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**Faculty of Law
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Lawless Laws: Land Rights, Poverty and Empowerment of Common People in Bangladesh

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REVIEW OF REGULATIONS ON WASTEWATER AND ITS REUSE IN AGRICULTURE IN RAJSHAHI CITY AREA

Abu Naser Md. Wahid*

ABSTRACT *This Article¹ discusses about relevant Policies, Acts and Ordinances alongside the duties and responsibilities of answerable bodies related with regulation of wastewater and its reuse. The aim of this article is to explore the legal issues composed with wastewater and its reuse by showing the disintegrations among various overriding laws through examining primary and secondary literature.*

KEYWORDS: *Wastewater, reuse, Environmental hazard, health hazard, Bangladesh, Rajshahi*

1. INTRODUCTION

Water demand is predicted to increase significantly over the coming decades. The importance of wastewater reuse is becoming significant day by day. The agricultural sector is currently responsible for 70 percent of global water abstractions (Seckler et al. 1998: 9) and water now used for agriculture may be diverted to the urban and industrial sectors because of increasing demand from municipal and industrial sectors. A number of examples from Asia, North Africa, and Latin America are witnesses to this fact (Molle and Berkoff 2006: 8). One response to this constrict on agricultural water supply is to promote greater use of treated urban wastewater for irrigation and currently about 43 percent of the treated wastewater is being recycled for these purposes (Raschid-Sally and Jayakody 2008: 6). A recent comprehensive compilation of data on water reuse (Jimenez and Asano 2008: 648) provides an understanding of common practices around the world, particularly of treated wastewater for municipal, industrial and agricultural uses and for groundwater recharge.

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¹This article has been written on the basis of the report captioned 'Review of Regulations on Wastewater and Its Reuse in Agriculture in Rajshahi City Area' as a part of implemented action research in the peri-urban areas of Rajshahi City Corporation entitled 'Wastewater Agriculture and Sanitation for Poverty Alleviation in Asia' (WASPA Asia), conducted by the NGO Forum for Drinking Water Supply & Sanitation (NGO Forum), in partnership with the International Water Management Institute (Sri Lanka), IRC International Water and Sanitation Centre (Netherlands), COSI Foundation for Technical Cooperation (Sri Lanka) and Stockholm Environment Institute (Sweden).

Wastewater has the potential to serve as an alternative of untapped water and nutrient source for agriculture. However, if treatment is limited, it also has the latent to affect human health and pollute large volumes of freshwater, rendering them unfit for human uses (Raschid-Sally and Jayakody 2008: 7). The developing world is facing this problem more because of outpaced urban infrastructure development. The cities will be growing at an unprecedented rate accommodating 50 percent of the world population (UNEP 2002) and urban water demand per capita will also increase with increasing supply, coverage and overall urban economic growth. More than 80 percent of urban consumption returns as waste (Tchobanoglous and Schroeder 1985) and there is a forecast that it is likely to worsen in the future if not managed under a centralized collection and disposal system. Furthermore densification of urban areas reduces the possibility for onsite disposal via septic tanks. Centralized treatment systems in developing countries are expensive, and if the initiative is taken, they have always been vulnerable to the vagaries of skills, and institutional and financial capacities found in these countries. The present wastewater management practices in major cities of the less developed countries are inadequate and are an indication that future scenarios are likely to be worsen (Raschid-Sally and Jayakody 2008: 3). To meet the Millennium Development Goals for Sanitation, many countries are attempting to address the challenges of water supply and improved sanitation facilities for all. However, less attention is being paid to the disposal of the increasing volumes of wastewater into the natural drainage systems and streams of the cities (Raschid-Sally and Jayakody 2008: 3).

A number of case studies of city and countries conducted in middle and low-income countries of Africa, Asia and Latin America have recognized that the use of *untreated* wastewater is a widespread practice for the irrigation of high-value cash crops in and close to urban centers. Recent estimation indicates 20 million hectares under agriculture using treated, partially treated, diluted and untreated wastewater (Kerai et al. 2008). Wastewater is a highly important productive resource to millions of poor farm households despite in the absence of a more accurate overall estimation. They use wastewater in a more informal ways significantly to supply the perishable produce such as fresh vegetables, to urban areas which proved to be profitable (Drechsel et al. 2006: 40). Cities in developing countries have difficulty because of lack of necessary infrastructure and cooled storage trucks for transport in sourcing perishable crops from more distant locations and making them dependable on agriculture in market proximity. Furthermore, it is recognized that for these poor urban farmers, wastewater irrigation is a substantial and sometimes even primary source of cash income in addition to contributing towards urban food supply (Van et al. 2007: 95).

2. INTERNATIONAL LEGAL REGIME ON WASTE AND WASTEWATER

Despite the importance of use of wastewater has been seen in agriculture in significant number of countries, the state of international legal regulation on waste and wastewater is very poor. Except for rules on International trade in wastes, the area of laws relating to wastes is not a well developed area of international law and playing a limited role in preventing the generation of waste (Sands 2003: 675). It is also seen that because of the specific focus on different precise issues difficulty arise to define waste (Sands 2003: 677).

In this scenario of definitional disagreements regarding waste, wastewater as a component of waste, totally ignored in the international environmental legal regime because of its domestic nature. None of these international instruments paid attention to focus on wastewater management. However, several directives and guidelines provided by WHO (WHO 2006; 1989), FAO (FAO 1997) and EC, specially the Hyderabad Declaration on Wastewater Use in Agriculture,² have been playing a very crucial role to inaugurate wastewater with the world's legislation. Among these, the European Council Directive 91/271/EEC is the only international regional instrument which has binding force and to protect the environment from the adverse effects of discharges of urban wastewater and wastewater from certain industrial sectors. The Directive reflected an early example of the increasingly detailed nature of EC environmental law, and has entailed significant and costly improvements to the treatment of wastewater in many of the member states. However, WHO guidelines and the Hyderabad Declaration are not binding upon the relevant countries, they can be considered as persuasive while enacting any laws regarding wastewater and can be taken as an internationally recognized standard. Therefore, for setting the standard of using wastewater in Agriculture, these aspects derived from the guidelines should be reflected in the national law.

