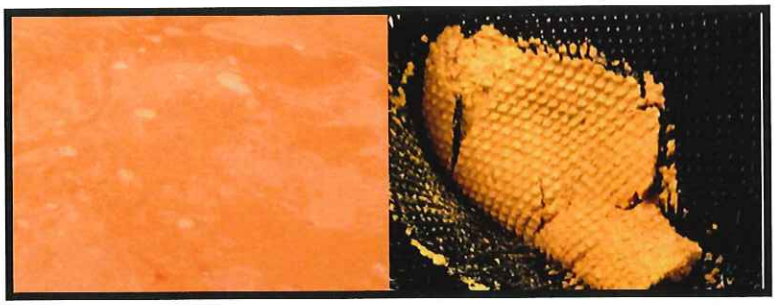
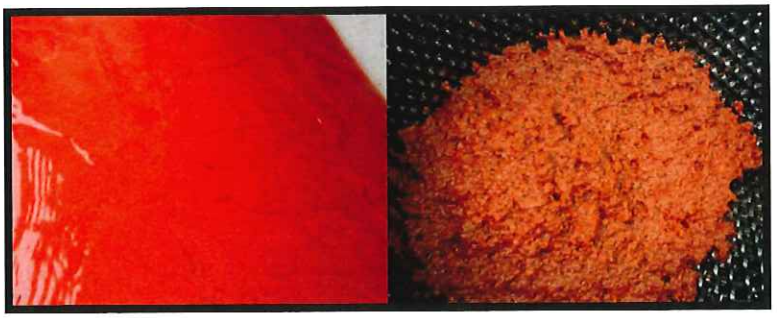
# LAND DISTURBING POLLUTION PREVENTION MITIGATION MEASURES

# BMPs MANUAL

## SLOPE EROSION CONTROL BMPs, SEDIMENT CONTROL PE-BMPs (PAM-BLOCK & ATS LIQUID)





**INSTITUT ALAM SEKITAR MALAYSIA**
**(EiMAS)**

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# TYPICAL HILL SLOPE CONSTRUCTION SITE

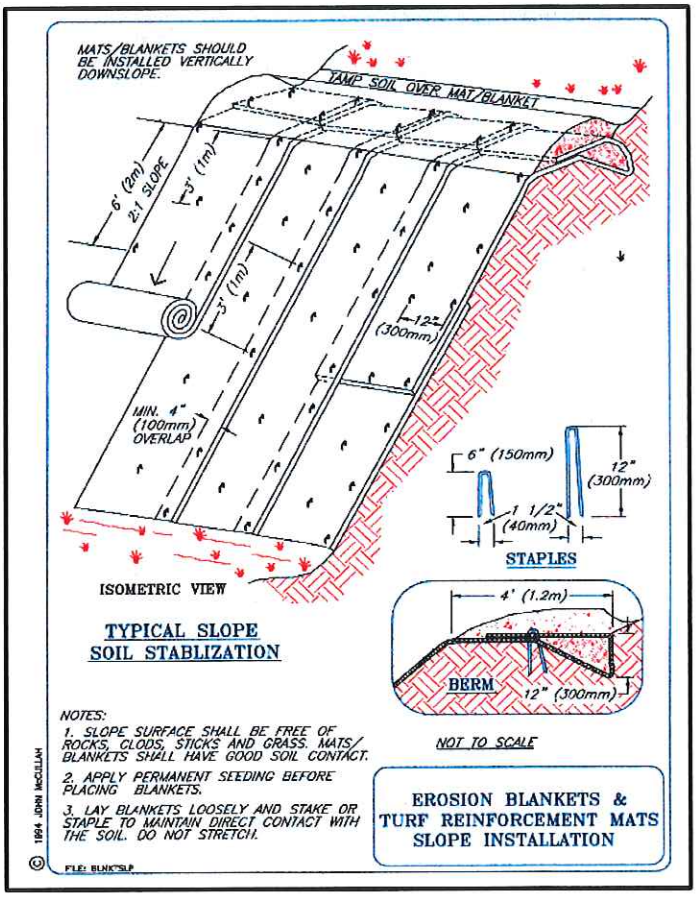
## ERODED HILL-SLOPES WITH NO LDPPMM BMPs

## UNPROTECTED SOIL STOCKPILE CONTAMINATES ADJACENT PUBLIC PARK PONDS

## SEDIMENT FLOW FROM UNPROTECTED SOIL SURFACE, KILLS POND AQUATIC LIFE

EiMAS – LDPPMM
SLOPE EROSION CONTROL & REVEGETATION BMPs

# EROSION CONTROL MATTRESSES APPLIED @ LINEAR CONSTRUCTION SLOPES TO REDUCE EROSION & REVEGETATE




## SLOPE EROSION CONTROL BMPs

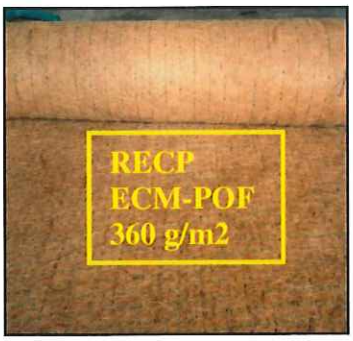
### ROLL EROSION CONTROL PRODUCTS (RECP) FUNCTIONS & BENEFITS :

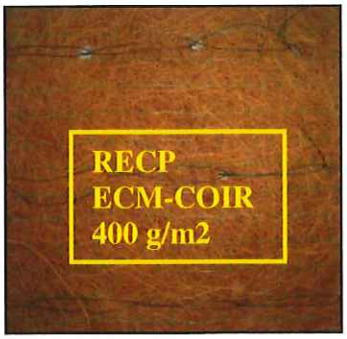
- All Roll Erosion Control Products (RECPs) are manufactured with organic mulch materials and functions to protect land disturbed and "opened" soil surface from erosion.
- Manufactured typically from organic fibres (coconut coir, palm oil fibre, jute, wood chips, straw..) and "sandwiched" in-between polypropylene(HDPE, nylon…) nettings (UV or non-UVstabilized), stitched together to form a mattress/blanket.
- 3-Dimensional structure protects soil surface and seedlings by reducing rain impact during rainstorms and eroding forces onto bare soil surface by absorbing the rain impact energy.
- 3-Dimensional structure also helps reinforce vegetation root system, the organic mulch retains both moisture and nutrient, moderate temperature and shelter seedlings for good growth.
- Turf Reinforced Mattresses (TRMs..) provides high vegetation roots reinforcement together with above benefits. Made of a polymer base 3-Dimensional corrugated netting. High Strength addition provides load transfer ability and tensile force capacity in geotechnical applications.

