उत्तराखण्ड सरकार

Overview of construction works at 3 model sites

Version-2

The Project for
Natural Disaster Management
in Forest Areas in Uttarakhand

Outline of the Project

In June 2013, as an aftereffect of heavy rains in the Himalayan region, the unexpected large-scale destruction due to floods and landslides caused tremendous loss to human life and property in Uttarakhand. This is one of the largest natural calamities in India.

Responding to this, the disaster management component of the Yen Loan project, "Uttarakhand Forest Resource Management Project" (UFRMP) and the technical cooperation project, "Project for Natural Disaster Management in Forest Areasin Uttarakhand" have been commenced to enhance the capacity of Uttarakhand Forest Department (UKFD) and to improve the preparedness of the people in Uttarakhand against sediment-related disasters in future.

At the first Joint Coordinating Committee (JCC) of the Project held in August 2017, three (3) sites, i.e., Nirgad, Jawadi and Padli were decided as model sites for implementing the reconstruction work with maximizing exhibition effect and showcasing the maximum techniques.

Objective of the Project

1. Overall Goal
   (1) Erosion control works for slope disaster management in forest area are appropriately implemented in Uttarakhand.
   (2) Knowledge and technology on erosion control works are disseminated to other Himalayan states.
2. Project Purpose
   System to appropriately implement erosion control works for slope disaster management in forest area is established in Uttarakhand.
3. Outputs
   (1) Technology for erosion control which is adapted in Uttarakhand is developed.
   (2) Knowledge and skills on erosion control of staff in UKFD and another related organization are improved.
   (3) Appropriate technology developed for erosion control in forest area is shared in the state and with other Himalayan states.
   (4) Collaboration with UFRMP for implementing the interventions under the erosion control and sediment disaster mitigation component is achieved.

Project period

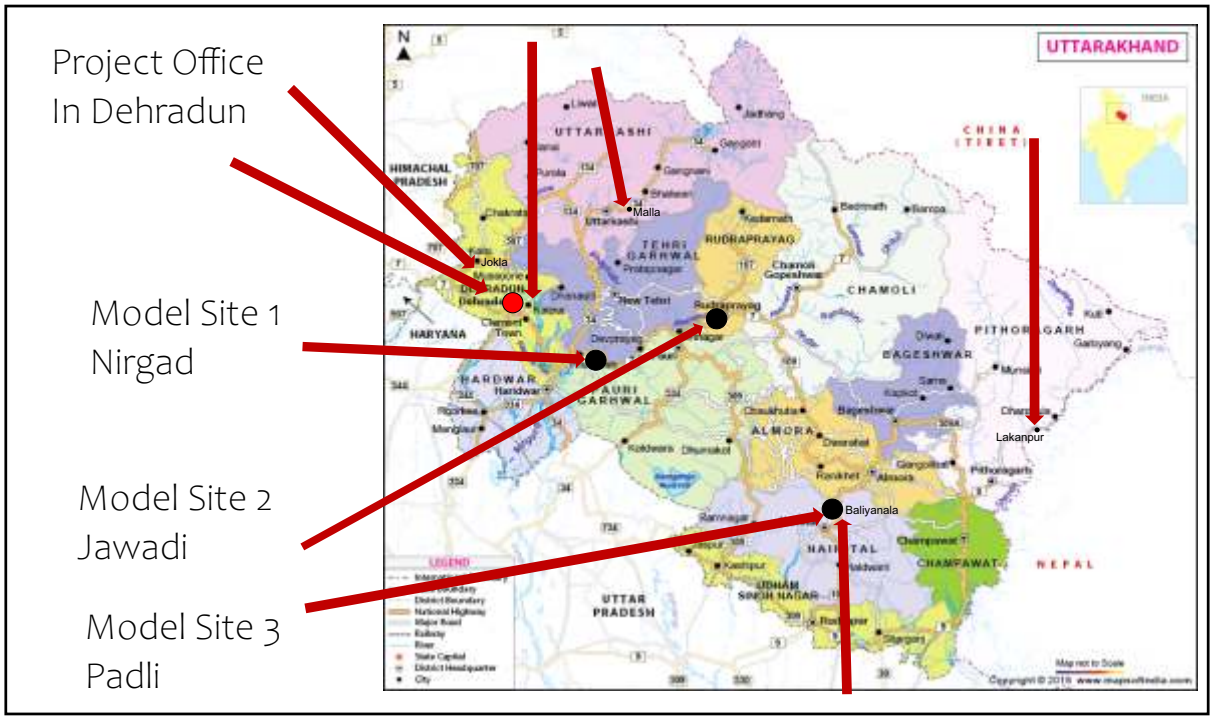
Five (5) years from 26 March 2017 originally

Extended for two (2) years

Concept of Chisan

Chisan is the Japanese term which means restoration and erosion prevention works in forest areas. The objective of Chisan is to prevent and mitigate disasters and to contribute to water conservation through appropriate construction of erosion control facilities and maintenance of forests.

