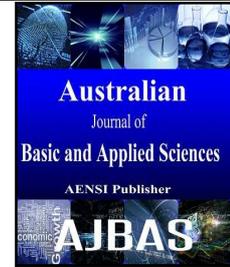




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# The Improvement of Environmental Sanitation Knowledge And Community Participation In The Jakarta Bay To Control Water Pollution

<sup>1</sup>Suyud Warno Utomo, <sup>2</sup>Haryoto Kusnoputranto, <sup>3</sup>Sri Wrinarti, <sup>4</sup>Nastiti Mugi Lestari

<sup>1,2</sup>Department of Environmental Health, Faculty of Public Health University of Indonesia And Center for Research of Human Resources and The Environment, Postgraduate Program, University of Indonesia

<sup>3,4</sup>Environmental Science, Post Graduate Program, University of Indonesia

### Address For Correspondence:

Suyud Warno Utomo, Department of Environmental Health, Faculty of Public Health University of Indonesia And Center for Research of Human Resources and The Environment, Postgraduate Program, University of Indonesia  
E-mail: suyudwarno@gmail.com

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### ABSTRACT

The Jakarta Bay is a vulnerable area, dynamic, and the condition and shape may easily change. Changes in coastal areas could be caused by a variety of activities such as industry, housing, transport, ports, aquaculture, agriculture, tourism, and others. The purpose of this study is to obtain the baseline data for environmental management in the Jakarta Bay. The data collection is done by using secondary data which is supported by the primary data. The figures of potential pollution from sanitation patterns with the highest pollution load for E-coli is  $1.41E + 20$ , BOD of 18,778, 17,839 TSS, Total N of 915.4, and detergent of 88.7 by using direct discharge patterns by all residents in the ten coastal villages in the Administrative City of North Jakarta. The potential pollutant load in activities in North Jakarta is Coli with the amount of  $5.8E + 09$  per day, a total of 3,480 kg N/day, P total of 0.352 kg/day, 119 274 kg BOD/day. The increased pollution loads in the Bay of Jakarta showed that the management of coastal and marine environment is still poor. Environmental education in the community is needed to improve the quality of the environment and public health in the coast of the Jakarta Bay.

### INTRODUCTION

The Jakarta Bay is a vulnerable area, dynamic, and the condition and shape may easily change. Changes in coastal areas could be caused by a variety of activities such as industry, housing, transport, ports, aquaculture, agriculture, tourism, and others. The increasing non-point source pollution is one of the biophysical degradation which has reached an alarming level (Directorate General of Coastal Marine and Small Islands of the Ministry of Marine and Fisheries, 2006). Non-point sources pollution (distribution or spread) is a pollutant that comes from sources that are in certainty unknown. Pollutants drift into the water through runoff of agricultural area, residential and urban areas. Law on Environmental Protection and Management Act and the Management of Coastal Areas and Small Islands have explained that the management of coastal areas should be integrated (Pramudyanto, 2014).

According to SLHD of the Province of Jakarta (2014), pollution in the Jakarta Bay is also due to contamination of the waters by domestic liquid waste derived from households (domestic). The waste streams through the waters around the settlement to the river and will enter the waters of the Jakarta Bay. Runoff from agricultural areas that contain pesticides and fertilizers will increase the nutrients in the water, especially nitrogen, phosphate and potassium. These nutrients if not utilized by the water biota or the existence of the chemicals exceed the necessity of the waters, it will cause eutrophication in rivers and in estuaries. Waste

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generated from the Livestock, either in the form of feces, urine, food remains, as well as water from the cleaning of livestock and cage, can be a source of water pollution of the river if there is no further waste management (Prawira, *et al.*, 2015).

The pollution that occurs in the fishing industries can lead to the reduction of fish that can be caught and the declining quality of the environment and public health (Ministry of Environment of the Republic of Indonesia, 2012). According to Primavera (2006) in Cao *et al.* (2013), wastes originating from fishing activities are solid, chemical, and pharmaceutical wastes. According to the Regulation of the Minister of Environment No. 05 of 2009 on the Management of wastes in ports, the type of waste that comes from routine ship operations and/or auxiliary port activities include oil, hazardous liquid and/or solid materials in bulk, hazardous materials of packaging waste, domestic waste, trash, emissions, as well as electronic and/or scrap ships wastes. The Local Environmental Management Agency (BPLHD) records the source of water in North Jakarta which generally already contains *E. coli* or bacteria that cause diarrhea.

