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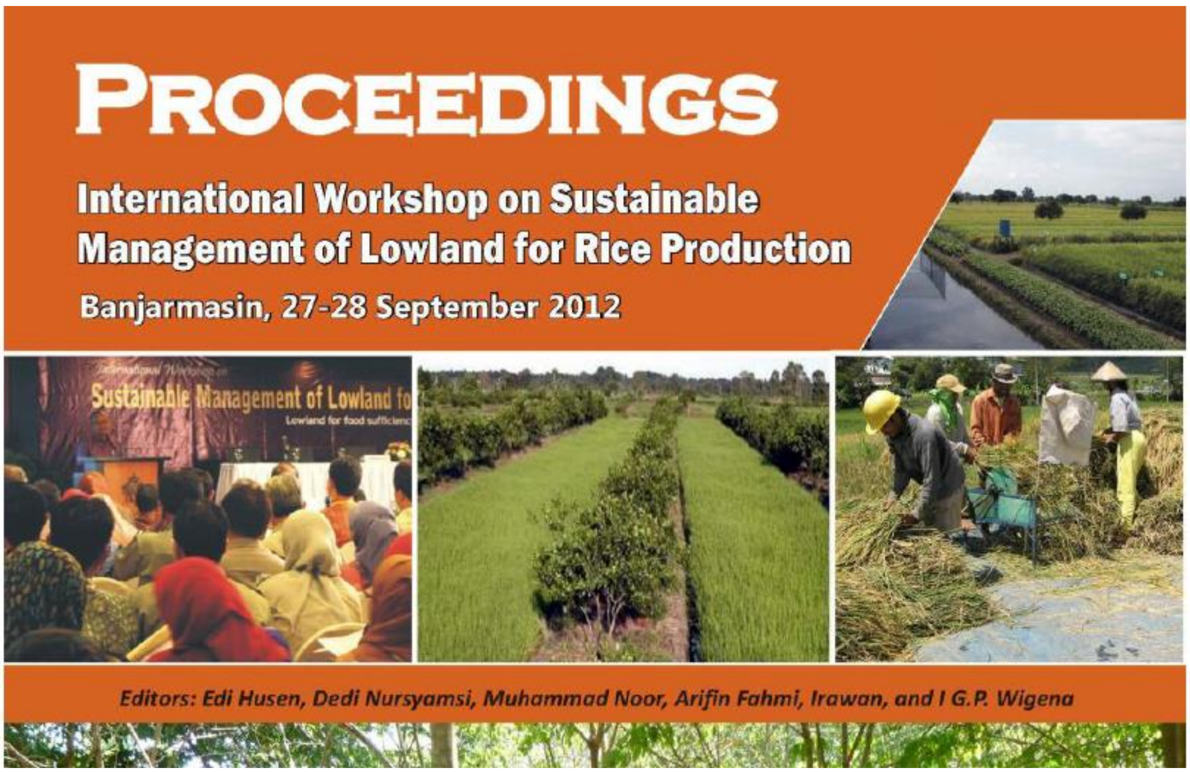

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20 TECHNICAL APPROACH OF EROSION AND SEDIMENTATION ON CANAL (CASE STUDY IN DELTA TELANG I, BANYUASIN, SOUTH SUMATRA PROVINCE)

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Abstract. Dynamics of the water level in the swamp area in both tertiary and in the channels is strongly influenced by several conditions, among others: the amount of rainfall, land hydrotopography, potential flood tide, the potential for drainage, water management network conditions, and operation of the waterworks building. Those components must be evaluated and analyzed to support the plant water needs. In the channel itself it is needed direct observations in the field in order to get accurate observational data. But this way takes time, effort, and considerable expense. Therefore the use of computer models to predict and evaluate the performance of the network is an appropriate solution. This study examined the existing condition and SDU SPD channels on the secondary block of P8-13S Telang I swamps by analyzing sediment cohesiveness in the channel, cross-sectional survey, and profile measurements of longitudinal channels as well as observations of water level in the channel for 2 times in 24 hours. The results showed that the erosion occurring on cross section roads of SPD P0 (at the beginning line) was 5,001.5 m^3. On the P38 segment (middle line) and P76 segment (end line), the erosions were 3,444) and 3228 m^3. Cumulatively, the erosion on the channel SPD amounted to 126,713.5 m^3. SDU channel sedimentation occurring at P0 segment (initial line) was 582.2 m^3. On P36 segment (middle line) scale sedimentation was 915.5 m^3 and on the segment P74 (end line), the sedimentation value was 1,088.5 m^3. Cumulatively, the amount of sediment in the channel SDU P8-13S was 34,184.7 m^3.