It is seen that giving a definition of wastewater in respect of Bangladesh tends to produce difficulty as for the non-existence of a definition of wastewater in the prevalent legislations. Nonetheless, many laws have indirect provisions for the regulation and control over wastewater; not any of them has the perfect understanding of what the wastewater is.

3. THE RELEVANT POLICIES IN BANGLADESH

From a critical review on the history of water resource management in Bangladesh, it has been observed that despite flood and flood type catastrophe, fisheries and minor irrigation had given separate importance, the concept of wastewater or its reuse is still very limited. There are few policies in Bangladesh which have relevancy with wastewater and its reuse. The National Water Policy of 1999 has, therefore, provided an idea of the partial wastewater reuse and thus, logically put stress on taking separate standing for use of recycled drainage water in agricultural sector, with the fact in hand that wastewater should not be categorized only as drainage water.³

Then, it is visibly clear that the Water Management Plan, 1992 was formulated in accordance with the National Water Policy. However, the Plan, like to some other Acts, is derailed from the track of using wastewater and does not bear even any resemblance with national water policy regarding wastewater and its reuse.

Henceforth, after analyzing the gist of the National Agricultural Policy of 1999, it is significant that there has been no indication of the creation and utilization of wastewater. It is a matter of huge concern that, though, wastewater could be successfully implemented in the vast arena of agriculture and could be incorporated

² The Hyderabad Declaration on Wastewater Use in Agriculture, 14 November 2002, Hyderabad, India.

³ The National Water Policy, Article 4.7.

with country's agricultural economy, but has been undermined and overlooked by the policy setters.

The Industrial Policy of 2010 is to set up planned industries considering the real domestic demand, prospect of exporting goods abroad, and discouraging unplanned industries in the light of past experience. However, it is unclear whether this planned industrialization goes in conformity with the notion of sustainable development or not. One of the major objects of the Industrial Policy is that the industrialization process is compliant with internationally agreed environment, health, safety and labour standards.⁴ However, the Policy refers only to the settlement and adjudication of the authority concerned and not to the industrial waste disposal and no provision relating to quality and quantity of wastewater discharge has found in this Policy.

It has, therefore, been seen while reviewing the Environmental Policy of 1992 that, though, nothing particular has been mentioned about wastewater management in the Policy, a number of associated provisions can be accumulated for the designing of wastewater use. Yet, the provisions which could have positive effect to idealize wastewater management; have never been seen to be implemented in real.⁵

Thus, after reviewing the Policies and Plans, it is clear that, those did not bring a favorable situation to implement environmental laws in Bangladesh. The policies and laws relating to water sector, in particular wastewater are not exceptional from this general picture of lack of co-ordination and absence of comprehensive approach regarding various sectors. The obscure boundary of implementing authorities' power, especially conflicting administering power of various government and local government bodies made the scenario very complex (Ara et al. 2007: 40).

4. INTRODUCTION OF WASTEWATER USE IN RAJSHAHI CITY AREA

Rajshahi City Corporation was a Paurashava under the then Paurashava Ordinance, and it was upgraded as a City Corporation by the Rajshahi City Corporation Ordinance of 1987 and vested some responsibility to give a sound urban day to day life to city dwellers. Later, the Rajshahi City Corporations Ordinance, 1987 has been repealed⁶ and the Government of Bangladesh unified all city corporations under one umbrella law named the Local Government (City Corporation) Ordinance, 2008, by which the sections and the schedules are changed though the duties and responsibilities have not been changed.

RCC covers an area of 45 km² and accommodates about a population of 449,757 (Faridatul and Jahan 2014:1) Bangladesh can be divided into seven climatic zones and Rajshahi City is within the boundary of the western dry zone and it has a gross annual rainfall of below 1524 mm compared to a national average of 2540 mm.⁷ The rainfall pattern in Rajshahi is uni-modal with 70% of the annual rainfall occurring

⁴The National Industrial Policy 2010, Article 2.15.

⁵ The National Environmental Policy, 1992, Articles 3.1.1-3.1.5, 3.2.1, 3.2.2, 3.2.5, 3.3.1, 3.3.2, 3.3.5, 3.5.1-3.5.7.

⁶The Local Government (City Corporation) Ordinance, 2008, Section 125.

⁷Bangladesh Bureau of Statistics 2005.

between June and September.⁸ The average monthly rainfall data from the Rajshahi rainfall monitoring station shows some monthly variation between years but clearly shows that November to March are months of very low rainfall. The minimum temperature varies from year to year from between 10°C to 27°C and the maximum temperature varies between 24°C to 36°C. During April and in May, Rajshahi experiences the highest temperature (Clemett et al. 2006:8). Rajshahi District also covers five of the 30 agro-ecological zones that Bangladesh has been divided into. Predominant soil textures are Loamy and Clayey and soil pH varies from pH 5.5 to pH 7.1 (Dissanayake et al. 2007: 7).

Rajshahi City Corporation (RCC), with financial support from government allocations, by public taxes and from donor funds, is responsible for governing various development activities in the 48 square kms area that constitutes its jurisdiction. The RCC is responsible for development of water supply, disposal of solid wastes, construction and reconstruction of roads and culverts, restoration of storm water and wastewater drains, eradication of mosquitoes and the provision of health services to city residents through urban health centers and urban maternal health centers (Ara et al. 2007: 12).

RCC is, therefore, entirely vested the authority to make public recreational and private dwellings safe, hygienic and comfortable for its residents. These functions are stipulated in several laws those covering RCC's responsibilities regarding sanitation; unsanitary buildings notifications; removal, collection and disposal of refuse; latrines and urinals; water supply; and drainage and drainage schemes.

