# LAKE 2014

Topic :

## Ground Water Quality Deterioration in Urban Areas

By :

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# Need to do the research

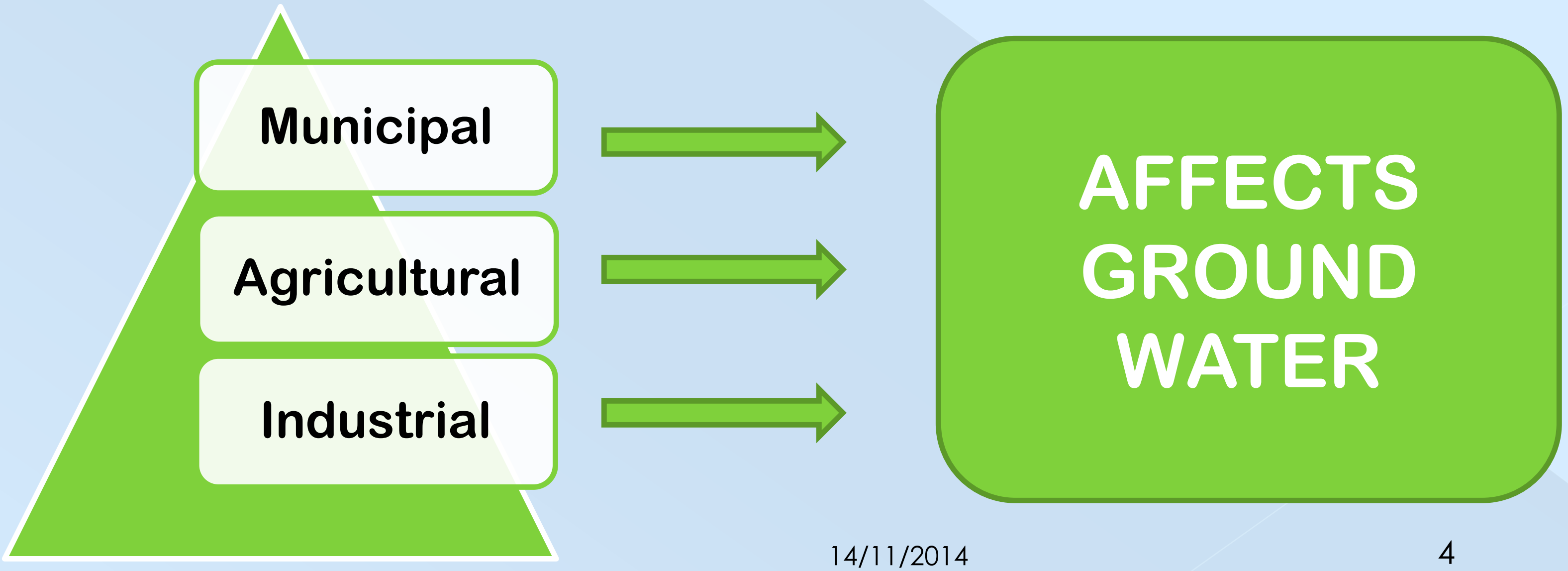
- Water borne diseases kill 25000 people everyday.
- 70% of the world population is without safe water.
- Need of water is increasing, and its quality is deteriorating.
- Ground water is a part of hydrological cycle. It is the largest available source of fresh water.
- At present, nearly 1/5$^{th}$ of all the water used in the world is obtained from ground water resources.
- Agriculture depends on ground water.

# GROUND WATER

- **Groundwater is the water located beneath the Earth’s surface in soil pores and in the fractures of rock formation.**
- **The study of distribution and movement of ground water is HYDROGEOLOGY or GROUND WATER HYDROLOGY.**

# POLLUTION OF GROUNDWATER

- The artificially induced degradation of natural groundwater quality.
- In contrast with surface water pollution, subsurface pollution is difficult to detect, and is even more difficult to control, and may persist for decades.



# WATER TESTING

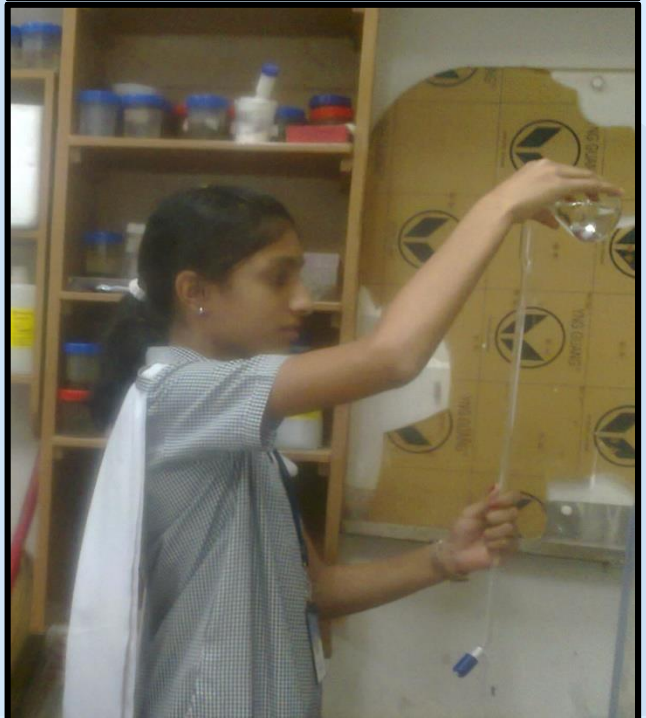
## Physical Characteristics

- TDS (Total Dissolved Solids)
- EC (Electrical Conductivity)
- Turbidity
- Density
- Viscosity
- Surface Tension

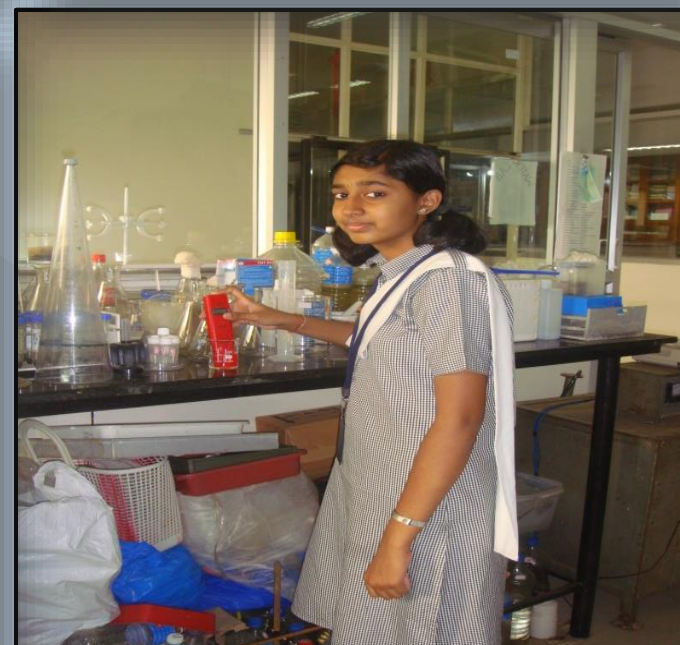
## Chemical Characteristics

- pH
- COD (Chemical Oxygen Demand)
- Alkalinity
- Chloride
- Total Hardness
- Calcium Hardness
- Magnesium Hardness
- Phosphate
- Nitrate
- Sodium
- Potassium