Keywords: Canal in wetlands, dynamics of water level, erosion, and sedimentation

Abstrak*. Dinamika muka air di daerah rawa baik di petak tersier maupun di saluran sangat dipengaruhi oleh beberapa kondisi, antara lain: jumlah curah hujan, hidrotopografi lahan, potensi luapan air pasang, potensi drainase, kondisi jaringan tata air, dan operasi bangunan tata air. Untuk itu seluruh komponen tersebut harus dievaluasi dan di analisis untuk mendukung upaya pemenuhan kebutuhan air tanaman. Di salurannya sendiri diperlukan data pengamatan secara langsung di lapangan agar di dapat data pengamatan yang akurat. Namun cara seperti ini memerlukan waktu, tenaga dan biaya yang cukup besar. Oleh karena itu penggunaan model komputer untuk menduga dan mengevaluasi kinerja jaringan merupakan suatu solusi yang tepat.*

Penelitian ini mengkaji kondisi eksisting saluran SPD dan SDU pada blok sekunder P8-13S daerah rawa Telang I dengan melakukan analisis kohesivitas sedimen di saluran, survei pengukuran profil potongan melintang dan memanjang saluran serta pengamatan tinggi muka air di saluran selama 2 kali 24 jam. Hasil penelitian menunjukkan bahwa erosi yang terjadi potongan melintang SPD pada ruas P0 (di awal saluran) sebesar 5.001,5 m^3. Pada ruas P38 (tengah saluran), erosi yang terjadi sebesar 3.444 m^3 dan pada ruas P76 (ujung saluran), terjadi erosi sebesar 3.228 m^3. Secara kumulatif, erosi yang terjadi pada saluran SPD adalah sebesar 126.713,5 m^3. Sedimentasi saluran SDU yang terjadi pada ruas P0 (awal saluran) sebesar 582,2 m^3. Pada ruas P36 (tengah saluran) besaran sedimentasinya adalah 915,5 m^3 dan pada ruas P74 (ujung saluran), nilai sedimentasinya adalah 1.088,5 m^3. Secara kumulatif, besarnya sedimentasi pada saluran SDU P8-13S adalah sebesar 34.184,7 m^3.

Kata kunci: Saluran di daerah rawa, dinamika muka air, erosi dan sedimentasi

INTRODUCTION

Tidal marsh areas are generally areas that have relatively flat topography, situated at the river mouth near the beach, and naturally formed and also influenced by tides on a periodic basis. Characteristic of the tidal marsh area is very unique when compared to the technical irrigation area because water supply availability of tidal marshes is always of high and low tides of the seawater. The land has unique properties that are acidic, pyrite and peat contents, and salt-water intrusion during dry season.

Based on the data collected by the Directorate General of Coastal Wetlands and Water Resources in 2006, through studies of inventory data swampland west and the east, the conclusion that the total area of wetlands that have been reclaimed 1.8 million ha are included 0.8 million ha of wetlands are abandoned or unused land. Abandoned land is caused by many things including water system existing network of sub-optimal in providing its function in water management, because the flow system are not appropriate. Canal conditions and the water was too old buildings are not rehabilitated, and so are not optimal in terms of canal maintenance. In terms of maintenance of the canal, one of which is necessary to increase the water system through a network of channels associated with the maintenance of stability of the channel itself. This problem concerns related to issues other than technical, field conditions, the network infrastructure is still weak institutions manage the field level.

For that, we need a way out so that all problems can be solved in a comprehensive manner. Besides, it should be understood also that the construction of a system of water / water in the tidal marshes today are mostly located on the first stage, which was at the completion of construction of the network only. While the construction of support facilities (waterworks) is still not widely applied. Control of water levels in wetlands reclamation process is a key process that must be done properly and correctly. In this connection, swamp reclamation should use the concept of "shallow-intensive drainage"

(Skaggs 1982; Skaggs 1991; Susanto 1996) and not "intensive-deep drainage". These two concepts should be combined with control of the disposal and containment of water (Susanto 2002; Imanudin 2010).

However, according to Suryadi (1998), reclamation of tidal marsh when associated with water management and design criteria can be done with two approaches, namely the minimum reclamation (minimum disturbance), and total reclamation (maximum disturbance). For the conditions in Indonesia, minimum disturbance approach is still the best (Imanudin and Susanto 2004).

