"AN ENVIRONMENTAL STUDY ON DEGRADATION AND TEMPORAL CHANGES OF WETLANDS IN KALNA MUNICIPALITY, EASTBURDWAN DISTRICT, WEST BENGAL"

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Received: May 2, 2018 Accepted: June 10, 2018

ABSTRACT *Wetlands are versatile natural water bodies on the land surface of the earth. They have a significant role in ecosystem and bio-diversity. Therefore, this paper tends to project Kalna Municipality in East Burdwan District because of its numerous wetlands and also river 'Bhagirathi', a Riverne wetland, flows northern portion of this municipality, upon which almost the entire locality gets socio-economical benefits in terms of pisciculture, irrigation purpose use ,domestic works and so on. Besides, this paper also attempts to trace the reason behind their present misuse, derogation and also tries to find out the temporal changes of Wetlands through field survey(2017), secondary data and using Google Earth images (2003, 2014). Here also suggests some measurements to preserve wetlands and also seeks to have the supported hand and necessary help from the municipality.*

Keywords: *Wetland, Solid waste, Temporal Change, Environment.*

I. Introduction

According to Ramsar convention(1971)wetland is defined as "Area of marsh, pen, peat land or water, whether natural or artificial, permanent or temporary, with water i.e. static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed 6 meters." About six percent of the world's surface is taken under wetlands. So they are very important natural resources with multiple uses in terms of sociology, ecology and economy. These wetlands are the major sources of surface water in Kalna Municipality. Some of these are natural and some are manmade (maximum excavated by Burdwan Maharajas). But today wetland is under constant threat and many of them are in degraded condition that can bring a vital environmental, social and economic problem.

II. Objectives

The primary objectives of the study are:

- To assess the temporal changes in water bodies over time of the study area.
- To identify the major causes of wetland loss and degradation and project the impact of degraded wetlands on environment and society due to the misuse of them.
- And also, to suggest few way outs for conservation of wetlands.

III. Study Area

Geographically this town issituated by the side of river Bhagirathi on the North, Kalna-II PanchayetSamity on the East and South, and Kalna-I PanchayetSamity on the West. This town is about 70 kms in the eastern direction from Burdwan and it lies at 23°20' N to 23°24'N and 88°34'E to 88°38'E.The municipality at present comprises 18 wards covering an area of 4.55 sq. kms. There are dispersedly placed enormous wetlands on which huge no of local people dependent.

