

# GREYWATER MANAGEMENT OF PANTAI BARU PANDANSIMO BANTUL DISTRICT FOR CREATING ZERO WASTE ZONE

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## Abstract

The beach which is experiencing the current developments in the districts of Bantul is Pantai Baru Pandansimo. This area is an area that has been declared by the Bantul regent as *zero waste zone*. The development of Pantai Baru Pandansimo will give some impact. Thing that can arise is the environmental pollution from trading activity at restaurants around Pantai Baru Pandansimo. Every restaurant produce washing waste (greywater) had only absorbed into the ground or yard restaurants because do not have access to treatment plant.

The main objective of this research is plan alternative system management for greywater that corresponding to Pantai Baru Pandansimo area so can creating sustainable zero waste zone. The results of the analysis obtained that alternative management unit greywater that appropriate and can be used at Pantai Baru Pandansimo is subsurface constructed wetland because easy to understand society and easy maintenance. Application of processing units that had been planned to reduce the BOD load in the amount of 41% depending on the extent of the unit to be used and reduce greywater is discharged into the environment 60% -80% of waste. From calculations obtained, wetland unit dimensions used by the average discharge within one week of 276.25 liters / day is  $1 \times 0.5 \times 0.8 \text{ m}^3$  with detention time (td) 0,5 day. Wetland that is used can be used as a park around the culinary of Pantai Baru Pandansimo and can encourage people to be more aware of the concept of zero waste.

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BOD

## 1. Introduction

The beach which is experiencing the current developments in the districts of Bantul is Pantai Baru Pandansimo. This area is an area that has been declared by the regents as the Bantul area is a zero waste approach and the application of systems and waste treatment technology and scale individual scale urban areas in an integrated manner with the goal to reduce the volume of waste as little as possible (Surbakti, 2010). Activities in the region will be able to have an impact, such as environmental pollution caused by the activity of buying and selling in shops around Pntai Baru Pandansimo, each restaurant will certainly use clean water and approximately 60% -85% of the water use would be domestic wastewater (Metcalf and Eddy, 1991). So far the community just throw waste by burying or insert into the ground and discharged into the surrounding environment, such as laundry wastes derived from fish stalls either former or other washing or commonly known as greywater. Greywater is the liquid waste from the activity or activities of the kitchen, washing clothes, bathroom (besides feces), and so forth, who are coming home, school, or office (Eriksson et al., 2002). Greywater is a reflection of household activities, the main characteristic is highly dependent on factors such as cultural habits, standard of living, household demographics, type of household chemicals are used and others (Morel A. and Diener S., 2006).

Based on the problems that arise on the need for prevention and appropriate solutions. The management of waste is done by utilizing advance so that the waste is not directly discharged into the environment or the use of processing units that can minimize the risk of waste disposal, it is necessary perencanakan alternative for

greywater management system in accordance with Pantai Baru Pandansimo. The system is made not only to the environment but also for the community to form the behavior that led to the concept of zero waste.

## 2. Methodology

The research was conducted in the area of the District Pantai Baru Pandansimo Srandakan, Poncosari village, Bantul, Yogyakarta. The location determination is done by purposive (deliberately) with the consideration that the region Pandansimo a new beach that does not have adequate waste management systems. Data collection was conducted primary data collection and secondary data collection. The research process begins with identifying the existing wastewater problems in Pantai Baru Pandansimo. Identification is performed to determine the degradation of the environment and the state of the field theory. The theory is used to approach zero waste then selecting alternative processing unit which performed community empowerment. To determine the composition and the discharge of waste is carried out lab tests and field measurements for 7 days. Then, an evaluation of waste management that have been made public. The next stage, gave questionnaires to the public to determine attitudes towards wastewater management. To get a more in-depth data is carried out also focus group discussion (FGD) so that information can be seen clearly. Once the data is obtained, it is made in the form of wastewater management alternatives greywater. In the last stage of evaluation of the concept of zero waste that can be occurred in Pantai Baru Pandansimo a sustainable manner. Besides FGD analysis method used is descriptive qualitative and quantitative in

order to provide a picture of systematic, factual and accurate information on existing greywater waste management in the study area.

