HANDS-ON TRAINING PROGRAM

ON

SOIL EROSION & SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMPs)

By

EiMAS TRAINERS

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- Arahan KSU

OBJECTIVE and OUTCOME of THIS COURSE

Objective of this Course

- Transformation of DOE/DID officers skills in managing SESC at Construction sites with competent, high integrity and respect.

Outcome of this Course

- Communicate with project developers and contractors on SESC BMPs effectively.
- Execute Performance Monitoring of SESC BMPs with respect to installation, inspection and maintenance (2I’s1M).
- Complete SESC BMPs inspection report**.**

Competent Erosion and Sediment Control Inspector (CESCI), In Making

- To Avoid SYOK SENDIRI
- Brainstorming
- Problem Taker
- Ice breaking
- WIFM
- WAFY
- Troubleshooting

TRAINING APPROACH

How?

Scenarios of SESC

(Pictorial and Videos Presentation)

PART 1

1. Master Keywords (Erosion, Sediment, Sedimentation, SESC BMPs)
2. Master SESC Principles Vs BMPs Components
3. Master Construction Stages

PART 2

4. Internalize demonstration case of the SESC BMPs Implementation

PART 3

5. SESC and Runoff Estimation

PART4

6. DOE's Officers Right-to-know on inspections of SESC BMPs (Equipment, Maps & Drawings, Field Inspection Manual, SESC Model)

PART 5

6. DOE's Officers field inspection

PART 6

7. Reporting and documentation of DOE's officers inspection report.

PART 1

PICTURES PRESENTATION

ACCESS ROAD TURNING INTO STREAM

PAVEMENT ROAD TURNS TO DIRT ROAD

MUDFLOW OFFSITE

BADLY MANAGED STREAM CROSSING

STREAM CROSSING

EVERYTIME WHEN RAINS

UNSEEN CONTROL MEASURES

A MASSIVE LAND CLEARING

RIVERBANK END TIPPING

MERCILESS ACTION

DESTRUCTIVE VIEW

EVEN IF THERE ARE CONTROLS!

THE THINKING OF EROSION AND SEDIMENT CONTROL IS ALL ABOUT PUTTING UP SEDIMENT TRAP

PERMANENT DRAIN GET PAID?!

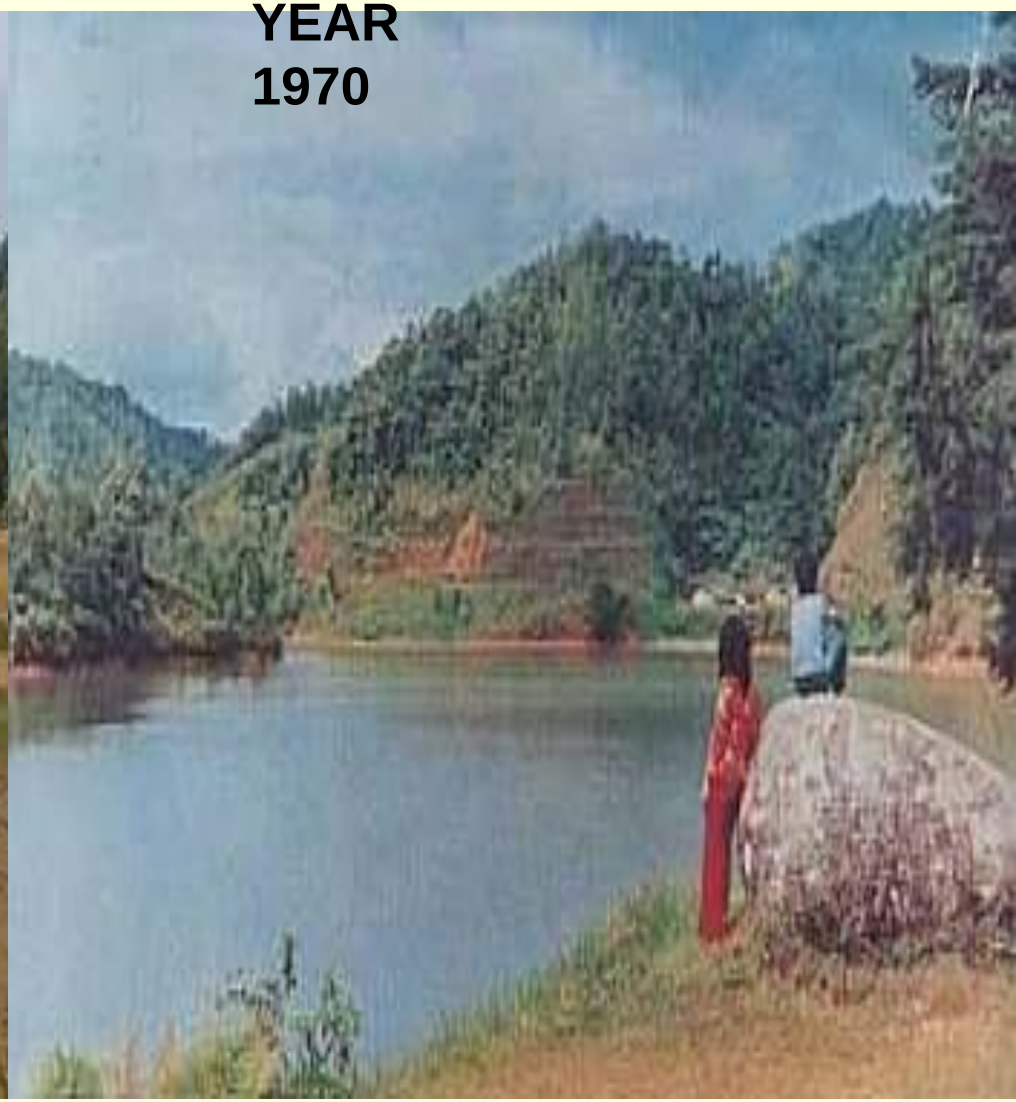
MAINTENANCE ISSUES ALL THE TIME

GOOD STABILIZATION METHOD BUT IS IT SAFE?

Impacted To Our Rivers

SEDIMENTATION TO OUR LAKES

YEAR
1970



CAMERON HIGHLANDS STILL HAS CLEAN RIVER WATER

WE EVEN COULD HAVE THIS, JUST LIKE IN ’70s

UNDERSTANDING SESC BMPs CONCEPT

1. Master Keywords (Erosion, Sediment, Sedimentation, SESC BMPs)

Terms	Definition	Relation to EIA
Erosion	Detachment of soil particles	Impact
Sediment	Soil particles suspended in stormwater runoff.	Impact
Sedimentation	Deposition of sediment	Impact
SESC BMPs	Measures to minimize erosion and sedimentation due to soil disturbance.	Mitigation

2. Master SESC Principles Vs BMPs Components

2.1 Master SESC Principles

a. Integrate project design with site constraints. (Ideal Situation)
b. Preserve and stabilize drainage ways. (Focus)
c. **Minimize the extent and duration of disturbance.** (Focus)
d. **Control storm water flows onto**, through, and from the site in stable drainage structures. (Focus)
e. **Install perimeter controls**. (Focus)
f. **Stabilize disturbed areas promptly in a timely manner.** (Focus)
g. Protect steep slopes. (Focus during construction)
h. Use sediment controls to prevent off-site damage. (Focus)
i. Protect inlets, storm drain outfalls, and culverts. (Focus)
j. Provide access and general construction controls. (Focus)
k. **Inspect and maintain control measures**. (Focus)
l. Employ experienced and competent personnel. (Focus)

KEYWORD

- Protect
- Preserve
- Cover
- Stabilize
- Minimize
- Intercept
- Divert
- Reduce
- Dissipate
- Contain
- Treatment
- Inspect
- Maintain

2. 2 Master BMPs Components

Five components for:

2.2.1 Site Planning & Management

2.2.1 Erosion Control

2.2.3 Sediment Control

2.2.4 Runoff Control

2.2.5 General Construction Control

2.2.1 SITE PLANNING & MANAGEMENT

2.2.1. Site Planning and Management

BMPs that instituted to plan for the containment, treatment or other management of pollutants on site as such:

- Preservation of existing vegetation and trees.
- Preserving topsoil for the next construction
- Phasing/Scheduling/Sequencing of construction works in line with installation of erosion and sediment measures.
- Training of employees towards understanding of pollution control.

2.2.1.Site Planning & Management (Inspection should focus)

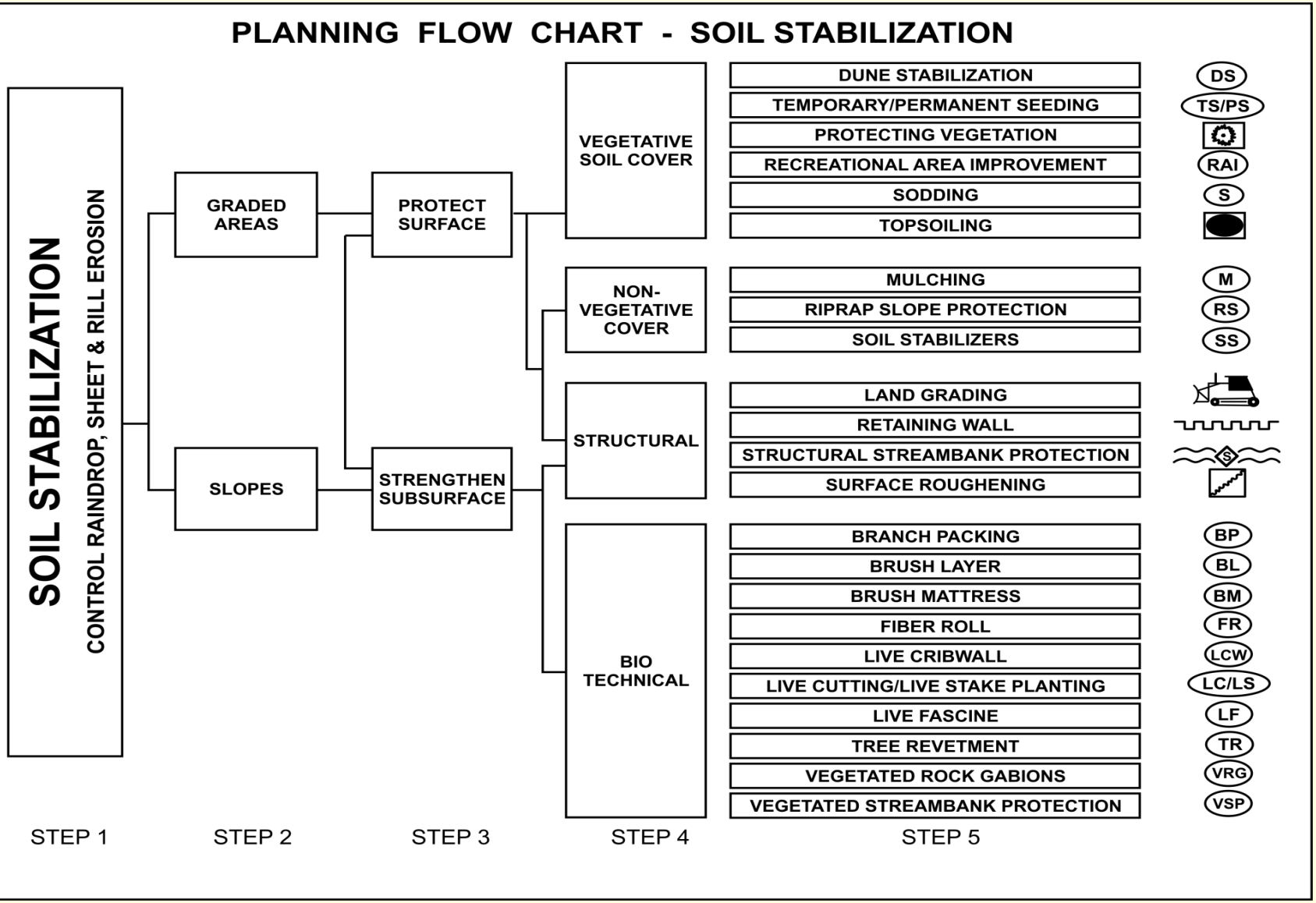
- 1.1 Preservation of Existing Vegetation (Delineation)
- 1.2 Tree Protection
- 1.3 Scheduling-Sequencing
- 1.4 Topsoiling
- 1.5 Training & Certification
- 1.6 Biomass, Plant Nursery (native), Gravels & rocks

2.2.2 EROSION CONTROL (SOIL STABILIZATION)

2.2.2 Erosion Control or Soil Stabilization (Inspection should focus)

- Chemical Stabilization
- Compost
- Hydromulch
- Hydroseed
- Mulching
- Nets/Blankets
- Plastic Covering
- Seeding
- Sodding
- Soil Retention
- Soil Roughening
- Temporary Stabilization
- Vegetated Buffers

FLOW CHART SOIL STABILIZATION



SOURCE:CPESC

FLOW CHART SOIL STABILIZATION

2.2.3 Runoff Controls

2.2.3. Runoff Controls (Inspection should focus)

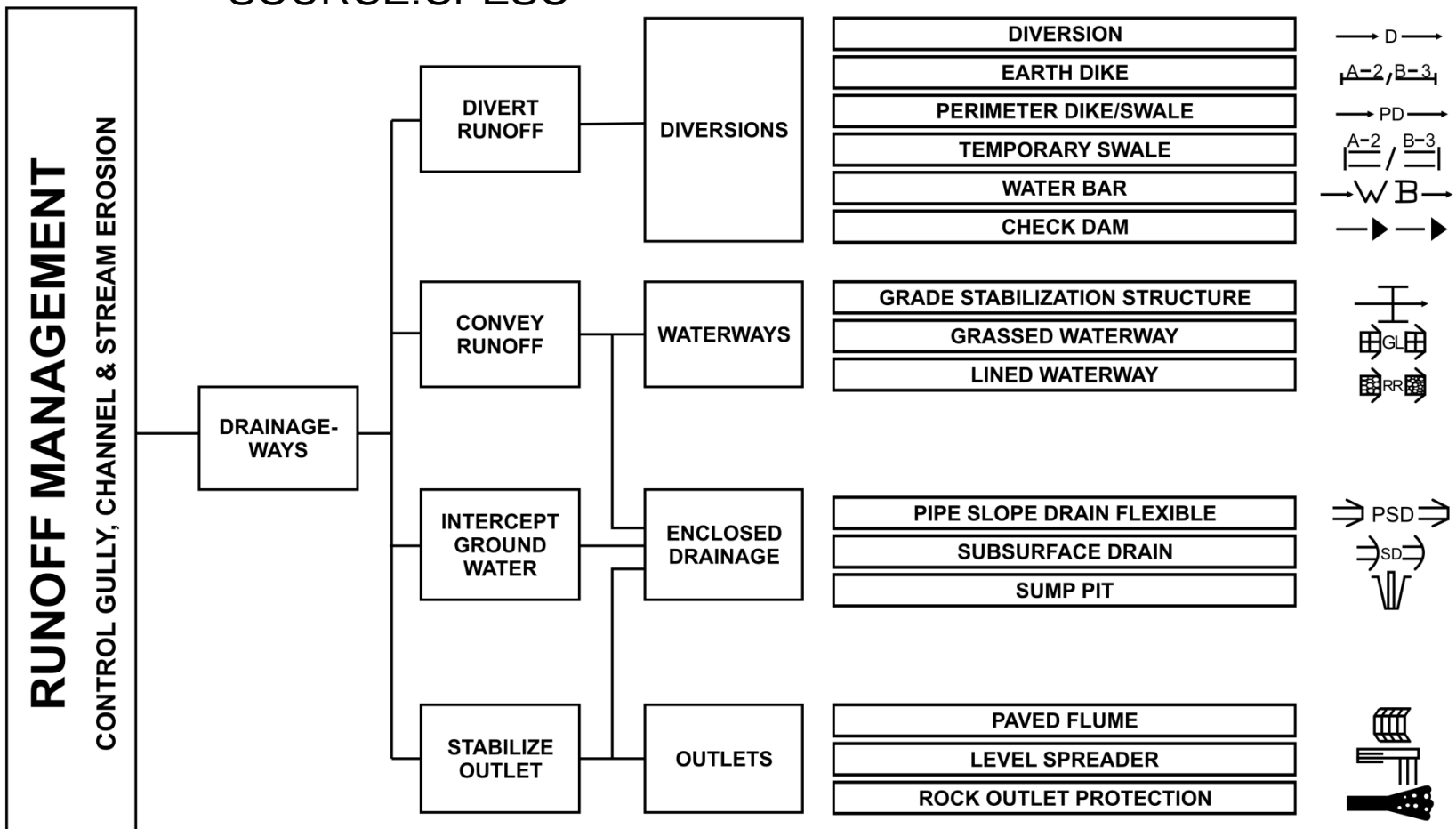
Runoff controls - BMPs implemented to control drainage or flood discharge that leaves an area as surface flow or as pipeline flow

- Dikes
- Diversions
- Check Dam
- Inlet Protection
- Outlet Protection
- Dissipator
- Gabions
- Level Spreaders
- Pipe Slope Drain
- Retaining Wall
- Riprap
- Swales