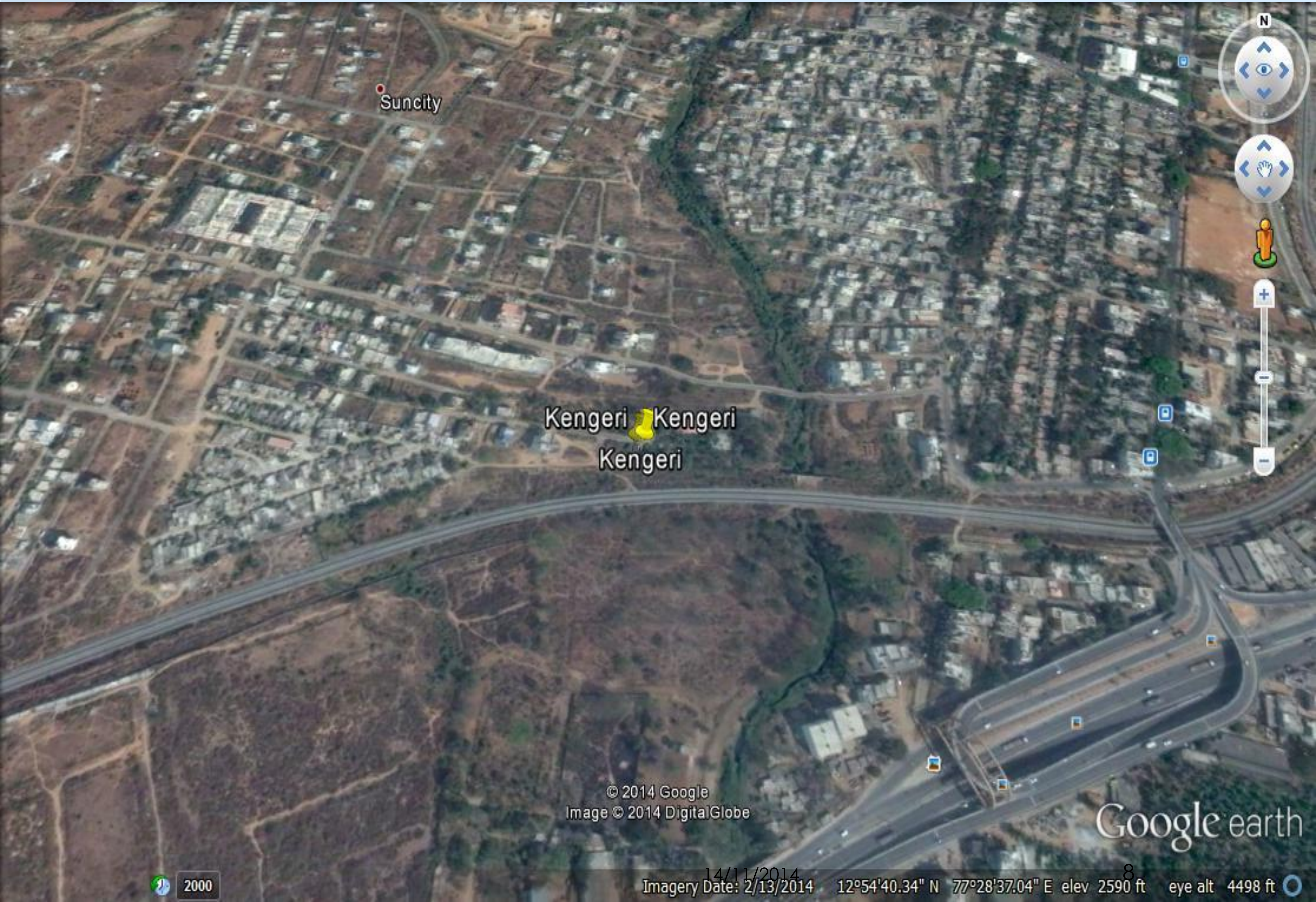
# PHOTOS



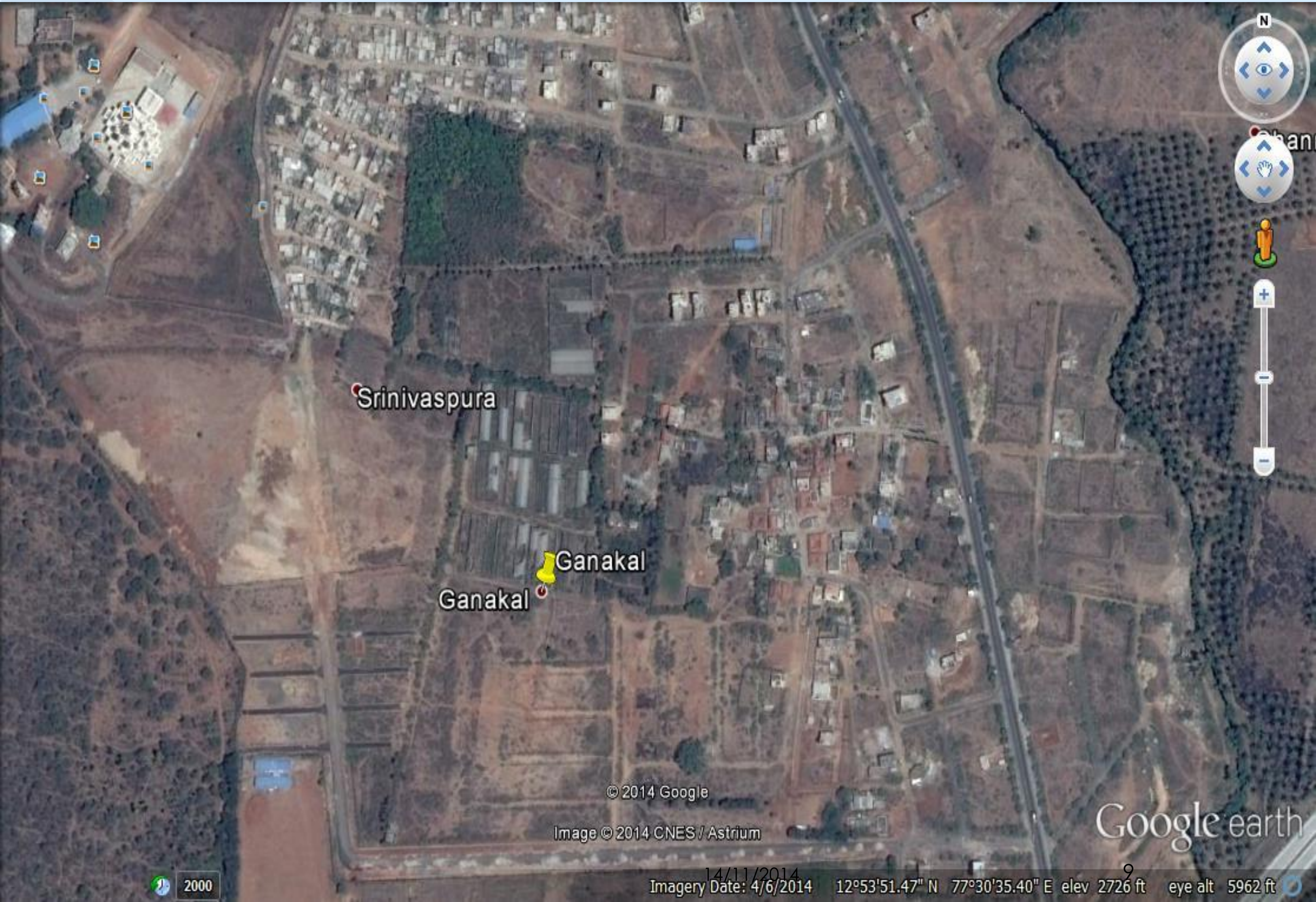
# PHOTOS



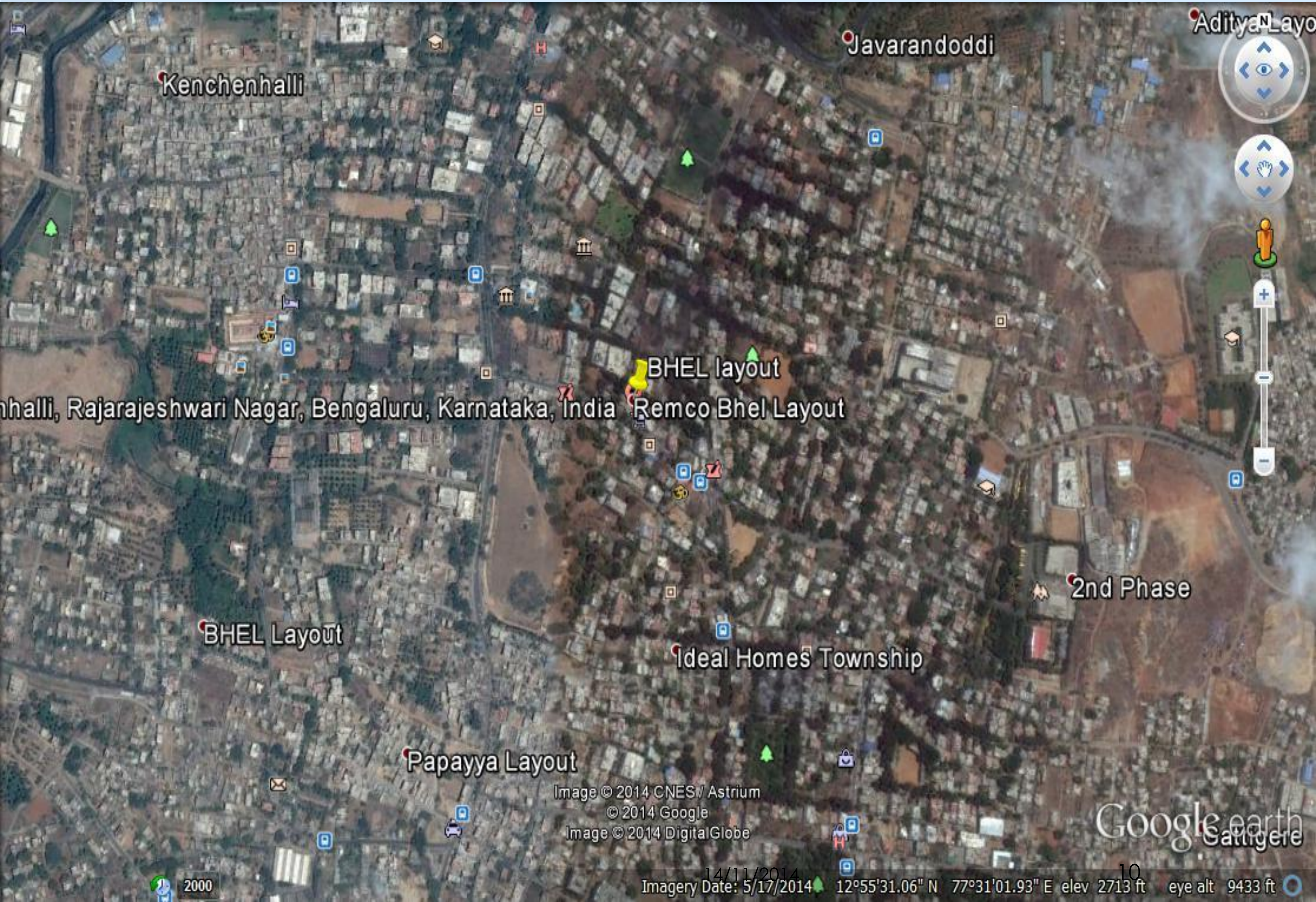
# Sample 1 - Kengeri



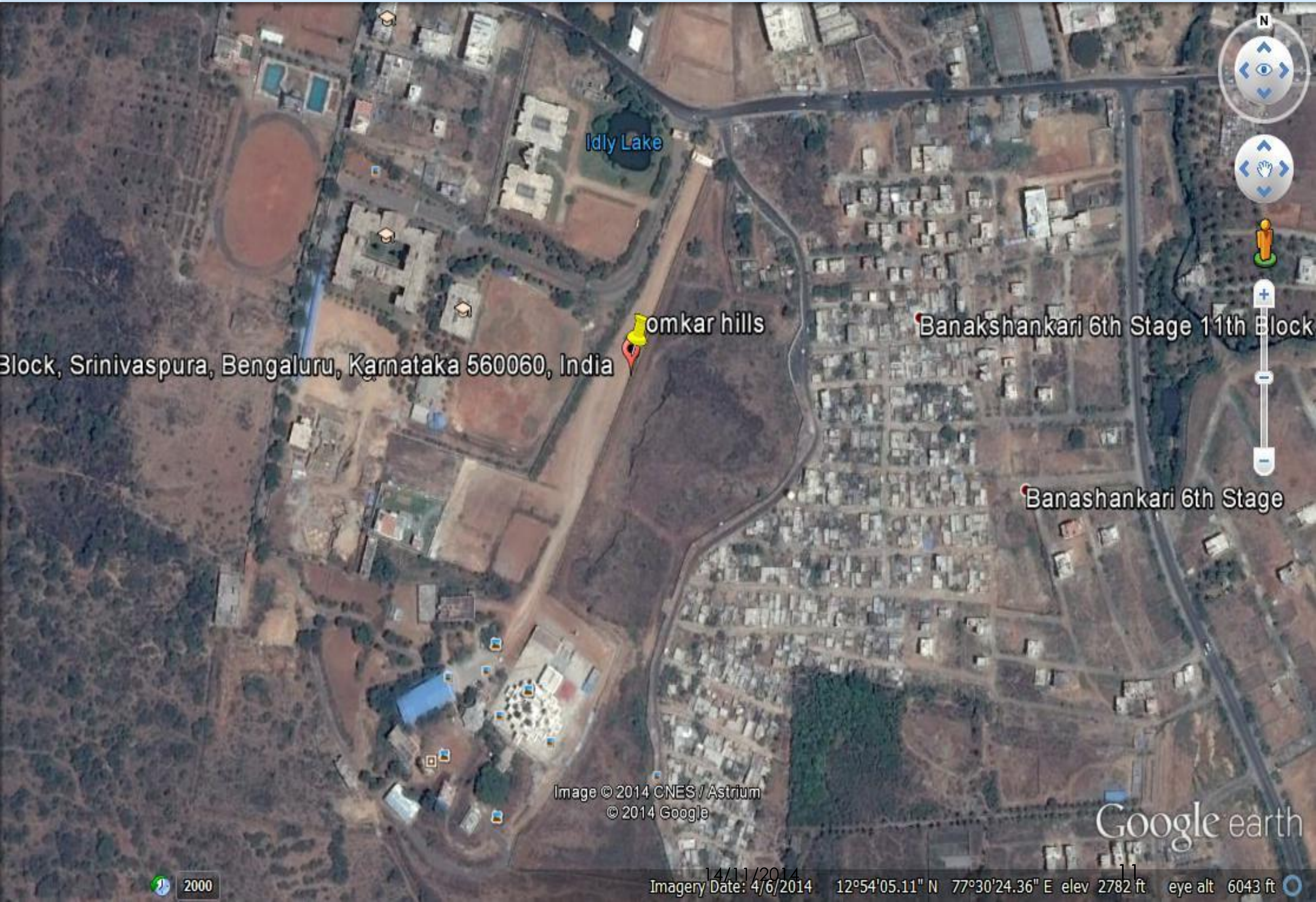
# Sample 2 - Ganakal



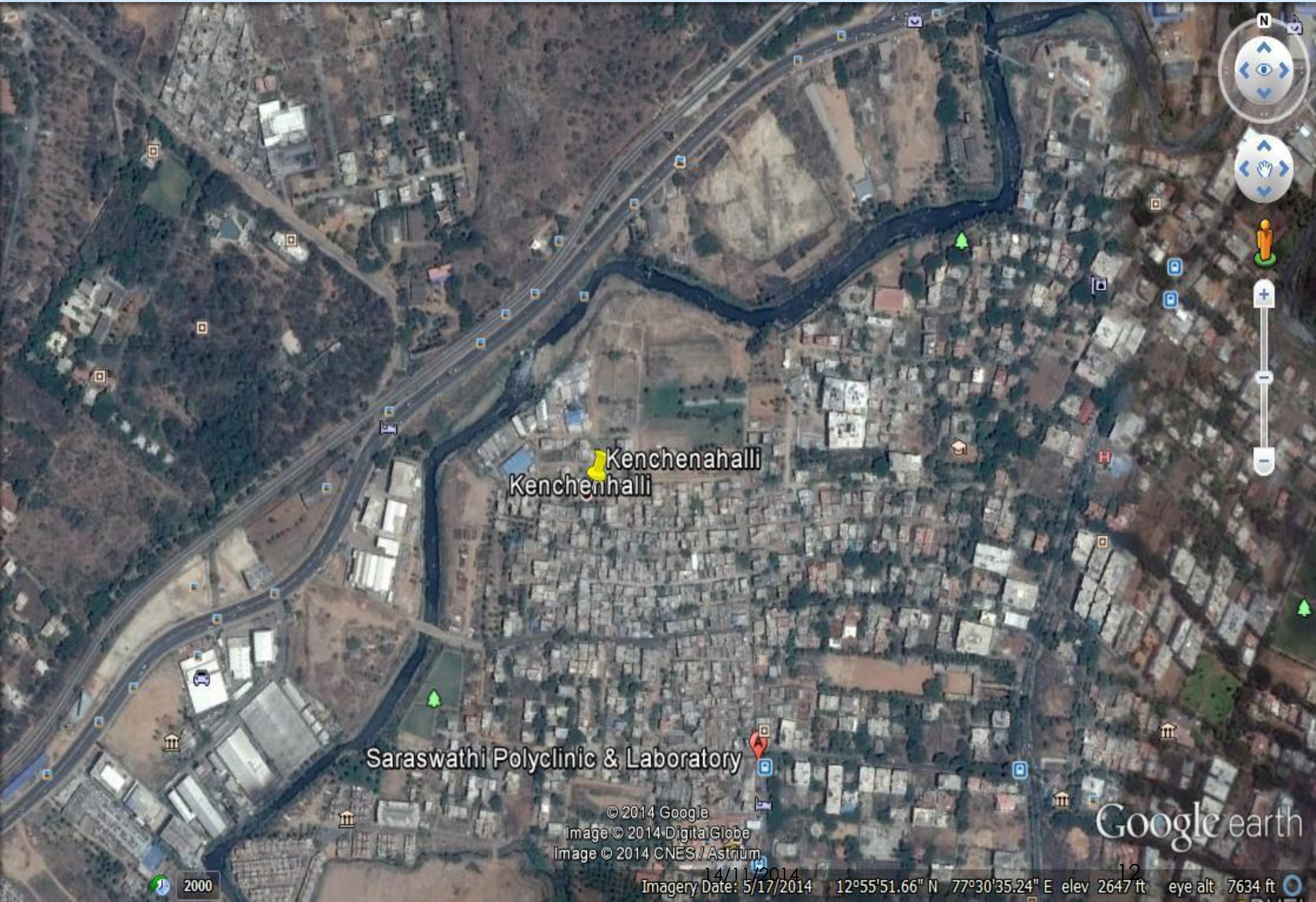
# Sample 3 - BHEL  Layout



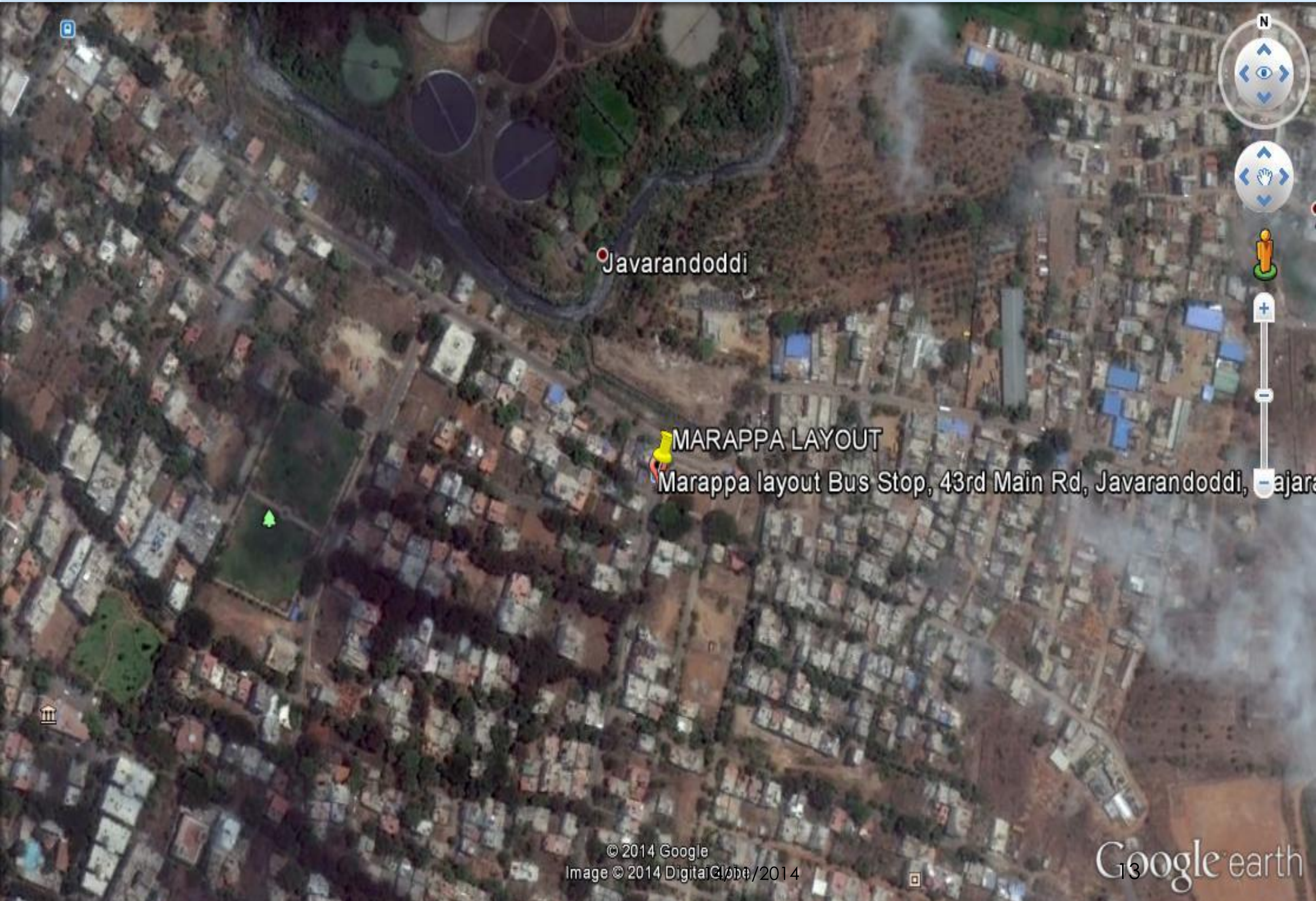
# Sample 4 - Omkar Hills



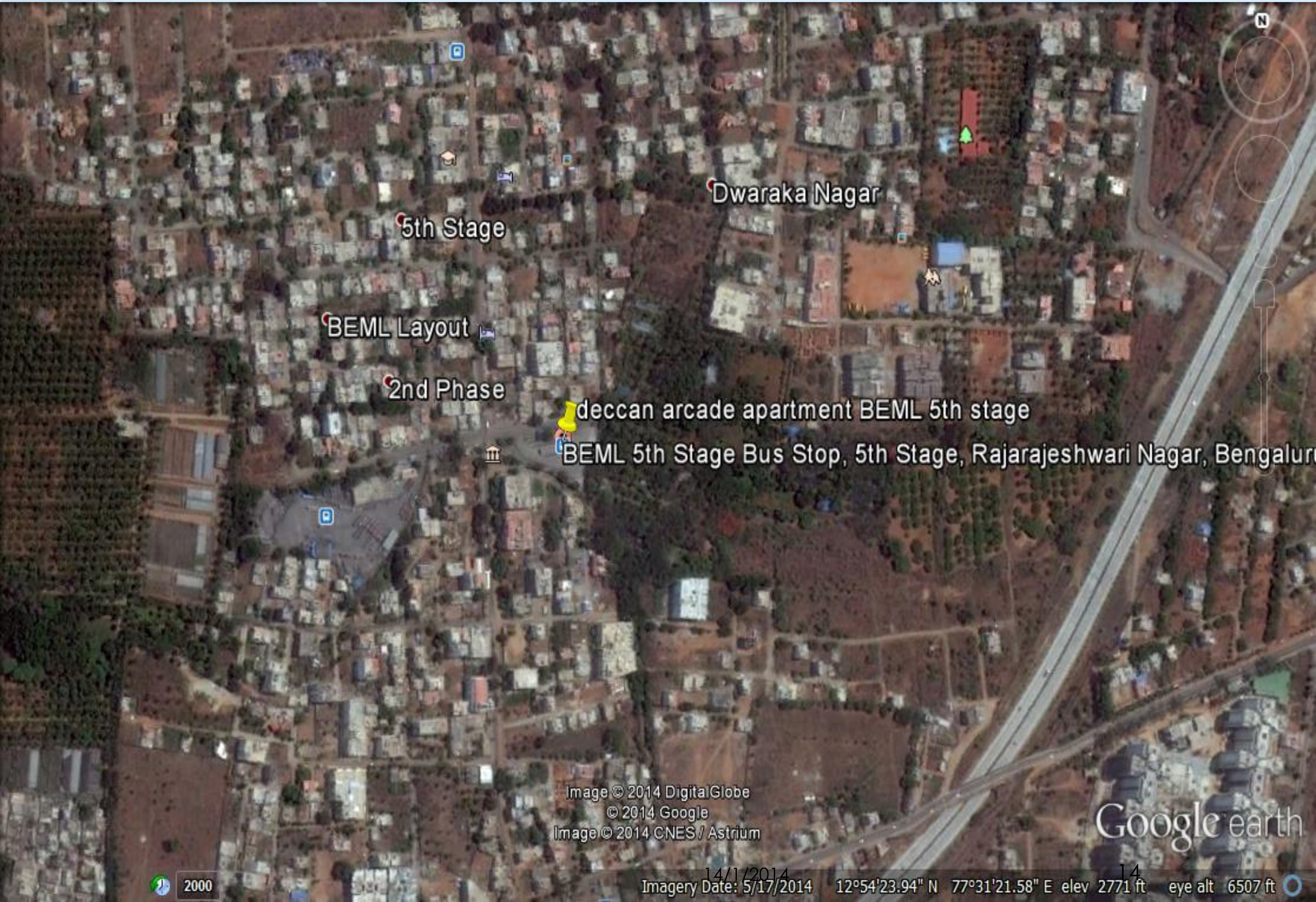
# Sample 5 - Kenchenahalli



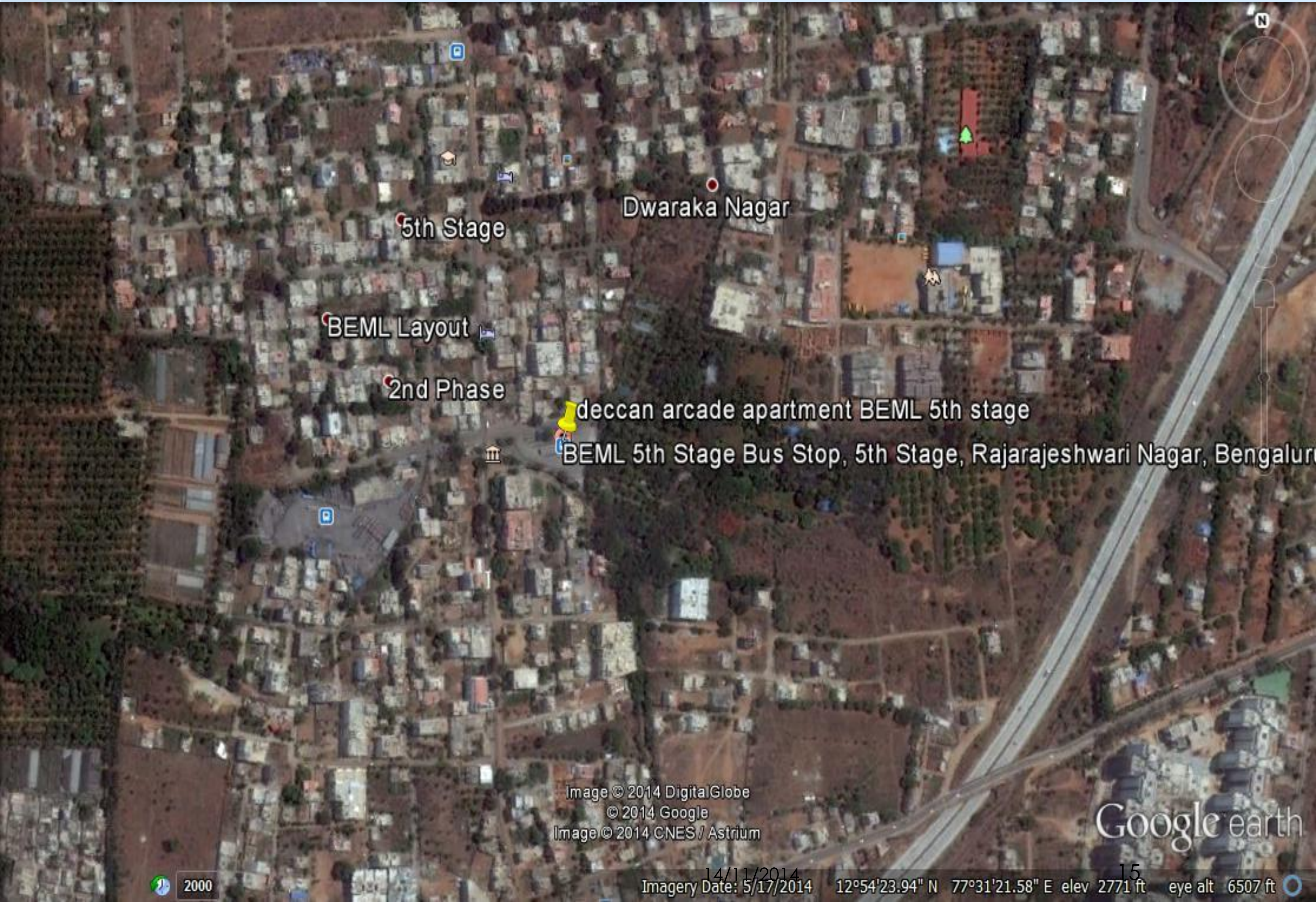
# Sample 6 - Marappa Layout



# Sample 7 - BEML Complex



# Sample 8 - BEML 5$^{TH}$ Stage



# Total Dissolved Solids (TDS)

- Total amount of mobile ions, including minerals, salts or metals dissolved in a given volume of water.
- Determined by measuring the Electrical Conductance.
- Electrical Conductance is a measure of the ability of water to conduct an electric current, which is the function of water temperature and TDS.

