EWCE 461

River Engineering and Flood Management

3 Credit Hour

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Lecturer

Department of EWCE

Sec-B: Flood Management- 1.0 Credit

Syllabus of Sec-A: 2.0 Credit

- Behavior of alluvial rivers
- River channel pattern and fluvial processes
- Aggradations and degradation
- Local scours
- River training and bank protection works
- Navigation and dredging of sediment movement in river channels
- Bed form and flow regimes
- Case studies

Syllabus of Sec-B: 1.0 Credit

- Flood and its causes
- Flood process in urban and rural area
- Flood management measures: structural and non-structural measures such as dams, reservoirs
- Diversion channels and floodways
- Improvement of channel capacity by dredging
- Land management, Flood proofing, Flood zoning, Flood hazard mapping
- Flood forecasting and warning, Flood damage assessment

Course Outcome (CO)

CO1	Be able to explain the relationships of river planforms with the river Morphological parameters
CO2	Be proficient in calculating and estimating sediment distribution and sediment load of a river
CO3	Be able to apply different engineering perceptions to estimating the scour depth.
CO4	Be familiar with different bank protection and river training work and understand the dredging and navigation processes
CO5	Apply knowledge of flood processes and management strategies to analyze and assess flood risk.

Reference Books

- Any book on Flood Management and Mitigation
- **Water Resources Engineering by R. K. Linsley, J. B. Franzini, D. L. Freyberg and G. Techobanojlous**
- Fluvial Processes in River Engineering (1992) by H. H. Chang
- **Flood Control and Drainage Engineering, Fourth Edition, S.N. Ghosh**
- Urban Flood Management; by Chris Zevenbergen (Author), Adrian Cashman (Author), Niki Evelpidou (Author), Erik Pasche (Author), Stephen Garvin (Author), Richard Ashley (Author)
- Flood Risk: Planning, Design and Management of Flood Defence Infrastructure, By: Paul Sayers
- Vulnerability and Adaptation to Climate Change in Bangladesh: Processes, Assessment and Effects by MD Aboul Fazal Younus

Lecture-7

Flood Proofing

WHAT IS FLOOD PROOFING??

-It is a process for preventing or reducing flood damages to the structure and/or to the contents of buildings located in flood hazard area.

-It involves altering or changing existing properties.

-Can be incorporated into the design and construction of new buildings.

Flood proofing is done

-By making structural or non structural changes.

-By adjustment in the design, construction.

BASIC TECHNIQUE

- **Raising the foundation above the flood level using fill or supports.**
- **Surrounding the building with flood proof masonry or concrete walls or berms.**
- **Sealing all openings below the flood line.**

Flood proofing on the basis of types of protection

- Permanent measure
- Contingent measures
- Emergency measures

ADVANTAGES OF THE TECHNOLOGY

- Can be undertaken by individual property owners without waiting for Government.
- Much more cost effective approach to reducing flood risk.
- Does not require the additional land that would be needed to offer the same degree of flood protection through seawalls or dikes.
- Flood proofed structures are less likely to fail during floods.

DISADVANTAGES OF THE TECHNOLOGY

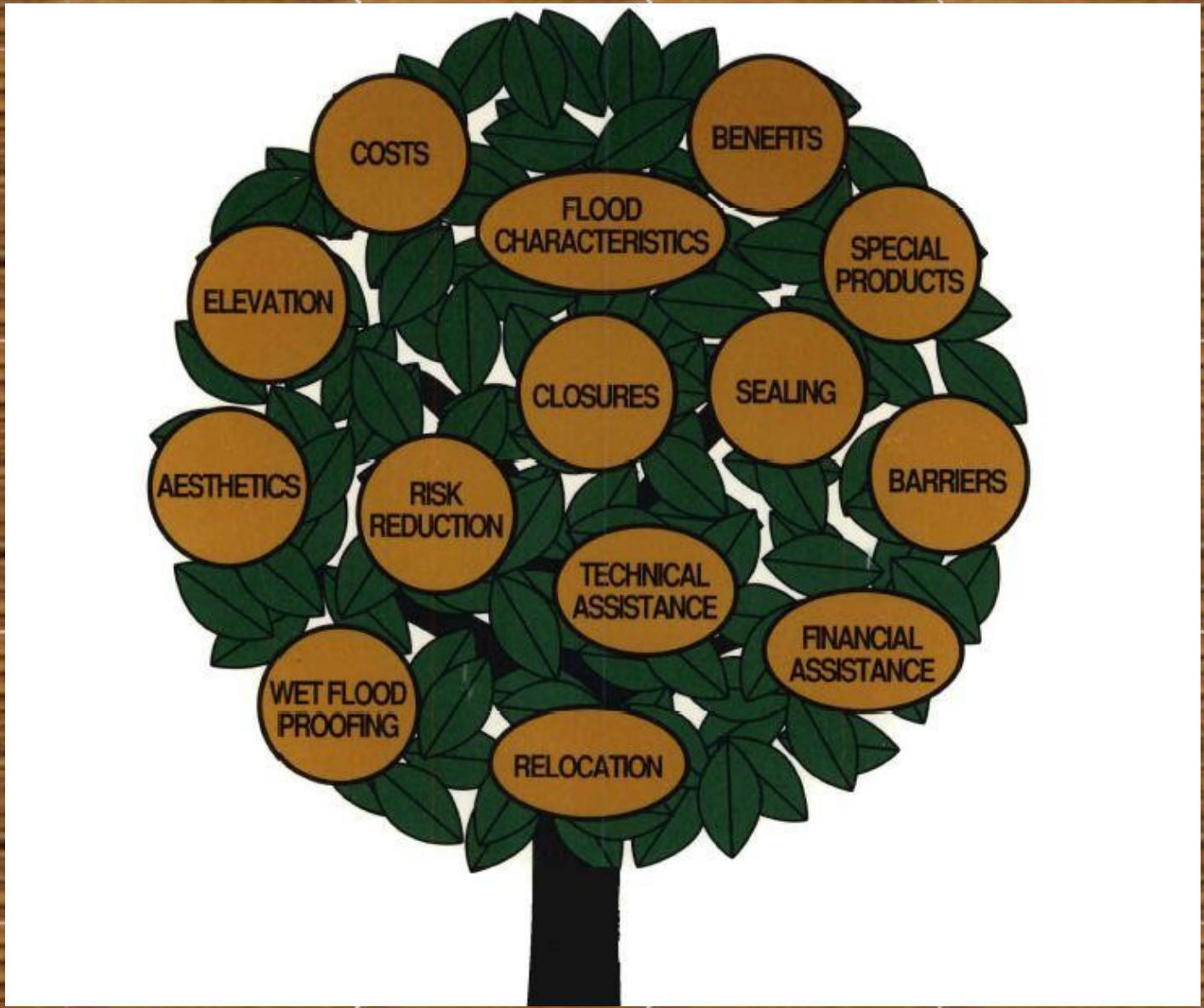
- Require current knowledge about flood Hazards, flood mapping and flood warning studies.
- Is effective where flood level is low.
- Does little to minimise damage caused by high velocity flood flow and wave action.

