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Sewage Treatment Plant Of Hussain Sagar Lake, Hyderabad- A Case Study

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Abstract:
The picturesque Hussain Sagar Lake situated in the heart of the twin cities of Hyderabad and Secunderabad is a perfect example of what can go wrong with nature when people start neglecting nature and even abuse it for their own ends. Hussain Sagar Lake is a living example of gross abuse of nature due to rapid industrialization without adequate emphasis on environmental planning. The principal object of this project is to study the operation, maintenance and performance evaluation of 20 MLD Sewage Treatment Plant at Hussain Sagar. After the study conducted, it was found that the plant is efficient in treating domestic wastewater, which had an adverse effect on the lake. Hence, we can conclude that the best attempt to rejuvenate the Hussain Sagar Lake and revive its past glory as a tourist spot.

Introduction:

The renowned Hussainsagar Lake is situated in the heart of the twin cities of Hyderabad and Secunderabad and by which the city is divided into twin cities. The lake water was used as drinking water source until 1930's. By that time due to unplanned industrialization and urbanization of the catchment area of about 240 Sqkm, the lake water polluted and thus the blue water gradually changed to a brownish black in colour and the lake became biologically dead by 1990's. The aquatic life including fish was killed. Hussain Sagar Lake is located in the heart of Hyderabad city. Hyderabad is situated at an elevation of 540 meters above mean sea level and the landscape is essentially flat to rolling. Hyderabad is the capital of Andhra Pradesh state, which lies between 120 401 and 190-151 North latitude and 76-451 and 84-401 East longitude. The capital city encompasses approximately 204.6 square kilometers area of which 5.7 sq.km is occupied by Hussain Sagar Lake. The population of the city as per 2001 Census is 50 Lakhs with 1, 50,000 as floating population. Generally the climate is hot and the air temperature reaches approximately 410 C in summer, and drops to 120 C in winter and the annual rainfall varies between 500 – 1000 mm.

Hussain Sagar Lake is an oval shaped man-made lake, which was constructed on the tributary of Musi River during the Golconda Kingdom of Qutub Shahi dynasty in 1562. During the 170 years of Qutub Shahi rule, the value of fresh water lakes was fully realized. The Hussain Sagar Lake whose water spread was over 8 sq. miles when it was built during the reign of Ibrahim Quli Qutub Shah bears the testimony to ecological wisdom shown by the Qutub Shahis. The son-in-law of Ibrahim Qutub Shah, Hussain Shah Wali engineered the idea of constructing a lake on a natural depression in the tributary of the Musi River. The lake was constructed under his supervision and named after him. Originally the lake was constructed for the supply of water for drinking & irrigation purpose. Till 1930s, the lake was the major source of water supply to the population of Hyderabad.

SALIENT FEATURES OF HUSSAIN SAGAR LAKE:

The watershed of the lake extends from Kukatpally and Jeedimetla to the heart of the city and covers parts of the Northern and Western areas of the city and its surroundings. The watershed exhibits undulatory to rugged topography with a slope due south-South East. The lake with the grand monolith of the Buddha near its center stands out as one of the most picturesque spots of the city. This Buddha monolith was installed in 1992 and is 52 ft in height. With passage of time and urban development and migration of people from other areas, the ecology and environment of these lakes has been disturbed. The most affected among all the lakes is the Hussain Sagar Lake. This lake has been receiving untreated waste and industrial effluents through the four main nalahs. The lake is mainly fed by the Kukatpally nalah, which contributes domestic and industrial effluents from the Kukatpally industrial area. The other nalahs, Picket, Banjara and Balkapur carrying untreated waste also have outfalls into the Hussain Sagar thereby deteriorating the water quality of the lake.

Due to the influx of polluted water into the Huissain Sagar Lake and deterioration of water quality of the lake it is no more a resource for water supply. The lake receives its inflows from four nalahs. The average annual rainfall of the city is 75 cm and the average run-off into the lake is about 30 million cubic meter. A part from the rain water following domestic and industrial waste water enter the lake as dry weather flows.

Sl. No.	Name of the Nalah	Domestic Flow (in Mld)	Industrial Flow (in Mld)	Total Flow (in Mld)
1	Kukatpally Nalah	55	15	70
2	Picket Nalah	6	---	6
3	Banjara Nalah	6	---	6
4	Balkapur Channel	13	---	13
	TOTAL	**80 Mld**	**15 Mld**	**95 Mld**

IMPACT OF POLLUTION ON THE LAKE:

Deadly mix of domestic sewage and industrial effluents entering the lake has totally destroyed the lentic ecosystem. The increased eutrophication of the lake, during the past 25 years appears to be a result mainly of the increased nutrient loading due to a rapidly expanding contributing domestic population and associated wastewater flows arising from within the lake catchment area. Sedimentation of organic matter and algae also contributes to the increased annual nutrient loading. Hydrogen Sulphate formation at the sediment lake water interface occurs sometimes and it is related from the water columns, along with other volatiles to produce unacceptable odour particularly along the lake margins.