| SAMPLES | VALUES (mg/L) |
|---|---|
| Kengeri | 637 |
| Banashankari 6th stage | 571 |
| BHEL layout | 660 |
| Omkar hills | 487 |
| Kenchenahalli | 486 |
| Marappa layout | 743 |
| BEML complex | 425 |
| BEML 5th stage | 375 |

**Permissible value: 500 mg/L**

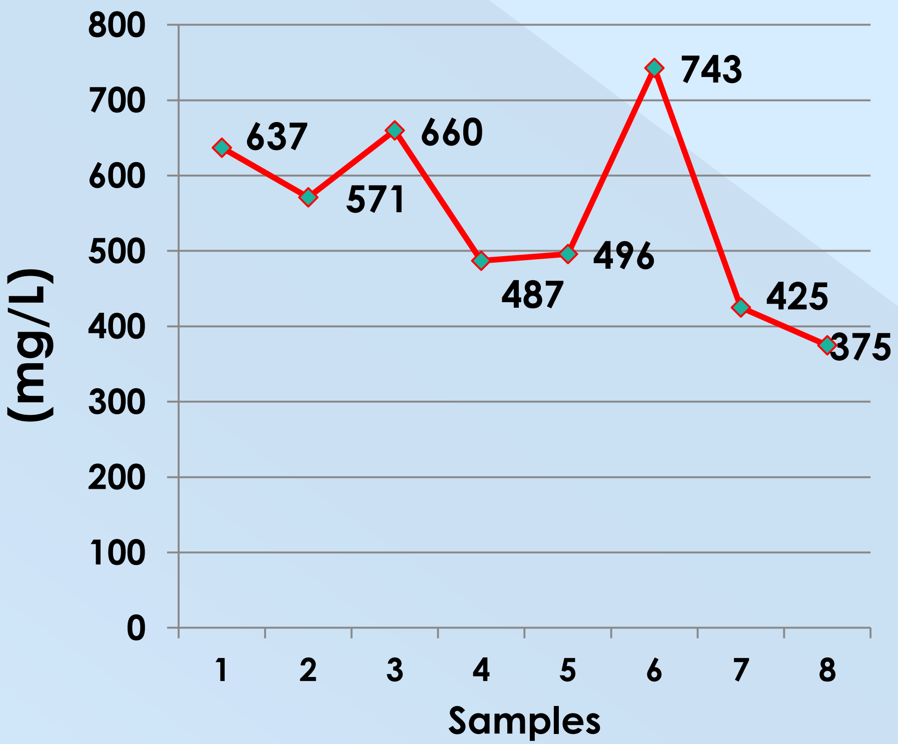
# ELECTRICAL CONDUCTIVITY

- Is a measure of the ability of water to conduct an electric current, which is a function of water temperature and TDS. (chlorides, sulphates, carbonates, sodium, magnesium, calcium and potassium)

| Samples | Values (µS/cm) |
|---|---|
| Kengeri | 841 |
| Banashankari 6th stage | 832 |
| BHEL layout | 955 |
| Omkar hills | 785 |
| Kenchenahalli | 800 |
| Marappa layout | 1052 |
| BEML complex | 729 |
| BEML 5th stage | 657 |

