Artificial Glacier: A High Altitude Water Conservation & Harvesting Technique

Leh Nutrition Project

Leh Nutrition Project
Housing Colony,Leh.
P.O.Box 59
e.mail: lnpleh@yahoo.co.in
WWW.lehnutritionproject.org

Why Artificial Glaciers?

- A high altitude water conservation technique: responding to climate change.
- 80% of the farmers in Ladakh depends on snow and glacier melt water for irrigation and domestic use.
- The glaciers are receding rapidly; winters are getting shorter and warmer. Whatever little snowfall is received melts away quickly.
- The snow and glacier melt water drains into river without any use for most part of the year; it goes completely waste.
- It is a mean for harvesting glacial melt water for additional irrigation.
- Natural glaciers are way up in the mountains, and they melt slowly in summer and thereby reaching the village in June.
- Whereas, artificial glacier starts melting in spring, right in time for first irrigation (called '*Thachus*' which means '*germinating water*').

What is artificial glacier?

- **Artificial Glacier is a simple water harvesting technique suited for high altitude cold deserts that are totally dependent on glaciers.**
- **Glacier melt water at different altitude is diverted to shaded area of the hill, facing north side, where winter sun is blocked by a ridge or a mountain slope.**
- **At the start of winter (or November), the diverted water is made to flow onto sloping hill face, through appropriately designed distribution channels / outlets.**
- **At regular intervals stone embankments are built which impede the flow of water making shallow pools**
- **In the distributing chambers, 1.5" diameter G pipes are installed after every 5ft for proper distribution of water**
- **Water flows in small quantity with less velocity through the G pipes which freezes instantly**
- **The process of ice formation continues for 3-4 winter months and huge reserve of ice accumulates on the mountain slope, aptly termed as '*artificial glacier*'.**

Artificial glacier – a water harvesting and conservation technique in high altitude regions

Target Group

- **Artificial glaciers are constructed close to a village.**
- **All the families in the village or hamlets are equally benefited.**
- **Community contributes towards the construction and maintenance of the glacier and that makes the project sustainable and long-term beneficial.**

Financing

- **In LNP, artificial glaciers have been in operation for the last 14 years. It was first experimented in 1987 at Phuktse village.**
- **A limited fund is allotted for artificial glaciers under the Watershed Development Programmes.**
- **Sadhbavna, the philanthropic wing of the Indian Army has financed one artificial glacier project in 2008.**
- **Cost of an artificial glacier varies from site to site. Generally, it cost around 3-10 lakh INR rupees.(Euro 5000 – 16600)**

Implementation Methodology

❖ Community mobilisation and participation

- Villagers are main stakeholders and their involvement is crucial for sustainability of a project
- Meeting is arranged with them to discuss about:
  - Water availability in the stream during peak winter time
  - Presence of shady area along the course of the stream
  - Timing of sunrise and sunset
  - Village history regarding water and wasteland availability for future development
- Location/proximity to the village (artificial glacier must be close to village)

Impacts of Artificial Glaciers (I)

- **Economical benefits**
  - Overall increase in agricultural production and annual family income
  - Availability of irrigation water in early spring enables farmers to harvest two crops in a year which was not possible earlier
  - Food security
  - Increase in tree plantations - trees are a good source of income as the twigs, branches and trunk are used in house constructions. It gives fuel and fodder and increase biomass of the earth
  - Pasture development creates conducive conditions for cattle rearing

Impacts of Artificial Glaciers (II)

- **Environmental benefits**
  - groundwater recharge and rejuvenation of spring water
  - Significant increase in agricultural land holdings
  - Mitigation against adverse effects of extreme climatic conditions such as droughts and desertification on crops, human and livestock population
  - Maintain ecological balance by harnessing, conserving natural resources viz. land, water and vegetation
  - Also contributes towards soil moisture conservation – creating conducive conditions for plantations and agriculture
  - Increase in cattle population leads to increased use of manure on agricultural fields rather than chemical fertilizers

Impacts of Artificial Glaciers (III)

- **Social Impacts**
  - Reduced water disputes among neighbours and families in the community due to enhanced water availability
  - More confidence and interest in farming activities. Villagers can earn cash income while remaining as farmers.
  - Decrease in migration of villagers to town for seeking employment
  - Overall improvement in social and cultural life of villagers
  - Reduced in human drudgery - no need to walk-up the hills to fix the headrace of irrigation canal.

