division Heads, namely (1) Division of Wastewater Planning, (2) Division of the WWTP, (3) Division of Wastewater Operations, (4) Division of Public Services (for on-site sanitation services), and (5) Division of Administration.
- Head of Wastewater Planning will oversee 3 sub-divisions, namely (1) Sub Division of Planning, (2) Sub-Division of Construction Supervision, (3) Sub-Section Documentation and Map.
- Head of the WWTP will oversee 3 sub-divisions, namely (1) WWTP Margasari, (2) WWTP Sepinggan and (3) WWTP Somber. Each Sub-Division is responsible for the operation and maintenance of WWTP, pumps, and supporting facilities.
- Head of Wastewater Operations will oversee 3 sub-divisions, namely (1) Zone Margasari, (2) Zone Sepinggan, and (3) Zone Somber. Each sub-division is responsible for the operation and maintenance of wastewater networks and supporting facilities.
- Head of Public Service will be in charge of 2 sub-divisions, namely (1) Desludging Services (L2T2 and L2T3), and (2) operation and maintenance of Sludge Treatment Plant (IPLT).
- Head of Administration will be in charge of 2 Subdivision, namely (1) Administration and Finance, (2) Customer Relations and Marketing.

Figure 30: Proposed structure of PDAM

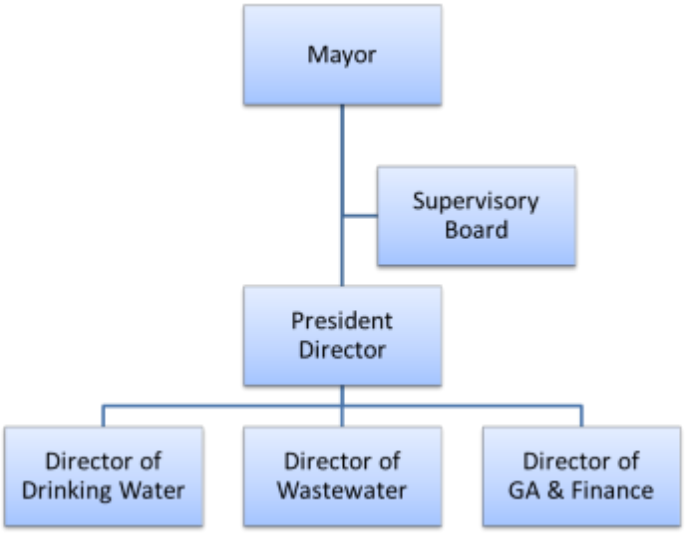
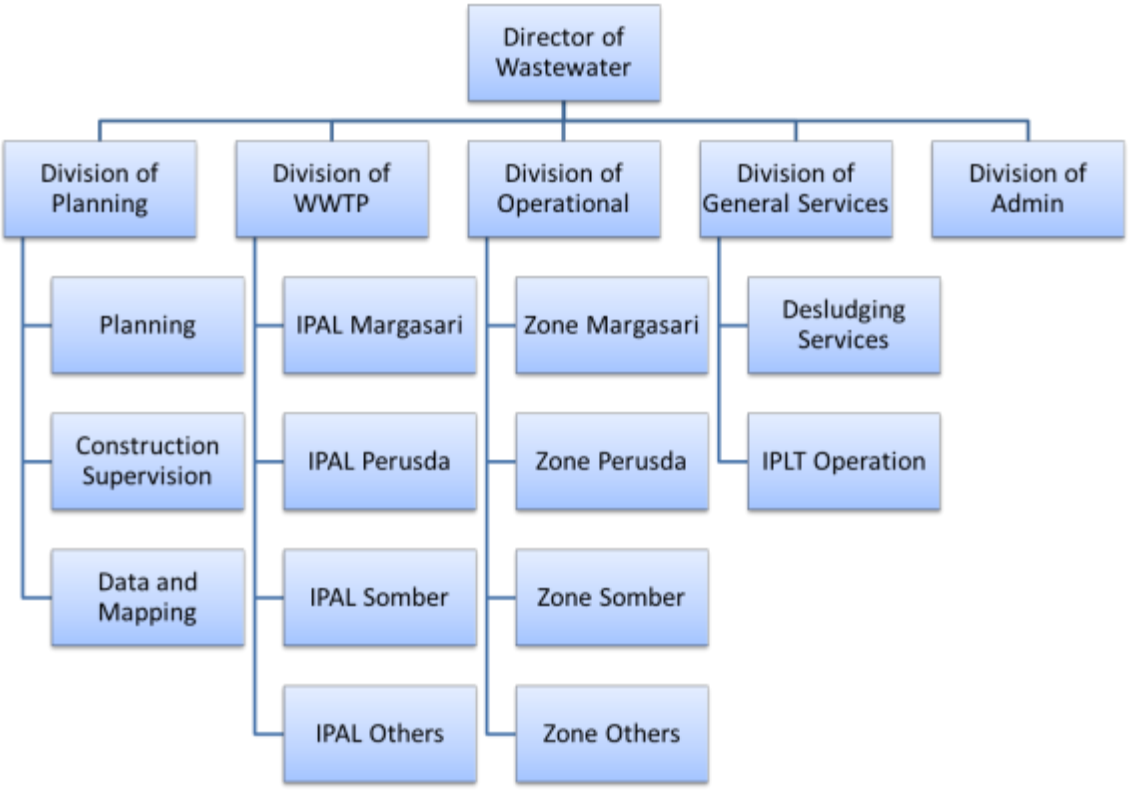


Figure 31: Proposed Organization of Directorate of Wastewater



Note: 'Perusda' should be read 'Sepinggan'

5.6.4 General Tasks and Responsibilities

General tasks and responsibilities of each Sub Division among other as follows:

- Implementation of general administration tasks
- Preparation of work program, annual work plan and budget
- Coordination with other units, internal and external PDAM
- Monitoring and evaluation of the activities

Sub Division of Wastewater Planning:

- Data collecting and processing for wastewater planning;
- Carry out field surveys for wastewater planning;
- Determine the most appropriate equipment in terms of quality standards and prices;
- Planning for new, substitution, addition or expansion of WWTP installations;
- Planning for new wastewater connections;
- Carry out construction supervision and monitoring;
- Maintain, store and reproduction of wastewater planning drawing and mapping;

Sub Division of Wastewater Treatment Plant (IPAL):

- Maintaining cleanliness of the IPAL and its surroundings;
- Maintaining the environmental sustainability around the IPAL (drainage, river flows, solid waste management, etc.)
- Monitoring and checks on the process and results of wastewater processing;
- Monitoring the operations and ensure the smooth and proper functioning of wastewater treatment operations;
- Monitoring the wastewater pollution condition;
- Carry out maintenance and repair of damages/disorder of the WWTP installations.

Sub Division of Wastewater Operation:

- Carry out the installation of new wastewater connection and/or disconnection;
- Carry out the operations and ensure the smooth and proper functioning of wastewater installations operations;
- Carry out maintenance and repairs of damage/disorder wastewater installations;
- Monitoring and checking of the installation of wastewater operation;
- Implement the new, replacement, addition and expansion of wastewater installations;
- Implement new wastewater connections;
- Implement controls on the installation leakages;

5.6.5 Working Relationship

Internal working relationship and coordination between Directorate of Wastewater with other Division or Sub Division as follows:

- Sub Division of Planning
- Sub Division of Procurement
- Sub Division of Warehousing
- Sub Division of Laboratory

- Sub Division of Customer Relations
- Sub Division of Public Relations (PR)

External working relationship and coordination between Directorate of Wastewater with:

- National and Provincial Government
- City Government and Local Parliament (DPRD)
- Donor countries (AusAID, USAID, etc)
- Electricity company (PLN)
- Private sectors and partners
- Non-Government Organization (LSM).

5.7 Program

Short-term program to be implemented in the framework of the implementation of wastewater infrastructure development, especially WWTP Margasari, Sepinggan and Somber are as follows:

1. Review, evaluation and revision of the PDAM Corporate Plan and Business Plan, especially for aspects of wastewater services. Prepare new Corporate Plan and Business Plan;
2. Prepare detailed Feasibility Study (FS) and the preparation of funding from various sources (APBN state budget, APBD local budget, grant or loan from international financial institution or donors, private sectors and other sources);
3. Carry out the preparation of the Master Plan and the Detailed Engineering Design (DED, including Budget and Tender Documents) for the new WWTP Sepinggan and Somber;
4. Implement socialization, public campaign and social marketing to the potential customers in the Sepinggan and Somber areas;
5. Develop a database management for prospective customer (especially for Sepinggan and Somber areas), and updating the database for Margasari areas;
6. Prepare managers, technical staff and operational and maintenance staff through capacity building and training (particularly that will handle the new wastewater technology in WWTP Sepinggan and WWTP Somber);
7. Prepare the PDAM organizational restructuring process, from 3 Directorates to 4 Directorates.
8. Improving and enhancing coordination, cooperation and communication among stakeholders related to wastewater infrastructure development (WWTP) in Balikpapan, including government (national, provincial and local), private sector and local communities.

6 CURRENT FINANCIAL SITUATION MARGASARI

6.1 Margasari WWTP operation

Currently there is only one off-site waste water treatment facility that managed by the city of Balikpapan i.e., at Margasari sub-district which has 800m3/day maximum capacity and operating at around 216 m3/day (27%) and serves 1,512 connections.

Margasari WWTP has been completely built in 2003 that in line with the city Master Plan in which contained KUDP (Kalimantan Urban Development Program) which financed by IBRD Loan.

The mayor decree no.188.45-49/2005 stipulating that the operation of Margasari WWTP was under PDAM which then PDAM established new division: IPAL Margasari.

Since then the operation of Margasari WWTP has received grant from the city budget (APBD):

- from 2003 to 2011 :	Rp 300 million of total
- from 2012 to 2013 :	Rp 500 million of total
- 2014	Rp 1.857 billion
- 2015	Rp 2.2 billion
- 2016	Rp 1 billion
Total	**Rp. 5.857 billion**

For this year 2017 there would be no longer grant for operation of IPAL Margasari.

6.2 Recommended Financial Options

Financing Options

Several external financing options are available for Balikpapan, comprising domestic (APBN, national banking institution and non-banking such as PT SMI and IIF) and international financial institutions and Donors (by bilateral agreements with Government of Indonesia). City of Balikpapan is also to some extent financially capable to finance in the Waste Water sector to realize some of its vision in becoming a green city and sustainable development by applying appropriate waste water management and development (see also sub-chapter Linking Project to Financing).

Potential Sources of Revenues and Tariff Strategy

Several sources of revenues that have been proved to support in proper collecting WW service fee in systematic and organized way are as follows:

1- As far according to the Mayor, Balikpapan has currently achieved 6,9% funding earmarking for sanitation sector which has exceeded the minimum of 2% of the city budget must be allocated for sanitation sector according to Perda of Balikpapan no.8/2016 (article 52). This is also in line with other 342 cities of sanitation care which agree to allocate the minimum of 2% of their budget. Though the fund should be divide into 3 parts of sanitation i.e., drainage, waste water, and solid waste management system.

2- Wastewater bill attached to PDAM bill (for PDAM customers)

Wastewater service fee of some IPAL Margasari customers has been included under the PDAM water supply bill, as currently applied since 2011. This surcharge could be most successful implemented because PDAM is also owned by the local government. This option has been effective to increase collection ratio of more than 72% (since 75% of the WW Margasari customers in PDAM customers) .The current ratio of PDAM service coverage area for Balikpapan City currently is around 76% in 2016 with total customer is around 96,060.

3- Strategy on wastewater service fee collection

Since 2011 WW collection bill has been attached in PDAM water bill which there are around more than 96,000 water connection and more than 85,000 out of these are residential households. PDAM has 76% connection coverage ratio in its service area. With the population of the city are more than 736,000 in 2016 and 3 persons for each household, the total households come to around 240,000 for the city, while the number of household in Margasari serviced by WW and connected to PDAM is only 1,060 (the other 325 are not connected to PDAM), besides there are 126 connection pipe that ready to connect (from DAK) and 500 ready to tap from sAIIG/AusAid and the total is 1,512. Accordingly, the collection rate is around 4% which has effective billing but have potential to be increased to around 40% (96.000 hh), and the remaining 60% requires a different method of wastewater service fee collection mechanism until they get water connection.