Toxic Algal Blooms: The lake sustains algal blooms throughout the year. Among toxic blue green blooming species, microcystis aeruginosa and melsoria granulate are the most dominant. Particularly in summer thick scans of algal are found drifting towards shore by wind action. Nutrient enrichment and favourable environmental condition are sighted as main reasons for the algal blue phenomenon. Upto to the year 1984, progressive eutrophication led to extensive proliferation of water hyacinth. In 1984, whole lake surface was covered by the hyacinth. Once the weed was removed manually, it was replaced by algal bloom.

Foul Smell and Irritation: The Hussain Sagar Lake environment stinks due to decaying organic matter and gases like Hydrogen Suplhide, Co2, Ammonia and Methane which are mainly produced due to anaerobic conditions prevailing. The effect is more severe in summer due to high temperature. An evening stroll on tank bund or parks around is enough to produce irritation to eyes and throat infection.

Mosquito Breeding: The Lake presents an ideal habitat for prolific breeding of mosquitos' swarms of which are visible in the evening time. The pollution induced loss of larvivorous fishes is the reason for this problem.

Biodiversity: The first victims of pollution are sensitive species of flora and fauna which are gradually replaced by pollution resistance hardly species in course of time. Hussain Sagar Lake once which was rich in biodiversity including migratory birds, with progressing pollution lost sensitive species which includes fishes like common carps. Notopterus which was main victim in "fish kills" is no more found in the lake.

Fish Kills: Summer fish kills in the lake Hussain Sagar are reported right from the year 1976. Incidentally the major kill was reported from the period when inudstrialisation and urbanization of the lake catchment was taking place at a faster rate. This was the result of the polluted inflow into the lake. The lake lost its specifies of fish like etroplus, Mystus, Tilapia, Notoplerus due to bioaccumulation and bio-concentration of heavy metals like pb, zn, cu etc.

BACTERIOLOGY OF SEWAGE

Bacteriology of Sewage: The strength of sewage is its potential for producing nuisance caused by the offensive odour and the oxidisable organic matter

content and is referred to as Bio-Chemical Oxygen Demand (B.O.D.). The BOD is a parameter by which sewage strength is measured.

Characteristics of Sewage:

Physical Characteristics: Odour, colour, turbidity and temperature are physical characteristics. The septic sewage give offensive odor of hydrogen sulphide, colour is turbid and dark resembling dirty dishwater and temperature is higher than that of the water supply because of heat added during the utilization of water.

Chemical Characteristic: Fresh sewage is alkalic but septic sewage is acidic and the pH varies in between 6-7. Sewage contains 0.08 to 0.1 percent solid matter in the form of suspended, dissolved, collided and settleable. The solid sewage comprise of both organic and in organic matter. The organic matter is 45% of total solids consists of animal and vegetable matter, sugar, starches, cellulose, fats, kitchens, laundries etc. The inorganic matter is 55% of solids and consists of minerals and salts such as sand, gravel, debris, dissolved salts, chlorides, sulphates etc. Besides solids, liquids, gases like H_2S, Co_2 and CH_4 due microbial action are present in sewage.

Biological Characteristics: Large number of bacteria and living organisms like algae, fungi, protozoa etc., are present in sewage. Most of these bacteria are harmless to man and help in converting the organic compounds of sewage into simple stable organic and mineral compounds resulting in purification of sewage. Some of the bacteria however particularly pathogenic type are harmful and cause disease. The bacteria useful in sewage treatment are known as metatrophic group and they are further sub-classified as aerobic, anaerobic and facultative. Aerobic bacteria live on free oxygen of air and on dissolved oxygen in water and convert organic compounds of sewage in to simpler, stable and un-objectionable organic and mineral compounds resulting in purification of sewage. For example aerobic bacteria decompose Nitrogen, Carbon, and Sulphur into stable and unobjectionable compounds of Nitrates, Carbohydrates and Sulphates and process is known as Oxidation.

Biochemical Oxygen Demand (BOD): The biochemical oxygen demand (BOD) is one of the most important parameters and is a measure of organic matter present in wastewater. The BOD is a measure of the amount of oxygen used in the respiratory process of micro organisms in oxidizing the organic matter in the sewage and for the further metabolism of cellular components synthesized from the wastes. One of the primary reasons for treating sewage or waste water prior to its being returned to the water resources (stream or lake) is to reduce the drain of dissolved oxygen supply of the receiving body of water. The magnitude of the BOD is related to the amount of organic material in the sewage i.e. the more oxidizable organic material, the higher the BOD. The "strength" of sewage is expressed in terms of BOD level.

Microbiological Characteristics: Since the composition of sewage various, it is to be expected that the types and number of organisms will fluctuate. Fungi, Protozoa, Algae, Bacteria and Viruses are present. Raw sewage may contain millions of bacteria per milliliter including the coliforms, streptococeige, and anaerobic spore forming bacilli, the proteus group and other types originating in the intestinal tract of humans. Sewage is also a potential source of pathogenic protozoa, bacteria and viruses. The causative agents of dysentery, cholera and typhoid fever may occur in sewage. The poliomyelitis virus, the virus of infectious hepatitis and the Coxsackie's viruses are excreted in the spices of infected hosts and thus may appear in sewage, certain bacterial viruses are readily isolated from sewage.