FLOW CHART RUNOFF MANAGEMENT

PLANNING FLOW CHART - RUNOFF MANAGEMENT

SOURCE:CPESC



2.2.4 Sediment Control

2.2.4. Sediment Control (Inspection should focus)

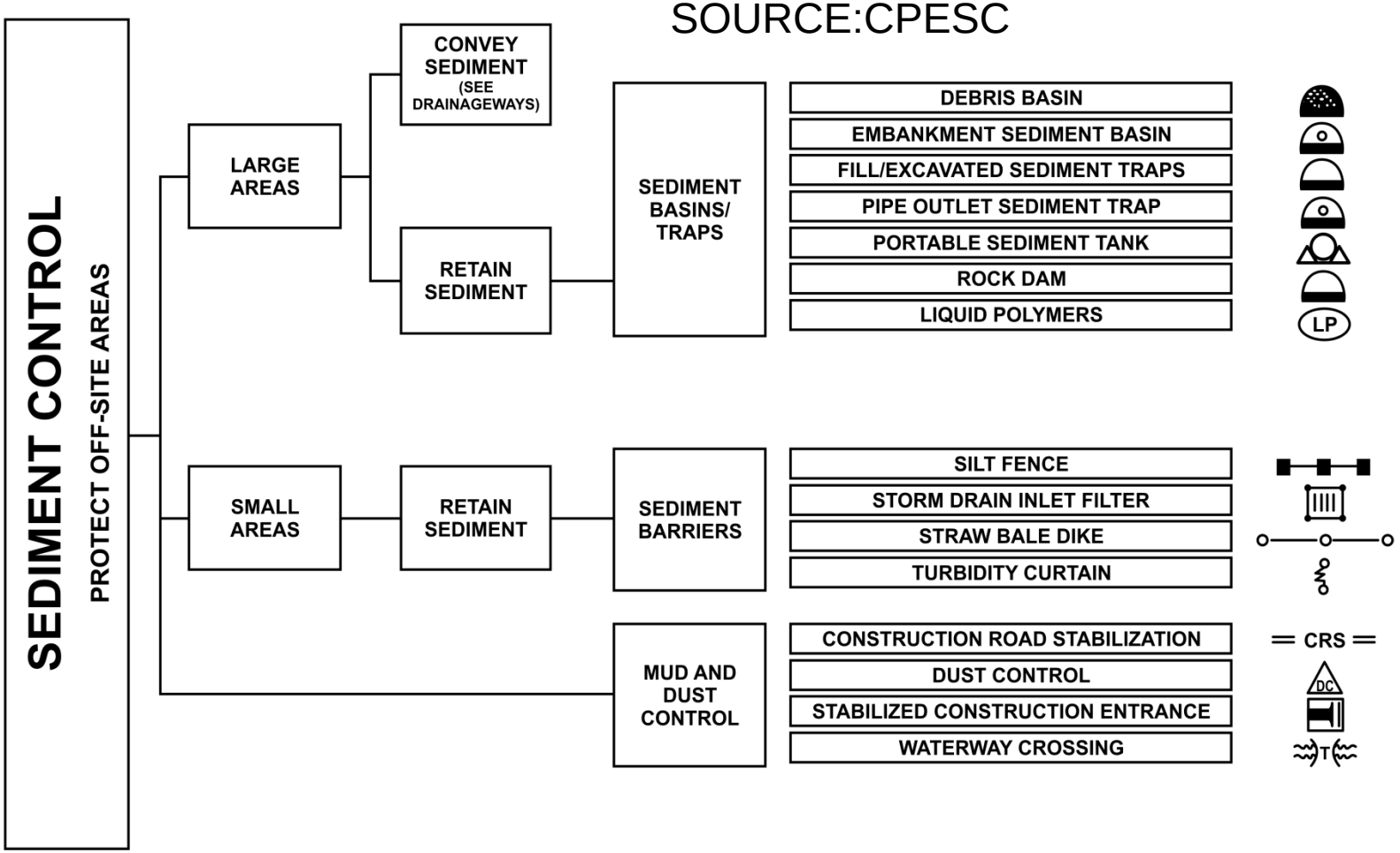
Sediment control - meant for preventing sediment from leaving a site and entering public and natural waterway.

- Baffles
- Cut-Back Curbs
- Dewatering Bags
- Fiber Rolls
- Sediment Basins
- Sediment Traps
- Silt Fence
- Skimmers
- Temporary Stream Crossing
- Sediment Bags
- Sediment Tube Ditch Check
- Stabilized Construction Entrance/Exit
- Straw Bales
- Triangular Filter Fabric Dikes
- Turbidity Curtain/Barrier
- Active Treatment System (polymer,flocculant,geotube,pump)

FLOW CHART SEDIMENT CONTROL

PLANNING FLOW CHART - SEDIMENT CONTROL

SOURCE:CPESC



2.2.5 GENERAL CONSTRUCTION CONTROL

2.2.5. GENERAL CONSTRUCTION CONTROL (Inspection should focus)

- Concrete Washout
- Equipment/Vehicle Maintenance & Cleaning
- Sanitary Waste Management
- Secondary Containment
- Spill Prevention
- Stockpile Management
- Street Cleaning
- Trash Containment
- Wind Fence

2.3. Master Construction Stages

2.3. Master Construction Stages

Code of Practice in Earthwork

In practice earthworks design is an iterative process where design decisions are often taken by various parties (employer, consultant, main contractor, sub-contractors and construction validation team).

2.3. Master Construction Stages

Code of Practice in Earthwork

The engineering environment in which the earthworks are carried out does influence the approach that is applicable to earthworks reflect the overall earthworks process:

where earthworks are planned, designed, constructed, adopted/approved following construction, and then the earthworks moves into an asset management process

2.3. Master Construction Stages

Code of Practice in Earthwork

Earthwork

- Work of excavating, or the raising or sloping of ground
- **Earthworks**
- 1) structures formed by the excavating, raising or sloping of ground, e.g. embankments, cuttings or remediated natural slopes
- 2) civil engineering process that includes extraction, loading, transport, transformation/improvement, placement and compaction of natural materials (soils, rocks), and/or secondary or recycled materials, in order to obtain stable and durable cuttings, embankments or engineered fills

2.3. Master Construction Stages

Code of Practice in Earthwork

Scheme conception

- **Design strategy**
- Feasible, functional, constructible and suitable for the proposed end use.

- Consider land requirements, including all temporary works. The design should be developed to minimize environmental impact during the construction phase, in use and for future maintenance operations.

2.3. Master Construction Stages

Code of Practice in Earthwork

Drainage during construction

- Provide adequate temporary drainage. The assessment of Generally the responsibility of the contractor undertaking the earthworks who should use their skill and experience to ensure the temporary drainage provided is adequate.

- Record temporary drainage issues of particular note for the scheme are identified during the design of the permanent earthworks and drainage so that the earthworks contractor can make adequate provision.

GENERAL UNDERSTANDING ON DIFFERENCES OF CONSTRUCTION ACTIVITIES

Land Clearing	Earthworks	Erosion and Sediment Control	Road and Drainage
Usage of light machineries	Usage of heavy machineries	Usage of heavy machineries	Usage of heavy machineries
No excavation	Involve excavation	Involve excavation	Involve excavation
-	Temporary feature	Temporary feature	Permanent feature
Involve removal of biomass	-	-	-
Pre-Construction Stage	Construction Stage	Construction Stage	Construction Stage
Land Office Approval	Local Council Approval	DID / DOE Approval	Local Council Approval
Activity does not change land form	Activity may change land form	-	-
Do not involve ground level change	Earthwork Plan will dictate the final proposed platform level	ESC Plan will dictate the different staging of earthworks to achieve the final platform level	Road and Drainage Plan will dictate the permanent features to be installed once the final platform level is achieved

DOE Interpretation of "Earthwork"

"Earthwork" inclusive any land disturbance, soil detachment, land clearing, cut and fill, grubbing, excavation, embankment and grading.

Rationale: All those activities contribute to soil erosion and sedimentation (Off-site pollution and properties damages).

- INPUT DIAGRAM

SESC BMPS Level of Defense

Key Construction Activities	**BMPs Principles**	**Significance Level of SESC Defense**
Before Construction	Mark trees and buffer areas for preservation	1
Construction access	Stabilize bare areas immediately	1
Sediment traps and barriers	Install principal basins **after** construction site is accessed and progressively during grading.	1
Runoff control	Install key runoff control **before** land grading and progressively during grading	1
Runoff conveyance system	Stabilize conveyances as early as possible.	2
Land clearing and grading	Clearing and grading **after** principal sediment and key runoff-control measures are installed.	1
Surface stabilization	Apply temporary or permanent stabilization measures Immediately on all disturbed areas where work is delayed or complete.	1
Building construction	Install necessary erosion and sedimentation control practices as work takes place.	3
Landscaping and final stabilization	Stabilize all open areas and remove all temporary control areas.	2

•1= Mandatory
•2= Very Significance
•3= Significance

PART 2

Internalize demonstration case of the SESC BMPs Implementation

PART 3

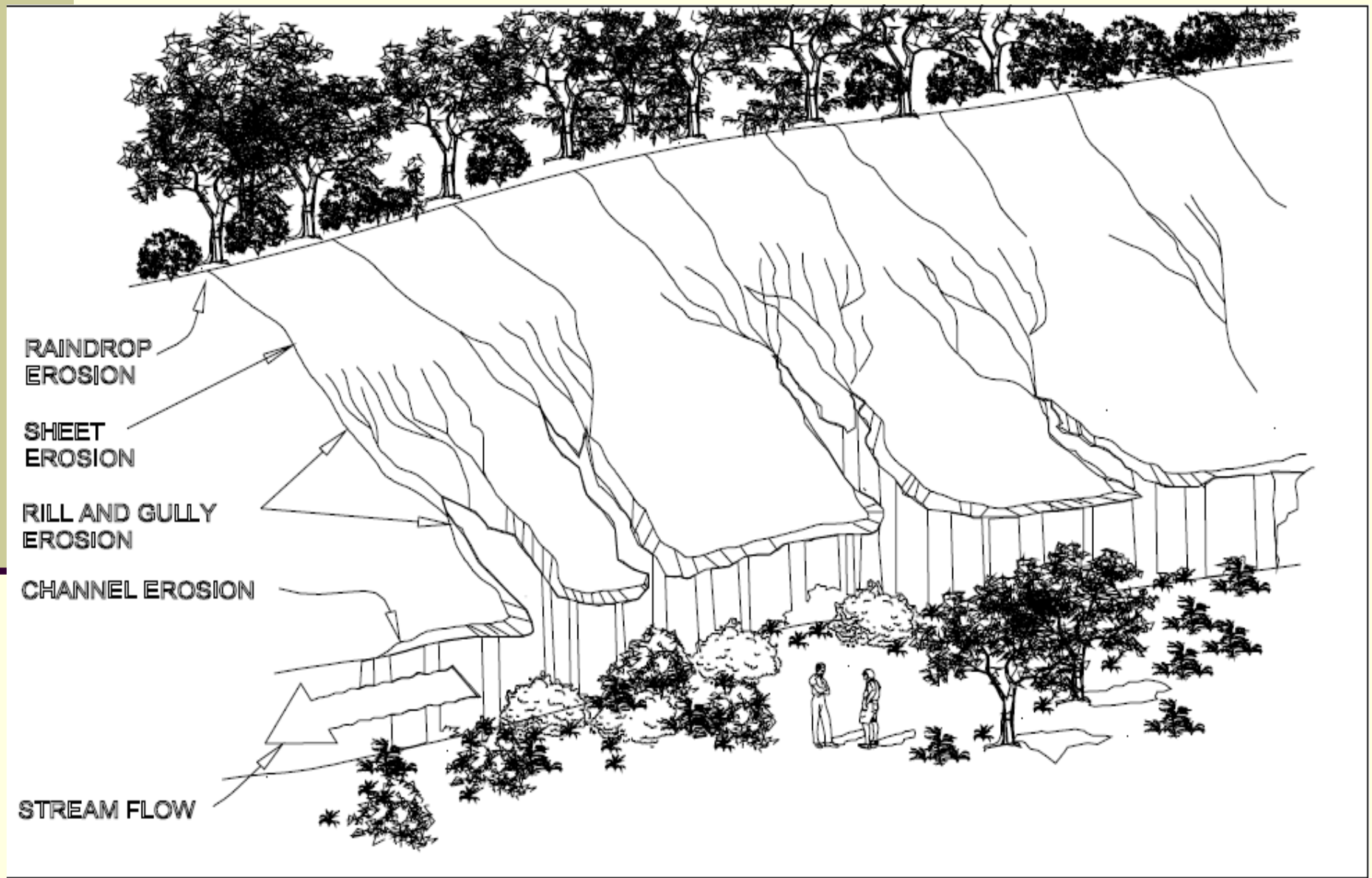
SESC and Runoff Estimation

THE EROSION PROCESS

- Raindrop impact erosion

  (**Typical rain drop, 2 mm in diameter, falls at ~6 m/s or 22 km/hr**)
- Sheet erosion
- Rill erosion
- Gully erosion
- Channel erosion

FIVE TYPES OF EROSION



THE EROSION PROCESS

- Erosion: The process by which rainfall, wind and water dislodges soil particles.
- *Splash erosion* is the dislodging of soil particles by raindrop impacts, resulting in the dispersal and mobilization of the soil particles.
- *Sheet flow erosion* is the uniform removal of saturated soil particles conveyed in runoff waters.
- *Rill erosion* is a long, narrow depression or soil incision caused by increased topographic relief and higher runoff velocities. They are the result of concentrated flows that result in vertical (meaning, incising into the ground) and sheet flow erosion.
- *Gully erosion* is the deep and wide depression caused by concentrated flows.
- *Stream bank erosion* is the removal of soil by a natural drainage pattern, such as toe cutting and bank sloughing.
- *Shoreline erosion* is the removal of soil by high-energy wave action, resulting in sloughing and mass wasting.
- • Sediment: Soil particles suspended in, or moved by, stormwater runoff.
- • Sedimentation: The deposition of sediment.

FACTORS THAT INFLUENCE EROSION

- **Soil Erodibility**
- **Vegetative Cover**
- **Topography**
- **Climate**
- **Season**

WHAT DATA REQUIRED FOR SOIL LOSS ESTIMATION?

- A = Average annual Soil Erosion Loss (t/ha/yr)
- R = Rainfall Erosivity Factor (MJ.mm/(ha.hr.yr))
- K = Soil Erodibility Factor (t.ha.hr/(ha.MJ.mm))
- L = Slope Length Factor
- S = Slope Steepness Factor
- C = Cover and Management Factor
- P = Conservation Practice Factor

A = RKLSCP (RUSLE Equation)

Data on K,LS(Field Investigation) and R,C,P (JPS ESC Guidelines)

WHAT DATA REQUIRED FOR SEDIMENT ESTIMATION MUSLE EQUATION

$$Y = 89.6(VQ_p)^{0.56}(K.LS.C.P)$$

Y = Sediment yield per storm event (tones)

V = Runoff volume in cubic meters

$Q_{p=}$ Peak discharge in m^3/s

K = Soil Erodibility Factor (t.ha.hr/(ha.MJ.mm))

L = Slope Length Factor

S = Slope Steepness Factor

C = Cover and Management Factor

P = Conservation Practice Factor

Data on V,Q,K,LS(Field Investigation) and C,P (JPS ESC Guidelines)

MUSLE EQUATION

V - Runoff volume in cubic meters

- V = Direct Runoff x Area

Q_p - Peak discharge in m^3/s

$$Q_y = \frac{C^y I_t A}{360}$$

Where,

Q_y - y year ARI peak flow (m^3/s).
C - Dimensionless runoff coefficient.
^yI_t - y year ARI rainfall intensity over t_c (mm/hr).
A - Catchment area (hectares)

Flow Estimation

1) Determine Catchment Boundary
2) Determine Tc
3) Determine Design Storm
    1) Rainfall Intensity
    2) Rainfall Temporal
4) Determine hydrologic losses
5) Transform the effective rainfall

SOIL - PARTICLE SIZES

- ***Boulder.***

  Largest rock transported by a stream or rolled in the surf; arbitrarily heavier than 12 kg and larger than 200 mm.

- ***Cobble.***

  Rock smaller than a boulder and larger than gravel; arbitrarily 0.5 to 12 kg, or 75 to 200 mm in diameter.

- ***Gravel***.

  Rock larger than sand and smaller than cobble, arbitrarily ranging in diameter from 5 to 50 mm.

- ***Pebble***.

  Stone 10 to 75 mm in diameter, including coarse gravel and small cobble.

- ***Sand***.

  Granular soil coarser than silt and finer than gravel, ranging in diameter from 0.05 to 5 mm.

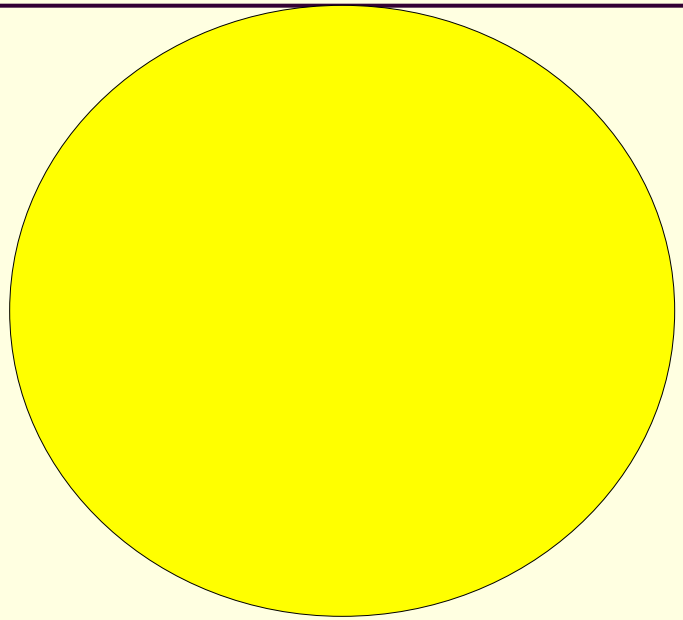
- ***Silt.***

  (1) Water-borne sediment. Detritus carried in suspension or deposited by flowing water, ranging in diameter from 0.005 to 0.05 mm. The term is generally confined to fine earth, sand, or mud, but is sometimes both suspended and bedload. (2) Deposits of waterborne material, as in a reservoir, on a delta, or on a floodplain.

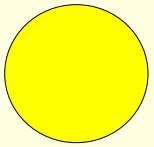
- ***Stone***.

  Rock or rock-like material; a particle of such material, in any size from pebble to the largest quarried blocks.