RCC provides service to clean roads, drains and collect solid waste in order to fulfill its solid waste management obligations. There are two different types of drainage systems in the city: man-made drains; and natural *khals* (drainage canals). Ten storm water drains flow through RCC's area (Dissanayake et al., 2007:2), almost all of which run towards the north of the city due to the natural contours, despite the fact that the *Padma* River runs south of the city and the *Barnoy* River in the north. Many drains discharge into *beels* (natural seasonal water bodies, like shallow lakes) in and around the city, or into the *Barnoy* River. In consideration of width and depth, several of the drains are under standard and the problem is compounded by poor design, lack of adequate maintenance and the daily disposal of solid waste into the channels which leads to water logging at certain points in the drainage system. This drainage system is in place to deal with all the wastewater discharges, especially during the monsoon. (Dissanayake et al. 2007: 2).

In RCC area, there is a Drainage Master Plan adopted in 1994 and was being executed in three phases. The main objective of the first phase of the Drainage Master Plan was to meet the physical needs regarding drainage and environmental sanitation up to the year 2000. Under the first phase, 28 km of new drains were to be constructed and 57 km of existing *khals* and drains were to be rehabilitated (GoB 1994). The first phase of the completed drainage works includes 17.74 km of

⁸Bangladesh Bureau of Statistics 2005.

primary drains, 17.61 km of secondary drains and 9.41 km of tertiary drains which was supposed to be completed by 2004 (Ara et al. 2007: 12& 13).

The network of drains to collect surface run-off covers Rajshahi City, running from near the *Padma* in the south through the city and out towards river *Barnoy*. Except few smaller drains, they are typically uncovered, which means that they collect a lot of solid waste. A study finds that (Clemett et al. 2006: 18) in absence of a sewerage system in Rajshahi, these surface run-off drains essentially act as sewers, taking the overflow from septic tanks and increasingly being linked to directly by households and also receive a large majority of the grey water used in the city including not only domestic waste but also waste from commercial units, markets and small industries. In addition to this, the units in the industrial area are mostly connected directly to this system. Despite plans for creating treatment facilities to the north of the city (RDA Vol-1 2004: 29, however, such facilities has not been seen by the above study.

While discussing about the matter of drain, it is noticed that, a number of different sets of Acts have provided more or less identical structural definition of drain. These definitions are termed based on their working purpose but it is also felt that there are shortcomings on providing a clear and precise definition of drain. If the Rajshahi Development Authority (RDA) and Rajshahi City Corporation (RCC)'s administering laws would closely be studied, it would be observant that the drains of Rajshahi City Corporation were initially made to just outlet the wastewater of city corporation area. But recent survey done on the water of the drain of RCC provides the data of the multi-purpose use of the drain, as such being used as dump liner of chemical, medical, domestic, sewerage and usual storm water disposal. As it is adverse to our environment and eco-biological system, it should be given preference to be taken proper steps of. It is apparent that, RDA is bearing the authority related planning of RCC drains. However, it is also seen that, RCC contains the authority of formulation of a Master Plan for the city area. Under the Master Plan, the RCC has the power to plan the drains as well. RCC and RDA both have the authority for the constructions of RCC drains and therefore carry the overlapping responsibilities to form scheme and build the infrastructure of RCC drains. For this reason, eventually, the drains of RCC will be treated according to the legal instruments of both the authorities. However, according to the Ordinance, it is noticeable that, one of the major responsibilities of RCC is to make arrangements to keep the drains clear, clean, and pollution free.

4.1 Wastewater through RCC Drains

The RCC drains are open and penetrable for being used to contain junks and there are five kinds of waste which are mixing with the drain-water, those are:

4.1.1 Solid waste

Solid waste management is also an issue for wastewater agriculture as a proportion of it ends up in the storm water drains which ultimately flow to the fields. This category of waste includes food waste, residential waste, commercial waste, municipal waste, rubbles, construction waste, agricultural waste, dead animals, slaughter house waste and any other waste of solid nature. In Rajshahi city, approximately 210 tons of solid waste are collected form daily generated 350-400 tons and over 40% of solid waste

dumped into drains (Ali 2010). The Drainage Feasibility Study 1994 (GoB 1994) commented that at that time the management of solid waste was satisfactory, and observations suggest that there is room for improvement to both prevent it from entering storm water drains and to remove it before it reaches agricultural areas.

4.1.2 Liquid waste

There are several kinds of perilous liquids mixing with the water of RCC drains, among those, waste of the septic tank is notable (Ara et al. 2007: 24).

According to the Building Construction Act, 1952 and the Building Construction Rules 1996, there should be provision for septic tanks for every construction, and without fulfillment of this provision, RDA will not approve the construction plan. The RDA is also empowered to demolish those building which were made by not following the RDA plan. Therefore, it is the duty of every city dweller to comply with the RDA plan and it is also the statutory duty of RDA to monitor these facts very cautiously and take proper actions, if necessary. However, the monitoring and follow-up evaluation have never had taken place headed by the RCC authority.

The Environment Conservation Rules of 1997 provides specific standard regarding the discharge of sewage in to the surface water and it needs to be treated with chlorine prior to discharge.⁹ Therefore, responsibility lies on Department of Environment as well to oversee whether the standard has been maintained or not.

Furthermore, an underground sewerage system was supposed to be planned by RDA and RCC would construct and implement the plan. But, there is no separate sewerage system for Rajshahi city although a separate authority has been formed under the Water Supply and Sewerage Authority Act, 1996 for the RCC area.

Therefore, the RCC authority with their own shortcomings, cannot possibly ask the city dwellers to connect their latrines and urinals with the sewerage system. As there is no alternative way for the city dwellers, they usually are connecting their septic tanks with RCC drains and this type of untreated liquid waste polluting the water of RCC drains and causing serious health and environmental hazards. Although penal provision is there in The Local Government (City Corporations) Ordinance, 2008 which says without the prior permission of the Corporation, either intentionally or negligently, the discharge of sewerage or any other harmful substances from the latrines or urinals and connection to any drainage work that has not been used for mentioned purpose, will be treated as offence and therefore it can be punishable of fine up to 5000 taka considering as first offence, and to next, 500 taka for every single day.¹⁰

4.1.3 Industrial waste

This kind of waste derived from by-products of industrial operation and manufacturing processes from industry. In Bangladesh Small and Cottage Industries Corporation area of Rajshahi, there are some small industries without having

⁹The Environmental Conservation Rules, 1997, Schedule 9.

