Sustainable Revitalization in Cultural Heritage Kampong Kauman Surakarta Supported by Spatial Analysis

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Abstract. Revitalization is a much-needed for a historic kampong as a settlement, place of business, and as tourist destinations. The research was conducted in Kauman as one of the cultural heritage kampong which was formerly as a residence of abdidalemulamaKeraton who also work as batik entrepreneurs. This study aims to formulate a sustainable revitalization step based on the character of the area and the building. Aspects of sustainable revitalization that analyzed are the physical and non-physical condition of the environment. This research is an applied research with qualitative rationalistic approach supported with spatial distribution analysis through satellite imagery and Arch-GIS. The results revealed that sustainable revitalization for Kauman can be done through: 1) Physical condition of the environment consists of land and building use, green open space, recreational park and sport activities, streets, drainage network, sewer network, the garbage disposal network; 2) Non-physical of the environment consists of economy, heritage socio-cultural, and the engagement of relevant stakeholders. The difference of this study with others is, this study is a continuation of the Kauman revitalization assistance program which involves community participation to produce a more appropriate solution for the problem of kampong.

Keywords: Sustainable Revitalization, Cultural Heritage Kampong, Spatial Analysis

1. Introduction

The conflict of interest between maintaining cultural heritage and conservative development is an important topic for society around the world [1]. This opinion is also stated by Moosavi [2], the planning of a city's development must take into account history, culture and meaning. The attempt to revitalize history, culture and identity in the city will face two conflicting challenges. On the one hand, the old city with its unique is irreplaceable monument, history, culture and identity, and on the other hand, contemporary urban life with its technological requirements.

The effort to overcome this is by sustainable revitalization, which is an integration of technologies and solutions to meet new needs as the impact of socio-economic dynamics by enhancing the vitality
of historical potential of urban area in adaptive reuse [3]. Cultural value development activities aim to improve the welfare of the community [4,5]. Revitalization covers the management of the physical aspects as well as the social and economic impacts of the region concerned.

The revitalization of land and buildings as spatial elements can inform the specific architecture of region, architecture can take part in the creation of heterogeneous space in environmental built based on culture [6]. Sustainable revitalization of urban, physical, economic and socio-cultural historic areas is done to counter rapid changes due to the impact of globalization and urbanization. Sustainable revitalization use to prevent environmental degradation, and can only be done with a sustainable strategy involving all stakeholders related with holistic approach [7].

From the description above, it can be interpreted that sustainable revitalization is needed to preserve the historic areas that have decreased environmental quality, which includes physical, economic and socio-cultural aspects. In addition to these aspects, relevant stakeholders also play an important role in sustainable revitalization. Revitalization action is a phase of a non-linear process involving frequent and intense negotiations between stakeholders [8]. Without good coordination, conservation measures will not be able to achieve optimal results.

The role of stakeholders bringing change such as local and central government, state-owned and private companies, and the public, is indispensable for the sustainable development of legacy heritage sites in the future. The top-down regional management system without considering the will of the local community has failed, and has caused difficulties in implementing the revitalization plan of the historic area [9]. Governments should seek to protect cultural heritage assets by considering the wishes of the community, so that conservation and development can proceed in a balanced [1].

Buildings and heritage sites are crucial elements of the city development; they can either act as an image of the city or tourist attractions. One of Surakarta City Government’s efforts to revive the traditional territories is by proclaiming the Surakarta City’s tourism vision as “The future Solo is the old Solo”. The vision proclaimed by Mayor Joko Widodo on 18 February 2009, coincided with the 264th anniversary of Surakarta City.

As an old town, Solo has 81 buildings, 17 monuments, 5 parks and cemeteries along with 6 cultural heritage sites as listed in the Mayor Decree No. 646/116/I/1997 on the stipulation of the buildings and heritage sites and is complemented by the Decree of the Head of the City Spatial Planning No. 646/40/I/2014 on the stipulation of buildings deemed eligible as cultural heritage.

However, in Surakarta many ancient buildings are not maintained, torn down replaced by other commercial buildings, mortgaged to seek loans to the bank, or dismantled for sale retail [10]. Investors and building owners tend to raze the historical objects for more commercial purposes. Thus, revitalizing the heritage sites with all its activities is crucial to do, so that Solo will not lose its identity as a cultural center of Java.