Location of 3 model sites in Uttarakhand



Nirgad near Rishikesh as Model site 1,

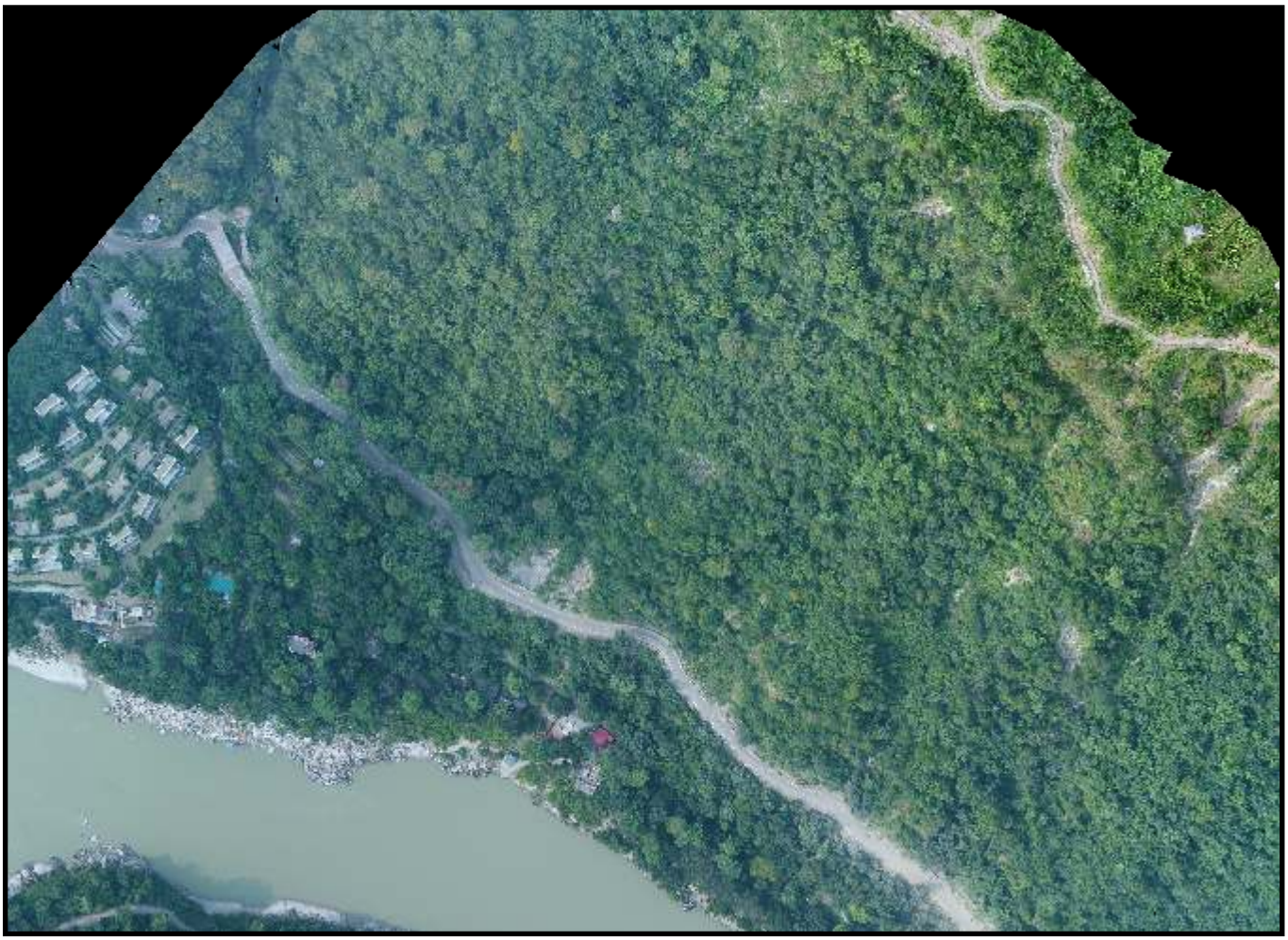
Jawadi near Rudraprayag as Model site 2, and

Padli near Nainital as Model site 3.