e ISSN 2348 –1269, Print ISSN 2349-5138
Cosmos Impact Factor 4.236

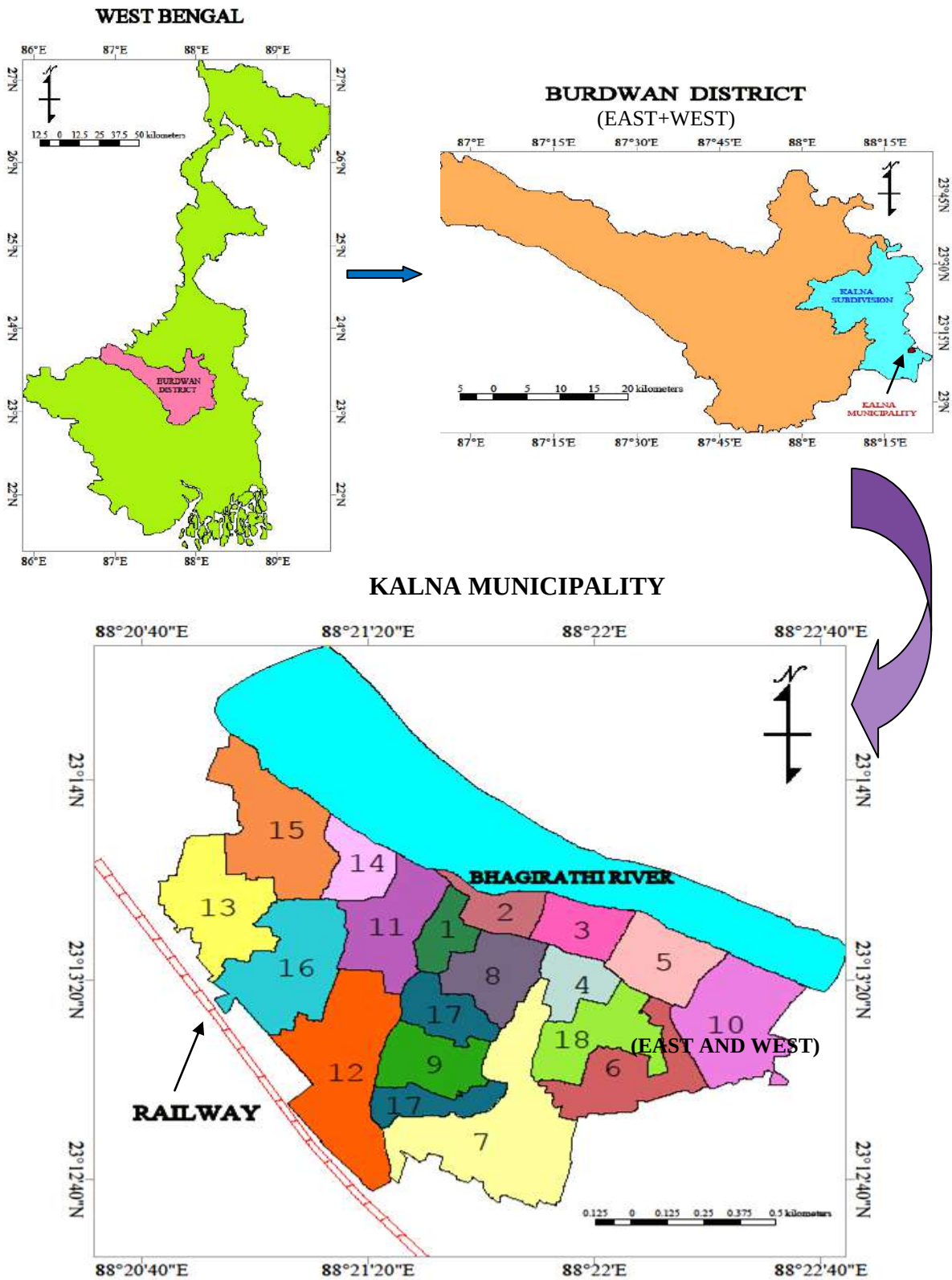

Fig.1: Location Map of the Study Area

(Source: Prepared by Author)

IV. Database and Methodology

This paper has been prepared with the help of primary and secondary data and also followed some methods and techniques.

IV.1. Sources of the Data

Primary data are collected through direct field observation by structured questionnaire and personal interviews (March, 2017) and Secondary data have been collected from Kalna Municipality and Google Earth.

IV.2. Methodology

The studies on Wetlands of Kalna Municipality were performed into three stages:-

Pre field stage involved study of wetlands of the study area, its impotency on human life and environment and its problem. This is accomplished through gather of secondary information like satellite imageries, various journals, maps etc.

Field stage involved field study, sample survey by Random sampling method and primary data collection through questionnaire and personal interviews. For better work, secondary data also collected from Kalna Municipality.

Post field stage engaged data compilation, calculation, processing and analysis to draw some remarkable statements. This data analysis has been done through different techniques of remote sensing and GIS software, like TNT mips 2013, MapInfo Professional 7.0. At first Kalna Municipality Map has been geo-referenced and then the boundary of it has been digitized with the help of those above mentioned software to prepare thematic maps and also digitized 2003 and 2014 Google Earth images by using TNT mips software. Microsoft Office excel has also been used to create various diagrams.

IV.3. Sample Design

According to Google Earth (9th Sept. 2014) image, 254 Wetlands have been recorded. Out of which 38 Wetlands that is approx 15% of the total wetlandshave been taken from ward No. 3,5,7,11,12,13,14,16 for primary survey. Selection of wetlands was based onpurposive,random sampling.

V. Temporal Changes in the Wetlands

The study reveals a drastic decrease in the coverage of wetlands, which contributed to a concomitant increase mainly in Built up area and activities to develop the necessary infrastructure to the growing population, like roads, market etc. The temporal changes, which the wetlands of the study area have undergone, both sets of data were collected from Google Earth on the 11th May 2003 and 9th September 2014. In the succeeding decades, lack of maintenance caused the solid waste deposits to choke the wetland structure.

Recoded Google Earth images reveal a gradual drying up of the wetland. Wetland coverage is found to decrease continuously from 2003 to 2014. According to Google Earth, total wetland area in 2003 and 2014 has been calculated as 533542.1 Sq. m. and 485987.5651 Sq. m. respectively. It is determined that 6.62% (18 wetlands) of the wetlands were lost (fig.2, 3, 4, Table-1) and 47554.5349 Sq. m. area has been decreased during this period (Fig.5).

