

# **The Model Village/Town: Sustainable Strategies for Sanitation**

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## Executive Summary

The vast majority of people in India live in rural villages, small towns and along the edges of India's growing cities. These places, despite appearing different, have many common features including:

1. Organic unplanned growth
2. Water supply below 70-80 Litres/Per Capita/Per Day (LPCD)
3. Limited or no sanitation servicing resulting in Open Defecation

The reason that throughout India we see Grey coloured wastewater flowing in open drains is that in the vast majority of India's Villages, Small Towns and even along the peripheries of major cities there is inadequate water supply to move the solid component of sewage from its source to a sewage treatment facility.

A common solution - septic tanks and/or soak pits, are at best a short term solution as all they do is collect concentrated solid sewage in tanks while allowing the liquid component to discharge into the ground and then travel underground to drain into nearby water bodies and nallahs. In fact, even the solid sewage that is accumulated in them must frequently be drained either via tankers or by the deplorable practice of manual scavenging and disposed of in fields or depressions from which rain or seepage will once again mix this concentrated sludge into water bodies. The idea that this waste can be reused as agricultural fertilizer ignores the fact that there are many social issues related to its handling which actively work against this solution.

The severe pollution affecting the majority of India's water bodies is directly or indirectly responsible for the countless illnesses, deaths and lost working days through water borne disease like gastroenteritis, typhoid and cholera. It is estimated that today in India 70 – 80 percent of all diseases are related to water contamination and poor sanitation (Tate et al. (2009), "Disease and economic burden of rotavirus diarrhea in India." Vaccine. Vol. 27, Supplement 5). The World Bank's Water & Sanitation Partnership estimates that in India this Sanitation problem translates into an actual economic loss of Rs. 324,000 Crores (2.87% of GDP, 2013) annually. The old adage that the poor suffer the most is especially true here as they can least afford the lost working hours, the cost of medicines and doctor visits. Sewage contamination of drinking water can therefore easily push families into debt cycles from which escape is often impossible.

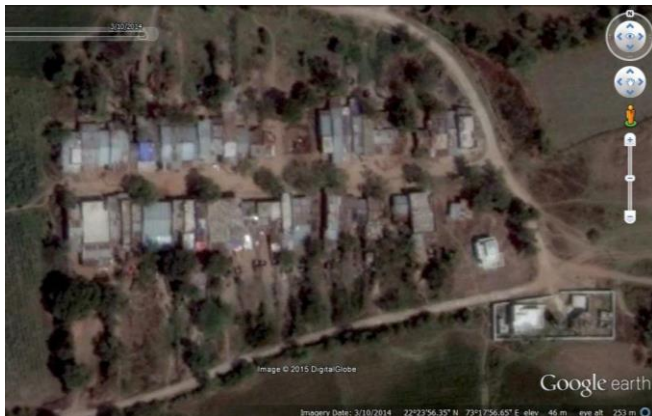
Clearford Water Systems Inc., a Canadian publically listed company, has spent twenty five years developing its unique, proprietary sewage collection, treatment and recycling system to tackle the issue of how to deploy sewerage networks in areas of low water supply and help mitigate the loss of life and income earning opportunity caused by illness. The Clearford One™ solution works on the principle of decentralized sewage collection and has three major components: underground ClearDigest™ Smart Digester tanks, a ClearConvey™ network of sealed HDPE piping and an end of the line ClearRecover™ Sewage Treatment Plant (STP) dedicated to recycling as much of the water as possible and augmenting available water resources.

*This step-by-step decentralized process offers many advantages over traditional sewerage collection and treatment systems and for the first time allows the deployment of sewage collection and treatment across Rural India and on the outskirts of urban areas. It allows development strategies to have a real impact in terms of overall community health in an affordable and sustainable manner that does not have to be recreated every few years.*

# Creating a Model Open Defecation Free Village

## The Village

Gujarat Road and Infrastructure Co. Ltd. a SPV between IL&FS and the Gujarat Government as part of their CSR initiatives has adopted a number of villages along their road concession between Vadodara and Halol in Gujarat. As a part of this initiative IL&FS identified the village of Jambudiyapura as a test bed for the creation of a model ODF village and requested Clearford Water Systems Inc. through its Indian subsidiary Clearford India Pvt. Ltd. to install the Clearford One™ system there.



