*Research Paper*

*International Journal of Research and Review*
*Vol. 10; Issue: 7; July 2023*
*Website: www.ijrrjournal.com*
*E-ISSN: 2349-9788; P-ISSN: 2454-2237*

# Analysis of Efficiency and a Time for Draining Mud Bag in Patihan Irrigation Area, Blora Regency

**Ahmad Hakim Bintang Kuncoro[1], Istianah[2], Diah Setyati Budiningrum[3]**

[1,2,3]Department of Civil Engineering, Semarang University, Semarang, 50196, Indonesia.

Corresponding Author: Ahmad Hakim Bintang Kuncoro

**DOI: https://doi.org/10.52403/ijrr.20230794**

## ABSTRACT

Patihan Irrigated Area (IA) is located in Ketileng Village, Todanan District, Blora Regency, Central Java Province. IA Patihan's water source comes from the Jembangan River, which contains sediment transportation. The content of large amounts of sediment enters the irrigation canal and hinders water distribution, so it is necessary to check the efficiency of the sludge bag. This study aims to determine the amount of sediment entered, determine the efficiency of deposition of sludge bags, and find the right draining time so that the performance of sludge bags can be optimal. The approximate amount of sediment transport was calculated using the Meyer-Peter and Muller, Einstein, Shun and Hung, and Engelund and Hansen methods. For settling efficiency and draining time can use the KP-02 cause. Based on the results of transport sediment calculations, the largest amount of sediment was obtained from the calculations of the Shun and Hung Method, with a yield of 1.91 tons/day and a settling efficiency of 83.75%. Draining time to optimize the performance of the IA Patihan irrigation canal sludge bag is necessary to drain it once every week.

***Keywords:*** efficiency, sludge bag, optimal, dewatering, sedimentation.

## INTRODUCTION

The Patihan Irrigation Area (IA) is located in Ketileng Village, Todanan District, Blora Regency, Central Java Province, to be precise, at the coordinates 6°57'36.43" South Latitude and 111°10'45.07" East Longitude. DI Patihan requires a debit of ±71.9 l/s to irrigate a rice field area of ±55 Ha [1]. The water source for DI Patihan comes from the Jembangan River which is a natural river and contains sediment transport. Currently the Patihan DI irrigation canal has a draining structure that also functions as a mud bag. Currently the condition of the canal is still relatively good, but the discharge flowing through the canal is sometimes unable to meet the needs of irrigation water. Some areas under certain conditions cannot access water. This condition is probably due to the silt content which is quite a lot in the water flow which hinders the distribution of water, this condition can be seen in Figure 1. There is a need for a review regarding the sludge bag in order to determine the efficiency of settling and the timing of the sludge bag drainage in order to optimize the function of the sludge bag.

When the soil turns into finer particles and then carried or transported by the flow of water, some will remain on the surface of the soil and some will enter the canal or river and follow the flow to become sediment transport [2]. The result of erosion in the form of moving material grains due to the force and velocity of the flow of a channel or river is the definition of sediment transport [3]. Sediment transport in a channel or river flow can move or shift on the bottom of a channel or river depending on the specific gravity and grain size, and is also influenced by the speed and depth of the flow [4]. As a result of sedimentation, it can cause a reservoir such as a reservoir to reduce its capacity, and the intake of irrigation canals can be hampered due to the sediment deposition [5]. Sediment samples taken at the bottom of canals or rivers and have been tested in the laboratory can be used as input for calculations of sediment transport [6]. There are 3 empirical formulas for calculating sediment transport rates which have close results, namely the Meyer-Peter and Muller Method, the Einstein Method, and the Colby Method [7].


**Figure 1. Condition of the Primary Channel in Patihan**

Based on the background above, this study aims to determine the estimated amount of sediment transport, settling efficiency, and determination of processing time so that the sludge bag performance can be optimal in accordance with KP-02 criteria [8].

## METHODS

Analysis in research using primary and secondary data. The primary data is in the form of mud or sediment samples at the study site. Then the data was tested at the Soil Mechanics Laboratory with the results in the form of specific gravity and gradation distribution of soil grains. The discharge and dimensions of the mud bag are secondary data obtained from the relevant agencies [1].

There are 3 stages of calculation in this study, which consist of analysis of sediment transport, checking of sludge bag settling efficiency, and determining when the sludge bag will drain optimally. Sediment transport calculations are based on four empirical equations, namely the Meyer-Peter and Muller (MPM) method, Einstein, Shun and Hung, and Engelund and Hansen.

