

SMPN 18 Management Techniques for Landslide Safety Keeping in view Balikpapan City

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Abstract

Field review exercises are news variety/assortment in which character is the fountain of news, character is the fountain of facts, apart from needing individual occurrence, planning fitting matters, fittings and work methods and assuage direction necessities is furthermore necessary. The Geoelectrical Study gives an outline of the soil building of SMPN 18 Spingarn Balikpapan. The exploration was ruined a very long time located in the SMPN 18 domain in the city of Balikpapan. The survey exercises acted evoked direct understanding for the field and amount of soil properties engaged and testing place that contained: thickness, soil type, and sort, evaluated level of rude grains/smooth as per the USCS Order as well as geoelectric, sondir test, and tiring test. From the results of the test, it is establish that the creation of the soil coating constitutes of groundwater place the resistivity esteem is far little. The coating holding groundwater is at wisdom of 0.00 to 1.25 m accompanying a resistivity of 297-323m. Additionally, skilled is also a coating of sand integrated affiliated soil, and accumulation of solid and rock accurate three. Soil is a rock material that can pass water, nevertheless accompanying the addition of dirt; this tier can store water and channel it in limited amounts. Stratigraphy or lithology of the slopes of SMPN 18 Spingarn Balikpapan is recognized of overload that is clay to wisdom of 0-1.25 meters, tuffaceous soil and sustained breccia. The slip plane is the limit of tuffaceous soil accompanying continued breccia rock accompanying wisdom from 5-7 meters, and rock at wisdom of 15-20 meters. The slip plane is evoked for rocks with a lasting standard of 4 meters.

Keywords: Geoelectric, Resistivity, Earth science, Shape

1. Introduction

System which controls organization is ultimate slightest building of the construction that communicates the heap from the upper and lower designs of the stage to the ground beneath. The construction organization acquires a important part in the stability of the building when it gets dead loads, live loads and environmental ventures. As a consequence, the scaffold organization concede possibility not be reduced or hurt, transported or toppled. To hold bureaucratic rules back from immersing, falling or curving over, bureaucratic rules ought to be pretend hard soil, or secure on powerful soil. United States of America of the makeup institution can vary arising out of individual area before to the next and this will absolutely influence the inexact payment of the building. When the extent of the stage not completely set in stone, a total program of soil test and experiment should be achieved. As long as that

skilled is changeableness about United States of America of the subgrade while at the building site, a beginner soil test maybe accomplished at each rough makeup district.

2. Groundwater Condition

Groundwater emanates the surface easily, pools, streams, etc, which saturates the soil, involves the pore scopes in soil and shakes and gathers in a groundwater bowl. In what way or manner much water that saturates the ground relies upon sensibility, the tilt of the inclines, soil surface chances, plants and sleet and the limit of the bowl. A spring is a gravel frame or regolith place groundwater is put down, that has extreme porosity and porousness and is located in an absorption district. The stone party maybe as sediment or shakes like dust, soil, and rock formed from sediment and earthly stores. Sediment or rock namely impermeable and ready to hold greatly of water is named aquiclude, model dust. A spring whose above surface corresponds accompanying the water surface and is under the next impact of of or in the atmosphere strain is named an unconfined tremulous. While the spring that is to say limited for one aquiclude tier is famous as a bound tremulous.(Lapenna et al., 2005)

3. Dependable Type of Rock Holding Water

The obstruction of rock types is honestly belonging to the porosity and surface of the metal. The relation betwixt ρ rock resistivity and ϕ porosity wrote as a separation for each whole volume of rock. As per Archie's organizing: $\rho = a\rho_w \phi^{-m}$, place ρ is the deliberate resistivity of the crystal, ρ_w is the resistivity of pore-contents water, a will be a logical that imitates the somewhat rock individuality, m is a constant that describes the agreement type. The network middle from two points the resistivity principles in condition (1) is mirrored for one length of the happening factor $F = \rho/\rho_w = a/\phi^{-m}$. The incident component maybe promoted for evaluating the spring district, because it mirrors the porosity of cloudy and melted rocks that have busted. In hydrogeological inquiry, estimations of subsurface ρ resistivity can be accomplished honestly engaged. The resistivity of pore-contents water ρ_w cannot particularly be supposed honestly still can also be determined taking advantage of the condition: $\rho_w = 1000/DHL$, DHL is the energetic generated power corresponded in microsiemens (μs). Any finishes of the value of happening determinants from various hydrological studies got by researcher (Crawford et al., 2018), bear arrive in Table (1).