The conservation of heritage sites does not actually hinder the growth of new buildings, but aims to harmonize old and new buildings in the region with cultural and economic activities to become the identity of a leading district in the city. According to Chung [8], harmonization will form the identity of the city that presents a series of events through a series of traces of building culture, architectural details and regional colors on the next generation.

There are four cultural heritage areas in Surakarta namely Baluwarti, Laweyan, Loji Wetan and Kauman. Kauman was chosen as the object of research because of its close relation with Keraton Surakarta (the palace of Surakarta), its potential as a kampong of santri that still exist [11], and alot of environmental problems in it. The location of Kampong Kauman blends with Masjid Agung (the Great
Mosque), forming an Islamic character in this community. The development of the kampong began in the mid-1800s, when batik entrepreneurs built traditional Javanese and Indische houses [12].

The quality of Kauman’s environment began to decrease alongside with the bankruptcy of batik industries in 1930-1970s. The area then turned into slums and the old buildings began to collapse [13]. Sustainable revitalization of Kauman is needed before the area collapses and disappears, particularly because of the location of this kampong which has a potential to be developed into a tourism asset of Surakarta.

Kampong revitalization program has been conducted by the writer with the team from Department of Architecture Faculty of Engineering Universitas Sebelas Maret since 2006. The strategies implemented in the revitalization are: short-term, reviving the batik business; Medium-term, revive the village of santri; And long-term, making Kauman as a tourist kampong of religious and batik [12]. Since 2008 The municipal, provincial and central governments have provided financial support to revitalize the area, but to date the results have not been maximized despite an increase in economic aspects. Sustainable revitalization is needed so Kauman can be more comfortable and healthy to live in and can be used as religious tourism and batik.

This research is a continuation of the kampong revitalization assistance program that has been conducted since 2006, involving community participation and relevant stakeholders. The purpose of this study is to find a sustainable revitalization step that must be done to make the environment more healthy, comfortable to live and can be developed into a religious tourism kampong and batik. Issues raised in this study are:

a) How is the existing condition of environmental in cultural heritage Kampong Kauman nowadays?
b) How is the sustainable revitalization program that should be applied for Kauman?

2. Data and Method

2.1. Data

*Kelurahan* Kauman is located in the Pasar Kliwon district, at the city center of Surakarta (figure 1). In this district there is *Masjid Agung* (the Great Mosque), that becomes the center of the spatial orientation of kampong. Kauman is a *santri* and batik kampong, marked by old traditional Javanese and Indo-European (called Indische) architecture, as well as Islamic community events.

![Figure 1. The Location of Kauman in Surakarta](source: www.surakarta.go.id, 2011)

![Figure 2. The divided area of Kauman](source: Drawn by Musyawaroh, 2016)

*Kelurahan* Kauman is divided into 7 *Rukun Warga* (Community Association) and 22 *Rukun Tetangga* (Neighborhood Association). The area of *Kelurahan* Kauman (based on Bakosurtanal topographical maps, 2001) is 20.497 hectares, with most of area covered by buildings and pavement (see figure 2).
2.2. Method

This research was conducted in Kelurahan Kauman in the city of Surakarta, considering the existing problem to revitalize the cultural heritage kampong in Surakarta. This is an applied research, providing solutions to continue the revitalization program that has been implemented, so that environmental issues can be solved better.

This research used a rationalistic qualitative approach, providing interpretation of the phenomena that occur in the field by using the theory developed derived from research and community assistance program previous. The research was carried out by collecting data from literature study, interviews (with residents of Kauman, Pamong Praja and related institutions), satellite imagery observation and field surveys. The data that collected validated with field surveys.

Sampling was done purposively, selected samples are the house of abdi dalem keraton (cleric servant of the palace and another), the Kauman community activities and the environment physical conditions of Kauman. The data obtained were identified, classified and analysed. Data on the physical condition of the environment were analyzed based on National Standard on the Regulation SNI 03-6981-2004 of the simple housing environment is not structured in urban areas and SNI 03-1733-2004 on the planning of urban housing environment. Data on non-physical environmental conditions were analyzed using interactive model analysis continuously until the data were saturated (figure 3). Activities in the analysis include data reduction, display data, conclusion drawing and verification.