Table-1:Status of Wetlands in 2003 and 2014

Year	2003	2014
No. of Wetlands	272	254
Area of Wetlands(in Sq. meter)	533542.1	485987.5651

(Source: Computed by Author Based onGoogle Earth)

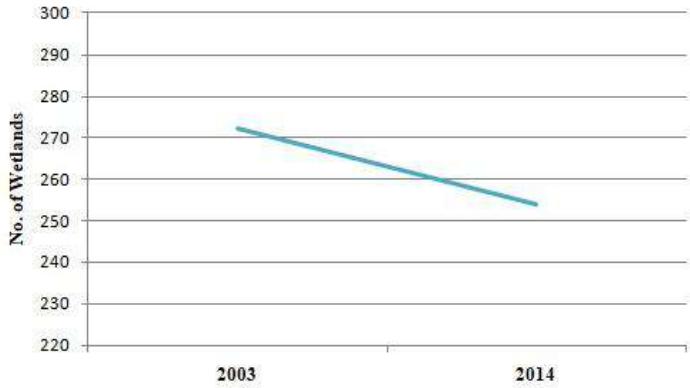

Fig.2: Decrease of Wetlands in 2003-2014

(Source: Based on Table-1)

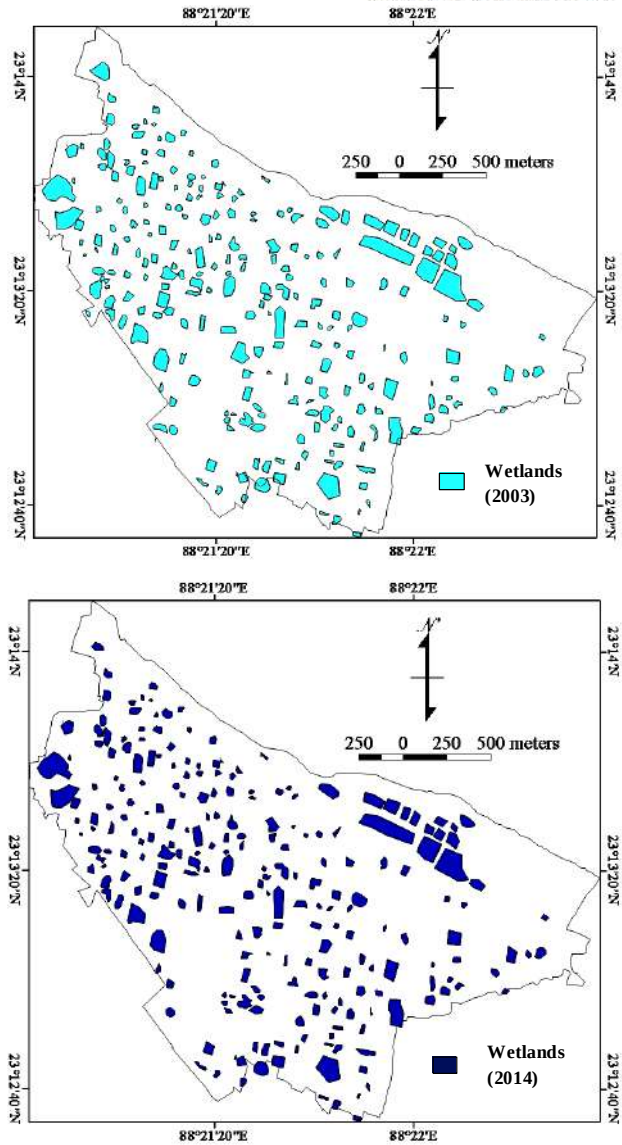

Fig.3: Comparison between Wetlands of 2003-2014

(Source: Prepared by Author Based on Google Earth)