Contractor

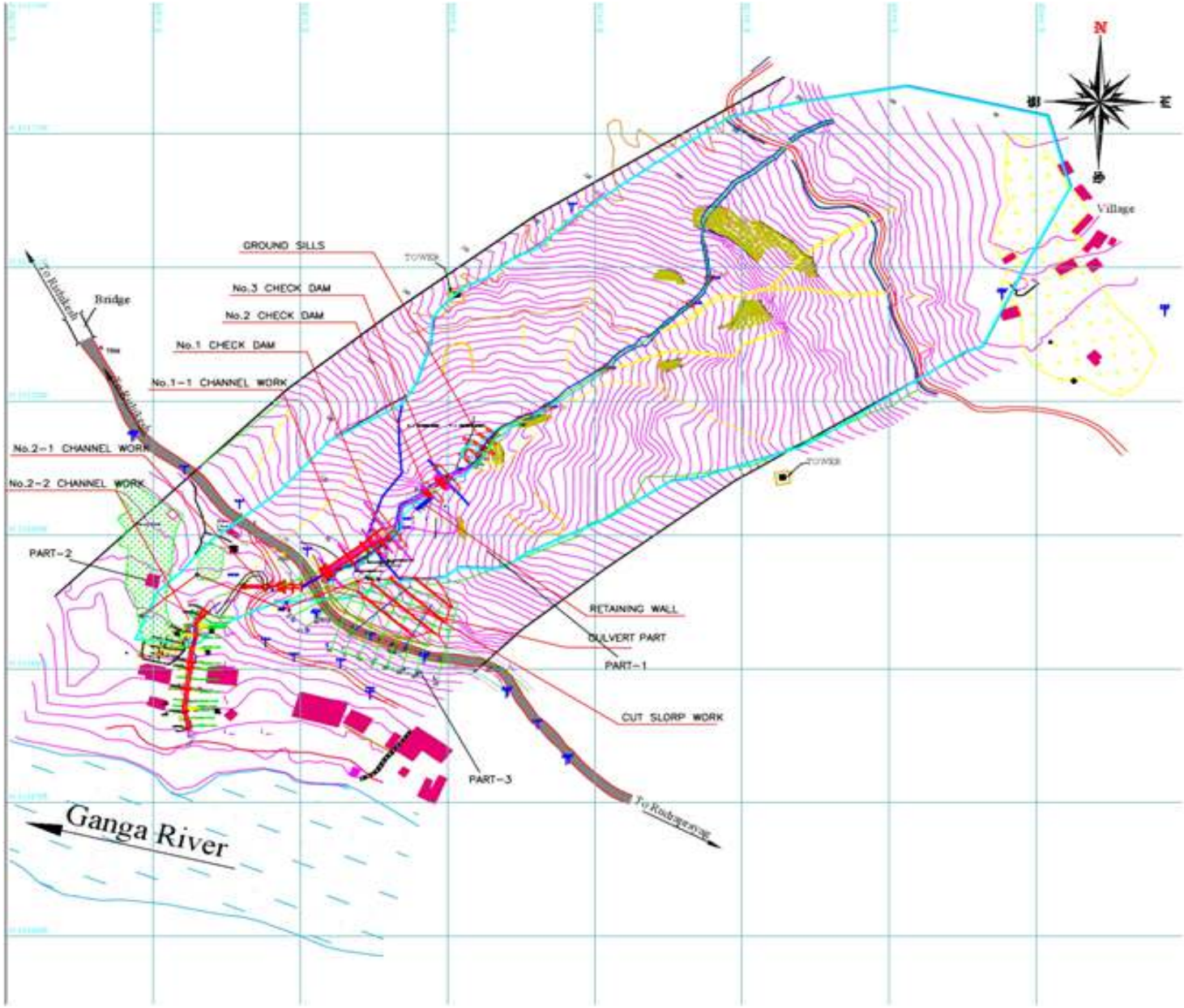
In January 2020, Project Management Unit of UFRMP and M/s BUMI JV, New Delhi entered into the contract on the construction of model sites.

1. Nirgad near Rishikesh



This is a debris flow type of landslide, locating at the stream near the river Ganges.
During rainy season,large amount of water flows in the different tributaries at the top of the hill. These small tributaries form a single stream while flowing down the hill and a huge amount of water collected flows in the stream.
This had caused the erosion of the stream bed and stream bank thereby carrying the small and big stones and boulders on to the National Highway7 downstream. This had disturbed the traffic of the National Highway.