Predominant physiological types of bacteria may shift during the course of sewage digestion. In an anaerobic digester facultative types (Enterobacteria, Alcaligenes, Escherichia, pseudomonas etc) predominate during initial stages. This is followed by methane producers, which are strict anaerobes. For eg: Methanobacterium, Methanosarcina, and Methanococcus, the organic acids produced by the facultative bacteria are metabolized by the methane formers; the end products are methane and carbon dioxide. Large amounts of the gases are produced in anaerobic digesters. The various process associated with treatment of sewage bring about pronounced changes in the predominant types of organisms. The decomposition of Nitrogen, Carbon and oxidation through the agency of the aerobic bacteria are parts of famous Nitrogen, Carbon and Sulphur cycles. In Nitrogen cycle, the Ammonia in sewage is oxidized first to Nitrates and then Nitrates which are final stable compounds by aerobic bacteria. In Sulphur cycle, the Hydrogen Sulphide is oxidized by the aerobic action into inoffensive sulphates. In Carbon cycle, the organic matter containing cellulose, starch and sugar are transformed into carbohydrates. The above principle is used in biological process in aeration tank. In this particular plant extended aeration with

21 hours of detention time, extending the bacteria's life upto endogenous respiration of the growth curve for the BOD removal of about 9% and high – suspended solids removal is used. For good, biological process in aeration tank a MLSS of 3000-5000 mg/l and a dissolved oxygen level of 2 mg/l are required and the same are being maintained.

Peak Summer Sample Report

Sl. No.	Tests	Results		Reduction
		Influent Sample Receiving Chamber	Treated Effluent Outlet Chamber of SST	
1	pH	6.92	7.45	---
2	Suspended solids (mg/l)	528	29	94.5%
3	Phosphates as PO_4 (mg/l)	25	9	---
4	Phosphates as P (mg/l)	8.16	2.93	64%
5	Nitrates as NO_3 (mg/l)	8	56	---
6	Total Kjeldahl Nitrogen (mg/l)	39	7	82%
7	Total Nitrogen (mg/l)	41	20	51.2%
8	C.O.D (mg/l)	992	56	94.3%
9	B.O.D. for days at 27^0C (mg/l)	450	9	98%
II		**AT**	**SST**	
1.	Dissolved Oxygen (mg/l)	2.10	3.60	---

Rainy Season Sample Report

Sl. No.	Tests	Results		Reduction
		Influent Sample Receiving Chamber	Treated Effluent Outlet Chamber of SST	
1	pH	7.06	7.52	---
2	Suspended solids (mg/l)	132	18	86.3%
3	Phosphates as PO_4 (mg/l)	256	2	67%
4	Phosphates as P (mg/l)	1.96	0.65	---

5	Nitrates as NO_3 (mg/l)	5	18	---
6	Total Kjeldahl Nitrogen (mg/l)	8	1	87.5%
7	Total Nitrogen (mg/l)	9	5	45%
8	C.O.D (mg/l)	164	20	87.8%
9	B.O.D. for days at 27^0C (mg/l)	80	3	96.3%
II		**AT**	**SST**	
1.	Dissolved Oxygen (mg/l)	2.35	4.50	---

RESULTS AND CONCLUSION
The Sewage Treatment Plant (STP):

The 20 MLD Sewage Treatment Plant at Madarsa-Maktha nearly Hussain Sagar Lake was established to treat the polluted water entering the Lake. The wastewater from various nalahs are diverted and are not allowed to enter the lake, which was previously let into the lake. The wastewater is treated in the plant and then disposed into the lake. Because of this establishment of the plant, the past glory of the lake is rejuvenated to a large extent and it is estimated that by coming of two or three monsoons the lake will be almost completely free from pollution.

Evaluation of the Treatment Plant:
With a view to evaluate the functioning of the sewage treatment plant, a sufficient number of physical, chemical and biological parameters have been studied. Tests have been conducted to estimate the parameter concentration prior to treatment by collecting samples from the influent receiving chamber. After treatment tests have been conducted on the sample collected from the treated effluent outlet chamber.
The parameters chosen are as follows:

1. pH
2. Suspended Solids
3. Phosphates as P
4. Total Nitrogen
5. COD
6. BOD
7. DO
8. Colour

Table Showing Yearly – Average Values
for the period 4/2003 to 3/2004

Parameters	**Prior to Treatment**	**Post Treatment**	Percentage Reduction
pH	7.03	7.44	---
Suspended Solids	349 mg/l	25.69 mg/l	92.6

Phosphates as P	6.27 mg/l	2.05 mg/l	67.3
Total Nitrogen	30.93 mg/l	16.17 mg/l	47.7
COD	594.56 mg/l	47.15 mg/l	92.0
BOD	273.34 mg/l	7.63 mg/l	97.2
DO	2.13 mg/l (AT)	3.61 mg/l (SST)	---
Colour	***Yellowish orange***	***Greenish Yellow***	

Evaluations:

The efficiency of the treatment plant is evaluated by monitoring the following parameters for a period of one year.

i) pH: The average pH of the effluent sample is 7.44. Hence it is observed that the treatment process is increasing the alkalinity of the wastewater. This occurs due to breaking down the complex organic matter into simpler compounds and subsequent release of alkalis. A pH value of 5.5 to 8.5 is satisfactory for the treated sample from the view point of discharge of the treated sample into an inland water body.

ii) Suspended Solids: The treatment process has reduced the suspended solids from 350 mg/l to 25 mg/l i.e. 92.6% which is very good reduction in the suspended solids and hence indicates that the setting process in the plant is very effective.