The dynamics of water in a swamp area in both tertiary and in the canal influenced by several conditions, among others: the amount of rainfall, hydro-topography land, the potential flood tide, the potential for drainage, water system network conditions, and operation of water system construction. Therefore all components must be evaluated and analyzed to support the water needs of plants. Required data in its own channel of direct observations in the field to the observational data can be accurate. But this way takes time, effort and considerable expense.

Therefore the use of computer models to predict and evaluate the performance of the network is an appropriate solution. Meanwhile, to evaluate the condition of the water system network in the capacity of the supply and disposal has developed a computer model of DUFLOW (Suryadi 1996). DUFLOW the model simulation results can provide practical recommendations in terms of improving the network and operating system of water management (Suryadi and Schultz 2001; Imanudin and Susanto 2003; Suryadi *et al.* 2010).

This study will use one-dimensional SOBEK software. SOBEK simulation program can also be used to: 1). Support program decision-making on a wide river, such as the Watershed or controlling the flow of the water gate; 2). Predicted daily water levels along the river; 3). Calculation of water level rise to levee safety check; 4). Calculation of saltwater intrusion in the dry season period;

In connection with the above problems, it needs to be a study in addition to evaluating the performance of the existing drainage system in the control of water levels. In tidal marsh areas also need to canal stability analysis in an effort to support the operation and maintenance of the canal. The use of computer models have been tested and developed as it can save time, effort and money. However, the calibration process needs to be done to get good results with other words that the results of the modeling is almost equal to the results of field measurements (Suryadi 2010).

MATERIALS AND METHODS

Description of Research Areas Delta Telang I was in the swamps of South Sumatra, which also reclaimed following the generation of second-generation design of double-grid layout (Rib System) along with Telang II, Delta Saleh and Sugihan. (Bogor Agriculture Institute (IPB 1976). The next design for the open channel system is prepared by the Institute of Technology Bandung (ITB). The system consists of the main canal (also used for navigation), secondary canals and tertiary canals. (Figure 1. Map of study site).

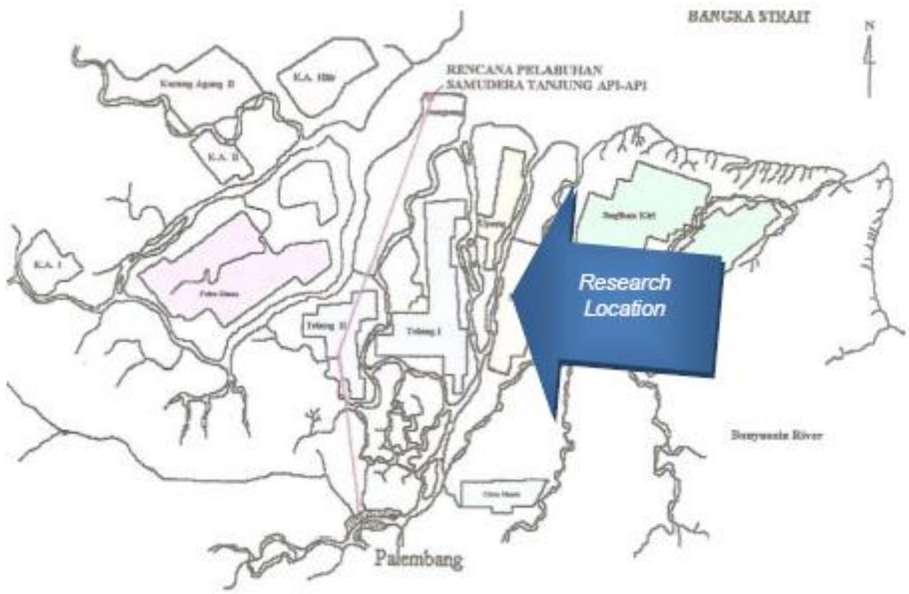

Figure 1. Map of Research Sites (BPSDA, 2010)

By Geographic Region Telang I located at 020 29' to 020 48' S and 1040 30' to 1040 52' longitude. In general, Telang I located in the north bordering the Strait of Bangka, South of the river adjacent to the contrary, to the east and west of the Musi river bordered by Telang I (Figure 2).