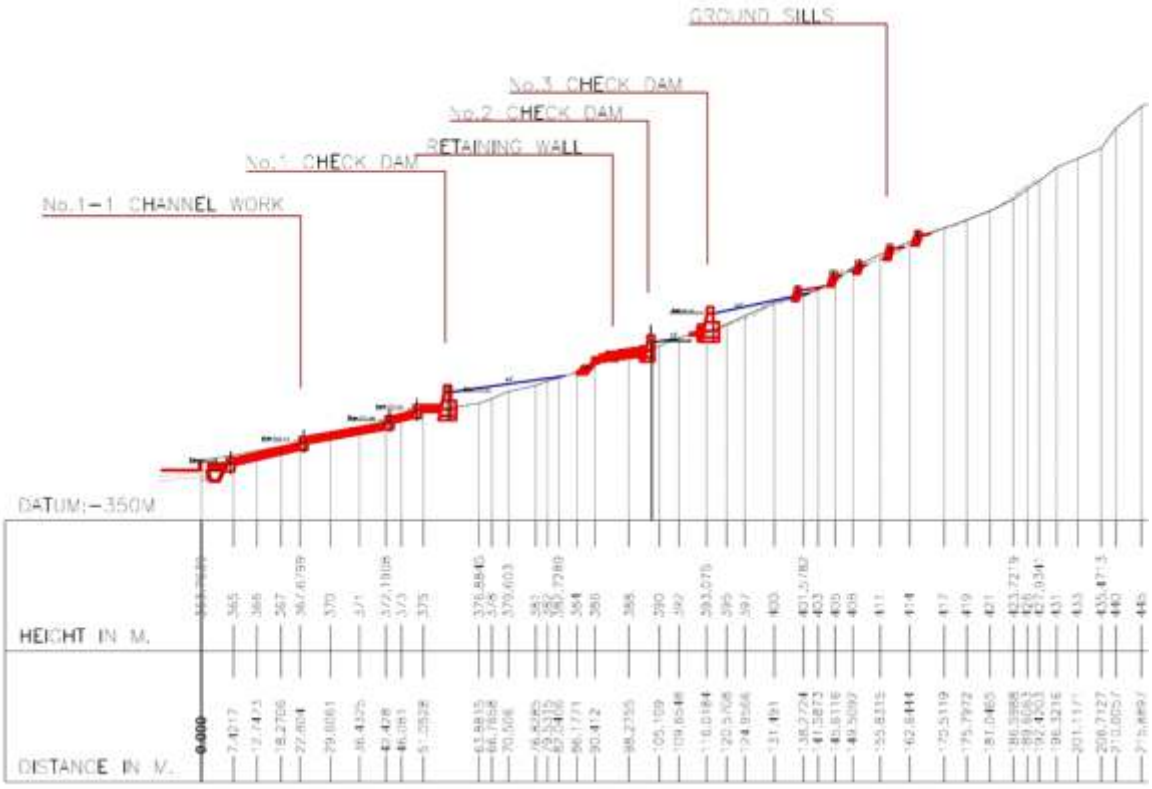
Work Plan Map



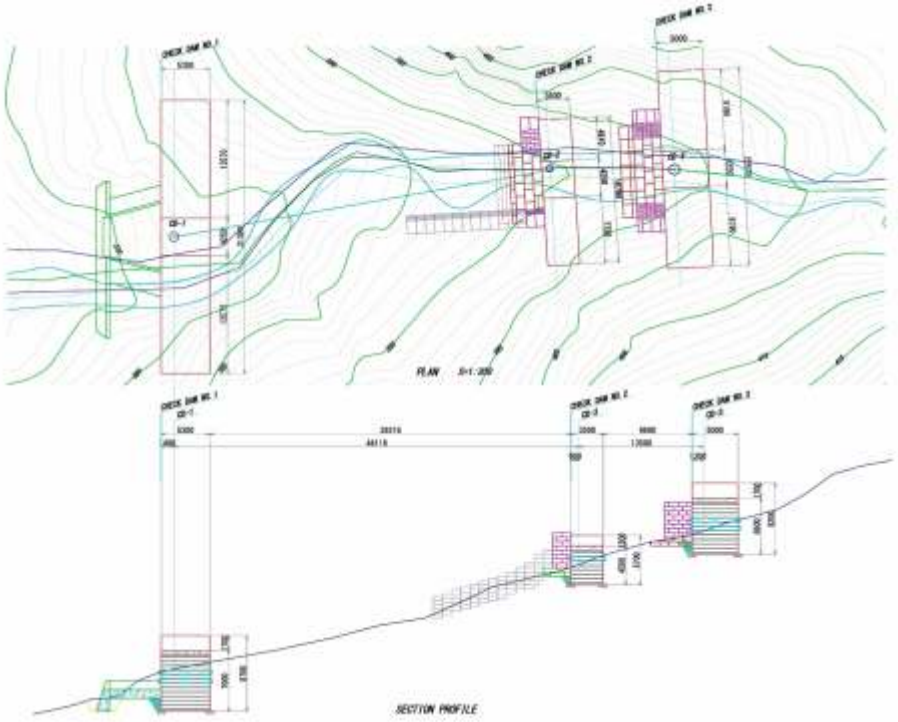
The site consists of a devastated mountain stream with 12 ha catchment area and 3.6 ha devastated hillside, in which torrent works and hillside works have been planned.

3 double wall check dams, 5 groundsills, channel work as torrent work, and cut slope work, mat work as hillside work are to carry out.