**Mindset**

Framework of this study can be seen in Figure 1 which gives the translation of the beginning of the obvious degradation of environmental problems that occur in Pantai Baru Pandansimo region to plan for wastewater governance with the concept of sustainable zero waste, to be explained in more detail as follows:

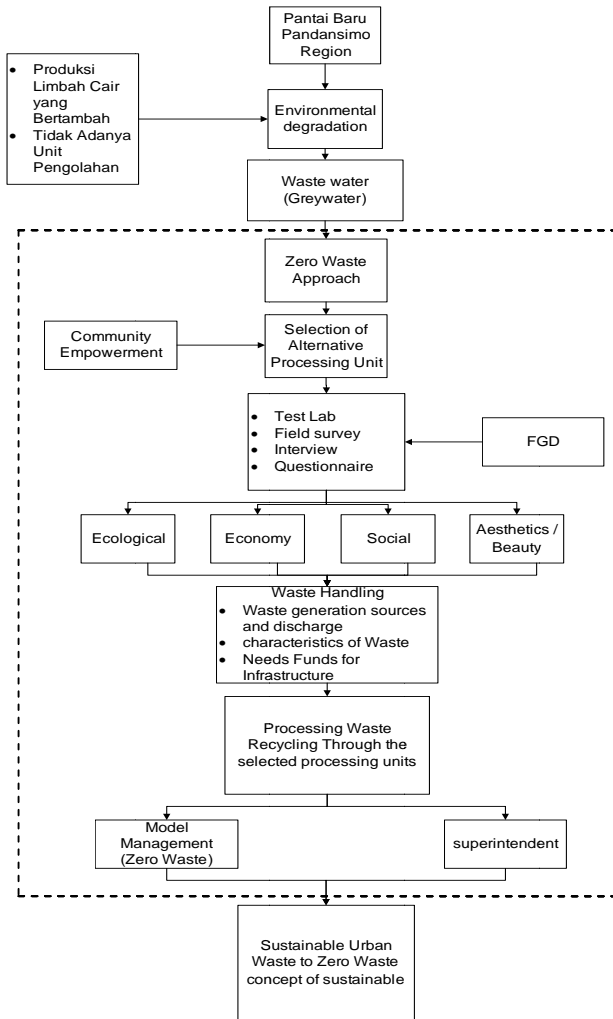


Figure 1. Mindset

**Research Process Flowchart**

Process research on the flow of liquid waste management system in the form of greywater in New Beach Pandansimo can be explained in Figure 2 below:

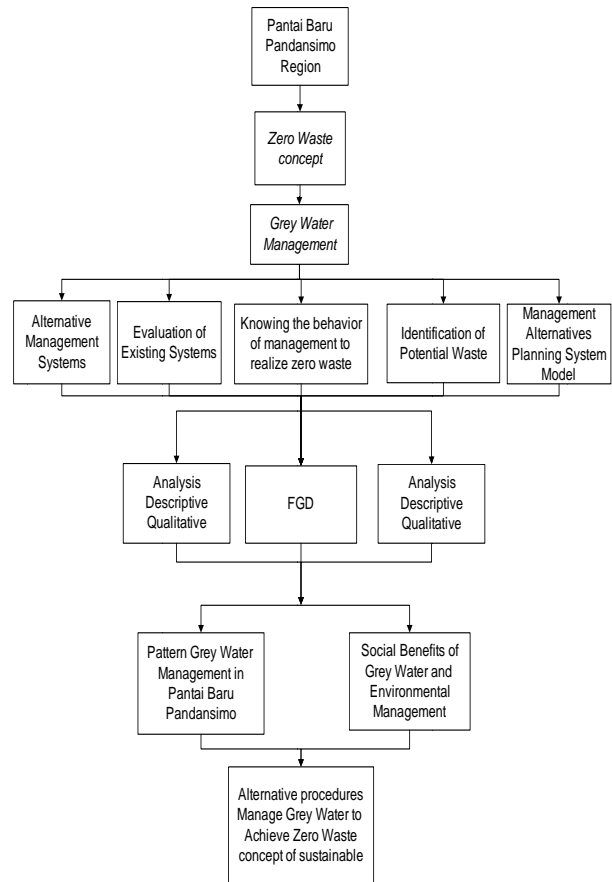


Figure 2. Flowchart of Research

**3. Results and Discussion**

**Sources and Greywater Generation**

Source of greywater in the culinary area dominated from the washing of fish, vegetables and washing dishes.



