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CIRCULAR

Subject:-Process selection for Municipal wastewater Treatment Plant to be constructed by ULB's in various cities of Rajasthan

Urban Local bodies are in the phase of introducing sewerage works in various towns under UIDSSMT or from their own funding source or taking loans to provide sewerage facility in the towns. Sewerage works includes the laying of sewer line in the municipal area to collect the municipal (house) sewage, treatment of municipal (domestic) sewage & its safe disposal & 5 year operation & maintenance of STP & Sewage pumping stations. The cost of laying of sewer & its treatment is a major component. The gravity sewer is generally most economical for the operation & maintenance. Pumping of sewage involves the power charges therefore O&M cost for collection of sewage become more. Sewage treatment Plant is an important unit before disposal of the treated wastewater. It generally depends on availability of land area, safe disposal point of treated wastewater whether it's river or Nalla or made available for Irrigation. The degree of treatment also depends on reuse of treated wastewater. In Rajasthan there is already scarcity of water thus the reuse of treated waste water can be one method to save potable water for future. The treatment also reduces the harmful bacteria/ virus which reduces many common diseases. Treatment of wastewater indirectly saves the money spent on treatment of various diseases.

All ULB's are directed to use the enclosed guide lines for process selection of proposed STP's. The **O&M of at least 5 years** shall be put on the part of contractor who will construct the STP. In case DPR is prepared through consultant engaged by them, they should check the DPR's as per enclosed guide lines.

Encl.

Principal Secretary
UDH& LSGD, GoR, Jaipur

Copy to following for information & necessary action:-

No. F3(106)(41)/IPMU-CDM/2011/ 15203-353 Date: 14/9/2011

1. PS to Principal Secretary ULB &LSGD.
2. Secretary LSGD.
3. Project Director RUIDP
4. Team Leader, RUIFDCO, Jaipur
5. Executive Director, RUIFDCO, Jaipur.
6. CEO Jaipur/Kota/Bikaner/Ajmer/Jodhpur
7. Director Local Bodies Jaipur
8. Project Director DLB, Jaipur
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10. All Municipal Council/ Executive Officers --------------------------

Project Director
RUIDP, Jaipur

GUIDE LINES FOR PROCESS SELECTION OF PROPOSED STP'S

1. Object of wastewater treatment

The object of sewage treatment is to dispose off the wastewater with a suitable degree of treatment up to the standard set out by the State Pollution control Board / Central Pollution control Board. The another object is to stabilize the decomposable organic matter present in sewage so as to produce an effluent (treated wastewater) and sludge which can be disposed of in the environment without causing health hazards or nuisance.

The degree of treatment will mostly be decided by the regulatory agencies (RPCB Rajasthan in our case) and the extent to which the final products of treatment are to be utilised. These regulatory bodies have laid down standards of the effluent & the conditions under which the effluent could be discharged into a natural stream, sea or disposed off on land. These regulatory bodies may be the local body or a State Pollution Control Board. The method of treatment adopted should not only meet the requirements of these regulatory agencies but also result in the maximum use of end products (treated wastewater) consistent with economy.

2. General impurities (contaminants) & their significant

Municipal wastewater, General impurities (contaminants) & their significant are as below:-

Contaminant	Significance	Origin
Settleable solids (sand, grit)	Settleable solids may create sludge deposits and anaerobic conditions in sewers, treatment facilities or open water	Domestic, runoff
Organic matter (BOD); Kjeldahl nitrogen	Biological degradation consumes oxygen and may disturb the oxygen balance of surface water; if the oxygen in the water is exhausted anaerobic conditions, odour formation, fish kills and ecological imbalance will occur	Domestic, Industrial
Pathogenic microorganisms	Severe public health risks through transmission of communicable water borne diseases such as cholera	Domestic
Nutrients (N and P)	High levels of nitrogen and phosphorus in surface water will create excessive algal growth	Domestic, rural run-off, Industrial