Longitudinal section of the stream



Layout design of Check dams



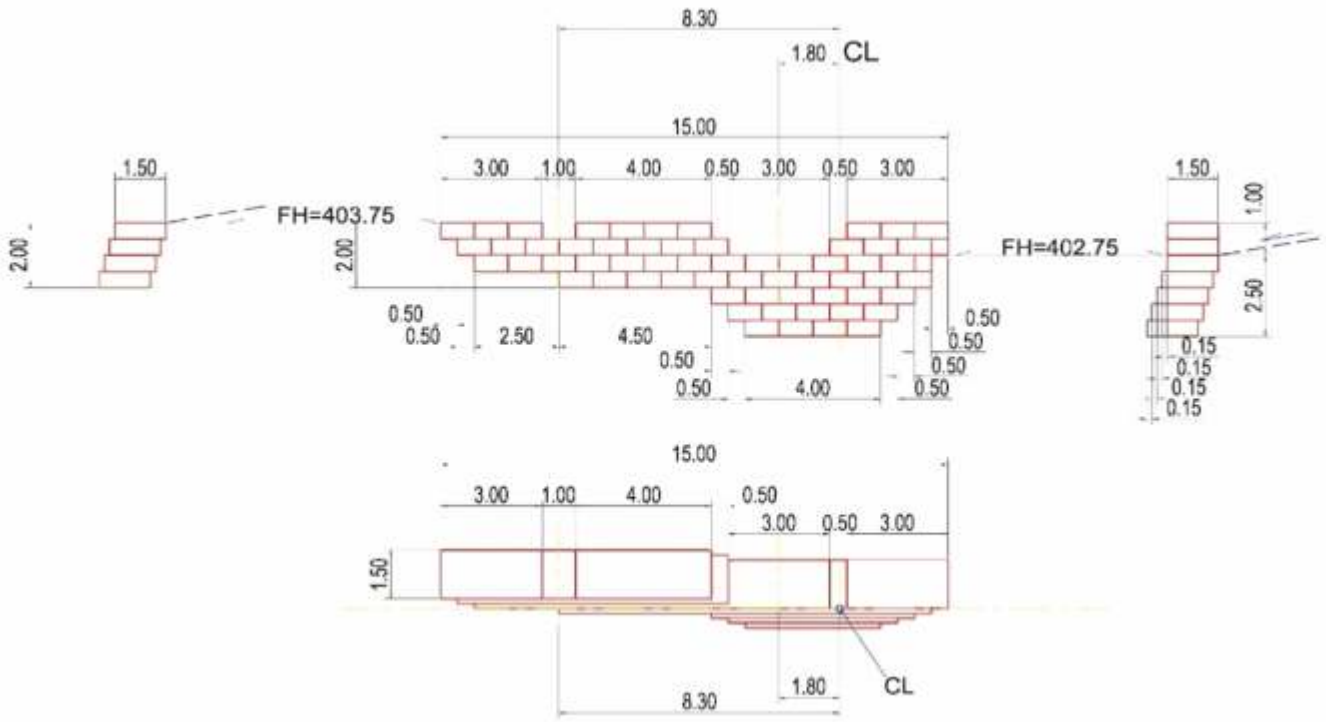
Double wall (DW) checkdam

DW check dam is a gravity structure consisting of wall material such as segmented steel sheet piles and expand metals connected by multistage tie rods, and stuffing material such as excavated soil and boulders on site. The dam construction is relatively easy, which reduces time and dumping soil.