(a) (b)

Figure 3. Greywater Disposal Conditions in Pantai Baru Pandansimo, (a) Greywater washing results, (b) Situation of greywater sewer

Discharge sampling conducted for 7 consecutive days at the same location in accordance with the Regulation of the Minister of Public Works No. 18 / PRT / M / 2007. When viewed as a whole gained an average discharge of 276.25 liters / day. Smallest discharge can be seen on Wednesday ie 78 liters / day which is a mid-week day and a work day so that very few of the visitors who come. The number of food stalls and kiosks are located in the region are as many as 78 buildings. The survey results show that each commercial building will produce wastewater. More detail can be seen in the picture below:

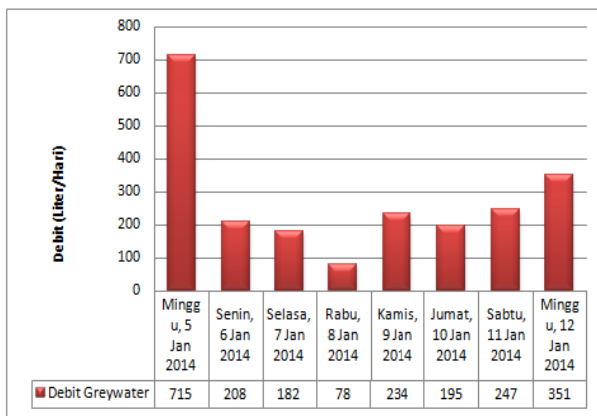


Figure 4. Measurement results discharge Greywater in 1 Week

**Characteristics of Greywater**

Greywater characteristics as tested sampling taken from one of the stalls that represent characteristics of greywater in New Beach Pandansimo. Samples taken later brought to laboratoirum to know the characteristics of the waste. For the test results can be seen in the following table:

Table 1. Greywater Characteristics of Sampling at restaurant Culinary of Pantai Baru Pandansimo

Parameter	Sample results in a stall culinary fish Laundry	Sample results in the accumulation of Greywater One Day stall culinary	Unit
BOD	222,9	109,9	mg/L
COD	120	88	mg/L
TSS	360	257	mg/L
pH	6,6	6,5	-
P	34,506	2,91	mg/L
N	907,6	608,46	mg/L
K	989	302	mg/L

**Focus Group Discussion**

In this research, the selection of units to be used as a greywater treatment, the selection is taken based on data obtained and community involvement in order to specify the units used can be easily understood and used by the people of these options is a Subsurface Constructed Wetland and Methods Vertical Garden.

FGD people prefer option (a) Subsurface Constructed Wetland this can easily be done if they have the unused tub and using plants to treat greywater through which fluids. Meanwhile, for option (b) Method of Vertical Garden has the advantage to save space horizontally and can be used on the plant shelf, but when the dry season prevailing winds Pantai baru Pandansimo region will blow harder so that it can knock down objects that stand upright without the presence of buffer. It will interfere with the performance of the option (b). FGD results provide community management requirements that can be received is:

1. It takes up too much land, if the form of the processing units can dikamuflekan so subtle, where

the unit is being used to add value to others, such wetland that can be formed into a simple garden.

2. The cost of the material used is cheap and easy to obtain.
3. People familiar with the management unit as having elements of plants, because they have other jobs are farmed.
4. Not interfere with activities of daily work community.
5. Using the potential of the resources available in the region of Pantai Baru Pandansimo.



Figure 5. Focus group discussion in Pantai Baru Pandansimo

**Alternative Planning Unit**

Subsurface Constructed Wetland on this, the treated wastewater is greywater waste from stalls of culinary activity. Large discharge greywater calculated based on measurements made in the field with an average discharge of 276.25 liters / day for a stall by stall samples were taken. This discharge will be used for calculating basic design Constructed Wetland. Greywater samples that have been tested to have a lab BOD value 109.9 mg / l, with processing through Subsurface Constructed Wetland expected to reduce the concentration of BOD by 50% which can go down to 55 mg / l.

- The rate of flow (discharge)

$$Q = 276,25 \text{ liters/day} = 0,27625 \text{ m}^3/\text{day}$$

- Constants at temperatures in the wetland per day ( $K_T$ )

$$K_T = K_{20} (1,06)^{(T-20)}$$

$K_{20} = 1,104/\text{hari}$  (Reed et al,1994) dengan  $T = 25 \text{ }^\circ\text{C}$  temperature waste in wetland

$$\text{So, } K_T = 1,104 * (1,06)^{(25-20)} = 1,48/\text{day}$$

- Surface Area( $A_s$ )

Depth = 0,8 using plants Bulrush, *Scirpus* (Reed, 1993), plant selection to find the roots of plants based on the most in order to minimize the surface area of the unit.