Contaminant	Significance	Origin
	(eutrophication). Dying algae contribute to organic matter (see above)	
Micro-pollutants (heavy metals, organic compounds)	Non-biodegradable compounds may be toxic, carcinogenic or mutagenic at very low concentrations (to plants, animals, humans). Some may bioaccumulate in food chains, e.g. chromium (VI), cadmium, lead, most pesticides and herbicides, and PCBs	Industrial, rural run-off (pesticides)
Total dissolved solids(salts)	High levels may restrict wastewater use for agricultural irrigation or aquaculture	Industrial, (salt water intrusion)

Source: Metcalf and Eddy Inc., 1991

As per Schedule 1 (Rule 3) of Pollution control Board the typical treated effluent standards as a function of the intended use of the receiving waters as listed below i.e. effluent (treated wastewater) shall meet the following criteria.

3. Standards for Discharge of Environmental Pollutants

General important Standards for Discharge of Environmental Pollutants (as per Schedule of the Env Protection Rules 1980 are given below:-

IMPORTANT STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS

Parameters		Standards			
		Inland Surface Water	Public Sewer	Land for Irrigation	Marine/ Coastal area
1.	Biochemical oxygen demand (3 days at 27°C),(BOD) mg/I, max.	30	350	100	100
2.	Chemical oxygen demand,(COD) 'mg/I, max.	250			250
3.	Suspended Solids mg/l, max. (SS)	100	600	200	(a)For process waste water (b)For cooling water effluent 10 per cent above total suspended matter of influent.

Parameters		Standards			
		Inland Surface Water	Public Sewer	Land for Irrigation	Marine/ Coastal area
4.	Total Kjeldahl* nitrogen(TKN) (as N) mg/l, max.	100			100
5.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0

- Kjeldahl nitrogen (TKN) is the sum of organic nitrogen, ammonia (NH_3),and ammonium(NH_4^+) in the chemical analysis of wastewater(e.g. sewage treatment plant effluent).

OTHER STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS

Parameters		Standards			
		Inland Surface Water	Public Sewer	Land for Irrigation	Marine/ Coastal area
1.	Color and Odor	See 6 of Annexure I		See 6 of Annexure I	See 6 of Annexure I
2.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a) Floatable solids, solids' max. 3 mm (b) Settleable solids, max 850 microns
3.	Oil and grease, mg/I max,	10	20	10	20
4.	Temperature	shall not exceed 5°C above the receiving water temperature			shall not exceed 5°C above the receiving water temperature
5.	Total residual chlorine, mg/I max.	1.0	-	-	1.0
6.	Ammonical nitrogen (as N), mg/I, max	50	50	-	50
7.	Free ammonia (as NH3), mg/l, max.	5.0			5.0
8.	Arsenic(as As).	0.2	0.2	0.2	0.2
9.	Mercury (As Hg). mg/I, rnax.	0.01	0.01		0.01
10.	Lead (as Pb) mg/I, max	0.1	1.0		2.0
11.	Cadmium (as Cd) mg/I, max	2.0	1.0		2.0
12.	Hexavalent chro- mium (as	0.1	2.0		1.0

Parameters		Standards			
		Inland Surface Water	Public Sewer	Land for Irrigation	Marine/ Coastal area
	Cr + 6), mg/I, max.				
13.	Total chromium (as Cr) mg/I, max.	2.0	2.0		2.0
14.	Copper (as Cu) mg/I, max.	3.0	3.0		3.0
15.	Zinc (asZn) mg/I, max.	5.0	15	-	15
16.	Selenium (as Se)	0.05	0.05		0.05
17.	Nickel (as Ni) mg/I, max .	3.0	3.0		5.0
18.	Cyanide (as CN) mg/I, max.	0.2	2.0	0.2	0.2
19.	Fluoride (as F) mg/I, max.	2.0	15		15
20.	Dissolved phos-phates (as P), mg/I, max.	5.0		-	
21.	Sulphide (as S) mg/I, max.	2.0			5.0
22.	Phenolic compounds (as C_6H_5OH) mg/I, max.	1.0	5.0		5.0
23.	Radioactive materials				
	(a) Alpha emitters micro curie mg/I, max.	10^{-7}	10^{-7}	10^{-8}	10^{-7}
	(b) Beta emitters micro curie mg/I	10^{-6}	10^{-6}	10^{-7}	10^{-6}
24.	Manganese	2 mg/I	2 mg/I		2 mg/I
25.	Iron (as Fe)	3mg/1	3 mg/I		3 mg/I
26.	Vanadium (as V)	0.2 mg/I	0.2 mg/I		0.2 mg/I
27.	Nitrate Nitrogen	10 mg/I			20 mg/I