¹⁰The Local Government (City Corporations) Ordinance, 2008, Fifth Schedule, Article 29 & section 93 & 94.

treatment plant despite they are bound to establish treatment plant¹¹. These industries generally outlet their untreated waste to RCC drains (Dissanayake et al. 2007: 6). There are also statutory standards for disposal of different types of industrial wastes in the Environmental Conservation Rules of 1997¹² and the industries are discharging their own untreated waste to RCC drains ignoring these standards and making impacts on the Drainage water. However, the Bangladesh Small and Cottage Industries Corporation Act 1957 does bear any provision regarding waste management, however, this legislation only deals with the administrative structure and functions of the authority.

The industrial waste management is regulated by the Bangladesh Environment Conservation Act, 1995 and the Rules of 1997 framed under it and if any industry does not comply with any provision of these rules, the Department of Environment (DoE) has the power to take legal action against such industry. However, no action has been taken regarding the pollution into the RCC drain by the industries. Thus the drains of RCC are becoming more polluted day by day.

4.1.4 Medical waste

Previously, RCC was responsible for disposal of the solid waste produced by Rajshahi Medical College Hospital (RMCH). Later the hospital took over the process because of the mismanagement by RCC. Presently, the hospital does not manage or treat its liquid wastes. Large quantity of wastewater, according to the Deputy Director of RMCH, is produced from the Surgical Department of the RMCH (Ara et al. 2007: 34).

In a study (Ara et al. 2007) it is mentioned that RCC previously requested that clinics should separate their waste into certain categories based on hazard. The clinics still maintain the system but RCC later recombines the waste at the time of collection, which makes the process rather pointless. According to the current system, RCC collects all solid waste from clinics and incinerates those. The clinics are not prepared at present to seek their own solutions for solid waste management because of the cost implications (Ara et al. 2007: 34).

The objective of the Safe Blood Transfusion Act of 2002 is to collect and conserve safe blood for the patients. In this Act, there should be an authority called National Safe Blood Transfusion Council formed by the Government to make a policy about collect, conserve and transfusion safe blood for the patients and take necessary steps to implement its policy.¹³ The person who is in charge of transfusion of blood from patient's body will destroy and make it confirmed that once if the equipments are used for one patient would not reused to another and if he failed to comply with the provision of this act, there should be an imprisonment for six month or 5 thousand Taka as penalty or both.¹⁴

¹¹The Environmental Conservation Rules, 1997, section 7.

¹²*Ibid*, 1997, Schedule 10 & 12.

¹³The Safe Blood Transfusion Act-2002, sections 4 and 5.

¹⁴The Safe Blood Transfusion Act-2002, sections 21 and 22.

The Medical Practice and Private Clinics and Laboratories (Regulation) Ordinance, 1982 regulates medical practice and functioning of private clinics and laboratories. According to this Act, any person can established private clinics, medicals and laboratories by getting a license from an authorized authority by fulfilling some conditions like proper accommodation with hygienic environment, standard space, air-conditioned operation theatre, essential equipments and medicines and specific number of full time registered medical practitioners.¹⁵ And if any one failed to comply with any provision, there is imprisonment and fine for the accused.¹⁶ The Ordinance is restricted to the activities required to provide effective and efficient treatment and diagnostic services, and consequently does not cover such things as waste management.

Absence of any provision found regarding safe disposal of medical waste in the above mentioned two Acts. The Private Clinics and Laboratories take license from RCC. There is the emphasis given on collection of fees for issuing licenses and also have provision to fine up to 5000 taka for failure to obtain a license. However, no detail rules have been framed regarding issuance of license. Therefore, there are scopes for RCC to impose restrictions on the private clinics and hospitals to set up medical waste management system prior to issue license. The RCC now collects and disposes of waste from hospitals or private clinics separately.

Surprisingly, no provision found in the Bangladesh Environment Conservation Act of 1995 regarding medical waste management, and the Environmental Conservation Rules, 1997 does not have standard relating to medical waste. The Medical Waste (Management and Processing) Rules 2008 supposed to regulate these activities but implementation is not seen in Rajshahi area.

4.1.5 Pesticides

The farmers are using pesticides to their agricultural field and rainwater washing those and taking in to the drains. There are three Acts regarding insects, pests and pesticides.

The Pesticides Ordinance 1971 defines "pesticide" as any substance or mixture of substances to use or to represent as a means for preventing, destroying, repelling, mitigating or controlling, directly or indirectly, any insect, fungus, bacterial organism, nematodes, virus, weed, rodent, or other plant or animal pest but does not include a substance which is a 'drug' within the meaning of the Drugs Act, 1940.¹⁷

The Destructive Insects and Pests Act, 1914 has been constructed to prevent any insect, fungus or other pest's introduction into Bangladesh which are likely to be destructive or may be proved as destructive to crops. The Government may prohibit or regulate or impose restrictions and conditions the import of any article likely to

¹⁵The Medical Practice and Private Clinics and Laboratories (Regulation) Ordinance, 1982, sections 8 and 9.

¹⁶The Medical Practice and Private Clinics and Laboratories (Regulation) Ordinance, 1982, section 13.

¹⁷The Pesticides Ordinance 1971 section 3(n).

cause infection to any crop or of insects generally or any class of insects into Bangladesh.¹⁸

In 1962, the Government of Bangladesh introduced an ordinance to provide the prevention of spread of agricultural pests in Bangladesh named the Agricultural Pests Ordinance, 1962. This Act focuses about preventive measures, a way to eradicate and to prevent the spread any agricultural pest.