Lessons Learnt & Constraints

- Difficult to find labours during severe winters for monitoring and maintenance of the water distribution systems.
- Need for mechanization of operations of headrace and distribution chambers to reduce manual and regular monitoring works.
- The actual cost of an artificial glacier is very high due to following reasons:
  - High altitude (above 4600 m)
  - Inaccessibility by road
  - low labour efficiency
  - high transportation cost of materials

The first artificial glacier in Ladakh

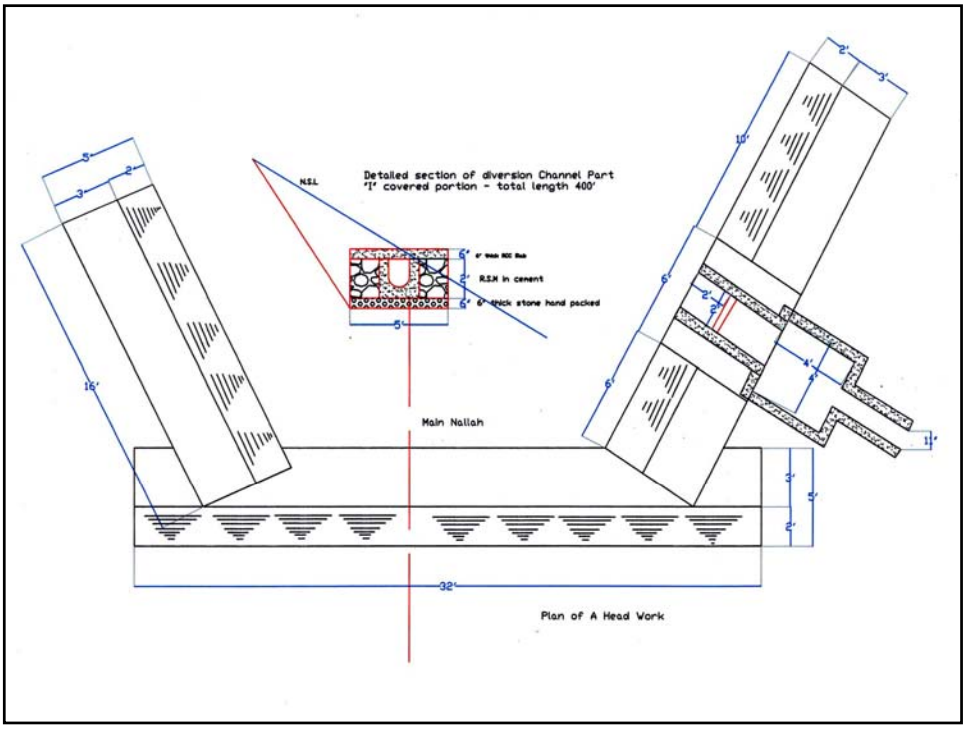
- The first and the largest artificial glacier was built by me at Phuktse Phu in 1987. It was built as an experiment.
- It is about 2km in length and 30-100 m in breath and has an average depth of about 1.60 m.
- It supplies irrigation water to four hamlets in the valley viz. Phuktse Phu, Phuktse, Shara and Sharmos.
- Initial cost of construction was about Euro 1580.
- After the success of Phuktse glacier, LNP has built 10 more glaciers in its Watershed Project Area.