These standards shall be applicable for industries, operations or processes other than those industries, operations or process for which standards have specified in Schedule of the Environment Protection Rules, 1989.

4. Wastewater composition

Wastewater can be characterized by its main contaminants which may have negative impacts on the aqueous environment in which they are discharged. At the same time, treatment systems are often specific, i.e. they are meant to remove one class of contaminants and so their overall performance deteriorates in the presence of other contaminants, such as from industrial effluents. In particular, oil, heavy metals, ammonia, sulphide and toxic constituents may damage sewers (e.g. by corrosion) and reduce treatment plant performance. Therefore, municipalities may set additional criteria for accepting industrial waste flows into their sewers.

Variation in the composition of domestic wastewater

Contaminant	Specific production (g cap-1 d-1)2	Concentration1 (mg l-1)2
Total dissolved solids	100-150	400-2,500
Total suspended solids	40-80	160-1,350
BOD	30-60	120-1,000
COD	70-150	280-2,500
Kjeldahl-nitrogen (as N)	8-12	30-200
Total phosphorus (as P)	1-3	4-50
Faecal coliform (No. per 100 ml)	10^6-10^9	4×10^6-1.7×10^7

BOD- Biochemical oxygen demand, COD -Chemical oxygen demand

1 Assuming water consumption rate of 60-250 lpcd

2 Except for faecal coliforms

5. Classification of common wastewater treatment processes

Classification of common wastewater treatment processes according to their level of advancement is listed below for reference purpose:-

Primary	Secondary	Tertiary	Advanced
Bar or bow screen	Activated sludge	Nitrification	Chemical treatment
Grit removal	Extended aeration	Denitrification	Reverse osmosis
Primary sedimentation	Aerated lagoon	Chemical precipitation	Electro-dialysis
Comminution	Trickling filter	Disinfection	Carbon adsorption
Oil/fat removal	Rotating bio-discs	(Direct) filtration	Selective ion exchange
Flow equalization	Anaerobic	Chemical	Hyperfiltration

Primary	Secondary	Tertiary	Advanced
	treatment/UASB	oxidation	
pH neutralization	Anaerobic filter	Biological P removal	Oxidation
Imhoff tank	Stabilization ponds	Constructed wetlands	Detoxification
	Constructed wetlands	Aquaculture	
	Aquaculture		
	SBR/MBR/MBBR		

UASB : Up-flow Anaerobic Sludge Blanket, SBR- Sequential Batch Reactor, MBR- Membrane Bio Reactor, MBBR- Moving Bed Bio Reactor. These are advanced secondary treatment processes.

6. Selection criteria:-

Selection criteria generally depend on

- **Average, or typical, efficiency and performance of the technology.**

  This is usually the criterion considered to be best in comparative studies. The possibility that the technology might remove other contaminants than those which were the prime target should also be considered an advantage. Similarly, the pathways and fate of the removed pollutants after treatment should be analyzed, especially with regard to the disposal options for the sledges in which the micro-pollutants tend to concentrate.

- **Reliability of the technology.**

  The process should, preferably, be stable and resilient against shock loading, i.e. it should be able to continue operation and to produce an acceptable effluent under unusual conditions. Therefore, the system must accommodate the normal inflow variations, as well as infrequent, yet expected more extreme conditions. This pertains to the wastewater characteristics (e.g. occasional illegal discharges, variations in flow and concentrations, high or low temperatures) as well as to the operational conditions (e.g. power failure, pump failure, poor maintenance). During the design phase, "what if scenarios should be considered. Once disturbed, the process should be fairly easy to repair and to restart.