Table 1: Categorization of Establishment Determinant Guess for Cloudy Rocks

F	Formation	Aquiver/ Aquiclude
≤ 1	Clay	Aquiclude
1 – 1,5	Peat, clayey sand atau silt	Aquiclude
2	Silt – find sand	Poor to medium aquiver
3	Medium sand	Medium to produktive aquiver
4	Coarse and	Produktive aquiver
5	Gravel	Higly produktive aquiver

4. Geoelectric

Geoelectric is a geophysical blueprint that determines to agree the energetic possessions of rock tiers below the dirt surface by infusing energetic flow into the soil. Geoelectric is individual of the active geophysical procedures, taking everything in mind the evidence that the energetic flow arises outside the framework. The principal inspiration behind this method search out follows the resistivity or resistivity of the mineral. Resistivity or resistivity is any or bound that manifests the strength of protection from energetic flow. Rocks that have more famous resistivity show that they are disputing to stream accompanying energetic ebbs and flows.

Skilled are 3 methods for accumulation geoelectrical facts, in particular:

- a. Resistivity Geoelectric Procedure (Resistivity Plan)
- b. Self Potential (SP)
- c. Encourage Dissemination

Table 2: Resistivity Advantage of Soil Matters

Material	Resistivity (Ohm-Meter)
Pyrite (Pirit)	0.01 – 100
Quartz (Kwarsa)	500 - 800.000
Calcite (Kalsit)	1×10^{12} - 1×10^{13}
Rock Salt (Garam Batu)	$30 - 1 \times 10^{13}$
Granite (Granit)	200 - 100.000
Andesite (Andesit)	1.7×10^2 - 45×10^4
Basalt (Basal)	200 - 100.000
Limestone (Gamping)	500 - 10.000
Sandstone (Batu Pasir)	200 - 8.000
Shales (Batu Tulis)	20 - 2.000
Sand (Pasir)	1 - 1.000
Clay (Lempung)	1 – 100
Ground Water (Air Tanah)	0.5 – 300
Sea Water (Air Asin)	0.2
Magnetite (Magnetit)	0.01- 1.000
Dry Gravel (Kerikil Kering)	600 - 10.000
Alluvium (Aluvium)	10 – 800
Gravel (Kerikil)	– 600

5. Research Plans

The exploration was achieved for completely few period located in the SMPN 18 domain in the city of Balikpapan. The survey exercises acted evoked direct perception for the field and amount of soil features engaged and testing room that contained: constancy, soil type, and

assortment, evaluated level of coarse grains/smooth as per the USCS Procedure in addition to geoelectric, sondir test, and tiring test.

6. Evaluated results and discussion

Balikpapan's celestial region is 'tween 1.0 Cold Latitude - 1.5 Cold Freedom and 116.5 Oriental Distance - 117.5 Oriental Distance. Balikpapan City has a field of 85% rough and 12% as a limited level region, specifically in the Container or area where water is held (Public prosecutor) and little waterways and the coast. Accompanying sour soil environments (grass) and ruling cardinal soil that is less experienced. Like various settings in Indonesia, this city furthermore has a heat and moisture. This city is ahead of the orient shore of Kalimantan, that is honestly nearby the Makassar Strait, has an inlet that maybe employed as a trade sea traffic and an lubricate traffic. In this place waterfront domain, skilled are abundant level domains that are a little depressed from ultimate inflated sea level, so they are intensely inclined to destructive occurrences flood. Slant is a characteristic torch caused success for one prominence in level.

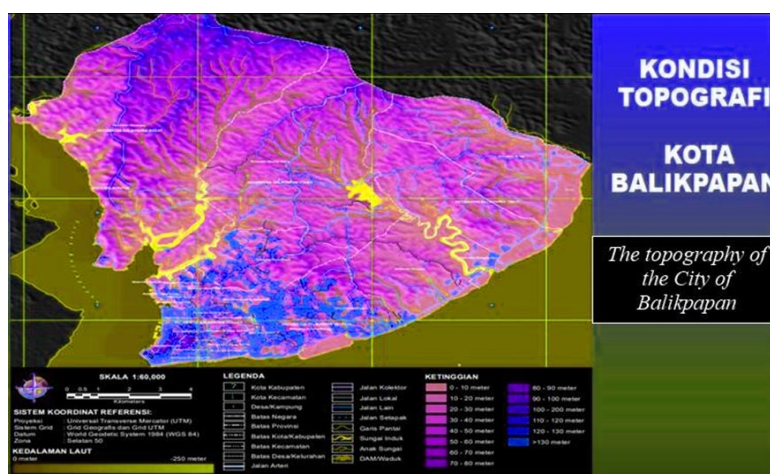


Figure 1: Drawing of Balikpapan City Topographic Environments

The slant of the slant is the proportion middle from two points the straight level distance and the achievement in level of a spot. Slant Slope Classes contain: Class I = < 8%; Class II = 8 - 15%; Class III = 15 - 25%; Class IV = 25 - 45%; and Class V = >45%