The PDAM itself is given authority to manage the operation of existing WWTP in Margasari and is the most suitability to manage other off-site WW development throughout city of Balikpapan.

4- Tariff increasing

Regarding tariff increase, this should be done gradually on phases and depending on the level of service provided by the City of Balikpapan/PDAM (door to door service, through water supply billing or communal service, etc.) and in parallel with additional investments and improvements in the quality of service (to be able to convince the public for the importance of paying more WW service fees), with classifications of the connection users (low, middle and high income, commercial and non-domestic, etc.), since increase will differ between communities. The tariffs and the periodic increase could be done based on the findings of an appropriate survey on the Willingness To Pay (WTP) and affordability of the various communities throughout the City of Balikpapan and at all levels. The PFS 2014 noted that the maximum WTP is maximum Rp.20,000/household/month which still did not represent the community affordability since it was far below the average per capita or household income of Balikpapan

6.3 Service fee (Retribution)

Since year 2011 the levy tariff for waste water service fee is stipulated by Local Regulation (Perda) no. 9/2011. This tariff currently applies for customer connected to WW treatment plant of Margasari which operated under PDAM – IPAL sub division. Nevertheless only some part of the tariff classification applies as indicated on table below:

Table 42: Tariff classification applied based Perda no. 9/2011

	Customer category	Rp./month
1	House hold	15,000
2	Kiosk and shop in market	18,750
3	Shop in streetside / ouside market	22,500
4	Private offices	26,250

5	Lodge	30,000
6	Restaurant	37,750
7	Cook shop	33,750
8	Coffee shop	41,250
9	Hotel	400,000

Source: IPAL Sub Division of PDAM

Nevertheless due to this tariff has been considered being not suitable with PDAM cost spending on ww services operation (after all based on the agreement between PDAM and the city government where PDAM has the right to determine the tariff) the regulation is to be replaced with PDAM Director Decree which considering cost recovery and would be based on water volume consumption. However the decree draft is still in discussion and need to be approved by the local parliament (DPRD).

In relation with scheduled sludge off-drain (L2T2) it is likely all customer connected with PDAM would be additional charge fee of Rp.9500/customer/month with sludge off-drain every 4 year. The off-drain operation PDAM would engage private party as contractor with fee of **Rp.400,000/trip**.

6.4 Revenues

Based on the current tariff the city has received revenues from IPAL Margasari services as shown in table below.

Table 43: Overall sanitation and wastewater revenue (actual) 2012-2015 (in mRp)

Levies	2012	2013	2014	2015
Collected Revenue	**249.2**	**183.8**	**183.6**	**189.0**

Source: BPKAD of Balikpapan 2011 - 2015

The table above shows that there is no significant increase in revenue. Unfortunately the revenue levy cannot be used directly by its management but first must make a request to the city to cover the cost needed which is – the same process as government agencies – which need more complicated process and cannot ensure its realization amount (substantially below the need). This has become important issue that hinders the sanitation development and services.

6.5 Levy collection

The collection ww levy for customer connected with PDAM is carried out every month by PDAM which attached to its water bill while customer without connection to PDAM pipe done by staff that visits each of them or by 'door to door'. Currently there are 1,512 customers of wastewater services which comprises 1,061 connected to PDAM pipe (out of total PDAM customers of approx. 96,060 which has achieved 76% coverage of the total Balikpapan population) and 325 that are not connected to PDAM and 126 ready to connect to houses.

The efficiency of collecting ww levy for IPAL Margasari customer till November 2016 is around 72.2% (based on data from IPAL Margasari management).

6.6 Customers

Currently the existing customer classification of IPAL Margasari is shown as in table below.

Table 44: Structure of customers for IPAL Margasari

	Customer category	With PDAM water connection	without PDAM water connection	Add. from DAK fund	Total
1	House hold	1018	319	126	1,463
2	Social	26	1		27
3	Shop house	14	4		18
4	Offices	3	-		3
5	Hotel	-	1		1
	Total	1061	325		1,512

Source: Balikpapan PDAM - IPAL subdivision 2016

In the end of 2016 there are more new 126 house connection from national specific allocation fund (DAK) and piping ready for 500 connections from SAIIG program (AusAID) total expected in 2017 to become 2,012 units.

6.7 Present O&M Costs Margasari

The cost structure for operating WW plant for 2016 in Margasari are as follows:

Table 45: Cost Structure for IPAL Margasari 2016

		unit cost (Rp mill)	Volume	Total (Rp mill)
Operation and Maintenance				
	Electricity	9.250	12	111.000
	Fuel	10.032	1	10.032
	Chemicals	0.836	12	10.027
	Maintenance	23.750	12	285.000
Personnel				
	Permanent staff (9 person)	53.625	12	643.500
	Wages (contractual of 4 person)	11.500	12	138.000
Overhead				
	Office supply	1.900	12	22.800
	Socializing	40.000	1	40.000
	Subscription Fee of Forkalim	12.000	1	12.000
Depreciation		0.997	12	11.969
	Total			**1,284.33**

Cost of effluent processed / connection/month (Rp)	**102.27**

Source: PDAM – IPAL Margasari Subdivision

6.8 Revenue and Cost Margasari PFS2013 vs Actual

The tables below shows the summary of revenues and cost in the previous PFS report 2013 in terms of total, as per connection per year, per month, per day and per m3 waste water entering the installation in Margasari. Then what is it like if compared to the current condition.

Table 46: Revenues vs Cost for PFS 2014

Revenue		Costs		Units
Rp	US$	Rp	US$	
249m	21,282	1,142 m	97,607	total / yr
181,223	15.49	831,150	71.04	per yr per conn.
15,102	1.29	69,262	5.92	per month per conn.
682,192	58.31	3,128,767	267.42	per day
4,264	0.36	19,554	1.67	per m^3

Source: PFS report 2013 by Mott McDonald

Table 47: Revenues vs Cost for Actual 2016

Revenue		Costs		Units
Rp	US$	Rp	US$	
185m0	13,698.06	1,284 m	95,135.56	total / yr
133,423	9.88	925,977	68.59	per yr per conn.
11,119	0.82	77,165	5.72	per month per conn.
506,640	37.53	3,518,712	260.65	per day
2,346	0.17	16,290	1.21	per m^3

Source: PDAM-IPAL Margasari 2017

The table above indicates the revenue of in 2016 was going down from Rp.4,204 /m3 to became Rp 2,346/m3 while the cost is Rp 16,290 which was smaller than in the PFS 2014 (Rp 19,554/m3).

The revenue can only cover around 14.4% of the total costs while the city support around Rp 1 billion through grant, and the remaining was covered by PDAM.

6.9 Overview of PDAM Financial Capacity

The financial condition of PDAM can be seen from the evaluation and scoring on its performance in 2015 based on The Decree of the Chairman of BPPSPAM (Water supply system development agency) no. 002/KPTS/K-6/IV/2010 on Performance Evaluation of PDAM Services. PDAM Balikpapan got rating of “Health” by the Agency. The evaluation comprises Financial, Services, Operational and Personnel aspects. All evaluations were presented using main ratios as follows:

Table 48: Ratios Financial Performance PDAM Tirta Manggar-City of Balikpapan 2014-2015

Ratio		in million Rp	2015 (in mIDR)		2014 (in mIDR)		increase/ decrease
1	Net profit to Asset	Net profit	8,085	2.4%	14,914	4.7%	-2.26%
		Productive asset	332,265		317,566		
2	Profit Margin	Earnings before tax	8,085	3.4%	14,914	7.2%	-3.86%
		Sales (water)	240,771		206,618		
3	Current ratio	Current asset	151,732	7.31	145,457	4.49	2.82
		Current liability	20,757		32,384		
4	Long-term debt to Equity	Long-term debt	6,385	0.02	6,351	0.02	(0.00)
		Equity	354,235		337,879		
5	Total asset to Total debt	Total asset	381,545	13.97	376,613	9.72	4.25
		Total debt	27,310		38,734		
6	Operating Expense Ratio	O&M Cost	236,361	0.98	197,261	0.95	0.03
		Operating income	240,771		206,618		
7	Debt service	Earning before Depriciation	33,246		39,977		
		Principal repayment + interest + other related cost	-		-		
8	Productive asset to sales (water)	Productive asset	332,265	1.50	317,566	1.63	(0.12)
		Sales (water)	220,889		194,923		
9	Receivable collecting period	Operating receivable	15,568	23.28	9,303	16.21	7.07
		Daily sales	669		574		
10	Collecting effectiveness	Collected customer bills	213,164	96.5%	192,834	98.9%	-2.43%
		Water selling	220,889		194,923		

Source: Performance Audited Report of Balikpapan 2015

It shows that the Profit Margin decreases significantly from 7.2% in 2014 to 3.4% in 2015 while the Operating Expense Ratio increases from 0.95 to 0.98 at the same period. This learns that the increase of water sales was not followed by its gross profit (going down from Rp 14.9 billion to just Rp 8.1 billion) since operating cost increases by Rp 40 billion but operating income just increases by Rp 36 billion. It suggests that the PDAM need to exert attempts to reduce OM cost to increase its efficiency.

The Borrowing Capacity

It should consider **Total asset to Total debt ratio** and the **Debt Service Ratio**. The first ratio shows 13.97 in 2015 which has increased from 4.25 in 2014. If the appropriate ratio should be minimum 1.7 which means “good” or score 4 out of 5 (according to the Technical guide for

PDAM evaluation performance, prepared by BPPSPAM and in line with Public Works Regulation 18/2007 on Water Supply Dev. Management) or being considered as viable to propose debt. Beside there is Debt service ratio which assuming the minimum debt service is no more than 2.5 and the same interest rate applies (8.25% + 0.75%) with tenor of 10 years then the maximum capacity to borrow should no more than **Rp 85.3 billion** (its present value).

7 FINANCIAL ASPECTS

7.1 Review PFS

There are several aspects that should be taking into account namely municipal financial aspect, various schemes that can link the project to financing, the financial condition of existing waste water plant operation by IPAL SubDivision of PDAM and reviewing the financial content in the PFS 2014.

Socio-Economic: The PFS 2014 uses a number of variables to assess socio-economic of the project, a/o health savings and polluter levy.

For more proper analysis these parameters should be included in Social Cost Benefit Analysis for selected alternatives and also must include the one without project. The parameter used for this analysis such as economic net present value (ENPV) which should be positive and economic internal rate of return (EIRR), that should be above the minimum social discount rate.

Comments on the PFS 2014:

- Apparently not seen the parameters used: NPV, FIRR, EIRR, Payback period
- There seems no sensitivity analysis
- Span of analysis was using 15 years which should properly be matched with the project lifetime of 30 years or more.

7.2 Local Financial Capacities

This sub chapter is to assess the financial condition of City of Balikpapan. The assessment uses several ratios such as debt service coverage ratio, borrowing capacity, financial independency, effectiveness and efficiency of budget realization.

Analysis of the municipal government budget is undertaken with the objective:

a. To assess if funds are available to finance public infrastructure development in Balikpapan especially in the field of sanitation and waste water;

b. To identify opportunities to increase availability of funds for the sanitation and waste water services development project by:

    - Increasing availability of city budgets by – among others – improving the financial efficiency of the city administration, increasing wastewater services fee collection rates or introducing new local taxes and levies;
    - Increasing availability of city budgets by prioritizing budgets specifically for sanitation and waste water services investments.

7.3 Revenue and Expenditure

The description of financial management for Balikpapan is stipulated by Ministry of Home Affairs Regulation no. 21/2011 on Local Finance Management Operation Guidance.