- **Institutional manageability**

  In developing countries few governmental agencies are adequately equipped for wastewater management. In order to plan, design, construct, operate and maintain treatment plants, appropriate technical and managerial expertise must be present. This could require the availability of a substantial number of engineers with postgraduate education in wastewater engineering, access to a local network of research for scientific support and problem solving, access to good quality laboratories, and experience in management and cost recovery. In addition, all technologies (including those thought "simple") require devoted and experienced operators and technicians who must be generated through extensive education and training.

- **Financial sustainability**

  The lower the financial costs, the more attractive the technology. However, even a low cost option may not be financially sustainable, because this is determined by the true availability of funds provided by the polluter. In the case of domestic sanitation, the people must be willing and able to cover at least the operation and maintenance cost of the total expenses. The ultimate goal should be full cost recovery although, initially, this may need special financing schemes, such as cross-subsidization, revolving funds, and phased investment programmes.

- **Application in reuse schemes.**

  Resource recovery contributes to environmental as well as to financial ustainability. It can include agricultural irrigation, aqua- and pisciculture, industrial cooling and process water re-use, or low-quality applications such as toilet flushing. The use of generated sludges can only be considered as crop fertilisers or for reclamation if the micro-pollutant concentration is not prohibitive, or the health risks are not acceptable.

- **Regulatory determinants.**

  Increasingly, regulations with respect to the desired water quality of the receiving water are determined by what is considered to be technically and financially feasible. The regulatory agency then imposes the use of specified, up-to-date technology (BAT or BATNEEC) upon domestic or industrial dischargers, rather than prescribing the required discharge standards.

7. Expected Efficiency of Various Treatment Units

S. No	Process		SS	BOD	Total Coliform
1	Primary Treatment (Sedimentation)		45-60	30-45	40-60
2	Chemical Treatment		60-80	45-65	60-90
3	Secondary Treatment				
4	i	Standard Trickling Filters	75-85	70-90	80-90
	ii	High rate trickling filters			
	a	Single stage	75-85	75-80	80-90

S. No	Process		SS	BOD	Total Coliform
	b	Two stage	90-95	90-95	90-60
	iii	Active Sludge Plants	85-90	85-95	90-96
	iv	Extended Aeration	90-95	85-98	90-96
5	a	Stabilization Ponds (Single Cell)	80-90	90-95	90-95
	b	Stabilization Ponds (Two Cell)	90-95	95-97	95-98
6		UASB	60-70	60-70	80-90
7		SBR	95-98	95-98	95-98
8		MBBR	95-98	95-98	95-98
9		MBR	95-98	95-98	95-98

Tertiary Treatment is adopted when reuse of effluent for industrial purpose is contemplated or when circumstances dictate the requirement of higher quality effluents.

8. Various Technologies Available , Land requirement & per MLD cost of construction

The technology must remove the organic contaminants either by aerobically (in the presence of Oxygen)or Anaerobically(in the absence of oxygen) along with other contaminants. Similarly, the pathways and fate of the removed pollutants after treatment should be analyzed, especially with regard to the disposal options for the sledges in which the micro-pollutants tend to concentrate. There are following technologies available for treatment of municipal wastewater:-

S.No	Treatment process	Per MLD land (in Hactares)	Per MLD Capital cost based on 5 to 10 MLD capacity (Rs. in lacs)
1	Conventional ASP	0.23	105-90
2	Extended Aeration	0.15	105-90
3	Waste stabilization pond (pumping is at STP)	0.93	65-45
4	Facultative aerated lagoons	0.14	85-65
5	Up-flow Anaerobic Sludge Blanket (UASB)+ followed by Facultative Pond(in case pumping is at STP)	0.65	90-70
6	Trickling Filter	0.19	75-65
7	Sequential Batch Reactor	0.09	115-95
8	Moving Bed Bio Reactor(MBBR)	0.075	130-100
9	Membrane Bio Reactor(MBR)	0.075	135-115