The MPM method is an equation obtained through an empirical approach. The MPM equation is an equation that is quite superior to other equations, because of the large data interval used [9]. The MPM equation for bed load can be calculated using Equation 1 to Equation 8 [10].

$$Q_s = Q_b B \rho_s \quad (1)$$

$$Q_b = \phi (g \Delta D_m^3)^{1/2} \quad (2)$$

$$\phi = (4\psi' - 0{,}188)^{3/2} \quad (3)$$

$$\psi' = \frac{\mu g R S}{\Delta D_m} \quad (4)$$

$$\Delta = \frac{\rho_s - \rho_w}{\rho_w} \quad (5)$$

$$\mu = \left(\frac{C}{C'}\right)^{3/2} \quad (6)$$

$$C = \frac{V}{\sqrt{RS}} \quad (7)$$

$$C' = 18 \log \frac{12R}{D_{90}} \quad (8)$$

Where:

Qs = sediment load (tonnes/day)

Qb = sediment load discharge per unit width (m3/s/m)

B = width of the channel or river (m)

D = water depth (m)

S = slope of a channel or river

R = hydraulic radius (m)

V = flow velocity (m/s)

g = acceleration due to gravity (m/s$^2$)

D90 = diameter of grain passing 90% sieve (mm)

Dm = diameter of the grain passing through the sieve 50%-60% (mm)

ρs = density of sediment (kg/m$^3$)

ρw = specific gravity of water (kg/m$^3$)

φ = sediment transport intensity

Δ = ratio of specific gravity
ψ' = effective flowing intensity
μ =*ripple factor*
C =*friction factor*
C' =*intensive friction factor*

This equation uses D35 for the transport parameter, while D65 is used for roughness. The Einstein method sediment transport can be calculated by Equation 9 to Equation 16 [10].

$$Q_s = Q_b B \rho_s \quad (9)$$

$$Q_b = \phi(g \Delta D_{35}^3)^{1/2} \quad (10)$$

$$\phi = 0{,}044638 + 0{,}36249\psi' - 0{,}226795\psi'^2 + 0{,}036\psi'^3 \quad (11)$$

$$\psi' = \frac{\mu g R S}{\Delta D_{35}} \quad (12)$$

$$\Delta = \frac{\rho_s - \rho_w}{\rho_w} \quad (13)$$

$$\mu = \left(\frac{C}{C'}\right)^{3/2} \quad (14)$$

$$C = \frac{V}{\sqrt{RS}} \quad (15)$$

$$C' = 18 log \frac{12R}{D_{65}} \quad (16)$$

Where:
Qs = sediment load (tonnes/day)
Qb = sediment load discharge per unit width (m3/s/m)
B = width of the channel or river (m)
D = water depth (m)
S = slope of a channel or river
R = hydraulic radius (m)
V = flow velocity (m/s)
g = acceleration due to gravity (m/s$^2$)
D35 = diameter of the grain passing through the sieve 35% (mm)
D65 = diameter of the grain passing through the sieve 65% (mm)
ρs = density of sediment (kg/m$^3$)
ρw = specific gravity of water (kg/m$^3$)
φ = sediment transport intensity
Δ = weight ratio
ψ' = effective flowing intensity
μ =*ripple factor*
C =*friction factor*
C' =*intensive friction factor*

*Shen and Hung* assumes that sediment transport does not use the Reynolds number because sediment transport is so complex [11]. Shen and Hung tried to find the dominant variable in sediment transport rate, they then recommended an equation based on 587 laboratory data sets. Sediment transport by the Shen and Hung method can be calculated using Equation 17 to Equation 19 [12], and combined with the calculation of the particle settling velocity using Equation 20 [13].

$$Q_s = \left(\frac{QC_t}{10^6}\right)\rho_w \quad (17)$$

$$\log C_t = -107404{,}459 + 32414{,}74Y - 326309{,}589Y^2 + 109503{,}872Y^3 \quad (18)$$

$$Y = \left[\frac{VS^{0,57}}{\omega^{0,32}}\right]^{0,0075} \quad (19)$$

$$\omega = \left[\frac{gD_{50}^2}{18V}\right]\left(\frac{\rho_s - \rho_w}{\rho_w}\right) \quad (20)$$

Where:
Qs = sediment load (tonnes/day)
Q = channel or river discharge (m$^3$/s)
B = width of the channel or river (m)
V = flow velocity (m/s)
g = acceleration due to gravity (m/s$^2$)
S = slope of a channel or river
D50 = diameter of the grain passing through the 50% sieve (mm)
ρs = density of sediment (kg/m$^3$)
ρw = specific gravity of water (kg/m$^3$)
ω = speed of falling sediment (m/s)
Y = sediment concentration coefficient
Ct = total sediment concentration (ppm)