Degradation in the Jakarta Bay requires environmental management. Environmental management is an attempt to control pollution in the coastal environment. Pollution control is the effort of prevention, mitigation and recovery of environmental quality that the quality of the environment remains as intended. The neighborhood is one of the important factors that positively affects the realization of people's health status. Therefore, environmental education is needed to prevent environmental-based diseases in the community.

### Methodology:

Sources of non-point pollution sources in this study are pollutants that come from domestic sewage, agriculture, livestock, fisheries, and activities at the port. The location of the inventory activity of pollutant sources of non-point sources in ten (10) villages located in five (5) districts in which the territories are bordered by the Bay of Jakarta. The data collection was mostly done using secondary data which is supported by the primary data. The collection of data that will be used as reference in identifying sources of non-point sources of pollutants have been obtained from the relevant agencies.

**Table 1:** List of the Villages in North Jakarta which is directly bordered by the Bay of Jakarta

No.	Subdistrict	Village
1	Subdistrict of Penjaringan	a. Village of Penjaringan b. Village of Pluit c. Village of Kapuk Muara d. Village of Kamal Muara
2	Subdistrict of Pademangan	Village of Ancol
3	Subdistrict of Tanjung Priok	Village of Tanjung Priok
4	Subdistrict of Koja	Village of Koja
5	Subdistrict of Cilincing	a. Village of Kali Baru b. Village of Cilincing c. Village of Marunda

Data analysis was conducted to determine potential pollution load as follows:

#### 1. Domestic Waste

$$PBP = \text{Total Population} \times \text{Emission Factor} \times \text{Equivalent Ratio} \times \alpha$$

Description:

- PBP : Potential Pollution Load  
 Emission factor : The emission factor for several types of pollutants for each of the parameters such as TSS, DOD, *E-coli*, detergents and N total  
 Equivalent Ratio : The ratio equivalent to the type of regions, cities, suburbs and rural areas  
 $\alpha$  (*Alpha*) : Value of River Reaching Coefficient in which the value depends on the pattern of sanitation (direct discharge into the river, direct discharge into open drains or direct disposal of septic tanks)

For the value of emission factor, the ratio of equivalent and alpha ( $\alpha$ ) can be seen in Table 2, Table 3 and Table 4.

**Table 2:** Price if River Reaching Coefficient ( $\alpha$ )

Sanitation Pattern	River Reaching Coefficient
Direct Discharge into the River	1
Open Channel	0.5
Septic Tank	0.25

Source: Irianto, Iskandar in SDA Puslitbangin KLHK of 2012

**Table 3:** Value of Equivalent Ratio

Region	City Equivalent Ratio ( <i>rek</i> )
City	1
Suburbs	0.8125
Inland	0.6250

Source: Irianto, Iskandar in SDA Puslitbangin KLHK of 2012

**Table 4:** Value of the Emission Factor of Various Pollutant Parameters

Pollutants	Emission Factor (gr/day)
TSS	38
BOD	40
E-Coli	3E+14
Detergen	0.189
N Total	1.95

Source: Irianto, Iskandar in SDA Puslitbangin KLHK of 2012

**Fisheries:**

According to the formula from Ackefors and Enell in the Ministry of Environment of the Republic of Indonesia (2012), the amount of Nitrogen loading into the waters is determined by using the following formula:

$$\text{Ton Nitrogen} = (A \times C_{d \text{ Nitrogen}}) - (B \times C_{f \text{ Nitrogen}})$$

Information:

- Ton Nitrogen : Nitrogen Loading into the waters  
 A : Weight of pellets (fishmeal) used (moisture content 8-10%). Feed requirements for the production of 1 to 2.2 tons of fish  
 B : Wet Weight of fish produced  
 Cd nitrogen : Nitrogen content of the pellets (8.25% wet weight)  
 Cf Nitrogen : Nitrogen content of the carcass of fish (2.63% wet weight)

**Livestock:**

- The determination of pollutant sources of livestock waste, namely E. coli Total, Sodium (N) total, phosphate (P) total, and BOD.
- The calculation of potential pollutant load of Livestock waste uses the formula (irianto in KLH RI, 2012):

$$\text{PBP} = \text{Total of Livestock} \times \text{FE} \times \text{Rek}$$

Description:

- PBP : Potential Pollutant Load  
 FE : Emissions factor based on the emission factor of domestic waste water  
 Rek : City equivalent ratio

Emission factors refer to the emissions factors used to calculate the potential load of pollutants from livestock which can be seen in Table 5.