DEVELOPING A FLOOD PROOFING STRATEGY

Considerations:

- Analysis of Flood Hazards
- Site Characteristics
- Building Characteristics
- Regulations
- Appearance
- Accessibility
- Benefit/Cost Analysis

How to choose your option



Analysis Of Flood Hazards

- Determination of potential depth of flood.
- To calculate the force acting upon a structure(hydrostatic, hydrodynamic, and impact loads).
- Hydrodynamic forces consist of frontal impact by the mass of moving water.
- Impact loads are imposed on the structure by objects carried by moving water.

Site Characteristics

- Should be evaluated with respect to mapped floodplains and floodways and the potential for local flooding from storm water conveyance elements.
- Soil properties during conditions of flooding(saturated soil pressures, allowable bearing capacity, potential for scour, frost zone location, permeability, and shrink-swell potential.)

Building Characteristics

- The building should be evaluated with respect to the type of construction and the condition of the structure.

- The type of foundation, foundation materials, wall materials, and the method of connection all play a role in deciding which retrofitting method will be most applicable.

Appearance

- The final appearance of a building and property after retrofitting will depend largely on the retrofitting method used and the **F**lood **P**rotection **E**levation (FPE**)**.
- A change in appearance will not necessarily be a change for the worse.

Accessibility

- Accessibility refers to how easy or difficult it is to routinely reach and enter the building after the retrofitting project is completed.

Human Intervention Required

- For retrofitting methods that require human intervention, owners must be willing, able, and prepared to take the necessary action.

- The owner must always have adequate warning of a coming flood and must be present or near enough to reach the building.

Cost Analysis

- The cost of retrofitting will depend largely on the retrofitting method used and the FPE.

- In general, costs will increase as the FPE increases, but there may be tradeoffs between alternative methods.

Flood Proofing Reference

- The Federal Emergency Management Agency (FEMA)

- FEMA has published numerous references on the subject of flood proofing (FEMA 1984, 1986a, 1986b, 1991, 1993a, 1993b, 1993c, 1993d, 1993e, 1994, 1995, 1996)

Methods of flood proofing

FEMA outlines six methods of flood proofing:

- **Elevation**
- **Wet Flood Proofing**
- **Relocation**
- **Dry Flood Proofing**
- **Levees and Floodwalls**
- **Demolition**

Basic approaches to floodproofing



Relocation



Elevation



Floodwalls



Dry floodproofing



Wet floodproofing

ELEVATION

- Raising the structure so that the lowest floor is above the flood level.
- Can be done by elevating the entire building, including the floor, or by leaving the building in its existing position and constructing a new, elevated floor within the building.