= Porositas, dengan *gravelly sand* : 0,35 (Reed, 1993)

$$A_s = (L)(W) = \text{-----}$$

$$A_s = \text{-----} = 0,46 \text{ m}^2$$

Area = Length \* Width

By comparison between the length and width 2 : 1, Subsurface Constructed Wetland then the dimensions are the following : Length = 0.96 m; width = 0.48 and a depth of 0.8 m. **So to rounding length = 1 m; width = 0.5 m and depth = 0.8 m**

- Detention time in *Subsurface Constructed Wetland*

$$t = \text{HRT} = (L.W.D)/Q$$

$$t = (0,35 * 0,96 * 0,48 * 0,8) / 0,27625 = 0,5 \text{ day}$$

- Hydraulic load

$$\text{HLR} = Q / A_s = 0,5976 \text{ m}^3/\text{m}^2\text{-day}$$

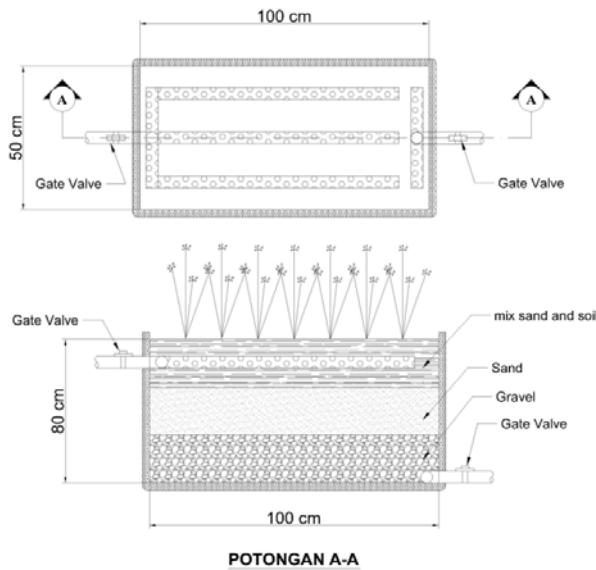


Figure 6. Design of Subsurface Constructed Wetland for Greywater Management in Pantai Baru Pandansimo

To facilitate the public take into account how much area is required if the increased discharge that occurs in their stalls as a result of increasing the number of visitors then can use the following table:

Table 2. Calculation Table Design Subsurface Constructed Wetland

The water used (L / day)	Waste generated (L / day)	L	W	H
300	240	0,9	0,5	0,8
350	280	1	0,5	0,8
400	320	1,1	0,6	0,8
450	360	1,1	0,6	0,8
500	400	1,2	0,6	0,8
550	440	1,3	0,7	0,8
600	480	1,3	0,7	0,8
650	520	1,4	0,7	0,8
700	560	1,4	0,7	0,8
750	600	1,5	0,8	0,8
800	640	1,5	0,8	0,8
850	680	1,6	0,8	0,8
*1000	800	1,7	0,9	0,8
1100	880	1,8	0,9	0,8
1150	920	1,8	0,9	0,8
1200	960	1,8	0,9	0,8
1250	1000	1,9	1	0,8
1300	1040	1,9	1	0,8
1350	1080	1,9	1	0,8
1400	1120	2	1	0,8
1450	1160	2	1	0,8
1500	1200	2	1	0,8

Note: Intake numbers are in the middle when using larger numbers. \* Projected waste results 10 years later

**Greywater Management System**

Methods and wastewater treatment process has been developed with a variety of diverse, depending on the content of pollutants and types of waste generated. In this study based on the management of community

participation by adapting processing unit to be used with the existing condition in Pantai Baru Pandansimo region. Viewed from the results of the data obtained is then adjusted to the processing unit provided to the public then be applicable management is the establishment of a simple system that is easy to understand society.