**Table 5:** Emission Factors for Calculating the Pollutant Load From Livestocks

No.	Type of Livestock	Emission Factor			
		Coli Total (total/head/day)	N Total (gr/day)	P Total	BOD
1	Cow	3,7E+06	0,933	0,153	292
2	Buffalo	9,2E+06	2,599	0,39	206,71
3	Sheep	2,1E+05	0,278	0,115	55,68
4	Goat	2,1E+06	1,624	0,116	34,1
5	Chicken	4,3E+0,4	0,002	0,003	0,003
6	Duck	1,0E+05	0,001	0,005	0,005

Source: Irianto, Iskandar in SDA Puslitbangin KLHK of 2012

**Agriculture:**

According to Irianto in SDA Puslitbang in the Ministry of Environment of the Republic of Indonesia (2012), the potential agricultural pollution can be determined by using the formula of Potential Domestic Pollution Load (PBP) on the following formula:

$$\text{Large emission} = \text{emission factor per unit area} \times \text{extent of diffused source}$$

The Emission factors refer to the emissions factors used to calculate the potential burden of pollutants from agriculture which can be seen in Table 6

**Table 6:** Emission Factors for the Calculation of Pollutant Burden in Agriculture

No	Agricultural Waste	Emission Factor (Kg/ha)	
		Rice Fields	Other Plantation
1.	BOD	22,5	32,5
2.	N	20	3
4	P	10	1,5
4.	TSS	0,04	1,6
5	Pesticides	0,16	0,024

Source: Irianto in DPU SDA Puslitbang in the Ministry of Environment of the Republic of Indonesia (2012).

**RESULTS AND DISCUSSIONS**

Economic activity and population growth can lead to problems in the coastal areas and the waters of the Jakarta Bay. The damage caused to the Bay of Jakarta is very complex due to various activities undertaken around the bay that transformed the Jakarta Bay into a rubbish bin. Various types of waste that washed into the river basin automatically have a serious impact on the improvement of the deposition material (sediments) to the waters of the Jakarta Bay. The high sedimentation rate will then cause the deposition process of organic and inorganic materials faster. The peak of the sedimentation is the environmental issue that can cause damage to the ecological structure and function of coastal areas of the Bay of Jakarta that consists of coral reefs, seagrass, and mangrove (Maritime Magazine, 2014). Land clearing activities at the upstream and coastal areas for agriculture, aquaculture, residential, industrial and urban development is a source of sediment loads and pollution of coastal waters.

The amount of solid waste (garbage) that goes into the Jakarta Bay from the data received from the Administrative District of the Department of Sanitation of the Thousand Islands (2015), the average garbage from the month of January to August 2015 was as much as 267,465m<sup>3</sup>/day. The average number of the waste that can be handled is only about 185m<sup>3</sup>/day while the remaining 82.46 m<sup>3</sup> of waste in the Bay of Jakarta has yet to be overcome. According to Pramudyanto (2014), the sea receives continuous contamination from the flow of the river. In addition, some activities of dumping waste directly into the sea frequently occur and some even illegally, hence turning the sea into a very large dumpster.

According to the Jakarta Provincial Government (2012) in Pramoko *et al.* (2013), data from the Jakarta Sanitation Department showed that the amount of waste produced by the public of the capital currently reaches 27,996 m<sup>3</sup> per day, with an average increase of 5% annually. Domestic waste that goes into the Jakarta Bay consists of solid and liquid wastes. The potential number of domestic solid waste from residents coming from the ten Villages is 1,596.29m<sup>3</sup>/day, with the generation of garbage/solid waste of 3.4004 liters/person/day. 86% (1,111.68 tons/day) of waste in North Jakarta can be overcome, while the remaining 14% (184.08 tons/day) is not transported. It is estimated that the waste failed to be transported is going to go into the waters of the Jakarta Bay. The sanitation of solid waste such as domestic waste in the Jakarta Bay is conducted by the Department of Sanitation of the Special Capital Region of Jakarta routinely. Domestic liquid waste from residents in ten villages in North Jakarta which are bordering the coast produce 56,333.16m<sup>3</sup>/day, with a number of domestic waste issued by each person/day amounting to 120 liters/person/day. The Potential Pollution Load (kg/day) in ten coastal villages in the Administrative City of North Jakarta in 2014 is as follows:

**Table 7:** Data of Potential Pollution Load (kg/day) in the Ten Coastal Villages of North Jakarta 2014

Sanitation Pattern	Total Population	Potential Pollution Load (kg/day)				Total N	Detergent
		E-coli	BOD	TSS	Total N		
Direct Discharge (100%)	469,443	1.41E+20	18,778	17,839	915.4	88.7	
Open Channels (100%)	469,443	7.04E+19	9,389	8,919	457.7	44.4	

The potential figure of the highest E-coli pollution load is 1.41E + 20, BOD of 18,778, 17,839 TSS, Total N of 915.4 and 88.7 detergents with the assumption that the pattern of sanitation is the direct discharge conducted by all (100%) of the population in ten coastal villages located in North Jakarta. Based on the data of SLHD

Jakarta in 2014, the content of E-coli in the urban villages in North Jakarta that has polluted the wells are in Semper Barat which has 290mpn/100ml, Cilincing and Sukapura have 210 MPN/100ml, and Rorotan has 93 mpn/100ml, in which the village of Cilincing is included as the area of research.

**Table 8:** Potential Pollutant Load of Livestock in the Administrative City of North Jakarta

Total Livestock	Total (head)	Emission Factor				Water and Livestock Pollution Load			
		Coli Total (total/head/day)	N Total (gr/day)	P Total	BOD	Coli Total (jml/hr)	N Total (kg/day)	P Total	BOD
Cow	87	3,7E+06	0.933	0.153	292	3,2E+08	0,08117	0,01331	25,404
Buffalo	22	9,2E+06	2.599	0.39	206.71	2,0E+08	0,05718	0,00858	4,54762
Sheep	390	2,1E+05	0.278	0.115	55.68	8,2E+07	0,10842	0,04485	21,7152
Goat	1.981	2,1E+06	1.624	0.116	34.1	4,2E+09	3,21714	0,2298	67,5521
Chicken	3.500	4,3E+04	0.002	0.003	0.003	1,5E+08	0,007	0,0105	0,0105
Duck	8.900	1,0E+05	0.001	0.005	0.005	8,9E+08	0,0089	0,0445	0,0445
Total						5,8E+09	3,480	0,352	119,274

Potential pollutant load in livestock activities in North Jakarta is Coli with the total of  $5,8E + 09$  per day, aN total of 3,480 kg/day, P total of 0.352 kg/day, BOD of 119.274 kg/day. Livestock waste of goats provides the most potential contamination of the Coli, N total, P total, and BOD parameters.

Waste of fishery products may take the form of solids, liquids or gases. Waste that has a solid form is pieces of fish meat, scales, gills or digestive tracts. Fish waste in the form of liquid includes blood, mucus and water from washing the fish. While fish waste in the form of gas creates an odor that is caused by the presence of compounds of ammonia, hydrogen sulfide or ketone (Prihatiningsih, *et al.*, 2013).

**Table 9:** Estimated Volume Solid Waste Ports in Jakarta

Name of Ports	Location	Land Area (Ha)	Total Volume Solid Waste in Ports (M <sup>3</sup> /Day)
Port of Tanjung Priok	Tanjung Priok	604,80	
Port of Sunda Kelapa	Sunda Kelapa	50,80	17,30
Port of Muara Angke	Muara Angke	3,00	
Port of Nizam Zachman	Muara Baru	-	-

Source: SLHD Jakarta of 2014

The estimated volume of solid waste at the existing three ports of Tanjung Priok, Sunda Kelapa Harbor, and Port of Muara Angke is 17.30m<sup>3</sup>/day, which can be seen in Table 9. The estimated numbers including waste generated by traders and wastes unloading but not including wastes that flowed in from the sea which can be seen in Table 9.