iii) Colour: Prior to the treatment of water, the colour was Yellowis-organge. Hence, there is a considerable reduction in colour of the water.

iv) Phosphates: The content in the water prior to the treatment is reduced to a large extent. The amount of phosphates present in the water was found to be 6.27 mg/l before the treatment and 2.05 mg/l after treatment of the water. Therefore, one can say that the plant is efficient in removing the Phosphates to a large extent i.e. upto 67%.

v) Total Nitrogen: The amount of Nitrogen was found to be reduced substantially. Prior to treatment process the total Nitrogen content was found to be 30.93 mg/l, while after treatment it is 16.17 mg/l. Hence it can be concluded from the result that the plant can reduce the total Nitrogen content to the great extent upto 47.7%.

vi) Chemical Oxygen Demand (COD): The treatment process has reduced the COD from 595 mg/l to 47.15 mg/l. This is a very good reduction in the COD i.e. 92% and hence indicates that the aeration process in the plant is very effective.

vii) Biological Oxygen Demand (BOD): The treatment process has considerably decreased the BOD in the water. Before treatment of water as tested was found to be 273.34 mg/l, but after the treatment of water the BOD in the water is 7.63 mg/l. Hence, it can be concluded that the treatment is effective, as 97.2% BOD removal is taking place.

viii) Dissolved Oxygen (DO): The treatment process has increased the DO from 2 mg/l to 3 mg/l. This is a very good enhancement in the DO i.e. 50% and hence indicates that the process in the plant is very effective. This increase helps to enhance the aquatic life in Hussain Sagar Lake.

Conclusions: Based on the experiment results and information about the pollution of Hussain Sagar Lake prior to the commissioning of the 20 Mld Sewage Treatment Plant, the following conclusions are drawn. Raw sewage flowing from various nalahs was being directly discharged into the Hussain Sagar Lake leading to host of

environment problems. The concentrated industrial waste water playing havoc with the ecosystem of the Lake. Apart from polluting the water, leading to extinction of aquatic life, the recreational use of the lake was also threatened due to highly obnoxious odour emanating from the polluted water. The construction of 20 Mld STP at Hussain Sagar Lake to treat the raw sewage prior to its discharge into the lake has provided to be highly beneficial in preserving the ecology of the lake. Decontamination is an extremely long and painful process. However, the improvements observed in the lake after commissioning of the STP help us in believing that the process of rejuvenation is moving in the right direction. The treatment process used in the STP is highly effective in reducing the pollution load of raw sewage. The information given in the above table shows that the treatment plant is highly effective is meeting the desired objectives of the sewage treatment plant.

TABULAR REPRESENTATION OF THE ANNUAL PERFORMANCE OF 20 MLD SEWAGE TREATMENT PLANT

Performance of Sewage Treatment Plant (STP):

The daily performance of 20 MLD Sewage Treatment Plant at Madarsa-Maktha nearly Hussain Sagar Lake, is recorded in terms of different parameters such as pH, Suspended Solids, Phosphates, Total Nitrogen, COD, BOD, DO, for a period of one year (i.e. April-2003 to March'2004). The monthly averages for the above mentioned parameters are calculated which represent the annual performance of the STP. The following are the monthly average of different parameters.

Monthly Average of pH* Value

From April 2003 to March 2004

Month	Before Treatment	After Treatment
April'2003	6.87	7.46
May'2003	6.99	7.51
June'2003	7.01	7.43
July'2003	7.06	7.48
Aug'2003	7.05	7.51
Sept'2003	6.98	7.33
Oct'2003	6.99	7.35
Nov'2003	7.04	7.44
Dec'2003	7.06	7.51
Jan'2004	7.07	7.48
Feb'2004	6.96	7.39
Mar'2004	6.98	7.41
Average	7.00	7.44

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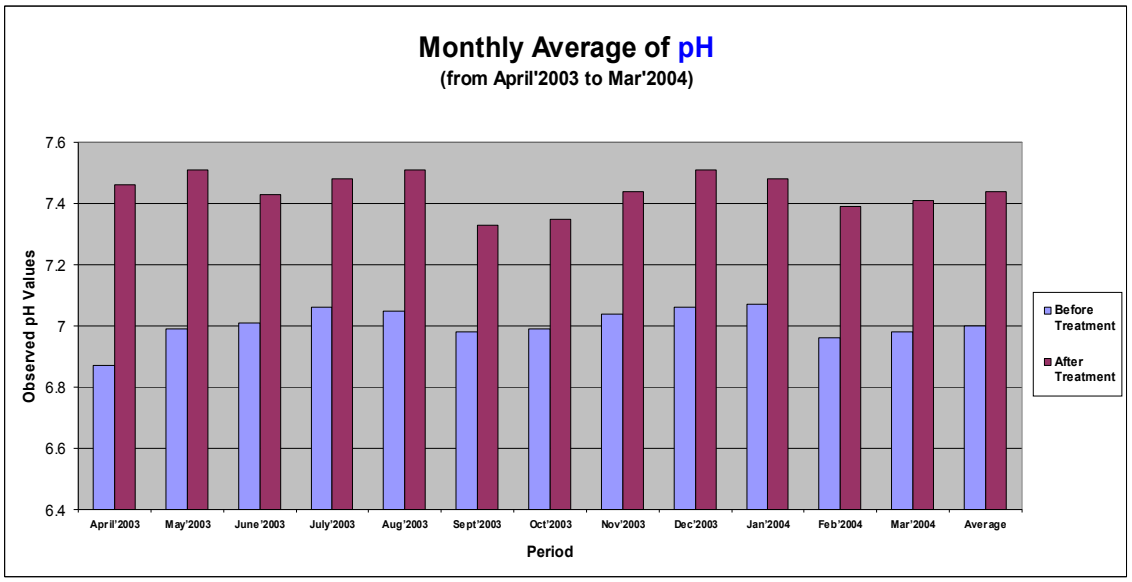
pH = Parameter used to measure the acidity or alkalinity of wastewater in the operation of biological units.

