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CONSTRUCTED WETLAND AND ITS TYPE

Neha Patil[1], Shivani Hatgaonkar[2], Kartik Shire[3]

[1]*Student,Civil Engineering Department, J.D.I.E.T, Yavatmal,nehap29995@gmail.com*
[2]*Student,Civil Engineering Department, J.D.I.E.T, Yavatmal,shivanihatgaonkar@gmail.com*
[3]*Student,Civil Engineering Department, J.D.I.E.T, Yavatmal,kartik.shire@gmail.com*

ABSTRACT

A constructed wetland (CW) is an artificial wetland created for the purpose of treating municipal or industrial wastewater, greywater or stormwater runoff. It may also be created for land reclamation after mining, refineries, or other ecological disturbances such as required mitigation for natural areas lost to land development. Mainly there are two types of constructed wetland surface flow constructed wetland and subsurface flow constructed wetland. Constructed wetlands are a proven technology for removal of conventional pollutants in a variety of wastewaters and other impaired water streams. Thousands of wetland treatment systems have been constructed world-wide to reduce BOD, TSS, nitrogen, phosphorus, and trace metals.

Constructed wetlands are engineered systems that use natural functionsof vegetation, soil, and organisms to treat different water streams.Constructed wetlands can be designed to emulate the features of natural wetlands, by acting as a bio-filter or removing pollutants and destroying pathogens. The two main types of constructed wetlands are subsurface flow and surface flow wetlands.

Keywords: *wetland; Constructed wetland; proven technology; Wastewater treatment*

1. INTRODUCTION

1.1 Wetland

A wetland is a land area that is fully saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem.

The primary factor that distinguish wetlands from other land forms or water bodies is the characteristics vegetation of aquatic plants adapted to the unique hydric soil.

1.1.1 Natural Wetland

Natural wetland system have often been describe as the "earth's kidney" because they filter pollutant from water that flows through on its way to receiving lake, stream and oceans.

1.1.2 Constructed Wetland

Constructed wetland are artificial waste water treatment system consisting of shallow (usually less than 1 m deep) ponds and channels which have been planted aquatic plants, and which rely upon natural microbial, biological, physical and chemical processes to treat waste water. Typically they have impervious clay or synthetic liners and engineered structure to control the flow direction, liquid detention time and water level.

Constructed wetland are most economical as compare to conventional treatment unit which need more energy for its process and this method require cheaper materials.

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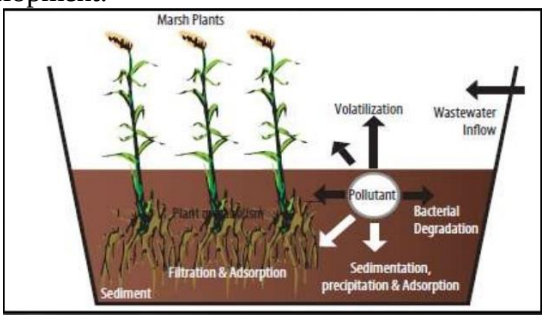


Fig.1: Constructed wetland

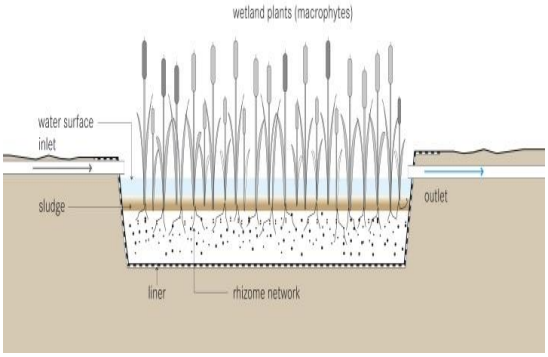
The soil layer below the water is anaerobic but the roots of the plants release oxygen around them, this allows complex biological and chemical reactions. Surface flow wetlands can be supported by a wide variety of soil types including alcove mud and full of silt clay.

2. TYPES OF CONSTRUCTED WETLAND (CW)

2.1 Surface Flow Constructed Wetland

Surface flow wetlands, also known as free water surface constructed wetlands, that can be used for tertiary treatment or polishing outflowing from waste water treatment plant.Aeration takes place in surface

flow constructed wetlands. The wastewater is pass thorough the matrix ensuring intensive contact between wastewater and the bacteria in the rhizosphere (root zone of the plants). In this way all wastewater is treated and no short circuit flow is potential. Horizontal subsurface flow constructed wetlands, when accurately designed, provide an extremely reliable low cost aerobic post treatment solution which is applicable all over the world. However, surface flow constructed wetlands may boost mosquito breeding. They may also have high algae production that lowers the waste water quality and due to open water surface mosquitos and odours, it is more difficult to mix them in an urban neighbourhoods.

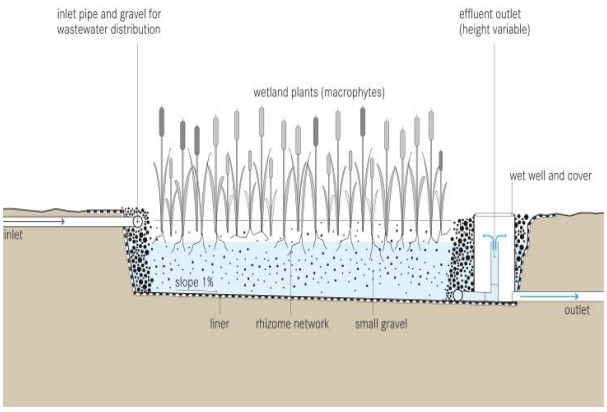


2.2 Subsurface Flow Constructed Wetland

Subsurface flow wetlands can be further categorised into horizontal flow and vertical flow constructed wetlands.

