Solid & Liquid Waste Management in Rural Areas

The Govt. of India has launched Swachh Bharat Mission-Gramin (SBM-G) under which Solid & Liquid Waste Management (SLWM) is a component, primarily with the objective of improving the quality of life of rural people.

Solid & liquid waste management is one of the most challenging issue faced in the rural Haryana. Poor and unscientific management of solid & liquid waste is causing the serious environmental and health problems leading to adverse impacts on socio-economic development of the community. Sanitation, health and hygiene are directly related to each other. Health and hygiene are largely dependent of availability of adequate safe drinking water and proper sanitation facilities including solid-liquid waste management in proper manner.

For sustainable development of rural areas, it is necessary to manage the solid-liquid waste properly at village levels for the resource conservation and socio-economic development. Poor attitude and lack of information toward the solid-liquid waste are more responsible factor for generation and mismanagement of solid-liquid waste.

Management of Solid & Liquid Waste in villages is indeed a matter of great concern for all of us. The State Government is seized of the matter and is committed to mitigate this problem. Swachh Bharat Mission (Gramin) initiated by the Hon'ble Prime Minister in October, 2014 is a path breaking step to tackle this problem in a comprehensive manner.

There is no doubt that open drains can be a source of contamination of drinking water and food which leads to various diseases like jaundice and diarrhoea. The dirty water of the villages being accumulated in the ponds primarily consists of Liquid Waste coming from the various houses, which is called the grey water. This problem is further aggravated by the practices at some places of disposal of human excreta specially of children, into open drains. Moreover, there are reports that due to defects in design of septic tanks made by individuals, over flow of the septic tank also enters the open drain. This makes the water of the drains black which is a big health hazard.

Therefore, Solid & Liquid Waste Management in the rural areas is one of the top most priorities of the State Government. Swachh Bharat Mission (Gramin), aims to providing a comprehensive solution through construction of Individual Household Latrines, Community Sanitary Complexes and Solid & Liquid Waste Management.

Under the Swachh Bharat Mission, aim is to provide solid & liquid waste management in all villages by October, 2019. The total assistance under the SBM(G) for SLWM projects being worked out on the basis of total number of households in each GP, subject to a maximum of Rs.7 lakh, Rs.12 lakh, Rs.15 lakh and Rs.20 lakh for a GP having upto 150, 300, 500 and more than 500 households respectively. However,

on an average expenditure on SLWM projects is in between Rs.15 to Rs.45 lakh. Additional cost requirement is to be met with funds from the State/GP, and from other sources like Finance Commission Grants/HRDFA Board.

The various components & stages of Liquid Waste Management includes :-

a. **Household Level Management** : Household level management can be done by the following methods :-

   a. **Kitchen Garden** :-With this methodology, the liquid waste from kitchen can be utilized to grow vegetables, flower or fruits in courtyard of the house by passing it through a small trench, with or without laying perforated PVC pipe, and covering it with small gravels and plastic sheet.

   b. **Leach Pit** :- Leach pit is a brick lined pit constructed in honeycomb masonry having a volume of about 0.75 cubic meter. This pit is useful where adequate space for kitchen garden is not available in the house.

   c. **Soakage Pit** :- A dug out kachha pit filled with stone or over burnt bricks. The large number of stones / bricks increase the surface over which biological & chemical action takes place. The water seeps into the ground & reduces danger of polluting the ground water sources. This is one of the efficient ways to dispose waste water locally.

b. **Community Level Management** :The grey water which cannot be managed at domestic level has to be managed at community level in following two ways :-

   1. **On site management** :- The grey water in rural areas in public places like public stand posts for water supply, wells, hand pumps, schools etc. require on-site management which can be done by adopting the following technological options :-

      a. **Plantation with intercepting chamber** :-The grey water at public places in rural areas, is usually spilled over. As such it is cleaner water. Hence, this water can be reused conveniently for plantation.

      b. **Community leach pit** :-If land is not available for plantation, the spilled water can be absorbed in the soil by constructing a larger size leach pit.

      c. **Soakway channel** :- Soakage pits can be built in every house but near public wells or stand posts where large quantity of waste water flows, pits have to be built like big channels, which are called soakway channels.