**EiMAS – LDPPMM**
**SLOPE EROSION CONTROL & REVEGETATION BMPs**

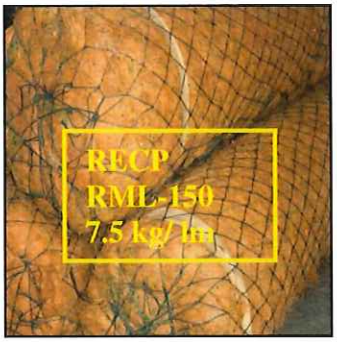

## SLOPE EROSION CONTROL BMPs

## APPLICATION OF ROLL EROSION CONTROL PRODUCTS (RECP)








**EiMAS – LDPPMM**

**SLOPE EROSION CONTROL & REVEGETATION BMPs**

**SLOPE SURFACE PREPARATION**

1. Clear & Grub surface of all debris and vegetative matter.
2. Care: all "open-surface" to be temporarily covered after daily work, to avoid exposure to rainfall event.
3. Measure the slope angle of inclination. Typically should be less than 2(H):1(V) or 30°. Here it was at 40°....ok.

**ANCHOR TRENCH**

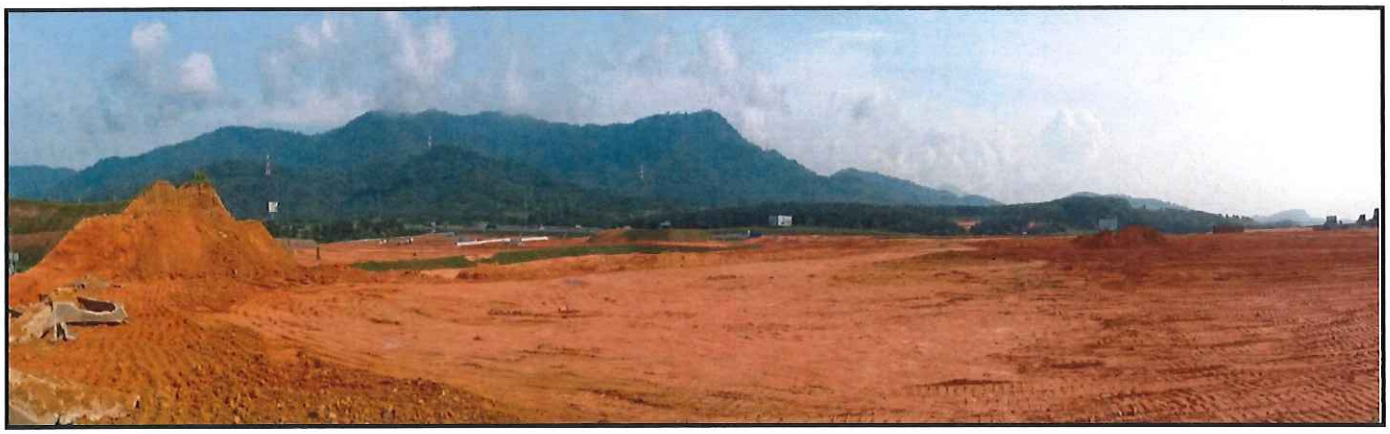
4. At top of berm, anchor earth trench is dug by hand as there is limited access and length is small.
5. Anchor earth trench 100+mm(deep) x 300mm+(wide) is approx.500+mm from edge of slope.

**INSTALLATION OF RECP**

5. Secure ECM/TRM mattresses ends at bottom of trench with wooden stakes and backfill with soil and compact to grade.
6. ECM/TRM mattresses are gently rolled down slope.
7. ECM/TRM mattresses are secured by wooden stakes at 1m centres.
8. Maintain side-overlap at 100mm and end-overlap at 200mm, upslope end on top of lower end, to enable water to "flow-over" connection.
9. Allow ECM/TRM to "fill-into" depressions and cavities. Maintain good mattress-soil contact by walking down slope gently. Do not over-stretch ECM/TRM.
10. Install Roll Mattress Logs (RML-150) at 1+m intervals down slope at pre-dug depression/trench of 50mm (D).
11. RML-150 logs shall be secured by wooden stakes/J-Rebars 12mm(Ø) x1300mm(L) and "criss-cross strap-down" with coated tie-wire/UV stabilized multi-purpose rope.
12. Hand seeding: mix grass seeds & NPK fertilizer in pail.
13. Disperse by hand or hand broadcaster...
14. Avoid "shadowing", seed different angle.
15. Avoid walking on slope till grass establish
16. Check ECM/TRM after storm and repair.
17. Check for bald areas(birds) and re-seed.