Relative Sizes of Soil Particles



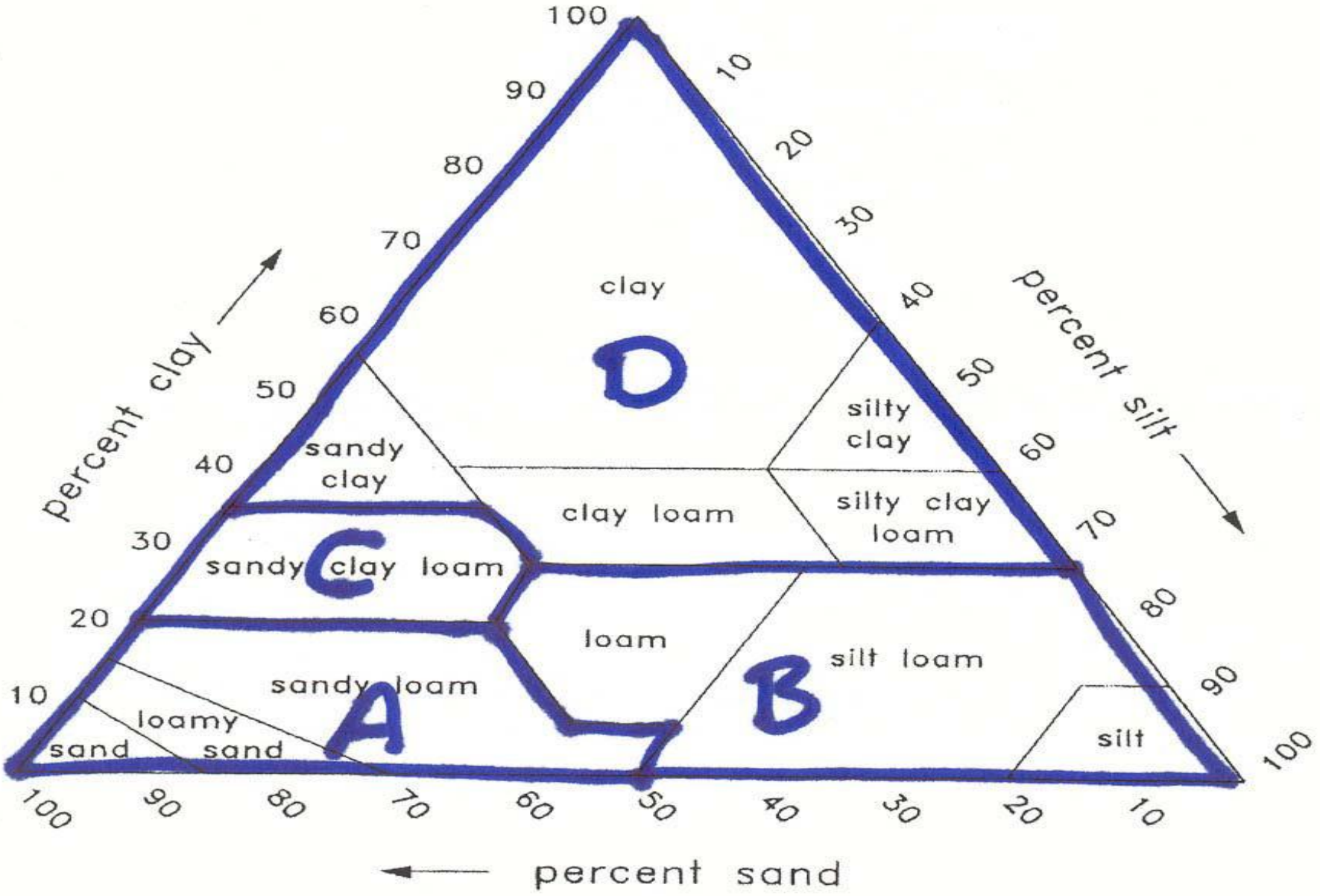
Sand, 50 microns

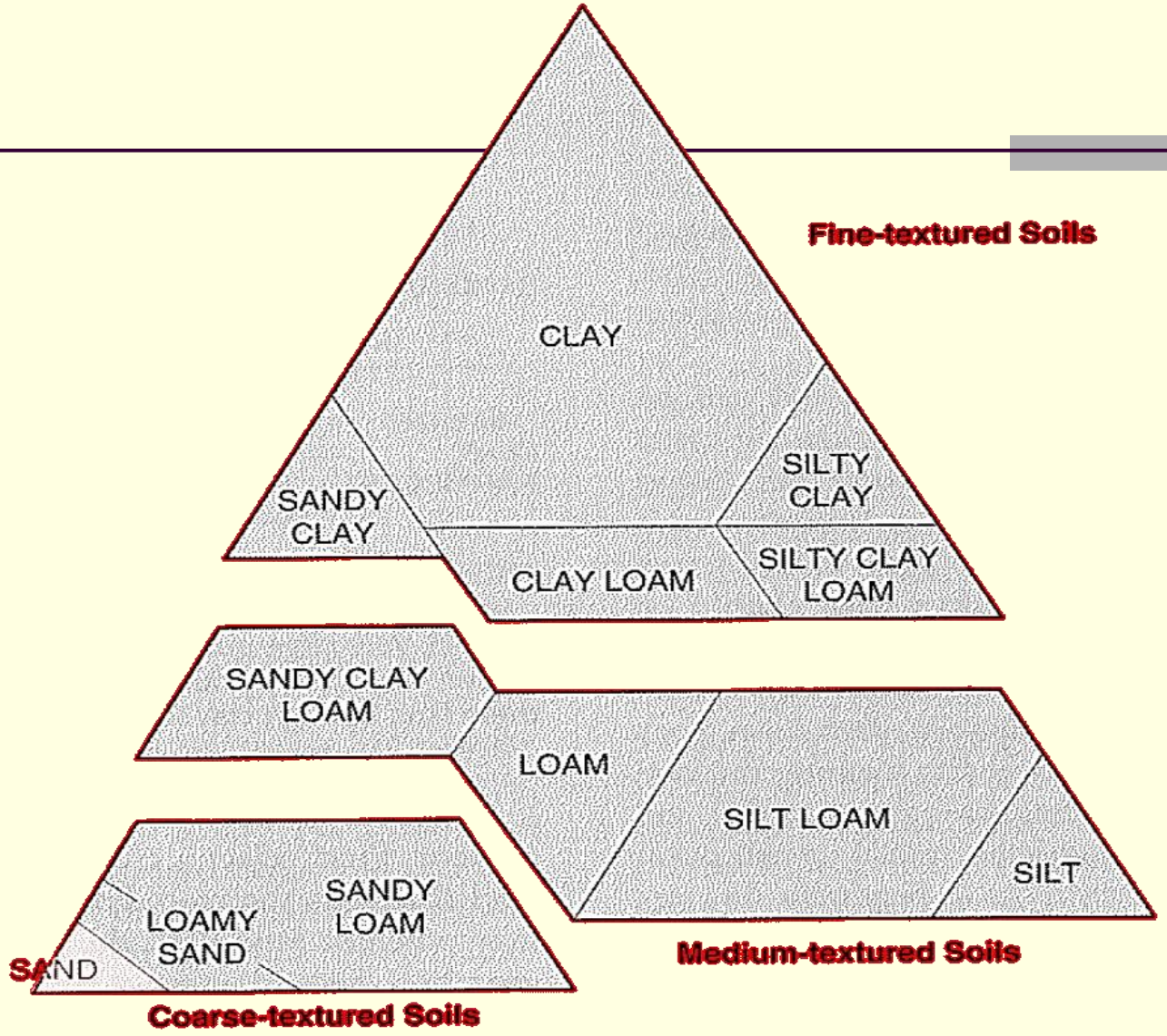


Silt, 10 microns

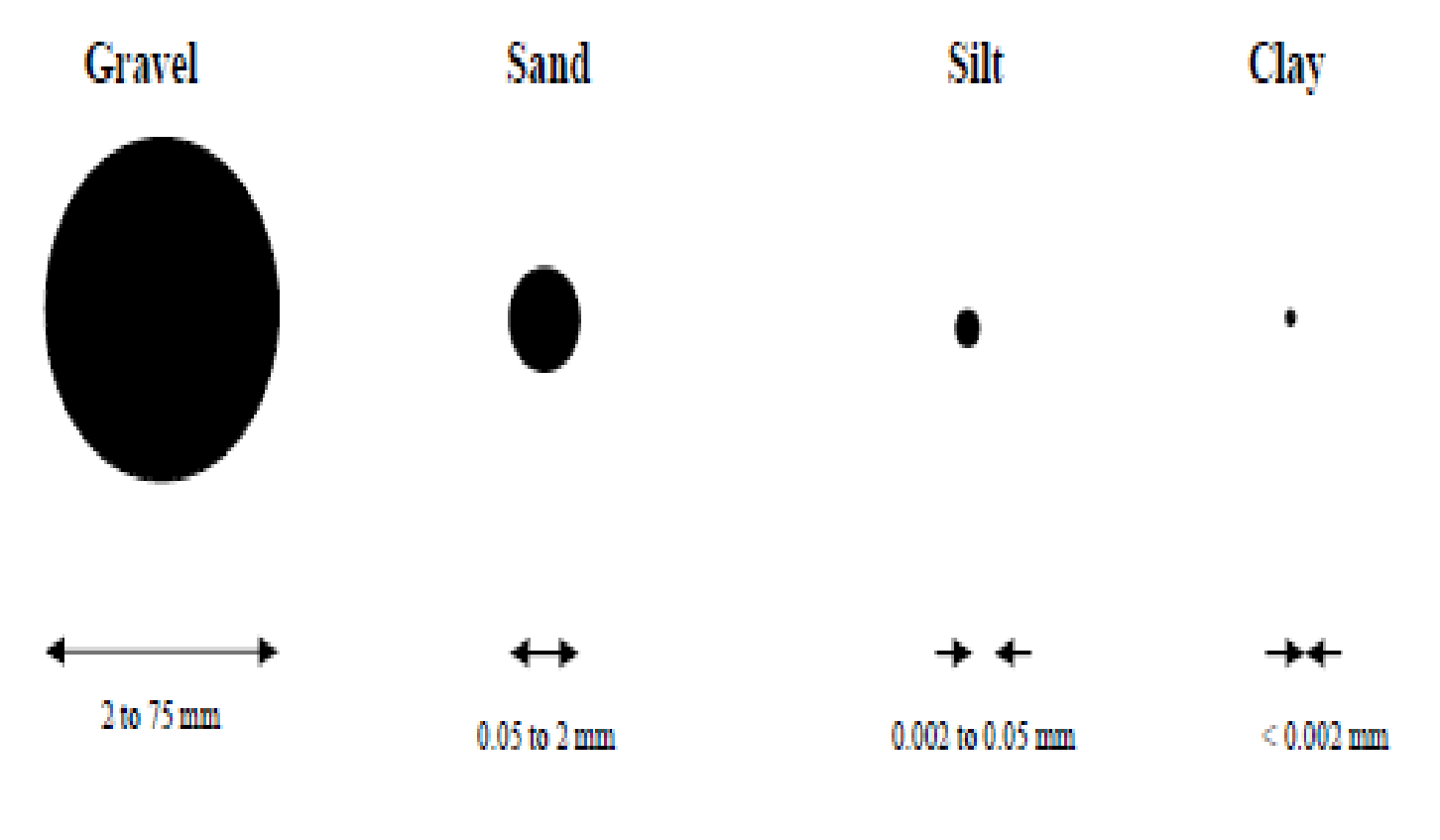
Clay, 2 microns

SOIL

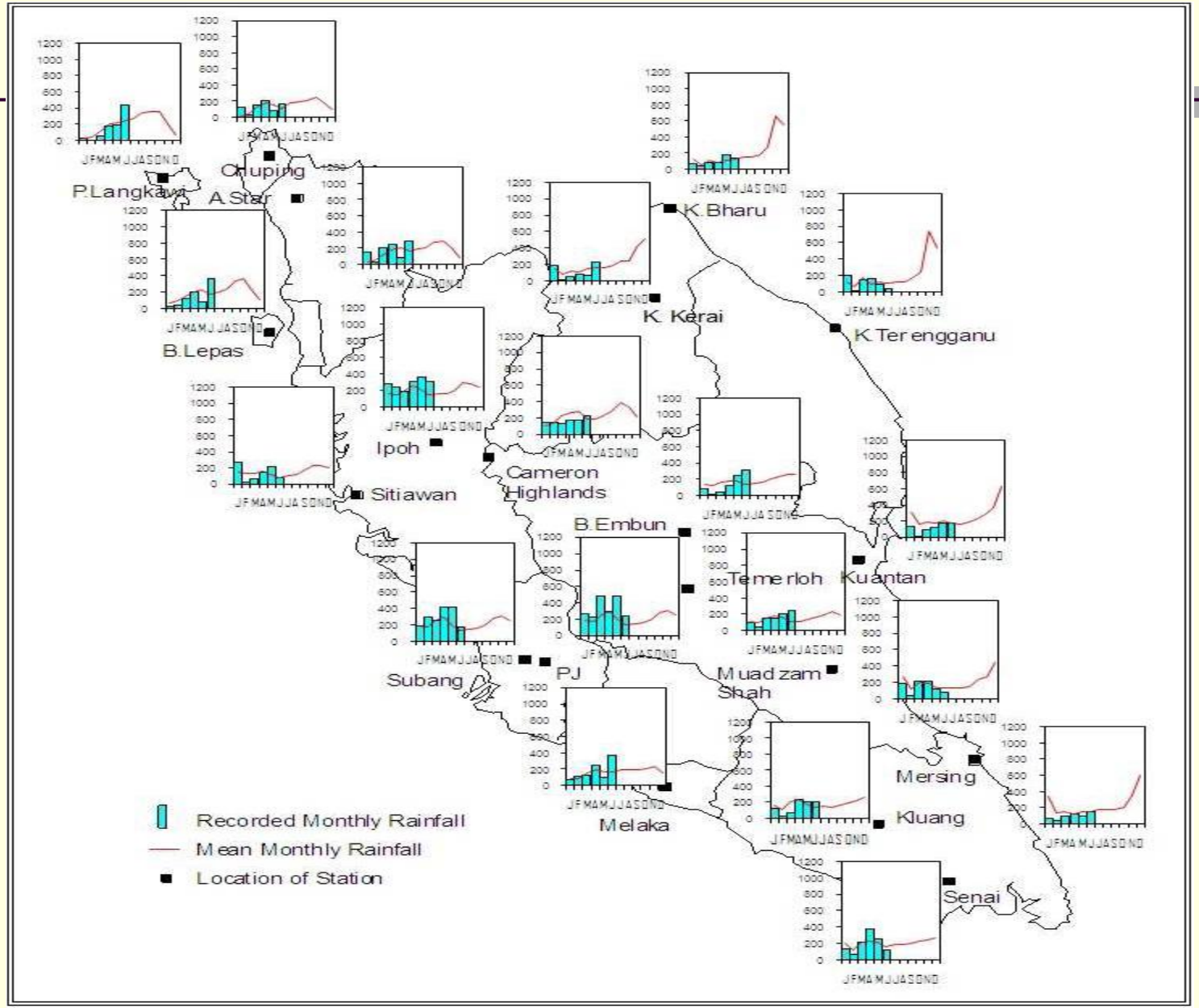

100
90
80
70
60
50
40
30
20
10
percent clay
clay
D
silty clay
sandy clay
clay loam
silty clay loam
C
sandy clay loam
loam
silt loam
B
sandy loam
A
loamy sand
sand
silt
percent silt
percent sand


Fine-textured Soils
CLAY
SANDY CLAY
SILTY CLAY
CLAY LOAM
SILTY CLAY LOAM
SANDY CLAY LOAM
LOAM
SILT LOAM
SILT
Medium-textured Soils
SANDY LOAM
LOAMY SAND
SAND
Coarse-textured Soils