This equation uses the shear stress approach as the basis for its calculations. The transport sediments of the Engelund and Hansen method can be calculated using Equation 21 to Equation 23 [14].

$$Q_s = BQ_b \quad (21)$$

$$Q_b = 0{,}05\rho_w V^2 \left(\frac{D_{50}}{g\left(\frac{\rho_s}{\rho_w} - 1\right)}\right)^{1/2} \left(\frac{\tau_0}{(\rho_s - \rho_w)D_{50}}\right)^{3/2} \quad (22)$$

$$\tau_0 = \rho_w DS \quad (23)$$

Where:
Qs = sediment load (tonnes/day),
Qb = sediment load discharge per unit width (m3/s/m)
B = width of the channel or river (m)
D = water depth (m)
S = slope of a channel or river
R = hydraulic radius (m)
V = flow velocity (m/s)
g = acceleration due to gravity (m/s$^2$)
D50 = diameter of the grain passing through the 50% sieve (mm)
τ0 = shear stress (kg/m$^2$)

In order to determine the functioning of the sludge bag, it is necessary to check the settling efficiency and rinsing efficiency [8]. The parameters used to check the settling efficiency are (ω) the settling velocity of particles whose size is outside the planned particle size in m/s units, (ω0) the design settling velocity in m/s units, and (V0) the average flow velocity in sludge bag in m/s unit. It is recommended that sediment in the form of fine sand be deposited at least 60% - 70% [8]. The settling efficiency can be estimated using the graph in Figure 2.

Checking the deposition efficiency needs to be done with 2 conditions, namely when the full state is calculated using Equation 24, and when the empty state is calculated using Equation 26.

$$\frac{V'}{\omega} > \frac{5}{3} \quad (24)$$

$$V' = \sqrt{gDS} \quad (25)$$

$$V > \frac{\omega}{1{,}6S} \quad (26)$$

Where:

V' = sliding speed (m/s)

V = average speed of flow (m/s)

ω = sediment particle settling velocity (m/s)

g = gravitational accelerationearth (m/s2)

D = water depth (m)

S = channel slope

Checking the flushing efficiency depends on the shear forces that occur between grains in the channel based on the graph in Figure 3. Then checking the shear stress of the sediment in a suspended state can be calculated using Equation 27.

$$\tau_0 = \rho_w gDS \quad (27)$$

Where:

τ0 = shear stress (N/m$^2$)

g = acceleration due to gravity (m/s$^2$)

ρw = specific gravity of water (kg/m$^3$)

D = water depth (m)

S = channel slope

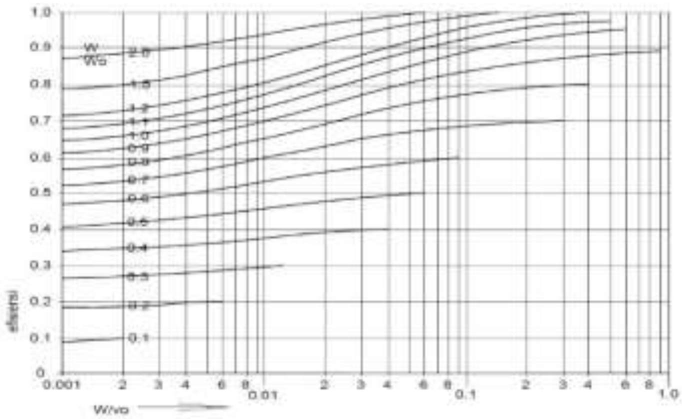


**Figure 2.Graph of Camp Sediment Discharge for Turbulence Flow [8]**

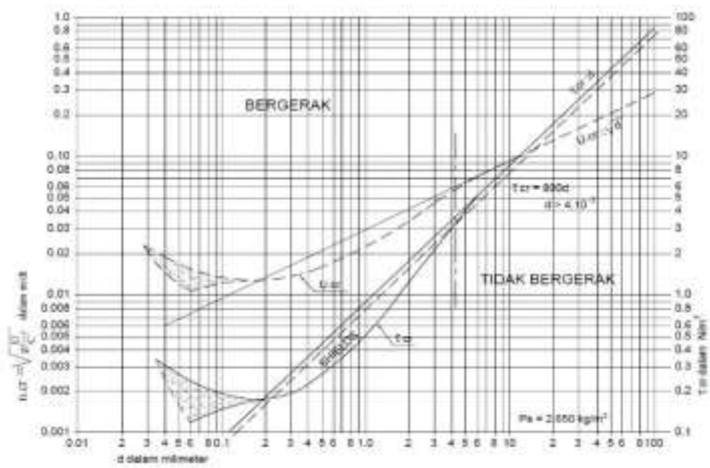


**Figure 3. Critical Shear Stress And Critical Shear Speed As A Function Of Grain Size For ρs = 2650 kg/m3 (Sand) [8]**

The initial planning of the mud bag can use the scheme according to Figure 4 and is calculated using Equation 28. However, in the planning of the mud bag one must pay attention to the L/B rule > 8 so that the flow does not meander in the bag. With the graph in Figure 5 it is possible to determine the particle settling velocity (ω) of various sediment sizes [15].