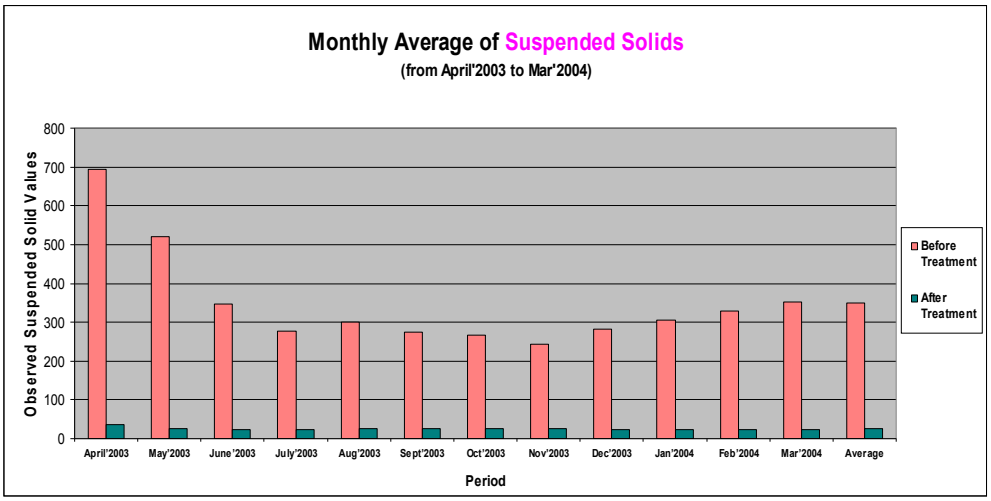


Monthly Average of Suspended Solids(SS)*

From April 2003 to March 2004

Month	Before Treatment	After Treatment
April'2003	694.73	35.27
May'2003	519.74	27.03
June'2003	348.20	24.37
July'2003	276.68	22.93
Aug'2003	301.35	25.61
Sept'2003	275.04	26.15
Oct'2003	267.48	25.81
Nov'2003	242.43	25.23
Dec'2003	282.92	24.23
Jan'2004	305.42	23.52
Feb'2004	328.09	24.15
Mar'2004	353.09	23.61
Average	**349.79**	**25.69**

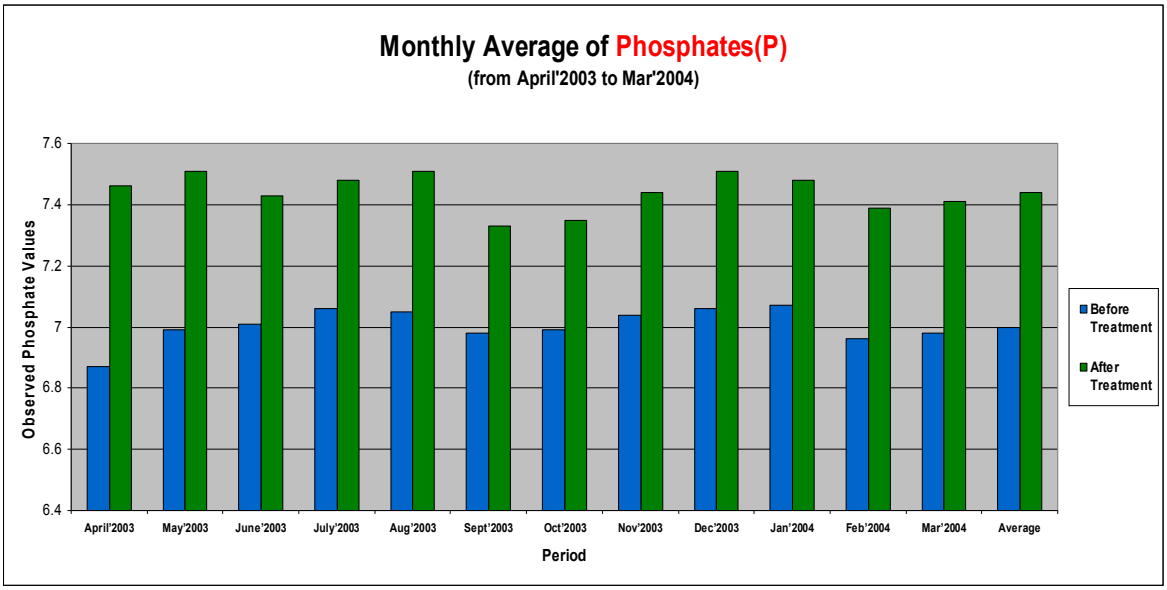
SS = These are classified as fixed and volatile. Fixed solids are inert materials while the volatile solids are organic in nature and are amenable to biological degradation.