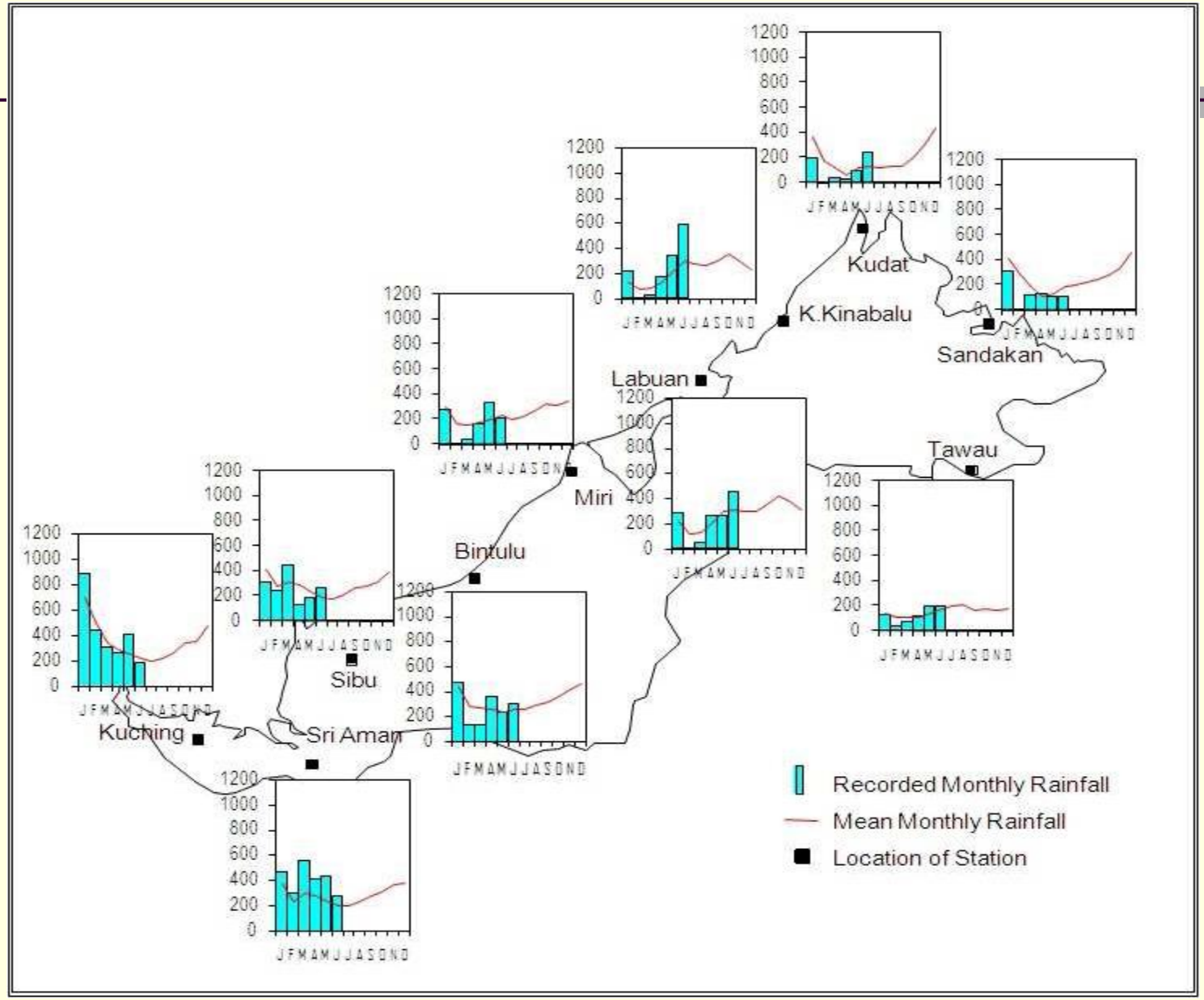
SOIL


Gravel
Sand
Silt
Clay
2 to 75 mm
0.05 to 2 mm
0.002 to 0.05 mm
< 0.002 mm

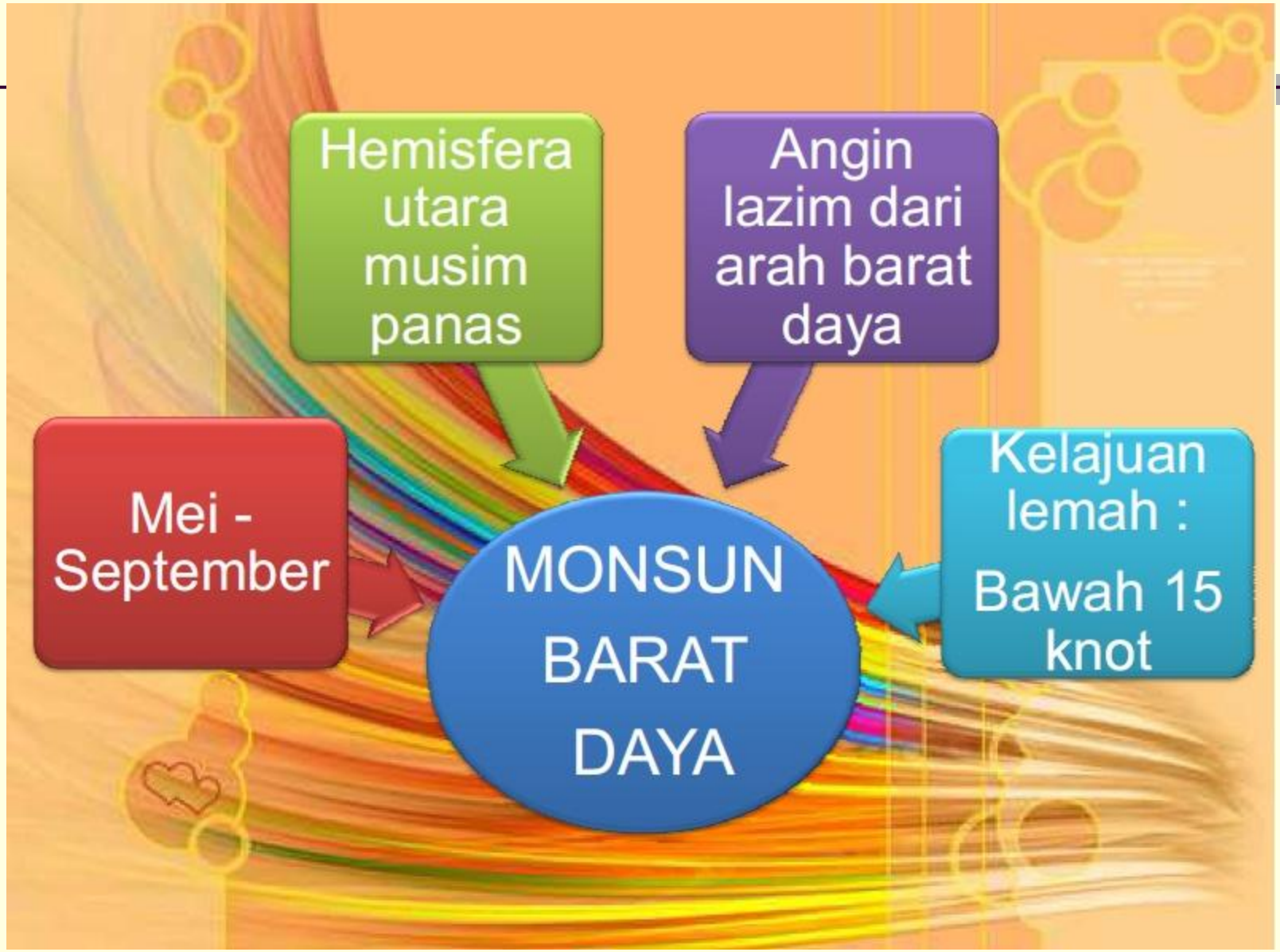
RAINFALL


P.Langkawi
A.Star
Chuping
B.Lepas
Ipoh
Sitiawan
Cameron Highlands
B.Embun
Subang
PJ
Melaka
K.Bharu
K.Kerai
K.Terengganu
Temerloh
Kuantan
Muadzam Shah
Mersing
Kluang
Senai
Recorded Monthly Rainfall
Mean Monthly Rainfall
Location of Station

RAINFALL


Kudat
K.Kinabalu
Sandakan
Labuan
Miri
Tawau
Bintulu
Sibu
Kuching
Sri Aman
J F M A M J J A S O N D
Recorded Monthly Rainfall
Mean Monthly Rainfall
Location of Station

SEASON


Hemisfera utara musim panas
Angin lazim dari arah barat daya
Mei - September
MONSUN BARAT DAYA
Kelajuan lemah :
Bawah 15 knot

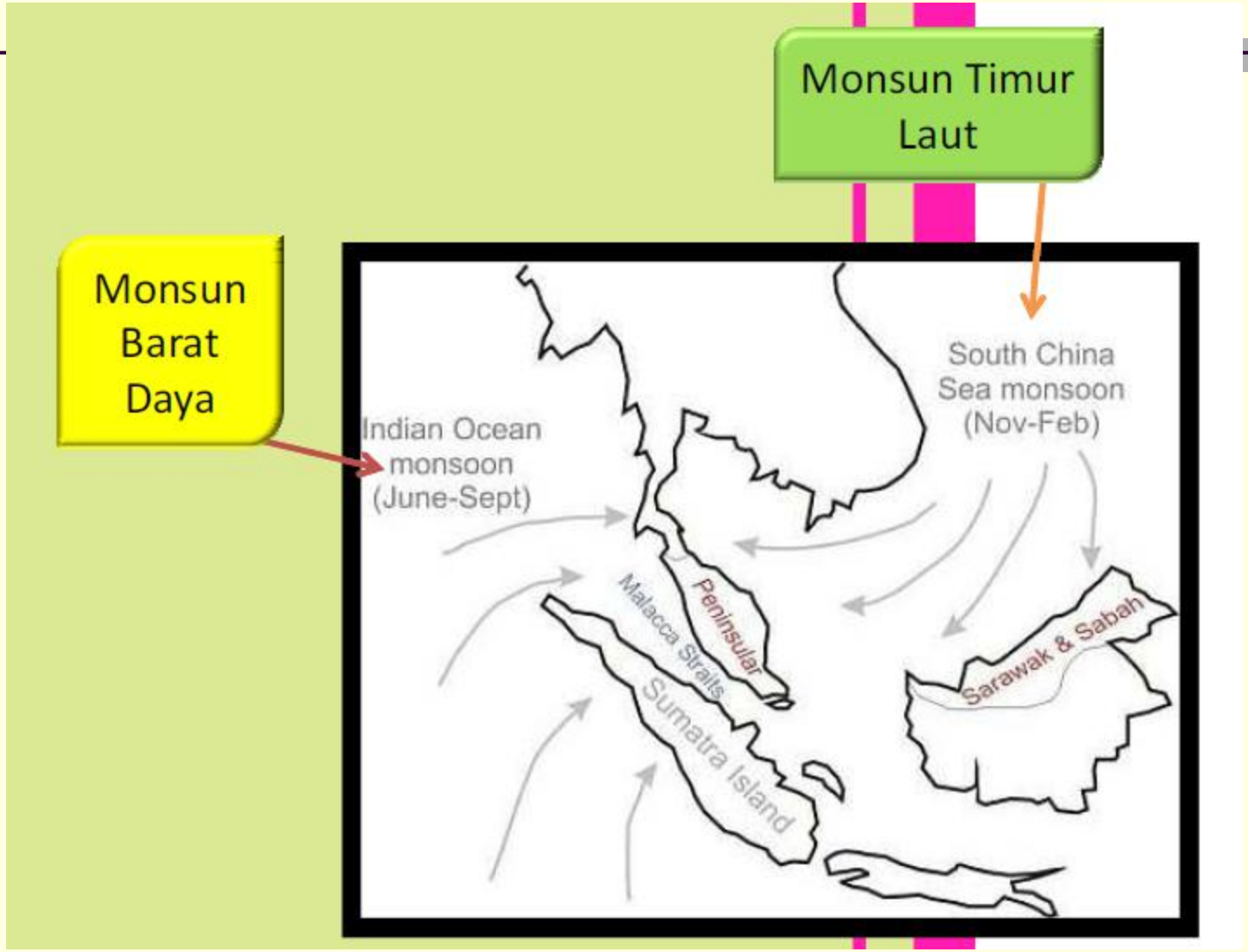
SEASON


November - Mac
Angin lazim dari arah timur @ timur laut
Kelajuan :
10- 20 knot
Negeri pantai timur :
30 knot
Luruan udara sejuk dari siberia – hujan lebat - banjir
Musim hujan utama di Malaysia
Monsun timur laut

SEASON


Arah tiupan angin tidak tepat
Semenanjung Malaysia
April & Oktober
Monsun peralihan
Keadaan udara sentiasa tenang
Hujan perolakan

CLIMATE


Monsun Timur Laut
Monsun Barat Daya
Indian Ocean monsoon (June-Sept)
South China Sea monsoon (Nov-Feb)
Peninsular
Malacca Straits
Sumatra Island
Sarawak & Sabah

SLOPE

Slope

Slope is composed of two parts: **elevation change and slope length**. Change in elevation, or rise, is the difference between the highest and lowest point on the site or drainage area. In practice, use the elevation of the point where water will exit the site or drainage area as the lowest point, and the highest point of elevation should be the highest point of the site that drains to that area.

Slope length, or run, is the horizontal distance between these two points. It is not always easy to find the horizontal distance; sometimes the easiest way to get this distance is indirectly using the overland distance or elevation change and angle between the horizontal and the terrain .

To determine the slope length from the overland distance d and survey angle θ, the formula is:
Slope Length = d cos θ

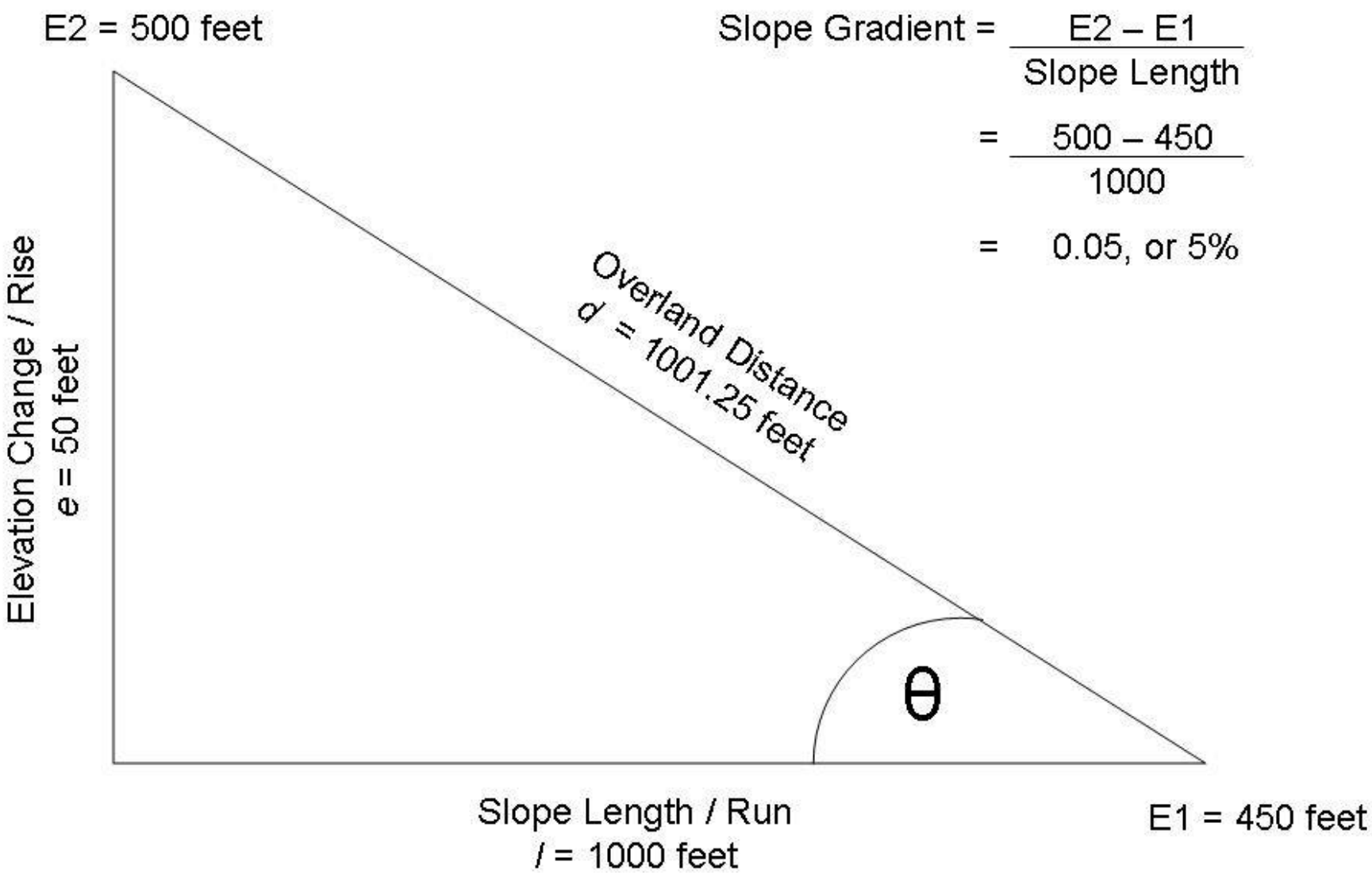
To determine the slope length from the elevation change e and survey angle θ, the formula is:
Slope Length = e sin θ

Likewise, to determine the elevation change from the slope length l and survey angle θ, the formula is:
Elevation Change = l sin θ

Slope gradient, or steepness, is the ratio of elevation change to slope length, or rise over run.
For instance, if the elevation at point 1 is 450 feet and at point 2 is 500 feet, and point 2 is 1,000 horizontal feet from point 1, then the elevation change, or rise, is 500 – 450 = 50 feet and slope length, or run, is 1,000 feet. The slope gradient is the ratio of these two values, or 50/1000 = 5/100 = 0.05, or 5%

The survey angle can also be used to determine gradient directly using the formula:
Slope Gradient = tan θ
If you use this formula, you will need to multiply the gradient by 100 to express the gradient as a percent.

TOPOGRAPHY


E2 = 500 feet
Slope Gradient = E2 – E1 / Slope Length
= 500 – 450 / 1000
= 0.05, or 5%
Overland Distance
d = 1001.25 feet
Elevation Change / Rise
e = 50 feet
θ
Slope Length / Run
l = 1000 feet
E1 = 450 feet

Critical Slope Lengths

Erosion Hazard	Slope Gradient	Critical Slope Length
Low to medium	0-6%	200'
Medium to high	6-12%	100'
Severe	Over 12%	50'

Slope (%)	Description
0 to 10	Gentle
10 to 15	Moderate
Over 15	Steep

Length	Description
Under 70 m	Moderate
Over 70 m	Long

Some Finding Conclusion

Erosion is likely to occur at any concentration of flow; however, it occurs most severely in high flow concentrations.

Erosion most commonly occurs:

- on slopes of more than 1,000 ft (300 m) (and less depending on the percent slope and soil type);
- on the outer banks of curved channels;
- at a culvert outlet or inlet;
- where the longitudinal slope of the ditch exceeds 2.5%;
- where there is sheet flow over a foreslope or backslope.

PART 4

DOE's Officers Right-to-know on inspections of SESC BMPs (Equipment, Maps & Drawings, Field Inspection Manual, SESC Model)

Erosion and Sediment Control (Best Management Practices)

Best Management Practices (BMPs) To Address Erosion and Sediment

DEFINITION OF BMPs- USEPA

A BMP is a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge.

BMPs include simple nonstructural methods, such as good housekeeping and preventive maintenance.

BMPs are most effective when used in combination with each other, and customized to meet the specific needs (drainage, materials, activities, etc.) of a given operation.

BMPs can also function as treatment controls.