These pesticides affecting products, land, water bodies and overall environment and as the pesticides are poison and it is harmful for human being as well as all living organism, the Government introduces the Pesticides Ordinance, 1971 to regulate the import, manufacture, formulation, sale, distribution and use of pesticides. The pesticides are generally detrimental or injurious to vegetation, domestic animals or public health. But generally no precautionary measures have been taken on land from which the pesticides spread or for the protection of workers against risk of poisoning by pesticides arising from their working. To minimize the health hazards some sort of restrictions or conditions or limitations of the use of any pesticide should have been imposed by the Government.

In these Acts, there are rules to issue license to the pesticide dealer. The pesticide sellers are permitted to sell legally produced or imported pesticides and strictly restricted to sell illegal ones. However, the Government can cancel the license of the seller on the notification of selling of illegal pesticides. As the monitoring of notification has not yet been taken place, the sellers are selling and the farmers are buying illegal pesticides entering into the country through smuggling and using those. Moreover, no specification about the quantity of pesticide to be used in the field has been set in the relevant Acts and Ordinances. The farmers, however, being illiterate and ignorant about the derogatory effect of overuse of pesticides, using them excessively and thus hampering both them and the environment. The excessive and unregulated used pesticides have an adverse impact on wastewater as well.

Therefore, it is obvious that the water of RCC drains is being polluted. The farmers are using the polluted water to produce crops and the people are consuming the crops. So massive health risk is probable on the human health.

4.2 Water Quality of RCC Drains

The RCC drain carrying wastewater through the city to a river. The huge waste mixing in the drains, which are open and gathering a lot of waste, has a combined chemical reaction, and the farmers are using this water for irrigation to produce crops and vegetables. Without knowing the reality, people are consuming such crops. The wastewater is spreading over the irrigated lands with dangerous particles and making them barren. The open water bodies are also losing their own characteristics. People working with wastewater agriculture, are also suffering from many health hazards.

The WASPA has conducted a base line water quality survey of RCC drains (Dissanayake et al. 2007) in order to know more about the quality of wastewater in the city drains and the suitability of that water for irrigation. It concluded that the major

¹⁸The Destructive Insects and Pests Act, 1914, section 3.1.

potential health risk of farmers and some residents of the Village *Bashua* using wastewater in agriculture or household is microbial and parasitological contamination. Electrical conductivity, Total dissolved solids and Sodium absorption ratio are found to be matter of concern in terms of impacts on crops and Nutrients Nitrogen, phosphorous and potassium were all high and could impact on crop yield or increase pest attacks. However, they also could reduce the quantity of fertilizer to be used and reduce production cost for farmers (Dissanayake et al. 2007: 25).

According to the Environmental Conservation Rules 1997, standard of water for Bangladesh is given below:

	p ^H	BOD Mg/l	DO Mg/l	Total Coliform number/100
a. Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b. Water usable for recreational activities	6.5-8.5	3 or less	5 or more	200 or less
c. Source of drinking water for supply after conventional treatment	6.5-8.5	6 or less	6 or more	5000 or less
d. Water usable by fisheries	6.5-8.5	6 or less	5 or more	
e. Water usable by various process and cooling industries	6.5-8.5	10 or less	5 or more	5000 or less
f. Water usable for irrigation	6.5-8.5	10 or less	5 or more	5000 or less

Notes:

1. In the sample water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2. Electrical conductivity for irrigation water - 2250 mmhoms/cm (at a Temperature of 25° C); Sodium- less than 26%; boron- less than 0.2%.

The above standard is a statutory standard and enforceable to whole of Bangladesh. However, if the quality of the water of the RCC drains is considered, which was found in the base line survey of WASPA (Dissanayake et al. 2007) it will be evident that the standard are being overlooked.

After all these studies, some findings have been unveiled which are absolutely important to be taken care of. Those are showed as below (Dissanayake et al. 2007):

- 1) Use of wastewater poses a health risk to the farmers as well as to the consumers.
- 2) Microbial contamination is the main concern, suggesting that interventions to reduce the quantity of domestic waste entering the drainage channels could be beneficial.
- 3) Since microbial contamination is the main problem, on-farm practices and post-harvest activities (such as washing vegetables) could reduce the risk for farmers and their families, and consumers of the produce.
- 4) The use of wastewater for irrigation has positive impacts for short term productivity but may have negative consequences in the long Term.

- 5) Heavy metal concentrations do not appear to be high which is important for agricultural productivity and consumers. However, the Water from the tube-wells contains high levels Lead and some other heavy metals and should be investigated further.

According to the above report of base line survey of WASPA, this polluted water has some quality of being used as fertilizer. Thus, the farmers have lessened the use of extra fertilizer. On the other hand, plants have attained rapid growth and they are attracting various kinds of pests which causing farmers to increase the use of pesticide. With the absence of acknowledge of the exact limit of the pesticide, they are using excessive pesticide.

4.3 Wastewater and Its Impact on Health

The rights to have protection against offences to human health have been guaranteed under various laws of the country. A number of laws have been identified which directly contain such provisions, while scattered provisions are inserted inside other laws. These laws can be mentioned under different section based on their contents such as Health care service, Dental care, Drug control, Laws on specific diseases, Protection of health, Medical facilities and Safety.

4.3.1 Impact on users

The farmers who are working with wastewater very few farmers complained about physical injury from sharp objects, however, they are suffering from many physical problems these include disability of smelling, skin diseases, mosquito nuisance etc. It is said that the farmers who are working with wastewater are in a great health risk (Jakakody et al. 2007: 16).