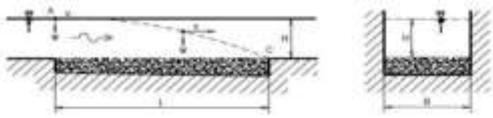

**Figure 4. Sludge Bag Schematic [8]**

$$LB = \frac{Q}{\omega} \quad (28)$$

Where:

L = mud bag length (m/s)

B = mud bag width (m/s)

Q = channel discharge ($m^3$/s)

ω = sediment particle settling velocity (m/s)

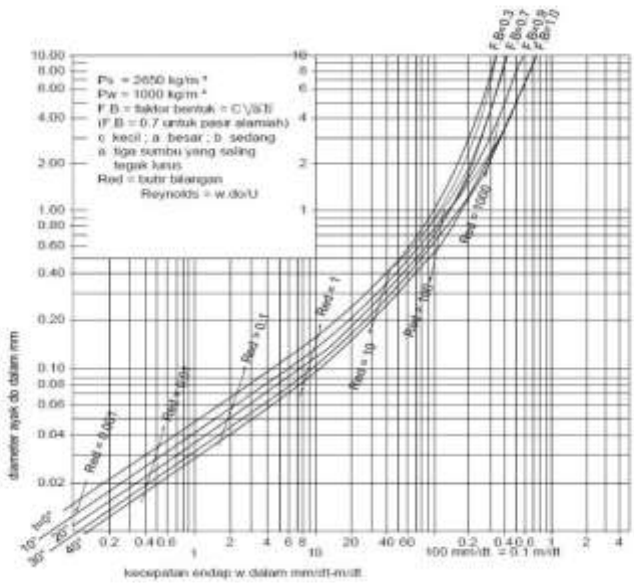

**Figure 5. Relationship Between Sieve Diameter And Sediment Rate For Still Water [8]**

The storage capacity is calculated based on secondary data in the form of technical drawings of sludge bags obtained from the relevant agencies [1]. The highest result from the calculation of sediment transport is used as input for calculating the handling time according to the capacity of the sediment storage. By dividing the sediment storage capacity by the sediment transport value, the processing time is obtained.

## RESULT

Testing of samples or primary data in the form of soil specific gravity values and distribution of soil grains was carried out at the Soil Mechanics Laboratory, University of Semarang. The test results in the form of sediment specific gravity get a value of 2682 kg/m3. Then the sediment samples were also subjected to a gradation test to determine the grain distribution of the sediment samples with the results that can be seen in Figure 6. Secondary data was obtained from the relevant agencies in the form of the dimensions of the existing mud bag which can be seen in Figures 7 and Figure 8. Then discharge data (Q) the data used in the form of a network scheme states that the water requirement in Patihan is 0.072 m3/s [1]. The summary of the data used can be seen in Table 1.