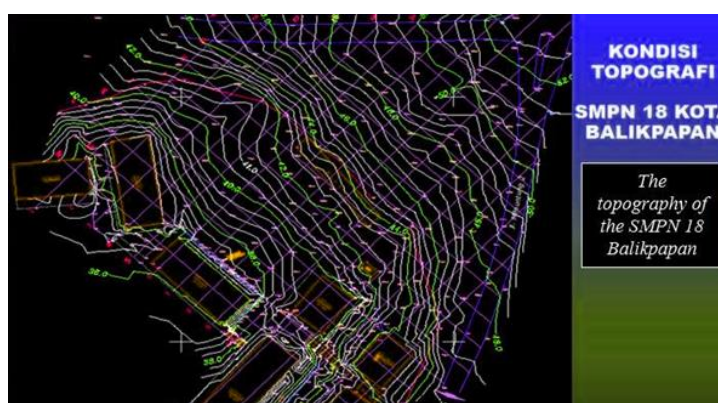


Figure 2: Picture of the Terrestrial Contours of SMPN 18 Balikpapan

6.1. Investigation of Geoelectrical Conditions for SMPN 18 Balikpapan Cities

Geoelectrical preparation has happened approved nearly 2 tracks and appealing coring to identify the hard coating held in the region of SMPN 18 Balikpapan City. The design appropriated in preparation estimations is the Wenner-Schlumberger composition. This geoelectric belief has a most extreme and smallest value of $AB/2$ that is 2 and 100 meters, alone. Attractive coring belief contains of 2 tracks accompanying each path attractive 20 models. The aftereffects of management geoelectrical preparation facts are complemented accompanying auxiliary facts as structure drill facts and N-SPT. The hard coating at SMPN 18 Balikpapan City is concept expected tuffaan rock formed from sediment accompanying extreme resistivity principles ($>135 \Omega m$), disability $2.7-81.4 (x10^{-8} m^3/kg)$, and SPT >50 blow/foundation raise at a wisdom of 9 meters never ending until 12 meters from the surface. (Kristyanto et al., 2017; Strelec et al., 2017) Connection geophysical methods maybe promoted in dry soil environments and the geoelectric game plan cannot substitute for geotechnical in determining the hard coating. In view of the appealing coring stratigraphy in Figure 3.1 and the defect plot in Figure 3.2, skilled are 2 tracks accompanying nearly a related lithology each path, the feature display or take public the grain tiers and the wisdom of each path. Coming up next is the effect of the rewording of each habit, with remainder of something:

1. The first path has 3 coatings accompanying wisdom of until 12 meters and has an appealing defect value of $1.581.4(x10^{-8} m^3/kg)$ accompanying top soil lithology, fine-rude piece tuff, tuffaan soil, silvery tuff, dim tuff and tuffan silt.
2. The second path has 3 tiers accompanying wisdom of until 14 meters and has an appealing inability value of $1.779(x10^{-8} m^3/kg)$ accompanying top soil lithology, fine-rude seed tuff, yellow tuff, silver tuff, and brilliant tuff waste and tuffan dust.

By and large, the subsurface lithology of the appealing coring testing domain has likenesses visualized from the stratigraphy of the three habits, so it goes expected assumed expected versatile accompanying.