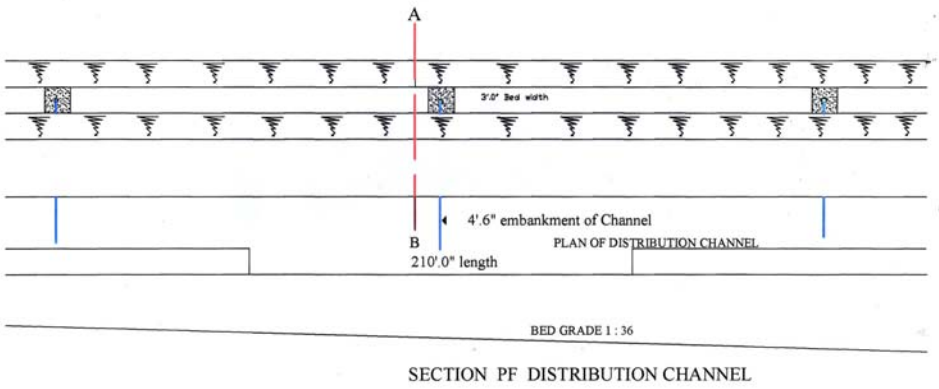
Replication

- **The technique of artificial glacier is easy and simple and can be replicated in similar geo-climatic regions as Ladakh, such as Spiti (H.P.) and some central Asian countries like Kazakhstan, Kyrgyzstan etc.**

- **This technology can be replicated in area which have the following features:**
  - **4666 to 5333 mtrs altitude**
  - **Temperature as low as -15 to -20 degree Celsius during peak winters**
  - **Longer winter period of 4-5 months to ensure longer expansion and formation of glaciers**
  - **Villages that are primarily dependent on glaciers or snowmelt water for irrigation**

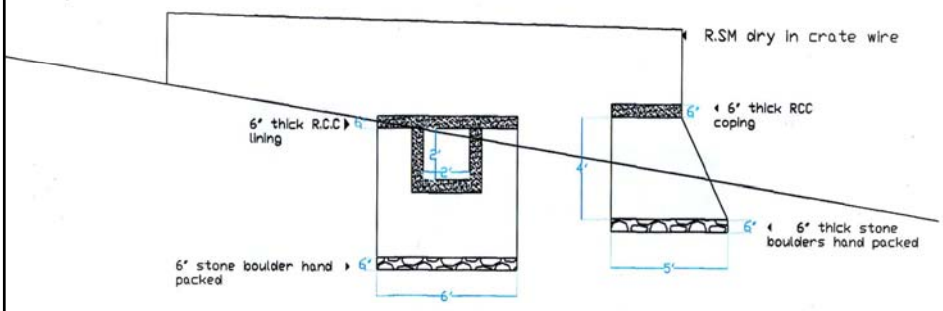
Artificial glacier – a water harvesting and conservation technique in high altitude regions