3. Result and Discussion

The environment existing condition has gradually changed since 2006, because the revitalization program that has been done by community of Kampong Wisata Batik Kauman supported by revitalization team from UNS Architecture Department. Evaluation of Kauman existing environment condition is needed, covering some aspects as follows.
3.1. The Physical Condition of Environment in Kauman

3.1.1. Land and Buildings Conditions

As described above, the area of Kauman is 20.497 hectares, with most of area covered by buildings and pavement. The total number of buildings is 735 and there are 16 market buildings [14], see figure 4.

![Figure 4. Figure Ground of Kauman.](image)

![Figure 5. Green Open Space in Kauman.](image)

From the figure ground image above, it can be observed that the area covered by buildings is 128.622 m² or 62.75% with an open space of 76.350 m² or 37.25%. The open space consists of hardscape (streets and channels), and soft scape (green open space). Based on the result of field surveys and satellite imagery, the open space consists of 60% pavement area or 45.810 m² and 40% of green open space or 30.540 m².

3.1.2. Green Open Space Conditions

From the 40% green open space in Kauman (figure 5), 438.249 m² or 14% of it is private green open space in public buildings property and 857.726 m² or 27.4% of it is private green open space at the yard of houses. There is no public green open space in Kauman.

3.1.3. Recreational Park and Sport Activities

In Kauman there is no park for recreation, or facilities to exercise at all. The community uses the Masid Agung yard, the alley in the kampong and the "city walk" on Slamet Riyadi street for sporting activities and children's playground. The Masid Agung yard is used for martial arts sports in the evenings, "city walk" for jogging activities and healthy walk in the morning, and alleys for children's playground in the afternoon.

3.1.4. Streets Conditions

The existing road network in Kauman according to SNI 03-1733-2004 namely local secondary roads type II with the asphalt road 6 m, local road/secondary road III with asphalt/paving block/concrete road 3 m, the environment I road with paving block/concrete road 2 m, and the environment II road with paving block/concrete road 1.2 m. The two-way roads that made of asphalt and are passable by motorized vehicles and non-motorized vehicles are Trisula Street, Kalimosodo Street, Masjid Agung Street, Wijaya Kusuma Street and Cakra Street.
One way road is made of asphalt and is passable by motorized vehicles (motorcycles and cars) and non-motorized vehicles is Hasyim Ashari Street. Others are alleys that made of paving blocks or concrete, that only passable by motorcycles and non-motorized vehicles.

3.1.5. Drainage Network Conditions

Most of Kampong Kauman area does not have drainage channels, and in other parts, drainage channels are mixed with household waste channels that cause environmental pollution. Kauman has only 50% of proper drainage channels, the rest (especially those in the small alleys) let rainwater flow to lower lands, and partly to small and non-permanent channels that are created by the local community.

The drainage channel causing most problems in Kauman is at Wijaya Kusuma Street. The channel is located in the middle of the road, and collects all types of wastewater such as rain water, domestic waste water (including fecal), and batik wastewater. These channels release a bad odor and disturb the neighborhood. Furthermore, the channel concrete cover has many holes and is bumpy, making it uncomfortable to pass.

3.1.6. The Sewer Network Conditions

There are two kinds of sewers in Kauman, household wastewater sewers (domestic) and batik wastewater sewers. Most of the community in Kauman does not have a septic tank because of the limited land, and they are still not aware of the usage of PDAM’s interceptor (the sewer network of Local Water Company) as the channel to dump the feces. Even though it has been informed, it is still poorly implemented.

Interceptors channels for domestic waste are only available on some roads in the Eastern region of Kauman (east area of Wijaya Kusuma Street), the western region of Kauman has no particular domestic sewer network. The domestic waste channels still merge with the drainage channels.

3.1.7. The Garbage Disposal Network Conditions

For garbage disposal network, the citizens provide a simple garbage bin at each house. The garbage is taken every morning by garbage men to be thrown away to garbage dump in the form of garbage truck provided between 6.00 to 8.00 a.m. at Kalimosodo street (located in the west of Bank Central Asia at Gladag) Kauman itself does not have a garbage dump. The nearest garbage dump is located at Gajahan district, in the west of Klewer Market.