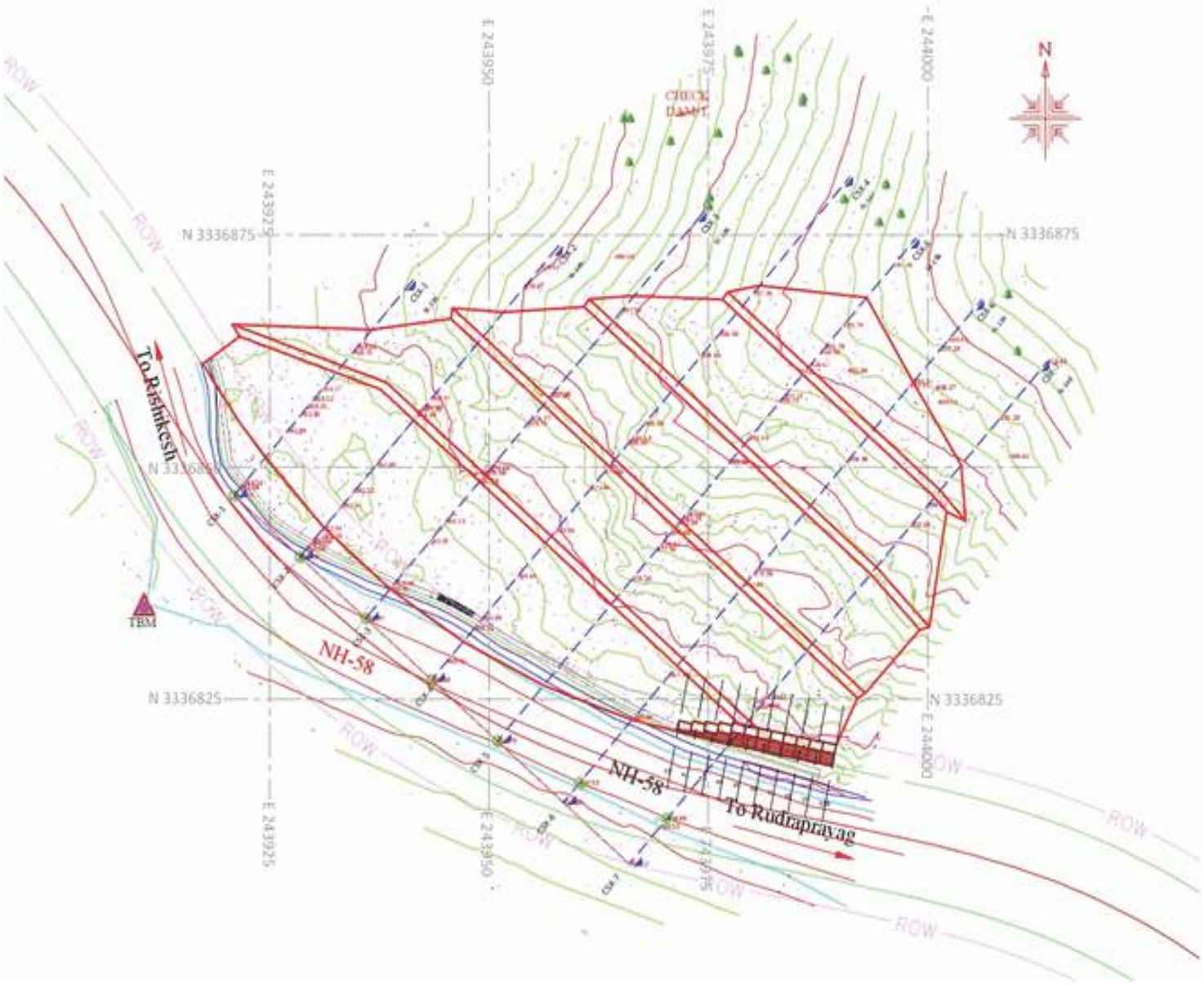
Gabion groundsills (GS)

Groundsills are identical to the wire crate barriers constructed widely in India, with the difference of stepped construction. Stepwise GS prevent the unstable soil flowing down and reduce the flow velocity,thus erosion on stream bed is prevented.

Design of Groundsill No.1



Design of Cut Slope Work



Coverwork (laying erosion control mat)

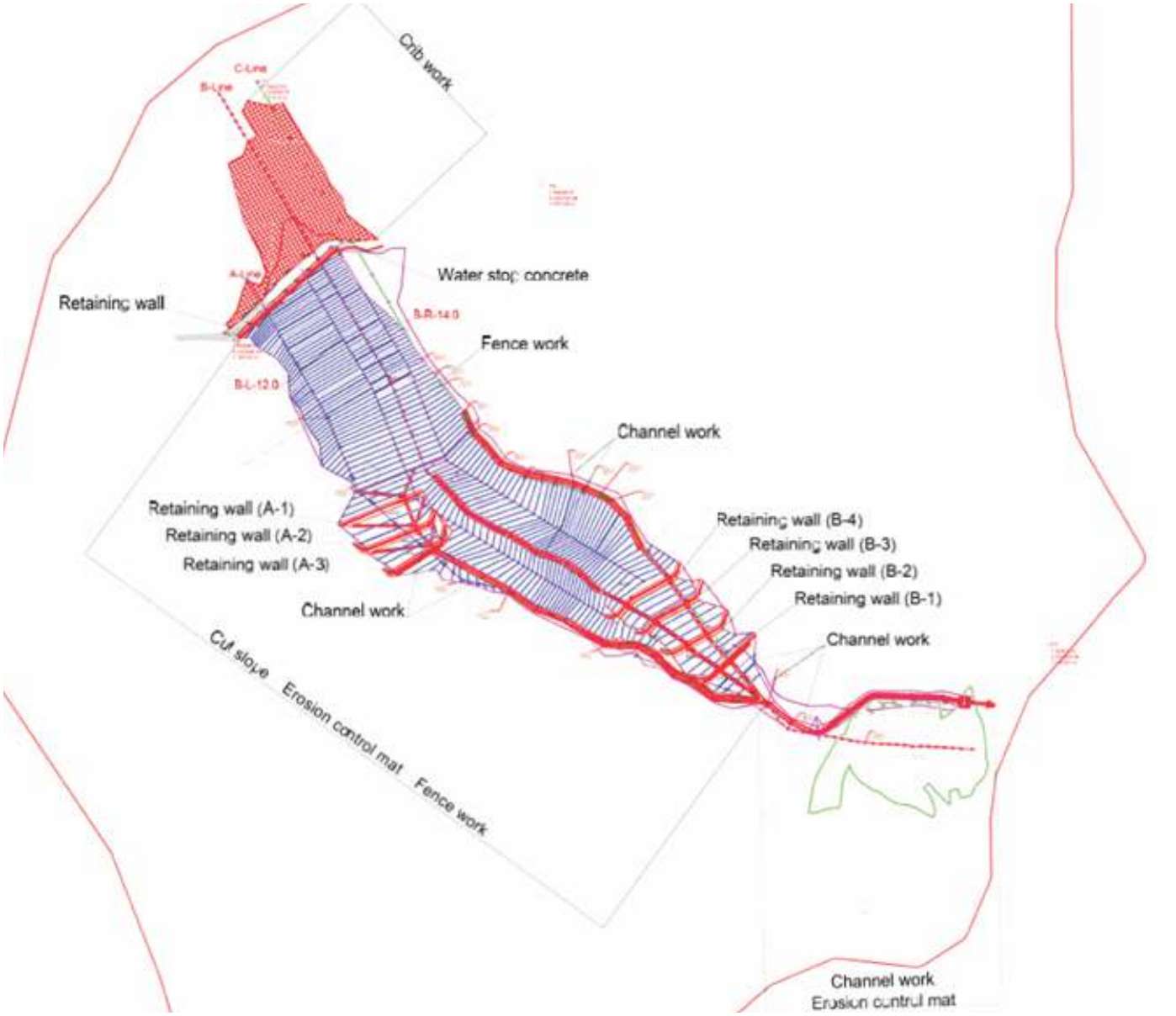
After making the slope gentle, cover work is carried out on the cut slope area to apply the erosion control mat so as for native vegetation to invade on the slope after the work completes.