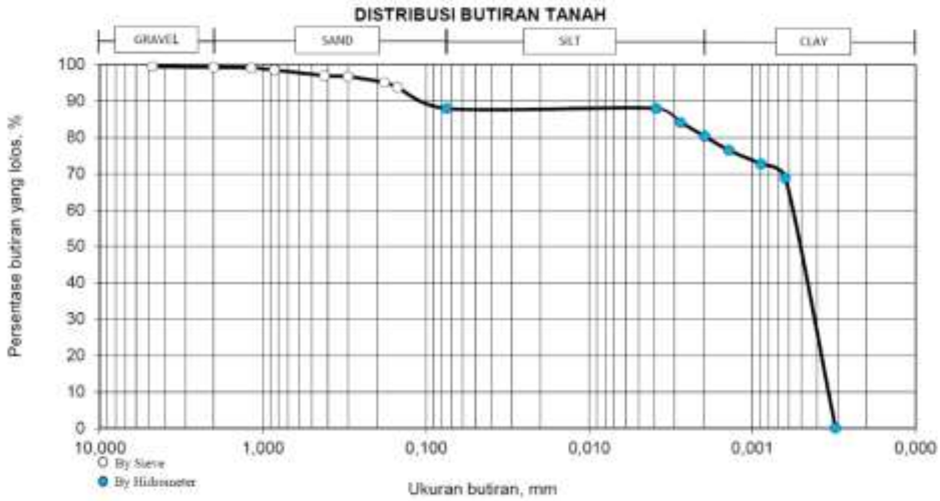


**Figure 6. Soil Grain Distribution**

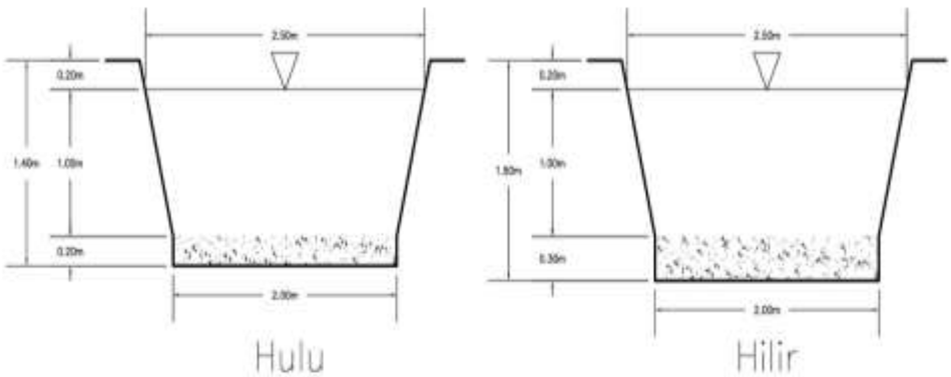


**Figure 7. Cross Section of the Existing Sludge Bag**

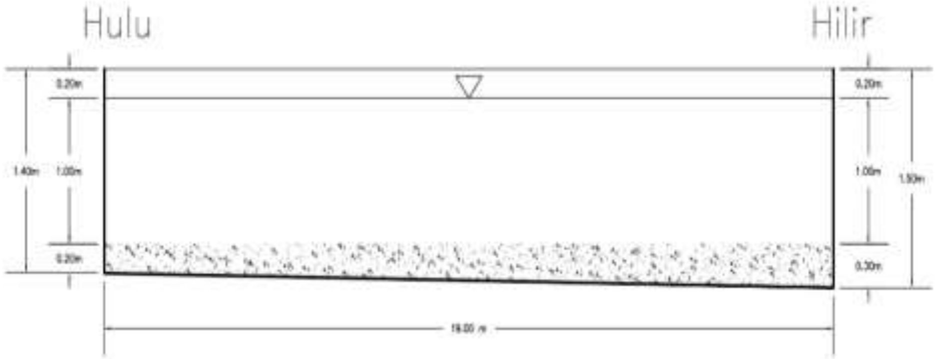


**Figure 8. Long Section of Existing Sludge Bag**

**Table 1. Data recapitulation**

| Information | Symbol | Unit | Existing |
|---|---|---|---|
| Mud Bag Length | L | m | 19.00 |
| Top Width of Sludge Bag | Ba | m | 2.50 |
| Mud Bag Bottom Width | Bb or B | m | 2.00 |
| Water depth | D | m | 1.00 |
| debit | Q | m3/s | 0.072 |
| The slope of the Olak Pool Wall | m | | 0.25 |
| Wet Cross-sectional Area | A | m2 | 2.25 |
| Wet Cross Section | P | m | 4.06 |
| Channel Tilt | S | | 0.0053 |
| Gravity Acceleration | g | m/s2 | 9,81 |
| Upper Elevation | elv. upstream | masl | 183,437 |