Advantages

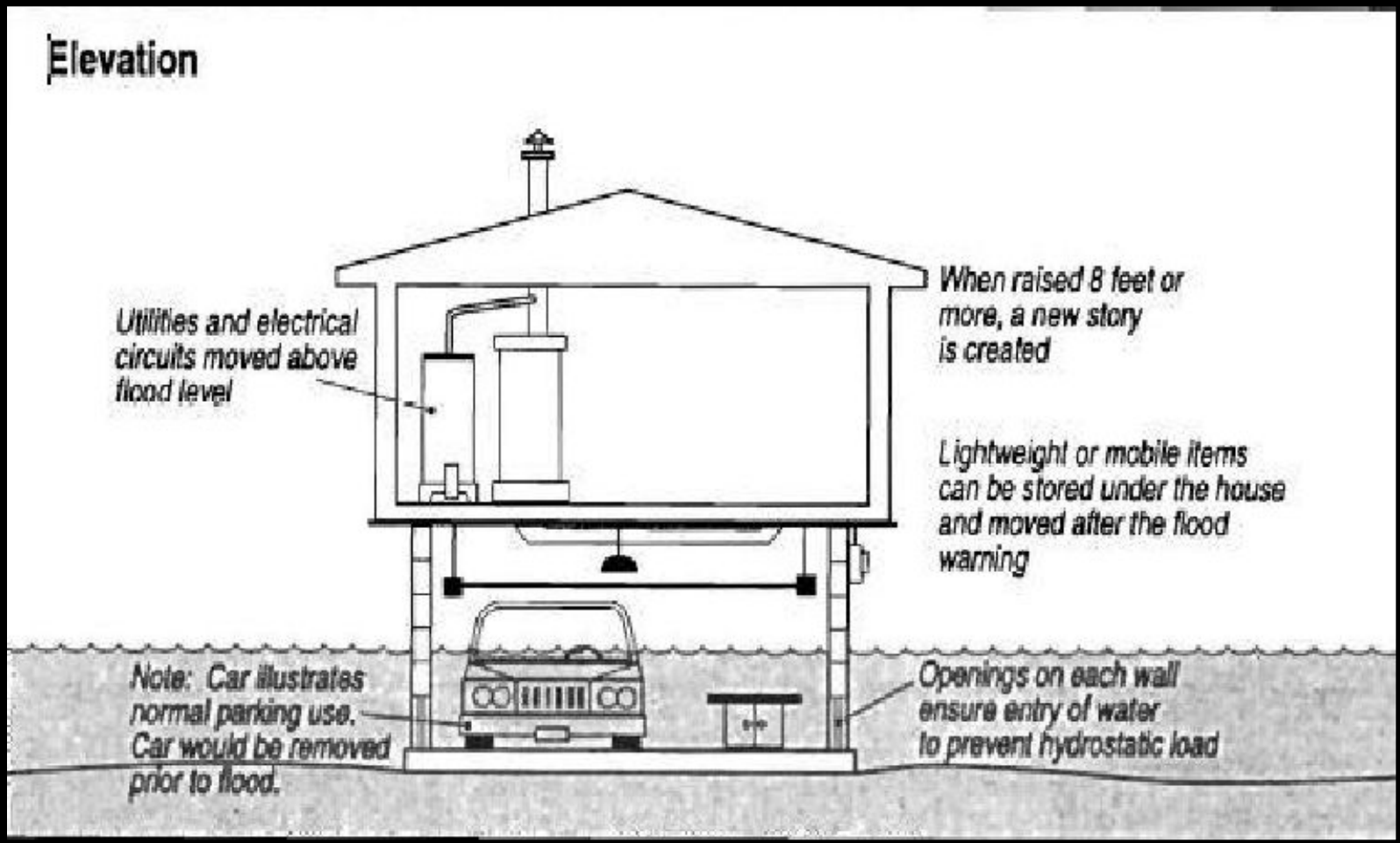
- ❑ Well known, and qualified contractors are often readily available.
- ❑ Reduces the flood risk to the building and its contents.

Disadvantages

- Cost may be prohibitive.
- Access to the building may be adversely affected.
- Additional costs are likely.

- Lighter wood frame buildings are easier and cheaper to raise than masonry buildings. Masonry buildings not only are more expensive to raise, but are susceptible to cracks.