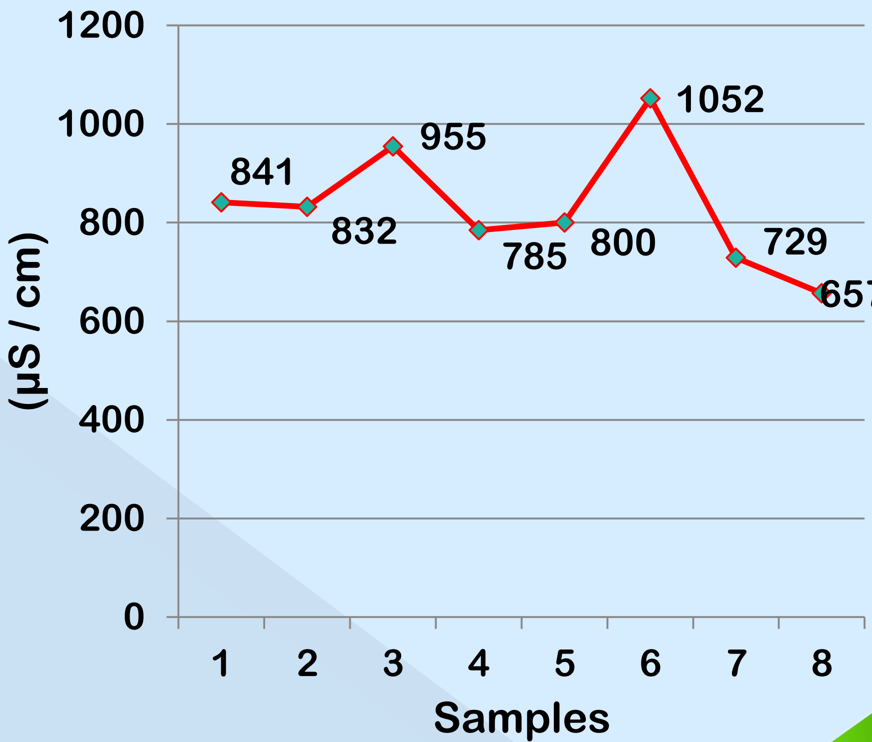
Permissible value: 750 µS/cm

# TDS



800
700
600
500
400
300
200
100
0
(mg/L)
637
571
660
487
496
743
425
375
1
2
3
4
5
6
7
8
Samples


# EC

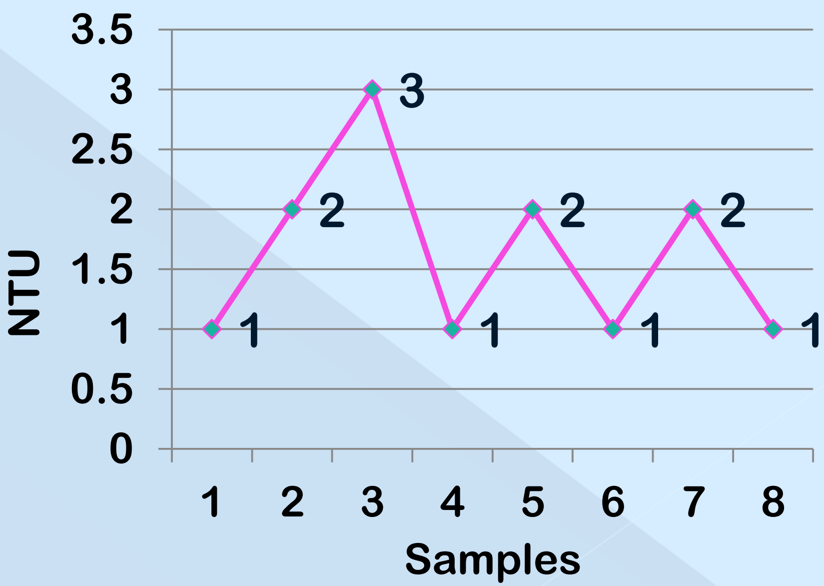


1200
1000
800
600
400
200
0
(µS / cm)
841
832
955
785
800
1052
729
657
1
2
3
4
5
6
7
8
Samples

# TURBIDITY

- Opacity or muddiness caused by particles of extraneous matter; not clear or transparent.
- The more is the matter suspended in water, the greater is the water's turbidity and the lower is its clarity.
- Clay, silt, sand, algae, plankton, micro-organisms and other substances affecting the light penetrating ability.

| Samples | Values (NTU) |
|---|---|
| Kengeri | 1 |
| Banashankari 6th Stage | 2 |
| BHEL layout | 3 |
| Omkar hills | 1 |
| Kenchenahalli | 2 |
| Marappa layout | 1 |
| BEML layout | 2 |
| BEML 5th stage | 1 |