Table 49: Actual Revenue and Expenditure Balikpapan 2012 to 2016 (in Rp.billion)

	2012	2013	2014	2015	2016*	Growth	Share
a. Revenue	1,647.1	2,422.2	2,498.5	2,230.0	2,234.8	**7.9%**	100.0%
i. Local Income	290.0	470.7	752.6	579.0	556.0	17.7%	24.0%
ii. High level government transfer	1,074.5	1,281.5	1,321.5	1,145.3	1,265.4	4.2%	55.2%
iii. Other Income	282.6	670.0	424.4	505.7	413.4	10.0%	20.8%
b. Expenditure	1,823.8	2,420.8	2,499.6	2,907.6	2,459.6	**7.8%**	100.0%
i. Operating Expense	1,233.5	1,334.2	1,462.0	1,793.1	1,703.1	8.4%	62.1%
ii. Capital Expense	585.3	1,084.1	1,032.8	1,090.4	749.1	6.4%	37.5%
iii. Contingencies	5.0	2.5	4.8	24.1	7.5	10.7%	0.4%
c. Surplus/(deficit)	-176.7	1.4	-1.0	-677.6	-224.9		
d. Financing in	186.5	984.4	964.3	935.7	227.9		
e. Financing out	9.9	21.0	27.6	30.2	3.0		
f. SILPA	0.0	964.8	935.7	227.9	0.0		

Source: Actual Budget Report 2012-2015 and Budget 2016; BPKAD of Balikpapan

The table above shows that the city's revenue was growing by an average of 7.9% p.a. since 2012. Growth is made up of local income of 24.0%, transfer from high level government (55.2%) and other income (20.8%). This means Balikpapan is high dependent on national financial policy. Nevertheless the growth of local income is much higher than the one of higher level transfer (17.7% versus 4.2%).

On the expenditure side the yearly growth has been growing by an average of 7.8% since 2012 which is still a bit lower than of its revenue (7.9%), thus the city could still has least saving.

The growth of capital expenditures from 2012 was a bit lower than its total growth (6.4% versus 7.8%). This means the efficiency of the city has sufficient balanced in terms of CAPEX.

On the contrary the growth of operating expense (OPEX) which dominated the city expense of 62.1% has been growing substantially by 8.4%. OPEX consist of expenses for personnel, goods and services for city administration, maintenance and operation of city infrastructure. OPEX dominated the city expense of more than 60%.

7.4 Ratios

A number of ratios have been used for assessing the financial condition of the city. Since there is no specific regulation on assessing a local government financial condition then it uses several

reference writing (Mardiasmo[3] and Brown[4]), such its independency from central government funding, effectiveness and efficiency. Important financial ratios for the City are indicated in the table below.

Table 50: Major Financial Ratios of the City of Balikpapan 2011-2015

Ratio	2012	2013	2014	2015	2016	Average	Trend
Independency Local income / Higher transfer	26.9%	36.7%	56.9%	50.6%	43.9%	**43.0%**	**13.1%**
Fiscal Decentralize Local income / Total revenue	15.6%	19.4%	30.1%	26.0%	24.9%	**23.2%**	**12.4%**
Effectiveness Actual / Target of local income	Tbd	132.7%	117.8%	107.2%		**119.2%**	**54.0%**
Efficiency Capital expense / Total expenditure	41.2%	44.8%	41.3%	37.5%	30.5%	**39.1%**	**-7.3%**
Efficiency Operating expense / Total expenditure	58.4%	55.1%	58.5%	61.7%	69.2%	**60.6%**	**4.3%**
Efficiency Personnel expense / Total expenditure	33.4%	32.2%	33.8%	32.7%	41.7%	**34.8%**	**5.7%**

Source: Actual Budget Report of Balikpapan 2012-2015, and CDIA Consultant Assessment

Independency & Fiscal Decentralization

The table indicates that the Independency (indicated by the ratio of local income to higher transfer) is 43.0% on average and has positive trend by 13.1% since 2012. Fiscal Decentralization reflects the local income as a percentage of total revenues. Since 2012 up to 2015, the ratio is 23.2% and has grown on average 12.4%.

When looking at these ratios, they seem to indicate that the city has high dependency on the national government to fund its development. Nevertheless it shows a significantly positive growth.

[3] Prof. Dr. Mardiasmo, MBA; Otonomi dan Manajemen Keuangan Daerah, 2015

[4] Brown, KW 1993, The 10-Point Test of Financial Condition: Toward an Easy-to-Use Assessment Tool for Smaller Cities. Government Finance Review, vol. 9, no. 6

The above analysis should raise awareness for the city to further increase local income, for example by improving collection rates of taxes and levies and enforcing appropriate policies and regulations.

Effectiveness

The effectiveness ratio reflects the Actual local income as a percentage of the projected Target income. This ratio is 119.2% on average between 2013 – 2015. This learns that the actual income was over its target by 19.2% on average.

The effectiveness suggests that tax collection rates perform very well the forecasts. However due to decentralization ratio (local income to total revenue) previously mentioned which was relatively low of 23.2%. This should raise question if there are still possibilities to increase local taxes and levies and what is the collection rate for each of them measured such as number of inhabitants and companies subject to tax and levy in comparison with those of paying the tax and levy.

Efficiency

The ratio between capital expense and total expenditure shows 38.8% which also indicates that most of the expenditure is for operating expenses (60.8 %). Of operating expenses 57.2% goes to personnel (equaling 34.8% of total expense) and 42.8% is for non-personnel. This means a maximum of 26.0% of total expenditures could have been used for maintaining local government assets and infrastructure.

The efficiency ratio could suggests that relatively little of the available budgets spent for the city most needed, i.e. capital and operating expenditures to improve and maintain the city's infrastructure.

7.5 Fiscal Capacity

Fiscal capacity is using for determining amount of national grant (DAU) for local government and Loan provision. According to MoF Regulation no.37/PMK.07/2016 on Map of Local Fiscal Capacity, City of Balikpapan has scored 4,80 which classified as Very High.

7.6 Real Financing Capacity

Real financing capacity is the ability of the city to finance its infrastructure development needs after paying non-discretionary expenses, mainly personnel expenses and other high priority expenses. The real financing capacity is the amount that can be used for flexible expenses, including investment, maintenance and operation of the municipal infrastructure.

Table 51: Real Financing Capacity for Balikpapan (in billion Rp)

	y2012	y2013	y2014	y2015	y2016*	Growth
Revenue (excl. earmarked trnfr)	1,633.7	2,399.0	2,490.6	2,220.5	2,148.2	7.1%
Previous Surplus/Deficit	186.5	984.4	964.3	935.7	227.9	
Sub total	***1,820.2***	***3,383.4***	***3,454.9***	***3,156.2***	***2,376.1***	
Deducted by non-discretionary:						
Mandatory & high priority exp.	**925.5**	**1,051.7**	**1,139.7**	**1,284.8**	**1,386.1**	10.6%
Real Financing Capacity	**894.67**	**2,331.7**	**2,315.2**	**1,871.4**	**990.0**	

Capacity for Sanitation	**61.73**	**160.89**	**159.75**	**129.12**	**68.31**

Source: Actual Budget of Balikpapan 2012-2015, Budget Plan of Balikpapan 2016 and Analysis. Assuming high priority expenses is around 35% of the staff expenses (based on best practice for other similar type of other cities).

Table above indicates the amount of Real financing capacity for all development sector and for sanitation sector assuming the city (according to city spending for sanitation which achieved 6.9% in 2016 of the total).

The capacity for sanitation was dropped in 2015 to become **Rp 129.12 billion** (around US$ 9.56 million) and keep lowering in 2016 to become **Rp. 68.31 billion** (around US$ 5.06 million).

Since the RPJMD of Balikpapan has ended in 2016 and the one of next 5 periods is still in progress, the estimate of Real Financing Capacity and Capacity for Sanitation assumes 7% growth of the Revenue and 9% of the Mandatory and other high priority expenses as shown on table below.

Table 52: Estimate Real Financing Capacity and Capacity for Sanitation over next 5 years

	Est. growth	2017*	2018*	2019*	2020*	2021*
Revenue (excl. earmarked trnfr)	7.0%	2,298.6	2,459.5	2,631.7	2,815.9	3,013.0
Previous Surplus/Deficit						
Sub total		***2,298.6***	***2,459.5***	***2,631.7***	***2,815.9***	***3,013.0***
Deducted by non-discretionary:						
Mandatory & high priority exp.	9.0%	1,510.9	1,646.9	1,795.1	1,956.6	2,132.7
Real Financing Capacity	3.0%	**787.7**	**812.6**	**836.6**	**859.3**	**880.3**
Capacity for Sanitation		**54.35**	**56.07**	**57.72**	**59.29**	**60.74**

Source: Consultant assessment

Further according to Perda no.8/2016 (article 52) funding needed for sanitation operation could be from either National, Provincial or Local budget or community and other sources of fund as well according to prevail regulations. Funding from Local budget alone could be at least 2% from total budget which was equal to **Rp 49.25 billion** (US$3.65 million) (2% times total revenue+financing) in 2016.

Funding from National and Provincial budget should be in line with Local mid-term development Plan (RPJMD) and Mid-term infrastructure investment plan (RPIIJM) for related sector. However the old RPJMD was for period of 2011-2016 while the next 5 years period is still to be in discussion. Anyway accessing fund according to these document need complicated coordination and time consuming and frequently not suitable with what is needed due to different cause such as incomplete document, different priority between national and local, and limited available budget.

7.7 Debt Service Coverage Ratio and Net Borrowing Capacity

DSCR[5] is a ratio to measure capability of a local government to do repayment of its outstanding debt (usually used for middle or long term debt). It is one of requirement to propose new debt (borrowing capacity) as per Government Regulation no.30/2011 that stipulates Local Debt. Further DSCR will determine the maximum debt could be taken (net borrowing capacity). It is noticed that since 2010 City of Balikpapan has paid off its outstanding long term debt. The table below shows current DSCR and net borrowing capacity for the city of Balikpapan.

The formula to calculate the DSCR is:

(average of audited Net Income of previous 3 years)/ (average of interest+ principle repayment+ other debt related cost of existing and proposed debt)

The formula to calculate the potential borrowing capacity is:

- Net Income = Local income + DAU Grant + Sharing - reforestation - mandatory expense (staff of its local government and its parliament/DPRD)
- Maximum 75% of the total revenues in the previous year (audited)
- DSCR cannot be below 2.5 to propose new debt.
- Total debt does not exceed 60% of GDP. In 2015 GDP of Balikpapan reached Rp.40.21 trillion (US$ 3 billion) with economic growth of 4.28%.

Table 53: Net income of Balikpapan 2012 to 2016 (in billion Rp.)

		2012	2013	2014	2015	2016*	Avg growth
A	**Income**						
	Total Revenue (excl. earmarked)	1,633.7	2,399.0	2,490.6	2,220.5	2,148.2	7.1%
B	**Net Income**						
	Local income	290.0	470.7	752.6	579.0	556.0	17.7%
	Grant (DAU)	385.1	427.1	450.0	388.2	391.9	0.4%
	Sharing (DBH excl. reforestation)	1,003.6	1,168.0	1,073.8	970.0	968.9	-0.9%

[5] Government Regulations No 30/2011 stipulates that Cities can borrow from the National Government, financial institutions (bank or non-bank), other local government and people. The regulation stipulate that:

- DSCR > 2.5 : the local government is allowed to obtain debt
- DSCR = 2.5 : the local government is allowed to obtain debt with certain condition,
- DSCR < 2.5 : the local government is not allowed to obtain debt.

All of these loans must meet the main conditions for Local Debt such Debt Service Coverage Ratio (DSCR) of 2.5, while the total amount of loan should not exceed 75% of previous year of actual general income, no overdue with other loans from the National Government.

	Sub-Total of Net Income	***1,678.7***	***2,065.8***	***2,276.4***	***1,937.2***	***1,916.8***	***3.4%***
	Deducted by:						
	Mandatory expense	925.5	1,051.7	1,139.7	1,284.8	1,386.1	10.6%
	Total Net Income	***753.1***	***1014.1***	***1136.7***	***652.4***	***530.7***	***-4.7%***

The table above shows that General revenue has been growing by an average of 7.1% and Total of Net income of 3.4%. Though Local income has a substantial growth rate of 17.7% but Transfer which comprises Grant (DAU) and Sharing tend to be steady or even decreasing by 0.4% and minus 0.9% respectively. On the other side the mandatory expenses (staff of the government and parliament) has been growing by an average of 10.6% which was very high in comparison with the total of Net income (3.4%). This suggests that the city government should take measures to balance its mandatory expense.