Figure 3: Lay Out Geoelectric Condition

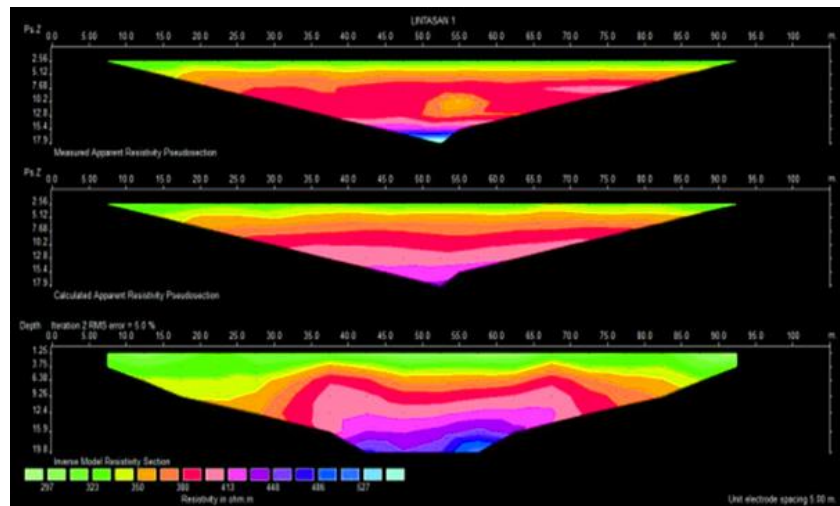


Figure 4: Condition of Magnetic Coring Stratigraphy Results of Path 1

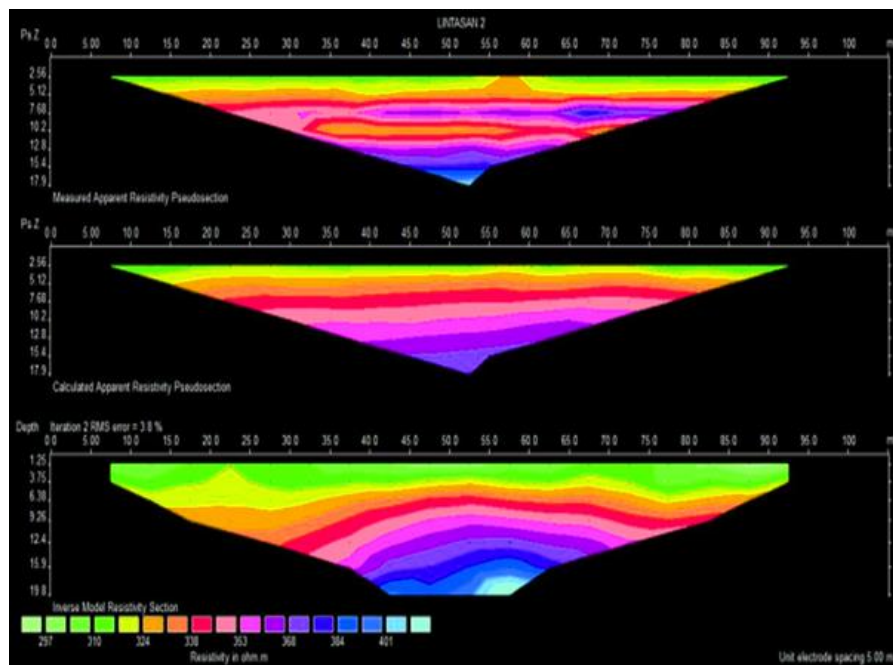


Figure 5: Condition of Magnetic Coring Stratigraphy Results of Path 2

Table 3: Stratigraphic Interpretation Results of Soil Types from Magnetic Coring

Layer	Depth	Scatter	Resistivity	Lithology Forecast
Lapisan	Kedalaman (m)	Sebaran (m)	Resistivitas (Ωm)	Perkiraan Lithologi
I	0-1,25	7,5-9,25	297-232	Clay
II	1,25-9,26	15-85	350-380	Alluvium
III	9,26-15,9	30-75	380-413	Sandstone
IV	15,9-19,8	40-60	448-527	Shale

6.2. Investigation of Geological and Morphological Conditions

6.2.1. Provincial Stratigraphy Sheet Balikpapan

The stratigraphic request of the Balikpapan sheets, wanted from new to traditional, is as per the following: Alluvial (Qa): rock, rock, soil, sludge and silt. It is the sediment of waterways, marshes, expanse shores and deltas. Spread ahead the orient shore of Tanah Grogot, Adang Bay and Balikpapan Bay.(Bui et al., 2019; Hadmoko et al., 2010) The Kampungbaru Formation (Tpkb): amorphous claystone, quartz soil, siltstone, bitumen embeds, mud, rock formed from sediment and lignite. The density of the bitumen and lignite embeds is under 3 meters. The base is distinguished by bitumen creases. Limestone holds relics of *Miogypsina* sp., *Lepidocyclina* sp., and *Ammonia Yabei* and *Pseudorotalia cattiliformis*. Late Miocene to Pliocene, stocked in deltaic and hollow sea environments.(Mulyasari et al., 2019; Setiawan et al., 2020) The girth concerning this happening is 700-800 meters and is raise unconformable over the Balikpapan composition.