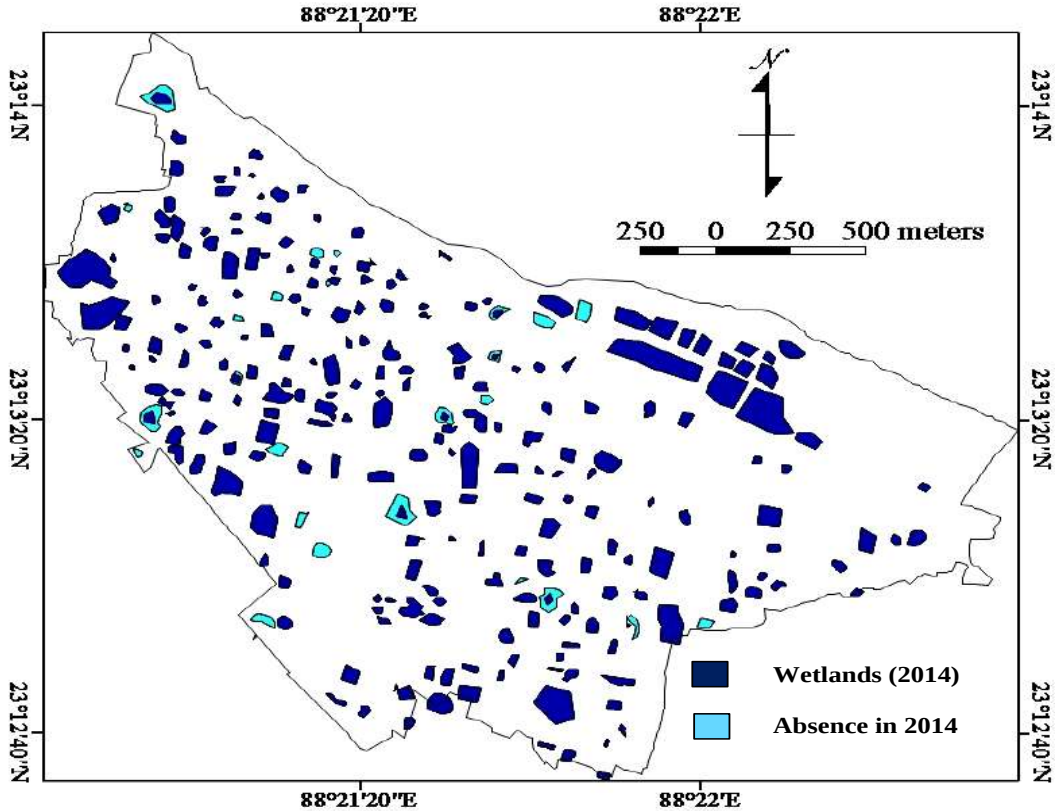

Fig.4: Decreasing of Wetlands from 2003 to 2014
(Source: Prepared by Author Based on Google Earth)

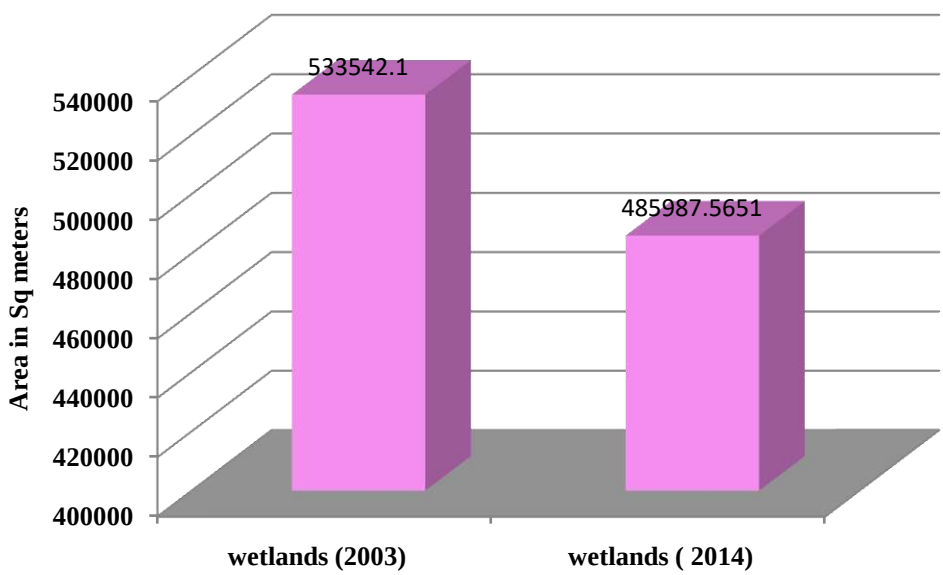

Fig.5: Reduction of Wetlands Area from 2003 to 2014

(Source: Based on Table-1)

VI. Present Status of Sample Wetlands

This paper has included 38 wetlands as sample among 254 to gather information about wetlands of Kalna Municipality and to produce a list to show its location, embankment condition, water quality and its present use and misuse. That is why, few samples of wetlands are taken from ward no. 2, 3 and 5 that are situated at the bank of River Bhagirathi and few are taken from ward no.11, 12, 13, 14, 16 and 17 that are placed away from the river. Thus, based on these samples, a prediction has been made to show the present circumstances of all the wetlands of KalnaMunicipality (Fig.6).