The following table assumes conservative growth of Local income (15%) and Grant by 5% and Sharing (excluding reforestation fund) by 0% and Mandatory expense by maximum 7%. The Net borrowing capacity can be estimated as presented on the table below.

Table 54: DSCR & Net Borrowing capacity 2017 to 2019 (in billion Rp.)

		% Est	2017*	2018*	2019*
A	**Income**				
	Total Revenue (excl. Earmarked)	**5.0%**	**2,255.6**	**2,368.4**	**2,486.8**
B	**Net Income**				
	Local income	15.0%	639.4	735.3	845.6
	Grant (DAU)	5.0%	411.5	432.1	453.7
	Sharing (DBH excl. reforestation)	0.0%	968.9	968.9	968.9
	Subtotal		***2,019.8***	***2,136.3***	***2,268.1***
	Deducted by				
	Mandatory expense	10.0%	1,524.7	1,677.2	1,844.9
	Total Net Income		***495.0***	***459.0***	***423.2***
C	***Nett borrowing capacity***		***1,611.2***	***691.4***	***-***
D	***DSCR***		4.94	2.50	2.21

Source: Actual Budget of Balikpapan 2012-2015, Budget 2016 and Analysis.

Assuming 8.25%+ 0.75% pa interest and provision rate prevail (according to 2017 State Bonds (SUN) benchmark with tenor of 20 years which comply with Decree of Directorate General of Financing and Risk no.47/PR/2016),

The analysis shows that the estimates of maximum the city can borrow in 2017 would be Rp. 1.611 billion (US$ 119.3 million) and in 2018 around Rp. 691.4 billion (US$ 51.2 million). In 2019 its DSCR calculation becomes fewer than 2.5 causing no more borrowing capacity in 2020.

There are number of permutation to keep DSCR equal to or above 2.5 i.e.:

- Decreasing amount of the drawdown, and/or
- shortening the tenor, and/or

- find another source of debt which could give lower interest rate.

7.8 Linking Project to Finance

There is a number of ways/scheme for linking the project to financing that should need further assessed.

The following are several schemes that possible using for access funding and finance for the project:

1. *Government budget* (at national/local level)

   National/local budget is one of conventional financing options which facing very limited in availability of fund and likewise propose Local debt to national.

2. *Grant*

   Currently there is an available grant for waste water sanitation system from Australia through sAIIG program. The amount of money provided is around Rp 400 billion and has been used around Rp 35 billion thus leaving Rp 335 billion that could be utilized by the local government. It can be used to build connection pipe from houses to manhole @ Rp 3,5 – 4 million/connection.

3. *Local bond* (Obligasi Daerah)

   It is an option that is currently supported by national government. However local governments need longer time for meeting its requirement and preparing their internal capacity.

4. *Local owned company (BUMD) assignment*

   With own paid-up capital around 20%-30% of the total project value they could get substantially financing from various banking institution and/or capital market. The downside of this option a/o is when there is an error in determining and selecting the project then the company have to bear the loss i.e. paid-up capital, insufficient revenue, swelling of operating cost, etc.

5. *Government – Business Entity Partnership*

   This option is expected to be mutual cooperation between government (as facilitator), private company and community in which the asset still owned by government and could do proper risk sharing between parties. With this option government could optimize in using its budget to finance project development. The downside of this option when the entity partner do not have enough capability to operate and manage the project which could cause harm to the project owner/government.

6. *Local debt*

   Local Debt would be highlighted due to complexity and long processed of other options. Local debt is an essential component in implementing local autonomy and fiscal decentralization, that could provide financing source alternative for local government to speed up local economy growth and improving public services. Of its benefits are to finance procurement of public infrastructure and facility and/or other local government owned asset in relation with public services which could increase local revenue directly or indirectly.

   However debt could carries risks a/o principal repayment installment, fiscal capability sustainability, exchange rate, and/or operating risks. The following requirement should be taken into account which must comply with PP no.30/2011 on Local Debt:

a. Prudent in determine amount of debt to be proposed : maximum 75% of previous year of net income (Total revenue – DAK – emergency fund – existing debt – other income for specific use)
b. Ability to pay back the debt : indicated by DSCR which should be minimum of 2.5
c. No overdue on debt from national government
d. Approved by local parliament (debt) for medium-term and long-term debt

One of the institutions that supported by the national government to provide financing for infrastructure development is PT SMI which was established as an infrastructure financing state owned company according to PP no.66/2007 jo PP no.75/2008.

Further Requirements should comply with PMK no.174/2016 on Guarantee for Local Debt (Art.7 point 1 & 2) are as follows:

1. PT SMI would receive debt proposal from local government to obtain financing for their infrastructure development
2. Local Government need to attach supporting documents:
    a. Local Parliament (DPRD) approval
    b. Copy of inauguration document of the local head
    c. Statement that the Local Government do not have overdue of debt from the National
    d. Feasibility Study document
    e. Audited financial report
    f. Official applicable docs such as RPJMD
    g. Budget plan of the current year

Stages needed to propose Local debt to SMI is described below:

- **Local government**:

Propose debt request - requirement match checking –presenting project by head of local government – visit project location

- **By SMI**:

due diligence and FS – take decision – offering letter – signing agreement in project location – monitoring – loan drawdown – establish effectively requirement.

8 COSTING AND FINANCIAL ANALYSIS

Expenditures for waste water system development consist of capital expenditures (CAPEX) and operation & maintenance expenses (OPEX). The following sections present the CAPEX and OPEX for the proposed waste water system for city of Balikpapan and the three investment packages.

8.1 Costing for Recommended Waste Water System

Expenditures

Expenditures for WW development plan consist of capital expenditures (CAPEX) and operation & maintenance expenses (OPEX). The following sections present the CAPEX and OPEX for the recommended WW development system for the City of Balikpapan at Margasari, Sepinggan and Somber, namely optimalization of Margasari WWTP and new development of WWTP system in Sepinggan and Somber.

8.2 Capital Expenditures (CAPEX)

Land:

All optimalization (at Margasari) and new constructions (at Sepinggan and Somber) are assumed using the available land owned by the Balikpapan government, however in Somber 2,000 m2 is available and there is a need of 3,280m2 additional land for construction of the waste water treatment plant. This purchase is included in the cost estimate.

WWTP and its equipment:

The WWT development system recommended in the technical concept for City of Balikpapan would require the following capital expenditures after including the existing equipment for Margasari WWTP that was still in good working condition.

The plan for WWTP of Margasari is to optimalize the existing plant in Margasari from its current operation capacity of 216 m3/day to become its original design capacity of 800 m3/day with replacing 13 new pumps with automatization control equipment, adding water meter effluent discharge etc..

The CAPEX for Sepinggan and Somber are to build new construction of WWTP and network piping with new house connections.

For Sepinggan and Somber the WWTP and all equipment figure is presented in table below.

Network Piping and House Connections:

Margasari would need to replace 24,696 m of dia.90 mm and 7,221 m of 100 mm to resp. 150 mm and 200 mm network pipes. The old network pipes and the number of connections could be increased to 2,200 from 1,512 currently.

The number of household connections for WWTP in Sepinggan is estimated of 5,000 HH and for WWTP in Somber 5,500 HH. Besides there would be number of small commercial and non-domestic connections which estimated around resp. 20% and 5% of the number of its household.

The CAPEX for the different equipment are presented in Tables below (as in the technical section plus inclusion for socialization cost and contingency of 15%).

Table 55: Total CAPEX ww system Margasari, Sepinggan and Somber areas (constant price 2017 mRp)

Package 1: Improvement of Margasari	vol	price unit- Rp 000	Sub Total
WWT Improvement & Automatization	1	3,766,000	3,766
Pump procurement & Installment w/ Lev	20	50,000	1,000
Replace Sewer Pipe d 90 by 150 mm	24,696	1,967	48,565
Replace Sewer Pipe d 100 by 150 mm	7,221	1,967	14,200
House connection	210	6	1,260
Reconnected Grey water pipe	1,285	900	1,157
DED Preparation	1	2,798	2,798
Social Engineering	1	250	250
Contingency	15%	69,947	10,492
Total (constant price)			***83,487***

Package 2: Development of Perusda	vol	price unit- Rp 000	Sub Total
Site preparation & earthfill	4,800	2,500	12,000
WWT Plant Construction	2,000	14,625	29,250
Trickling Filter Unit	1	20,000,000	20,000
Biogas system & Pre-treatment	1	3,120,000	3,120
Electrical & Mechanical Work	1	4,387,500	4,388
Facility building & site works	1	8,666,667	8,667
Sewer pipe	1	64,715	64,715
Flood Protection			9,528
Manhole	620	12,000	7,440
Pipe Bridge	1	2,500,000	2,500
Pump Stations	3	3,000,000	9,000
House connection	5,000	6	30,000
DED preparation	1	8,024	8,024
Social Engineering	1	500	500
Contingency	15%	181,668	27,250
Total (constant price)			***236,382***

Package 3: Development of Somber	vol	price unit- Rp 000	Sub Total
Land acquisition	3280	1500	4,920
Site preparation & earthfill	5280	1500	7,920
WWT Construction	2,200	14,625	32,175
Aerobic Pond	1	9,533,333	9,533
Biogas system + Pre Treatment	1	3,432,000	3,432
Mechanical Electrical Work	1	4,826,250	4,826
Facility Building & Site Works	1	9,533,333	9,533
Sewer pipe	40,262		87,063
Manhole	805	12,004	9,663
Pipe Bridge	1	2,500,000	2,500
Pump Station	2	3,000,000	6,000
House connection	5,500	6	33,000
DED Preparation	1	8,423	8,423
Social Engineering	1	500	500
Contingency	15%	197,726	29,659
Total (constant price)			***249,148***

Source: Consultant

8.3 Operating and Maintenance Expenses (OPEX)

Assumptions

Operation & Maintenance expenses for the recommended WWT system consist of several components and assumption which are as follows

Table 56: O&M costs for WWTP Margasari, Sepinggan and Somber

For Margasari	Rp million/yr
Power cost	856.6
Recurring cost	387.5
Civil, EM, and Maintenance cost	265.1
Overhead	203.9
Manpower and staff	326.3
For Sepinggan	
Power Cost	179.2
Civil, E&M maintenance cost	932.0
Recurring cost (chemical, etc)	430.1
Non-recurring cost (7 years for E&M item)	1,168.6
Manpower O&M cost	215.1
For Somber	
Power Cost	197.2
Civil, E&M maintenance cost	1,025.2
Recurring cost (chemical, etc)	473.2

Non-recurring cost (7 years for E&M item)	1,285.4
Manpower O&M cost	236.6

Source: IPAL Margasari sub-Division, PDAM Balikpapan and Consultant

Other Cost Assumptions

Projections are consisting of several projections of CAPEX and OPEX, Depreciation, and Revenue Income Two scenarios have been proposed, namely, conservative scenario (with existing prices and WW service fees) and realistic scenario (based on upgrading the Margasari WWTP and new WWTP in Sepinggan and Somber with its service quality and consequently higher WW service fees). The assumptions used for this financial analysis are as follows:

1- Escalating factor: is applied for some of the OPEX and CAPEX components that could be produced locally. OPEX escalation factors are in accordance with national inflation rate BI (Indonesian Central Bank) estimation of 4% on average. Though estimation for salaries and wages could be higher.

2- The sources of funding to finance CAPEX and OPEX (financial gap) are assumed to be from the Local Government, Central Government, and loans and/or grants.

