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Present Investigations on the few Specific Parameters of Nirmal Lake waters at Vasai, Maharashtra, India

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Abstract

Nirmal Lake is about 50 kms. from Mumbai, situated in Nirmal village near Vasai town, Thane district, Maharashtra at 19° 23´ 29´´ N and 72° 46´ 57´´ E. Nirmal Lake comprises of 2 ponds namely Vimal and Malai that are separated by a tar-road for public use. The two ponds are inter-connected with each other by an internal drainage system. The lake waters are utilized for a variety of purposes including ritual ceremonies, domestic and agricultural purposes. Water serves many beneficial purposes-primarily drinking and others such as domestic, industrial, agricultural purposes, for stock and wild-life, propagation of aquatic life, aesthetic enjoyment etc. Regular monitoring of waters is of paramount importance as a relationship can be established between different parameters that can indicate the status of a habitat. The current investigations are carried out to analyze certain specific parameters required to establish and notify the quality and sustainability for varied purposes. Our observations suggest that by adopting and implementing modern scientific-cum-technological measures, the lake can be reconstituted for a variety of purposes.

Keywords: Lake, parameters, domestic**.**

Introduction

Water is the world's most precious resource as the life of plants and animals directly depend on it. Water parameters signify the quality of water and its assessment helps to prevent any further deterioration and also ensure that it is also aesthetically adequate. Potable water requires a high degree of purity and should be free from any material that will settle to form objectionable deposits, floating debris, scum, oil and other comparable matter. Safe drinking water is a human birth right as much a birthright as clean air however much of the world's population does not have access to safe drinking water[1]. Substances that affect odour, taste and colour may produce undesirable physiological responses to human beings, fishes and other animals and plants.

Material and Methods

Collection of water sample: Water sample is collected randomly at regular intervals of three-four months from 4 sites of NirmalLake. The samples were collected in plastic cans of 5 liters capacity without entrapping any air bubbles. The samples were kept in refrigerator and maintained at 4°C. Recent scientific instruments and procedures with high efficiency and efficacy were utilized for all practical purposes.

Analysis of Water Sample: Analysis of water were carried out for various water quality parameters such as pH, DO, BOD, COD, CO_2, odour, nitrate-nitrite, chlorides, sulphate, phosphates, alkalinity, acidity, total hardness etc. using standard methods[2]. All the reagents used for the analysis were of AR grade and double distilled water was used for preparation of solutions.

Results and Discussion

The mean average parameters of water of the above-mentioned sites are calculated and described as follows:

pH: pH is the term used universally to express the intensity of acid or alkaline condition of a solution. Most of water samples are slightly alkaline due to presence of carbonates and bicarbonates. The mean average pH value of water sample analyzed is 7.2 and was found within the limits prescribed by WHO. The pH values fluctuated in between 7–8. The higher range of pH indicates higher productivity of water that may eventually lead to eutrophication[3]. pH Value for all four sites are found within limit prescribed by WHO.

DO in mg/lit: DO (Dissolved oxygen) is an important parameter in water quality assessment and reflects the physical and biological processes prevailing in water. DO is of significant importance to the respiration activities of the aquatic organisms[4]. Mean average DO values of sample analyzed is 5.06mg/lit. The DO values fluctuated in between 5 – 6 mg/lit. DO values for all four sites are found below the range of Indian standard but according to WHO site 1 value is more while site2, site3 and site 4 shows values below the limit prescribed by WHO.

Hardness in mg/lit: Hardness is the property of water which prevents the lather formation with soap and increases boiling point of water[5]. Hardness of water mainly depends up [on the amount of calcium or magnesium salts or both[6]. Mean average hardness value of sample analyzed is 90.18 mg/lit. The hardness values fluctuated in between 90 – 100 mg/lit. All 4 sites shows the values found below the range prescribed by Indian Standard while according to International Std. Site 2, site3, site4 shows the value below prescribed range.