| | | | |
|---|---|---|---|
| Downstream Elevation | elv. downstream | masl | 183,337 |
| Sediment Specific Gravity | ρs | kg/m3 | 2682 |
| Specific Gravity of Water | ρw | kg/m3 | 1000 |
| The diameter of the grain passes the filter 100% | D100 | mm | 4.90 |
| Diameter of grain passes 95% sieve | D95 | mm | 0.18 |
| Diameter of grain passes 90% sieve | D90 | mm | 0.12 |
| The diameter of the grain passes the sieve 85% | D85 | mm | 0.0028 |
| The diameter of the grain passes the sieve 80% | D80 | mm | 0.0019 |
| Diameter of grain passes sieve 75% | D75 | mm | 0.0013 |
| The diameter of the grain passes the sieve 70% | D70 | mm | 0.00064 |
| Diameter of grain passes sieve 65% | D65 | mm | 0.00060 |
| The diameter of the grain passes the sieve 60% | D60 | mm | 0.00058 |
| Granule diameter passes 55% sieve | D55 or Dm | mm | 0.00054 |
| Diameter of grain passes 50% sieve | D50 | mm | 0.00050 |
| The diameter of the granules passes the sieve 45% | D45 | mm | 0.00048 |
| The diameter of the grain passes the sieve 40% | D40 | mm | 0.00045 |
| The diameter of the grain passes the sieve 35% | D35 | mm | 0.00043 |
| The diameter of the grain passes the sieve 30% | D30 | mm | 0.00041 |
| The diameter of the grain passes the sieve 25% | D25 | mm | 0.00039 |
| The diameter of the grain passes the sieve 20% | D20 | mm | 0.00037 |
| Diameter of grains passing 15% sieve | D15 | mm | 0.00036 |
| Diameter of grains passing 10% sieve | D10 | mm | 0.00034 |
| Diameter of granules passing 5% sieve | D5 | mm | 0.00032 |

The initial calculation is in the form of an estimate of the amount of sediment transport based on several empirical formulas described in the previous chapter. The data used to calculate transport sediments are in the form of sediment specific gravity, sediment grain gradations, as well as dimensions and hydraulic behavior in the sludge bag. The results of calculating sediment transport with several methods are shown in Table 2.

**Table 2. Recapitulation of Sediment Transport Calculations**

| Method | Sediment Transport (Qs) | |
|---|---|---|
| Meyer-Peter and Muller | 0.45 | m3/day |
| Einstein | 0.34 | m3/day |
| Shen and hung | 0.71 | m3/day |
| Engelund and Hansen | 0.28 | m3/day |

In Table 2 it can be seen that the highest sediment transport value was obtained based on calculations using the Shun and Hung method with a value of 0.71 m3/day. This value will be used as a reference in calculating the dewatering time according to the dimensional conditions of the sludge bag. The settling efficiency test aims to determine the performance level of the existing sludge bag. If the efficiency has reached 60% -70%, it can be said that the sludge bag is in a condition that meets the requirements. Calculation of the speed of falling sediment is based on Figure 3, but if the size of the grains passing through the filter is smaller than that shown in the graph, then use the formula from Equation 20 which is adjusted to the grain size being reviewed. The reference sediment fall velocity is the result of calculations with sediment grains D10 (ω0). As for the speed of falling sediment outside the plan, it is the result of calculating the speed of falling sediment based on the diameter of the sediment other than D10 (ω). Then the flow rate is based on the hydraulic properties of the sludge bag (V0).

**Table 3. Calculation of Sedimentation Efficiency**

| Details | ω/V0 | ω/ω0 | Efficiency (%) | Information |
|---|---|---|---|---|
| D100 | 1.0 | 2.0 | 100 | Precipitated |
| D95 | 1.0 | 2.0 | 100 | Precipitated |
| D90 | 0.4 | 2.0 | 100 | Precipitated |
| D85 | 0.007 | 2.0 | 93 | Precipitated |
| D80 | 0.003 | 2.0 | 89 | Precipitated |
| D75 | 0.002 | 2.0 | 88 | Precipitated |
| D70 | 0.001 | 2.0 | 87 | Precipitated |
| D65 | 0.001 | 2.0 | 87 | Precipitated |

| | | | | |
|---|---|---|---|---|
| D60 | 0.001 | 2.0 | 87 | Precipitated |
| D55 | 0.001 | 2.0 | 87 | Precipitated |
| D50 | 0.001 | 2.0 | 87 | Precipitated |
| D45 | 0.001 | 2.0 | 87 | Precipitated |
| D40 | 0.001 | 1,8 | 87 | Precipitated |
| D35 | 0.001 | 1,6 | 79 | Precipitated |
| D30 | 0.001 | 1.5 | 79 | Precipitated |
| D25 | 0.001 | 1,3 | 72 | Precipitated |
| D20 | 0.001 | 1,2 | 72 | Precipitated |
| D15 | 0.001 | 1,1 | 67 | Precipitated |
| D10 | 0.001 | 1.0 | 65 | Precipitated |
| D5 | 0.001 | 0.9 | 62 | Precipitated |
| Average | | | 83.75 | Precipitated |

Based on Table 3, it shows that the sludge bag deposition efficiency in Patihan gets a value of 83.75%, so based on KP-02 these conditions meet the requirements.