Elevation method





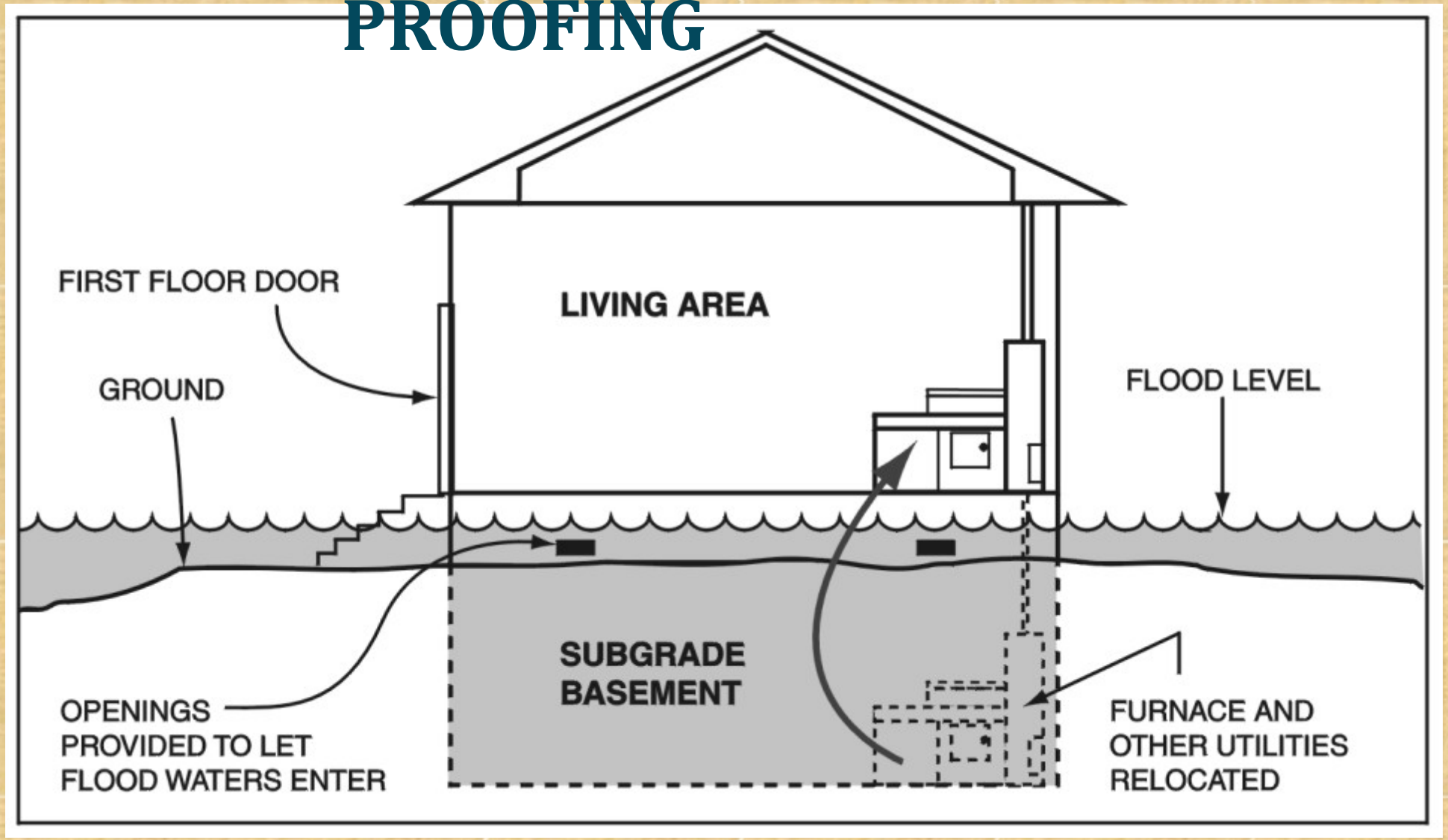


WET FLOOD PROOFING

- Is done by modifying the uninhabited portions (such as a crawl space or an unfinished basement) so that floodwaters will enter but not cause significant damage to either the building or its contents

- Interior and exterior hydrostatic pressures is equal.

WET FLOOD PROOFING



Advantages

- The loads on walls and floors will be less than in a dry flood-proofed building.
- Wet flood-proofing measures are often less costly than other types of retrofitting.
- The appearance of the building is usually not adversely affected.

Disadvantages

- Limits the uses of the floodable area of the building.
- Periodic maintenance may be required.
- Extensive cleanup may be necessary.

RELOCATION

Moving accommodation place to high ground, outside the flood hazard area

Relocating usually involves jacking it up and placing it on a wheeled vehicle, which delivers it to the new site.

Advantages

- Significantly reduces flood risk to the building and its contents.
- Techniques are well known, and qualified contractors are often readily available.

Disadvantages

- Cost may be prohibitive.
- A new site is to be located and purchased

RELOCATION



DRY FLOOD PROOFING

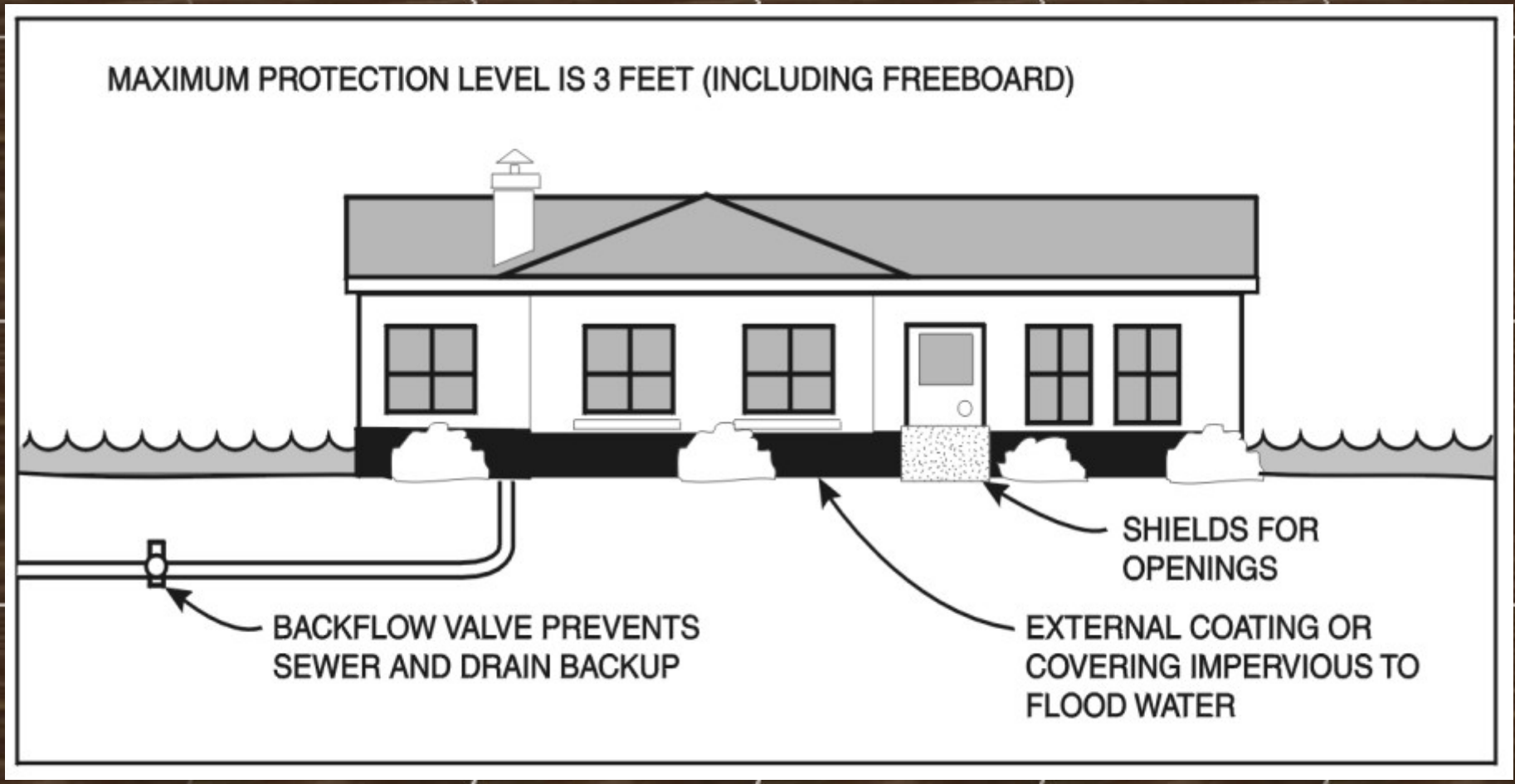
-Requires sealing the walls with waterproof coatings, impermeable membranes, or supplemental layers of masonry or concrete.