Table-2: An inventory of sample wetlands of study area and their information

Sl. No.	Ward No.	Location of Wetland	Name of the Wetland	Embankment condition	Pisciculture Status	Uses	Problems	Quality of water	Existence	Tek-en Step
1	3	KadamTala	Choker Dighi	Brick Work	Yes	P, I, R	Sw, E	Good	YES	NO
2	3	Mahismardini Tala	N.A.	One Side Brick	Yes	D, P	Sw, Ds, Wp	Moderate	YES	NO
3	3	Mahismardini Tala	N.A.	One Side Brick	Yes	D, P, I	Sw, Ds, DDL, Wp, Er	Moderate	YES	NO
4	3	Pathuria Mahal	N.A.	Kancha	No	D, I	Sw, Ds, DDL	Bad	YES	NO
5	3	Pathuria Mahal	N.A.	One Side Brick	No	D, I	Sw, Ds	Bad	YES	NO
6	3	Pathuria Mahal	N.A.	One Side Brick	Yes	D, P, Ii	Sw, Ds	Moderate	YES	NO
7	5	Mahismardini Tala	N.A.	Kancha	Yes	P	Er	Good	YES	NO
8	5	Military Road	N.A.	Two Side Brick	Yes	D, P	Ds, DDL	Moderate	YES	NO
9	5	Kati Ganga	N.A.	One Side Brick	No	R	Sw, Ds, DDL, E, Wp	Bad	WF	NO
10	5	Kati Ganga	N.A.	One Side Brick	No	R	Sw, Ds, DDL	Bad	YES	NO
11	5	Kati Ganga	N.A.	One Side Brick	Yes	P	Sw, E	Moderate	YES	NO
12	5	Kati Ganga	N.A.	Kancha	Yes	P, Ii	Er	Good	YES	NO
13	5	Kati Ganga	N.A.	Kancha	Yes	P, Ii	Sw	Good	YES	NO
14	5	Kati Ganga	N.A.	Brick Work	Yes	D, P	Sw, Ds, DDL, Wp	Moderate	YES	NO
15	2	Danga Para	N.A.	Kancha	Yes	D, P	Sw, Ds, DDL, E, Er	Moderate	YES	NO
16	2	Danga Para	MathorDoba	Not Existed	No	NU	Sw	No Water	NO	NO
17	7	Barui Para	Mile's Pond	One Side Brick	Yes	D, P	Sw, Ds, DDL, Er	Moderate	YES	NO
18	11	Kansari para	JhapantalaDighi	One Side Brick	Yes	D, P	Sw, Ds, Wp	Moderate	YES	NO
19	11	Kansari para	Kansaripara Dighi	Kancha	Yes	D, P	Sw	Moderat	YES	YES

								e		
20	12	Madhubon	Kalbari Pond	Kancha	Yes	D, P	Ds, Er	Moderate	YES	NO
21	12	college Road	College Dighi	One Side Bamboo pilling	No	NU	Sw, DDL	Bad	YES	YES
22	12	Amlapukur	AmlapukurDighi	Brick Work	Yes	D, P, Ii	Sw, Ds, DDL, E	Moderate	YES	NO
23	12	Station Road	GalakataDighi	Kancha	Yes	P	Sw, Ds	Moderate	YES	NO
24	13	Nep Para	N.A.	Not Existed	No	NU	Sw, Ds, DDL, E, Wp	No Water	NO	NO
25	14	Chotodengri	MairaDighi	Brick Work	Yes	P, R	Np	Good	YES	NO
26	16	ChotoDenri	Shiv Doba	One Side Bamboo pilling	No	Ii	Sw, Ds, E, Wp	Bad	WF	NO
27	16	ChotoDenri	PanuDighi	Brick Work	Yes	P, R	Np	Good	YES	NO
28	16	Kansari Para	N.A.	Kancha	No	D,Ii	Ds	Moderate	YES	NO
29	16	Kansari Para	N.A.	One Side Brick	Yes	D. P, R	DDL, Er	Moderate	YES	NO
30	16	Baramitra Para	N.A.	Two Side Brick	Yes	D, P, R	DDL, Er	Moderate	YES	NO
31	16	Baramitra Para	N.A.	Two Side Brick	No	NU	Sw,DDL, Ds	Bad	WF	YES
32	16	Baramitra Para	N.A.	Two Side Brick	No	D	Sw	Moderate	YES	NO
33	16	Baramitra Para	N.A.	Two Side Brick	Yes	D, P	Sw	Moderate	YES	NO
34	16	Baramitra Para	N.A.	Not Existed	No	NU	Sw, Ds, DDL, E, Wp	No Water	NO	NO
35	17	Ghatak Para	Sota Pond	Kancha	No	NU	Sw, Ds, DDL, E, Wp	Bad	WF	NO
36	17	Ghatak Para	GhatakDighi	Kancha	Yes	D, P	Ds, DDL	Moderate	YES	NO
37	17	Ghatak Para	N.A.	Kancha	No	NU	Sw, Ds, DDL, E, Wp	Bad	YES	NO
38	17	Show Sarkar Road	N.A.	Not Existed	No	NU	Sw, Ds, DDL, E, Wp	No Water	NO	NO

(Source: Field Survey 2017)

[Legend of Abbreviations: D=Domestic work, P=Pisciculture, I= Irrigation, R=Recreation, Ii=Immersion of idols, NU= Not Use, DDL=Direct drainage link, Sw=Solid waste, Ds=Domestic sewage, Er=Erosion, Wp= Weed pollution, E=Eutrophication, N.A. = Not Applicable.]