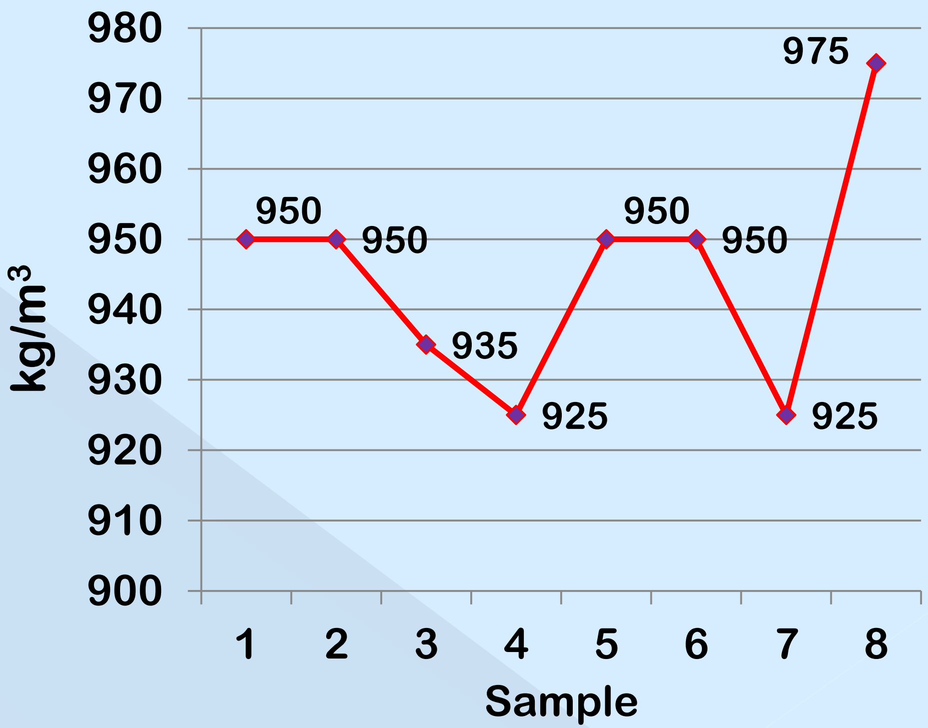



Permissible value: 5 NTU

# DENSITY

Mass per its volume $$\rho = \frac{M}{V}$$

| Samples | Values (kgm$^{-3}$) |
|---|---|
| Kengeri | 950 |
| Banashankari 6th stage | 950 |
| BHEL layout | 935 |
| Omkar hills | 925 |
| Kenchenahalli | 950 |
| Marappa layout | 950 |
| BEML layout | 925 |
| BEML 5th stage | 975 |

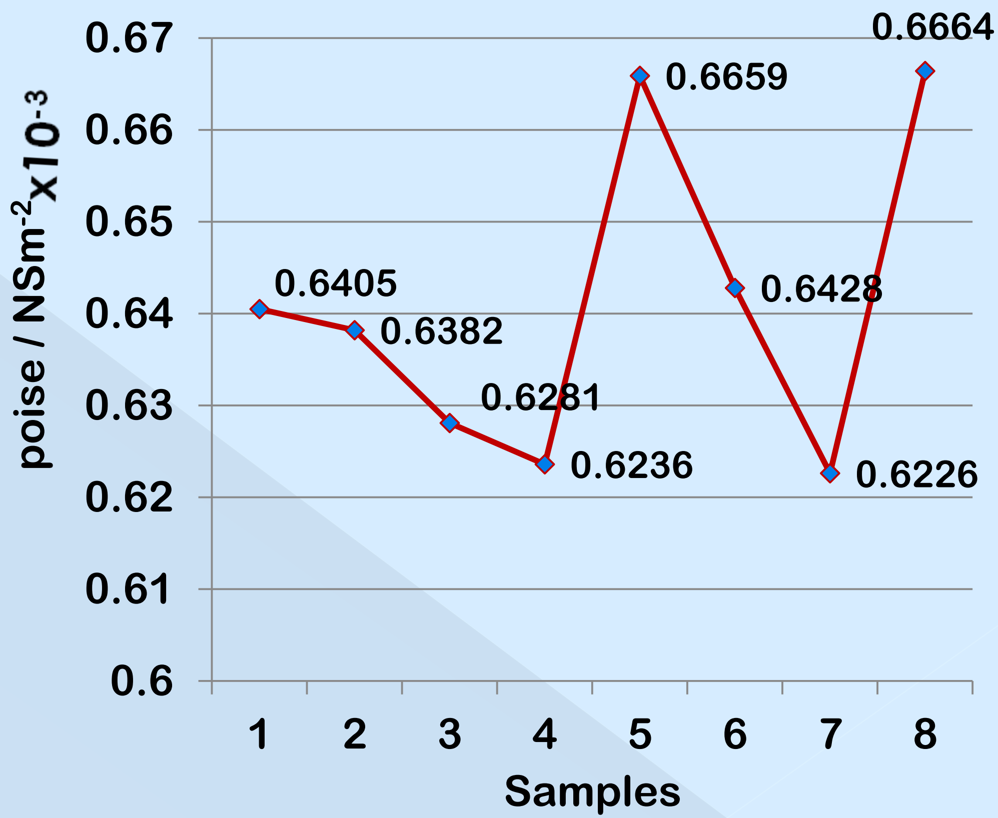



**Permissible Value : 998 kgm$^{-3}$**

# VISCOSITY

- Internal friction in a water that resists / prevent the flowing away of the water.
- It decreases with temperature.

| Samples | Values x $10^{-3}$ (poise / $NSm^{-2}$) |
|---|---|
| Kengeri | 0.6405 |
| Banashankari 6th Stage | 0.6382 |
| BHEL layout | 0.6281 |
| Omkar hills | 0.6236 |
| Kenchenahalli | 0.6659 |
| Marappa layout | 0.6428 |
| BEML layout | 0.6226 |
| BEML 5th stage | 0.6664 |

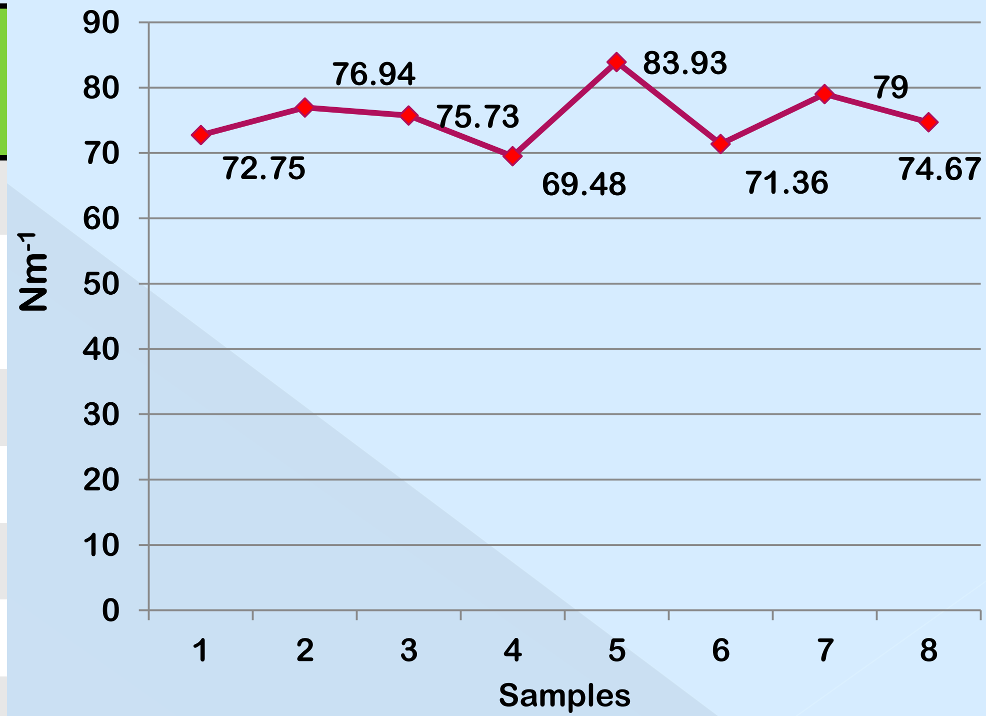



**Permissible Value : 1.000x$10^{-3}$ poise / $NSm^{-2}$**

# SURFACE TENSION

- The surface of water has a tendency to contract so as to acquire minimum surface area.
- Increasing the temperature and adding soap decreases the surface tension.

| Samples | Surface Tension X $10^{-3}$ ($Nm^{-1}$) |
|---|---|
| Kengeri | 72.75 |
| Banashankari 6th stage | 76.94 |
| BHEL layout | 75.73 |
| Omkar hills | 69.48 |
| Kenchenahalli | 83.93 |
| Marappa layout | 71.36 |
| BEML layout | 79.00 |
| BEML 5th stage | 74.67 |




**Permissible Value : 72.7 x$10^{-3}$ $Nm^{-1}$**

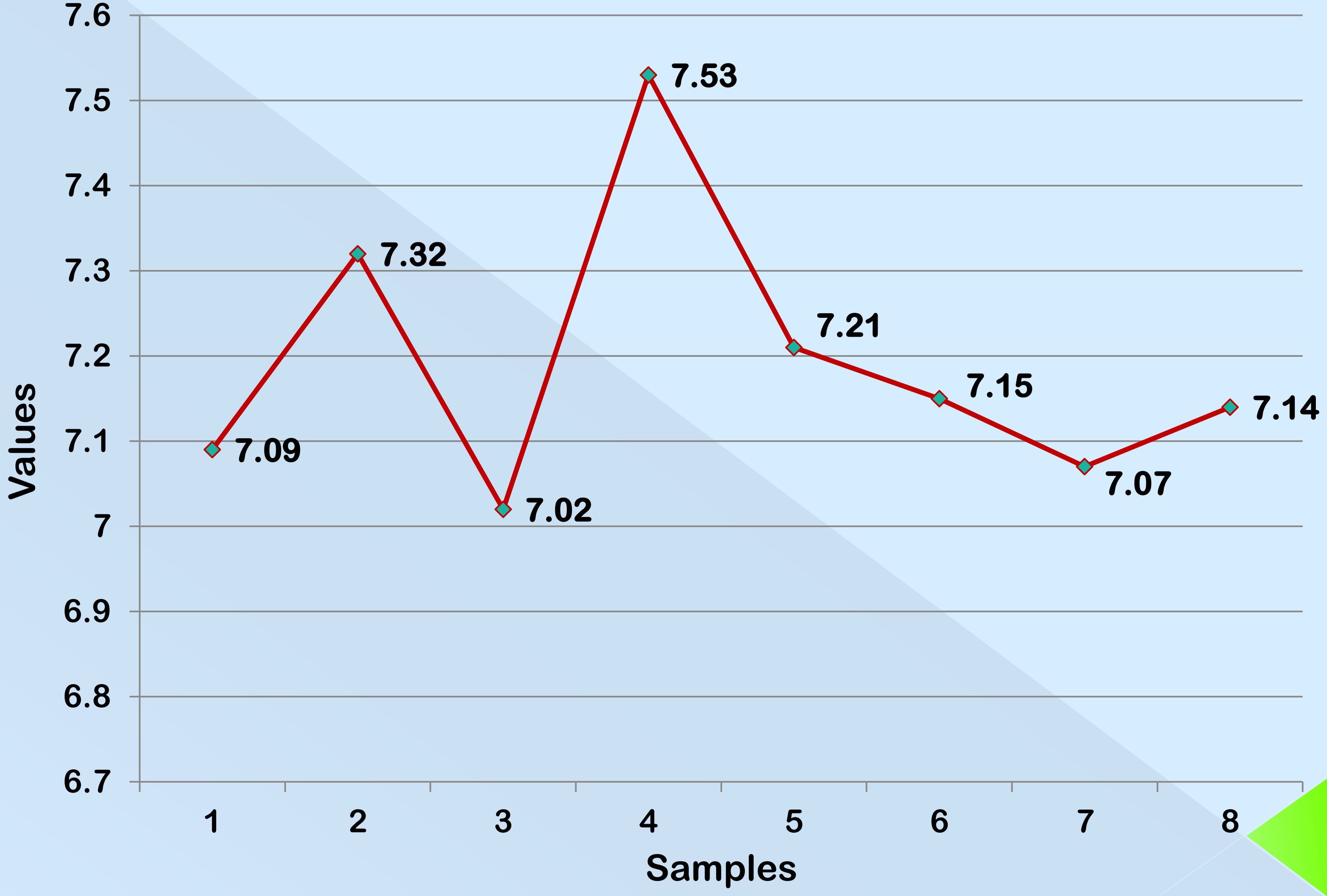
# pH

- Is a measure of acidity or alkalinity. Pure water has pH of 7, acidic solutions have lower pH values and alkaline solutions have higher values.
- The hydrogen–ion concentration (pH) refers to the effective concentration (activity) of hydrogen-ions in the water.