Sulphate in mg/lit: Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals[7]. Discharge of domestic sewage tends to increase its concentration. The source of sulphate could probably be from the mineral rocks antbropogenically added and also enters with the rain[8]. The mean average sulphate concentration of sample analysed is 302.06 mg/lit. The sulphate values fluctuated in between300-400mg/lit. All four sites shows higher range as compared to Indian and International Standard.

Phosphates in mg/ml: Phosphate is a nutrient that triggers eutrophication and is required by algae and other hydrophytic plants, animals in small quantities[9]. The phosphate may occur in water as a result of domestic sewage. Phosphate leads to eutrophication which could also lead to unpleasant odour of the water when algae die and decompose thus deterioting the quality of water [10]. The mean average phosphate concentration of sample analyzed is 267.03 mg/ml. The phosphate values fluctuated between 240 to 290 mg/ml. All four sites shows highest values as compared to Indian and International Standard.

BOD: BOD is the measure of oxygen required by microorganisms to breakdown organic matter. The aim of BOD is to determine the amount of biochemically oxidizable carbonaceous matter[11]. The mean average BOD concentration of sample analyzed is 0.48 mg/lit/hr. The BOD values fluctuated between 0.2to 1.3mg/lit/hr. All Four sites show the low values as compared to Indian and International Standard.

COD: COD is the amount of oxygen consumed during the chemical oxidation of organic matter using strong oxidizing agent like acidified potassium dichromate[12]. The mean average COD concentration of sample analyzed is 102mg/lit. The COD values fluctuated in between 90 to 110 mg/ml. All four sites show the high values as compared to Indian and International Standard.

CO_2: Free CO_2 dissolved in water is the only source of carbon that can be used in photosynthetic activity of aquatic autotrophs. Decomposition of organic matter and the respiration by aquatic animals also contribute to the free carbondioxide present in water[13]. CO_2 once fixed by autotrophs can be further utilized by organisms at other tropical levels. In absence of free CO_2, the carbonates are converted into 2 carbonates releasing CO_2 which is utilized by autotrophs, thus making the water alkaline. Mean average free CO_2 concentration of sample analyzed is 0.6 mg/lit. The CO_2 values fluctuated in between 0.4 to 0.8 mg/lit. All four sites values are found below the range prescribed by Indian and International Standard.

Nitrate-nitrite: Nitrite is the partially oxidized form of nitrogen found in very low concentration in natural waters. Nitrite in the water is either due to oxidation of ammonium compounds or due to reduction of nitrate as an intermediate stage in nitrogen cycle[14.] It has no mineral source in water but occurs as an intermediate formed during de-nitrification and nitrification reactions. Presence of even a minute quantity of nitrite in water is indicative of organic pollution and prevailing low O_2 concentration. At high concentration it may cause blue-baby disease. Mean average nitrite concentration of sample analyzed is 30 mg/lit. The nitrite values fluctuated in between 30 – 40 mg/lit. Site 1 and 2 values are found less than the value prescribed by Indian and International Standard While Site 3 and4 Shows absence of nitrite.

Nitrate: Beneficial effect of nitrate on crop production has been reported specially in brackish water. Ground water can be contaminated by sewage and other wastes rich in nitrates[15]. Nitrate is the highest oxidized form of nitrogen and in water most important source is biological oxidation of nitrogenous organic matter of both autochthonous and all ochthonous origin. The high concentration of nitrate in water is indicative of pollution but subsequently an important plant nutrient[16]. Mean average nitrate concentration of sample analyzed is 260 mg/lit. The nitrate values fluctuated in between 250-270 mg/lit. All four sites values are found more than range of Indian and International Standard.

Alkalinity: The alkalinity of water is a measure of its capacity to neutralize a strong acid. Alkalinity is the factor responsible for determining the amenability of water to biological treatment[17]. The alkalinity is due to the presence of carbonates, bicarbonates and hydroxides of calcium, sodium and potassium. The alkalinity of natural water is primarily due to salts of weak acids, although weak or strong bases may also contribute. Mean average alkalinity of sample analyzed is 718.15 mg/lit. The alkalinity values fluctuated in between 700–800 mg/lit. All Four sites show the high values as compared to Indian and International Standard.

