

# Contents

<b>1. Introduction</b>	<b>1</b>
1.1 Review of Literature .....	1
1.1.1 Soil Quality.....	1
1.1.1.1 Defining Soil Quality .....	2
1.1.1.2 Soil as a nutrient store .....	3
1.1.1.3 Contamination of Soil .....	5
1.1.1.4 Buffering of toxicants by soil .....	7
1.1.1.5 Evaluation of Soil Quality .....	9
1.1.1.6 Monitoring change in Soil Quality .....	11
1.1.2 Water Quality: An Overview.....	14
1.1.2.1 Access to Safe Drinking Water .....	16
1.1.2.2 Contamination of Drinking Water .....	17
1.1.2.3 Indian Scenario .....	21
1.1.2.4 Drinking Water Quality and Health .....	25
1.1.2.5 Drinking Water Quality Regulation .....	27
1.2 Objectives .....	29
1.3 Purpose and scope of the Study .....	29
<b>2. Study Area</b>	<b>32</b>
2.1 North Eastern India.....	32
2.2 Darrang District: A Profile .....	34
2.3 Location .....	35
2.4 Boundary.....	35
2.5 Climate and Weather .....	36
2.6 The River System .....	37
2.7 Population .....	37
2.8 Literacy .....	38
2.9 Tea Gardens .....	38
2.10 Sampling Information .....	40
2.10.1 Soil Sample Collection .....	40
<b>3. Materials and Methodology</b>	<b>46</b>
3.1 Soil Chemical Analysis.....	46
3.1.1 Soil Sample Collection .....	46
3.1.2 Soil Sample Preparation: .....	49

3.1.3 Soil Texture .....	49
3.1.4 Bulk density of soil:.....	50
3.1.5 Soluble Salts: Conductivity Method (1:5 soil: water ratio).....	50
3.1.6 Soil pH (1:5 soil: water ratio).....	51
3.1.7 Organic Matter.....	51
3.1.8 Total Kjeldahl Nitrogen.....	52
3.1.9 Available Phosphorus.....	52
3.1.10 Potassium.....	52
3.1.11 Calcium and magnesium.....	53
3.1.12 Sulphate .....	54
3.1.13 Chloride : .....	54
3.1.14 Iron.....	55
3.2 Water Chemical Analysis .....	56
3.2.1 Colour and temperature .....	58
3.2.3 Turbidity :.....	58
3.2.4 Electrical Conductivity:.....	58
3.2.5 pH .....	59
3.2.6 Total Alkalinity:.....	59
3.2.7 Solids .....	60
3.2.8 Dissolved Oxygen.....	61
3.2.9 Chloride .....	62
3.2.10 Nitrate .....	62
3.2.11 Phosphate.....	63
3.2.12 Sulphate .....	63
3.2.13 Total Hardness.....	63
3.2.14 Calcium and Magnesium .....	64
3.2.15 Iron.....	65
3.2.16 Fluoride.....	66
3.2.17 Sodium and potassium :.....	66
3.2.18 Copper, Lead, Manganese, Arsenic, Zinc & Cadmium:.....	66
3.3 Data Analysis.....	67
<b>4. Results and Discussion</b> .....	<b>72</b>
4.1 Soil Quality.....	72
4.1.1 Soil Texture .....	72
4.1.2 Electrical Conductance (EC) .....	75
4.1.3 Soil pH.....	78
4.1.4 Organic Carbon.....	81
4.1.5 Total Nitrogen (N) .....	87
4.1.6 Phosphorus (P).....	90
4.1.7 Potassium (K) .....	94
4.1.8 Bulk Density ( $P_b$ ) .....	97
4.1.9 Zinc (Zn).....	101

4.1.10 Copper (Cu) .....	105
4.1.11 Manganese (Mn).....	108
4.1.12 Iron (Fe).....	112
4.1.13 Lead (Pb) .....	115
4.1.14 Calcium and Magnesium (Ca & Mg) .....	119
4.1.15 Chloride and Sulphate (Cl <sup>-</sup> & SO <sub>4</sub> <sup>2-</sup> ) .....	125
4.2 Water Quality.....	131
4.2.1 Temperature.....	131
4.2.2 Colour .....	131
4.2.3 Odour .....	134
4.2.4 Taste.....	134
4.2.5 Solids .....	136
4.2.6 Turbidity .....	138
4.2.7 Electrical Conductance (EC) .....	142
4.2.8 pH .....	146
4.2.9 Dissolved Oxygen (D.O.) .....	150
4.2.10 Total Alkalinity.....	154
4.2.11 Total Hardness (as CaCO <sub>3</sub> ).....	158
4.2.12 Calcium and Magnesium (Ca & Mg) .....	162
4.2.13 Chloride (Cl <sup>-</sup> ).....	169
4.2.14 Sulphate (SO <sub>4</sub> <sup>2-</sup> ) .....	173
4.2.15 Nitrate(NO <sub>3</sub> <sup>-</sup> ).....	177
4.2.16 Phosphate(PO <sub>4</sub> <sup>3-</sup> ).....	181
4.2.18 Fluoride (F <sup>-</sup> ).....	185
4.2.19 Iron (Fe).....	189
4.2.20 Lead (Pb) .....	193
4.2.21 Arsenic (As).....	198
4.2.22 Cadmium (Cd) .....	202
4.2.23 Copper (Cu) .....	206
4.2.24 Manganese ( Mn).....	210
4.2.25 Zinc ( Zn).....	214
4.2.26 Sodium (Na).....	218
4.2.27 Potassium (K) .....	222

## **5. Conclusions** **227**

5.1 Soil Quality .....	227
5.2 Water Quality.....	233
Papers published in journals: .....	247
Paper published in seminar proceedings: .....	247

## **BIBLIOGRAPHY** .....

**248**

### **Reprints of published Papers**