   2. **Off site Management** :In very compact and crowded village, effective on-site waste water management may not be feasible, due to non availability of adequate space. Therefore, 'off site' management will have to be considered, in the following manner :-

a. **Collection and transportation** -First step would be to establish a system for collecting & transporting this grey water for the final treatment on a suitable location. A suitable drainage system, comprising of drains & nalas of various sizes, has to be provided to achieve this.

b. **Final treatment and reuse :-** Once the community grey water is collected at one or multiple places, such as ponds, final treatment is required to convert it into harmless and reusable water.

Technological options for treatment

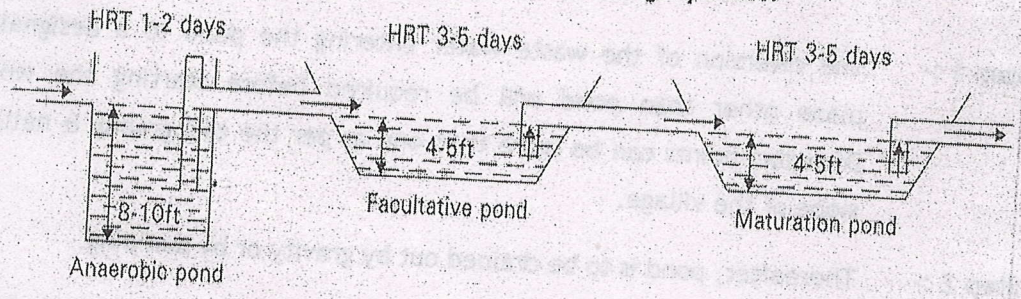
State Government is trying to identify best suitable methods and technologies for treatment of liquid waste so as to ensure maximum reuse of such waste for agriculture purposes with least operation and maintenance costs. At present, Waste Stabilization Ponds (WSP) technology has been successfully adopted in the state for treatment and reuse of waste water.

1. WASTE STABILIZATION PONDS SYSTEM (Three Ponds System)

This is a simple & effective system for treatment of waste water collected via drainage system. The grey water so collected is made to pass through three ponds, excavated at suitable land site, and placed serially to act as a stabilization system in which gray water is stabilized, its pathogenicity is reduced and stabilized water becomes useable. The system has mainly three ponds namely :-

- Anaerobic Pond
- Facultative Pond
- Maturation Pond

Waste stabilization pond for grey water



(a) **ANAEROBIC POND :-**The grey water from the drains reaches the first pond that is anaerobic pond. The pond should have a depth of 10 feet. The grey water reaching the pond via drains, usually has high solid content. Grey water is retained in this pond for 2 days. In this period, solids settle at the

bottom, where these are digested anaerobically. Thus, the partially clarified liquid is discharged onwards into a facultative pond for further treatment.

(b) FACULTATIVE POND :- This pond should have a depth of 5 feet. The partially clarified water is retained for 3 to 5 days. In this pond, oxidation of grey water takes place. It is called 'Facultative' because in this pond in the upper layer aerobic conditions are maintained while in the lower layer, anaerobic conditions exist. In this pond solids are generally taken care of by three mechanisms.

- Aeration from air through the surface.
- Oxidation due to oxygen liberated through photosynthetic activity of algae growing in the pond because of the availability of plant nutrients, from bacterial metabolism in water and the incident light energy from sun.
- The pond bacteria utilize the algal oxygen to metabolize the organic content of grey water.

Thus the facultative pond plays a very important role in stabilization of gray water. The process involved is a natural process.

(c) MATURATION POND :- The dimensions of maturation pond can be similar to facultative pond i.e. depth of 5 feet & a retention time is also same i.e. 3 to 5 days. The stabilized water from facultative pond is led to this pond. The main function of the maturation period is the destruction of pathogens. This pond is wholly aerobic.

CONSTRUCTION METHODOLOGY

Step 1 :- The diversion of the waste water entering the pond to a designated place other than pond will be required before starting the work. Diversion points can be more than one as per the topography & natural slope of the village.

Step 2 :- Thereafter, pond is to be drained out by gravity or by pumping.

Step 3 :- De-silting of pond including removal of impervious layer created at the bottom & its disposal, wherever required, will be done in this step.

Step 4 :- Construction of embankment including dressing, stabilization with grass/plantation or brick lining, wherever required will be done.

Step 5 :- Laying of pipes and other fittings will be done at suitable depths as per the design.