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (PAM-BLOCK)**

# TYPICAL RESIDENTIAL DEVELOPMENT CONSTRUCTION SITE

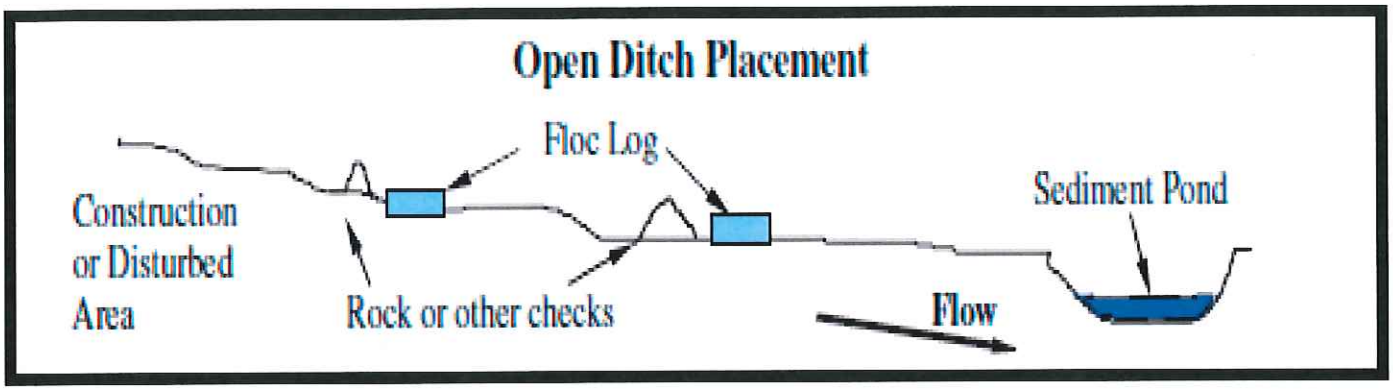


**SILT TRAPS INSTALLED TO HANDLE 100AC EXPOSURE……**

**MISS-PLACED INLETS & OUTLETS……ERODED EARTH DITCH**

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (PAM-BLOCK)**

# PAM-BLOCK APPLIED @ CONSTRUCTION SITES

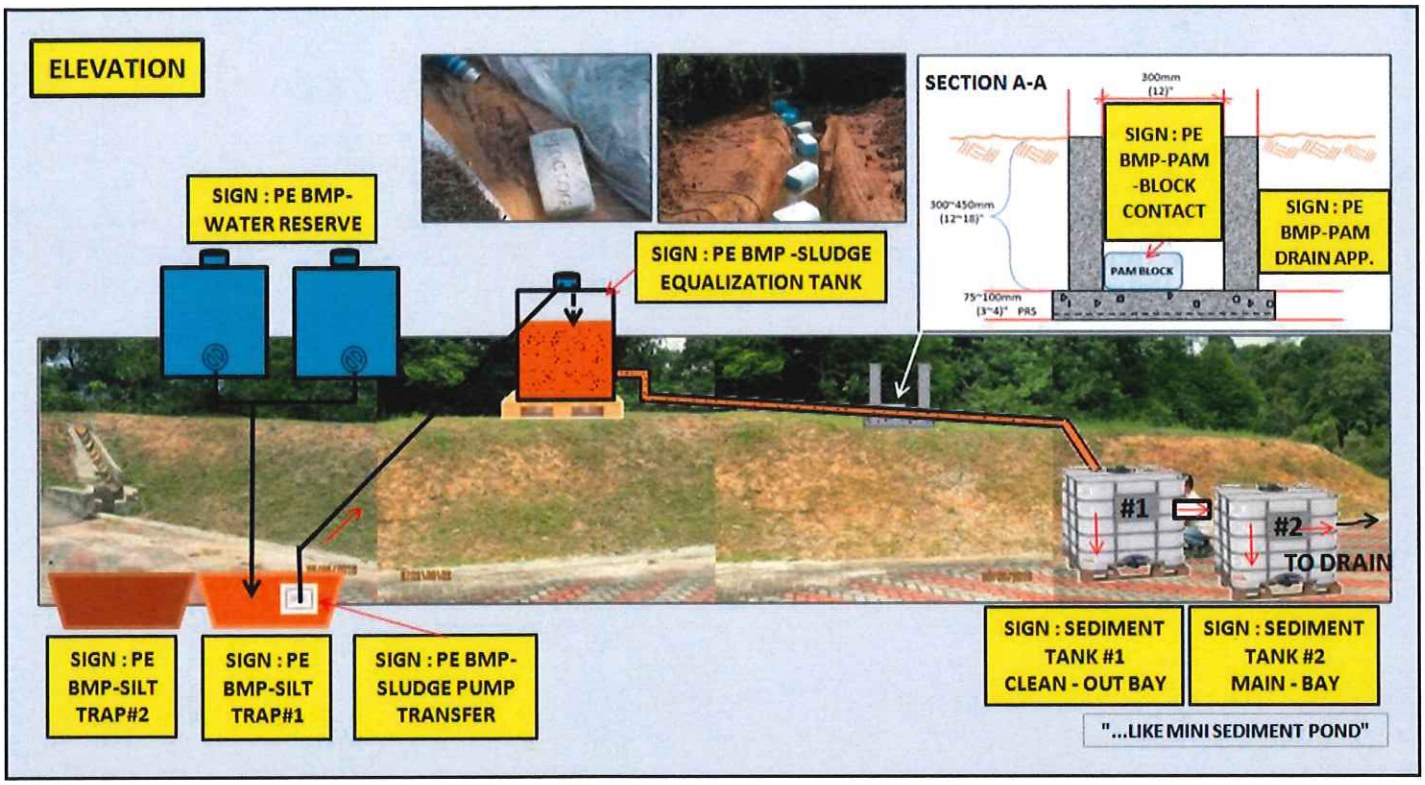



**WATER QUALITY IMPROVEMENT @ CONSTRUCTION NEAR STREAM/RIVER CHANNELS**

**WATER QUALITY IMPROVEMENT @ CONSTRUCTION SITE DRAINAGE DITCHES**

EiMAS – LDPPMM SEDIMENT CONTROL
POLYMER ENHANCED BMPs (PAM-BLOCK)

# POLYMER ENHANCED BMP (PE-BMP) PAM-BLOCK SEDIMENT REMOVAL & CLEAN WATER DISCHARGE




## POLYMER ENHANCED BMP (PE-BMP)

## APPLICATION OF PAM-BLOCK

### PRELIMINARY ANALYSIS

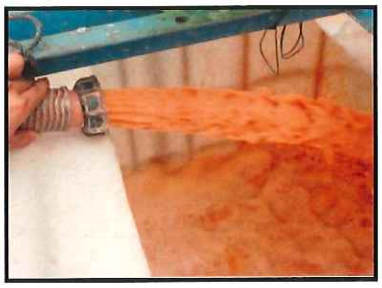
1. Sample collection from construction site silt trap.
2. Perform quick PAM-BLOCK test for effectiveness of anionic PAM types.


3. Visual check floc size and uniformity.
4. Test for pH of sediment/sludge = pH 3-4.

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (PAM-BLOCK)**

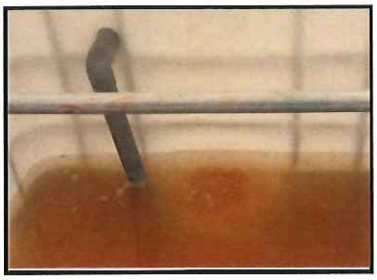
**PAM-BLOCK APPLICATION**


5. Mix Sludge for uniformity.
5. Pump sludge to equalization tank.




7. Sludge mixture discharge into drainage channel-ditch that is lined with PAM-BLOCKS (8).


8. Sediment pollutant immediate contact, when passing over PAM BLOCKS.
9. Flocculation reaction immediately upon PAM contact and flocs "settle-out" of sludge flow.