| Samples | Values |
|---|---|
| Kengeri | 7.09 |
| Banashankari 6th stage | 7.32 |
| BHEL layout | 7.02 |
| Omkar hills | 7.53 |
| Kenchenahalli | 7.21 |
| Marappa layout | 7.15 |
| BEML complex | 7.07 |
| BEML 5th stage | 7.14 |

**Permissible value: 6.5-8.5**

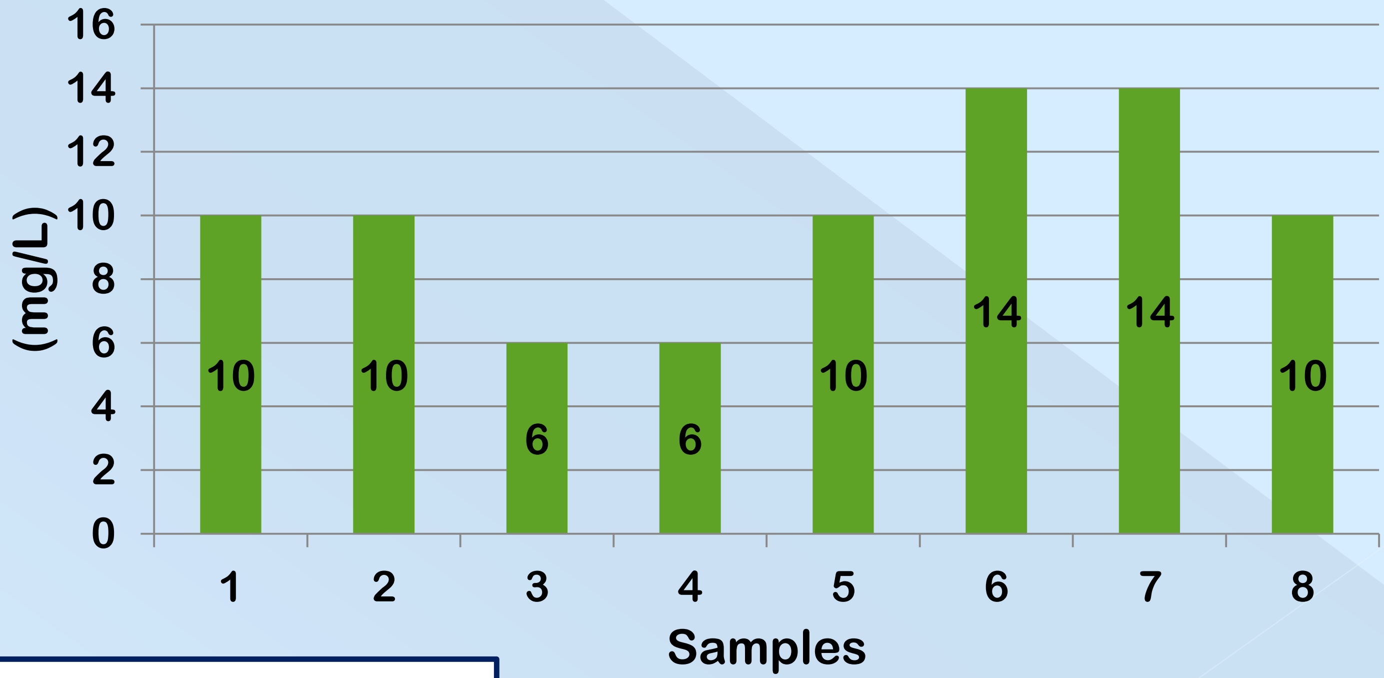
# pH values



7.6
7.5
7.4
7.3
7.2
7.1
7
6.9
6.8
6.7
Values
7.09
7.32
7.02
7.53
7.21
7.15
7.07
7.14
1
2
3
4
5
6
7
8
Samples

# CHEMICAL OXYGEN DEMAND (COD)

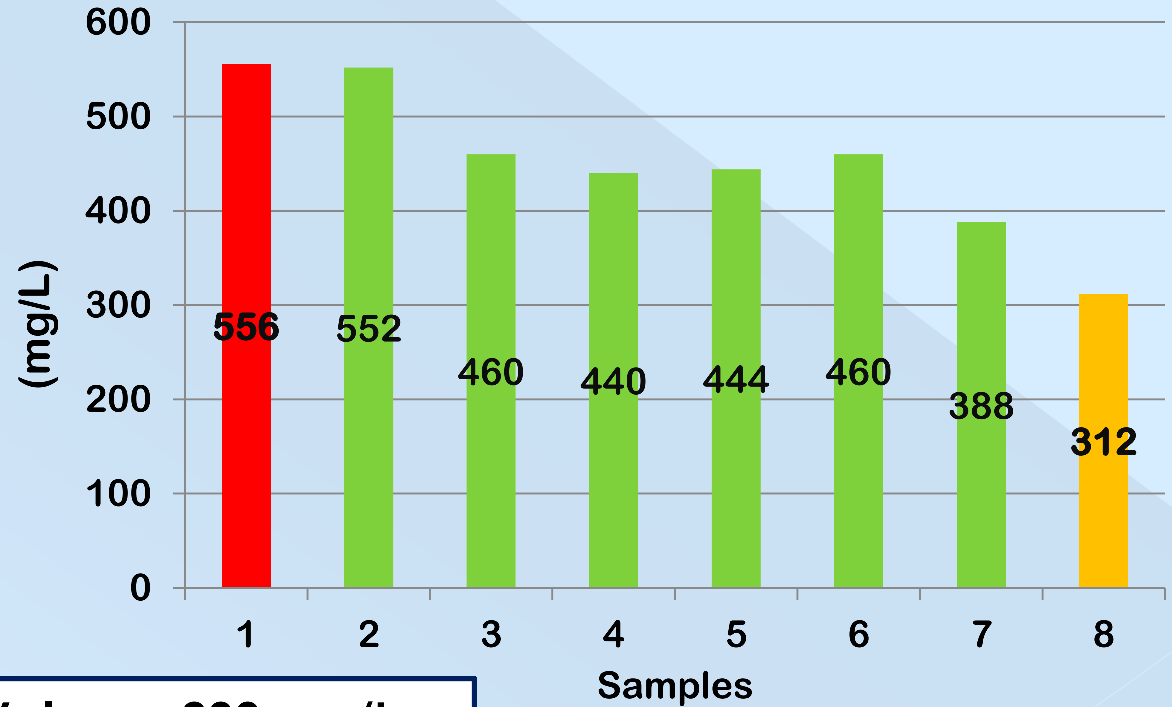
- Determines the Oxygen required for the chemical oxidation of organic matter.
- Amount of dissolved oxidizable organic matter including non-biodegradable matter present in it.




**Permissible Value : 30 mg/L**

# ALKALINITY

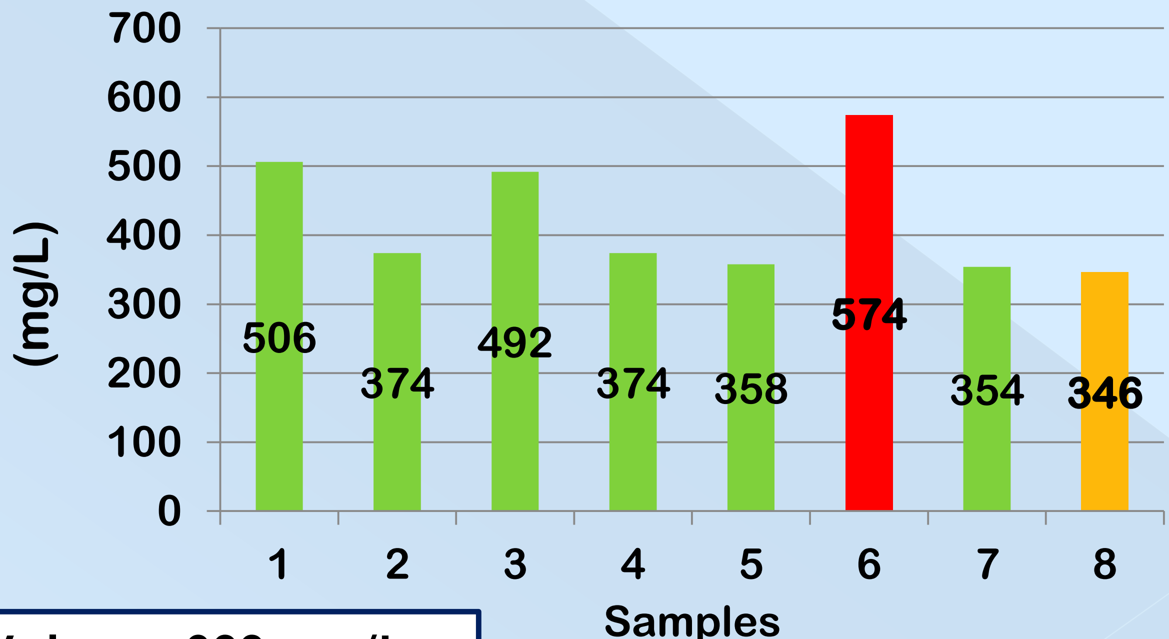
- Natural water, that are not highly polluted alkalinity is more commonly found than acidity.
- Dissolved inorganic carbon (bicarbonates and carbonate anions).
- Minor contributions to alkalinity come from ammonia, phosphates, borates, silicates and other basic substances.




Permissible Value : 200 mg/L

# TOTAL HARDNESS

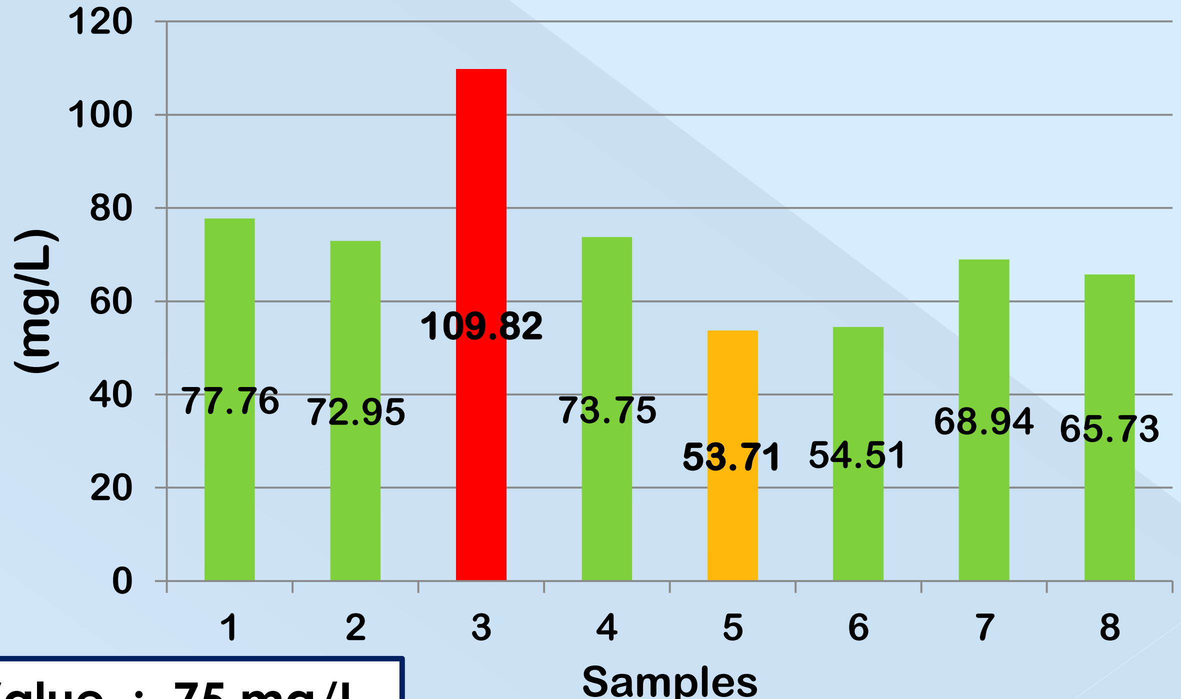
- Water hardness is a measure of the capacity of water to react with soap, hard water requiring a considerable amount of soap to lather.
- Divalent cations - calcium, magnesium and alkaline earth metals - iron, manganese, strontium, etc.
- The total hardness is the sum of calcium, magnesium concentrations, both expressed as $CaCO_3$.