Monthly Average of Suspended Solids
(from April'2003 to Mar'2004)
Observed Suspended Solid Values
800
700
600
500
400
300
200
100
0
April'2003
May'2003
June'2003
July'2003
Aug'2003
Sept'2003
Oct'2003
Nov'2003
Dec'2003
Jan'2004
Feb'2004
Mar'2004
Average
Period
Before Treatment
After Treatment

Monthly Average of Phosphates (P)

From April 2003 to March 2004

Month	**Before Treatment**	**After Treatment**	**Efficiency (%)**
April'2003	8.37	2.63	68
May'2003	7.29	2.35	67
June'2003	4.86	1.69	65
July'2003	5.17	1.48	71
Aug'2003	5.74	2.07	63
Sept'2003	4.89	1.83	62
Oct'2003	5.65	1.75	67
Nov'2003	5.91	2.03	65
Dec'2003	6.64	2.03	69
Jan'2004	7.08	2.02	68
Feb'2004	7.21	2.33	67
Mar'2004	6.27	2.42	66
Average	**7.00**	**2.05**	**67**


Monthly Average of Phosphates(P)
(from April'2003 to Mar'2004)
Observed Phosphate Values
7.6
7.4
7.2
7
6.8
6.6
6.4
April'2003
May'2003
June'2003
July'2003
Aug'2003
Sept'2003
Oct'2003
Nov'2003
Dec'2003
Jan'2004
Feb'2004
Mar'2004
Average
Period
Before Treatment
After Treatment

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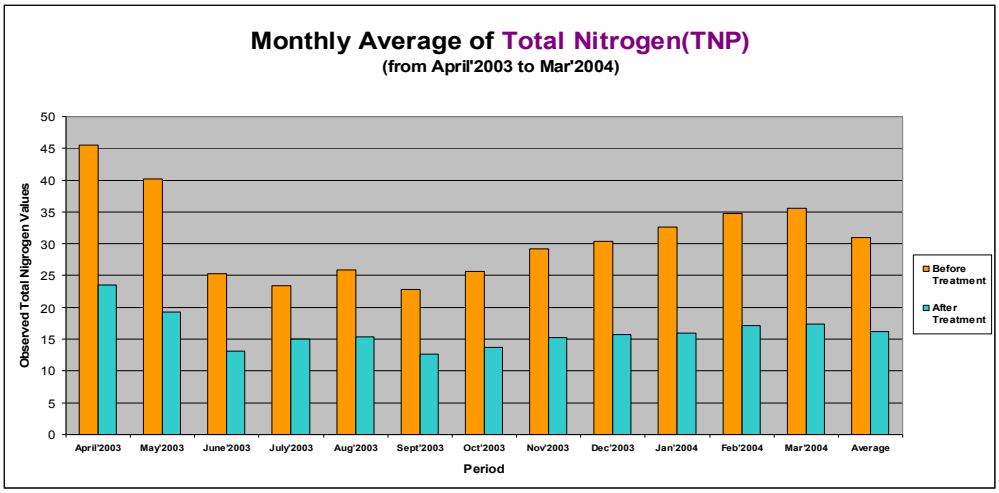
Monthly Average of Total Nitrogen (TNP)

From April 2003 to March 2004

Month	**Before Treatment**	**After Treatment**	**Efficiency (%)**
April'2003	45.50	23.47	48
May'2003	40.23	19.32	51
June'2003	25.33	13.13	48
July'2003	23.45	15.03	35
Aug'2003	25.83	15.39	40
Sept'2003	22.81	12.59	44
Oct'2003	25.61	13.74	46
Nov'2003	29.20	15.20	47
Dec'2003	30.35	15.74	48
Jan'2004	32.58	15.97	51
Feb'2004	34.75	17.18	50
Mar'2004	35.58	17.32	51
Average	**30.93**	**16.17**	**48**


Monthly Average of Total Nitrogen(TNP)
(from April'2003 to Mar'2004)
Observed Total Nigrogen Values
50
45
40
35
30
25
20
15
10
5
0
April'2003
May'2003
June'2003
July'2003
Aug'2003
Sept'2003
Oct'2003
Nov'2003
Dec'2003
Jan'2004
Feb'2004
Mar'2004
Average
Period
Before Treatment
After Treatment