10. Flocs fall to bottom of tank (fore-bay) and clean water "overflow" out of system into drainage system.

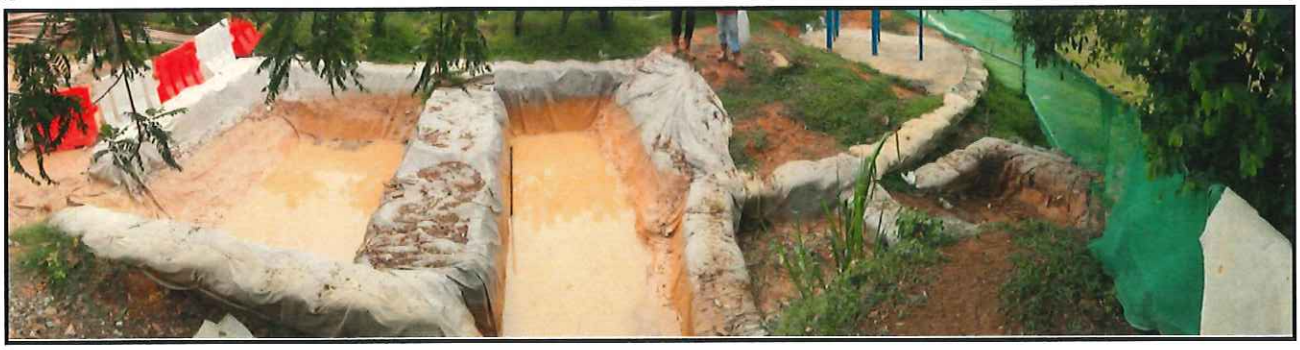

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (ATS-LIQUID)**

# TYPICAL LINEAR CONSTRUCTION SITE

**SEDIMENT PUMPED FROM PILE-FOOTING INTO SILT TRAP AFTER STORM EVENT**

**LIMITED SPACE FOR SEDIMENT TRAP & POND**

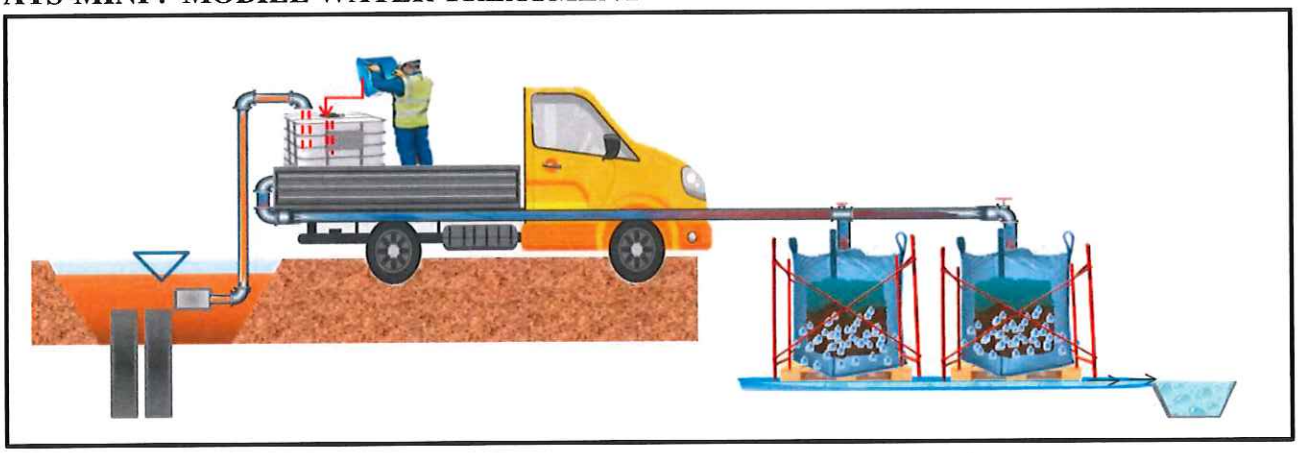
**SEDIMENT OVER-FLOWING SILT TRAP DURING-AFTER STORM EVENT**