According to the Local Government (City Corporations) Ordinance, 2008, the City Corporation will be responsible for the health system of the city area and will take necessary steps.¹⁹ And the corporation can take any step to enhance public health inclusive of health education.²⁰ However, the Rajshahi City Corporation has not seen to take any measures for mitigating the health threats raised in the farmers working with wastewater not even provided by the health education (Ara et al. 2007: 38)

The Public Health (Emergency Provisions) Ordinance, 1944 is an Ordinance to make special provisions in regard to public health and the purpose of this Ordinance includes the purpose of ensuring the provision of adequate medical services, of preventing the spread of human disease, and of safe guarding the public health as well as of providing or maintaining services essential to the health of the community. "Public health service and public health establishment" includes respectively sanitary, water supply, vaccination, sewage disposal, drainage and conservancy services and establishment maintained for the purposes of such services, and other service or establishment of a local authority that the appropriate government may by notification

¹⁹ The Local Government (City Corporations) Ordinance, 2008, Third Schedule, Article 1.

²⁰ *Ibid*, Article 5.

in the official gazette can declare to be a public health service or public health establishment for any purpose of this ordinance.²¹

Therefore, no implications regarding the issuance of facilitation of medical care towards the farmers using wastewater have been seen. It is also visible that, the "public health service and public health establishment" has not been extended to the wastewater users accorded to the provisions of the ordinance.

4.3.2 Indirect impact on health

Some poor farmer are using the drainage water for growing crops like spinach, cabbage and cauliflower, maize, wheat, potatoes, sugarcane and jute (Jakakody et al. 2007: 7). Though the poor farmers using this water because they have no alternative water source but the consumer do not know how vegetable and crops have been produced. There are some laws relating to food and consumer protection.

Laws on Quality Control of Agricultural Products

The Agriculture Produce (Grading and Marking) Act, 1937 is designed with the motto to prepare a benchmark of quality for the agricultural or horticultural food products. Though, it is well acknowledged that, use of wastewater can be termed as a thriving resource to stagger the concurrent scenario of agriculture, and it is also important to have a well examined standard settled in the laws of the countries. It appears that, the Act remains silent about whether the agricultural food crops, cultivated by using wastewater, are of high standard, or they lack the essential traits to be treated as up to the mark for being marketed. The daily sold agricultural crops have never been under examination.

Noticeable, wastewater, supported with some results of a considerable number of scientific surveys, alarmingly containing hazardous and injurious elements for public health. If the products, which are grown off by using wastewater, intended to be marketed, then there must be certain provisions to pre-check those elements of produced crops and to regulate if results come up as hampering.

The Agricultural Produce Markets Regulation Act, 1964 is to provide the rules and regulations of the purchase and sale of agricultural produce and of markets in which such produce is purchased and sold in Bangladesh. It also discussed about the License to market the agricultural products and about maintenance of standard weights and measures but nothing about the ingredients contain of those agricultural products. Though this Act works for setting the standards for different food products, the standard quality of wastewater food crops has not been signified or even mentioned. The wastewater foods are being traded in the markets, and the consumers are suffering severely through the intake of those, for the shortcomings of information regarding the standard of wastewater food crops and the regulation of those.

A Government agency named Bangladesh Standard and Testing Institution (BSTI) formed under the Bangladesh Standard and Testing Institution Ordinance 1985 is supposed to examine and control the standard of the products to be distributed and marketed. However, it should be a matter of concern that BSTI has not yet taken any

²¹The Public Health (Emergency Provisions) Ordinance, 1944, section 2(e).

initiative to regulate the standard of wastewater crops. The Pure Food Ordinance, 1959 subsequently connects with the manufacture and sale of foods, analysis, inspection and seizure of foods. The Act provides a wide range of regulations regarding dairy products, fishery and food. The "food" means any kinds of fish, fruits, meat, or vegetable for human consumption.²² Nobody is entitled to manufacture or sell any adulterated food product. Here, "adulterated food" refers to those kinds of foods having any poisonous or deleterious ingredients which may render it injurious.²³ The Act has provided rule and regulations to maintain the standard of different kind of foods and furthermore mentions standards for different kind of dairy and food products. It also emphasizes on the official scrutiny or analysis for the investigation for finding out the standards of the food products. The Government has provided provisions for setting up Pure Food Court heading with a first class magistrate²⁴ which may award a penalty of rigorous imprisonment starts with minimum six months up to maximum three years and also with fine starts with taka 5000 up to 2 Lakhs on the basis of the nature of the offence.²⁵

Though this Act works for setting the standards for different food products, the standard quality of wastewater food crops has not been signified or even mentioned. The wastewater foods are being traded in the markets, and the consumers are suffering severely through the intake of those, for the shortcomings of information regarding the standard of wastewater food crops and the regulation of those. It is evident from the above discussion that the relevant provisions of the related laws are either overlooked or never implemented in Bangladesh.

4.3.3 Laws on irrigation

Wastewater is being used for the purpose of irrigation in Rajshahi City area. In a report (Jayakody et al. 2007), it has been mentioned that most of the farmers said that they used wastewater because crops grow well and it contains fertilizer. They also used it because they did not have access to any other sources of water, moreover, wastewater was sufficient and did not have to practice any form of crop rotation based on water availability. Some farmers also commented that the availability of the water meant that it was possible to have a high cropping intensity (Jayakody et al. 2007: 16). However, Bangladesh has some laws bearing provisions on irrigational aspects which can be discussed below.

According to the Local Government (City Corporations) Ordinance, 2008, it has been declared as an offence by the Corporation to irrigate in any cultivable land in such a way that is deleterious to public health and the surrounding areas. Therefore, it can be presumed that, if the uses of wastewater in irrigation will be proved as harmful for public health by production of substantial scientific evidence, then, it will be an offence under schedule 5 of the said Act and can be punishable of fine up to 5000

²²The Pure Food Ordinance, 1959, Sections 4 & 5.

²³*Ibid*, Sections 3.1(g).

²⁴*Ibid*, Sections 41(1) & (2).

²⁵The Pure Food (Amendment) Act, 2005, Sections 10.

taka considering as first offence, and to next, 500 taka for every single day.²⁶ However, the provision has never been seen to be implemented.