9. Per MLD O&M cost, power consumption for various process based on (5 to 10 MLD capacity)

Most of the towns are of population having 50,000- 90,000 population. Generally STP's are being constructed in modules & replication of earlier is done in later stage if the process is functioning satisfactory. The capacity to be proposed in towns is generally in the range of 5 to 10 MLD. Therefore based on standard books ,journals and field experience of various agencies, the expected power consumption cost & O&M cost for 5 MLD to 10 MLD capacity STP's for various process as tabulated below:-

(Rs. in lacs)

S.N.	Treatment process	Per MLD / month Power charges based on 5 to 10 MLD capacity	Per MLD/ month O&M charges based on 5 to 10 MLD capacity	Total Per MLD /month O&M charges based on 5 to 10 MLD capacity	Treated waste water (effluent) parameters	Remarks.
1	Conventional ASP	1-0.85	0.55-0.325	1.55-1.18	BOD_5- less than 30 SS less than 50	Less area requirement. Power consumption is more. Generally propose where treated water is to be disposed off in a water body.
2	Extended Aeration	1.0-.0.90	0.55-0.325	1.65-1.125	BOD_5- less than 30 SS less than 30	Less area require than ASP. Power consumption is more than ASP. Generally in use where treated water is to be disposed off in a water body.
3	Waste stabilization pond (pumping is at STP)	0.25-0.20	0.25-0.18	0.50-0.38	BOD_5- less than 100 SS less than 100	More area is required. Very less power & O&M cost. Generally proposed where land is easily available & treated water is to be discharged on land.
4	Facultative aerated lagoons	1.00-0.70	0.50-0.35	1.50-1.05	BOD_5- less than 30 SS less than 100	Land requirement is less than WSP & low BOD wastewater is to be treated process may be proposed.
5	Up-flow Anaerobic Sludge Blanket (UASB)+ followed by	0.30-0.20	0.30-0.20	0.60-0.40	BOD_5- less than 100 SS less then 100	Land requirement is less than WSP. Power requirement is also less. O&M require specific attention. Treated wastewater

S.N.	Treatment process	Per MLD / month Power charges based on 5 to 10 MLD capacity	Per MLD/ month O&M charges based on 5 to 10 MLD capacity	Total Per MLD /month O&M charges based on 5 to 10 MLD capacity	Treated waste water (effluent) parameters	Remarks.
	Facultative Pond(in case pumping is at STP)					can be discharged on land.
6	Trickling Filter	1-0.85	0.55-0.325	1.55-1.18	BOD_5- less than 30 SS less then 100	Land requirement is less then ASP. Power requirement is almost same as in ASP. O&M require specific attention. Environmental nuisance is more at site than other process.
7	Sequential Batch Reactor	1.0-.8	0.55-0.326	1.65-1.13	BOD_5- less than 10 SS less then 10	Land requirement is less than ASP. Better quality treated water. After chlorination can be used for cleaning washing etc. also.
8	Moving Bed Bio Reactor(MBBR)	.25-.2	0.25-0.18	0.50-0.38	BOD_5- less than 10 SS less then 100	It is modified version of ASP. Less area is required. Generally used for smaller capacity 1-5 MLD. Treated quality is almost same as in SBR. More care is require during O&M (media removal & cleaning).
9	Membrane Bio Reactor(MBR)	1.00-0.70	0.50-0.35	1.50-1.05	BOD_5- less than 10 SS less then 100	It is new technology. area requirement is less than SBR. Generally proposed for small capacities. More care is required during O&M (membrane repair & replacement).

The process shall be selected considering the above specified requirement on techno economic consideration. The availability of land & value of land at proposed site is an important aspect in selection of process. The Capital cost available, capacity to bear power charges & O&M cost & availability of skill manpower also play a big role in selection of Process.