-The flood characteristics that affect the success of dry flood proofing are flood depth, flood duration, flow velocity, and the potential for wave action and flood-borne debris.

Precautions

It is very tempting for the owner of a dry flood proofed building to try to keep the flood out if floodwaters get deeper than two or three feet. This can result in collapsed

Dry Flood Proofing



Advantages

- Less costly than other retrofitting methods.
- Does not require the additional land that may be needed for levees and floodwalls.

Disadvantages

- Ongoing maintenance is required.
- Flood shields may not be aesthetically pleasing.
- Damage to the exterior of the building and other property may not be reduced

LEVEES AND FLOODWALLS

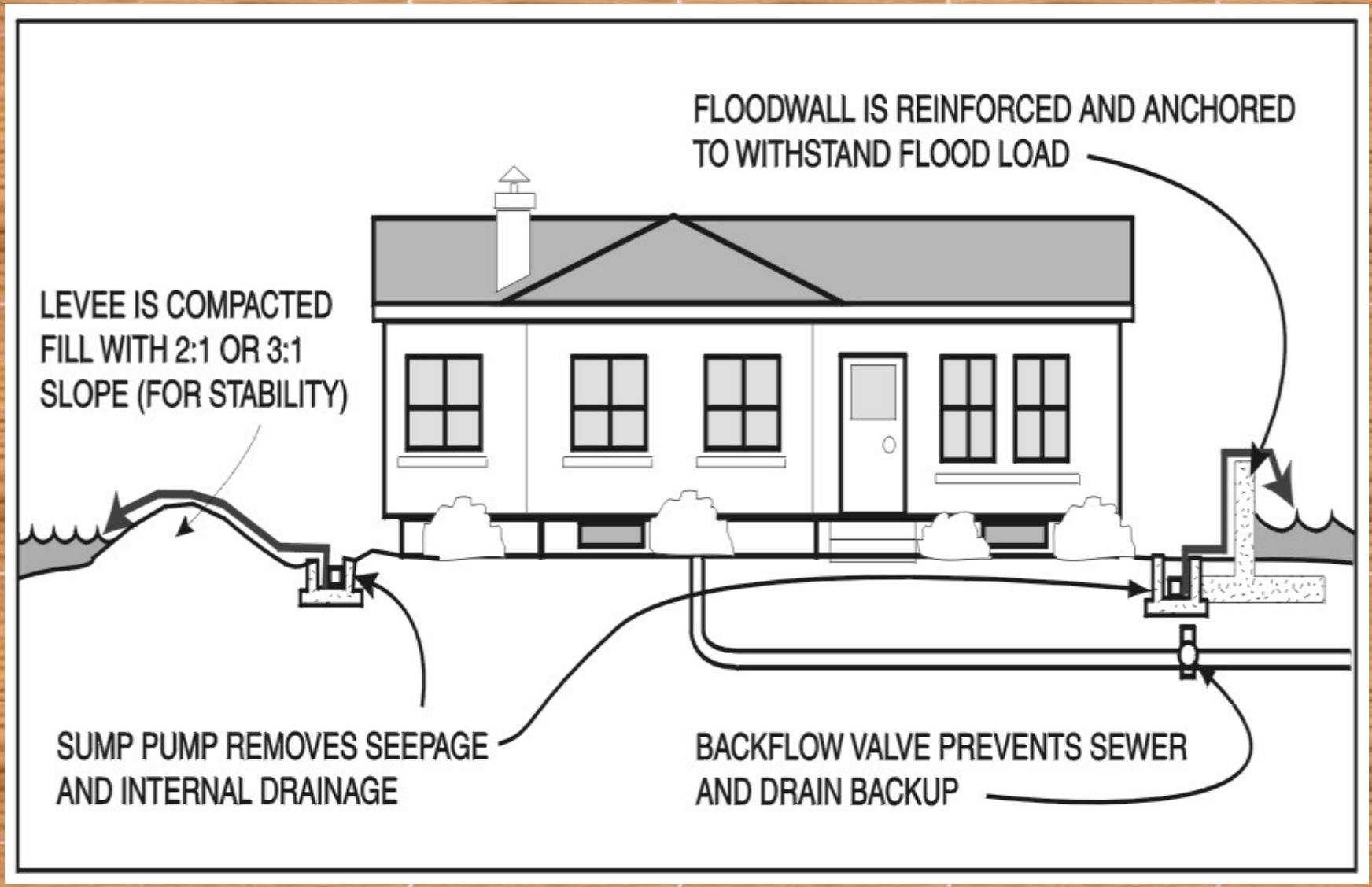
- Levees and floodwalls are types of flood protection barriers

- Greater depths result in greater water pressures, so taller levees and floodwalls must be designed and constructed to withstand the increased pressures.

- Levees are natural barriers made of clay, sand or sandy clay.

- Floodwall types are made of cement block bricks or poured concrete.

Levees and Floodwalls



Advantages

- No significant changes to the building will be required.
- The building can be occupied during construction of levees and floodwalls.

Disadvantages

- An interior drainage system must be provided.
- Local drainage can be affected, possibly creating or worsening flood problems for others.
- A large area may be required for construction, especially for levees.