Chlorides: Chlorides are found practically in all natural waters. This is the most common inorganic anion present in water[15].The chloride measures concentration serves as an indicator of pollution due to sewage since people are accustomed to higher chloride in water and are subjected to laxative effects[18]. Mean average chlorides of sample analyzed is 124.25 mg/lit. The chloride values fluctuated in between 150-160mg/lit. All four sites values are found below the range prescribed by Indian and International Standard.

Acidity: Acidity is the effects of combination of compounds

and conditions in water It is the power of water to neutralize hydroxyl ions and is expressed in terms of calcium carbonate[19]. Mean average acidity of sample analyzed is 28.12mg/lit. The acidity values fluctuated in between 20-40 mg/lit.

Conclusion

The present day scenario of water, its resources and indiscriminate utilization including contamination has led to the depletion and scarcity resulting into undue stress on human welfare. Recent studies indicate that water and its resources have to be effectively conserved, reconstituted, treated and managed by scientific measures so as to serve the biosphere. The parameters of Nirmal Sarovar indicate that by adopting and implementing technological measures, including chemical biological and mechanical etc., the lake can be reconstituted and its water can be utilized for a variety of purposes including introduction of organism for propagation.

Acknowledgement

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Table- 1
Tabulated form of Analysis of water sample from 4 different sites for Year 2011-12

Area	pH	Co_2	DO	COD	BOD
Site1(S1)	7.2	0.6	7.168	100	1.3
Site2(S2)	7.3	0.6	5.19	98	0.2
Site3(S3)	6.9	0.8	4.05	107	0.2
Site4(S4)	7.5	0.4	3.83	103	0.2
International	7 to 8.5	6	5.5	14	5
Indian	8 to 8.5	6	8.5to9	8.5 to11	8.5 to 10

Except pH value reported for all parameters in mg/L

Table-2
Tabulated form of Analysis of water sample from 4 different sites Year 2011-12

Area	Ca Hardness	Sulphate	Total Acidity	Total Alkalinity	Nitrate	Chloride
Site1(S1)	100.2	291.6	25	500	280	159.75
Site2(S2)	92.18	250	25	875	280	166.85
Site3(S3)	92.18	375	25	625	240	85.2
Site4(S4)	76.15	291.66	37.5	875	240	85.2
International	100	200	-------	200	45	200
Indian	300	150	-------	103	50	250

Table- 3
Tabulated form of Analysis of water sample from 4 different sites Year 2011-12

Area	Phosphate	Silicate	Nitrite
Site1(S1)	246.4	48.38	30
Site2(S2)	260.2	16.12	30
Site3(S3)	273.9	16.12	0
Site4(S4)	287.6	32.25	0
International	0.05	30	45
Indian	0.05	30	50