Jambudiyapura Village, Gujarat

The Village itself is a poor Scheduled Tribe village with 54 houses, 2 schools and a population ranging between 250-300 people. The majority of the villager's source of income is either agriculture or manual labour. When IL&FS first looked at the village only 2 houses had toilets and the majority of the population practised open defecation in the fields around the village. In addition, while a few of the houses had proper bathing areas, the majority of the village bathed outdoors on stone slab platforms with cloth screens for privacy. The wastewater being generated from these platforms was found to collect in open pits nearby adding to the unhygienic conditions present.



Typical House Backyard



Stagnant Water from Bathing Area

## **Project Targets**

As the overall objective of this CSR initiative was to create a locally sustainable ODF village that not only eliminates open defecation but also improves the long term health of the villagers; it was decided that in Jambudiyapura Clearford would:

1. Build model toilet and bathroom complexes for individual homes.
2. Collect all the wastewater (toilet, bathroom and laundry/utensil washing) using the Clearford One™ system.
3. Transport the wastewaters after anaerobically reducing the solid organic component in the Clearford ClearDigest™ Smart Digester™ tanks to a low cost treatment facility.
4. The treated wastewaters should be reusable for irrigation purposes thus allowing the villagers to benefit from increased water availability for their crops especially in the summer months.
5. The main road passing between the houses in the village should have a rainwater drainage system alongside to prevent puddling of waters.
6. Annual Operation and Maintenance should be minimized and the installed system should be maintainable by the villagers themselves.
7. Clearford would operate the system for a period of 3 years after commissioning during which villagers would be trained to operate the system after handover.

## **The Clearford One™ System**

The Clearford One™ system designed for Jambudiyapura will remove sewage solids at source in ClearDigest™ Smart Digesters™ before releasing liquid effluent into the SBS® ClearConvey™, a network of smaller diameter pipes that carries liquid sewage to an optimized CAMUS SBT Wastewater Treatment facility for final processing. Recovered water will be safely returned to the environment for use in irrigation as required by the villagers.

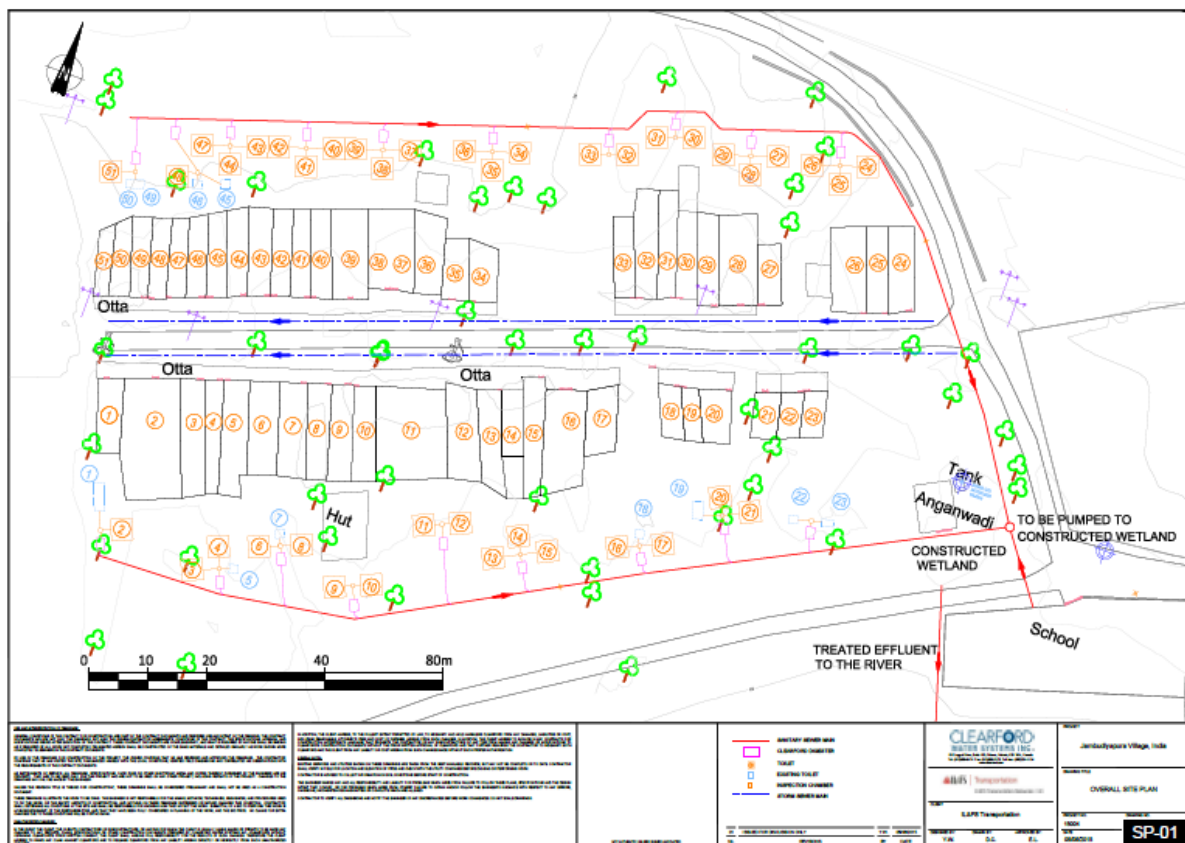
After a series of Gram Sabha meetings with the villagers to ascertain their desire to make the village ODF; it was decided that each household not having a Toilet and/or Bathroom would get one. These new constructions would have attached *Mori's* or washing areas where clothes and utensils could be washed.



