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ENVIRONMENTAL EFFECT OF LIFT IRRIGATION SCHEME- A CASE STUDY

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ABSTRACT

Purandar Lift Irrigation scheme is on Mula-Mutha River near Pune in India envisaged to supply 4 TMC of water to drought prone area of Purandar, Daund, Haveli & Baramati. It is observed that the raw water quality available near source is far below the acceptable limits for surface water irrigation.
The farmers are raising objections for supply of raw water for irrigation purpose. The main reason for the reluctance of the farmers in using available river water is undesirable organic & in organic impurities, blackish green color & obnoxious smell of water. The chemical analysis results indicate that BOD (Biological Oxidation Demand) & COD (Chemical Oxidation Demand) values of the river water used for irrigation purpose are above permissible limits.
Our main aim in the project was to find out whether the polluted water of the river would have any long term environmental effects on the soil and ground water of the Saswad-Purandar area. For this purpose we conducted several site visits to check the extent of pollution of the river water at different locations. We tested soil & ground water samples of the area where lifted water is used for irrigation. We also suggested low cost treatmentaerated facultative lagoons to treat the river water.

KEY WORDS: BOD, COD, Lift irrigation scheme.

INTRODUCTION

Purandar Lift Irrigation scheme is on Mula-Mutha river envisaged to supply 4 TMC of water to drought prone area of Purandar, Daund, Haveli & Baramati. It is observed that the raw water quality available near source is far below the acceptable limit for surface water irrigation.
The farmers are raising objections for supply of raw water for irrigation purpose. The main reason for the reluctance of the farmers in using available river water is undesirable organic & in organic impurities, blackish green color & obnoxious smell of water. The Chemical analysis results indicate that BOD (Biological Oxidation Demand) & COD (Chemical Oxidation

Demand) values of the raw water are ranging from 45 to 450 Mg / lit. The raw water is supporting profuse growth of plant and aquatic life.
According to Maharashtra Pollution Control Board (MPCB) norms, treated sewage effluent discharged into inland water body must have BOD less than 20 Mg / lit. On this backdrop the BOD of supplied water is far in excess of tolerance limits. Considering the farmers' strong demand it is inevitable to provide suitable treatment to this water.
Purandar Lift Irrigation scheme is designed to irrigate 25100 Ha. land in 4 TMC of water. For optimum & efficient use of available water closed conduit system and drip irrigation system is proposed. For drip irrigation system water should be free from algae & suspended matter. This suspended matter in algae can choke up the nozzles provided in the laterals of the micro irrigation system.
The electrical conductivity of the sewage water is high & hence the water cannot be used for all types of crops which are proposed in cropping pattern of the Purandar Lift Irrigation Scheme.

NECESSITY OF TREATMENT

1) PHYSICAL APPEARANCE

The water needed for the Saswad-Purandar Lift Irrigation scheme is lifted from the Mula-Mutha river. This as mentioned before contains all the sewage and industrial effluents from the city Pune. It also contains discharges from the factories on the way from Pune to Koregaon Mul where the water if lifted. The water is and looks extremely polluted. Its colour is yellowish. The water also smells obnoxious. This clearly indicates that the river has not been able to rejuvenate itself.
A few months a year, the river is completely filled with water hyacinth. Again this indicates pollution to a large extent and the presence of metals like phosphorous, etc. Water hyacinth does not allow the atmospheric oxygen to dissolve in the water, thereby destroying the natural river flora and fauna.
Debris such as plastic bags and bottles, pieces of cloth, etc. are also prevalent in the river.

2) CHEMICAL PROPERTIES

DO levels were zero whenever tested. Such a condition implies that the organisms in the water were not able to oxidize the harmful bio-degradable contents of the river water as they had no dissolved oxygen to do so.

3) COMPLAINT FROM FARMERS

The farmers who have used the water up till now have objections to its quality. They obviously don't like the yellowish colour and the water has a bad, obnoxious smell coming from it. In the years when the rainfall is scanty and they do not have a choice, they do pay for it, but they wish to have clean water to irrigate their crops.

4) LONG TERM ENVIRONMENTAL EFFECTS

The long term effects of water pollution are referred to as those which are manifested after an elapse of extended period following the entry of pollutants in an aquatic system. If the water used for irrigation is polluted, it will certainly affect the soil and the groundwater in that area. As the water seeps into the ground, only the water will pass leaving behind deposits of several minerals and in some cases toxic substances. These will have a direct effect on the crops that are grown there.

Fig.1.Eutrophication near the K.T. Wier, Koregaon Mul

TESTING RESULTS AND DISCUSSION

1 Testing of river samples

To find out the extent of pollution of the river in Pune, we decided to test a few samples. Three samples of water were collected from three different locations.

Table 1:Testing results of river water samples in Pune at different locations are as follows:

Sr No.	Source	pH	DO (mg/lit)	BOD (mg/lit)	COD (mg/lit)
1	Sangam Bridge, Pune	7.3	0	250	836
2	Lakdi Pul, Pune	7.2	0	230	940
3	Bund Garden, Pune	7.5	0	235	1200

Discussion: The BOD, COD & DO levels are exceeding permissible limits. Thus treatment is necessary. The appearance of this water is very dirty with a foamy, polluted look and an obnoxious smell. This clearly indicates that treatment is necessary.