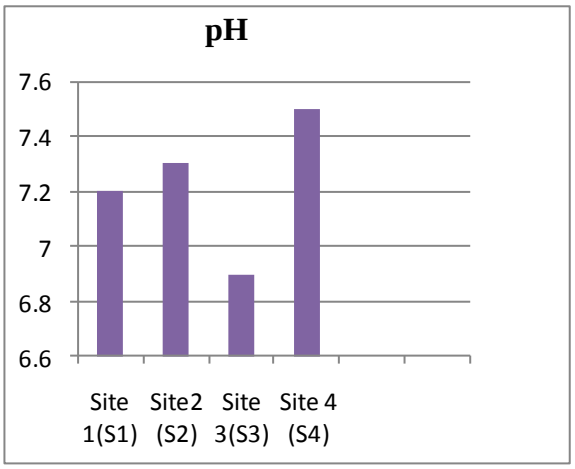

Figure-1.1
Graphical representation of pH

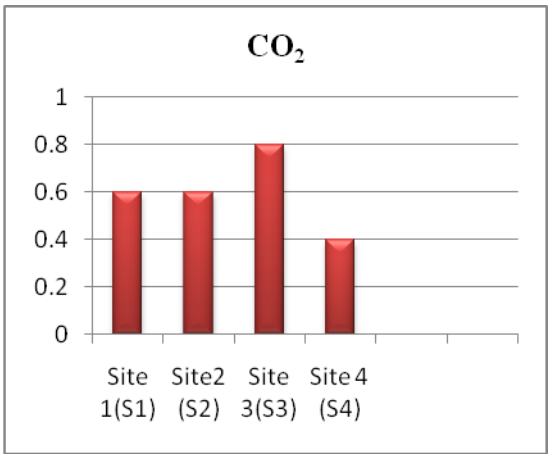

Figure-1.2
Graphical representation of CO_2

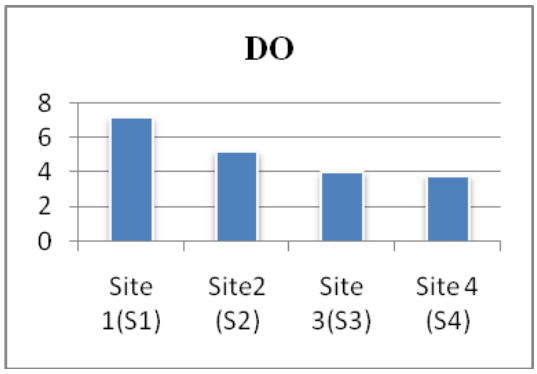

Figure-1.3
Graphical representation of DO

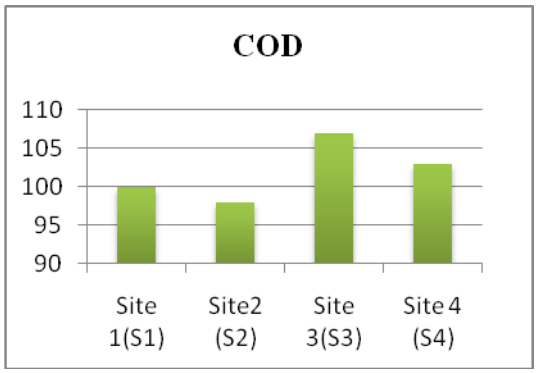

Figure-1.4
Graphical representation of COD

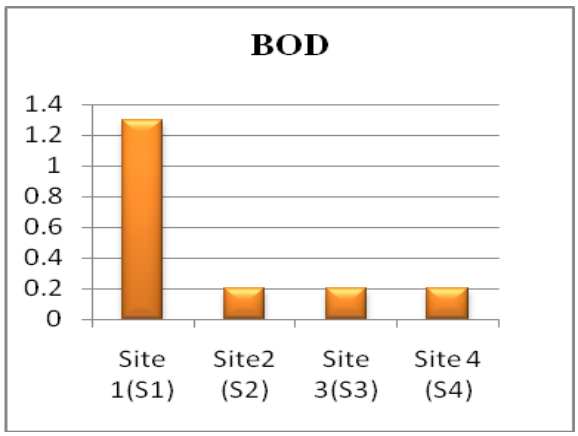