**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (ATS-LIQUID)**

# ATS-MINI APPLIED @ CONSTRUCTION SITE CHERAS

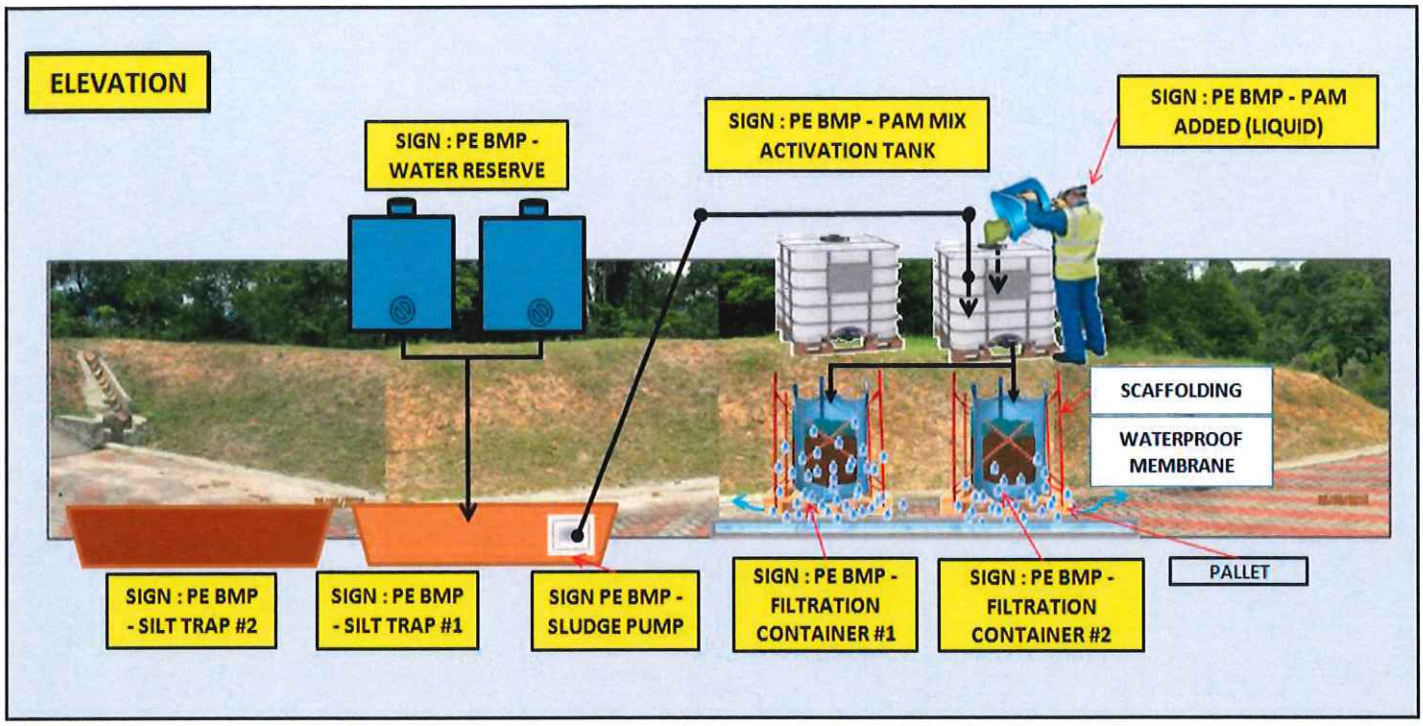
## ATS-MINI : MOBILE WATER TREATMENT



## ATS-MINI: SEDIMENT REMOVAL & CLEAN WATER DISCHARGE

## LIQUID PAM TREATMENT AFTER JAR TEST DETERMINES TYPE & DOASGE

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (ATS-LIQUID)**




## POLYMER ENHANCED BMP (PE-BMP)

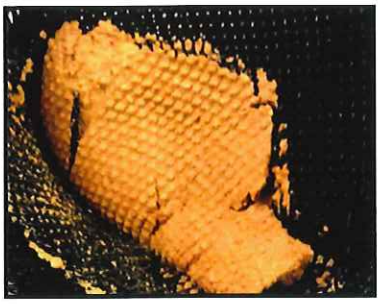
## APPLICATION OF ATS-LIQUID


### PRELIMINARY ANALYSIS

1. Sediment from construction site silt trap.
2. Mix Sludge for uniformity.
3. Test for pH. Sediment @ pH 3-4

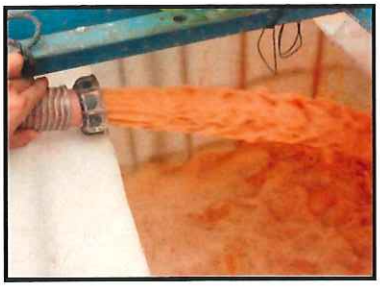
4. Conduct "Jar Test" Flocculation.
5. Determine most appropriate anionic PAM.
6. Determine PAM dosage & concentration.

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (ATS-LIQUID)**

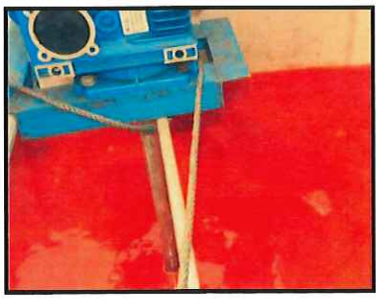



7. Conduct "Filtration" process.
8. Determine "best floc cake" and adjust.
9. Determine "best water clarity" and adjust.

**ATS-LIQUID APPLICATION**

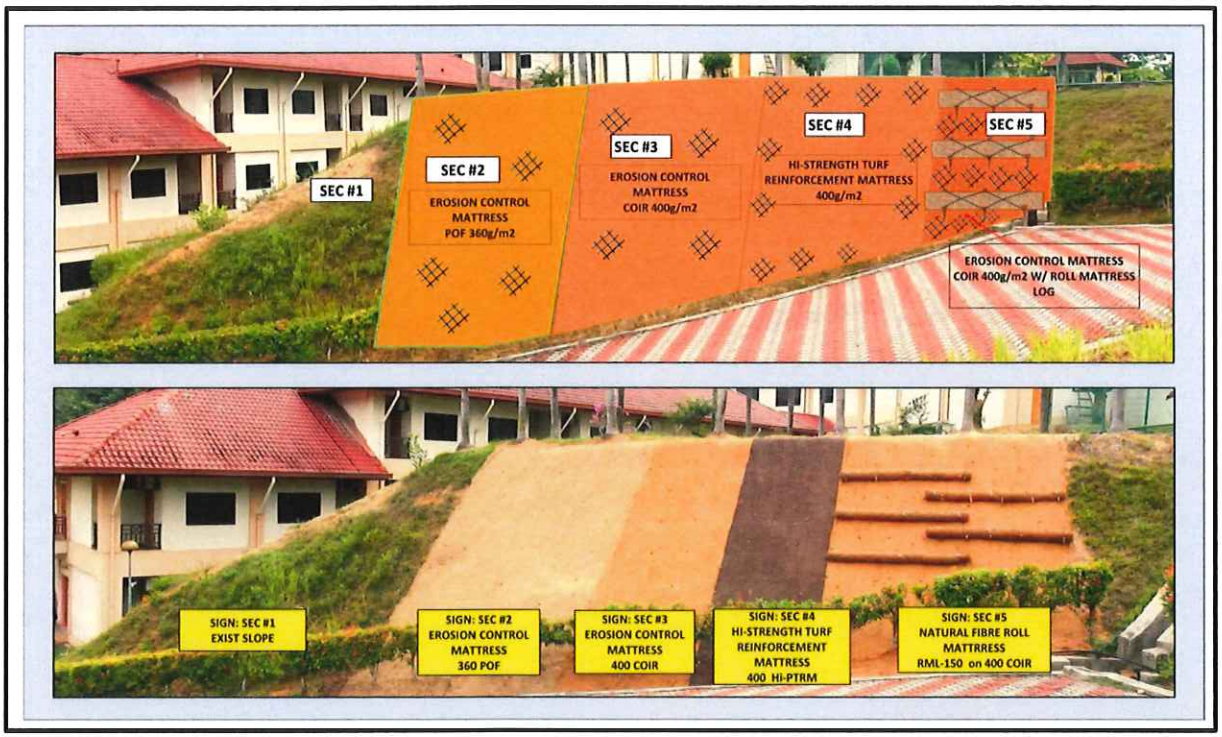
10. Pump sludge from "silt trap" into activation tank.