DEFINITION OF BMPs- DOE

activities, facilities, measures, planning or procedures used to minimize accelerated erosion and sedimentation and manage storm water to protect and maintain the quality of soil or inland or Malaysian waters and the existing and designated uses of waters before, during, and after earth disturbance activities

SUMMARY OF BMPs FOR ROADWAYS PROJECT

NO	ESCM	Description
1	Bench	A slightly reverse sloping step on a back slope to reduce slope length.
2	Berm ditches	A temporary or permanent ridge of soil located to channel runoff water to planned location.
3	Brush barriers	Used in conjunction with filter fabric, filter sediment from runoff before leaving a site.
4	Channel liners	Control measure used to facilitate the establishment of a vegetative growth in a drainage way or as a protection prior to the placement of a permanent armoring.
5	Channels	A drainage way used to convey runoff through, along, or around an area. Conveying runoff in a channel that has an uninterrupted positive grade to the outlet.
6	Check dam	A small temporary barrier or dam constructed across a drainage ditch.
7	Culverts	Divert flood flows and redirect storm runoff to another area such as a basin or a trap.
8	Detention basins	Depressed areas that store runoff during wet weather and dry the rest of the time.
9	Ditch checks	Protect ditches from erosion and to filter sediment from flowing water.
10	Diversions	A temporary or permanent dike or berm located so water can be directed to planned location.

SUMMARY OF BMPs FOR ROADWAYS PROJECT

NO	ESCM	Description
11	Energy dissipaters	An obstacle placed at the outlet of a drainage pipe or any other location that requires reduction of rapid water flow to prevent erosion.
12	Filter berms	A temporary ridge of porous material such as stone or gravel, that can be stabilized in rows, banks, or mounds.
13	Filter strip	A strip of grass planted at right angles to the flow of runoff.
14	Flotation silt curtain	A silt curtain used in a lake or pond to keep silt-laden water within the construction area.
15	Infiltration trench	A trench designed for the filtration of storm water and collection of sedimentation.
16	Infiltration basin	A depressed area with a vegetated bottom, similar to a dry pond. Used as storm water management designed to reduce the peak flow for a 2 to 10 year storm.
17	Inlet protection	Carries runoff water in an underground drainage system; used in conjunction with storm drain diversion measures.
18	Matting	A temporary erosion control practice used for the establishment of vegetation that helps protect seeding and increase germination.
19	Mulching	Applying plant residue or other suitable material to protect the soil surface.
20	Outlet protection	An apron or other energy dissipating device placed at the outlet of a drainage pipe.

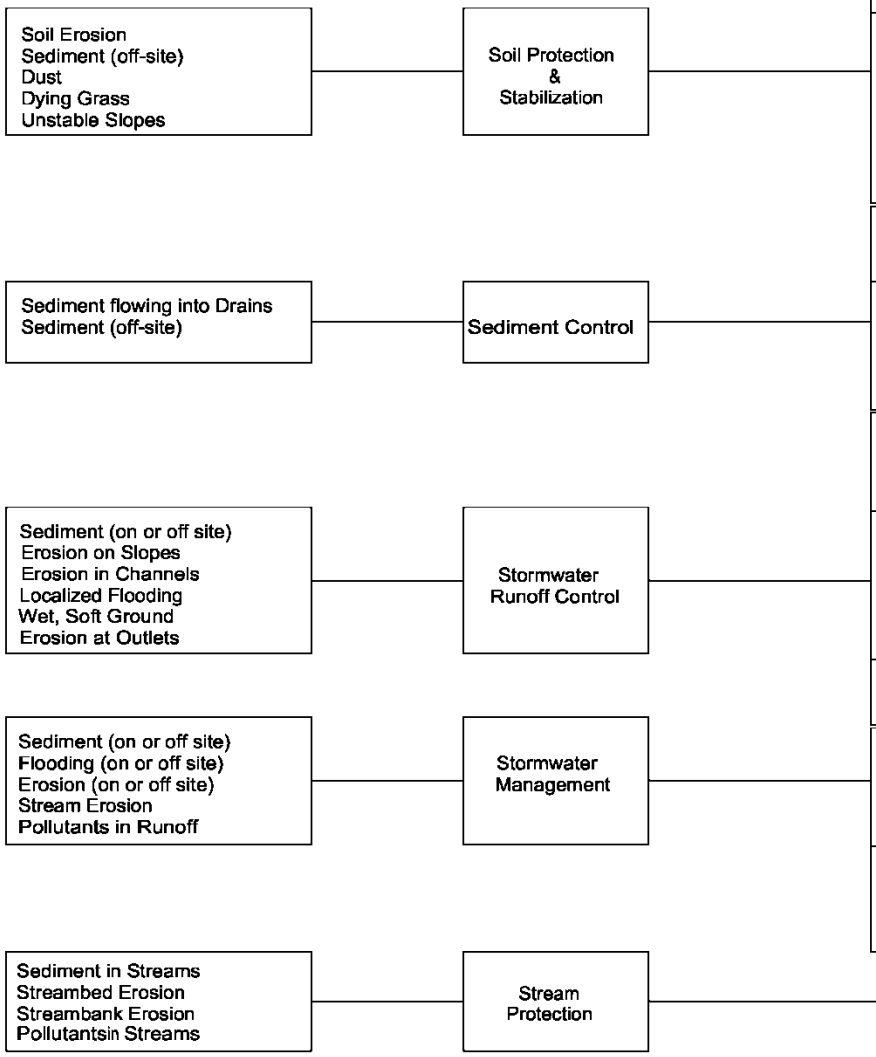
SUMMARY OF BMPs FOR ROADWAYS PROJECT

NO	ESCM	Description
21	Permanent seeding	Permanent seeding of lawn grasses and tall grass mixtures used as an effective method of controlling long term erosion.
22	Retaining walls	A constructed wall used to assist in the stabilization of cut or fill slopes where permissible slopes cannot be obtained without the use of a wall.
23	Retention pond	A permanent pool of water that has the capacity to store storm water until it is released from the structure.
24	Revetment flume	A device used to transport water in a structure to a lower level without erosion.
25	Sediment basin	A basin created by excavating and/or building a dam across a waterway. A sediment basin usually consists of a dam, a pipe outlet, and an emergency spillway.
26	Serrated cut	Stairstep grading used in soils containing large amounts of soft rock which may be impossible or impractical to smooth grade.
27	Shoulder drains	Used during fill slope construction for the purpose of conveying flow from the roadway surface level down to the toe of slope.
28	Shrubs	Used for the control of surface drainage and soil and wind erosion.
29	Silt fence	A temporary barrier of geotextile fabric used to intercept sediment on small drainage areas. This is one of the most convenient ESCM.
30	Slope/Terrace	Used to intercept and convey surface runoff at a non-erosive velocity to a suitable outlet and to retain runoff for moisture conservation.

SUMMARY OF BMPs FOR ROADWAYS PROJECT

NO	ESCM	Description
31	Sodding	Used to cover bare soil with cut sod (usually bluegrass) in order to provide rapid ground cover and stabilization of the soil. Often used in waterways and flumes.
32	Straw bales	Are used to filter sediment from runoff in sheet flow applications.
33	Surface roughening	Used to provide a rough finish on clay soils. This procedure should generally be used after the fall seeding period has passed.
34	Temporary sediment trap	A depressed area in a drainage location that allows the runoff to slow and the silt to settle.
35	Temporary seeding	Seeding grasses and legumes planted on disturbed areas of soil. Grass cover is the most effective method of controlling erosion.
36	Temporary slope drain	A structure (metal or flexible pipe) used to carry runoff water from the top of a slope to the bottom.
37	Top soiling	Salvaged topsoil placed over subsoils that provides a growing media for establishing a cover of grass.
38	Trees	Used for the control of surface drainage, soil and wind erosion.
39	Under drains	A perforated conduit such as pipe, tubing, or tile installed beneath the ground to intercept and convey ground water.
40	Vines and ground covers	Used for the control of surface drainage and soil and wind erosion.

Decision-Making Matrix for Erosion, Sediment and Stormwater Runoff Control in Developing Areas



Types of Protection	Control Practice	Page
Vegetative	Temporary Seeding	35
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	Sodding	55
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COMMUNICATIONS AND ATTITUDE
OF
AN INSPECTOR

INSPECTOR CHECKLIST

EROSION AND SEDIMENT CONTROL MANAGER (ESCM)→EO/M

- **Have you met with and talked with the person identified as the ESCM?**
- **Do you believe this person has adequate knowledge to perform this work?**
- **Does this person understand all the required duties of the ESCM?**
- **Does this person have the authority to direct resources and make changes in an emergency situation?**

COMMUNICATIONS AND ATTITUDE OF AN INSPECTOR

- Establish communications and becomes acquainted with the contractor's key personnel.
- Discuss the plans and specifications for the project, traffic control techniques, and define lines of authority.
- Proactive by understanding the project from the contractor's point of view but does not permit reduced quality in order to increase the contractor's productivity.
- Influences the construction process to obtain the best possible results.
- Offer assistance while being careful not to supervise construction.

QUALIFICATIONS OF THE INSPECTOR

- Be honest and conduct him/herself in a fair straightforward manner.
- When under stress, the inspector must still be able to maintain personal composure and make good decisions.
- Be frank and sincere in relationships with people, and be a skilled diplomat able to handle tough situations without arousing hostility.
- Be observant and be capable of keeping neat, concise accurate records.
- Technical study and/or construction experience is necessary to perform well as an inspector.

- •Knowledge
- •Common Sense
- •Observational Skills
- •Courtesy.

WHAT TO RESPONSE TO THESE COMMON QUESTIONS

- It’s normal to cause little pollution (siltations) during any land development.
- We don’t have the knowledge in handling ESC since we are not so called technical guys.
- It’s costly and expensive to implement ESC.

The Pre-Inspection Process

- **Site Review**
- Review Plans
  - Map Contours
  - Sensitive Areas ◊ Wherever pollutants can make way out across boundary.
  - Critical Areas ◊ Wherever soils detachment likely to occur.
  - Site Perimeter ◊ Protected.
- Entrances & Exits ◊ Stabilized

PLANS

- LOCATION PLAN OR VICINITY PLAN
- LAYOUT PLAN OR TOTAL SITE AREA PLAN
- SURVEY PLAN
- EARTHWORK PLAN
- **ESC PLAN**

Knows The Problem Areas And Attend To Appropriately

1. slopes;
2. streams and waterways;
3. surface drainageways;
4. large, flat surface areas;
5. borrow areas; and
6. adjacent properties.

- As a general rule there will be a potential hazard if slope lengths exceed the following:
- **0-7% - 100 metres; 7-15% - 50 metres; >15% - 25 metres.**
- Vegetative stabilization, diversion measures, slope drains and slope stabilization measures may counteract problems created by modifying slopes.

EROSION AND SEDIMENT CONTROL PLAN

ESCP

ESCP

- **ESC Narrative**

  - Written portion of the ESCP
  - Describe and explain the overall development.
  - Combined with site plan.
  - Sufficient information to ensure that esc controls are iim as designed.

- **ESC Site Plan**

  ESC site plan is a map(s) that depicts information contained in the narrative.

Elements of the Erosion and Sediment Control Plan

1. *The narrative.*
2. *The map/site plan.*
3. *Construction details, specifications, and notes.*
4. *Calculations.*

ESC Plans / Drawings?

- MAL.site.MT.025A
- MAL.site.MT.025B
- MAL.site.MT.025C
- MAL.site.MT.025D

ESC Plans / Drawings?

- Maps_for_Ch7
- attachment_b
- MODEL ESCP1

MAP AND DRAWING

READ AND INTERPRET

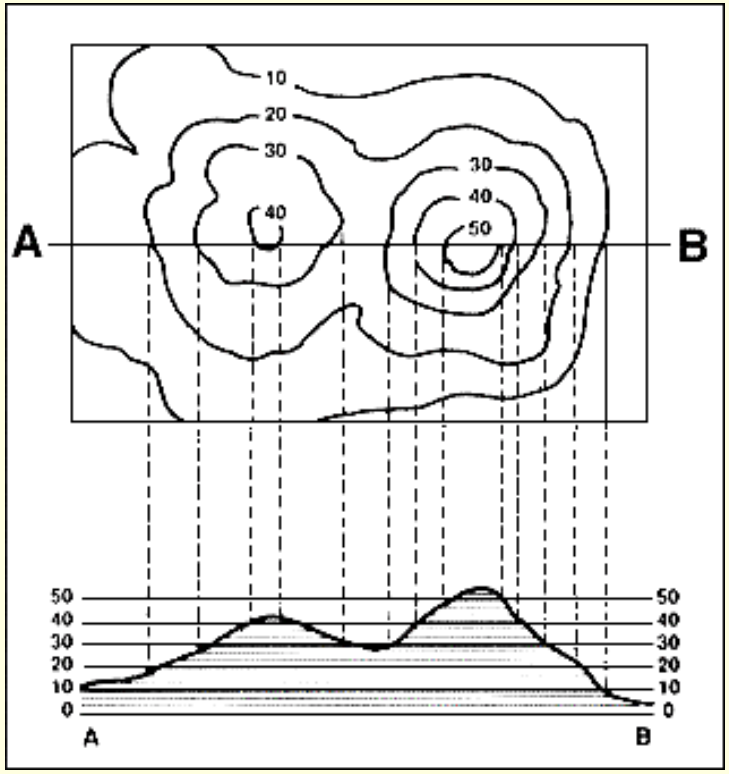
Maps, Plans...What's the Difference?

- Maps show physical features of the natural or built environment at established scale and orientation.

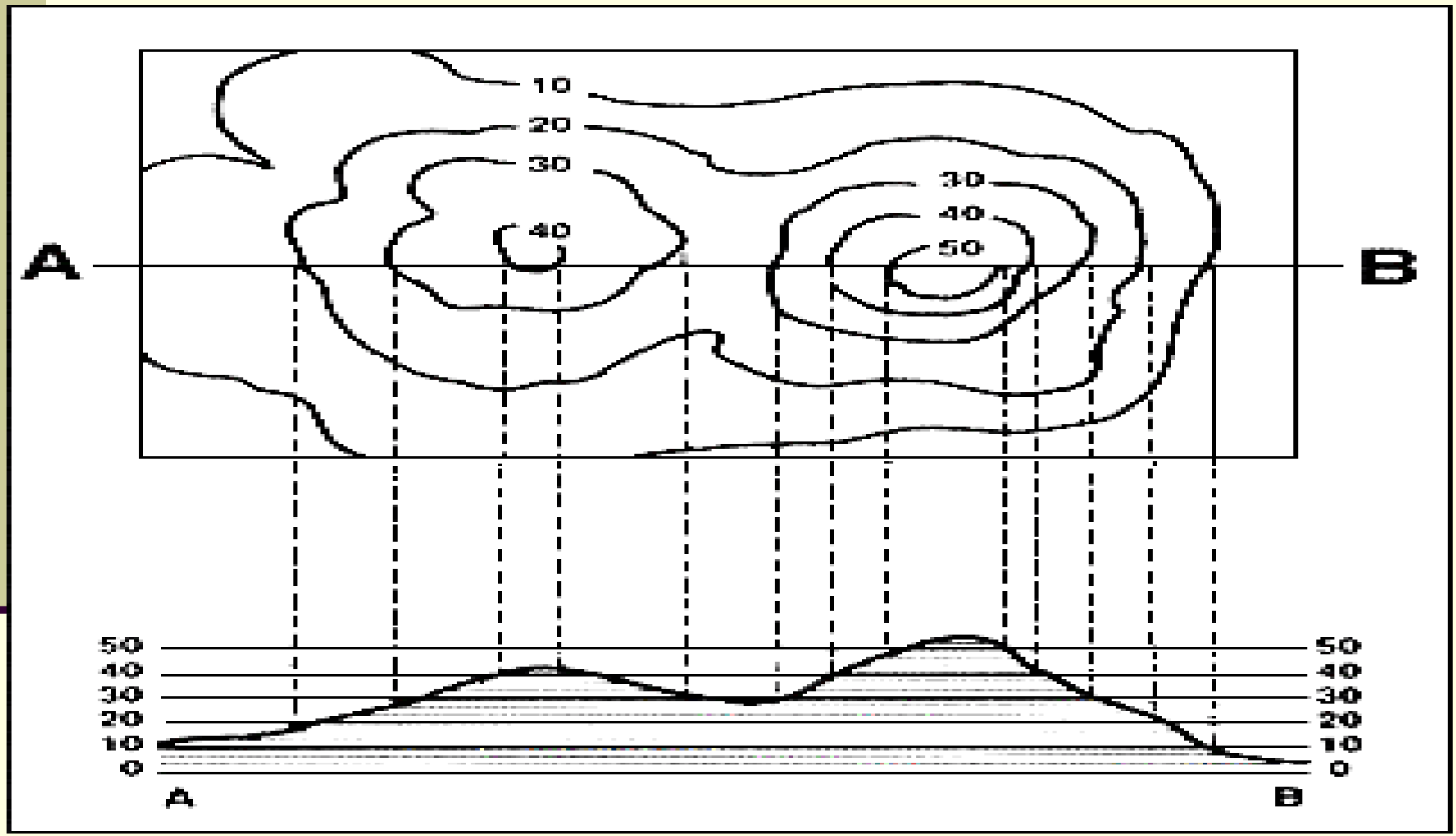
- Plans are engineered drawings made to scale showing existing physical features of a site and proposed changes to accommodate development.