Figure-1.5
Graphical representation of BOD

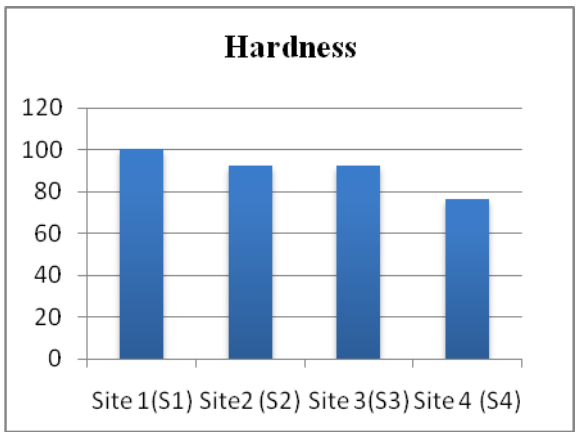

Figure-2.1
Graphical representation of Hardness

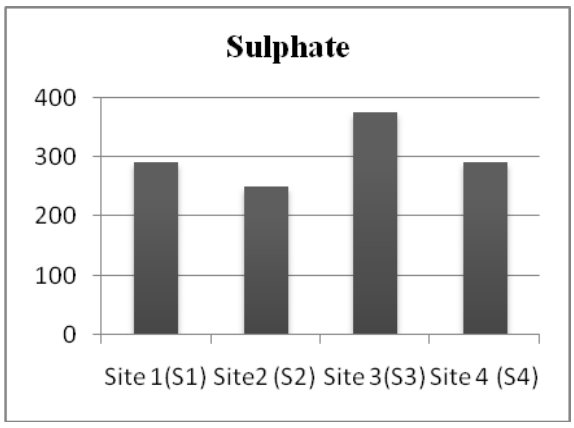

Figure-2.2
Graphical representation of Sulphate

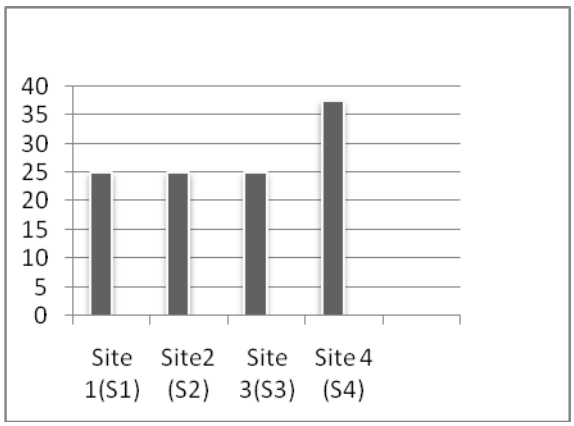

Figure 2.3
Graphical representation of Total Acidity

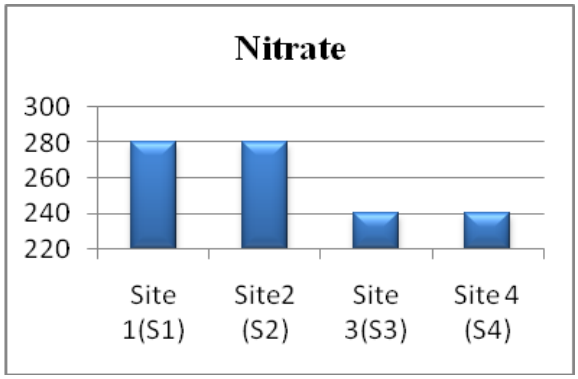