**Permissible Value : 300 mg/L**

# CALCIUM HARDNESS

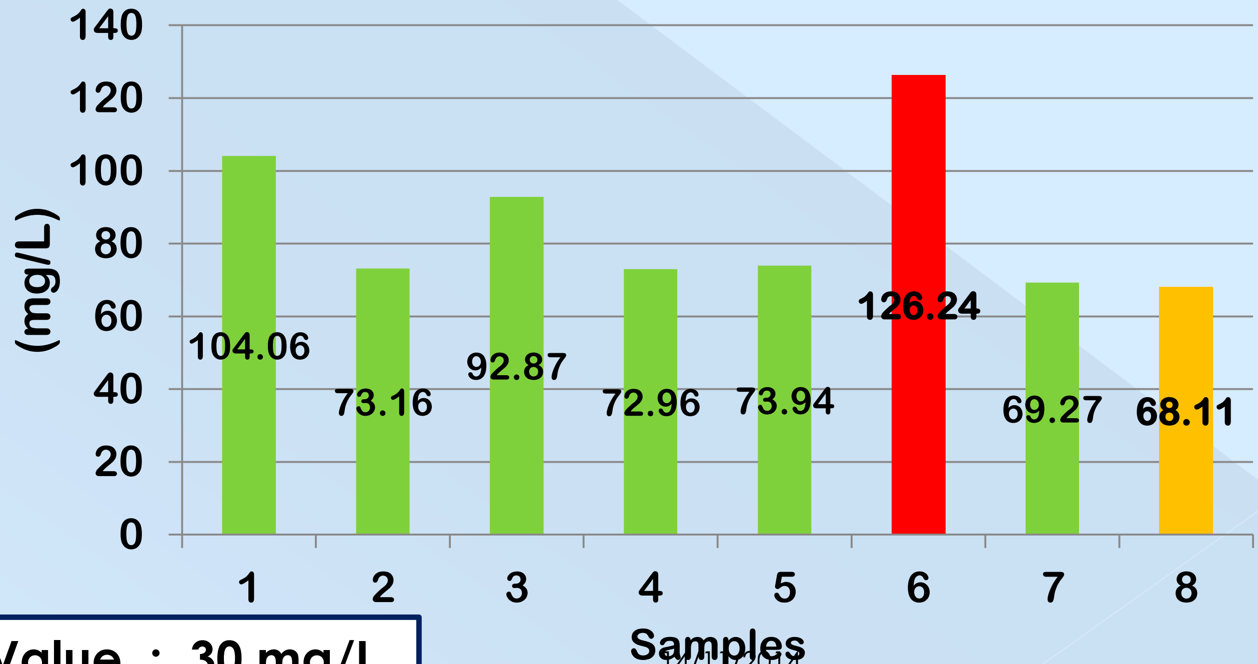
- The presence of calcium in water results from passage through or over deposits of limestone, dolomite, gypsum and such other calcium bearing rocks.
- Calcium is present in all water and is readily dissolved from rocks rich in calcium minerals, particularly as carbonates and sulphates.




**Permissible Value : 75 mg/L**

# MAGNESIUM HARDNESS

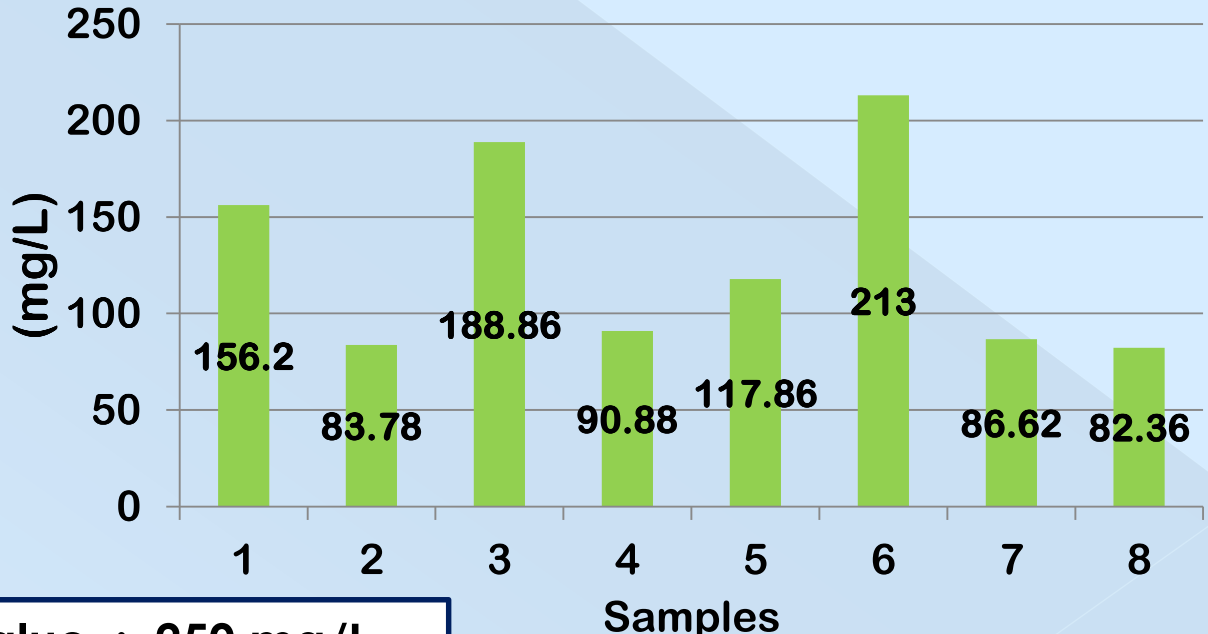
- Relatively abundant element in the earth's crust, ranking eighth.
- In all natural waters and its source magnesium lies in rocks, present in lower concentration than calcium.
- Is an important element contributing to total hardness and a necessary constituent of chlorophyll.




**Permissible Value : 30 mg/L**

# CHLORIDE

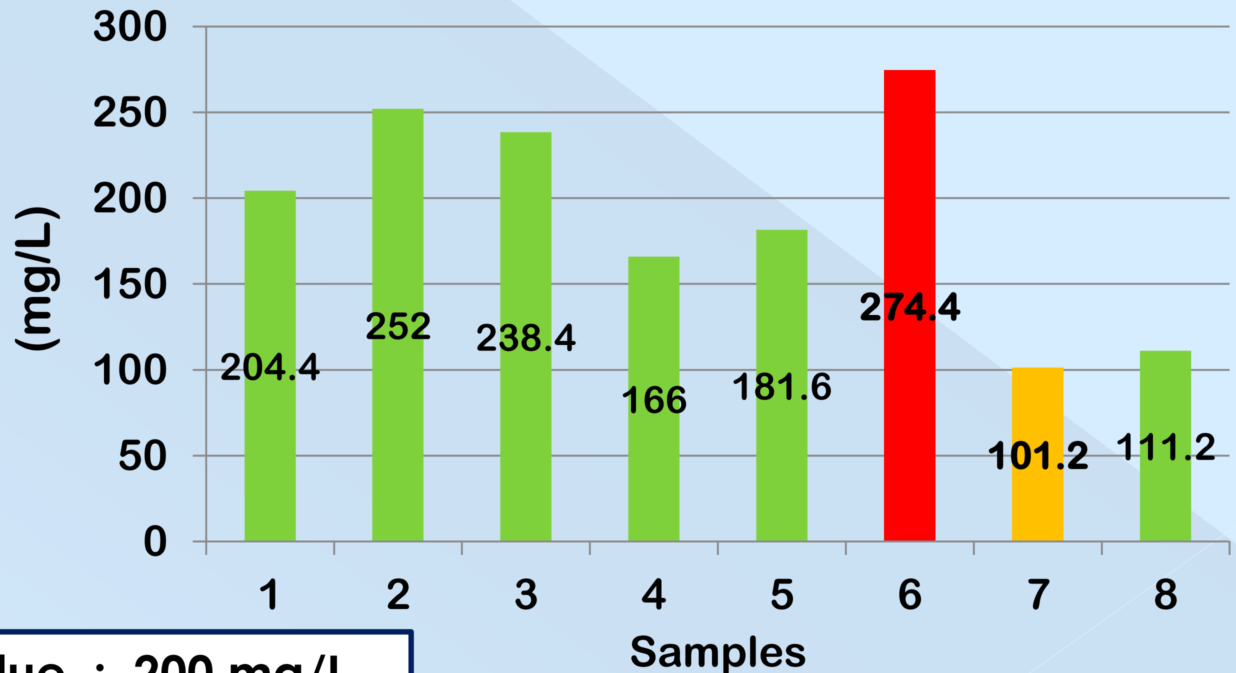
- Chloride enters surface waters by the atmospheric deposition of oceanic aerosols with the weathering of some sedimentary rocks (mostly rock salt deposits), industrial effluents and agricultural run-off.
- An anion found in the wastewaters and is a good indicator of pollution sources.




Permissible Value : 250 mg/L

# SODIUM

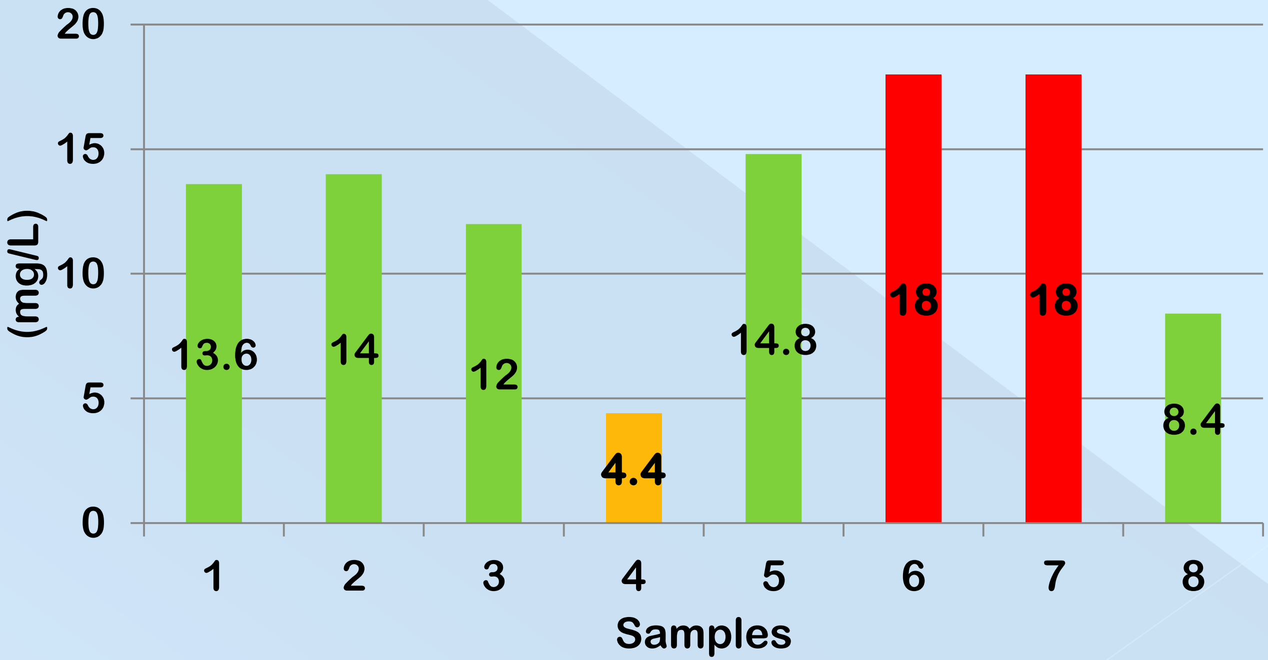
- One of the most abundant elements and is a common constituent of natural waters and is due to rocks and soil.
- The sodium concentration of water is of concern primarily when considering their solubility for agricultural uses or boiler feed water.