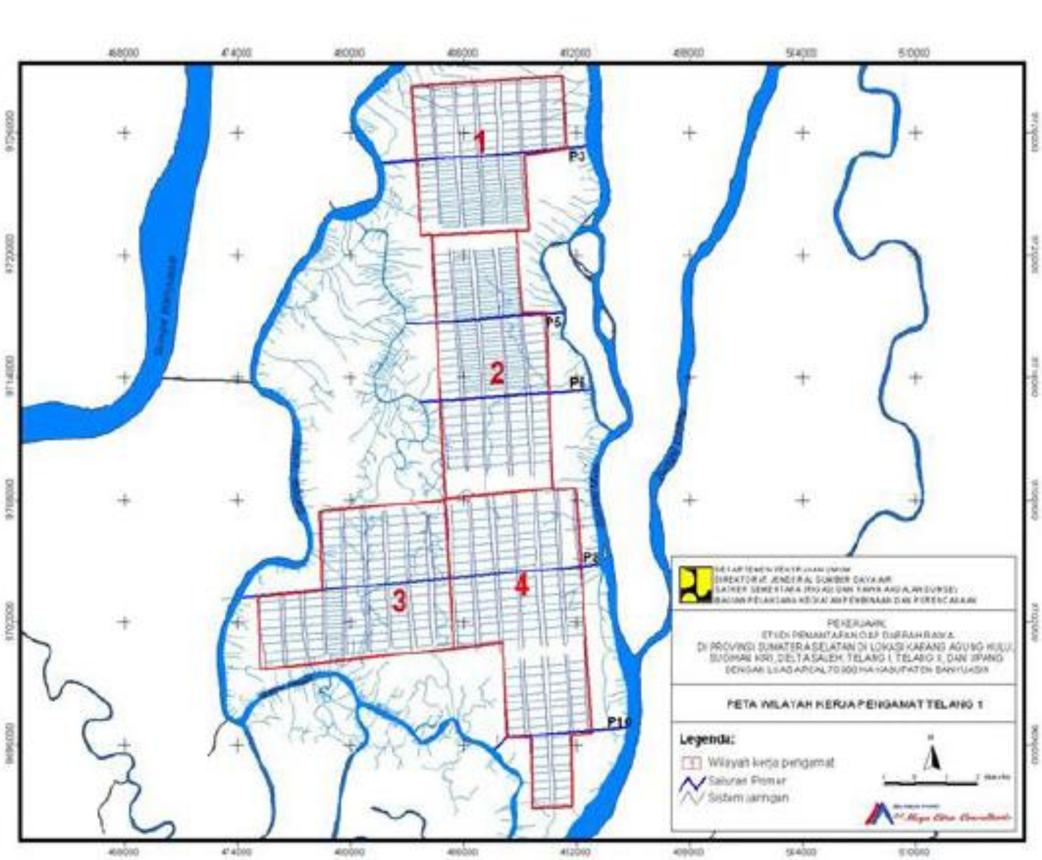

Figure 2. Network map tidal marsh reclamation Delta Telang I (Mega Citra Consultants, 1994)

In hydrological, Telang I region is an area which is surrounded by tidal rivers. The eastern region bordering the Musi river, west of the river adjacent to Telang, South of the Bangka Strait and north of the river adjacent to the contrary. Figure 3 shows the layout of the block in the secondary and tertiary Telang I. Hydrology of the block is determined by the condition of the adjacent canal, the water status in each canal, the operation of the door, the influence of tidal and climatic conditions such as rainfall and evapo-transpiration (Susanto 1998)