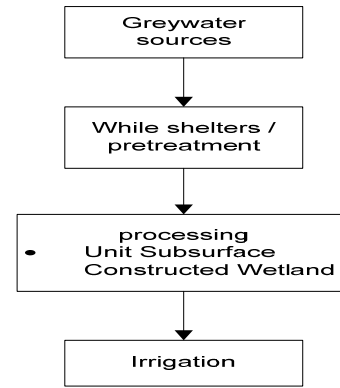


Figure 7. Management Flowchart

More detail can be seen in the following figure sketches management:



Figure 8. Sketch Using Greywater Management Unit Subsurface Constructed Wetland

From the results of the application can be used as a comparison or an example for management development in other areas that have similar environmental characteristics. Management systems are given a concept taken from the Waste Water Garden (WWG) due to the use of this concept of processing units does not look stiff but can ditamani with ornamental plants. These systems have the advantage of this WWG does not require high cost, simple technology and durable, as well as the maintenance is very simple, using existing resources, as well as add to the beauty and can ditamani with other plants menghasilkan additional products (www wastewatgardens.com). Applied so that the wetland is expected to make management easier to understand, apply real and sustainable.

**Analysis Application of Concept Zero waste**

The result of the calculation constructed subsurface wetland application used to design the wetland tubs can reduce the BOD load by 41% and it has been below the

quality standard which means that the pollutant load has been reduced and the corresponding requirements. To get a reduction in BOD load greater extent it is necessary to add a larger wetland depends on the available land. Greywater management can reduce waste by 60% -80% as indicated from the amount of water used and wastewater entering kepenampungan does not make a whole, there is a 20% -40% are discharged into the environment where it is dependent on the behavioral patterns of workers was in the kitchen shop. The results of the BOD load reduction can dilihat in the following table:

**Table 3 Results of Wetland Waste Treatment designed**

Paramater	Inlet	Outlet	Unit
pH	6,5	6,3	-
BOD	109,9	64,17	mg/L

#### **Making Examples of Subsurface Constructed Wetland in Pantai Baru Pandansimo**

Changing the mindset of the people to be more concerned about the environment is not easy and requires a short time, but if driven continuously, the awareness of the environment, especially the management of greywater that their production will slowly emerge within them. To encourage people to be motivated to manage their wastewater then socialization and guidance should be given as an example of making Subsurface Constructed Wetland in Pantai Baru Pandansimo. Making this example aims to build understanding of how to manage greywater with a simple and easy way to utilize the existing resources of their environment. Making this example shows how management can be done in their culinary tour.



**Figure 9. Making Examples of Subsurface Constructed Wetland in Pantai Baru Pandansimo**

#### **Zero Waste Sustainability Analysis at Pantai Baru Pandansimo**

Continuity zero waste depends on the role of communities in Pantai Baru Pandansimo region. The result showed that this concept has great potential to continue to grow in the region. It is seen from the motivation and enthusiasm of the community at the time of making an example of subsurface constructed wetland with evidence they instantly form a group that would handle the liquid waste. Previous perkembangan groups that support the concept of zero waste in the region is the creation of waste and networking have been given assistance by the government of Bantul composter units that will be contested nationally.

Change the mindset of society require continuous assistance from the government and from other institutions such as universities go directly to the field. The role will support the development of a group of zero waste, especially with the launching of zero waste in the region have a great impact for the community in the form of visitors who got to know the location. The Proclamation also an impact on public perception to pay more attention to the waste produced. To further the public will continue to work closely with relevant parties, with the full support of the University of Gadjah Mada, and BLH Bappeda Bantul Bantul region corresponding to establish the concept of zero waste goal and providing environmental advantage of not only the economy but the welfare of society.

#### **4. Conclusion**

Based on the objectives and results of the research that has been conducted on this study it can be concluded as follows:

1. The composition is in greywater result culinary of Pantai Baru Pandansimo a BOD 109.9 mg / l, COD 88 mg / l, TSS 255 mg / l, pH 6.5, phosphorus 2.91 mg / l, 608 Nitrogen, 46 mg / l and potassium 302 mg / l.
2. discharge greywater are produced from culinary tourism fluctuated with the largest discharge reaches 715 liters / day had an average of 276.25 liters / day of the week so it needs to be used as a buffer tank before processing.
3. Units are suitable for use to perform management of greywater in New Pandansimo Coast region is subsurface constructed wetland as easy to understand as well as easy maintenance community.
4. Application of processing units that had been planned to reduce the BOD load by 41% depending on the area of the unit to be used. Greywater and waste management in Pantai Baru Pandansimo will reduce the greywater is discharged into the environment 60% -80% of waste.

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