11. Add PAM Liquid into activation tank to proportions measured in "jar test".
12. Stir mixture (mechanical).

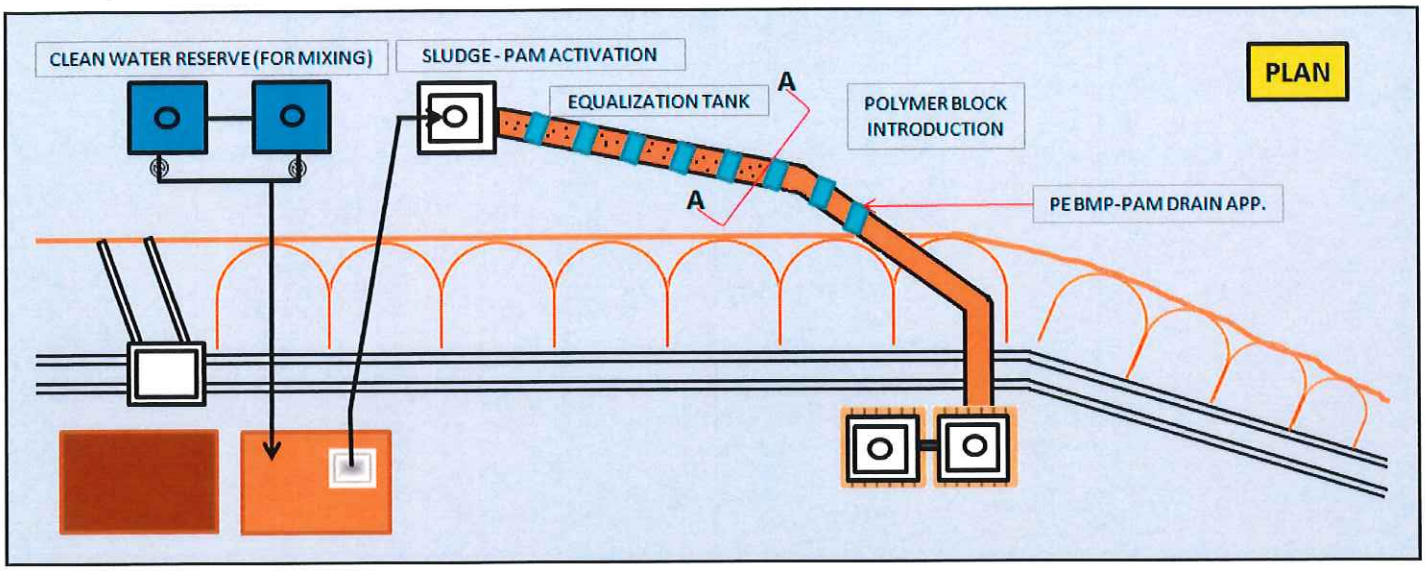

13. Mixture is "gravity" pipe into filtration bag set-up.
14. Stir mixture (mechanical).

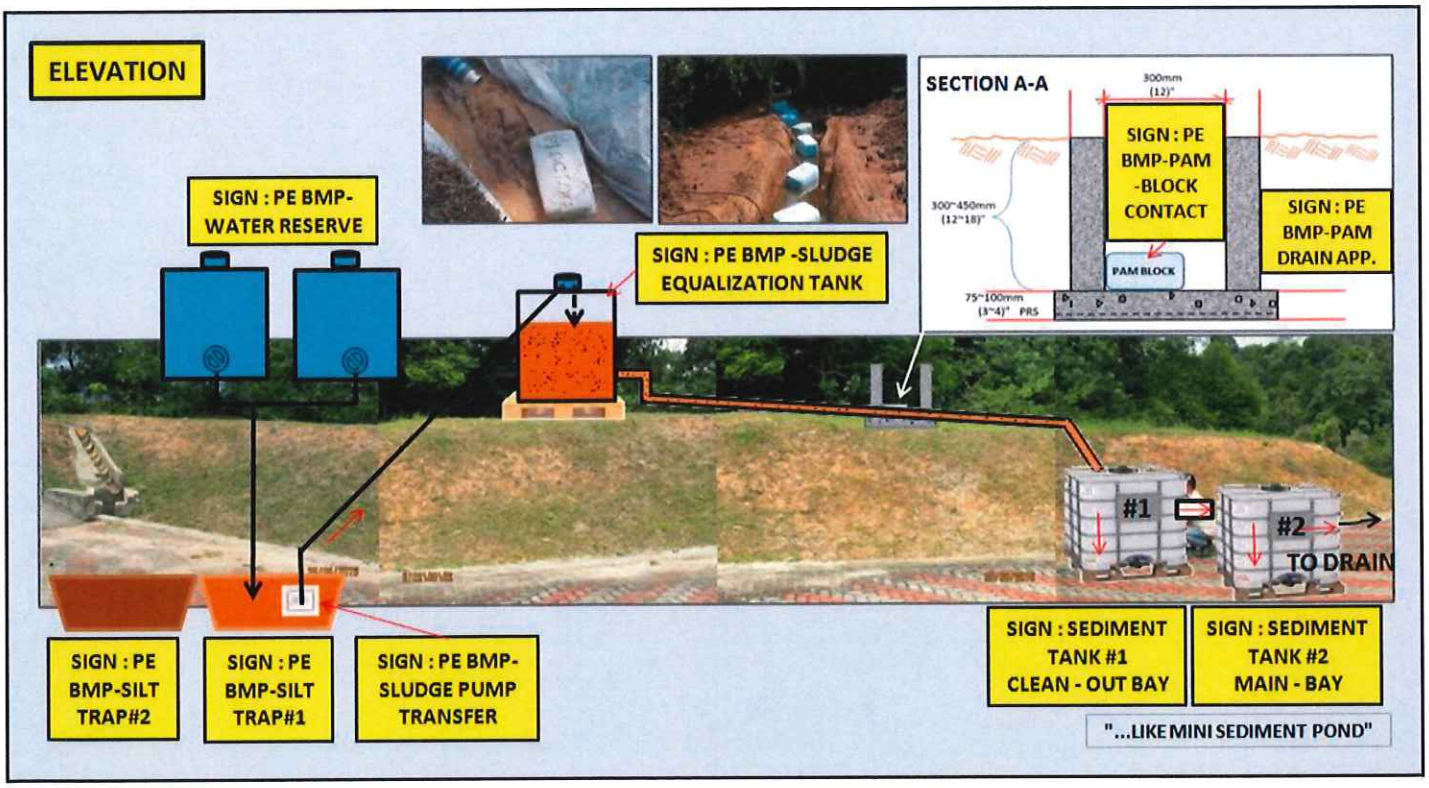

15. Floc solid is trapped in filtration bag.
16. Clean water discharged into environment, drainage system.




| | **SUMMARY LIST OF SIGNS :** |
|---|---|
| **SEC #1** | **EROSION CONTROL MATTRESS**<br>Existing Slope Condition |
| **SEC #2** | **EROSION CONTROL MATTRESS : 360 POF**<br>SPEC : Palm Oil FibreMattress @ 360g/m2 Density & Hand Grass Seeding |
| **SEC #3** | **EROSION CONTROL MATTRESS : 400 COIR**<br>SPEC : Coconut Coir Mattress @ 400g/m2 Density & Hand Grass Seeding |
| **SEC #4** | **HI-STRENGTH TURF REINFORCEMENT MATTRESS : 400 Hi-PTRM**<br>SPEC : Coconut Coir Mattress @ 400g/m2 Density<br>Hi-Reinforcement @ 38kN/m & Hand Grass SeedingSEC #2 |
| **SEC #5** | **NATURAL FIBRE ROLL MATTRESS LOG : RML-150 on COIR**<br>SPEC : Roll Coir Mattress @ >450g/m2 Density<br>Coconut Coir Mattress @ 400 g/m2 & Hand Grass Seeding |