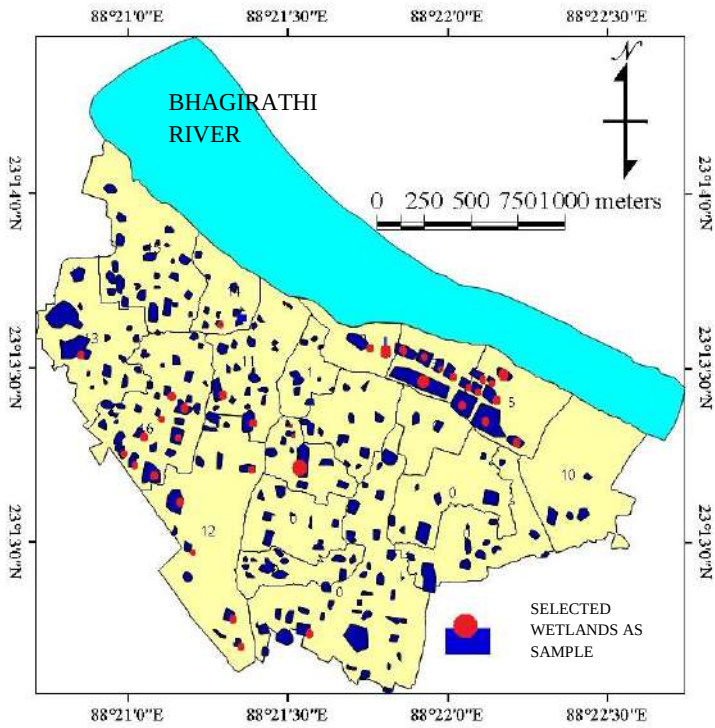

Fig.6: Ward Wise Location Map of Wetlands

(Source: Field survey2017 and Google Earth, prepared by Author)

VII. Causes behind the Degraded Wetlands

In spite of having multi uses, today wetlands are under a constant threat. From the field report, here identified some main reasons which may degrade their presence:-

- Solid Waste
  Wetlands are highly affected by the deposit of solid waste around and inside of them.Thin plastic carry bags in solid waste prevent water infiltration and reduce water holding capacity of wetlands. From the primary data, it has been identified that out of 38 wetlands, 28 (73.68%) have already been more or less covered by the vast amount of solid waste and as a result,4 of them are fully dead and 4 will be filled up very soon, making wetlands nothing but the 'Dustbin of Solid Waste'(Table-3, Fig.8).
- Sewage Problem
  The wetlands of the study area are also affected due to domestic sewages. Because of increasing population day by day, the amount of sewage deposit is also proliferated. According to the primary data, 24 (63.15%) wetlands are facing this problem (Table-3, Fig.8).
- Bank Erosion
  Bank erosion is also a problem of wetland. It is found that out of 38 wetlands, 8 are under the threat of bank erosion. As a result, deposition of silt is raised day by day (Table-3, Fig.8).
- Direct Drain Link

According to K.M. data (2008), approx. 60 have direct link with domestic drain (Fig.7).It has also been identified from the primary survey that 19 wetlands (50%) out of 38 have direct connection with drain. As a result, sewages of drain get mixed with water and become unhygienic (Table-3, Fig.8).

