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Pond Lining

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Abstract

Water is an essence of human life and India is blessed with many rivers, lakes and ponds contain plenty of water. They are perennial or seasonal, depends on the monsoon. Global climate change and increase the demands by the various water users, priority to conserve the water in a storage structure during the rainy season and use during the lean period is the need of the hour. Water storing in the pond faces seepage and evaporation losses issue. Reduction of seepage losses at the bottom and sides of the pond can be achieved by laying plastic sheets, one of the promising techniques, researches revealed. 200-micron thick plastic sheet laid in 2:1 stable side slope of pond is the common practice. This method maximizes water storing period and multiple uses of water.

Introduction

Water is an essential element for producing agricultural produces. The main source of water is precipitation in the form of rainfall. Water received from the rainfall flows over the surface of land, stores in places where depression, flows in river, meets the demands, finally reaches the sea. From the demand point if we look, predominantly water is used for domestic use, followed by irrigation and industrial use. Now-a-days demand of fresh water is increasing, hence conserving every drop of water is important, utilize maximum its potential. In this way catching the rainwater and how to store in the ponds lined with plastic material is discussed here.

Ponds

India is a traditional user of ponds, which are small water bodies either man-made or natural. They are traditional water harvesting structures and the water stored in these structures is commonly used for drinking water supply, washing / bathing for human and animals, irrigating crops and raising the fish. In India, approximately 25 lakh ponds are used for a variety of applications. The traditional areas of ponds are in Andhra Pradesh, Karnataka, Tamil Nadu, Orissa and Madhya Pradesh.

Ponds are water conservation structure, stores rain water. Based on the purpose ponds may be divided into farm pond or percolation pond. Percolation ponds are mainly used for recharging ground water but farm ponds are used for multipurpose. Ponds are constructed in the natural depression or areas where water is diverting from different streams. The main drawbacks observed in storing of water in ponds are losses of water from the ponds. The losses are by evaporation, percolation and seepage. The causes of seepage may be either poor site selection (i.e. more permeable soil) or cracks in the embankment through roots of plants. Reduction of

evaporation loss is little bit difficult and losses are minimum. Whenever going for a new pond construction, sufficient ceiling must be given to arrest seepage at the bottom of the pond in the original design.

Usually top soil in the identified site for pond construction must be removed for deepening and placed over embankment. If the exposed soil is in coarse textured in nature, consideration must be given to arrest water loss by lining the ponds.

Pond Lining

It is considered as a serious leak if water level in the ponds drops much more than 12 to 28 cm in one month. Water losses from pond can be arrested by placing clay materials over the surface or laying a plastic sheet over soil. Bentonite clay a commercial product is used to seal leaky ponds. Another method of arresting seepage through laying plastic sheet is more effective and retains high depth of water (Figure 1).

Polythene sheet laid pond is the process of sealing or lining by laying impervious material, or mechanically treating the soil in a pond to prevent water loss. High Density and Linear Low Density Polyethylene (HDPE and LLDPE) materials are commonly used as lining materials. These materials are manufactured with a predetermined length and width comes in rolls. The length of rolls may be of about 40 meters for convenience in handling. Plastic sheets are joined for the desired length and width by thermal or chemical fusion methods. These sheets are UV light resistant, lasting many years (generally 100 plus).

The surface of the soil on which the plastic sheet is to be placed must be smooth, compacted and free of clods, stones, roots, sticks, or other objects that could puncture or tear the plastic sheets. The steep sides of the pond and slick surface of liner materials make it very difficult for humans or animals to climb from the pond. Wooden boards on the liner slopes should be considered to allow small animals to climb from the water (Ashwani Kumar and Rajbir Singh, 2010).

Qualities of Plastic Sheet

Ideal plastic sheet should have the following qualities: it has impermeable to water, reasonable durability, flexibility over a wide range of temperatures, resistance to mechanical damage, temperature and deterioration from biological activities.

Specifications of Plastic Sheet

Plastic sheet thickness is denoted in microns. It varies with depth of water. When plastic sheet is laid over earth cover; and depth of water upto 1 m, 200 microns thick sheets can be used. When water depth is 1 to 3 m, 250-micron is to be laid. And 300-micron sheet are to be laid

when the water depth exceeds 3 m. If the surface is rigid cover, 150 to 200-micron thick sheets can be placed.



Figure 1: Farm Pond with lining (Courtesy: Ocean Non-Woven Pvt Ltd., Delhi)

Method of Laying Plastic Sheets

The plastic sheets shall be laid by spreading over subgrade prepared below the designed bed level to the extent of cover thickness, in strips. Depending on the width of bed / perimeter of the section, the sheet can be laid parallel or perpendicular to the flow of the water. Longitudinal joints should be avoided.

Where longitudinal joints cannot be avoided, the loose ends of the sheets strip shall be anchored with an allowance of 50 cm for anchoring in the trenches, where ever necessary. Necessary space shall be kept vacant at the trenches for anchoring the film. The film shall be spread loosely over the subgrade so that it shall attain the contours of subgrade and compensate for thermal variations during the day. An extra length of one percent in both the directions on this account shall be provided. The adjacent layers of sheets shall be laid in such a manner that overlap shall point towards down stream of canals. The film shall be jointed using any suitable method.

Plastic sheets shall be spread in the above manner and held in position at the two extremities of bed by placing excavated earth or sand bags on it, while the two ends of film are being loosely held over the embankment.

At the time of purchase the rolls are packed properly. Unpacked film rolls should not be exposed to sun over prolonged periods store them preferably indoors. It should be verified that uniform pressure is applied while heat sealing the sheets. Rough handle or drag the rolls as the sheets may get damaged in the process. While the lining operation is in progress the workers may not be allowed to walk on the sheet. Also use of hooks for lifting the sheets, sliding the cover material like

bricks, tiles etc. on the film may be avoided.

Cost Economics

Usually ponds are laid with plastic sheets on the inner sides and banks of the pond. Hence accurate measurement should be needed the about the specification of ponds. Quantity of plastic sheets required can be arrived based on bottom and side surface area of the pond, then converts into in terms of weight of plastic sheets. Cost of laying sheet is calculated by summing the cost plastic material and cost of labour for laying the sheet.

Conclusion

Various researches conducted in different parts of India revealed that laying the pond with plastic sheets to arrest the seepage losses are more promising and

effective method. Further it increases water standing period. Scientific studies recommendations for plastic lined ponds are: i) Stepped sides with 30 cm soil cover on 2:1 side slope (2 horizontal to 1 vertical) is stable slope for the ponds lining with LDPE film; ii) LDPE film of 200 micron, was the most economical lining material, hence is recommended for the field application.

Reference

Ashwani, K., Rajbir, S., 2010. Plastic Lining for Water Storage Structures. Technical Bulletin No. 50, Directorate of Water Management, Chandrasekharpur, Bhubaneswar-751 023, India, page: 34.