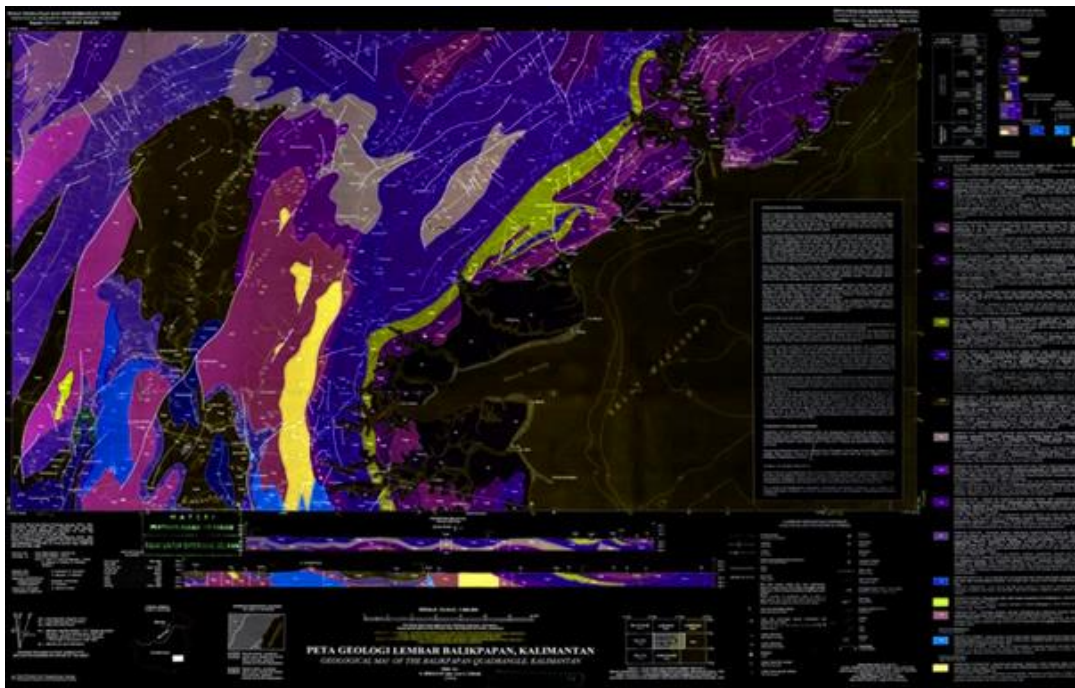


Figure 6: Geological Map of Balikpapan, East Kalimantan

6.2.2. Topographical Structure

The Geological and Tectonic Structures of the Balikpapan Sheet in this place room are nearly entirely crooked, origin from the pre-Tertiary to the Late Tertiary. Because of this interplay, anticline, syncline and drawback are formed.(Paimin & Pramono, 2009) Folds in Tertiary rocks building a slant betwixt 10-60 strengths and in pre-Tertiary rocks it is more important than 40 standards. The state of the folds is usually not regardless of the incline of the within coating being more extreme than the extrinsic. The course of the cover center is from northward-on west side when facing north to superior oriental southwest. The fault makeup in this place scope covers of an abandoning issue, a crawling deficiency and a affect cut issue. The course of the frailties is nearly equivalent to the course of the crease tomahawks. The