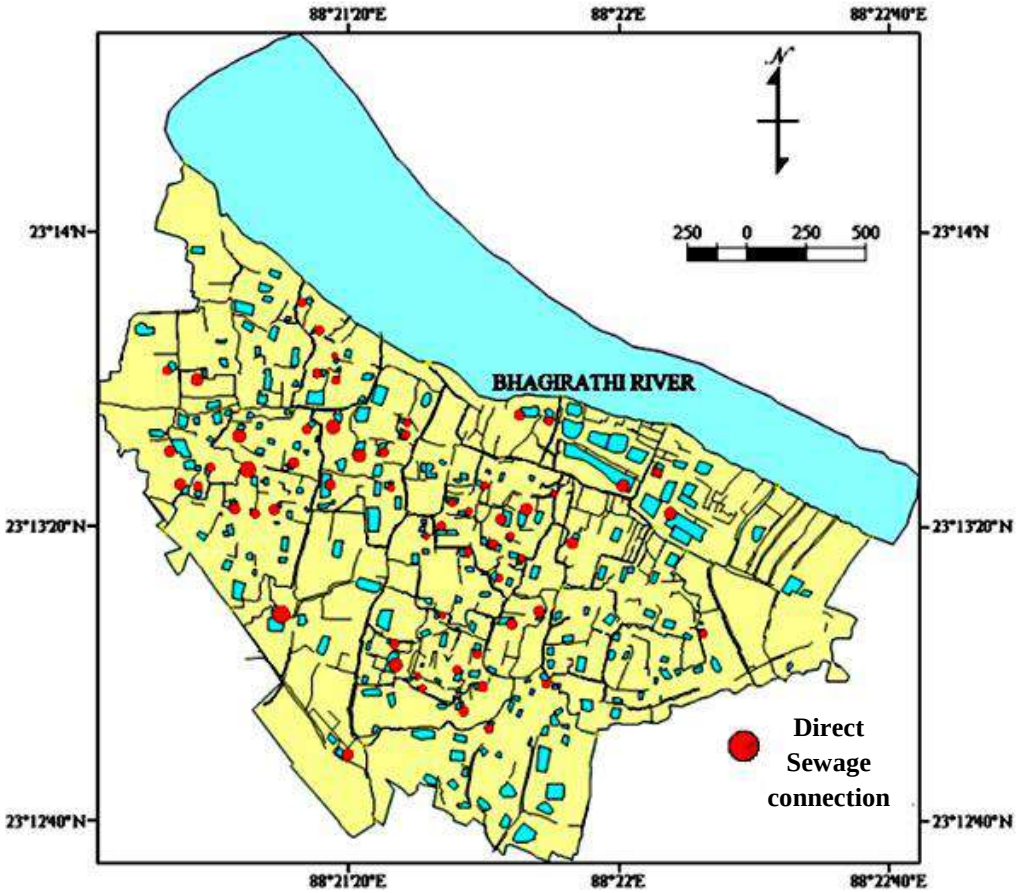

Fig.7: Direct Sewage Connection with Wetland

(Source: Based on K.M. data, prepared by the Author)

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Table-3: Problems of Wetlands

Problems:	Solid Waste	Domestic Sewage	Bank Erosion	Direct Sewage Link	Eutrophication	Weed problem
No. of Wetland:	28	24	8	19	11	11

(Source: Field Survey 2017)

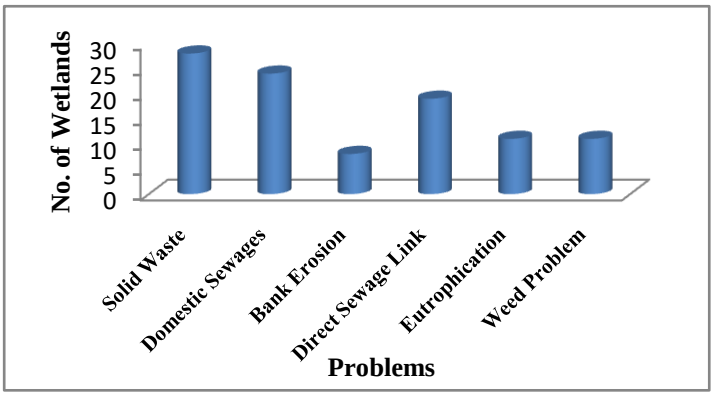

Fig.8: Problems of Wetlands *(Source: Based on Table-3)*

- Eutrophication and Weed Problem

From the field survey,eutrophicationis one of the main problems in eleven wetlands and eleven of them are suffered weed problem. Consequently their water is unusable for work.

- Siltation

Bank erosion, run-off, deforestation etc. are responsible for deposition of silt. Due to huge amount of siltation, many of wetlands have already been filled and many are under threat.

- Decreasing Water Quality

Deposition of solid waste,domestic sewages around the wetlands and direct linkage of drain are responsible for the degradation of water quality. It is noticed that the numbers of good quality wetlands are decreased in comparison with K.M. data (2008) that includes many good quality of wetlands.

- Unplanted Urbanization

Due to unplanned urbanization, wetlands are under "developmental pressure" (Sarkar, 2011).From the field survey, it has been found that one wetland is shrinkage by the inhabited building and already four are completely dead for deposition of excessive amount of solid waste, domestic sewages and mixing polluted waste water of households. The condition of four wetlands is also very poor; they will be filled up very soon.