Sedimentation efficiency requires control due to turbulent flow conditions which result in scouring when the sludge bag is full or empty with water conditions. The flow is expected not to erode the sediment that has been deposited. Based on Equation 24 to Equation 27, the data is in the form of sediment falling velocity (ω) with a 10% filter passing diameter (D10) of 0.0000033 m/s, flow velocity when the water is full (V) of 0.032 m/s and when it is empty or when the remaining water with a depth (D) of 0.10 m is 0.355 m/s. Then the acceleration due to gravity (g) is 9.81 m3/s and the canal slope (S) is 0.0053, so the calculation is described as follows.

Sliding Speed

$$V' = \sqrt{gDS}$$

$$V' = \sqrt{9{,}81\ .\ 1{,}00\ .\ 0{,}0053} = 0{,}23\ m/s$$

Full condition requirements

$$\frac{V'}{\omega} > \frac{5}{3}$$

$$\frac{0{,}23}{0{,}0000033} > \frac{5}{3} \longrightarrow 68521{,}01 > 1{,}67\ (qualify)$$

Blank condition requirement

$$V > \frac{\omega}{1{,}6S}$$

$$0{,}355 > \frac{0{,}0000033}{1{,}6\ .\ 0{,}0053} \rightarrow 0{,}355 > 0{,}00039\ (qualify)$$

From the results of checking turbulence in full and empty water conditions, the sludge bag meets the requirements. Then in terms of the dimensions of the mud bag, namely the ratio between length (L) and width (B) (L/B > 8) also meets the requirements.

The next efficiency check is related to rinsing efficiency based on Equation 27 and the graph in Figure 3. The data used to calculate the specific gravity of water (ρw) is 1000 kg/m3, the acceleration due to gravity (g) is 9.81 m/s2, the radius hydraulic radius (R) of 0.55 m, and the slope of the channel (S) of 0.0053, the calculation is described as follows.

shear stress

$$\tau_0 = \rho_w gRS$$

$$\tau_0 = 1000\ .\ 9{,}81\ .\ 0{,}55\ .\ 0{,}0053 = 28{,}60\ N/m^2$$

The shear stress results are plotted on the graph in Figure 3, so the diameter carried during draining is 30.00 mm. Based on the results of the gradation test, the largest diameter, namely the sediment passing the 100% filter (D100) of 4.90 mm, has a size smaller than 30.00 mm, so it can be said that the rinsing efficiency meets the requirements.

From the data obtained from interviews with the chairman of the farmer association in Patihan, explained that the process of draining the mud bag was carried out once a month or based on the vision that the mud bag was full so it was drained. Based on secondary data related to the dimensions of the mud bag, it shows that the volume of the bottom storage in the sludge bag at Patihan is 9.50 m3. This condition will take into account the approximate number of days the storage capacity will be full based on the largest value from the results of the sediment transport calculation using several methods or empirical formulas that have been carried out. The highest value of the transport sediment calculation results is based on the Shun and Hung method with a value of 1.91 tons/day or 0.71 m3/day. Calculation of optimal handling time on DI sludge bags

$$Drainage\ time = \frac{Vol._{mud\ bag}}{Q_s(S\&H)}$$

$$Drainage\ time = \frac{9{,}50}{0{,}71}$$

$$Drainage\ time = 13{,}37\ days$$

Seeing the results of the calculation above, it is recommended that the processing time be carried out once every 13 days. However, to simplify scheduling and for more optimal results in maintaining the capacity of the sludge bag, it can be drained for 7 days or once a week.

## CONCLUSION

Based on the results of the analysis carried out, the calculation of the amount of transport sediment in the Patihan DI irrigation canal based on the Meyer-Peter and Muller method yields a value of 1.21 tons/day or 0.45 $m^3$/day, the Einstein method yields a value of 0.92 tons/day day or 0.34 $m^3$/day, the Engelund and Hansen method produces a value of 0.28 tons/day or 0.76 $m^3$/day, and the largest yield and as a reference for calculating the dewatering time is the Shun and Hung method with a value of 1 .91 tons/day or 0.71 $m^3$/day. Then the value of the sedimentation efficiency in the sludge bag of the Patihan DI irrigation canal is 83.75%. Finally, regarding the optimal draining time for the sludge bag of the Patihan irrigation canal, this is once every 7 days or once a week.

### *Declaration by Authors*

**Acknowledgement:** We want to express our gratitude to LPPM USM for providing funding so that this research can be carried out properly and on time.