# EiMAS – LDPPMM SEDIMENT CONTROL
# POLYMER ENHANCED BMPs (PAM-BLOCK)



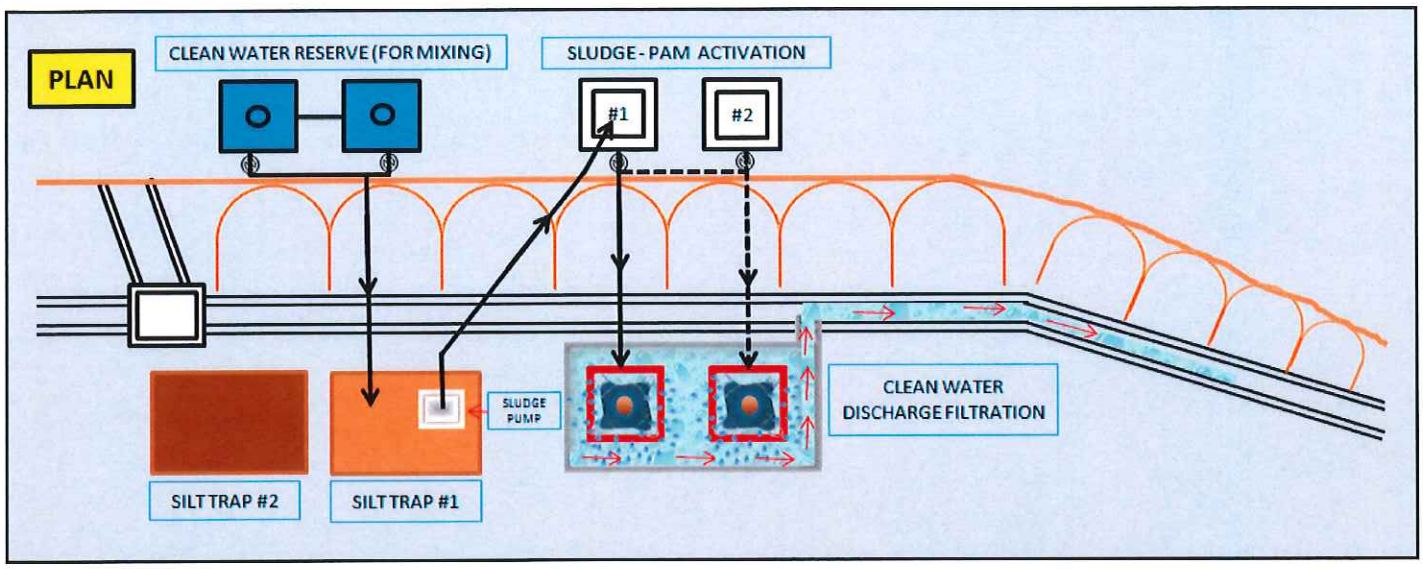



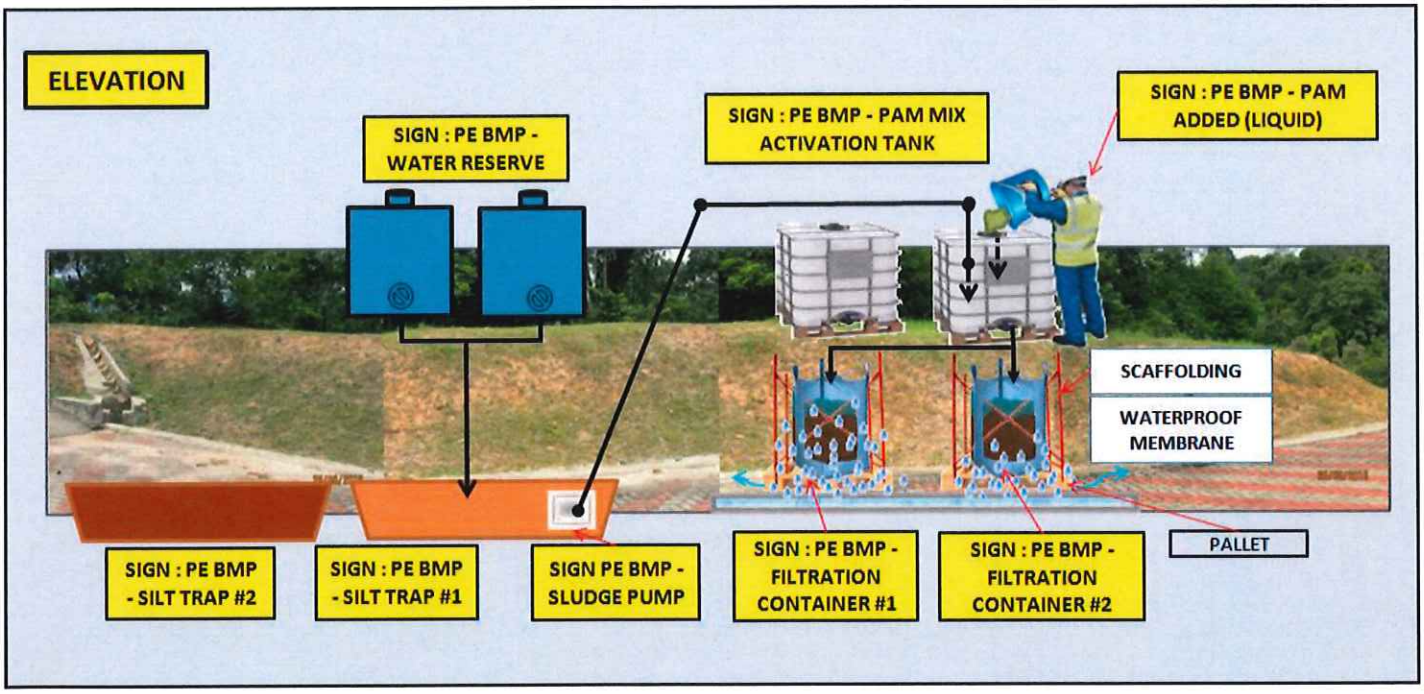

| | SUMMARY LIST OF SIGNS : |
|---|---|
| **PE BMP-WATER** | **WATER RESERVE**<br>SPEC :Clean Water Reserve – 2 x 1000 Litres (approx) |
| **PE BMP-SILT TRAP #1** | **SILT TRAP #1**<br>SPEC:Silt Trap #1 –Sediment from typical Construction Site |

**EiMAS – LDPPMM SEDIMENT CONTROL**
**POLYMER ENHANCED BMPs (PAM-BLOCK)**

| | |
|---|---|
| **PE BMP-SILT TRAP #2** | **SILT TRAP #2**<br>SPEC :Silt Trap #2 – Sediment from Mineral Mining Site: Bauxite/Iron Ore.. |
| **PE BMP-SLUDGE PUMP** | **SLUDGE TRANSFER**<br>SPEC :Sludge Pump – Pump Sludge for Treatment |
| **PE BMP-SLUDGE EQUALIZATION TANK** | **SLUDGE EQUALIZATION TANK**<br>SPEC :Polyacrymide Mixing-Activation Tank :<br>Discharge of Sediment of Construction Site/Minerals Bauxite/Iron Ore<br>Capacity : 1 x 1000 Litres. Actual Site has to be designed by ESCP/ LDPPMM specialist. |
| **PE BMP-PAM-BLOCK INSTALLATION** | **PAM – BLOCK CONTACT**<br>SPEC :Pre-Test to determine :<br>1) pH, 2) PAM-BLOCK Type needed for treatment &3) Install (8-10)PAM-Blocks in series at(1-2)m intervals in construction site drainage ditch "leading" to sediment pond/basin/silt-trap (about 12-15 units). |
| **PE BMP-PAM-DRAIN APP.** | **PAM – DRAINAGE APPLICATION**<br>SPEC :Drainage App :<br>1) PAM Blocks secured to bottom of drain ditch,<br>2) Sediment from Construction Site/Minerals tailings/sludges (Bauxite/Iron Ore..) flow over (by gravity or pumped) and treated by activation from PAM-blocks. |