It appears that, the Irrigation Act 1876 does not bear any direct provision relating to wastewater. However, the irrigation aspect of wastewater and the meting of RCC drain with the irrigation canals posses the relevancy with wastewater. From the scientific results of studies on wastewater, it is visible that, use of wastewater can be dangerous for human health. Thus, there should be the existence of provision relating the regulation of appropriate use of wastewater for the following notion 'injury to the public health or public convenience'.²⁷

It is important to notice that, The Agricultural and Sanitary Improvement Act, 1920 is a central law and discussed a lot about natural irrigation and the improvement of district level agriculture and sanitation.²⁸ Again, there is nothing mentioned about wastewater reuse, or urban water scarcity. It is mentionable that, wastewater is however, according to some scientific studies and surveys could successfully be integrated to boost up the agriculture. Wastewater should also be given thoughts as it is necessarily cemented with the sanitation system. The Act, then, involves the entire regulation and to be taken activities associated with agriculture and sanitation but, has not given direct directive on wastewater.

The Canals Act, 1864 is to amend and consolidate the law relating to the collection of tolls on canals and other lines of navigation, and for the construction and improvement of lines of navigation in Bangladesh. There is not a single word about irrigation, or any plan or scheme to develop agricultural activity or uses of water in cultivation.

4.4 Impacts on Water

4.4.1 Open water bodies

A number of ten drains collecting storm water is flowing from south of Rajshahi through the city to the north, either meeting in *beels* or ending in *Barnoy* River, some 15 km away from the heart of the city.

A study (Clemett et al. 2006: 14) found that the Surface water quality is similarly poor and affecting agriculture and human health because untreated urban effluent is discharged through various drains into the *khals* (canals) and *beels* (seasonal ponds), and ultimately spreading over the agricultural fields to the north. Tests conducted on the surface water bodies in the area, including the Padma and *Barnoy* rivers, some *beels* and ponds, exceeds the national standards for drinking water for Bangladesh of 50 or less total coliform number/100 (TCN/100), having fecal coliform bacteria counts of 70-400 number/100 (RDA Vol-1 2004: 29). It also exceeds the standards for water for recreational use, which is 200 TCN/100.²⁹ Tests for the measurement of

²⁶The Local Government (City Corporations) Ordinance, 2008, Fifth Schedule, Article 29 & sections 93 & 94.

²⁷The Irrigation Act, 1876, Section 40.

²⁸The Agricultural and Sanitary Improvement Act 1920, Sections 3 & 4.

²⁹The Environment Conservation Rules of 1997, Annex III.

chloride showed that the concentration of chloride is within limits (Clemett et al. 2006: 15). The concentration of iron in the river *Padma* is within the drinking water limits during the rainy season but not the summer, however, manganese is within limits in samples collected from the *Padma* in the dry season but exceeded limits in almost all locations in the rainy season. The presence of iron in the *Barnoy River* exceeds the limit in both seasons (Clemett et al. 2006: 15). Dissolved Oxygen (DO) measurements using a HACH kit showed that the *Padma*, *Barnoy* and *Foliar Beel* were within limits, however, the water quality of *Shilinder Beel* and *Tikure Beel* was very poor due to the drainage discharged from Rajshahi City (Clemett et al. 2006: 15). It is noticeable that those *Beels*, *Khals* and *Rivers* are the public watercourses which can be called as public spring or reservoir.

According to the Penal Code, 1860, anyone corrupting or fouling any public spring or reservoir, by rendering it unfit for ordinary use, will be punished with imprisonment of either description for a term which may extend to three months, or with fine which may extend five hundred taka or with both.³⁰ According to this provision, City Corporation is committing a corporate crime by out letting untreated municipal wastewater in to public reservoir.

According to the Protection and Conservation of Fish Act, 1950, the Government can make rules about the prohibition of the destruction or any attempt to destroy fishes by the poisoning of water or the depletion of fisheries by pollution, by trade effluent or otherwise.³¹ Therefore, there is a scope for Rajshahi District Fishery Officer to take some steps against such pollution. Though it is a punishable offence with rigorous imprisonment not less than one year and can be extended up to two years or with fine which may extend to 5000 taka or, with both.³² A court of metropolitan magistrate or magistrate of first class can try the offence but it has not been seen to be implemented in RCC area.³³

4.4.2 Ground water

Ground water pollution has been found to be a critical problem in Rajshahi City and the surrounding areas. The main problems relate to the iron, manganese and arsenic content which exceed the national drinking water standards. (Clemett et al. 2006: 13). Hardness levels are below the Bangladesh standard but above the WHO standard (RDA Vol-1 2004: 29).

In a study, Dissanayaka (2007) found that the chromium (CR) levels in the ground water sampled were double, both the Bangladesh and WHO drinking water quality guidelines. Chromium can cause skin irritation and liver and kidney damage in the long-term. The study also mentioned that there is no obvious industrial source of Cr in the project area, therefore the soils may be the source, especially as Cr compounds

³⁰ The Penal Code, 1860, section 277.

³¹ The Protection and Conservation of Fish Act, 1950, Sections 6(4) & 7(b).

³² The Protection and Conservation of Fish Act, 1950, Section 5(1).

³³ The Protection and Conservation of Fish Act, 1950, Section 7(c).

bind to soil and are not likely to migrate from the surface to ground water (Dissanayake et al. 2007: 22).

The above study also found that the Lead (Pb) levels were very high at 10 times the Bangladesh guidelines and 50 times the WHO guidelines. Lead is known to impair the mental development of children and can cause kidney problems in adults. The most common source of Pb in many countries is corrosion of household plumbing, although erosion of natural deposits is also common (Dissanayake et al. 2007: 22).

The iron concentrations in the ground water samples were much higher than the Bangladesh Drinking Water Standards at 4.49 and 6.95 mg l⁻¹ which is common across Bangladesh where iron concentrations are much higher than the WHO and national recommended limits. However, the study suggested that Iron is therefore more of a nuisance than a health problem as there are no known human health implications except there may be a risk of iron being stored in the body (Dissanayake et al. 2007: 23).