Figure-2.4
Graphical representation of Nitrate

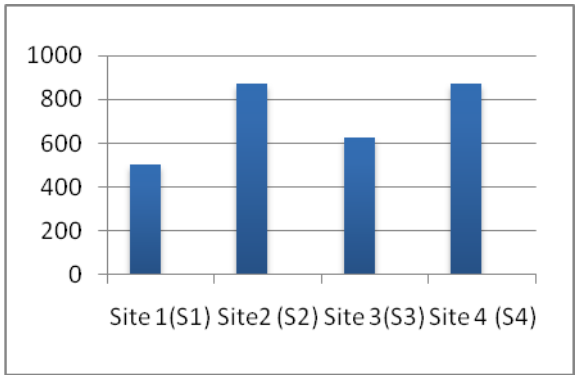

Figure-2.5
Graphical representation of Total Alkalinity

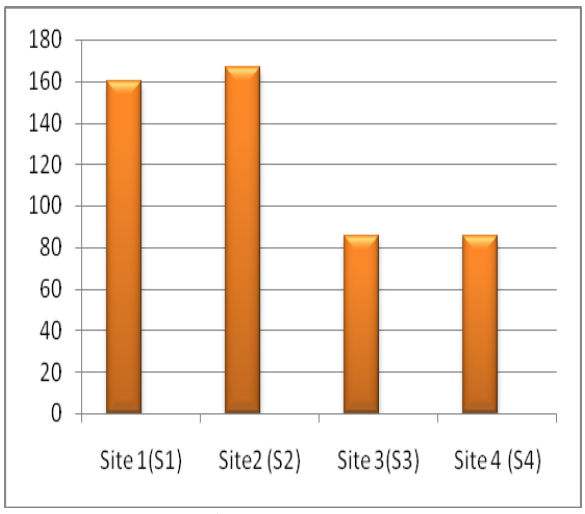

Figure-2.6
Graphical representation of Chloride

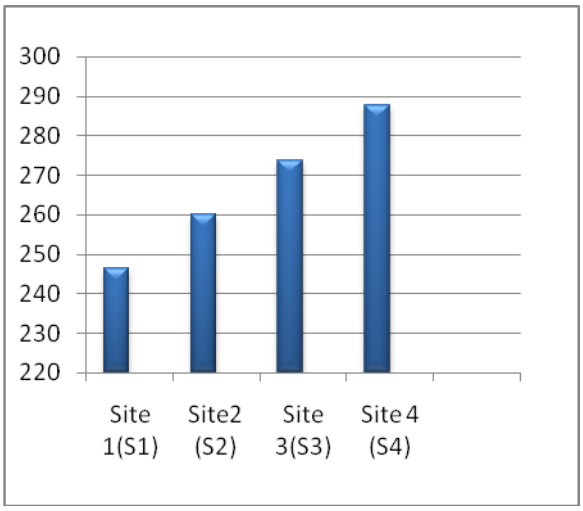

Figure 3.1
Graphical representation of Phosphate

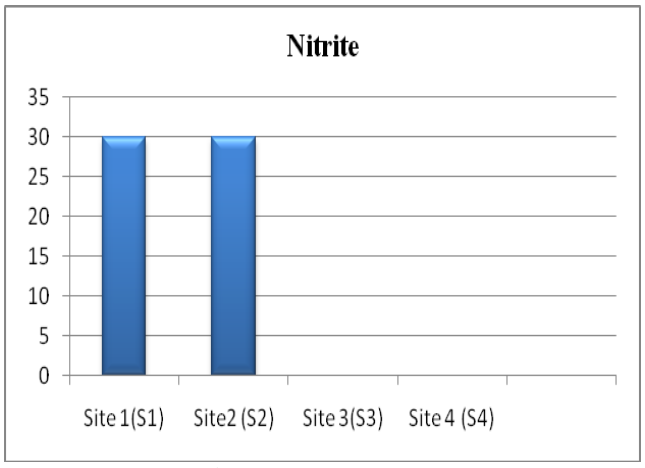