CRITERIA BASED PROCESS SELECTION

S. No	Criteria	Conventional ASP	Extended Aeration	Waste stabilization pond	Facultative aerated lagoons	Up-flow Anaerobic Sludge Blanket (UASB)+ followed by Facultative Pond(in case pumping is at STP)	Trickling Filter	Sequential Batch Reactor (SBR)	Moving Bed Bio Reactor (MBBR)	Membrane Bio Reactor (MBR)
1	Treated waste water (effluent) parameters(mg/lit)									
	BOD_5	≤ 30	≤ 30	≤ 100	≤ 30	≤ 100	≤ 30	≤ 10	≤ 10	≤ 10
	SS	≤ 50	≤ 30	≤ 100	≤ 100	≤ 100	≤ 100	≤ 10	≤ 100	≤ 100
	COD	≤ 150						≤ 100		
2	Per MLD land requirement (in Hactares)	0.23	0.15	0.93	0.14	0.65	0.19	0.09	0.075	0.075
3	Power charges Per MLD / month based on 5 to 10 MLD capacity (Rs. in lacs)	1-0.85	1.0-0.90	0.25-0.2	1.00-0.70	0.30-0.20	1-0.85	1.0-0.8	0.25-0.2	1.00-0.70

Exemplary process selection:-

S.No	Treatment process	Remarks.
1	Conventional ASP	Process may be proposed if land area is less , costly & near to residential area. Treated water is to be disposed off in a water body. The capacity of STP is more so power from sludge may be generated to run the Plant. Effluent may be reused for industrial & other purposes.
2	Extended Aeration	Process may be proposed if land area is less, costly & near to residential area. Treated water is to be disposed off in a water body. Effluent may be reused for industrial & other purposes.
3	Waste stabilization pond (pumping is at STP)	Process may be proposed if land area is easily available, not costly & not near to residential area. Treated water is to be disposed off on land or to be used in Irrigation.
4	Facultative aerated lagoons	Process may be proposed if land area is less, costly & not so near to residential area. Treated water is to be disposed off in a water body. Now days it is generally not proposed for municipal wastewater treatment.
5	Up-flow Anaerobic Sludge Blanket (UASB)+ followed by Facultative Pond(in case pumping is at STP)	Process may be proposed if available land area is less than required for WSP, moderately costly & not near to residential area. Treated water is to be disposed off on land or to be used in Irrigation.
6	Trickling Filter	Process may be proposed if land area is less, costly & not near to residential area. But Environmental nuisance is more at site than other process.
7	Sequential Batch Reactor	Process may be proposed if land area is less, costly & near to residential area. Treated water is to be disposed off in a water body or to be used for industrial purpose & better quality effluent is needed.
8	Moving Bed Bio Reactor(MBBR)	Process may be proposed if land area is less, costly & near to residential area. Treated water is to be disposed off in a water body or to be used for industrial purpose & better quality effluent is needed. It is modified version of ASP. Better for small capacity.
9	Membrane Bio Reactor(MBR)	Process may be proposed if land area is less, costly & near to residential area. Treated water is to be disposed off in a water body or to be used for industrial purpose & better quality effluent is needed. It is modified version of ASP. Better for small capacity.

10. Reuse of effluent & gases generated during digestion of sludge

There is scarcity of water in Rajasthan & day by day it is becoming more & more. Now it is right time to start the reuse of treated wastewater of STPs specifically for gardening & parks development.

Once freshwater has been used for an economic or beneficial purpose, it is generally discarded as waste. Wastewater are discharged, either as untreated waste or as treated effluent, into natural watercourses, from which they are abstracted for further use after undergoing "self-purification" within the stream. Through this system of indirect reuse, wastewater may be reused up to a dozen times or more before being discharged to the perennial flow rivers/sea. However, more direct reuse is also possible: the technology to reclaim wastewaters as potable or process waters are a technically feasible option for agricultural and some industrial purposes (such as for cooling water or sanitary flushing), and a largely experimental option for the supply of domestic water. Wastewater reuse for drinking raises public health, and possibly religious, concerns among consumers. One of the most critical steps in any reuse program is to protect the public health, especially that of workers and consumers. To this end, **it is most important to neutralize or eliminate any infectious agents or pathogenic organisms that may be present in the wastewater**. For some reuse applications, such as irrigation of non-food crop plants, secondary treatment may be acceptable. For other applications, further disinfection, by such methods as chlorination or ozonation, may be necessary. Table presents a range of typical survival times for potential pathogens in water and other media. Table showing Typical Pathogen Survival Times at 20 - 30°C (in days).