**Permissible Value : 200 mg/L**

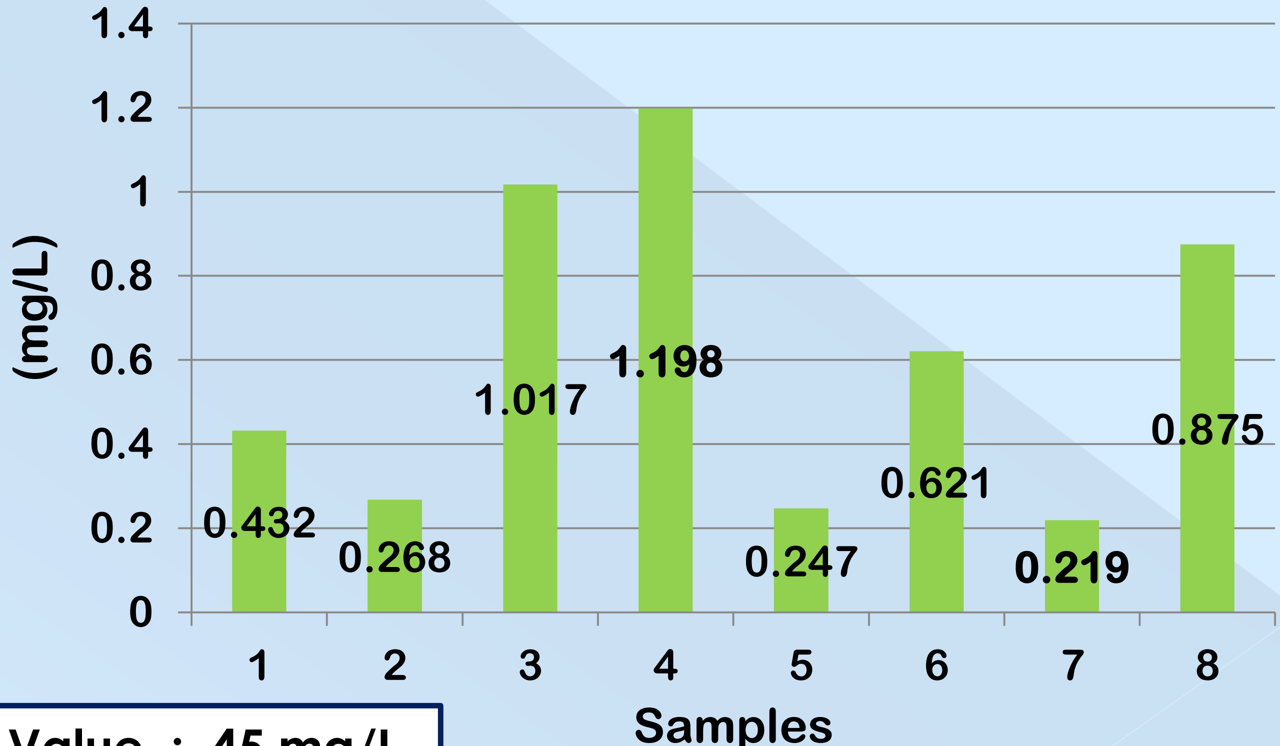
# POTASSIUM

- Ranks seventh among the elements in order of abundance, behaves similar to sodium and remains low.
- Though found in small quantities it plays a vital role in the metabolism of fresh water environment.



# NITRATE

- Nitrate ion is the common form of combined nitrogen found in natural waters.
- It may be bio chemically reduced to nitrite by denitrification processes, usually under anaerobic conditions.

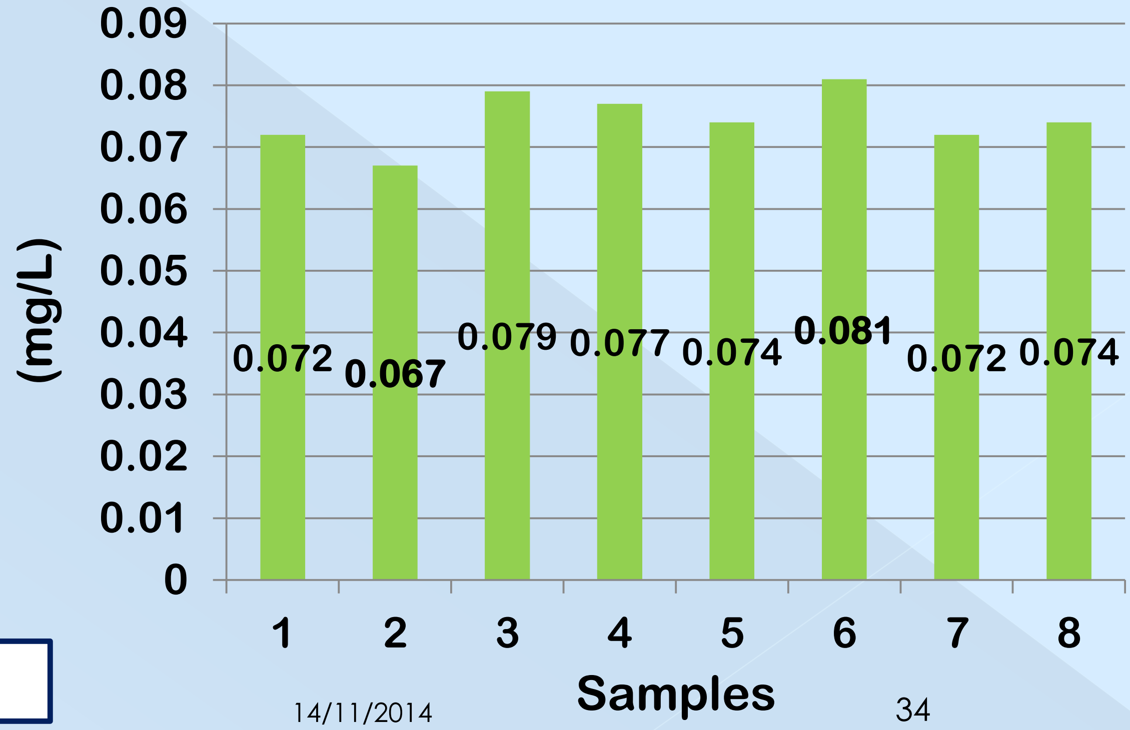



Permissible Value : 45 mg/L

# PHOSPHATES

It an essential nutrient for living organisms and exist in both forms as dissolved and particulate species orthophosphates, polyphosphates and organic bound phosphates .

- The phosphate ($PO_4$) may occur in ground water as a result of domestic sewage, detergents, agricultural with fertilizers and industrial waste water.




Permissible Value : 2 mg/L

# Water Testings (Chemical Analysis)

| Sl No | Samples | pH | COD (mg/L) | Alkalinity (mg/L) | Chloride (mg/L) | Total Hardness (mg/L) | Ca Hardness (mg/L) | Mg Hardness (mg/L) |
|---|---|---|---|---|---|---|---|---|
| 1 | Kengeri | 7.09 | 10 | **556** | 156.2 | 506 | 77.76 | 104.06 |
| 2 | Banashankari 6th Stage | 7.32 | 10 | 552 | 83.78 | 374 | 72.95 | 73.16 |
| 3 | BHEL Layout | **7.02** | **6** | 460 | 188.86 | 492 | **109.82** | 92.87 |
| 4 | Omkar Hills | **7.53** | **6** | 440 | 90.88 | 374 | 73.75 | 72.96 |
| 5 | Kenchenahalli | 7.21 | 10 | 444 | 117.86 | 358 | **53.71** | 73.94 |
| 6 | Marappa Layout | 7.15 | **14** | 360 | **213** | **574** | 54.51 | **126.24** |
| 7 | BEML Complex | 7.07 | **14** | 388 | 86.62 | 354 | 68.94 | 69.29 |
| 8 | BEML 5th Stage | 7.14 | 10 | **312** | **82.36** | **346** | 65.73 | **68.11** |

*Continued...*

# Water Testings (Chemical Analysis)

| Sl. No. | Samples | Phosphate (mg/L) | Nitrate (mg/L) | Sodium | Potassium |
|---|---|---|---|---|---|
| 1 | Kengeri | 0.072 | 0.432 | 204.4 | 13.6 |
| 2 | Banashankari 6th Stage | **0.067** | 0.268 | 252 | 14 |
| 3 | BHEL Layout | 0.079 | 1.017 | 238.4 | 12 |
| 4 | Omkar Hills | 0.077 | **1.198** | 166 | **4.4** |
| 5 | Kenchenahalli | 0.074 | 0.247 | 181.6 | 14.8 |
| 6 | Marappa Layout | **0.081** | 0.621 | **274.4** | **18** |
| 7 | BEML Complex | 0.072 | **0.219** | **101.2** | **18** |
| 8 | BEML 5th Stage | 0.074 | 0.875 | 111.2 | 8.4 |

# Water Testings (Physical Analysis)

| Sl . No. | Samples | TDS (mg/L) | EC (µS/cm) | Turbidity (NTU) | Density (kg/m$^{-3}$) | Viscosity x $10^{-3}$ (poise / NSm$^{-2}$) | Surface Tension X $10^{-3}$ (Nm$^{-1}$) |
|---|---|---|---|---|---|---|---|
| 1 | Kengeri | 637 | 841 | 1 | 950 | 0.6405 | 72.758 |
| 2 | Banashankari 6th Stage | 571 | 832 | 2 | 950 | 0.6382 | 76.947 |
| 3 | BHEL Layout | 660 | 955 | 3 | 935 | 0.6281 | 75.732 |
| 4 | Omkar Hills | 487 | 785 | 1 | 925 | 0.6236 | 69.483 |
| 5 | Kenchenahalli | 496 | 800 | 2 | 950 | 0.6659 | 83.930 |
| 6 | Marappa Layout | 743 | 1052 | 1 | 950 | 0.6428 | 71.362 |
| 7 | BEML Complex | 425 | 729 | 2 | 925 | 0.6226 | 79.002 |
| 8 | BEML 5th Stage | 375 | 657 | 1 | 975 | 0.6664 | 74.672 |

# INFERENCE

- Continuous increase in water demands and the near exhaustion of surface water, ground water has become a major water source.
- Demands for water in agriculture, industry and the accelerating growth of global population, unscientific disposal of municipal, and agricultural wastes have polluted the ground water.
- The lakes are very few in number where most of them are polluted, thus recharge of ground water is not balancing the withdrawal of the ground water.
- Planned use of water and proper scientific disposal of wastes, surplus recharging of water and precautionary measures before using is very much essential.

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# Acknowledgement


Principal of VPS

Residents

Teachers

IISc Staff

Parents

Thank you…