8.4 Funding Assumptions

The land is assumed could be provided by the city goverment while the WWTP construction, pumps, mechanical electrical equipment and sewer pipe financed by the National grant of around 30% of its investment value and for part of household connection installation cost can be financed by the city or other Grant. The rest of could be financed by debt which

Table 57: Funding Assumptions

Debt (Rp million)	70%	
Gov.support (Rp million):		
- Grant from National	30%	Construction, EM equipment, Pumps, Sewer Pipe
- City Budget (APBD)	Maximum Rp. 18.12 billion/yr	For part of household connection and some of OM cost
- Household and Non domestic		According to the tariff applies
Debt interest rate+prov. (p.a.)	9.0%	Based on 8.25% National Bond rate bencmark for 20 years plus 0.75% additional interest.
Debt Tenor		10 years
Grace period	1	1 year

8.5 Tariff and Revenue

Revenue is coming from WW service fees, user connection fees and installation over a period of analysis of 30 years.

Waste Water Service Fee

These revenues are based on the existing tariff for waste water (Perda no.9/2011) and PDAM Director Decree no.3/2015 that needs to be adjusted overtime.

Table 58: Tariff structure of Wastewater Services

Tariff			
	Escalating factor	20%	every 3 years
Conservative	Household	15,000	Rp. /conn/mo
Based on Perda no.	Social	15,000	Rp. /conn/mo
9/2011	Shop house	26,250	Rp. /conn/mo
	Offices	22,500	Rp. /conn/mo
	Hotels	400,000	Rp. /conn/mo
Realistic Based on 20% of water use price (Based on PDAM tariff and average of water use)	Household	31,650	Average (Rp./conn/mo)
	Social	6,696	Average (Rp./conn/mo)
	Shop house	42,834	Average (Rp./conn/mo)
	Offices	14,544	Average (Rp./conn/mo)
	Hotel	42,834	Average (Rp./conn/mo)

Source: PDAM and Perda no.9/2011 on Balikpapan WW Tariff

Some of the WW billing is carried out by the PDAM in the form of a surcharge on the monthly water bill between City of Balikpapan and PDAM.

The billing development plan

Table 59: Percentage of Connections billing Margasari

Collection	Conn.Type	Percentage
PDAM	Household	73.4%
PDAM	Social	1.9%
PDAM	Shop house	1.0%
PDAM	Offices	0.2%
PDAM	Hotel	
	Sub total	76.6%
Non-PDAM	Household	23.0%
Non-PDAM	Social	0.1%
Non-PDAM	Shop house	0.3%
Non-PDAM	Offices	0.0%
Non-PDAM	Hotel	0.1%
	Sub total	23.4%
	Total	100%

Source:Balikpapan IPAL Margasari

The tariffs are assumed to increase 20% every 3 years and the collection rate estimated could achieve 90% compared as 72% in Margasari.

House Connection Fee

It is a one-time fee which should be paid by household once being connected to WW reticulation pipe network. It is estimated around Rp 1.2 million for household, Rp 1.5 million for small commercial, and Rp. 6 million for non-domestic.

Table 60: House Connection Development

Connection			y-0	Y-1	y-2	y-3
Margasari	Existing connection (unit)					
	- KUDP (since 1995)	1,386	1,386			
	- SAIIG	500	500			
	- DAK	126	126			
	- New connections	210		210		
Sepinggan	- New connections	5,000		1667	1667	1667
Somber	- New connections	5,500		1833	1833	1833
	Total connections	**12,722**	**2,012**	**3710**	**3500**	**3500**

Source: IPAL Margasari Div. And CDIA estimates

8.6 Financial Analysis Summary

The calculations of financial analysis are conducted for the recommended WWTP development in Margasari (optimalization) and Sepinggan and Somber. The revenues and cost that is taken into account in the analysis are based on its incremental compared to the existing system especially in Margasari.

Results

Table 61: Comparison Annual Operating Costs and Revenue of proposed WW System

	Business As usual	Overall System	Package1: Margasari	Package2: Sepinggan	Package3: Somber
Annual OPEX (Rp mio)	1,284	4,124	1,484	1,243	1,371
Annual Revenue (Rp mio)	479	2,435	472	952	1,025
Annual Operating Gap (Rp mio)	-805	-1,689	-1,012	-291	-347
Avg.Operating Ratio (OM cost : revenue)	2.68	1.69	3.14	1.31	1.34

The table above shows that overall and each subproject have substantial losses. Though the operating ratio with the project in general can be dropped to around a half of if without the project (2.68 to 1.69) due to more efficient in operating for Sepinggan and Somber (1.31 and 1.34)

The results of the annual revenue for the whole packages are below its operation cost. This suggests that the project needs significant support of funding or grant from the government.

Besides PDAM currently has proposed a decree (in process to be approved by DPRD) to stipulate applying waste water levy based on 20% (minimum) of water use price to all their customer (currently around 96.000 connection) so it is expected able to cover not only OPEX but also to give sufficient return to sustain its waste water services. Table below shows very pessimistic estimate if the regulation is applied to at least 30% of all PDAM customer.

Table 62: Comparison Without and With Applying 20% of Water Use Price (PDAM Customer) for Overall Project

	w/o applying 20% water sale tariff for PDAM connection house	w/ applying 20% water sale tariff for PDAM connection house*
Annual OPEX (Rp mio)	4,124	4,124
Annual Revenue (Rp mio)	2,435	17,394
Annual Operating Gap (Rp mio)	-1,689	13,270
Avg.Operating Ratio (OM cost : revenue)	1.69	0.24
NPV (@wacc 9.83%[6])	(199,324)	58,659
IRR	-6.04%	12.27%
Payback (yr)	-	14

***** *Assumed collecting rate of 30% (of all PDAM connection)*

The revenue could significantly increase around 7 times and can cover all cost of Capex and Opex that indicated by positive Net Present Value and IRR above its average cost of capital (12.27% > 9.83%).

[6] WACC can be calculated from (9% x 70%) + (11.75% x 30%) = 9.83%. Cost of debt is taken from standar year 2017 National Bond (SUN) benchmark for 20 years (8.25%) plus premium 0.75% while for equity (11.75%) is from standard current Central Bank rate of 6.75% plus premium risk 5%.

9 ECONOMIC ANALYSIS

9.1 Overview of Economic Analysis

The objective of the economic analysis is to analyse economic benefits and costs which cannot be included in the financial analysis. The sanitation waste water management development could generate benefits beyond the financial revenue stream proceed from the project and then generates welfare increasing to the society. The economic analysis section describes the economic benefits and costs and quantifies them based on available data mainly in the previous PFS 2014 with some adjustment. Key indicators such as the Net Present Value (NPV), the Economic Internal Rate of Return (EIRR) and the benefit and cost ratio (B/C) are used to depict the project.

The proposed WWT project has several benefits. The most direct benefits are accrued to the population who receive better impact in terms of improved sanitation. Generally, the population is not directly concerned with the off-site WW treatment but prefers healthier, safe, environmentally sound and affordable tariff. The Willingness to Pay (WTP) is a common method to estimate the value consumer put on improved waste water services and hence economic benefits of the project. The data is taken from the previous FS and some information from various other sources like PDAM, Environment Agency, and Health Ministry. The analysis draws on the WWTP estimates conducted for similar cities to estimate WWTP for the City of Balikpapan

WWT management system is also generates additional benefits from waste water recovery process. Under the proposed waste water management concept, the benefit are also health saving, cheaper cost for park/garden showering, and keep the ground water from polluted waste water thus decrease cost for drinking water provision which not all could be quantified in this report.

Investment to improve WW treatment development will also lead to operational efficiency gained by reducing costs per unit of waste water processing.

In addition, improved WW treatment development mainly in terms of technology also lead to land requirement saving. Moreover, improved waste water operation can reduce waterways pollution to the groundwater. Costs of treatment (or avoided cost of treatments) are one of the benefits of improved WW treatment investment.

Local improvement technology could benefit also in odor reducing pose to the population living nearby the WWTP site. The value such of smell are not easy to be quantified but obviously can affect level of welfare and quality of life by impacting consumption and production activities of households in the affected areas.

Economic Internal Rate of Return

The economic analysis is undertaken for the improved WWT development investment for the three locations. The EIRR for the project is calculated based on available data. However, it should be noted that the results are preliminary and a more detailed analysis may be required to better the assumptions and fine-tune the results.

9.2 Costs

Costs for WW development plan consist of capital expenditures (CAPEX) and operation & maintenance expenses (OPEX) (see previous chapter).

9.3 Benefits

Benefits are coming from WW service fee, user connection fee installation - as explained in the previous chapter – plus health saving, park cleansing & showering saving, environmental levy and the residual value of WW incremental investment at the end of period analysis of 30 years.

Waste Water Service Fee Willingness to Pay

These revenues are based on the willingness to pay (WTP) for monthly fee which around maximum Rp.20.000 (according to the previous FS 2014). Thus it could be adjusted for year 2017.

House Connection Fee

It is a one-time fee which should be paid by household once being connected to WW reticulation pipe network. It is estimated around Rp 1.2 million for household, Rp 1.5 million for small commercial, and Rp. 6 million for non-domestic.

Health Saving

Based on the previous PFS 2014 health saving is estimated around Rp 1,702 million/year if most the city of Balikpapan residences are connected or have proper WW treatment. The number is equal to Rp 114,736/hh for year 2017.

Polluter Levy

The total polluter levy based on previous FS 2014 was estimated Rp 7,000 per PDAM connections per month. It should be billed for all PDAM customers whether they are connected or not to WWTP. For this analysis it is adjusted to become Rp 9000/hh/month for year 2017.

Economic Calculation

The calculations of economic analysis are conducted for the recommended WWTP development in Margasari (optimalization) and Sepinggan and Somber. The benefits that taken into account in the analysis are based on its incremental compared to the existing system especially in Margasari.

9.4 General Assumptions

Table 63: Assumptions for Economic Analysis

Assumptions	In Rp	Remarks
Avg. HH WTP of tariff (IDR/month)	23,153	PFS 2014 adjusted
Avg. HH WTP of new connection (IDR)	115,763	PFS2014 adjusted
Avg. Small Commercial WTP of tariff (IDR/month)	26,822	
Avg. Small Commercial WTP of new conn. (IDR)	1,500,000	
Avg. Non Domestic WTP of tariff (IDR/month/conn.)	400,000	
Avg. Non Domestic WTP of new connection (IDR)	6,000,000	
Exchange Rate (IDR to 1 USD)	13,500	
Health saving (IDR/hh/yr)	114,736	As of January 2017
Effluent utilization (IDR/m3)	12,500	
OM saving in clean water processing (Rp/m3)	1,900	
Polluter levy (IDR/HH/mo)	8,999	
Water produced utilization (IDR/m3)	2,000	

National Conversion Factor – Capex	0.8	
National Conversion Factor – Opex	1.0	
Social discount rate threshold	12%	ADB/WB
Project time horizon	30	Years

9.5 Results

The results of the economic analysis show that the EIRR for the whole packages is 13.92% which exceeds the threshold of 12%. The NPV is positive at IDR 64,535 million at the discount rate of 12%. The B/C ratio is 1.15 which is substantially above the threshold of 1. Thus based on the calculation the project could be considered as economically viable and can generates positive welfare to the community. It should be noted that it is possible to add other several environmental benefits which have not been quantified to gather reliable data to carry out accurate estimations

Table 64: Economic indicators of proposed WW System development

	EIRR (%)	NPV at 12% Discount Rate (million IDR)	B/C Ratio
Proposed Project	13.92	64,535	1.15

Source: Consultants Calculation

Sensitivity Analysis

A sensitivity test was conducted to examine the impact of an increase in cost and decrease in benefit on the EIRR, NPV and B/C. In the scenario where benefits are reduced by 10% and cost increases by 10%, the EIRR for proposed WW system reduced to 13.21% and 12.74% respectively. The NPV is positive for both the 10% decrease in benefit and 10% increase in cost suggest that the project is more sensitive to cost increasing. It is the same for EIRR in 10% decrease is still higher than the threshold EIRR of 12% but going down in 10% increase in cost. This implies that the project is appropriate to be realized.