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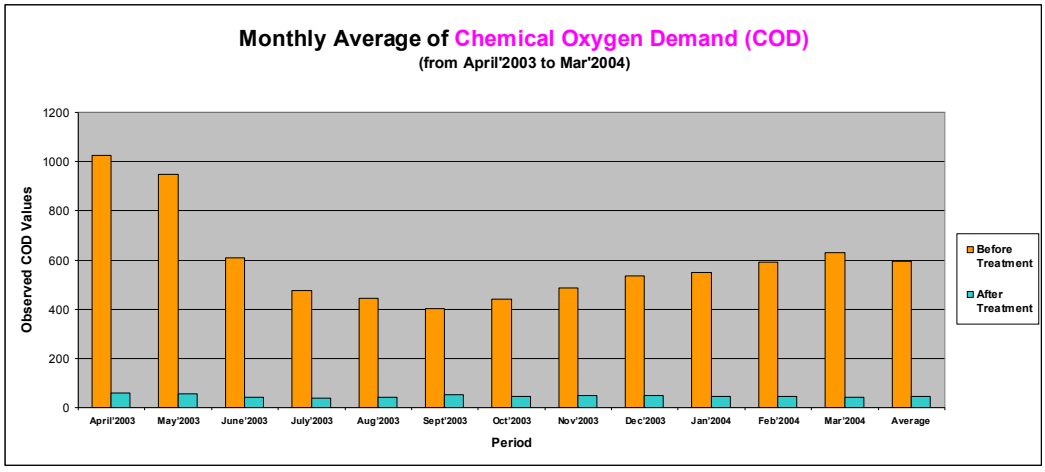
Monthly Average of COD*

From April 2003 to March 2004

Month	Before Treatment	After Treatment
April'2003	1025.93	60.53
May'2003	949.84	56.00
June'2003	609.56	43.40
July'2003	474.55	37.16
Aug'2003	444.26	42.69
Sept'2003	400.59	52.96
Oct'2003	440.19	44.38
Nov'2003	484.60	48.13
Dec'2003	534.77	48.93
Jan'2004	550.23	45.03
Feb'2004	591.89	44.93
Mar'2004	628.32	41.74
Average	**594.56**	**47.15**

COD = Parameter is used to indicate the strength of wastewater. The determination of COD is useful generally when industrial wastes are discharged.



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Monthly Average of BOD*

From April 2003 to March 2004

Month	**Before Treatment**	**After Treatment**	**Efficiency (%)**
April'2003	445.33	10.83	98
May'2003	439.19	8.77	98
June'2003	288.83	6.57	97.7
July'2003	219.03	5.64	97.4
Aug'2003	217.83	6.96	96.8
Sept'2003	192.59	6.70	96.5
Oct'2003	209.84	6.93	96.6
Nov'2003	223.00	7.53	96.6
Dec'2003	237.50	8.09	96.5
Jan'2004	254.03	7.90	96.8
Feb'2004	268.74	8.14	97.9
Mar'2004	284.19	7.52	97.3
Average	**273.34**	**7.63**	**97.2**

BOD = Parameter is used to measure the organic matter present in wastewater.

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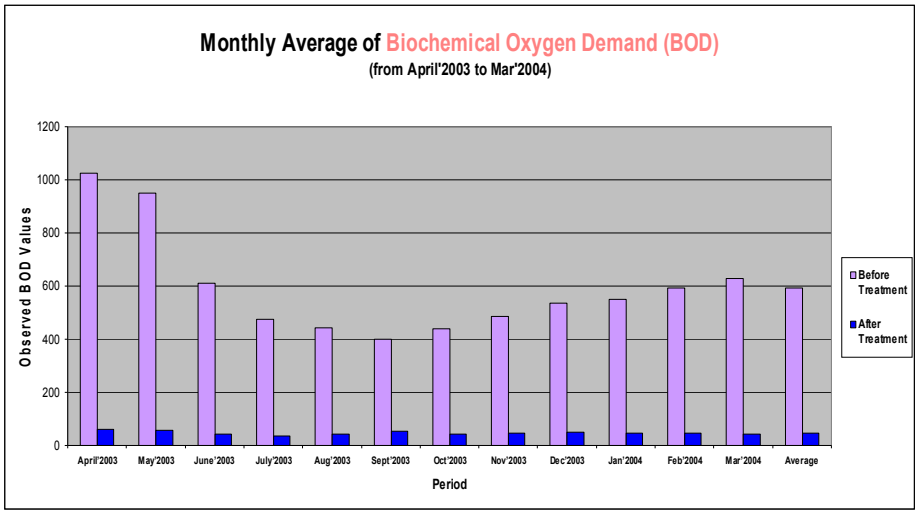

Monthly Averages of Dissolved Oxygen(DO)*

From April 2003 to March 2004

Month	Aeration Tank	SST
April'2003	2.10	3.28
May'2003	2.14	3.44
June'2003	2.17	3.84
July'2003	2.18	3.97
Aug'2003	2.13	3.78
Sept'2003	2.18	3.88
Oct'2003	2.17	3.79
Nov'2003	2.07	3.62
Dec'2003	2.08	3.52
Jan'2004	2.11	3.55
Feb'2004	2.13	3.32
Mar'2004	2.17	3.33
Average	**2.13**	**3.61**

DO = Measure of oxygen in water i.e. water supply is usually saturated with oxygen. When organic wastes are added to the water, dissolved oxygen rapidly gets depleted.