Step 6 :- Provision for out flow of treated water, through gravity or pumps, for subsequent use in agriculture/fish farming/ground water recharging or final disposal into nearby drain of the irrigation department, will be done in this step.

Step 7 :- Provision of barbed wire fencing with Brick/RCC precast pillars has to be done to ensure safety.

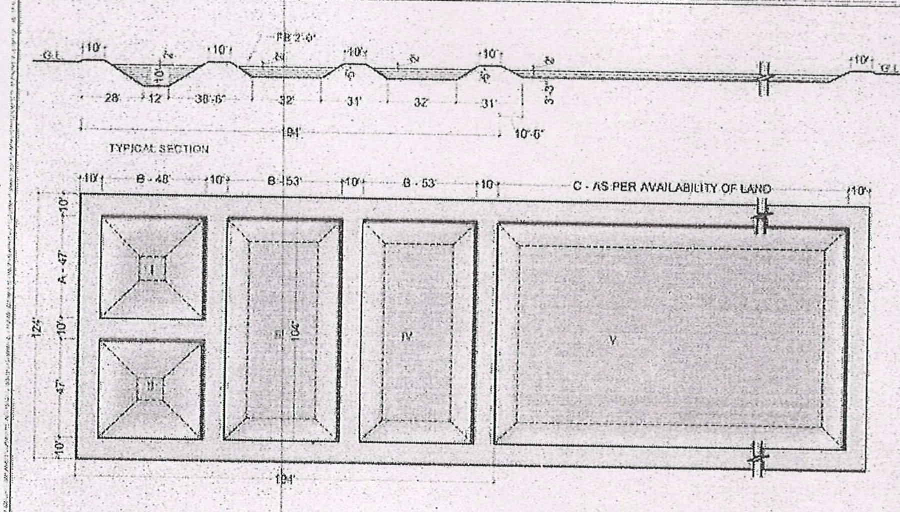
Step 8 :- Beautification shall be done through landscaping or by constructing parks, fixing benches, solar lights etc.

FIVE PONDS SYSTEM

Some limitations of Three Ponds System were observed. Cleaning/de-silting of Anaerobic pond is required more frequently in comparison to other ponds. Therefore, provision of "Alternate Anaerobic Pond" is required for diversion of waste water, during cleaning/de-silting of Anaerobic pond. It was also observed that for getting better results of water quality parameters and to enhance the storage capacity of treated water, one more Maturation pond is required with larger area and depth as 3 feet.Provision of "Bye-Pass Channel" for discharging rainy water directly to additional Maturation pond during rainy season, is also required to avoid overflowing of other ponds. Hence, Five Ponds System has now been adopted instead of Three Ponds System.

This system has five ponds namely :-

- Anaerobic Pond
- Alternate Anaerobic Pond
- Facultative Pond
- Maturation Pond
- 2nd Maturation Pond



TYPICAL PONDS LAYOUT PLAN
FOR 300 HOUSEHOLDS OR 1500 POPULATION
(Assuming Existing Ponds of size 124'0"X1051'-0")

SIZES OF POND (MEASUREMENT AT TOP)

Sl.NO	Population	No. of Houses	Anaerobic pond	Alternate anaerobic pond	Facultative Pond	Maturation Pond	2nd Maturation Pond
1	750	150	13'-0"x28'-0"	47'-0"x36'-0"	34'-0"x104'-0"	34'-0"x104'-0"	
2	1500	300	48'-0"x47'-0"	48'-0"x48'-0"	53'-0"x104'-0"	53'-0"x104'-0"	As per availability of land Remaining area of existing pond
3	2500	500	13'-0"x47'-0"	69'-0"x48'-0"	82'-0"x104'-0"	82'-0"x104'-0"	
4	5000	1000	116'-0"x47'-0"	116'-0"x47'-0"	150'-0"x104'-0"	150'-0"x104'-0"	

NOTE:-
1. ALL DIMENSIONS ARE IN FEET

DESCRIPTION :-
I - Anaerobic Pond
II - Alternate Anaerobic Pond
III - Facultative Pond
IV - Maturation Pond
V - 2nd Maturation Pond

Total area of pond (Existing) = 3.0 acre
Area under ponds (I to IV) = 0.55 acre
Remaining area under ponds (V) = 2.45 acre

LIQUID WASTE MANAGEMENT

SULLAGE STABILIZATION PONDS SYSTEM

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