3.2. The non-physical condition of environment in Kauman

3.2.1. Santri’s Heritage Socio-cultural

According to the data from the Kelurahan Office in February 2016, the population of Kauman currently consists of, 95% Muslims (3,367 people), 47 Christians, 95 Catholics, and 36 Buddhists. The non-Muslim population consists of immigrants (mostly of Chinese descent) who live on the outer edge of Kauman. As a cultural heritage kampong, Kauman has heritage potentials as follow.

a) The settlement kampong of abdi dalem ulama keraton, another abdi dalem and kawulo dalem.
b) Kampong where batik businessmen live and run their business.
c) Kampong where Sekaten ceremony and Grebeg take place.

There are 6 langgar (small mosque) in Kauman, one of the langgar (LanggarSememen) was converted into Sememen Mosque. The culture of santri is still dominant until today which can also be identified by many pengajian (religious activities) done in this kampong (figure 5).
All langgar/small mosque can still survive up to this day except Pengulon Mosque and Cendanan Mosque. As for the keraton servant clerics’ houses which still survive include house of Ketib Iman’s, Tafsir Anom VI’s, Ketib Anom II’s and R.Ng. Condrowiyoto’s. Meanwhile, the house damaged is house of Ketib Anom I’s. Ketib Sememi’s house has already transformed into Nahdhatul Muslimat School and Ketib Arum’s house turned into a new building.

3.2.2. Batik Heritage Socio-cultural

The batik business has been maintained for generations in Kauman, although it went bankrupt in 1939 until the 1970s [13] but began to rise again since 2006. In 2006 batik business which only live 8 [12], now increased to more than 100 entrepreneurs. Business activities have evolved since community empowerment intensified in Kauman with various ways of socialization to the community.

Some of the ancient houses in Kauman are used as commercial buildings such as shops, batik shops, convection stores, bookstores, florists, jewelry stores, restaurants, stationery and office stores. Especially ancient buildings along Wijaya Kusuma street and Cakra street. In some alleys, such as Wijaya Kusuma III Road, there is a row of batik house showroom facing directly to the road, so the atmosphere is like being in the middle of the batik market (figure 6).

Besides the religious activities and batik, everyday cultural activities conducted in Kauman in example Sekaten (on the ward Pradonggoof Masjid Agung), hadrah (on Langgar Modinan), karawitan (in the House of Mr. Bintoro RT 02 RW 08), Grebeg in Kuncungan (the canopy of Masjid Agung) and Keroncong (at RT 02 RW 01).

3.2.3. Economic Aspects

Kauman is a dense settlement with population density on March 2016 was 3,553 inhabitants that consist of 721 householders with 735 houses (Musyawaroh, 2016). At present, most citizens livelihoods as a traders (719 people), construction workers (111 people), industry labors (155 people), entrepreneurs (348 people), transportation (65), pensioners (74 people), civil servants/the army/police (49 people) and others (1,341 people). Batik business in Kauman has rise again, initially only 8 are active now become more than 100 entrepreneurs [14].

The association of Batik Tourism Kampung Kauman has three shared showrooms, established to achieve a vision to encourage Kauman people to sell and produce batik. This association’s office is located at Cakra Street No 14 Kauman, Solo.
3.2.4. Engagement Aspects

The community has been actively involved in revitalizing and reviving their area since 2006 by establishing the Association of Tourism Kampong of Batik Kauman. In addition, the community embraces the competent parties in their fields such as universities (UNS) and private institutions (Association of Experts Management and Association of Transportation Entrepreneurs).

In addition to the authors, several universities had conducted research in the Kauman area. Nevertheless, this research is not followed up with a concrete program to develop this area with the community. Aid programs have been conducted by researchers and teams since 2006, continuing the research findings in 2001.

The local government’s agencies involved in physical treatment of Kauman were the Spatial and Urban Planning Agency in 2009 in the form of street furniture planning and program of the Tourism Agency in 2006-2007. Other activities with other institutions were merely training and seminar/FGD invitation. The region revitalization which was done by the Ministry of Public Work in 2007-2008 was DED creation and in 2011 was drainage planning which was then repaired in 2012.

3.3. Sustainable Revitalization for Physical Environment of Kauman

3.3.1. Sustainable Revitalization for Land and Building Use

Ancient buildings are the cultural tourism assets in Kauman (figure 6). To preserve this building, socio-economic functions need to be cultivated so that it can benefit the owner, as regulated in Law no. 11 of 2010 Chapter I Article 1 Paragraph 22. Not all ancient houses in Kauman have been used as commercial buildings. Due to very expensive maintenance costs, the building is then sold/destroyed and replaced with new commercial buildings that are more profitable to the owner.