Table 65: Sensitivity Analysis (10% Decrease in Benefits and 10% increase in Costs)

	EIRR (%)	NPV at 12% Discount Rate (mIDR)	B/C Ratio
10% decrease in benefit	13.21	40,635	1.10
10% increase in cost	12.74	27,314	1.06

Source: Consultants Calculation

10 STRATEGIES AND SCENARIOS

10.1 Strategies

In order to expand Wastewater treatment and service coverage in accordance with the goals set out in Balikpapan's City Sanitation Strategy, the Balikpapan Municipal government wishes to optimize its existing Wastewater System and Treatment works.

RPJMN 2015-2019 declared the target of universal access in sanitation. At the national level sanitation access is targeted to reach 100% in 2019, consisting of proper access (85%), and basic access (15%).

- Basic sanitation* access is improved sanitation through facilities that ensure hygienic separation of human excreta from human contact. They include a/o:
  - Flush or pour-flush toilet/latrine to a piped sewer system, a septic tank or a pit latrine.
  - Ventilated improved pit latrine.
  - Pit latrine with slab.
  - Composting toilet.

** Source: UN Joint Monitoring Programme (JMP). http://www.un.org/waterforlifedecade/sanitation.shtml*

The Sanitation situation in Balikpapan can be presented as follows:

- Off-site wastewater treatment means the percentage of population connected to a sewerage system and wastewater treatment plant; and,
- On-site wastewater treatment means the percentage of population with a septic tank.

In the next table, the three projects are indicated and also the situation for the whole city of Balikpapan. The whole city is considered with a population of about 768,000 inhabitants (2016).

It is assumed that all houses with On-site systems have a septic tank (100%), although undoubtedly still several houses dispose their black-grey water directly into nearby rivers or sea.

Table 66: Percentages Households connected in project areas and city of Balikpapan: before-after

Location	Present situation 2016 in percentage %			Situation after implementation in percentage %	
	Off-site	On-site		Off-site	On-site
Margasari Service area	17%	83%		18%	82%
Sepinggan 1 Catchment area	0%	100%		33%	67%
Somber 2 Catchment areas	0%	100%		19%	81%
Balikpapan whole City	0.9%	99.1%		6%	94%

The table above shows clearly that most of the citizens are still relying on an On-site system with septic tanks, even after implementation of the proposed measures as mentioned in this report. Using septic tanks in a densely populated city is not sustainable due to the following a/o:

1) Not regular maintenance of the septic tanks in means of emptying on time and repairing leakages;

2) Only black water is treated, grey water is still disposed in nearby open drainage channels, causing health problem and environmental problem;

3) Due to small land areas of the houses they have no drain-fields and the not-fully treated wastewater is contaminating the groundwater. This groundwater in turn is extracted through groundwater wells for local water supply.

4) During the rainy season there is a risk of flooding and overflowing of the septic tanks. The contents of the septic tanks may flow on the ground/street level causing environmental and health threats.

The National Strategy for Sanitation aims at 100% coverage of Sanitation in the city by 2019, however it does not reflect on which percentage should be On-site system or which percentage should be Off-site system. Also it does not cover the treatment of the grey-water which should be included.

As indicated in the observations mentioned above, - especially the Health and Environmental issues -, it is highly recommended to extend the Off-site systems in the whole city. However, to realize this, more strategy fundamentals are required.

For Wastewater Sanitation Management there are several components to deal with a/o:

Strategy Wastewater Management:

- Need of a Long Term Strategy of minimal 25 years
- City Spatial Planning / City Development Plans / City Sanitation Plan
- City Wide Decision: Where and What to implement
- Environmental & Health Protection (black water & grey water)
- Temporary Planning Priorities (short term and medium term)

Besides Managing Wastewater and Sanitation also the method of the Systems have to be developed about what type of system, etc. a/o:

Strategy Wastewater Systems:

1) Network Systems versus On-site Systems
2) Decentralized Wastewater Treatment Systems versus Centralized Wastewater Treatment System
3) Analyses of Scenarios: Pro's and Contra's
4) Short Term High Priorities (next 1 - 5 years)
5) Medium Term Implementations (5 – 15 years)

6) Transformational Stages and Measures
7) Phasing and Modular Expansion

The following paragraph presents the different proposed Scenarios for Balikpapan City which are essential for further studies.

10.2 Future Scenarios

As strategic solutions, the Balikpapan Municipality has to investigate in more alternatives to face the challenges for better and efficient sanitation for the whole city. Therefore several scenarios are suggested for a **City-wide** approach. They are not necessarily to be used for the updating of the PFS 2014, however for a long term strategic vision it should be seriously considered. Strategic options are essential for the City's Master Plan (which needs to be reviewed and upgraded regularly).

There are several wastewater system options which would be possible to implement at City-wide level in Balikpapan. Referring to the Master Plan 2012, more alternatives should be investigated. The following table shows these scenarios.

Table 67: Possible Future Scenarios Wastewater System in Balikpapan

Scenario I	Decentralized System with 10 waste water treatment plants extended over the city (Master Plan 2012)
Scenario II	Decentralized + On-site System with 3 waste water treatment plants and rest of city covered with septic tanks (PFS 2014)
Scenario III	Semi - Centralized System with maximal 5 Wastewater treatment plants
Scenario IV	Centralized System with 1 (or 2) large Wastewater treatment plants for the whole City

The following sub-paragraphs present basic considerations for each Scenario.

10.2.1 Scenario I: Decentralized System with 10 WWTP

The following table indicates the advantages and disadvantages of the Scenario as indicated in the Master Plan 2012 with 10 WWTP.

Table 68: Advantages-disadvantages Scenario I Decentralized with 10 WWTP

Advantages	Disadvantages
Closer to "polluters" means less pumping stations	Total investment costs of all 10 WWTP are higher than other scenarios
Easier to implement in a phased planning schedule	Very difficult to find locations large enough (moreover for future expansions)

	More environmental and social issues due to proximity to living areas..
	Higher operational costs due to more operating staff required at each location
	Expected NPV over 30 years higher than other options
	Environmentally more difficult to control over many locations

The major problem with this Scenario is to find the locations within the city. There are not so many open spaces and not large enough to construct even a small wastewater treatment plant. Also the neighborhood will create problems due to resistance of the neighboring people. Social it will not be accepted to have a wastewater treatment plant close to housing areas.

Therefore this Scenario I with 10 wastewater treatment plants is no further considered feasible.

10.2.2 Scenario II: Decentralized 3 WWTP plus On-site system

Decentralized + On-site System with 3 waste water treatment plants and rest of city covered with septic tanks (PFS 2014)

The following table indicates the advantages and disadvantages of this Scenario:

Table 69: Advantages-disadvantages Scenario II Decentralized plus On-site system

Advantages	Disadvantages
Lower investments costs compared to Scenario III and IV.	The 3 wastewater treatment plants could be social not accepted due to proximity to housing areas. Carefully dealing with social issues is a must.
Locations already in existing urban development plans	Extra investment costs for additional tank trucks for emptying septic tanks and operational costs of septic tank sludge treatment facility
Can be implemented in Short Term	More operational cost due to vacuum truck operators and sludge treatment facility
	More environmental risks due to leaking septic tanks and / or not regular emptying of septic tanks resulting in ground water pollution with high risks on water supply wells (private and business)
	Expected NPV over 30 years higher than other options
	No grey water treatment, normally grey water

	is drained of in nearby open canals and open drainage channels

This Scenario II is feasible for Short Term implementation. Still there is need for proper septic tank management in the city as only **6%** of the city will be covered by the off-site system (the 3 wastewater treatment plants) and the rest of the city, **94%**, is still using septic tanks.

It is recommended to implement this Scenario II for the short term; however it is also recommended that the city of Balikpapan look for further sanitation developments to connect much more household to an off-site system and connecting to a sewerage system.

10.2.3 Scenario III: Semi-Centralized System with 5 WWTPs

The following table indicates the advantages and disadvantages of this Scenario III Semi - Centralized System with maximal 5 Wastewater treatment plants:

Table 70: Advantages-disadvantages Scenario III Semi-Centralized with 5 WWTP

Advantages	Disadvantages
Closer to “polluters” means less pumping stations	Wastewater treatment plants still close to housing areas, creating social disapprovals
Easy to implement in a phased planning schedule	Difficult to find locations in the city large enough for these wastewater treatment plants (>2 ha or more depending on techniques used)
Could be follow up program of Scenario II, extending from 3 wwtp to 5 wwtp	Economy of scale not fully used as 5 wastewater treatment plants have higher operational cost than Scenario IV.
	Due to long term implementation of the sewer system in the city, there is still need of septic tanks and vacuum tank trucks for emptying (transformation stage)

This Scenario option is feasible for the medium or long term. It is not possible to implement the sewerage system in the short term to connect to the wastewater treatment plants over the whole city. It could be a follow-up system of Scenario II through upgrading and extensions of these 3 wastewater treatment plants and adding 2 new wastewater treatment plants at a later stage.

It is recommended that the city of Balikpapan considers this Scenario III and prepare a Study, desirable in combination with Scenario IV.

10.2.4 Scenario IV: Centralized System with 1 (or 2) WWTP for whole City

A Scenario with 1 (or 2) large Wastewater treatment plants is a long term strategy. It is impossible to construct the connecting sewerage system for the whole city in a short period. The implementation of the sewerage has to be gradually expanded over the city.

The following table presents the advantages and disadvantages of this Scenario IV

Table 71: Advantages-disadvantages Scenario IV Centralized System 1 (or 2) WWTP

Advantages	Disadvantages
Economies of scale	High investment costs
Lower operational costs per m3 treated wastewater	Difficult to find locations large enough (also for future expansions, maybe 20ha. or more depending on chosen technology)
Expected NPV over 30 years lower than other options	Need of more Pumping Stations (automatic) spread over the city.
Once location is established no further pursuit for new locations needed for next 50 years or more.	Long Term Planning
Environmentally easier to control	
No social issues due to location outside of city	

This Scenario IV is used at many cities similar to Balikpapan (and much larger cities) all over the world and is very effective and efficient. As it takes a long implementation period for the sewerage system to build, it can be implemented in several phases over the years; also the wastewater treatment plant can be constructed in modular schemes. This will also extend financial issues over the long period.

It is highly recommended the City of Balikpapan to study this Scenario IV in depth for future implementation.

10.3 General Planning Processes

The following table presents an overview of all planning processes of a typical infrastructure project. At the moment the Balikpapan Sanitation Project is in the process of Step “Initial Planning” and at the start of “Basic Design & Planning”.

Table 72: General Planning Processes

Steps	Key Activities and Scope
Pre- Planning (Initial Findings)	Identification of design objectives
	Decision on the planning
	Baseline studies, information
	Functional & economic assessment of existing infrastructure & proposed projects
Initial Planning	Pre-Feasibility on project alternatives – technical options and their financial, social, environmental, institutional, legal aspects
	Fund mobilization, scheme alignment requirements, role definition
Basic Design & Planning	Feasibility for selected technical option and their financial social, environmental, institutional, legal aspects

	Clearances from Regulatory agencies, land acquisition, development of project structure, concessionaire type
	Decision on implementation approach – conventional or PPP based
Detailed Planning & Design	Project phasing, implementation & operational plan, nomination of operating entities or identification of private sector operators, formation of operational entities
	Detailed engineering designs, cost estimations, project financial plan for efficient & timely implementation
Procurement	RFP (Request For Proposal) preparations
	Tendering & Procurement
Construction & Operation	Implementation related Contracts (where applicable for stepwise implementation)
	Operation related Contracts, Supervision Contracts
Monitoring	Completion Control Monitoring

This planning process is a generic overview of all activities, it should be noted that some steps can be omitted or adapt and/or other steps should be added depending on the local situation.