Pollutants in water comprise of chemical elements, bacteria, and changes in physical and chemical properties of water. Bacteria result in pollution which can cause various diseases in humans and animals because in general the chemical elements become toxic that pollute the water (Bahtiar, 2007). Based on the above data it is known that E. coli contamination in the bay of Jakarta is very high. The environment and people's behavior are an important factor for the level of public health (Notoatmodjo, 2007). The increment of pollution load in the Bay of Jakarta showed that the management of coastal and marine environment is still poor. This can have an impact on public health in the coastal area. The estimation of diarrhea cases in North Jakarta in 2012 amounted to 67,673 cases (Report Program Diarrhea Jakarta Provincial Health Office in Jakarta Health Profile 2012). Based on data from the Central Bureau of Statistics (2014), Jakarta residents who have completed their High School education amounted to 36.99%, but the awareness of the importance of protecting the coastal and marine environment is yet to be seen. Environmental education is needed in order to improve the environmental quality and public health. The existence of environmental education is expected to raise awareness of the importance of the role of the community in the effort to control pollution in coastal and marine areas. Public participation is an important factor in the success of the environmental health program. In addition, the role of the community is an important element for sustainable development, because people are the main actors in the management of environmental resources. By the community-based environmental management, it is expected to increase the public awareness in safeguarding the coastal and marine environment. The public can also provide feedback to interested parties, and is obliged to manage and protect the marine and coastal environment Hudiansyah (2003) in Fitriansah (2012). In line with Dahuri (2003), a deep understanding of each of the main actors on the roles and responsibilities in implementing the program is an important factor for realizing the success of the community-based management. The management of coastal areas should be integrated, namely integration of planning that balances the interests of economic, social, cultural, and conservation of natural resources and the environment (Alikodra 2006 in Harahap). Environmental management should be tailored to the existing circumstances, so that the environmental management strategies that are taken are in accordance with the conditions of the managed area.

**Conclusion:**

1. The figures of potential contamination from the sanitation pattern with the highest pollution load for E-coli is  $1.41E + 20$ , 18,778 BOD, 17.839 TSS, Total of N 915.4 and 88.7 detergents by using a pattern of direct disposal of all residents in ten villages in the coast of the Administrative City of North Jakarta.
2. The potential pollutant load in husbandry activities in North Jakarta is Coli with the total reaching up to  $5,8E + 09$  per day, a total of 3,480 kg N/day, P total of 0.352 kg/day, 119,274 kg BOD/day. Waste of goat Livestocks provides the most potential contamination of Coli parameter, total of N, total of P, and BOD.
3. Environmental education can raise awareness of the importance of the role of the community in an effort to control pollution in coastal and marine areas.

**Suggestions:**

1. The Jakarta Provincial Government in collaboration with the relevant agencies are expected to implement the control measures of waste that goes into the Jakarta Bay by increasing community participation in waste management, especially the inhabitants at the bordering rivers and the northern coast of Jakarta and provide education and increase public knowledge on the management of waste to households, small and medium enterprises.
2. Department of Marine, Agriculture and Food Security of Jakarta is expected to cooperate with institutions and related parties for the supervision, management, and coaching the management of waste generated by the activities/businesses of agriculture, fishery, and livestock, and in particular the activities that were on Fish Auction Place and Piers/Ports of fishing boat.
3. The Transport Department of the Special Provincial Capital Region of Jakarta in cooperation with the relevant agencies and ship owners are to minimize waste originating from activities in ports/docks.
4. The Ministry of Environment and Forestry in cooperation with relevant agencies are to minimize in the decreasing quality of waters of Jakarta Bay and minimize the amount of non-point sources pollutants that go into the Jakarta Bay and take actions by the enforcement of regulations related to environmental management and monitoring.