Toilet & bathroom Complex

The wastewaters and sewage generated would be collected and transported to the Clearford One™ system's ClearDigest™ Smart Digester™ tanks which provide decentralised pre-treatment of the organic component of wastewater through anaerobic digestion, while retaining inert solids in the tank. These Smart Digesters™ greatly reduce the solids and organic loading in the liquid effluent while continuously decomposing sewage solids.

After exiting the tanks, the Clearford One™ system's ClearConvey™ Small Bore Sewers® (SBS®) network of HDPE pipes will convey the liquid effluent away to the wastewater treatment facility by gravity. The flexible small diameter pipes used allows for adaptable installations in shallow trenches with less material requirements. Additionally, the seamless fusion of pipe sections eliminates infiltration of rainwater into the system and stops leakage of sewage into the environment.



The Clearford One™ system, Jambudiyapura

As the ClearDigest™ Smart Digester™ tanks significantly pre-treat the incoming sewage and wastewaters, the requirement for final treatment is significantly reduced compared to conventional systems as solids (TSS) and organic matter (BOD) are reduced by over 65%. This reduction in TSS and BOD provided Clearford with an opportunity to work with Vision Earth Care (an IIT Mumbai faculty venture) to specifically tailor their CAMUS SBT treatment facility to the requirements at Jambudiyapura and achieve significant operation and maintenance savings.

The step-by-step process thus offers many advantages to the villagers including:

1. The Clearford One SBS™ system collects and transports sewage without causing blockages in the low water supply regime (70 LPCD) present which conventional sewers would not have been able to achieve.
2. The Smart Digesters do not use electricity, added bacteria or chemicals but digest the solid organic sewage using naturally present anaerobic bacteria. As a result there is significantly less sludge in our tanks effectively eliminating the frequent sludge removal and disposal requirements of alternate systems like septic tanks. This reduces annual operating costs.
3. The significantly cleaner liquid effluent requires less additional treatment at a wastewater treatment facility to reach irrigation standards once again saving costs.
4. The cleaner and attenuated effluent delivered by the Clearford One™ system will result in the CAMUS SBT Wastewater Treatment Plant having a smaller footprint and requiring lower electricity consumption for its pumps.
5. The ClearConvey™ HDPE pipe network requires shallower trenching, can often be dug with local manual labour reducing excavation costs and allowing sewerage networks to be installed faster.
6. The ClearConvey™ HDPE network is sealed eliminating the sewage leakages into the surrounding environment common with other pipe types. This significantly reduces the chances of groundwater contamination and sewage entering wells, water supply pipes and natural water bodies.
7. It allows the installation of community based sewage solutions and the reuse of treated wastewater which is critical as shifting responsibility to the Panchayat will ensure that individual households do not relapse once ODF status is achieved.
8. It will generate a significant quantity of treated water daily that can be used for irrigation purposes reducing freshwater and/or groundwater requirements and thus in effect increasing the total water supply available locally.



CAMUS SBT Treatment Facility

While CAPEX is a onetime expenditure, the critical component that often determines the success or failure of a sanitation project is a combination of ease of use as well as the quantum of recurring expenditure.

It is in terms of Operating and Maintenance that the true benefit of utilizing the Clearford One™ system is visible with the collection and treatment of both the greywater as well as the sewage requiring minimal to no maintenance for years to come. In addition, the CAMUS SBT treatment facility optimally designed for Jambudiyapura uses just 10 kWh/day of electricity and requires under Rs. 1000/month of chemicals to operate with most maintenance work requiring no more skill than that possessed by a gardener or a handyman.

The successful installation and operation of the Clearford One™ system at Jambudiyapura will provide improved holistic sanitation advocates with a new and proven tool in the effort to end open defecation in India.

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