2. Jawadi near Rudraprayag

Jawadi site is a slope failure type of landslide which is located at northwest mountain hillside, about 5 km from Rudraprayag city. 2013 Uttarakhand disaster heavy rains caused the surface erosion of the slope and high quantum of water ingress in the loose soil of the hill occurred.This resulted in this landslide.

A huge quantity of debris and landslide sediments have flown through the slope and are resting on the steep slope. This loose mass of sediments has been disastrous and may flow in the event of accumulation and flow of heavy water in several streams already formed in the area. To remove/ settle the threat is the key of countermeasure for the site.

Work Plan Map



Target area is 8 ha with slope gradient 30 - 40 degrees, in which hillside work such as crib work, channel work, retaining wall work, cover work/ laying erosion control mat, fence work, etc. are planned.

Crib work

Crib work is a technique which is new to India. Concrete pillars prevent the collapse of the hillside efficiently, the crib structures suppress the movement of topsoil with introduction of vegetation.

A specific procedure is adopted for the application of crib work as per the following steps;

i) In the crib work, the complete area to be applied with crib is covered with wire mesh exactly as per the profile of the surface.
ii) After the wire mesh is laid on the surface, formwork is carried out.
iii) Later the reinforcement bars are tied between the form work with the help of hoop ties, and fixed into the surface soil with 800 mm long main anchor bar and 500 mm long sub anchor bar.
iv) The mortar is then sprayed in the formwork prepared.
v) The beams in the form of grids are constructed.
This procedure completely stabilizes the failed slope.

Channel work

In hillside work, drainage that causes collapse is the key to treat.Channel work is applied on the sedimentation area to channelize the water on the hillside slope to flow down safely. This will prevent erosion during the flow of water.

(Gabion) retaining wall work

In the sedimentation area, retaining structures are constructed to retain the loose soil and mitigate the sediment runoff and the flow of water.

Cover work

Cover work is carried out to stabilize the loose soil at the top below the scarp area. The gradient of the slope is made gentle before conducting cover work/ laying the erosion control mat.

Fence work

Fence work is carried out to make the gradient of the slope gentler and to stabilize the surface soil so that water flow velocity is reduced and water flow is dispersed. Thus, the vegetation bas will be secured.