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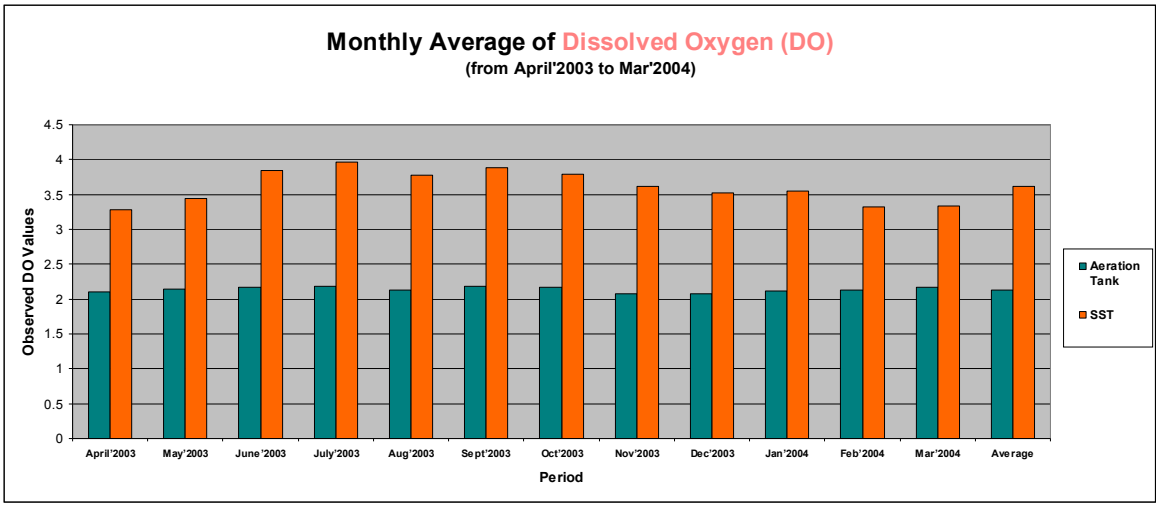

CONCLUSIONS

The rejuvenation and conservation of Hussain Sagar is in the interest of man as its ecological, cultural and touristic value is immense. One of the most important steps in the rejuvenation and conservation of the lake is to restore the water quality by controlling the pollution through different remedial measures. The case of Hussain Sagar will be a trend setter in the field of lake rejuvenation conservation and similar measures could be initiated for the protection of a number water bodies in the urban environment all over the country. The Sewage Treatment process designed by M/s.AIC Watson, Mumbai and the plant constructed by M/s.SACEDE Engineers & Consultants, Chennai, at a cost of Rs.60 Million (Rupees Sixty Million) is sophisticated and futuristic to the core. The process ensures that treated effluent is free of solids and organic matter are let into the Hussain Sagar Lake. The entire Project has been completed with World Bank Aid and appointed the National Environmental Engineering Research Institute (NEERI), in September, 1997 to carry out environmental monitoring of the lake waters and sediments by HMWSSB. The study is aimed at generating valuable data on the impact of the abatement of pollution measures on the ecology of the lake, analysis of which would provide the basis for fine tuning the ongoing and proposed pollution control measures. The commissioning of 20 Mld STP marks the beginning of a new ear of environmental protection Project in Hyderabad.

REFERNECES

1. Practical Handbook on : Public Health Engineering (updated edition – 2003) by ER.G.S.Bajwa.
2. Reddy, M. V., Babu, K. S., Balaram, V., & Satyanarayanan, M. (2012). Assessment of the effects of municipal sewage, immersed idols and boating on the heavy metal and other elemental pollution of surface water of the eutrophic Hussainsagar Lake (Hyderabad, India). Environmental monitoring and assessment, 184(4), 1991-2000.
3. Ramachandraiah, C., & Prasad, S. (2004). Impact of urban growth on water bodies: The case of Hyderabad. Hyderabad: Centre for Economic and Social Studies.
4. Arceivala, S. J., & Asolekar, S. R. (2006). Wastewater treatment for pollution control and reuse. Tata McGraw-Hill Education.
5. Mahapatra, D. M., Chanakya, H. N., & Ramachandra, T. V. (2011). Assessment of treatment capabilities of Varthur lake, Bangalore, India. International Journal of Environmental Technology and Management, 14(1-4), 84-102.
6. Mohanty, J. C., Ford, T. E., Harrington, J. J., & Lakshmipathy, V. (2002). A cross-sectional study of enteric disease risks associated with water quality and sanitation in Hyderabad City. Journal of Water Supply: Research and Technology-AQUA, 51(5), 239-251.
7. Ramachandraiah, C., & Vedakumar, M. (2007, September). Hyderabad's Water Issues and the Musi River: Need for

Integrated Solutions. In Proceedings of the 2nd International Water Conference.
8. Chigurupati, R. (2008). Urban growth, loss of water bodies and flooding in Indian cities: The case of Hyderabad. Water and Urban Development Paradigms: Towards an Integration of Engineering, Design and Management Approaches, 121-125.
9. Bassi, N., Kumar, M. D., Sharma, A., & Pardha-Saradhi, P. (2014). Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies. Journal of Hydrology: Regional Studies, 2, 1-19.
10. Prakash, A. (2010). The periurban water security problématique: a case study of Hyderabad in Southern India. *Peri Urban Water Security Discussion Paper Series*, *4*.
11. Amerasinghe, P., Bhardwaj, R. M., Scott, C., Jella, K., & Marshall, F. (2013). Urban wastewater and agricultural reuse challenges in India (Vol. 147). IWMI.
12. Starkl, M., Brunner, N., Amerasinghe, P., Mahesh, J., Kumar, D., Asolekar, S. R., ... & Sarah, S. (2015). Stakeholder views, financing and policy implications for reuse of wastewater for irrigation: a case from Hyderabad, India. Water, 7(1), 300-328.