Figure-3.2
Graphical representation of Silicate

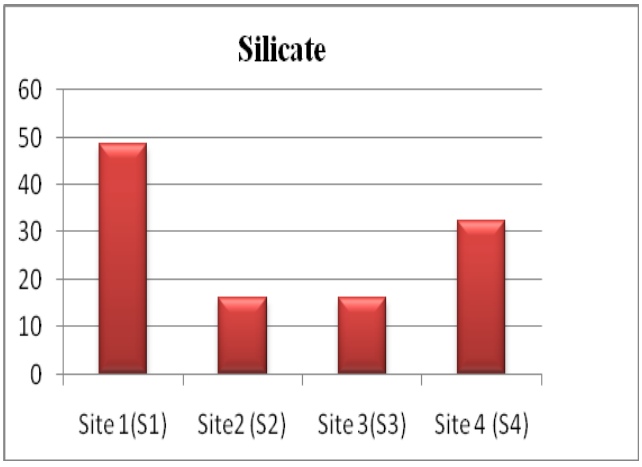

Figure-3.3
Graphical representation of Nitrite

Figure-1
Nirmal lake

Figure-2
Domestic Utilization

Figure-3
Domestic utilization of water

Figure- 4
Present Scenario of lake

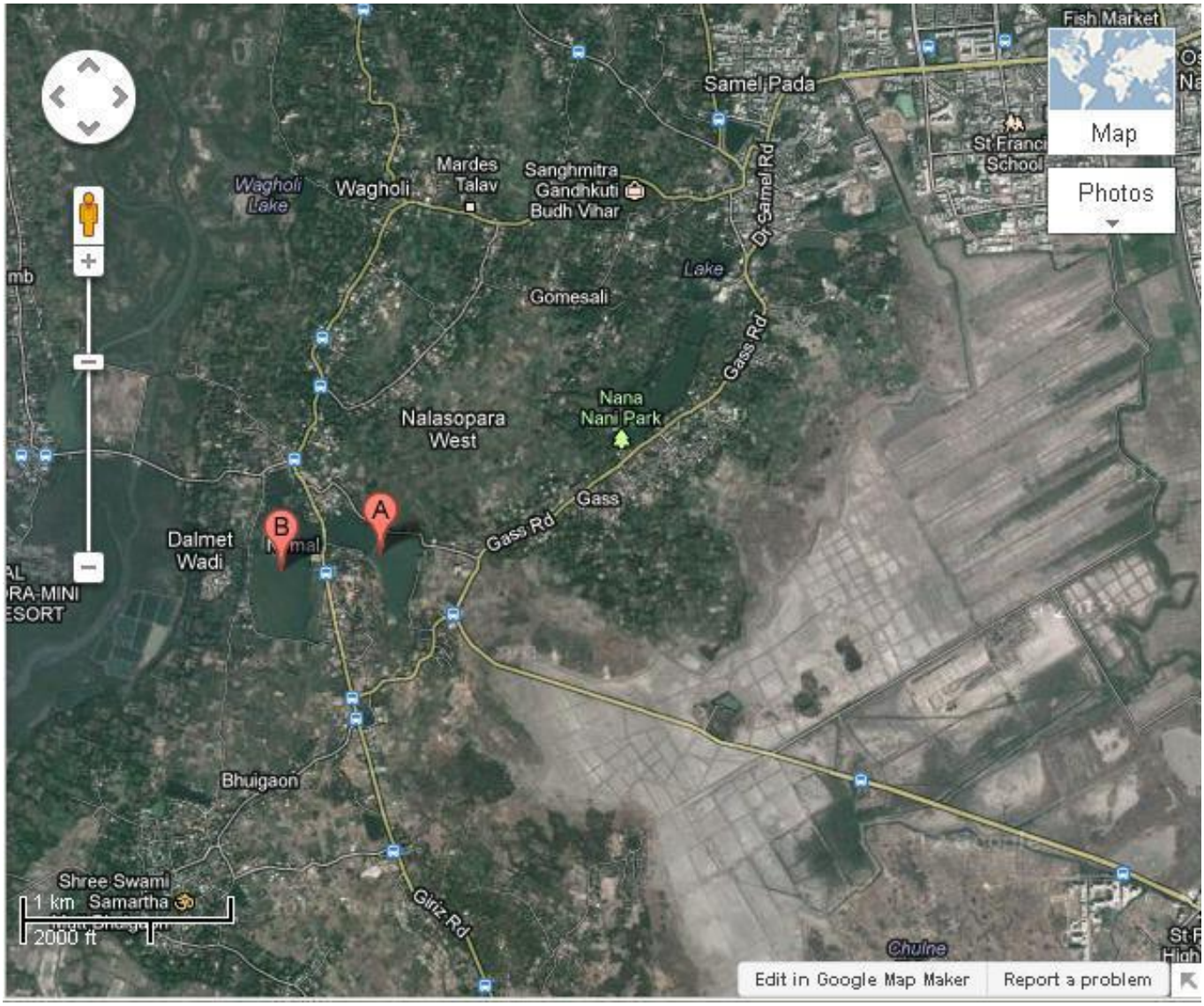

Figure-5
Google Image Mapping for Site Location