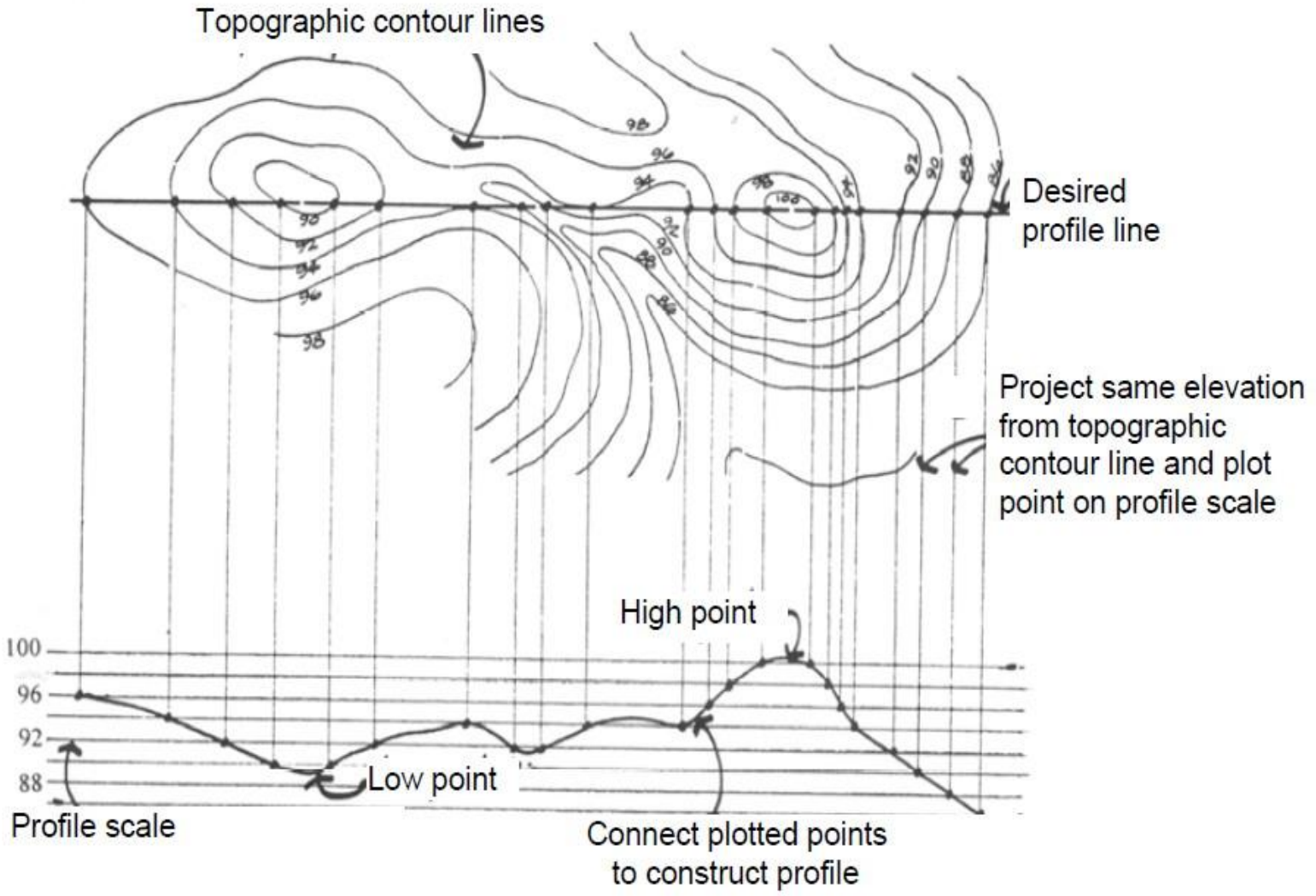
Type of Slope

- Slope features
- Slope measurements
- Rise over run
- Slope percentage
- Slope degrees



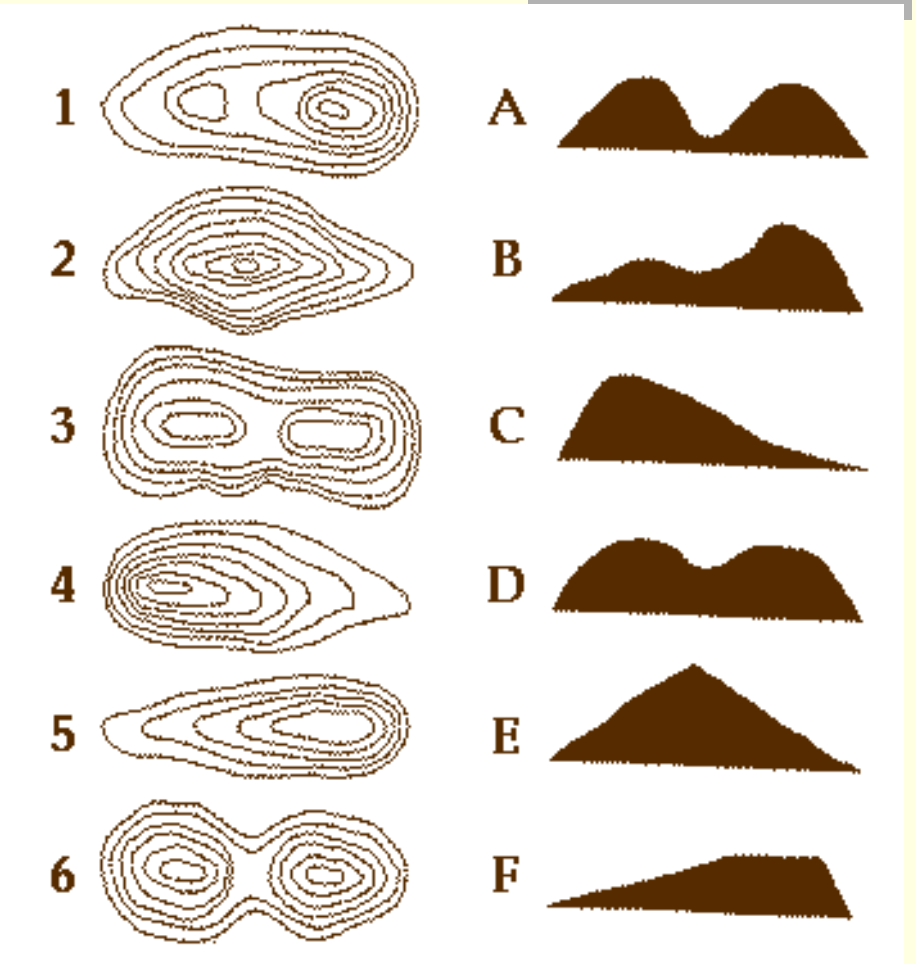
Type of Slope




Topographic contour lines
Desired profile line
Project same elevation from topographic contour line and plot point on profile scale
High point
100
96
92
88
Low point
Profile scale
Connect plotted points to construct profile

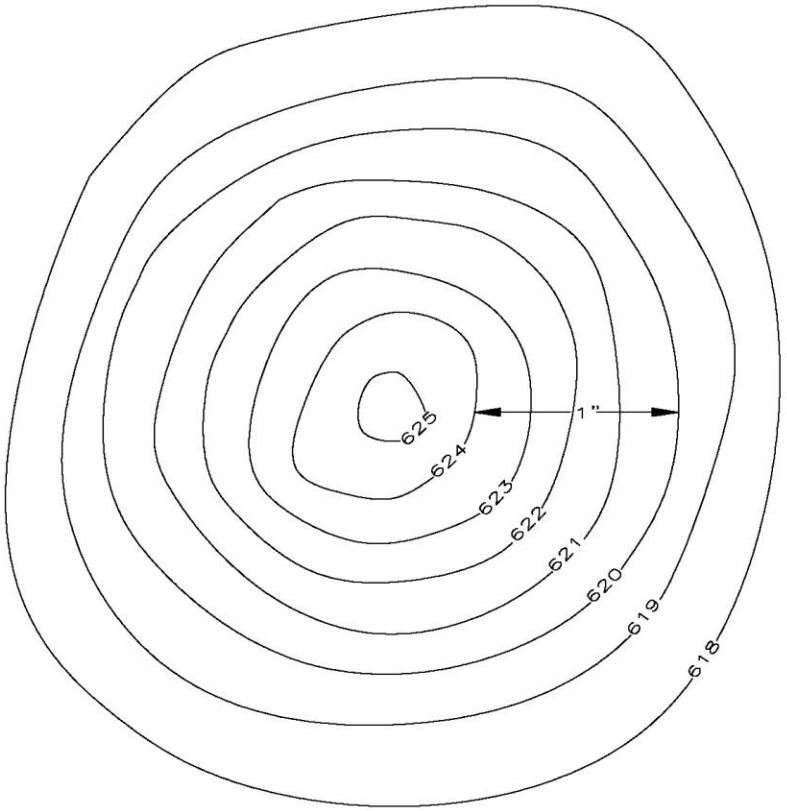
Type of Slope

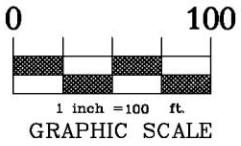
- Slope Features



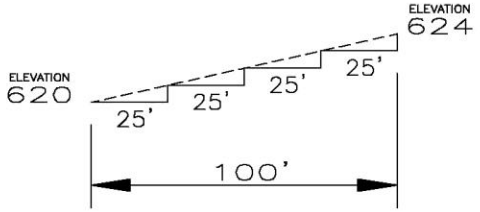
Slope Measurements

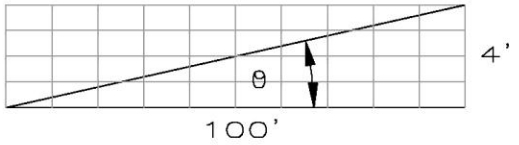
Type of Slope

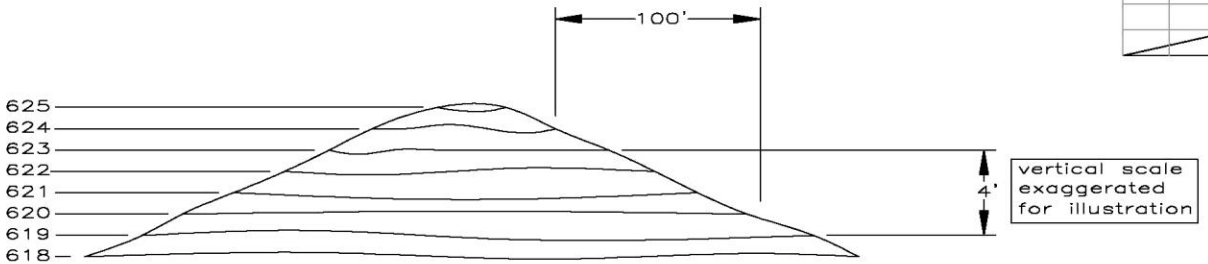




* ELEVATION IN AREA OF INTEREST: 4' = 624−620
* SLOPE% = $\frac{\text{RISE}}{\text{RUN}} = \frac{4}{100} = 0.04$ OR 4%
* 25:1 SLOPE
* TAN $\theta = \frac{4'}{100'}$
* ARCTAN $\frac{4'}{100'} = \theta$
* θ =2.3°







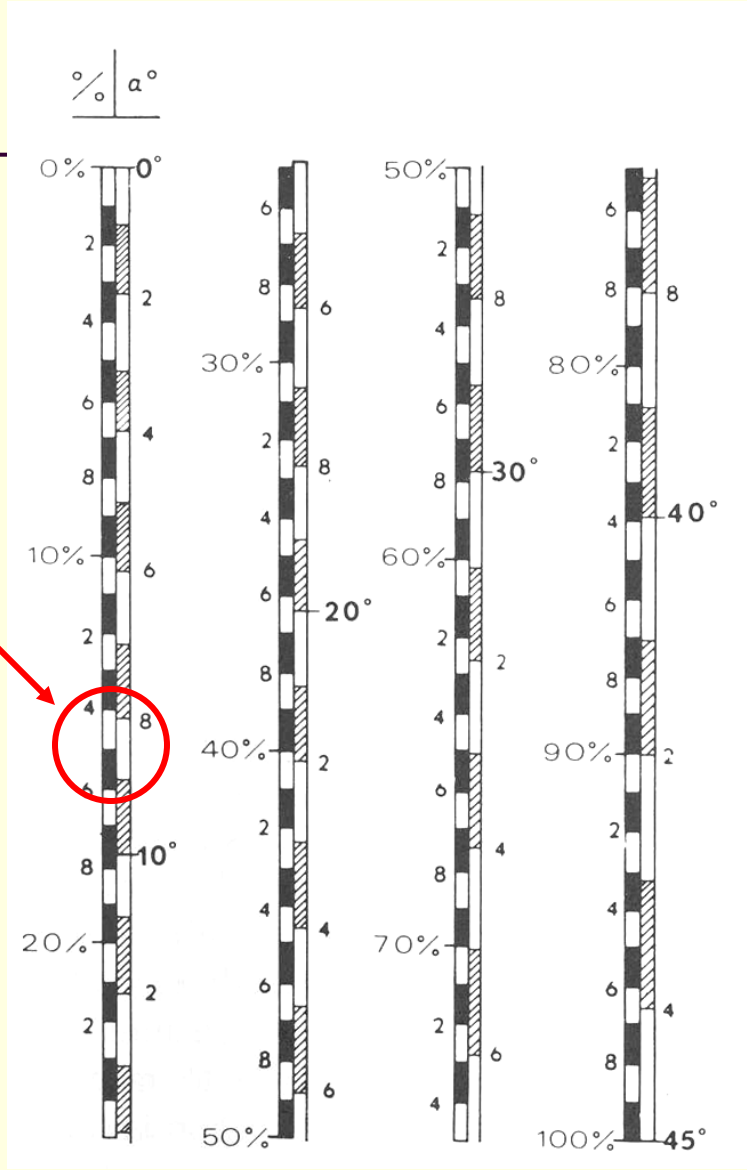
Slope is expressed as a percentage or as an angle

5% slope = 2.8 degrees

10% slope = 5.6 degrees

15% slope = 8.4 degrees

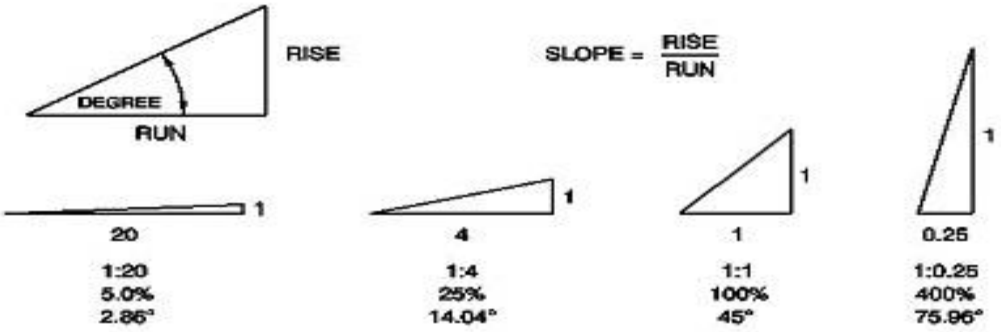
100% slope = 45 degrees



SLOPE INCLINATION CONVERSION WORKSHEET

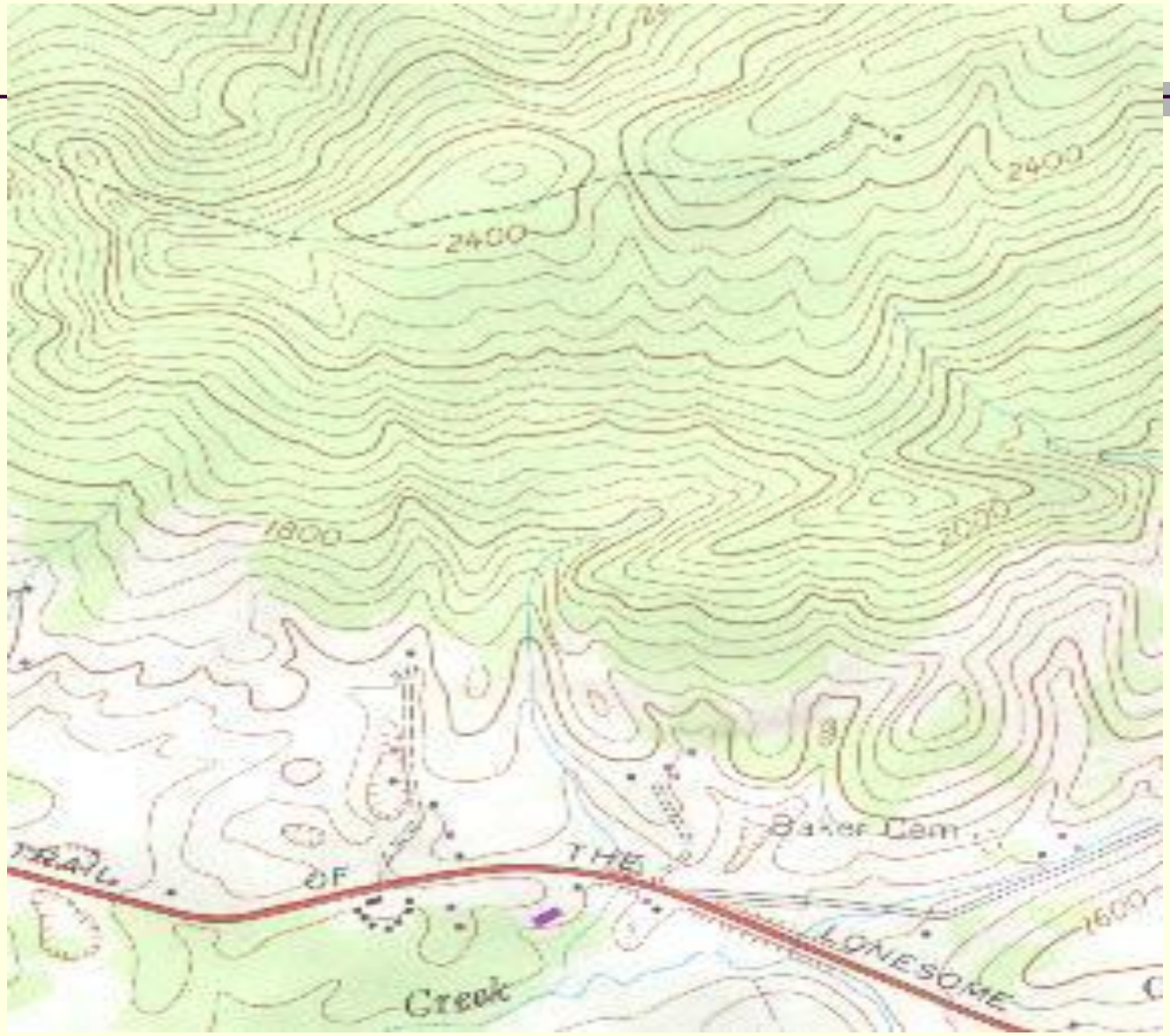
RISE	RUN	RATIO	PERCENT	DEGREE
1	20	1:20	5.0	2.86
1	10	1:10	10.0	5.71
1	9	1:9	11.1	6.34
1	8	1:8	12.5	7.12
1	7	1:7	14.3	8.13
1	6	1:6	16.67	9.46
1	5	1:5	20	11.31
1	4	1:4	25	14.04
1	3	1:3	33.3	18.43
1	2	1:2	50	26.57
1	1.5	1:1.5	66.67	33.69
1	1.25	1:1.25	87	38.66
1	1	1:1	100	45
1	0.75	1:0.75	133.33	53.13
1	0.50	1:0.50	200	63.43
1	0.25	1:0.25	400	75.96