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

1. From Technical perspective, the following implementations are considered as the ideal solutions:
   a. The activities in Margasari service area are to upgrade the existing WWTP and improve the sewer network. Several house connections need to be reconnected and 200 additional house connections will be implemented. After implementation of the activities, the total house connections will be 2,222 units in Margasari.
   b. A new WWTP will be constructed in Sepinggan Retention pond area and 5,000 house connections will be connected to a new sewer network. A flood protection program will be implemented to solve the flood problem at Sepinggan Market.
   c. In the Somber service area a new WWTP in KIKS Somber will be constructed and a new sewer network. Total of 5,500 new house connections will be realized.
2. From Economic perspective, to achieve full cost recovery for the proposed systems in Margasari, Sepinggan and Somber can be realistic due to:
   f. The city government budget for sanitation system development which achieves more than Rp. 68.3 billion (just for year 2016) or Rp.22.8 billion (assuming one third) for waste water development;
   g. The city government still has substantial capability to propose debt to finance part of its needs to develop new infrastructure (all sectors) of around total of Rp 1,600 billion. There are several national and international institutions that could provide potential source for the financing;
   h. The waste water development is supported by National Government through a/o Grant from Indii/AusAid/sAIIG program which provide Rp 400 billion until 2019 to achieve 100% sanitation coverage. However additional budget is required to realize the mission of 100% waste water sanitation covering and its sustainable development;
   i. The current collection of billing mechanism through PDAM bill for most of WWTP Margasari connections is considered successful though it is not sufficient to cover its present cost. However, the new proposed project can reduce operating cost and with its billing mechanism and new tariff revenue per household, can cover all future operating cost.
   j. Its economic benefit value is still higher than its economic cost.

11.2 Recommendations

The following elements for improving the sanitation system and management for Balikpapan City are recommended:

1. to update the Master Plan 2012 and incorporate the four above mentioned Scenarios with emphasis on Long-Term Planning (a Master Plan covers normally a 25-years period);
2. to include the results of the updated Master Plan (2017 or 2018) in the City Spatial Planning / City Development Plans / City Sanitation Plan;
3. to proceed with the proposed implementations mentioned in this Revised PFS Report 2017:
    a. Margasari: Upgrading existing wastewater treatment plant, renovating existing sewerage system and pump stations, extension of sewerage system with more household connections;
    b. Sepinggan: Implementation of a new wastewater treatment plant on the indicated location at the retention pond in Sepinggan (*Alt. 3*) and implementation of a new sewerage system in one catchment area;
    c. Somber: Implementation of a new wastewater treatment plant on the indicated location at KIKS and implementation of a new sewerage system in two catchment areas.
4. To implement the proposed Institutional arrangements with PDAM;
5. Introduce the proposed Tariff system introducing a new tariff collecting mechanism through applying certain percentage (e.g. 20%) of water use price for each PDAM user;
6. Uses maximal available grants to support some of the investment cost for the proposed systems;
7. Gaining access from national financing institutions for speeding up infrastructure developments.

APPENDIX I: OUTLINE RESETTLEMENT PLAN

Example of an Outline of Resettlement Plan

OUTLINE OF A RESETTLEMENT PLAN

This outline is part of the Safeguard Requirements. A resettlement plan is required for all projects with involuntary resettlement impacts. Its level of detail and comprehensiveness is commensurate with the significance of potential involuntary resettlement impacts and risks. The substantive aspects of the outline will guide the preparation of the resettlement plans, although not necessarily in the order shown.

Executive Summary
This section provides a concise statement of project scope, key survey findings, entitlements and recommended actions.

Project Description
This section provides a general description of the project, discusses project components that result in land acquisition, involuntary resettlement, or both and identify the project area. It also describes the alternatives considered to avoid or minimize resettlement. Include a table with quantified data and provide a rationale for the final decision.

Scope of Land Acquisition and Resettlement
This section:

- discusses the project's potential impacts, and includes maps of the areas or zone of impact of project components or activities;
- describes the scope of land acquisition (provide maps) and explains why it is necessary for the main investment project;
- summarizes the key effects in terms of assets acquired and displaced persons; and,
- provides details of any common property resources that will be acquired.

Socio-economic Information and Profile
This section outlines the results of the social impact assessment, the census survey, and other studies, with information and/or data disaggregated by gender, vulnerability, and other social groupings, including:

- define, identify, and enumerate the people and communities to be affected;
- describe the likely impacts of land and asset acquisition on the people and communities affected taking social, cultural, and economic parameters into account;
- discuss the project's impacts on the poor, indigenous and/or ethnic minorities, and other vulnerable groups; and,
- identify gender and resettlement impacts, and the socioeconomic situation, impacts, needs, and priorities of women.

Information Disclosure, Consultation, and Participation
This section:

- identifies project stakeholders, especially primary stakeholders;

- describes the consultation and participation mechanisms to be used during the different stages of the project cycle;
- describes the activities undertaken to disseminate project and resettlement information during project design and preparation for engaging stakeholders;
- summarizes the results of consultations with affected persons (including host communities), and discusses how concerns raised and recommendations made were addressed in the resettlement plan;
- confirms disclosure of the draft resettlement plan to affected persons and includes arrangements to disclose any subsequent plans; and
- describes the planned information disclosure measures (including the type of information to be disseminated and the method of dissemination) and the process for consultation with affected persons during project implementation.

Grievance Redress Mechanisms

This section describes mechanisms to receive and facilitate the resolution of affected persons' concerns and grievances. It explains how the procedures are accessible to affected persons and gender sensitive.

Legal Framework

This section:

- describes national and local laws and regulations that apply to the project and identify gaps between local laws and ADB's policy requirements; and discuss how any gaps will be addressed.
- describes the legal and policy commitments from the executing agency for all types of displaced persons;
- outlines the principles and methodologies used for determining valuations and compensation rates at replacement cost for assets, incomes, and livelihoods; and set out the compensation and assistance eligibility criteria and how and when compensation and assistance will be provided.
- describes the land acquisition process and prepare a schedule for meeting key procedural requirements.

Entitlements, Assistance and Benefits

This section:

- defines displaced persons' entitlements and eligibility, and describes all resettlement assistance measures (includes an entitlement matrix);
- specifies all assistance to vulnerable groups, including women, and other special groups; and.
- outlines opportunities for affected persons to derive appropriate development benefits from the project.

Relocation of Housing and Settlements

This section:

- describes options for relocating housing and other structures, including replacement housing, replacement cash compensation, and/or self-selection (ensure that gender concerns and support to vulnerable groups are identified);
- describes alternative relocation sites considered; community consultations conducted; and justification for selected sites, including details about location, environmental assessment of sites, and development needs;
- provides timetables for site preparation and transfer;
- describes the legal arrangements to regularize tenure and transfer titles to resettled persons;
- outlines measures to assist displaced persons with their transfer and establishment at new sites;
- describes plans to provide civic infrastructure; and
- explains how integration with host populations will be carried out.

Income Restoration and Rehabilitation

This section:

- identifies livelihood risks and prepare disaggregated tables based on demographic data and livelihood sources;
- describes income restoration programs, including multiple options for restoring all types of livelihoods (examples include project benefit sharing, revenue sharing arrangements, joint stock for equity contributions such as land, discuss sustainability and safety nets);
- outlines measures to provide social safety net through social insurance and/or project special funds;
- describes special measures to support vulnerable groups;
- explains gender considerations; and
- describes training programs.

Resettlement Budget and Financing Plan

This section:

- provides an itemized budget for all resettlement activities, including for the resettlement unit, staff training, monitoring and evaluation, and preparation of resettlement plans during loan implementation.
- describes the flow of funds (the annual resettlement budget should show the budget-scheduled expenditure for key items).
- includes a justification for all assumptions made in calculating compensation rates and other cost estimates (taking into account both physical and cost contingencies), plus replacement costs.
- includes information about the source of funding for the resettlement plan budget.

Institutional Arrangements

This section:

- describes institutional arrangement responsibilities and mechanisms for carrying out the measures of the resettlement plan;
- includes institutional capacity building program, including technical assistance, if required;
- describes role of NGOs, if involved, and organizations of affected persons in resettlement planning and management; and
- describes how women's groups will be involved in resettlement planning and management,

Implementation Schedule

This section includes a detailed, time bound, implementation schedule for all key resettlement and rehabilitation activities. The implementation schedule should cover all aspects of resettlement activities synchronized with the project schedule of civil works construction, and provide land acquisition process and timeline.

Monitoring and Reporting

This section describes the mechanisms and benchmarks appropriate to the project for monitoring and evaluating the implementation of the resettlement plan. It specifies arrangements for participation of affected persons in the monitoring process. This section will also describe reporting procedures.

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APPENDIX II: IMPLEMENTATION SCHEDULE

FINAL REVISED PFS REPORT
MARCH 2017

TA 6293 REG–INO: Balikpapan Sanitation Project PFS Review and Update

Implementation Plan - Balikpapan Sanitation Project

Item	Activity	Duration Months	2017		2018				2019				2020				2021				2022				2023				2024				2025			
			Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Appointment of DED Consultants**																																			
1.1	Preparation of Scope of Services	3																																		
1.2	Bidding, Evaluation and Appointment	6																																		
2	**Preparation of DED and Bid Documents**																																			
2.1	Preparation of DED for existing Margasari WWTP and Network improvement	6																																		
2.2	Preparation of DED for Perusda WWTP and Network Development	9																																		
2.3	Preparation of DED for Somber WWTP and Network Development	9																																		
2.4	Finalisation of DED and Bid documents	3																																		
3	**Bidding, Evaluation and Contract Award for Contractor**																																			
4	**Social Marketing**	30																																		
5	**Construction and commissioning**																																			
5.1	***Margasari WWTP and Sewerage System improvement***																																			
5.1.1	Sewer Network and Pump station (with progressive commissioning during year 3)	36																																		
5.1.2	WWTP Improvement	30																																		
5.1.3	Connection rehabilitation	30																																		
5.1.4	Defects Liability Period	12																																		
5.2	***Site Preparation & Earthworks - WWTP Perusda and Somber***																																			
5.2.1	Site preparation (earthpad fill)	6																																		
5.2.2	Earthpad fill consolidation and monitoring (WWTP site)	12																																		
5.2.3	Defects Liability Period (WWTP site)	12																																		
5.3	***Perusda Sewerage System***																																			
5.3.1	Sewer Network (with progressive commissioning during year 3)	36																																		
5.3.2	Defects Liability Period (sewer network)	12																																		
5.3.3	Pump Station and Pressure Main	18																																		
5.3.4	Defects Liability Period (Transfer pump station and pressure mains)	12																																		
5.4	***Somber Sewerage System***																																			
5.4.1	Sewer Network (with progressive commissioning during year 3)	36																																		
5.4.2	Defects Liability Period (sewer network)	12																																		
5.4.3	Pump Station and Pressure Main	18																																		
5.4.4	Defects Liability Period (Transfer pump station and pressure mains)	12																																		
5.5	***Wastewater Treatment Plant Perusda and Somber***																																			
5.5.1	Construction and testing	24																																		
5.5.2	Commissioning (undertaken progressively over 6 months)	6																																		
5.5.3	Defects Liability Period	12																																		
5.5.4	Operation and Maintenance (including Operator training)	12																																		
5.6	***Property Works and Connections***																																			
5.6.1	Construction and connections (Perusda and Somber sewer network)	60																							4000 HC's				4000 HC's				4500 HC's			

APPENDIX III: INSTITUTIONAL - PDAM

Tasks and Functions of PDAM Management

Tasks and Functions of PDAM Management

Position	BOARD OF SUPERVISOR
Main Tasks **(Article 12)**	1. Implement monitoring, control and guidance to the organization and management of PDAM; 2. Giving consideration and advice to the Mayor, solicited or unsolicited, for the improvement and development of PDAM include the appointment of the Board of Directors, the work program proposed by the Board of Directors, the plan to change the status of a wealth of PDAM, the loan plan and legal bonds with other parties, as well as receive, check and sign Quarterly Reports and Annual Reports; and 3. Checking and deliver Business Strategic Plan (business plan / corporate plan) and Annual Work Plan and Budget made by Directors of PDAM to the Mayor for approval.
Authority **(Article 12)**	1. Assessing the performance of the Board of Directors in managing the PDAM; 2. Assessing the Quarterly Reports and Annual Reports submitted to the Board of Directors approved by the Mayor; 3. Request information from the Board of Directors regarding the management and development of PDAM; and 4. Propose the appointment, suspension, rehabilitation and termination the Board of Directors to the Mayor.