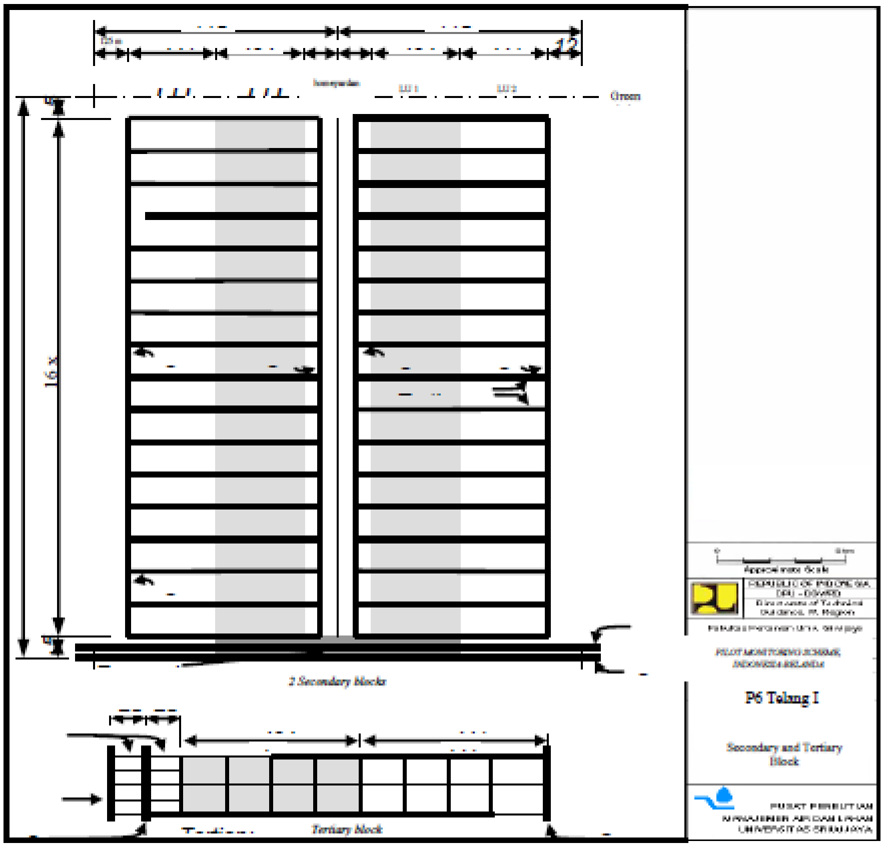

Figure 3. Layout the blocks in the secondary and tertiary blocks of Telang I (Land and Water Management Research Centre 2004); (Sartika 2009)

Climate

Climate in Telang I was the tropical rain, hot and humid throughout the year with maximum temperatures between 29-32° C, minimum temperature of 21-22° C and humidity between 84-89%. Wet months (rainfall over 200 mm per month) occurred during the period November-April and dry month on average in August (rainfall less than 100 mm per month). The annual rainfall averages about 2,400 mm. According to the classification Oldeman, agro-climate is the C-1, with 5 to 6 months of consecutive wet (rainfall over 200 mm) and 0-1 dry months (rainfall less than 100 mm) (Sartika 2009).

Rainfall

This area is free of tropical storms although local storms can cause damage. Climate and rainfall supports a variety of plants (Euroconsult 1996). Figure 4 shows the annual rainfall Telang I and Figure 5. shows the monthly rainfall and ET of Telang I, respectively.

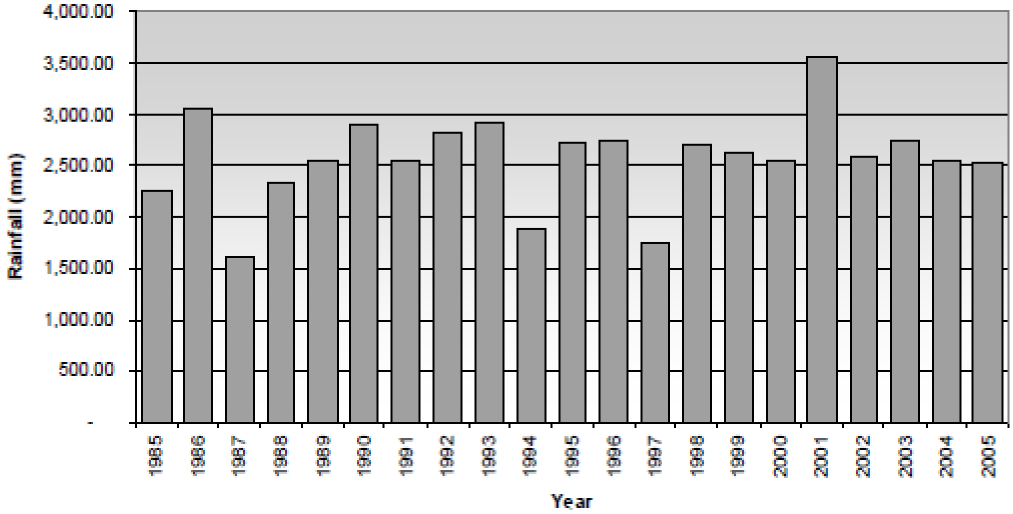

Figure 4. Annual rainfall of 1985-2005 Telang I (Rainfall Stations of Kenten 2008); (Sartika 2009)