The utilization of ancient building is undertaken by employing adaptive-reuse, with receiving a new function without destroying the original building’s facade. Thus the ancient building can change from cost center to profit center [3,15]. In addition to functioning as a residence, ancient house can be utilized as batik showroom, homestay, book store, food stall and others. With the improvement of building function, it is hoped that people can preserve their ancient land and buildings independently.

3.3.2. Sustainable Revitalization for Green Open Space

In this case, the total inhabitant of Kauman is 3,545 inhabitants. Therefore, the open green space needed is 3.545 x 0.3 m² = 1.063,5 m². Open space available in Kauman is 30,540 m², thus the width of green open space in Kauman has fulfilled the standard. However the green open space in Kauman is dominated by green open space in the area of the Great Mosque of Surakarta and BCA. There is no public green open space inside the kampong.

In the afternoon, the weather in Kauman is so hot that reaches 42° C (according to measurement result in Musyawaroh [14] since the region is too dense without greening. Alongside the roads it is not possible to greening because the road is too narrow as well as at house yard which is mostly used for carport. The greening of this region can only be done by planting in pot, hanging pot and creeping plants over pergola.

3.3.3. Sustainable Revitalization for Recreational Park and Sport

According to SNI 03-6981-2004 and SNI 03-1733-2004, each village unit inhabited by 30,000 inhabitants needs park and sport field to serve society’s activity needs, for instance sport match, ceremony and other activities. Park and sport field for a village unit with 30,000 inhabitants need 9,000 m² space in size or by the standard of 0.3 m²/inhabitant.
Because in Kauman there is absolutely no space available for recreational space, children's play and sports activities, so the activity is done in the area of roads / alley at the region in the morning /evening, and in the courtyard of the Great Mosque in the Night, or along the city walk in the morning.

The space used for the activity is organized as follows:

a) Endeavored in the morning and afternoon (before 08.00 am and after 4 pm pm) motor vehicles do not enter this area (except the occupants or unloading / loading), so as not to interfere with children's play/recreation/sports activities of communities.

b) Children play area/recreation/sports on the alley planted with greening, so that the air becomes fresher, reduce heat and more beautiful.

c) Certain places are provided with garden chairs and pergolas.

3.3.4. Sustainable Revitalization for Street.

In Kauman, the widest road is 6 m whereas the narrowest road is 1.2 m. In order to avoid traffic congestion, the traffic arrangement is made as figure 7. This is done to avoid the chaos of traffic flow and congestion within the kampong.

![Traffic management in Kauman](source: Musyawaroh, 2016 : 26)

![Parking management in Kauman](source: Google Earth 2016 & Musyawaroh, 2016 : 25)

Parking area can not be constructed inside the Kauman area, because the road width is very limited. For that car Kauman visitors parked on the edge of the road around the area, or in the area on the edge of Jl. Hasyim Ashari and Jl. Trident (figure 8).

3.3.5. Sustainable Revitalization for Drainage Network.

Drainage channel on Wijaya Kusuma street according to Muttaqin’s calculation (in Musyawaroh, 2016) has filled the capacity, but becomes a source of problems in Kauman. This channel should only be rain water sewer. On the other hand, domestic wastewater is channeled into the interceptor of Regional Water Utility Company (PDAM). Meanwhile, batik waste water is firstly processed and then channelled into these drains.
The damaged of concrete cover can be repaired on the high embankments buffer 1/3 of the channel edge. For more thorough perfect, changed the old drain that overlapped with the pre-cast concrete channel whose diameter is 1 m.

3.3.6. Sustainable Revitalization for Sewer Network

Currently, the capacity of Kauman’s batik wastewater has reduced greatly. Almost every batik-creating process is carried out outside of Kampong Kauman, such as in Bekonang, Laweyan, Masaran and others. This is done because Kauman does not have an integrated batik wastewater processing yet, and the batik producers do not have their own wastewater treatment unit. Only at certain times, the full process of creating batik is done in Kauman (especially for tourism promotion purposes), but they use natural dyes from Teger wood, Tingi wood, Jambal wood and so on.