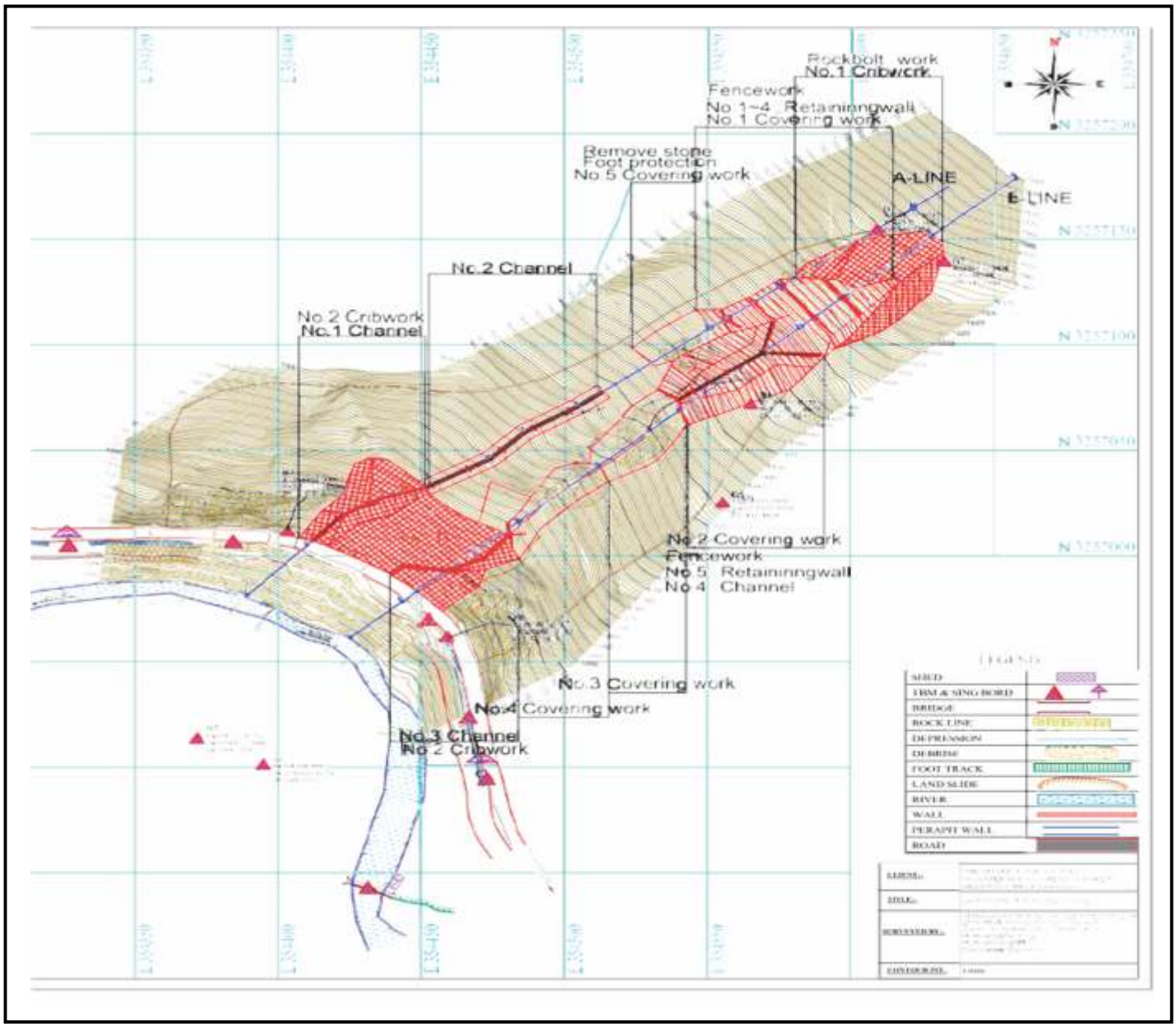
Rock fall protection fence

During the construction of crib work including its preparation work, lots of rock fall is prone to occur. To prevent any damage to the traffic on the road, the rock fall protection fence is provided.

3. Padli near Nainital

Padli site is situated about 15 km from Nainital city on the Nainital-Almora Highway. This is a slope failure landslide. A huge soil mass at the top of the slope has failed and has become very vulnerable. Rocks and loose debris had erupted after the slope failure was affected by the subsurface water. The current primary cause of sediment runoff is erosion by surface water during rainfall.

Work Plan Map



Target area is 5 ha with slope gradient of more than 50 degree, where hillside work such as crib work, rock bolt work, retaining wall work, channel work, vegetation work are planned.
Work shall be at 190 m above the National Highway 109 so that realignment of the road is carried out for securing the traffic safety.

Crib and Rock bolt work

On the Padli site also, crib work is applied but here the rock nailing is done (rock bolt work). The nailing is approximately four meters deep within the slope surface.

For rock bolt work, boring is done with the machine. Nails (bolts) are inserted in the borehole and grouting is done with cement slurry blown around the bolt.

Fence work with laying erosion control mat

Fence work and application of erosion control mat are carried out together to stabilize the loose soil at the top below the scarp area. The gradient of the slope is made gentle before the work.

Retaining wall work

Retaining structures are constructed to retain the loose soil and mitigate the sediment runoff and the flow of water.

Channel work

Water collected during rainfall flows and causes erosion on the concave topography on the slope, causing sediment discharge. Channel work can collect water and drain the same out of the collapse slope safely.

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