**Source of Funding:** LPPM USM

**Conflict of Interest:** The authors declare no conflict of interest.

## REFERENCES

1. Dinas Pekerjaan Umum dan Penataan Ruang Kabupaten Blora, “Penyusunan IKSI dan AKNPI Irigasi,” Kabupaten Blora, 2021.
2. M. F. Sood, Kartini, and D. Gunarto, “Analisa Angkutan Sedimen Sungai Jawi Kecamatan Sungai Kakap Kabupaten Kubu Raya,” *JeLAST J. PWK, Laut, Sipil, Tambang*, vol. 5, no. 2, 2018, doi: http://dx.doi.org/10.26418/jelast.v5i2.29167 .
3. A. Munandar and Terunajaya, “Analisis Laju Angkutan Sedimen bagi Perhitungan Kantong Lumpur pada D.I. Perkotaan Kabupaten Batubara,” Universitas Sumatera Utara, Medan, 2014.
4. I. P. Putra, Kartini, and Nurhayati, “Analisis Angkutan Sedimen di Muara Parit Berkat,” *JeLAST J. PWK, Laut, Sipil, Tambang*, vol. 6, no. 2, 2019, doi: http://dx.doi.org/10.26418/jelast.v6i2.33598 .
5. A. H. B. Kuncoro, D. S. Budiningrum, and Istianah, “Analisis Sedimentasi di Tampungan Embung Daerah Irigasi Jurug Lendah Kulon Progo,” *Fondasi J. Tek. Sipil Univ. Sultan Ageng Tirtayasa*, vol. 11, no. 1, pp. 88–97, 2022, doi: http://dx.doi.org/10.36055/fondasi.v0i0.14402.
6. N. Basri and A. Purwanto, “Studi Laju Sedimentasi Bagian Hilir Sungai Saddang,” Universitas Muhammadiyah Makassar, Makassar, 2018.
7. T. Harfiani, K. Amri, and L. Z. Mase, “Kajian Laju Angkutan Sedimen pada Kantong Lumpur Bendung Air Lais Kabupaten Bengkulu Utara,” in *Civil Engineering and Built Environment Conference*, 2019, pp. 315–324.
8. Kementerian Pekerjaan Umum Direktorat Jenderal Sumber Daya Air Direktorat Irigasi dan Rawa, “Standar Perencanaan Irigasi Kriteria Perencanaan Bagian Bangunan Utama (Head Works) KP-02,” Jakarta, 2013.
9. I. F. G. Putra, “Evaluasi Kinerja Kantong Lumpur Bendung Karangtalun,” Universitas Islam Indonesia, Yogyakarta, 2019.
10. Y. Ayas P., “Analisis Angkutan Sedimen dengan Metode MPM dan Metode Einstein

pada Saluran Primer Bendung Mencongah," Universitas Mataram, Mataram, 2017.
11. H. Pangestu and H. Haki, "Analisis Angkutan Sedimen Total pada Sungai Dawas Kabupaten Musi Banyuasin," *J. Tek. Sipil dan Lingkung.*, vol. 1, no. 1, 2013.
12. K. Amri, "Analisis Laju Angkutan Sedimen di Sungai Luas Bengkulu dengan Metode Shen Hungs dan Engelund Hansen," *RADIAL J. Perad. Sains, Rekayasa dan Teknol.*, vol. 10, no. 1, pp. 1–10, Jun. 2022, doi: 10.37971/radial.v10i1.239.
13. R. Siswanto, Kartini, and H. Herawati, "Studi Karakteristik dan Laju Angkutan Sedimen Parit Langgar Desa Wajok Hilir Kecamatan Siantan Kabupaten Mempawah," *JeLAST J. PWK, Laut, Sipil, Tambang*, vol. 8, no. 1, pp. 1–9, 2021, doi: http://dx.doi.org/10.26418/jelast.v8i2.49395.
14. A. Andriani, "Studi Perbandingan Metode Yang dengan Metode Engelund and Hansen pada Angkutan Sedimen Total (Qt) Sungai Cimuntur Kabupaten Ciamis," *J. Media Teknol. Univ. Galuh*, vol. 7, no. 1, pp. 1–10, 2020.
15. D. Tanjung, R. Harahap, and R. Tanjung, "Valuasi Kapasitas Kantong Lumpur pada Bendung Sei Padang Kota Tebing Tinggi Provinsi Sumatera Utara," *Bul. Utama Tek.*, vol. 17, no. 1, pp. 7–13, 2021.

How to cite this article: Ahmad Hakim Bintang Kuncoro, Istianah, Diah Setyati Budiningrum. Analysis of efficiency and a time for draining mud bag in Patihan Irrigation Area, Blora Regency. *International Journal of Research and Review*. 2023; 10(7): 796-805.
DOI: *https://doi.org/10.52403/ijrr.20230794*

******