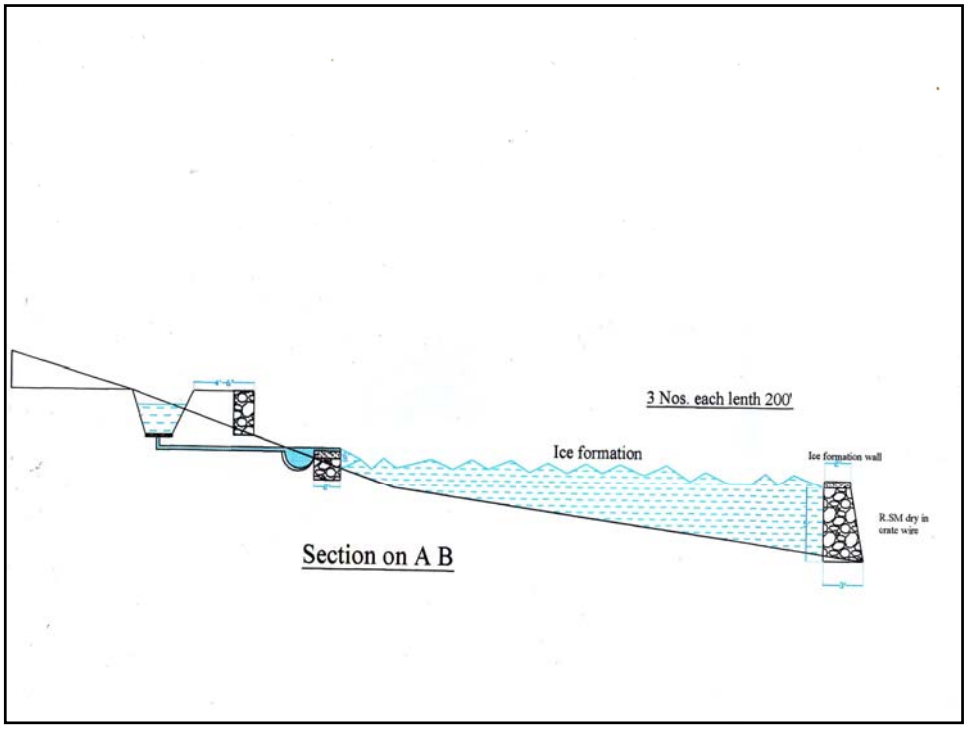


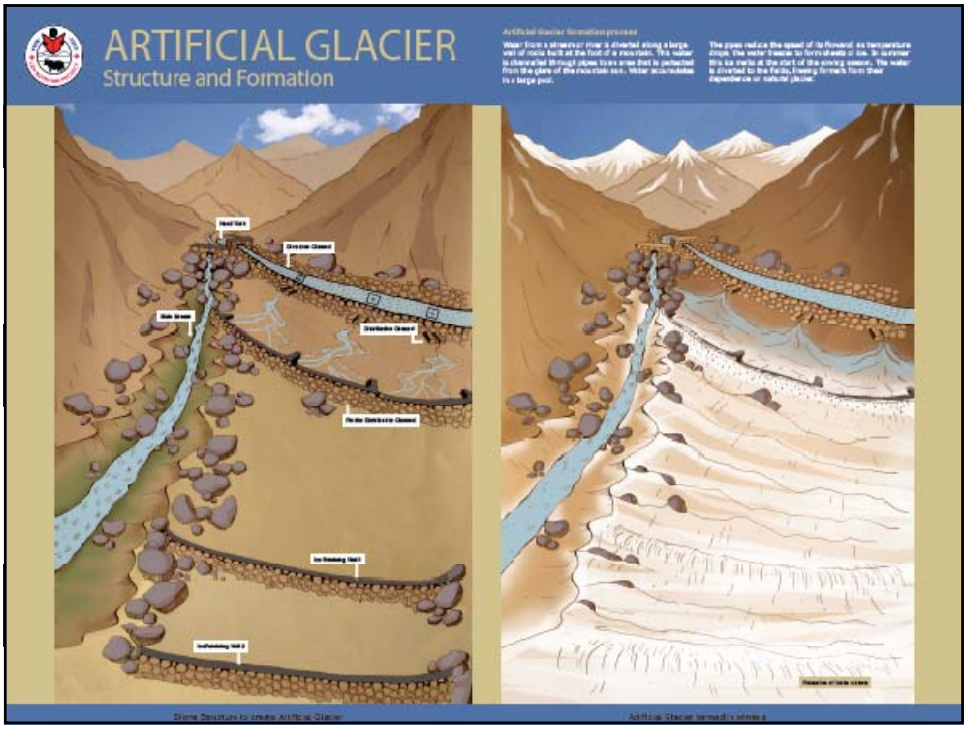
SECTION PF DISTRIBUTION CHANNEL

Artificial glacier – a water harvesting and conservation technique in high altitude regions



SECTION ON A, B


3 Nos. each lenth 200'
Ice formation
Ice formation wall
R.SM dry in crate wire
Section on A B


ARTIFICIAL GLACIER
Structure and Formation