DEMOLITION

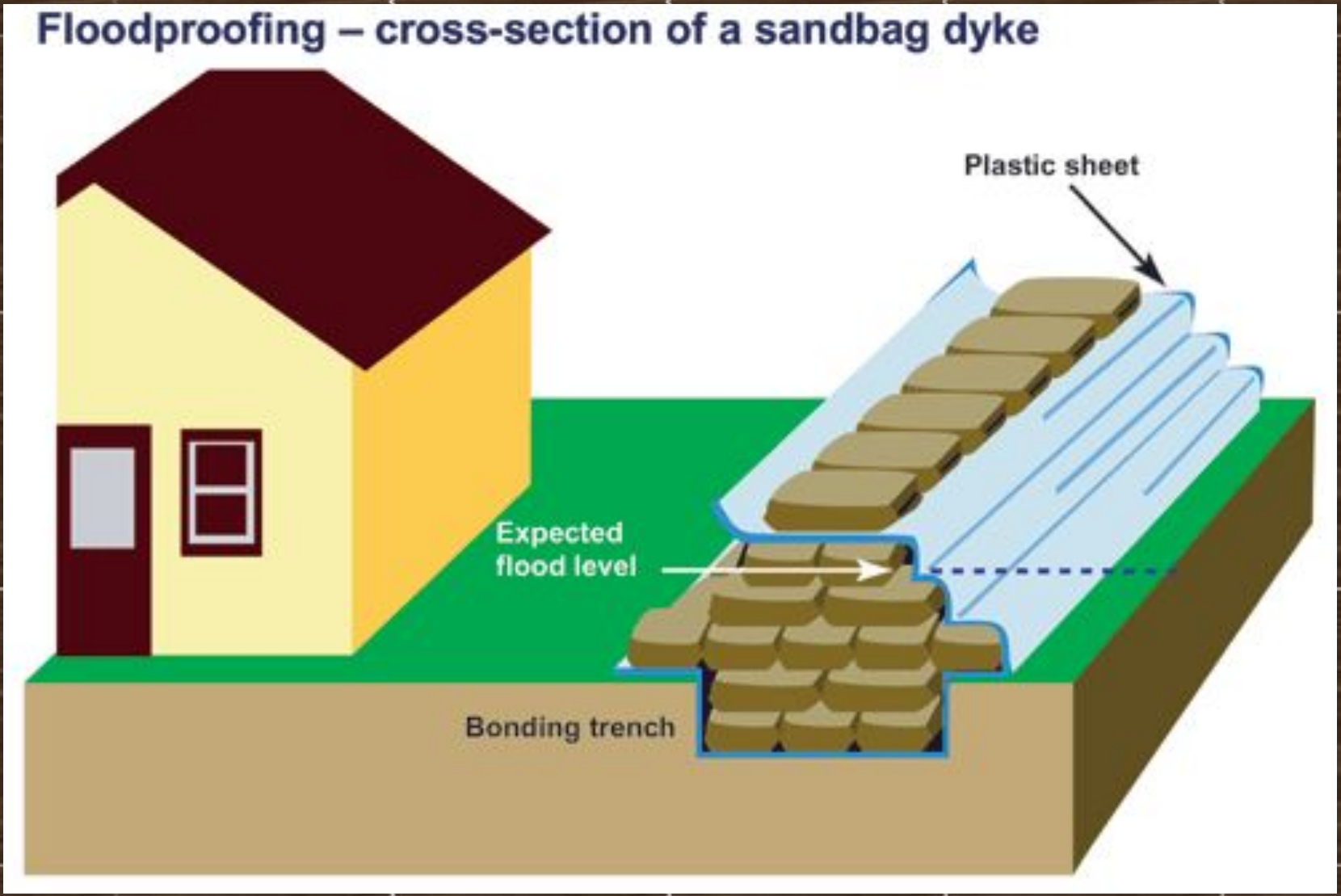
- Means tearing down a damaged house and re-building it on the same place or a less vulnerable spot.
- May be the most practical of all when a building has sustained extensive damage, especially severe structural damage.
- Whether rebuilding or moving, the damaged building must be torn down and the site restored.

❖The advantages and disadvantages of demolition depend on the decision of where to rebuild the structure.

EMERGENCY FLOOD PROOFING MEASURES

- Emergency flood proofing measures are set in motion on short notice.
- The techniques commonly used entail building dykes or barriers using whatever natural or stored materials may be on hand at the site.
- Hard work involved.

EMERGENCY FLOOD PROOFING MEASURES



Case study: Chars Livelihoods Programme (CLP)