| **PE BMP-SEDIMENT TANK#1** | **SEDIMENT CLEAN-OUT/FOREBAY**<br>SPEC :Sediment Basin/Tank #1 – "Settle-out" flocculated Sediment/ Pollutants from Construction Sites, Mineral Tailings from Tire Washouts and Sediment Traps of Bauxite/Iron Mines.<br>EiMAS Training : 1 x 1000 Litres,<br>Actual Sediment Basin Size depends on LDPPMM designer. |
| **PE BMP-SEDIMENT TANK#2** | **SEDIMENT MAIN-BAY**<br>SPEC :Sediment Basin/Tank #2 – "Settle-out" flocculated fine Sediments/Pollutants fromForebay/Cleanout Bay. Clean Water discharge.<br>EiMAS Training : 1 x 1000 Litres,<br>Actual Sediment Basin Size depends on LDPPMM designer. |

# EiMAS – LDPPMM SEDIMENT CONTROL
# POLYMER ENHANCED BMPs ATS-LIQUID




| | SUMMARY LIST OF SIGNS : |
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| **PE BMP-WATER** | **WATER RESERVE**<br>SPEC : Clean Water Reserve – 2 x 1000 Litres (approx) |
| **PE BMP-SILT TRAP #1** | **SILT TRAP #1**<br>SPEC : Silt Trap #1 – Sediment from typical Construction Site |
| **PE BMP-** | **SILT TRAP #2** |

| | |
|---|---|
| **SILT TRAP #2** | SPEC : Silt Trap #2 – Sediment from Minerals Mining Site Bauxite/Iron Ore… |
| **PE BMP-SLUDGE PUMP** | **SLUDGE TRANSFER**<br>SPEC : Sludge Pump – Pump Sludge for Treatment |
| **PE BMP-PAM (LIQUID) ADDITION** | **PAM ADDED (Liquid)**<br>SPEC : Pre-Test to determine :<br>1) pH, 2) PAM Type & 3) Dosage |
| **PE BMP-PAM MIX-ACTIVATION** | **PAM MIX-ACTIVATION TANK**<br>SPEC : Polyacrymide Mixing-Activation Tank :<br>Treatment of Sediment of Construction Site/Minerals Bauxite/Iron Ore<br>Capacity : 1 x 1000 Litres (approx.) |
| **PE BMP-FILTRATION SYSTEM #1** | **FILTRATION SYSTEM #1**<br>SPEC : Filtration Container #1 – Sediment from Construction Site Floc-Cake (residue separated) |
| **PE BMP-FILTRATION SYSTEM #2** | **FILTRATION SYSTEM #2**<br>SPEC : Filtration Container #2 –Sediment Mineral Bauxite/Iron Ore Floc-Cake (residue separated) |