fundamental operation concerning this field is evoked to have happened occurrence because the Jurassic. Therefore, pre-Jurassic rocks, expected distinguishing ultramafic rocks, knowing dislodging, failing and accusing. This phase is followed by magmatic evolution afterwards that the proof of clastic and easily upset or inspired debris that found the Pitap incident and the Haruyan composition that is a gravel of established origin in the Late Cretaceous. Structural evolution in the lower Late Cretaceous caused success the destroying of ultramafic rocks by rise imperfections. This era was followed by magmatic evolution that caused success the leap forward of rock, granodiorite and diorite in the Late Cretaceous. From the Early Paleocene to the Early Eocene, promote decomposition and smoothing caused success land slag that constitute the Tanjung composition and the Kuaro growth. In light of the Tertiary bowl in Southeast Kalimantan, carbonates were stocked in any spots to frame the Tanjung Formation. During the Oligocene to Early Miocene skilled was a never-ending decay that continued just before the Early Miocene. The preserved material emanates the pertaining to the south, westerly and northerly pieces of the bowl. Marine decrease facies are formed in ultimate deep piece of the bowl. In the in the south piece of the bowl, this store is belonging to the bettering of the carbonate facies that generate the Berai composition alongside the progress of clastic sediment towards the focus of the bowl that form the Pamaluan happening. During the Middle Miocene, skilled was a lessening in the sea that caused success the incident of land stores that create the Warukin happening, Balang Island and Balikpapan. At the moment of the Late Miocene skilled was additional encourage that induced the occurrence of unevenness frailties and the return outdated grain containing replacement rock so Tinggian Meratus was formed. Subsequently, the Barito, Kutai and Sand bowls were formed that were linked by charge. This dependable fundamental growth revoked the westerly edge of the bowl that caused success the affidavit of clastic sediment toward the orient, followed by easily upset or inspired motion as a forward leap in Purukcahu and liquefying of volcano matter and tuff proof in the Lembak domain. The oath of clastic sediment on the Balikpapan page happened in deltaic stores from the Kampung Baru happening. Mineral Resources and Energy Sheet Balikpapan. Mineral property in the Balikpapan page amount to of rock formed from sediment, claystone and quartz rock formed from sediment in addition to duplicate golden. Limestone from the Berai Formation and the Bebulu Formation is very prodigious. Quartz rock formed from sediment in the direction of the Kampungbaru, Balikpapan, Pulaubalang and Warukin plans maybe controlled for various new needs. Gold is looked from the Kuaro and Panjang waterways and is evoked to have arise pre-Tertiary rocks. Petrol is in the direction of the Kampung Baru, Balikpapan, Balang and Warukin happenings. Coal takes place as a supplement in the Tanjung, Kuaro, Balikpapan, Pulaubalang and Warukin incidents. The character of the bitumen changes as per the depositional temperature. Based on the calorific value and sulfur content of bitumen in the Tanjung incident and the Kuaro composition, the feature is outside limits that in the direction of the Balikpapan, Balang Island and Warukin plans.

- **ALUVIUM:** Gravel, rock, soil, silt and silt as sediment in waterways, bogs, expanse shores and deltas. Spread near the orient shore of Tanah Grogot, Adang Bay and Balikpapan Bay.

- **KAMPUNGBARU FORMATION:** Sandy claystone, quartz soil, siltstone, bitumen embeds, workable earth material, rock formed from sediment and lignite. The girth of the bitumen and lignite embeds is under 3 m. the base is distinguish by bitumen creases. Limestone holds relics: *Miogypsina* sp., *Lepidocyclina* sp., *Ammonia Yabei* and *Pseudorotalia cattiliformis*, ripened Late Miocene-Pliocene. The kampungbaru happening was preserved in a deltaic and empty sea mood. The density concerning this composition is 700-800 m. The region of the kind is in Kampungbaru, oriental of Sanga, Samarinda. This composition isn't regulated over the Balikpapan Formation.



Figure 7: Description of Sepinggan Geological Map of Balikpapan City

7. Conclusion and future Scope Directions

7.1. Conclusion

In light of the aftereffects of test, case and dialogue, ends maybe fatigued, in this manner:

1. The Geoelectrical Study gives an outline of the soil design of SMPN 18 Sepinggan Balikpapan. From the results of the survey, it is establish that the building of the soil coating constitutes of groundwater place the resistivity consider is mainly little. The tier holding groundwater is at wisdom of 0.00 to 1.25 m accompanying a resistivity of 297-323 $\square$ m. Furthermore, skilled is similarly a coating of soil harmonized related soil, and accumulation of solid and rock accurate three. Sand is a rock material that can pass water, still accompanying the adding of muck, this tier can store water and channel it still in limited amounts.
2. Stratigraphy or lithology of the slopes of SMPN 18 Sepinggan Balikpapan is recognized of overload that is soil to wisdom of 0-1.25 meters, tuffaceous soil and continued breccia. The slip plane is surplus of tuffaceous soil accompanying sustained breccia rock accompanying wisdom from 5-7 meters, and rock at wisdom of 15-20 meters. The slip plane is evoked for rocks accompanying a lasting point of 4 meters.

7.2. Future Scope Directions

1. It is main to review the borlog test to receive possessions and machinelike characters as a equivalence of geoelectrical resistivity.
2. It is main to review sondir test to resolve the value of conus and deterioration.

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