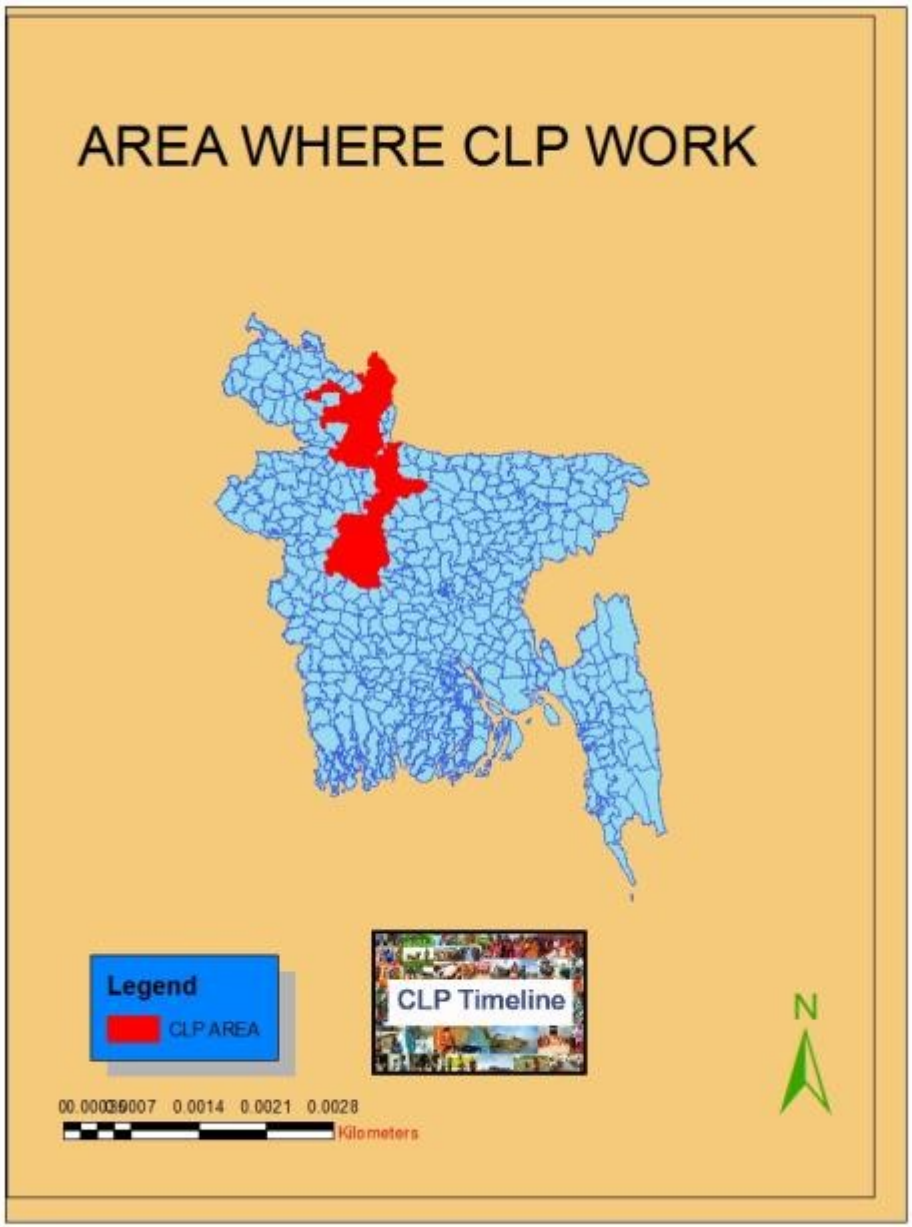
Location:

-Char Livelihood Program(CLP) is implementing in the Northern part of the country covering 150 char Unions in 28 Upazilas under five districts namely- Kurigram, Jamalpur, Gaibandha, Bogra and Sirajganj along the river Brahmaputra.