EXAMPLES:



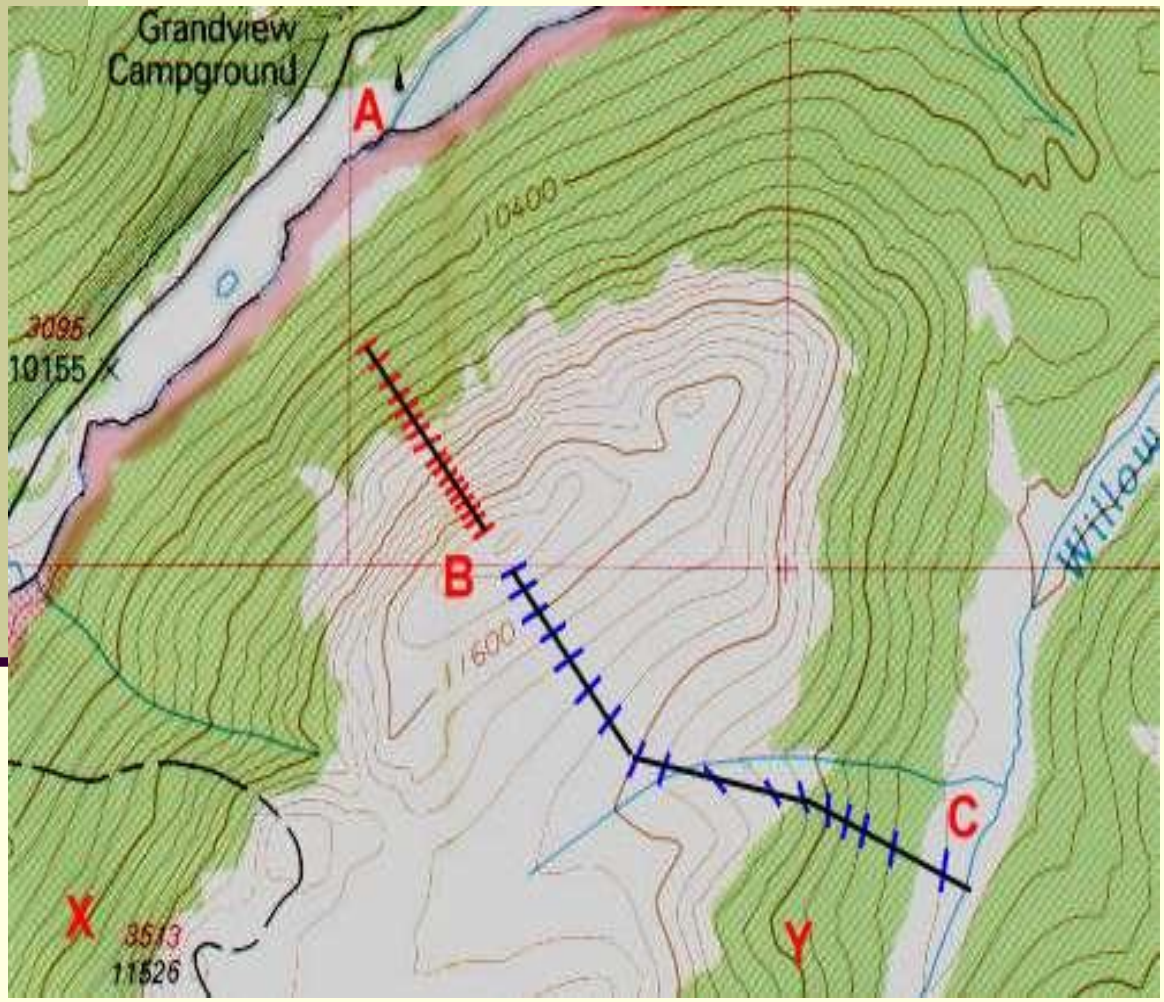
	OREGON DEPARTMENT OF TRANSPORTATION	SLOPE CONVERSION TABLE
	GEO / ENVIRONMENTAL SECTION	DATE: 6/01/2006

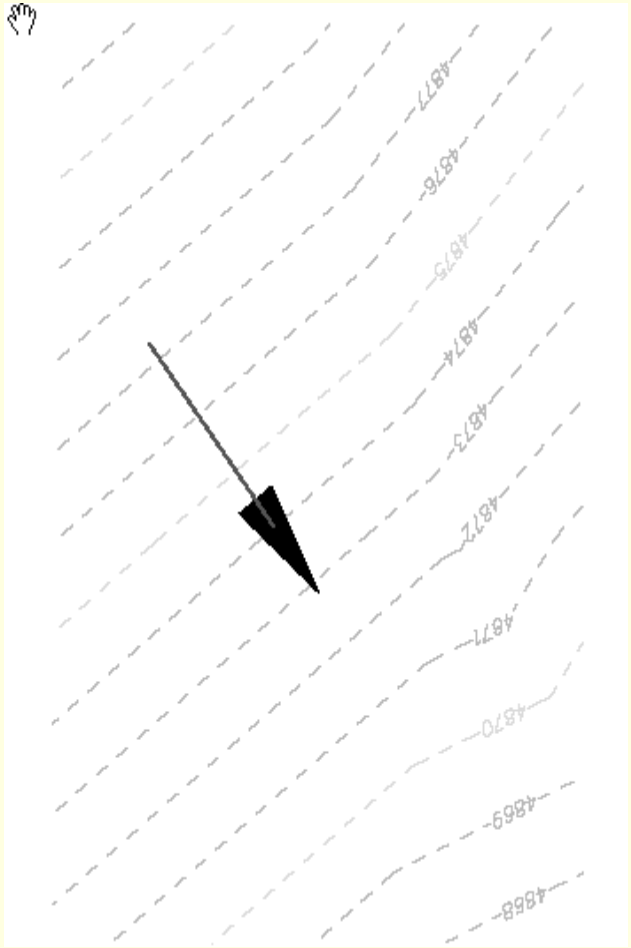
TOPOGRAPHIC MAP



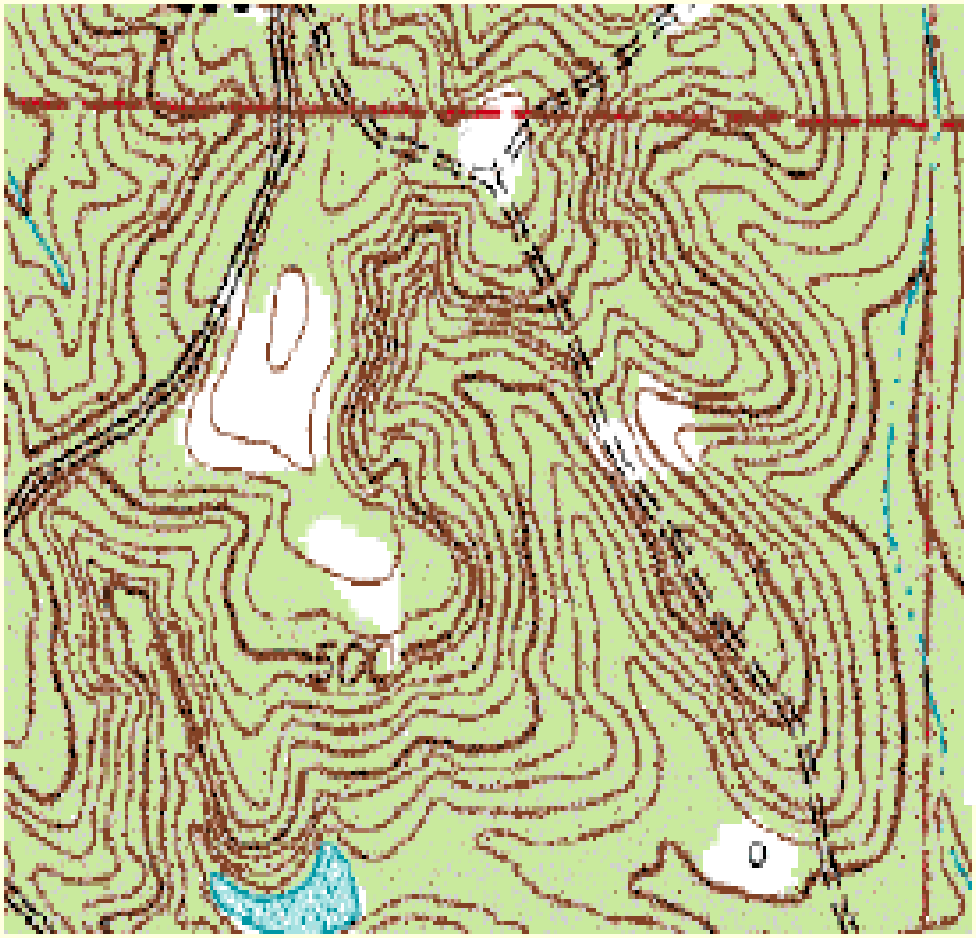
Direction of Sheet Flow

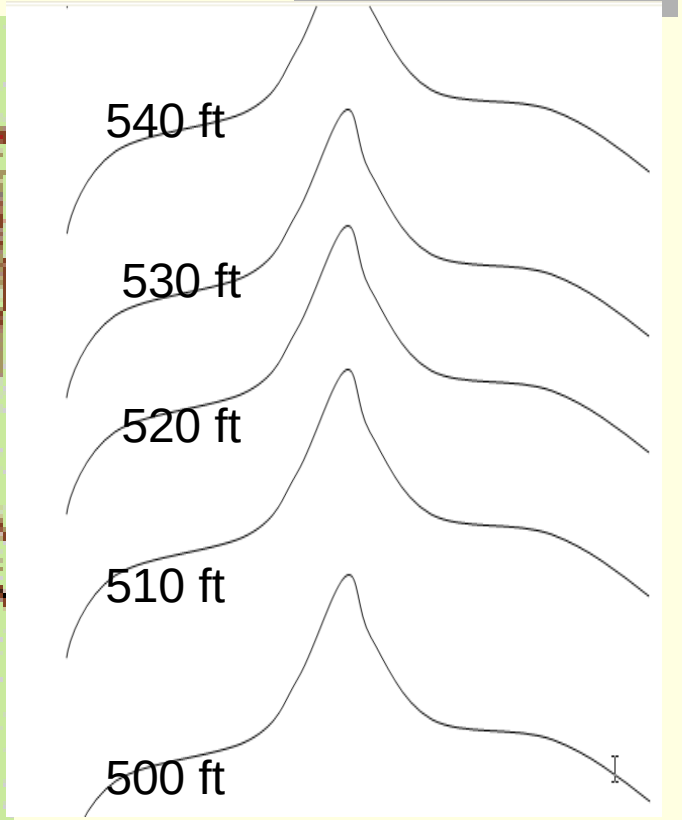
– Flow is always perpendicular to the contour lines





Direction of Concentrated Flow





CONTOUR INTERVAL

- A **topographic map** is a map which shows changes in elevation by using contour lines. **Contour lines** are imaginary lines that join points of equal elevation on the surface of the land above or below a reference surface such as average sea level.
- brown lines are contour lines.
- contour lines never cross.
- The thicker brown lines are known as **index contours**

$$\text{Contour interval} = \frac{(\text{Elevation of first index contour}) - (\text{Elevation of second index contour})}{\text{Number of contours crossed}}$$

How to read a topo map...

- The **contour interval** is the vertical distance between contours, generally 10ft. on topo maps. **Contour lines** never cross each other.

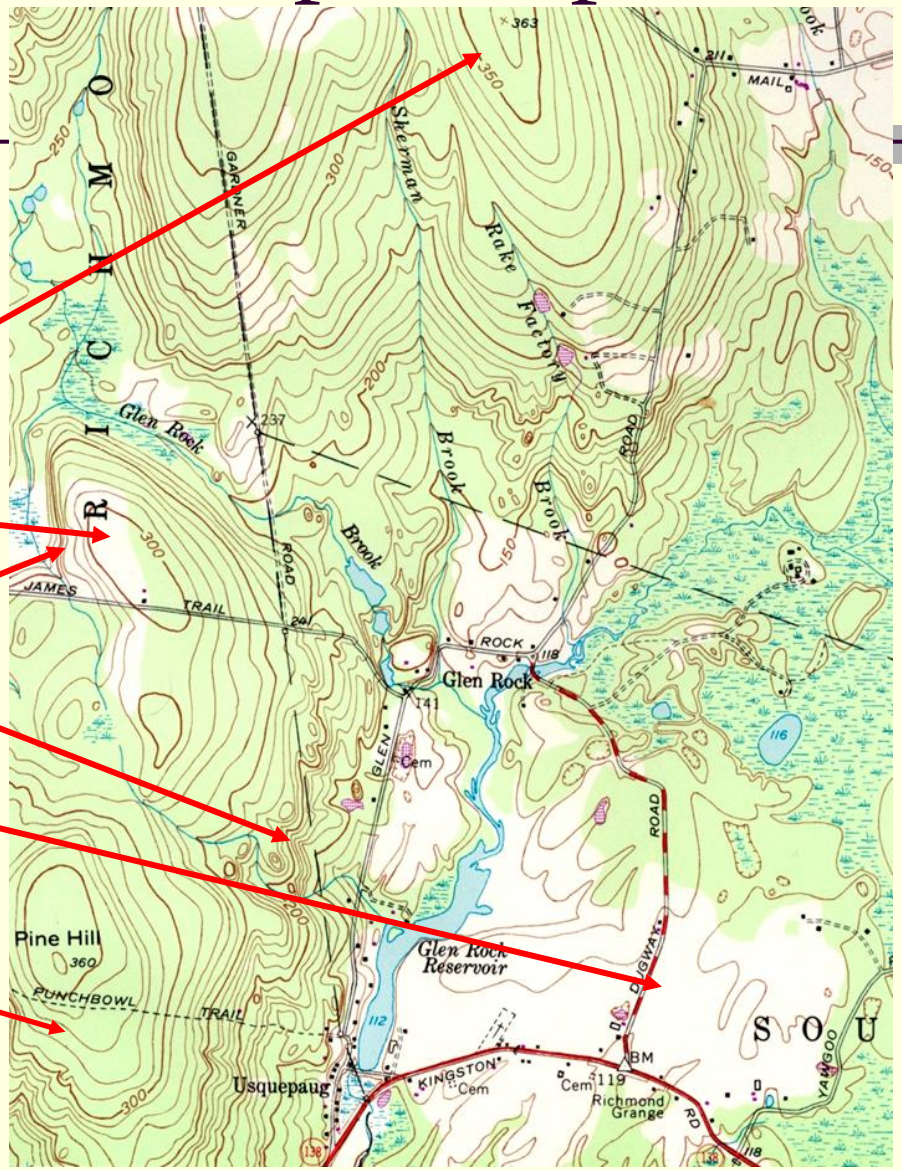
- Every fifth contour line is an **index contour** and is usually labeled.

- **Hilltops** are indicated by progressively smaller, closed contours.

- Contours close together indicate a **steep slope**.

- Contours far apart indicate a **gentle slope**.

- **Forest Cover** is green



How to read a topo map...

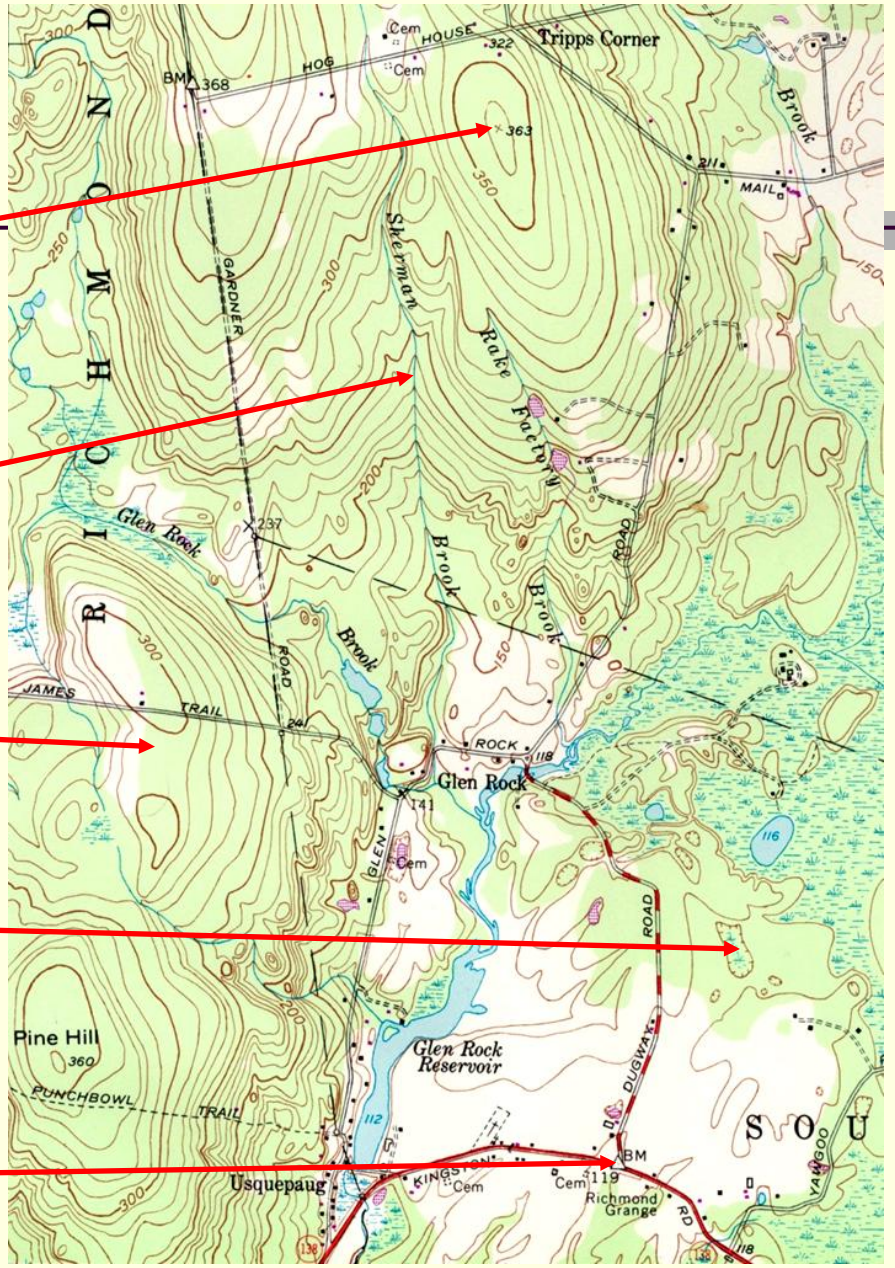
- A **spot elevation** is a point with a known elevation.