- Problems of river Bhagirathi

River Bhagirathiis also highly affected by reason of municipal (residential, commercial, municipal services etc.), agricultural, industrial solid waste. The entire municipality's swages assemble with river through drain which polluted water of it. Immersion of idols is another big problem that increases water pollution.

VIII. Impact of Degraded Wetlands on Society and Environment

- Decline of fish production

  The huge amount of solid waste makes a thick layer of plastic under the wetland obstructing the fishes to go deeper into the water. Therefore the fishes have to float on the surface level that virtually brings death to them. As a result, a constant declination of fish production has been taken place.

- Reduction of using Wetland water in domestic field

  Because of the water pollution, the local people are unable to use the water for their daily domestic purposes.

- Loss of bio-diversity and hampered ecosystem

Due to the growth of urbanization there is an encroachment of Wetlands to mitigate the ever increasing demands of residential settlement, commercial facilities and so on. This reduction of wetlands and poor quality of water do not allow the species of Wetlands to continue their life-circle, by hampering the eco-system. It is really shocking to note that few decades back, these species were there in great numbers but now they are gradually decreased into disappearance. Today's maximum numbers of brick embankment also contribute to hamper the eco-system.

Table-4: Embankment Condition

No. of Wetlands		
Type of Embankment(38 sample)	Kalna Municipality(2008)	Field Survey (2017)
Kancha	28	16
Brick Work	5	5
One side Brick Work	5	10
Two side Brick Work	0	5
One side Bamboo Pilling	0	2

(Source: Kalna Municipality and Field Survey)

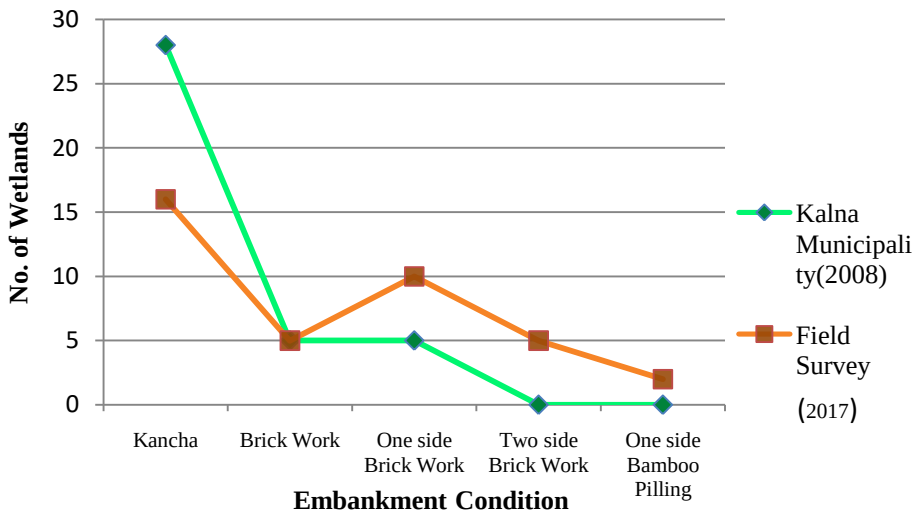

Fig.9: Changing Scenario of Embankment Condition in 2008 and 2017

(Source: Based on Table No. 4)

- Decrease migrated birds

Few years before the migrated bird used to come to the wetland side in winter season but now the polluted Wetlands hinders them to come.

IX. Conclusion

Solid waste deposition is a major problem, faced by the wetlands. Several of them now become nothing but the "Dustbin of solid waste". Maximum wetlands have a direct link with drain of domestic sewage. Through a drainage channel, the polluted waste of the entire municipality is mixed up with river Bhagirathi. It has also been found that from the last decade a large no. of wetlands were disappeared due to solid waste deposition and unplanned urban growth.

X. Suggestions and mitigations techniques

Conservation and management should be taken by Government and non Government for sustainable use of these wetlands. Keeping in mind that wetlands have immense economic potentiality, few suggestions are given below:

- Removal of encroached wetlands by strong Government Act.
- Control of wetland erosion by concrete embankment.
- Proliferation of plant material in both sides of the wetlands.
- Improve water quality by controlling pollutants from various sources.
- Dumping of garbage, penetration of domestic swage, chemical fertilizer from adjoining agricultural field should be stopped.
- Sewage treatment pool should be dug near the wetlands to treat polluted water.
- Mass awareness should be done through constant monitoring and management.

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Problems of Wetlands

Photo-1: Wetland Blocked By Solid Waste

Photo-2: Declining of Water Quality due to Weed Problem

Photo- 3: Eutrophication problem

Photo-4: Sewage Connection with Wetland