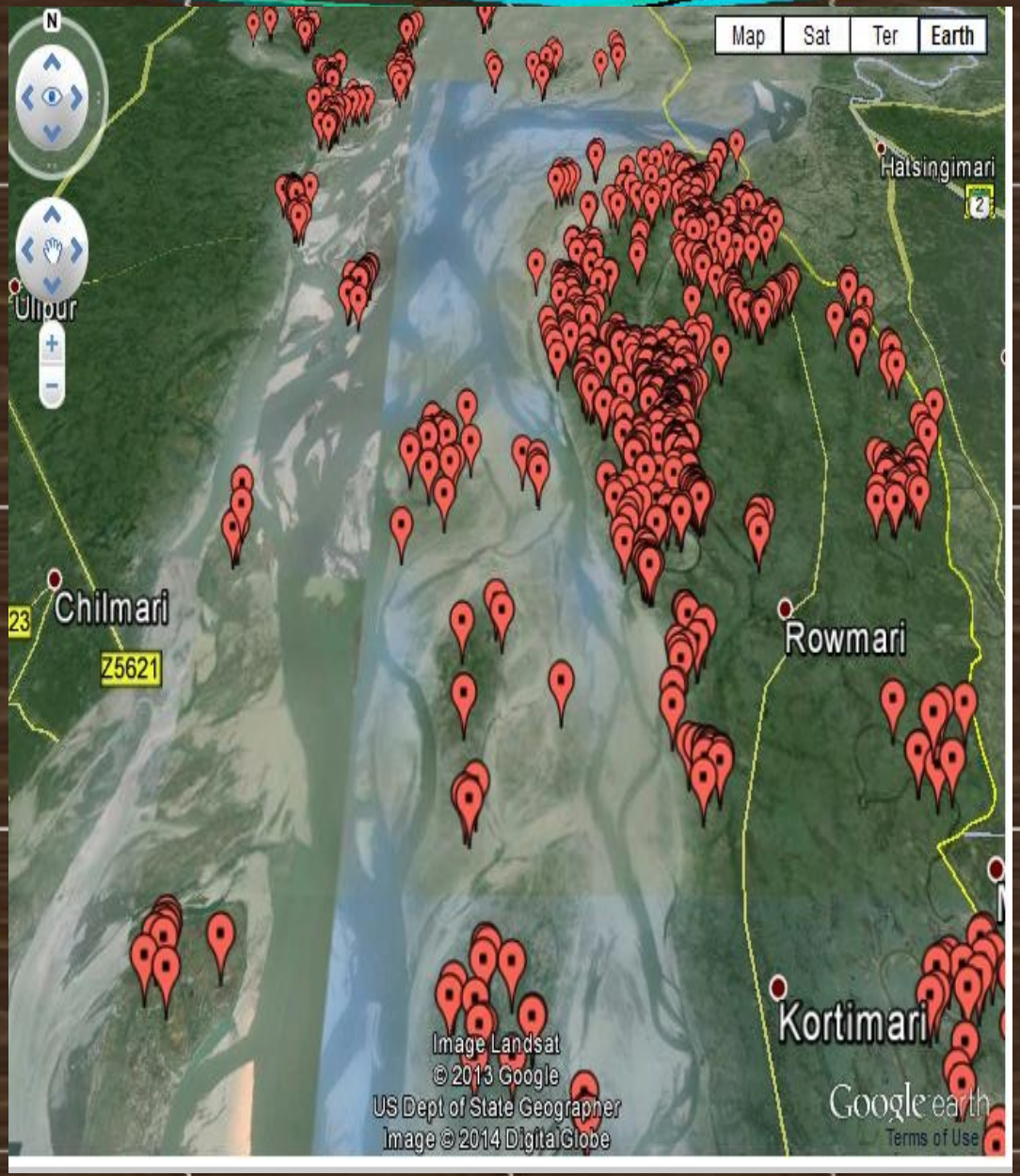
Target

To reduce vulnerability of char dwellers through targeted provision of infrastructure and services.

Project area are shown in Banglades h map



Implemented project are shown by google earth



Activities of CLP

-Flood protection

-Protection of homesteads and communal facilities from erosion

They are helping in sustainable way





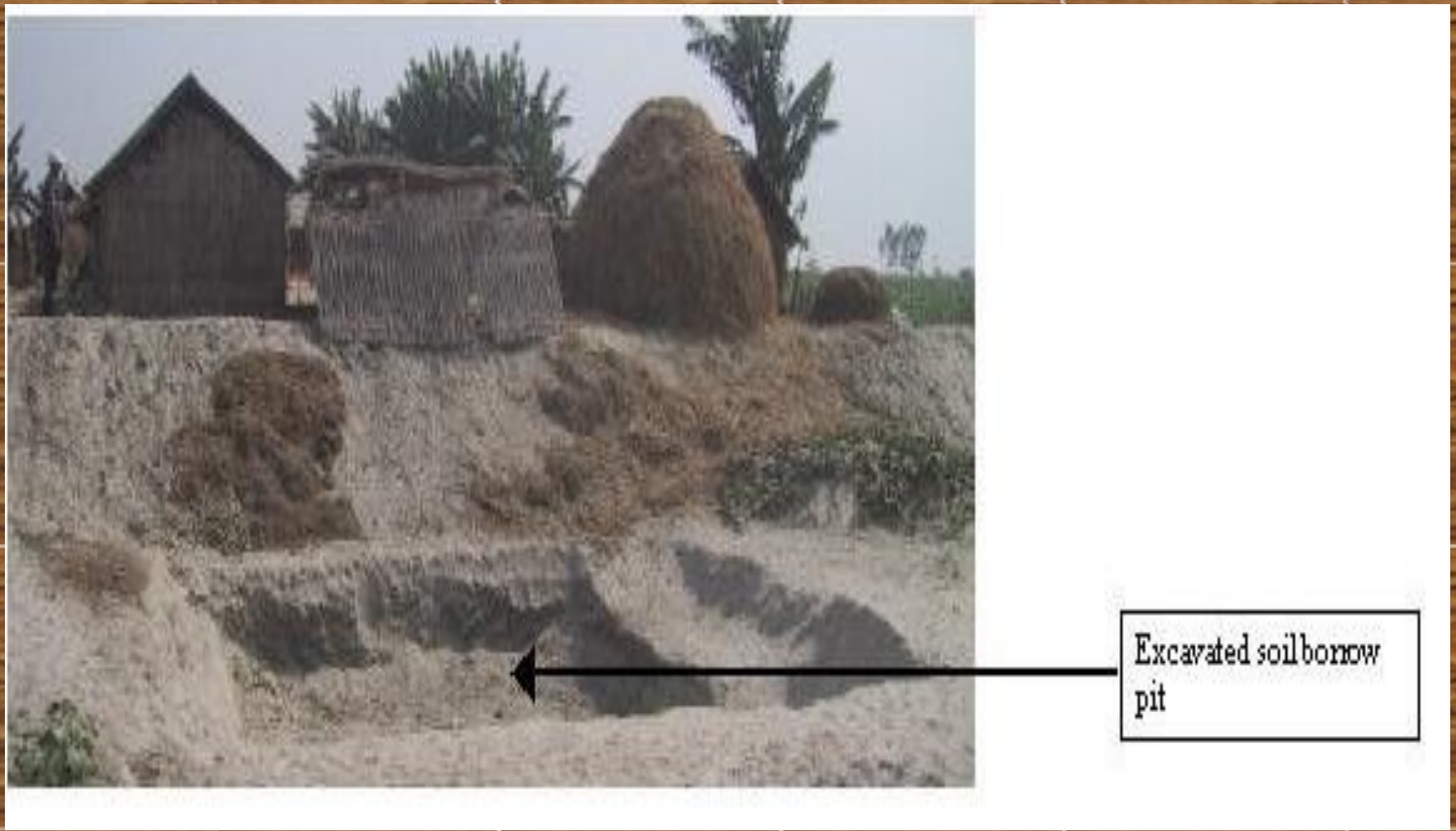
Strategy to development

- Flood plinth level study
- Flood hazard study
- House clustering
- Connecting road
- Providing training

Women involved in homestead raising



PROVIDING TECHNICAL RECOMMENDATION IN FLOOD PROOFING



Making the strategy sustainable



Turfing and plants to protect the raised homestead from erosion

THANK YOU