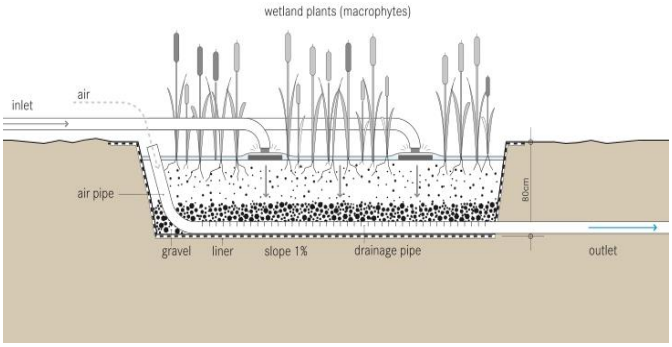
2.2.1 Horizontal Subsurface Flow Constructed Wetlands

This type of constructed wetland is most commonly used for aerobic post treatment of waste water and can take a higher hydraulic load than a surface flow constructed wetland. In order to dissolve solid constituent anaerobic pre-treatment in a septic tank or bio digester is required. A thick layer of gravel above the aquifer holds a layer of stagnant air and prevents odour pain in the locality. They are also suitable to treatstormwater drainage. Any diseases producing agents are destroyed by natural decay, predation from higher organisms, sedimentation and UV irradiation since the water is exposed to direct sunlight.



2.2.2 Vertical Flow Constructed Wetlands

They want to further reduce the size of constructed wetlands led to the development of vertical flow constructed wetlands. Anaerobic pre treated wastewater coming from a septic tank or bio digester is intermittently pumped on top of the constructed wetland. By trickling down the wastewater effectivelysucks air in the constructed wetland whenever the pump stops, forcing aeration of the rhizosphere. This increases the aeration capacity up to approximately twenty times compare to horizontal subsurface flow constructed wetlands. Apart from that no short circuit flows are possible and due to lower levels of oxygen deeper in the matrix nitrate is removed under anoxic conditions. We can illustrate the level of the aquifer and the depth of the matrix as design parametric quantity.



2.3 Hybrid Constructed Wetlands

Respective types of constructed wetlands may be combined to attain higher remotion efficiency, especially for nitrogen. The design consists of two stages, several parallel VF beds followed by 2 or 3 HF beds in series (VSSF-HSSF system). The VSSF wetland is intended to remove constituent and suspended solids and to encourage nitrification, while inHSSF wetland denitrification and further removal of organics and suspended solids occur.

Another configuration is a HSSF-VSSF system. The large HSSF bed is placed first to remove organics and suspended solids and to promote denitrification. An intermittently loaded VFCW bed is used for additional removal of constituent and suspended solids and for nitrification of ammonia into nitrate. To maximize removal of total nitrogen, however, the nitrified effluent from the VF bed must be recycled to the sedimentation tank .The VSSF-HSSF and HSSF-VSSF constructed wetlands are the most common hybrid systems of constructed wetlands could be combined to attain higher treatment effect.

3. APPLICATION OF CONSTRUCTED WETLANDS FOR WASTEWATER TREATMENT

Constructed wetlands are used to improve the quality of water polluted from point and nonpoint sources of

water pollution, including stormwater runoff, domestic wastewater, agricultural wastewater, and mine drainage. Constructed wetlands are also being used to treat petroleum refinery wastes, compost and landfill leachates, aquaculture discharges, and pre-treated industrial wastewaters, such as those from pulp and paper mills, textile mills, and seafood processing. For some wastewaters, constructed wetlands are the sole treatment; for others, they are one component in a sequence of treatment processes (US EPA, 1995). There are various types of constructed wetlands used for treatment of wastewater, and following paragraph highlights the main classification of constructed wetlands.

3.1 Advantage of Constructed Wetland

1) Constructed wetlands are typically inexpensive to build and maintain.
2) They require little or no energy to operate.
3) They can provide effective tertiary treatment.
4) They can provide additional wildlife habitat.
5) They can be aesthetically pleasing additions to homes and neighborhoods.
6) They are viewed as an environmentally friendly technology and are generally well received by the public.

3.2 Disadvantages of Constructed Wetland

1) Constructed wetlands require more land area than many other treatment options.
2) Surface flow wetlands can attract mosquitoes and other pests.
3) Wetlands are not appropriate for treating some wastewater with high concentrations of certain pollutants.
4) The performance of wetlands may vary based on usage and climatic conditions.
5) There may be a prolonged initial start-up period before vegetation is adequately established.

6. CONCLUSION

Constructed wetlands are now playing an important role in indirect potable reuse where they are part of the overall system. This role is providing a robust barrier to micro constituents as well as an environmental buffer that serves as a psychological separation of the drinking water supply from the source water.

Constructed wetlands are a proven technology for removal of conventional pollutants in a variety of wastewaters and other impaired water streams. Thousands of wetland treatment systems have been constructed world-wide to reduce BOD, TSS, nitrogen, phosphorus, and trace metals. Best use of constructed wetlands is as the final step in an overall treatment train that includes primary and secondary pre-treatment. Thus, constructed wetlands can provide the near-final step for producing an effluent that can meet advanced water treatment (AWT) standards.

Public use facilities are generally included in many of the large-scale constructed wetlands, such as at WadiHanifa, where passive recreational facilities and wildlife habitat are supported. Water produced at the firing point is useful for a broad variety of non-potable applications

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