In 2012, a portable batik waste treatment unit had been designed for Kauman by Utomo, Musyawaroh & Sawitri [16] that called Upal-RE, based on the result development of the research by Musyawaroh, Utomo & Triratma in 2009. Upal-RE reduced the level of pollutants COD by 95.92% and color by 75.90%, and has been tested in Kauman on 14th January 2013. But Upal-RE cannot be optimal used, need much electric power to operate it. The development of this tool is still being carried out.

3.3.7. Sustainable Revitalization for The Garbage Network

According to SNI 03-6981-2004 and SNI 03-1733-2004, the municipal waste disposal network is a large waste bin for temporary dump (TPS) of 12 m3. However, in Kauman there is no land available for that, in order to not troublesome the following steps should be taken:

a) Provides a simple, easy-to-use, portable and durable trash can in front of residents' homes.

b) The existing landfill for Trisula Street is maintained and repaired.

c) Garbage dump with garbage truck is still needed.

3.4. Sustainable Revitalization for Non-physical Environment of Kauman

3.4.1. Sustainable Revitalization Planed for Heritage Socio-Culture

Sustainable revitalization for Santri culture that planned for Kauman is as follows:

a) Preserving the homes of abdi dalem ulama and other abdi dalem remaining for commercial buildings.

This effort needs to be optimizing by utilizing higher commercial value in accordance with current needs such as cafes, boutiques, homestays and others. The house used for business place can bring economic benefits for its owner, so that it can be preserved.
b) Providing an area of expansion langgar by installing awnings, to accommodate the need for increased activities such as Tarawih prayer, Islamic studies and others. This effort needs to be improved by sharing space management with the alley around to make it more convenient and rewarding. While, Islamic study activities can be done in the local communities’ house.

For batik activities, since the revitalization program implemented and community empowerment in 2006 batik business has increased to more than 100 entrepreneurs. Most of the houses along the street / alley in Kauman transformed into batik showrooms. But, this condition is slightly changed when Pasar Klewer burned in 2014, batik entrepreneurs in Kauman decreased again. Sustainable revitalization for batik culture namely needed to improve wastewater management facilities and village infrastructure so that businesses in this area will rapidly increase again.

### 3.4.2. Sustainable Revitalization Planed for Economy

The analysis on economic aspect was done by economic valuation, namely to assess the economic benefits of heritage resource management. The method used for economic valuation of cultural heritage Kauman was a merger between the theory proposed by Suparmoko [17], Soeroso and Susilo [18]. These values include: 1) direct, indirect and alternative use values; 2) value without use of which includes inheritance and existence.

From the assessment, shows that the economic benefits of Kauman region is currently very high but without maintenance within a period of 50 years, the condition of the area will be damaged by the amount of quality degradation value which is much higher than the value of the economic benefit [14]. Therefore, it is necessary to undertake revitalization.

### 3.4.3. Sustainable Revitalization Planed for Engagement

Revitalization activities carried out involve relevant stakeholders, consist of local community, university (UNS) and the government. The cooperation with capital owners of private sector is not yet accomplished. The program has not been implemented with coordinated well, its still partially, overlapping and ineffective. For a better management, all stakeholders must coordinate so that the program undertaken is more integrated and useful for the community.

### 4. Conclusion

From the above description it can be seen that more than 60% of the Kauman area is covered by buildings, most of which are ancient buildings. In Kauman there are no green open spaces, parks for recreation and sports. Most of the roads in Kauman have a width of less than 4 meters, with heavy traffic. The drainage system is on the edge / bottom of this road network, mostly mixed with sewerage.

The santri culture in Kauman is still well preserved, but the house of the abdi dalem has been damaged a lot. Meanwhile, batik culture has increased, economic activity has also increased but not followed by adequate infrastructure facilities. There has been regional conservation action by related stakeholders, but not well coordinated, so that the implementation of each other overlap. Sustainable revitalization that should be applied to land and buildings is to further increase the use tailored to the needs of the present, in order to bring more profits for the owner.

Because there is no land left, recreation place, children play and sport is done on the road / gang in the area. The area is planted with green planting in pots, hanging pots and pergola, to reduce heat, refresh the air and to make it more beautiful. Drainage channels, household wastewater and batik waste water are separated. Repair of damaged drainage channels. Household waste channels are channeled into PDAM interconnector networks, as well as batik wastewater channels (once processed...
first). For garbage disposal network, an improvement on the TPS in Trisula street and keep using trucks for temporary dumps.

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