2 Testing of river water at source of lift irrigation scheme

The next site visit was conducted to obtain samples from the source and a location earlier to it. This location was decided to be Theur as there was a sugar factory present in it which discharged its effluents directly into the river. Theur is located before Koregaon Mul and there is a sugar factory present there. Samples were collected from Koregaon Mul (the source) as well as from Theur. Pumping of water was not being done at that time as the demand was not high.

Table 2:**Testing results of river water at source of lift irrigation scheme are as follows:**

Sr No.	Source	pH	DO (mg/lit)	BOD (mg/lit)	COD (mg/lit)	Total Solids (mg/lit)
1	Koregaon Mul (Source)	7.268	0.9	867.2	1246.86	6157
2	Theur	7.56	0.3	912.78	1561.87	9316

Discussion: The BOD and COD levels were abnormally high. The water surface had undergone extensive eutrophication which portrayed the necessity of treatment.

3 Testing of ground water samples:

The next site visit was done with the objective of collecting groundwater samples in order to see whether the water from the river had caused any effect on ground water by way of percolation or not. The first sample well was located in a village called Shindewadi. The water was a clear green and seemed quite clean. One sample was taken from there. The second sample well was located close to the last i.e. sixth Distribution centre.

Table 3: Testing results of ground water samples are as follows:

Sr no.	Sample	Hardness mg/l	Chlorides mg/l	pH	Turbidity NTU
1	1st Well	1385.1	55.302 mg/lt	7.11	10
2	2nd Well	2145.6 mg/lt	46.794 mg/lt	7.23	13.6 NTU

Discussion

Though the chloride content is normal, the hardness values are abnormally high. Hardness is caused by the salts of calcium and magnesium. The high value of hardness in the groundwater may be caused due to the salts present in the soils. The only probable reason for the salt content to be so high in the soil is that there are salts of calcium and magnesium in the polluted river water which are seeping in the groundwater with water.

4) Testing of soil samples:

This site visit was done to test the effect of the irrigation water on the soil. Samples were collected from two places; the first one was a field containing black cotton soil and the second one murum. Both fields were located close to outlets from where the irrigation water was being distributed to the fields. The samples were submitted to the Agriculture College, Pune for testing. Their results are as follows:

Table 4: Testing results of First soil Sample:

Sr.no	parameter	Value	Rating
1	pH	8.5	Moderately alkaline
2	Electrical conductivity	0.1	Normal
3	Organic carbon	0.1	Very low
4	Organic carbonates	8.75	Calcareous
5	Available nitrogen	113	Very low
6	Available phosphorus	1	Very low
7	Available potassium	101	Low
8	Fe	9.4	High
9	Mn	9.2	High
10	Zn	0.6	High
11	Cu	1	High

Discussion:

The given soil has moderately alkaline pH and contains low soluble salts, very low organic carbon and calcareous nature. It also has very low nitrogen and phosphorous and contains low potassium. Micronutrients' content is high.

As per six tier system, recommended by MPKV, in given soil increase of 50% of nitrogenous and phosphate fertilizer dose. Micronutrients are applied with compost.

As calcium carbonate in soil is high, it may be harmful for crop growth. It is therefore suggested to use high organic manures as it will improve the fertility of the soil. Fertilizers other than calcium should be used. Proper drainage facility should be provided to the soil.

Table 5: Testing results of second soil sample:

Sr no	parameter	value	Rating
1	pH	7.77	Mildly alkaline
2	Electrical conductivity	0.41	Normal
3	Organic carbon	0.63	Moderately high
4	Calcium carbonate	12.5	Highly calcareous
5	Available nitrogen	176	Low
6	Available phosphorus	4	Very low
7	Available potassium	560	Very high
8	Fe	34.2	High
9	Mn	45.4	High
10	Zn	1.6	High
11	Cu	4.6	High

Discussion: The given soil sample has mildly alkaline pH and contains low soluble salts, moderately high organic carbon and the soil is highly calcareous. Given soils have very low phosphorous, nitrogen and a very high dose of potassium. Micronutrient content is very high.
As per six tier system, recommended by MPKV, in given soil increase 25% of nitrogenous fertilizer dose, 50% of phosphate fertilizer dose and decrease 50% of the potassium fertilizer dose.
As calcium carbonate content in the soil is high, it may be harmful for crop growth. Chemical fertilizers other than calcium should be used. Proper drainage facility should be provided to the soil.

SUGGESTION OF TREATMENT

Low Cost Treatment methods: The conventional biological treatment methods (trickling filters and activated sludge process) are very expensive to install and maintain. On the other hand, low cost treatment systems are very simple to construct, require little or no skilled supervision and mechanization is least. In our country, the low cost systems have achieved a good degree of

treatment as compared to the conventional systems under certain conditions. Low cost treatment like aerated facultative lagoons can be effectively used to treat river water at source of lift irrigation scheme.

CONCLUSION

A sample study of environmental effect of lift irrigation scheme at Saswad – Purandar has been presented through this paper. The extent of pollution of the river Mula-Mutha at the source, Koregaon - Mul as well as at three different upstream locations in Pune has been assessed.

The level of soil pollution and groundwater pollution has also been determined and has been compared with the permissible limits for the respective parameters.

Taking into account the pollution levels present, a low cost treatment, namely aerated facultative lagoons has been suggested. The low cost treatment suggested is economical as well as effective in improving the quality of the water used for irrigation.

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