Pathogen	Freshwater and sewage	Crops	Soil
Viruses	< 120 but usually <50	<60 but usually < 15	<100 but usually <20
Bacteria	<60 but usually <30	<3 0 but usually < 15	<70 but usually <20
Protozoa	<30 but usually <15	<10 but usually <2	<70 but usually <20
Helminths	Many months	<60 but usually <30	Many months

Guidelines for Reuse of Treated Wastewater

Table below presents some guidelines for the utilization of wastewater, indicating the type of treatment required, resultant water quality specifications, and appropriate setback distances. In general, wastewater reuse is a technology that has had limited use, primarily in small-scale projects in the region, owing to concerns about potential public health hazards. Wastewater reuse is primarily in the form of irrigation water, some hotels can use wastewater treatment effluent for golf course irrigation, while the major industrial water users, engage in extensive recycling of their process waters, effluent from sewage treatment plant can be used for lawn irrigation.

Type of Reuse	Treatment Required	Reclaimed Water Quality	Recommended Monitoring	Setback Distances
Agricultural Food crops commercially processed	Secondary Disinfection	pH=6-9	pH weekly	300 ft from potable water supply wells
		BOD = up to 30 mg/l	**BOD weekly**	
		SS = up to 30 mg/l	**SS daily**	

Type of Reuse	Treatment Required	Reclaimed Water Quality	Recommended Monitoring	Setback Distances
Orchards and Vineyards		FC = up to 200/100 ml	FC daily	100 ft from areas accessible to public
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
Pasturage	Secondary Disinfection	pH = 6-9	pH weekly	300 ft from potable water supply wells
pasture for milking animals		BOD up to 30 mg/l	BOD weekly	
		SS up to 30 mg/l	SS daily	
pasture for livestock		FC up to 200/100 ml	FC daily	100 ft from areas accessible to public
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
Forestation	Secondary Disinfection	pH = 6-9	pH weekly	300 ft from potable water supply wells
		BOD up to 30 mg/l	BOD weekly	
		SS up to 30 mg/l	SS daily	
		FC up to 200/100 ml	FC daily	100 ft from areas accessible to the public
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
Agricultural	Secondary Filtration Disinfection	pH = 6-9	pH weekly	50 ft from potable water supply wells
Food crops not commercially processed		BOD up to 30 mg/l	BOD weekly	
		Turbidity up to 1 NTU	Turbidity daily	
		FC = 0/100 ml	FC daily	
		Cl_2 residual = 1 mg/l min.	Cl_2 residual continuous	
Ground Water Recharge	Site-specific and use-dependent	Site-specific and use-dependent	Depends on treatment and use	Site-specific

Source: USEPA, Process Design Manual: Guidelines for Water Reuse, Cincinnati, Ohio, 1992

Generally in every town the treated wastewater is being discharged in the existing Nallahs, from there wastewater is being used by farmers through putting pumps directly in Nalla without any disinflation which is not desirable. Treated wastewater can be used for Agriculture, Forestation, Ground Water recharge and Pasture for milking animals Pasture for livestock after proper disinfection. Without disinfection use of secondary treated wastewater for agricultural purpose is harmful for farmers as well as users of the production. For the use of Industrial Purpose it can be used after doing further treatment as per the Industry requirement and guidelines given above. Industries can use this treated water for their gardening, washing cleaning workshop etc & other works. This reuse can help us in reduction of use of fresh water for such purposes where treated wastewater can be used. This indirectly saves the good quality under ground/ surface water. The use can help us in reduction of use of fresh water for such purposes where treated wastewater can be used. This indirectly saves the good quality under ground/ surface water available for future.