**REFERENCES**

- Harahap, R., 2015. Sustainable Community-Based Coastal Management. University of North Sumatra.
- The Central Bureau of Statistics. 2015. *Jakarta dalam Angka*.
- Bahtiar, A., 2007. Groundwater Pollution Due to Industrial and Household Waste and Problem Solving. Padjadjaran University.
- Cao, L., W.Wang, Y.Yang, C.Yang, Z.Yuan, S.Xiong, J.Diana, 2007. Environmental impact of aquaculture and countermeasures to aquaculture pollution in China, *Environmental Science and Pollution Research - International*, 14(7)11 pp., Translated by Novriadi, R. (2012). <http://www.slideshare.net/Romitisam/dampak-lingkungan-pada-kegiatan-budidaya-perikanan-di-china>. 28th December 2015, at 17:05 pm.
- Dahuri, R., 2003. *Keanekaragaman Hayati Laut Aset Pembangunan Berkelanjutan Indonesia*. Jakarta: GramediaPustakaUtama.
- Directorate General of Coastal Marine and Small Islands of the Ministry of Marine and Fisheries, 2006. *Model Materi Muatan Penyusunan Peraturan Daerah Provinsi dan Kabupaten/Kota tentang Pengelolaan Wilayah Pesisir*. Jakarta: n.n.
- Fitriansah, H., 2012. Sustainable Management of Coastal Environment Through Community Empowerment in the Rural of KwalaBedagaiSerdang Lama. *Jurnal Pembangunan Wilayah dan Kota* 8(4): 360-370.
- The Ministry of Environment of the Republic of Indonesia, 2012. Menuju Industri Perikanan Ramah Lingkungan dan Berkelanjutan. <http://www.menlh.go.id/menuju-industri-perikanan-ramah-lingkungan-dan-berkelanjutan/>. 27<sup>th</sup> December 2015, at 16:27 pm.
- The Ministry of Environment of the Republic of Indonesia, 2012. *Analisis Beban Pencemaran Dan Penyusunan Laporan Inventarisasi Dan Identifikasi Sumber Pencemar Air dari Kegiatan Domestik di Daerah Aliran Sungai (DAS) Martapuradan Barito di Kota Banjarmasin Tahun 2012*.
- Maritime Magazine, 2014. *Sedimentasi Akut di Teluk Jakarta*. <http://m.maritimemagz.com/2014/12/01/sedimentasi-akut-di-teluk-jakarta/>, accessed on 23<sup>rd</sup> November 2015 at 9:08 pm.
- Notoatmodjo, S., 2007. *Pendidikan dan Kesehatan Perilaku*. Jakarta: RinekaCipta.
- The Provincial Government of Jakarta, 2015. <http://www.www.jakarta.go.id>, accessed on 5<sup>th</sup> October 2015 at 20:20 pm.
- Regulation of the Minister of Environment No. 05 of 2009 on Waste Management in Ports.
- Pramoko, A.G., H.A.Kurniawati, 2013. Study of Trash-Skimmer Boat Design in the waters of the Jakarta Bay. *Pomits Technical Journal.*, 2(1)6. <http://ejurnal.its.ac.id/index.php/teknik/article/view/2481/800>, accessed on 23<sup>rd</sup> November 2015, at 7:53 pm.

Pramudyanto, B., 2014. Marine and Coast Pollution Control. *Jurnal Lingkar Widya Swara Edisi 1 No. 4*, 20 p. [http://juliwi.com/published/E0104/Paper0104\\_21-40.pdf](http://juliwi.com/published/E0104/Paper0104_21-40.pdf), accessed on 23<sup>rd</sup> November 2015, at 0:13 pm.

Prawira, J., M. Rizal, E. Morina, S. Cahyani, M. Larasan, 2015. *Manajemen Sumberdaya Perairan Analisis Pencemaran Daerah Aliran Sungai: Studi Kasus Pencemaran Limbah Industri, Domestik Dan Pertanian Disepanjang Daerah Aliran Sungai*, [http://www.academia.edu/16388900/Studi\\_Kasus\\_Pencemaran\\_Limbah\\_Industri\\_Domestik\\_Dan\\_Pertanian\\_Disepanjang\\_Daerah\\_Aliran\\_Sungai](http://www.academia.edu/16388900/Studi_Kasus_Pencemaran_Limbah_Industri_Domestik_Dan_Pertanian_Disepanjang_Daerah_Aliran_Sungai), 25<sup>th</sup> December 2015, at 00:28 pm.

Prihatiningsih, B., Sadhotomo And M. Taufik, 2013. *Dinamika Populasi Ikan Swaggi (Priachantustayenus) di Perairan Tangerang - Banten*. Marine Fisheries Research Institute Jakarta., 5(2): 81-87. Jakarta Health Agency. Jakarta Health Profile 2012. [www.depkes.go.id/.../11%20Profil\\_Kes.Prov.DKIJakarta\\_2012.pdf](http://www.depkes.go.id/.../11%20Profil_Kes.Prov.DKIJakarta_2012.pdf). Accessed on 4<sup>th</sup> February 2016, at 13:00 pm

SLHD Jakarta, 2014. *Regional Environmental Status of the Province of Special Capital Region of Jakarta 2014*. Environmental Management Agency (BPLHD) of the Province of Special Capital Region of Jakarta.

Department of Sanitation of The Administrative District of the Thousand Islands, 2015. Waste Data of the Thousand Islands District of.