In a report on the microbiological quality of groundwater samples showed Coliform contamination, which means that they do not conform to the Bangladesh and WHO guidelines of 0 CFU/100 ml (Dissanayake et al. 2007: 23). However, they did not show any faecal contamination despite the fact that across Bangladesh 54 per cent of hand pumped tube wells were found to have faecal contamination, due to poor wellhead design, faulty construction and management, even though the aquifers themselves were not polluted (Hoque 1998; cited in UNEP 2002). The tube wells analyzed in the above study are both deep tube wells and are unlikely to be contaminated with Coliforms leaching from the *Basuar* Beel, the drains or even septic tanks (Dissanayake et al. 2007: 22). The water sampled in the tube wells exceeds WHO and Bangladesh Drinking Water Standards for many parameters including both Metals and Coliforms. The Metals may be of long-term concern but the Coliforms may be of more immediate health significance (Dissanayake et al. 2007: 23).

However, more tests are needed to confirm the observed levels of pollutants and further research is required to determine the sources of contamination (Dissanayake et al. 2007: 24). Here exists scientific uncertainty on the effect of *Basuarbeel* on ground water quality. Thereby, the pre-cautionary principle of environmental law should be applied assuming that wastewater may have impact on groundwater.

The Ground Water Management Ordinance, 1985 is the only law to manage the ground water resources for agricultural production. Nonetheless, the ordinance has essentially made by using the term "Management", but it only concerns with the licensing of tube wells. There has been no provision to administer other issues as numbers of water resources, maximum level of extraction, distribution or contamination of ground water.

According to this law anyone who obtained a license from the said authority can extract water from ground. Therefore, there is no infrastructure mentioned in the ordinance to use of surface water in irrigation. It is also silent in case of reuse of water in any purpose. There is nothing said about the combined use of ground and surface water and therefore, the ordinance escapes the scope of using reusable water alias wastewater.

The wastewater in Rajshahi City may contaminate the ground water aquifer. However, this law does not have any provision to prevent ground water contamination which may become a very serious environmental issue.

5. CONCLUSIONS

It is evident from the above discussion that the relevant provisions of the related laws are either overlooked or never implemented in Bangladesh. It has been seen that there are multifarious laws, mainly focused on national and local government tiers, inserted regarding the urban areas and the multiplicity of these laws causing lack of combination and co-ordination. In order to get a successful implementation coordinated, simple, colossally researched, and practical laws are needed which will be able to mitigate different objectives but not overlapping different organizations, authorities and purposes. A sheer picture of lack of co-ordination amongst the existing acts and ordinances is observed as well. The main focus of all those acts and ordinances are to frame and implement initiatives for the betterment of agricultural establishments, but, as the wastewater is playing a vital role in a distinct way, a perfect structure issued for the definition, organization, utility, filtration, regulation of wastewater is a bare need of the day. Therefore, either co-ordination amongst acts and ordinances inclusive the wastewater uses or separate enactment issued for used water or wastewater is needed to be earmarked as imminent as possible.

Suggestions

1. The Government policy makers should be provided with the prompt acknowledgement and of the power of foresightness to realize and initiate appropriate actions in against future scarcity of water.
2. A comprehensive policy will have to be formulated on all aspects of water uses and management. All the national policies need to be consistent with each other.
3. There should be an enhanced and comprehensive Environmental Law made to regulate every single concern associated with environmental issues. The water law has to be incorporated as a part of a comprehensive environmental law with all subsequent water services as like agricultural, health, sanitation, drinking, industrial purposes etc.
4. In the part of that water law, the Authorization of the wastewater treatments installation, requirements for the discharging of wastewater, restrictions on cultivation of various crops and other relevant issues will have to be integrated with other aspects of water services.
5. There has to be a well-coordinated structure amid all the authoritative institutions, laws, policies existing in the country in order to gain more efficiency over the preparation, construction and regulation of water issues. The intermingle reigning about different definitions, issues and decisions in those administering bodies, enactments and organs should be mitigated.
6. Local authorities have to be given priority in the matters concerning them to implement the existing effective provisions of laws related to water and they should be provided with more control and responsibility.

7. The term wastewater and its related issues should obtain proper integration in existing laws and they should be given emphasis on the determination of using purposes.
8. There are several provisions of existing laws which, if properly implemented and regulated, could maximize the best use of wastewater and minimize hinders on using it. Therefore, until the promulgation of revised law, existing laws need to be implemented actively and properly.
9. In the Conservation of Environment Rules, 1997, the provisions regarding wastewater are not detailed enough. Though, some relevancies have been found with waste in the Rules, they are not quite enough to set standard in all aspects wastewater usage. As some guidelines as WHO, FAO, which have been provided in world wide area to connect issues come out of wastewater, should be reflected.
10. Mass people should be made well aware about the information of the impact using wastewater, the procedure to reduce or neutralize the existing and possible health threats, possible crop pattern after using wastewater in the cultivable land, and predominant regulations and implications of wastewater law.
11. The agricultural food crops, cultivated by using wastewater should have the necessary standard and grading in accordance with law. There should be the incorporation of procedure of standardizing and grading of wastewater agricultural crops.
12. Scientific ability has to be enhanced as to examine the quality of wastewater agricultural crops and its impacts on human health.
13. There are a good number of laws prevailing in the area which, if properly followed and obeyed, can yield neutralized situation for use of wastewater in agriculture. But it is seen that, the provisions of those laws are not maintained as per environmental law. Sometimes, they are not being implemented properly and sometimes, they are simply overlooked. So compliance and implementation of existing laws need to be ensured.
14. Non-Government Organisations (NGOs) should be incorporated with different activities such as promoting public awareness about the various aspects of wastewater, necessary research activities for better exploitation and management and necessity of compliance with laws.
15. People's participation should be encouraged to mandate the most effective use of wastewater through the safest way.

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