Position	BOARD OF DIRECTORS
Main Taks **(Article 18)**	1. Directing and controlling all activities of PDAM; 2. Plan and prepare annual work plans and 5 (five) years; 3. Prepare and submit the Annual Work Plan and Budget as the annual elaboration of the Strategic Business Plan to the Mayor through the Supervisory Board; 4. Fostering employee; 5. Administer and manage the wealth of PDAM; 6. Carrying out general administration and finance; 7. Conducting technical activities of PDAM; 8. Representing PDAM both inside and outside the court; 9. Prepare and submit reports of all PDAM activities to the Mayor through the Supervisory Board.
Authority **(Article 19)**	1. Appoint and terminate employees of PDAM based on the Regulation of PDAM Employment; 2. Establish organizational structure and working procedures of PDAM with the approval of the Supervisory Board; 3. Hiring for positions under the Board of Directors; 4. Representing PDAM inside and outside the court; 5. Pointing the power to take legal actions represent PDAM; 6. Signing the Quarterly Report and the Annual Report;

	7. Sell, pledge or otherwise dispose of assets belonging of PDAM to the approval of Mayor based on the consideration of the Board of Supervisory; 8. Doing loans, entering into agreements and cooperation with other parties with the consent of the Supervisory Board of Mayor on consideration of the pledge to PDAM.

Position	**DIVISION HEAD OF WASTEWATER**
Function	Coordinating and controlling the activities of development as well as wastewater treatment to comply with wastewater standards that have been set
Main Tasks **(SOTK PDAM)**	1. Preparing annual work plan for Wastewater Division 2. Coordinating and controlling the activities of wastewater treatment management that meets the standards continuously and sustainably 3. Coordinating activities and resources for building maintenance of wastewater treatment plants 4. Planning for the development of waste water production and services based on the potential development of technologies at Wastewater Subdivision 5. Evaluation of wastewater activities 6. Propose measures to be taken if it is found circumstances that hinder the wastewater treatment 7. Perform calculations and efficiency and be accountable for the operational costs and maintenance in the Wastewater Division 8. Implementation of the management and operation of wastewater management system 9. Coordinating the retribution collecting of wastewater in accordance with applicable regulations 10. Monitor the work of staff 11. Prepare reports on the implementation of tasks to the Technical Director 12. Carry out other duties assigned by the Technical Director
Responsibility	1. Guarantee the production capacity of waste water according to the desired capacity 2. Guarantee the production quality of waste water in accordance with the quality standards applicable to wastewater 3. Solve problems that arise in the Wastewater Division 4. Conduct training for human resources in the Wastewater Division 5. Ensure effective wastewater levy following the payment and remittance to the local treasury. 6. Maintain cleanliness, health, and safety in the workplace

Authority	1. Approved the quality standards of wastewater discharged into water bodies 2. Approved the implementation of the work plan in each work unit within the Wastewater Division. 3. Approved the implementation of the specifications of equipment and instruments used in the Wastewater Division 4. Giving approval for expenses incurred in the implementation of operational activities in the Wastewater Division 5. Provide recommendations / assessment of the performance of the staff of the Wastewater Division 6. Proposed development in human resources training for Wastewater Division.
Working Relationships **(Internal)**	1. Division Head of Wastewater directly accountable to the Technical Director 2. Division Head of Wastewater coordinating with: - Sub Division of Planning Techniques - Sub Division of Laboratory - Sub Division of Supplies - Sub Division of Finance - Sub Division of Customer Relations - Public Relations (PR)
Working Relationship **(External)**	1. Local Government (Environment Office, Health Departement, Public Works Departement, etc). 2. Service Provider/ Partner

Position	**SUB-DIVISION HEAD OF WASTEWATER ADMINISTRATION**
Function	Manage and organize the administrative services and finance waste water management system, both concerning the financing and operations, so as to support the implementation of wastewater management services
Main Tasks **(SOTK PDAM)**	1. Preparing annual work program, technical instructions or guidelines in the administration of wastewater treatment 2. Implementing billing and monitoring of waste water customers account 3. Perform calculations and efficiency and be accountable for the entire operational and maintenance costs in the environment of Sub Division of Wastewater Administration 4. Monitoring the work of staff 5. Creating a task execution reports to Division Head. 6. Carrying out other duties assigned by the Head of Wastewater
Responsibility	1. Ensuring the implementation of operational administration of the waste water treatment systems.

	2. Resolving problems arising in the Sub-Division of Wastewater Administration 3. Fostering human resources in environment of Sub Division of Wastewater Administration 4. Ensuring the operation of wastewater management system 5. Maintain cleanliness, health, and safety in the workplace
Authority	1. Manage the administration and finance for the installation and operation of wastewater treatment. 2. Propose the extension of services, equipment and instruments are needed in the Sub-Division of Wastewater Administration 3. Perform necessary actions in the implementation of operational activities and render a decision in terms of the conditions that require immediate action. 4. Provide recommendations / assessment of the performance of employees in the Sub division of Wastewater Administration
Working Relationships **(Internal)**	1. Sub Division Head of Wastewater Administration is directly responsible to the Division Head of Wastewater 2. Sub Division Head of Wastewater Administration coordinating with: - Sub Division of Procurement - Sub Division of Warehousing - Sub Division of Planning - Sub Division of Laboratory - Sub Division of Customer Relations - Public Relations (PR)
Working Relationship **(External)**	1. City Government (Environment, Public Works, BAPPEDA, Muspika, etc.). 2. Central Government (Ministry of Public Works) and Provincial Office 3. Service Provider / Partner 4. Electricity State Company (PLN) 5. Forkalim (Communications Forum for Wastewater)

Position	**SUB DIVISION HEAD OF WASTEWATER ENGINEERING**
Function	Conducting maintenance on waste water equipment in accordance with the planning of preventive maintenance, according to the requirements for discharge into water bodies or utilized as needed.
Main Tasks **(SOTK PDAM)**	1. Prepare work program, technical instructions or guidelines in the maintenance of waste water equipment 2. Operate, maintain and improve the system of waste water treatment which includes: installation of subscriber lines, pipelines, IC, manhole, PS Box, RSPS Box, Equalization Tank, Aeration Tank, Water processed, Sedimentation Tank, Sludge Tank, Reservoir and other support in order in a state ready for operation. 3. Establish registration and data recording to resources and operational equipment, so it can help in achieving the specified

	capacity. 4. Keep records and control of the production equipment, so as to assist in achieving processing capacity is required. 5. Carry out maintenance and supervision sewage aerator on the building and the wastewater treatment plant that includes aerator pumps, sluice, generator, chlorine, and other supporting instruments. 6. Perform calculations and efficiency and be accountable for the entire operational and maintenance costs in the neighborhood Subdivision Wastewater Engineering 7. Monitoring the work of operator staff 8. Monitor the Budget Plan (*Rencana Anggaran Biaya*) 9. Creating a task execution reports to Division Head. 10. Carry out other duties assigned by the Division Head of Wastewater
Responsibility	1. Perform preventive maintenance on equipment wastewater 2. Solve problems that arise in the environment Subdivision Wastewater Engineering 3. Conduct training for staff and operator in the Sub-Division of Waste Water Engineering 4. Ensuring the operation of waste water management system 5. Maintain cleanliness, health, and safety in the workplace
Authority	1. Temporarily suspend the operation time installation and drainage of waste water to perform maintenance and repair of facilities and infrastructure 2. Propose the addition of equipment and instruments needed in Sub Section of Wastewater Engineering 3. Perform necessary actions in the implementation of operation and render a decision in terms of the conditions that require immediate action. 4. Provide recommendations / evaluation on the performance of employees in the Sub-Division of Engineering Wastewater
Working Relationships **(Internal)**	1. Sub Division Head of Wastewater Engineering is directly responsible to the Division Head of Wastewater 2. Sub Division Head Wastewater Engineering coordinating with: - Sub Division of Procurement - Sub Division of Warehousing - Sub Division of Administration - Sub Division of Planning - Sub Division of Laboratory
Working Relationship **(External)**	1. City Government (Environment, Public Works, Town Planning, etc.). 2. Service Provider / Partner

APPENDIX IV: FINANCIAL PROJECTIONS

Projections of Capital Expenditure and Operating Expenditure

Projections of Capital Expenditure

Package 1: Improvement of Margasari	Y1	Y2	Y3
WWT Improvement & Automatization	1,332	1,372	1,413
Pump procurement & Installment w/ Level Control	354	364	375
Replace Sewer Pipe d 90 by 150 mm	17,174	17,689	18,220
Replace Sewer Pipe d 100 by 150 mm	5,022	5,172	5,327
House connection	1,260		
Reconnected Grey water pipe	1,157		
DED Preparation	2,798		
Social Engineering	250		
Contingency	3,945	3,690	5,124
Sub total (current price)	***33,290***	***28,287***	***39,282***

In Rp million, at current price

Package 2: Development of Sepinggan	Y1	Y2	Y3	Y4
Site preparation & earthfill	12,000			
WWT Plant Construction		30,128		
Trickling Filter Unit		20,600		
Biogas system & Pre-treatment		3,214		
Electrical & Mechanical Work		4,519		
Facility building & site works		8,927		
Sewer pipe		22,219	22,885	23,572
Flood Protection		9,814		
Manhole		2,554	2,631	2,710
Pipe Bridge			2,652	
Pump Stations			4,774	4,917
House connection		10,300	10,609	10,927
DED preparation	8,024			
Social Engineering	500			
Contingency	1,800	16,841	6,533	6,319
Sub total (current price)	***22,324***	***129,115***	***50,084***	***48,445***

Package 3: Development of Somber	Y1	Y2	Y3	Y4
Land acquisition	4,920			
Site preparation & earthfill	7,920			
WWT Construction		16,570	17,067	
Aerobic Pond		4,910	5,057	
Biogas system + Pre Treatment		3,535		
Mechanical Electrical Work		2,486	2,560	
Facility Building & Site Works		4,910	5,057	
Sewer pipe		29,892	30,788	31,712
Manhole		3,318	3,417	3,520
Pipe Bridge		858	884	911
Pump Station		3,090	3,183	
House connection		11,330	11,670	12,020
DED Preparation	8,423			
Social Engineering	500			
Contingency	1,926	12,135	11,953	7,224
Sub total (current price)	***23,689***	***93,032***	***91,636***	***55,387***

Projections of Operating Expenditure

For Margasari	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	...	Y31
Power cost	776	882	909	936	964	993	1,023	1,053	1,085	...	2,079
Recurring cost	351	399	411	423	436	449	463	477	491	...	941
Civil, EM, and Maintenance cost	240	273	281	290	298	307	317	326	336	...	644
Overhead	185	210	216	223	230	236	244	251	258	...	495
Manpower and staff	326	349	374	400	428	458	490	524	561	...	2,484
Total	***1,878***	***2,114***	***2,191***	***2,272***	***2,356***	***2,444***	***2,535***	***2,631***	***2,731***	***...***	***6,642***
For Sepinggan											
Power Cost	-	62	127	196	202	208	214	220	227	...	435
Civil, E&M maintenance cost	-	320	659	1,018	1,049	1,080	1,113	1,146	1,181	...	2,262
Recurring cost (chemical, etc)	-	148	304	470	484	499	514	529	545	...	1,044
Non-recurring cost (7 years for E&M item)	-	401							1,480	...	
Manpower O&M cost	215	230	246	263	282	302	323	345	370	...	1,637
Total	***215***	***1,161***	***1,336***	***1,948***	***2,017***	***2,089***	***2,163***	***2,241***	***3,802***	***...***	***5,378***
For Somber											
Power Cost	-	68	139	215	222	229	235	242	250	...	479
Civil, E&M maintenance cost	-	352	725	1,120	1,154	1,188	1,224	1,261	1,299	...	2,488
Recurring cost (chemical, etc)	-	162	335	517	533	549	565	582	599	...	1,148
Non-recurring cost (7 years for E&M item)	-	441							1,628	...	
Manpower O&M cost	237	253	271	290	310	332	355	380	406	...	1,801
Total	***237***	***1,277***	***1,470***	***2,143***	***2,218***	***2,297***	***2,380***	***2,465***	***4,183***	***...***	***5,916***