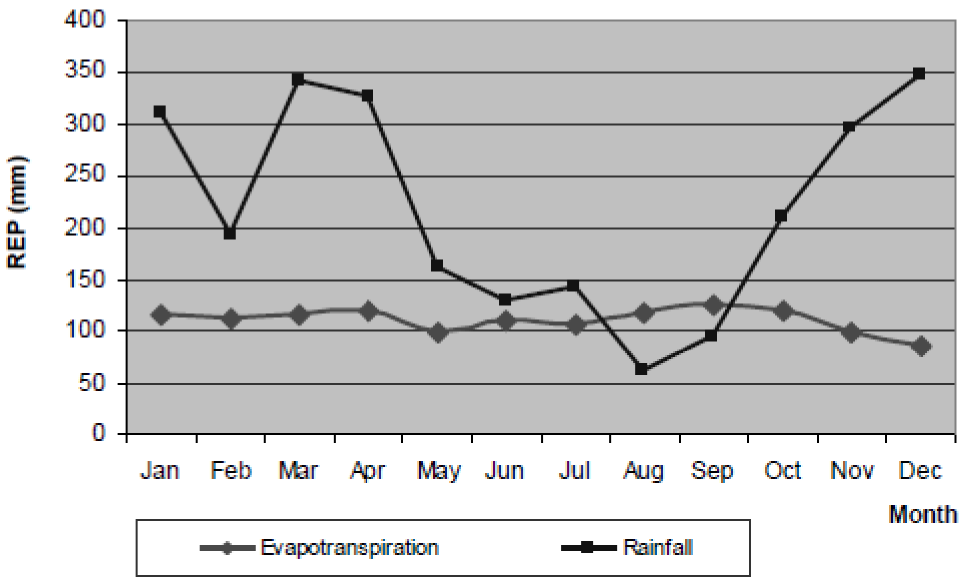

Figure 5. Monthly rainfall and ET Potential Telang I 1996-2005 (Rainfall Station Kenten 2008); (Sartika 2009)

Existing Canal Condition

Visually, the current canal is still not doing maintenance on a regular basis. It can be seen that although the canal has been done "dredging" or digging, but cliff erosion and the grass so it is possible to keep the canal erosion and sedimentation and soil erosion at the base of the cliff/erosion on the side of the canal.

Similarly, in the study sites in P8-13s is not enough water available gate structure (flap-gate), although it is still available but it is simple and technically there is need for improvement. This is due to the gate structure tertiary blocks is built upon public participation and without the construction of adequate technical guidance from the local government.

Figure 6. Secondary canal and flap gate in P8-13S Telang I, 2012

RESULTS AND DISCUSSION

Operation and Maintenance Problems of irrigation networks in tidal marshes is a function of soil, water, climate, water system (network), floodgates building, human resources, institutions, farmers, and the means of production. Therefore, the initial step in this research is to identify existing conditions and all relevant variables of each component that will be analyzed and studied in relation to one another in order to obtain a stable canal forms to support Operations and Maintenance activities in certain areas. Sources of data obtained from the main physical data, and land environment by conducting field surveys and secondary data by the method of desk study.

In the implementation, Operation and Maintenance activities are divided into two, namely the Operation and Maintenance activities, and in particular to the implementation of the rules of operation of activities whose purpose to appropriate water management for crop needs. Implementation of Operation and Maintenance must be performed simultaneously with monitoring. Monitoring will provide information needed to control and if necessary change the rules and Operations and Maintenance. In addition, monitoring can provide information for planning long-term development in the regions concerned.

Erosion on cross section SPD P.0 (at the beginning) was about 5,001.5 m^3. On P.38 segment (middle), the erosion was 3,444 m^3 and P.76 (end) erosion was 3,228 m^3.

Cumulatively, the erosion on the channel SPD amounted to 126,713.5 m^3. SDU channel sedimentation occurring at P.0 segment (initial line) was about 582.2 m^3. On P.36 (middle line) sedimentation was 915.5 m^3 and the segment P.74 (end line), the sedimentation value was 1,088.5 m^3. Cumulatively, the amount of sediment in the channel SDU P8-13S is 34,184.7 m^3.

CONCLUSION

This study shows that to achieve the desired objectives in the development of Operation and Maintenance in the reclamation of tidal marsh, it is necessary to step-by-step activities, which must be done to each other in an integrated manner.

Results of investigations in the field of erosion and sedimentation are cumulative values of each channel. Cumulatively, the erosion on the channel SPD amounted to 126,713.5 m^3 and the amount of sediment in the channel SDU P8-13S is 34,184.7 m^3.

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