- When contour lines cross a stream, they form a "**V**" that always points **uphill**.

- A **saddle** is a lower area, often on a ridge, between two areas of higher elevation.

- **Depressions** are indicated by closed contours with inward-pointing ticks.

- A **benchmark (BM)** is a point of known position & elevation used as a point of reference for surveys



INSPECTION APPROACH

ENFORCEMENT / INSPECTION APPROACH

Enforce Approval Conditions? →

- The whole lot of conditions.
- Compliance that reflect directly to public concern or to any of pollution occurred.
- or maybe consultation should first take place.
- Study and observe owners/contractors attitude and commitment towards ESC.

Challenges in ESC Inspector

- No ESCP
- Inadequate ESCP
- Lump sum provision
- BQs not itemized
- Documentation
- Lack of knowledge by all
- EO not clear or no detailed job description
- SHEO experience only in safety and health not env
- EO no power over CM – issues of coordination
- Misunderstood ESC-SWM-Landscaping
- Nationwide acceptance to the existing situation wrt land development: Cost, no technical know-how, minimum pollution unavoidable, sideline matters, unskilled
- End of pipe
- Approaches to earthwork
- Formation level not achieved
- Slope cut and fill not completed
- Building contractor not yet come in
- Turf grass or sod delayed order
- Hydroseeding contractor not scheduled timely
- Maintenance, maintenance and maintenance
- Dewatering
- EO proved missing in action
- CPM

Inspection

- Pre-inspection
- ESCP Enforcement
- EIA Enforcement
- EMP Enforcement
- ESCP Consultation
- ESCP Notice – Part by Part approach

Gadget

- ESCP
- EIA AC
- Measuring Tape
- Protractor
- Sampling Equipment
- Notebook/ID/All sort of forms

Pre-con Meeting –First Visit

PRIOR TO NOTIFIED COMMENCE DATE .

Preconstruction Meetings

- **Related documents**.
- Clarify the erosion & sediment control, storm water objectives
- **Designate a contact person**
- Determine if the sequence & plan will work
- Ensure everyone reviews the Plan
- Remind everyone that BMPs are performance based and could require changes

DOCUMENTS

- CONTRACT DOCUMENT
- METHOD STATEMENT
- BQ 1

PERSONNEL TO BE ENGAGED?

- PP
- CONTRACTOR
- CONSULTANT
- PROJECT MANAGER
- RE
- SUPERVISOR
- COWS
- EO&SHEO

FOLLOW-UP VISIT

Conduct Off-Site Area Surveys

And

Observation

INSPECTION

BMPs Inspection Manual shall be used as a minimum references:

1) Borang Pemeriksaan BMPS
2) JADUAL 2 BMPs Description

INSPECTION IN PROGRESS

- **Walk the site**
- Take Notes
- Photos
- Reference Site Map/Drawing
- Sketch Map
- Tools
- Samples
- Citation
- Reports
- Sketch Map

WALK THE SITE

- PHASE
- SECTOR
- PLOT
- STRETCH
- PROJECT COMPONENT
- BMPs
- Etc
- FORMAT WALK THE SITE, Reporting Ex1, Ex2, Ex3→SENAI

THE INSPECTION AND ENFORCEMENT

Compliance

1. Determine that an erosion and sediment control plan for the site has been developed and approved, where applicable.

2. Determine that all specified practices have been installed and are being fully and properly maintained.

3. Determine that offsite sedimentation and turbidity in receiving waters are being prevented.

The Inspection

1. To be certain that all erosion and sediment control measures and other BMPs in the approved plan have been properly installed and maintained.

2. That erosion is being controlled.

3. That offsite sedimentation is being prevented.

4. That no turbidity is being generated in receiving waters.

Preparing for an Inspection

1. Check contour maps to see how the water flows through the site. Note where water enters and leaves the site. Determine the direction of flow, the watershed where the project is located, and the receiving water(s).

Preparing for an Inspection

2. Note critical or sensitive areas, such as a wetland, stream, conservation easement, pipe outlets, extreme slopes, etc., that may border the site. These areas must be well-protected from impacts.

Preparing for an Inspection

3. Look for adequate access and space to maintain erosion and sediment control measures during and after construction.

4. Make sure that the plan provides an installation sequence for the construction of BMPs, with measures for one phase being installed before the grading of the next phase begins.

Preparing for an Inspection

5. Study the construction schedule to determine whether there are long periods between phases of construction. If so, temporary seeding or other temporary soil stabilization may be required.

6. Check to make sure that the plan requires all surfaces to be stabilized as soon as possible after the completion of the project and within fourteen working days. The plan should state the preferred stabilization method.

Preparing for an Inspection

7. Ensure that all potential discharge points (wetland boundaries, stormwater management system outfall structures, construction entrances, etc.) are protected with sufficient BMPs to prevent pollutants from entering and impacting receiving waters. It may be also beneficial to divert run-on from adjacent property around highly erodible areas during construction.

Preparing for an Inspection

8. Make sure that maintenance plans are adequate and that the contractor's performance-monitoring procedures are specified. For example, it should be specified clearly whether the general contractor, subcontractor, or construction manager is to do the inspection and maintenance.

Preparing for an Inspection

9. Note any proposed borrow, stockpile, and waste storage areas on the plans and indicate which BMP will be used.

10. Make a list of specific items in the plan that you want to inspect closely when visiting the site. Highlight potential problem areas before leaving the office.

Preparing for an Inspection

11. Reviewing the ESCP should provide you with a solid grasp of the proposed project. From the review, you can identify parts of the erosion control system that may need to be strengthened and parts that should be watched carefully to see if the performance requirement is met. Your experience in the field and in a particular geographic area provides valuable assistance in the approval or revision of the submitted plan.

Preconstruction Meeting

1. Clarify the objectives of erosion and sediment control and inform all parties of the specific requirements for compliance in this project. Also, discuss the inspection procedures and schedule for major earth-moving activities.

2. Ask the responsible authority to designate a contact person for communicating compliance issues and concerns.

3. Be sure that all parties receive/view a copy of the approved erosion and sediment control plan.

Preconstruction Meeting

4. Inform the responsible authority and contractors that the program is performance oriented and that the plan may need to be updated during the course of construction. Inform all parties about procedures for changing the plans.

5. Try to hold the conference onsite so the group can walk the site. Evaluate the plans to determine whether the measures are appropriate, are located properly, and can be maintained once installed.

Preconstruction Meeting

6. Discuss the schedule for clearing and grading. Emphasize that sediment control measures should be installed before the actual grading begins, in order to capture sediment as it is generated. Be sure that the schedule allows for stabilizing surfaces with temporary and permanent measures between phases of grading and construction.

Preconstruction Meeting

- 7. Discuss the maintenance requirements so that the responsible authority and contractors know who is responsible for inspecting, cleaning, and repairing the erosion and sediment control measures. Regular inspection and maintenance may need to be supplemented with extra work if a large storm is forecast, or if there are cleanup activities after a large storm, or even if there is a higher-than-normal amount of site activity.

- 8. Establish open communications at the preconstruction meeting; this provides a good foundation for your relationship with the responsible authority during the project.

Before You Leave the Office

1. Take the time to review the plans thoroughly before you go to the site, even if you have already reviewed them when they were first submitted.

2. Outline your approach for each inspection. It is necessary to know in detail the erosion control system specified.

3. Always take a copy of the approved plans with you to the site for quick referral (unless they are already onsite).

4. Always bring the project file and necessary reporting forms.

5. Always take equipment for measuring (level, tape measure, turbidity sampling kit, etc.) and documenting (camera, camcorder).

6. Be sure to have all necessary personal protection equipment with you, such as boots, hard hat, sun and insect protection, rain gear, water, firstaid kit, radio, etc.

Inspecting the Site

At the construction site, ask yourself the following eight questions

1. Does this project have an approved permit?

2. Is the erosion and sediment control system installed as shown on the approved plans?

3. Is erosion being controlled onsite?

4. Is sediment being contained onsite?

5. Is potential turbidity in receiving waters being prevented?

6. Are inspections being recorded and available for review?

7. Are previous noncompliance issues and maintenance activities addressed within seven days of their occurrence?

8. Are other potential sources of pollution being controlled?

Inspecting the Site

- If the answer to **ALL** of these questions is YES, then the site is in compliance. File an inspection report stating that the site is in compliance and take field notes to support the inspection report. It is a good idea to keep track of the sites where the erosion and sedimentation control plans work well, so that you can show others examples of good sites.
- If the answer to **ANY** of the above questions is NO, then the site is not in compliance. File an inspection report listing the items that are not in compliance. Your field notes should describe precisely each noncompliance issue and its location. Remember that others may need to use your field notes, so make them readable and understandable.

The following points will help you in checking for compliance

1. Carry a set of the approved plans to the site for your reference. They are necessary to determine what measures make up the erosion control system and how they are to be installed and maintained.

2. Take detailed, orderly field notes as you do the inspection. Be sure that your notes are neat, concise, and complete (remember, they may be needed as evidence in court).

The following points will help you in checking for compliance

3. Check in with the job superintendent when you arrive so that the contractor knows who you are and what you are doing.

4. Walk the perimeter of the site. This gives you a good idea of the terrain and alerts you to any problems with offsite water and sedimentation.

The following points will help you in checking for compliance

5. You may want to start your inspection from the lowest point and work your way upstream through the stormwater management system/site. This helps to make you aware of the amount of sediment leaving the site and can help you locate its source.

6. If sediment is flowing offsite, go far enough downstream to see the extent of the damage. In these situations, it is important to document the damage. Estimate the sediment volume. Photos and videotapes make good evidence. Be sure to write the time, date, and other items in your notes and on the inspection report. If there are other sites contributing to downstream impacts, make sure to document these as well.

The following points will help you in checking for compliance

7. If turbidity is present in nearby waters, sampling upstream and downstream of the discharge point can provide the best possible evidence that the site is in or out of compliance.

8. Bring the necessary tools to measure the devices and disturbed areas in the field. Be sure that basins and traps are sized according to the plans, that channels and diversions have the proper grade, and that contributing areas for the control devices are no larger than those used in the design.

The following points will help you in checking for compliance

9. Pay particular attention to the maintenance of erosion and sediment control measures. All measures require regular maintenance and may require special attention after severe storms.

10. Keep in mind that when certain structural measures fail from improper installation or maintenance, more offsite sediment damage may occur than if the device had not been installed.

11. Always fill out an inspection report for each trip to a site while you are at the site. The pertinent inspection points are fresh in your mind and you can recheck items that may be in question.

Causes of Noncompliance

1. The responsible party has made little or no effort to comply.

Causes of Noncompliance

2. There are design errors in the erosion control system or the site conditions have changed

Violations and failures may occur because the design was inadequate or the site conditions have changed since the plan was prepared. In this event, the plan needs to be revised and approved. The inspection report should note all items of noncompliance and the need for a revised plan. Compare the original design with conditions in the field. Look for changes in the site conditions and construction plan. Ask yourself the following questions when checking for violations caused by design errors and changes:

1. Are the planned measures retaining the sediment onsite?
2. Are there modifications to the plan?
3. Are ground covers adequate for the slope and orientation of the areas to be protected? Is the slope too steep for the ground cover chosen?
4. Is the perimeter protected, given the conditions at the site?
5. Have the contributing drainage areas changed significantly, thus potentially overloading the control measures? Are additional control measures needed?
6. Is the maintenance plan adequate for the existing conditions?

Again, appropriate enforcement action should be taken.

Causes of Noncompliance

3. The installation or maintenance of a measure is faulty or inadequate.

Most noncompliance occurs because measures were not installed correctly or maintained properly.

Determining the reasons that the measures are failing requires technical knowledge about the devices and how to construct them properly.

Causes of Noncompliance

4. Severe weather has occurred.

Occasionally, a meteorological event or a series of events that cannot be planned for results in noncompliance. These types of issues must be handled carefully. For example, if a site receives more than six inches of rain in each of three separate storm events over a period of a week or two, there is a good chance that the BMPs used will have at least partially failed.

Another example is a tropical system, which can produce well over a foot of rain. These types of mitigating circumstances must be taken into account using the following two guidelines:

1. If the storm event was predicted, did the site take all “reasonable” steps to minimize any potential adverse environmental impacts?
2. Regardless of whether the storm was predicted, what steps did the site take to address and mitigate the impacts to return the site to compliance, and how quickly did they take these steps?

Causes of Noncompliance

Remember when evaluating a noncompliance issue established procedures and policies of your agency and to take into account whether a violation was caused by ignorance, belligerence, or other reasons.

Inspection Reports

Inspection reports can have many different formats, styles, and looks. However, the most important aspect to designing or using an inspection report is making sure that it addresses all of the requirements of your jurisdiction. Some inspection reports only address physical issues, while others also handle administrative issues. In general, though, it is recommended that whatever report form you use, adhere to the following procedures so that you have a clearly worded, defendable, and usable product:

Inspection Reports

Document all findings on the inspection forms:

Forms should be filled out completely with no blank spaces. If something is not applicable (N/A), then indicate N/A. If something was not checked, indicate N/C. There should be no blank cells. Your inspection form becomes part of the site's (or your office's) administrative record, so make it accurate, detailed, impartial, and defendable.

A Notes/Comments section is suggested so you can expand on some items that may be performance based but that are not permit compliance issues—for example, "It is recommended that subcontractors not be allowed to park on the lots, as it causes more dirt to be tracked into the road." While this is not a permit-related compliance item, it is a good suggestion that can be offered.

Make sure that the inspection date is indicated.

Make sure to indicate what type of inspection this is: Initial, Follow-up, Weekly, After Rain Event, Monthly, etc.

Inspection Reports

Only indicate facts on the inspection report, not opinions.

A signed hard copy of the report should be left at every inspection site if possible.

Let your site contact know that you have completed your inspection. At the very least, make sure to debrief them on all noncompliance issues.

Understand that the construction site, the ESCP, and the inspections do not occur in a vacuum. There needs to be dynamic interaction between all of these elements for full compliance to be achieved.

PART 5

DOE's Officers field inspection

- Multiple Sites
- Senai Airport City Hands-on Inspection Concept and Learning Outcome

Performance Monitoring

Performance Monitoring

- Install
- Inspect
- Maintenance
- Reporting

Performance Monitoring – Job Function

- *Environmental Officer* (EO) hendaklah bertanggungjawab melaksanakan perkara-perkara berikut :-
- Penyeliaan kerja-kerja kawalan hakisan dan sedimen di tapak untuk pelaksanaan ESCP dan pengurusan alam sekitar;
- Kemaskini Buku Harian Tapak;
- Kemaskini Rekod Hujan;
- Mengambil dan merekod bacaan Rekod Tolok Hujan;
- Menjalankan pemeriksaan ke atas langkah-langkah kawalan serta struktur *Best Management Practices* (BMPs) setiap hari;
- Mengadakan mesyuarat tapak setiap 2 minggu bersama pemaju dan kontraktor;
- Menjalankan pengukuran in-situ parameter kekeruhan di takat pelepasan dalam tempoh tidak melebihi 30 minit selepas hujan. Sekiranya hujan berterusan melebihi 24 jam, pengukuran hendaklah dijalankan sekali setiap hari. (Kegagalan mematuhi syarat ini perlu dicatatkan dengan alasan yang kukuh dan munasabah)
- Penyelenggaraan semua komponen BMPs hendaklah dilaksanakan dan rekod penyelenggaraan disediakan dan disimpan dengan baik untuk tujuan pemeriksaan.
- Pemeriksaan terhadap semua komponen BMPs hendaklah dijalankan dalam tempoh 24 jam selepas catatan hujan adalah bersamaan atau melebihi 12.5 mm.

Performance Monitoring – Reporting

EO2DOE BRIEFING SAMPLE

Note:

By conducting all those installation, inspection and maintenance at jobsite will make possible to produce report or briefing evidently.

LEGAL (EIA)

LEGAL REQUIREMENTS

Approval Conditions :

EIA-EMP-ESCP

EIA AC

LEGAL REQUIREMENTS

Arahan Pejabat Bil 5 2012 (Syarat EIA)

PART VI

Reporting and documentation of DOE's officers inspection report.

CONCLUSION

- KSU

CONCLUSION

Lesson learned from this course:

- 1. DOE/DID officers to be technically competent in managing SESC at Construction sites.
- a) Understanding of SESC Vs BMPs
- b) Estimation of soil erosion and sediment
- c) Inspection skill on SESC
- 2. Communication skills with project developers and contractors on the importance of SESC BMPs
- 3. Method of executing Performance Monitoring on SESC BMPs especially during installation, inspection and maintenance (2I's1M) and understanding the corrective actions to be taken by developers or contractors for inadequate measures at site.
- 4. Capability to present SESC BMPs inspection report**.**
- **5. To fulfill the KSU directive of transforming DOE and DID to execute 1NRE Enforcement**

THANK YOU